OMRON

High-function General-purpose Inverter

RX2 Series

User’s Manual

3G3RX2-□□□□□

I620-E1-01

Introduction

Thank you for purchasing the High-function General-purpose Inverter (Model: 3G3RX2).

This manual describes the installation and wiring methods of the 3G3RX2 Series Inverter, and parameter setting methods which are required for the operation, as well as troubleshooting and inspection methods.

Intended Readers

This manual is intended for the following individuals.

Those who have electrical knowledge (certified electricians or individuals who have equivalent knowledge) and also are qualified for one of the following:

- Introducing control equipment
- Designing control system
- Installing and connecting control systems
- Managing control systems and facilities

Notice

This manual contains information you need to know to correctly use the High-function General-purpose Inverter (Model: 3G3RX2).

Before using the inverter, read this manual and gain a full understanding of the information provided herein.

After you finished reading this manual, keep it in a convenient place so that it can be referenced at any time.

Make sure this manual is delivered to the end user.

Manual Configuration

This user's manual consists of the following sections.

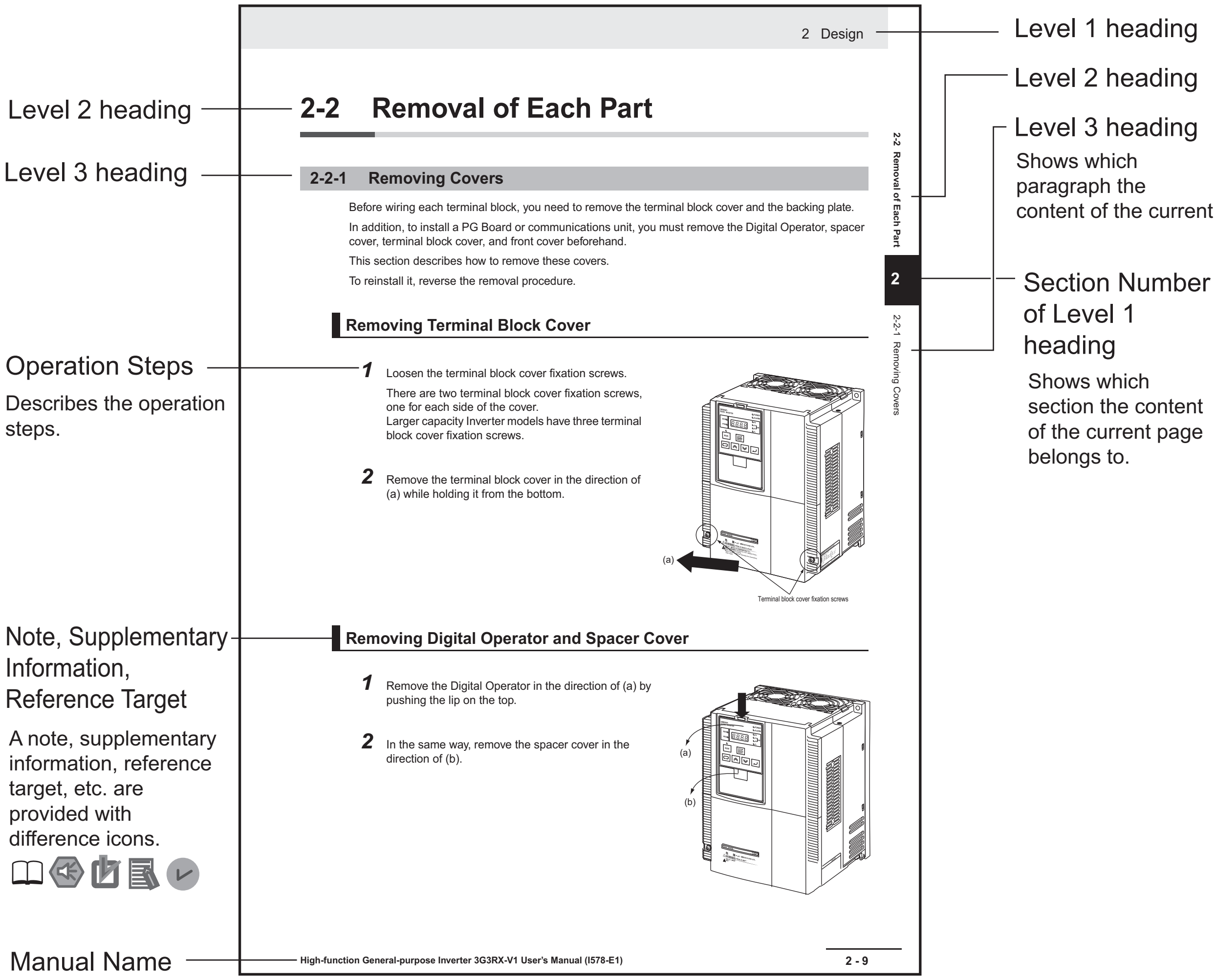
Read the necessary sections with a reference of the following table.

Section/Title		Outline
Section 1	Overview	This section provides the features of this product, specifications, external dimensions, and part names.
Section 2	Design	This section describes the installation and wiring methods for this product.
Section 3	Operation	This section describes the followings: • Operation methods • Parts name in digital operator for test run • Its key operation
Section 4	Test Run	This section describes how to perform a test run.
Section 5	Monitor	This section describes various monitoring functions built-in an inverter.
Section 6	Basic Parameter Settings	This section describes settings of connections to each destination of frequency commands and operation commands.
Section 7	Advanced Settings	This section describes various functions built-in an inverter.
Section 8	Applied Settings	This section describes functions other than Section.6 and 7.
Section 9	Communications Functions	This section describes the general-purpose serial communications functions (RS-485 communication).
Section 10	DriveProgramming	This section describes the features of the DriveProgramming.
Section 11	Options	This section describes the specifications and external dimension of peripheral equipment.
Section 12	Troubleshooting	This section describes how to analyze the cause and take countermeasures if the inverter fails, and provides troubleshooting for possible troubles.
Section 13	Maintenance and Inspection	This section describes the maintenance and periodical inspection items.
Appendices		This section describes the technical information and parameters.

Manual Structure

Page Structure and Symbol Icons

The following page structure and symbol icons are used in this manual.



Note The above page is only a sample for illustrative purposes. It is not the actual content of the manual.

Special Information

Special information in this manual is classified as follows:

Precautions for Safe Use

Precautions on what to do and what not to do to ensure safe usage of the product.

Precautions for Correct Use

Precautions on what to do and what not to do to ensure proper operation and performance.

Additional Information

Additional information to read as required.

This information is provided to increase understanding or make operation easier.

Sections in this Manual

Terms and Conditions Agreement

Warranty, Limitations of Liability

Warranties

- **Exclusive Warranty**

Omron's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.

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OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE.

Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right.

- **Buyer Remedy**

Omron's sole obligation hereunder shall be, at Omron's election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron's analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty.

See http://www.omron.com/global/ or contact your Omron representative for published information.

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OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.

Application Considerations

Suitability of Use

Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases.

NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Programmable Products

Omron Companies shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

Disclaimers

Performance Data

Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron's test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Omron's Warranty and Limitations of Liability.

Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Safety Precautions

To ensure that the High-function General-purpose Inverter (Model: 3G3RX2) is used safely and correctly, be sure to read this Safety Precautions section and the main text before using the product.

Learn all items you should know before use, regarding the equipment as well as required safety information and precautions.

Make an arrangement so that this manual also gets to the end user of this product.

After reading this manual, keep it in a convenient place so that it can be referenced at any time.

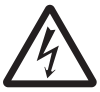
Indications and Meanings of Safety Information

In this user's manual, the following precautions and signal words are used to provide information to ensure the safe use of the High-function General-purpose Inverter (Model: 3G3RX2). The information provided here is vital to safety. Strictly observe the precautions provided.

Meanings of Signal Words

⚠ DANGER	Indicates an imminently hazardous situation which, if not avoided, is likely to result in serious injury or may result in death. Additionally there may be severe property damage.
⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, will result in minor or moderate injury, or may result in serious injury or death. Additionally there may be significant property damage.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

Explanation of Symbols

	⊘ This symbol indicates a prohibited item (an item you must not do). The specific instruction is indicated using an illustration or text inside or near ⊘ . The symbol shown to the left indicates “disassembly prohibited.”
	△ This symbol indicates danger and caution. The specific instruction is indicated using an illustration or text inside or near △ . The symbol shown to the left indicates “beware of electric shock.”
	△ This symbol indicates danger and caution. The specific instruction is indicated using an illustration or text inside or near △ . The symbol shown to the left indicates “non-specific general danger.”
	△ This symbol indicates caution (including warning). The specific instruction is indicated using an illustration or text inside or near △ . The symbol shown to the left indicates “risk of hot surface.”
	● This symbol indicates a compulsory item (an item that must be done). The specific instruction is indicated using an illustration or text inside or near ● . The symbol shown to the left indicates “general compulsory items.”
	● This symbol indicates a compulsory item (an item that must be done). The specific instruction is indicated using an illustration or text inside or near ● . The symbol shown to the left indicates “grounding required.”

Precautions for Correct Use

⚠ WARNING
Turn off the power supply and implement wiring correctly. Not doing so may result in a serious injury due to an electric shock.
Wiring work must be carried out only by qualified personnel. Not doing so may result in a serious injury due to an electric shock.
Do not change wiring and slide switches (SW1 to SW6), put on or take off Operator and optional devices, replace cooling fans while the input power is being supplied. Doing so may result in a serious injury due to an electric shock.
Be sure to ground the unit. Not doing so may result in a serious injury due to an electric shock or fire. (200-V class: type-D grounding, 400-V class: type-C grounding)
Do not remove the terminal cover during the power supply and 15 minutes[*1*2] after the power shut off. Doing so may result in a serious injury due to an electric shock.
Do not operate the Operator or switches with wet hands. Doing so may result in a serious injury due to an electric shock.
Inspection of the inverter must be conducted after the power supply was turned off. Not doing so may result in a serious injury due to an electric shock. The main power supply is not necessarily shut off even if the emergency shut off function is activated.
Do not touch the inverter fins, braking resistors and the motor, which become too hot during the power supply and for some time after the power shut off. Doing so may result in a burn.

*1. 10 minutes: For models 3G3RX2-A2004 to A2220 and 3G3RX2-A4007 to A4220

*2. 15 minutes: For models 3G3RX2-A2300 to A2550 and 3G3RX2-A4300 to B413K

⚠ Caution

Be sure to confirm safety before conducting maintenance, inspection or parts replacement.

Do not connect resistors to the terminals (PD/+1, P/+, N/-) directly. Doing so might result in a small-scale fire, heat generation, or damage to the unit.

Install a stop motion device to ensure safety. Not doing so might result in a minor injury.
(A holding brake is not a stop motion device designed to ensure safety.)

Be sure to use a specified type of braking resistor/regenerative braking unit. In case of a braking resistor, install a thermal relay that monitors the temperature of the resistor. Not doing so might result in a moderate burn due to the heat generated in the braking resistor/regenerative braking unit. Configure a sequence that enables the inverter power to turn off when unusual over eating is detected in the braking resistor/regenerative braking unit.

The inverter has high voltage parts inside which, if short-circuited, might cause damage to itself or other property. Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing and wiring.

Take safety precautions such as setting up a molded-case circuit breaker (MCCB) that matches the inverter capacity on the power supply side.

Not doing so might result in damage to property due to the short circuit of the load.

Do not dismantle, repair or modify the product.

Doing so may result in an injury.

If a parameter is set incorrectly when starting up, adjusting, maintaining, or replacing, an unexpected operation may occur.

If the DriveProgramming stops during multi-function output, the output status is held. Take safety precautions such as stopping peripheral devices.

Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing the PG Unit and wiring.

Precautions for Safe Use

Installation and Storage

Do not store or use the product in the following places.

- Locations subject to direct sunlight.
- Locations subject to ambient temperature exceeding the specifications.
- Locations subject to relative humidity exceeding the specifications.
- Locations subject to condensation due to severe temperature fluctuations.
- Locations subject to corrosive or flammable gases.
- Locations subject to exposure to combustibles.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

Transportation, Installation, and Wiring

- Do not drop or apply strong impact on the product. Doing so may result in damaged parts or malfunction.
- Do not hold by the front cover and terminal cover, but hold by the fins during transportation.
- Confirm that the rated input voltage of the inverter is the same as AC power supply voltage.
- Do not connect an AC power supply voltage to the control input/output terminals. Doing so may result in damage to the product.
- Be sure to tighten the screws on the terminal block securely. Wiring work must be done after installing the unit body.
- Do not connect any load other than a three-phase inductive motor to the U, V, and W output terminals.
- Take sufficient shielding measures when using the product in the following locations. Not doing so may result in damage to the product.

  Locations subject to static electricity or other forms of noise.

  Locations subject to strong magnetic fields.

  Locations close to power lines.
- When using DriveProgramming, confirm that the program data is downloaded normally before starting operation.
- Connect the PG Unit to the Inverter tightly with fixing screws. In addition, be sure to connect terminal wires on the PG Unit securely.

Operation and Adjustment

- Be sure to confirm the permissible range of motors and machines before operation because the inverter speed can be changed easily from low to high.
- Provide a separate holding brake if necessary.
- If the clock command is used in DriveProgramming, an unexpected operation may occur due to weak battery. Take measures such as detecting a weak battery by [E042] RTC Error and stopping the inverter or programs. When the LCD Operator is removed or disconnected, DriveProgramming is in a waiting status by the clock command.
- Be sure to confirm the RUN signal is turned off before resetting the alarm because the machine may abruptly start.
- Do not come close to the machine when you enable “restart” setting that results in automatic start after a deceleration stop (bA-30, bb-20, bb-21), the machine may abruptly start after the power is turned on.
- Provide a separate emergency stop switch because the STOP Key on the Operator is valid only when function settings are performed.
- When checking a signal during the power supply and the voltage is erroneously applied to the control input terminals, the motor may start abruptly. Be sure to confirm safety before checking a signal.
- Check whether the motor rotation direction is correct and unusual sound or vibration occurs during operation.

Maintenance and Inspection

- The capacitor service life is influenced by the ambient temperature. Refer to “Smoothing Capacitor Life Curve” described in the manual. When a capacitor reaches the end of its service life and does not work as the product, you need to replace the capacitor.
- When disposing of LCD operators and wasted batteries, follow the applicable ordinances of your local government. When disposing of the battery, insulate it using tape.

廢電池請回收

The following display must be indicated when products using lithium primary batteries (with more than 6 ppb of perchlorate) are transport to or through the State of California, USA.

Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate

Label or mark the above display on the exterior of all outer shipping packages of your products when exporting your products which the lithium primary batteries (with more than 6 ppb of perchlorate) are installed to the State of California, USA.

- Do not short + and –, charge, disassemble, heat, put into the fire, or apply strong impact on the battery. The battery may leak, explode, produce heat or fire. Never use the battery which was applied strong impact due to such as fall on the floor, it may leak.
- UL standards establish that the battery shall be replaced by an expert engineer. The expert engineer must be in charge of the replacement and also replace the battery according to the method described in this manual.
- When the display of LCD Operator can not be recognized due to the service life, replace the LCD Operator.

Precautions for Correct Use

Installation

Mount the product vertically on a wall with the product's longer sides upright.

The material of the wall must be noninflammable such as a metal plate.

Installation and Wiring

Confirm that the power voltage for the encoder is the same as the rated voltage (+12 VDC or +5 VDC) of the product.

Restart Selection Function

Do not come close to the machine when using Instantaneous power failure/under-voltage trip (bb-24) or over-current (bb-28) because the machine may abruptly start after the alarm cleared.

Maintenance and Parts Replacement

- Generally speaking, inverters contain components and will operate properly only when each component operates normally. Some of the electrical components require maintenance depending on application conditions. Periodic inspection and replacement are necessary to ensure proper long-term operation of Inverters.
- When a cooling fan reaches the end of its service life, replace it.

Product Disposal

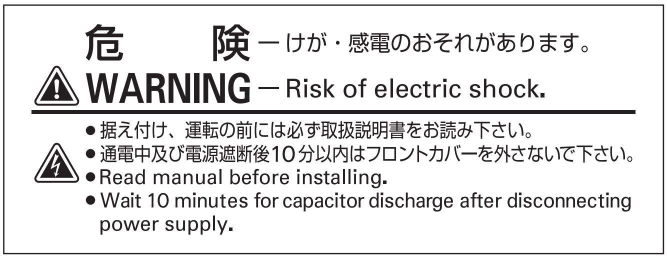
Comply with the local ordinance and regulations when disposing of the product.

Dispose of in accordance with WEEE Directive

Warning Label

- This product bears a warning label at the following location to provide handling warnings.
- Be sure to follow the instructions.
  The appearance differs depending on the capacity of the inverter.

Warning Description



Regulations and Standards

To export (or provide to nonresident aliens) any part of this product that falls under the category of goods (or technologies) for which an export certificate or license is mandatory according to the Foreign Exchange and Foreign Trade Control Law of Japan, an export certificate or license (or service transaction approval) according to this law is required.

Markings		Standards
CE	EMC	EN 61800-3:2004+A1:2012
	Machinery	IEC61800-5-2: 2016 STO SIL3 ISO13849-1: 2015 Cat.4 PLe IEC61800-5-1/A1:2016
UL	US	UL61800-5-1
	CA	CSA C22.2 No. 274
	FS	IEC61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe
KC		KN61800-3
EAC		-
RCM		EN 61800-3:2004+A1:2012

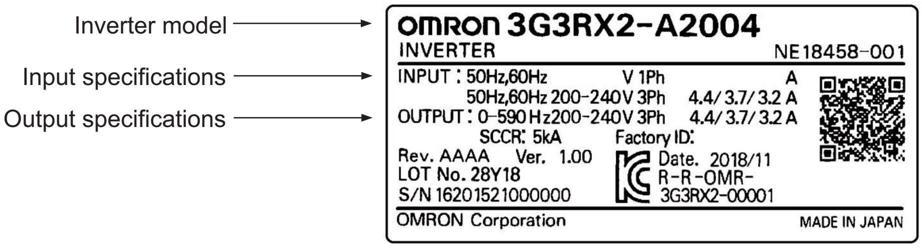
Items to Check after Unpacking

After unpacking, check the following items.

- Is this the model you ordered?
- Was there any damage sustained during shipment?

Checking the Nameplate

The nameplate is affixed to the product.



Checking the Model

3 G 3 R X2 - A 2 0 5 5

Maximum applicable motor capacity (normal duty rating [ND])

004	0.4 kW
007	0.75 kW
015	1.5 kW
022	2.2 kW
037	3.7 kW
055	5.5 kW
075	7.5 kW
110	11 kW
150	15 kW
185	18.5 kW
220	22 kW
300	30 kW
370	37 kW
450	45 kW
550	55 kW
750	75 kW
900	90 kW
11K	110 kW
13K	132 kW

Voltage class

2	3-phase 200 VAC (200-V class)
4	3-phase 400 VAC (400-V class)

Enclosure rating

A	IP20/UL open type
B	IP00/UL open type

Checking the Accessories

The instruction manual is the only accessory included in the High-function General-purpose Inverter (Model: 3G3RX2).

Mounting screws and other necessary parts must be provided by the user.

LCD operator does not come with battery. When you desire to display time and date in LCD operator, prepare the optional battery (CR2032, 3V). As for the method for setting the battery and for its use, refer to section *3-1-5 How to Set Battery and the Time Setting* on page 3-12.

Accessory	3G3RX2-A2004/ -A2007/ -A2015/ -A2022/ -A2037/ -A2055/ -A2075/ -A2110/ -A2150/ -A2185/ -A2300/ -A4007/ -A4015/ -A4022/ -A4037/ -A4055/ -A4075/ -A4110/ -A4150/ -A4185/ -A4220/ -A4300	3G3RX2-A2220	3G3RX2-A2370/ -A2450/ -A2550/ -A4370/ -A4450/ -A4550/ -B4750/ -B4900/ -B411K/ -B413K
LCD Operator	1 (equipped with this inverter)		
User’s Manual	1		
Sheet supporting 25 foreign languages	1		
Warning Label Sheet	1		
Spacer, Screw (M3×8)	-	each 4	-
Eye-bolts (M8 CB08EY 2M)	-	-	2

Related Manuals

Please see the manuals below for related product information.

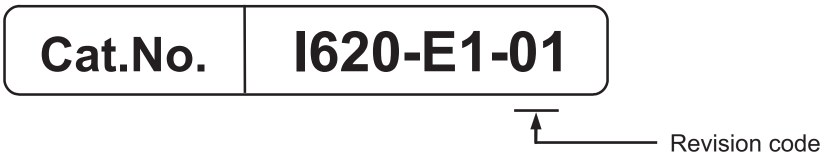
Name	Catalog No.
Regenerative Braking Unit 3G3AX-RBU User’s Manual	I563
CX-Drive Operation Manual	W453
DriveProgramming User’s Manual	I622

For the PG option, refer to *2-3-6 Wiring for PG Option Unit* on page 2-63 in this manual.

Revision History

The manual revision code is a number appended to the end of the catalog number found in the bottom right-hand corner of the front and back covers.

Example



Revision code	Revision date	Revised Content
01	March 2019	Original production

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Appendices B STO Function

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1

Overview

This section provides an overview of the 3G3RX2 Series features, standard specifications, and external dimensions by inverter capacity.

1-1 Overview of Functions

The High-function General-purpose Inverter (Model: 3G3RX2) is a human- and environmental-friendly inverter suitable for a variety of applications. It provides various features, such as convenient functions intended for ease of use and diverse I/O. In addition, the 3G3RX2 Series complies with safety standards for any nations such as IEC Standard. You can use this product as a world standard inverter.

1-1-1 Features of 3G3RX2 Series Inverter

The 3G3RX2 Series Inverter has the following features.

Enhanced Application Support

The 3G3RX2 Series provides high performance and high functionality, which are the requirements of a general-purpose inverter. It enhances the capability to support applications and addresses diverse needs with optimal performance.

● Adoption of the Triple Rating Function (Normal Duty, Low Duty and Very Low Duty)

At 3G3RX2 the previous heavy and light load modes were renewed to **Normal Duty (ND)**, **Low Duty (LD)** and **Very Low Duty (VLD)** to provide the triple rating function.

The Low Duty is available for a fan, pump, or other device that operates at the rated motor torque or less in a normal state. Setting the **Low Duty** causes the rated current of the inverter to increase, enabling the inverter to drive a motor that is one size larger in capacity.

However, pay attention to when selecting an inverter because the overload capacity decreases to 1 minute, 120% of the rated current.

Precautions for Correct Use

Switching the **Normal, Low and Very Low Duty** changes the setting ranges and default data of the related parameters. Refer to *6-1-1 Inverter Load Rating Settings* on page 6-3 for details.

● Implementation of the Programming Function

The 3G3RX2 Series has the built-in simple sequence function (DriveProgramming), which enables a stand-alone inverter to perform simple sequence control.

You can create programs easily in flowchart or text language method by using the CX-Drive.

For details, refer to the *DriveProgramming User's Manual* (Cat. No. I622).

● Implementation of the Vector Control Functions

With sensorless vector control, the inverter realizes a high starting torque at 200% of the motor rating in 0.3 Hz.

With 0-Hz sensorless vector control, the inverter can also output a high starting torque at 150% of the motor rating in even lower frequencies.

The inverter has various vector control functions as listed below, in addition to V/f control.

- Sensorless vector control
- 0-Hz sensorless vector control
- Sensor vector control

Availability of Position Control by the Feedback

The inverter can realize accurate position control by feeding back the load-side position information, just like a servo system. It is effective to save costs for the whole sysytem because the position control system with a motor over 15 kW is available, and also other position controllers are unnecessary if the inverter's internal position control function is used.

This inverter has the following position control functions.

- Absolute position control mode and high-resolution absolute position control mode that can control up to 8 points
- Pulse train position control mode that can control via pulse input from the host controller
- Orientation function that controls a rotating shaft to stop at a fixed position

PID Control Function

The inverter provides PID control that adjusts the feedback value to match the target value.

This is available to the process control such as temperature, pressure, flow rate without temperature controller or external controller.

Power Interruption Restart Function

If a momentary power interruption occurs during operation, the inverter automatically recognizes the rotation speed of the motor at power recovery, without detecting undervoltage, to enable a smooth restart.

Stall Prevention Function

Induction motors may stall (or step out) if a large load is applied due to rapid acceleration or load fluctuation.

This inverter has the overload limit function that prevents such a stall condition and ensures a persistent operation.

Ease of Use

The 3G3R2 Series Inverter contributes to the reduction of man-hours in all phases of inverter-related work: from wiring, parameter setting, operation, through to maintenance.

Removable Color LCD Digital Operator Equipped

This inverter has a removable LCD Digital Operator as standard equipment.

This Color LCD Display is equipped to provide easier view of the monitor for parameter settings. You can save inverter data to LCD operator and it can be used as a copy unit.

By connecting the optional special cable, it is possible to operate the Digital Operator at hand or install it to the front face of the control panel. This is convenient during setup or maintenance operation.

When the optional battery (CR2032, 3V) is set in the LCD operator, date and time can be displayed in the error history. This display is useful in troubleshooting when an error occurs.

Safe Torque OFF (STO) Function

Safe Torque OFF (STO) function complying with IEC61800-5-2 is equipped. By a signal from safety devices like emergency shutoff button, the motor current can be shutoff to stop the motor safely.

Modbus Communication Function as Standard

The inverter has the RS485 communications circuit and the Modbus communication protocol as standard.

You can use Modbus communication to control and monitor the inverter status, or read and write various parameter settings.

Simplified Parameter Setting by User Parameters

This inverter provides User Selection (UA-31 to UA-62) as user parameters. You can register parameters that are frequently used to simplify the parameter setting and adjustment.

It is also possible to automatically register changed parameters as user parameters.

Environmental Consideration

OMRON gives consideration to not only the inverter, but also the service life and energy efficiency of the connected motor.

This inverter, as a standard product, complies with the RoHS directive and international standards to realize an environmental-friendly inverter.

Measures against Noise and Harmonic Interference for Peripheral Protection

The inverter has the built-in EMC noise filter as standard as a measure against noise for compliance with the EMC directive.

By connecting the optional radio noise filters and DC reactors, the specifications which complies with the standard by Ministry of Land, Infrastructure, Transport and Tourism of Japan are achieved.

Long Life Design

The inverter has a design life of 10 years through the use of long-life pars for its capacitors, fan, and other consumables. Using an inverter for a longer period than ever before has an advantage in extending the life of your facility.

Automatic Energy-saving Function

The automatic energy-saving function automatically adjusts the output power of the inverter operating at a constant speed to the minimum. It has an energy-saving effect in applications such as a fan or pump.

Compliance with Safety Standards

The inverter complies with safety standard for any nations such as IEC Standard.

Complies with RoHS Directive

This inverter, as a standard product, complies with the RoHS Directive that restricts the use of 10 hazardous substances.

1-1-2 Classes of 3G3RX2 Series Inverter

There are two voltage classes for 3G3RX2 Series Inverters: 3-phase 200 VAC and 3-phase 400 VAC.

The applicable motor capacity is 0.4 to 132 kW.

All models comply as standard with the EC Directives

Rated voltage	Enclosure rating	Max. applicable motor capacity	Model
3-phase 200 VAC	IP20	0.4 kW	3G3RX2-A2004
		0.75 kW	3G3RX2-A2007
		1.5 kW	3G3RX2-A2015
		2.2 kW	3G3RX2-A2022
		3.7 kW	3G3RX2-A2037
		5.5 kW	3G3RX2-A2055
		7.5 kW	3G3RX2-A2075
		11 kW	3G3RX2-A2110
		15 kW	3G3RX2-A2150
		18.5 kW	3G3RX2-A2185
		22 kW	3G3RX2-A2220
		30 kW	3G3RX2-A2300
		37 kW	3G3RX2-A2370
		45 kW	3G3RX2-A2450
		55 kW	3G3RX2-A2550
3-phase 400 VAC	IP20	0.75 kW	3G3RX2-A4007
		1.5 kW	3G3RX2-A4015
		2.2 kW	3G3RX2-A4022
		3.7 kW	3G3RX2-A4037
		5.5 kW	3G3RX2-A4055
		7.5 kW	3G3RX2-A4075
		11 kW	3G3RX2-A4110
		15 kW	3G3RX2-A4150
		18.5 kW	3G3RX2-A4185
		22 kW	3G3RX2-A4220
		30 kW	3G3RX2-A4300
		37 kW	3G3RX2-A4370
		45 kW	3G3RX2-A4450
		55 kW	3G3RX2-A4550
	IP00	75 kW	3G3RX2-B4750
		90 kW	3G3RX2-B4900
		110 kW	3G3RX2-B411K
		132 kW	3G3RX2-B413K

Model Criteria

3G3RX2-A2055

Max. Applicable Motor Capacity Standard Rating (normal duty rating [ND])

004	0.4 kW
007	0.75 kW
015	1.5 kW
022	2.2 kW
037	3.7 kW
055	5.5 kW
075	7.5 kW
110	11 kW
150	15 kW
185	18.5 kW
220	22 kW
300	30 kW
370	37 kW
450	45 kW
550	55 kW
750	75 kW
900	90 kW
11K	110 kW
13K	132 kW

Voltage class

2	3-phase 200 VAC (200-V class)
4	3-phase 400 VAC (400-V class)

Enclosure rating

A	IP20/UL open type
B	IP00/UL open type

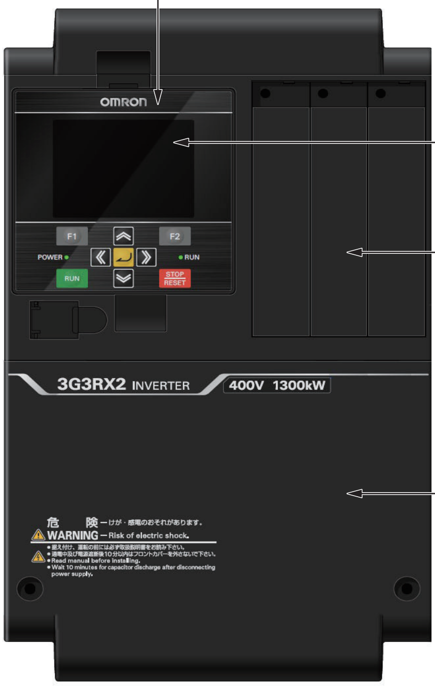
1-1-3 Compliance with International Standards

Because the 3G3RX2 Series complies as standard with the international IEC standard, the series conform to any standard for any nations including European nations.

		Applicable standard
CE	EMC	EN 61800-3:2004+A1:2012
	Machinery	IEC61800-5-1/A1:2016 IEC61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe
UL	US	UL61800-5-1
	CA	CSA C22.2 No. 274
	FS	IEC61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe
KC		KN61800-3
EAC		-
RCM		EN 61800-3:2004+A1:2012

1-2 Appearance and Part Names

The following shows the front view when the product is unpacked (an example of 3G3RX2-A2055/A2075/A2110/A4055/A4075/A4110).



LCD operator

Use this to set parameters, view various monitor data, run/stop the inverter, etc.

Data display

This displays the frequency reference value, output frequency, parameter set value, or other relevant data.

Option Unit Connection Cover

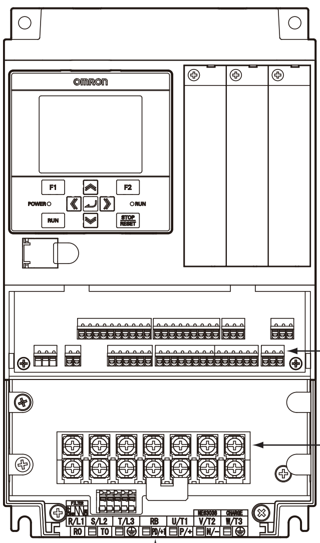
Remove this to mount option boards.

Terminal Block Cover

Remove this when connecting cables to each terminal block.

Open the terminal block cover to wire the main circuit terminal block and the control circuit terminal block.

Moreover, you can open the Option Unit Connection Cover to mount option boards.



Control Circuit Terminal Block

Use this to connect various digital/analog I/O signals for inverter control.

Main circuit terminal block

Use this to connect the inverter main power supply, motor, braking resistor, and other devices.

Backing plate

Cut off the cutout portions of this plate to connect power supply lines, signal lines, etc.

1-3 Specifications

1-3-1 Standard Specifications

Refer to *Derating of Rated Output Current* on page 2-10.

Common Specifications

Control mode (output to the motor)	Sine wave PWM control voltage output (line sine wave modulation)	
Output frequency range *1	0.00 to 590.00Hz	
Frequency accuracy	Digital command ±0.01% and analog command ±0.2% (25°C±10°C) against the maximum frequency	
Frequency resolution	Digital setting: 0.01Hz Analog setting: maximum frequency/4000 (Ai1 terminal/Ai2 terminal: 12bit/0 to +10V or 0 to +20mA, Ai3 terminal 12bit/-10 to +10V)	
Control mode (frequency/voltage calculation) *2	IM	V/f control (fixed torque/reduced torque/free), automatic boost control, cascade model sensorless vector control, 0 Hz range sensorless vector control, vector control with sensor.
	SM/PMM	Synchronous starting sensorless vector control, IVMS starting smart sensorless vector control
Speed fluctuation *3	±0.5% (during sensorless vector control)	
Acceleration or deceleration time	0.00 to 3600.00sec (linear, S-shaped, U-shaped, reverse U-shaped, EL-S shaped)	
Display monitor	Output frequency, output current, output torque, trip history, I/O terminal status, I/O power *4, P-N voltage.	
Starting functions	Start after DC braking, frequency collection start, frequency entrainment start, reduced voltage start, retry start	
Stopping functions	Free-run stop, DC braking after deceleration stop or terminal DC braking (braking power, operating speed adjustment)	
Stall prevention function	Overload restraining function, overcurrent suppression function, overvoltage suppression function	
Protective function *5	Overcurrent error, Motor overload error, Braking resister Overload error, Overvoltage error, Memory error, Undervoltage error, Current detector error, CPU error, External trip error, USP error, Ground fault error, Incoming over voltage error, Instantaneous power failure error, Temperature detector error, Cooling fan rotation speed reduction temperature error, Temperature error, Input open-phase error, IGBT error, Output open-phase error, Thermistor error, Brake error, Low-speed range overload error, Controller overload error, RS485 communication error, Operator keypad disconnection error.	
Other functions	V/f free settings (7 points), Upper/lower limit frequency limiter, Frequency jump, Curve acceleration/deceleration, Manual torque boost, Energy-saving operation, Analog output adjustment function, Minimum frequency, Carrier frequency adjustment, Motor electronic thermal function (free setting is also possible), Inverter electronic thermal function, External start/end (volume/ratio), Frequency input selection, Trip retry, Restart after instantaneous stop, Output of signals, Initialization settings, PID control, Automatic deceleration at power shut-off, Brake control function, and Auto-tuning for commercial switching function (online/offline).	

Input	Frequency setting	Standard operator keypad	Parameter setting using arrow keys	
		External signals *6	Ai1/Ai2 terminal (when changing voltage)	Setting through input of 0 to 10VDC voltage (input impedance: 10kΩ)
			Ai1/Ai2 terminal (when changing current)	Setting through input of 0 to 20mA current (input impedance: 100Ω)
			Ai3 terminal	Setting through input of -10 to +10V voltage (input impedance: 10kΩ)
			Multistage speed terminal (use of input terminal function)	15 speed
			Pulse string input (A/B terminal, use of input terminal function)	32kHz×2 at maximum
		External port	Setting via RS485 serial communication (protocol: Modbus-RTU)	
	Normal rotation/ reverse rotation Run/stop	Standard operator keypad	Execution with the RUN /STOP key (normal rotation/reverse rotation can be switched by setting parameters)	
		External signals	Normal rotation operation (FW)/reverse rotation (RV) (when an input terminal function is assigned) 3-wire input available (when an input terminal function is assigned)	
		External port	Setting via RS485 serial communication (protocol: Modbus-RTU (maximum: 115.2kbps)	
	Input terminal function		11 terminals (input of pulse string is available on terminal A and B)	
			FW (Normal rotation)/RV (Reverse rotation), CF1-4 (Multistage speed 1-4), SF1-7 (Multistage speed bit 1-7), ADD (Addition of frequency), SCHG (Switching of frequency command), STA (3-wire start)/STP (3-wire stop)/F_R (3-wire normal/reverse), AHD (Retention of analog command), FUP (Increase of speed via remote operation/FDN (Deceleration via remote operation), UDC (Deletion of data via remote operation), F-OP (Forced command switching), SET (Second control), RS (Reset), JG (Jogging), DB (External current braking), 2CH (2-stage acceleration/deceleration), FRS (Free-run stop), EXT (External abnormality), USP (Prevention of restart after restoration of power), CS (Commercial switching), SFT (Soft-lock), BOK (Brake check), OLR (Overload restriction switching), KHC (Clearance of integrated input power), OKHC (Clearance of integrated output power), PID (PID1 disabled), PIDC (PID1 integration reset), PID2 (PID2 disabled), PIDC2 (PID2 integration reset), SVC1-4 (PID1 multistage target values 1-4), PRO (PID gain switching), PIO (PID output switching), SLEP (SLEEP condition satisfied)/WAKE (WAKE condition satisfied), TL (Torque restriction enabled), TRQ1, 2 (Switching of torque limit 1,2), PPI (Switching of P/PI control), CAS (Switching of control gain), FOC (Preparatory excitation), ATR (Torque control enabled), TBS (Torque bias enabled), LAC (Cancellation of acceleration/deceleration), Mi1-11 (General-purpose input 1-11), PCC (Clearance of pulse counter), ECOM (Start of EzCOM), PRG (Program run), HLD (Acceleration/deceleration stop), REN (Operation permission signal), PLA (Pulse string input A), and PLB (Pulse string input B)	
	Backup power supply terminal		P+/P-: DC24V input (allowable input voltage: 24V±10%)	
	STO input terminal		2 terminals (simultaneous input)	
	Thermistor input terminal		1 terminal (possible to switch between positive temperature coefficient/negative temperature coefficient resistance element)	
Output	Output terminal function		Transistor output 5 terminal, 1a contact relay 1 point, 1c contact relay 1 point	
	Relay and alarm relay (16, AL)		RUN (During operation), FA1-5 (Reached signal), IRDY (Operation ready completion), FWR (During normal rotation operation), RVR (During reverse rotation operation), FREF (Frequency command operator keypad), REF (Operation command operator keypad), SETM (Second control under selection), AL (Alarm signal), MJA (Severe failure signal), OTQ (Over torque) *7, IP (During instantaneous power failure), UV (Under insufficient voltage), TRQ (During torque limitation), IPS (During power failure deceleration), RNT (RUN time over), ONT (Power on time over), THM (Electronic thermal warning), THC (Electronic thermal warning), WAC (Capacitor life advance notice), WAF (Fan life advance notice), FR (Operation command signal), OHF (Cooling fin heating advance notice), LOC/LOC2 (Low-current signal), OL/OL2 (Overload advance notice), BRK (Brake release), BER (Brake abnormality), ZS (Zero-speed detection signal), OD/OD2 (PID deviation excessive), FBV/FBV2 (PID feedback comparison), NDc (Communication disconnection), Ai1Dc/Ai2Dc/Ai3Dc (Analog disconnection Ai1/Ai2/Ai3), WCAi1/WCAi2/WCAi3 (Window comparator Ai1/Ai2/Ai3), LOG1-7 (Logical operation result 1-7), MO1-7 (General output 1-7), and OVS (Receiving overvoltage).	
	EDM output terminal		Output for STO diagnosis	
	Monitor output terminal *8		Possible to output through selection from monitor data of parameters	
EMC filter switching *9			Possible to enable the EMC noise filter (switching method is different depending on the model)	
External access to PC			USB Micro-B	
Use environment	Ambient temperature *10		ND (normal duty)	-10 to 50°C
			LD (low duty)	-10 to 45°C
			VLD (very low duty)	-10 to 40°C
	Storage temperature *11		-20 to 65°C	
	Humidity		20-90%RH (location free of condensation)	
	Vibration *12		5.9m/s^2 (0.6G) 10 to 55Hz: 3G3RX2-A2004 to A2220/3G3RX2-A4007 to A4220 2.94m/s^2 (0.3G) 10 to 55Hz: 3G3RX2-A2300 to A2550/3G3RX2-A4300 to A413K	
	Use location *13		1000 m altitude or lower (location free from corrosive gas, oil mist, and dust)	
Expected Life time			Smoothing capacitor 10 years	
			Designed life of cooling fan 10 years (models equipped with a cooling fan) free from dust	
			Memory element on the control circuit board	
Applicable standards *14			Compliance with UL/cUL/CE standards, RCM, Functional Safety SIL3/PLe	
Painting color			Black	
Operating, display			LCD Operator*15	
Number of option slots			3 ports	
Other options			Braking resistor, AC reactor, DC reactor, noise filter	

*1. The output frequency range depend on the control and motor used. When running the inverter exceeding 60Hz, check the maximum allowable frequency with the manufacturer of the motor.

*2. When the control mode is changed, unless the motor constant is appropriately configured, you cannot obtain the desired starting torque or the inverter may trip.
*3. The variable range of motor speed may vary depending on your system or the environment where the motor is used. Please contact us for details.
*4. Both the input power and output power are reference values, which are not appropriate for use in calculation of efficiency values, etc. To obtain an accurate value, use an external device.
*5. The IGBT error [E030] is generated by the protective function not only for short circuit protection but also when IGBT is damaged. Depending on the operating conditions of the inverter, the overcurrent error [E001] may occur, instead of the IGBT error.
*6. At the factory default setting, when voltage and current on Ai1/Ai2 terminal is changed using a switch, with input of voltage at 9.8V and current at 19.8mA, the maximum frequency is commanded. To change characteristics, make adjustments using the analog start/end function.
*7. The threshold for signal output varies depending on the motor to be combined with the inverter, parameter adjustment, etc.
*8. The output data of analog voltage monitor and analog current monitor are reference values for connecting an analog meter. Due to the meter to be connected and variation in analog output circuit, the maximum output value may slightly vary from 10V or 20mA. To change characteristics, make adjustments using the Ao1 adjustment and Ao2 adjustment functions. Some monitor data cannot be output.
*9. To enable the EMC filter, connect with a power supply grounded at a neutral point. Otherwise, the leakage current may increase.
*10. Use the 400V class inverter at an input voltage of 500VAC or below. If input voltage exceeds 500VAC due to fluctuation of power, use the inverter at 40°C or lower ambient temperature.
*11. The storage temperature is the temperature during transport.
*12. To be in accordance with the testing method specified in JIS C 60068-2-6: 2010 (IEC 60068-2-6:2007)
*13. When the inverter is used in a location at 1000m or higher altitude, air pressure reduces approximately 1% every 100m elevation. Perform 1% current derating and conduct evaluation for every 100m elevation.
*14. For insulation distance, comply with UL and CE standards
*15. When a clock function is used, the optional battery (CR2032, 3V) is required. When you purchase, this LCD operator does not come with the battery.

1-3-2 200V Class Specifications

3G3RX2-A2□□□□□				A2004	A2007	A2015	A2022	A2037	A2055	A2075	A2110	A2150	A2185	A2220	A2300	A2370	A2450	A2550
Applicable motor (4-pole) capacity (kW)			VLD	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
			LD	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75
			ND	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output	Rated output current (A)		VLD	4.4	8.0	10.4	15.6	22.8	33.0	46.0	60.0	80.0	93.0	124	153	185	229	295
			LD	3.7	6.3	9.4	12.0	19.6	30.0	40.0	56.0	73.0	85.0	113	140	169	210	270
			ND	3.2	5.0	8.0	11.0	17.5	25.0	32.0	46.0	64.0	76.0	95.0	122	146	182	220
	Overload current rating		VLD	110% 60sec / 120% 3sec														
			LD	120% 60sec / 150% 3sec														
			ND	150% 60sec / 200% 3sec														
	Rated output voltage			3-phase (3-wire) 200 to 240V (depending on receiving voltage)														
	Rated capacity (kVA)	200V	VLD	1.5	2.8	3.6	5.4	7.9	11.4	15.9	20.8	27.7	32.2	43.0	53.0	64.1	79.3	102.2
			LD	1.3	2.2	3.3	4.2	6.8	10.4	13.9	19.4	25.3	29.4	39.1	48.5	58.5	72.7	93.5
			ND	1.1	1.7	2.8	3.8	6.1	8.7	11.1	15.9	22.2	26.3	32.9	42.3	50.6	63.0	76.2
		240V	VLD	1.8	3.3	4.3	6.5	9.5	13.7	19.1	24.9	33.3	38.7	51.5	63.6	76.9	95.2	122.6
			LD	1.5	2.6	3.9	5.0	8.1	12.5	16.6	23.3	30.3	35.3	47.0	58.2	70.3	87.3	112.2
			ND	1.3	2.1	3.3	4.6	7.3	10.4	13.3	19.1	26.6	31.6	39.5	50.7	60.7	75.7	91.5
Input	Rated input current (A) *1		VLD	5.2	9.5	12.4	18.6	27.1	39.3	54.8	71.4	95.2	110.7	147.6	182.1	220.2	272.6	351.2
			LD	4.4	7.5	11.2	14.3	23.3	35.7	47.6	66.7	86.9	101.2	134.5	166.7	201.2	250.0	321.4
			ND	3.8	6.0	9.5	13.1	20.8	29.8	38.1	54.8	76.2	90.5	113.1	145.2	173.8	216.7	261.9
	Rated input AC voltage			Control power supply: Power supply single phase 200 to 240V/allowable variation range 170 to 264V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz)														
				Main circuit power supply: 3-phase (3-wire) 200 to 240V/allowable variation range 170 to 264V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz)														
	Power supply equipment capacity (kVA) *2		VLD	2.0	3.6	4.7	7.1	10.3	15.0	20.9	27.2	36.3	42.2	56.3	69.4	83.9	103.9	133.8
			LD	1.7	2.9	4.3	5.4	8.9	13.6	18.1	25.4	33.1	38.6	51.3	63.5	76.7	95.3	122.5
			ND	1.5	2.3	3.6	5.0	7.9	11.3	14.5	20.9	29.0	34.5	43.1	55.3	66.2	82.6	99.8
Carrier frequency operating range *3			VLD	0.5 to 10.0kHz														
			LD	0.5 to 12.0kHz														
			ND	0.5 to 16.0kHz														
Motor start torque *4				200%/0.3Hz														
Braking	Regenerative braking			Equipped with BRD circuit (with a discharging resistor separately installed)											Regenerative braking unit separately installed			
	Minimum resistance that can be connected (Ω)			50	50	35	35	35	16	10	10	7.5	7.5	5	---	---	---	---
Dimension	Height (mm)			255	255	255	255	255	260	260	260	390	390	390	540	550	550	700
	Width (mm)			150	150	150	150	150	210	210	210	245	245	245	300	390	390	480
	Depth (mm)			140	140	140	140	140	170	170	170	190	190	190	195	250	250	250
Protective construction				IP20*5 / UL open type														
Approximate mass (kg)				3	3	3	3	3	6	6	6	10	10	10	22	33	33	47

*1. The rated input currents shown in the table are the values when the rated current is output. The values vary depending on impedance on the power supply (wiring, breaker, input reactor option, etc.)

*2. The power supply equipment capacities shown in the table are the values when 220V rated current is output. The values vary depending on impedance on the power supply (wiring, breaker, input reactor option, etc.)

*3. The setting of rated values for carrier frequencies [bb101]/[bb201] are internally limited in accordance with the description. Also, it is recommended to set values equivalent to or above (maximum output frequency for driving ×10) Hz for the setting of carrier frequencies [bb101]/[bb201]. Also, in the case of induction motor (IM) control, for items other than those subject to V/f control, it is recommended to set carrier frequency at 2kHz or more. In the case of synchronous motor (SM)/permanent magnet motor (PMM) control, it is recommended to set carrier frequency at 8kHz or more.

*4. The value of the sensor-less vector control applied to the ND rating in the Standard motor. Torque characteristics may vary depending on the control method and the motor used.

*5. Based on self declaration.

1-3-3 400V Class Specifications

3G3RX2-□□□□□				A4007	A4015	A4022	A4037	A4055	A4075	A4110	A4150	A4185	A4220	A4300	A4370	A4450	A4550	B4750	B4900	B411K	B413K
Applicable motor (4-pole) capacity (kW)			VLD	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160
			LD	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160
			ND	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132
Output	Rated output current (A)		VLD	4.1	5.4	8.3	12.6	17.5	25.0	31.0	40.0	47.0	62.0	77.0	93.0	116	147	176	213	252	316
			LD	3.1	4.8	6.7	11.1	16.0	22.0	29.0	37.0	43.0	57.0	70.0	85.0	105	135	160	195	230	290
			ND	2.5	4.0	5.5	9.2	14.8	19.0	25.0	32.0	39.0	48.0	61.0	75.0	91.0	112	150	180	217	260
	Overload current rating		VLD	110% 60sec / 120% 3sec																	
			LD	120% 60sec / 150% 3sec																	
			ND	150% 60sec / 200% 3sec																	
	Rated output voltage			3-phase (3-wire) 380 to 500V (depending on receiving voltage)																	
	Rated capacity (kVA)	400V	VLD	2.8	3.7	5.8	8.7	12.1	17.3	21.5	27.7	32.6	43.0	53.3	64.4	80.4	101.8	121.9	147.6	174.6	218.9
			LD	2.1	3.3	4.6	7.7	11.1	15.2	20.1	25.6	29.8	39.5	48.5	58.9	72.7	93.5	110.9	135.1	159.3	200.9
			ND	1.7	2.8	3.8	6.4	10.3	13.2	17.3	22.2	27.0	33.3	42.3	52.0	63.0	77.6	103.9	124.7	150.3	180.1
		500V	VLD	3.6	4.7	7.2	10.9	15.2	21.7	26.8	34.6	40.7	53.7	66.7	80.5	100.5	127.3	152.4	184.5	218.2	273.7
			LD	2.7	4.2	5.8	9.6	13.9	19.1	25.1	32.0	37.2	49.4	60.6	73.6	90.9	116.9	138.6	168.9	199.2	251.1
			ND	2.2	3.5	4.8	8.0	12.8	16.5	21.7	27.7	33.8	41.6	52.8	65.0	78.8	97.0	129.9	155.9	187.9	225.2
Input	Rated input current (A) *1		VLD	4.9	6.4	9.9	15.0	20.8	29.8	36.9	47.6	56.0	73.8	91.7	110.7	138.1	175.0	209.5	253.6	300.0	376.2
			LD	3.7	5.7	8.0	13.2	19.0	26.2	34.5	44.0	51.2	67.9	83.3	101.2	125.0	160.7	190.5	232.1	273.8	345.2
			ND	3.0	4.8	6.5	11.0	17.6	22.6	29.8	38.1	46.4	57.1	72.6	89.3	108.3	133.3	178.6	214.3	258.3	309.5
	Rated input AC voltage			Control power supply: Power supply single phase 380 to 500V (allowable variation range 323 to 550V), 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz)																	
				Main circuit power supply: 3-phase (3-wire) 380 to 500V (allowable variation range) 323 to 550V, 50Hz (allowable variation range: 47.5 to 52.5Hz)/60Hz (allowable variation range: 57 to 63Hz)																	
	Power supply equipment capacity (kVA) *2		VLD	3.7	4.9	7.5	11.4	15.9	22.7	28.1	36.3	42.6	56.3	69.9	84.4	105.2	133.4	159.7	193.2	228.6	286.7
			LD	2.8	4.4	6.1	10.1	14.5	20.0	26.3	33.6	39.0	51.7	63.5	77.1	95.3	122.5	145.2	176.9	208.7	263.1
			ND	2.3	3.6	5.0	8.3	13.4	17.2	22.7	29.0	35.4	43.5	55.3	68.0	82.6	101.6	136.1	163.3	196.9	235.9
Carrier frequency range *3			VLD	0.5 to 10.0kHz														0.5 to 8.0kHz			
			LD	0.5 to 12.0kHz														0.5 to 8.0kHz			
			ND	0.5 to 16.0kHz														0.5 to 10.0kHz			
Motor start torque *4				200%/0.3Hz														180%/0.3Hz			
Braking	Regenerative braking			Equipped with braking resistance circuit (with a discharging resistor separately installed)												Regenerative braking unit separately installed					
	Minimum resistance that can be connected (Ω)			100	100	100	70	70	35	35	24	24	20	15	15	-	-	-	-	-	-
Dimension	Height (mm)			255	255	255	255	260	260	260	390	390	390	540	550	550	550	700	700	740	740
	Width (mm)			150	150	150	150	210	210	210	245	245	245	300	390	390	390	390	390	480	480
	Depth (mm)			140	140	140	140	170	170	170	190	190	190	195	250	250	250	270	270	270	270
Protective construction				IP20*5 / UL open type														IP00 / UL open type			
Approximate mass (kg)				3	3	3	3	6	6	6	8.5	8.5	8.5	22	31	31	31	41	41	53	53

*1. The rated input currents shown in the table are the values when the rated current is output. The values vary depending on impedance on the power supply (wiring, breaker, input reactor option, etc.)

*2. The power supply equipment capacities shown in the table are the values when 220V rated current is output. The values vary depending on impedance on the power supply (wiring, breaker, input reactor option, etc.)

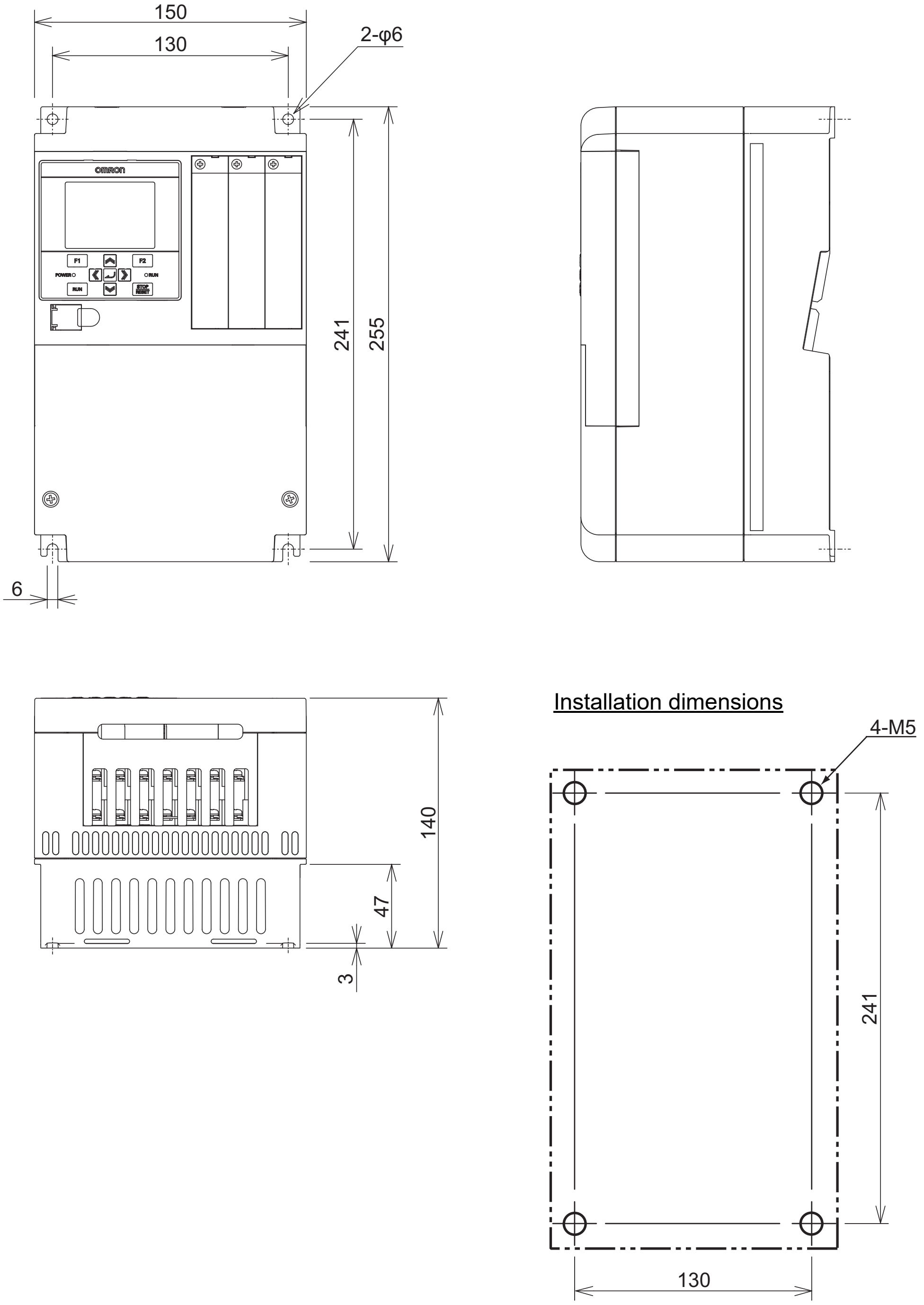
*3. The setting of rated values for carrier frequencies [bb101]/[bb201] are internally limited in accordance with the description. Also, it is recommended to set values equivalent to or above (maximum output frequency for driving ×10) Hz for the setting of carrier frequencies [bb101]/[bb201]. Also, in the case of induction motor (IM) control, for items other than those subject to V/f control, it is recommended to set carrier frequency at 2kHz or more. In the case of synchronous motor (SM)/permanent magnet motor (PMM) control, it is recommended to set carrier frequency at 8kHz or more.

*4. The value of the sensor-less vector control applied to the ND rating in the Standard motor. Torque characteristics may vary depending on the control method and the motor used.

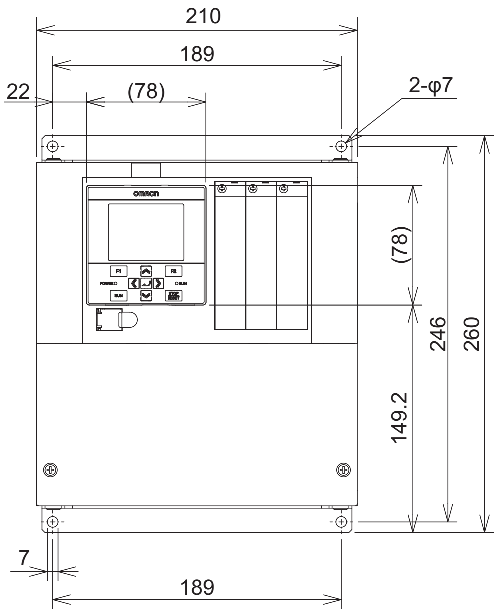
*5. Based on self declaration.

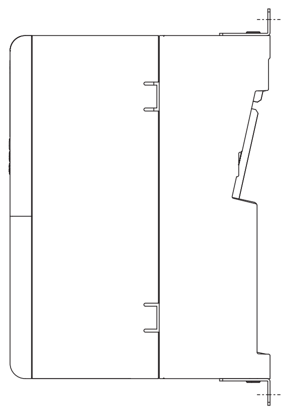
1-3-4 External Dimensions

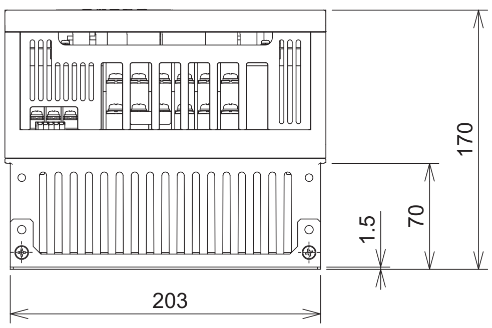
- **3G3RX2-A2004/A2007/A2015/A2022/A2037/A4007/A4015/A4022/A4037**



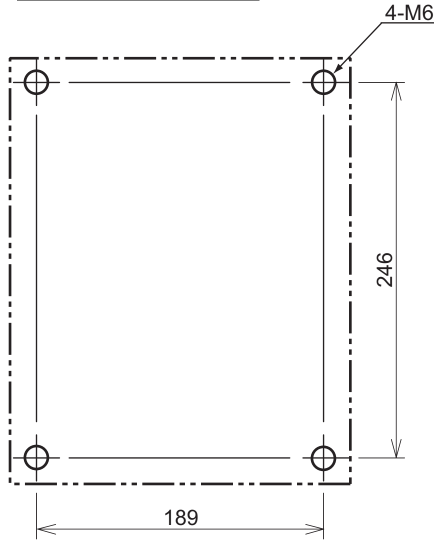
- **3G3RX2-A2055/A2075/A2110/A4055/A4075/A4110**







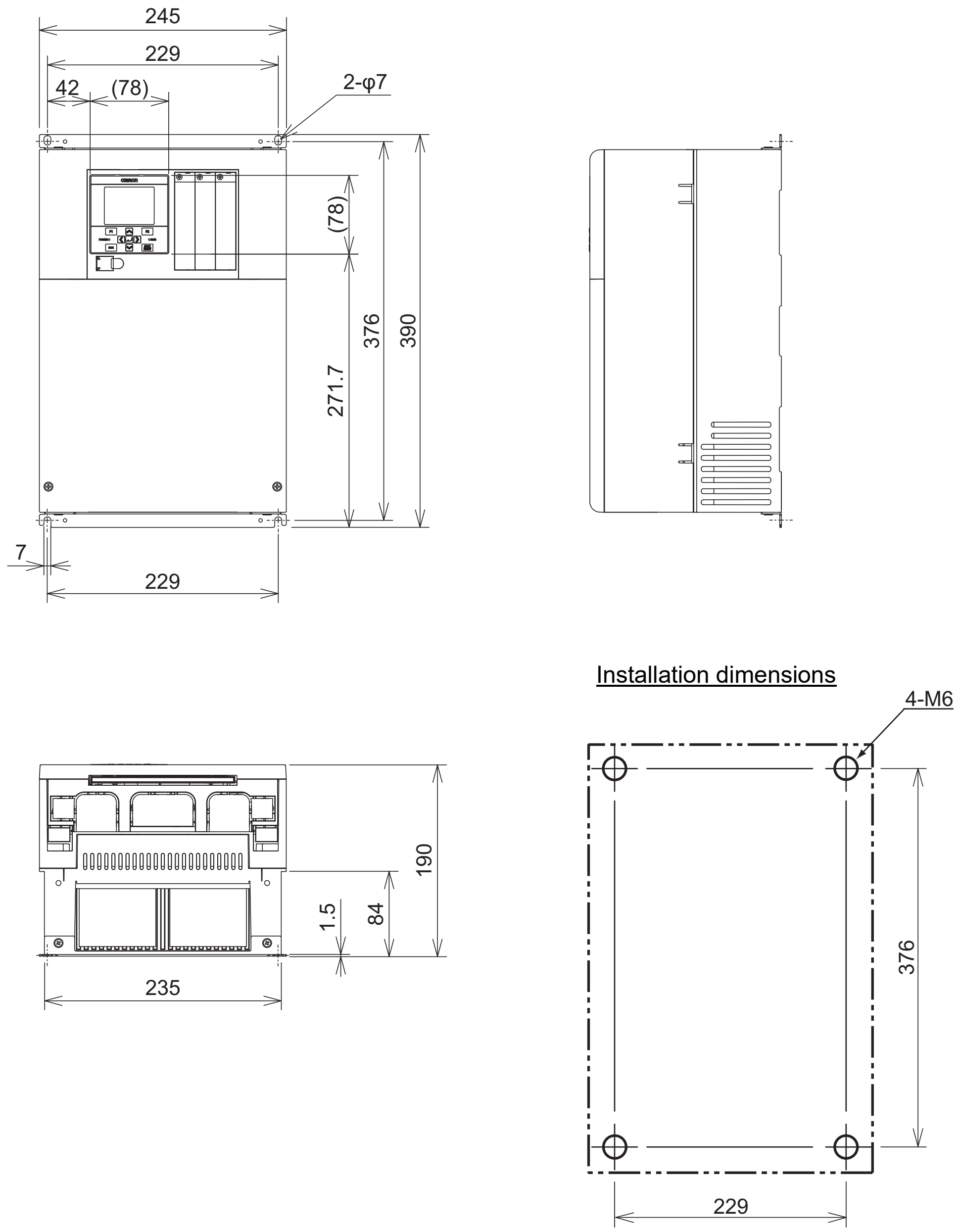
Installation dimensions



Precautions for Correct Use

In case you operate 3G3RX2-A2110 at **Low Duty (LD)** or **Very Low Duty (VLD)**, the inverter is subject to the restriction of installing method. As for the details, refer to *2-1-2 Precaution for Installation* on page 2-4.

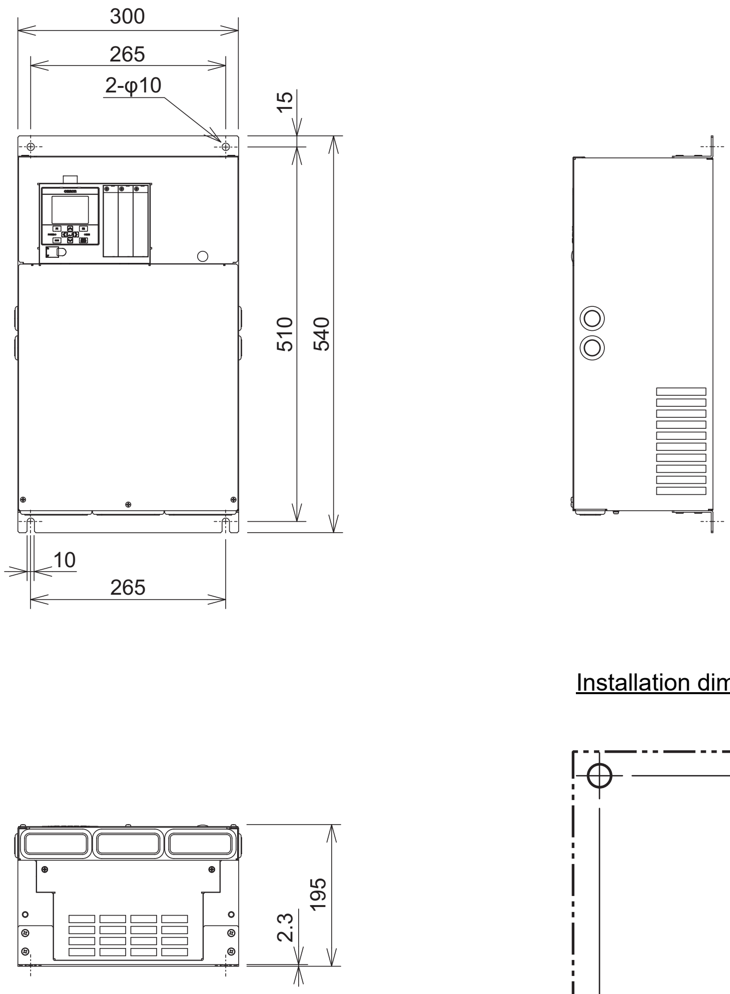
- **3G3RX2-A2150/A2185/A2220/A4150/A4185/A4220**



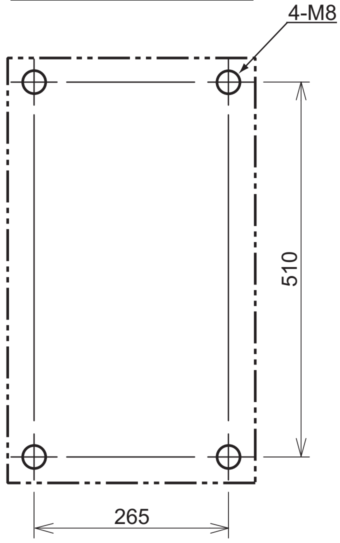
Precautions for Correct Use

In case you operate 3G3RX2-A2220 at **Very Low Duty (VLD)**, the inverter is subject to the restriction of installing method. As for the details, refer to *2-1-2 Precaution for Installation* on page 2-4.

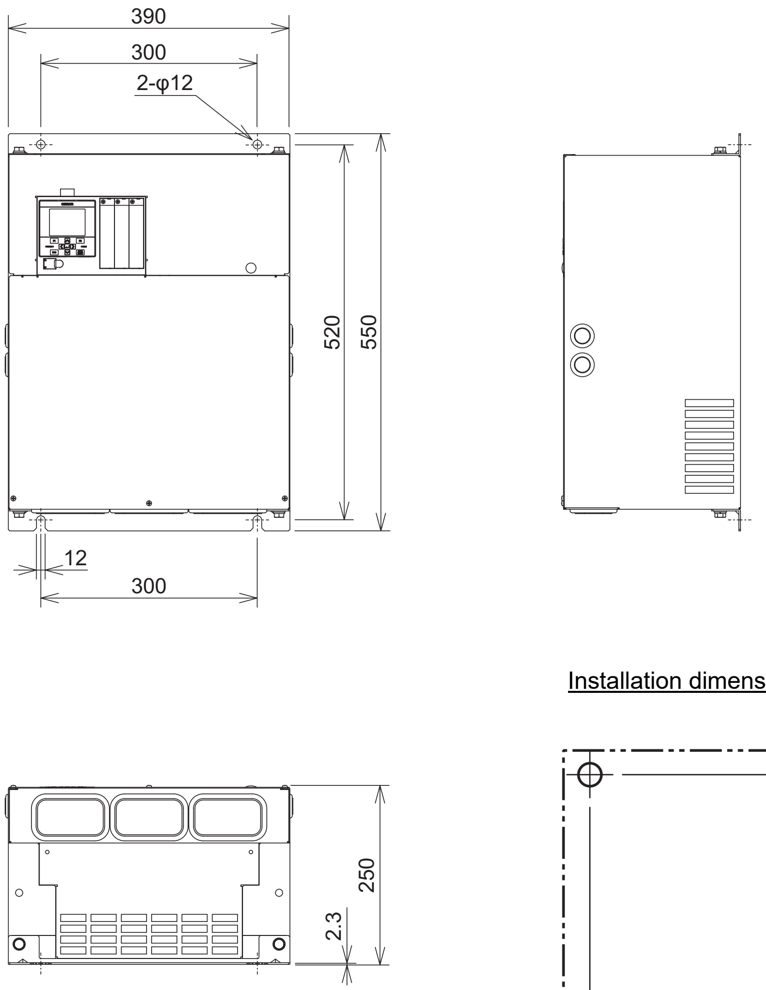
- **3G3RX2-A2300/A4300**



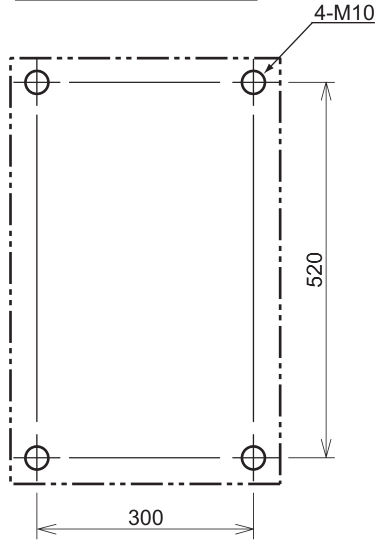
Installation dimensions



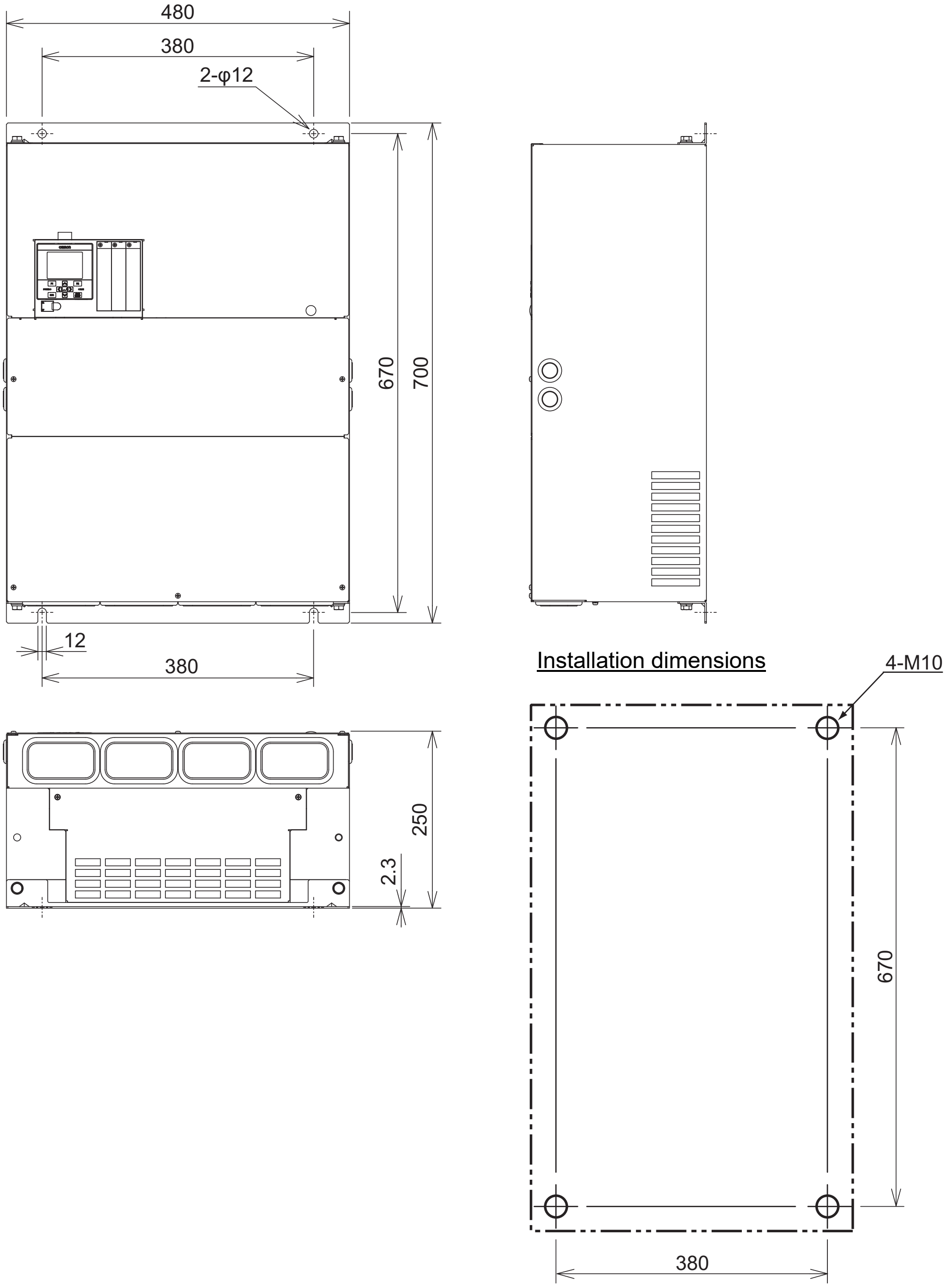
- **3G3RX2-A2370/A2450/A4370/A4450/A4550**



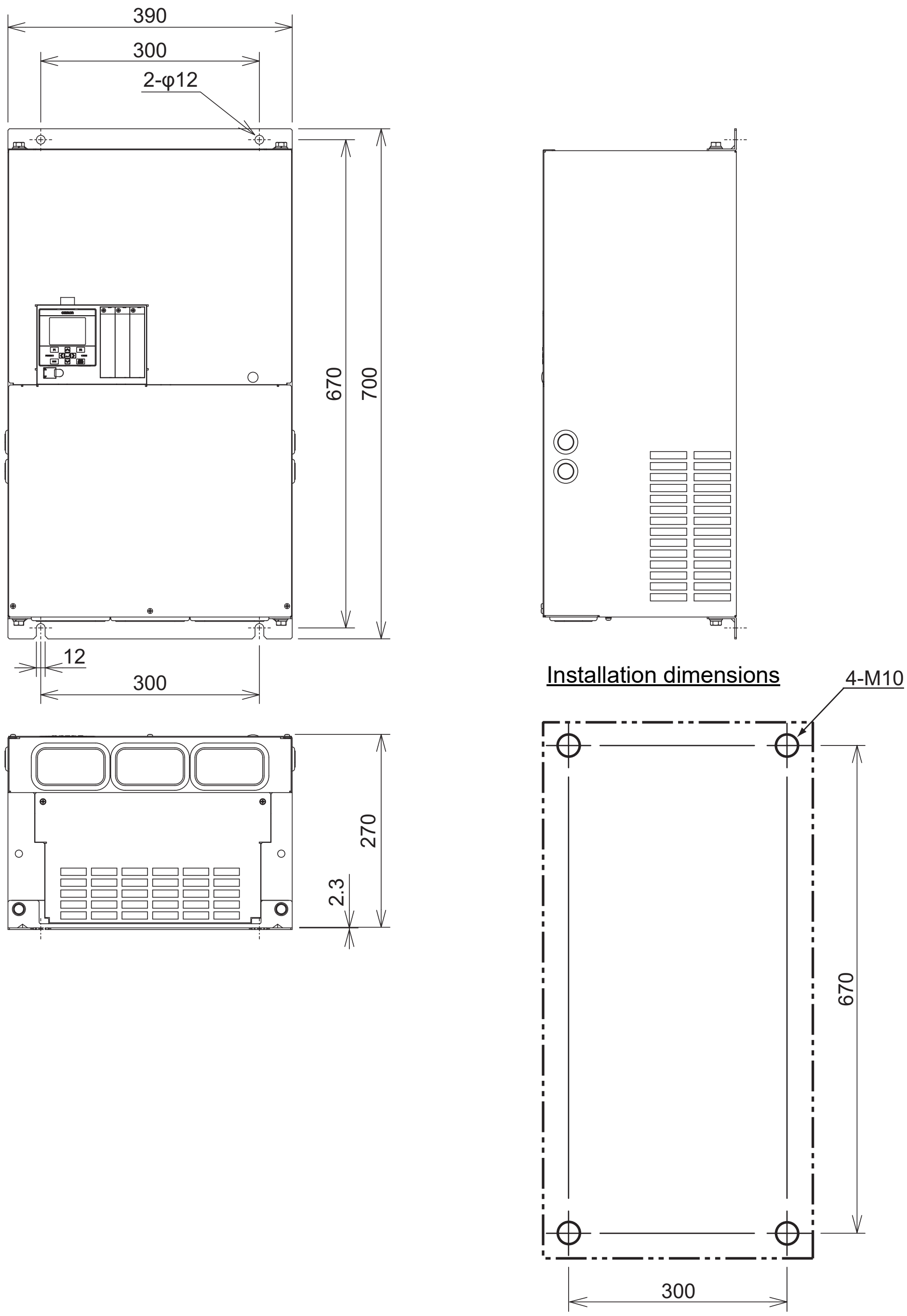
Installation dimensions



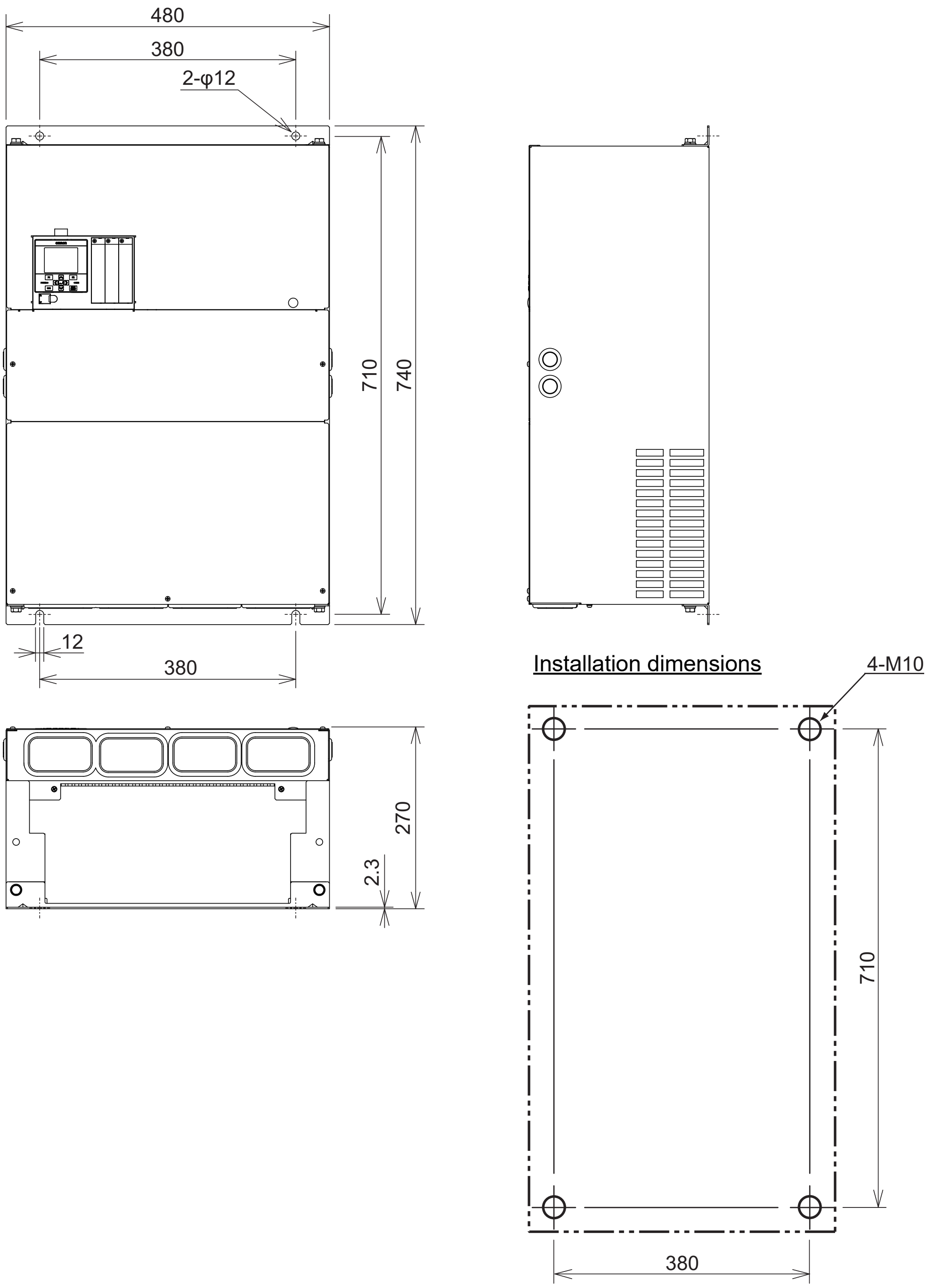
- **3G3RX2-A2550**



- **3G3RX2-B4750/B4900**



● **3G3RX2-B411K/B413K**



1-4 Restrictions

Limitation on 0-Hz Sensorless Vector Control

When 0-Hz sensorless vector control is used, a large current flows at low frequencies. To protect the inverter against overload, select and use an inverter whose rated capacity is one size larger than the rated capacity of the motor.

2

Design

This section describes the installation and wiring methods.

WARNING

Turn off the power supply and implement wiring correctly. Not doing so may result in a serious injury due to an electric shock.	
Wiring work must be carried out only by qualified personnel. Not doing so may result in a serious injury due to an electric shock.	
Do not change wiring and slide switches (SW1 to SW6), put on or take off Operator and optional devices, replace cooling fans while the input power is being supplied. Doing so may result in a serious injury due to an electric shock.	
Be sure to ground the unit. Not doing so may result in a serious injury due to an electric shock or fire. (200-V class: type-D grounding, 400-V class: type-C grounding)	

Caution

Do not connect resistors to the terminals (PD/+1, P/+, N/-) directly. Doing so might result in a small-scale fire, heat generation, or damage to the unit.	
Install a stop motion device to ensure safety. Not doing so may result in a minor injury. (A holding brake is not a stop motion device designed to ensure safety.)	
Be sure to use a specified type of braking resistor and regenerative braking unit. In case of using a braking resistor, install a thermal relay that monitors the temperature of the resistor. Not doing so may result in a moderate burn due to the heat generated in the braking resistor/regenerative braking unit. Configure a sequence that enables the inverter power to turn off when unusual overheating is detected in the braking resistor and regenerative braking unit.	
The inverter has high voltage parts inside which, if short-circuited, might cause damage to itself or other property. Place covers on the openings or take other precautions to make sure that no metal objects such as cutting bits or lead wire scraps go inside when installing and wiring.	
Setting wrong parameter at startup, adjustment, maintenance and exchange may result in severe damage. Operate the device after sufficient checking.	

Safety Information

Installation and Storage

Do not store or use the product in the following places.

- Locations subject to direct sunlight.
- Locations subject to ambient temperature exceeding the specifications.
- Locations subject to relative humidity exceeding the specifications.
- Locations subject to condensation due to severe temperature fluctuations.
- Locations subject to corrosive or flammable gases.
- Locations subject to exposure to combustibles.
- Locations subject to dust (especially iron dust) or salts.
- Locations subject to exposure to water, oil, or chemicals.
- Locations subject to shock or vibration.

Transportation, Installation, and Wiring

- Do not drop or apply strong impact on the product. Doing so may result in damaged parts or malfunction.
- Do not hold by the front cover and terminal cover, but hold by the fins during transportation.
- Confirm that the rated input power voltage of the inverter is the same as AC power supply voltage.
- Do not connect an AC power supply voltage to the control input/output terminals. Doing so may result in damage to the product.
- Be sure to tighten the screws on the terminal block securely. Wiring work must be done after installing the unit body.
- Do not connect any load other than a three-phase inductive motor to the U, V, and W output terminals.
- Take sufficient shielding measures when using the product in the following locations. Not doing so may result in damage to the product.

  Locations subject to static electricity or other forms of noise

  Locations subject to strong magnetic fields

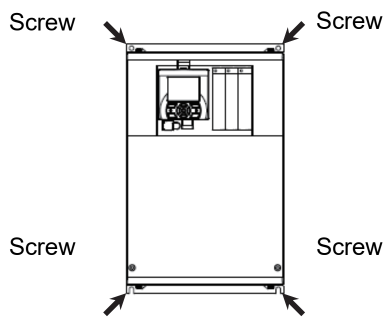
  Locations close to power lines
- When using the DriveProgramming, confirm that the program data is downloaded normally before starting operation.

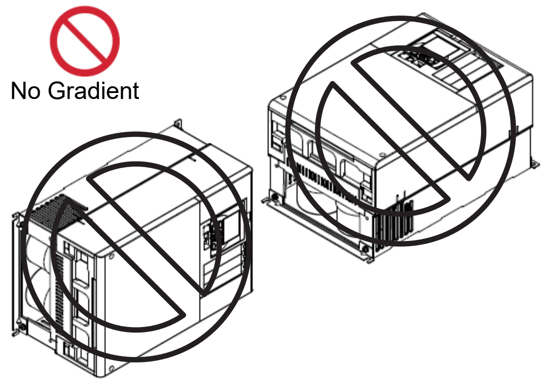
2-1 Installation

2-1-1 Inverter Installation

Mount the 3G3RX2 Series Inverter vertically on a wall withstanding the weight and vibration with screws.

Not installing the product vertically on the wall may cause loosing cooling capacity and cause trips and damages.





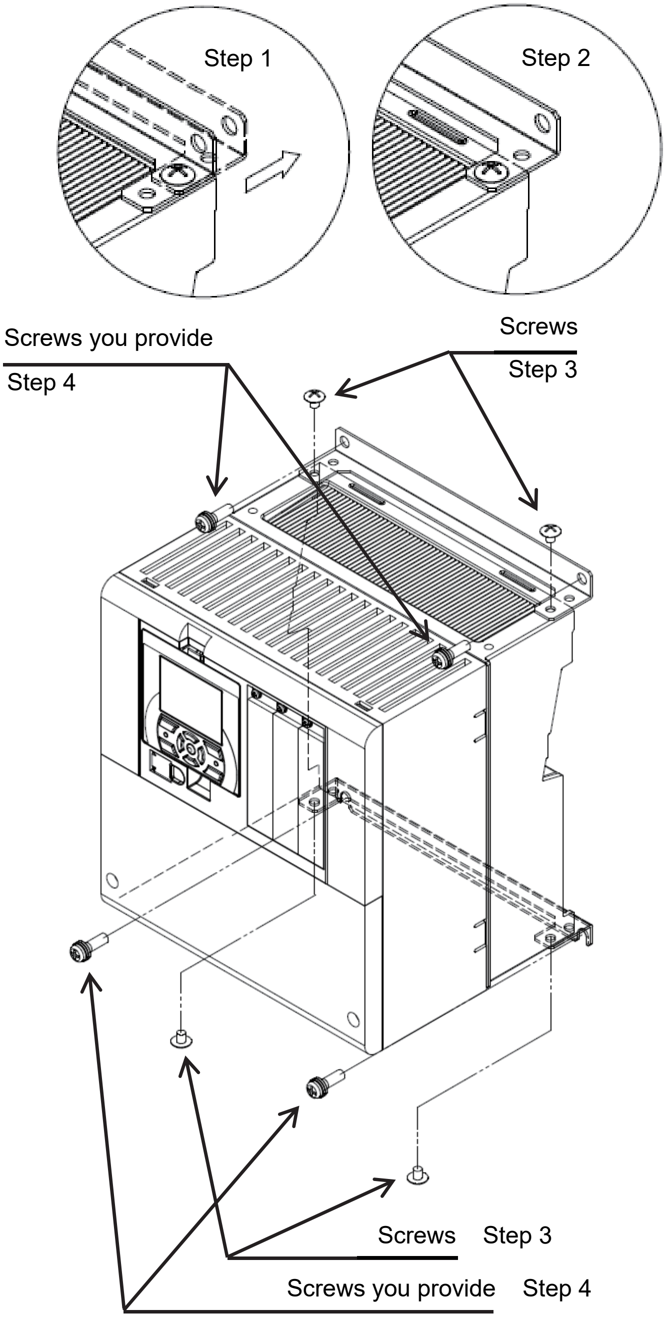
For the mounting dimensions, refer to *1-3-4 External Dimensions* on page 1-13.

2-1-2 Precaution for Installation

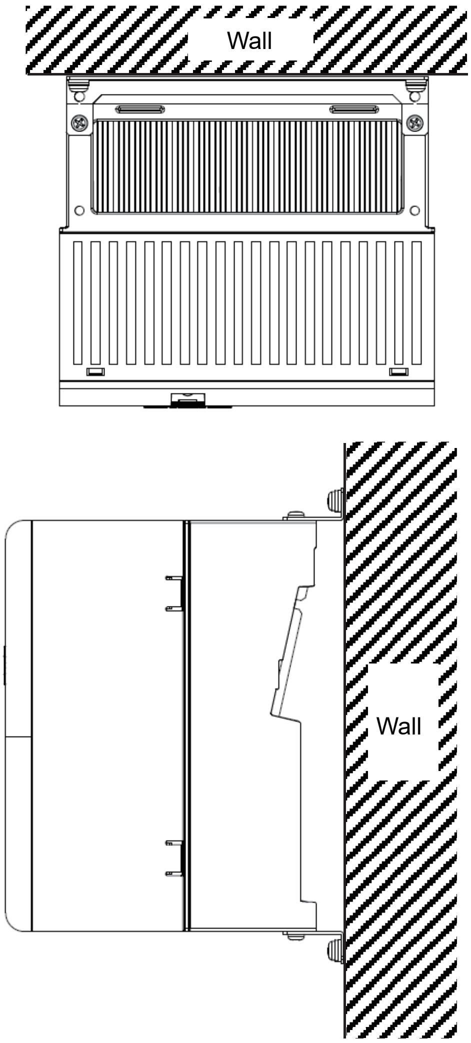
When you use 3G3RX2-A2110 at Low Duty (LD) / Very Low Duty (VLD) or 3G3RX2-A2220 at Very Low Duty (VLD), you must attach the main body on the wall in a special way as shown the instruction below.

Mounting of 3G3RX2-A2110:

1. Unscrew the four screws temporarily fixing the mounting fittings (top and bottom) as factory shipping
2. Pull and slide the fittings (top and bottom) to match the next hole on the fittings to the screw holes on the main body.
3. Fix the fittings on the main body by the four screws you removed at step 1. (Torque: 2.2 to 2.5 N·m)
4. Fix the main body on the wall with four other screws you provide.



Mounting method



Right side view

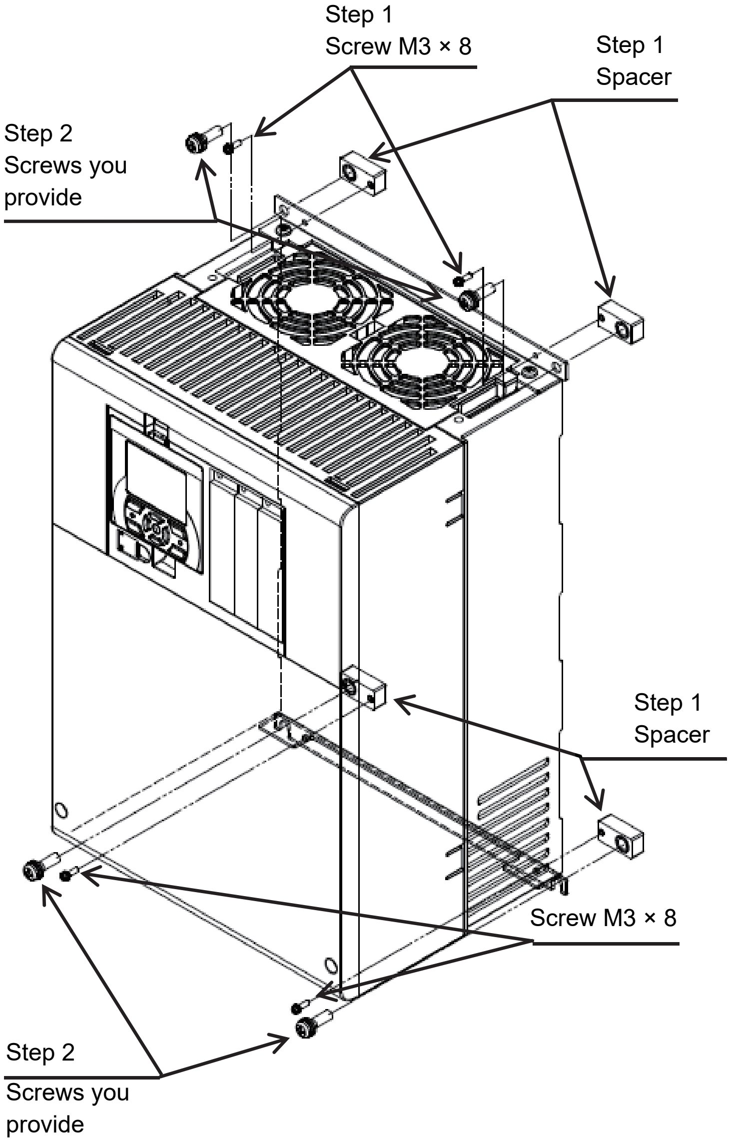
Precautions for Correct Use

Set [Ub-03]=00(VLD) or [Ub-03]=01(LD) for Light Duty or Very Light Duty respectively.

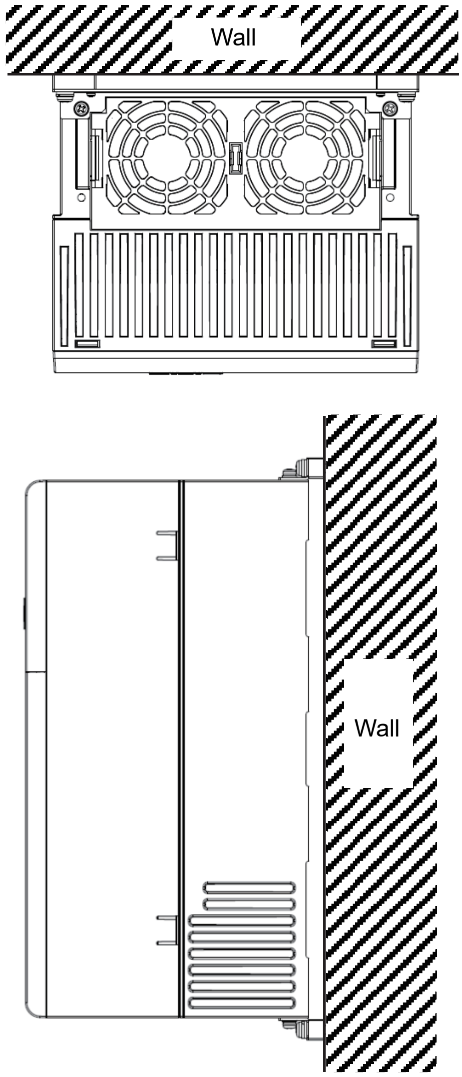
Mounting of 3G3RX2-A2220:

1 Fix the four spacers to the main body at the fittings both on the top and bottom using four M3×8 screws included in the pack (Torque: 0.6 to 0.8 N·m).

2 Fix the main body on the wall with four other screws you provide.



Mounting method



Right side view

Precautions for Correct Use

Set [Ub-03]=00 for Very Light Duty (VLD)

2-1-3 Installation Environment

Operating Environment Conditions

Install the inverter in a location that meets the following conditions.

Rating	Operating ambient temperature*1	Operating ambient humidity
ND (Normal Duty)	- 10 to 50°C	20% to 90% (with no condensation)
LD (Light Duty)	- 10 to 45°C	20% to 90% (with no condensation)
VLD (Very Light Duty)	- 10 to 40°C	20% to 90% (with no condensation)

*1. The operation of 1,400V-class inverter is only allowed at input voltage below 500 VAC. In case the voltage exceeds 500 VAC by power supply fluctuation, operate the inverter below 40°C in ambient temperature.

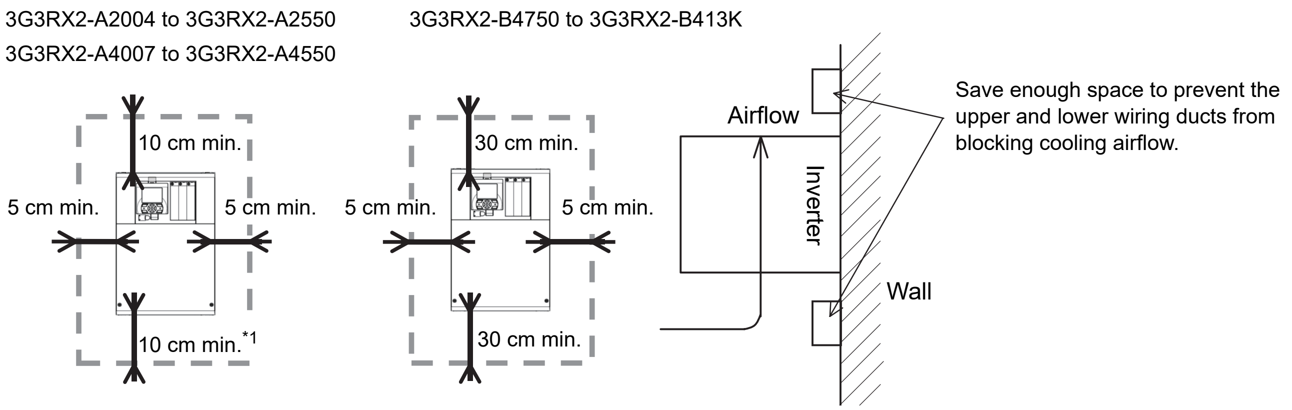
Installation Conditions

Inverters might be heated up to 150°C and might cause fire accident. Install the inverter on the non-flammable vertical wall (made of metals and others).

Keep the inverter clear of heating elements such as a braking resistor or reactor so that the heat emitted does not influence the operation.

If the inverter is installed in a control panel, take into consideration dimensions and ventilation to keep the ambient temperature within the range of the specifications.

To allow heat radiation from inside the inverter, provide the clearance specified in the figure below. Do not install more than one inverter side by side without clearance.



*1. Save the space for maintenance in the following sites at 22 cm or more. After that, install the inverter.

- 3G3RX2-A2150 to 3G3RX2-A2220
- 3G3RX2-A4150 to 3G3RX2-A4220

The inverter is needed to be taken off when consumable components are replaced on the following models.

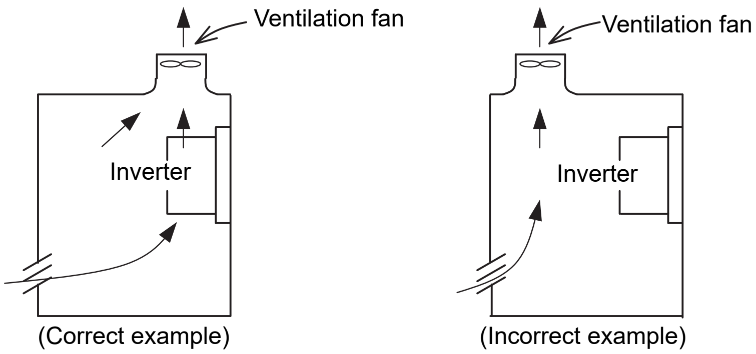
- 3G3RX2-A2055 to 3G3RX2-A2110
- 3G3RX2-A4055 to 3G3RX2-A4110

Ambient Temperature Control

To ensure reliable operation, use the inverter in an environment subject to minimal temperature rise as much as possible.

When mounting multiple inverters in an enclosure with a ventilation fan, carefully design the layout of the ventilation fan, air intake port, and inverters.

An inappropriate layout will reduce the inverter-cooling effect and raise the ambient temperature. Plan the layout so that the inverter ambient temperature will remain within the allowable range. A ventilation fan located directly above the inverter could drop dust on it. To prevent this, move the inverter horizontally to a suitable position.



Position of ventilation fan

Entry of Foreign Objects during Installation

Place a cover over the inverter or take other preventative measures to prevent foreign objects, such as drill filings, from entering the inverter during installation.

Be sure to remove the cover after installation is completed. Using the inverter with the cover placed results in poor ventilation, which causes the inverter to overheat.

Loss according to the Inverter Capacity

For the calculation of heat radiation from a cabinet, the following table shows the amount of heat generation (loss) according to the inverter capacity.

Voltage	Loss at 100% load (W)					
	200V			400V		
	ND	LD	VLD	ND	LD	VLD
0.4	50	53	65			
0.75	65	80	105	62	67	76
1.5	93	118	135	94	98	104
2.2	142	162	197	96	107	134
3.7	225	253	314	145	163	189
5.5	348	365	420	235	260	290
7.5	376	400	520	240	280	306
11	498	625	754	260	306	380
15	742	922	1059	361	444	482
18.5	964	1167	1332	495	601	633
22	1163	1263	1377	687	805	860
30	1317	1536	1698	783	854	920
37	1534	1801	2092	812	880	971
45	1625	1940	2300	1047	1218	1300
55	1878	2669	3046	1130	1488	1592
75				1570	1811	2020
90				2034	2150	2359
110				2219	2397	2557
132				3872	4352	4598

Derating of Rated Output Current

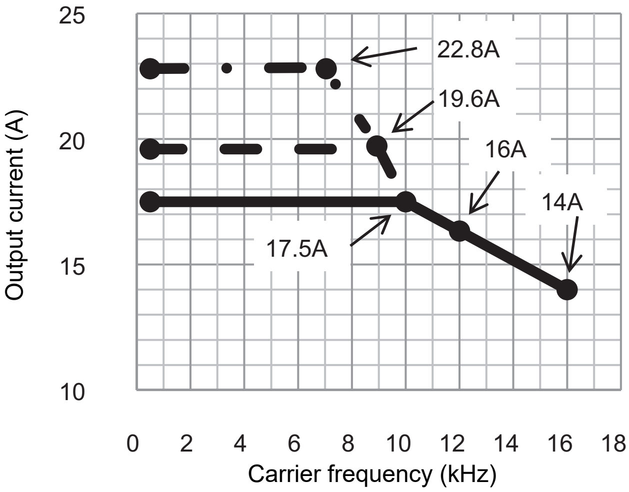
Please use the inverter within the current range in accordance with the derating tables of respective models. If you use the inverter exceeding the derating range, note that the inverter may be damaged or its life may be shortened.

50°C: ND rating (normal duty rating)
45°C: LD rating (low duty rating)
40°C: VLD rating (very low duty rating)

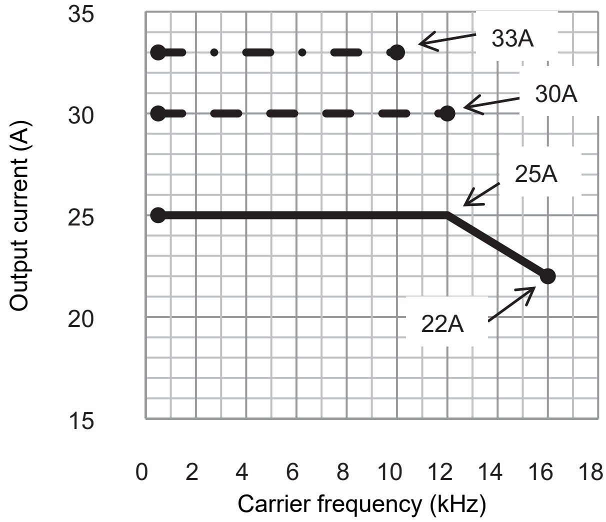
● 200 V class

3G3RX2-A2004/A2007/A2015/A2022 Derating is not required.

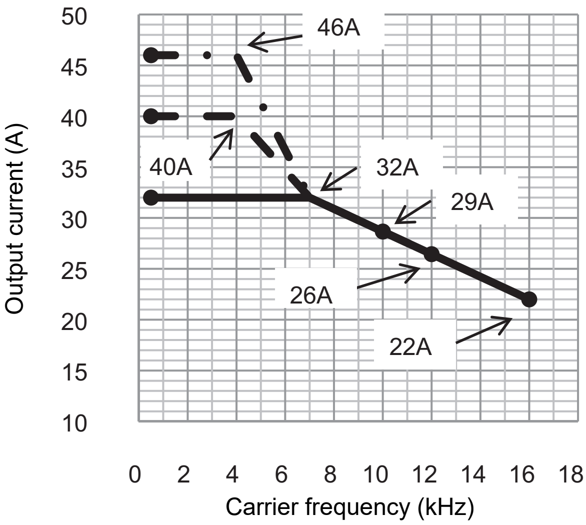
• 3G3RX2-A2037



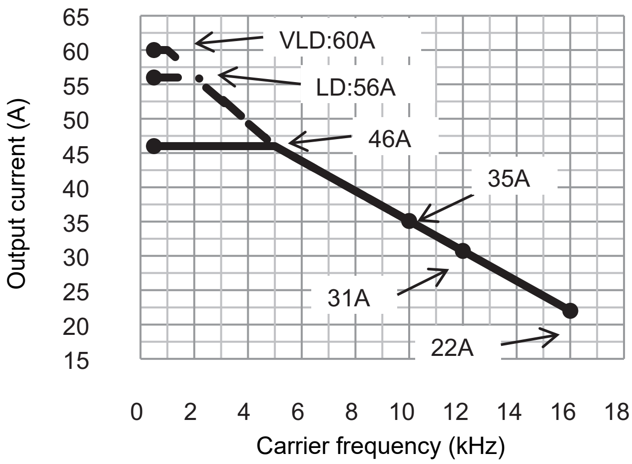
• 3G3RX2-A2055



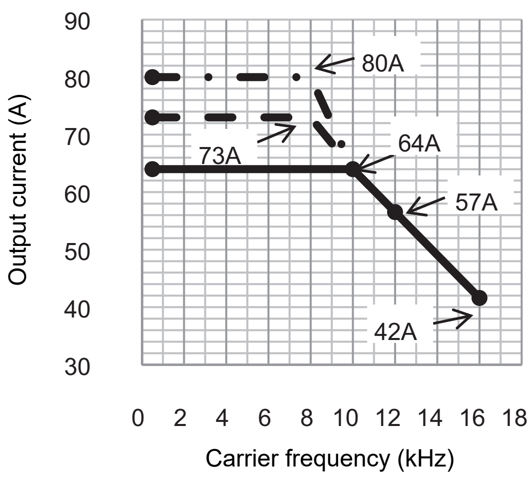
• 3G3RX2-A2075



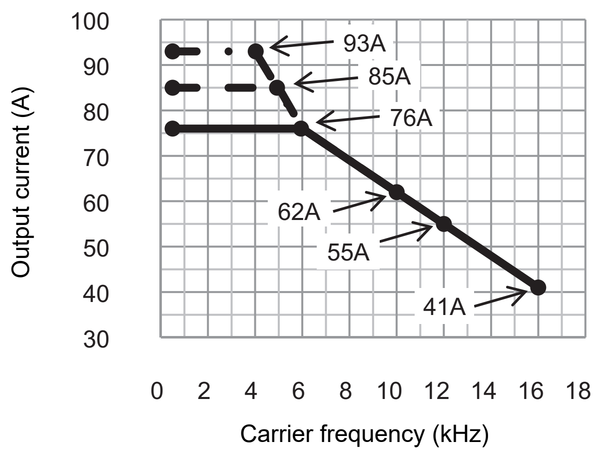
• 3G3RX2-A2110



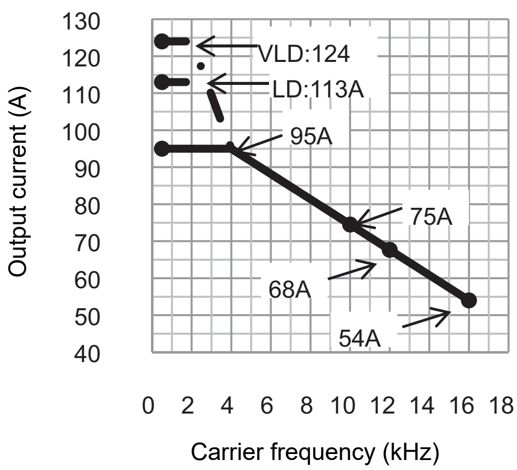
• 3G3RX2-A2150



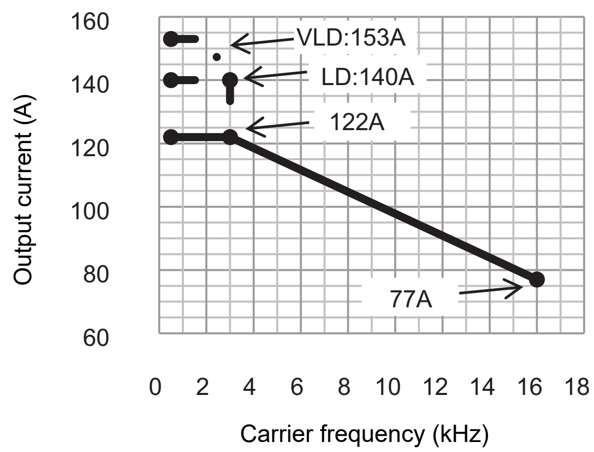
• 3G3RX2-A2185



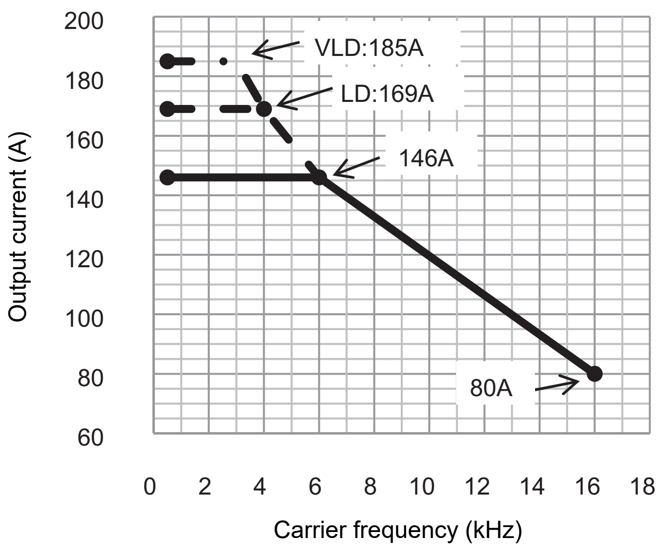
• 3G3RX2-A2220



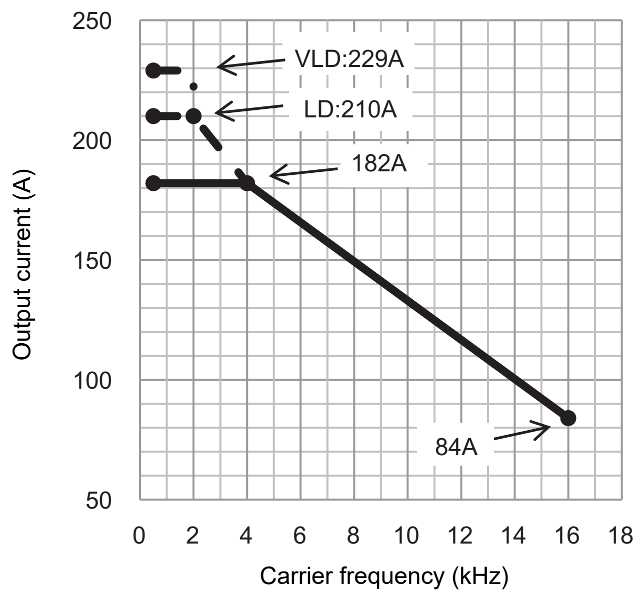
• 3G3RX2-A2300



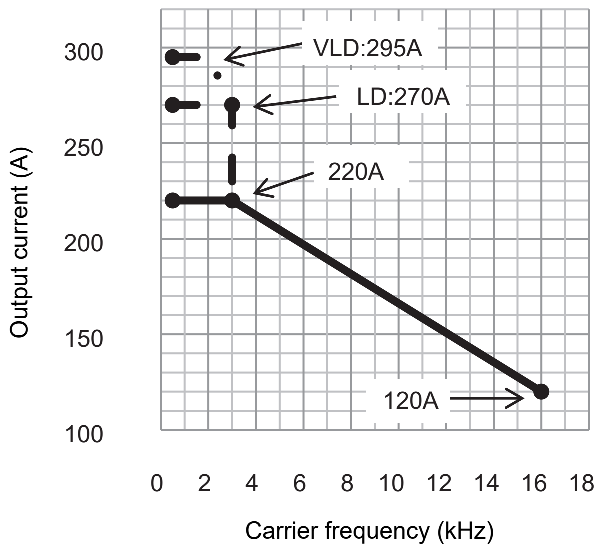
• 3G3RX2-A2370



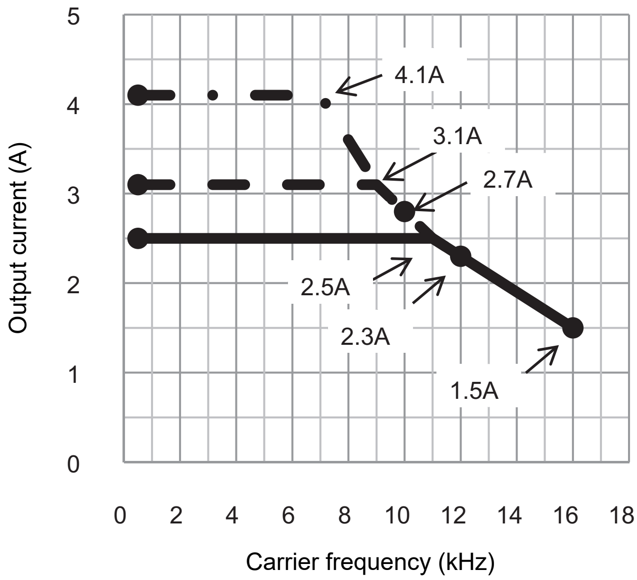
• 3G3RX2-A2450



• 3G3RX2-A2550

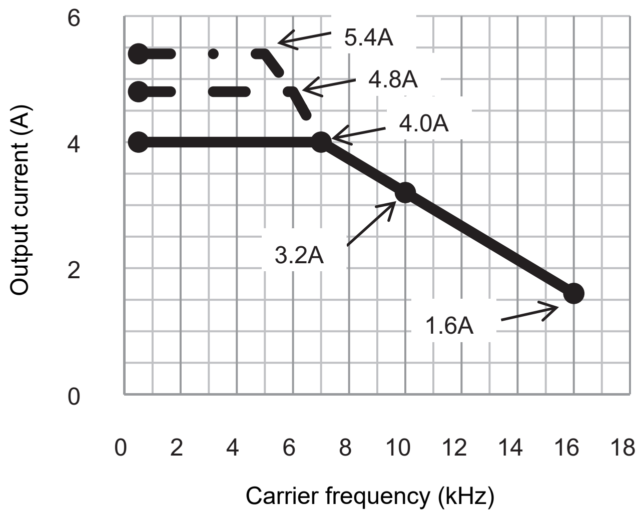


• 3G3RX2-A4007

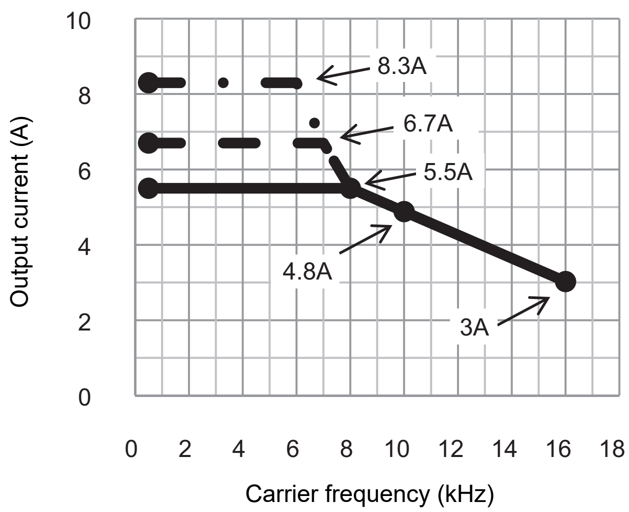


● 400 V class

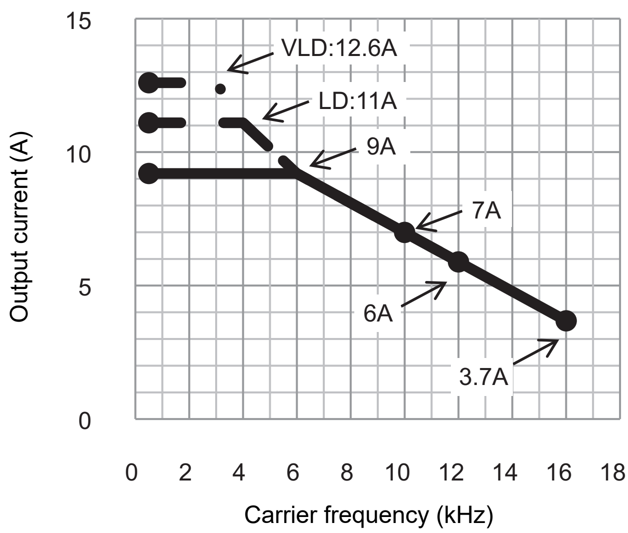
• 3G3RX2-A4015



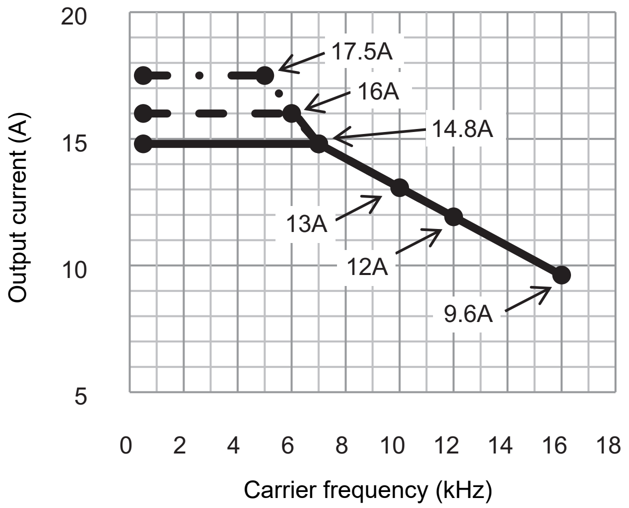
• 3G3RX2-A4022



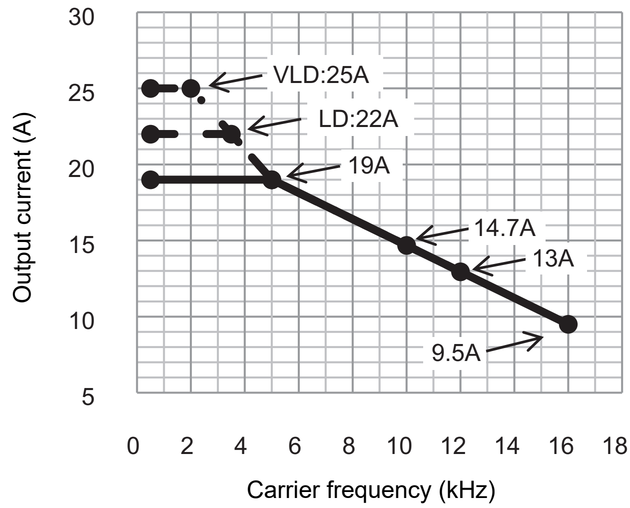
• 3G3RX2-A4037



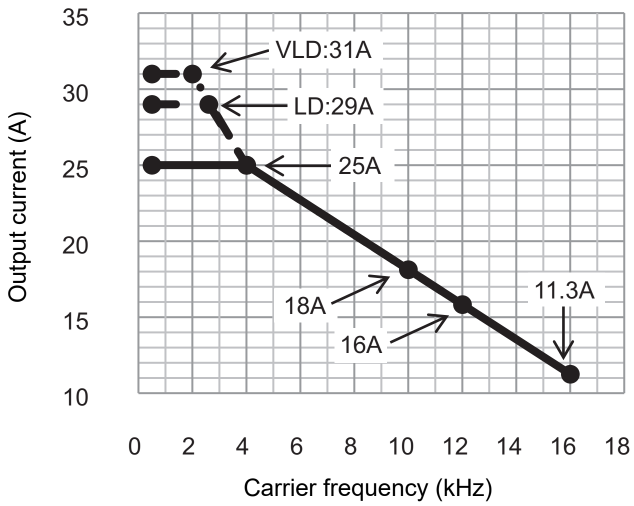
• 3G3RX2-A4055



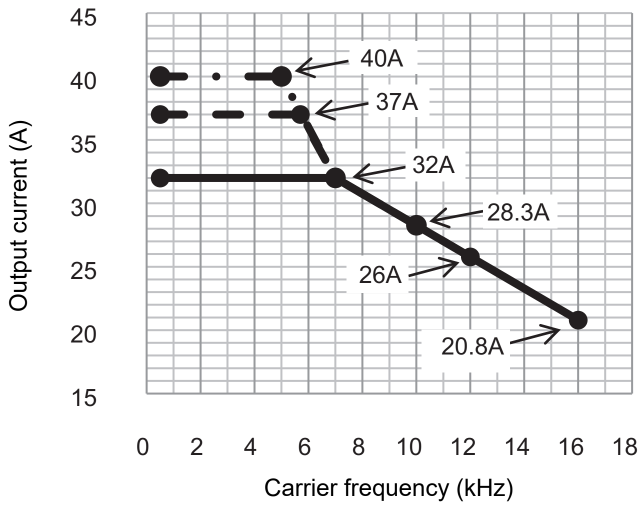
• 3G3RX2-A4075



• 3G3RX2-A4110



• 3G3RX2-A4150



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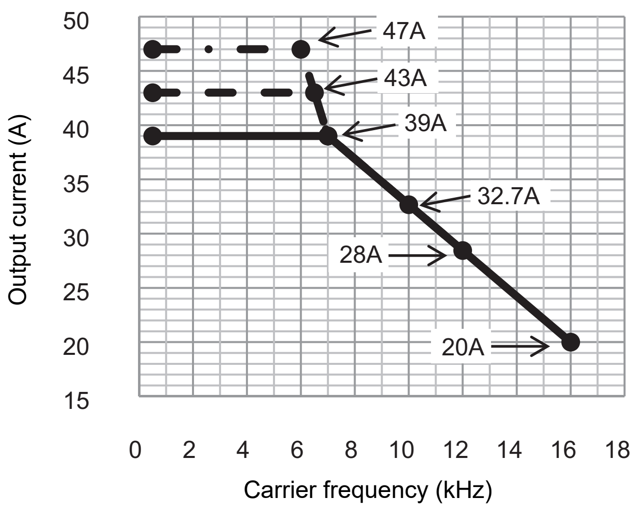
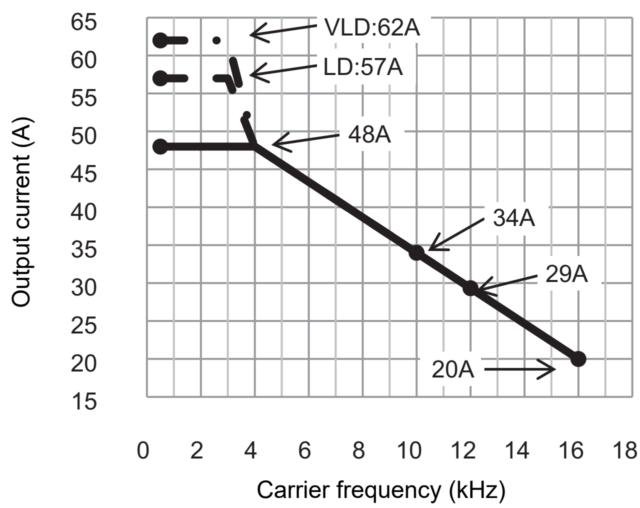
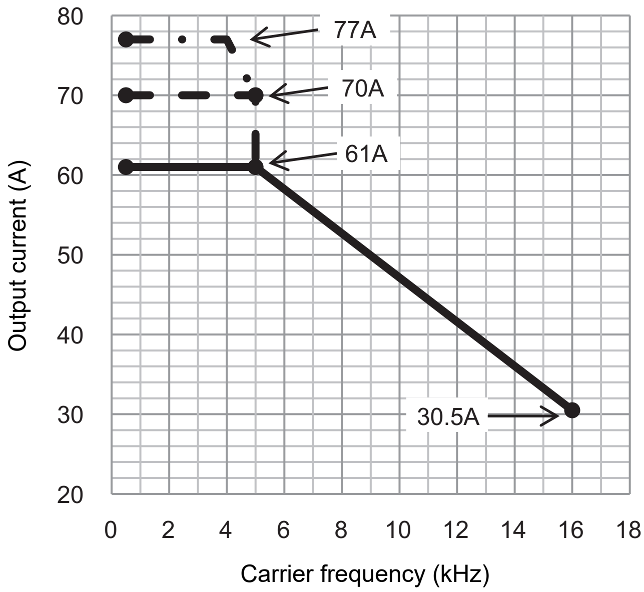


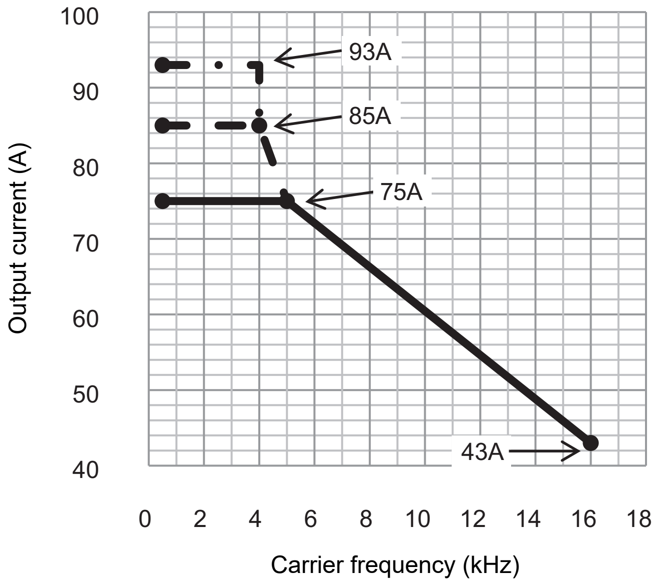
• 3G3RX2-A4220



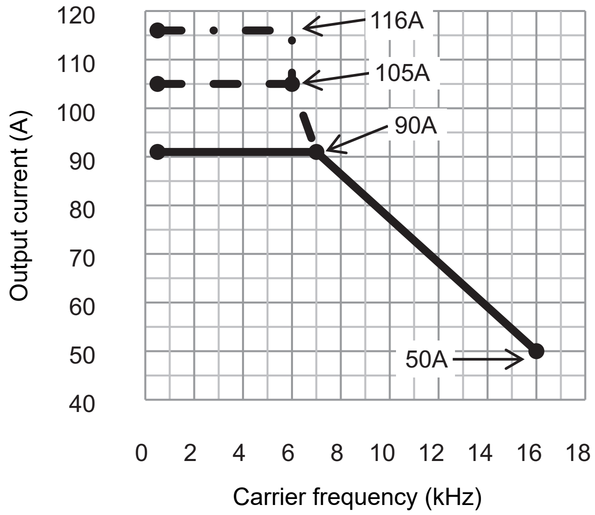
• 3G3RX2-A4300



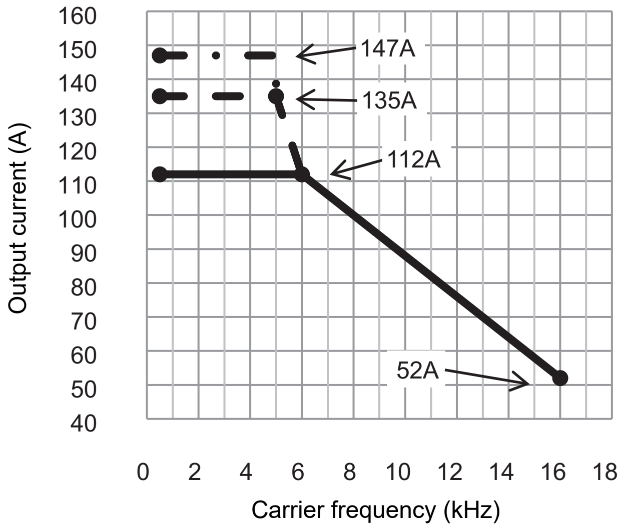
• 3G3RX2-A4370



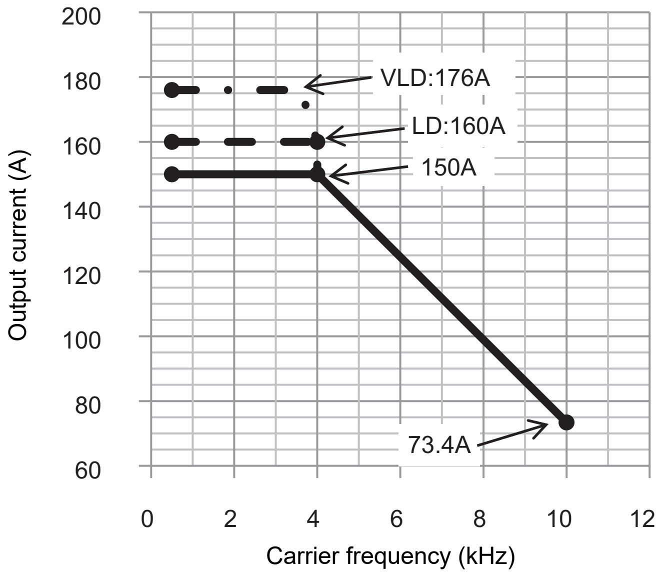
• 3G3RX2-A4450



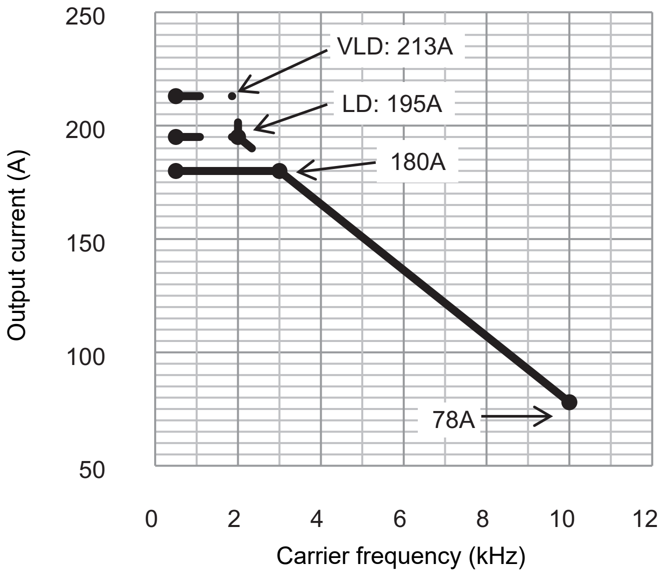
• 3G3RX2-A4550



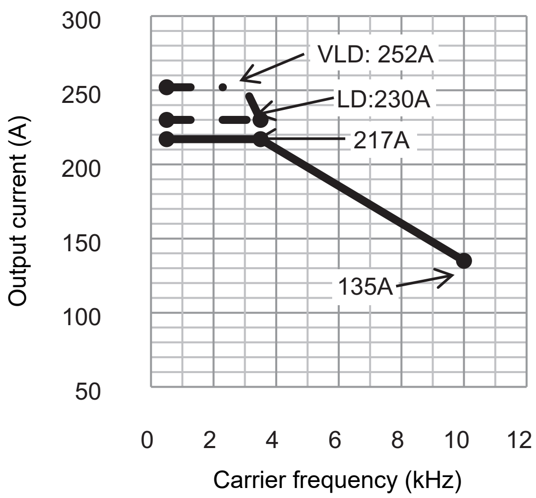
• 3G3RX2-B4750



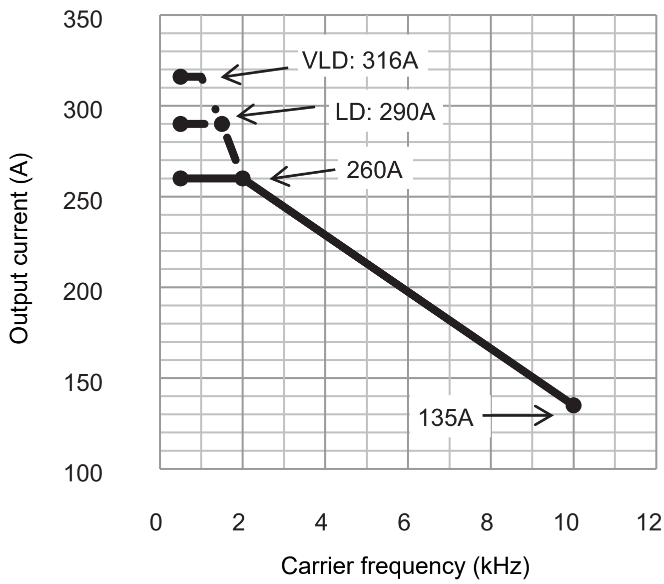
• 3G3RX2-B4900



• 3G3RX2-B411K



• 3G3RX2-B413K



2-2 Removal of Each Part

2-2-1 Removing Cover

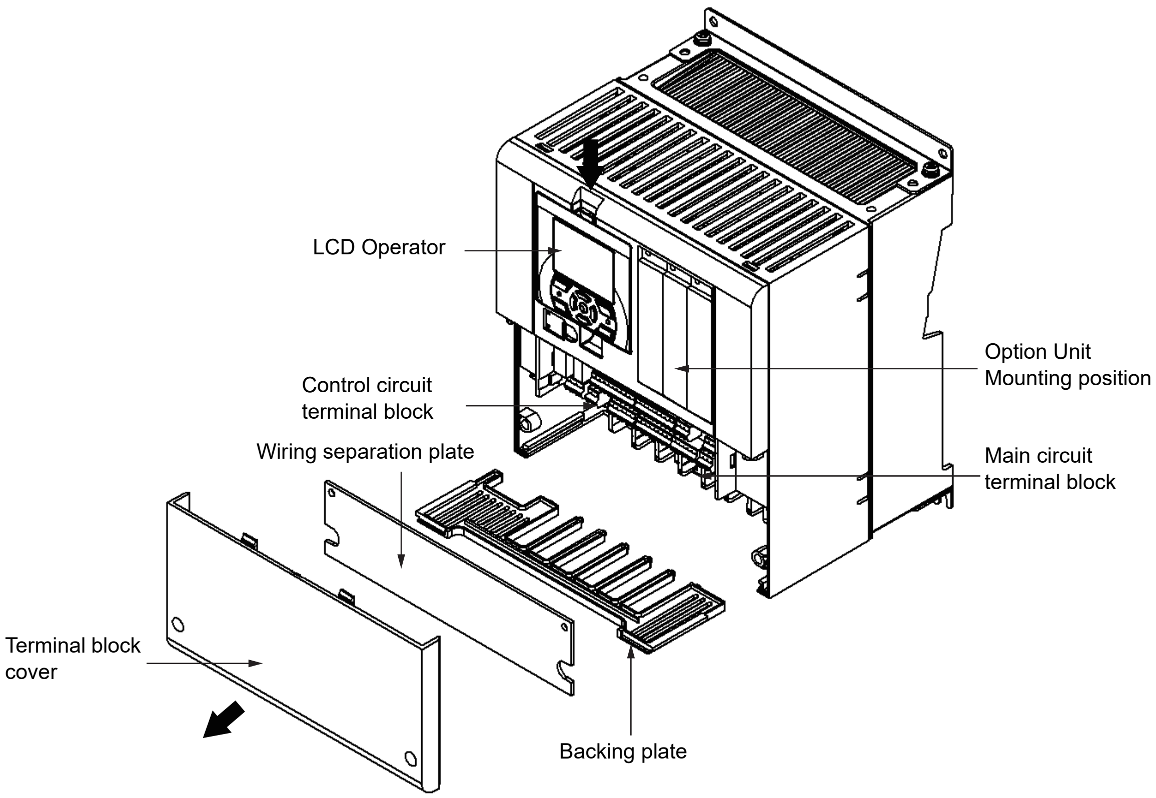
Before wiring each terminal block, you need to remove the terminal block cover and the backing plate.

In addition, to install a PG Option Unit, you must remove the Option Unit Cover beforehand.

This section describes how to remove them. To reinstall it, reverse the removal procedure.

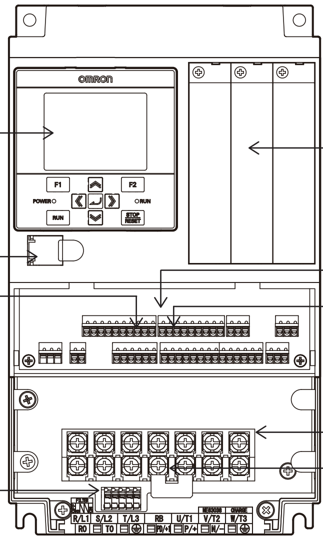
Removing Terminal Block Cover, LCD Operator, Backing Plate and Option Unit Cover

1. By removing the cover of the terminal bock, you can check the control circuit terminal block. By removing the wiring separation plate and backing plate, you can check the main circuit terminal block.
2. By pushing the upper lip part to the direction of arrow, remove the LCD operator.
3. Take out the LCD operator into the arrow direction after removal of the cover of the terminal block.
4. Unscrew and remove the Option Unit Mounting Position Cover when you desire to connect option units. Because you need the screws when you install option units, do not lose them. The cover you removed is necessary when you remove the option unit to restore the original status.



2-2-2 Terminal Blocks

Before wiring each terminal block, remove the terminal block cover and the backing plate. Wiring to the terminal blocks and setting vary depending on the model. Here is the example of 3G3RX2-A2004.
Refer to *2-3-4 Wiring for Main Circuit Terminals* on page 2-32 for detail.



Positions of the main circuit terminal block, EMC filter function setting, charge indicator, arrangement of terminals and setting methods vary depending on models.

Name	Description
LCD Operator	For data display and input operation
Control circuit terminal block	The terminal block for connecting various digital/analog I/O devices used for inverter control.
Main circuit terminal block	The terminal block for connecting the main power supply for the inverter, outputs to the motor, Braking Resistor, etc.
Mounting position of option unit	The position where the option unit is mounted.
EMC filter function setting	For switching filter function in order to conform the inverter to EMC Directives in EC Directives.
RS485-communication terminal block	The communications terminal for RS485 communication between the inverter and external control equipment.
Charge LED	Lights up even after power supply shutoff if the main circuit DC voltage (between the terminal P and N) is approximately 45 V or higher. Make sure the charge indicator is not lit before wiring etc.
Slide switch SW1	Enables or disables the emergency shutoff function.
USB (micro-B)	The USB connector of micro-B for connecting PC

2-2-3 Preparing Backing Plate

In Case of Backing Plate 1 and 2

When AL terminal is wired with high voltage, pull and separate the backing plate from control circuit wiring.

● Backing Plate 1

3G3RX2-A2055 to 3G3RX2-A2110

3G3RX2-A4055 to 3G3RX2-A4110

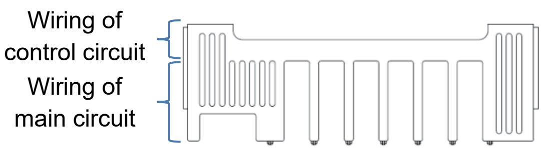
● Backing Plate 2

3G3RX2-A2150 to 3G3RX2-A2220

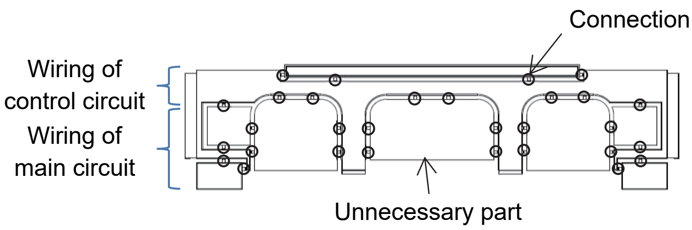
3G3RX2-A4150 to 3G3RX2-A4220

When wiring cables, cut the points between the backing plate and unnecessary portions with nippers or a wire cutter, and remove.

• Backing plate 1



• Backing plate 2



In Case of Backing Plate 3

Backing Plate 3

3G3RX2-A2300 to 3G3RX2-A2550

3G3RX2-A4300 to 3G3RX2-B413K

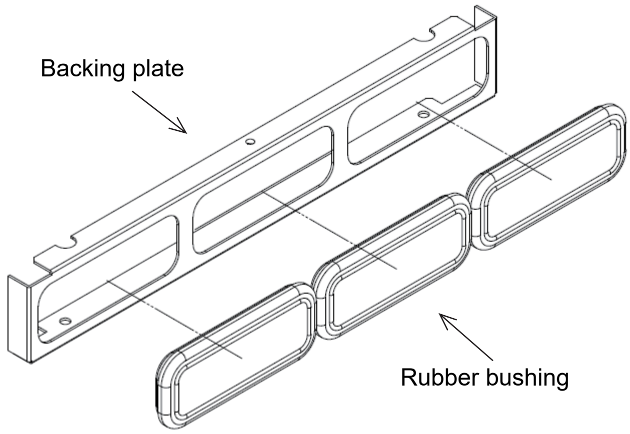
When a Conduit Tube Is Not Connected

Cut the rubber bushing to create a notch using nippers or a cutter for wiring.

When a Conduit Tube Is Connected

Remove the rubber bushing in the portion where a conduit tube is to be connected, and then connect the conduit tube.

Backing plate 3



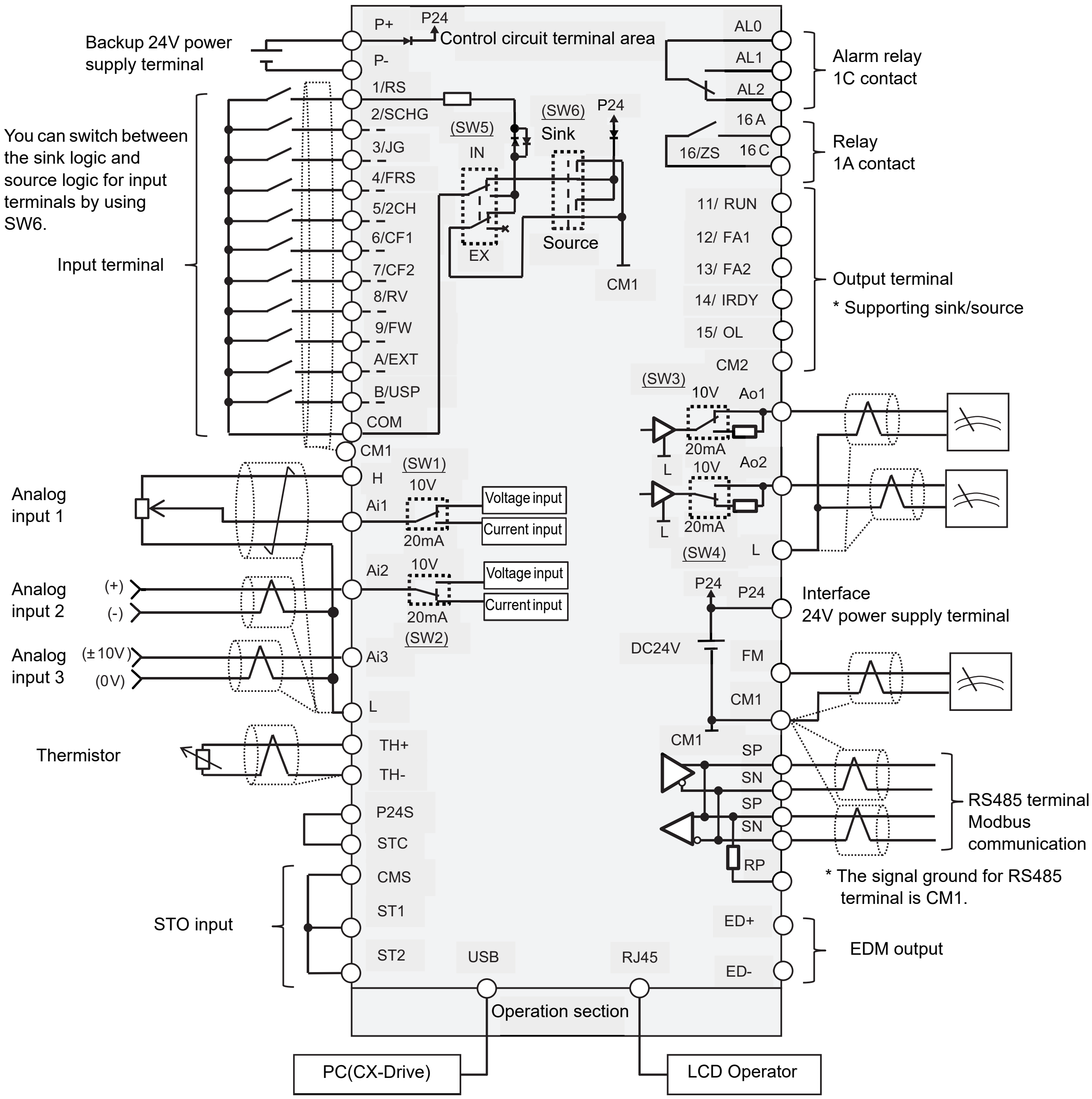
Precautions for Safe Use

Do not remove the rubber bushing unless you connect a cable conduit. Doing so may result in damage to the cable sheath by the inner edge of the backing plate, resulting in a short-circuit or ground fault.

2-3 Wiring

2-3-1 Standard Connection Diagram

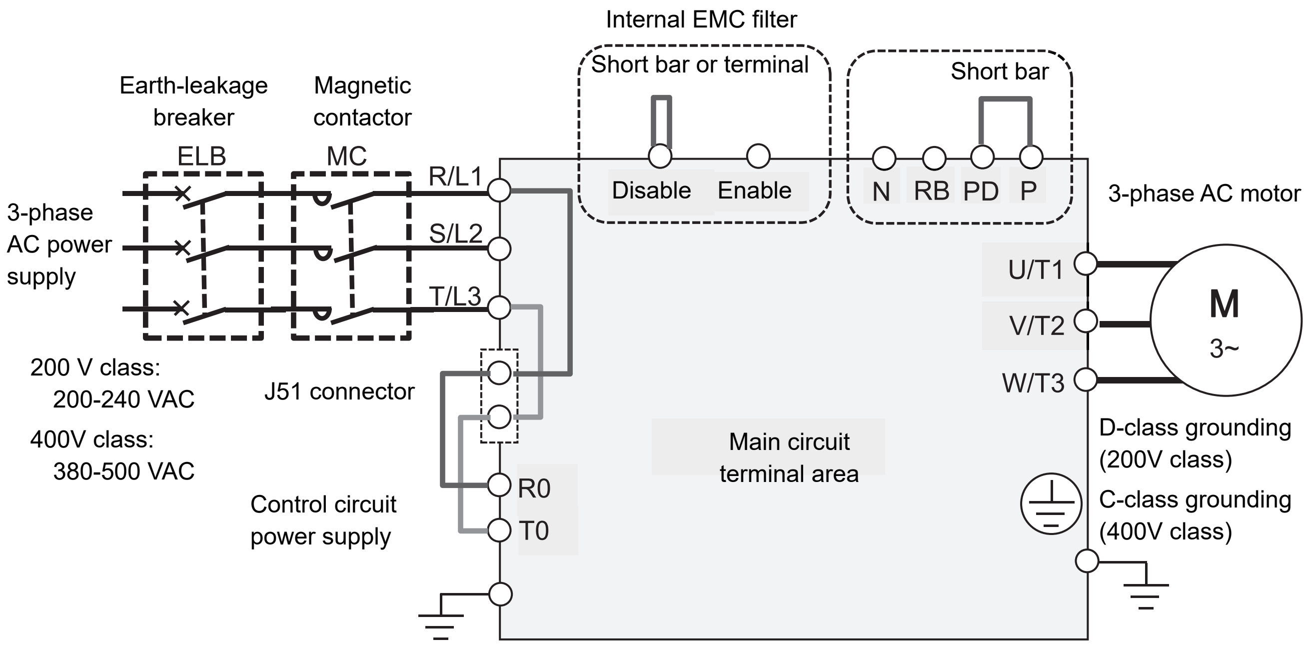
Outline of control circuit



2-3-2 Arrangement and Function of Main Circuit Terminal Block

The table below shows the arrangement of the main circuit terminal block and description of each terminal.

Main Circuit Terminal Block



Precautions for Correct Use

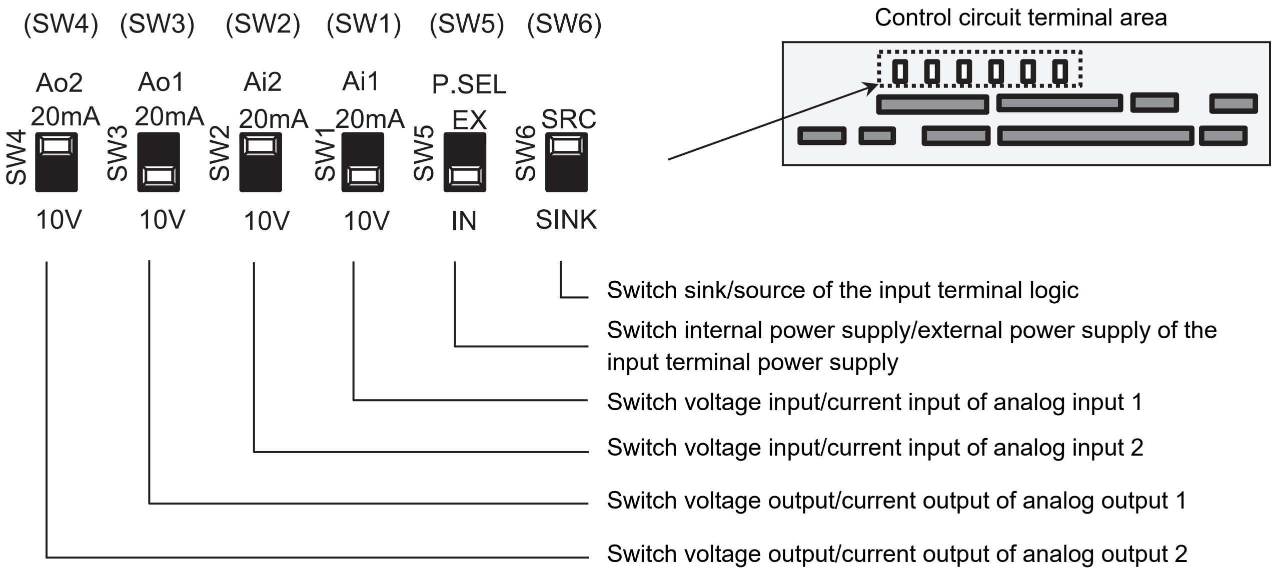
- EMC filter is enabled at factory default setting.
- P-PD is short-circuited when shipped from the factory. If P-PD is not connected, power is not supplied to the main circuit, which disables operation.

Terminal symbol	Terminal name	Description
R,S,T (L1,L2,L3)	Input terminal for main power supply	Connect to the AC power supply.
U,V,W (T1,T2,T3)	Inverter output terminal	Connect to the 3-phase motor.
PD,P (+1,+)	DC reactor connection terminal	Remove the short bar between PD and P terminals, and connect the optional reactor DCL for improving power factor.
P,RB (+,RB)	Connection terminal for external braking resistor	Connect the optional external braking resistor. For models equipped with the braking resistor circuit, see *1-3-3 400V Class Specifications* on page 1-12. Models not equipped with the braking resistor circuit do not have the RB terminal.
P,N (+,-)	Connection terminal for regenerative braking unit	Connect the optional regenerative braking unit BRD.
⏚	Inverter earth terminal	The earth terminal for the Inverter case. Please connect this terminal to the ground. Conduct class-D ground work for 200V class, and class-C ground work for 400V class.

2-3-3 Arrangement and Function of Control Circuit Terminal Block

The diagram and table below describe arrangement and function of control circuit terminal block and switch settings.

Switch Configurations



Indication	SW name	Description
Ai1 (SW1)	Analog input 1 switch	Switches input specification of analog input 1 (Ai1 terminal). 10 V: Voltage input is available. 20 mA: Current input is available.
Ai2 (SW2)	Analog input 2 switch	Switches input specification of analog input 2 (Ai2 terminal). 10 V: Voltage input is available. 20 mA: Current input is available.
Ao1 (SW3)	Analog output 1 switch	Switches output specification of analog output 1 (Ao1 terminal). 10 V: Sets to voltage output. 20 mA: Sets to current output.
Ao2 (SW4)	Analog output 2 switch	Switches output specification of analog output 2 (Ao2 terminal). 10 V: Sets to voltage output. 20 mA: Sets to current output.
P.SEL (SW5)	Switching the method of power supply to the input terminals	Switches the method of power supply to the input terminals. IN: Uses the internal power supply EX: Uses the external power supply (In the case of EX, a power supply is required between the input terminals and COM.)
SRC/SINK (SW6)	Switch of sink/source for the input terminals	Switches the sink/source logic for input terminals. This switch is enabled when SW5 is IN. SINK: Enables sink logic. SRC: Enables source logic.

Precautions for Correct Use

- Using a switch under power-on condition may cause failure. Use the switch only after turning off the power and confirming that the POWER lamp on the operator keypad is off.
- The factory default setting is shown below. If the switch status does not match the actual input and output specifications, it may cause failure. Make sure to check that input and output to be used and switch characteristics are the same.

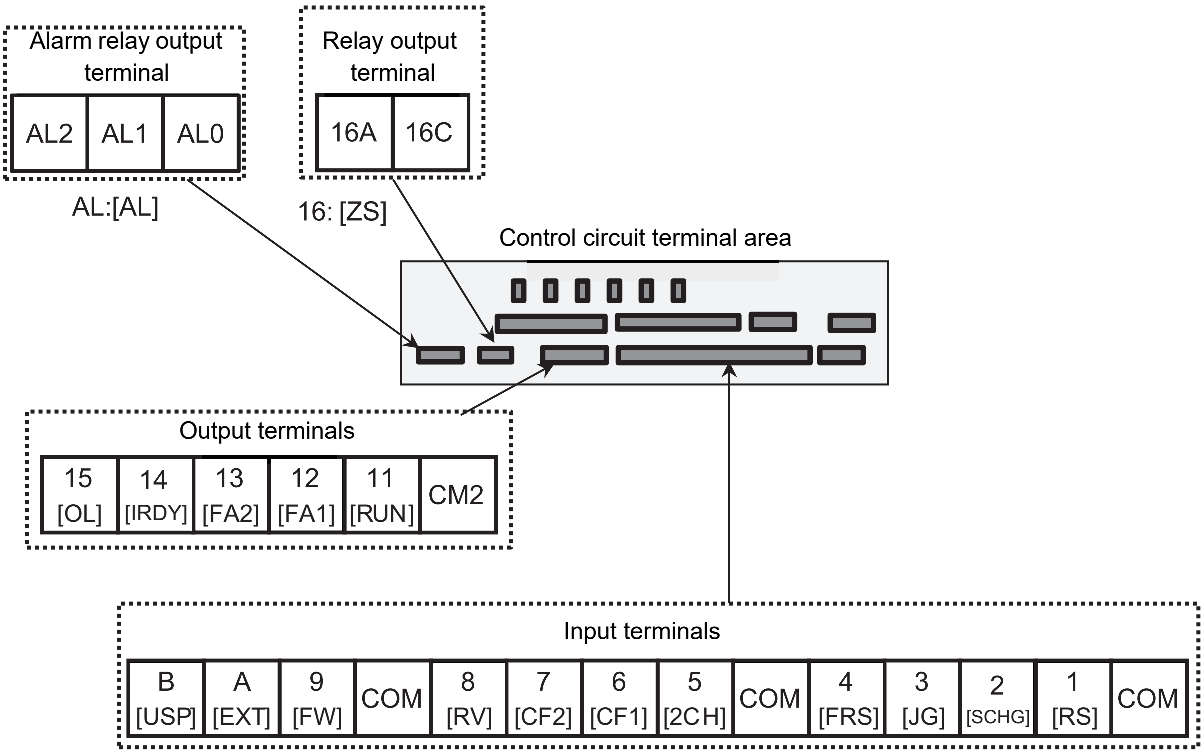
  Analog input terminal settings: Ai1 (SW1) = Voltage input (10 V),
  Ai2 (SW2) = Current input (20 mA)

  Analog output terminal settings: Ao1 (SW3) = Voltage output (10 V),
  Ao2 (SW4) = Current output (20 mA)

  Switches power supply method of I/O terminal: P.SEL (SW5) = External power supply (EX)

  Switches I/O terminal sink/source: SRC/SINK (SW6) = Source (SRC)

Wiring Portion under Control Circuit

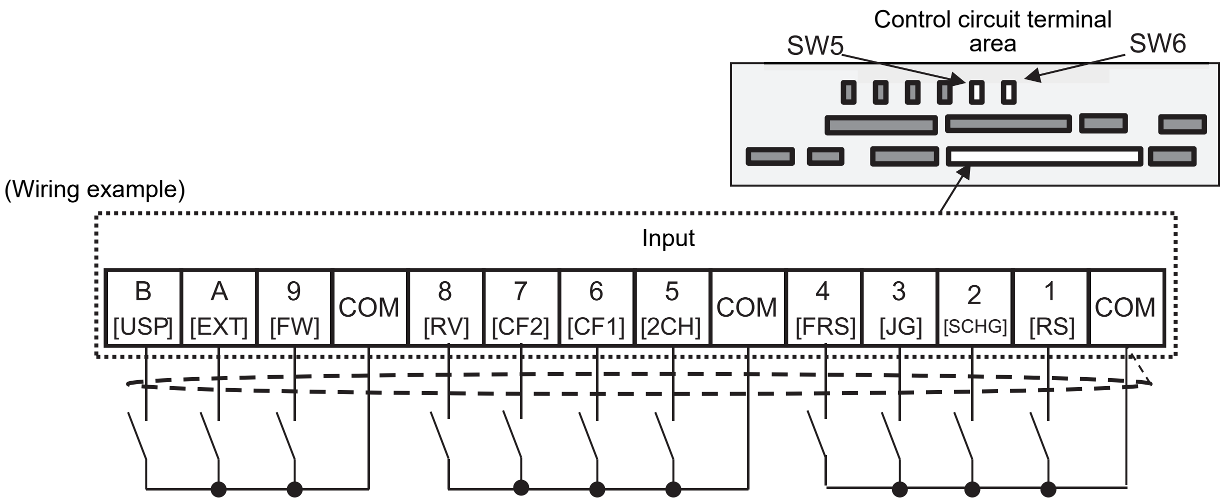


[ ] indicates the factory default setting.

Precautions for Correct Use

- You can switch between the sink/source logic of input terminal by SW6
- When connecting contacts to control circuit terminals, use a relay that does not generate contact failure even at weak current or voltage emitted from cross-bar twin contacts.
- When connecting a relay with output terminals, connect a diode for absorbing surge in parallel with the coil. Otherwise, internal elements may burn.

- **Input Terminals**
  - All COM terminals are at the same potential.
  - When connecting a power supply between 1-9, A, B and COM, switch SW5 to the external power supply (EX).
  - You can switch between the sink/source logic of input terminals by SW6.

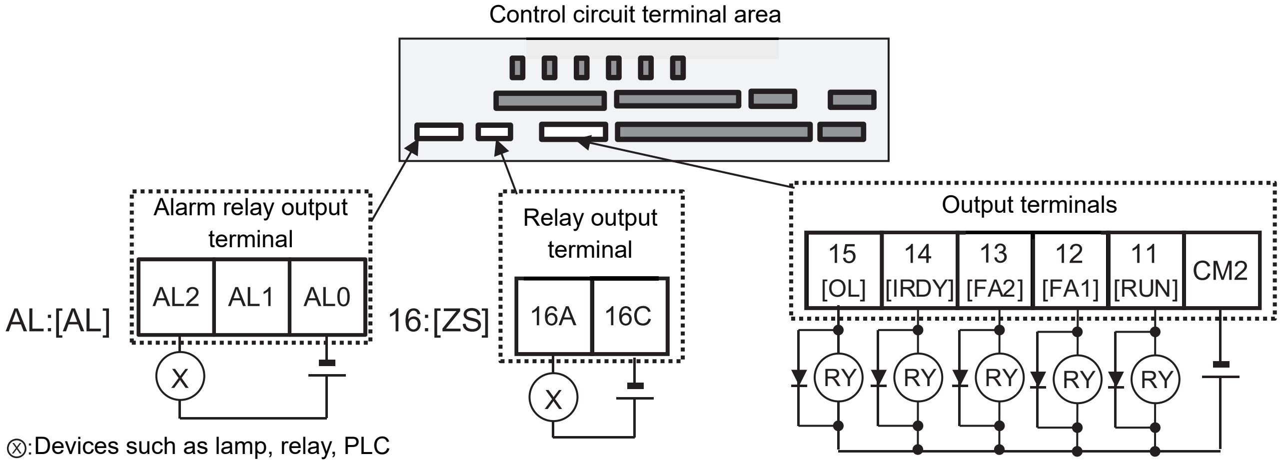


- [ ] indicates the factory default setting.

			Terminal symbol	Terminal name	Description	Electrical characteristics
Input terminal	Digital input	Contact	9, 8, 7, 6, 5, 4, 3, 2, 1	Input terminal	You can select terminal functions using the parameter settings corresponding to each terminal. You can switch between the sink logic and source logic by switching SINK/SRC of SW6.	Voltage between each input/COM • ON voltage Min. DC18V • OFF voltage Max. DC3V • Maximum allowable voltage DC27V • Load current 5.6mA (at DC27V)
		Contact/pulse	A	Pulse input-A	When [CA-90] is set to 00, A, and B terminals can be used as input terminals. You can select terminal functions using the parameter settings corresponding to each terminal. When [CA-90] is not set to 00, they are used as terminals for pulse string input. The maximum input pulse is 32kpps.	Voltage between each input/COM • ON voltage Min. DC18V • OFF voltage Max. DC3V • Maximum allowable voltage DC27V • Load current 5.6mA (at DC27V) • Maximum 32kpps pulse input
			B	Pulse input-B		
		Common	COM	Common for input terminal	Common terminals for digital input terminals (1,2,3,4,5,6,7,8,9,A,B). There are three COM terminals.	

- **Output Terminals**

(Wiring example)



Ⓧ:Devices such as lamp, relay, PLC
Ⓡⓨ:Relay

[ ] indicates the factory default setting.

Precautions for Correct Use

Make sure to use diode. Otherwise the internal circuit may be damaged.

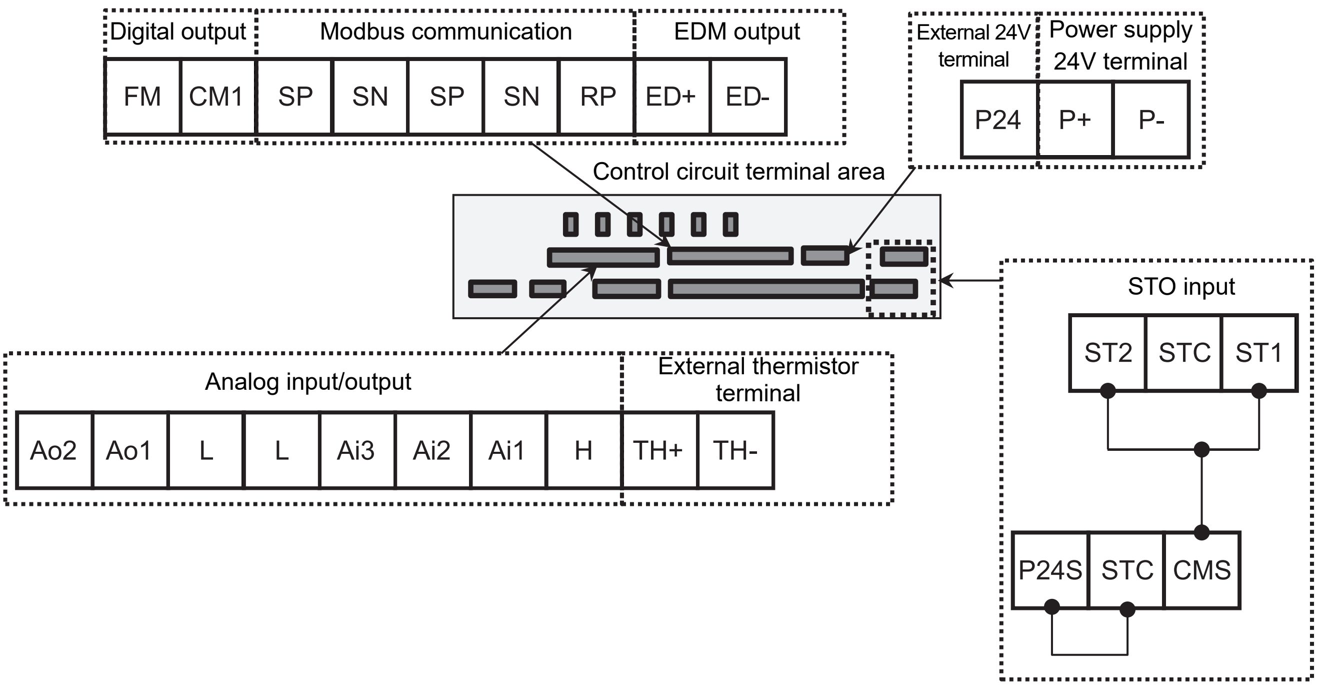
			Terminal symbol	Terminal name	Description	Electrical characteristics
Output terminal	Digital output	Open collector	15,14 13,12 11	Output terminal	You can select terminal functions using the parameter settings corresponding to each terminal. These terminals can be used both in sink logic or source logic.	Open collector output • Between each terminal and CM2 • Voltage drop at ON: 4V or below • Maximum allowable voltage: 27V • Maximum allowable current: 50mA
			CM2	Common for output terminal	Common terminals for output terminals 11-15	
		Relay	16A 16C	1a relay terminal	A relay for contact A output.	Maximum capacity of contact • AC250V, 2A (resistance)/ AC250V, 1A (induction) Minimum capacity of contact • DC1V,1mA
			AL0 AL1 AL2	1c relay terminal	A relay for contact C output.	Maximum capacity of contact AL1/AL0: • AC250V, 2A (resistance)/ AC250V, 0.2A (induction) AL2/AL0: • AC250V, 1A (resistance)/ • AC250V, 0.2A (induction) Minimum capacity of contact (common) • AC100V, 10mA/DC5V, 100mA

Precautions for Correct Use

- [AL] function is assigned to [CC-07] C contact relay of AL1-AL0/AL2-AL0 as initial state. Set the alarm signal of output terminal 017 [AL] function to any of [CC-01] to [CC-07] and outputs the signal.
  The behavior of alarm relay AL1-AL0/AL2-AL0 is shown in the below table.

[CC-17]	Control power supply	Inverter error output	Output terminal states	
			AL1-AL0	AL2-AL0
00	ON	Normal	Open	Close
		Alarm output	Close	Open
	OFF	-	Open	Close
01	ON	Normal	Close	Open
		Alarm output	Open	Close
	OFF	-	Open	Close

Wiring Portion Above Control Circuit

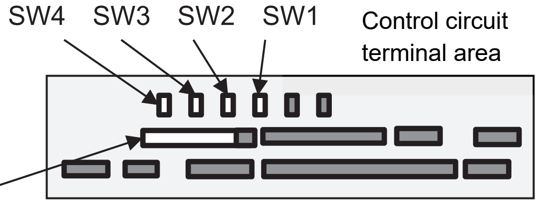


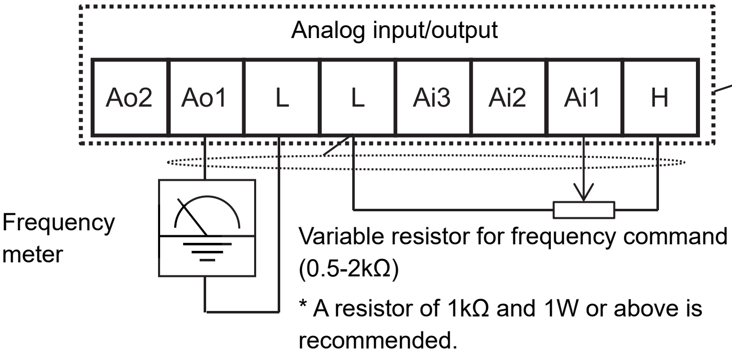
Precautions for Correct Use

- Factory default settings are shown below. You can change the setting for your needs.
  Analog input terminal setting switch: Ai1 (SW1) = Voltage input, Ai2 (SW2) = Current input
  Analog output terminal setting switch: Ao1 (SW3) = Voltage output, Ao2 (SW4) = Current output
- When shipped from the factory, wiring is performed so that STO input is disabled.
- Do not short between the analog power supply H and L terminals, power supply P+ and P- terminals, P24 and P- terminals, P+ and CM1 terminals, and P24 and CM1 terminals. Otherwise, the inverter may fail.

● Analog Input/Output

(Wiring example)



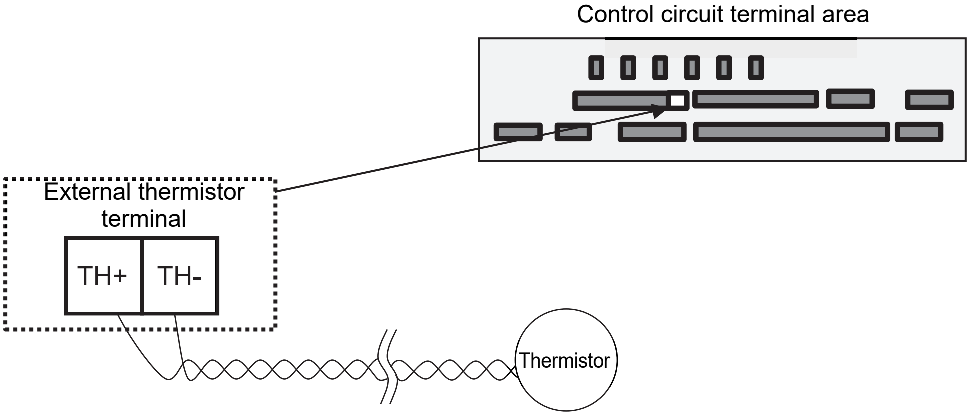


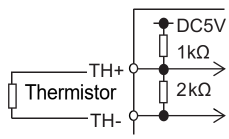
- In the example shown on the left, voltage is input when the variable resistor is used in H-Ai1-L, therefore, set the SW1 of analog input 1 (Ai1) to the voltage side.
- In the example shown on the left, if the frequency meter supports current measurement feature (4-20mA), set the SW3 of analog output 1 (Ao1) to the current side.

		Terminal symbol	Terminal name	Description	Electrical characteristics
Analog input terminal for switching voltage and current	Power supply	L	Analog power common	Common terminals for analog input terminals (Ai1, Ai2, Ai3) and analog output terminals (Ao1, Ao2). There are two L terminals.	
		H	Power supply for setting speed	This is a 10V VDC power supply. It is used when using analog input terminals (Ai1, Ai2, Ai3) and variable resistor for inputting voltage.	Maximum allowable input current 20mA
	Analog input	Ai1	Analog input terminal 1 (voltage/current switching SW1)	For Ai1 and Ai2, 0-10 VDC voltage input and 0-20 mA current input can be switched using a switch for use. It can be used for input frequency command or feedback.	In the case of voltage input: • Input impedance about 10kΩ • Allowable input voltage -0.3 to 12V In the case of current input: • Input impedance about 100Ω • Maximum allowable input current 24 mA
		Ai2	Analog input terminal 2 (voltage/current switching SW2)		
		Ai3	Analog input terminal 3	-10 to 10 VDC voltage input is available. It can be used for input frequency command or feedback.	Only voltage input: • Input impedance about 10 kΩ • Allowable voltage input -12 to 12 VDC
	Analog output	Ao1	Analog output terminal 1 (voltage/current switching SW3)	For Ao1 and Ao2, 0-10 VDC voltage output and 0-20 mA current output can be switched using a switch as output of information monitor data of the inverter.	In the case of voltage output: • Maximum allowable output current 2 mA • Output voltage accuracy ±10% (Ambient temperature: 25±10°C) In the case of current input: • Allowable load impedance 250Ω or below • Output current accuracy: ±20% (Ambient temperature: 25±10°C)
		Ao2	Analog output terminal 2 (voltage/current switching SW4)		

● External Thermistor

(Wiring example)



		Terminal symbol	Terminal name	Description	Electrical characteristics
Thermistor terminal	Analog input	TH+	External thermistor input	When an external thermistor is connected, and resistance abnormality occurs due to abnormal temperature, etc., trip the inverter.	0 to 5 VDC [Input circuit] 
		TH-	Common for external thermistor	Connect the thermistor with TH+ and TH-. The level of detecting resistance abnormality can be adjusted from 0 to 10000Ω. [Recommended thermistor characteristics] Recommended product: SHIBAURA ELECTRON-ICS Co., Ltd. PB-41E Allowable rated power: 100mW or more Impedance at abnormal temperature: 3kΩ	

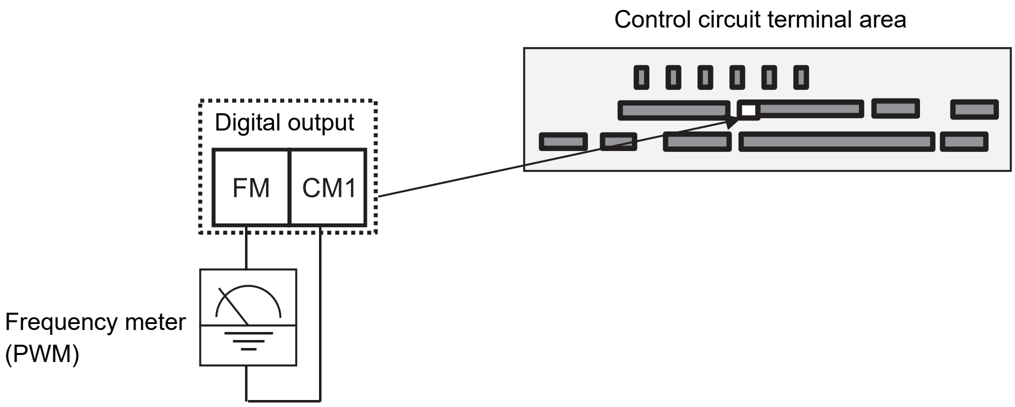
Precautions for Correct Use

To prevent malfunctioning, note the following when performing wiring.

- For connection to the TH terminal, twist only wires connecting to TH+ and TH-, and separate them from other wires.
- Since the current flowing in the thermistor is very weak, separate the wires from main circuit line (power line).
- The length of wiring to the thermistor shall be within 20m.

● FM Output Terminal

(Wiring example)



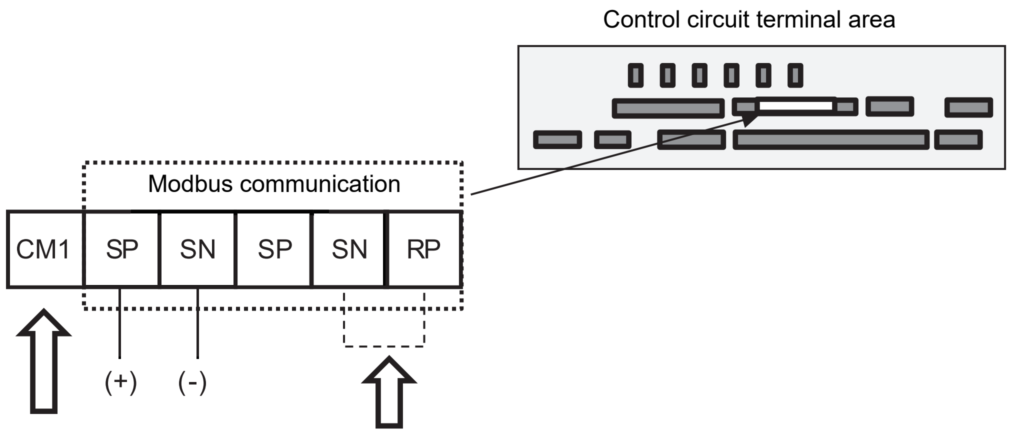
For FM output, you can choose the PWM output method at 6.4 ms fixed interval or pulse output method in which pulse frequency varies. You can control FM output by setting parameters.

			Terminal symbol	Terminal name	Description	Electrical characteristics
Digital	output	Monitor output	FM	Digital monitor (voltage)	For digital monitor output, you can choose the PWM output method at 6.4ms interval or pulse output method with about 50% duty in which frequency varies.	Pulse string output DC0-10V • Maximum allowable current 1.2mA • Maximum frequency 3.60kHz
			CM1	Common for digital monitor	The common terminal for digital monitor.	

● RS485 Communication Terminal Block

Arrangement and configuration of RS485 Communication Terminal Block are described below:

(Wiring example)



Connect CM1 to the SG (signal ground) of an external device.

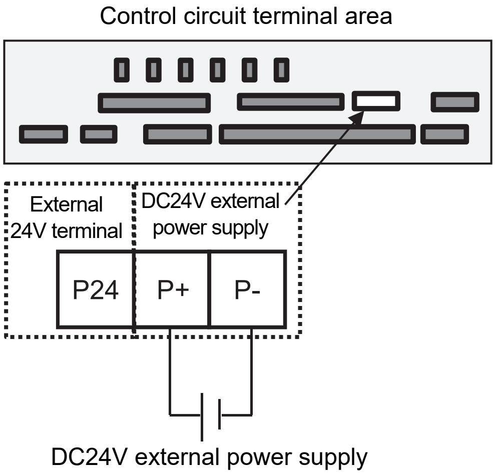
When enabling the terminating resistor, short RP-SN.

SP and SN terminals with the same names are internally connected respectively, so they can be used for wiring multiple terminals.

		Terminal symbol	Terminal name	Description	Electrical characteristics
RS485 communication	Serial communication	SP SN RP (CM1)	RS-485 terminal for Modbus communication	SP terminal: RS-485 differential (+) signal SN terminal: RS-485 differential (-) signal RP terminal: Connect to SP via the terminating resistor CM1 terminal: Connect with the signal ground of an external communication device. (also used by FM terminal) There are are two SP terminals and SN terminals each, which are connected internally. Maximum baud rate is 115.2kbps.	Equipped with terminating resistor (120Ω) Enable: Short RP-SN Disable: Open RP-SN

● Power Input/Output

(Wiring example)

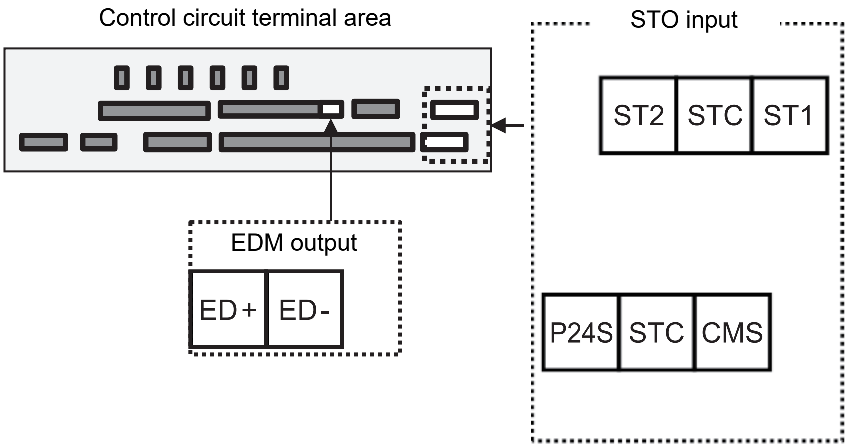


When 24 V power is supplied to P+ and P- from an external source, change of parameters and communication of optional devices are enabled even without main power supply.

		Terminal symbol	Terminal name	Description	Electrical characteristics
24V power supply	Power input	P24	24V output power terminal	24 VDC power supply for contact signal The common terminal is P-.	100mA output at maximum
		P+	External 24V input terminal (24V)	Input an external 24 VDC power to the inverter. With input of 24 V power, you can change parameter settings or operate optional communication without using a control power supply	Allowable input voltage 24 VDC±10% Maximum power consumption 1A
		P-	Terminal for P24/P+ (0 (zero) V)		

● STO Terminal

Terminal symbol	Terminal name
P24S	24V output power terminal
CMS	Common terminal for STO terminal
STC	Logic switching terminal
ST1	STO input 1
ST2	STO input 2
ED+	Monitoring output terminal
ED-	Monitoring output common



As for the terminal function, see section *2-3-9 Wiring for STO Function* on page 2-73.

2-3-4 Wiring for Main Circuit Terminals

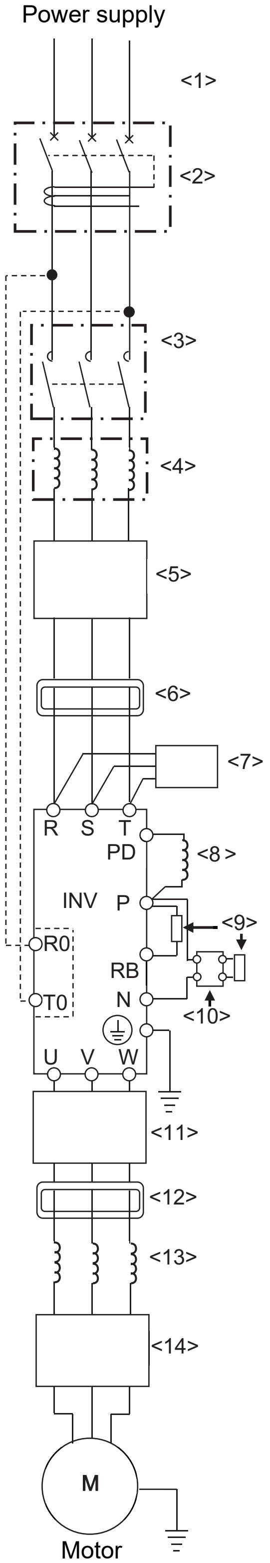
Outline of Applicable Peripheral Devices

Configuration diagram and functions of the inverter and main circuit peripheral are described below:

Precautions for Correct Use

- Those devices are only applicable in case the standard 3-phase induction motor with four poles.
- Breakers must be selected in consideration of break capacity.
  (Use a type applicable for inverter)
- Use an earth-leakage breaker (ELB) for your safety.
- Use a 75°C heatproof copper wire (HIV wire).
- If the wiring length exceeds 20 meters, heavier power lines need to be applied.
- Select for alarm output contact of 0.75 mm^2.
- Tighten the terminal screws at a specified torque. If they are not tightened enough, it may cause short circuit or fire. If they are tightened too much, it may damage the terminal block or inverter.
- Select variable sensitive currents for earth-leakage breaker (ELB) depending on the total wire length between the inverter and power supply and between the inverter and motor. Select a time-delay type of earth-leakage breaker. Otherwise a high-speed inverter may malfunction.
- When wiring a CV line in a metal pipe, leak current is approximately 30 mA/km.
- Because the relative permittivity of IV wire is high, the current increases by about eight times. Therefore, use an item with 8 times sensitive current that is shown on the table below. In case the total length of wire exceeds 100 meters, use a CV wire.

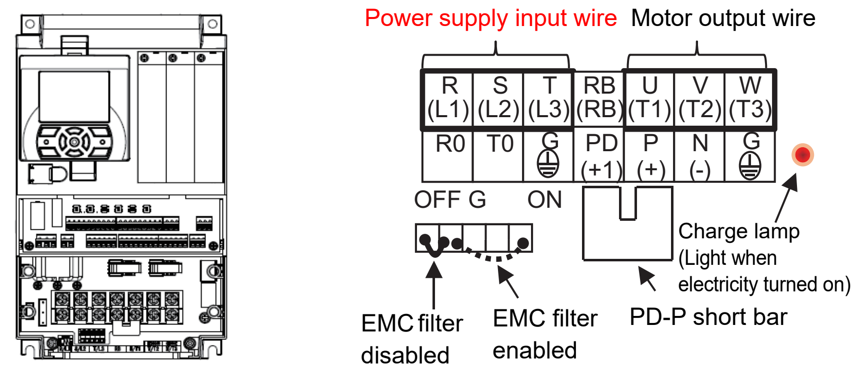
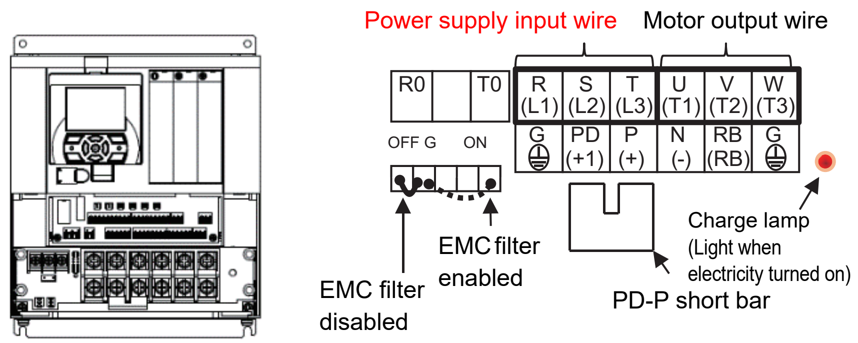
Total wiring length	Sensitive current (mA)
100 m or shorter	50
300 m or shorter	100

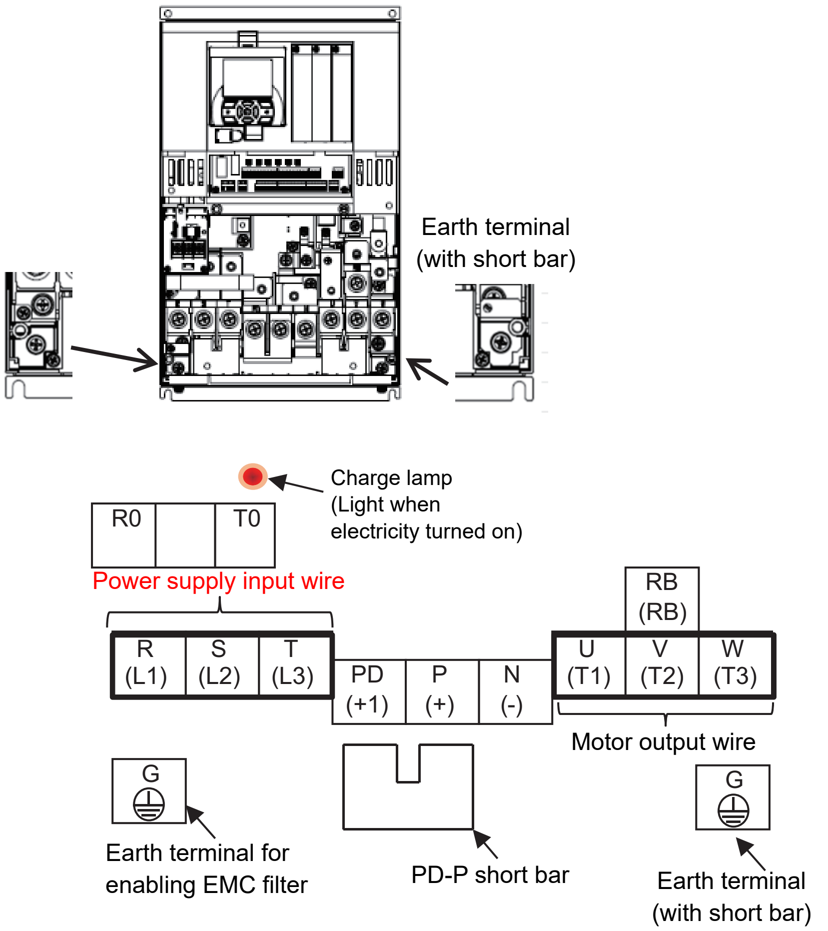
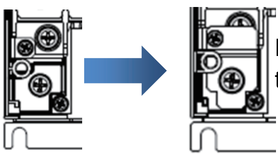
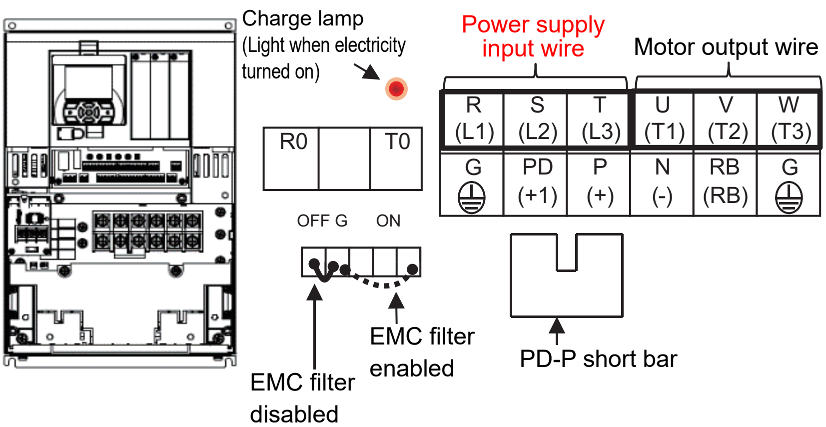


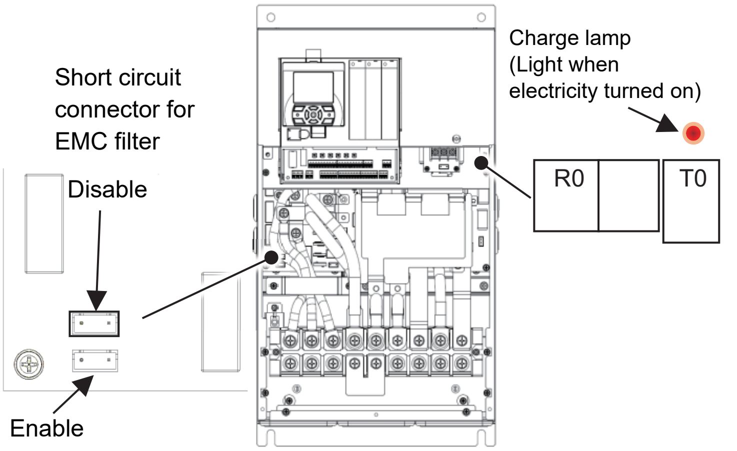
No.	Name	Function
<1>	Wire	See *Recommended Wire Diameter, Wiring Tools, and Crimping Terminals* on page 2-43.
<2>	Earth-leakage breaker (ELB)	
<3>	Magnetic contactor (MC)	
<4>	Input side reactor	This is applied as a countermeasure against harmonic suppression, or when imbalance of power supply voltage is 3% or above, or when power supply capacity is 500kVA or above. It is also used when a rapid change is made to power supply voltage. It is also effective in improving power factor.
<5>	Inverter noise filter	This reduces the conductive noise that is generated from the inverter and transferred to the wire. Connect to the primary side (input side) of inverter.
<6>	Radio noise filter (zero-phase reactor)	When the inverter is used, noise may be generated on an adjacent radio or other devices through wiring on the power supply side. This is used for reducing the noise (reducing radiation noise).
<7>	Input-side radio noise filter (capacitor filter)	This reduces the radiation noise that is emitted from the wire on the input side.
<8>	DC reactor	This suppresses harmonics generated from the inverter.
<9>	Braking resistor	This is used for increasing the braking torque of inverter, repeating power on and off at high interval, or reducing the speed of high load caused by moment of inertia.
<10>	Regenerative braking unit	
<11>	Output-side noise filter	This is installed between the inverter and motor to reduce the radiation noise that is emitted from the wire. It is used to reduce radio interference on radios or televisions or prevent malfunctioning of measurement instruments and sensors.
<12>	Radio noise filter (zero-phase reactor)	This is applied for reducing noise generated on the output side of inverter. (It can be used on both the input side and output side.)
<13>	Output-side AC reactor	When a general-use motor is driven by the inverter, compared with when it is run by commercial power supply, larger vibration may be generated. By connecting this device between the inverter and motor, you can reduce the vibration of motor. Also, if the wiring length between the inverter and motor is long (10m or longer), by inserting a reactor, you can prevent malfunctioning of the thermal relay caused by harmonic attributable to switching of inverter. You can also use a current sensor instead of the thermal relay.
<14>	LCR filter	This is a filter installed between the inverter and motor. It improves output current and voltage waveform to reduce motor vibration, noise, and radiation noise emitted from the wire to convert output-side waveform to sine wave. It is also effective in suppressing surge voltage.

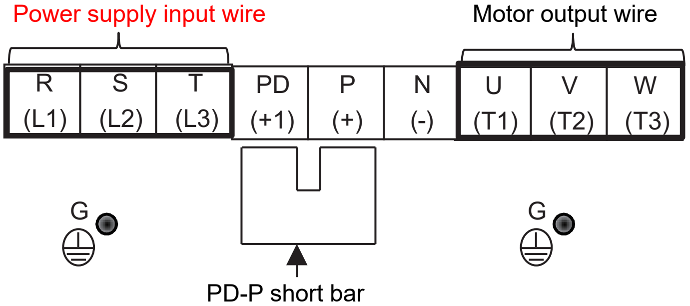
Arrangement of Main Circuit Terminals

The arrangement of inverters' main circuit terminals are shown in the following diagrams.

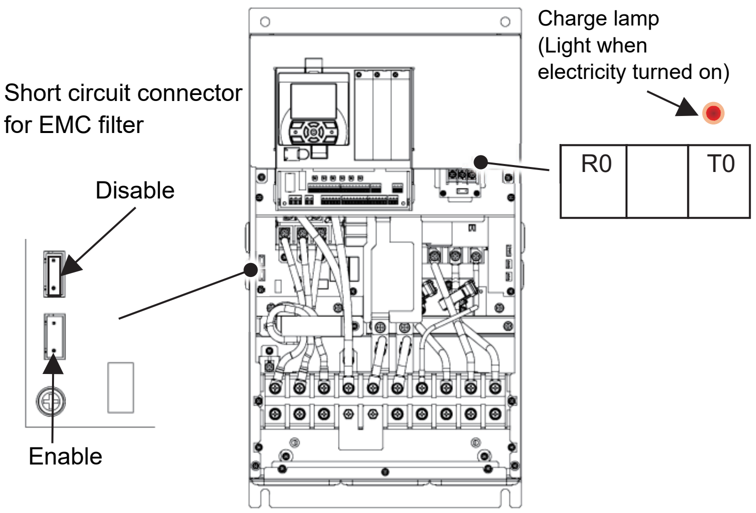
Arrangement of Terminals	Model
 * The EMC filter is enabled/disabled by switching the short bar connector.	3G3RX2-A2004 3G3RX2-A2007 3G3RX2-A2015 3G3RX2-A2022 3G3RX2-A2037 3G3RX2-A4007 3G3RX2-A4015 3G3RX2-A4022 3G3RX2-A4037 R0, T0: M4 Earth terminal: M4 Others: M4
 * The EMC filter is enabled/disabled by switching the short bar connector.	3G3RX2-A2055 3G3RX2-A2075 3G3RX2-A4055 3G3RX2-A4075 R0, T0: M4 Earth Terminal: M5 Others: M5 3G3RX2-A2110 3G3RX2-A4110 R0, T0: M4 Earth Terminal: M6 Others: M6

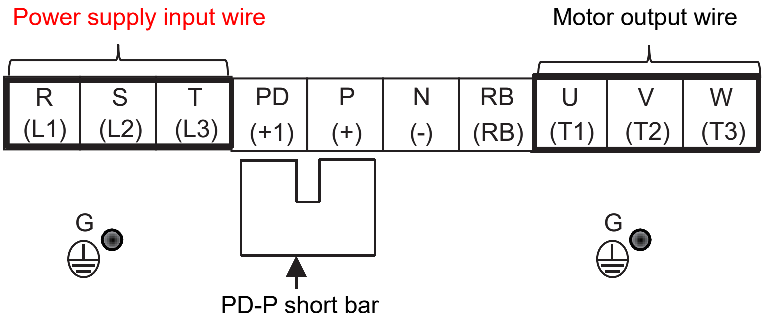
Arrangement of Terminals	Model
 * The EMC filter is enabled by replacing the grounding screw equipped with short bar with the earth terminal for enabling the EMC filter.  Fix the short bar with two screws.	3G3RX2-A2150 3G3RX2-A2185 R0,T0 : M4 Earth Terminal : M6 Others : M6 3G3RX2-A2220 R0,T0 : M4 Earth Terminal: M6 Others: M8
 * The EMC filter is enabled/disabled by switching the short bar connector.	3G3RX2-A4150 3G3RX2-A4180 3G3RX2-A4220 R0,T0 : M4 Earth terminal: M6 Others: M6

<table>
<tr><th>Arrangement of Terminals</th><th>Model</th></tr>
<tr><td>


* The EMC filter is enabled/disabled by switching the short circuit connector.


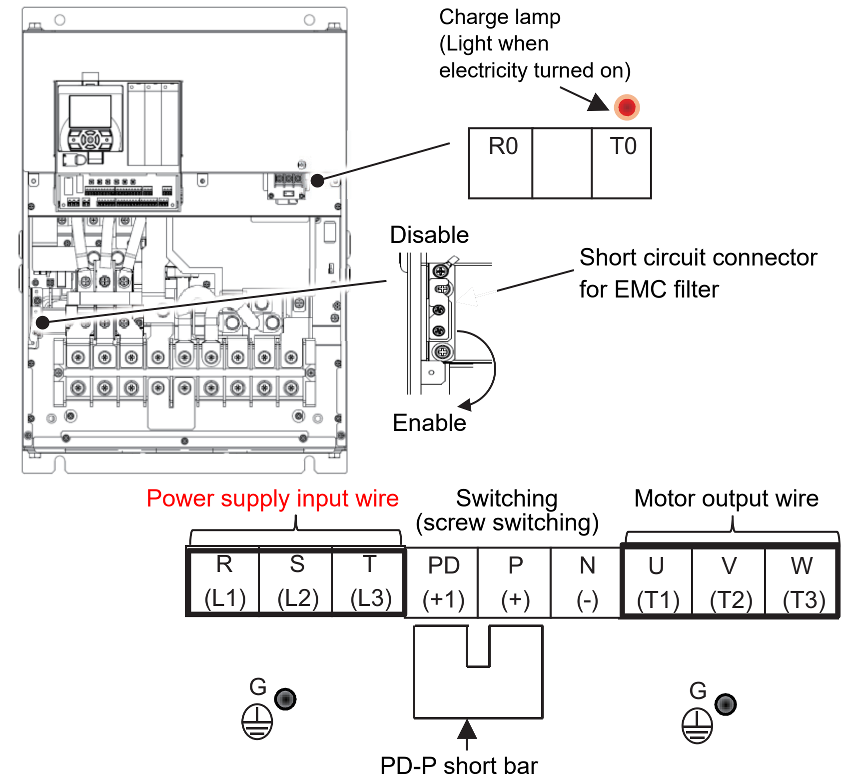
</td><td>3G3RX2-A2300

R0,T0 : M4
Earth terminal: M6
Others: M8</td></tr>
<tr><td>


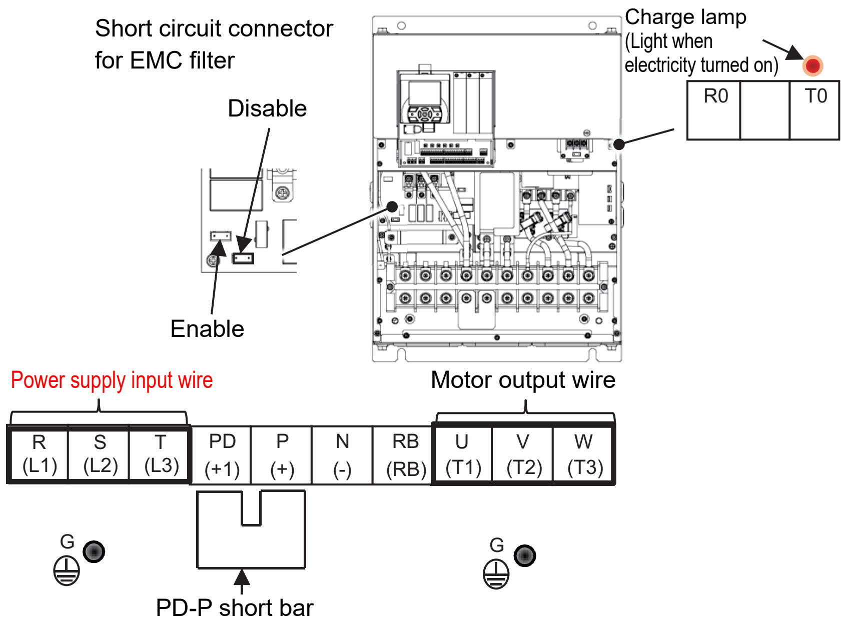


* The EMC filter is enabled/disabled by switching the short circuit connector.
</td><td>3G3RX2-A4300

R0,T0 : M4
Earth terminal: M6
Others: M8</td></tr>
</table>

<table>
<tr><th>Arrangement of Terminals</th><th>Model</th></tr>
<tr><td>

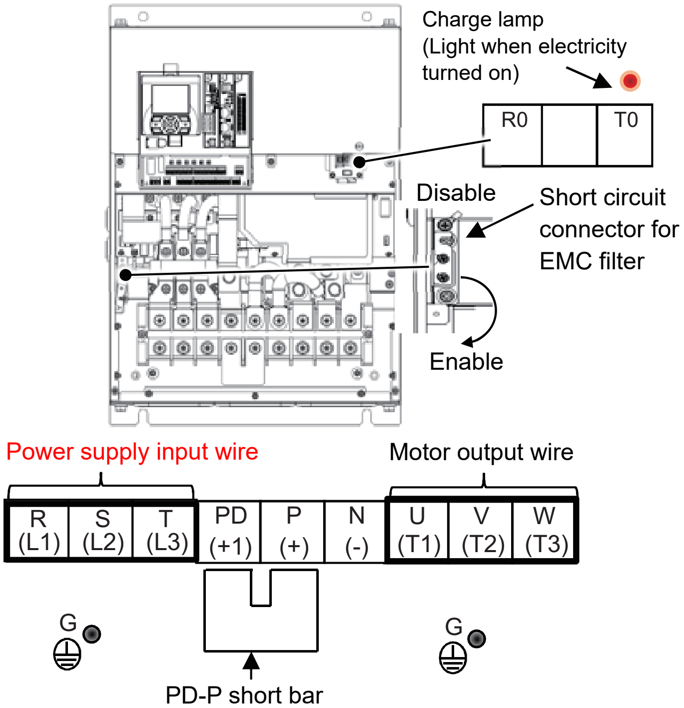
* The EMC filter is enabled/disabled by switching the short circuit bar.</td>
<td>3G3RX2-A2370

R0,T0 : M4
Earth terminal: M8
Others: M8</td></tr>
<tr><td>

* The EMC filter is enabled/disabled by switching the short circuit bar.</td>
<td>3G3RX2-A4370

R0,T0 : M4
Earth terminal: M8
Others: M8</td></tr>
</table>

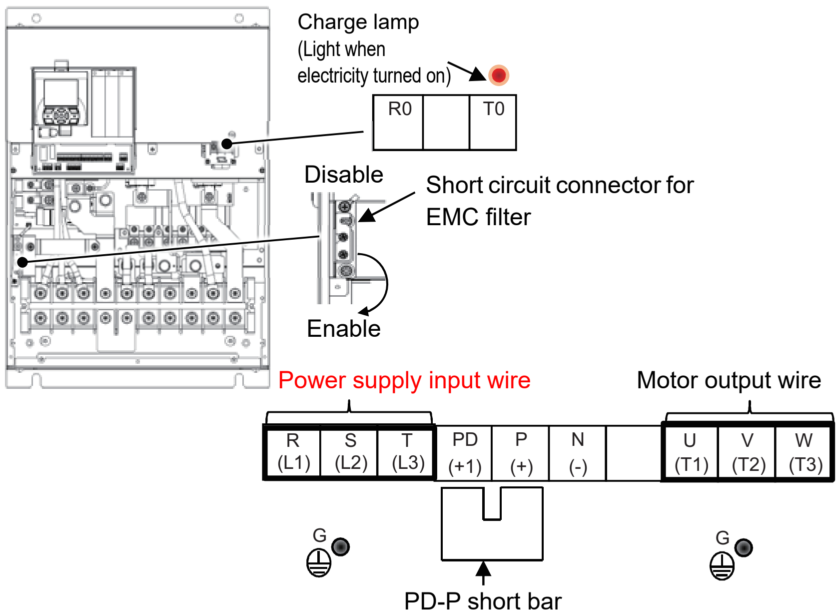
<table>
<tr><th>Arrangement of Terminals</th><th>Model</th></tr>
<tr><td>



* For the switching method of EMC filter, refer to the description on the bottom of the table.

</td><td>3G3RX2-A2450

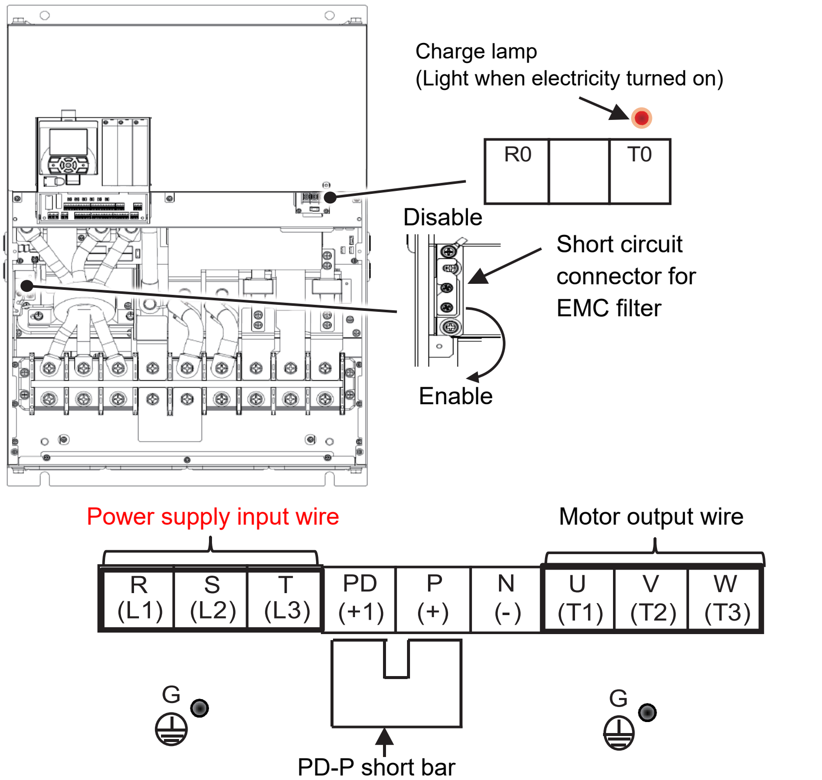
R0,T0 : M4
Earth terminal: M8
Others: M8</td></tr>
<tr><td>



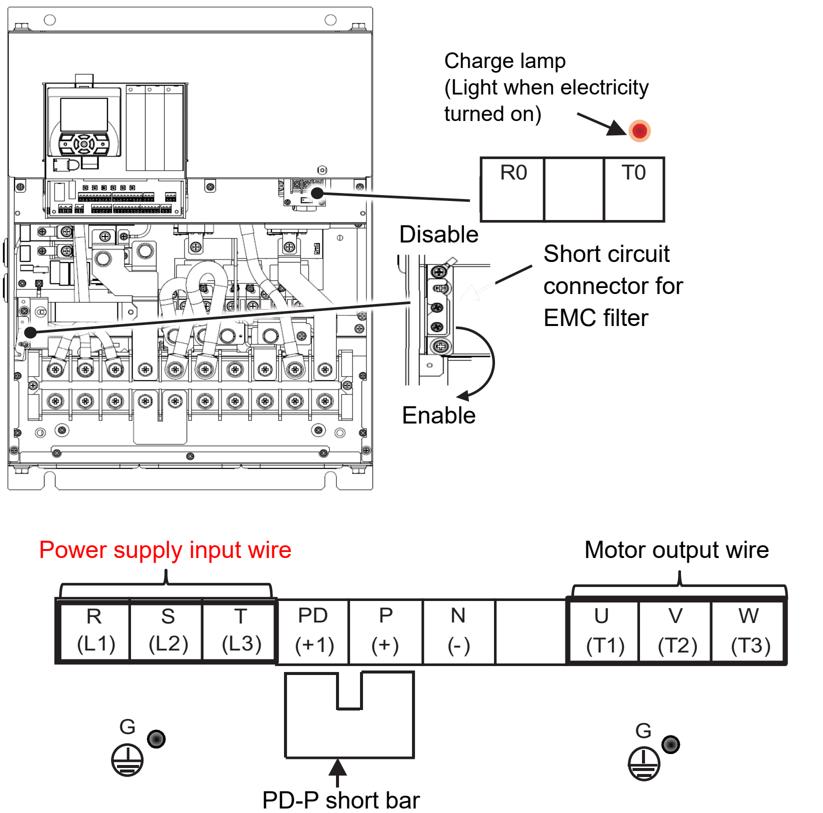
* For the switching method of EMC filter, refer to the description on the bottom of the table.

</td><td>3G3RX2-A4450

R0,T0 : M4
Earth terminal: M8
Others: M8</td></tr>
</table>

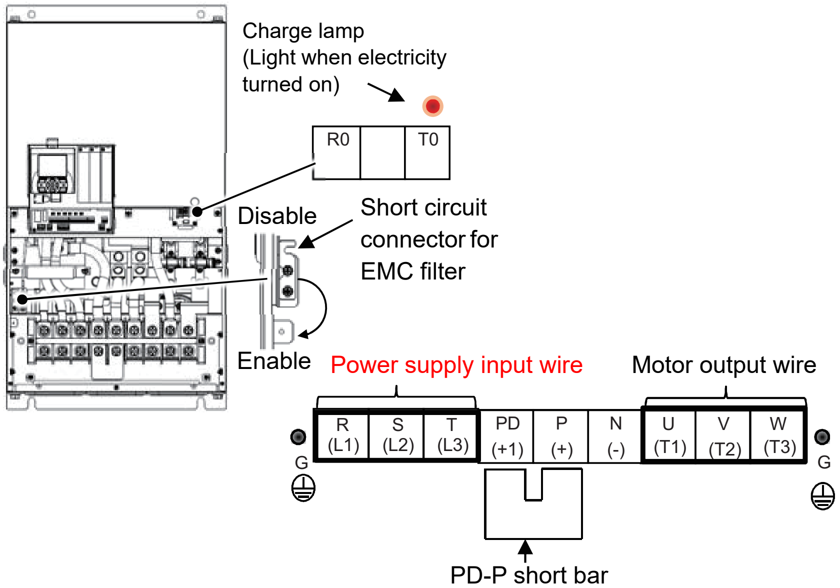
<table>
<tr><th>Arrangement of Terminals</th><th>Model</th></tr>
<tr><td>


* For the switching method of EMC filter, refer to the description on the bottom of the table.
</td><td>3G3RX2-A2550

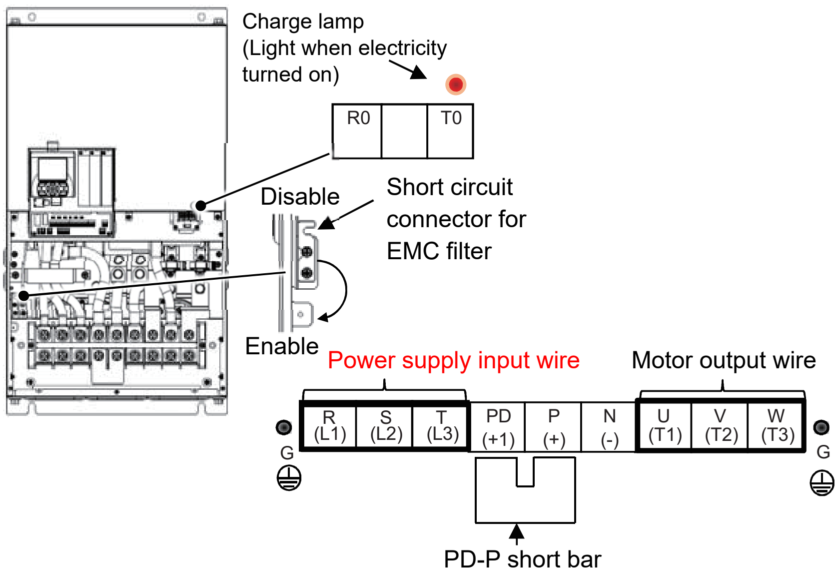
Ro, To: M4
Earth terminal: M8
Others: M10</td></tr>
<tr><td>


* For the switching method of EMC filter, refer to the description on the bottom of the table.
</td><td>3G3RX2-A4550

R0,T0 : M4
Earth terminal: M8
Others: M8</td></tr>
</table>

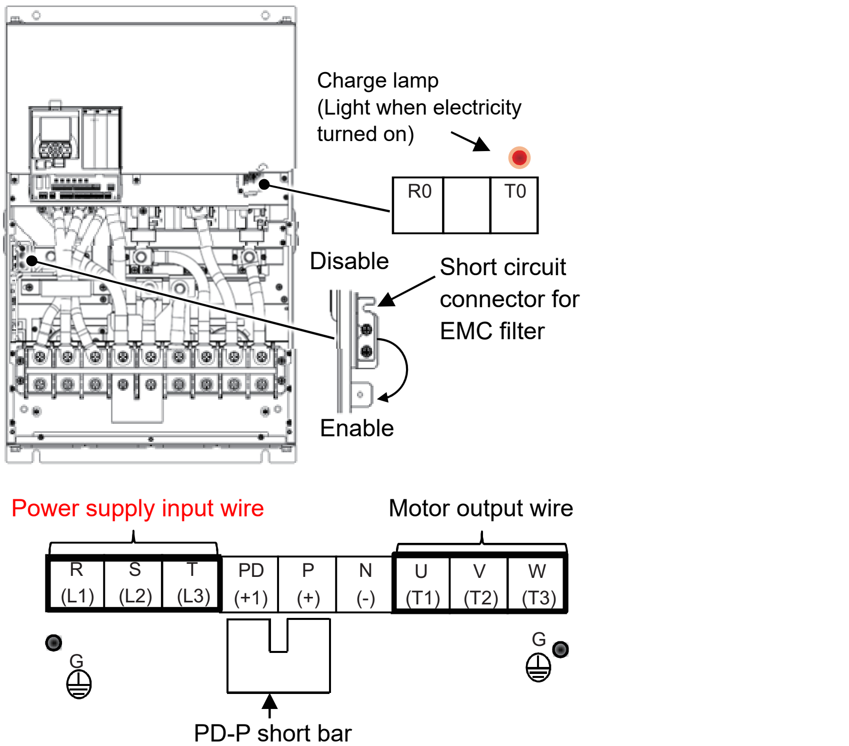
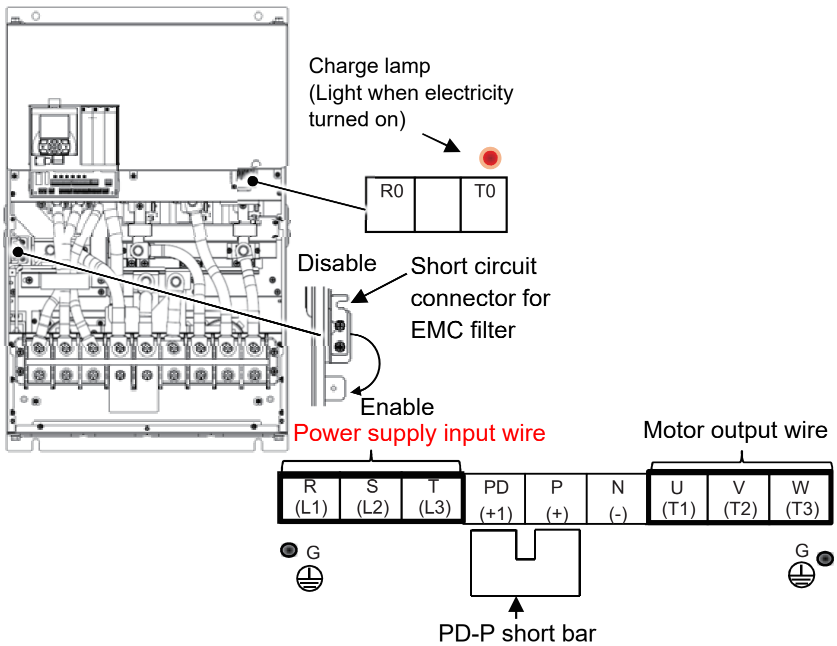
<table>
<tr><th>Arrangement of Terminals</th><th>Model</th></tr>
<tr><td>

* For the switching method of EMC filter, refer to the description on the bottom of the table.</td><td>3G3RX2-B4750

R0,T0 : M4
Earth terminal: M8
Others: M10</td></tr>
<tr><td>

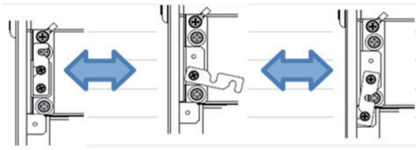
* For the switching method of EMC filter, refer to the description on the bottom of the table.</td><td>3G3RX2-B4900

R0,T0 : M4
Earth terminal: M8
Others: M10</td></tr>
</table>

Arrangement of Terminals	Model
 * For the switching method of EMC filter, refer to the description on the bottom of the table.	3G3RX2-B411K R0,T0 : M4 Earth terminal: M8 Others : M10
 * For the switching method of EMC filter, refer to the description on the bottom of the table.	3G3RX2-B413K R0,T0 : M4 Earth terminal: M8 Others: M10

Switching method of EMC filters

The EMC filter is enabled/disabled by following the description below.



Disabled Switching (screw switching) Enable

Recommended Wire Diameter, Wiring Tools, and Crimping Terminals

Refer to the below table for the wiring to the inverter, the crimping terminal and the tightening torque of the terminal screw.

● 200 V class

Model 3G3RX2-****	Rated settings	Power line AWG (mm^2) R,S,T,U,V,W, P,PD,N	Ground line AWG (mm^2)	Braking resistor AWG between P and RB (mm^2)	Screw size of power line terminal	Crimping terminal power line/ ground line	Tightening torque N•m
A2004	ND	14(2.1)	14(2.1)	14(2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A2007	ND	14(2.1)	14(2.1)	14(2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A2015	ND	14(2.1)	14(2.1)	14(2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A2022	ND	14(2.1)	14(2.1)	14(2.1)	M4	2-4/2-4	1.4
	LD						
	VLD	10(5.3)	10(5.3)	10(5.3)		5.5-4/5.5-4	
A2037	ND	10(5.3)	10(5.3)	10(5.3)	M4	5.5-4/5.5-4	1.4
	LD						
	VLD						
A2055	ND	8(8.4)	8(8.4)	8(8.4)	M5	8-5/8-5	3.0
	LD						
	VLD						
A2075	ND	8(8.4)	6(13.3)	8(8.4)	M5	8-5/8-5	3.0
	LD						
	VLD	6(13.3)		6(13.3)		14-5/8-5	
A2110	ND	6(13.3)	6(13.3)	6(13.3)	M6	14-6/14-6	4.0
	LD	4(21.2)		4(21.2)		22-6/14-6	
	VLD						
A2150	ND	4(21.2)	6(13.3)	4(21.2)	M6	22-6/14-6	2.5 to 3.0
	LD	3(26.7)		3(26.7)		38-6/14-6	
	VLD						
A2185	ND	3(26.7)	6(13.3)	3(26.7)	M6	38-6/14-6	2.5 to 3.0
	LD	2(33.6)		2(33.6)			
	VLD	1(42.4)		1(42.4)		60-6/14-6	
A2220	ND	1(42.4)	6(13.3)	1(42.4)	M8	60-8/14-6	5.5 to 6.6
	LD	1/0(53.5)		1/0(53.5)			
	VLD	2/0(67.4)		2/0(67.4)		70-8/14-6	
A2300	ND	2/0(67.4)	4(21.2)	-	M8	70-8/22-6	6.0
	LD	1/0×2 (53.5×2)				60-8/22-6	
	VLD						
A2370	ND	4/0(107.2)	4(21.2)	-	M8	100-8/22-8	15.0
	LD	1/0×2 (53.5×2)				60-8/22-8	
	VLD						
A2450	ND	1/0×2 (53.5×2)	4(21.2)	-	M8	60-8/22-8	6.0 to 10.0
	LD						
	VLD	2/0×2 (67.4×2)				70-8/22-8	
A2550	ND	350kc(177)	3(26.7)	-	M10	180-10/38-8	19.6
	LD	3/0×2 (85.0×2)				80-10/38-8	
	VLD						

● 400 V class

Model 3G3RX2-****	Rated settings	Power line AWG (mm^2) R,S,T,U,V,W, P,PD,N	Ground line AWG (mm^2)	Braking resistor AWG between P and RB (mm^2)	Screw size of power line terminal	Crimping terminal power line/ ground line	Tightening torque N•m
A4007	ND	14(2.1)	14(2.1)	14(2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A4015	ND	14(2.1)	14(2.1)	14(2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A4022	ND	14(2.1)	14(2.1)	14(2.1)	M4	2-4/2-4	1.4
	LD						
	VLD						
A4037	ND	14(2.1)	14(2.1)	14(2.1)	M4	2-4/2-4	1.4
	LD						
	VLD	12(3.3)	12(3.3)	12(3.3)		5.5-4/5.5-4	
A4055	ND	12(3.3)	12(3.3)	12(3.3)	M5	5.5-5/5.5-5	3.0
	LD						
	VLD	10(5.3)	10(5.3)	10(5.3)			
A4075	ND	10(5.3)	10(5.3)	10(5.3)	M5	5.5-5/5.5-5	3.0
	LD						
	VLD	8(8.4)	8(8.4)	8(8.4)		8-5/8-5	
A4110	ND	8(8.4)	8(8.4)	8(8.4)	M6	8-6/8-6	4.0
	LD						
	VLD						
A4150	ND	8(8.4)	8(8.4)	8(8.4)	M6	8-6/8-6	4.0
	LD						
	VLD						
A4185	ND	8(8.4)	8(8.4)	8(8.4)	M6	8-6/8-6	4.0
	LD	6(13.3)		6(13.3)		14-6/8-6	
	VLD						
A4220	ND	6(13.3)	8(8.4)	6(13.3)	M6	14-6/8-6	4.0
	LD	4(21.2)		4(21.2)		22-6/8-6	
	VLD						
A4300	ND	3(26.7)	6(13.3)	-	M8	38-8/14-6	6.0
	LD	2(33.6)					
	VLD	1(42.4)				60-8/14-6	
A4370	ND	1(42.4)	6(13.3)	-	M8	60-8/14-8	15.0
	LD						
	VLD						
A4450	ND	1(42.4)	6(13.3)	-	M8	60-8/14-8	6.0 to 10.0
	LD	1/0(53.5)					
	VLD	2/0(67.4)				70-8/14-8	
A4550	ND	2/0(67.4)	4(21.2)	-	M8	70-8/22-8	6.0 to 10.0
	LD	1/0×2 (53.5×2)				60-8/22-8	
	VLD						
B4750	ND	1/0×2 (53.5×2)	4(21.2)	-	M10	60-10/22-8	10.0 to 12.0/ 11.7 (16.5/12.5)
	LD						
	VLD						
B4900	ND	1/0×2 (53.5×2)	3(26.7)	-	M10	60-10/38-8	10.0 to 12.0/ 11.7 (16.5/12.5)
	LD						
	VLD	2/0×2 (67.4×2)				70-10/38-8	
B411K	ND	2/0×2 (67.4×2)	1(42.4)	-	M10	70-10/60-8	10.0 to 12.0/ 11.7 (16.5/12.5)
	LD						
	VLD	3/0×2 (85.0×2)				80-10/60-8	

Model 3G3RX2-****	Rated settings	Power line AWG (mm^2) R,S,T,U,V,W, P,PD,N	Ground line AWG (mm^2)	Braking resistor AWG between P and RB (mm^2)	Screw size of power line terminal	Crimping terminal power line/ ground line	Tightening torque N•m
B413K	ND	3/0×2 (85.0×2)	1(42.4)	-	M10	80-10/60-8	10.0 to 12.0/ 11.7 (16.5/12.5)
	LD	4/0×2 (107×2)				100-10/60-8	
	VLD	250kcmil×2 (127×2)				150-10/60-8	

Wiring of Main Power Supply Input Terminal (R/L1, S/L2, T/L3)

Wiring of main power supply input terminal, peripherals and others are described here.

● Establishing Breakers for Wiring

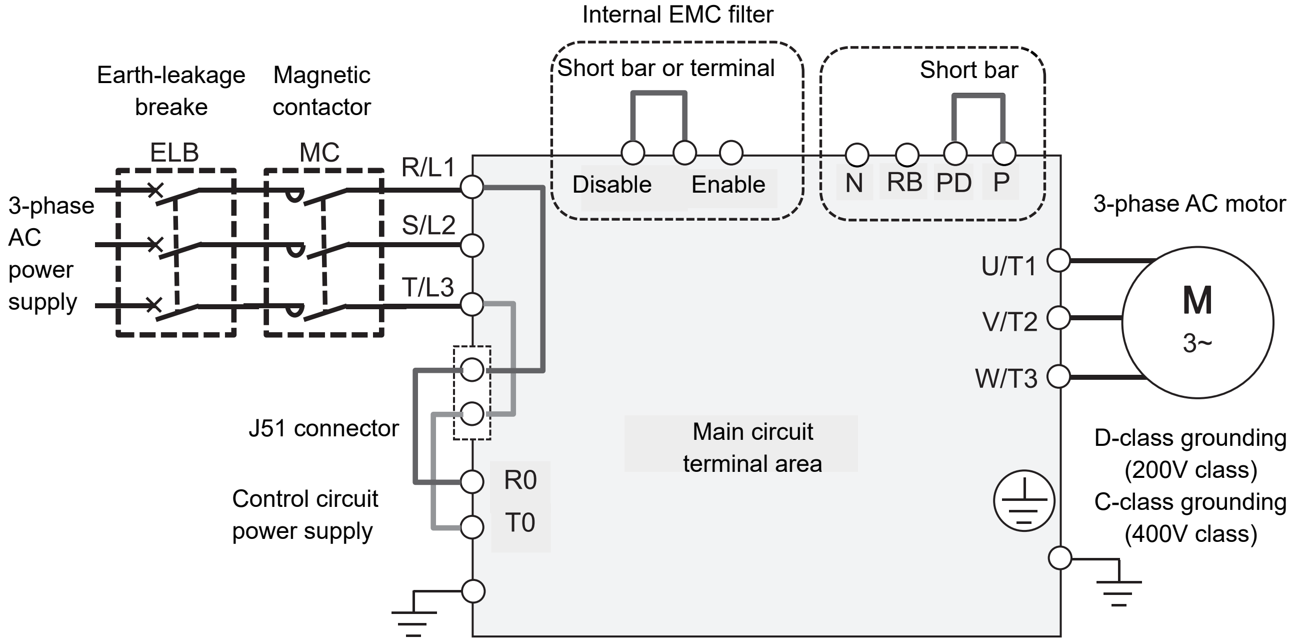
Connect R, S, T (L1, L2, L3) to the AC power supply.

Connect U, V, W (T1, T2, T3) to the motor.

Driving a 200-Volt motor by a 400-Volt inverter may result in fire.

The input power supply must be in the range shown below:

Voltage class	Input range
200 V class	200 to 240 VAC (allowable variation range: +10%/-15%) Power supply frequency 50 Hz/60 Hz (variation range ±5%)
400 V class	380 to 500 VAC (allowable variation range: +10%/-15%) Power supply frequency 50 Hz/60 Hz (variation range ±5%)



● Installing Earth Leakage Breaker

When selecting the earth leakage breaker to use between the power supply and the main power supply input terminals (R, S, T), consider the following two points.

High-frequency leakage current from inverter

The inverter produces a high-frequency leakage current due to its high-speed output switching.

In general, a leakage current of approximately 100 mA will flow for the power cable length of 1 m per inverter. Moreover, an additional leakage current of approximately 5 mA will flow with the increasing length by 1 m.

Therefore, earth leakage breaker that will be used at the power supply input shall be the followings:

- It must remove a leakage current with high frequency.
- It must detect only leakage current in a frequency band that is hazardous to human beings.
- It shall be for an inverter.
- Use an earth leakage breaker that is dedicated for an inverter. Pay an attention that the breaker with a sensitive current of 10 mA or more shall be selected per an inverter.
- When the general earth leakage breaker (to detect a high frequency leakage current) is used, it must be selected with the sensitive current 200 mA or more and the operation time of 0.1 sec. or more per an inverter. However, since even a low frequency sensitive current has a high value, the effect to prevent an electric shock may reduce. Select it at a location that a human being unlikely touch to protect other devices.

Leakage current of EMC noise filter

EMC noise filter is designed in conformity with CE standard in Europe.

When the noise filter designed according to neutral ground based on Europe power supply specification is used with S-phase ground in-house, a leakage current increase.

- With the condition of the noise filter installation in which a leakage current is strictly regulated on the use in-house, when the installation site is not applicable to EMC regulation, disable built-in EMC noise filter and consider use of 3G3AX-ZCL and a ferrite core as a measure against a noise.
- EMC noise filter for 3G3RX2 is enabled at factory default setting. If unnecessary, change from enable to disable. As for the changing method, refer to *2-3-2 Arrangement and Function of Main Circuit Terminal Block* on page 2-21.
- Confirm the following: while the use of the noise filter (3G3AX-NFI) at input side of an external option leads to a noise reduction, it does to a generation of a leakage current.

● External Filter

Refer to the following table.

It is efficient to improve the status on whether it conforms to EMC or not.

When setting the light duty mode, select a maximum applicable motor capacity of the light duty mode.

Power Supply	Model	Maximum applicable motor capacity (kW)		Input Current	Leakage Current (mA max.) with 60Hz
		3-phase 200 VAC	3-phase 400 VAC		
Three-phase AC200 V / AC400 V	3G3AX-EFI41	0.4, 0.75	0.4 to 2.2	7A	150
	3G3AX-EFI42	1.5	3.7	10A	150
	3G3AX-EFI43	2.2, 3.7	5.5, 7.5	20A	170
	3G3AX-EFI44	5.5	11	30A	170
	3G3AX-EFI45	7.5	15	40A	170
	3G3AX-EFI46	-	18.5	50A	250
	3G3AX-EFI47	11	22	60A	250
	3G3AX-EFI48	15	30	80A	250
	3G3AX-EFI49	18.5	37	100A	250
	3G3AX-EFI4A	22, 30	45, 55	150A	250
	3G3AX-EFI4B	37	75, 90	200A	250

● Installing Magnetic Contactor

To shut off the main circuit power supply with a sequence, you can use a magnetic contactor (MC) on the inverter side closer than a molded case circuit-breaker (MCCB).

However, do not run or stop the inverter by turning ON/OFF a magnetic contactor established at the input and output side of power supply of inverter. Otherwise, it may cause damage on the inverter.

Use the RUN command signal (FW/RV) via the control circuit terminal of the inverter.

- Construct a sequence that turns OFF the power supply via the alarm output signal of the inverter.
- To use one or more braking resistors/regenerative braking units, construct a sequence that turns OFF a magnetic contactor via a thermal relay contact in each unit.

Precautions for Correct Use

Do not shut off the power supply more than once in 3 minutes. Doing so may result in inverter damage.

● Inrush Current Flow When the Inverter Power Supply Is Turned ON

When the inverter power supply is turned ON, the charging current, which is called inrush current, flows in the main circuit board capacitor.

The table below shows the reference values at a power supply voltage of 240 V or 480 V when the power supply impedance is low. Take this into consideration when selecting the inverter power supply.

- With a low-speed no-fuse breaker, an inrush current 10 times the rated current can flow for 20 ms.
- To turn ON the power supply for multiple inverters simultaneously, select a no-fuse breaker with a 20-ms allowable current greater than the total inrush current shown in the following table.

Three-phase 200 V Level		Three-phase 400 V Level	
3G3RX2-	Inrush Current (Ao-P)	3G3RX2-	Inrush Current (Ao-P)
A2004-A2007	24	A4007-A4037	23
A2015-A2037	17	A4055-A4110	34
A2055-A2110	45	A4150-A4220	68
A2150-A2220	89	A4300-A4370	39
A2300	54	A4450-A4550	65
A2370-A2550	96	A4750-A4950	130
		A411K-A413K	260

● Main Power Supply Phase Loss and Single-phase Input

This inverter is designed for 3-phase power supply input. It cannot be used with a single-phase power supply. Similarly, do not use the inverter in an input phase lost state of the 3-phase power supply. Doing so may result in inverter damage.

Be sure to check the wiring for the 3-phase power supply before using the inverter. Note that the inverter operates without detecting a phase loss if it occurs in the phase S as shown below.

Phase loss	State
Phase R	The inverter does not operate.
Phase T	The inverter does not operate.
Phase S	The inverter operates in a single-phase. Under voltage or over current could occur, which could lead to the inverter broken.

⚠ WARNING

Do not remove the terminal cover during the power supply and 15 minutes*1*2 after the power shut off. Doing so may result in a serious injury dueto an electric shock.

*1. 10 minutes: For models 3G3RX2-A2004 to A2220 and 3G3RX2-A4007 to A4220

*2. 15 minutes: For models 3G3RX2-A2300 to A2550 and 3G3RX2-A4300 to B413K

Precautions for Safe Use

Even when the inverter is in an input phase lost state, built-in capacitors are charged, which may result in an electric shock or injury.

● Power Supply Environment

In the following cases, the internal converter module (rectifier) may be damaged.

Take countermeasures such as installing an AC reactor on the main circuit input side of the inverter.

- The power supply voltage unbalance factor is 3% or more.
- The power supply capacity is at least 10 times larger than the inverter capacity and, at the same time, 500 kVA or more.
- Rapid change in the power supply voltage occurs.

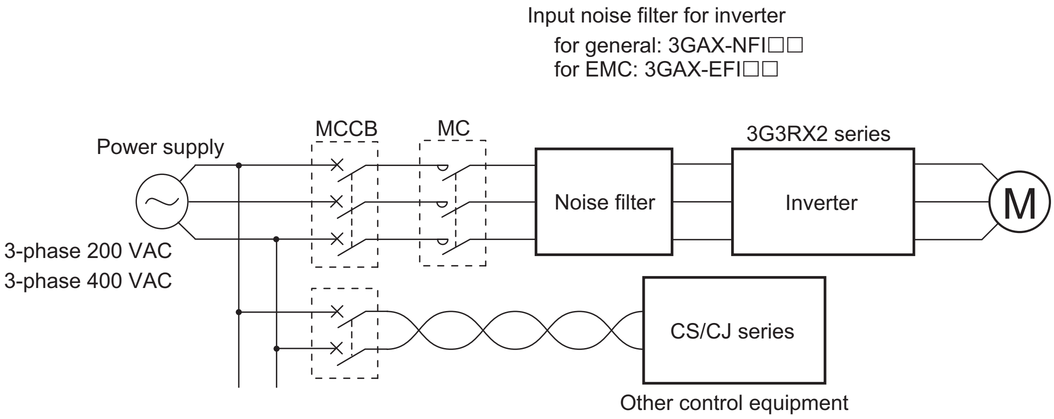
  Example: the phase advance capacitor is turned on/off

● Installing Input Surge Absorber

When using an inductive load (such as a magnetic contactor, magnetic relay, magnetic valve, solenoid, or electromagnetic brake), use a surge absorber or diode together.

● Installing Input Noise Filter

The inverter performs high-speed output switching, which may cause the noise flow from the inverter to power supply lines that negatively affects on peripheral equipment. Therefore, it is recommended to use an input noise filter to reduce noise flowing out to power supply lines. This also helps to reduce noise that enters the inverter from power supply lines.



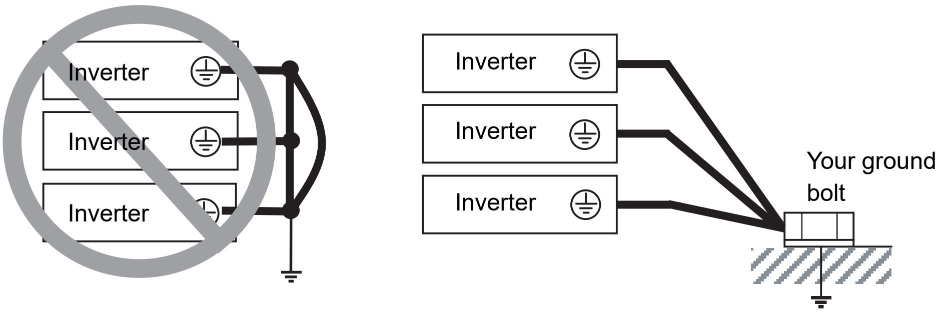
Wiring for Ground Terminal (G⏚)

To prevent electric shock, be sure to ground the inverter and the motor.

The 200-V class should be connected to the ground terminal under type-D grounding conditions (conventional Class 3 grounding conditions: 100 Ω or less ground resistance). The 400-V class should be connected to the ground terminal under type-C grounding conditions (conventional special Class 3 grounding conditions: 10 Ω or less ground resistance).

For the ground cable, use the applicable cable or a cable with a larger diameter. Make the cable length as short as possible.

When several inverters are connected, the ground cable must not be connected across several inverters or looped. Otherwise, the inverters and peripheral control equipment may malfunction.



Harmonic Current Measures and DC/AC Reactor Wiring (PD, P)

In recent years, there is an increasing concern about suppressing the harmonic currents to the power supply line in accordance with “Guideline to reduce harmonic emissions caused by electrical and electronic equipment for household and general use.”

The following provides an overview of harmonics and measures against harmonics implemented in this inverter.

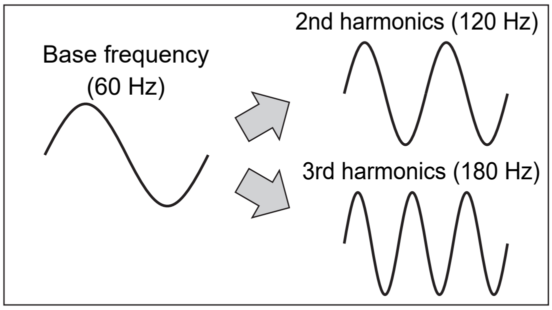
● Harmonics

The voltage or current whose frequency is an integral multiple of certain standard frequency (base frequency) is called a harmonic.

If a commercial power supply frequency of 60 Hz (50 Hz) is the reference frequency, the harmonics of that signal is:

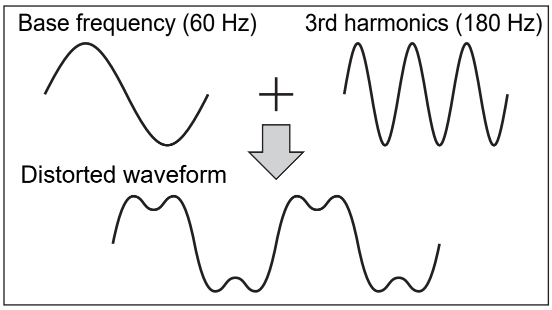
x2 = 120 Hz (100 Hz),

x3 = 180 Hz (150 Hz), and so on.



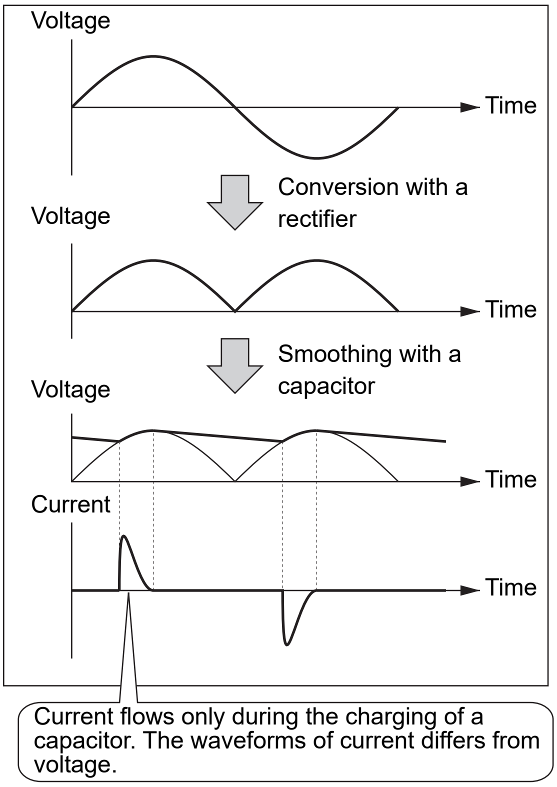
● Reason Why Harmonics Cause Problems

As the number of harmonics increases, the waveform of the commercial supply has more distortion. This distortion causes the malfunction of the connected equipment or leads to abnormal heat generation.



Causes of Harmonics

- General electrical equipment internally converts AC input power (commercial power) into DC power. At this time, harmonic currents occur because of the difference in the current flow direction between AC power and DC power.
- In an AC-to-DC power conversion, the rectifier converts the input power into a unidirectional voltage, which is then smoothened by the capacitor. As a result, the current charged into the capacitor has a waveform that contains harmonic components.
- This inverter also performs an AC-to-DC conversion as with other electrical equipment, which allows current with harmonic components to flow. In particular, the inverter has more current than other equipment, so the number of harmonic components in current is larger.



DC/AC Reactor

To suppress harmonic currents, use the DC (direct current) and AC (alternating current) reactors.

The DC/AC reactor functions to suppress a steep change in the current.

The DC reactor has higher harmonics suppression ability, so even higher suppression ability can be expected when used in conjunction with the AC reactor.

Suppressing harmonic currents also leads to the improvement in the power factor on the input side of the inverter.

Before Wiring

The DC reactor is connected to the DC power supply located inside the inverter. Before wiring, be sure to turn off the power supply and make sure that the charge indicator is not lit.

Wire the inverter so that the heat from DC reactor (DCL) does not give any influences on the inverter.

Before connecting the DC reactor DCL option, remove this short-circuit bar between PD and P.

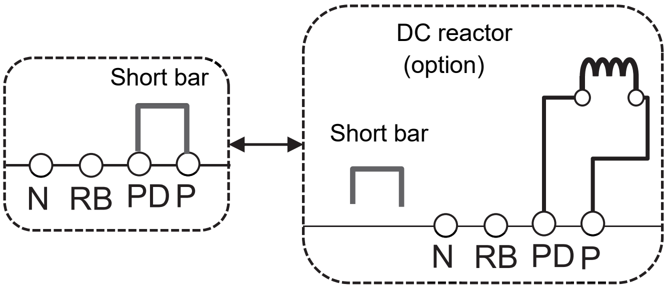
Note that the length of the DC reactor connection cable must be 5 m or shorter. Otherwise, you cannot have enough results you desire.

In case you do not use DC reactor DCL option, do NOT remove the PD-P short bar.

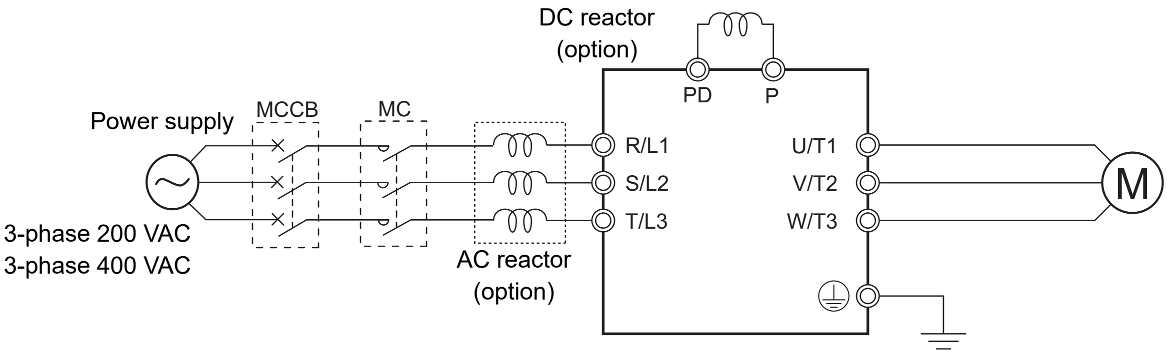
If you remove the short-circuit bar with the DC reactor unconnected, the inverter cannot operate because no power is supplied to its main circuit.

● Wiring Method

With DC reactor



With DC reactor and AC reactor



● Effect of Reactors

Through the use of the DC/AC reactor, the rate of harmonic current occurrences can be reduced as shown in the table of typical examples below.

Measure against harmonics	Harmonic current occurrence rate [%]							
	5th	7th	11th	13th	17th	19th	23rd	25th
None (Inverter only)	65	41	8.5	7.7	4.3	3.1	2.6	1.8
With AC reactor	38	14.5	7.4	3.4	3.2	1.9	1.7	1.3
With DC reactor	30	13	8.4	5	4.7	3.2	3.0	2.2
With DC and AC Reactors	28	9.1	7.2	4.1	3.2	2.4	1.6	1.4

● Guideline for Reactor Selection

When implementing measures against harmonics, first install a DC reactor and evaluate its effect.

Then, if further reduction is required, add an AC reactor.

To implement harmonic countermeasures in consideration of the power supply environment, first install an AC reactor and evaluate its effect. Then, if further reduction is required, add a DC reactor.

If you have multiple inverters and use the AC reactor, use one AC reactor for each inverter. Using only one AC reactor for more than one inverter does not provide sufficient reduction.

Wiring for Inverter Output Terminals (U/T1, V/T2, W/T3)

The following describes the wiring for the inverter output terminals (U/T1, V/T2, W/T3).

● Never Connect Power Supply to Output Terminals

Never connect the power supply to the output terminals U/T1, V/T2, W/T3.

The inverter is damaged internally if power supply voltage is applied to the output terminals.

● Never Short or Ground Output Terminals

Do not touch the output terminals with bare hand or contact the output wires with the inverter's case.

Doing so may result in electric shock or ground fault.

Be careful not to short the output wires.

● Do Not Use Phase Advance Capacitors/noise Filters

Never connect a phase advance capacitor or LC/RC noise filter for general-purpose power supplies to the output circuit.

Doing so may result in damage to the inverter or burnout of these parts.

● Do Not Use Magnetic Switches

Do not connect any magnetic switches or magnet contactor to the output circuit.

If a load is connected to the inverter in operation, the inverter's overcurrent protection circuit is activated due to the inrush current.

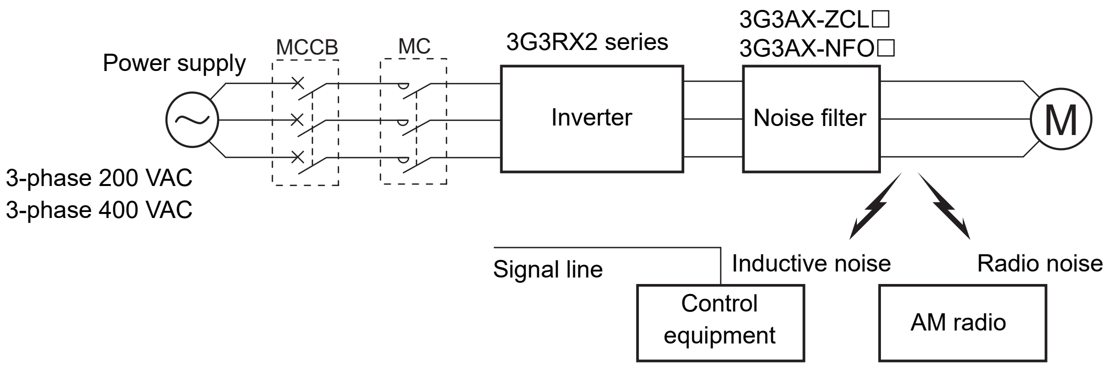
● Precautions for Connecting More Than One Motor to Inverter's Output Terminals

If connecting more than one motor to the output terminals of the inverter, note the following three points.

- Make sure that the ND-rated current (Normal Duty) of the inverter is higher than the sum of the rated current values of the connected motors. Select an inverter with a sufficient capacity, taking emergency situations into consideration.
- The inverter cannot provide overload protection for individual motors, because it only detects a sum of the current values for all the connected motors. Install a thermal relay for each motor. The RC value of each thermal relay must be 1.1 times larger than the rated current of the motor.
- Set the inverter to detect only overloading that occurred in it by setting the Electronic Thermal Level to the rated output current of the inverter.

● Installing Output Noise Filter

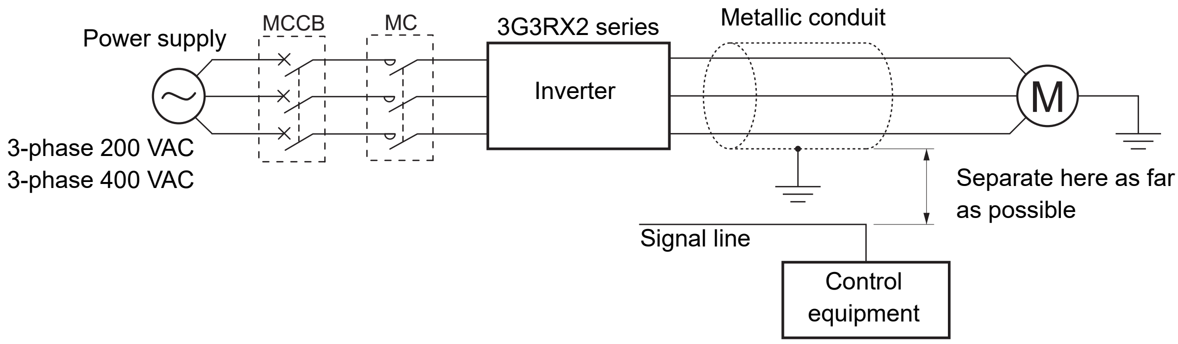
Connecting a noise filter to the output side of the inverter enables the reduction of radio noise and inductive noise.



Noise	Description
Inductive noise	Produced by electromagnetic induction, this noise causes malfunction of control equipment due to noise in signal lines.
Radio noise	The electromagnetic waves emitted from the inverter body or cables cause noise in radio receivers.

● Measures against Inductive Noise

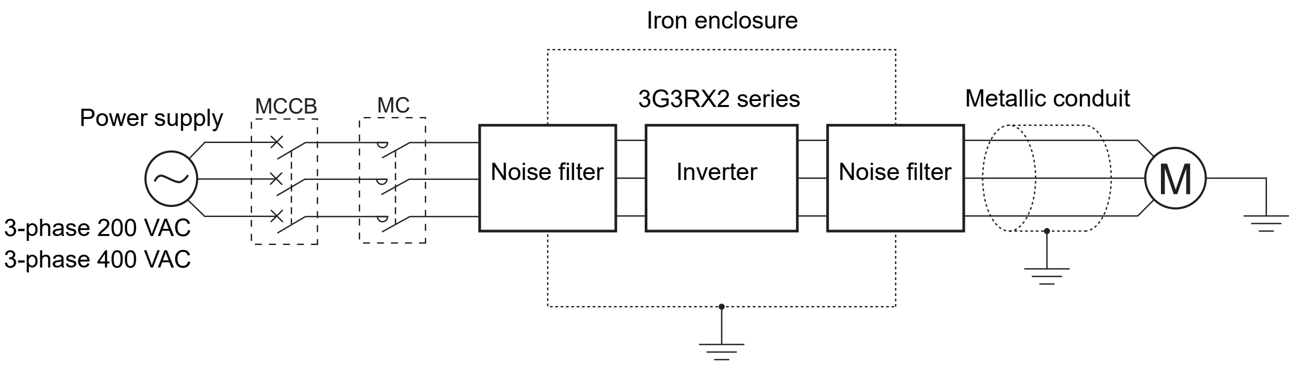
In addition to the noise filter described above, you can suppress the inductive noise produced on the output side by connecting a bundle of wires through a grounded metal conduit. Separate the metal conduit as far as possible from the signal line in order to suppress the influence of inductive noise.



● Measures against Radio Noise

Besides the I/O wires, radio noise is radiated from the inverter itself. This radio noise can be reduced by installing noise filters on both the input and output sides of the inverter and by installing and shielding the inverter body in a grounded iron enclosure etc.

Keep the cables between the inverter and the motor as short as possible.



● Cable Length Between Inverter and Motor

If the length of the cables between the inverter and the motor is long, consider how to address the following problems.

- Voltage drop in output cables. As the cable length between the inverter and the motor increases, the resistance in the cables becomes higher and accordingly the amount of voltage drop in the inverter output voltage becomes larger. This causes a decrease in the voltage that is to the motor, which results in a low output torque.

  If the cable is long, take measures to reduce the resistance, for example, by selecting cables whose wire diameter is larger than specified.
- Surge in long cables

  If the cable length exceeds 20 m, a surge voltage (approximately 1200 V maximum for 400-V class) may be generated at the motor terminal depending on the stray capacitance or inductance of the cable, which may result in motor burnout.

  In particular, when using a 400-V class inverter with a cable length of over 20 m, it is recommended to use a dedicated inverter motor. Dedicated inverter motors are designed to support the above surge voltage level.
- Leakage current from output cables

  As the cable length between the inverter and the motor increases, stray capacitance increases between the inverter output and the ground. The increase in the stray capacitance on the output side of the inverter causes an increase of the high-frequency leakage current.

  This high-frequency leakage current may negatively affect the current detector in the inverter output section or peripheral equipment. It is recommended to keep the wiring distance between the inverter and the motor at 100 m or shorter.

  If your system configuration requires the wiring distance of over 100 m, take measures to decrease the stray capacitance. The applicable measures are such as not wiring in a metal duct and using a separate cable for each phase.

  In addition, set a carrier frequency appropriate for the wiring distance between the inverter and the motor according to the table below.

Wiring distance between inverter and motor	50 m max.	100 m max.	Over 100 m
Carrier frequency	10 kHz max.	5 kHz max.	2.5 kHz

External Braking Resistor Connection Terminal (P, RB)/ Regenerative Braking Unit Connection Terminal (P, N)

When driving a load with a large inertia or a vertical shaft, regenerated energy is fed back to the inverter when it is decelerating or generating downward movement.

If the amount of regenerative energy exceeds the allowable amount for the inverter, an overvoltage is detected. Use braking resistors or regenerative braking units to prevent this.

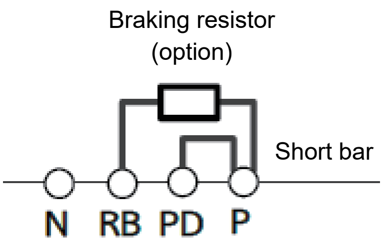
● 200 V Class Models with 22 kW or Lower/400 V Class Models with 37 kW or Lower

The models have a built-in regenerative braking circuit.

To improve the braking capacity, connect the optional external braking resistor to these terminals (P, RB).

Precautions for Safe Use

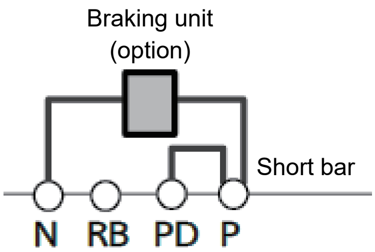
- Be sure to install a circuit that detects overheating of the braking resistor via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.
- Do not connect a resistor whose resistance is lower than the minimum connection resistance value specified in the standard specifications table. Doing so may result in damage to the regenerative braking circuit.
- When using the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC) with a 400-V class inverter, be sure to connect two braking resistors of the same model in series. Using the inverter with only one braking resistor connected may cause damage to the braking resistor.



● 200 V Class Models with 30 kW or Higher/400 V Class Models with 45 kW or Higher

These models have no built-in regenerative braking circuit.

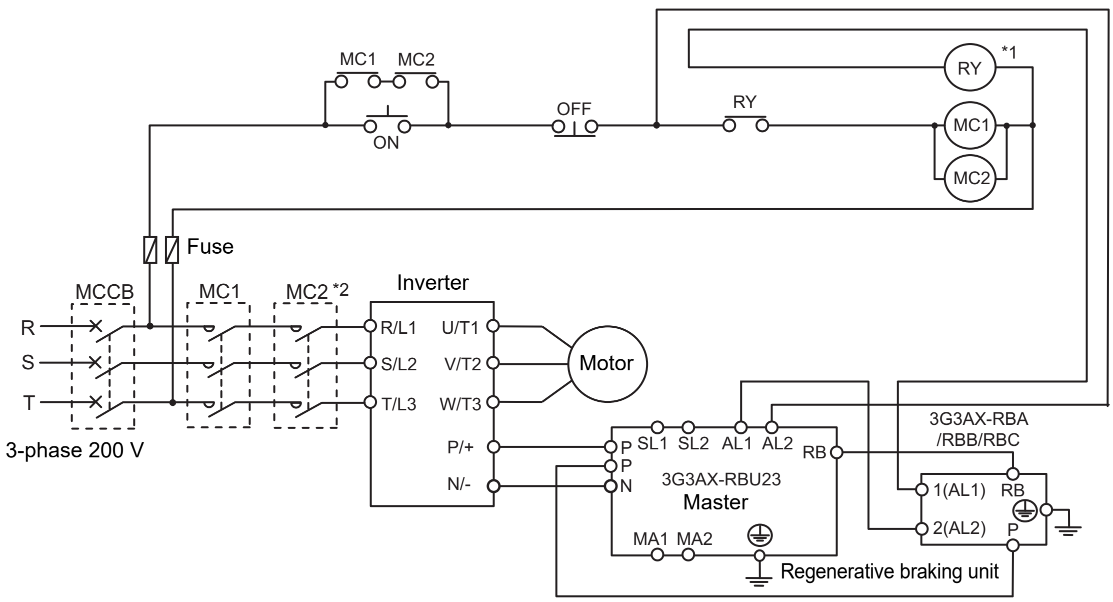
To improve the braking capacity, use the optional external braking resistor(s) and regenerative braking unit(s). In this case, connect the terminals (P, N) of the regenerative braking unit to the inverter's terminals (P, N).



Precautions for Safe Use

- Be sure to install a circuit that detects overheating of the regenerative braking unit(s) and braking resistor(s) via alarm contacts (thermal relay output terminals) and shuts off the input power supply of the inverter.
- Do not connect a resistor whose resistance is lower than the connection resistance value specified in the specifications table for that regenerative braking unit. Doing so may result in damage to the regenerative braking unit.
- When using the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC) with a 400-V class Regenerative Braking Unit (Model: 3G3AX-RBU41/RBU42/RBU43), be sure to connect two braking resistors of the same model in series. Using the Regenerative Braking Unit with only one braking resistor connected may cause damage to the braking resistor.
- When using the Regenerative Braking Unit (Model: 3G3AX-RBU21/RBU22/RBU41) with a built-in braking resistor with the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC), remove the built-in resistor according to the manual for the regenerative braking unit. Using the Regenerative Braking Unit with the built-in resistor connected may cause burnout of the built-in resistor.

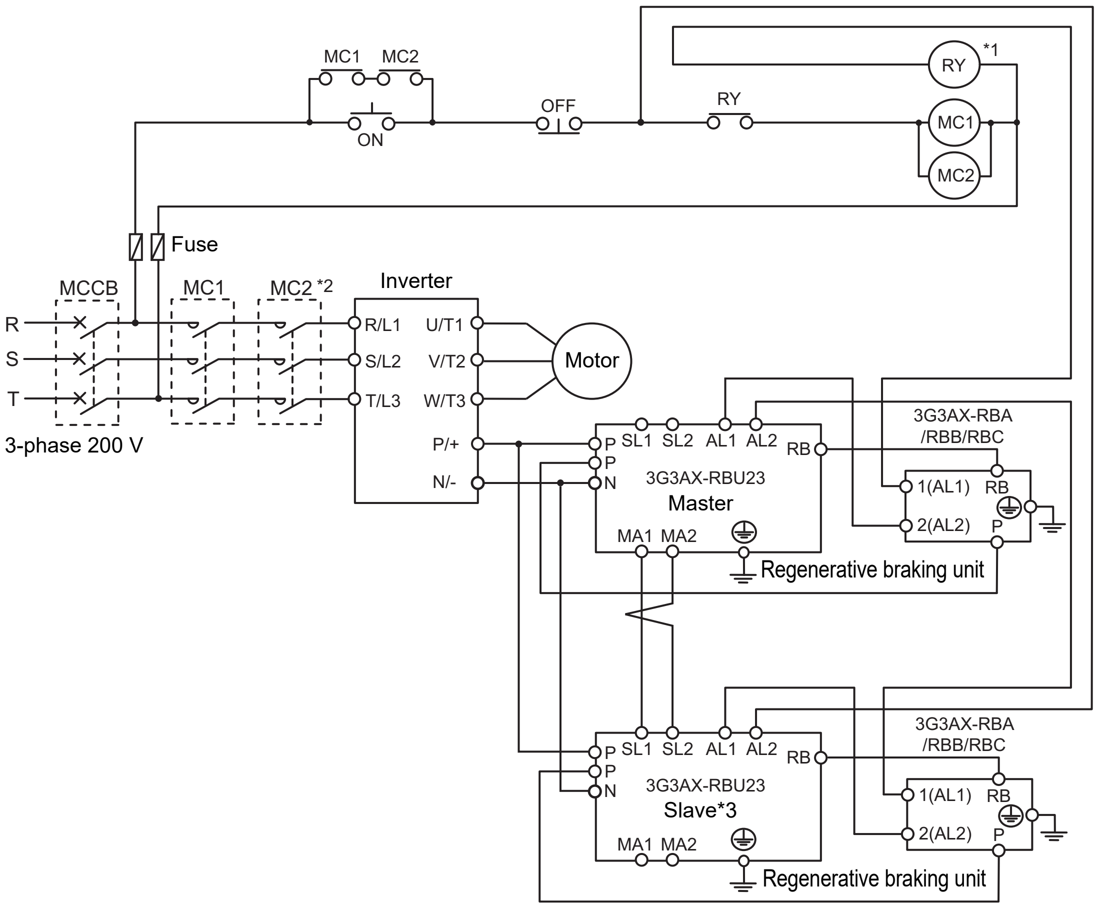
- Wiring diagram for connecting one Regenerative Braking Unit (Model: 3G3AX-RBU23)



*1. For RY, select the contact rating according to the ratings of the coils MC1 and MC2.

*2. MC1 and MC2 are used not only to provide redundancy, but also to meet safety standards.

- Wiring diagram for connecting two Regenerative Braking Units (Model: 3G3AX-RBU23)



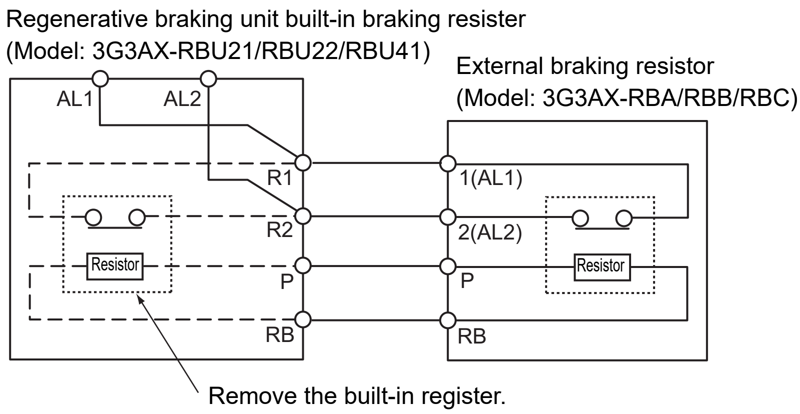
*1. For RY, select the contact rating according to the ratings of the coils MC1 and MC2.
*2. MC1 and MC2 are used not only to provide redundancy, but also to meet safety standards.
*3. You need to set DIP switch to regenerative braking unit as a slave, and wire terminal SL1 and SL2.

Precautions for Correct Use

- Each braking resistor has alarm contact (thermal relay output) terminals as shown below. Be sure to perform wiring for these terminals.

Model	Alarm contact terminals
3G3AX-RBA□/RBB□	Between terminal 1 and terminal 2
3G3AX-RBC□	Between terminal AL1 and terminal AL2

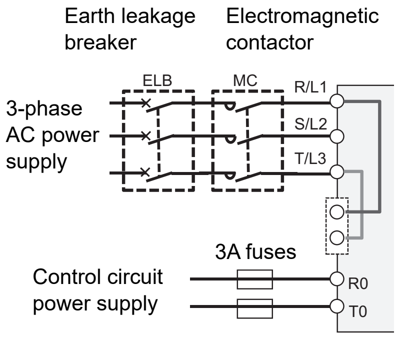
- To remove the built-in register from the Regenerative Braking Unit with a Built-in Braking Resister (Model: 3G3AX-RBU21/RBU22/RBU41) in order to use the Braking Resistor (Model: 3G3AX-RBA/RBB/RBC), remove the wiring of thermal relay for the built-in resistor and connect the alarm contact (thermal relay output) terminals of the braking resistor with the terminals R1 and R2.



Connection for Separating Inverter Control Circuit Power Supply from Main Power Supply

If the inverter protection circuit is activated to shut off the magnetic contactor of the input power supply, the power to the inverter control circuit is also turned off, and the alarm signal [AL] cannot be retained. If the alarm signal must be retained, use control circuit power supply terminals Ro and To. Connect control circuit power supply terminals Ro and To with the primary circuit of the magnetic contactor according to the following procedure.

(Connection method)
Receiving electricity specifications
200-V class:
200 to 240 VAC (+10%, –15%)
(50/60 Hz ±5%)
(282 to 339 VDC)
400-V class:
380 to 500 VAC (+10%, –15%)
(50/60 Hz ±5%)
(537 to 707 VDC)



(1) Disconnect the connected wire to R0 and T0.
(2) Disconnect the J51 connector.
(3) Connect the control circuit power supply cable to R0 and T0.

Precautions for Correct Use

To separate the control circuit power supply (Ro, To) from the main circuit power supply (R, S, T), observe the following instructions:

- For wiring between terminals Ro and To (terminal screw size: M4), use a cable of 1.25 mm^2 or heavier.
- Connect a 3 A fuse to the control circuit power supply cable.
- If the control circuit power supply (Ro, To) is turned on before the main circuit power supply (R, S, T), ground fault detection at power-on is disabled.
- If you supply direct current power supply to the control circuit power supply (R0, T0), set the output terminal NO/NC selection [CC-11] – [CC-17] to “00.” Otherwise when the direct current is shut off, output signal may chatter.
- For the terminals Ro and To, the tightening torque should be as follows.
  M4: 1.2 N·m (1.4 N·m max.)

2-3-5 Wiring for Control Circuit Terminals

Wiring for Control Circuit Terminals

The terminals L, COM and CM2 are insulated from each other via the input and output signal common terminals. Do NOT short-circuit or ground terminals. Do NOT ground terminals via external equipment, either. When finished wiring, check the external equipment ground conditions.

For wiring to the control circuit terminals, use twisted-pair shielded wires. Connect the shielded wire to each common terminal.

Twist a cable connected to the terminal TH (thermistor input) with a cable of the terminal SC individually, and separate them from other SC common cables. Since the current flowing through the thermistor is weak, separate the thermistor cable from main circuit wiring (power lines). The thermistor connection cable should be 20 m or shorter.

Connect diodes to output terminals and relay output terminals for the countermeasure of reverse electric power.

The control circuit terminal block has two rows of terminals. Start wiring from the lower terminals. Wiring from the upper terminals makes it difficult to wire the lower terminals.

Precautions for Correct Use

- Wiring the I/O signal lines for more than one inverter results in creating a sneak path in the circuit. Connect a diode for sneak current prevention.
- The control circuit connection cables should be 20 m or shorter. Otherwise the inverter may not perform specified characteristics due to voltage reduction or other reasons. When it is inevitable to use a connecting wire shorter than 20 meters, apply analog insulating signal converter and confirm it performs correctly.
- Separate the cables for control circuit terminal connection from the main circuit cable (power lines) and the relay control circuit cable. If you cannot avoid crossing cables each other, try to keep them at right angles to each other. Not doing so may result in the inverter malfunction.

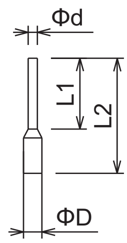
  Separate signal lines from power supply lines when wiring.
- Do not short-circuit the analog power supply terminals FS and FC and/or the interface power supply terminals P24 and SC. Doing so may result in failure of the inverter.
- After wiring, pull the wire slightly to confirm that it is connected properly.

● Recommended Terminals for Wiring

Spring-clamp types of terminals are used for the control circuit terminal blocks. We recommend rod-terminals in the following specifications for improvement of wiring and reliability of connecting.

Pin-terminals with sleeves.

Wire size mm^2 (AWG)	L1 [mm]	L2 [mm]	Φd [mm]	ΦD [mm]
0.25 (24)	8	12.5	0.8	2.0
0.34 (22)	8	12.5	0.8	2.0
0.5 (20)	8	14	1.1	2.5
0.75 (18)	8	14	1.3	2.8

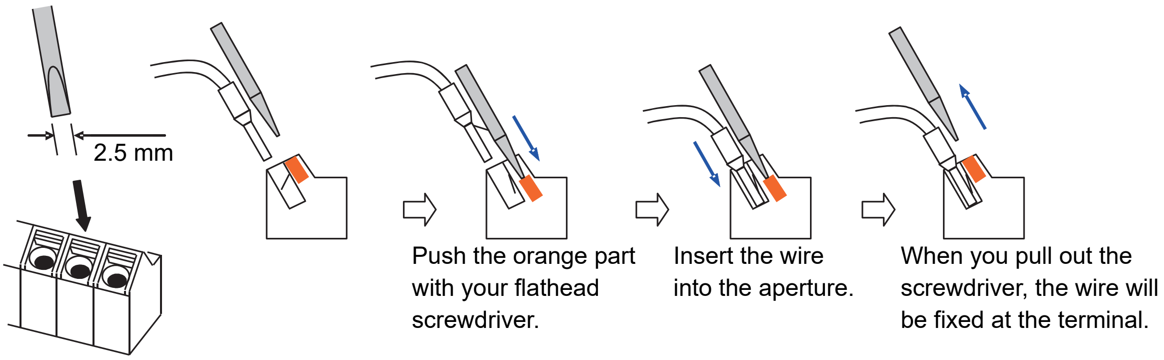


● Wiring Method

1 Push the orange colored part on the control circuit terminal block with a flathead screwdriver (2.5 mm widths or narrower), and the wire-inserting aperture (the circular hole) will open.

2 While you are holding the screwdriver in the hole, insert the wire or rod-terminal into the wire-inserting aperture.

3 When you pull out the screwdriver, the wire will be fixed at the terminal.

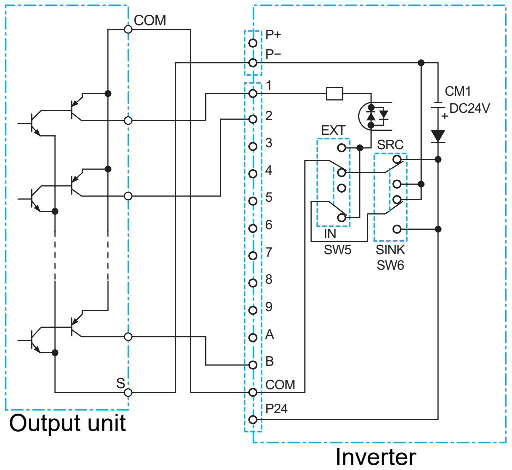
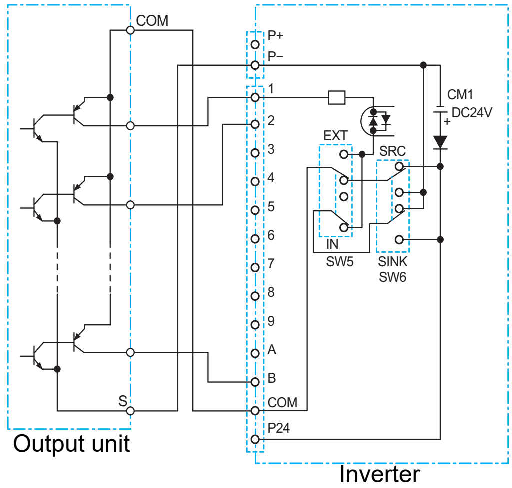


Precaution for Pulling Out the Wire

Pull the wire out of the terminal block, while you keep opening the wire-inserting aperture by pushing the orange part with your screwdriver.

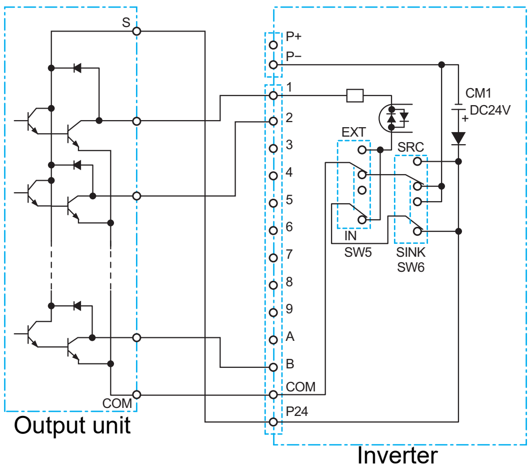
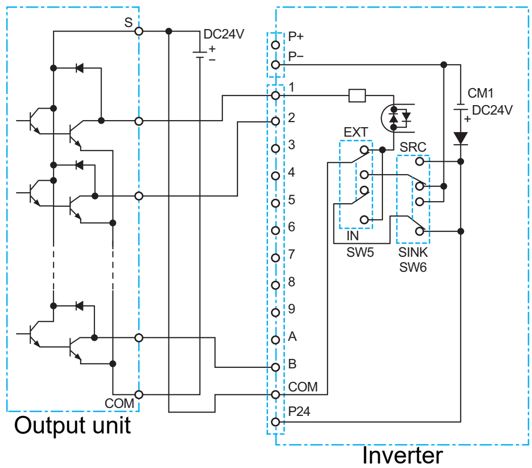
Input Terminals and Programmable Controller Connection

● Source Logic

When inverter's internal power supply is applied	When external power supply is applied
	

- If you apply the inverter's internal power supply, set SW5 to IN.
- If you apply the external power supply, set SW5 to EXT.
- If you connect output unit of source type, set SW6 to SRC.

● Sink Logic

When inverter's internal power supply is applied	When external power supply is applied
	

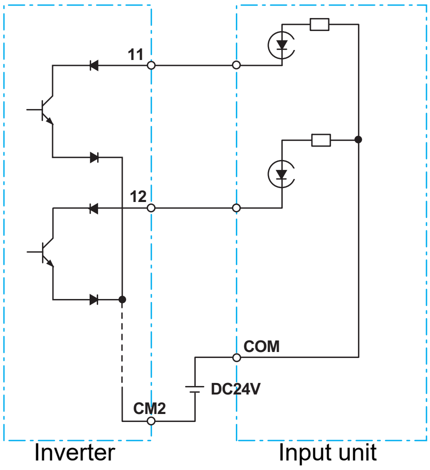
- If you apply the inverter's internal power supply, set SW5 to IN.
- If you apply the external power supply, set SW5 to EXT.
- If you connect output unit of sink type, set SW6 to SINK.

Precautions for Correct Use

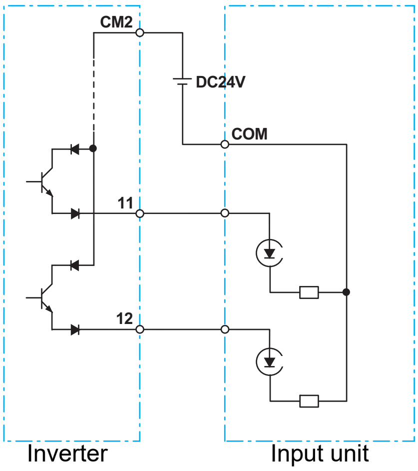
- Confirm the SW6-position for switching the sink/source logic, before turning on the main power supply. Not doing so may result in damage of the inverter or its peripheral unit.
- Make sure you must turn on the programmable controller and its external power supply at first before you turn on the inverter's power supply. Otherwise inverter's inner data may be altered.

Output Terminals and Programmable Controller Connection

● Sink Logic



● Source Logic



2-3-6 Wiring for PG Option Unit

To use PG vector control with this inverter, you need to mount and wire the PG Option Unit 3G3AX-RX2-PG01. Then, install a detector (encoder) to the motor rotating shaft and wire it to the PG Option Unit. For the detector (encoder), use a line-driver output type encoder. This is required for PG vector control, position control, or torque control operation.

Terminal Functions

Terminal name		Terminal symbol	Functions	Common terminal	Electric specifications
Input terminal	Pulse train position command input	SAP SAN SBP SBN RSA RSB	• Pulse train input procedure MD0: 90º phase difference pulse MD1: Forward/Reverse signal, pulse train MD2: Forward pulse/Reverse pulse Mode settings is made in the pulse train mode selection (ob-11). • RSA: Termination resistor ON/OFF terminal between SAP and SAN • RSB: Termination resistor ON/OFF terminal between SBP and SBN • Termination resistor settings Built-in termination resistor: 150 Ω, switch between enabled and disabled with the wiring RSA, RSB terminals released: Built-in termination resistor disabled RSA-SAN short-circuit, RSB-SBN short-circuit: Built-in termination resistor enabled		5V DC receiver input (RS-422 compliance)
	Encoder signal input	EAP EAN EBP EBN EZP EZN	A, B, Z: Rotary encoder signal input		Photo coupler input (Corresponds to the 5V DC line driver output type rotary encoder)
Output terminal	Encoder signal output	AP AN BP BN ZP ZN	Output the encoder signal input. (Pulse ratio 1 : 1)		5V DC line driver output (RS-422 compliance)
	Power supply for encoder	EP5	+5V DC power supply	EG	Total supply capacity of EP5 and EP12 (250 mA max.)
		EP12	+12V DC power supply		
Functional Grounding terminal		FG	Connect to the Functional Grounding connection. (Screw size: M3)		

Specifications

Item		Specifications	
Model		3G3AX-RX2-PG01	
Dimensions (width × height × depth)		20.5×98.0×70.0 mm	
Weight		170 g	
Environment	Ambient operating temperature	-10 to 50°C	With no icing or condensation
	Ambient operating humidity	20 to 90% RH	
	Storage temperature*1	-20 to 65°C	
	Vibration resistance	5.9 m/s² (0.6G), 10 to 55 Hz	
	Protective structure	IP00	
Encoder feedback		• Standard encoder pulse number: 1024 pulse/r • Max. input pulse number: 200k pulse/s	
Position command		Max. input pulse number: 200k pulse/s	
Protection function		• Encoder cable breakage protection • RX2-PG Connection Error	

*1. The storage temperature is the temperature during transportation.

PG Option Unit mounting

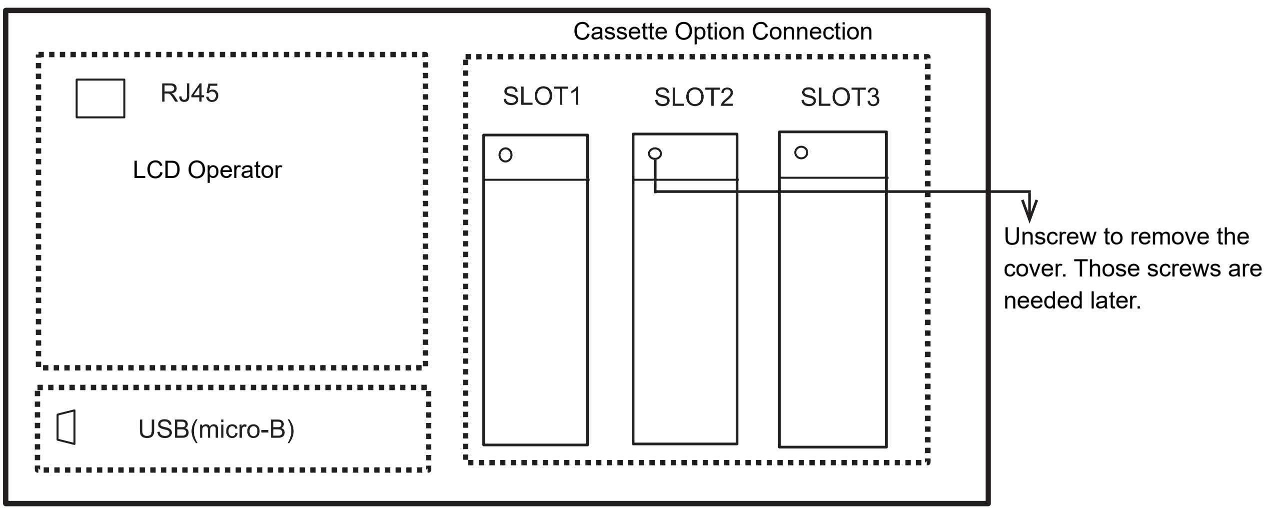
Install the PG Option Unit to SLOT 2 in the inverter's Cassette Option Connection.

Precautions for Correct Use

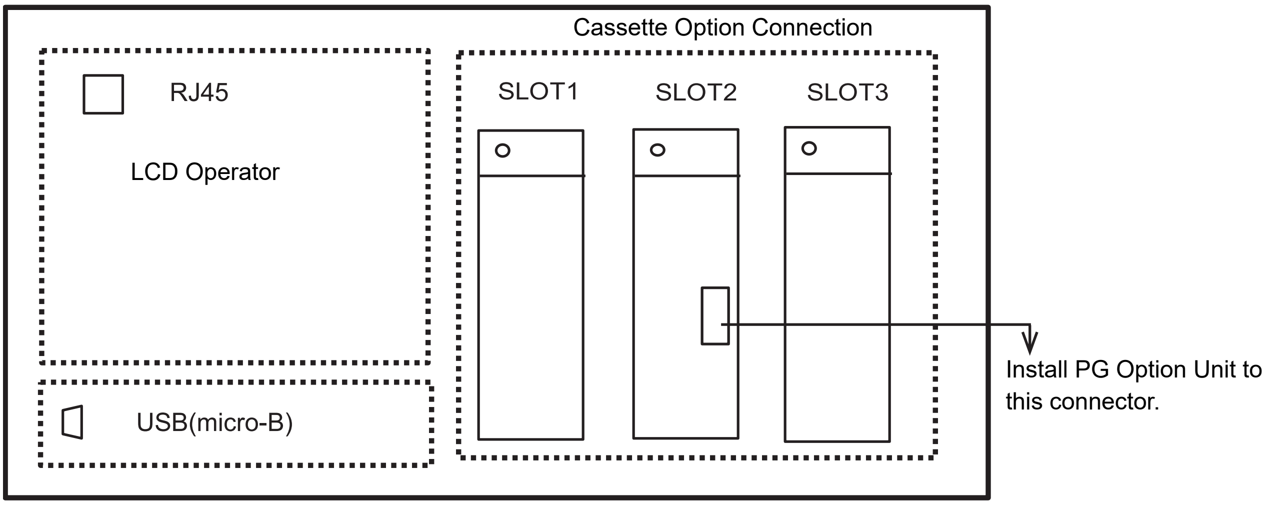
If you install PG Option Unit to SLOT1, the inverter cannot be operated due to the power disconnection.

If you install PG Option Unit to SLOT3, the inverter and PG Option unit may result in damage due to connector's interference.

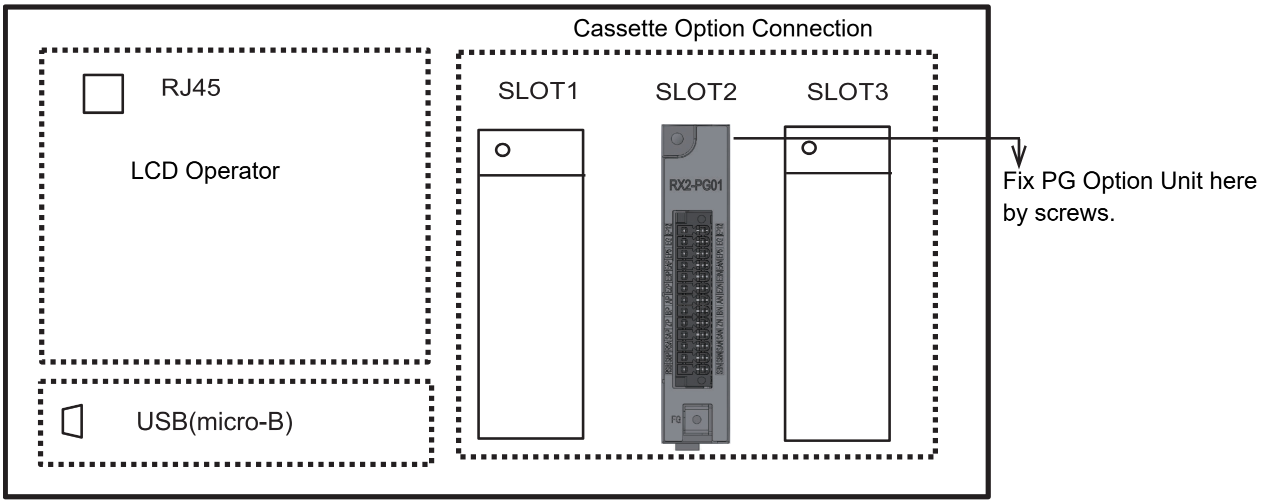
(a) Remove the cover on the Cassette Option Connection of the main body. The cover is not needed any more but it must be retained because it may be needed in case you operate the inverter temporarily when option unit fails. The screws which had fixed the cover are needed for fixing the PG Option Unit.



(b) Install PG Option Unit to the connector in SLOT2. Do NOT use the other connector located above for PG Option Unit.



(c) Install the PG Option Unit to SLOT2 using the screws which you unscrewed at step 1. Then, connect FG terminal to the function ground.

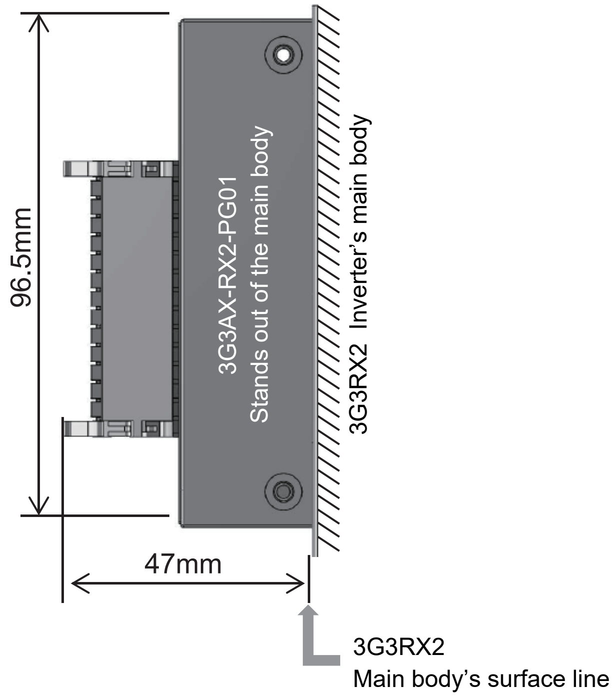


Precautions for Correct Use

- To mount the PG Option Unit, be sure to tightly fix it with the two provided fixing screws after putting the connector securely in place. Otherwise, the inverter cannot operate properly.
- When removing the PG Option Unit from the inverter, be sure to back the cover of the inverter to the original position.

Installation Dimension of PG Option Unit

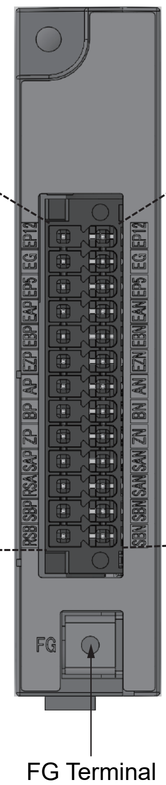
When you install PG Option Unit 3G3AX-RX2-PG01 to the inverter, it will stand out of the inverter’s front surface as following dimension. When you install the unit, take a special care for it.



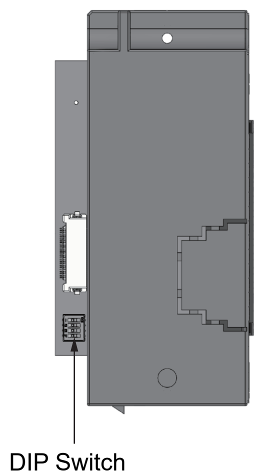
Terminal Arrangement on PG Option Unit

The arrangement of the terminals on the PG Option Unit 3G3AX-RX2-PG01 is shown below.

EP12	1
EG	3
EP5	5
EAP	7
EBP	9
EZP	11
AP	13
BP	15
ZP	17
SAP	19
RSA	21
SBP	23
RSB	25



2	EP12
4	EG
6	EP5
8	EAN
10	EBN
12	EZN
14	AN
16	BN
18	ZN
20	SAN
22	SAN
24	SBN
26	SBN



● Input Terminals

Terminal code	Terminal name	Function description	Electronic specifications
SAP SAN SBP SBN RSA RSB	Pulse train position command input	• Pulse train mode selection (P013)*1 Mode 0: 90°phase difference pulse train Mode 1: Forward/Reverse command + pulse train Mode 2: Forward pulse + Reverse pulse • RSA: Terminating resistor ON/OFF terminal between SAP and SAN • RSB: Terminating resistor ON/OFF terminal between SBP and SBN • Built-in terminating resistor value: 150 Ω	Line-driver input 5-VDC receiver input (RS-422 compliant)
EAP EAN EBP EBN EZP EZN	Encoder signal input	A/B/Z: Encoder signal input	Photocoupler input (5 VDC line-driver output type rotary encoders supported)

*1. Select the pulse train mode with the inverter parameter P013.

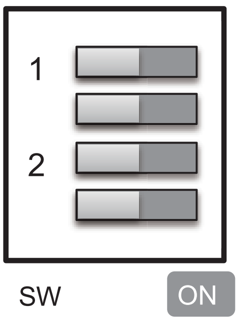
● Output Terminals

Terminal code	Terminal name	Function description	Electronic specifications
AP AN BP BN ZP ZN	Encoder signal output	Output encoder input pulses in a ratio 1 to 1.	5 VDC line-driver output (RS-422 compliant)
EP5 EP12 EG (Common)	Encoder power supply	EP5: 5 VDC power supply EP12: 12 VDC power supply	Total power supply capacity of EP5 and 12: 250 mA max.

● DIP Switch

When you slide the dip switch to the left it can be turned OFF and right to turn ON.

All the dip switches are turned OFF at the factory default setting. Set the switches before installing the device.

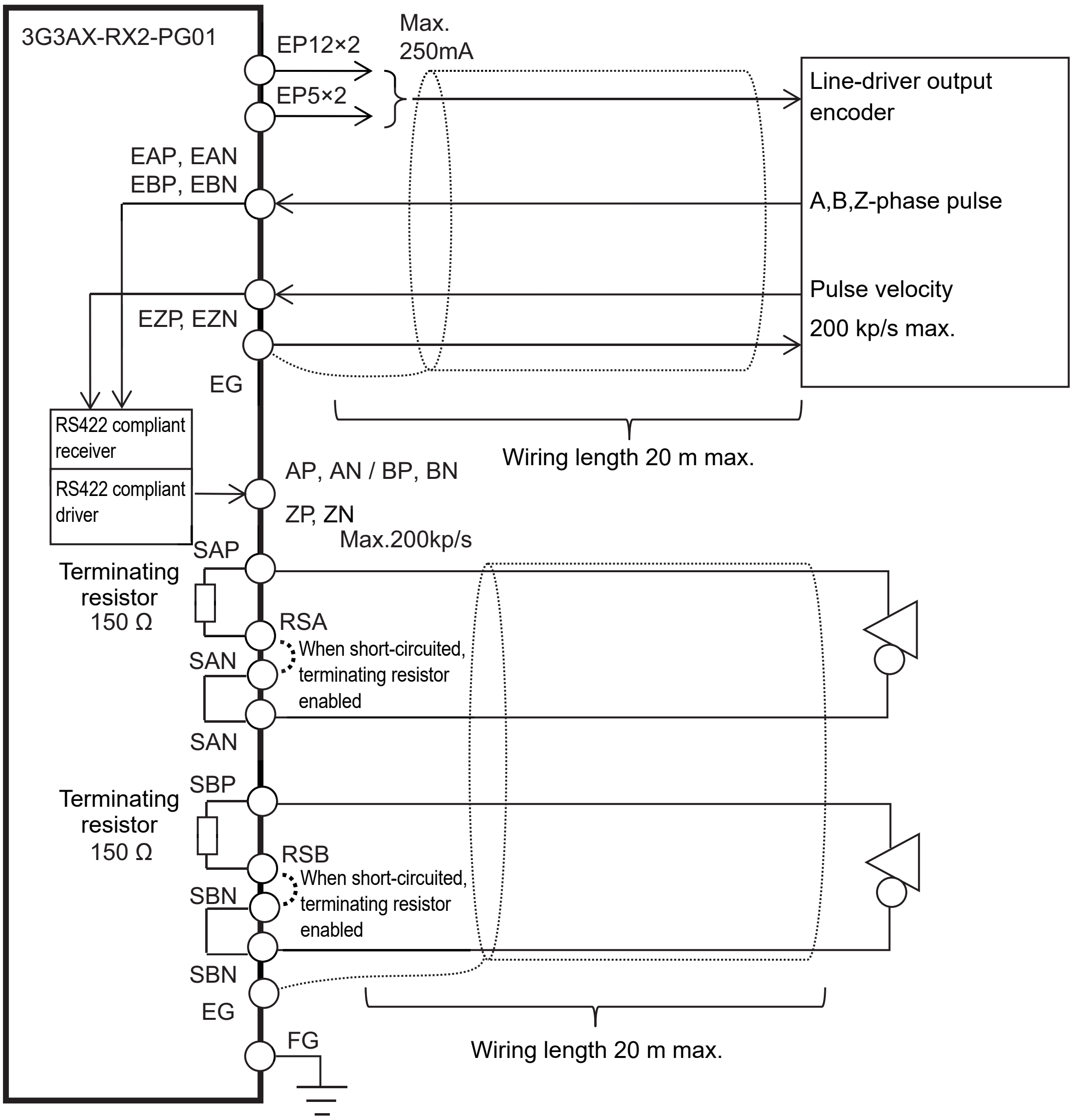


The switches are located behind the unit. You must set the terminal before installation.

Switch number	Setting description	
1	ON	Encoder A and B phase disconnecting detection enabled
	OFF	Encoder A and B phase disconnecting detection disabled
2	ON	Encoder Z phase disconnecting detection enabled
	OFF	Encoder Z phase disconnecting detection disabled
3	ON	Do not change the setting
	OFF	
4	ON	Do not change the setting
	OFF	

Wiring of PG Option Unit

The following describes the wiring of PG Option Unit 3G3AX-RX2-PG01.



The wire length between the encoder and PG Option Unit must be 20 m or shorter.

Use twist pair for the signal line.

When you connect cables, we recommend you to connect an encoder’s shielded wire to EG terminal on PG Option Unit. If the cable is not shielded properly, the inverter may incorrectly perform due to the influences of external noises. Generally, shield wires are connected to common signal terminal or chassis earth terminal. However do not connect at multiple points.

Connect FG terminal of PG Option Unit to Function Ground.

If you link-up the encoder power supply terminal of PG Option Unit by relay amplifier, distance among the relay amplifier, PG Option Unit must be 20 meters or shorter.

When you connect a cable between the relay amplifier and PG Option Unit, we recommend you to connect the shielded wire to EG terminal at PG Option Unit.

As for the connection between relay amplifier and encoder (connecting method and cable length), ask and confirm the input specifications of relay amplifier to the producer before connecting.

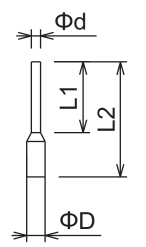
In case the wiring to PG Option Unit exceeds 20 meters, the inverter performs improperly due to the influences of external noise. Take a special care for the wiring of relay amplifier for it.

When you supply the power to the encoder from devices other than PG Option Unit, connect the common of encoder power supply (basic potential) to EG terminal at PG Option Unit.

● Recommending Terminals

For the improvement of easy wiring and credibility, we recommend those pin-terminals shown in the table below for signal lines.

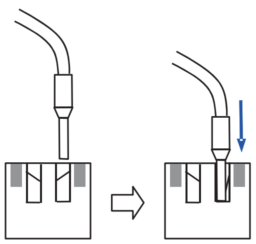
Wire size mm^2 (AWG)	L1 [mm]	L2 [mm]	Φd [mm]	ΦD [mm]
0.25 (24)	10.0	14.5	0.8	2.0
0.34 (22)	10.0	14.5	0.8	2.0
0.5 (20)	10.0	16	1.1	2.5
0.75 (18)	10.0	16	1.3	3.4



Note Those specifications above are different from the recommended pin-terminals for the inverter’s main body.

● Insertion Method

Insert the pin-terminal to the terminal block of PG Option Unit. A proper pin-terminal can be inserted without tools.

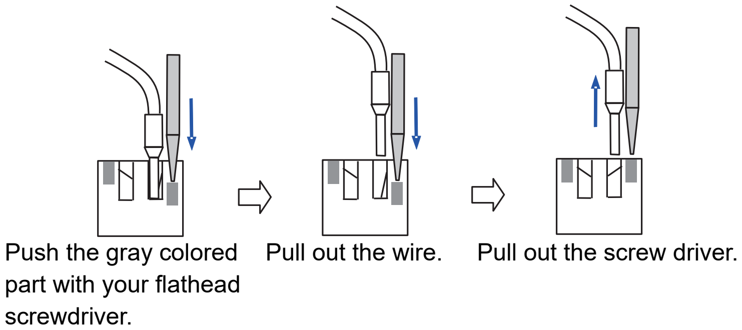


Insert the wire here.

In case you use improper pin-terminals, insert the cable by the order of steps of pull-out method with a flathead screwdriver shown below.

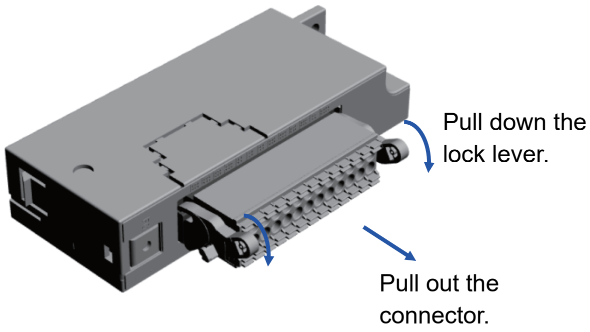
● **Pullout Method**

1. Push the gray colored part on the PG Option Unit terminal block with a flathead screwdriver (2.5 mm widths or narrower), and the aperture for wire-inserting will open.
2. While you are holding the screwdriver in the hole, pull out the wire or pin-terminal.
3. Pull out the screwdriver.



● **Method of Disconnecting the Connector**

1. Pull down the lock lever to the direction indicated by the arrow to release the lock.
2. Pull out the connector.



PG Option Unit Disconnection Detection

The encoder input terminal ((EAP/EAN/EBP/EBN/EZP/EZN) has a function to detect disconnection when the wires are not connected. When you do not connect any encoders (EAP/EAN/EBP/EBN/EZP/EZN not connected), turn the DIP switch 1 and 2 to OFF in order to disable the disconnection function.

As for the encoder without Z-phase, turn the DIP switch 2 to OFF to disable the detection of Z-phase disconnection.

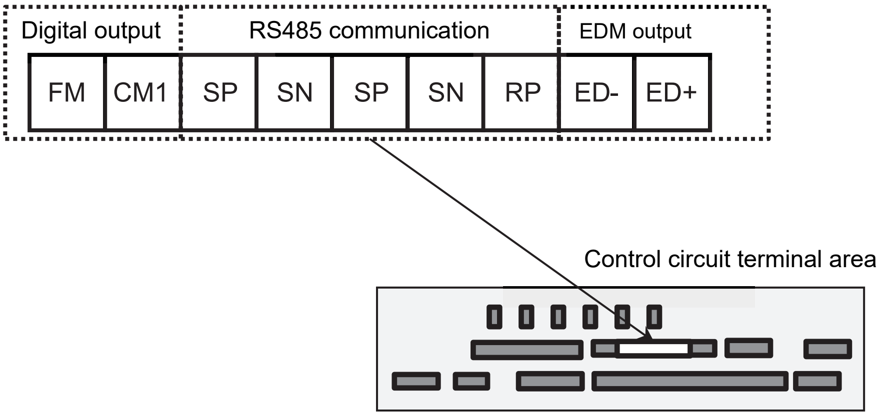
2-3-7 Wiring for RS485-Communication Terminals

The 3G3RX2 Series has an RS485 communications capability that enables the inverter to communicate with an external controller from its RS485 communications terminal block on the control terminal block PCB.

For the communications protocol, the inverter supports the Modbus communication.

This section describes the wiring procedure for the RS485 communications terminal block and the installation of the terminating resistor.

Wiring for RS485 Communications Terminal Block



Abbreviated Terminal Name	Description	Function
SP	RS485 Sending/receiving terminal + side	At + side of Sending/receiving signal of RS485 communications
SN	RS485 Sending/receiving terminal - side	At - side of Sending/receiving signal of RS485 communications
RP	Enable terminating resistor terminal	A terminal which enables internal terminating resistor (100Ω). The internal terminating resistor can be enabled when you connect – side of RS485 communication sending/receiving terminal (for connecting terminating resistor) to RP.
(SN)	RS485 Sending/receiving terminal - side (for connecting terminating resistors)	
(CM1)	Signal ground	You can connect a signal ground of an external communication device. (Also for FM terminal)

Wire size

Screw size	Tightening torque [N·m]	Wire type	Wire size [mm^2]
M2	0.22 to 0.25	Solid wire	0.14 to 1.5 (If two equal-sized wires are connected to one pole: 0.14 to 0.5)
		Stranded wire	0.14 to 1.0 (If two equal-sized wires are connected to one pole: 0.14 to 0.2)
		Stranded wire with pin terminal	0.25 to 0.5

Wiring Method

Connect the communication wire to the control circuit terminal block.

Precautions for Correct Use

- Separate signal lines for control from the main circuit cable and other power supply/power lines when wiring.
- Do not solder the wire ends. Doing so may result in a contact failure.
- When pin terminals are not used, the wire strip length must be approximately 5.0 mm.
- Connect the shielded wire to the terminal CM1 (frequency reference common) of the 3G3RX2 Series. Do not connect it to the controller.
- Insulate the cable shielded wire with tape or some other means to prevent them from contact with other signal lines or equipment.

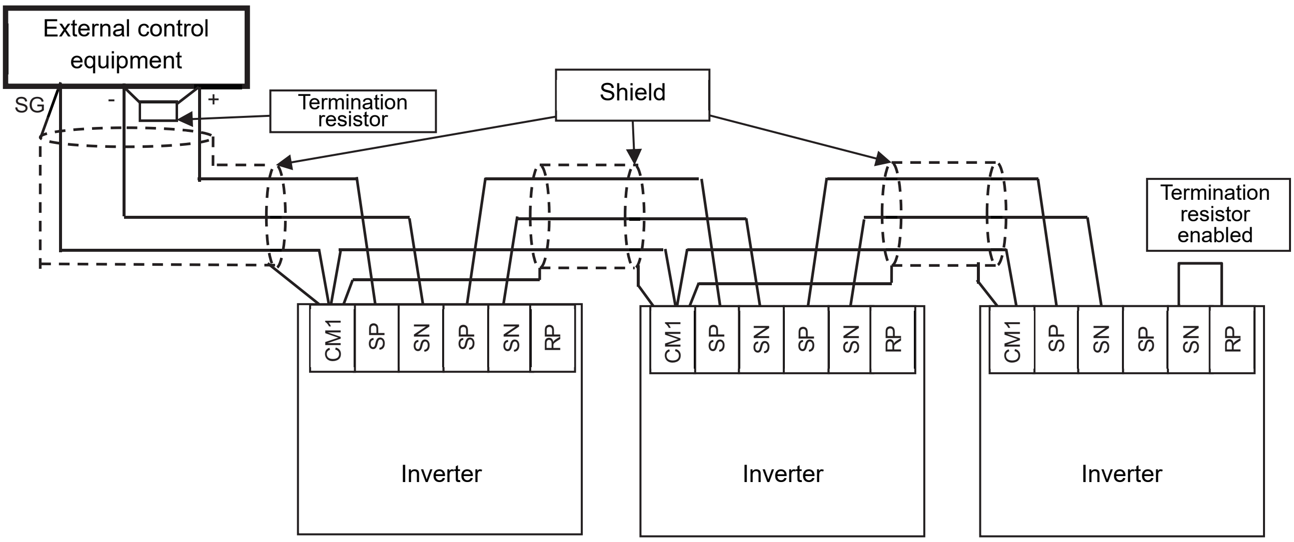
Terminating Resistor Installation

Connect each inverter in parallel as shown below.

For the terminating inverter, short-circuit between terminals RP and SN.

When you connect only one inverter, also short-circuit between terminals RP and SN.

For this inverter, the built-in terminating resistor (100Ω) can be connected by shorting the terminals PR and SN.

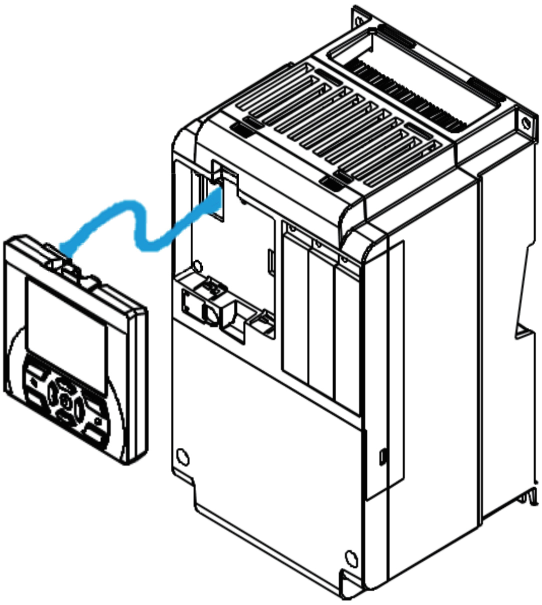


2-3-8 Wiring for Digital Operator

The LCD operator can be used with the panel being taken out the enclosure of the inverter.

You can take out the Digital Operator outside the main body for operation. Use optional cables 3G3AX-OPCN 1 (1m) or 3G3AX-OPCN-3 (3m).

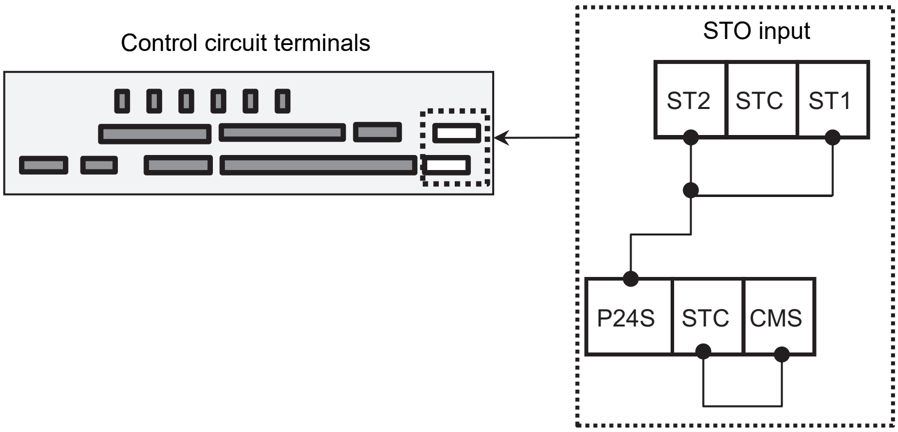
While power is supplied to the inverter, do not attach or remove the Digital Operator.



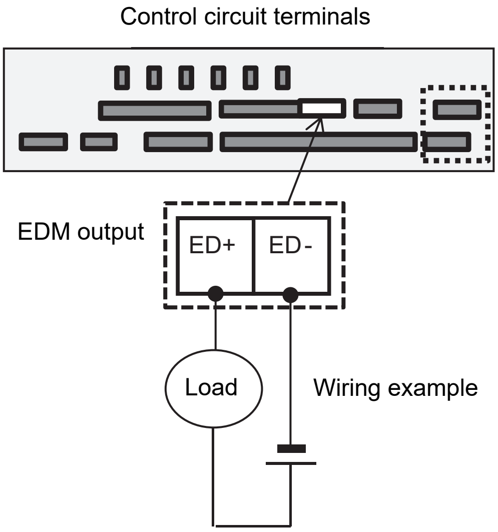
Height: 78mm, Width: 78mm

2-3-9 Wiring for STO Function

The following describes STO input used at STO function and EDM output.



Wiring at factory default



Terminal code	Terminal name	Description	Electronic characteristics
P24S	24-V Output terminal (dedicated for STO input)	24-VDC power supply for contact signals dedicated for ST1/ST2 terminal. Common is CMS.	Maximum output current is 100 mA
CMS	24-V output terminal common (dedicated for STO input)	Common terminal of 24-VDC power supply for contact signals dedicated for ST1/ST2 terminal	
STC	Input logic switching terminal	This is a STO input logic switching terminal. The input logic can be changed by changing the position of short bar. In case of using external power supply, remove short bars and then it is used as ST1/ST2 input common.	<at sink logic> Short bar: connect between P24S and STC. <at source logic> Short bars: connect between CMS and STC.
ST1/ST2	STO input terminal	Input terminal of STO	Voltage between ST1-STC/ST2-STC • ON voltage 15 VDC min. • OFF voltage 5 VDC max. • Maximum allowable voltage 27 VDC • Load current 5.8 mA (at 27 VDC) Internal resistance: 4.7 kΩ
ED+	EDM signal output terminal (+)	+ side terminal of EDM signal (STO status monitor)	Open collector output • Between ED+/ED- • Voltage depression 4 V or below at ON • Maximum allowable voltage 27 V • Maximum allowable current 50 mA
ED-	EDM signal output terminal (-)	- side terminal of EDM signal (STO status monitor)	

2-3-10 Conditions of Conformity of EU Directives

Specifications

EMC	EN61800-3:2004/AI:2012
Machinery	IEC61800-5-2:2016 EN ISO 13849-1:2014 EN61800-5-1:2007

- This is a product designed for industrial environments.
  Use in residential area may cause radio interference, in which case the user may be required to take adequate measures to reduce interferense.
- This type of PDS is not intended to be used on a low-voltage public network which supplies domestic premises.

Manufacturer and EU Representative

Manufacturer: OMRON Corporation
Shiokoji Horikawa, Shimogyo-ku, Kyoto, 600-8530 Japan

Representative and Importer in EU: OMRON EUROPE B.V.
Wegalaan 67-69,2132 JD Hoofddorp, The Netherlands

GENERAL:

3G3RX2 series Type inverter is open type AC Inverter with three phase input and three phase output. It is intended to be used in an enclosure. It is used to provide both an adjustable voltage and adjustable frequency to the ac motor. The inverter automatically maintains the required volts-Hz ratio allowing the capability through the motor speed range. It is multi-rated device and the ratings are selectable according to load types by operator with key pad operation.

Compatibility Conditions of EMC Directives

CAUTION for EMC

(Electromagnetic Compatibility)

3G3RX2 series inverter conforms to requirements of Electromagnetic Compatibility (EMC) Directive (2014/30/EU). However, when using the inverter in Europe, you must comply with the following specifications and requirements to meet the EMC Directive and other standards in Europe:

⚠ WARNING	This equipment must be installed, adjusted, and maintained by qualified engineers who have expert knowledge of electric work, inverter operation, and the hazard ouscircumstances that can occur. Otherwise, personal injury may result.

1. Power supply requirements
   a) Voltage fluctuation must be -15% to +10% or less.
   b) Voltage imbalance must be ±3% or less.
   c) Frequency variation must be ±4% or less.
   d) Total harmonic distortion (THD) of voltage must be±10% or less.
2. Installation requirement
   a) 3G3RX2 series includes a built-in EMC filter. The built-in EMC filter must be activated.
   b) According to EN61800-3 it is mandatory to mention that any inverter with only C3 filter inside may NOT be connected to a low voltage public power supply in residential areas since for these installations C1 is required.

c) In case of external filter for C2, an additional note is required according to EN61800-3 that “this product may emit high frequency interference in residential areas which may require additional EMC measures”.

d) According to the EN6100-3-12, an additional AC reactor or DC choke should be installed for reducing harmonics in power line.

3. Wiring requirements

a) A shielded wire (screened cable) must be used for motor wiring, and the length of the cable must be according to the following table.

b) The carrier frequency must be set according to the following table to meet an EMC requirement.

c) The main circuit wiring must be separated from the control circuit wiring.

4. Environmental requirements (to be met when a filter is used)

a) 3G3RX2 series inverter that is activated built-in EMC filter must be according to 3G3RX2 series specifications.

Table 1

Model 3G3RX2	Cat.	Cable length	Carrier frequency	Model 3G3RX2	Cat.	Cable length	Carrier frequency
A2004	C3	10m	2kHz	--	--	--	--
A2007	C3	10m	2kHz	A4007	C3	10m	2kHz
A2015	C3	10m	2kHz	A4015	C3	10m	2kHz
A2022	C3	10m	2kHz	A4022	C3	10m	2kHz
A2037	C3	10m	2kHz	A4037	C3	10m	2kHz
A2055	C3	5m	2kHz	A4055	C3	5m	2kHz
A2075	C3	5m	2kHz	A4075	C3	5m	2kHz
A2110	C3	5m	2kHz	A4110	C3	5m	2kHz
A2150	C3	10m	1kHz	A4150	C3	10m	2kHz
A2185	C3	10m	1kHz	A4185	C3	10m	2kHz
A2220	C3	10m	1kHz	A4220	C3	10m	2kHz
A2300	C3	5m	2kHz	A4300	C3	5m	2kHz
A2370	C3	5m	2kHz	A4370	C3	5m	2kHz
A2450	C3	5m	2kHz	A4450	C3	5m	2kHz
A2550	C3	5m	2kHz	A4550	C3	5m	2kHz
---	---	---	---	B4750	C3	3m	2kHz
---	---	---	---	B4900	C3	3m	2kHz
---	---	---	---	B411K	C3	3m	2kHz
---	---	---	---	B413K	C3	3m	2kHz

- For the power supply lines of the inverter, use a shield braided cable with a minimum cable length, and connect via an EMC compliant input noise filter.
- Ground the cable shield.
- Keep the ground cable as short as possible. For 400-V class inverters, the ground terminal must be connected to the neutral point of a power supply. Also ground the metal control panel as well as the door simultaneously.
- Use shield braided cables also for connection between the inverter and the motor. Keep the cable as short as possible at a length 20 m or less, with the cable shield grounded. Installing a clamp filter near the inverter output terminals is an effective countermeasure.
- Connect the cable shield directly to an earth (ground) plate with a conductive cable clamp.
- With the motor frame grounded directly, connect the ground cable from the motor directly to an EMC compliant input noise filter.
- For the control panel door, use a conductive gasket to improve the shielding effect.
- In the same control panel, do not install equipment that generates by design electromagnetic waves, especially radio waves.

Conditions of Electrical Safety (LVD)

The condition in the next section UL standard explain the condition of the electrical safety. It is necessary to comply with the description items such as temperature condition, installation condition etc.

2-3-11 Compatibility Conditions of UL/CSA Standards

Standards

US	UL61800-5-1
CA	CSA 22.2 No.274
FS	IEC61800-5-2:2016 STO SIL3 ISO13849-1:2015 Cat.4 PLe

UL CAUTION

GENERAL:

Model 3G3RX2 series inverter is an open type AC Inverter with three phase input and three phase output. It is intended to be used in an enclosure. It is used to provide both an adjustable voltage and adjustable frequency to the ac motor. The inverter automatically maintains the required volts-Hz ratio allowing the capability through the motor speed range. It is a multi-rated device and the ratings are selectable according to load types by operator with key pad operation.

Markings:	
Maximum Surrounding Temperature:	
ND (Normal Duty):	50°C
LD (Low Duty):	50°C*1
VLD (Very Low Duty):	45°C*1
Storage Environment rating:	65°C (for transportation)
Instruction for installation:	pollution degree 2 environment and Over voltage category III
Electrical Connections:	See [Main circuit Wiring Diagram] of this Instruction Manual
Interconnection and wiring diagrams:	See [Outline of control circuit] of this Instruction Manual

*1. For actual use, use within the temperature range indicated in the common specifications.

● 3G3RX2 Series Models Short Circuit Rating and Overcurrent Protection Device Rating

- 3G3RX2-A2□□□ series models
  Suitable for use on a circuit capable of delivering not more than (a) rms symmetrical amperes, at (b) V maximum. (see table below)
- 3G3RX2-A4□□□ 3G3RX2-B4□□□ series models
  Suitable for use on a circuit capable of delivering not more than (a) rms symmetrical amperes, at (b) V maximum. (see table below)

	3G3RX2-□□□□□	(a)	(b)
200V	A2004 to A2220	5,000A rms	240V
	A2300 to A2550	10,000A rms	240V
400V	A4007 to A4220	5,000A rms	500V
	A4300 to A4550,B4750, B4900	10,000A rms	500V
	B411K, B413K	18,000A rms	500V

Integral

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Canadian Electrical Code, part1 or the equivalent. (For Canada)

Field Wiring Terminal Conductor Size and Torque Values Making for Field Wiring Terminal

<table>
<tr><th>Model 3G3RX2</th><th>Load Type</th><th>Required Torque (N·m)</th><th>Conductor size (AWG)</th><th>Model 3G3RX2</th><th>Load Type</th><th>Required Torque (N·m)</th><th>Conductor size (AWG)</th></tr>
<tr><td rowspan="3">A2004</td><td>VLD</td><td rowspan="3">1.4</td><td rowspan="3">14</td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>LD</td></tr>
<tr><td>ND</td></tr>
<tr><td rowspan="3">A2007</td><td>VLD</td><td rowspan="3">1.4</td><td rowspan="3">14</td><td rowspan="3">A4007</td><td>VLD</td><td rowspan="3">1.4</td><td rowspan="3">14</td></tr>
<tr><td>LD</td><td>LD</td></tr>
<tr><td>ND</td><td>ND</td></tr>
<tr><td rowspan="3">A2015</td><td>VLD</td><td rowspan="3">1.4</td><td rowspan="3">14</td><td rowspan="3">A4015</td><td>VLD</td><td rowspan="3">1.4</td><td rowspan="3">14</td></tr>
<tr><td>LD</td><td>LD</td></tr>
<tr><td>ND</td><td>ND</td></tr>
<tr><td rowspan="3">A2022</td><td>VLD</td><td rowspan="3">1.4</td><td rowspan="3">10</td><td rowspan="3">A4022</td><td>VLD</td><td rowspan="3">1.4</td><td rowspan="3">14</td></tr>
<tr><td>LD</td><td>LD</td></tr>
<tr><td>ND</td><td>ND</td></tr>
<tr><td rowspan="3">A2037</td><td>VLD</td><td rowspan="3">1.4</td><td rowspan="3">10</td><td rowspan="3">A4037</td><td>VLD</td><td rowspan="3">1.4</td><td>12</td></tr>
<tr><td>LD</td><td>LD</td><td rowspan="2">14</td></tr>
<tr><td>ND</td><td>ND</td></tr>
<tr><td rowspan="3">A2055</td><td>VLD</td><td rowspan="3">3</td><td rowspan="3">8</td><td rowspan="3">A4055</td><td>VLD</td><td rowspan="3">3</td><td>10</td></tr>
<tr><td>LD</td><td>LD</td><td rowspan="2">12</td></tr>
<tr><td>ND</td><td>ND</td></tr>
<tr><td rowspan="3">A2075</td><td>VLD</td><td rowspan="3">3</td><td>6</td><td rowspan="3">A4075</td><td>VLD</td><td rowspan="3">3</td><td>8</td></tr>
<tr><td>LD</td><td rowspan="2">8</td><td>LD</td><td rowspan="2">10</td></tr>
<tr><td>ND</td><td>ND</td></tr>
<tr><td rowspan="3">A2110</td><td>VLD</td><td rowspan="3">4</td><td rowspan="2">4</td><td rowspan="3">A4110</td><td>VLD</td><td rowspan="3">4</td><td rowspan="3">8</td></tr>
<tr><td>LD</td><td>LD</td></tr>
<tr><td>ND</td><td>6</td><td>ND</td></tr>
<tr><td rowspan="3">A2150</td><td>VLD</td><td rowspan="3">2.5 to 3.0</td><td rowspan="2">3</td><td rowspan="3">A4150</td><td>VLD</td><td rowspan="3">4</td><td rowspan="3">8</td></tr>
<tr><td>LD</td><td>LD</td></tr>
<tr><td>ND</td><td>4</td><td>ND</td></tr>
<tr><td rowspan="3">A2185</td><td>VLD</td><td rowspan="3">2.5 to 3.0</td><td>1</td><td rowspan="3">A4185</td><td>VLD</td><td rowspan="3">4</td><td rowspan="2">6</td></tr>
<tr><td>LD</td><td>2</td><td>LD</td></tr>
<tr><td>ND</td><td>3</td><td>ND</td><td>8</td></tr>
<tr><td rowspan="3">A2220</td><td>VLD</td><td rowspan="3">5.5 to 6.6</td><td>2/0</td><td rowspan="3">A4220</td><td>VLD</td><td rowspan="3">4</td><td rowspan="2">4</td></tr>
<tr><td>LD</td><td>1/0</td><td>LD</td></tr>
<tr><td>ND</td><td>1</td><td>ND</td><td>6</td></tr>
<tr><td rowspan="3">A2300</td><td>VLD</td><td rowspan="3">6</td><td rowspan="2">Parallel of 1/0</td><td rowspan="3">A4300</td><td>VLD</td><td rowspan="3">6</td><td>1</td></tr>
<tr><td>LD</td><td>LD</td><td>2</td></tr>
<tr><td>ND</td><td>2/0</td><td>ND</td><td>3</td></tr>
<tr><td rowspan="3">A2370</td><td>VLD</td><td rowspan="2">6 to 10</td><td>Parallel of 1/0</td><td rowspan="3">A4370</td><td>VLD</td><td rowspan="3">15</td><td rowspan="3">1</td></tr>
<tr><td>LD</td><td>Parallel of 1/0</td><td>LD</td></tr>
<tr><td>ND</td><td>15</td><td>4/0</td><td>ND</td></tr>
</table>

Model 3G3RX2	Load Type	Required Torque (N·m)	Conductor size (AWG)	Model 3G3RX2	Load Type	Required Torque (N·m)	Conductor size (AWG)
A2450	VLD	6 to 10	Parallel of 2/0	A4450	VLD	15	1/0
	LD		Parallel of 1/0		LD		
	ND		Parallel of 1/0		ND		1
A2550	VLD	10 to 12	Parallel of 3/0	A4550	VLD	6 to 10	Parallel of 1/0
	LD		Parallel of 3/0		LD	15	2/0
	ND		350kcmil		ND		1/0
				B4750	VLD	10 to 12	Parallel of 1/0
					LD		
					ND		
				B4900	VLD	10 to 12	Parallel of 2/0
					LD		Parallel of 1/0
					ND		
				B411K	VLD	10 to 12	Parallel of 3/0
					LD		Parallel of 2/0
					ND		
				B413K	VLD	10 to 12	P. of 250kxmil
					LD		Parallel of 4/0
					ND		Parallel of 3/0

Note 1. Temperature rating of field wiring installed conductors is 75°C only.

2. Use Copper conductors only.

Required Protection by Fuse and Circuit-breakers

● 200V class

Model 3G3RX2	Fuse			Circuit Breaker	
	Type	Maximum Rating		Maximum Rating	
		Voltage (V)	Current (A)	Voltage (V)	Current (A)
A2004	Class J or T	600	15	-	-
A2007	Class J or T	600	30	-	-
A2015	Class J or T	600	40	-	-
A2022	Class J or T	600	40	-	-
A2037	Class J or T	600	50	-	-
A2055	Class J or T	600	100	-	-
A2075	Class J or T	600	150	-	-
A2110	Class J or T	600	150	-	-
A2150	Class J or T	600	150	-	-
A2185	Class J or T	600	200	-	-
A2220	Class J or T	600	200	-	-
A2300	Class J or T	600	300	-	-
A2370	Class J or T	600	300	-	-
A2450	Class J or T	600	400	-	-
A2550	Class J or T	600	500	-	-

● **400V class**

Model 3G3RX2	Fuse			Circuit Breaker	
	Type	Maximum Rating		Maximum Rating	
		Voltage (V)	Current (A)	Voltage (V)	Current (A)
A4007	Class J or T	600	15	-	-
A4015	Class J or T	600	20	-	-
A4022	Class J or T	600	30	-	-
A4037	Class J or T	600	30	-	-
A4055	Class J or T	600	75	-	-
A4075	Class J or T	600	75	-	-
A4110	Class J or T	600	75	-	-
A4150	Class J or T	600	100	-	-
A4185	Class J or T	600	100	-	-
A4220	Class J or T	600	100	-	-
A4300	Class J or T	600	200	-	-
A4370	Class J or T	600	200	-	-
A4450	Class J or T	600	200	-	-
A4550	Class J or T	600	250	-	-
B4750	Class J or T	600	300	-	-
B4900	Class J or T	600	400	-	-
B411K	Class J or T	600	500	-	-
B413K	Class J or T	600	500	-	-

2-3-12 Korean Radio Regulation (KC)

사용자안내문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서
가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

Guide for Users

This equipment has been evaluated for conformity in a commercial environment.

When used in a residential environment, it may cause radio interference.

2-3-13 Reference Manual for Options

The following describes outlines of option and peripheral devices and reference manual.

Regenerating Braking Unit (3G3AX-RBU □□□)

When you desire to reduce the motor’s deceleration time, use this unit in combination with braking resistor

Name	Instruction Manual number
Regenerative Braking Unit 3G3AX-RBU □□ User’s Manual	I563-E1

PG Option Unit (3G3AX-RX2-PG01)

A High accuracy operation which suppresses velocity fluctuation and positional control by pulse train position command input is achieved by feedback after detecting the rotation velocity of the encoder-equipped motor.

Name	Manual number
High-function General-purpose Inverter RX2 Series User’s Manual	I620-E1

CX-Drive

This is a tool which enables you to edit inverter’s parameter and monitor the inverter status.

Name	Manual number
CX-Drive Operation Manual	W453-E1

DriveProgramming

You can implement an easy sequence control by a single inverter.

Name	Manual number
DriveProgramming User’s Manual	I620-E1

3

Operation

3

This section describes the LCD Operator and the support tool “CX-Drive”.

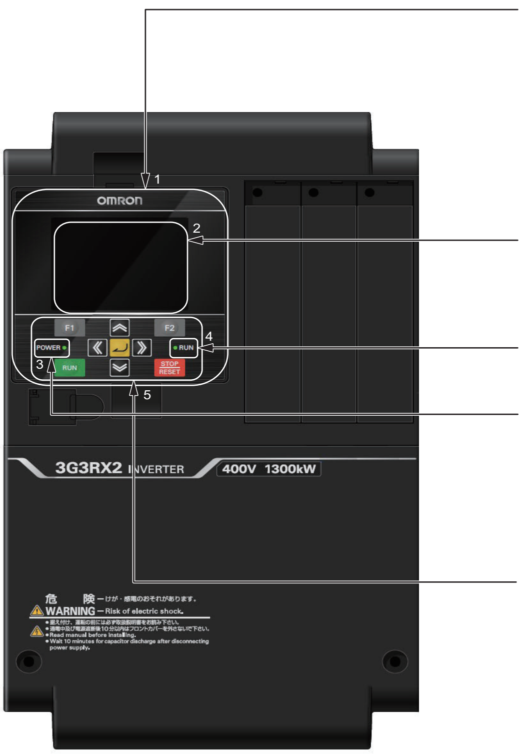
3-1 Overview of LCD Operator

Overview of LCD Operator is described.

This section describes the overview in the state that date and time are displayed in trip history and in retry history. In purchasing, the date and the time are not displayed. Instead, “-” is displayed. If you desire to display them, refer to section *3-1-5 How to Set Battery and the Time Setting* on page 3-12, and set optional batteries (CR2032, 3V) to the LCD operator in order to operate clock function.

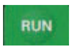
3-1-1 Part Names and Descriptions

Name and function of each part of the LCD Operator is described below.



1. LCD Operator
   Operates to set parameter constants, monitors, perform operation and stop.
2. LCD Display
   Displays the frequency reference value, output frequency, parameter constant and other relevant data.
4. Operation Lamp (RUN)
   Lights in green when operation is commanded.
3. Power Supply Lamp (POWER)
   Lights in green when power is supplied to the LCD Operator. When power is supplied to R0 and T0 in the main circuit and to P+ and P- in the terminal block, it is lit.
5. Operation keys
   Operating section for indicating and settings.

3-1-2 Names of Operation Keys

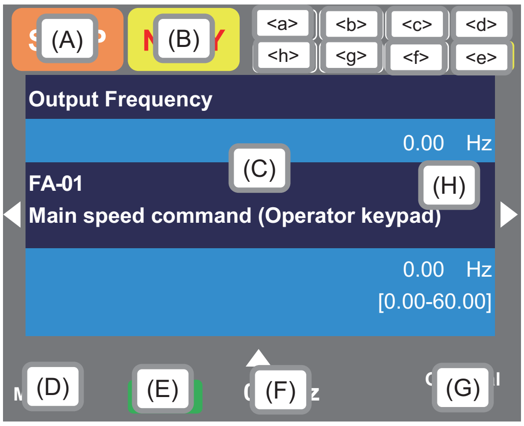
No	Image of the key	Name	Function
1		F1 key	Displays functions such as navigation to the home screen and cancellation at the bottom left of the screen.
2		F2 key	Displays functions such as data storage at the bottom right of the screen.
3		RUN key	The device runs when this key is enabled.
4		STOP/RESET key	Performs deceleration stop and trip reset.
5		Enter key	Proceeds to the display on the lower layer. When it is changing the parameter, it returns to the original display after confirming and documenting the values.
6		Increment key	Moves the cursor upward and increases parameter numbers or parameter data.
7		Decrement key	Moves the cursor downward and decreases parameter numbers or parameter data.
8		Left key	Moves the cursor leftward. Return to the previous mode when the display indicates navigation level.
9		Right key	Moves the cursor rightward. Proceed to the next mode when the display indicates navigation level.

Precautions for Safe Use

Establish an emergency stop button separately from the stop button at this operator because this button is only available when function is set.

3-1-3 LCD Display

Outline of Display Screen



Number	Description
(A)	Displays the operational status
(B)	Displays the warning status
(C)	Displays data/parameters
(D)	Displays details of the function assigned to the F1 key.
(E)	Displays the operation of RUN key on the LCD operator.
(F)	Displays frequency command, torque command, inverter name, clock, etc. The function to be displayed in this section can be selected using the F2 key (option) on the main screen.
(G)	Displays details of the function assigned to the F2 key.
(H)	When soft-lock function is enabled, the [LKS] mark is displayed.

Number	Name	Description
<a>	Power status	Displays the type of input power supply.
<b>	SET function	SET terminal function: Displays the first setting or second setting
<c>	Parameter	Displays the status of display restriction mode.
<d>	Screen No.	Displays the screen number.
<e>	STO function	Displays the STO command.
<f>	Control mode	Displays the command control mode.
<g>	Drive Programming	Displays the program operation of DriveProgramming.
<h>	Special status	Displays the operation of special function.

Display (A): Operation Status Display

No.	Indication	Description
A1	RUN FW	Displayed during normal rotation operation. There is a parameter that cannot be changed during operation.
A2	RUN RV	Displayed during reverse rotation operation. There is a parameter that cannot be changed during operation.
A3	RUN OHz	Output is in process by 0Hz command. This is also displayed by DB, FOC, and SON functions. There is a parameter that cannot be changed during operation.
A4	TRIP	Displayed during trip after the occurrence of error. For errors that cannot be canceled, perform reset operation to cancel.
A5	WARN	Displayed when setting inconsistency occurs. Resolve the inconsistency.
A6	STOP	This is displayed when the device is forcibly stopped by a function although an operation command is issued. • The operation command is issued with frequency command at 0Hz. • When the operation command is issued from a source other than the LCD Operator, the device is stopped by the STOP key on the LCD Operator. • When the operation command is issued from a source other than the LCD Operator, the device is stopped by the breaking terminal function [RS], [FRS], etc. • The device is stopped by the instantaneous power failure non-stop function. At this time, the RUN lamp blinks.
A7	STOP	The operation is suspended due to lack of operation command. If the operation command is issued from the LCD operator, the operation is stopped when the breaking function is enabled.

Display (B): Warning Status Display

No.	Indication	Description
B1	LIM	This is displayed by the following functions. • Under overload limit • Under torque limit • Under overcurrent suppression • Under overvoltage suppression • Under upper/lower limit operation • Under jump frequency operation • Under minimum frequency limit
B2	ALT	This is displayed by the following functions. • Overload advance notice • Motor thermal advance notice • Inverter thermal advance notice • Motor heating advance notice
B3	RETRY	Displayed during retry standby or restart standby.
B4	NRDY	Operation is not started even if the operation command is issued. • Under insufficient voltage of the main power • Under operation only by the 24V power supply • Under reset operation • Off when the [REN] terminal function is enabled
B5	FAN	Displayed upon the fan life advance notice.
B6	C	Displayed upon the capacitor life advance notice on the circuit board.
B7	F/C	Displayed upon the fan life advance notice and capacitor life advance notice on the circuit board.
B8	(None)	A status other than above

Display (E): Display of RUN Key Function on the LCD Operator

No.	Indication	Description
E1	oFW	Normal rotation by the RUN key on the LCD operator
E2	oRV	Reverse rotation by the RUN key on the LCD operator
E3	>FW	The RUN key is enabled by the [F-OP] terminal or LCD operator. (Normal rotation)
E4	>RV	The RUN key is enabled by the [F-OP] terminal or LCD operator. (Reverse rotation)
E5	(None)	The command other than the RUN key is selected

Display <a>: Power Status Display

No.	Indication	Description
a1	(None)	There is input to the main power supply/control power supply.
a2	CTRL	There is input to the control power supply.
a3	24V	The device runs with 24V input to P+/P-.

Display <b>: Display of SET Function Operation Status

No.	Indication	Description
b1	M1	The [SET] terminal is not selected or the [SET] terminal is selected but the function is disabled. (common setting and first setting are enabled)
b2	M2	The [SET] terminal is selected and the function is enabled. (common setting and second setting are enabled)

Display <c>: Selection of Parameter Display

No.	Indication	Description
c1	(None)	All-parameter display mode.
c2	UTL	Individual-function display mode.
c3	USR	User-setting display mode.
c4	CMP	Data-comparison display mode.
c5	MON	Monitor display mode.

Display <d>: List of Monitor Screen Numbers

Monitor screen numbers are listed below:

No.	Name	Screen number
1	Three-line monitor screen	H01
2	Setting screen for rotating direction of LCD operator	H02
3	Setting screen	H03
4	Monitor with large characters	H04
5	Selection screen for parameter code	H05
6	Trip history	H06
7	Trip currently occurring	H07
8	Detailed trip history screen	H08
9	Retry history	H09
10	Detailed retry history screen	H10
11	Detailed screen for limitation status icon	H11
12	Home screen option	o01
13	Inverter name setting	o02
14	Selection of data displayed at the bottom center	o03
15	Menu screen	M01
16	R/W function screen	R01
17	Screen for selecting data uploaded using the R/W function	R02
18	Screen for selecting saving location for data uploaded using the R/W function	R03
19	Screen for displaying progress status of uploading using the R/W function	R04
20	Screen for selecting data downloaded using the R/W function	R05

No.	Name	Screen number
21	Screen for selecting the location for reading data that is downloaded using the R/W function	R06
22	Screen for displaying progress status of downloading using the R/W function	R07
23	System settings screen	S01
24	Language selection screen	S02
25	Dimming setting screen	S03
26	Setting screen for automatic light off time	S04
27	Setting screen for dimming at light off	S05
28	Setting screen for automatic home transition time	S06
29	Monitor screen for basic inverter information	S07
30	Selection screen for operator initialization	S08
31	Operator version display screen	S09
32	Date and time screen	S11
33	Date and time setting screen	S12
34	Selection screen for date and time display format	S13
35	Setting screen for battery level warning	S14
36	Inverter model selection screen	S19
37	Read lock selection screen	S21
38	Selection screen for blinking at the time of trip	S22
39	Color setting screen	S23
40	Selection screen for self-check mode	S25 to S35
41	Setting screen for automatic home screen	S36
42	Remote mode switching screen	S38
43	Scroll menu	L01
44	Scroll screen	L02
45	Message screen	*1

*1. If a message is displayed, see *12-3-3 Checking Message* on page 12-30.

Display <e>: STO Function Display

No.	Display	Description
e1	(None)	Operation of ST1 and ST2 are both enabled (contact point ON), the inverter's output motion is also enabled.
e2	P-1A	From the status that the operation of ST1 and ST2 are both enabled (contact point ON), only ST2 transitions to STO (contact point OFF) and later ST1 is kept operation-enabled (contact point ON) for the STO switching allowable time [bd-02].
e3	P-2A	From the status that the operation of ST1 and ST2 are both enabled (contact point ON), only ST1 transitions to STO (contact point OFF) and later ST2 is kept operation-enabled (contact point ON) for the STO switching allowable time [bd-02].
e4	P-1b	(1) The status of P-1A or P-1b continued for the STO switching allowable time [bd-02]. (2) At the status that the operation of ST1 and ST2 were both enabled (contact point ON), only ST2 transitioned to STO (contact point OFF) and later the operation was allowed (contact point ON).
e5	P-2b	(1) The status of P-2A or P-2b continued for the STO switching allowable time [bd-02]. (2) At the status that the operation of ST1 and ST2 were both enabled (contact point ON), only ST1 transitioned to STO (contact point OFF) and later the operation was allowed (contact point ON).
e6	P-1C	From the status that the operation of ST1 and ST2 are both STO (contact point OFF), ST2 transitions to be operation-allowed (contact point ON), and later ST1 is kept STO (contact point OFF) for the STO switching allowable time [bd-02].

No.	Display	Description
e7	P-2C	From the status that the operation of ST1 and ST2 are both STO (contact point OFF), ST1 transitions to be operation-allowed (contact point ON), and later ST2 is kept STO (contact point OFF) for the STO switching allowable time [bd-02].
e8	STO	ST1 and ST2 are both in the STO status (contact point OFF).

Display <f>: Control Command Mode Display

No.	Indication	Description
f1	(None)	The speed control mode.
f2	TRQ	The torque control mode.
f3	POS	The position control mode.

Display <g>: DriveProgramming Operation Mode Display

No.	Indication	Description
g1	(None)	DriveProgramming is not selected.
g2	Ez_S	DriveProgramming is stopped
g3	Ez_R	DriveProgramming is working

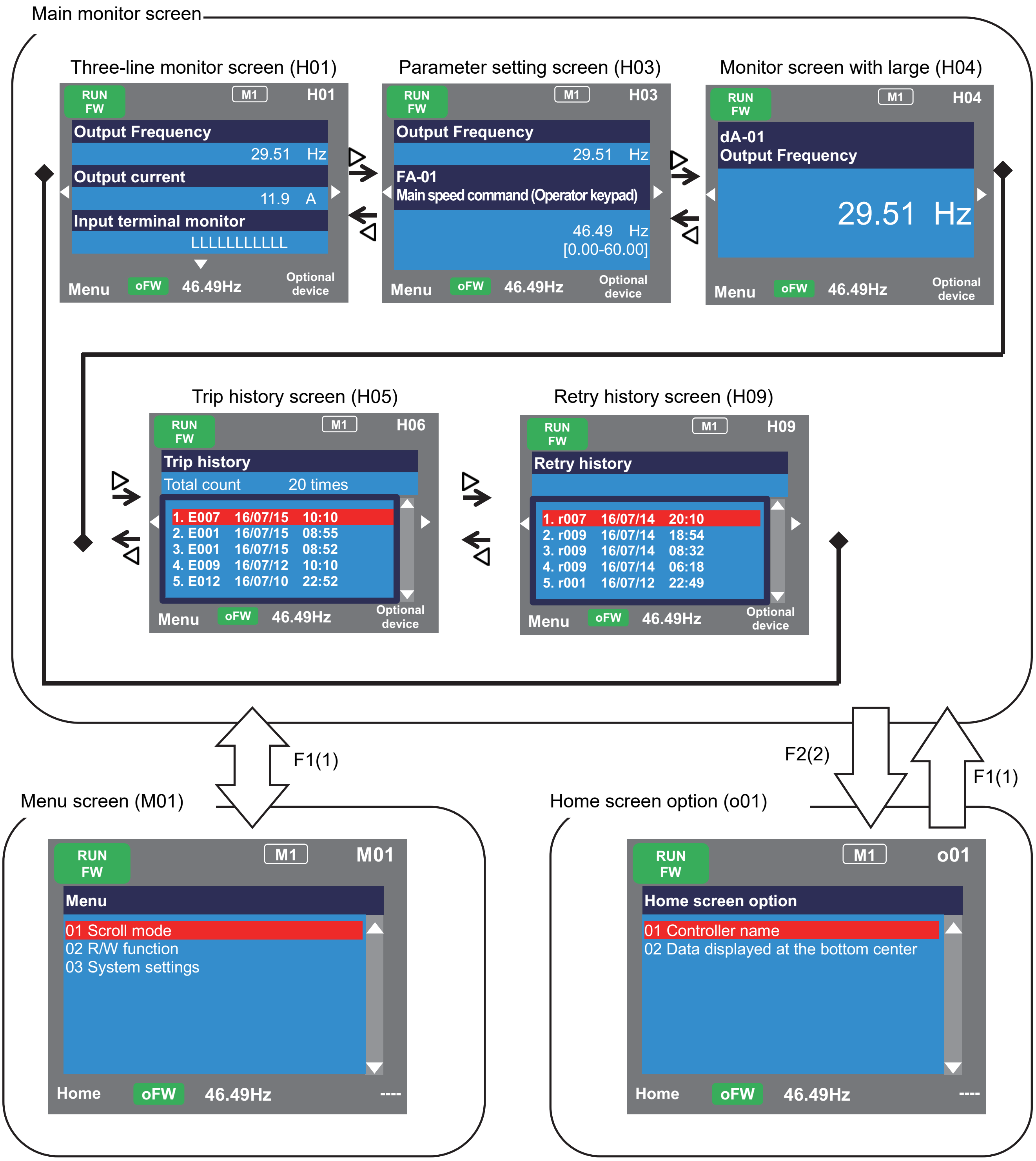
LCD Display Backlight

For LCD display backlight, two colors are provided: white and orange.

Colors varying depending on the inverter’s status are shown in the table below:

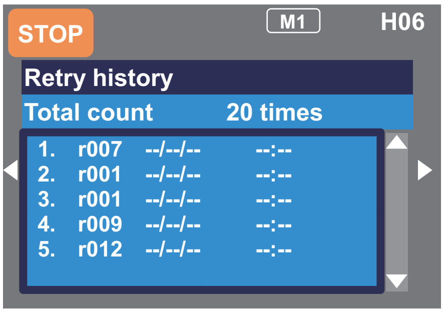
Backlight color	Status
White	Normal (not related to inverter’s operation and stop)
Orange	Warning (parameter discrepancy)
White and orange (blinking alternatively at one-second interval)	Trip (equivalent to alarm LED)

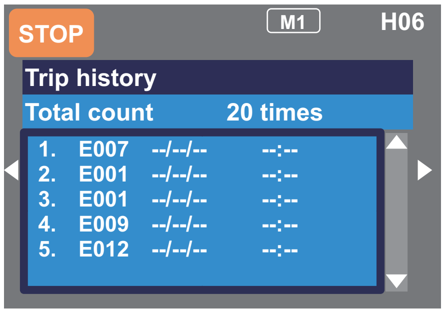
3-1-4 Transition of Screen Display



Precautions for Correct Use

- To display time in retry history and trip history, you need to configure clock settings.
- To use the clock function, you need an optional battery that is separately sold (CR2032, 3V).
- When the clock function is not used with being retained, the display of error history and trip history are shown below.





3-1-5 How to Set Battery and the Time Setting

The clock function of LCD operator can display the date and the time of trip/retry history.

To use this function, prepare an optional battery (CR2032, 3V) for the LCD operator.

The procedure to set the clock function and insert a battery is as follows:

1 Show a system setting screen of LCD operator.
Select “10: battery level warning.”
Then select “01: valid.”

2 Power-off the inverter.
Make sure that the power light of LCD operator is off.

3 Remove the LCD operator from the inverter.

4 Open the lid on the back side of LCD operator and insert a battery.
Make sure the positive side of the battery can be seen.

5 Close the lid and set the LCD operator to the inverter.

6 Power-on the inverter.

7 Make sure that the following screen comes up. Set the date and time.

8 Make sure that the battery is inserted properly.

Turn OFF the inverter and turn it ON again.

When the battery is properly inserted, the inverter starts without errors.

If the same screen (procedure.7) comes up again, the battery is not set properly. Please try the setting procedure from the beginning.

You can set the time by “09: Date and time” of the system setting screen. However, remember that you should insert battery and set the time/date to activate the clock function. Also do not forget to switch the battery level warning to “valid” for the battery charge detection.

Precautions for Safe Use

- When disposing of LCD operators and wasted batteries, follow the applicable ordinances of your local government. When disposing of the battery, insulate it using tape.

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<table><tr><td>The following display must be indicated when products using lithium primary batteries (with more than 6 ppb of perchlorate) are transport to or through the State of California, USA.
<table><tr><td>Perchlorate Material - special handling may apply.
See www.dtsc.ca.gov/hazardouswaste/perchlorate</td></tr></table>Label or mark the above display on the exterior of all outer shipping packages of your products when exporting your products which the lithium primary batteries (with more than 6 ppb of perchlorate) are installed to the State of California, USA.</td></tr></table>

- Do not short + and –, charge, disassemble, heat, put into the fire, or apply strong impact on the battery. The battery may leak, explode, produce heat or fire. Never use the battery which was applied strong impact due to such as fall on the floor, it may leak.
- UL standards establish that the battery shall be replaced by an expert engineer. The expert engineer must be in charge of the replacement and also replace the battery according to the method described in this manual.

Additional Information

- Even without battery, parameters saved in LCD operator and programs for DriveProgramming are retained
- If you cannot see what is displayed on the LCD operator because the service life is near its end, replace the LCD operator.

3-2 Parameter Settings

Two procedures are provided for parameter settings:

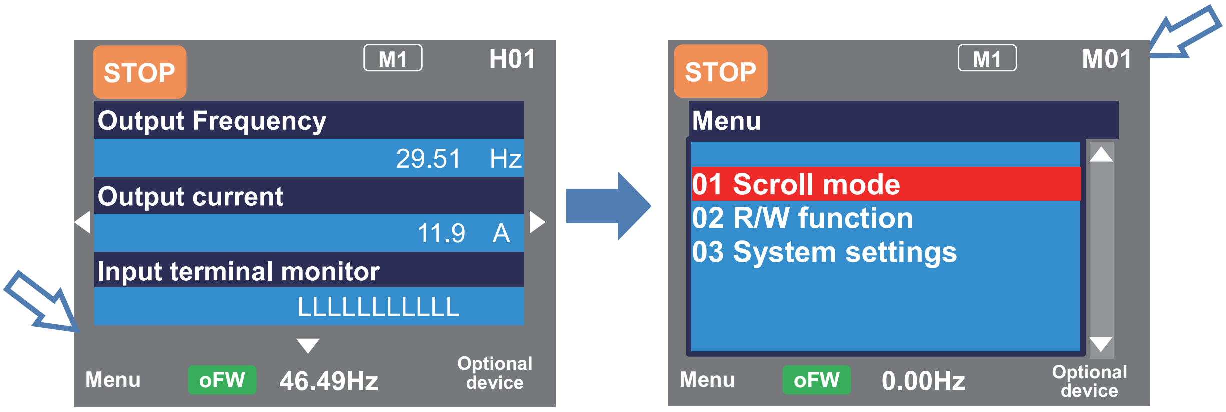
- “scroll mode” in which you can check list of setting data of parameters
- “concurrent monitor mode” you can change parameters while watching the monitor under operation.

3-2-1 Scroll Mode

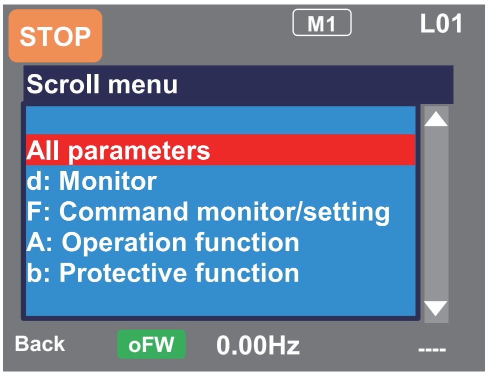
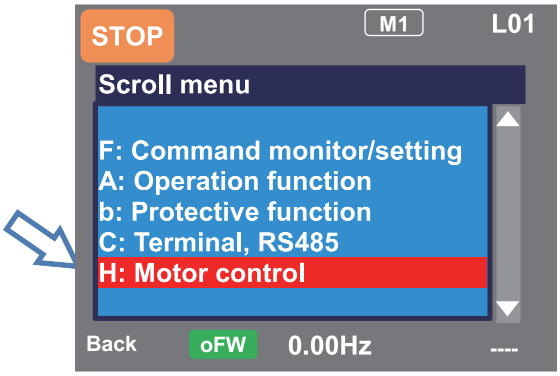
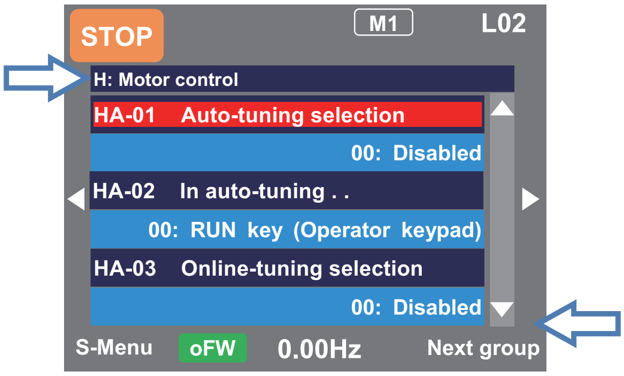
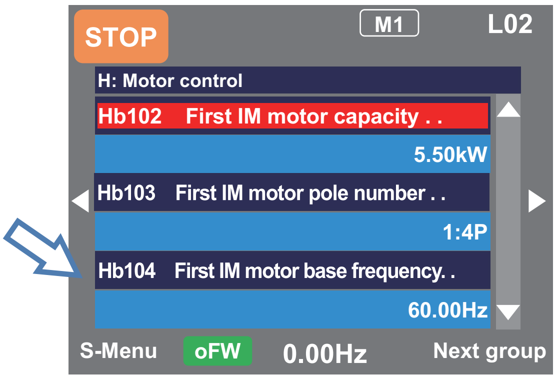
When configuring basic settings of motor, base frequency, rated voltage of motor, input and output of terminals, as well as when configuring individual functions, change parameters in the scroll mode.

You can check list of setting data of parameters in the scroll mode, therefore, it is also useful when checking the settings.

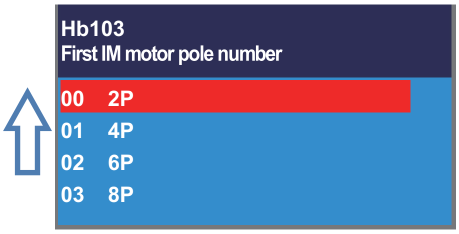
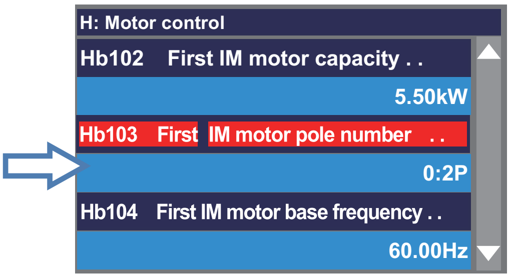
Press F1 (Menu) key on the screen that is displayed upon power-on (Multi-monitor in the example below) to move to the system settings screen (M01).



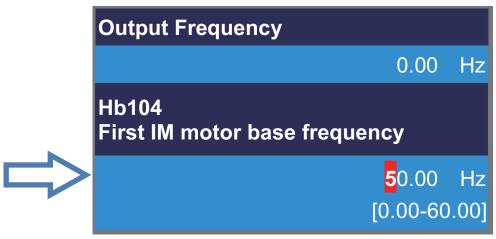
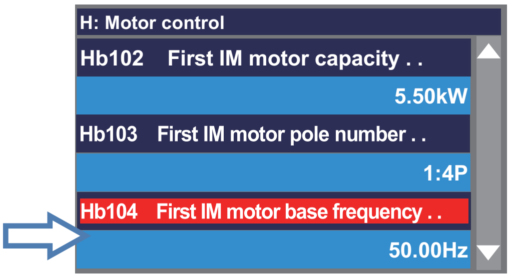
Scroll menu - Parameter selection screen

Set-up procedure	Action
	Choose the scroll mode on the system settings screen (M01) and press the Enter key to show the scroll menu (L01).
	Choose a group you want to browse using the up and down ( ) keys, and then press the Enter key to move to the parameter list display. For example, select “H: Motor control”. Example: In the example shown below, the Hb group, which is a basic parameter of induction motor, is checked, and a parameter is changed.
	Parameters of “H: Motor control” are displayed. Using the up and down ( ) keys, you can check parameters. Pressing the F2(2) key jumps to the top [Hb102] of the next group of [HA]. (Tips) You can jump to the top parameter of the sub-group in the group ([HA], [Hb], etc. in the case of group H) using the F2(2) key (transition is performed in one direction). Example of group H: ...->HA->Hb->HC->Hd->HA->...
	Using the up and down ( ) keys, you can check parameters. Choose the parameter to change, and then press the Enter key. Example1) [Hb103] The parameter to change the first IM motor pole number. Example2) [Hb104] The parameter to change the first IM motor base frequency.

Example1) Change [Hb103] First IM motor pole number

Set-up procedure	Action
	If the number of motor poles is 2, using the up and down ( ) keys, adjust it to “00 2P”, and then press the F2(Save) key. Data is saved when the F2(2) key is pressed. It is still saved even after the device is turned off. When configuring an item, the entire screen changes to the screen for setting the item. When not saving the setting after changing it, press the F1(Back) key. The screen returns to the parameter list display.
	To confirm if the data is correctly changed, check the lower section of the parameter display. Press the F1(1) key three times to return to the monitor.

Example2) Change [Hb104] First IM motor base frequency.

Set-up procedure	Action
	You can change the right-most digit of data area. Change the value using the arrow ( ) keys, and then press the F2(2) key. To 3.9. (Tips) In the figure on the left, base frequency is changed to 50.00Hz. Data is saved when the F2(2) key is pressed. It is still saved even after the device is turned off. You can make adjustments while performing monitoring. The monitor on the upper area shows the parameter selected in the monitor of the capital letters.
	To confirm if the data is correctly changed, check the lower section of the parameter display. Press the F1(1) key three times to return to the monitor.

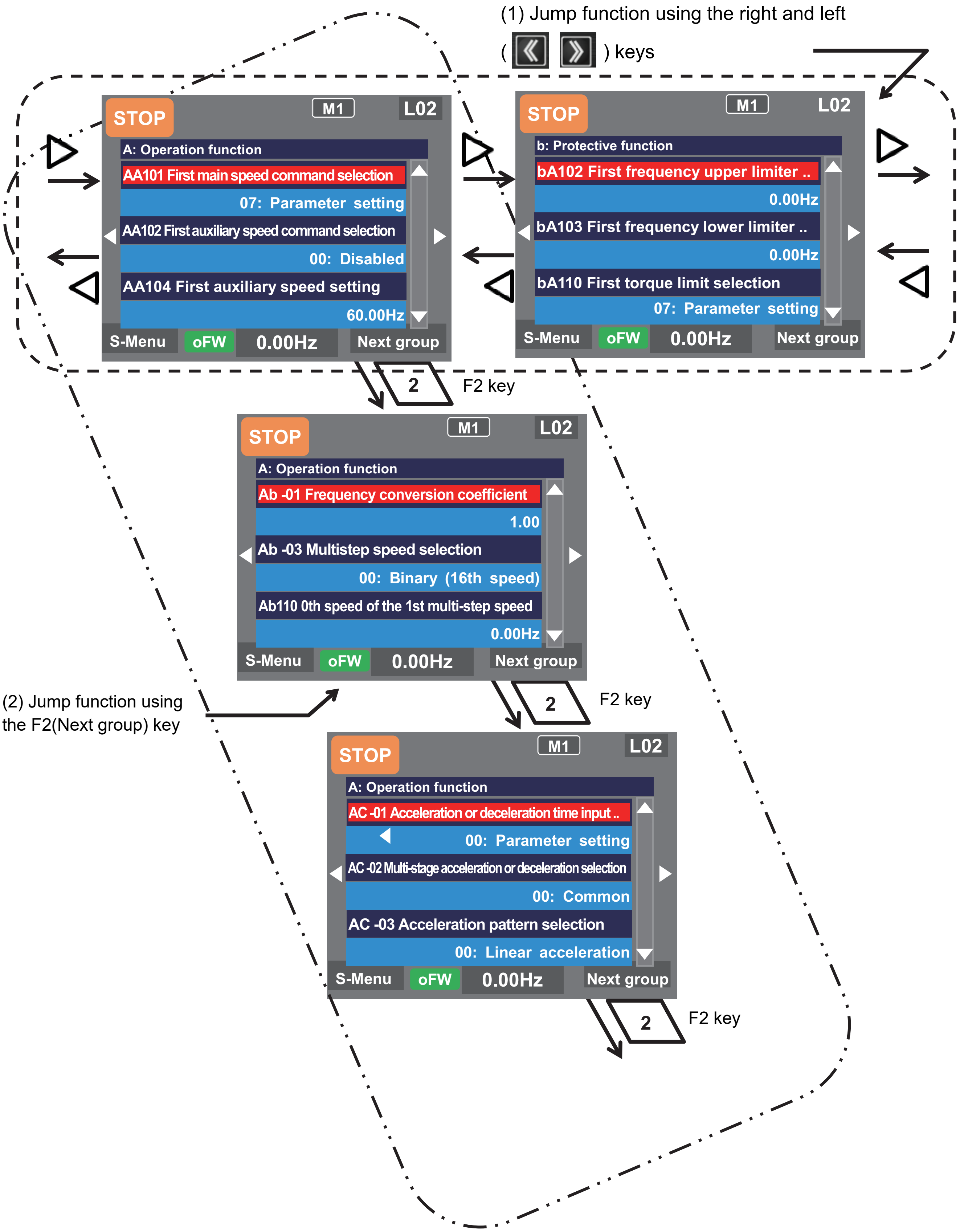
In the scroll mode screen (L02), (1) you can jump to the parameter at the top of each group by using the right and left ( ) keys or (2) jump to the parameter at the top of the sub-group (AA, Ab etc.) of the group by using F2 (Next group) key.

(1) You can jump to the top parameter of each group by using the right and left ( ) keys.

(...<->All parameters<->d: monitor<->F: Command monitor/setting<->...<->U: Initial setting, PDN <->All parameters<->...)

(2) You can jump to the top parameter of the sub-group in the group (AA, Ab, etc.) using the F2 (Next group) key (transition is performed in one direction (see below)).

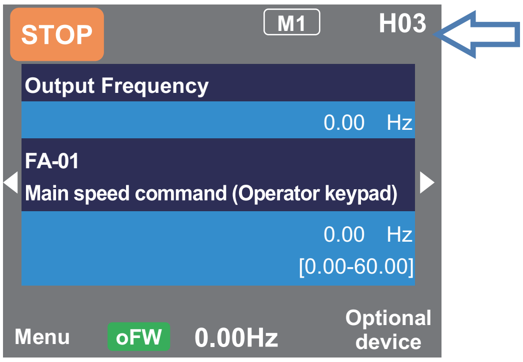
Example of group A: ...->AA->Ab->AC->...AJ->AA->...



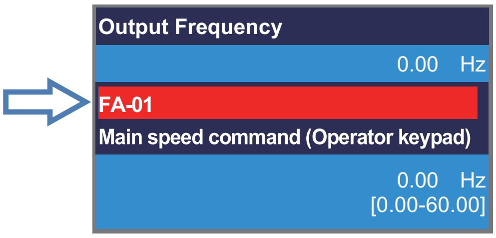
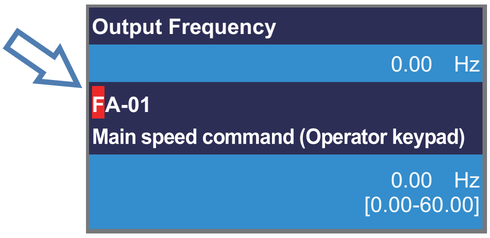
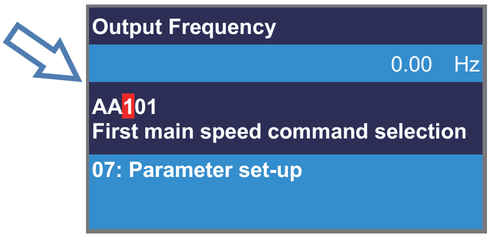
3-2-2 Concurrent Monitor Mode

When configuring settings such as frequency command and acceleration/deceleration time while watching the monitor during operation, you can change the settings on this monitor screen.

On the screen that is displayed upon power-on, using the right and left ( ) keys, navigate to a setting screen “Concurrent monitor” (H03).

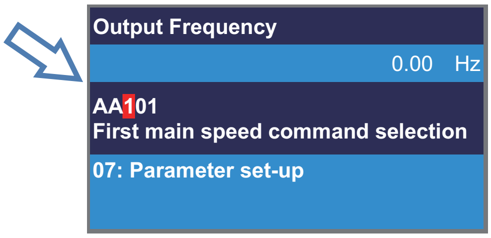
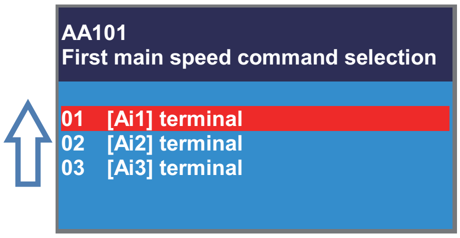
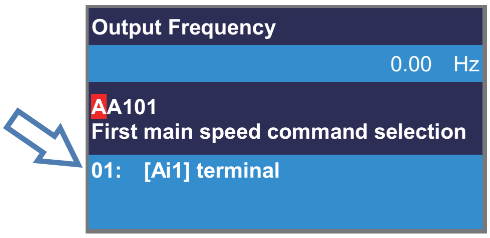


Monitor screen - Parameter selection screen

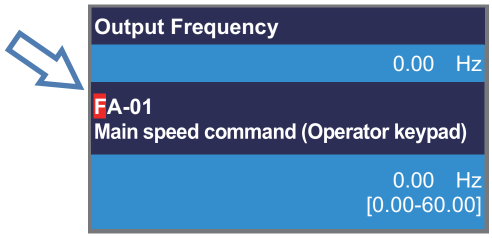
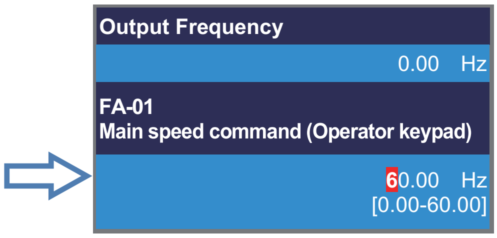
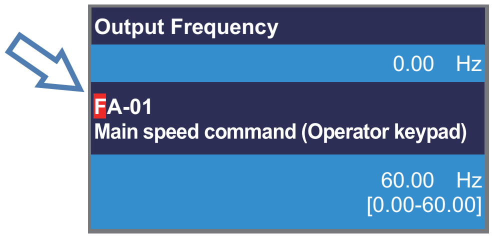
Set-up procedure	Action
	Press the Enter key to change the color of parameter field. (Tips) Using the up and down ( ) keys, you can choose to change the parameter or change the monitor.
	When the Enter key is pressed again, the left-most letter of the parameter can be changed.
	Using the arrow ( ) keys to change the parameter number that you want to change, and then press the Enter key. Example1) When the frequency command destination [AA101] First speed command selection is changed. Example2) When the frequency command value is controlled in [FA-01] while the frequency command destination is set to 07: Parameter setting.

Example1) Change the [AA101] First main speed command selection to [Ai1] terminal.

The [Ai1] terminal is an analog input terminal (voltage/current).

Set-up procedure	Action
	Press the Enter key while [AA101] is displayed. (Tips) The information currently selected is shown in the lower section. “07: Parameter setting” is currently selected.
	Using the up and down ( ) keys, select “01 [Ai1] terminal”, and then press the F2(2) key. (Tips) Data is saved when the F2(2) key is pressed. It is still saved even after the device is turned off. When configuring an item, the entire screen changes to the screen for setting the item.
	To confirm if the data is correctly changed, check the lower section. Press the F1(1) key to return to the monitor. (Tips) The information currently selected is shown in the lower section. “01 [Ai1] terminal” is currently selected.

Example2) Change frequency command in [FA-01].
(If the frequency command selection is “07: Parameter setting”)

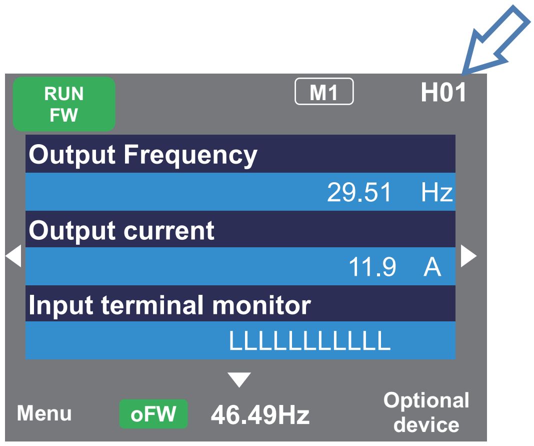
Set-up procedure	Action
	Press the Enter key while [FA-01] is displayed. (Tips) In [FA-01], the set value can be changed if the string inside () of main speed command indicates the operator keypad or multi-step speed. In other cases, it is set to the command monitor.
	You can change the right-most digit of data. Change the value using the arrow () keys, and then press the F2(2) key. (Tips) In the figure on the left, base frequency is changed to 60.00Hz. Data is saved when the F2(2) key is pressed. It is still saved even after the device is turned off. You can make adjustments while performing monitoring.
	To confirm if the data is correctly changed, check the lower section. Press the F1(1) key to return to the monitor. (Tips) The current frequency command is shown in the lower section. Currently, 60.00Hz is input as the command.

3-3 Monitor Function

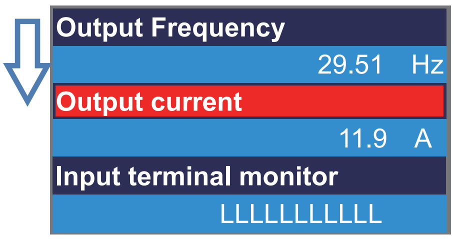
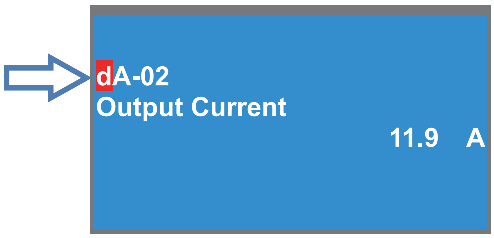
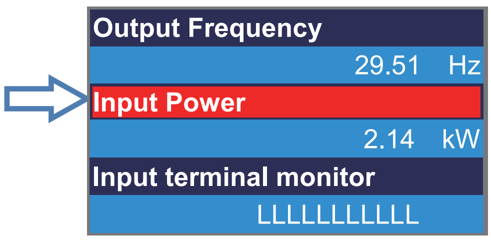
3-3-1 Three-line Monitor Screen

In the three-line monitor screen, you can monitor three types of information at the same time. You can change and save the monitored data.

On the screen that is displayed upon power-on, using the right and left ( ) keys, navigate to “H01”.



Example) Change the output current monitor to the input power monitor.

Set-up procedure	Action
	Press the Enter key to change the color of the field in upper section. Using the up and down ( ) keys, navigate to the second line.
	When the Enter key is pressed, the left-most letter of the parameter can be changed.
	Using the arrow ( ) keys, change [dA-02] to [dA-30].
	Press the Enter key to confirm the monitoring target. Press the F1(1) key to return to the monitor.

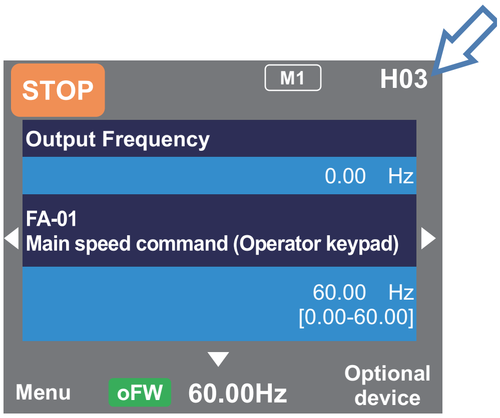
Precautions for Correct Use

What is displayed on the first line of the three-line monitor screen (H01) is the same as that displayed on the upper area of the setting screen (H03) and the screen with large character (H04).

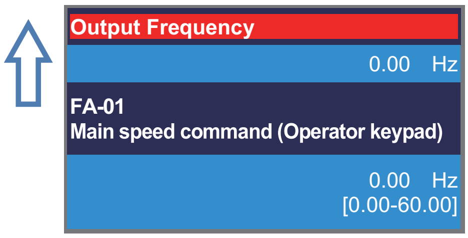
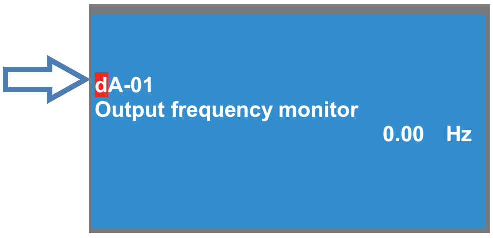
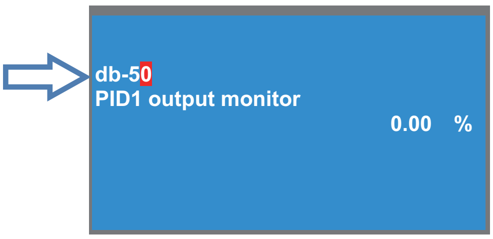
3-3-2 Setting Screen “Concurrent Monitor”

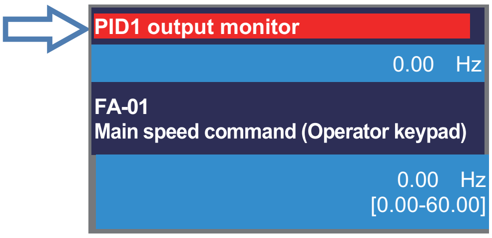
On the setting screen, you can control parameter data while performing monitoring. To change the selected data, the screen changes to the setting screen that shows options.

On the screen that is displayed upon power-on, using the right and left (《 》) keys, navigate to “H03”.



Example) Change the output frequency monitor to the PID1 output monitor.

Set-up procedure	Action
	Press the Enter key to change the color of parameter field. Using the up and down (︽ ︾) keys to select and navigate to the detail of monitoring.
	When the Enter key is pressed, the left-most letter of the parameter can be changed.
	Using the arrow (︽ ︾ 《 》) keys, change [dA-01] to [db-50].

Set-up procedure	Action
	Press the Enter key to confirm the monitoring target, which is then displayed in the upper section. Press the F1(1) key to return to the monitor. You can also configure parameters using the up and down ( ) keys.

Precautions for Correct Use

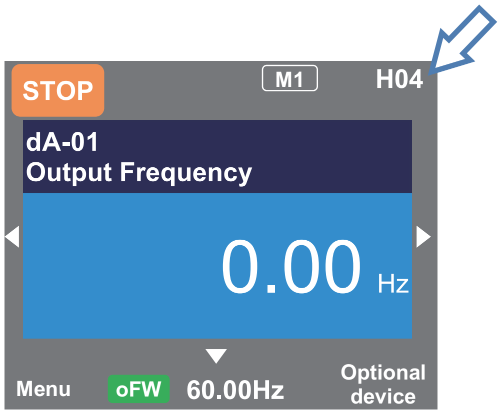
What is displayed on the upper monitor of the setting screen “Concurrent monitor” (H03) is the Same as that displayed on the first line of three-line monitor screen (H01) and the screen with large characters(H04).

3-3-3 Monitor with Large Characters

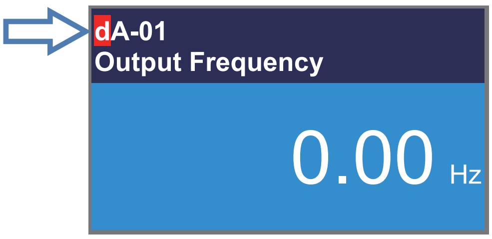
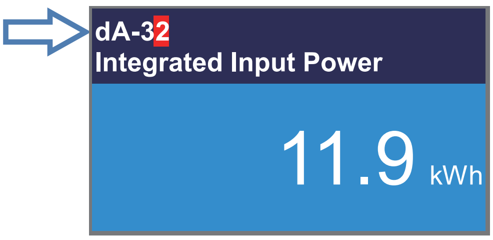
In the monitor screen with large characters, you can display a parameter in bigger size.

On the screen that is displayed upon power-on using the right and left ( ) keys, naviate to “H04”.

And later operate the device in the following proce-dures.



Example) Change the output frequency monitor to the integrated input power monitor.

Set-up procedure	Action
	When the Enter key is pressed, the left-most letter of the parameter can be changed.
	Using the arrow ( ) keys, change [dA-01] to [dA-32]. Press the Enter key to confirm and return to the monitor.

Precautions for Correct Use

What is monitored on the screen with large characters (H04) is the same as the upper monitor of the setting screen (H03) and the first line of three-line monitor screen (H01).

3-4 Error History Display

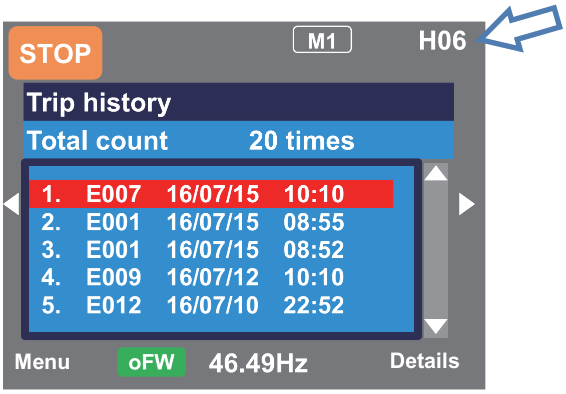
3-4-1 Trip History

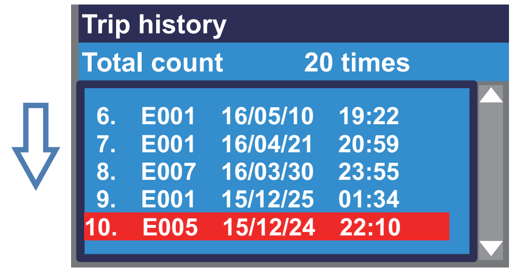
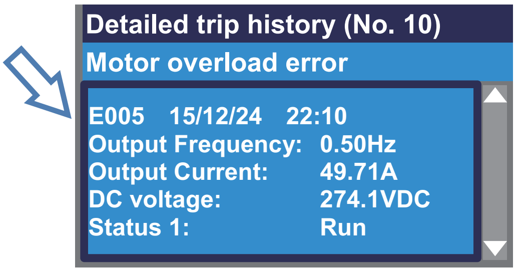
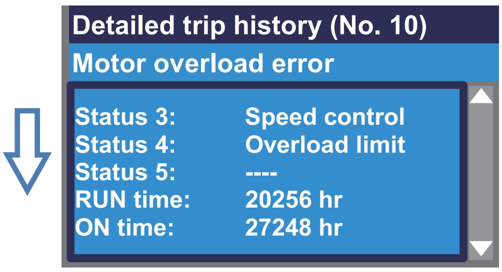
The trip history screen shows details of the errors that have occurred and the total number of times trip occurred.

For details of errors, refer to *12-1 Checking Alarm Display* on page 12-2.

On the screen that is displayed upon power-on, using the right and left ( ) keys, navigate to "H06".

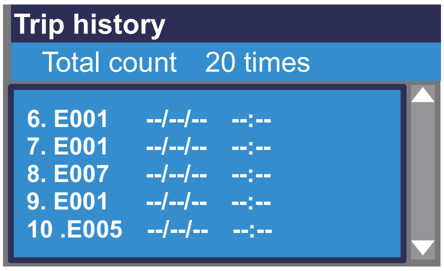
And later operate the device in the following procedures.



Set-up procedure	Action
	Using the up and down ( ) keys, select history information you want to check.
	Press the Enter key to show details of the selected history information.
	Using the up and down ( ) keys, you can check details. Press the F1(1) key to return to the monitor.

Precautions for Correct Use

- To display time in trip history, you need to configure clock settings.
- To use the clock function, you need an optional battery that is separately sold (CR2032, 3V).
- When the clock function is not used with being retained, the display of error history is shown below.



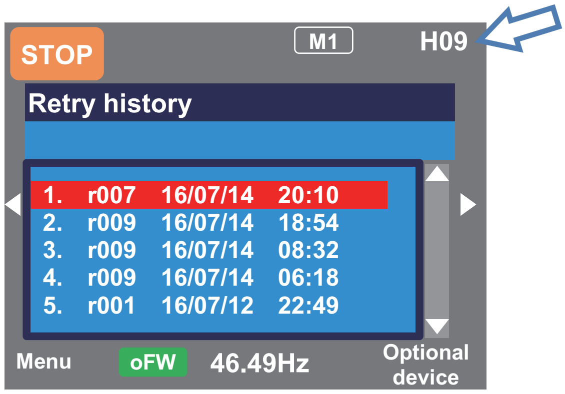
3-4-2 Retry History

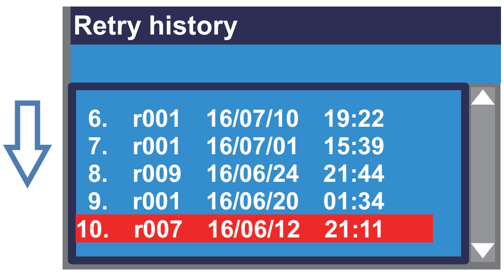
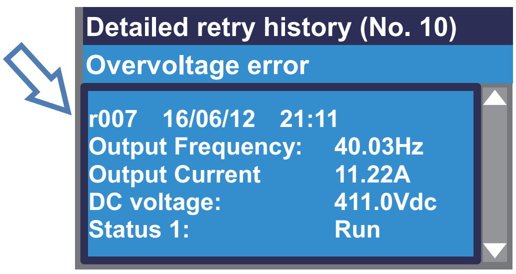
The retry history screen shows details of the errors that have occurred and the total number of times retry was performed.

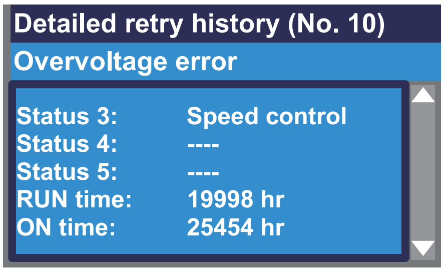
For details of error, refer to *12-1 Checking Alarm Display* on page 12-2.

On the screen that is displayed upon power-on, using the right and left ( ) keys, navigate to retry history screen "H09".

And then operate the device in the following procedures.

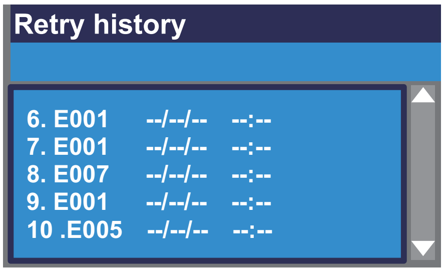


Set-up procedure	Action
	Using the up and down ( ) keys, select history information you want to check.
	Press the Enter key to show details of the selected history information.

Set-up procedure	Action
	Using the up and down ( ) keys, you can check details. Press the F1(1) key to return to the monitor.

Precautions for Correct Use

- To display time in retry history, you need to configure clock settings.
- To use the clock function, you need an optional battery that is separately sold (CR2032, 3V).
- When the clock function is not used with being retained, the display of error history is shown below.



3-5 Data Copy Function

With R/W function, you can copy the data at Inverter and transfer to LCD operator or write the copied data to the inverter.

In case you rewrite a backup data to the inverter or to copy data at other inverters, this function is available.

Only a set of data can be saved.

3-5-1 Read Function

Copy the data at Inverter and transfer to LCD operator.

On the screen that is displayed upon power-on, press the F1 (1) key to navigate to the menu screen “M01”. Then, select the R/W function by pressing the Enter key.

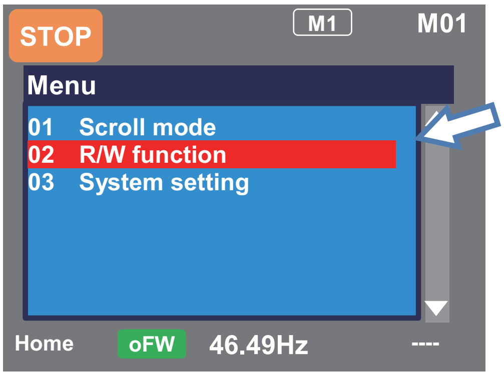
Main monitor screen

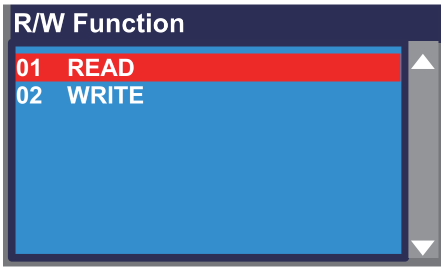
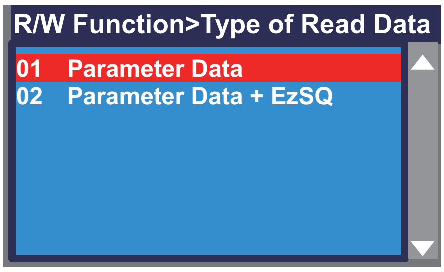
↓ F1 (1) key

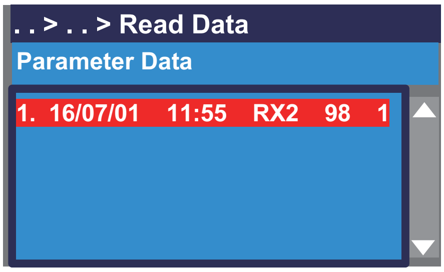
Menu screen (M01)

↓ * Select 02 R/W function by (up) (down) + Enter key.

Transfer to R/W function screen (R01) and follow the procedure below.



Set-up procedure	Action
	Press the Enter key to confirm the READ function.
	Select data to be read by using the up and down ((up) (down)) keys. Then, confirm the function by pressing the Enter key.

Set-up procedure	Action
 	In accordance with the instruction shown on the screen, specify the location of data you desire to save, and press the F2(2) key to navigate to the confirmation screen. Then, press the F2(2) key to start reading the data. When the completion screen appears, the procedure is complete. Display description: No. Date Time Inverter name: No. Data type * Inverter name: No. is unique to each inverter. * Data type is 1: Only parameters or 2: Parameters+EzSQ. * To display date and time, you need to configure clock settings from System settings.

3-5-2 Write Function

Write the data pasted to LCD operator to the inverter.

On the screen that is displayed upon power-on, press the F1 (1) key to navigate to the menu screen “M01”. Then, select the R/W function by pressing the Enter key.

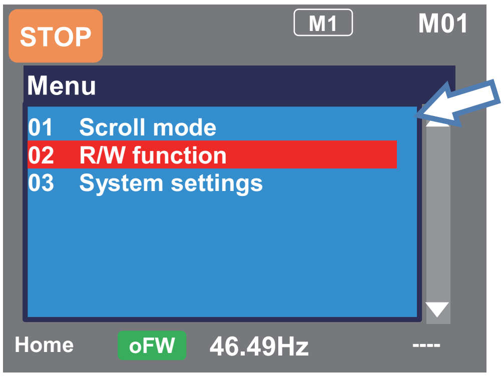
Main monitor screen

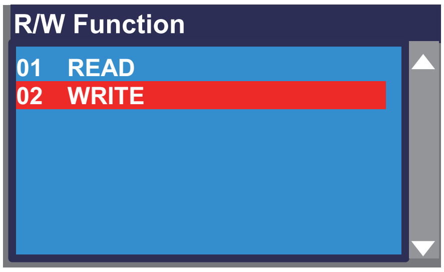
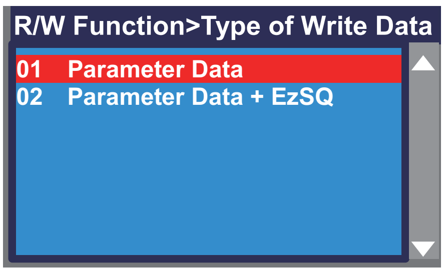
↓ F1(1) Key

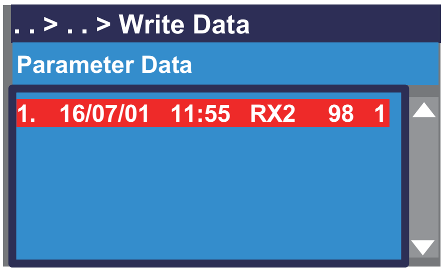
Menu screen (M01)

↓ * Select 02 R/W function by [up] [down] + Enter key.

Transfer to R/W function screen (R01) and follow the procedure below.

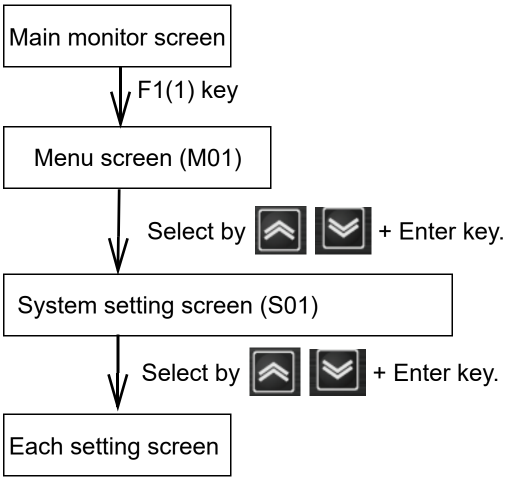


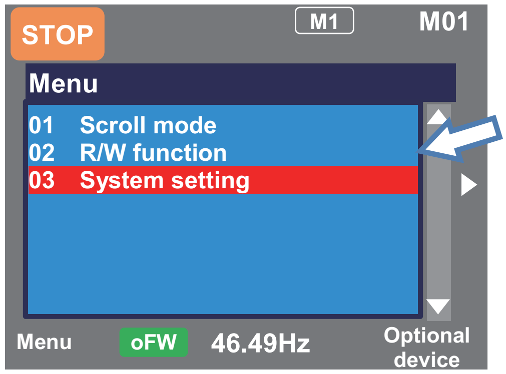
Set-up procedure	Action
 	Select the write function by using the up and down ( ) keys. Then, confirm by pressing the Enter key.
 	Select data to be written by using the up and down ( ) keys. Then, confirm the function by pressing the Enter key.

Set-up procedure	Action
	In accordance with the instruction shown on the screen, select data to be written to the inverter, and press the F2(2) key to start writing. When the completion screen appears, the procedure is complete. Display description: No. Date Time Inverter name: No. Data type * Inverter name: No. is unique to each inverter. * Data type is 1: Only parameters or 2: Parameters+EzSQ. * To display date and time, you need to configure clock settings from System settings.

3-6 System Settings

On the System settings screen, you can use extended functions.





On the screen that is displayed upon power-on, press the F1 (1) key to navigate to the menu screen “M01”. Then, select the R/W function by pressing the Enter key or right ( ) key.

No.	Name	Description
01	Language selection	Changes the language setting.
02	Dimming	Controls the brightness of LCD operator screen.
03	Automatic light off time*1	Controls the time to automatically light off the screen.
04	Dimming at light off*1	Controls the brightness when the screen is automatically lit off.
05	Automatic home transition time	Sets the time to automatically return to the home screen.
06	Initial home screen selection	Sets the screen that is displayed upon power-on and automatic return to the home screen.
07	Read lock	Limits the reading of data
08	Blinking during trip	Sets whether blinking is performed or not during trip.
09	Date and time*2	Configures settings of time, display format, and battery level warning.
10	Battery level warning	Displays a warning message when the battery runs out.
11	Color setting	Sets the background color.
12	Basic inverter information monitor	Checks information of the main unit.
13	Selection of connected model	Sets RX2.
14	LCD operator version	Displays the version of the LCD operator.
15	Initialization of LCD operator	Initializes the LCD operator.
16	Self-check mode	Operates self-check mode.
17	Remote mode switching	If this setting is enabled, when the F1 key on the home screen is pressed for 1 second or more, you can switch the frequency command and operation command to commands issued from the LCD operator.
18	Reserve	Do not change the setting from OFF.

*1. The light off function is disabled until trip is canceled after the occurrence of trip.

*2. To use the clock function, you need an optional battery that is separately sold. (CR2032, 3V)
If no electricity is supplied to the inverter, battery replacement is required every two years.

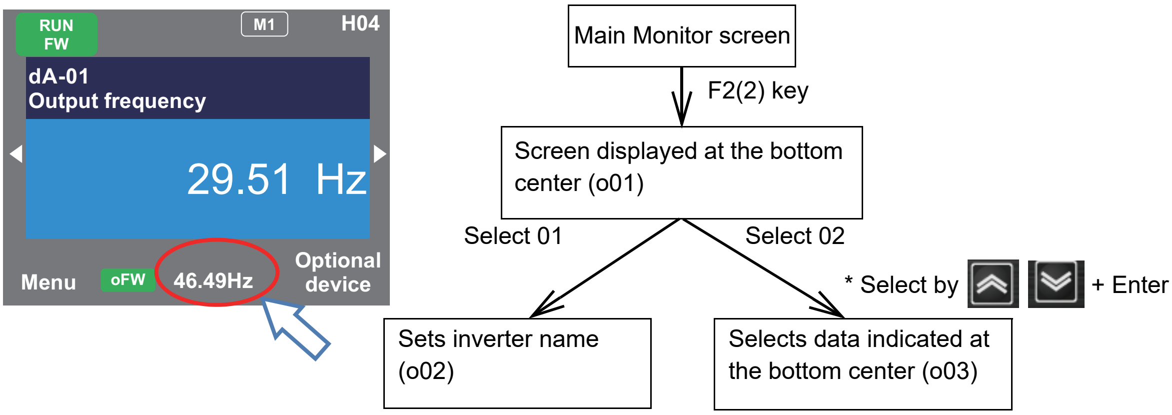
Precautions for Correct Use

If there is an error in the memory area in the LCD operator, an error message is displayed on the LCD operator. In such a case, initialize the LCD operator from the System settings, and confirm the settings. If the error on the LCD operator is not solved, the internal memory may be damaged. You need to replace the LCD operator.

3-7 Changing the Data Indicated at the Bottom Center

You can change the data contents indicated.

Instead of the preset indication, you can set a controller’s (inverter) name to indicate.



On the screen that is displayed upon power-on, press the F2(2) key to navigate to the option screen “o01”. Then, select data that is shown at the bottom center by pressing the Enter key. After selecting data, save it by pressing the F2(2) key.

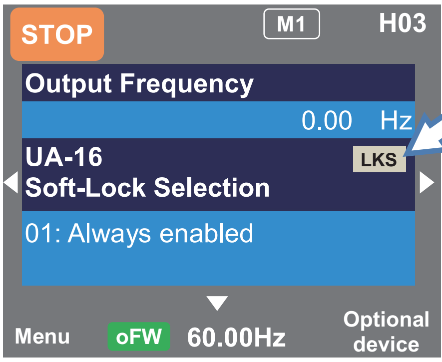
Sets the indicating item as following table.

Option		Description
01 Controller (inverter) name (o02)		You can specify 8-digit string from alphanumeric letters and symbols.
02 Data displayed at the bottom center (o03)	00 Frequency command	The current frequency command is displayed.
	01 Torque command	The current torque command is displayed during torque control.
	02 Time	The current time is displayed.
	03 Controller name	The specified controller (inverter) name is displayed.

3-8 Parameter Function

3-8-1 Parameter Preservation Function

By configuring the soft-lock function you can prevent parameters from being changed.



By configuring the soft-lock selection [UA-16] and [UA-17], you can prevent parameters from being changed.

While soft-lock function is enabled, the LKS mark (Lock State mark) LKS is shown on the right of parameters.

● Parameters

Item	Parameter	Data	Description
Soft-lock selection	[UA-16]	00	Normal state. Only when the soft-lock terminal [SFT] is on, data set to [UA-17] other than [UA-16] are locked.
		01	After the setting is performed, the data set to [UA-17] other than [UA-16] are locked.
Soft-lock target selection	[UA-17]	00	All data other than [UA-16] cannot be changed
		01	Data other than [UA-16] and set frequency cannot be changed
Input terminal selection	[CA-01] to [CA-11]	036	[SFT]: Used when the soft-lock function is used on terminals.

3-8-2 Limiting Displayed Parameters

You can change the content of display on the LCD operator according to your purpose.

To know which parameters are changed, you can check by setting [UA-10] to 03.

If you do not want to display parameters for functions not in use, you can reduce them by setting [UA-10] to 01.

Related Parameter

Item	Parameter	Data	Description
Display restriction selection	[UA-10]	00	All parameters are displayed.
		01	Parameters are displayed by function. Disabled functions are not displayed with some exceptions.
		02	Display is performed in accordance with the settings configured by the user. Parameters set to [UA-31] to [UA-62] are displayed with some exceptions.
		03	Parameters that have been changed from the factory default settings and some other parameters are displayed.
		04	Monitor parameters and some other parameters are displayed.
2nd-motor parameter display selection	[UA-21]	00	Hides parameters of second setting [**2**].
		01	Displays parameters of second setting [**2**].
Option parameter display selection	[UA-22]	00	Hides parameters that start with o.
		01	Displays parameters that start with o.
User parameter selection	[UA-31] to [UA-62]	no	No assignment
		*****	Choose the code you want to display. (all codes are subjected)

I you are not using the input terminal function [SET] for switching to the second setting, by setting [UA-21] to 00, you can reduce a great number of displayed items.

I you are not using option unit, by setting [UA-22] to 00, you can reduce indications for option unit.

[UA-10]=01: Function-specific Display

If a function is not selected, parameters related to the function are hidden.

For more information about the display condition, see the table below.

The * mark in the table is replaced by 1 or 2. (1 represents first and 2 represents second.)

(a) IM control parameters

Display condition: AA121 ≤ 10 or AA221 ≤ 10

Parameter	Name
Hb*02	* selection of the IM motor capacity
Hb*03	* selection of the IM motor pole number
Hb*04	* IM base frequency
Hb*05	* IM maximum frequency
Hb*06	* IM motor rated voltage
Hb*08	* IM motor rated current
Hb*10	* IM motor constant R1
Hb*12	* IM motor constant R2
Hb*14	* IM motor constant L
Hb*16	* IM motor constant Io
Hb*18	* IM motor constant J
Hb*30	* minimum frequency
Hb*31	* reduced voltage start time
Hb*40	* selection of operation mode for manual torque boost
Hb*41	* volume of manual torque boost
Hb*42	* break point of manual torque boost
Hb*45	* selection of energy-saving operation
Hb*46	* energy-saving response/accuracy adjustment
Hb*50	* free V/f frequency 1
Hb*51	* free V/f voltage 1
Hb*52	* free V/f frequency 2
Hb*53	* free V/f voltage 2
Hb*54	* free V/f frequency 3
Hb*55	* free V/f voltage 3
Hb*56	* free V/f frequency 4
Hb*57	* free V/f voltage 4
Hb*58	* free V/f frequency 5
Hb*59	* free V/f voltage 5
Hb*60	* free V/f frequency 6
Hb*61	* free V/f voltage 6
Hb*62	* free V/f frequency 7
Hb*63	* free V/f voltage 7
Hb*70	* slip compensation P gain with sensor
Hb*71	* slip compensation I gain with sensor
Hb*80	* output voltage gain
HC*01	* voltage compensation gain of automatic torque boost
HC*02	* slip compensation gain of automatic torque boost
HC*10	* 0th speed range limiter (IM-0Hz-SLV)
HC*11	* amount of boost at the start (IM-SLV, IM-CLV)
HC*12	* amount of boost at the start (IM-0Hz-SLV)
HC*13	* selection of whether a secondary-resistance correction is to be conducted (IM-SLV, IM-0Hz-SLV,IM-CLV)
HC*14	* selection of reversal prevention (IM-SLV, IM-0Hz-SLV, IM-CLV)

Parameter	Name
HC*20	* time constant for torque current command filter
HC*21	* speed feed forward compensation adjustment gain

(b) SM (PMM) control parameter

Display condition: AA121 > 10 or AA221 > 10

Parameter	Name
Hd*02	* SM(PMM) motor capacity selection
Hd*03	* SM(PMM) motor poles selection
Hd*04	* SM(PMM) base frequency
Hd*05	* SM(PMM) maximum frequency
Hd*06	* SM(PMM) motor rated voltage
Hd*08	* SM(PMM) motor rated voltage
Hd*10	* SM(PMM) motor constant R
Hd*12	* SM(PMM) motor constant Ld
Hd*14	* SM(PMM) motor constant Lq
Hd*16	* SM(PMM) motor constant Ke
Hd*18	* SM(PMM) motor constant J
Hd*30	* SM(PMM) lowest frequency (switch) (SM-SLV, SM-IVMS)
Hd*31	* SM no-load current (SM-SLV, SM-IVMS)
Hd*32	* SM start method selection (SM-SLV, SM-IVMS, SM-CLV)
Hd*33	* SM initial position estimation Zero-V stand-by times (SM-SLV, SM-IVMS, SM-CLV)
Hd*34	* SM initial position estimation Detection stand-by times (SM-SLV, SM-IVMS, SM-CLV)
Hd*35	* SM initial position estimation Detection times (SM-SLV, SM-IVMS, SM-CLV)
Hd*36	* SM initial position estimation Voltage gain (SM-SLV, SM-IVMS, SM-CLV)
Hd*37	* SM initial position estimation Magnetic-pole position offset
Hd-41	IVMS carrier frequency
Hd-42	Filter gain of IVMS detection current
Hd-43	Open-phase voltage detection gain selection SM(PMM)-IVMS
Hd-44	Selection of open-phase switch threshold correction SM(PMM)-IVMS
Hd-45	Speed control P gain SM(PMM)-IVMS
Hd-46	Speed control I gain SM(PMM)-IVMS
Hd-47	Waiting time for open-phase switching SM(PMM)-IVMS
Hd-48	Restriction on the rotation-direction determination SM(PMM)-IVMS
Hd-49	Timing adjustment for open-phase voltage detection SM(PMM)-IVMS
Hd-50	Minimum pulse range adjustment SM(PMM)-IVMS
Hd-51	Current limit of IVMS threshold
Hd-52	IVMS threshold gain
Hd-58	IVMS carrier-frequency switching start/finish point

(c) Position control parameter

Display condition: AA123 ≠ 00 or AA223 ≠ 00

Parameter	Name
AE-01	Electronic gear installation position selection
AE-02	Numerator of electronic gear ratio
AE-03	Denominator of electronic gear ratio
AE-04	Positioning completion range setting
AE-05	Positioning completion delay time setting
AE-06	Positioning control feed forward
AE-07	Position loop gain

(d) Orientation

Display condition: AA123 = 01 or AA223 = 01

Parameter	Name
AE-08	Position bias volume
AE-10	Orientation stop position for input destination selection
AE-11	Orientation stop position
AE-12	Orientation speed setting
AE-13	Orientation direction setting

(e) Absolute position control

Display condition: AA123 > 01 or AA223 > 01

Parameter	Name
AE-20 to 50	Position command 0-15
AE-52	Position range designation (forward rotation)
AE-54	Position range designation (reverse rotation)
AE-56	Positioning mode selection
AE-60	Teaching selection
AE-61	Memorization of current position at power-off
AE-62	Preset position data
AE-64	Gain for calculating the deceleration stop distance
AE-65	Bias for calculating the deceleration stop distance
AE-66	APR control speed limit
AE-67	APR start speed
AE-70	Zero return mode selection
AE-71	Zero return direction selection
AE-72	Low speed zero return speed
AE-73	High speed zero return speed

(f) Normal acceleration/deceleration speed

Display condition: AC - 02 = 00

Parameter	Name
AC*15	* 2-stage acceleration/deceleration selection
AC*16	* 2-stage acceleration frequency
AC*17	* 2-stage deceleration frequency
AC*20	* acceleration time 1
AC*22	* deceleration time 1
AC*24	* acceleration time 2
AC*26	* deceleration time 2

(g) Multi-stage acceleration/deceleration

Display condition: AC – 02 = 01

Parameter	Name
AC-30	Acceleration time for multi-speed 1st speed
AC-32	Deceleration time for multi-speed 1st speed
AC-34	Acceleration time for multi-speed 2nd speed
AC-36	Deceleration time for multi-speed 2nd speed
AC-38	Acceleration time for multi-speed 3rd speed
AC-40	Deceleration time for multi-speed 3rd speed
AC-42	Acceleration time for multi-speed 4th speed

Parameter	Name
AC-44	Deceleration time for multi-speed 4th speed
AC-46	Acceleration time for multi-speed 5th speed
AC-48	Deceleration time for multi-speed 5th speed
AC-50	Acceleration time for multi-speed 6th speed
AC-52	Deceleration time for multi-speed 6th speed
AC-54	Acceleration time for multi-speed 7th speed
AC-56	Deceleration time for multi-speed 7th speed
AC-58	Acceleration time for multi-speed 8th speed
AC-60	Deceleration time for multi-speed 8th speed
AC-62	Acceleration time for multi-speed 9th speed
AC-64	Deceleration time for multi-speed 9th speed
AC-66	Acceleration time for multi-speed 10th speed
AC-68	Deceleration time for multi-speed 10th speed
AC-70	Acceleration time for multi-speed 11th speed
AC-72	Deceleration time for multi-speed 11th speed
AC-74	Acceleration time for multi-speed 12th speed
AC-76	Deceleration time for multi-speed 12th speed
AC-78	Acceleration time for multi-speed 13th speed
AC-80	Deceleration time for multi-speed 13th speed
AC-82	Acceleration time for multi-speed 14th speed
AC-84	Deceleration time for multi-speed 14th speed
AC-86	Acceleration time for multi-speed 15th speed
AC-88	Deceleration time for multi-speed 15th speed

(h) Internal direct current braking

Display condition: AF*01 = 01, 02

Parameter	Name
AF*02	* braking mode
AF*03	* DC braking frequency
AF*04	* DC braking delay time
AF*05	* DC braking force at the time of the stop
AF*06	* DC braking time at the time of the stop
AF*07	* DC current braking trigger selection
AF*08	* DC braking force at the start
AF*09	* DC braking time at the start

(i) Brake control 1 (common for forward/reverse)

Display condition: AF*30 = 01, 02

Parameter	Name
AF*31	* brake release establishment waiting time
AF*32	* acceleration waiting time
AF*33	* stop waiting time
AF*34	* brake check waiting time
AF*35	* brake release frequency
AF*36	* brake release current
AF*37	* brake apply frequency

(j) Brake control 1 (Forward/reverse set individually)

Display condition: AF*30 = 02

Parameter	Name
AF*38	* brake release establishment waiting time (reverse rotation)
AF*39	* acceleration waiting time (reverse rotation)
AF*40	* stop waiting time (reverse rotation)
AF*41	* brake check waiting time (reverse rotation)
AF*42	* brake release frequency (reverse rotation)
AF*43	* brake release current (reverse rotation)
AF*44	* brake apply frequency (reverse rotation)

(k) Brake control 2

Display condition: AF*30 = 03

Parameter	Name
AF*50	* brake release delay time
AF*51	* brake apply delay time
AF*52	* brake check time
AF*53	* servo lock time at start
AF*54	* servo lock time at stop

(l) Free electronic thermal

Display condition: bc*11 = 02

Parameter	Name
bC*20	* free electronic thermal frequency 1
bC*21	* free electronic thermal current 1
bC*22	* free electronic thermal frequency 2
bC*23	* free electronic thermal current 2
bC*24	* free electronic thermal frequency 3
bC*25	* free electronic thermal current 3

(m) Gain mapping 1

Display condition: HA*20 = 00

Parameter	Name
HA*21	* gain switch time
HA*27	* gain mapping P control P gain 1
HA*30	* gain mapping P control P gain 2

(n) Gain mapping 2

Display condition: HA*20 = 01

Parameter	Name
HA*22	* gain switch intermediate speed 1
HA*23	* gain switch intermediate speed 2
HA*24	* gain mapping maximum speed
HA*31	* gain mapping P gain 3
HA*32	* gain mapping I gain 3
HA*33	* gain mapping P gain 4
HA*34	* gain mapping I gain 4

(o) Instantaneous power failure non-stop

Display condition: bA – 30 ≠ 00

Parameter	Name
bA-31	Instantaneous power failure non-stop Function triggering voltage
bA-32	Instantaneous power failure non-stop Target level
bA-34	Instantaneous power failure non-stop Deceleration time
bA-36	Instantaneous power failure non-stop Deceleration start range
bA-37	Instantaneous power failure non-stop Constant DC voltage control P gain
bA-38	Instantaneous power failure non-stop Constant DC voltage control I gain

(p) Overvoltage suppression

Display condition: bA*40 ≠ 00

Parameter	Name
bA*41	* overvoltage suppression level setting
bA*42	* overvoltage suppression operating time
bA*44	* constant DC voltage control P gain
bA*45	* constant DC current control I gain

(q) Overexcitation deceleration

Display condition: bA*46 ≠ 00

Parameter	Name
bA*47	* overexcitation output filter time constant
bA*48	* overexcitation voltage gain
bA*49	* overexcitation suppression level setting

(r) PID 1

Display condition: AH – 01 = 01, 02

Parameter	Name
db-30	PID1 feedback data 1 monitor
db-32	PID1 feedback data 2 monitor
db-34	PID1 feedback data 3 monitor
db-42	PID1 target value monitor (after calculation)
db-44	PID1 feedback data monitor (after calculation)
db-50	PID1 output monitor
db-51	PID1 deviation monitor
db-52	PID1 deviation 1 monitor
db-53	PID1 deviation 2 monitor
db-54	PID1 deviation 3 monitor
db-61	PID current P gain monitor
db-62	PID current I gain monitor
db-63	PID current D gain monitor
db-64	PID feed forward monitor
FA-30	PID1 target value 1 (monitor + setting)
FA-32	PID1 target value 2 (monitor + setting)
FA-34	PID1 target value 3 (monitor + setting)
AH-02	PID1 deviation minus
AH-03	PID1 unit selection (PID1)
AH-04	PID1 scale adjustment (0%)
AH-05	PID1 scale adjustment (100%)

Parameter	Name
AH-06	PID1 scale adjustment (decimal point)
AH-07	PID1 target value 1 Input destination selection
AH-10	PID1 target value 1 Set value
AH-12	PID1 multistage target value 1
AH-14	PID1 multistage target value 2
AH-16	PID1 multistage target value 3
AH-18	PID1 multistage target value 4
AH-20	PID1 multistage target value 5
AH-22	PID1 multistage target value 6
AH-24	PID1 multistage target value 7
AH-26	PID1 multistage target value 8
AH-28	PID1 multistage target value 9
AH-30	PID1 multistage target value 10
AH-32	PID1 multistage target value 11
AH-34	PID1 multistage target value 12
AH-36	PID1 multistage target value 13
AH-38	PID1 multistage target value 14
AH-40	PID1 multistage target value 15
AH-42	PID1 target value 2 Input destination selection
AH-44	PID1 target value 2 Set value
AH-46	PID1 target value 3 Input destination 2 selection
AH-48	PID1 target value 3 Set value
AH-50	PID1 target value 1 Operator selection
AH-51	PID1 feedback data 1 Input destination selection
AH-52	PID1 feedback data 2 Input destination selection
AH-53	PID1 feedback data 3 Input destination selection
AH-54	PID1 feedback data Operator selection
AH-60	PID1 gain switch method selection
AH-61	PID1 proportional gain 1
AH-62	PID1 integral gain 1
AH-63	PID1 differential gain 1
AH-64	PID1 proportional gain 2
AH-65	PID1 integral gain 2
AH-66	PID1 differential gain 2
AH-67	PID1 gain switch time
AH-70	PID feed forward selection
AH-71	PID1 changeable range
AH-72	PID2 excessive deviation level
AH-73	PID1 feedback comparison signal OFF level
AH-74	PID1 feedback comparison signal ON level

(s) PID 2

Display condition: AJ – 01 = 01, 02

Parameter	Name
db-36	PID2 feedback data monitor
db-55	PID2 output monitor
db-56	PID2 deviation monitor
FA-36	PID2 target value (monitor + setting)
AJ-02	PID2 deviation minus
AJ-03	PID2 unit selection (PID2)
AJ-04	PID2 scale adjustment (0%)
AJ-05	PID2 scale adjustment (100%)

Parameter	Name
AJ-06	PID2 scale adjustment (decimal point)
AJ-07	PID2 target value Input destination selection
AJ-10	PID2 target value Set value
AJ-12	PID2 feedback data Input destination selection
AJ-13	PID2 proportional gain
AJ-14	PID2 integral gain
AJ-15	PID2 differential gain
AJ-16	PID2 changeable range
AJ-17	PID2 excessive deviation level
AJ-18	PID2 feedback comparison signal OFF level
AJ-19	PID2 feedback comparison signal ON level

(t) PID 3

Diplay condition: AJ – 21 = 01, 02

Parameter	Name
db-38	PID3 feedback data monitor
db-57	PID3 output monitor
db-58	PID3 deviation monitor
FA-38	PID3 target value (monitor + setting)
AJ-22	PID3 deviation minus
AJ-23	PID3 unit selection (PID3)
AJ-24	PID3 scale adjustment (0%)
AJ-25	PID3 scale adjustment (100%)
AJ-26	PID3 scale adjustment (decimal point)
AJ-27	PID3 target value Input destination selection
AJ-30	PID3 target value setting
AJ-32	PID3 feedback data Input destination selection
AJ-33	PID3 proportional gain
AJ-34	PID3 integral gain
AJ-35	PID3 differential gain
AJ-36	PID3 changeable range
AJ-37	PID3 excessive deviation level
AJ-38	PID3 feedback comparison signal OFF level
AJ-39	PID3 feedback comparison signal ON level

(u) PID 4

Display condition: AJ – 41 = 01, 02

Parameter	Name
db-40	PID4 feedback data monitor
db-59	PID4 output monitor
db-60	PID4 deviation monitor
FA-40	PID4 target value (monitor + setting)
AJ-42	PID4 deviation minus
AJ-43	PID4 unit selection (PID4)
AJ-44	PID4 scale adjustment (0%)
AJ-45	PID4 scale adjustment (100%)
AJ-46	PID4 scale adjustment (decimal point)
AJ-47	PID4 target value Input destination selection
AJ-50	PID4 target value setting
AJ-52	PID4 feedback data Input destination selection
AJ-53	PID4 proportional gain

Parameter	Name
AJ-54	PID4 integral gain
AJ-55	PID4 differential gain
AJ-56	PID4 changeable range
AJ-57	PID4 excessive deviation level
AJ-58	PID4 feedback comparison signal OFF level
AJ-59	PID4 feedback comparison signal ON level

(v) PID in general

Display condition: AH – 01 = 01, 02 or AJ – 01 = 01, 02 or AJ – 21 = 01, 02 or AJ – 41 = 01, 02

Parameter	Name
AH-75	PID selection of soft-start function
AH-76	PID soft-start target level
AH-78	PID acceleration time for soft-start
AH-80	PID soft-start time
AH-81	PID start abnormal judgment implement selection
AH-82	PID start abnormal judgment level
AH-85	PID sleep condition selection
AH-86	PID sleep start level
AH-87	PID sleep operation time
AH-88	PID selection of boost before sleep
AH-89	PID boost time before sleep
AH-90	PID boost volume before sleep
AH-91	PID minimum operating time before sleep
AH-92	PID minimum retention time of sleep state
AH-93	PID wake condition selection
AH-94	PID wake start level
AH-95	PID wake operation time
AH-96	PID wake start deviation amount

(w) simulation mode

Display condition: PA – 20 = 01

Parameter	Name
PA-21	Selection of error code for alarm test
PA-22	Output current monitor optional output selection
PA-23	Output current monitor optional setting value
PA-24	P-N voltage monitor optional output selection
PA-25	P-N voltage monitor optional setting value
PA-26	Output voltage monitor optional output selection
PA-27	Output voltage monitor optional setting value
PA-28	Output torque monitor optional output selection
PA-29	Output torque monitor optional setting value
PA-30	Frequency adjustment optional output selection
PA-31	Frequency matching optional setting value

(x) DriveProgramming

Display condition: UE – 02 ≠ 00

Parameter	Name
db-01	Program download monitor
db-02	Program number monitor
db-03 to db-07	Program counter (Task1-5)
db-08 to db-16	User monitor 0-4
db-18 to db-23	Analog output monitor YA0-YA5
UE-01	DriveProgramming execution interval
UE-10 to UE-73	Driveprogramming user parameter U (00)-U(63)
UF-02 to UF-33	DriveProgramming user parameter UL(00)-U(15)

User Setting: [UA-10]=02

Parameters set to the user setting functions [UA-31] to [UA-62], main speed command [FA-01], output frequency monitor [dA-01], and display selection [UA-10] are displayed.

Data-comparison Display: [UA-10]=03

- Only parameters that have been changed from the factory default settings are displayed.
- All monitor displays [d****] and [F****], display selection [UA-10], and the password for display [UA-01] are always shown.

Precautions for Correct Use

- The initial value used for comparison is determined by the inverter model and the following settings.

  Initialize Data selection [Ub-02]

  Load type selection [Ub-03]
- If you changes the base frequency, the value of the motor constant IO is changed, so the data-comparison displays the changes in parameter.

Monitor Display: [UA-10]=04

All monitor displays [d****] and [F****] and display selection [UA-10] are shown.

3-8-3 Saving Automatically Changed Parameters

Changed parameters can be saved.

When selection of user parameter automatic setting [UA-30] is set to 01, parameters whose data has been changed are automatically saved in [UA-31] to [UA-62].

Also, when you desire to retrieve history of parameter changes, set selection of user parameter automatic setting [UA-30] to 01.

Up to 32 changed parameters can be saved.

- **Parameter**

Item	Parameter	Data	Description
User parameter automatic setting selection	[UA-30]	00	Disable
		01	When a parameter is changed, the parameter is automatically set to [UA-31] to [UA-62].
User parameter selection	[UA-31] to [UA-62]	no	No assignment
		*****	When this function is enabled, automatically recorded parameters are displayed. (all codes are subjected)

Precautions for Correct Use

- [UA-31] is the newest data, and [UA-62] is the oldest data.
- Only one value is saved for a parameter.
- If more than 32 parameters are changed, the oldest data of [UA-62] is deleted, and values are shifted by one parameter. Then, new data is saved in [UA-31].

3-8-4 Protecting Parameters by Password

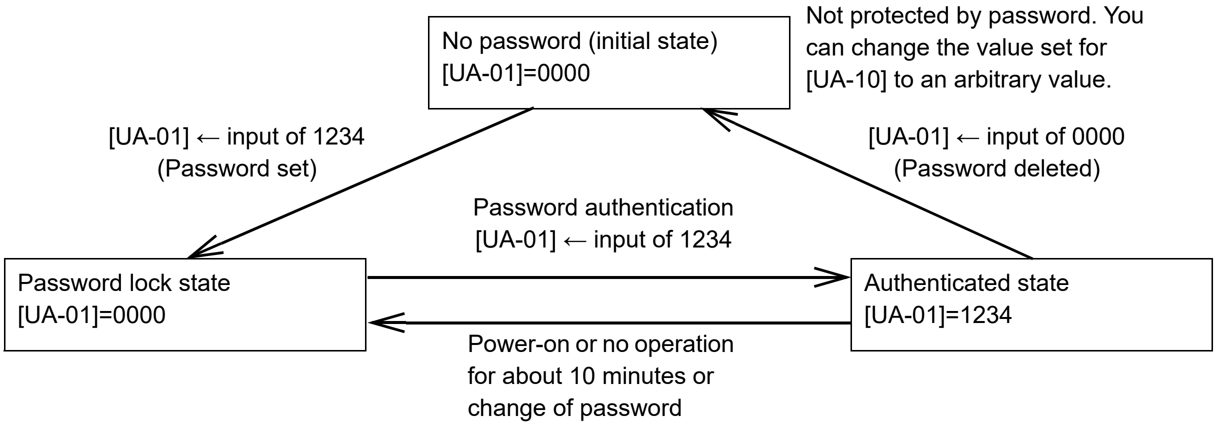
You can protect the parameters you changed by password.

By setting a password to the display selection function [UA-10] and soft-lock selection [UA-16], you can prevent parameters from being displayed or changed.

- **Parameter**

Item	Parameter	Data	Description
Password for display	[UA-01]	0000 to FFFF	Lock/unlock the display selection function [UA-10].
Soft-lock password	[UA-02]	0000 to FFFF	Lock/unlock the soft-lock selection [UA-16].
Display selection	[UA-10]	00	All parameters are displayed.
		01	Parameters are displayed by functions. Disabled functions are not displayed with some exceptions.
		02	Display is performed in accordance with the settings configured by the user. Parameters set to [UA-31] to [UA-62] are displayed with some exceptions.
		03	Parameters that have been changed from the factory default settings and some other parameters are displayed.
		04	Monitor parameters and some other parameters are displayed.
Soft-lock selection	[UA-16]	00	When the soft-lock terminal [SFT] is on, changes of data set to [UA-17] other than [UA-16] are locked.
		01	After the setting is performed, changes of data set to [UA-17] other than [UA-16] are locked.
Input terminal selection	[CA-01] to [CA-11]	036	[SFT]: Used when the soft-lock function is used on terminals.

Example of Password for Limiting Display

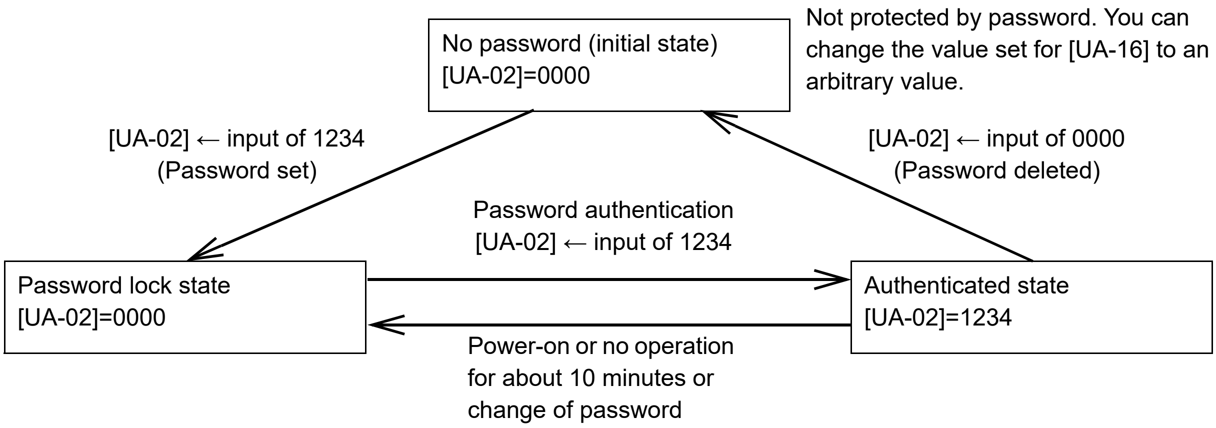


Protected by password. You cannot change the value set for [UA-10].

The LKP icon is displayed in the parameter section.

After password authentication, although the password setting information is not deleted, you can change the value set for [UA-10]. If power is turned on again or 10 minutes pass without any operation, the password is automatically locked again.

Example of a Soft-lock Password



Protected by password. You cannot change the value set for [UA-16]. The LKP icon is displayed in the parameter section.

After password authentication, although the password setting information is not deleted, you can change the value set for [UA-16]. If power is turned on again or 10 minutes pass without any operation, the password is automatically locked again.

Precautions for Correct Use

If you forget the set password, there is no way to unlock the password lock. Also, the password cannot be investigated by our plant or service station, therefore, care must be taken when setting a password.

3-9 Display Fixation Function

You can fix the display by DISP terminal.

When the [DISP] function of the input terminal function is on, display of the LCD operator is fixed on the monitor screen (the home screen selected in LCD operator).

When the [DISP] function of the input terminal function is on, keys other than the RUN key and STOP/RESET keys are disabled.

To disable the RUN key, set [AA111] to a value other than 02.

The following shows operations when the [DISP] terminal is on.

- When STOP key selection [AA-13] is 01, even if [AA111] is other than 02, you can stop the inverter or reset inverter trip by using the STOP/RESET key.
- When STOP key selection [AA-13] is 02, even if [AA111] is other than 02, you can reset inverter trip by using the STOP/RESET key.
- When STOP key selection [AA-13] is 00, if [AA111] is other than 02, the STOP/RESET key is also disabled, thus disabling all keys.

● Parameter

Item	Parameter	Data	Description
Selecting the input terminal	[CA-01] to [CA-11]	102	[DISP]: Used when the screen fixation function is used on terminals.
Operation command selection	[AA111]	00	[FW]/[RV] terminals
		01	3 wire
		02	RUN key on the LCD Operator
		03	RS485 setting
		04	Option 1
		05	Option 2
		06	Option 3
STOP key selection	[AA-13]	00	Disable
		01	Enable
		02	Enable only reset

3-10 Error Operation on the LCD Operator

3-10-1 Selection of Operation at Disconnection of LCD Operator

You can configure operation when the LCD operator is disconnected.

When about 5 seconds have passed after communication with the LCD operator is disconnected, it is determined that disconnection occurred.

For operation at disconnection, see the parameter table shown below.

● Parameter

Item	Parameter	Data	Description
Selection of operation at disconnection of LCD operator	[UA-20]	00	When disconnection occurs, the inverter trips due to [E040] LCD operator communication error.
		01	When disconnection occurs, the inverter trips due to [E040] LCD operator communication error after deceleration stop.
		02	Ignores detection of disconnection.
		03	Performs the free-run stop when disconnection occurs. No error occurs.
		04	Performs the deceleration stop when disconnection occurs. No error occurs.

3-10-2 Display of Battery Level Warning

You are informed with battery run-out, when the battery is run out. And then you can trip the inverter.

The LCD operator is monitored on a regular basis, and when it is determined the time setting of LCD operator returns to the initial state, it is determined to be error.

When [UA-19] is set to 01 and it is determined that abnormality occurs, the output terminal function 080[LBK] is turned on. When time is configured on LCD operator, [LBK] is turned off.

When [UA-19] is set to 02, when it is determined that abnormality occurs, an error is generated, and the inverter trips due to [E042] RTC error. The output terminal function 080 [LBK] is turned on at the same time the error occurs. When time on LCD Operator is configured, [LBK] is turned

● Parameter

Item	Parameter	Data	Description
Battery level warning selection	[UA-19]	00	Disable
		01	The output terminal function 080 [LBK] is turned on as a warning.
		02	Generates the [E042] RTC error and the inverter trips. Turns on the output terminal function 080 [LBK].

Precautions for Correct Use

- You can cancel trip of [E042] RTC error by performing the reset operation, however, if time is not configured, the error occurs again. In this case, the output terminal function 080 [LBK] is on.
- If [UA-19] is set to a value other than 00, insert the battery in the LCD operator, and set [UA-19] after configuring time.

3-11 Preventing Read and Write of Unnecessary Data

You can configure the prohibition of data reading and writing via LCD operator.

By setting [UA-18] Data R/W selection to 01, Read/Write access from LCD operator is disabled, and read and write of unnecessary data can be prevented.

After the parameter is confirmed, if it is set to 01 after data is read for backup, unnecessary read and write can be prevented.

● Parameter

Item	Parameter	Data	Description
Data R/W selection	[UA-18]	00	R/W enabled. Read and write are possible.
		01	R/W disabled. Read and write are prohibited.

3-12 Inverter Initialization

When the initialization target [Ub-01] is chosen and [Ub-05] Start Initialization is set to 01, the designated data can be initialized to the factory setting.

Only the trip history can be cleared without initialization of the stored parameter values.

Precautions for Correct Use

- Duty type selection (Ub-03) is not initialized.
- The initialization sets the parameters to initial values. If the data before the initialization are necessary, read the data using the R/W function (Read) on the operator keypad or use PC software to save the data on a PC.
- The parameter for initialization is not displayed, depending on the setting of Display Restriction Selection (UA-10). Set the initial values to 00 (Full display) to complete the initialization.
- The initialization cannot be achieved when a change of the parameter setting values is banned on the setting of Soft Lock Selection (UA-16). Be sure to perform the initialization after the banned change of the parameter setting values is reset.
- Take a caution that the initialization starts when you set data of Initialize Enable (Ub-05) to 01 (Start initialization) and press F2 key. The previous data cannot be returned.

● Parameter

Item	Parameter	Data	Description
Initialize Mode selection	[Ub-01]	00	The initialization is disabled.
		01	The trip history and retry history are cleared.
		02	All the parameters are all initialized.
		03	The trip history, retry history, and all parameters are initialized.
		04	The trip history, retry history, all parameters, and program data for DrivePrograming are initialized.
		05	Parameters other than those of I/O terminal function are initialized.
		06	Parameters other than the communication function parameters are initialized.
		07	Parameters other than those of I/O terminal function and communication function are initialized.
		08	Only the program data for DriveProgramming are initialized.
Initialize Data selection	[Ub-02]	01	Mode 1 (the factory setting)
Initialize Enable	[Ub-05]	00	Function disabled
		01	Initialization start

● [Ub-01] Parameters Chosen for Initialization

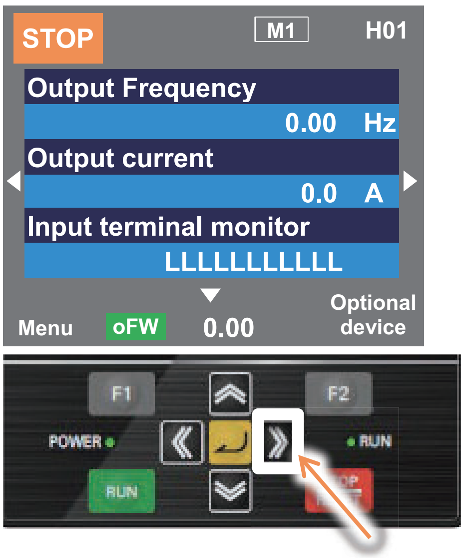
Initialization targets are indicated by ■.

[Ub-01]	(1) History data	(2) Setting of I/O terminal	(3) Communication function	(4) Other than parameters (2) and (3)	(5) DriveProgramming
00					
01	■				
02		■	■	■	
03	■	■	■	■	
04	■	■	■	■	■
05			■	■	
06		■		■	
07				■	
08					■

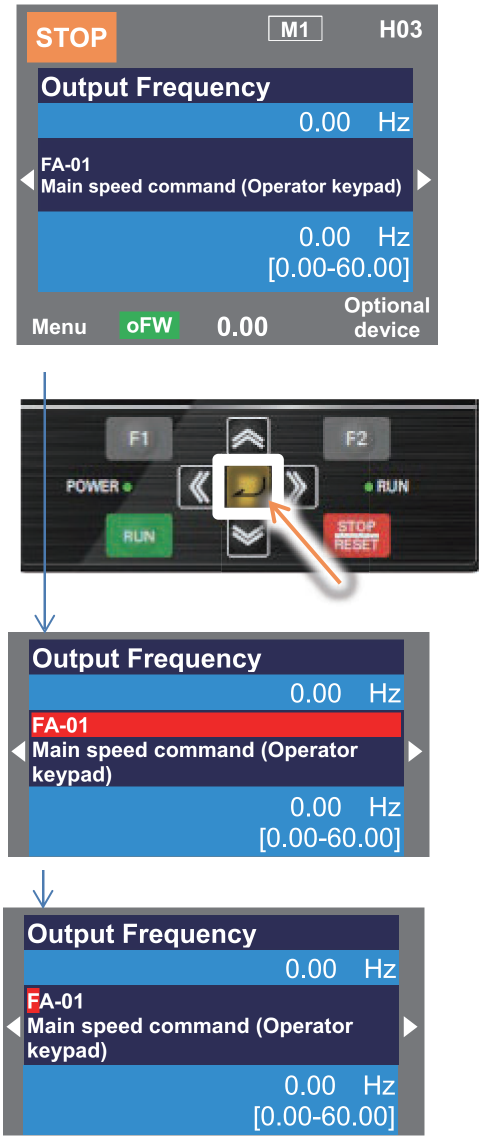
Item	Parameter range	Description
Input terminal setting	[CA-01] to [CA-11]	Input terminal selection
	[CA-21] to [CA-31]	a/b contact selection
	[CA-41] to [CA-51]	Input terminal response
	[Cb-40]	Thermistor selection
	[CC-01] to [CC-07]	Output terminal selection
	[CC-11] to [CC-17]	a/b contact selection
	[CC-20] to [CC-33]	Output delay
	[CC-40] to [CC-60]	Logical operation function
Communication functions	[CF-01] to [CF-10]	Setting of RS485 communication
	[CF-20] to [CF-38]	Setting of EzCOM communication

Example of initialization of the trip history, all the parameters, and the program data for DriveProgramming

1 Press right (▶) key on LCD operator.

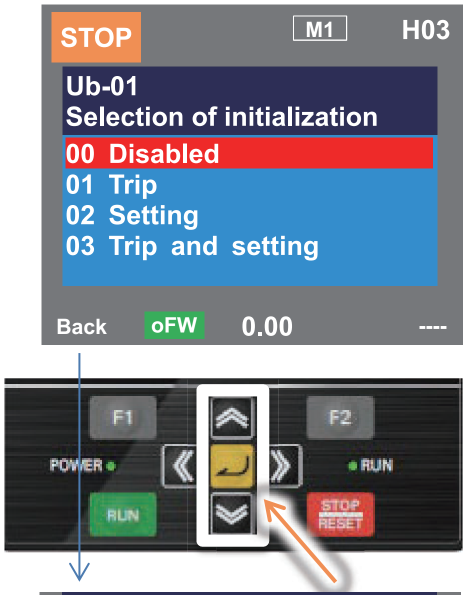


2 Press Enter key twice on the keypad and the parameter area begins blinking.



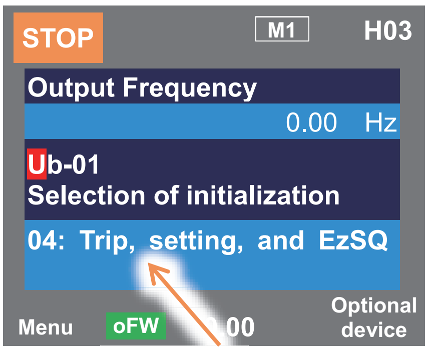
3 Use up, down, right, and left keys to choose a parameter and Enter key to set it.

4 Use up and down keys to choose a mode and Enter key to set it.

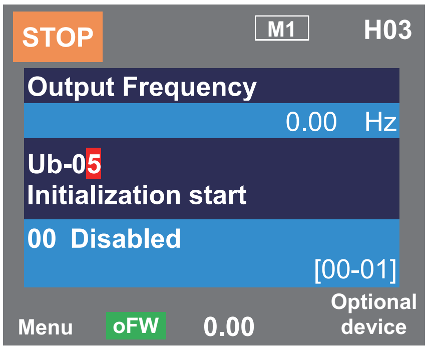


5 Check the content on the previous screen.

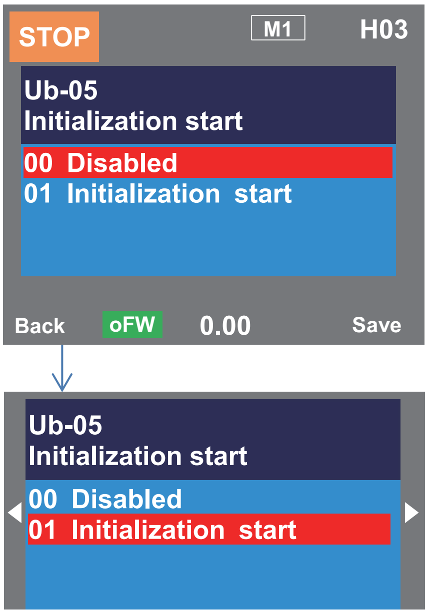
The initialization is not done yet.



6 Use up, down, right, and left keys to choose [Ub-05] and Enter key to set it.



7 Choose Enabled and press Enter key and initialization begins.



8 Initialization is on-going.

9 Initialization completed is displayed.

3-13 Connection and Functions of CX-Drive

The inverter/Servo support tool CX-Drive is support software to edit the inverter parameter settings.

Installing the OMRON CX-One software on your PC also installs the CX-Drive simultaneously.

The 3G3RX2 Series Inverter is supported in the following or higher versions of the CX-Drive product:

- CX-One: Ver. 4 or later
- CX-Drive: Ver. 3.0

This section describes how to connect the CX-Drive to an inverter and provides an overview of its functions.

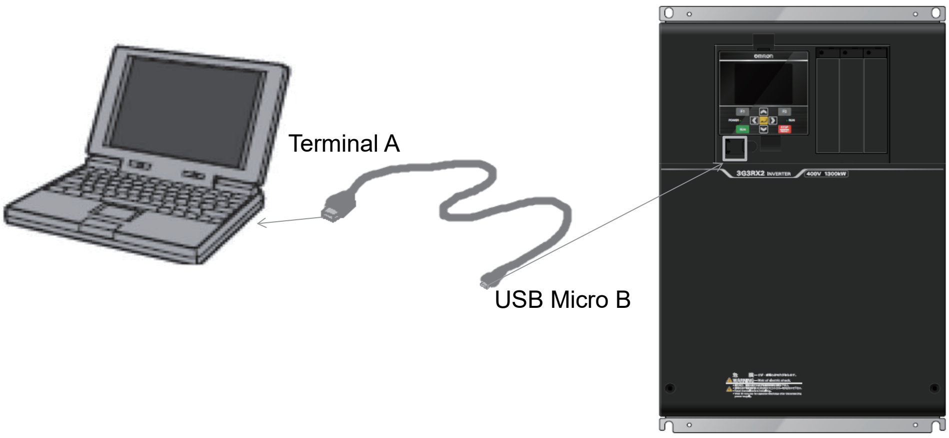
For details on the functions of the CX-Drive, refer to the *CX-Drive Operation Manual (Cat. No. W453-E1)*.

3-13-1 CX-Drive Connection Method

The following figure shows how to connect the 3G3RX2 Series with the inverter/Servo support tool CX-Drive.

Direct Connection via Serial Communications

Connect the CX-Drive directly to the serial communications port of the inverter.



CX-Drive Connection Procedures

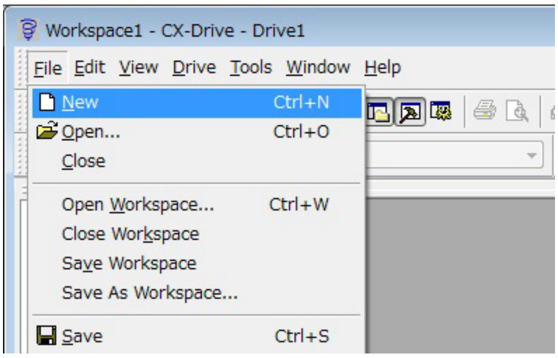
This section describes how to connect CX-Drive with an inverter.

● Connecting by Registering Inverter Connection Method Beforehand

Create a new inverter project, set the connecting method, and connect with the inverter.

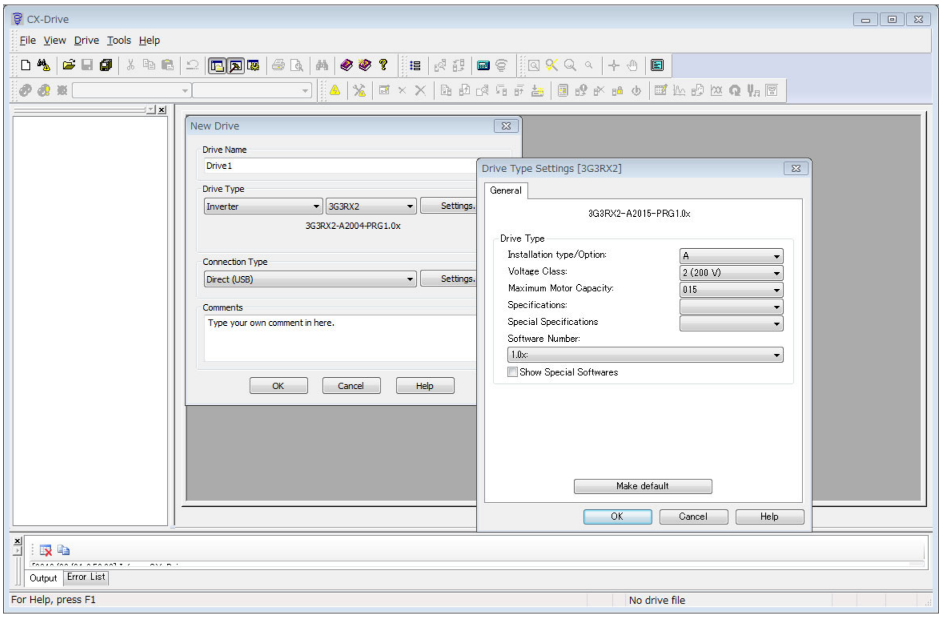
Follow the steps below.

1 Start the CX-Drive and, from the [File] menu, select [New].



2 In the [New Drive] window, set the drive type of the target inverter.

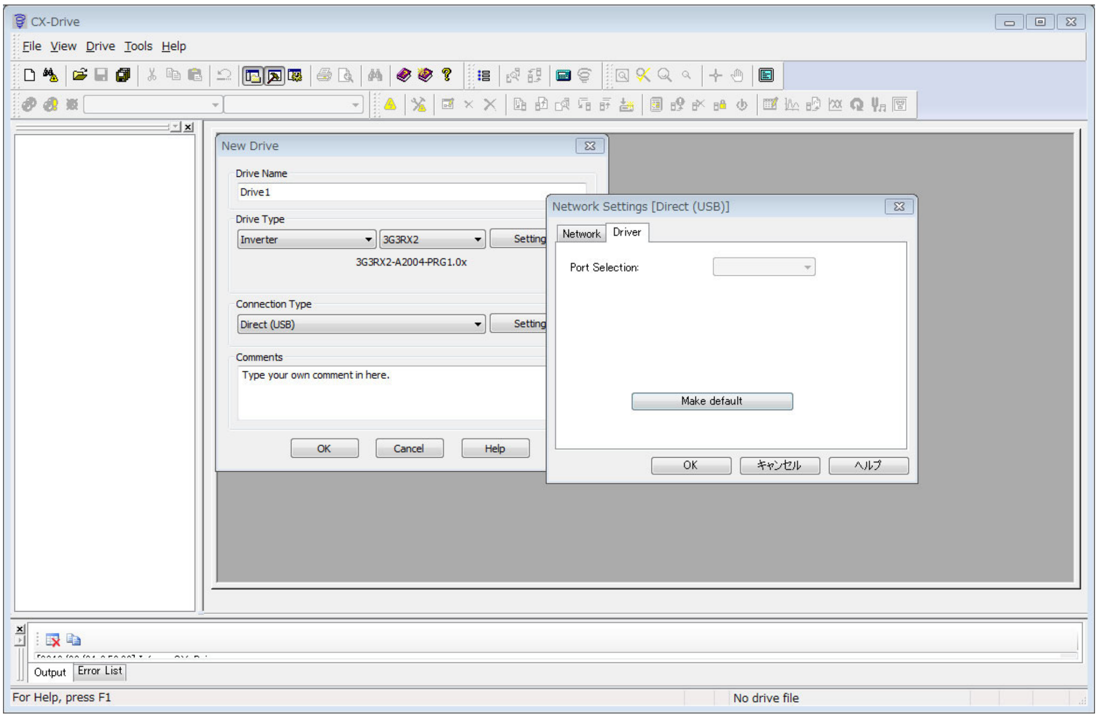
Select “3G3RX2” on [Drive Type]. After that, click the [Settings] button to the right. Set the Inverter Protective Structure, Voltage Class and Maximum Motor Capacity on the [Drive Type Settings] window. After these settings, click the [OK] button to close the [Drive Type Settings] window.



3 In the [New Drive] window, set the type of connection to the inverter.

Under [Connection Type], select [Direct] and click the [Settings] button to the right.

On the [Driver] tab, set the Port Selection to the port name of the computer on which the CX-Drive is installed.



4 After setting these items, click the [OK] button and close all windows.

The new project is registered in the workspace.

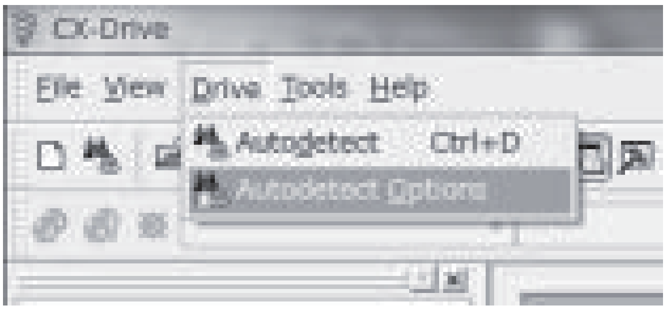
Click the [] (Work Online) icon to connect to the inverter.

● Automatically Detecting the Connected Inverter

Set the [Autodetect Options] in the CX-Drive and use the Autodetect function to automatically connect to the inverter.

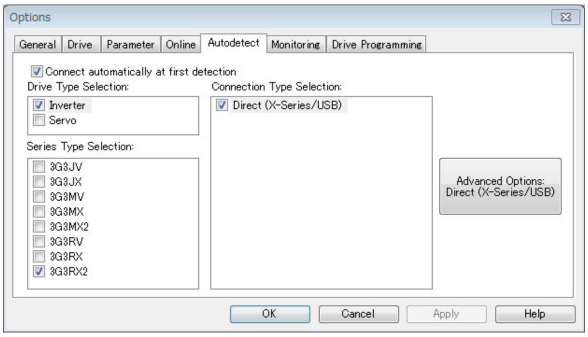
Follow the steps below.

1 Start the CX-Drive and, from the [Drive] menu, select [Autodetect Options] to open the Options window.



2 On the [Autodetect] tab, under [Drive Type Selection], check the [Inverter] box.

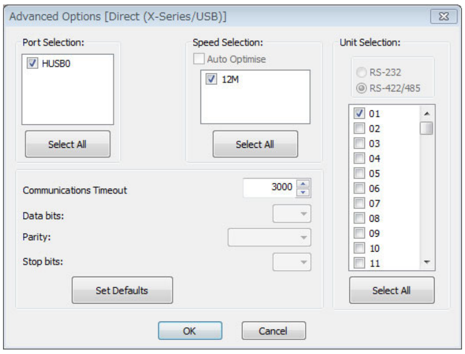
Then, under [Connection Type Selection], check the [Direct] box and click the [Advanced Options: Direct] button to the right.



Additional Information

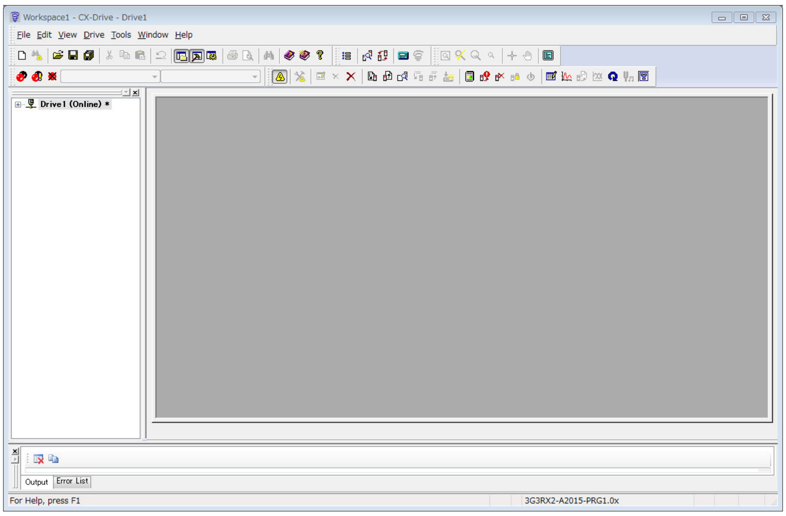
For the reduction of the automatic search time, deselect unnecessary check boxes to narrow down the scope of autodetection.

3 In the [Advanced Options [Direct (X-Series)]] window, set communications options.



4 After setting communications options, click the [OK] button and close all windows. Then, click [Autodetect].

The Autodetect function starts to create new drive projects automatically.



3-13-2 Outline of CX-Drive

The Inverter/Servo support tool CX-Drive enables you to edit inverter parameters and monitor the inverter status.

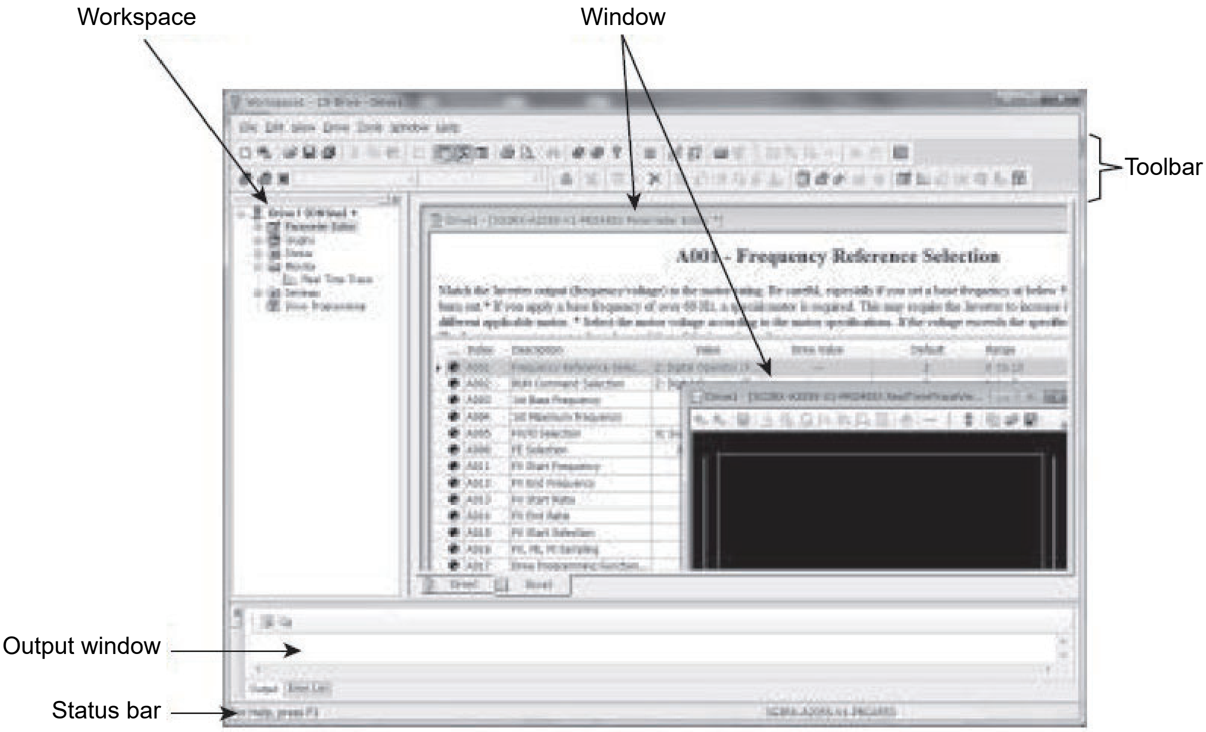
This section provides a functional outline of CX-Drive.

Screen Structure of CX-Drive

The screen structure of the CX-Drive is as shown below.

The workspace shows a list of registered drive projects. Double-clicking a project displays the functions contained in it.

Then, double-clicking each function opens a window corresponding to that function.



Precautions for Correct Use

CX-Drive, by default, does not allow connection to the inverter unless the software versions match.

- Software number of the inverter set in the CX-Drive project
- Software number of the inverter actually connected

If you cannot connect to the inverter due to a software number mismatch, select [Tools] - [Options] in the menu bar and, in the [Online] tab, deselect the [Check Drive Software Compatibility] check box. This allows CX-Drive to connect to the inverter operate normally, although a warning display appears.

To match the software numbers, right-click the project, select [Properties], and click the [Settings] button in the [Drive Type] section. In the Drive Type Settings window, set the Software Number that matches that of the inverter. If you cannot find the applicable software number in the CX-Drive's Software Number list, please upgrade the CX-Drive version.

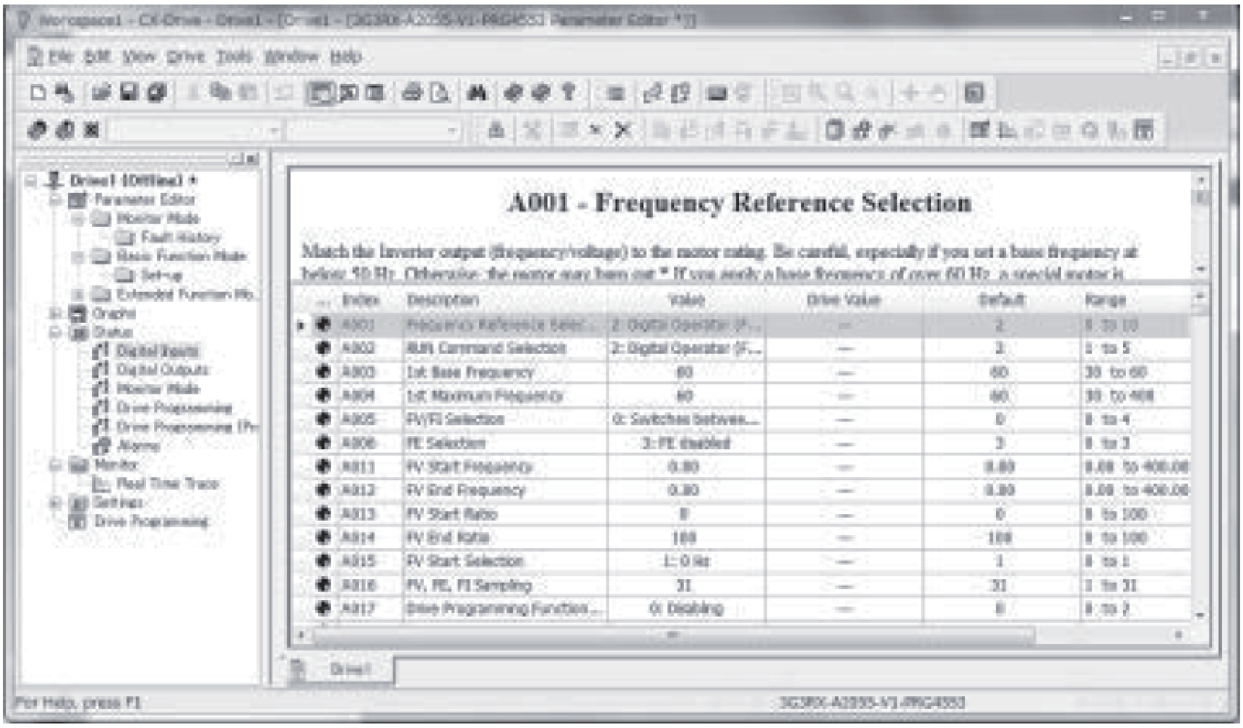
Editing Device Parameters Using CX-Drive

Double-clicking [Parameter Editor] in the project opens a window in which all inverter parameters are listed (in ascending order).

You can edit inverter parameters in this window.

To upload/download inverter parameters, use the [Transfer] buttons in the toolbar.

- Double-click one of the folders under Parameter Editor to narrow down the parameter list to only those parameters associated with it.
- Edit the value set for each parameter in the Value field of the parameter list.
- When a parameter is selected, the explanation of that parameter is displayed in the upper area.
- At the left end of the list, icons that represent the status of parameter data are displayed: Not default, Not default and different from the inverter, or Invalid. You can display only parameters with the same icon.
- You can select specific parameters and transfer data for only those selected parameters to the inverter.

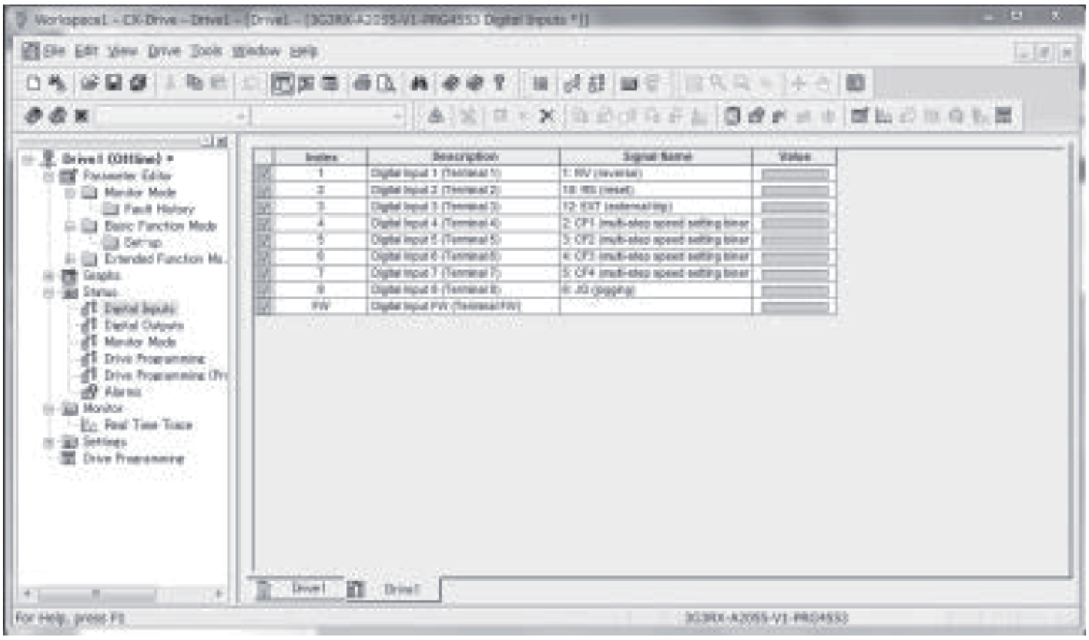


Status Function of CX-Drive

Open the Status folder in the project and double-click the status information.

The window corresponding to the selected status information opens.

Status icon category	Description
[Digital Inputs]	Displays the current ON/OFF status information, including the input function settings for the selected inverter.
[Digital Outputs]	Displays the current ON/OFF status information, including the output function settings for the selected inverter.
[Monitor Mode]	Displays the internal status values of the inverter. These status values are similar to those displayed in the monitor mode (dxxx) of the inverter.
[Alarms]	Displays an alarm history of the current and past alarms.

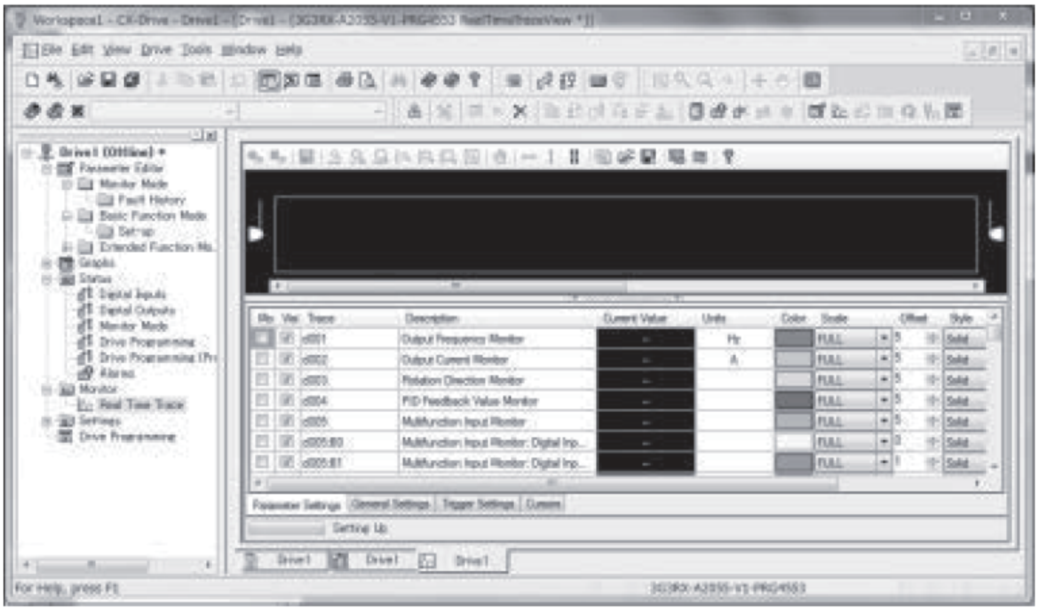


Monitor Function of CX-Drive

Open the Monitor folder in the project and double-click Real Time Trace.

The Real Time Trance window opens, in which you can monitor the operation status of the inverter.

- Up to 8 signals can be traced.
- Triggers can be set to the ON/OFF timing of the inverter's internal status, or numerically.



4

Test Run

This chapter provides an operational flow to do a test run.

4-1 Test Run Method

To perform a test run, follow the procedures shown below.

Carefully read and understand *Safety Precautions* on page 8 and the relevant instructions in the following chart before starting works.

Operation with the host device can be checked before connecting a load and motor.

● Procedure

Procedure ▶	Check Items ▶	For more details,
1. Safety check	See the precautions required for handling the inverter.	See *Safety Precautions* on page 8.
2. Checking the inverter	Confirm that there is no abnormality in items included in the package of inverter and the appearance of the inverter.	See *Checking the Accessories* on page 19.
3. Installation of the inverter	Confirm that the inverter is installed in a proper environment and in a proper setting.	See *1-3-4 External Dimensions* on page 1-13.
4. Wiring requirements	Confirm that wires are properly connected to the inverter.	See *2-3 Wiring* on page 2-20.
5. Setting up the operation method	Check how to operate the LCD operator.	See *Section 3 Operation*.
6. Setting up the running method	Set up the inverter running method.	See *6-3 Operation Command Settings* on page 6-19.
7. Selecting a control mode and protective function according to a load	Set up the inverter control method.	See *7-1 Overview of Motor Control Methods* on page 7-3 for descriptions of required items. The items required for running the inverter are provided in the following article.
Completed		

4-2 Settings and Commands Required for Running the Inverter

To turn the motor, configure the following settings.

Precautions for Correct Use

This article explains the settings for operation. Carefully read Safety Instructions before handling the inverter.

1 Basic setting for motor

Set the following parameters in accordance with the plate of motor. Set the data indicating the basic characteristics of motor.

Item	Parameter	
	IM	SM(PMM)
Async.Motor capacity setting, 1st-motor	[Hb102]	[Hd102]
Async.Motor poles setting, 1st-motor	[Hb103]	[Hd103]
Async.Motor Base frequency setting, 1st-motor	[Hb104]	[Hd104]
Async.Motor Maximum frequency setting, 1st-motor	[Hb105]	[Hd105]
Async.Motor rated voltage, 1st-motor	[Hb106]	[Hd106]
Async.Motor rated current, 1st-motor	[Hb108]	[Hd108]

Note See *6-2-1 Motor Basic Settings* on page 6-8 for details.

2 Setting for protection of motor

The motor may be burned if a large current keeps on flowing in the motor; the setting therefore must be performed appropriately.

Item	Parameter
Electronic thermal level setting, 1st-motor	[bC110]
Electronic thermal characteristic selection, 1st-motor	[bC111]

Note See *6-6 Thermal Protection of Motor (Electronic Thermal)* on page 6-48 for details.

3 Setting for activating the motor

The voltage output of the inverter requires not only an operation command but also a frequency command. In the initial state, a main speed command is used as a frequency command.

Item	Parameter
Main speed input source selection, 1st-motor	[AA101]
Run-command input source selection, 1st-motor	[AA111]
Main Speed reference monitor	[FA-01]

Note For details, see *6-3 Operation Command Settings* on page 6-19 and *6-4 Frequency Command Settings* on page 6-25.

4 Settings for motor control

- Set the motor control method.
- For changing to the mode of driving an SM (PMM), you need to change the control method.

Item	Parameter
Control mode selection, 1st-motor	[AA121]

Note For details, see *7-1 Overview of Motor Control Methods* on page 7-3.

- When driving an SM (PMM) or using vector control, you need to set up the following motor constants:

- For induction motor IM

Item	Parameter
Async.Motor constant R1, 1st-motor	[Hb110]
Async.Motor constant R2, 1st-motor	[Hb112]
Async.Motor constant L, 1st-motor	[Hb114]
Async.Motor constant Io, 1st-motor	[Hb116]
Async.Motor constant J, 1st-motor	[Hb118]

- For synchronous motor (permanent magnetic motor) (SM (PMM))

Item	Parameter
Sync.Motor constant R, 1st-motor	[Hd110]
Sync.Motor constant Ld, 1st-motor	[Hd112]
Sync.Motor constant Lq, 1st-motor	[Hd114]
Sync.Motor constant Ke, 1st-motor	[Hd116]
Sync.Motor constant J, 1st-motor	[Hd118]

4-3 Operation only with LCD Operator

This section describes how to conduct a test run with LCD operator.

To perform a test run only with the LCD operator, check the following parameters, or set the following parameters from the initial value.

(a) Frequency command source selection [AA101]

(b) Main speed command [FA-01]

(c) Operation command source selection [AA111]

(d) Setting the electronic thermal level of motor [bC110]

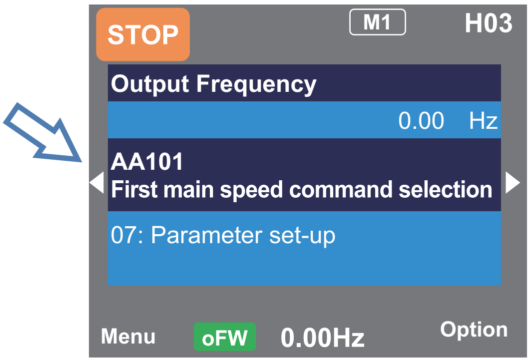
A test run can be performed with the LCD operator.

● Procedure

- From the initial screen displayed at power-on, move to “H03” with the LEFT/RIGHT ( ) keys.
- For procedure of changing parameters, see *3-2-1 Scroll Mode* on page 3-14.

1 Frequency command source selection [AA101]

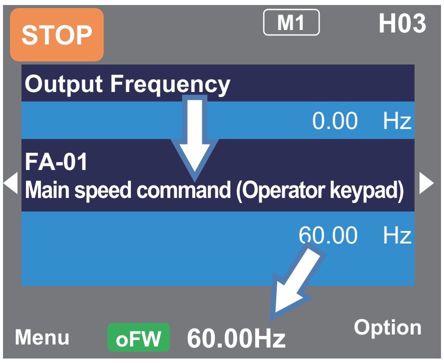
Set the frequency command destination to “07: Parameter set-up”.



2 Main speed command [FA-01]

When the frequency command source is set to “07: Parameter set-up”, “Main speed command (Operator keypad)” will be shown.

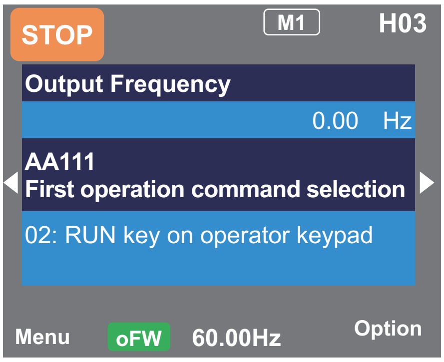
If a frequency command is set in this state, the value will be shown at the bottom command monitor area.



3 Operation command source selection [AA111]

When the operation command source is set to “02: LCD operator”, “oFW” will be shown on the LCD operator at the bottom in the area for displaying function of RUN key.

Note When the operation command source is set to reverse, "oRN" is displayed.



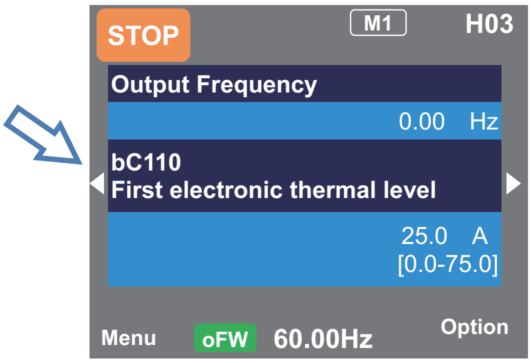
4 Setting the electronic thermal level of motor [bC110]

Set the level so that it does not exceed the rated current of motor.

Precautions for Correct Use

Note that the motor may be burned if the electronic thermal level is not appropriately set.

Note The electronic thermal for protecting the inverter works automatically.



4-4 Conduct a Test Run with Analog Input

This section describes how to conduct a test run, using variable resistance knobs into terminal block [FW] input and analog input H, Ai1 and L.

To perform a test run using analog input Ai1, set the following parameters from the initial value, or check the following parameters.

(a) Frequency command source selection [AA101]

(b) Main speed command [FA-01]

(c) Operation command source selection [AA111]

(d) Setting the electronic thermal level of motor [bC110]

A test run can be performed using a variable resistor.

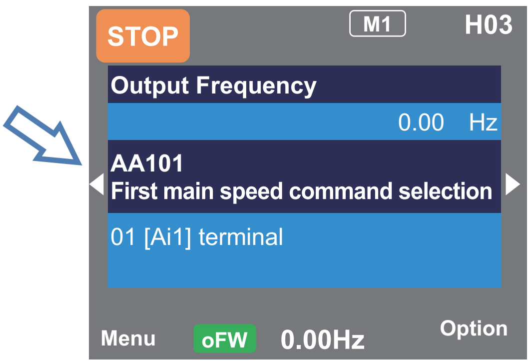
A test run can be performed with 10 V voltage input.

● Procedure

- From the initial screen displayed at power-on, move to “H03” with the LEFT/RIGHT arrow ( ) keys.
- For procedure of changing parameters, see *3-2-1 Scroll Mode* on page 3-14.

1 Frequency command source selection [AA101]

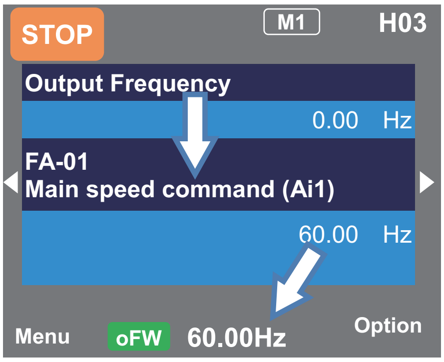
Set the frequency command source to “01:Ai1 input”.



2 Checking the main speed command [FA-01]

When the operation command source is set to “01:Ai1 input”, “Main speed command (Ai1)” will be shown.

If a frequency command is set in this state, the value will be shown at the bottom command monitor area.



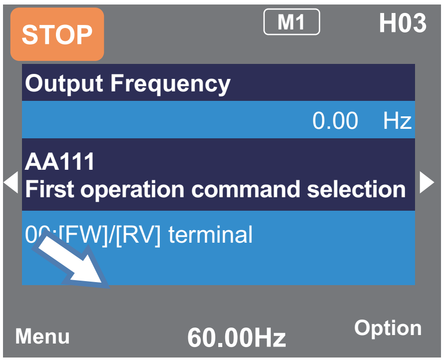
Precautions for Correct Use

- To connect a cable between Ai1 and L, or between Ai2 and L, make sure to check that a desired input (voltage or current) is provided to the corresponding positions of DIP switch SW1 and SW2.
- A damage may be caused by inputting a wrong voltage or current due to wrong selection of switches, input beyond the specified range (P24 terminal of 24 V is used instead of H terminal of 10 V), and wrong wiring (voltage/current being input reversely due to wrong wire connection or a cable between H and L is short-circuited at 0 Ω during wiring of a tab and so on).

3 Operation command source selection [AA111]

When the operation command source is set to “00:[FW]/[RV] terminal”, the display will disappear from the area for displaying function of RUN key on LCD operator at the bottom.

Note Normal/reverse rotation can be set at [FW]/[RV] terminal.



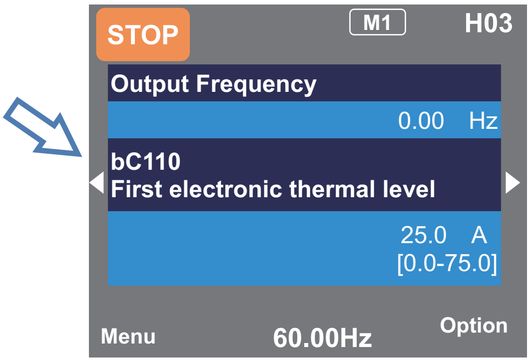
4 Setting the electronic thermal level of motor [bC110]

Set the level so that it does not exceed the rated current of motor.

Precautions for Correct Use

Note that the motor may be burned if the electronic thermal level is not appropriately set.

Note The electronic thermal for protecting the inverter works automatically.



Precautions for Correct Use

- Check the setting of the motor capacity, the number of motor poles, frequency, voltage, and current in order to conduct motor control.
- IM: Induction motor

General motor items	Code	Setting range (unit)
Capacity	[Hb102]	0.01 to 160.00 (kW)
Number of motor poles	[Hb103]	2 to 48 (poles)
Frequency	[Hb104]	10.00 to 590.00 (Hz)
	[Hb105]	10.00 to 590.00 (Hz)
Voltage	[Hb106]	1 to 1000 (V)
Current	[Hb108]	0.01 to 10000.00 (A)

- SM (PMM): Synchronous (permanent magnet) motor

General motor items	Code	Setting range (unit)
Capacity	[Hd102]	0.01 to 160.00 (kW)
Number of motor poles	[Hd103]	2 to 48 (poles)
Frequency	[Hd104]	10.00 to 590.00 (Hz)
	[Hd105]	10.00 to 590.00 (Hz)
Voltage	[Hd106]	1 to 1000 (V)
Current	[Hd108]	0.01 to 10000.00 (A)

- See *6-2 Parameter Setting for Motor Related* on page 6-8 for details.
- In the initial state, the motor is in the V/f control mode, in which voltage is output proportional to the frequency for induction motor control.
  For control modes, see *7-1 Overview of Motor Control Methods* on page 7-3.

4-5 Simulation Mode

If the simulation mode [PA-20] is set to 01 and the power is turned on again, the inverter enters the simulation mode and does not output to the motor.

To cancel the simulation mode, set [PA-20] to 00 and then turn on the power again.

Because the inverter behaves just like a normal operation except that it cannot output to the motor, you can check terminals and communication operations.

It will be possible to change the internal data on a real-time basis by assigning a parameter or analog input to the internal data.

Operation checks can be performed in the condition that the control power supply is input or 24-V power supply is used.

If the error code selection [PA-21] is set during the simulation mode, a trip is issued as soon as the setting is made. To cancel a trip, reset the inverter (turn ON the [RS] terminal or press RESET key) as usual. When the inverter is reset, [PA-21] is automatically set to 00.

Terminal checks can be performed without inverter output.

Precautions for Correct Use

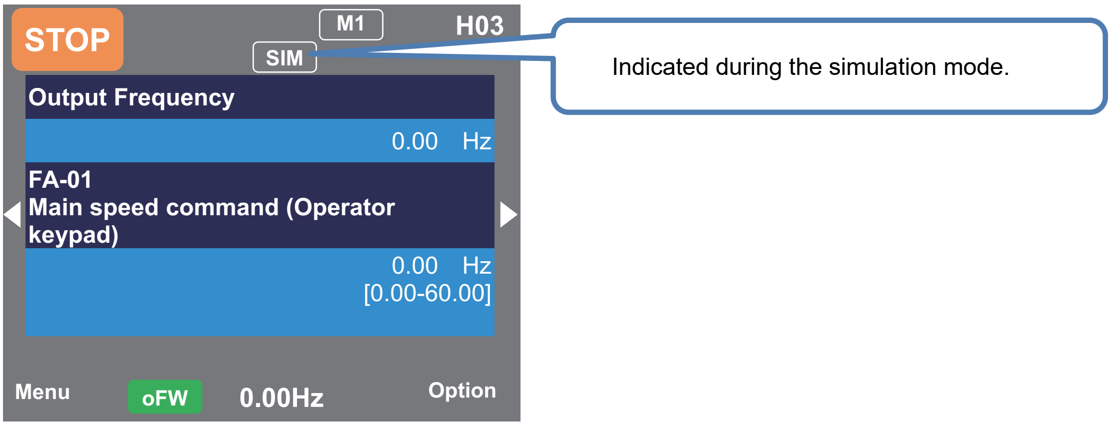
- The motor cannot be driven in the simulation mode.
- To check the actual motor behavior, set the simulation mode [PA-20] to “00: Disable” and then turn on the power again.
- To activate the simulation mode, activate it in the condition that 24-V power supply is input for 24-V power supply; that control power supply is input for control power supply terminals (R0, T0) inputs; and that R, S, and T terminals are input for main power supply inputs R, S, and T. Then turn off the power to end the simulation mode.
- Because the simulation mode is for simulating terminals’ behaviors, the function activated by a motor control operation does not work.
- In the simulation mode, if an error not listed in the selection of error code for alarm test [PA-21] is entered, the error will not be generated.
- In the simulation mode, if a serious fault error is entered to the selection of error code for alarm test [PA-21], the power needs to be turned on again.
  (Serious fault errors: E008, E010, E011, E014, E019, E020)

● [Procedure] Entering the simulation mode

1. Set the simulation mode [PA-20] to 01.
2. Turn off the power, and then turn it on again.
3. The simulation mode becomes active.

● [Procedure] Canceling the simulation mode

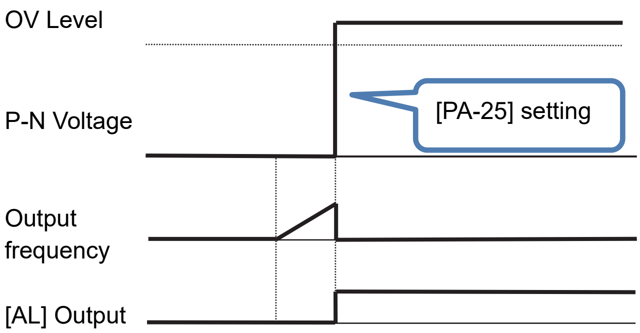
1. Set the simulation mode [PA-20] to 00.
2. Turn off the power, and then turn it on again.
3. The simulation mode is canceled.



(Example: usage 1)

[AL] Checking the behavior while the alarm [AL] is on.

- The operation was started.
- DC-bus voltage monitor optional output enable [PA-24] was set to 01, and DC-bus voltage monitor optional value output [PA-25] was set to the maximum value.

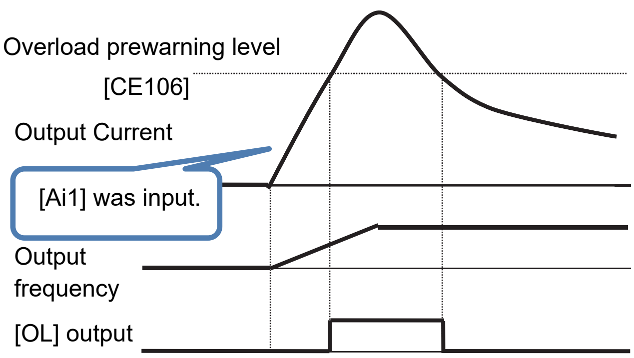


- An overvoltage error [E007] occurred and [AL] was ON.

(Example: usage 2)

Checking the signal output of overload prewarning level [OL].

- The over current detection level 1, 1st motor [CE106] was set, and the operation was started.
- Output current monitor optional output selection [PA-22] was set to 02, and [Ai1] was increased and decreased.



- [OL] was turned ON because the output current exceeded the over current detection level 1, 1st motor [CE106].

● Parameter

Item	Parameter	Data	Description
Simulation mode enable	[PA-20]	00	Disable
		01	Enable
Error code selection for Alarm test	[PA-21]	000 to 255	Issues a set error. Errors not listed in the selection do not occur.
Output current monitor optional output enable DC-bus voltage monitor optional output enable Output voltage monitor optional output enable Output torque monitor optional output enable Start with frequency matching optional Setting enable	[PA-22] [PA-24] [PA-26] [PA-28] [PA-30]	00	Disable
		01	Enable (Parameter setting)
		02	Enable (Setting by [Ai1])
		03	Enable (Setting by [Ai2])
		04	Enable (Setting by [Ai3])
		05	(Reserved)
		06	(Reserved)
		07	(Reserved)
Output current monitor optional output value setting	[PA-23]	0.0 to 3.0 × Inverter rated current (A)*1	Treats the set values as internal output values.
DC-bus voltage monitor optional value output	[PA-25]	200V class: 0.0 to 450.0 (Vdc) 400V class: 0.0 to 900.0 (Vdc)	Treats the set values as internal output values.
Output voltage monitor optional output value setting	[PA-27]	200V class: 0.0-300.0(V) 400V class: 0.0-600.0(V)	Treats the set values as internal output values.
Output torque monitor optional output value setting	[PA-29]	-500.0 to 500.0(%)	Treats the set values as internal output values.
Start with frequency matching optional value setting	[PA-31]	0.00 to 590.00(Hz)	Treats the set values as internal output values.

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].

When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V

When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

5

Monitor

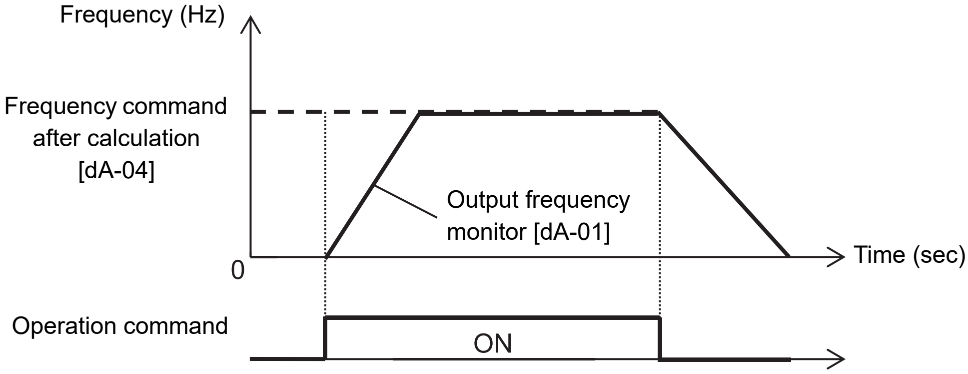
This section describes monitor functions installed with an inverter.

5-1 Frequency Monitor

5-1-1 Output Frequency Monitor

Displays the output frequency of an inverter.

Output frequency monitor adjusts frequency command according to the setting of the acceleration/deceleration time after the inverter starts operation.



● Parameter

Item	Parameter	Data	Description
Output frequency monitor	[dA-01]	0.00 to 590.00 (Hz)	Displays output frequency.
Output frequency monitor (with sign)	[dA-12]	-590.00 to 590.00 (Hz)	Displays output frequency with sign. A forward revolution is indicated with + sign, and a reverse revolution with -.

5-1-2 Frequency Command Monitor

Frequency command after calculation [dA-04] monitors the state of command which is input ultimately at the moment.

As for the Main Speed reference monitor [FA-01], frequency command setting value can be changed by using UP/DOWN keys on the monitor, if the Main speed input source selection, 1st-motor [AA101] is set to 07 (Parameter setting).

As for the Sub Speed reference monitor [FA-02], frequency command setting value can be changed by using UP/DOWN keys on the monitor, if the Sub frequency input source selection, 1st-motor [AA102] is set to 07 (Parameter setting).

Precautions for Correct Use

- If the frequency command monitor does not change when frequency command is changed, a command destination not intended by the frequency command may have taken a priority.
- The frequency command is influenced by the following functions:
  - Main speed input source selection, 1st-motor [AA101]
  - Sub frequency input source selection, 1st-motor [AA102]
  - Jogging command [JG]
  - Multi-speed command [CF/SF]
  - Operation switching [SCHG]
  - Calculation symbol selection for Speed reference, 1st-motor [AA105]
  - Forced operation [F-OP]
  - Addition [ADD]
- See *6-4 Frequency Command Settings* on page 6-25 for details.

● Parameter

Item	Parameter	Data	Description
Frequency command	[dA-04]	-590.00 to 590.00 (Hz)	Displays frequency command. Displays a result of function such as jogging, multi speed, and forced operation [F-OP].
Main Speed reference monitor	[FA-01]	0.00 to 590.00 (Hz)	Displays the command frequency selected for the main speed input source selection, 1st-motor [AA101].
Sub Speed reference monitor	[FA-02]	Monitor: 0.00 to 590.00 (Hz) Setting: -590.00 to 590.00 (Hz)	Displays the command frequency selected for the Sub frequency input source selection, 1st-motor [AA102].

5-1-3 Frequency Conversion Monitor

The frequency conversion monitor displays the value obtained by multiplying the frequency command (Hz) by coefficient which is set in the Frequency conversion gain [Ab-01]. Use this method when you want to change the displayed value of data such as motor rotation speed, etc.

Example of conversion of displayed frequency

"Output frequency conversion monitor [dA-06]" = "Frequency command (Hz)" x "Frequency conversion gain [Ab-01]"

(Example) Displaying the motor rotation speed

The relationship of rotation speed and frequency is as shown below:

Rotation speed N (min^{-1}) = (120 x f (Hz))/P (poles)

When the motor frequency is 60Hz and the number of poles is 4, the coefficient is 30; hence at 60Hz, where [Ab-01]=30.00, "60×30.0=1800 (min^{-1})" will be displayed on the monitor.

Table of sample conversions

Motor frequency (Hz)	Number of motor poles (P)	Coefficient [Ab-01]	Synchronous rotation [min-1]
50	2	60	3000
50	4	30	1500
50	6	15	750
50	8	7.5	375
60	2	60	3600
60	4	30	1800
60	6	15	900
60	8	7.5	450

Precautions for Correct Use

In this monitor, gain is applied to the output frequency monitor [dA-01].

● Parameter

Item	Parameter	Data	Description
Output frequency conversion monitor	[dA-06]	0.00 to 59000.00 (Hz)	Converted output frequency is displayed.
Frequency conversion gain	[Ab-01]	0.01 to 100.00	Set the gain of frequency conversion monitor.

5-1-4 Speed Detection Value Monitor

If the motor is controlled with the PG Option Unit, the feed back rotation speed data can be shown as frequency.

Precautions for Correct Use

- Frequency will not be displayed if the feedback function is not used.
- Frequency will not be correctly displayed if the number of pulses of encoder and the number of motor poles are not set accurately.

● Parameter

Item	Parameter	Data	Description
Speed detection value monitor	[dA-08]	-590.00 to 590.00 (Hz)	Displays the feed back speed detection value.
Encoder constant setting	[CA-81]	32 to 65535 (pls)	Enabled when the “pulse train input (inverter) detection target [CA-90]” is set to 02.
Pulse train detection object selection	[CA-90]	00	Disabled
		01	Pulse train input frequency command is enabled.
		02	Speed feedback
		03	Pulse count
Encoder constant setting	[ob-01]	32 to 65535 (pls)	Set the number of pulses of encoder which is input from PG Option Unit. It is enabled when [CA-90] is set to except for 02.
Async.Motor poles setting, 1st-motor	[Hb103]	2 to 48 (poles)	Set the number of motor poles.

5-2 Acceleration/Deceleration Time Monitor

The time of acceleration or deceleration currently underway can be shown, when, with 2-step acceleration/deceleration function or multi-speed function, the acceleration or deceleration time is switched or when you are using the inverter while changing the acceleration/deceleration time setting.

The time that it takes to rise from 0 Hz to the maximum frequency will be displayed as the acceleration time.

The time that it takes to fall from the maximum frequency to 0 Hz will be displayed as the deceleration time.

Precautions for Correct Use

- The acceleration time and deceleration time monitors are affected by the following functions:
  - Acceleration/deceleration function
  - 2-step acceleration/deceleration function
  - Multi-speed function
  - PID soft-start function
  - Acceleration/deceleration cancellation [LAC] function
  - Second setting [SET] function
- The acceleration time and deceleration time monitors are enabled only under the frequency control. A correct value may not be displayed when the acceleration or deceleration time fluctuates depending on the torque under the torque control.
- When the frequency is accelerated or decelerated after the acceleration or deceleration pattern is changed, the time to change between 0 Hz and maximum value will be displayed.

● Parameter

Item	Parameter	Data	Description
Acceleration time monitor	[FA-10]	0.00 to 3600.00 (s)	Displays the enabled acceleration time.
Deceleration time monitor	[FA-12]	0.00 to 3600.00 (s)	Displays the enabled deceleration time.

5-3 Operation Direction Monitor

The operation direction monitor displays conditions of the operation commands and the rotation direction.

The rotation direction is determined by methods of operation command and signs of frequency command.

Precautions for Correct Use

- In the zero-speed output mode, it is likely that the converter is outputting under 0Hz command due to the direct current function, forcing function, or 0Hz range sensorless vector control, etc.
- The inverter is stopped when an output is not made.

● Parameter

Item	Parameter	Data	Description
Operation direction monitor	[dA-03]	00: o (Stopped)	Inverter is stopped.
		01: d (0Hz output)	Inverter is outputting 0 Hz.
		02: F (Normal rotation in process)	Inverter is running under forward rotation command.
		03: r (Reverse rotation in process)	Inverter is running under reverse rotation command.

5-4 I/O Terminal Monitor

5-4-1 Input Terminal Monitor

The input terminal monitor displays the physical ON (H)/OFF (L) status of terminals.

The input terminal monitor shows the slow reaction according to the input terminal response time.

The input terminal monitor is not affected by setting of a/b contact.

(Example) The state where terminals 4 and 8 are ON.

Monitor	L L L H L L L H L L L
Terminal No.	(B)(A)(9)(8)(7)(6)(5)(4)(3)(2)(1)

Precautions for Correct Use

- If the monitor status doesn't change when a terminal is turned ON and OFF, the input wires may be disconnected.
- When the [RS] terminal is turned ON, the inverter enters a reset mode; hence the state of input terminal cannot be checked on the input terminal monitor. However, from the fact the inverter enters the reset mode, you know that the terminal is working.

● Parameter

Item	Parameter	Data	Description
Input terminal monitor	[dA-51]	LLLLLLLLLLL to HHHHHHHHHHH	Displays the ON/OFF status of input terminals (H: ON; L: OFF).

5-4-2 Output Terminal Monitor

The output terminal monitor displays the state of internal functions.

The output terminal monitor behaves as set for on-delay/off-delay of output terminals.

(Example) The state where terminals 15 and AL are ON.

Monitor	H L H L L L L
Terminal No.	(AL) (16) (15) (14) (13) (12) (11)

Precautions for Correct Use

- If the output terminal status doesn't change when the monitor status changes, the output wires may be disconnected.
- The output terminal monitor is not affected by setting of a/b contact.

● Parameter

Item	Parameter	Data	Description
Output terminal monitor	[dA-54]	LLLLLLL to HHHHHHH	Displays the ON/OFF status of output terminals (H: ON; L: OFF).

5-4-3 Output Current Monitor

Displays the output current flowing in the motor.

Precautions for Correct Use

The lower the carrier frequency, the more the value of current of monitor may fluctuate, depending on the PWM output system of the inverter.

● Parameter

Item	Parameter	Data	Description
Output current monitor	[dA-02]	0.00 to 655.35 (A)	Displays the effective value of output current flowing in the motor.

5-4-4 Output Voltage Monitor

Displays the output voltage which is output to the motor.

Precautions for Correct Use

A correct value may not be displayed when the input voltage is low.

● Parameter

Item	Parameter	Data	Description
Output voltage monitor	[dA-18]	0.0 to 800.0 (V)	Displays the voltage which is output to the motor.

5-5 P-N Voltage Monitor

Displays P-N voltage charged in the main circuit capacitor of an inverter.

Precautions for Correct Use

P-N voltage is DC voltage. The overvoltage error [E007] is generated in the following cases:

- When P-N voltage is over around 405 VDC in the class of 200 V inverter.
- When P-N voltage is over around 810 VDC in the class of 400 V inverter.

● Parameter

Item	Parameter	Data	Description
DC voltage monitor	[dA-40]	0.0 to 1000.0 (V)	Displays the P-N voltage of inverter.

5-6 Operation Time and Count Monitor

5-6-1 Cumulative operating hours monitor during RUN

The cumulative operating hours monitor during RUN displays the duration of the time when an inverter provides output after it receives an operation command.

Precautions for Correct Use

The cumulative operating hours monitor during RUN cannot be cleared by initialization or the similar method.

● Parameter

Item	Parameter	Data	Description
Cumulative operating hours monitor during RUN	[dC-22]	0 to 100000 [hr]	Stores and displays the duration of the time when an inverter provides output.

5-6-2 Cumulative Power-on Time Monitor

The cumulative power-on time monitor displays the duration of the time when the inverter was turned ON.

Precautions for Correct Use

The cumulative power-on time monitor cannot be cleared by initialization or the like.

● Parameter

Item	Parameter	Data	Description
Cumulative power-on time monitor	[dC-24]	0 to 100000 [hr]	Data of period that the inverter is ON is stored for monitoring.

5-6-3 Total Start-up Count Monitor

The total start-up count monitor displays the number of times when the inverter starts outputs from the power-off condition.

Precautions for Correct Use

Total start-up count monitor cannot be cleared by initialization or the like.

● Parameter

Item	Parameter	Data	Description
Total start-up count monitor	[dC-20]	0 to 65535 (Counts)	Checks the number of times the inverter entered an operation condition from an power-off condition.

5-6-4 Cumulative Power-on Count Monitor

The cumulative power-on count monitor displays the number of the times when the inverter was turned ON.

Precautions for Correct Use

- Power-on count monitor cannot be cleared by initialization or the like.
- Retry restarts due to instantaneous power failures are not counted.

● Parameter

Item	Parameter	Data	Description
Power-on count	[dC-21]	0 to 65535 (Counts)	Displays numbers of the times when the power supply for control circuit was turned ON.

5-7 Cooling Fin Temperature Monitor

The cooling fin temperature monitor displays the temperature of the inverter's fin.

Precautions for Correct Use

The temperature error [E021] is generated when the cooling fin temperature exceeds 120°C.

● Parameter

Item	Parameter	Data	Description
Cooling fin temperature monitor	[dC-15]	-20.0 to 200.0 (°C)	Displays the cooling fin temperature

5-8 Power Monitor

5-8-1 Input Power Monitor

The input power monitor [dA-30] displays the current power input to the inverter.

The integrated input power monitor [dA-32] displays the integrated data of the power input to the inverter.

Additional Information

- Display gain for Accumulation input power monitor [UA-13] mode, the displayed contents can be converted with gain.
  [dA-32]= "Calculated input power value (kWh)"/[UA-13]
  ([UA-13] can be set from 1. to 1000. by an unit.)
- Accumulation input power monitor clear [UA-12] to "01" and then determining it, you can clear an integrated input power value.
- Also, if 039 [KHC] (clearing of integrated input power) has been assigned to one of the input terminals, integrated input power value can be cleared via that terminal.

● Parameter

Item	Parameter	Data	Description
Input power monitor	[dA-30]	0.00 to 600.00 (kW)	Displays the input power. Changes according to input power factors.
Integrated input power monitor	[dA-32]	0.0 to 100000.0 (kWh)	Displays the integrated value of input power. Changes according to input power factors.
Accumulation input power monitor clear	[UA-12]	00	Disable
		01	Clear
Display gain for Accumulation input power monitor	[UA-13]	1 to 1000	Displays a value obtained by multiplying by gain.
Input terminal function	[CA-01] to [CA-11]	039	[KHC] Clearing of integrated input power terminal

5-8-2 Output Power Monitor

The output power monitor [dA-34] displays the current power output to the inverter.

The integrated output power monitor [dA-36] displays the integrated data of the power output to the inverter.

Additional Information

- Display gain for Accumulation output power monitor [UA-15] mode, the displayed contents can be converted with gain.
  Value indicated on [dA-36] = “Calculated output power value (kWh)”/[UA-15]
  ([UA-15] can be set from 1. to 1000. by an unit.)
- Accumulation output power monitor clear [UA-14] to “01” and then determining it, you can clear an integrated output power value.
- Also, if 40 (OKHC: clearing of integrated output power) has been assigned to one of the input terminals, integrated input power value can be cleared via that terminal.

● Parameter

Item	Parameter	Data	Description
Output power monitor	[dA-34]	0.00 to 600.00 (kW)	Displays the output power.
Integrated output power monitor	[dA-36]	0.0 to 100000.0 (kWh)	Displays the integrated value of output power.
Accumulation output power monitor clear	[UA-14]	00	Disable
		01	Clear
Display gain for Accumulation output power monitor	[UA-15]	1 to 1000	Displays a value obtained by multiplying by gain.
Input terminal function	[CA-01] to [CA-11]	040	[OKHC] Clearing of integrated output power terminal

5-9 Life Monitor

5-9-1 Life Diagnostic Monitor

The life diagnostic monitor displays the following conditions:

- The lives of capacitors on the main circuit board
- The cooling fan life

As for signals, a capacitor life prewarning signal (029 [WAC]) and a fan life advance notice signal (030 [WAF]) can be output.

Precautions for Correct Use

- The lives of capacitors are calculated once a ten minutes. If the power supply is repeatedly turned ON and OFF faster than this cycle, the inverter will be incapable of diagnosing the lives of capacitors normally.
- If the selection of the cooling fan operation is set to other than 00, the fan will stop automatically depending on the condition. The life diagnosis isn't carried out while the fan is in the automatic stop mode.

● Parameter

Item	Parameter	Data	Description
Life diagnostic monitor	[dC-16]	LL to HH	The monitors shows H at the end of the life spans. The monitor on the right indicates the lives of the capacitors on the circuit board, whereas that on the left indicates the life of the cooling fan.
Capacitor life advance notice	[CC-01] to [CC-07]	029	[WAC]: This signal is output when the lives of the capacitors on the circuit board are neared.
Fan life advance notice	[CC-01] to [CC-07]	030	[WAF]: This signal is output when the cooling fan rotation speed is decreased.
Cooling FAN control method selection	[bA-70]	00	Always ON
		01	The fan is turned ON during operation and continues rotating after the operation is stopped.
		02	Running depending on the temperature. The fan runs as the fin temperature rises.

For operation of cooling fan, see *8-5 Cooling Fan Control* on page 8-122.

5-9-2 Monitor of Cumulative Operating Time of Cooling Fan

The cumulative operating time of cooling fan displays the time when the cooling fan run.

The cumulative cooling fan operating time monitor can be used as a guide for a replacement of the cooling fan.

Precautions for Correct Use

The Cumulative Operating Time of Cooling Fan can be cleared by setting the parameter.

● Parameter

Item	Parameter	Data	Description
Cumulative operating time of cooling fan	[dC-26]	0 to 1000000 (hr)	Measures and displays the duration of time that the cooling fan has been operated.
Cooling FAN accumulation running time clear selection	[bA-71]	00	Not carries out.
		01	Carries out clearance at the set time.

5-10 Electronic Thermal Load Ratio Monitor

5-10-1 Electronic Thermal Load Ratio Monitor of Motor

Display the electric thermal load ratio of the motor. The overload protection error [E005] is generated when the displayed thermal load ratio is about to exceed 100%.

Precautions for Correct Use

Appropriately perform the basic settings of motor and electric thermal function settings.

● Parameter

Item	Parameter	Data	Description
Electronic thermal duty ratio monitor MTR	[dA-42]	0.00 to 100.00 (%)	Displays the thermal load ratio of the motor.

5-10-2 Electronic Thermal Load Ratio Monitor of Inverter

The monitor displays electronic thermal load ratio of the inverter. The controller overload protection error [E039] is generated when the displayed thermal load ratio exceeds 100%.

Precautions for Correct Use

The heat characteristics of the inverter has been predetermined.

● Parameter

Item	Parameter	Data	Description
Electronic thermal duty ratio monitor CTL	[dA-43]	0.00 to 100.00 (%)	Displays the thermal load ratio of the inverter.

5-11 Inverter Rated Monitor

5-11-1 Load Rated Monitor

Displays the load rating of the inverter.

Precautions for Correct Use

You should also check the rated current and current derating characteristics because they vary depending on load type selections.

● Parameter

Item	Parameter	Data	Description
Inverter load type selection monitor	[dC-01]	00	VLD: Very low duty
		01	LD: Low duty
		02	ND: Normal duty

5-11-2 Rated Current Monitor

Displays the rated current of the inverter.

Precautions for Correct Use

You should also check the rated current and current derating characteristics because they vary depending on load type selections.

● Parameter

Item	Parameter	Data	Description
Rated current monitor	[dC-02]	0.0 to 6553.5 [A]	Displays the rated current adopted to the inverter.

5-12 Braking Resistor Load Ratio Monitor

Display the use rate of braking resistor circuit (BRD).

Precautions for Correct Use

- A setting is required for a braking resistor circuit (BRD) to operate.
  For details, see *8-2-5 Regenerative Braking Function* on page 8-50.
- The breaking resistor overload error [E006] is generated when the displayed rate exceeds the Dynamic brake usage rate [bA-60].

● Parameter

Item	Parameter	Data	Description
BRD load factor monitor	[dA-41]	0.00 to 100.00 (%)	Displays the load ratio of braking resistor.
Dynamic brake usage rate	[bA-60]	0.0 to 100.0 (%)	Sets the maximum use rate of braking resistor.

5-13 Inverter Status Monitor

Displays the current conditions of inverter.

Precautions for Correct Use

Command destinations vary according to the state of terminal functions as well as to the settings. Commands not input from the currently enabled command destinations will be ignored.

Parameter

Item	Parameter	Data	Description
Detailed monitor for icon 2 LIM	[dC-37]	00 to 06	Refer to *3-1-3 LCD Display* on page 3-5.
Detailed monitor for icon 2 ALT	[dC-38]	00 to 04	
Detailed monitor for icon 2 RETRY	[dC-39]	00 to 02	
Detailed monitor for icon 2 NRDY	[dC-40]	00 to 05	

Detailed Monitor for Icon 2 LIM [dC-37]

Data	Status	Description
01	The overcurrent suppression function is applied due to increased current.	Under overcurrent suppression.
02	The overload limiting function is applied due to increased current.	Under overload limit.
03	The overvoltage suppression function is applied due to increased P-N voltage.	Under overvoltage suppression.
04	The torque limiting function is applied due to increased current.	Under torque limit.
05	The frequency is within the upper/lower limit or jump frequency limit.	Within upper limit. Within lower limit. Within jump frequency limit.
06	The frequency command at below the minimum frequency has been given.	Under minimum frequency limit.
00	A state other than those above.	A state other than those above.

Detailed Monitor for Icon 2 ALT [dC-38]

Data	Status	Description
01	Current is increased.	Overload advance notice in effect.
02	The motor thermal load is increased.	Motor thermal advance notice in effect.
03	The inverter thermal load is increased.	Inverter thermal advance notice in effect.
04	Motor temperature is rising.	Motor heating advance notice in effect.
00	A state other than those above.	A state other than those above.

● Detailed Monitor for Icon 2 RETRY [dC-39]

Data	Status	Description
01	Waiting to retry after a trip.	Retry Standby.
02	Waiting to restart.	Waiting to restart.
00	A state other than those above.	A state other than those above.

● Detailed Monitor for Icon 2 NRDY [dC-40]

Data	Status	Description
01	Tripped.	A trip has occurred.
02	Power supply abnormality.	Power failure or undervoltage state.
03	Being reset.	Being reset or waiting to cancel reset.
04	STO	STO is enabled.
05	Waiting.	Waiting for inverter’s internal circuit or internal condition to be stable.
06	Data inconsistency.	A setting inconsistency exists (warning).
07	Sequence abnormality.	Abnormality during a sequence operation.
08	Free-run.	Free-run is enabled (free-run operation).
09	Forced stop state.	Operation command isn’t permitted. Or forced stop is being issued. (Deceleration stop behavior)
00	A state other than those above.	A state other than those above.

5-14 Analog Input Value Monitor

Displays the input values for Ai1, Ai2 and Ai3 that are currently input to the terminal block of the inverter.

● Parameter

Item	Parameter	Data	Description
Analog input [Ai1] monitor	[dA-61]	0.00 to 100.00 (%)	Monitors analog input values. [Ai1][Ai2]: 0 to 10V/0 to 20mA [Ai3]: Equivalent to -10 to 10V
Analog input [Ai2] monitor	[dA-62]	0.00 to 100.00 (%)	
Analog input [Ai3] monitor	[dA-63]	-100.00 to 100.00 (%)	

5-15 Analog Terminal Setting Monitor

Displays the state of analog input/output changeover switch.

Precautions for Correct Use

- Note that the data cannot be obtained appropriately if the analog input switch selection differs from the actual input, which results in a damage.
- The data cannot be output appropriately if an analog output switch selection differs from the actual output.
- If the data on analog switch monitor does not switch after the switch is switched, check the switch because the switch may not be fully switched or may be damaged.

● Parameter

Item	Parameter	Data	Description
Analog I/O selection monitor	[dA-60]	VVVVVVVV to AAAAAAAA	Displays whether an analog input/output terminal is a voltage input/output terminal or a current input/out terminal. [Left side] (Reserved) (Reserved) (Reserved) (terminal Ai3 (Ii3/Vi3)) (terminal Ao2) (terminal Ao1) (terminal Ai2) (terminal Ai1) [Right side] V: voltage/A: current

5-16 Terminal Block Type Monitor

Displays options for a terminal block that is equipped with inverter.

● Parameter

Item	Parameter	Data	Description
Terminal block option mounted status	[dA-50]	00 (standard)	Displays terminal block option types.

5-17 Operation Command/Frequency Command Sources Monitor

Displays the operation command sources and the frequency command sources that are currently enabled.

Precautions for Correct Use

Command sources vary according to the state of terminal functions as well as to the settings.
Commands not input from the currently enabled command sources will be ignored.

● Parameter

<table>
<tr><th>Item</th><th>Parameter</th><th>Data</th><th>Description</th></tr>
<tr><td>Speed command destination monitor (main)</td><td>[dC-07]</td><td>01 to 07,
09 to 34</td><td rowspan="2">00 (disabled), 01 (Ai1), 02 (Ai2), 03 (Ai3),
07 (Multistage speed 0[Ab110]/[Ab210]),
08 (auxiliary speed[AA104]/[AA204]),
09 (Multistage speed 1[Ab-11]),
10 (Multistage speed 2[Ab-12]),
11 (Multistage speed 3[Ab-13]),
12 (Multistage speed 4[Ab-14]),
13 (Multistage speed 5[Ab-15]),
14 (Multistage speed 6[Ab-16]),
15 (Multistage speed 7[Ab-17]),
16 (Multistage speed 8[Ab-18]),
17 (Multistage speed 9[Ab-19]),
18 (Multistage speed 10[Ab-20]),
19 (Multistage speed 11[Ab-21]),
20 (Multistage speed 12[Ab-22]),
21 (Multistage speed 13[Ab-23]),
22 (Multistage speed 14[Ab-24]),
23 (Multistage speed 15[Ab-25]), 24 (JG[AG-20]),
25 (RS485), 29 (Pulse array (inverter)),
30 (Pulse array (Option))
31 (Drive Programming), 32 (PID),
34 (AHD retention speed)</td></tr>
<tr><td>Speed command destination monitor (auxiliary)</td><td>[dC-08]</td><td>00 to 34</td></tr>
<tr><td>Operation command destination monitor</td><td>[dC-10]</td><td>00 to 06</td><td>00 ([FW]/[RV] terminal)/01 (3 wire)/
02 (RUN key on LCD operator)/
03 (RS485 setting)/04 (Option 1)/
05 (Option 2)/06 (Option 3)</td></tr>
</table>

5-18 Options Monitor

Displays which option unit is equipped and where it is equipped.

Precautions for Correct Use

- Recognition of an optional unit is performed in the condition the power supply of the optional unit has been established.
- If the optional unit is poorly connected or damaged, it is regarded as in unconnected state.

● Parameter

Item	Parameter	Data	Description
Option slot 1 mounted state	[dA-81]	Option ID	Displays the ID of optional Unit mounted in the option slot 1.
Option slot 2 mounted state	[dA-82]	Option ID	Displays the ID of optional Unit mounted in the option slot 2.
Option slot 3 mounted state	[dA-83]	Option ID	Displays the ID of optional Unit mounted in the option slot 3.

Option ID

ID	Optional Unit type	Description
00	No	
33	RX2-PG	PG Option Unit

6

Basic Parameter Settings

This chapter explains the basic parameter settings.

The parameter number structure is indicated below.
This chapter explains how to set the first setting. For the second setting, follow the same procedure. The setting value and operation are common.

AA 1 01
- 01: In-Group Number
- 1:
  - -: Always enabled in both the first setting and second setting
  - 1: Enabled in the first setting when the [SET] terminal function is OFF
  - 2: Enabled in the second setting when the [SET] terminal function is ON
- AA: Parameter Group

The function assigned to In/Output terminals is indicated as a combination of three digits numbers and alphabets, like “023[F-OP].” For more details of the functions, refer to the *<List of input terminal functions>* on page C-44 and the *<List of output terminal functions>* on page C-49.

6-1 Basic Parameter Settings

6-1-1 Inverter Load Rating Settings

The duty rating mode of the inverter can be chosen from Normal Duty (ND), Low Duty (LD), and Very Low Duty (VLD).

The rated current, excess duty endurance, and rated temperature of the inverter vary depending on the duty rating mode.

A change of the inverter duty rating mode is reflected immediately after the Load type selection [Ub-03] is changed.

Precautions for Correct Use

- When [Ub-03] is changed, the parameter set for the electric current is automatically adjusted at the ratio of the changed rated current and the set value is changed accordingly.
- Another check is necessary if the electric current is set by using the excess duty limit function, direct current control function, electronic thermal function, excess duty warning function, or low current detection function.
- When VLD is selected and the control mode is selected out of the Control mode selection, 1st-motor [AA121], the control mode is automatically set to the V/f control. Another check is necessary when the control type setting is changed.

● Parameters

Item	Parameters	Data	Description	Default data
Load type selection	[Ub-03]	00	VLD (Very Low Duty)	02
		01	LD (Low Duty)	
		02	ND (Normal Duty)	

For details about the load rating mode that you can set in selecting load specifications, see the following tables.

Duty rating	ND (Normal Duty)	LD (Low Duty)	VLD (Very Low Duty)
Excess duty endurance	150% (1 min.) 200% (3 sec.)	120% (1 min.) 150% (3 sec.)	110% (1 min.) 120% (3 sec.)
Temperature characteristics	50°C (with derating)	45°C (with derating)	40°C (with derating)
Corresponding control type*1	Induction motor IM • V/f control • V/f control with sensor • SLV (sensorless vector) control • 0 Hz-range SLV control • Vector control with sensor Synchronous motor SM • SLV control • IVMS start type sensorless vector control (SM/PMM)	Induction motor IM • V/f control • V/f control with sensor • SLV (sensorless vector) control Synchronous motor SM • SLV control • IVMS start type sensorless vector control (SM/PMM)	Induction motor IM • V/f control • V/f control with sensor • SLV (sensorless vector) control Synchronous motor SM • SLV control
Major applications	Lifts, cranes, etc.	Conveyors, transportation machines, etc.	Fans, pumps

*1. PG option unit of the optional unit is necessary for the vector control with sensor.

6-1-2 Inverter Initialization

When the Initialize Mode selection [Ub-01] is chosen and [Ub-05] Initialize Enable is set to 01, the designated data can be initialized to the default data.

When you use an inverter of 3G3RX2 at the first time or you newly set the inverter, set Initialize Mode selection [Ub-01] to 04 (Trip history + parameters + DriveProgramming) in order to complete the initialization.

Only the trip history can be cleared without initialization of the stored parameter values.

Initial values to be stored after the initialization can be changed by changing the initial value selection [Ub-02].

Precautions for Correct Use

- The following data cannot be initialized: DriveProgramming user parameter U00 to U63 (UE-10 to UE-73) setting value, cumulative operating hours monitor during RUN (dC-22), cumulative power-ON time (dC-24), initialized data selection (Ub-02), duty type selection (Ub-03), analog adjustment (Cb-30 to Cb-35), thermistor adjustment (Cb-41).
- The initialization sets the parameters to initial values. When the data before the initialization is required, read out it with R/W function (Read) in LCD operator, or use CX-Drive to store it in PC.
- The initialized parameters are not displayed, depends on Display restriction selection (UA-10). Change the data to 00: total view to complete the initialization.
- When the soft lock selection (UA-16) setting bans on a change of parameter values, data can not be initialized. Be sure to reset the ban on a change of parameter values to carry out the initialization.
- When you select the data 01 in Initialize Enable (Ub-05) and press F2 key, the initialization starts. Take a caution you can not undo the data once the initialization starts.
- Initialization cannot be initialized in the following states:
  - During operation
  - When the trip occurs
  - During soft lock
- Even when the operation command is input during initialization, the inverter ignores the command. Input the operation command again after the initialization is finished.

● Parameters

Item	Parameters	Data	Description	Default data
Initialize Mode selection	[Ub-01]	00	The initialization is disabled.	00
		01	The trip history and retry history are cleared.	
		02	Parameters all initialized	
		03	The trip history, retry history, and all parameters are initialized.	
		04	The trip history, retry history, all parameters, and program data for EzSQ are initialized.	
		05	Parameters other than those of I/O terminal function are initialized.	
		06	Parameters other than the communication function parameters are initialized.	
		07	Parameters other than those of I/O terminal function and communication function are initialized.	
		08	Only the program data for DriveProgramming are initialized.	
Initialize Data selection	[Ub-02]	00	Mode 0	01
		01	Mode 1 (Factory setting)	
		02	Mode 2	
		03	Mode 3	
Initialize Enable	[Ub-05]	00	Function disabled	00
		01	Initialization start	

● Parameters Chosen for Initialization [Ub-01]

Item	Parameter range	Description
Classification of I/O terminal functions	[CA-01] to [CA-11]	Input terminal selection
	[CA-21] to [CA-31]	a/b contact selection
	[CA-41] to [CA-51]	Input terminal response
	[Cb-40]	Thermistor selection
	[CC-01] to [CC-07]	Output terminal selection
	[CC-11] to [CC-17]	a/b contact selection
	[CC-20] to [CC-33]	Output delay
	[CC-40] to [CC-60]	Logical operation function
Classification of communication functions	[CF-01] to [CF-10]	Setting of RS485 communication
	[CF-20] to [CF-38]	Setting of EzCOM communication

● Table of Initialization Targets

[Ub-01] Selection of initialization:

Initialization targets are indicated by ■.

[Ub-01]	(1) History data	(2) Setting of I/O terminal	(3) Communication function	(4) Other than parameters (2) and (3)	(5) DriveProgramming
00					
01	■				
02		■	■	■	
03	■	■	■	■	
04	■	■	■	■	■
05			■	■	
06		■		■	
07				■	
08					■

● Initialize Data selection [Ub-02]

The data is initialized in the following manners, depending on the selected mode. The default data is common in other parameters.

Set the default data during shipment to 01 (Mode 1).

Code	Function Name	Mode 0	Mode 1 (Default data during shipment)	Mode 2	Mode 3
AA101	Main speed input source selection, 1st-motor	07 (Parameter setting)	01 (Ai1 terminal input)	01 (Ai1 terminal input)	01 (Ai1 terminal input)
AA111	Run-command input source selection, 1st-motor	02 (RUN key on operator LCD Operator)	00 ([FW]/[RV] terminal)	00 ([FW]/[RV] terminal)	00 ([FW]/[RV] terminal)
AA201	Main speed input source selection, 2nd-motor	07 (Parameter setting)	01 (Ai1 terminal input)	01 (Ai1 terminal input)	01 (Ai1 terminal input)
AA211	Run-command input source selection, 2nd-motor	02 (RUN key on operator LCD Operator)	00 ([FW]/[RV] terminal)	00 ([FW]/[RV] terminal)	00 ([FW]/[RV] terminal)
bC111	Electronic thermal characteristic selection, 1st-motor	00 (Reduction characteristics)	01 (Constant torque characteristics)	01 (Constant torque characteristics)	01 (Constant torque characteristics)
bC211	Electronic thermal characteristic selection, 2nd-motor	00 (Reduction characteristics)	01 (Constant torque characteristics)	01 (Constant torque characteristics)	01 (Constant torque characteristics)
Hb104	Async.Motor Base frequency setting, 1st-motor	60.00	50.00	60.00	50.00
Hb105	Async.Motor Maximum frequency setting, 1st-motor	60.00	50.00	60.00	50.00
Hb106	Async.Motor rated voltage, 1st-motor	200 V class: 200 400 V class: 400	200 V class: 230 400 V class: 400	200 V class: 230 400 V class: 460	200 V class: 230 400 V class: 400
Hb204	Async.Motor Base frequency setting, 2nd-motor	60.00	50.00	60.00	50.00
Hb205	Async.Motor Maximum frequency setting, 2nd-motor	60.00	50.00	60.00	50.00
Hb206	Async.Motor rated voltage, 2nd-motor	200 V class: 200 400 V class: 400	200 V class: 230 400 V class: 400	200 V class: 230 400 V class: 460	200 V class: 230 400 V class: 400

6-2 Parameter Setting for Motor Related

6-2-1 Motor Basic Settings

Basic parameters to control and protect the motor are set.

The following basic parameters need to be set for any control type regardless of controlling method.

The motor operation could be stabilized if the motor items are set to the inverter.

The induction motor (IM) and synchronous motor (SM) / permanent magnet motor (PMM) are set separately.

Induction Motor (IM) Parameter

Items of Induction motor	Parameters of inverter		Setting range (unit)	Description	Default data
Capacity	[Hb102]	Async.Motor capacity setting, 1st-motor	0.01 to 160.00 (kW)	Sets the motor capacity.	Varies depending on inverter models and settings of duty rating.
Number of motor poles	[Hb103]	Async.Motor poles setting, 1st-motor	2 to 48 (poles)	Sets the number of motor poles.	4
Frequency	[Hb104]	Async.Motor Base frequency setting, 1st-motor	10.00 to 590.00 (Hz)	Sets the base frequency of motor.	50*1
	[Hb105]	Async.Motor Maximum frequency setting, 1st-motor	10.00 to 590.00 (Hz)	Sets the max. frequency of motor.	50*1
Voltage	[Hb106]	Async.Motor rated voltage, 1st-motor	1 to 1000 (V)	Sets the rated voltage of motor.	200 V: 230*1 400 V: 400*1
Current	[Hb108]	Async.Motor rated current, 1st-motor	0.01 to 10000.00 (A)	Sets the rated current of motor.	Varies depending on inverter models and settings of duty rating.

*1. Default data when default data selection (UB-02) is set to 01.

Parameters for Synchronous Motor (SM)/ Permanent Magnetic Motor (PMM)

Items of SM and PMM motor	Parameters of inverter		Setting range (unit)	Description	Default data
Capacity	[Hd102]	Async.Motor capacity setting, 1st-motor	0.01 to 160.00 (kW)	Sets the motor capacity.	Varies depending on inverter models and settings of duty rating.
Number of poles	[Hd103]	Async.Motor poles setting, 1st-motor	2 to 48 (poles)	Sets the number of poles.	Varies depending on inverter models and settings of duty rating.
Frequency	[Hd104]	Async.Motor Base frequency setting, 1st-motor	10.00 to 590.00 (Hz)	Sets the base frequency of motor.	Varies depending on inverter models and settings of duty rating.
	[Hd105]	Async.Motor Maximum frequency setting, 1st-motor	10.00 to 590.00 (Hz)	Sets the max. frequency of motor.	Varies depending on inverter models and settings of duty rating.
Voltage	[Hd106]	Async.Motor rated voltage, 1st-motor	1 to 1000 (V)	Sets the rated voltage of motor.	200 V: 230*1 400 V: 400*1
Current	[Hd108]	Async.Motor rated current, 1st-motor	0.01 to 10000.00 (A)	Sets the rated current of motor.	Varies depending on inverter models and settings of duty rating.

Precautions for Correct Use

- The motor could burn if the base frequency is set lower than the motor frequency. (Lower than 50 Hz in case of standard induction motor)
- For setting the maximum frequency higher than 60 Hz, make sure the motor's maximum allowable frequency.
- The motor could burn if the maximum frequency and rated voltage are set to exceed the specified range of rated voltage.
- After initialization, the motor protection function needs to be configured again. Otherwise, the motor could burn.

Capacity and Number of Poles

The inverter reads out preset standard motor data if the capacity and number of poles are changed.

The motor disturbance could be suppressed and the motor operation could be stabilized if the capacity and number of poles are correctly set.

Base Frequency

Set the base frequency according to the motor specifications.

Precautions for Correct Use

The induction motor should be regarded as a special one if used at higher than 60 Hz. In this case, the inverter capacity may need to be made larger as the maximum capacity of the inverter motor is incorrect.

Maximum Frequency

Sets the maximum frequency of motor to use.

Rated Voltage

Set the rated voltage of motor according to the motor specifications.

Precautions for Correct Use

- Expected characteristics may not be obtained if the motor rated voltage is set higher than receiving voltage or inverter rated voltage.
- Set the rated voltage of motor in the following way if the inverter is switched from 3G3RX-V1 Series.
  [Hb106]=A082×A045/100

Rated Current

Set the rated current of motor to the parameter according to the motor specifications. Inappropriate configuration may disable the motor protecting function or make motor control unstable.

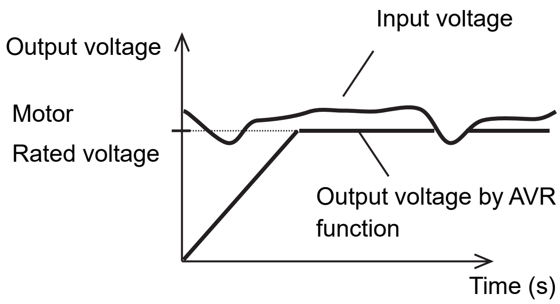
Precautions for Correct Use

Expected characteristics may not be obtained if the motor rated current is set higher than the inverter rated current. In some cases, the inverter protection works first.

Automatic Voltage Regulation Function (AVR Function)

The inverter automatically operates the automatic voltage regulation function (AVR function). This function outputs voltage to the motor correctly regardless of input voltage fluctuation supplied to the inverter.

Output of a voltage higher than the input voltage is not possible even using this function.



In case you set AVR function to OFF, configure the parameter [bA146] Over magnetization deceleration function selection, 1st_motor.

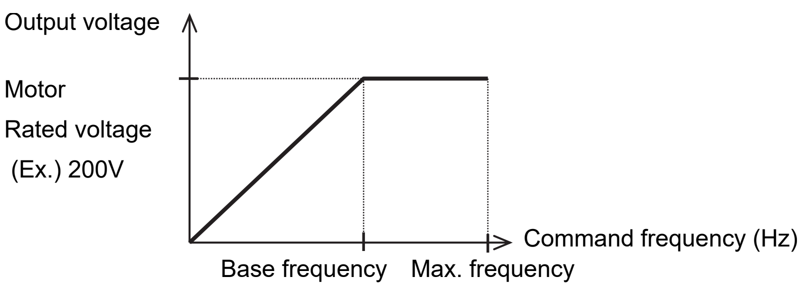
[bA146]=02 for AVR OFF during deceleration.

[bA146]=01 for AVR OFF all time.

Relation between Frequency and Voltage under General V/f Control (IM)

General V/f control command is given in the following with the base frequency and rated voltage being set.

The output voltage from the base to maximum frequency cannot exceed the rated voltage.



Control of General Synchronous Motor

Precautions for Correct Use

Basically the synchronous motor needs current calculation control and the motor parameters need to be set. The parameters in this item and motor constants in the next item need to be set.

6-2-2 Motor Constant Setting

The motor operation could be stabilized if the motor constants are set.

In particular, the motor constants need to be set according to the motor specifications when the automatic boost function, automatic boost function with sensor, sensorless vector control function, 0 Hz-range sensorless vector control function, or vector control function with sensor is used.

The motor constants of standard motor are automatically set to the followings when the motor capacity or number of motor poles is changed.

Some of the motor constants in the following tables are automatically set to acquired constant data when the auto-tuning function is used. For details, see the next section.

The motor constants can be chosen from the motor constant selection or manually changed or adjusted.

The standard motor constants are used as initial values of the induction motor (IM) constants.

Precautions for Correct Use

- Note that the motor constants will be overwritten if any of the following actions are taken.
  In case of induction motor (IM):
  - The motor capacity or number of motor poles is changed.
  - The auto-tuning is performed.
  - The initialization is performed.

  In case of synchronous motor (SM) and permanent magnet motor (PMM):
  - The motor capacity is changed.
  - The auto-tuning is performed.
  - The initialization is performed.

- Please be advised to save the constants using the R/W function on the LCD operator.
- For details of adjustment, see *7-1 Overview of Motor Control Methods* on page 7-3.

IM Motor Constant Parameters

Item	Parameters	Data	Description	Default data
Async.Motor constant R1, 1st-motor	[Hb110]	0.000001 to 1000.000000(Ω)	Sets the primary resistance of IM.	Varies depending on inverter models and settings of duty rating.
Async.Motor constant R2, 1st-motor	[Hb112]	0.000001 to 1000.000000(Ω)	Sets the secondary resistance of IM.	
Async.Motor constant L, 1st-motor	[Hb114]	0.000001 to 1000.000000(mH)	Sets the leakage inductance of IM.	
Async.Motor constant Io, 1st-motor	[Hb116]	0.01 to 10000.00(A)	Sets the no-load current of IM.	
Async.Motor constant J, 1st-motor	[Hb118]	0.00001 to 10000.00000(kgm^2)	Sets the moment of inertia of the system.	

Precautions for Correct Use

- Set the motor constant I0 in the following way if it is switched from 3G3RX-V1 Series.
  [Hb116]=(50Hz/A003)×H023 (or H033)
- When the base frequency is changed, the reference value of the motor constant I0 is changed and the change is recognized (the set value is kept). To obtain a correct value with the auto-tuning or call the initial value of induction motor (IM), set another value in the selection of number of motor poles [Hb103], for example, set to 2 poles from 4 and then to 4 poles again. This results in setting data corresponding to the base frequency after the change in the Async.Motor constant Io, 1st-motor [Hb116].

SM/PMM Motor Constant Parameters

Item	Parameters	Data	Description	Default data
Async.Motor constant R1, 1st-motor	[Hd110]	0.000001 to 1000.000000(Ω)	Sets the resistance of SM/PMM.	Varies depending on inverter models and settings of duty rating.
Async.Motor constant R2, 1st-motor	[Hd112]	0.000001 to 1000.000000(mH)	Sets the d-axis inductance of SM/PMM.	
Async.Motor constant L, 1st-motor	[Hd114]	0.000001 to 1000.000000(mH)	Sets the q-axis inductance of SM/PMM.	
Async.Motor constant Io, 1st-motor	[Hd116]	0.1 to 100000.0(mVs/rad)	Sets the calculated value of induced voltage of SM/PMM.	
Async.Motor constant J, 1st-motor	[Hd118]	0.00001 to 10000.00000(kgm^2)	Sets the moment of inertia of the system.	

Additional Information

- The base (maximum) frequency can be calculated from the rated number of revolutions of the motor (min^{-1}) and the number of poles in the following formula.
  Base (maximum) frequency (Hz) = rated number of revolutions (min^{-1}) × number of poles (pole)/120
- The motor constant Ke is the peak value of the phase inducted voltage (mV) per electrical angular speed (rad/s).

6-2-3 Auto-tuning of Motor

The auto-tuning is a function that measures and automatically sets the motor constants necessary for the motor control.

There are two types of auto-tuning functions: Offline auto-tuning where the auto-tuning function finishes after a single measurement and online auto-tuning where the auto-tuning function measures a change in the constants due to motor temperature increase every time the motor is started or stopped.

Use the offline auto-tuning to measure the motor constants if you use a motor whose constants are unknown.

The online auto-tuning can stabilize the motor behavior by correcting the temperature increase of the motor during operation.

Precautions for Correct Use

- When 02 (revolving) is chosen in the auto-tuning selection [HA-01], the motor automatically begins rotating when the tuning starts.
  Make sure of the followings.
  - No problem shall occur even with the rotation at a frequency close to 80% of the base frequency.
  - The motor shall not be driven from external.
  - The braking shall be in the open state.
- The torque is not high enough during the auto-tuning. Lift or other machine could have unexpected slipping. Remove the motor from the loading machine and perform the auto-tuning to the independent motor. (In this case, the moment of inertia J is that of the independent motor and hence the moment of inertia of the loading machine should be converted to the value about the motor axis and added to J.)
- For a machine with limited motor axis rotation (lift, ball screw, etc.), 01 (non-revolving) should be chosen in [HA-01] since rotation higher than the allowed one could occur causing a damage to the machine.

● Parameters

Item	Parameters	Data	Description	Default data
Auto-tuning selection	[HA-01]	00	Function disabled	00
		01	Non-revolving auto-tuning is performed. After this parameter is set, an operation command starts the tuning.	
		02	Revolving auto-tuning is performed. After this parameter is set, an operation command starts the tuning.	
		03	The tuning for the IVMS control type is performed. After this parameter is set, an operation command starts the tuning.	
RUN command selection at Auto-tuning	[HA-02]	00	RUN key on the operator keypad	00
		01	Command is sent from the designated operation commander.	
Online auto-tuning selection	[HA-03]	00	Function disabled	00
		01	The online tuning is performed. The online tuning is automatically performed after the deceleration stops in ordinary operations.	

Precautions for Correct Use

- The constants of standard induction motor (IE3 motor) are used as default in the factory setting. If you use standard induction motor, expected characteristics will be achieved without offline auto-tuning in most cases.
- Smooth tuning could be done if the offline auto-tuning is first performed for the factory-set parameters.
- If you use a synchronous motor SM (or permanent magnet motor PMM), perform the Control mode selection, 1st-motor [AA121] is set to 11 (SM/PMM: Synchronous activation) or 12 (SM/PMM: IVMS activation).
- If expected characteristics cannot be achieved, adjust the parameters and motor constants.
- Perform the offline auto-tuning before using the online auto-tuning function.
- The motor constants are for a single phase of Y-connection.
- The offline auto-tuning is performed only when the operation can be made.
- If no-load current is not known, check the current in the operation at the base frequency with the V/f control by using an electric current monitor and enter the value to [Hb116] before the auto-tuning.
- Even if 01 (non-revolving) is chosen for [HA-01], the motor could make a half-turn at the maximum.
- The offline auto-tuning automatically overwrites the parameters with acquired data. The online auto-tuning does not overwrite the parameters with the data as it corrects internal data.

Parameter Data Overwritten in the Offline Auto-tuning

Selection of IM/SM	Parameters to be overwritten	
	Non-revolving tuning [HA-01]=01	Revolving tuning [HA-01]=02
Induction motor (IM) control [AA121]=00 to 10	[Hb110] Motor constant R1 [Hb112] Motor constant R2 [Hb114] Motor constant L	[Hb110] Motor constant R1 [Hb112] Motor constant R2 [Hb114] Motor constant L [Hb116] Motor constant I0 [Hb118] Motor constant J
Control of synchronous motor (permanent magnetic motor) (SM (PMM)) [AA121]=11 to 12	[Hd110] Motor constant R [Hd112] Motor constant Ld [Hd114] Motor constant Lq	-

Note The above table shows the case where [SET] terminal is OFF or not selected. If [SET] terminal is made ON and the secondary setting is used, the parameters of [H*21*] ([Hb210], [Hd210], etc.) are effective and overwritten according to the selection of the control type [AA221].

Offline Auto-tuning

1 Check the control type [AA121].

For the induction motor (IM), make sure that the control type [AA121] is set to the one for IM. For the synchronous motor (SM) or permanent magnetic motor (PMM), make sure that the control type [AA121] is set to the one for PMM.

2 Set the auto-tuning selection [HA-01].

In the auto-tuning selection [HA-01], 01: Non-revolving or 02: Revolving is set. The tuning does not begin at this stage. Only “non-revolving” can be chosen for synchronous motor (SM) / permanent magnetic motor (PMM).

3 Set a start command for tuning.

Pressing OPERATION button on the LCD operator starts the tuning, Pressing STOP button terminates the tuning, However tuning data are not saved.

4 The inverter automatically operates.

Output of a preset pattern is given to the motor. If the auto-tuning selection [HA-01] is set to 01: Non-revolving, non-revolving output of three different patterns is given.

If the auto-tuning selection [HA-01] is set to 02: Revolving, acceleration and deceleration are repeated twice in addition to the above output. The frequency increases up to 80% of the base frequency.

After the above operation finishes, the output with no revolution is checked as final check.

5 The tuning finished.

When the tuning End display appears, the tuning finishes. Use STOP key to cancel the End display.

Online Auto-tuning

1 Perform the offline auto-tuning.

The online auto-tuning works with the designated motor constants and the offline auto-tuning described above is performed.

2 The Online auto-tuning selection [HA-03] is set.

Set the Online auto-tuning selection [HA-03] to 01: Enabled.

3 Check the online auto-tuning.

The online tuning operates for up to 5 s when every operation stops. Use the online tuning after making sure that the operation and stop can be made correctly by your operation command.

Precautions for Correct Use

- In case of termination due to trip or erroneous tuning, correct data cannot be acquired. See the following table.
- The result of the online tuning is automatically reflected in up to 5 seconds after the stop. It is not reflected if the operation is restarted during the tuning.
- In the factory setting, the offline auto-tuning can be started by the RUN Key on the LCD operator. It can be changed to a designated operation command by changing the operation command [HA-02] of the auto-tuning.
- When the following settings are enabled, the Online auto-tuning is not performed:
  - DC braking force setting
  - Servo ON [SON], Forcing [FOC]
  - Brake Control 2

● How to Reset Failures of Auto-tuning

Expected causes	Examples of measures
The control type is not suitable for the motor.	Since the tuning type changes depending on the Control mode selection, 1st-motor [AA121], IM control or SM/PMM control, set the type in accordance with the motor.
The base frequency, motor rated voltage, or motor rated current is not suitable for the motor specifications.	Since wrong basic parameters of the motor could cause excess current or trip, check the basic parameters and set them appropriately.
STOP key was pressed.	Pressing the STOP key on the LCD operator interrupts the auto-tuning. Check the setting of the auto-tuning again before starting the tuning.
External factors such as braking caused a trip.	Factors that cause the trip need to be removed.
The input terminal function worked.	The tuning could be disturbed if the input terminal function works during the auto-tuning.
The motor capacity is too small compared to the one set for the inverter.	If the tuning does not finish correctly, the motor constants need to be set manually.

Precautions for Correct Use

In case of failure of the auto-tuning, the motor constant data are not updated and the motor works in the untuned state.

IVMS Auto-tuning

Use IVMS control when a high torque is required for activation while you use SM/PMM motors.

Precautions for Correct Use

- If a high torque is necessary for activation, original IVMS control is used. If 03 is chosen for the auto-tuning selection [HA-01], it can be detected whether the target motor can be driven with the IVMS control, although combination check should be made in advance.
- The tuning with the IVMS control should be performed on an independent motor with the Control mode selection, 1st-motor [AA121] set to 12 (SM/PMM: IVMS activation).
- In case of failure of the auto-tuning with the IVMS control, data necessary for the IVMS control cannot be obtained from the motor and the Control mode selection, 1st-motor [AA121] should be set to 11 (SM/PMM: Synchronous activation) to drive the motor.

6-3 Operation Command Settings

6-3-1 Types of Operation Commands

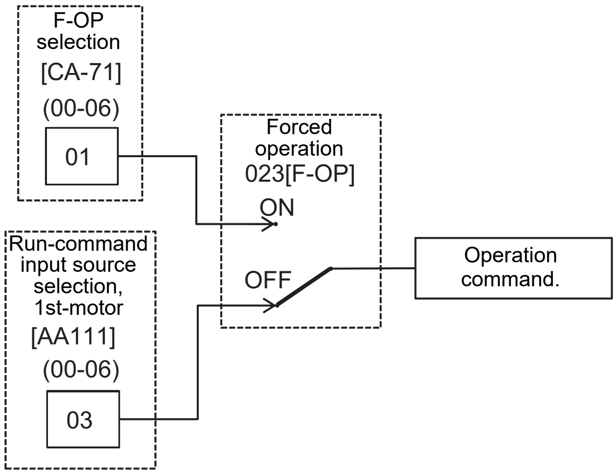
The operation command (operation modes) selected in a function is enabled.

For details, see the description in the next and subsequent sections.

Precautions for Correct Use

The operation of the inverter requires not only an operation command but also a frequency command.

parameter	setting data
CA-71 AA111	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD Operator 03: RS485 04: Option 1 05: Option 2 06: Option 3



Precautions for Correct Use

- The above shows an example of operation with [AA111]=02 (RUN key on the LCD operator).
- Functions not assigned to the input terminal functions [CA-01]-[CA-11] become OFF.

6-3-2 Operation with LCD Operator

The LCD operator is used to give a frequency command.

Use “RUN Key” and “STOP/RESET Key” for operation and stop respectively.

For operation using the LCD operator, the operation direction can be changed by setting RUN-key Direction of LCD operator, 1st-motor [AA-12].

Precautions for Correct Use

- The output of the inverter requires not only an operation command but also a frequency command.
- If the forced operation 023 [F-OP] of the terminal function is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

● Parameter

Item	Parameters	Data	Description	Default data
Run-command input source selection, 1st-motor	[AA111]	02	Operation command from “Operation key”/”Stop key” on the LCD operator.	00*1
RUN-key Direction of LCD operator, 1st-motor	[AA-12]	00	Forward rotation command from the LCD operator.	00
		01	Reverse rotation command from the LCD operator.	
Output terminal function	[CC-01] to [CC-07]	011	[REF] ON when an operation command can be given from the LCD operator.	-

*1. Default data when default data selection (UB-02) is set to 01.

6-3-3 Operation with Forward/Reverse Rotation Terminal

Forward and reverse rotation command from the inverter control circuit terminal enable the inverter operation.

A forward rotation command can be given from [FW] terminal and a reverse one from [RV] terminal.

In the factory setting, the [FW] and [RV] terminals are assigned to the terminal No. 9 and 8, respectively. This assignment can be changed by setting [CA-01]-[CA-11] in the input terminal setting selection.

a/b contact of each terminal can be switched by changing the corresponding setting item of [CA-21]-[CA-31].

Simultaneous input of a forward and reverse rotation commands is equivalent to stop command.

The relation between [FW] and [RV] terminals is given below.

FW terminal	RV terminal	Operation command.
OFF	OFF	Stop command
ON	OFF	Forward rotation command.
OFF	ON	Reverse rotation command.
ON	ON	Stop command

Commands can be given by [FW]/[RV] command of the DriveProgramming function.

Precautions for Correct Use

- The output of the inverter requires not only an operation command but also a frequency command.
- In case the input terminal function 023 [F-OP] is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

● Parameter

Item	Parameters	Data	Description	Default data
Run-command input source selection, 1st-motor	[AA111]	00	Run/Stop from the control circuit terminal block. ([FW], [RV] terminals)	00*1
Input terminal function selection	[CA-01] to [CA-11]	01	[FW] terminal function	-
		02	[RV] terminal function	
Input terminal a/b (NO/NC) selection	[CA-21] to [CA-31]	00	a contact (NO)	-
		01	b contact (NC)	

*1. Default data when default data selection (UB-02) is set to 01.

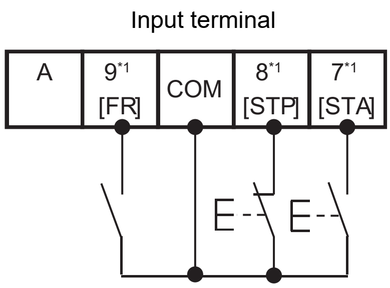
6-3-4 Operation with 3 Wire Function of Terminal Block

For 3-wire terminal commands, there are start, stop and forward/reverse operations. They are used to start and stop the inverter via an automatic reset contact such as a pushbutton switch.

Operation start command can be given from [STA] terminal and stop command from [STP] terminal.

To use the 3 wire function, the setting of the Run-command input source selection, 1st-motor [AA111] and the input terminal setting selection [CA-01]-[CA-11] needs to be changed.

Select [AA111]=01 3 wire function. In this example, the 3 wire function is assigned to the input terminal function in the following way.

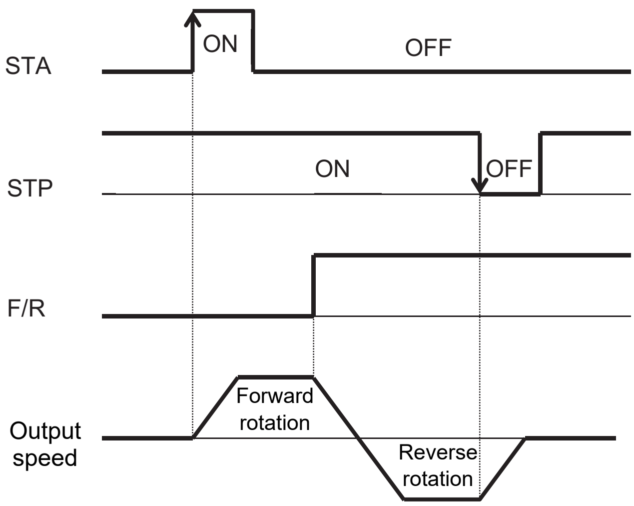


*1. Set the terminals as the terminal No. 7 [CA-07]=016, No. 8 [CA-08]=017, No. 9 [CA-09]=018.

Operation can be started/stopped by making the 016 [STA]/017 [STP] terminal function ON/OFF on the control circuit terminal block of the inverter.

018 [F/R] terminal function switches forward and reverse rotations by the contact.

The terminal action is made in the following way.



Precautions for Correct Use

- The output of the inverter requires not only an operation command but also a frequency command.
- In case the terminal 023 [F-OP] is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

Parameter

Item	Parameters	Data	Description	Default data
Run-command input source selection, 1st-motor	[AA111]	01	3 wire	00*1
Input terminal function selection	[CA-01] to [CA-11]	016	[STA] terminal function	-
		017	[STP] terminal function	
		018	[F/R] terminal function	

*1. Default data when default data selection (UB-02) is set to 01.

6-3-5 Operation with RS485 Communication

RS485 coil is used to give an operation start/stop command.

Precautions for Correct Use

- The output of the inverter requires not only an operation command but also a frequency command.
- The terminal 023 [F-OP] is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

Parameter

Item	Parameters	Data	Description	Default data
Run-command input source selection, 1st-motor	[AA111]	03	Start/Stop by RS485 communication command.	00*1

*1. Default data when default data selection (UB-02) is set to 01.

6-3-6 Operation from Optional Unit

An operation start/stop command is given from an optional board.

Precautions for Correct Use

- The output of the inverter requires not only an operation command but also a frequency command.
- The terminal 023 [F-OP] is enabled, the command destination specified in the [F-OP] function becomes effective irrespective of the present setting.

- **Parameter**

Item	Parameters	Data	Description	Default data
Run-command input source selection, 1st-motor	[AA111]	04	Operation command from option 1 enabled.	00*1
		05	Operation command from option 2 enabled.	
		06	Operation command from option 3 enabled.	

*1. Default data when default data selection (UB-02) is set to 01.

6-3-7 Disabling the Keys on LCD Operator

When a terminal command or communication command is given, the operation cannot be stopped from the LCD operator by setting [AA-13]=01.

Set [AA-13]=02 to disable the Stop key and use the resetting function in case of a trip.

When 102 [DISP] terminal function is ON, the operator keypad screen is fixed to home screen.

Precautions for Correct Use

- Set [AA-13] to 00: Disabled if a stop command is given from the LCD operator of the inverter in case of emergency.
- Usually, operation under an operation command from other than the LCD operator can be stopped by using the Stop/Reset key on the LCD operator.
- When the operation under an external command is stopped from the LCD operator, the operation stops for safety. To restart the operation, turn off the external command and on it again.

- **Parameter**

Item	Parameters	Data	Description	Default data
Run-command input source selection, 1st-motor	[AA111]	00	Run/Stop from the control circuit terminal block. ([FW], [RV] terminals)	00*1
		01	3 wire	
		02	Start/Stop by RS485 communication command.	
STOP-key enable at RUN-command from terminal, 1st-motor	[AA-13]	00	Function disabled Always recognizes stop/reset key operation.	01
		01	Function enabled The stop/reset key no longer works.	
		02	Only inverter trips can be reset by the stop/reset key.	
Input terminal function selection	[CA-01] to [CA-11]	102	[DISP] terminal function	-

*1. Default data when default data selection (UB-02) is set to 01.

Precautions for Correct Use

- [AA-13] STOP-key enable at RUN-command from terminal, 1st-motor is enabled when the Run-command input source selection, 1st-motor [AA111] is set to a value other than the value of the LCD operator (02).
- Unlike 3G3RX-V1 Series, the communication function on 3G3RX2 Series continues communication even during resetting and therefore no idling time is necessary for the resetting.

6-3-8 Temporary Change of Operation Command Destination

The operation command destination can be temporally changed with [F-OP] terminal.

When 023 [F-OP] terminal is ON, the command destination of [CA-71] is employed in a priority to the operation command destination given in [AA111].

Precautions for Correct Use

- When 023 [F-OP] terminal is ON, the frequency command destination also employs the frequency command selection designated in [CA-70].
- If [AA111] and [CA-71] are set differently from each other, the operation is interrupted when the [F-OP] terminal is made ON or OFF. The selected operation command is enabled when it is made OFF and then ON.

● Parameter

Item	Parameters	Data	Description	Default data
Input terminal function selection	[CA-01] to [CA-11]	023	[F-OP]: Gives a forced command.	-
Speed reference source selection at [F-OP] is active	[CA-70]	01 to 15	01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: parameter setting, 08: RS485 communication, 09:option 1, 10: option 2, 11: option 3, 12: pulse string input (main body), 13: pulse string input (optional) 14: program function, 15: PID arithmetic	01
RUN command source selection at [F-OP] is active	[CA-71]	00 to 06	00: [FW]/[RV] terminal, 01: 3 wire, 02: RUN key on LCD operator, 03: RS485 communication, 04: option 1, 05: option 2, 06: option 3	00

6-4 Frequency Command Settings

6-4-1 Frequency Command Selection

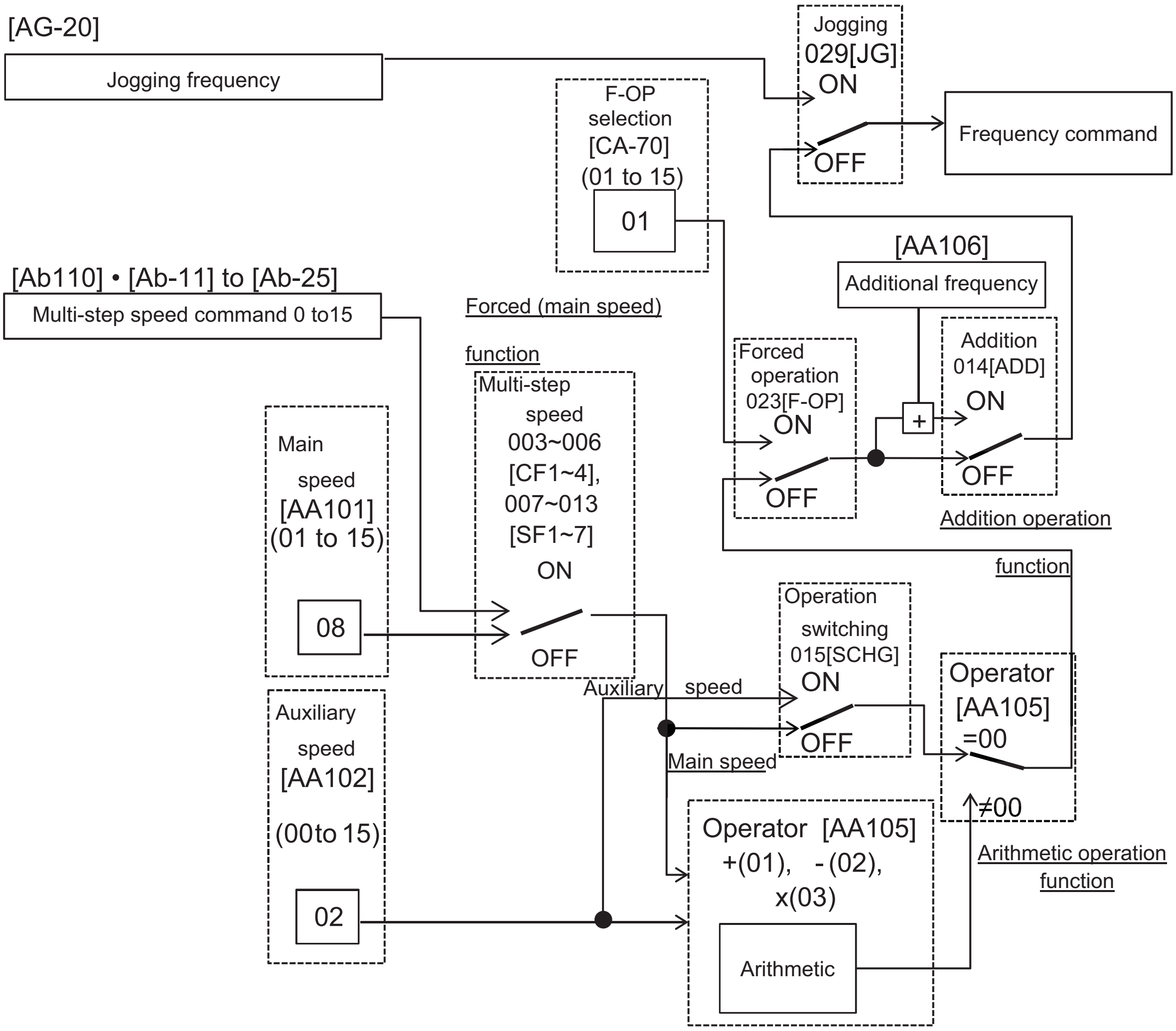
The frequency command selected in each function is enabled.

For details, see the next and subsequent sections.

The value of the enabled frequency command is shown in [FA-01].

Precautions for Correct Use

- The operation of the inverter requires not only a frequency command but also an operation command.
- To use the second setting switching [SET] of the input terminal function, replace 1 of the third digit of the parameter with 2. Ex.: [AA101]->[AA201]. If the third digit is "-", the parameter is shared for the first and second settings.



Parameter	Setting data
CA-70 AA101 AA102	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation

Precautions for Correct Use

- In the above example, [AA101]=08(RS 485) is enabled. For details, see the following explanation.
- Other command destinations can be chosen even when RS485 (Modbus communication, EzCOM function) and program function (Drive Programming) are being used.
- If an operation command is given from the operation screen of PC software CX-Drive, [AA101]=07 and [AA111]=03 are forcedly overwritten when the operation screen opens. Set [AA101]=07 and [AA111]=03.

6-4-2 Case where Command Is Given with LCD Operator

The LCD operator is used to give a frequency command.

For operation using the LCD operator, the operation direction can be changed by setting RUN-key Direction of LCD operator, 1st-motor [AA-12].

Precautions for Correct Use

- The output of the inverter (operation of the motor) requires not only a frequency command but also an operation command.
- The main and auxiliary speeds can be selected and calculated by using the input terminal function [SCHG] and the operator selection. For details, see *6-4-8 Case where Command Is Given with Main Speed Command and Auxiliary Speed Command* on page 6-35.
- If not using the LCD operator, you need to make FW/RV direction switching from each command.

● Parameter

Item	Parameters	Data	Description	Default data
Main speed input source selection, 1st-motor	[AA101]	07	The frequency set from the LCD operator is for main speed In this case the setting is made for [Ab110].	01*1
Sub frequency input source selection, 1st-motor	[AA102]	07	Auxiliary speed to use switching and arithmetic functions is set from the LCD operator. For auxiliary speed, the setting is made for [AA104].	
Multispeed-0 setting, 1st-motor	[Ab110]	0.00 to 590.00(Hz)	Frequency setting of the main speed on the LCD operator. Shared for the 0th speed of the multi-step speed function.	00
Sub speed setting, 1st-motor	[AA104]	0.00 to 590.00(Hz)	Frequency setting of the auxiliary speed on the LCD operator.	0.00
RUN-key Direction of LCD operator, 1st-motor	[AA-12]	00	Forward rotation operation	00
		01	Reverse rotation operation	
Output terminal function	[CC-01] to [CC-07]	010	[FREF] ON when a frequency command can be given from the LCD operator.	-

*1. Default data when default data selection (UB-02) is set to 01.

6-4-3 Case where Command Is Given from Terminal Block Analog Signals

A frequency command is given by input from the terminal block.

The inverter has three kinds of external analog input terminals.

Terminal connection	Input range	Switching method
Ai1-L	0 to 10 V/0 to 20 mA switchable	SW1 on the board is switched.
Ai2-L	0 to 10 V/0 to 20 mA switchable	SW2 on the board is switched.
Ai3-L	-10 to 10 V	-

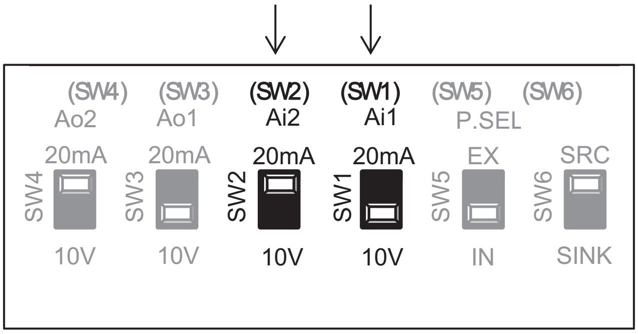
For each input, relation between the input signal and the frequency command can be set independently.

To add/subtract a command, the sub frequency input source selection, 1st-motor [AA102] and Calculation symbol selection for Speed reference, 1st-motor [AA105] should also be set. [Ai3] can be added to [Ai1] and [Ai2] without choosing an operator in the [Cb-22][Ai3] terminal selection. For details, see *8-10-5 Analog Input* on page 8-163.

Precautions for Correct Use

- The output of the inverter requires not only a frequency command but also an operation command.
- Note that the voltage input and the current input are switched from each other by the terminal block switch.
- For adjustment of the analog input, see *8-10 Input Terminal Function* on page 8-154.

First, the voltage SW and current SW are switched when the wiring is made.



Next, a command destination for the parameter [AA101] is set.

● **Parameter**

Item	Parameters	Data	Description	Default data
Main speed input source selection, 1st-motor	[AA101]	01	Input between Ai1 and L enabled.	01*1
		02	Input between Ai2 and L enabled.	
		03	Input between Ai3 and L enabled.	
		04	Reserved	
		05	Reserved	
		06	Reserved	

*1. Default data when default data selection (UB-02) is set to 01.

6-4-4 Case where Command Is Given through RS485 Communications

RS485 communication is used to give a frequency command.

Precautions for Correct Use

For details, see *9-1 Communication Specifications* on page 9-2

● **Parameter**

Item	Parameters	Data	Description	Default data
Main speed input source selection, 1st-motor	[AA101]	08	Command from RS485 communication	01*1

*1. Default data when default data selection (UB-02) is set to 01.

6-4-5 Case where Command Is Given through Input of Pulse String

Frequency command is given with a pulse string input.

Note To give a pulse string input, there are two methods. One is to use the main body's terminals and the other is to use the PG option unit.

Case where Command Is Given from Input Terminals [A] and [B]

To use the input terminals [A] and [B] of the main body as a pulse string input frequency command, set [CA-90] to 01: command.

A pulse string given as input to the input terminals [A] and [B] can be used as a frequency command / PID feedback value in each control mode.

Set an input pulse frequency that corresponds to the maximum frequency to the pulse string frequency scale [CA-92].

The pulse string input values to the input terminals [A] and [B] can be monitored with [dA-70].

Precautions for Correct Use

- Start/End function of analog input cannot be used. To limit the pulse string input frequency, use the pulse string frequency bias size [CA-94], the pulse string frequency upper detection limit [CA-95], and the pulse string frequency lower detection limit [CA-96]
- When the pulse input frequency is below the pulse string frequency lower detection limit [CA-96], it is regarded as 0 Hz in the processing.
- Slow start if the pulse string frequency lower detection limit [CA-96] is set to a high value.

● Parameter (Main body)

Item	Parameters	Data	Description	Default data
Main speed input source selection, 1st-motor	[AA101]	12	Frequency command from pulse string input (input terminals [A] and [B])	01*1
Input terminal [A] function	CA-10	103	pulse train input A	-
Input terminal [B] function	CA-11	104	pulse train input B	
Pulse train detection object selection	[CA-90]	01	Used for frequency command	00
Mode selection of pulse train input	[CA-91]	00	Mode 0: 90° phase difference pulse string	00
		01	Mode 1: Forward/Reverse rotation command and rotation direction	
		02	Mode 2: Forward rotation pulse string and reverse rotation pulse string	
Pulse train frequency Scale	[CA-92]	0.05 to 32.00 (kHz)	Input a pulse string frequency that corresponds to the maximum frequency.	25.00
Pulse train frequency Filter time constant	[CA-93]	0.01 to 2.00 (sec)	A filter is applied to the input of the pulse string frequency.	0.10
Pulse train frequency Bias value	[CA-94]	-100.0 to 100.0(%)	A bias is applied to the input of the pulse string frequency.	0.0
Pulse train frequency High Limit	[CA-95]	0.0 to 100.0 (%)	The output of the pulse string frequency input is limited.	100.00
Pulse train frequency detection low level	[CA-96]	0.0 to 100.0 (%)	In outputting the pulse string frequency input, pulses with the frequency lower than the limit is set to 0.0%.	0.0

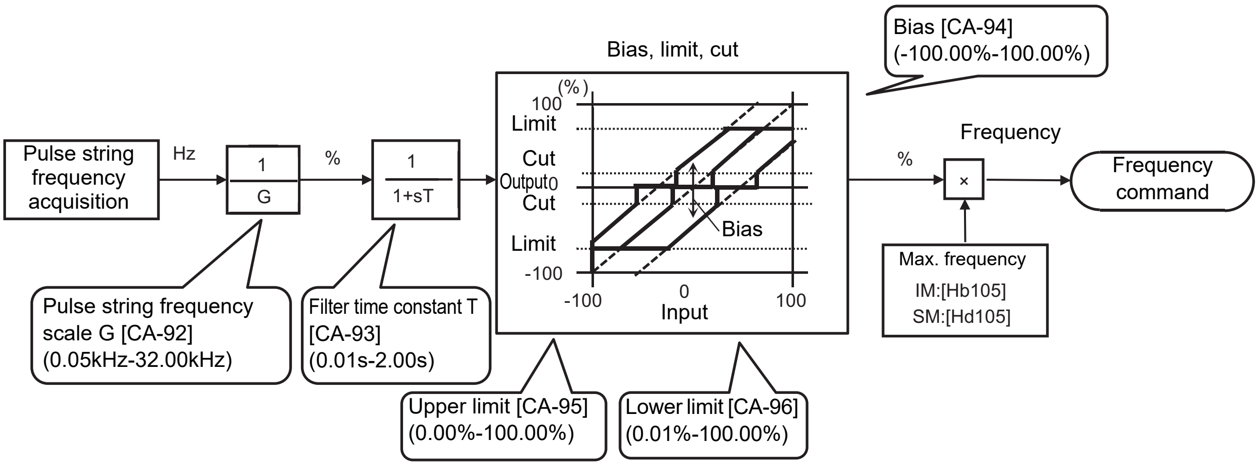
*1. Default data when default data selection (UB-02) is set to 01.

Monitor (Main Body)

Item	Parameters	Data	Description
Pulse string input monitor (main body)	[dA-70]	-100.0 to 100.00(%)	The frequency command from the pulse string input (input terminals A/B) is displayed.

Internal Arithmetic Block Diagram

Internal processing is schematically drawn.



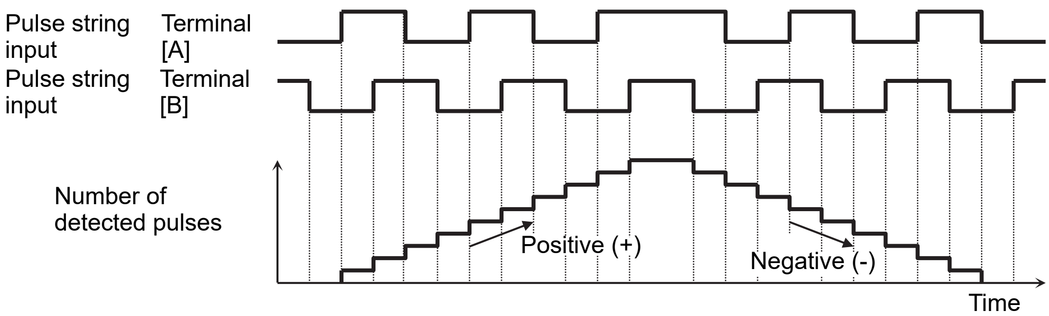
Pulse string frequency processing block

Details about Pulse String Input Mode

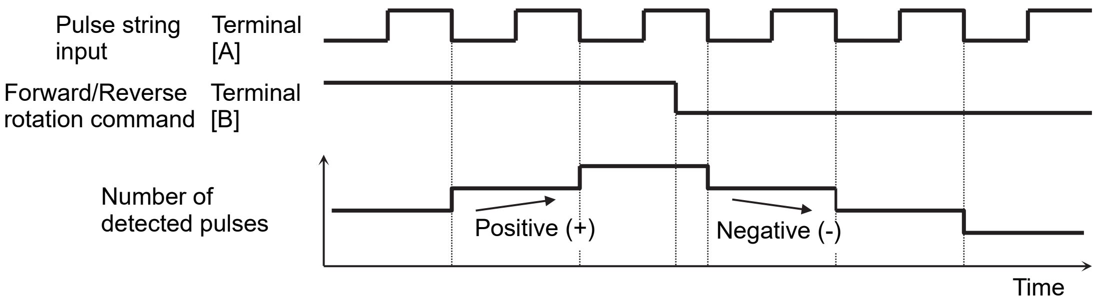
Command frequency is determined by the frequency of the pulse string input.

The sign of the command frequency is determined in the following way.

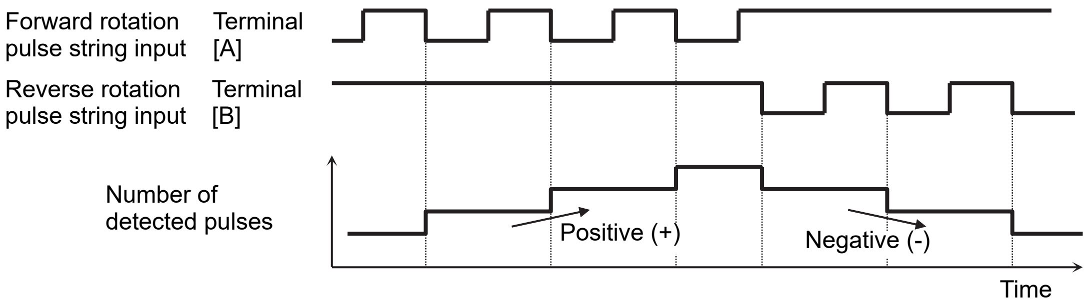
a) Mode 0: [CA-91]=00 90° phase difference pulse string



b) Mode 1: [CA-91]=01 forward and reverse rotation commands + pulse string



c) Mode 2: [CA-91]=02 Forward rotation pulse string + reverse rotation pulse string



Precautions for Correct Use

Your setting must be in accordance with the pulse string input to use. Make sure to set the proper pulse string input (the inverter) mode selection: [CA-91]. If your setting is incorrect, the motor could make reverse rotations or other unintended movements.

Case where Command Is Given with PG Option Unit

When you use the pulse string that is input in [SAP][SBP][SAN][SBN] of PG option unit as a frequency command, set main speed input source selection, 1st-motor [AA101] to 13 (Pulse string input: Option) and set Pulse train detection object selection [ob-10] to 00 (Pulse train detection object selection).

A pulse string given as input to PG option unit can be used as a frequency command / PID feedback value in each control mode.

Set an input pulse frequency that corresponds to the maximum frequency to the pulse string frequency scale [ob-12].

The pulse string input values to PG option unit can be monitored with [dA-71].

Precautions for Correct Use

- Start/End function of analog input cannot be used. To limit the pulse string input frequency, use the pulse string frequency bias size [ob-14], the pulse string frequency upper detection limit [ob-15], and the pulse string frequency lower detection limit [ob-16]
- When the pulse input frequency is below the pulse string frequency lower detection limit [ob-16], it is regarded as 0 Hz in the processing.
- Slow start if the pulse string frequency lower detection limit [ob-16] is set to a high value.

● Parameter (Main Body)

Item	Parameters	Data	Description	Default data
Main speed input source selection, 1st-motor	[AA101]	13	Frequency command from PG option unit enabled.	01*1
Pulse train detection object selection	[ob-10]	00	Used for frequency command	00
Mode selection of pulse train input	[ob-11]	00	Mode 0: 90° phase difference pulse string	01
		01	Mode 1: Forward/Reverse rotation command and rotation direction	
		02	Mode 2: Forward rotation pulse string and reverse rotation pulse string	
Pulse train frequency Scale	[ob-12]	0.05 to 200.0 (kHz)	A pulse string frequency equivalent to the maximum frequency is given.	25
Pulse train frequency Filter time constant	[ob-13]	0.01 to 2.00 (sec)	A filter is applied to the input of the pulse string frequency.	0.1
Pulse train frequency Bias value	[ob-14]	-100.0 to 100.0(%)	A bias is applied to the input of the pulse string frequency.	0.0
Pulse train frequency High Limit	[ob-15]	0.0 to 100.0 (%)	The output of the pulse string frequency input is limited.	100.0
Pulse train frequency detection low level	[ob-16]	0.0 to 100.0 (%)	In outputting the pulse string frequency input, pulses with the frequency lower than the limit is set to 0.0%.	0.0

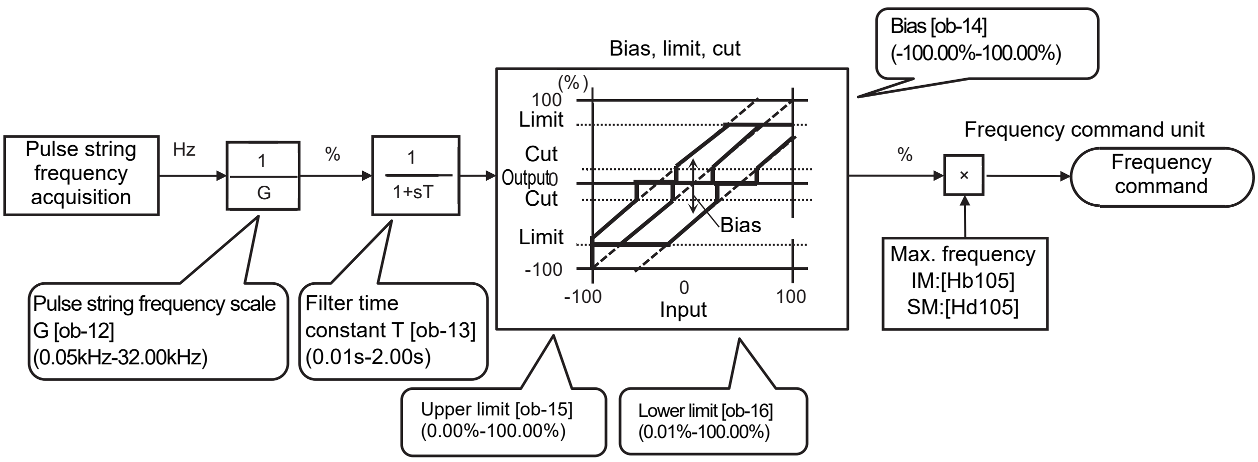
*1. Default data when default data selection (UB-02) is set to 01.

● Monitor (Main Body)

Item	Parameters	Data	Description
Pulse string input monitor (option)	[dA-71]	-100.00 to 100.00(%)	Frequency command from pulse string input (option input A phase / B phase)

● Internal Arithmetic Block Diagram

Internal processing is schematically drawn.



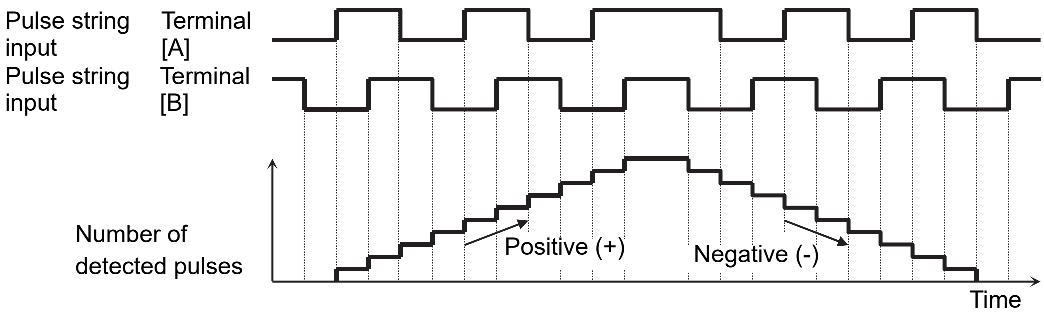
Pulse string frequency processing block

● Details about Pulse String Input Mode

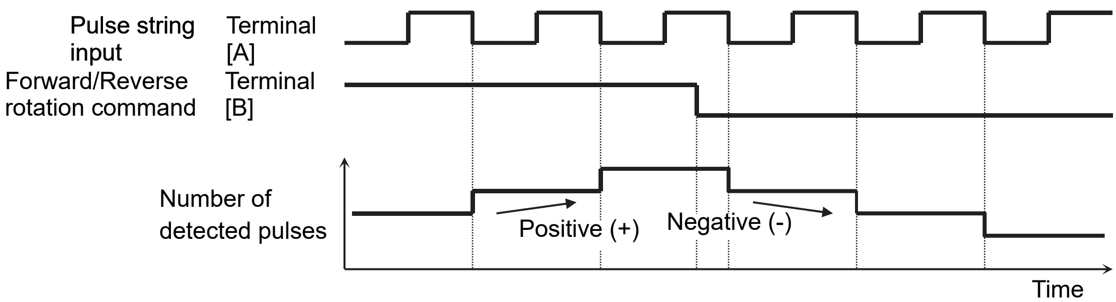
Command frequency is determined by the frequency of the pulse string input.

The sign of the command frequency is determined in the following way.

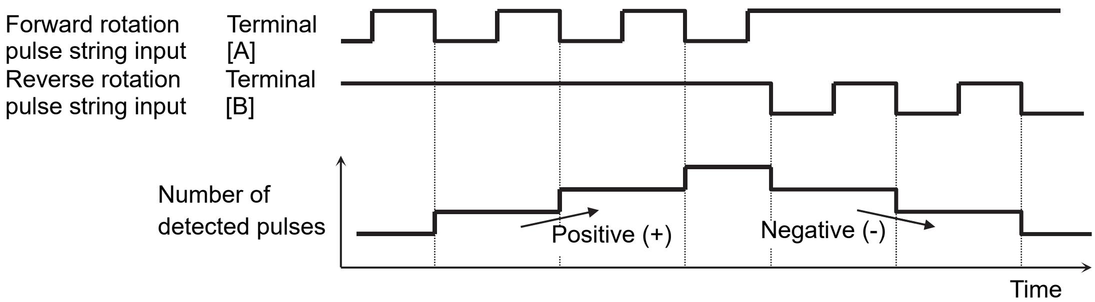
a) Mode 0: [ob-11]=00 90° phase difference pulse string



b) Mode 1: [ob-11]=01 Forward and reverse commands + pulse string



c) Mode 2: [ob-11]=02 Forward rotation pulse string + reverse rotation pulse string



Precautions for Correct Use

Your setting must be in accordance with the pulse string input to use. Make sure to set the proper pulse string input (option) mode selection: [ob-11]. If your setting is incorrect, the motor could make reverse rotations or other unintended movements.

6-4-6 Case where Command Is Given through DriveProgramming

Frequency command is given via DriveProgramming.

A frequency command can be given through the DriveProgramming when Set-Freq command is used in the program for DriveProgramming.

Precautions for Correct Use

- A program created on PC needs to be downloaded from the PC to the inverter.
- Downloaded program begins working when the program action of the DriveProgramming function is enabled.
- For the details, see the instruction manual of DriveProgramming SBCE-440.

● Parameter

Item	Parameters	Data	Description	Default data
Main speed input source selection, 1st-motor	[AA101]	14	Frequency command from the program function is enabled.	01*1
EzSQ function enable	[UE-02]	00	Actions of the downloaded programs disabled.	01
		01	The program starts when [PRG] terminal is made ON.	
		02	The program starts after the setting or power activation.	

*1. Default data when default data selection (UB-02) is set to 01.

6-4-7 Case where Command Is Given with PID Control

Frequency command is given with PID control.

To use the PID control for motor control, PID arithmetic is set in the frequency command selection after the PID function is set.

Precautions for Correct Use

To give a command from the PID control, parameters of the PID control function need to be set. For details, see *8-1 PID Control* on page 8-4.

● Parameter

Item	Parameters	Data	Description	Default data
Main speed input source selection, 1st-motor	[AA101]	15	An arithmetic result of the PID control is output.	01*1

*1. Default data when default data selection (UB-02) is set to 01.

6-4-8 Case where Command Is Given with Main Speed Command and Auxiliary Speed Command

By selecting an operator, you can either switch between main speed and auxiliary speed ([SCHG] switching with [AA105]=00) or make a command (arithmetic frequency) ([AA105] not equal to 00) on the basis of addition, subtraction, or multiplication of the two speeds.

● Parameter

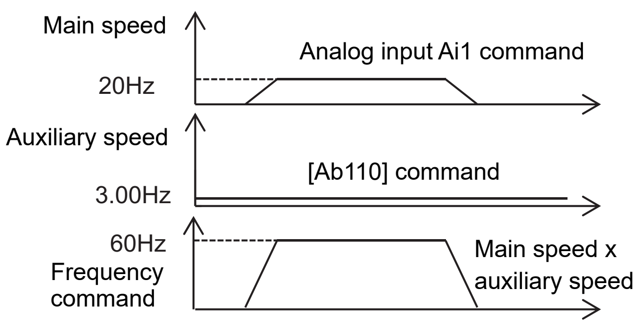
Item	Parameters	Data	Description	Default data
Main speed input source selection, 1st-motor	[AA101]	01 to 15	01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 07: parameter setting, 08: RS485 communication, 12: pulse string input (main body), 13: Pulse string input: Option, 14: program function, 15: PID arithmetic, 00: disabled (only for auxiliary speed)	01*1
Sub frequency input source selection, 1st-motor	[AA102]			00
Calculation symbol selection for Speed reference, 1st-motor	[AA105]	00	The arithmetic function is disabled and can be switched by using the [SCHG] terminal.	00
		01	(Main speed) + (auxiliary speed) is used for the command.	
		02	(Main speed) - (auxiliary speed) is used for the command.	
		03	(Main speed) x (auxiliary speed) is used for the command.	
Input terminal function	[CA-01] to [CA-11]	015	[SCHG] Main speed and auxiliary speed are switched from each other for the operation. OFF: Main speed is effective, ON: Auxiliary speed is effective. Note The operator needs to be [AA105]=00.	-

*1. Default data when default data selection (UB-02) is set to 01.

Calculation with Two Commands

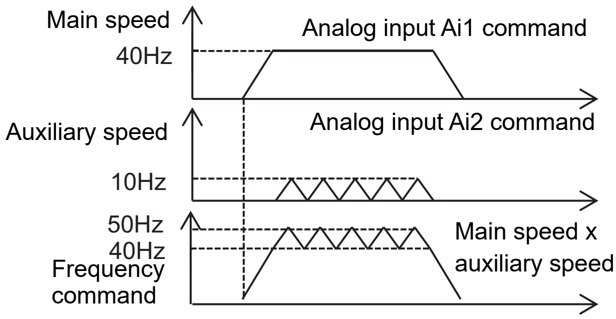
(Ex.1) Gain is multiplied.

[AA101]=01 ([Ai1] command)/[AA102]=07 (set [Ab110])/[AA105]=03 (multiplication)/[Ab110]=3.00(Hz)



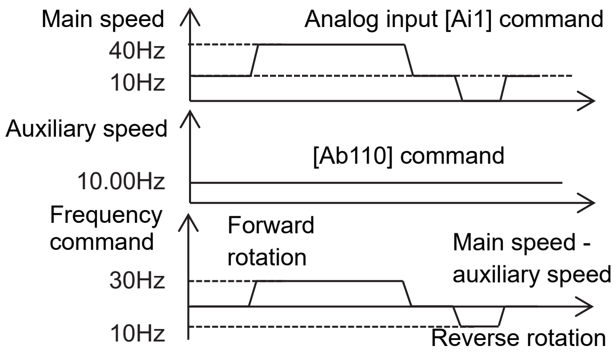
(Ex.2) Command by addition

[AA101]=01([Ai1] command)/[AA102]=02([Ai2] command)/[AA105]=01(addition)



(Ex.3) Forward rotation at a high speed and reverse rotation at a low speed are made by a command.

[AA101]=01 ([Ai1] command)/[AA102]=07 (set [Ab110])/[AA105]=02 (subtraction)/[Ab110]=10.00(Hz)

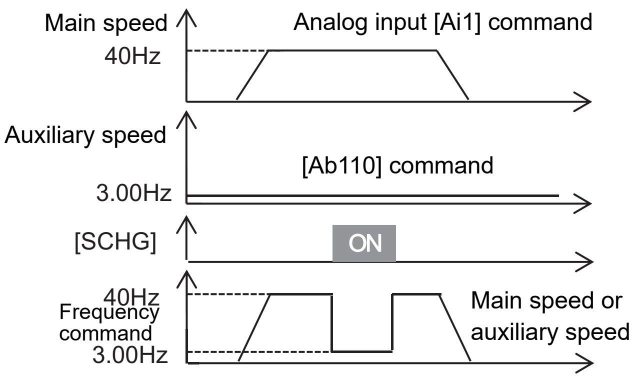


Precautions for Correct Use

- The same setting can be used for both [AA101] and [AA102], Square can be calculated multiplication.
- The input terminal [FUP]/[FDN] functions are effective for commands where the main speed can be set (with the LCD operator setting, multi-speed setting, and analog holding function [AHD]).

Switching with Two Commands

[AA101]=01 ([Ai1] command)/[AA102]=07 (set [Ab110])/[AA105]=00 (disabled)/[Ab110]=3.00(Hz)



Precautions for Correct Use

The output frequency of the inverter accelerates/decelerates toward the frequency command, following the setting of the acceleration/deceleration time.

6-4-9 Case where Command Is Given with Multi-Step Speed

A frequency command is controlled with a signal pattern by setting multiple command frequencies in advance.

In the multi-step speed command, one can either give a binary combination of 0 (OFF) and 1 (ON) or give a priority on certain terminals (bit operation).

In the binary operation, a frequency at maximum 16th speed with four terminals can be set. In the bit operation, a frequency at maximum 8th speed with seven terminals can be set.

Precautions for Correct Use

- If the LCD operator [AA101]=07 is chosen in the frequency command selection, rewriting of the main speed command [FA-01] automatically rewrites [Ab110], frequency setting of the 0th speed.
- The frequency setting for the 1st to 15th speeds should be made in the 1st-15th speeds of the multi-step speed function ([Ab-11]-[Ab-25]).
- With the multi-step speed function, one can set the acceleration/deceleration time individually for the frequency switching in the multi-step speed command. For details, see *6-7-3 Switching of Acceleration or Deceleration Time with Multi-Speed Step* on page 6-61.
- The multi-step speed function is effective only for the main speed command. Not applied to the auxiliary speed command
- If [SET] terminal is made ON and the secondary setting function is used, [Ab210] instead of [Ab110] becomes effective.

● Parameter

Item	Parameters	Data	Description	Default data
Main Speed reference monitor	[FA-01]	Data change depending on the frequency command selection.	The frequency command value is shown.	-
Multispeed operation selection	[Ab-03]	00	Binary operation, max. 16 speed modes	00
		01	Bit operation, max. 8 speed modes	
Multispeed-0 setting, 1st-motor	[Ab110]	0.00/Min. frequency -max. frequency (Hz)	0th speed of the multi-step speed	0.00
Multispeed-1to15 setting	[Ab-11] to [Ab-25]	0.00/Min. frequency -max. frequency (Hz)	1st-15th speeds of the multi-step speed	0.00
Multistage input determination time	[CA-55]	0 to 2000(ms)	This is the time to fix the frequency in switching the multi-step speed.	0

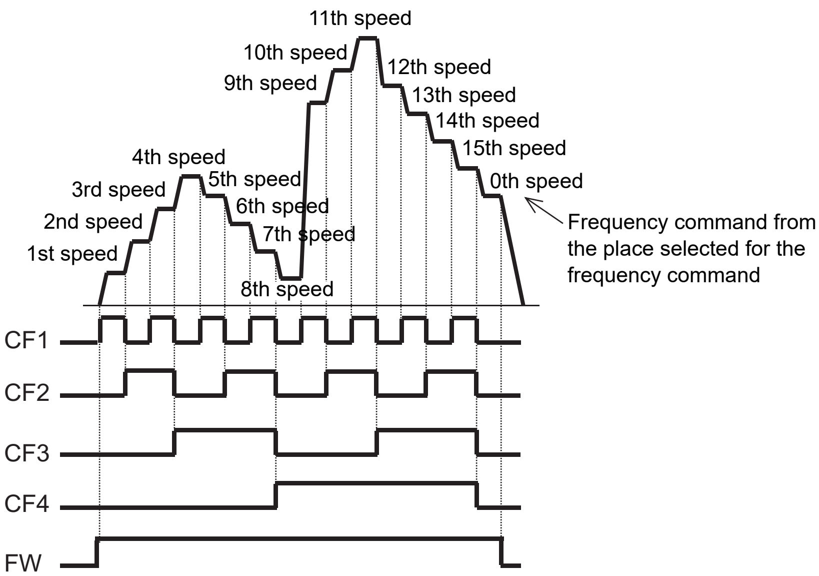
Binary Operation (Maximum 16-speed Command: [Ab-03]=00)

Multi-step speeds of 0th to 15th speeds can be chosen by assigning 003-006 ([CF1]-[CF4]) to the input terminals 1-9, A, and B [CA-01]-[CA-11].

● Action Table

Multi-step speed	CF4	CF3	CF2	CF1	Parameters
0th speed	OFF	OFF	OFF	OFF	**Ab110**
1st speed	OFF	OFF	OFF	ON	**Ab-11**
2nd speed	OFF	OFF	ON	OFF	**Ab-12**
3rd speed	OFF	OFF	ON	ON	**Ab-13**
4th speed	OFF	ON	OFF	OFF	**Ab-14**
5th speed	OFF	ON	OFF	ON	**Ab-15**
6th speed	OFF	ON	ON	OFF	**Ab-16**
7th speed	OFF	ON	ON	ON	**Ab-17**
8th speed	ON	OFF	OFF	OFF	**Ab-18**
9th speed	ON	OFF	OFF	ON	**Ab-19**
10th speed	ON	OFF	ON	OFF	**Ab-20**
11th speed	ON	OFF	ON	ON	**Ab-21**
12th speed	ON	ON	OFF	OFF	**Ab-22**
13th speed	ON	ON	OFF	ON	**Ab-23**
14th speed	ON	ON	ON	OFF	**Ab-24**
15th speed	ON	ON	ON	ON	**Ab-25**

● Action Chart

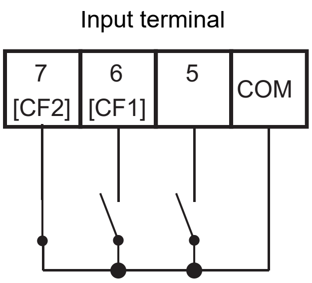


Precautions for Correct Use

- For the binary operation, idling time to wait for a terminal input to be given can be set in the Multistage input determination time [CA-55]. This can prevent transition during terminal switching.
- Data are fixed after the time specified in [CA-55] passes with no change in the input. Input response would be slow if the determination time is set to be large.
- For the command frequency of the 0th speed, the command designated in the Main speed input source selection, 1st-motor [AA101] is used. The above table is for [AA101]=07.

Ex.) 2nd speed is effective.

In this case we have [CA-06]=003 (CF1) and [CA-07]=004 (CF2).
No assignment is made for 005 (CF3) and 006 (CF4).
Only the input terminal No. 7 (CF2) is ON.



Multi-step speed	CF4	CF3	CF2	CF1
1st speed	OFF	OFF	OFF	ON
2nd speed	OFF	OFF	ON	OFF
3rd speed	OFF	OFF	ON	ON

Bit Operation (Maximum 8-speed Command: [Ab-03]=01)

Multi-step speeds of 0th to 7th speeds can be chosen by assigning 007-013 ([SF1]-[SF7]) to the input terminals selection 1-9, A, and B [CA-01]-[CA-11].

The frequency setting of [SF1]-[SF7] should be made to the multi-step speeds of 1st to 7th speeds ([Ab-11]-[Ab-17]).

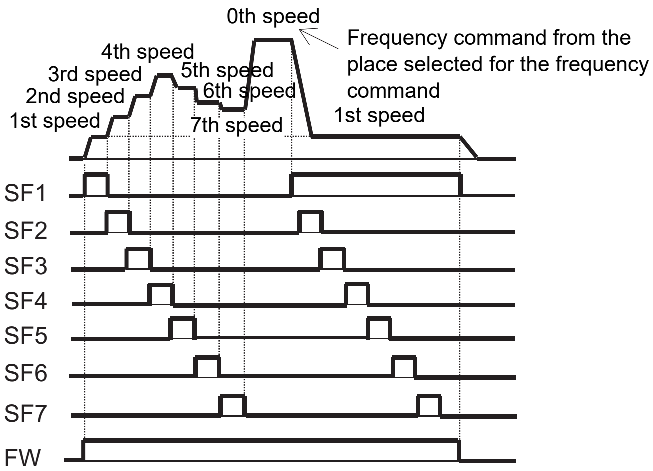
Precautions for Correct Use

- If multiple terminals are made ON simultaneously, the one with smaller number has priority. "-" in the table indicates that a frequency is chosen independently from ON/OFF state of the terminals.
- For the command frequency of the 0th speed, the command designated in the main speed selection [AA101] is used. The following table is for [AA101]=07.

● Action Table

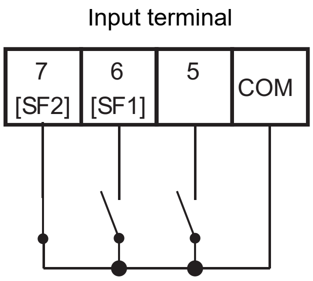
Multi-step speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1	Parameters
0th speed	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**Ab110**
1st speed	-	-	-	-	-	-	ON	**Ab-11**
2nd speed	-	-	-	-	-	ON	OFF	**Ab-12**
3rd speed	-	-	-	-	ON	OFF	OFF	**Ab-13**
4th speed	-	-	-	ON	OFF	OFF	OFF	**Ab-14**
5th speed	-	-	ON	OFF	OFF	OFF	OFF	**Ab-15**
6th speed	-	ON	OFF	OFF	OFF	OFF	OFF	**Ab-16**
7th speed	ON	OFF	OFF	OFF	OFF	OFF	OFF	**Ab-17**

● Action Chart



Ex.) 2nd speed is effective.

In this case we have [CA-06]=007 (SF1) and [CA-07]=008 (SF2).
No assignment is made for 009 (SF3) and 013 (SF7).
Only the input terminal No. 7 (SF2) is ON.



Multi-step speed	SF4	SF3	SF2	SF1
1st speed	-	-		ON
2nd speed	-	-	ON	OFF
3rd speed	-	ON	OFF	OFF

If SF1 becomes ON in this state, the 1st speed becomes effective.

6-4-10 Temporal Addition of Frequency Command

The frequency command can be changed temporally when the frequency is added by turning [ADD] terminal ON.

The frequency command can be subtracted when the sign of the frequency command changes (+) to (-).

Precautions for Correct Use

- The frequency addition of the input terminal function 014 [ADD] is made within the limited frequency range. If the frequency is not within the range between the upper and lower limits or exceeds the maximum frequency, the frequency command is restricted.
- If the sign of the frequency command changes ((-) to (+) or (+) to (-)) as a result of the arithmetic, the rotation direction is reversed.
- This function is also effective for PID target value.

● Parameter

Item	Parameters	Data	Description	Default data
Add frequency setting, 1st-motor	[AA106]	-590.00 to 590.00(Hz)	Sets the frequency to add.	0.00
Input terminal selection	[CA-01] to [CA-11]	014	[ADD] The designated frequency is added.	-

6-4-11 Up/Down Function (FUP, FDN)

The frequency command of the inverter can be changed by a signal input if 020 [FUP terminal and 021 [FDN] terminal are assigned in the input terminal function.

This function works for the selected frequency command when the frequency command selection [AA101] is 07 (parameter effective) or when a multi-step speed command is given.

While [FUP] terminal is turned ON, the frequency command increases.

While [FDN] terminal is turned ON, the frequency command decreases.

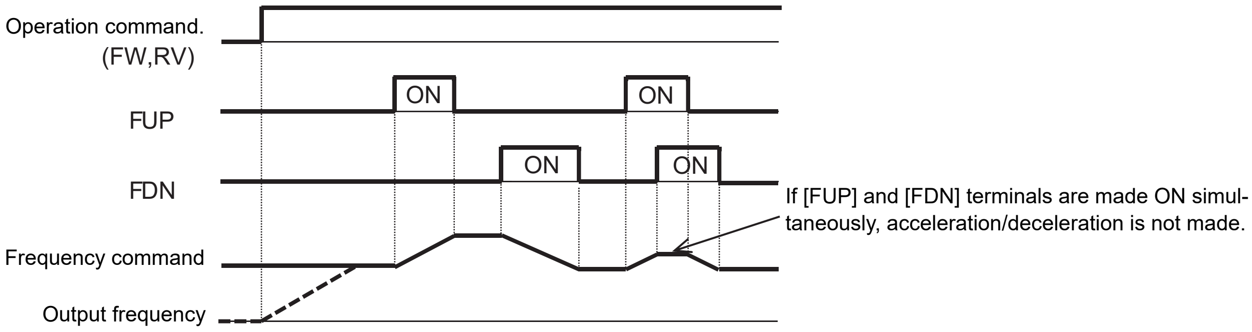
Acceleration/Deceleration follows Acceleration time setting for FUP/FDN function [CA-64]/Deceleration time setting for FUP/FDN function [CA-66].

If 01 (save) is chosen in [CA-61], frequency command data changed with [FUP] terminal and [FDN] terminal can be saved when the power supply is cut off. The operation of an inverter can be resumed with the saved frequency command even after the power supply is cycled. To clear the saved frequency value, assign 022[UDC] to the input terminal and change the [UDC] terminal from ON to OFF. Clearance by [UDC] follows the designated value of [CA-62].

Precautions for Correct Use

- When 020 [FUP] terminal / 021 [FDN] terminal is made ON/OFF immediately after the power shutdown, data may not be able to be correctly saved.
- Cannot be used to set the frequency of the input terminal function 029 [JG] jogging operation.

An example of operation on [FUP] and [FDN] terminals is shown as follow:



- **Parameter**

Item	Parameters	Data	Description	Default data
Main speed input source selection, 1st-motor	[AA101]	01 to 15	01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 07: parameter setting, 08: RS485 communication, 12: pulse string input (main body), 14: program function, 15: PID arithmetic	01*1
Input terminal function selection	[CA-01] to [CA-11]	020	FUP: Acceleration through remote operation	-
		021	FDN: Deceleration through remote operation	
		022	UDC: Clearing of remote operation data	
FUP/FDN overwriting target selection	[CA-60]	00	Overwrites the frequency command.	00
		01	PID target value is overwritten.	
FUP/FDN data save enable	[CA-61]	00	The command is not saved in case of power shutdown.	00
		01	The command is saved in case of power shutdown.	
FUP/FDN UDC selection	[CA-62]	00	Cleared to 0 Hz.	00
		01	Cleared to the saved command.	
Acceleration time setting for FUP/FDN function	[CA-64]	0.00 to 3600.00(s)	Sets acceleration time for FUP/FDN functions.	30.00
Deceleration time setting for FUP/FDN function	[CA-66]	0.00 to 3600.00(s)	Sets deceleration time for FUP/FDN functions.	30.00

*1. Default data when default data selection (UB-02) is set to 01.

6-4-12 Analog Command Hold Function (AHD)

The input terminal 019 [AHD] analog command holding holds the command of the analog input when the input terminal becomes ON. When the input terminal becomes OFF, the command returns to the analog command.

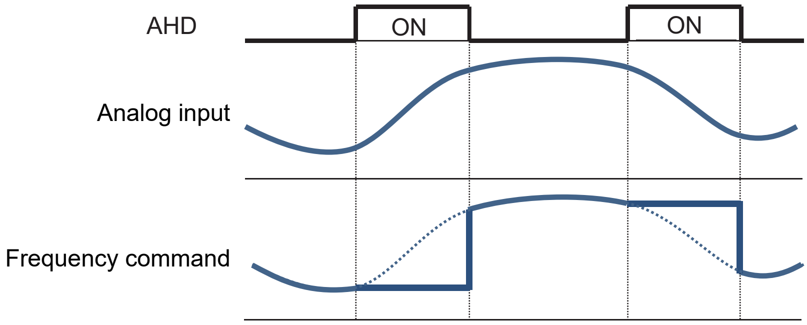
If the main speed command [AA101] is an analog input command (01-03), this function is effective even when data are held by the analog command holding [AHD] function.

If 019[AHD] function is effective, the held data can be moved up/down by using [FUP]/[FDN] function.

Precautions for Correct Use

Data changes with the [FUP]/[FDN] function are not saved.

A frequency command uses [AHD] in the analog input.



- **Parameter**

Item	Parameters	Data	Description
Main speed command selection	[AA101]	01 to 15	01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input
Input terminal function selection	[CA-01] to [CA-11]	019	AHD: Analog command holding

6-4-13 Temporal Change of Frequency Command Destinations

When [F-OP] terminal is ON, the frequency destination can be changed temporally.

When 023 [F-OP] terminal is ON, the command destination of [CA-70] is employed in a priority to the frequency command destination given in [AA101].

Precautions for Correct Use

When 023 [F-OP] terminal is ON, the operation command destination also employs the operation command selection designated in [CA-71].

- **Parameter**

Item	Parameters	Data	Description	Default data
Input terminal function selection	[CA-01] to [CA-11]	023	[F-OP]: Gives a forced command.	-
Speed reference source selection at [F-OP] is active	[CA-70]	01 to 15	01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: parameter setting, 08: RS485 communication, 09:option 1, 10: option 2, 11: option 3, 12: pulse string input (main body), 13: pulse string input (option) 14: program function, 15: PID arithmetic	01
RUN command source selection at [F-OP] is active	[CA-71]	00 to 06	00: [FW]/[RV] terminal, 01: 3 wire, 02: RUN key on LCD operator, 03: RS485 communication, 04: option 1, 05: option 2, 06: option 3	00

6-5 Limit Frequency and Operation Commands

6-5-1 Limit Frequency and Operation Commands

A limiter of the upper and lower limits of the frequency command can be set. The upper limiter can be set from analog input by setting [bA101].

This function limits a frequency command even if a frequency command value outside the range between the upper and lower limiters is set.

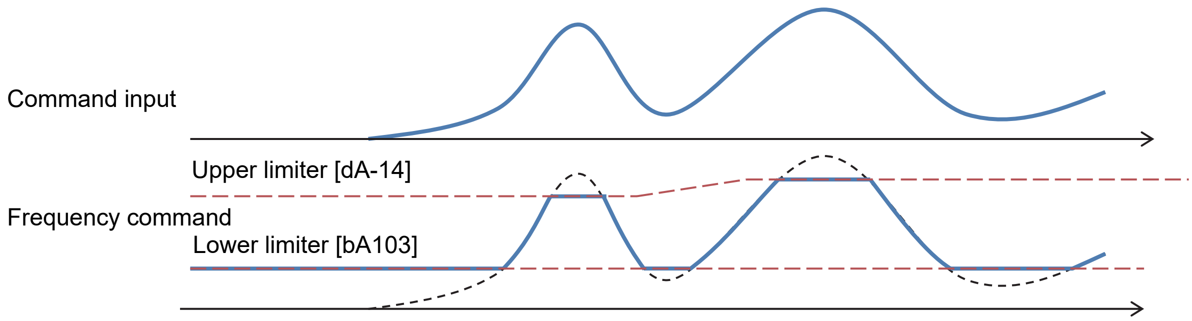
Precautions for Correct Use

- The upper and lower limiters should be set lower than the maximum frequency. Otherwise, warning of the inconsistency will arises.
- To set the limiters, set the upper limiter [bA102] first. Make sure that it is larger than the lower limiter value [bA103].
- Under the restriction by the upper and lower limiters and the minimum frequency, a LIM icon appears.
- To enable Upper Frequency limit [bA102], set [bA101] = 07: Parameter setting.

● Parameter

Item	Parameters	Data	Description	Default data
Max. frequency	For IM [Hb105] For SM (PMM) [Hd105]	10.00 to 590.00(Hz)	Sets the max. frequency. IM: Induction motor [AA121]=00-10 SM(PMM): Synchronous motor (permanent magnet motor) [AA121]=11, 12	50*1
Minimum frequency adjustment, 1st-motor	[Hb130]	0.00 to 10.00(Hz)	Sets the min. frequency to start output. Disabled when [AA121]=09, 10.	0.50
Frequency limit selection, 1st-motor	[bA101]	00 to 13	00 (disabling)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/ 04 (Reserved)/ 05 (Reserved)/06 (Reserved)/ 07 (parameter setting)/08 (RS485)/ 09 (option 1)/ 10 (option 2)/11 (option 3)/ 12 (pulse string input (main body))/ 13 (pulse string input (Option))	00
Upper Frequency limit, 1st-motor	[bA102]	0.00, lower limiter of frequency -max. frequency (Hz)	Sets the upper limit of the frequency command.	0.00
Lower Frequency limit, 1st-motor	[bA103]	0.00, start frequency -upper limiter of frequency (Hz)	Sets the lower limit of the frequency command. Disabled when 0.00 is set.	0.00
Frequency upper limit monitor	[dA-14]	0.00 to 590.00(Hz)	The employed upper limit of the frequency is shown.	-

*1. Default data when default data selection (UB-02) is set to 01.



6-5-2 Limit Operation Command Direction

Output in the allowed rotation direction can be obtained by setting the RUN-direction restriction, 1st-motor [AA114] to limit the direction of the operation.

Set the operation direction limit selection if reverse operation output could adversely affect connected machines.

The reverse rotation direction command due to a negative value of the frequency is also restricted.

Output stops when the direction is being limited.

Precautions for Correct Use

- Even if this function works, you may have output of reverse operation as a result of the control other than V/f control. In this case, enable the reverse operation prevention function.
  See *6-5-3 Limit Output Direction* on page 6-45.
- Even if this function is used, the motor may rotate in the reverse direction under an external force applied in that direction. If you use this function to limit the operation direction, use the function for a system that does not receive an external force applied in the reverse direction.

● Parameter

Item	Parameters	Data	Description	Default data
RUN-direction restriction, 1st-motor	[AA114]	00	Both forward and reverse rotations enabled	00
		01	Only forward rotation enabled	
		02	Only reverse rotation enabled	

6-5-3 Limit Output Direction

Under some control, output at a low speed in the direction opposite to the one specified in the operation command may occur. The output can be restricted in the direction specified in the operation command if the reverse rotation prevention function selection [HC114] is used.

Enable the reverse rotation prevention function selection if the reverse rotation of the motor could give damage to the connected machine.

Precautions for Correct Use

- This function is enabled when the control method [AA121] is set to 08 (sensorless vector control), 09 (sensorless vector control in zero speed range), or 10 (vector control with sensor).
- Even if this function is used, the motor may rotate in the reverse direction under a high-load external force applied in that direction. If you use this function to limit the operation direction, make sure that the motor would not make reverse rotation.

Item	Parameters	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	08	Sensorless vector control	00
		09	Sensorless vector control in zero speed range*1	
		10	Vector control with sensor*1	
Counter direction run protection selection, 1st-motor	[HC114]	00	Disabled	00
		01	Enabled	

*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 02 (VLD).

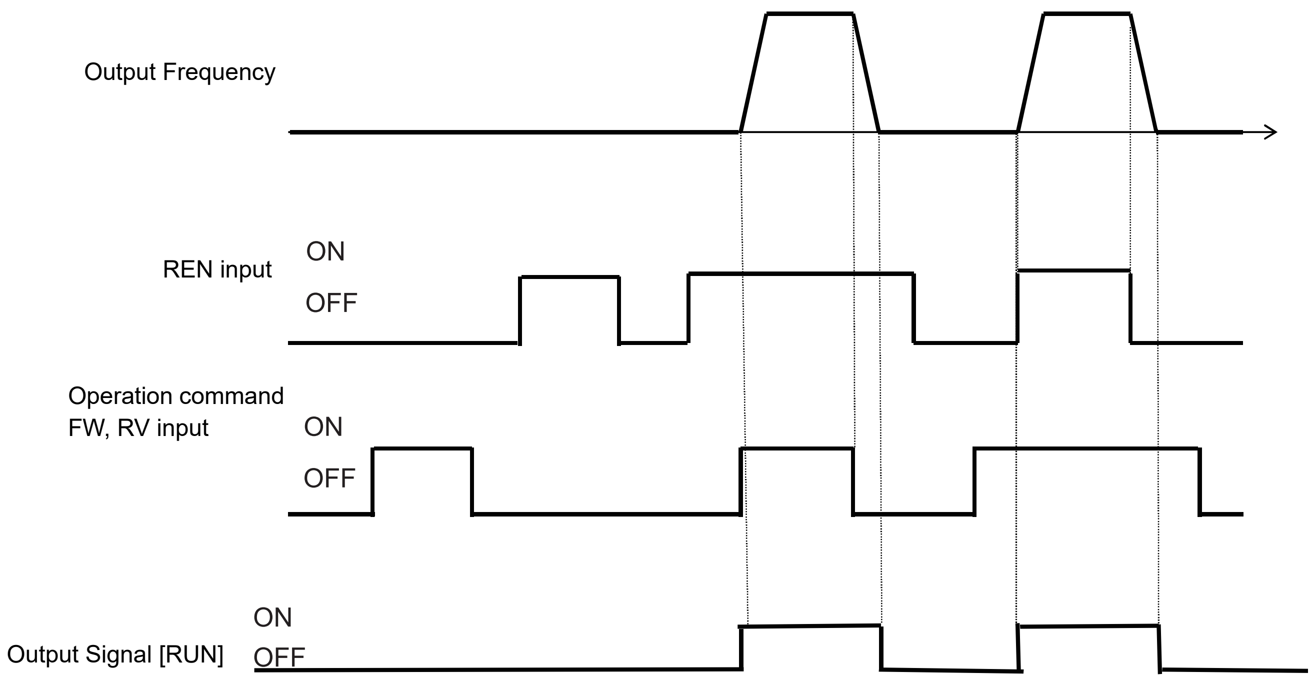
6-5-4 Operation Permission

The system is configured in such a way that the operation can be stopped for safety irrespective of the operation command until the system allows the operation.

This function becomes enabled when 101[REN] is set to any of the input terminal selections [CA-01]-[CA-11].

Precautions for Correct Use

The operation does not start if [REN] is set to OFF. To make output from the inverter based on an operation command in a trial operation, [REN] needs to be set to 000[no] temporarily.



● Parameter

Item	Parameters	Data	Description
Input terminal function	[CA-01] to [CA-11]	101	[REN]: Controls Permitted/Not permitted using operation permission signal. ON: Allowed OFF: Not allowed

6-6 Thermal Protection of Motor (Electronic Thermal)

6-6-1 Electronic Thermal Setting

Electronic thermal setting enables a motor to be protected from thermals.

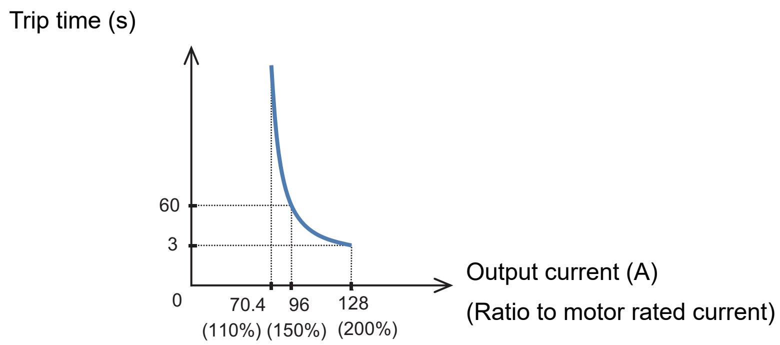
Change of Electronic Thermal Level

Setting in accordance with the motor rated current protects the motor from continuous current flows. To make the protection earlier, the protection level should be set lower than the motor rated current.

(Ex.1) Motor rated current 64A ([bC110]=64.0A)

Setting range:12.8A(20%) to 204.0A(300%)

When driven at a base frequency



Precautions for Correct Use

- Make the setting correctly as this is necessary to protect the motor.
- When the thermal protection begins, [E005] motor electronic thermal error occurs.
- Irrespective of the thermal setting of the motor, the inverter electronic thermal protection works independently to protect the inverter.
- When the current grows rapidly, [E001] excessive current error could occur before [E005] motor electronic thermal error.
- Even electronic thermal level is set high, electronic thermal for the inverter works separately and it may be reduced from 5 Hz while the reduction ratio may be × 0.8 at 0 Hz.

The electronic thermal time-limited characteristics is shown in (Ex.1) when the electronic thermal level setting, 1st-motor [bC110] is 64A

Example 1 shows the case of reduction ratio x1. (For example, the case of the motor driven at a base frequency for [bC111]=01.)

The magnification ratio and hence the time to a trip could change depending on the choice of the electronic thermal characteristic.

A trip occurs in 60 seconds when an electric current of 150% of the electronic thermal level x1 flows continuously.

● Parameter

Item	Parameters	Data	Description	Default data
First electronic thermal level	[bC110]	In range of 20 to 300% of the inverter rated current (unit: A)[*1]	Sets the protection current of motor.	1.00 × Inverter rated current
Electronic thermal characteristic selection, 1st-motor	[bC111]	00	Reduced torque characteristics: Pattern for cooling function deterioration at a low speed	01[*2]
		01	Constant torque characteristics: Pattern for constant output	
		02	Free setting: Multiple patterns are available according to the motor characteristics.	

*1. The inverter rated current is switched by the load type selection [Ub-03]. Even if [bC110] is set to be high, [E001] excessive current error occurs when the current exceeds the excess current level.

*2. Default data when default data selection (UB-02) is set to 01.

Change of Electronic Thermal Characteristics

Optimal protection characteristics can be achieved with the deterioration of the cooling ability of the motor at a low speed taken account of. ([bC111]=00)

Frequency-dependent characteristics can be set in the selection of the electronic thermal characteristics. ([bC111]=02)

Precautions for Correct Use

- Autocooling motor needs to be used with reduced load (current) since the cooling function of the autocooling fan becomes less effective when the motor rotation frequency decreases.
- The reduced torque characteristics are in accordance with the heat generation of the autocooling motor.

● Parameter

Item	Parameters	Data	Description	Default data
Electronic thermal characteristic selection, 1st-motor	[bC111]	00	Reduced torque characteristics: Pattern for cooling function deterioration at a low speed	01[*1]
		01	Constant torque characteristics: Pattern for constant output	
		02	Free setting: Multiple patterns are available according to the motor characteristics.	

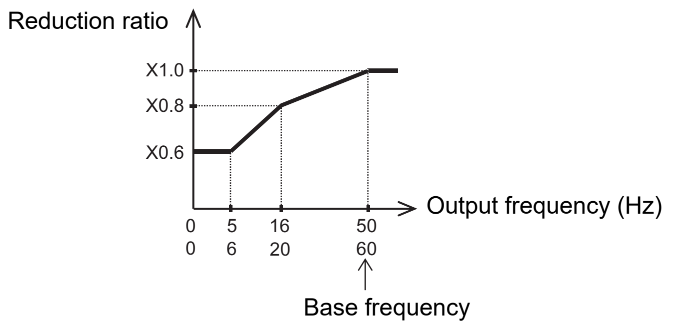
*1. Default data when default data selection (UB-02) is set to 01.

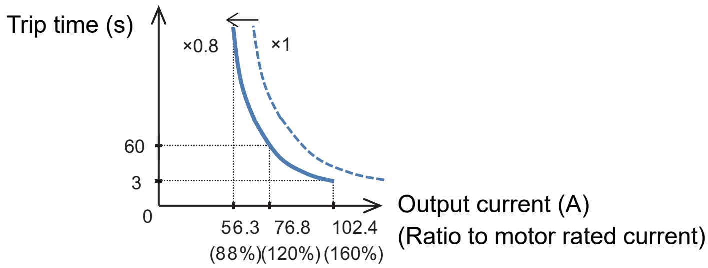
● Reduced Torque Characteristics [bC111]=00

Can be used for load reduction in accordance with the cooling performance at a low speed.

(Ex.2) Induction motor rated current 64A, [bC110]=64 (A)

For base frequency [Hb104]=60 Hz, output frequency=20 Hz





When the first electronic thermal level [bC110] is 64 A, the reduction ratio is ×0.8 for operations at a base frequency of 60 Hz and output frequency of 20 Hz and the electronic thermal time-limited characteristics are given in the lower part of Example 2.

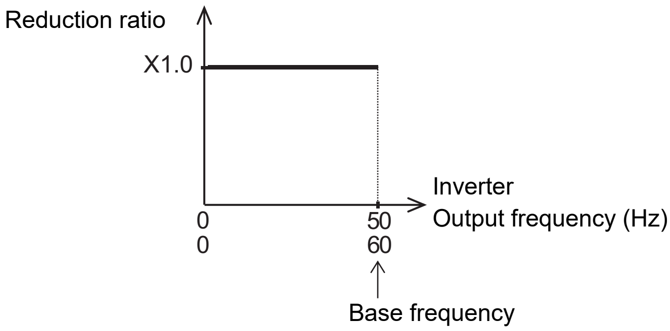
Since Example 1 shows the case of the reduction ratio ×1, a trip occurs in 60 seconds when an electric current of 150% ×1 of the motor rated current flows continuously. However in Example 2, a trip occurs in 60 seconds when an electric current of 150%×0.8=120% of the motor rated current flows continuously.

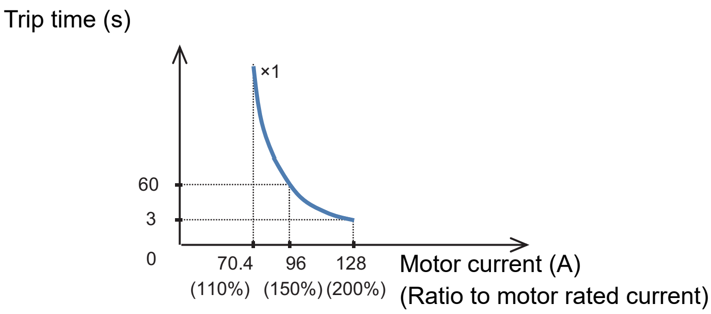
● Constant Torque Characteristics [bC111]=01

Use this setting to use the constant-torque motor

(Ex.3) For induction motor rated current: 64A, [bC110]=64(A)

Base frequency [Hb104]=50 Hz, output frequency =5 Hz





When the first electronic thermal level [bC110] is 64 A, the reduction ratio is ×1.0 for operations at a base frequency of 50 Hz and output frequency of 5 Hz and the electronic thermal time-limited characteristics are given in the lower part of Example 3.

Since Example 1 shows the case of the reduction ratio ×1, a trip occurs in 60 seconds when an electric current of 150% ×1 of the motor rated current flows continuously. The performance in the example 3 is the same as the one in the example 1.

● Free Settings [bC111]=02

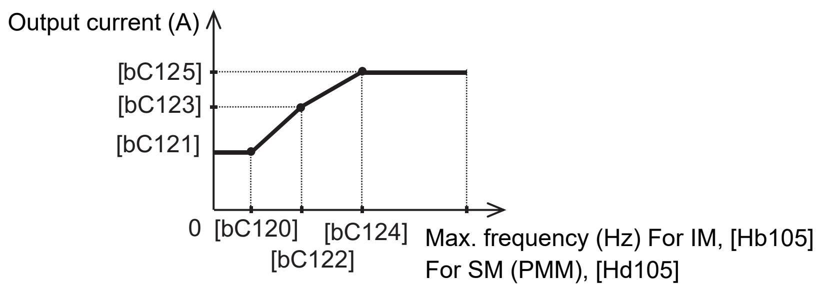
To protect the motor, the electronic thermal characteristics can be freely set in accordance with the load.

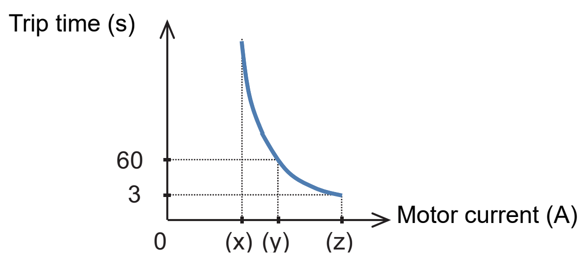
● Parameter

Item	Parameters	Data	Description	Default data
Free electronic thermal frequency 1	[bC120]	0.00 to [bC122](Hz)	Frequency corresponding to free electronic thermal current 1	0.00
Free electronic thermal current 1	[bC121]	Inverter rated current x 0 to 300% (A)*1	Current corresponding to free electronic thermal frequency 1	0.0
Free electronic thermal frequency 2	[bC122]	[bC120] to [bC124](Hz)	Frequency corresponding to free electronic thermal current 2	0.00
Free electronic thermal current 2	[bC123]	Inverter rated current x 0 to 300% (A)*1	Current corresponding to free electronic thermal frequency 2	0.0
Free electronic thermal frequency 3	[bC124]	[bC122] to 590.00(Hz)	Frequency corresponding to free electronic thermal current 3	0.00
Free electronic thermal current 3	[bC125]	Inverter rated current x 0 to 300% (A)*1	Current corresponding to free electronic thermal frequency 3	0.0

*1. The inverter rated current is switched by the load type selection [Ub-03].

(Ex.4) For output frequency of [bC122]





(x): [bC123]×110%
(y): [bC123]×150%
(z): [bC123]×200%

When the output frequency coincides with the free electronic thermal frequency-2, 1st-motor [bC122], the electronic thermal time-limited characteristics are given in the lower part of Example 4.

In Example 4, a trip occurs in 60 seconds when an electric current of 150% of the free electronic thermal current-2, 1st-motor [bC123] flows continuously.

Precautions for Correct Use

- When [bC121][bC123][bC125] are set as default (0.00) and [bC111] electronic thermal is set as 02, E005 is generated.
- Set the free electronic thermal frequency in the order of [bC125], [bC123] and [bC121]. At that time, set in the following manner: [bC125]≥[bC123]≥[bC121].

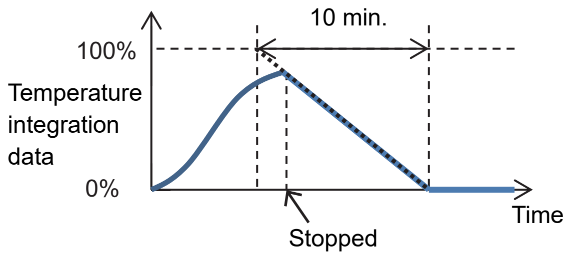
Change of Heat Emission Characteristics of Electronic Thermal

When you set Electronic thermal Subtraction function enable, 1st-motor [bC112] to 01 (Enabled) when the current is below the electronic thermal level, the temperature integration data can be reduced according to the heat emission from the motor.

Precautions for Correct Use

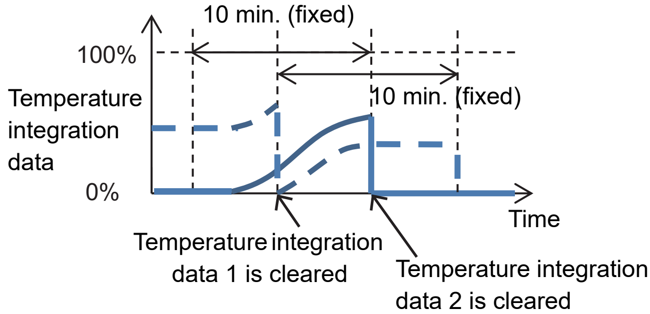
- The electronic thermal of the inverter works independently even when the electronic thermal subtraction time is made shorter.
- Appropriate setting should be made for the motor that you use.
- In case of [bC112]=00, resetting cannot be made in 10 seconds after occurrence of an error.
- [bC112]=00 to be set to be equivalent to 3G3RX-V1 Series.

Ex.1) Subtraction mode ([bC112]=01, for [bC113]=600 s (10 min.))



Ex.2) Constant period mode ([bC112]=00)

In the constant period mode, a motor overload error [E005] and a trip occurs when either of the duplicated counters reaches 100%. In the constant period mode, the thermal subtraction data are cleared every 10 minutes (fixed).



Note In the constant period mode, a trip occurs when either of the duplicated counters reaches 100%. In the constant period mode, data are cleared every 10 minutes.

● Parameter

Item	Parameters	Data	Description	Default data
Electronic thermal Subtraction function enable, 1st-motor	[bC112]	00	Invalid: constant period mode The temperature integration data are cleared every 10 minutes.	01
		01	Valid: Subtraction mode The temperature integration data are subtracted in accordance with the heat emission of the motor.	

Item	Parameters	Data	Description	Default data
Electronic thermal Subtraction time, 1st-motor	[bC113]	1s to 1000s	Should be set in accordance with the heat emission time of the motor. Sets the time for the integration data to change form 100% to 0%.	600

When the Power Supply Is Shut off or Reset, Electronic Thermal Data Is Held

The temperature integration data of the motor are saved even after power termination or inverter trip resetting. When the motor current increases again when the power is made on or the system is reset, the system is restarted with the saved temperature integration data.

Precautions for Correct Use

When the data-holding function is used, the integration data are held even if the inverter is powered off for a long period of time, and a risk of occurrence of an error would increase. After it is powered on, a short-time operation could cause an error.

The temperature integration data of an inverter is reset when the power supply is shut-off.

Item	Parameters	Data	Description	Default data
Electronic thermal counter memory selection at Power-off	[bC-14]	00	Not holding: The temperature integration data are cleared by the power shut-off and resetting.	01
		01	Holding: The temperature integration data are not cleared and subtracted only in the subtraction mode.	

Electronic Thermal State Monitor

The integration state can be monitored from [dA-42] electronic thermal load rate monitor (motor).

If you want a warning signal when the electronic thermal exceeds a certain level, set the output signal function 026 [THM] and [CE-30] electronic thermal warning level (motor). For details, see *8-6-8 Motor Thermal Warning Signal (THM)* on page 8-133.

The integration state can be monitored from [dA-43] electronic thermal load rate monitor (controller).

If you want a warning signal when the electronic thermal exceeds a certain level, set the output signal function 027 [THC] and [CE-31] electronic thermal warning level (controller). For details, see *8-6-9 Inverter Thermal Warning Signal (THC)* on page 8-134.

6-6-2 Monitoring of Motor Temperature

The temperature protection of an external device can be made by connecting a thermistor installed in the motor or other external device to the inverter and setting the function of the thermistor.

The external thermistor should be wired between the control terminals TH+ and TH-.

Set the thermistor selection [Cb-40] and the resistance value at error occurrence [bb-70] in accordance with the thermistor's specifications.

[E035] thermistor error occurs when the thermistor resistance reaches the thermistor error level [bb-70] depending on the motor temperature.

When [Cb-40] is set to 02, [dA-38] motor temperature monitor indicates the detected temperature of the motor.

Precautions for Correct Use

- When an external thermistor is not connected, a trip occurs if the thermistor selection [Cb-40] is set to 01.
- To use this function, the wiring distance between the motor and the inverter has to be 20 m or shorter. Since the current flowing in the thermistor is very weak, a measure such as wiring separation should be taken to prevent noise from the motor current.
- When [Cb-40] is set to a value other than 02, [dA-38] motor temperature monitor indicates 0 °C.

● Parameter

Item	Parameters	Data	Description	Default data
Thermistor error level	[bb-70]	0 to 10000.(Ω)	Set the resistance for the temperature at which a trip occurs in accordance with the thermistor resistance specifications. Effective when [Cb-40]=01, 02	3000
Thermistor selection	[Cb-40]	00	Disabled	00
		01	Enabled Positive temperature coefficient resistor (PTC)	
		02	Enabled Negative temperature coefficient resistor (NTC)	
Thermistor gain adjustment	[Cb-41]	0.0 to 1000.	Use as gain adjustment.	100.0
Motor temperature monitor	[dA-38]	-20.0 to 200.0(C°)	Indicates the detected motor temperature.	-

6-7 Acceleration/Deceleration Settings

6-7-1 Change Acceleration Time and Deceleration Time

Set up the acceleration time and the deceleration time of the motor. Set a longer time for slower acceleration or deceleration; set a shorter time for faster acceleration or deceleration.

As for the acceleration time, set the time that it takes to rise from 0 Hz to the maximum frequency; as for the deceleration time, set the time that it takes to fall from the maximum frequency to 0 Hz.

In the initial state, the acceleration time setting 1, 1st-motor [AC120] and the deceleration time setting 1, 1st-motor [AC122] are enabled.

The currently enabled acceleration time and deceleration time can be monitored with [FA-10] and [FA-12], respectively; In the initial state, [FA-10] = [AC120] acceleration time 1 and [FA-12] = [AC122] deceleration time 1

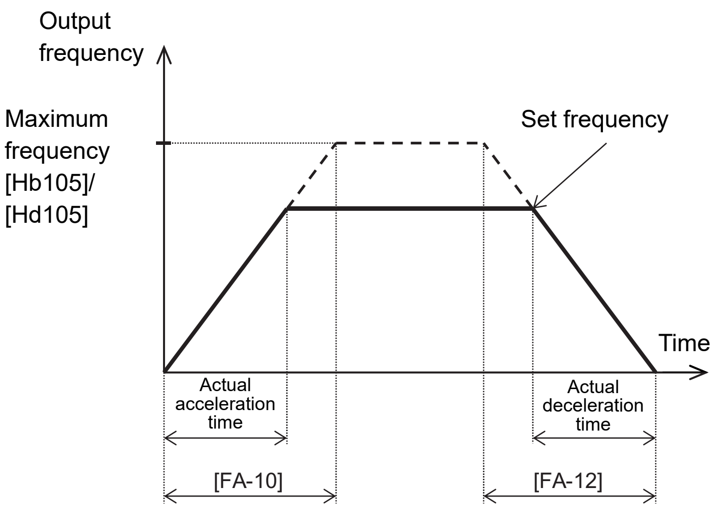
Precautions for Correct Use

- When the function of acceleration or deceleration action cancellation 071 [LAC] is selected as the Input terminal function and the signal is turned ON, the set acceleration or deceleration time will be reset to 0 seconds and the output frequency will be made instantaneously to follow the frequency command.
- The target of command for the acceleration or deceleration time can be selected with [AC-01].
  - Employ the internally-set acceleration or deceleration time.
  - Employ the acceleration or deceleration time of the program function Drive Programming.
- The acceleration or deceleration time may be changed in response to the command given by the multi-speed function. For details, see *6-4-9 Case where Command Is Given with Multi-Step Speed* on page 6-37.

● Parameter

Item	Parameters	Data	Description	Default data
Maximum frequency	For IM, [Hb105] For SM (PMM), [Hd105]	10.00 to 590.00(Hz)	Set the maximum value for the frequency.	50*1
Acceleration time setting 1, 1st-motor	[AC120]	0.00 to 3600.00(s)	Set, as the acceleration time, the time that it takes to rise from 0 Hz to the maximum frequency.	30.00
Deceleration time setting 1, 1st-motor	[AC122]	0.00 to 3600.00(s)	Set, as the deceleration time, the time that it takes to fall from the maximum frequency to 0 Hz.	30.00
Acceleration/ Deceleration Time input selection	[AC-01]	00 to 04	00: Parameter set-up 04: Program function DriveProgramming	00
Input terminal selection	[CA-01] to [CA-11]	071	Acceleration or deceleration cancellation function [LAC] OFF: Function disabled. ON: Ignore the acceleration or deceleration time, and follow the command.	-
Acceleration time (Monitor + Setting)	[FA-10]	0.00 to 3600.00(s)	Display the currently-enabled acceleration time.	-
Deceleration time (Monitor + Setting)	[FA-12]	0.00 to 3600.00(s)	Display the currently-enabled deceleration time.	-

*1. Default data when default data selection (UB-02) is set to 01.



Acceleration time t_s

$$t_S = \frac{(J_L+J_M) \times N_M}{9.55 \times (T_S-T_L)}$$

Deceleration time t_B

$$t_B = \frac{(J_L+J_M) \times N_M}{9.55 \times (T_B+T_L)}$$

J_L : Moment of inertia J ($kg \cdot m^2$) of the load converted into that of the motor shaft.

J_M : Moment of inertia J ($kg \cdot m^2$) of the motor.

N_M: Revolution speed of the motor (r/min)

T_s : Maximum acceleration torque (N·m) of the motor driven by the inverter.

T_B : Maximum deceleration torque (N·m) of the motor driven by the inverter.

T_L : required operating torque (N·m)

Precautions for Correct Use

However short the acceleration or deceleration time is set, the actual acceleration or deceleration of the motor cannot be shorter than the minimum acceleration or deceleration time that is determined by the moment of inertia J of the mechanical system and the motor torque. An act of acceleration or deceleration in a shorter time than the minimum acceleration or deceleration time may cause an over current or over voltage trip to happen.

6-7-2 Switch Acceleration Time and Deceleration Time in Two Stages

Setting this function allows you to change the acceleration or deceleration time while driving in response to the terminal command, the frequency command, or the direction command.

When [AC115] = 00, setting 031 [2CH] in any of the [CA-01] to [CA-11] and turning OFF/ON the target Input terminal allows you to switch the acceleration or deceleration time. ⇒ (Example 1)

When [AC115] = 01, the frequency command and the relationship between the set values [AC116] and [AC117] can be used to switch the acceleration or deceleration time.

⇒ (Example 2)

When you set Select method to switch to Accel2/Decel2 Profile, 1st-motor [AC115] to 02 (Switching normal/reverse rotation), the acceleration time and deceleration time can be configured by setting forward or backward rotation.

⇒ (Example 3)

Precautions for Correct Use

When the input terminal is used for switching, operation should be performed by assigning 031 [2CH] to any of [CA-01] to [CA-11].

● Parameter

Item	Parameters	Data	Description	Default data
Maximum frequency	For IM, [Hb105] For SM (PMM), [Hd105]	10.00 to 590.00(Hz)	Set the maximum value for the frequency.	50*1
Acceleration time setting 1, 1st-motor	[AC120]	0.00 to 3600.00(s)	Set, as the acceleration time, the time that it takes to rise from 0 Hz to the maximum frequency.	30.00
Deceleration time setting 1, 1st-motor	[AC122]	0.00 to 3600.00(s)	Set, as the deceleration time, the time that it takes to fall from the maximum frequency to 0 Hz.	30.00
Acceleration time setting 2, 1st-motor	[AC124]	0.00 to 3600.00(s)	Set, as the acceleration time, the time that it takes to rise from 0 Hz to the maximum frequency.	15.00
Deceleration time setting 2, 1st-motor	[AC126]	0.00 to 3600.00(s)	Set, as the deceleration time, the time that it takes to fall from the maximum frequency to 0 Hz.	15.00
Select method to switch to Accel2/Decel2 Profile, 1st-motor	[AC115]	00	Switching by [2CH] terminal (Example 1)	00
		01	Switching by 2-stage acceleration or deceleration frequency (Example 2)	
		02	Enabled only when the revolution is switched between the forward and the backward directions (Example 3)	
Accel1 to Accel2 Frequency transition point, 1st-motor	[AC116]	0.00 to 590.00(Hz)	Enabled when 2-stage acceleration or deceleration selection [AC115] is 01.	0.00
Decel1 to Decel2 Frequency transition point, 1st-motor	[AC117]	0.00 to 590.00(Hz)	Enabled when 2-stage acceleration or deceleration selection [AC115] is 01.	0.00

Item	Parameters	Data	Description	Default data
Acceleration/ Deceleration Time input selection	[AC-01]	00	Use the “Setting” of the operator keypad to input the type.	00
Input terminal function selection	[CA-01] to [CA-11]	031	2-stage acceleration or deceleration function [2CH]. When [AC115] = 00, OFF: The set acceleration or deceleration command is enabled. ON: [AC124]/[AC126] is forcefully enabled.	-

*1. Default data when default data selection (UB-02) is set to 01.

Precautions for Correct Use

Set, as the acceleration time, the time that it takes to rise from 0 Hz to the maximum frequency; and set as the deceleration time, the time that it takes to fall from the maximum frequency to 0 Hz. Each of the set times is the corresponding one of the following values.

Acceleration time 1: Calculated value from [AC120];

Deceleration time 1: Calculated value from [AC122];

Acceleration time 2: Calculated value from [AC124]; and

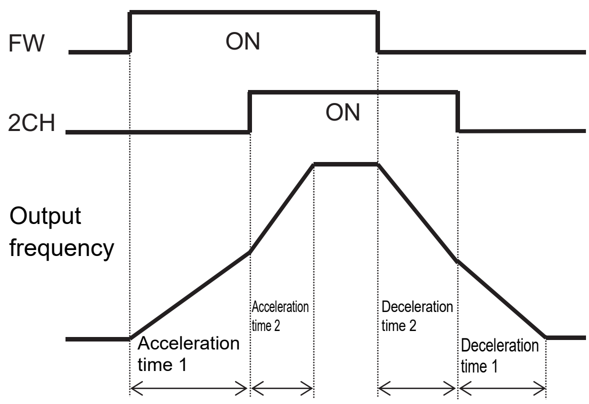
Deceleration time 2: Calculated value from [AC126].

You can use [AC115] to select one of the following three methods of switching the acceleration or deceleration time:

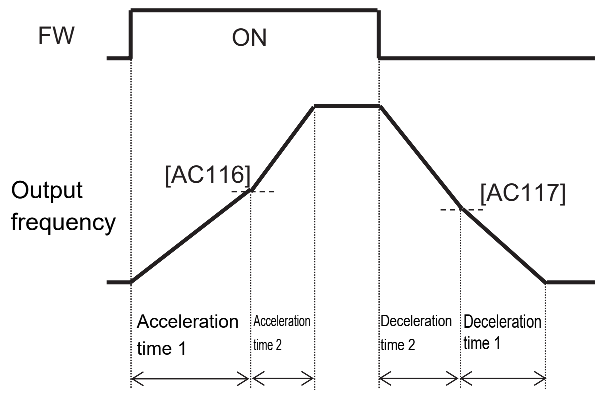
- Switching by the Input terminal function [2CH];
- Automatically switching by any given frequency; and
- Automatically switching only at the time of switching between the forward revolution and the backward revolution.

Described below is an exemplar case of switching between the acceleration or deceleration time 1 and the acceleration or deceleration time 2.

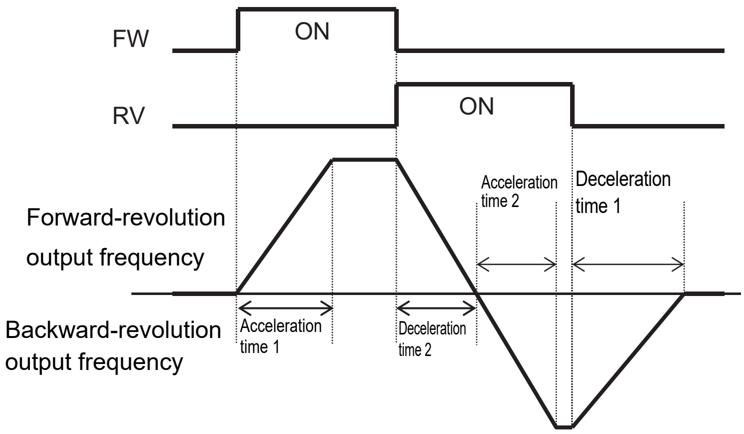
(Example 1) In the case of setting [AC115] = 00



(Example 2) In the case of setting [AC115] = 01



(Example 3) In the case of setting [AC115] = 02



6-7-3 Switching of Acceleration or Deceleration Time with Multi-Speed Step

Setting up this function allows the acceleration or deceleration time to be changed in response to the multi-speed command.

Also this function changes several settings of acceleration/deceleration times while the motor is being accelerated to reach the fixed frequency.

Precautions for Correct Use

- When using the input terminal function to switch the multiple speeds, operation should be performed by assigning 003 [CF1] to 006 [CF4] or 007 [SF1] to 013 [SF7] to any of [CA-01] to [CA-11].
- When [AC-02] Acceleration/ Deceleration Selection is 01, the 2-stage acceleration or deceleration function is disabled.

● Parameter

Item	Parameters	Data	Description	Default data
Acceleration/ Deceleration Selection	[AC-02]	00	The acceleration or deceleration time follows [AC120]/[AC122] or [AC124]/[AC126] (when 2-stage acceleration or deceleration function is enabled).	00
		01	The acceleration or deceleration time will be switched in accordance with the multi-speed command.	
Multi-speed command	[Ab-11] to [Ab-25]	0.00 to 590.00(Hz)	Set the multi-speed command with 1st speed [Ab-11] to 15th speed [Ab-25].	0.00
Acceleration time set-up for the multi-speed 1st to 15th speeds	[AC-30], [AC-34], [AC-38], [AC-42], [AC-46], [AC-50], [AC-54], [AC-58], [AC-62], [AC-66], [AC-70], [AC-74], [AC-78], [AC-82], [AC-86]	0.00 to 3600.00(s)	Set an acceleration time ranging from 0 Hz to the maximum frequency for each of the multi-speed commands.	0.00
Deceleration time set-up for the multi-speed 1st to 15th speeds	[AC-32], [AC-36], [AC-40], [AC-44], [AC-48], [AC-52], [AC-56], [AC-60], [AC-64], [AC-68], [AC-72], [AC-76], [AC-80], [AC-84], [AC-88]	0.00 to 3600.00(s)	Set a deceleration time ranging from the maximum frequency to 0 Hz for each of the multi-speed commands.	0.00
Multispeed operation selection	[Ab-03]	00	Corresponding to 16-speed binary operation. 003[CF1] to 006[CF4]	00
		01	Corresponding to 8-speed bit operation. 007[SF1] to 013[SF7]	
Input terminal function selection	[CA-01] to [CA-11]	003 to 006/ 007 to 013	Implementing the multi-speed command. 003[CF1] to 006[CF4]/007[SF1] to 013[SF7]	-

Shown below are the multi-speed table for binary operation (when [Ab-03] = 00) and that for bit operation (when [Ab-03] = 01).

Table for Binary Operation

[Ab-03]=00.

Input terminal function 003 [CF1] to 006 [CF4]

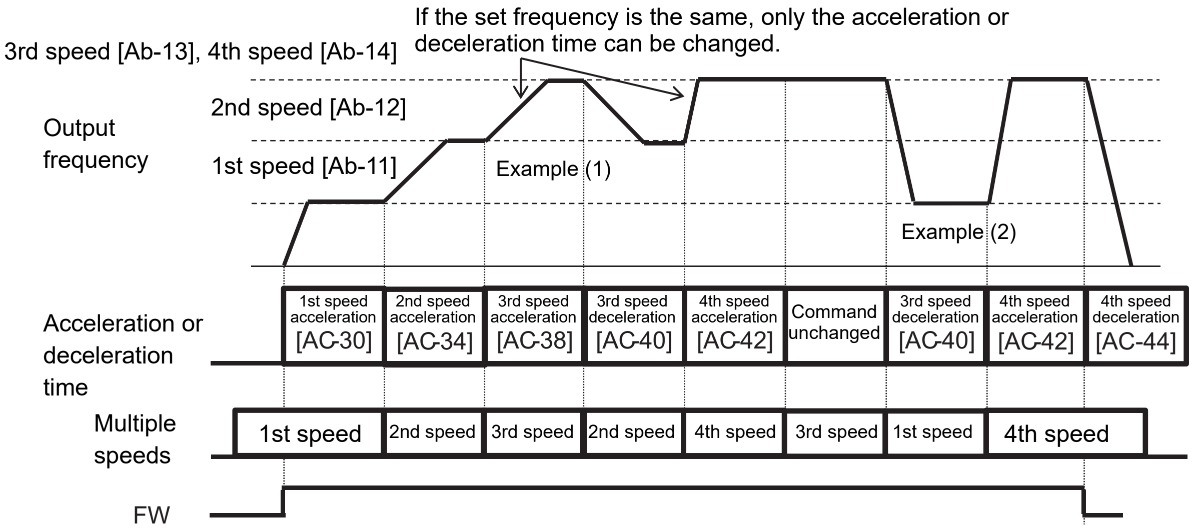
Multiple speeds	CF4	CF3	CF2	CF1
0th speed	OFF	OFF	OFF	OFF
1st speed	OFF	OFF	OFF	ON
2nd speed	OFF	OFF	ON	OFF
3rd speed	OFF	OFF	ON	ON
4th speed	OFF	ON	OFF	OFF
5th speed	OFF	ON	OFF	ON
6th speed	OFF	ON	ON	OFF
7th speed	OFF	ON	ON	ON
8th speed	ON	OFF	OFF	OFF
9th speed	ON	OFF	OFF	ON
10th speed	ON	OFF	ON	OFF
11th speed	ON	OFF	ON	ON
12th speed	ON	ON	OFF	OFF
13th speed	ON	ON	OFF	ON
14th speed	ON	ON	ON	OFF
15th speed	ON	ON	ON	ON

Table for Bit Operation

[Ab-03] = 01; Input terminal function 007 [SF1] to 013 [SF7]

Multiple speeds	SF7	SF6	SF5	SF4	SF3	SF2	SF1
0th speed	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1st speed	-	-	-	-	-	-	ON
2nd speed	-	-	-	-	-	ON	OFF
3rd speed	-	-	-	-	ON	OFF	OFF
4th speed	-	-	-	ON	OFF	OFF	OFF
5th speed	-	-	ON	OFF	OFF	OFF	OFF
6th speed	-	ON	OFF	OFF	OFF	OFF	OFF
7th speed	ON	OFF	OFF	OFF	OFF	OFF	OFF

Exemplar Operation

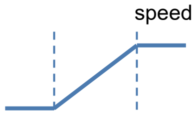


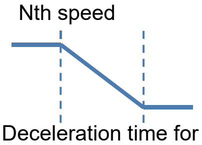
Example (1) If the multi-speed 3rd speed is engaged and the revolution is accelerating, the enabled acceleration time is the acceleration time setting for Multispeed-3 [AC-38].

Example (2) If the multi-speed 1st speed is engaged and the revolution is decelerating, the enabled deceleration time is the deceleration time setting for Multispeed-3 [AC-40] for the multi-speed 3rd speed that has been engaged until the multi-speed 1st speed is engaged.

Acceleration or Deceleration Time Table

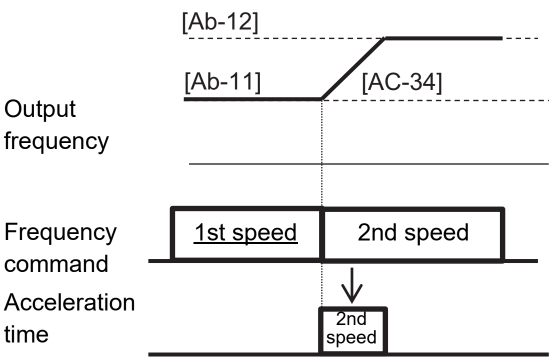
The following table shows the multi-speed commands and their corresponding acceleration or deceleration times.

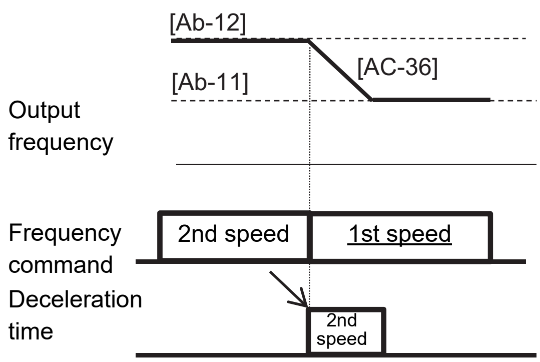
Setting state	Multi-speed command	Command state	Acceleration or deceleration time to be used
The frequency after a speed is ON will be higher than the speed before that. To the accelerating state Mth speed  Acceleration time for multi-speed Mth speed	1st speed ON	Multi-speed 1st speed [Ab-11] > Frequency before 1st speed is ON	Acceleration time for multi-speed 1st speed [AC-30]
	2nd speed ON	Multi-speed 2nd speed [Ab-12] > Frequency before 2nd speed is ON	Acceleration time for multi-speed 2nd speed [AC-34]
	3rd speed ON	Multi-speed 3rd speed [Ab-13] > Frequency before 3rd speed is ON	Acceleration time for multi-speed 3rd speed [AC-38]
	4th speed ON	Multi-speed 4th speed [Ab-14] > Frequency before 4th speed is ON	Acceleration time for multi-speed 4th speed [AC-42]
	5th speed ON	Multi-speed 5th speed [Ab-15] > Frequency before 5th speed is ON	Acceleration time for multi-speed 5th speed [AC-46]
	6th speed ON	Multi-speed 6th speed [Ab-16] > Frequency before 6th speed is ON	Acceleration time for multi-speed 6th speed [AC-50]
	7th speed ON	Multi-speed 7th speed [Ab-17] > Frequency before 7th speed is ON	Acceleration time for multi-speed 7th speed [AC-54]
	8th speed ON	Multi-speed 8th speed [Ab-18] > Frequency before 8th speed is ON	Acceleration time for multi-speed 8th speed [AC-58]
	9th speed ON	Multi-speed 9th speed [Ab-19] > Frequency before 9th speed is ON	Acceleration time for multi-speed 9th speed [AC-62]
	10th speed ON	Multi-speed 10th speed [Ab-20] > Frequency before 10th speed is ON	Acceleration time for multi-speed 10th speed [AC-66]
	11th speed ON	Multi-speed 11th speed [Ab-21] > Frequency before 11th speed is ON	Acceleration time for multi-speed 11th speed [AC-70]
	12th speed ON	Multi-speed 12th speed [Ab-22] > Frequency before 12th speed is ON	Acceleration time for multi-speed 12th speed [AC-74]
	13th speed ON	Multi-speed 13th speed [Ab-23] > Frequency before 13th speed is ON	Acceleration time for multi-speed 13th speed [AC-78]
	14th speed ON	Multi-speed 14th speed [Ab-24] > Frequency before 14th speed is ON	Acceleration time for multi-speed 14th speed [AC-82]
	15th speed ON	Multi-speed 15th speed [Ab-25] > Frequency before 15th speed is ON	Acceleration time for multi-speed 15th speed [AC-86]
	No multi-speed	Other than those above	Acceleration time [AC120]

Setting state	Multi-speed command	Command state	Acceleration or deceleration time to be used
The frequency after a speed is OFF will be lower than the speed before that. To the decelerating state 	1st speed OFF	Multi-speed 1st speed [Ab-11] > Frequency after 1st speed is OFF	Deceleration time for multi-speed 1st speed [AC-32]
	2nd speed OFF	Multi-speed 2nd speed [Ab-12] > Frequency after 2nd speed is OFF	Deceleration time for multi-speed 2nd speed [AC-36]
	3rd speed OFF	Multi-speed 3rd speed [Ab-13] > Frequency after 3rd speed is OFF	Deceleration time for multi-speed 3rd speed [AC-40]
	4th speed OFF	Multi-speed 4th speed [Ab-14] > Frequency after 4th speed is OFF	Deceleration time for multi-speed 4th speed [AC-44]
	5th speed OFF	Multi-speed 5th speed [Ab-15] > Frequency after 5th speed is OFF	Deceleration time for multi-speed 5th speed [AC-48]
	6th speed OFF	Multi-speed 6th speed [Ab-16] > Frequency after 6th speed is OFF	Deceleration time for multi-speed 6th speed [AC-52]
	7th speed OFF	Multi-speed 7th speed [Ab-17] > Frequency after 7th speed is OFF	Deceleration time for multi-speed 7th speed [AC-56]
	8th speed OFF	Multi-speed 8th speed [Ab-18] > Frequency after 8th speed is OFF	Deceleration time for multi-speed 8th speed [AC-60]
	9th speed OFF	Multi-speed 9th speed [Ab-19] > Frequency after 9th speed is OFF	Deceleration time for multi-speed 9th speed [AC-64]
	10th speed OFF	Multi-speed 10th speed [Ab-20] > Frequency after 10th speed is OFF	Deceleration time for multi-speed 10th speed [AC-68]
	11th speed OFF	Multi-speed 11th speed [Ab-21] > Frequency after 11th speed is OFF	Deceleration time for multi-speed 11th speed [AC-72]
	12th speed OFF	Multi-speed 12th speed [Ab-22] > Frequency after 12th speed is OFF	Deceleration time for multi-speed 12th speed [AC-76]
	13th speed OFF	Multi-speed 13th speed [Ab-23] > Frequency after 13th speed is OFF	Deceleration time for multi-speed 13th speed [AC-80]
	14th speed OFF	Multi-speed 14th speed [Ab-24] > Frequency after 14th speed is OFF	Deceleration time for multi-speed 14th speed [AC-84]
	15th speed OFF	Multi-speed 15th speed [Ab-25] > Frequency after 15th speed is OFF	Deceleration time for multi-speed 15th speed [AC-88]
	No multi-speed	Other than those above	Deceleration time [AC122]

Precautions for Correct Use

The switching timing of frequency command by multi-speed terminal command is different from that of the deceleration time.





6-7-4 Holding Function of Acceleration/Deceleration

The holding function of the acceleration or deceleration is enabled when a mechanical moment of inertia is large.

The acceleration-hold function is to withhold further acceleration until the motor that is starting its revolution achieves a small enough slip. Use this function when an over current trip happens at the start of the motor revolution.

The deceleration-hold function is to withhold further deceleration until the motor achieves a small enough slip. Use this function when an over voltage trip happens during deceleration.

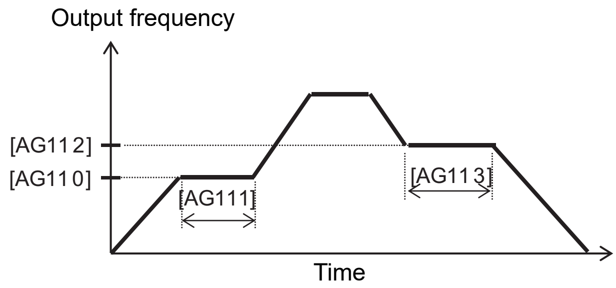
There are two methods of stopping the acceleration or deceleration, and they can be used together.

- Holding automatically at any frequency for any length of hold time.
- Holding by means of the Input terminal function.

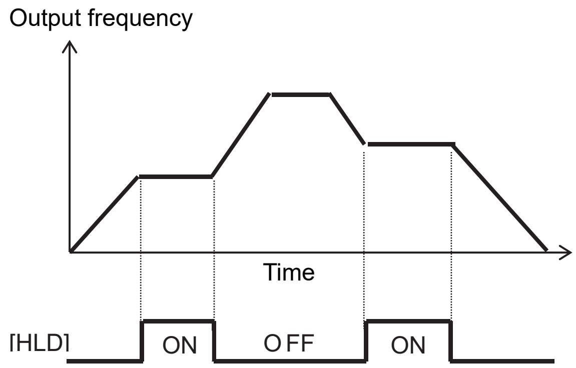
Precautions for Correct Use

- The working of this function depends on none of the content of the acceleration curve selection [AC-03] and that of the deceleration curve selection [AC-04]. This function works for all the patterns.
- When the acceleration (deceleration) command is switched to deceleration (acceleration) command while acceleration (deceleration)-hold function is withholding, halt the function and follow the changed command.

Case where Setting Time is held with Any Frequency



Case where Frequency is held with Input Terminal 100 [HLD] Terminal Function



- **Parameter**

Item	Parameters	Data	Description	Default data
Acceleration stop frequency setting, 1st-motor	[AG110]	0.00 to 590.00(Hz)	Setting the frequency at which the acceleration is withheld. A setting of 0.00 is not valid.	0.00
Acceleration stop time setting, 1st-motor	[AG111]	0.00 to 60.00(s)	Setting the length of time for which the acceleration is withheld.	0
Deceleration stop frequency setting, 1st-motor	[AG112]	0.00 to 590.00(Hz)	Setting the frequency at which the deceleration is withheld. A setting of 0.00 is not valid.	0.00
Deceleration stop time setting, 1st-motor	[AG113]	0.00 to 60.00(s)	Setting the length of time for which the deceleration is withheld.	0
Input terminal function selection	[CA-01] to [CA-11]	100	Using the acceleration- or deceleration-hold [HLD] function.	-

6-7-5 Change the Acceleration or Deceleration Pattern

Setting an acceleration or deceleration pattern is possible that suit each system.

Setting the acceleration pattern selection and the deceleration pattern selection can be done independently by [AC-03] and [AC-04], respectively.

To use an acceleration or deceleration pattern other than the linear one (00), a stable operation can be achieved by an command that can fix the target of the frequency command by means of the LCD operator command and/or the multi-speed command.

Even if an acceleration or deceleration pattern is set, the acceleration time should be set at the time that it takes to rise from 0 Hz to the maximum frequency and the deceleration time should be set at the time it takes to fall from the maximum frequency to 0 Hz.

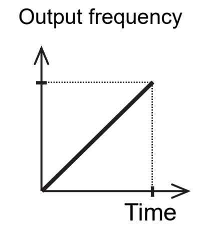
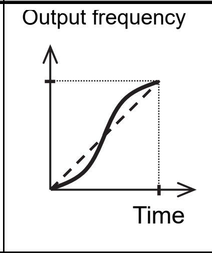
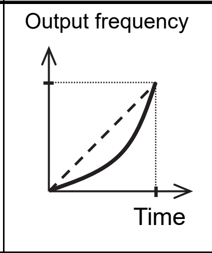
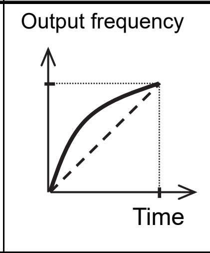
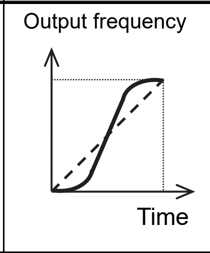
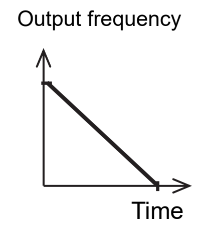
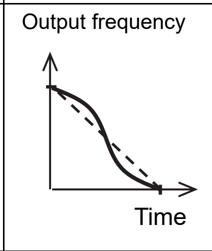
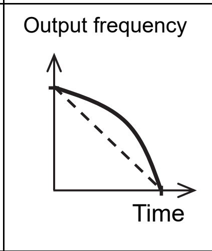
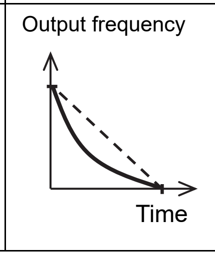
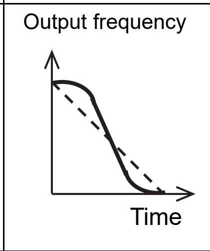
Calculation of the acceleration or deceleration pattern is performed from the minimum frequency (the command frequency) to the command frequency (the minimum frequency) when an inverter is started or stopped. In control mode in which the minimum frequency is disable, the calculation that ignores the minimum frequency is performed.

Precautions for Correct Use

- Changing the acceleration or deceleration pattern from one to another will create a sector with a(n) acceleration or deceleration time having a steep gradient. If the occurrence of an over current/over voltage is predicted, the acceleration or deceleration time has to be adjusted to prevent such an occurrence.
- When any other acceleration or deceleration pattern than the linear one (00) is set, a change of command value during the acceleration or deceleration may cause a recalculation of the acceleration or deceleration pattern, which may result in a shock.
- When any other acceleration or deceleration pattern than the linear one (00) is set, use any other command than the analog input one. An unsteady command value may cause a recalculation of the acceleration or deceleration pattern, which may prolong the actual acceleration or deceleration time.

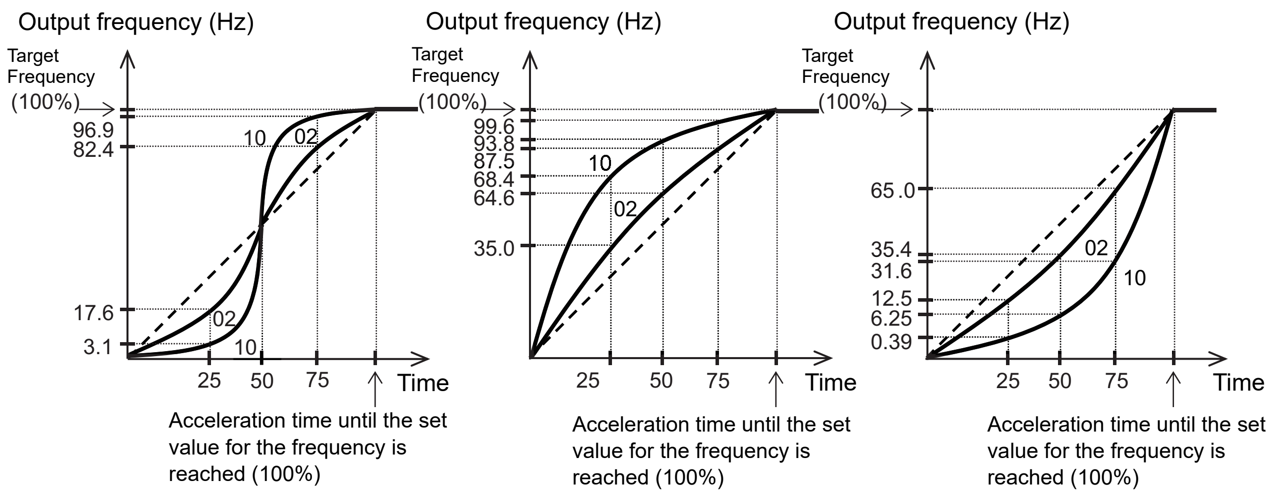
Pattern Selection

Select a pattern for each of the acceleration and the deceleration patterns by referring to the following table.

Set value	00	01	02	03	04
Curve	Linear	S-shaped	U-shaped	Inverse-U-shaped	EL-S-shaped
[AC-03] (Acceleration)					
[AC-04] (Deceleration)					
Description	Providing a linear acceleration up or deceleration down to the set frequency value.	Effective in the prevention of load collapse in lifts or on conveyors, for example.	Effective when a winder or the like needs to control of the tension and/or prevent the object to be wound from being cut. Usable for 1-shot winding/feeding.		Providing a shockless start/stop as in the case of the S-shaped curve, but providing a linear middle sector.

Curve Constant (Degree of Bulging) of Pattern

Determine the bulging degree by referring to the following figure.



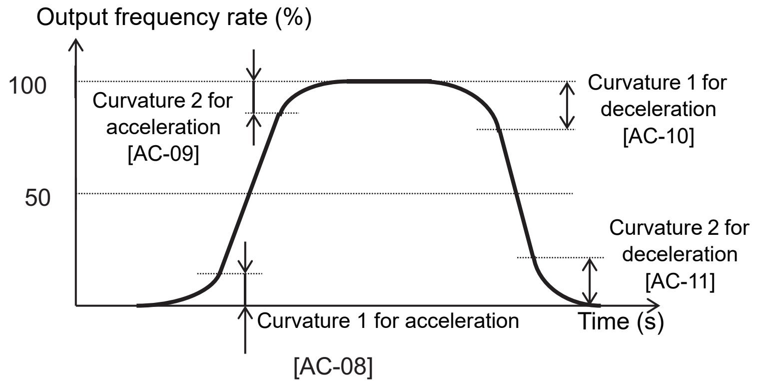
EL-S-shaped Curve's Curvature

Use of an EL-S-shaped curve allows the curvature settings [AC-08] to [AC-11] for acceleration/deceleration.

Setting all the curvatures at 50 (%) makes the EL-S-shaped curve equivalent to an S-shaped curve.

When setting the pair of [AC-08] and [AC-09] or that of [AC-10] and [AC-11], divide 100(%) into 2 segments, and assign one of which to the former of the pair and the other to the latter thereof (i.e., the two segments, if summed up, render a value up to 100%).

A setting where [AC-08] = 100 and [AC-09] = 0 makes the acceleration curve a U-shaped acceleration curve.



- **Parameter**

Item	Parameters	Data	Description	Default data
Acceleration curve selection Deceleration curve selection	[AC-03] [AC-04]	00	Linear acceleration/deceleration	00
		01	S-shaped acceleration/deceleration	
		02	U-shaped acceleration/deceleration	
		03	Inverse-U-shaped acceleration/deceleration	
		04	EL-S-shaped acceleration/deceleration	
Acceleration curve constant setting Deceleration curve constant setting	[AC-05] [AC-06]	1 to 10	1 (small bulging) ↕ 10 (large bulging)	2
EL-S-curve ratio @start of acceleration	[AC-08]	0 to 100(%)	Designate the curvature of the curved sector when an EL-S-shaped pattern is used. (For acceleration)	25
EL-S-curve ratio @end of acceleration	[AC-09]			
EL-S-curve ratio @start of deceleration	[AC-10]	0 to 100(%)	Designate the curvature of the curved sector when an EL-S-shaped pattern is used. (For deceleration)	25
EL-S-curve ratio @end of deceleration	[AC-11]			

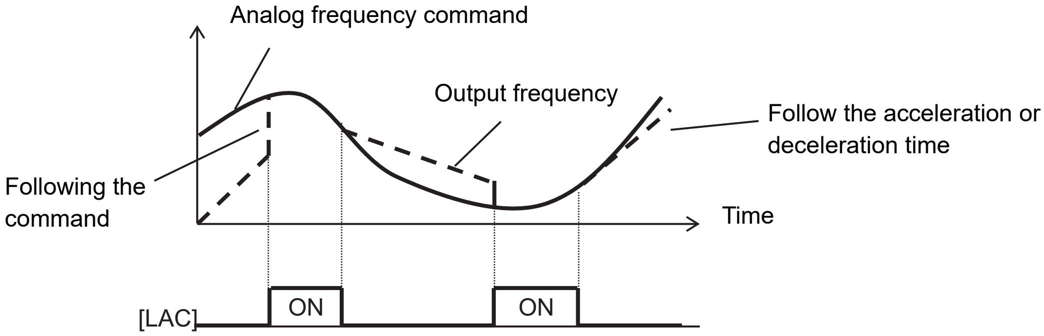
6-7-6 Following Frequency Command

If the acceleration or deceleration cancel [LAC] function is selected as the input terminal function selection and the signal is turned ON, the acceleration or deceleration time becomes ignored and the output frequency is made instantaneously to follow the set frequency.

Precautions for Correct Use

- As the use of the acceleration or deceleration cancellation function makes the output follow the command, a large amount of increase/decrease in the frequency demanded by the command may cause a trip.
- [LAC] function is valid for any frequency command such as one from parameter set-up, one from the communication, and so on.

Item	Parameters	Data	Description
Input terminal function selection	[CA-01] to [CA-11]	071	Acceleration or deceleration cancellation function [LAC] is selected. Canceling the acceleration or deceleration and making the output follow the command



7

Advanced Settings

This chapter explains the advanced settings of the motor control.

The parameter number structure is indicated below.
This chapter explains how to set the first setting. For the second setting, follow the same procedure. The setting value and operation are common.

```
AA 1 01
│  │  └─ In-Group Number
│  │     -: Always enabled in both the first setting and second setting
│  └──── 1: Enabled in the first setting when the [SET] terminal function is OFF
│        2: Enabled in the second setting when the [SET] terminal function is ON
└─────── Parameter Group
```

The function assigned to In/Output terminals is indicated as a combination of three digits numbers and alphabets, like “023[F-OP].” For more details of the functions, refer to the *<List of input terminal functions>* on page C-44 and the *<List of output terminal functions>* on page C-49.

7-1 Overview of Motor Control Methods

Select an appropriate motor control mode for the motor to be driven and the control method.

When you drive an induction motor (IM), set [AA121]=00 to 10.

Set [AA121] = 11 or 12 to drive a synchronous motor (SM)/permanent magnet motor (PMM).

The characteristics of the control operation may be improved by automatic tuning.

Whether the currently-selected mode is the control mode for induction motors or that for synchronous motors (SMs)/permanent magnet motors (PMMs) can be checked by [dC-45] IM/SM(PMM) monitor.

Precautions for Correct Use

- As improper settings for a given motor result in performance below its potential characteristics, be sure to set up appropriately.
- See *6-2 Parameter Setting for Motor Related* on page 6-8 for checking.
- To drive multiple induction motors (IMs) by a single inverter, it is recommendable to use it with V/f control's constant torque characteristics.
- An exemplar selection of control mode will be shown in the following section. Some of your systems may have more suitable modes than what is selected as the example.

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	00	V/f control-constant torque characteristics (IM)	00
		01	V/f control-reducing torque characteristics (IM)	
		02	V/f control-free V/f (IM)	
		03	Automatic torque boost (IM)	
		04	V/f control-constant torque characteristics (IM) with sensor	
		05	V/f control-reducing torque characteristics (IM) with sensor	
		06	V/f control with sensor-free V/f (IM)	
		07	Automatic torque boost (IM) with sensor	
		08	Sensorless vector control (IM)	
		09	Zero-Hz range sensorless vector control (IM)*1	
		10	Vector control (IM) with sensor*1	
		11	Synchronous-start type sensorless vector control (SM/PMM)	
		12	IVMS-start type sensorless vector control (SM/PMM)*2	
IM/SM monitor	[dC-45]	00	Induction motor IM being selected.	-
		01	Synchronous motor SM (permanent magnet motor PMM) being selected.	

*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

*2. Cannot be selected if [Ub-03] duty spec selection is 00 (VLD).

Note IM: Induction motor
SM (PMM): Synchronous motor (permanent magnet motor)

1 Check the motor type.

Use an induction motor (IM).
Proceed to #2

To use a synchronous motor (SM)/permanent magnet motor (PMM).
Proceed to *7-2-11 Synchronous Motor (Permanent Magnet Motor) Control* on page 7-22.

2 Select a control mode.

No feedback is to be used.

To use in applications, such as lifts and cranes, that require a high torque from the start.
Proceed to *7-2-9 Zero-speed Range (Zero-Hz Range) Sensorless Vector Control* on page 7-17.

To use in applications, such as conveyors and machine tools, that carry heavy loads and require a high torque.
Proceed to *7-2-8 Sensorless Vector Control* on page 7-15.

To use in applications where the frequency-voltage characteristics of a high-speed motor/special motor need to be changed freely as intended.
Proceed to *7-2-3 V/f Control (Free V/f)* on page 7-7.

To use in applications that require a certain torque at the start though the load is light.
Proceed to *7-2-5 Manual Torque Boost* on page 7-11 or *7-2-6 Automatic Torque Boost* on page 7-12.

V/f control is used for saving energy according to a fan/pump.
Proceed to *7-2-2 V/f Control (Reducing Torque Characteristics)* on page 7-6.

To use with generic characteristics of V/f control.
Proceed to *7-2-1 V/f Control (Constant Torque Characteristics)* on page 7-5.

To use in applications that require feedback from encoders, sensors, etc.

To use in applications: that carry a heavy load; that require control needing a high torque; and that require position control.
Proceed to *7-2-10 Vector Control with Sensor* on page 7-19.

To use in applications where a motor with an encoder is driven and the frequency-voltage characteristics of the motor need to be changed freely as intended.
Proceed to *7-2-14 Free V/f Control with Sensor* on page 7-34.

To use in applications: where a motor with an encoder is driven; that require a certain torque at the start; and where the motor revolution speed needs to be equal to the command speed.
Proceed to *7-2-15 Automatic Torque Boost Control with Sensor* on page 7-36.

To use in applications where afan/pump with an encoder is driven and where the motor revolution speed needs to be equal to the command speed while the energy consumption needs to be reduced.
Proceed to *7-2-13 V/f Control with Sensor (Reducing Torque Characteristics)* on page 7-33.

To use in applications where a motor with an encoder is driven and where the motor needs to be used with generic characteristics of V/f control.
Proceed to *7-2-12 V/f Control with Sensor (Constant Torque Characteristics)* on page 7-32.

Precautions for Correct Use

To conduct encoder feedback, see also *7-2-16 Encoder Feedback Control* on page 7-37.

7-2 Selection of Motor Control Methods

7-2-1 V/f Control (Constant Torque Characteristics)

It is suitable when constant torque is required regardless of the rotation speed of bogies, conveyor and crane, etc.

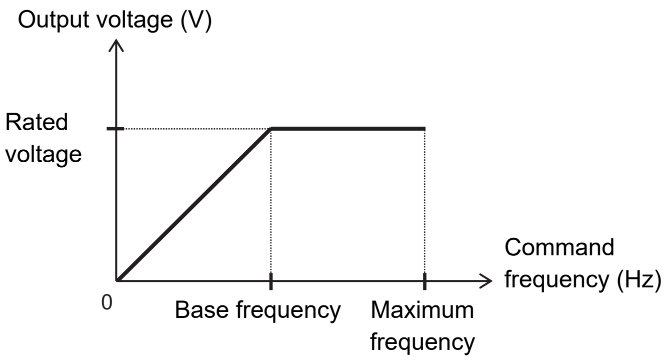
With constant torque characteristics, the output voltage is outputted proportionally to a given command frequency along the straight line drawn from the point 0 Hz/0 V to the intersection of the base frequency and the rated voltage.

The output voltage corresponding to a frequency range from 0 Hz to the base frequency is determined proportionally to the given frequency, but the output voltage corresponding to a frequency range from the base frequency to the maximum frequency is constant irrespective of the frequency.

Use of the manual boost function renders the output voltage higher than that on the basic proportional line by the boost voltage.
The manual boost function is effective in the cases of low speeds and insufficient torque.

Additional Information

- When a motor is hunting and vibrating, an adjustment of the stabilization constant, 1st-motor [HA110] may improve the state of the motor.
- When a single inverter runs multiple motors and the motors are vibrating, a downward adjustment of the stabilization constant, 1st-motor [HA110] may stabilize the state of the motors.



● Parameter

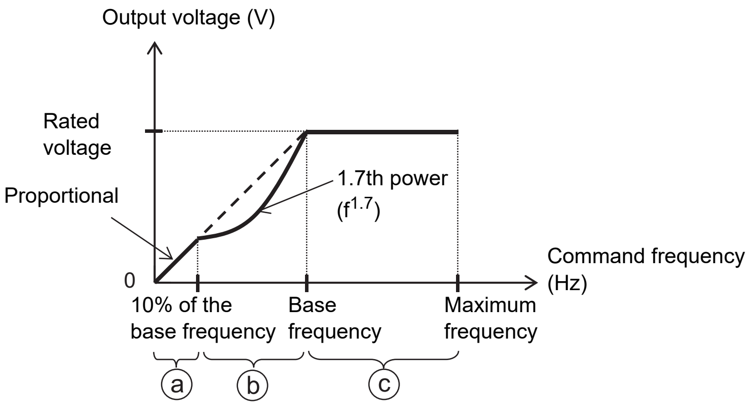
Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	00	To be used with the V/f control and the constant torque characteristics (IM).	00
Stabilization constant, 1st-motor	[HA110]	0 to 1000(%)	To adjust the control for reducing the hunting of motors.	100
Async.Motor Base frequency setting, 1st-motor	[Hb104]	10.00 to the maximum frequency (Hz)	To set the base frequency of motors.	50*1
Async.Motor Maximum frequency setting, 1st-motor	[Hb105]	Base frequency to 590.00 (Hz)	To set the maximum frequency of motors.	50*1
Async.Motor rated voltage, 1st-motor	[Hb106]	1 to 1000 (V)	Set the rated voltage of motors.	200V: 230*1 400V: 400*1

*1. Default data when default data selection (UB-02) is set to 01.

7-2-2 V/f Control (Reducing Torque Characteristics)

Suitable for applications, such as a fan/pump, that require no large torque at a low-speed range.

As the output voltage is low at a low-speed range, improved efficiency, lower noise, and less vibration can be expected.



Period a: Constant torque characteristics are employed for a period from 0 Hz to the frequency that is 10% of the base frequency. (e.g.) A 60-Hz base frequency yields constant torque characteristics for a range from 0 to 6 Hz.

Period b: Reducing torque characteristics are employed for a period from the frequency that is 10% of the base frequency to the base frequency. For a given frequency, the voltage on the curve of the 1.7th power to the given frequency is outputted.

Period c: The voltage has constant-output characteristics for a range from the base frequency to the maximum frequency.

Precautions for Correct Use

When a motor is hunting and vibrating, an adjustment of the stabilization constant, 1st-motor [HA110] may improve the state of the motor.

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	01	To be used with the V/f control and the reducing torque characteristics (IM).	00
Stabilization constant, 1st-motor	[HA110]	0 to 1000(%)	To adjust the control for reducing the hunting of motors.	100
Async.Motor Base frequency setting, 1st-motor	[Hb104]	10.00 to the maximum frequency (Hz)	To set the base frequency of motors.	50*1
Async.Motor Maximum frequency setting, 1st-motor	[Hb105]	Base frequency to 590.00 (Hz)	To set the maximum frequency of motors.	50*1
Async.Motor rated voltage, 1st-motor	[Hb106]	1 to 1000 (V)	Set the rated voltage of motors.	200V: 230*1 400V: 400*1

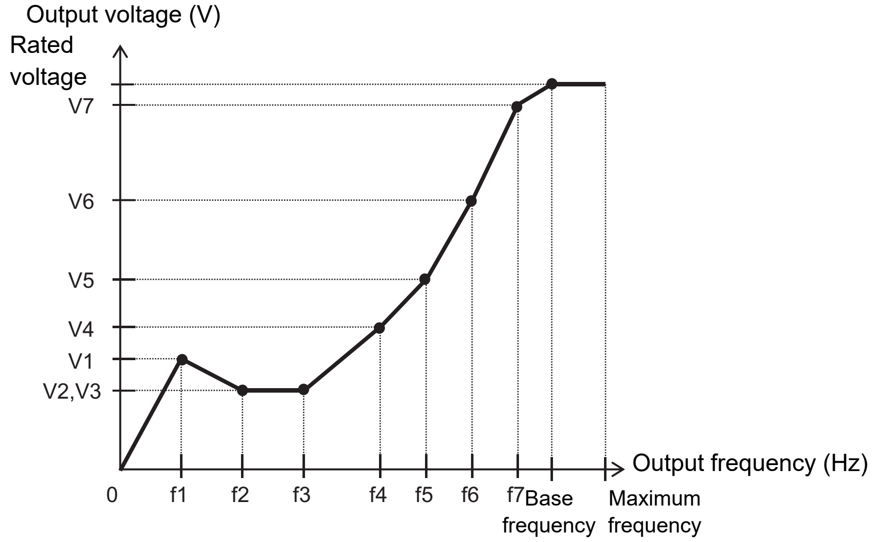
*1. Default data when default data selection (UB-02) is set to 01.

7-2-3 V/f Control (Free V/f)

It is suitable for an application in which load varies considerably in rotation speed.

In the free V/f set-up, any intended V/f characteristics can be set by setting the voltage and the frequency at 7 points.

Output voltage of an inverter can be adjusted according to applications. For example, when you use applications on which loads drastically vary in a rotation speed (output frequency), set frequency that makes the load heavier and adjust the output voltage. In such way, a motor can be controlled with the output torque according to loads.



Precautions for Correct Use

- When a motor is hunting and vibrating, an adjustment of the stabilization constant, 1st-motor [HA110] may improve the state of the motor.
- The frequencies set by free V/f set-up have to always meet the following requirement: f1 ≤ f2 ≤ f3 ≤ f4 ≤ f5 ≤ f6 ≤ f7 ≤ base frequency. The initial value for each of the frequencies set by the free V/f set-up is 0 Hz. Set the maximum frequency and the base frequency first, and then set the frequencies f7, f6, f5, f4, f3, f2, and f1 in this order by the free V/f set-up.
- Setting the [AA121] at 02 (free V/f set-up) disables the manual torque boost operational mode selection, 1st-motor [Hb140].
- Default data of frequency for Free V/f setting is 0Hz. Even when you set Control mode selection, 1st-motor [AA121] to 02 ([V/f] Free V/f (IM)), you can not operate an inverter. Be sure to set the frequency for Free V/f setting.

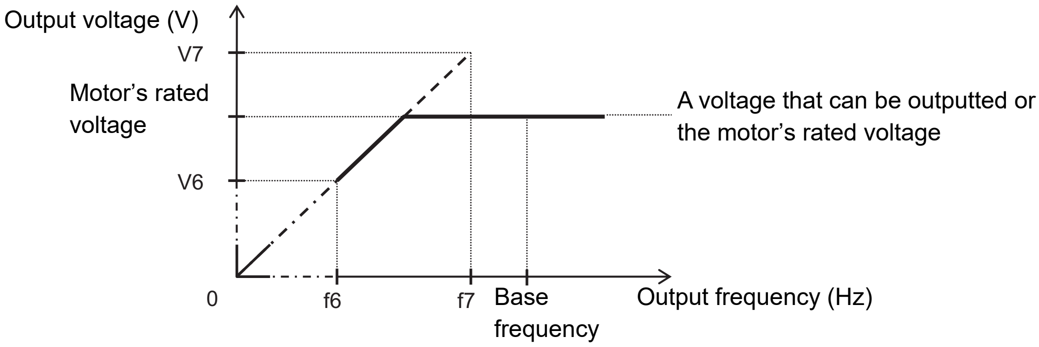
● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	02: Free V/f (IM)	To use the free V/f (IM)	00
Stabilization constant, 1st-motor	[HA110]	0 to 1000(%)	To adjust the control for reducing the hunting of motors.	100
Async.Motor Base frequency setting, 1st-motor	[Hb104]	10.00 to the maximum frequency (Hz)	To set the base frequency of motors.	50*1
Async.Motor Maximum frequency setting, 1st-motor	[Hb105]	Base frequency to 590.00 (Hz)	To set the maximum frequency of motors.	50*1
Async.Motor rated voltage, 1st-motor	[Hb106]	1 to 1000 (V)	Set the rated voltage of motors.	200V: 230*1 400V: 400*1
Free-V/f frequency 7 setting, 1st-motor	[Hb162]	[Hb160] to the base frequency (Hz)	Set the frequency at each break point.	0.00
Free-V/f frequency 6 setting, 1st-motor	[Hb160]	[Hb158] to [Hb162] (Hz)		
Free-V/f frequency 5 setting, 1st-motor	[Hb158]	[Hb156] to [Hb160] (Hz)		
Free-V/f frequency 4 setting, 1st-motor	[Hb156]	[Hb154] to [Hb158] (Hz)		
Free-V/f frequency 3 setting, 1st-motor	[Hb154]	[Hb152] to [Hb156] (Hz)		
Free-V/f frequency 2 setting, 1st-motor	[Hb152]	[Hb150] to [Hb154] (Hz)		
Free-V/f frequency 1 setting, 1st-motor	[Hb150]	0.00 to [H152](Hz)		
Free-V/f Voltage 7 setting, 1st-motor	[Hb163]	0.0 to 1000.0(V)	Set the output voltage at each break point.	0.0
Free-V/f Voltage 6 setting, 1st-motor	[Hb161]			
Free-V/f Voltage 5 setting, 1st-motor	[Hb159]			
Free-V/f Voltage 4 setting, 1st-motor	[Hb157]			
Free-V/f Voltage 3 setting, 1st-motor	[Hb155]			
Free-V/f Voltage 2 setting, 1st-motor	[Hb153]			
Free-V/f Voltage 1 setting, 1st-motor	[Hb151]			

*1. Default data when default data selection (UB-02) is set to 01.

Precautions for Correct Use

- Even the setting of 1000 V for all of the free V/f voltages 1 to 7 will not enable the inverter to output a voltage that is higher than the input voltage or the motor's voltage selection.
- Set the characteristics very carefully because inappropriately set characteristics may cause over current to happen during the acceleration or deceleration and/or may cause machine vibration.



7-2-4 Energy-Saving Mode

Adjust automatically so as to achieve the minimum output power of the inverter during constant-speed operation. Suitable for the load corresponding to the reducing torque characteristics of a fan/pump.

Running with this function needs a setting of 01 for the eco drive enable, 1st-motor [Hb145]. The response and the accuracy can be adjusted by the eco drive response adjustment, 1st-motor [Hb146].

Precautions for Correct Use

- Because this function is implemented by relatively slow control, a rapid change in load, such as an impact load, may stall the motor and cause an over current trip
- This function acts when either the V/f control (constant torque characteristics) or the V/f control (reducing torque characteristics) is selected.

● Parameter

Item	Parameter	Data	Description			Default data
Eco drive enable, 1st-motor	[Hb145]	00: disabled; 01: enabled	Select whether or not to conduct the energy-saving operation.			00
Eco drive response adjustment, 1st-motor	[Hb146]	0 to 100(%)	Setting	Response	Accuracy	50
			0 ↕ 100	Slow ↕ Fast	High ↕ Low	

7-2-5 Manual Torque Boost

Raise the output voltage by adding an extra voltage in order to achieve a higher torque at low speeds than otherwise.

In the V/f control, no special correction is conducted to control the motor. Accordingly, at low output voltages, the resistance component and/or the wiring in the motor will cause the voltage drop, which in turn lowers the voltage applied to the motor. Manual boost corrects the voltage and thereby improves the lowering of the torque at the low-speed range.

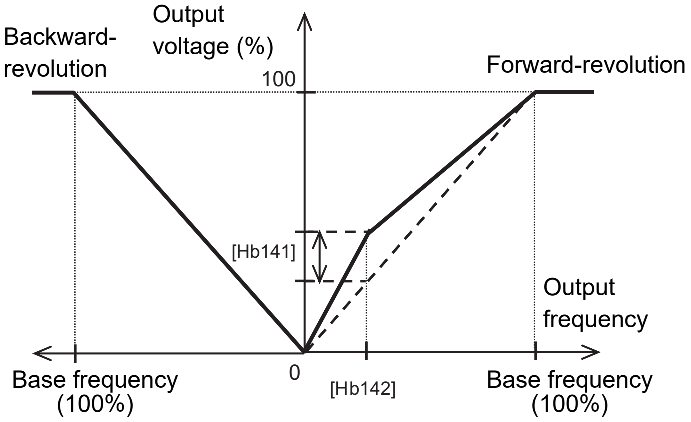
Confirm and adjust so that the output voltage of an inverter is within 150% level of the rated currents of a motor.

As the manual torque boost value, 1st-motor [Hb141], set the proportion thereof to the async.Motor rated voltage, 1st-motor [Hb106] (= 100 %). The set value is the maximum amount to be added at manual torque boost Peak speed, 1st-motor [Hb142].

As the manual torque boost Peak speed, 1st-motor [Hb142], set the proportion of the frequency at that point to the async.Motor Base frequency setting, 1st-motor [Hb104] (= 100%).

When an automatic torque boost is activated, you do not need to use the manual torque boost. Set the manual torque boost when you do not use an automatic torque boost or a motor goes into a stall while the deceleration.

e.g.) When [Hb140] = 02, the boost works only for the forward revolution of the motor.



Precautions for Correct Use

- Be sure not to cause an over excitation of the motor when raising the set value for the manual torque boost. Boosting increases the flow of the current, which may burn the motor.
- The target of the torque boost is the V/f control of induction motors. (except the free V/f)

● Parameter

Item	Parameter	Data	Description	Default data
Manual torque boost operational mode selection, 1st-motor	[Hb140]	00	Disabled	01*1
		01	Always enabled	
		02	Enabled only for forward revolution	
		03	Enabled only for backward revolution	
Manual torque boost value, 1st-motor	[Hb141]	0.0 to 20.0(%)	Setting the maximum amount of torque boost for the motor's rated voltage [Hb106] at the time of setting the manual torque boost break point.	0.0
Manual torque boost Peak speed, 1st-motor	[Hb142]	0.0 to 50.0(%)	Set, as the break point, the proportion of the boost amount to the base frequency [Hb104]	0.0

*1. Default data when default data selection (UB-02) is set to 01.

7-2-6 Automatic Torque Boost

Automatically adjust the frequency and the output voltage so as to achieve a higher torque.

The automatic boost corrects the frequency and the output in order to control the motor. Accordingly, it requires the acquisition of the motor constant by means of auto-tuning or the like.

Precautions for Correct Use

- When a motor is hunting and vibrating, an adjustment of the stabilization constant, 1st-motor [HA110] may improve the state of the motor.
- In the automatic torque boost, set appropriately the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current in order to conduct motor control.
- When a trip caused by overcurrent is generated while the deceleration, set a over magnetization deceleration function selection, 1st-motor (bA146) to 00: Enabled.
- When the motor performs below its potential characteristics, conduct the auto-tuning and make adjustment by referring to the next section.

● Parameter

Item	Parameter	Data	Description	Default data
Control mode	[AA121]	03	To use the automatic torque boost (IM).	00
Stability constant	[HA110]	0 to 1000(%)	To adjust the control for reducing the hunting of motors.	100
Async.Motor Base frequency setting, 1st-motor	[Hb104]	10.00 to the maximum frequency (Hz)	To set the base frequency of motors.	50*1
Async.Motor Maximum frequency setting, 1st-motor	[Hb105]	Base frequency to 590.00 (Hz)	To set the maximum frequency of motors.	50*1
Async.Motor rated voltage, 1st-motor	[Hb106]	1 to 1000 (V)	Set the rated voltage of motors.	200V: 230*1 400V: 400*1
Automatic torque boost voltage compensation gain, 1st-motor	[HC101]	0 to 255	To adjust the amount of the voltage added by the automatic torque boost.	100
Automatic torque boost slip compensation gain, 1st-motor	[HC102]	0 to 255	To adjust the amount of the frequency added by the automatic torque boost.	100

*1. Default data when default data selection (UB-02) is set to 01.

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
Slower motor revolution at low speeds than what is expected	Insufficient output voltage, which in turn renders the torque insufficient	Make an adjustment by incrementing the automatic torque boost voltage compensation gain [HC101] by approximately 5% each time.
	Insufficient frequency correction, which in turn renders the torque insufficient.	Make an adjustment by incrementing the automatic torque boost slip compensation gain [HC102] by approximately 5% each time
A heavy load lowers the revolution frequency of the motor.	Insufficient frequency correction, which in turn renders the torque insufficient.	Make an adjustment by incrementing the automatic torque boost slip compensation gain [HC102] by approximately 5% each time
A heavy load raises the revolution frequency of the motor.	An excessive frequency correction raises the frequency.	Make an adjustment by decrementing the automatic torque boost slip compensation gain [HC102] by approximately 5% each time
With a heavy load, an acceleration causes an over current.	An excessive voltage correction increases the current.	Make an adjustment by decrementing the automatic torque boost voltage compensation gain [HC101] by approximately 5% each time.
	An excessive frequency correction raises the frequency.	Make an adjustment by decrementing the automatic torque boost slip compensation gain [HC102] by approximately 5% each time

Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-7 Stabilization of Motor Rotation

This function is used to adjust a motor that is hunting and vibrating. It searches a set range for a point where the hunting stops and makes an adjustment.

When a single inverter drives multiple motors, setting the stability constant at 0 may improve the state.

When a load with large inertia such as a fan is rotated, decrementing the stabilization constant, 1st-motor [HA110] by 10% each time may improve the state.

When the motor capacity is smaller than the rated capacity of the inverter, incrementing the set value by 10% each time may improve the state. In contrast, when the motor capacity is larger than the rated capacity of the inverter, decrementing the set value by 10% each time may improve the state.

Precautions for Correct Use

- If the motor is hunting and vibrating, check if appropriate settings are provided for the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current.
- Then conduct the auto-tuning to check if the hunting ends, and adjust the stability constant.
- Exemplar methods of reducing the hunting include the following methods:

  1. Adjust the carrier speed setting, 1st-motor [bb101] by gradually decrementing it down to 2 kHz.

  2. Adjust the output voltage gain, 1st-motor [Hb180] by gradually decrementing it down to 80%.
  If no effect can be observed, restore the original values.

Precautions for Correct Use

Do not conduct a steady operation with a setting for the output voltage gain, 1st-motor [Hb180] that exceeds 100%.
The motor may be burned.

● Parameter

Item	Parameter	Data	Description	Default data
Stabilization constant, 1st-motor	[HA110]	0 to 1000(%)	To adjust the control for reducing the hunting of motors.	100
Output voltage gain, 1st-motor	[Hb180]	0 to 255(%)	Decrease it if the motor is hunting. A lower setting decreases the output voltage.	100
Carrier speed setting, 1st-motor	[bb101]	0.5 to 16.0(kHz) *1	Change the carrier frequency of the PWM output. If the motor is hunting, lower the setting.	2.0

*1. Some settings may limit the carrier frequency. For details, see *7-4 Reduction of Motor Noise, Noise and Inverter Heat Generation* on page 7-59.

7-2-8 Sensorless Vector Control

This application is used on such as conveyors and machine tools, that carry heavy loads and require a high torque.

Automatically adjust the frequency and the output voltage so as to achieve responsively a higher torque even at slow speeds.

In the sensorless vector control, to control the motor, the frequency and the output voltage are corrected and the response is adjusted with respect to the load inertia.

A motor constant and the load inertia must be set with auto-tuning, etc.

In the sensorless vector control, adjustment of the response is possible. The sensorless vector control can be used in applications that require a better follow-up performance of the frequency to the command.

When a motor is hunting and vibrating, an adjustment of the speed response [HA115] may improve the state of the motor.

To limit the output direction by enabling the reversal prevention function [HC114].

To correct the slip change caused by temperature changes by enabling the selection of the secondary resistance correction [HC113]. Connection is needed between a thermistor for measuring the temperature of the motor and the TH terminal.

Precautions for Correct Use

- In the sensorless vector control, set appropriately the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current in order to conduct motor control.
- When the motor performs below its potential characteristics, conduct the auto-tuning and make adjustment by referring to the next section.
- In the cases of a long wiring (approximately longer than 20 m) and in the cases of controlling motors other than out company's, the performance may be below what are expected from the characteristics.
- As the capacity becomes farther away from the maximum applicable motor capacity, sufficient operation characteristics becomes more difficult to get.

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	08	To use the sensorless vector control (IM).	00
Speed response for Async.M, 1st-motor	[HA115]	0 to 1000(%)	To adjust the responsiveness of the control. A larger value enhances the responsiveness.	100
Boost value at start for Async.M-SLV/IM-CLV, 1st-motor	[HC111]	0 to 50(%)	To adjust the current command at the start when the starting torque is not sufficient.	0
Secondary resistance correction, 1st-motor	[HC113]	00	Disabled	00
		01	Enabled Requiring a temperature thermistor.	
Counter direction run protection selection, 1st-motor	[HC114]	00	Disabled	00
		01	Enabled Limit the output to prevent the output in the reverse direction.	
Torque current reference filter time constant, 1st-motor	[HC120]	0 to 100(ms)	To adjust the filter for the torque current.	2
Speed feedforward compensation gain, 1st-motor	[HC121]	0 to 1000(%)	To adjust the feed forward control of the speed controller.	0

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
Socks occur during the revolutions at the start.	The control system has a speed response that is too high.	• Make an adjustment by decrementing the response adjustment [HA115] by 5% each time. • Make an adjustment by decrementing the IM motor constant J [Hb118] by 5% each time. • Make an adjustment by decrementing the boost amount at the start [HC111] by 5% each time.
Unsteady revolutions at low speeds, resulting in fluctuating revolutions.	The control system has a speed response that is too low.	• Make an adjustment by incrementing the response adjustment [HA115] by 5% each time. • Make an adjustment by incrementing the IM motor constant J [Hb118] by 5% each time.
The motor is hunting.	The control system has a speed response that is too low.	• Make an adjustment by decrementing the response adjustment [HA115] by 5% each time. • Make an adjustment by decrementing the IM motor constant J [Hb118] by 5% each time.
When a load in the motor-stopping direction is applied to the motor, the revolution frequency becomes lower.	The motor constant R2 is set at too small a value.	Make an adjustment by incrementing the IM motor constant R2 [Hb112] by 5% of the current value each time.
When a load in the motor-stopping direction is applied to the motor, the revolution frequency becomes higher.	The motor constant R2 is set at too large a value.	Make an adjustment by decrementing the IM motor constant R2 [Hb112] by 5% of the current value each time.
When a load in the motor-stopping direction is applied to the motor, the revolution frequency becomes higher.	Insufficient regenerative torque at low speeds.	• Make an adjustment by incrementing the IM motor constant R1 [Hb110] by 5% of the current value each time. • Make an adjustment by incrementing the IM motor constant I0 [Hb116] by 5% of the current value each time.

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
Revolution in the opposite direction to the command direction occurs for an instant.	A command demanding the revolution in the opposite direction is dispatched over the control system for an instant.	Enable the reversal prevention selection [HC114].

Precautions for Correct Use

- Set the carrier speed setting, 1st-motor [bb101] at a value of 2.0 kHz or higher. A set frequency of 1.9 kHz or lower may cause hunting.
- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-9 Zero-speed Range (Zero-Hz Range) Sensorless Vector Control

This application is used on such as lifts and cranes, that require a high torque from the start.

Automatically adjust the frequency and the output voltage so as to achieve responsively a higher torque even at slow speeds.

In the zero-speed range sensorless vector control, the sensorless vector control is supplemented with an output that can achieve an intended torque from at extremely low speeds such as those in the zero-speed range.

A motor constant and the load inertia must be set with auto-tuning, etc.

As in the case of the sensorless vector control, acquire the motor constant by means of auto-tuning or the like.

In the zero-speed range sensorless vector control, as in the case of the sensorless vector control, adjustment of the response is possible. In addition to the adjustment of the response, it is possible to set the torque boost for the current at the start.

When a motor is hunting and vibrating, an adjustment of the speed response for Async.M, 1st-motor [HA115] may improve the state of the motor.

The zero-speed range sensorless vector control cannot be used at the light load mode or the extra light load. When you select a load type selection (Ub-03), use the mode as 02: ND (Standard).

Precautions for Correct Use

- In the zero-speed range sensorless vector control, as in the case of the sensorless vector control, set appropriately the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current in order to conduct motor control.
- When the motor performs below its potential characteristics, conduct the auto-tuning and make adjustment by referring to the next section.
- In the case that a length of a wire is over 20 m, the motor's characteristic may be below what are expected.
- As the capacity becomes farther away from the maximum applicable motor capacity, sufficient operation characteristics becomes more difficult to get.

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	09*1	To use the zero-speed range sensorless vector control (IM) function.	00
Speed response for Async.M, 1st-motor	[HA115]	0 to 1000(%)	To adjust the responsiveness of the control. A larger value enhances the responsiveness.	100
Zero speed area limit for Async.M-0SLV, 1st-motor	[HC110]	0 to 100(%)	To limit the current at the start so as not to allow the rising of the current to rise too high.	80
Boost value at start for Async.M-0SLV, 1st-motor	[HC112]	0 to 50(%)	To adjust the current command at the start when the starting torque is not sufficient.	10
Secondary resistance correction, 1st-motor	[HC113]	00	Disabled	00
		01	Enabled Requiring a temperature thermistor.	
Counter direction run protection selection, 1st-motor	[HC114]	00	Disabled	00
		01	Enabled Limit the output to prevent the output in the reverse direction.	
Torque current reference filter time constant, 1st-motor	[HC120]	0 to 100(ms)	To adjust the filter for the torque current.	2
Speed feedforward compensation gain, 1st-motor	[HC121]	0 to 1000(%)	To adjust the feed forward control of the speed controller.	0

*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

In addition to the adjustment of the sensorless vector control, refer to the following description.

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
Socks occur during the revolutions at the start. Over current occurs at the start	Boost amount is too large.	• Make an adjustment by decrementing the zero-speed range limiter [HC110] by 5% each time. • Make an adjustment by decrementing the zero-speed range boost at the start [HC112] by 5% each time.
The motor cannot provide enough torque for the load is too high for the motor to at the start. Acceleration is not possible.	Boost amount is too small.	Make an adjustment by incrementing the zero-speed range boost at the start [HC112] by 5% each time.

Precautions for Correct Use

- Set the carrier speed setting, 1st-motor [bb101] at a value of 2.0 kHz or higher. A set frequency of 1.9 kHz or lower may cause hunting.
- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-10 Vector Control with Sensor

This application is used in the following cases: It carries a heavy load; that require control needing a high torque; and that require position control.

The feedback of the encoder signal from the motor allows highly accurate frequency control from the low-speed range.

In the vector control with sensor, to control the motor, the frequency and the output voltage are corrected and the response is adjusted with respect to the load inertia.
Accordingly, it requires the acquisition of the motor constant and the load inertia by means of auto-tuning or the like.

In the vector control with sensor, adjustment of the response is possible. The vector control with sensor can be used in applications that require a better follow-up performance of the speed to the command.

In the vector control with sensor, the position control mode can be used.

A motor constant and the load inertia must be set with auto-tuning, etc.

When a motor is hunting and vibrating, an adjustment of the speed response [HA115] and [HC120] may improve the state of the motor.

Precautions for Correct Use

- Conducting the vector control with sensor requires the encoder feedback from the motor.
- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EAP], [EBP], [EAN], and [EBN] of the PG option unit are enabled.
- See *7-2-16 Encoder Feedback Control* on page 7-37.
- In the vector control with sensor, set appropriately the motor capacity, the number of motor poles, the base frequency, the rated voltage, and the rated current in order to conduct motor control.
- As the motor's frame number becomes smaller and smaller from the one of the maximum applicable motor, sufficient operation characteristics becomes more difficult to get.
- In the case that a length of a wire is over 20 m, the motor's characteristic may be below what are expected.
- Once [HC114] Counter direction run protection selection, 1st-motor is enabled, output directions are limited.
- Once [HC113] Secondary resistance correction, 1st-motor is enabled, a slip change of motor rotation according to temperature change is corrected. Connect a thermistor, which measures the motor temperature, to TH terminals.

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	10*1	To use the vector control with sensor (IM).	00
Speed response for Async.M, 1st-motor	[HA115]	0 to 1000(%)	To adjust the responsiveness of the control. A larger value enhances the responsiveness.	100
Vector control mode selection, 1st-motor	[AA123]	00	Operation is possible by switching between the speed control and the torque control.	00
		01	Activate the pulse train position control mode.	
		02	Activate the absolute position control mode.	
		03	Activate the high-resolution absolute position control mode.	
Boost value at start for Async.M-SLV/IM-CLV, 1st-motor	[HC111]	0 to 50 (%)	To adjust the current command at the start when the starting torque is not sufficient.	0
Secondary resistance correction, 1st-motor	[HC113]	00	Disabled	00
		01	Enabled Requiring a temperature thermistor.	
Counter direction run protection selection, 1st-motor	[HC114]	00	Disabled	00
		01	Enabled Limit the output to prevent the output in the reverse direction.	
Torque current reference filter time constant, 1st-motor	[HC120]	0 to 100 (ms)	To adjust the filter for the torque current.	2
Speed feedforward compensation gain, 1st-motor	[HC121]	0 to 1000 (%)	To adjust the feed forward control of the speed controller.	0

*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
The performance is not sufficient for what the motor control characteristics predict.	An improper motor constant is being used.	The performance may be improved by automatic tuning. Check *6-2-3 Auto-tuning of Motor* on page 6-14.
Socks occur during the revolutions at the start.	The control system has a frequency response that is too high.	• Make an adjustment by decrementing the response adjustment [HA115] by 5% each time. • Make an adjustment by decrementing the IM motor constant J [Hb118] by 5% each time.
The motor is hunting.		
Unsteady revolutions at low speeds, resulting in fluctuating revolutions.	The control system has a frequency response that is too low.	• Make an adjustment by incrementing the response adjustment [HA115] by 5% each time. • Make an adjustment by incrementing the IM motor constant J [Hb118] by 5% each time.
Normal acceleration is impossible and the protection against the over load works.	An improper motor constant is being used.	The performance may be improved by automatic tuning. Check *6-2-3 Auto-tuning of Motor* on page 6-14.
	An improper phase sequence is being used.	Set V/f control (00) in [AA121], and check the frequency detection value monitor [dA-08]. The wiring is correct if the forward operation [FW] has a positive (+) value and if the reversal operation [RV] has a negative (-) value. If the forward and negative operations have incorrect values, rearrange the phase sequence in the encoder or check again, *7-2-16 Encoder Feedback Control* on page 7-37.

Precautions for Correct Use

- Set the Carrier speed setting, 1st-motor [bb101] at a value of 2.0 kHz or higher. A set frequency of 1.9 kHz or lower may cause an incorrect operation.
- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-11 Synchronous Motor (Permanent Magnet Motor) Control

Controlling a synchronous motor (permanent magnet motor) requires the setting-up of the motor constant. See, *6-2 Parameter Setting for Motor Related* on page 6-8 The motor constant is data corresponding to one phase of Y-connection (including wiring).

Precautions for Correct Use

- Set an appropriate over current level of the inverter [bb160]. Do not drive a motor whose maximum current (demagnetization level) is below the 150% of [bb160].
- Be aware of the root-mean-square value and the peak value. The rated output current listed in the specification table is the root-mean-square value.
- This is the control mode for the reducing torque applications where the motor that has the same frame number as the inverter's rating needs a torque at the start that is 50% or smaller.
- This mode can be used neither in applications that require a constant torque from low speeds nor in applications that involve rapid acceleration or deceleration and that require a large torque from low speeds. Never use this mode for applications involving a gravity load, such as lifts.
- Synchronous motors (permanent magnet motors) cannot be operated by a direct input from the commercial power supply.
- Multiple synchronous motors (permanent magnet motors) cannot be driven by a single inverter.
- Synchronous motors (permanent magnet motors) are more likely to cause over voltage errors than non-synchronous motors (induction motors). If the rapid deceleration and/or the direct-current braking function need to be used, consider the possible use of an optional braking resistor, a regenerative braking unit.
- When a hold brake is used, release the brake before the motor starts operation. Otherwise, the motor may lose its synchronism.
- The motor may move in the reverse direction at the start of its revolution. When a malfunction is caused by the reverse revolution, use the starting Method for Sync.M, 1st-motor [Hd132].
- Set the carrier speed setting, 1st-motor [bb101] at a value of 8.0kHz or higher. Some low carrier frequencies may make the motor generate a lot of heat.
- The tolerable load moment of inertia is 50 times as large as the motor's moment of inertia or smaller. Some applications whose loads moment of inertia exceed the above mentioned range may result in a performance that is below the desired one.
- If the wiring length between the motor and the inverter is about 20m or longer, the motor could not exhibit the full properties.
- In some cases of a long wiring (approximately longer than 20 m), frequency-synchronized re-start may cause an over current error.
- Driving a motor whose sync.Motor rated current, 1st-motor [Hd108] exceeds the inverter's rated current or a motor whose frame number is smaller than the maximum applicable motor by 2 or more may result in a performance that is below the desirable one.
- Set not only the sync.Motor rated current, 1st-motor [Hd108] but also the electronic thermal level setting, 1st-motor [bC110].
- If the initial position estimation is enabled in the starting Method for Sync.M, 1st-motor [Hd132], a shrill sound caused by the position detection action may be heard, but this sound has nothing to do with any abnormality.
- If the initial position estimation is enabled in the Carrier speed setting, 1st-motor [Hd132], start the operation from the state in which the motor stopped. Failure to acquire the correct position may occur, which may result in unintended revolution, over current, or loss of synchronization.

Disabled Functions

The following functions cannot be used when the synchronous motor (permanent magnet motor) control is conducted.

Even when they are enabled by parameters of setting, they are actually disabled.

In the following table, only the common settings (parameter center “-”) and the first settings (parameter center “1”) are listed, but it is not possible either to use the second settings (parameter center “2”) that correspond to the first settings in the following table.

Item	Parameter	Description
Functions associated with torque control	[FA-15], [FA-16], [dA-15], and [dA-16]	Torque command monitoring function
	[Ad-01] to [Ad-04], and [Ad-40] to [Ad-43], Input terminal 067 [ATR]	Torque controlling function
	[Ad-11] to [Ad-14], Input terminal 068 [TBS]	Torque biasing function
	[bA110] to [bA116], and [bA210] to [bA216], Input terminals 060 [TL], 061 [TRQ1], and 062 [TRQ2] Output terminal 022 [TRQ]	Torque limiting function
	[CE120] to [CE123], Output terminal 019 [OTQ]	Over torque signal
Over current restraining function	[bA120] and [bA121]	Over current restraining function
Functions associated with induction motor control	[HA110]	Stabilization adjustment gain
	[Hb130], [Hb131], [Hb140] to [Hb142], [Hb145], [Hb146], [Hb150] to [Hb163], [Hb170], [Hb171], and [Hb180]	Functions associated with V/f control
	[HC101] and [HC102]	Functions associated with automatic boost
	[HC110] to [HC114], [HC120], and [HC121]	Sensorless vector control, Zero-speed range sensorless vector control
Part of gain mapping function	[HA126],[HA129]	Constant for I control
Part of auto-tuning	[HA-01]=02	Rotating system tuning
	[HA-03]	Online auto-tuning
Commercial power supply switching function	Input terminal 035 [CS]	Switching to commercial power supply
Acceleration or deceleration cancellation function	Input terminal 071 [LAC]	Acceleration or deceleration cancellation function
Jogging operation	[AG-20], [AG-21], input terminal 029 [JG]	Jogging operation function

Synchronous-start Type Sensorless Vector Control (SM/PMM)

In this control mode, operations of magnetic-pole position estimation, synchronous start control, and sensorless vector control are started in this order.

In the magnetic-pole position estimation, it is possible to select whether the motor is started after the motor's magnetic-pole positions are estimated by use of the initial-position estimation function or the magnetic-pole positions are synchronized by use of the DC braking function.

In the case of starting after the magnetic-pole position estimation, estimation operation is conducted at the start by setting the Starting Method for Sync.M, 1st-motor [Hd132] at 01.

In the case of the Starting Method for Sync.M, 1st-motor [Hd132] being set at 00, the motor is started as its magnetic poles are synchronized with the output phases. In the cases where the magnetic poles and the output phases are unsynchronized by a great amount, or in the cases that require a certain starting torque, use the starting-time DB to synchronize the magnetic-pole positions and the output phases before the acceleration.

Use [AF108] to adjust the current during a synchronous starting. Adjustment is possible even when [AF101] = 00. When a larger torque is needed than what is needed in the synchronous starting mode, use of IVMS start mode may improve the situation.

The minimum Frequency for Sync.M-SLV, 1st-motor [Hd130] at which the synchronous start control is switched to the sensorless vector control is adjusted at the lowest frequency (switching).

When a motor is hunting and vibrating, an adjustment of the speed response for Async.M, 1st-motor [HA115] and/or the no-Load current for Sync.M-SLV, 1st-motor [Hd131] may improve the state of the motor.

When the starting-time DB function is used at the start, see *7-5-2 Startup DC Injection Braking* on page 7-64.

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	11	To use synchronous-start type sensorless vector control (SM/PMM)	00
Speed response for Async.M, 1st-motor	[HA115]	0 to 1000(%)	To adjust the responsiveness of the control. A larger value enhances the responsiveness.	100
Minimum Frequency for Sync.M-SLV, 1st-motor	[Hd130]	0 to 50(%)	The frequency at which the sensorless vector control is started. Set the ratio to the base frequency [Hd104].	8
No-Load current for Sync.M-SLV, 1st-motor	[Hd131]	0 to 100(%)	Set the ratio of the no-load current to the rated current during the sensorless vector control.	10
Starting Method for Sync.M, 1st-motor	[Hd132]	00	Initial position estimation is disabled.	00
		01	Initial position estimation is enabled.	
IMPE 0V wait number for Sync.M, 1st-motor	[Hd133]	0 to 255	This is a stand-by adjustment value to stabilize the reference value for the initial position estimation detection.	10
IMPE detect wait number for Sync.M, 1st-motor	[Hd134]	0 to 255	This is an adjustment value to stabilize the current rise of the initial position estimation operation.	10
IMPE detect number for Sync.M, 1st-motor	[Hd135]	0 to 255	This is a detection-operation adjustment value of the initial position estimation operation.	30
IMPE voltage gain for Sync.M, 1st-motor	[Hd136]	0 to 200(%)	This is a output-voltage adjustment gain of the initial position estimation operation.	100

Item	Parameter	Data	Description	Default data
IMPE Mg-pole position offset, 1st-motor	[Hd137]	0 to 359°	To conduct corrections in a case where the initial position estimation operation has a certain error.	0
DC braking selection, 1st-motor	[AF101]	01	Internal DC braking: enabled	00
DC braking force at start, 1st-motor	[AF108]	0 to 100(%)	To adjust the DC braking force. Setting of 100% will provide maximum braking force.	30
DC braking active time at start, 1st-motor	[AF109]	0.00 to 60.00 (s)	Enabled during the internal DC braking. When the operation command is turned ON, DC braking is started.	0.00
Over current detection level, 1st-motor	[bb160]	Inverter ND rated current × (0.2 to 2.2)	To Set the level at which the over current is detected.	2.2 × Inverter ND rated current

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
At the start, rotating temporarily in the opposite direction to the intended one.	Misalignment of the output phases and the motor's magnetic-pole positions	Enable the initial-position estimation function. [Hd132]=01 In the cases of a slight opposite-direction movement even in the initial-position estimation function, make an adjustment by incrementing [Hd137] by 5° at a time.
Over current occurs at the start At the start, the motor loses synchronization and no acceleration is observed.	• Insufficient starting torque • Misalignment of the output phases and the motor's magnetic-pole positions	• Enable the initial-position estimation function. [Hd132]=01 • Set the DC braking at the start [AF101] = 01, and after the start, the time needed for the motor to be stabilized is set in [AF109]. In addition, make an adjustment by incrementing the braking force at the start [AF108] by 5% each time.
A long starting time is required.	A long phase-synchronization time is required.	When the magnetic-pole positions are synchronized in the DC braking at the starting, enable the initial-position estimation function instead of the DC braking at the start. [Hd132]=01
Fluctuating revolutions occur at low speeds (at the lowest frequency (switch) or even lower)	Insufficient starting torque	Make an adjustment by incrementing the braking force at the start [AF108] by 5% each time.
Hunting occurs at low speeds (at the lowest frequency (switch) or even lower)	There is a motor constant error.	Decrement the motor constant R [Hd110] little by little until it reaches a value = set value × 0.7.
		Increment little by little each of the motor constant Ld [Hd112] and the motor constant Lq [Hd112] until they reach their respective values = set values × 1.4. Note, however that Ld ≤ Lq.
Shock or over current occurs at about the lowest frequency (switch).	The speed response is too low.	Make an adjustment by incrementing the speed response [HA115] by 5% each time.
	Load fluctuation occurs at around the switch.	Adjust the lowest frequency (switch) [Hd130].

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
Hunting occurs at higher speeds (at the lowest frequency (switch) or higher).	Unsynchronized speed response.	Make an adjustment by incrementing/decrementing the speed response [HA115] by 5% each time.
	Distorted wave form of the radio wave.	Make an adjustment by incrementing the no-load current [Hd131] by 5% each time.
A long initial position estimation time is required.	Set value for the estimation is too large.	Lower the values [Hd133] to [Hd135] by the same ratio. Note Too low a value may result in an operation in the opposite direction.
A movement in the opposite direction occurs while the initial position estimation is being used.	The estimation is improperly conducted.	Raise the values [Hd133] to [Hd135] by the same ratio, or raise the voltage gain [Hd136] by 5% each time.
While the initial position estimation is being used, over current errors may occur.	Voltage gain is too high.	Decrement the voltage gain [Hd136] by 5% each time.
Frequency-synchronized re-start may cause errors.	Too high revolution speeds and too large offset of the phases.	Make an adjustment by incrementing the speed response [HA115] by 5% each time. Waiting a longer time for the re-start may improve the situation.

Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, loss of synchronization, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

IVMS Start Sensorless Vector Control (SM/PMM)

In this control mode, operations of magnetic-pole position estimation, IVMS start control, and sensorless vector control are started in this order.

In this control mode, only the parameters set by the first set-up are enabled. Terminal [SET] cannot be used.

In the magnetic-pole position estimation, it is possible to select whether the motor is started after the motor's magnetic-pole positions are estimated by use of the initial-position estimation function or the magnetic-pole positions are synchronized by use of the DC braking function.

In the case of starting after the magnetic-pole position estimation, estimation operation is conducted at the start by setting the Starting Method for Sync.M, 1st-motor [Hd132] at 01.

In the case of the Starting Method for Sync.M, 1st-motor [Hd132] being set at 00, the magnetic poles are positioned to the output phases at the start. As a large offset between the magnetic poles and the output phases may fail the starting, use the starting-time DB to synchronize the magnetic-pole positions and the output phases before the starting.

IVMS start mode is a start mode where larger torque is provided than in the synchronous starting mode.

When the synchronous starting mode provides an insufficient torque, use of the IVMS start mode may improve the performance.

Use of the IVMS start mode requires an SM(PMM) constant that is set by the sensorless vector control and an adjustment dedicated for IVMS start mode.

Before the motor drive, conduct an IVMS auto-tuning and a test run with the load removed.

Precautions for Correct Use

- Some SM (PMM) may be unable to start in the IVMS start mode.
- For IVMS control mode, you are required to make a precise adjustment. By using the auto-tuning selection[AH-01]=03, check that the target motor can be operated by IVMS control. If the auto-tuning result is NG, you need to find other control modes because the target motor cannot be operated by IVMS control.
- IVMS start mode requires a re-adjustment when the inverter is replaced. When a malfunctioning inverter needs to be restored immediately by replacing the malfunctioning inverter with a new one, the synchronous starting mode should be used.
- As the IVMS start mode is a very special control, which may make a unique operation sound as the starting sound.

● Parameters for IVMS Start Mode

Item	Parameter	Data	Description	Default data
Carrier frequency at IVMS	[Hd-41]	0.5 to 16.0(kHz)	Set the carrier frequency during the IVMS drive. Usually, the value does not require to change.	2.00
Filter gain of current detection at IVMS	[Hd-42]	0 to 1000	The filter adjustment gain applied to the detection current during the IVMS drive.	100
Open phase voltage detection gain	[Hd-43]	00 to 04	The adjustment gain applied to the detection voltage during the IVMS drivel.	00
Open phase switching threshold compensation	[Hd-44]	00	IVMS correction: Disabled (no correction)	01
		01	IVMS correction: Enabled (correction to be conducted)	
P-Gain for speed control, SM(PMM)-IVMS	[Hd-45]	0 to 1000	Speed control P gain during the IVMS drive A larger value enhances the responsiveness of the speed control.	100
I-Gain for speed control, SM(PMM)-IVMS	[Hd-46]	0 to 10000	Speed control I gain during the IVMS drive A larger value enhances the responsiveness of the speed control.	100
Wait time for open phase switching, SM(PMM)-IVMS	[Hd-47]	0 to 1000	Waiting time for the open-phase switching during the IVMS drive. A larger value enhances the stability.	15
Limitation of decision about the drive direction, SM(PMM)-IVMS	[Hd-48]	00	Rotation-direction determination: Disabled (no restriction)	01
		01	Rotation-direction determination: Enabled (restricted to the operation-command direction)	
Open phase voltage detection timing adjustment, SM(PMM)-IVMS	[Hd-49]	0 to 1000	Adjustment value of the IVMS detection timing. Usually, the value does not require to change.	10
Minimum pulse width adjustment, SM(PMM)-IVMS	[Hd-50]	0 to 1000	To adjust the width of the voltage pulse during the IVMS drive. A larger value renders the pulse width wider.	100
IVMS Current Limit for threshold	[Hd-51]	0 to 255	Set a limit on each of the upper and the lower limits of the detection current during the IVMS drive. Enabled when [Hd-44] = 01 (enabled).	100
IVMS Threshold Gain	[Hd-52]	0 to 255	To adjust the IVMS auto-tuning value.	100
IVMS Carrier frequency start/end point	[Hd-58]	0 to 50(%)	To adjust the point where the carrier frequency is switched in the IVMS start mode. Usually, the value does not require to change.	5

● Parameters Common to This Mode and the Synchronous Starting Mode

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	12*1	To use IVMS-start type sensorless vector control (SM/PMM)	00
Speed response for Async.M, 1st-motor	[HA115]	0 to 1000(%)	To adjust the responsiveness of the control. A larger value enhances the responsiveness.	100
Minimum Frequency for Sync.M-SLV, 1st-motor	[Hd130]	0 to 50(%)	The frequency at which the sensorless vector control is started. Set the ratio to the base frequency [Hd104].	8
No-Load current for Sync.M-SLV, 1st-motor	[Hd131]	0 to 100(%)	Set the ratio of the no-load current to the rated current during the sensorless vector control.	10
Starting Method for Sync.M, 1st-motor	[Hd132]	00	Initial position estimation is disabled.	00
		01	Initial position estimation is enabled.	
IMPE 0V wait number for Sync.M, 1st-motor	[Hd133]	0 to 255	This is a stand-by adjustment value to stabilize the reference value for the initial position estimation detection.	10
IMPE detect wait number for Sync.M, 1st-motor	[Hd134]	0 to 255	This is an adjustment value to stabilize the current rise of the initial position estimation operation.	10
IMPE detect number for Sync.M, 1st-motor	[Hd135]	0 to 255	This is a detection-operation adjustment value of the initial position estimation operation.	30
IMPE voltage gain for Sync.M, 1st-motor	[Hd136]	0 to 200(%)	This is a output-voltage adjustment gain of the initial position estimation operation.	100
IMPE Mg-pole position offset, 1st-motor	[Hd137]	0 to 359(°)	To conduct corrections in a case where the initial position estimation operation has a certain error.	0
DC braking selection, 1st-motor	[AF101]	01	Internal DC braking: enabled	00
DC braking force at start, 1st-motor	[AF108]	0 to 100(%)	To adjust the DC braking force. Setting of 100% will provide maximum braking force.	30
DC braking active time at start, 1st-motor	[AF109]	0.0 to 60.0(s)	Enabled during the internal DC braking. When the operation command is turned ON, DC braking is started.	0.00
Over current detection level, 1st-motor	[bb160]	Inverter ND rated current × (0.20 to 2.20)	To Set the level at which the over current is detected.	2.20 × Inverter ND rated current

*1. Cannot be selected if [Ub-03] duty spec selection is 00 (VLD).

● Set-up Procedures of IVMS Start Mode

1 Set the protection for the PM motor.

- Setting the over current detection level [bb160]
- Setting the electronic thermal level [bc110]

Precautions for Correct Use

- The over-current detection level should be set appropriately by taking into account the maximum current (demagnetization level) of the PM motor to be used. Set the over-current detection level so that the SM (PMM)'s maximum current (demagnetization level) is not below 150% of the over-current detection level.
- See also *6-6-1 Electronic Thermal Setting* on page 6-48 and set it appropriately.

2 Set the PM motor's Plate Data.

- Setting the capacitance [Hd102]
- Setting the number of poles [Hd103]
- Setting the base frequency [Hd104]
- Setting the maximum frequency [Hd105]
- Setting the rated voltage [Hd106]
- Setting the rated current [Hd108]

Precautions for Correct Use

See also *6-2-1 Motor Basic Settings* on page 6-8 and set them appropriately.

3 Set the PM motor constants.

- Setting the motor constant R [Hd110].
- Setting the motor constant Ld [Hd112].
- Setting the motor constant Lq [Hd114].
- Setting the motor constant Ke [Hd116].
- Setting the motor constant J [Hd118].

Precautions for Correct Use

See also *6-2-2 Motor Constant Setting* on page 6-12 and set them appropriately.

4 Conduct the IVMS auto-tuning

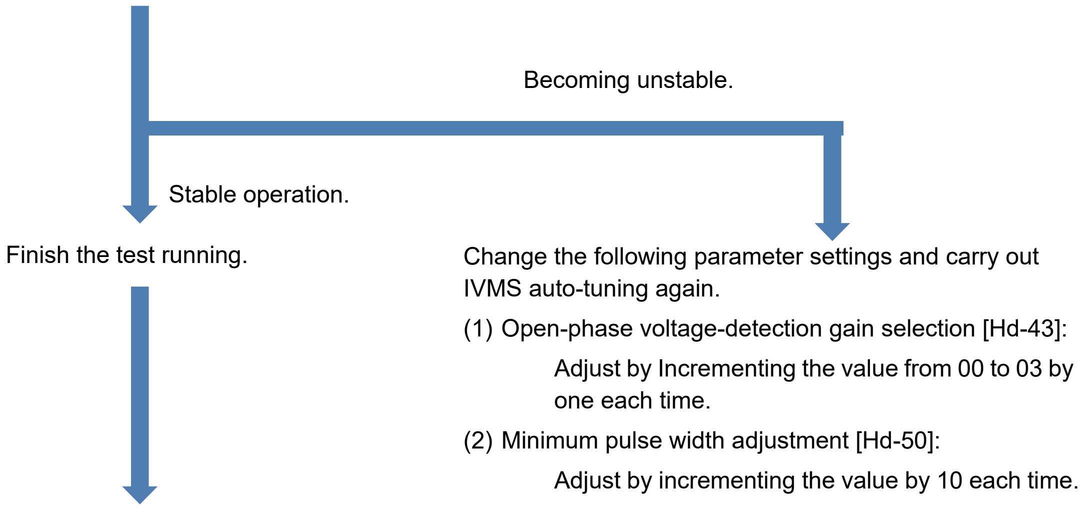
- Set the control mode [AA121] at 12 (SM-IVMS).
- Set the auto-tuning selection [HA-01] at 03 (IVMS).
- Input the command for starting the auto-tuning (operation command).
- The inverter is in an automatic operation.
- Tuning is finished.

Precautions for Correct Use

- For the procedures from the auto-tuning start to the auto-tuning finish, check *6-2-3 Auto-tuning of Motor* on page 6-14 and follow the procedures.
- In the IVMS auto-tuning, the tuning should be done as the motor shaft is being rotated little by little. When the motor shaft is locked, or when the load is heavy, even a normal finish of the auto-tuning may result in a adjustment failure. Conduct the IVMS auto-tuning with nothing attached to the motor shaft.
- When an over current occurs during the automatic operation of the IVMS auto-tuning, check the following items.
  (1) Motor lock caused by braking and/or foreign objects.
  (2) Setting over-current detection level [bb160]
  Check these items, and when there is no problem, conduct the IVMS auto-tuning by incrementing the minimum pulse width adjustment [Hd-50] by 10 each time.
- It may take approximately 5 minute to conduct the IVMS auto-tuning.

5 Run test running

- Set the main-speed command [FA-01] at a value that is smaller than the lowest frequency (switch) [Hd130], and check that stable drive can be provided for the forward revolutions, the backward revolutions, the acceleration, and the deceleration.
- Then, Set the main-speed command [FA-01] at a value that is larger than the lowest frequency (switch) [Hd130], and check that stable drive can be provided for the forward revolutions, the backward revolutions, the acceleration, and the deceleration.



Precautions for Correct Use

When the adjustment has been conducted repeatedly but no trial operation can be conducted, it may be due to the unavailability of IVMS start mode for use. Use the synchronous starting mode.

6 Conduct real operation

- Combine the target motor with a load device that you want to drive actually and then start the operation, and then check whether the motor can provide a stable drive. The drive performance may be improved by conducting a parameter adjustment. For more details, see the following.
- For the adjustment of the high-speed (lowest frequency (switch) or higher), see also the descriptions of the synchronous starting mode.

Precautions for Correct Use

During the operation, do not change the following set parameters. The operation may go into destabilization.

- Open phase voltage detection gain [Hd-43]
- Minimum pulse width adjustment, SM(PMM)-IVMS [Hd-50]

<table>
<tr><th>Phenomenon</th><th>Estimated cause(s)</th><th>Exemplar measures to be taken</th></tr>
<tr><td>Over current occurs at the start</td><td rowspan="2">• Insufficient starting torque
• Misalignment of the output phases and the motor’s magnetic-pole positions</td><td rowspan="2">• Enable the selection of open-phase switch threshold correction [Hd-44].
• Adjust each of the speed control P gain [Hd-45] and the speed control I gain [Hd-46] by 10 each time.
The adjustment should be conducted so that [Hd-45] ≤ [Hd-46].
Some motor characteristics require an adjustment by raising and lowering the settings.
• Adjust the waiting time for open-phase switching [Hd-47] by incrementing it by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.</td></tr>
<tr><td>At the start, the motor loses synchronization and no acceleration is observed.</td></tr>
<tr><td>Loss of synchronization, hunting, and/or over current occur at low speeds (at the lowest frequency(switch) or even lower).</td><td rowspan="2">• Insufficient torque
• Misalignment of the output phases and the motor’s magnetic-pole positions</td><td rowspan="2">• Enable the selection of open-phase switch threshold correction [Hd-44].
• Adjust each of the speed control P gain [Hd-45] and the speed control I gain [Hd-46] by 10 each time.
The adjustment should be conducted so that [Hd-45] ≤ [Hd-46].
Some motor characteristics require an adjustment by raising and lowering the settings.
• Adjust the waiting time for open-phase switching [Hd-47] by incrementing it by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.
• Adjust by decrementing the current limit of IVMS threshold [Hd-51] by 5 each time. Some motor characteristics may provide instability with excessively small settings.
• Adjust by decrementing the IVMS threshold gain [Hd-52] by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.</td></tr>
<tr><td>Loss of synchronization, hunting, and/or over current occur at low speeds (at the lowest frequency(switch) or even lower) and with a heavy load.</td></tr>
<tr><td>The drive becomes unstable at low speeds (at the lowest frequency(switch) or even lower)</td><td>Misalignment of the output phases and the motor’s magnetic-pole positions</td><td>• Adjust by decrementing the IVMS detection current filter gain [Hd-42] by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.
• Adjust the waiting time for open-phase switching [Hd-47] by incrementing it by 5 each time. Some motor characteristics require an adjustment by raising and lowering the settings.</td></tr>
</table>

7-2-12 V/f Control with Sensor (Constant Torque Characteristics)

A motor with an encoder can be used with general-purpose characteristics of V/f control.

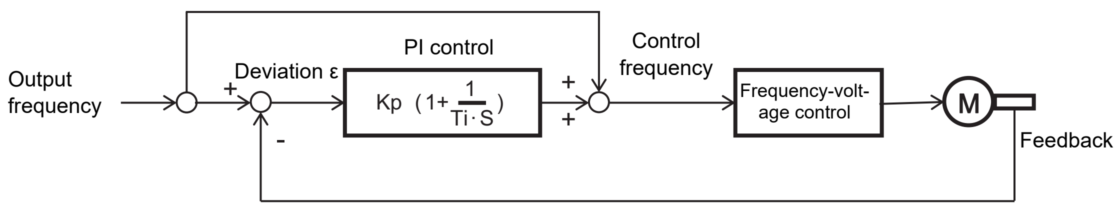
The feedback of the encoder signal from the motor allows highly accurate frequency control.

For the adjustment of V/f control (constant torque characteristics), see *7-2-1 V/f Control (Constant Torque Characteristics)* on page 7-5.

In the V/f control with feedback (FB), a correction of PI control is conducted on the command frequency for the fed-back frequency to control the motor.

Precautions for Correct Use

- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EA] and [EB] of the PG option unit are enabled.
- See *7-2-16 Encoder Feedback Control* on page 7-37.



Kp: proportional gain setting; Ti: integral time; s: operator; ε: deviation

Ki: integral gain setting (Ki = Ti/Kp)

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	04	To use V/f control with sensor (constant torque characteristics).	00
Slip Compensation P-gain witn encoder, 1st-motor	[Hb170]	0 to 1000(%)	This is the P gain for the slip compensation of control with sensor.	100
Slip Compensation I-gain witn encoder, 1st-motor	[Hb171]	0 to 1000(%)	This is the I gain for the slip compensation of control with sensor.	100

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
The motor speed follows the command slowly.	Response of the output is slow and the change in the fed-back value is slow.	Increment the proportional (P) gain [Hb170].
The motor operates unstably.	Response to the fed-back value is too quick.	Decrement the proportional (P) gain [Hb170].
Overshoot and/or hunting occur.		
The motor speed oscillates gently.	Response to the integral operation is slow.	Increment the integral (I) gain [Hb171].
Stabilization of the operation requires a long time.		
It takes time for the command value and the motor speed to be equal to each other.	Response of the output is slow and the change in the fed-back value is slow.	Decrement the integral (I) gain [Hb171].

Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-13 V/f Control with Sensor (Reducing Torque Characteristics)

V/F control is used to adjust the numbers of motor rotation to the command velocity while saving energy when a fan/pump with encoder is driven.

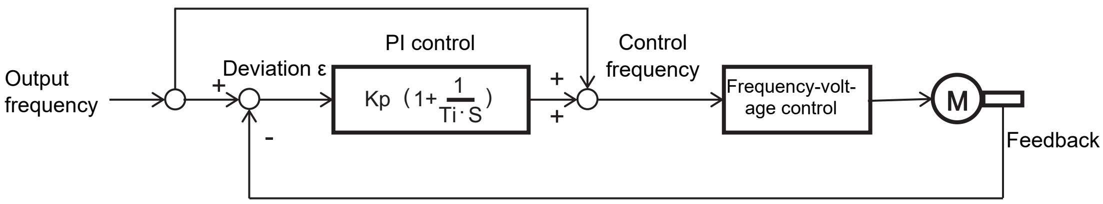
The feedback of the encoder signal from the motor allows highly accurate frequency control.

For the adjustment of V/f control (reducing torque characteristics), see *7-2-2 V/f Control (Reducing Torque Characteristics)* on page 7-6.

In the V/f control with feedback (FB), a correction of PI control is conducted on the command frequency for the fed-back frequency to control the motor.

Precautions for Correct Use

- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EA] and [EB] of the PG option unit are enabled.
- See *7-2-16 Encoder Feedback Control* on page 7-37.



Kp: proportional gain setting; Ti: integral time; s: operator; ε: deviation

Ki: integral gain setting (Ki = Ti/Kp)

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	05	To use V/f control with sensor (reducing torque characteristics).	00
Slip Compensation P-gain witn encoder, 1st-motor	[Hb170]	0 to 1000(%)	This is the P gain for the slip compensation of control with sensor.	100
Slip Compensation I-gain witn encoder, 1st-motor	[Hb171]	0 to 1000(%)	This is the I gain for the slip compensation of control with sensor.	100

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
The motor speed follows the command slowly.	Response of the output is slow and the change in the fed-back value is slow.	Increment the proportional (P) gain [Hb170].
The motor operates unstably. Overshoot and/or hunting occur.	Response to the fed-back value is too quick.	Decrement the proportional (P) gain [Hb170].
The motor speed oscillates gently. Stabilization of the operation requires a long time.	Response to the integral operation is slow.	Increment the integral (I) gain [Hb171].
It takes time for the command value and the motor speed to be equal to each other.	Response of the output is slow and the change in the fed-back value is slow.	Decrement the integral (I) gain [Hb171].

Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-14 Free V/f Control with Sensor

Free V/f control with sensor is used to change the frequency and voltage characteristics when a motor with an encoder is driven.

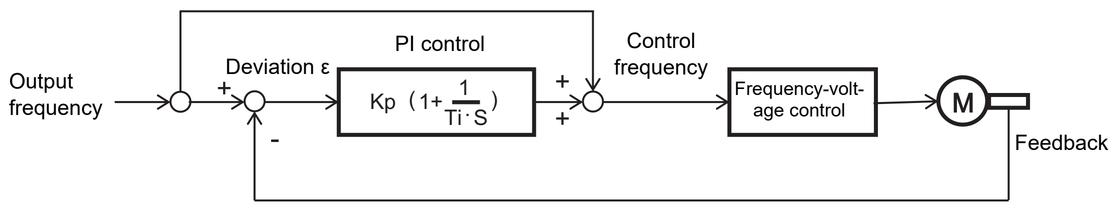
The feedback of the encoder signal from the motor allows highly accurate frequency control.

For the adjustment of V/f control (free V/f), see *7-2-3 V/f Control (Free V/f)* on page 7-7.

In the V/f control with feedback (FB), a correction of PI control is conducted on the command frequency for the fed-back frequency to control the motor.

Precautions for Correct Use

- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EA] and [EB] of the PG option unit are enabled.
- See *7-2-16 Encoder Feedback Control* on page 7-37.



Kp: proportional gain setting; Ti: integral time; s: operator; ε: deviation

Ki: integral gain setting (Ki = Ti/Kp)

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	06	To use V/f control with sensor (free V/f).	00
Slip Compensation P-gain witn encoder, 1st-motor	[Hb170]	0 to 1000(%)	This is the P gain for the slip compensation of control with sensor.	100
Slip Compensation I-gain witn encoder, 1st-motor	[Hb171]	0 to 1000(%)	This is the I gain for the slip compensation of control with sensor.	100

Phenomenon	Estimated cause(s)	Exemplar measures to be taken
The motor speed follows the command slowly.	Response of the output is slow and the change in the fed-back value is slow.	Increment the proportional (P) gain [Hb170].
The motor operates unstably.	Response to the fed-back value is too quick.	Decrement the proportional (P) gain [Hb170].
Overshoot and/or hunting occur.		
The motor speed oscillates gently.	Response to the integral operation is slow.	Increment the integral (I) gain [Hb171].
Stabilization of the operation requires a long time.		
It takes time for the command value and the motor speed to be equal to each other.	Response of the output is slow and the change in the fed-back value is slow.	Decrement the integral (I) gain [Hb171].

Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-15 Automatic Torque Boost Control with Sensor

Automatic torque boost control is used when a motor with an encoder is driven; that require a certain torque at the start; and when the motor revolution speed needs to be equal to the command speed.

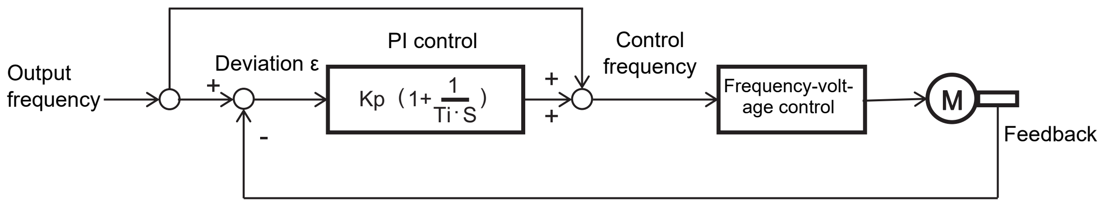
The feedback of the encoder signal from the motor allows highly accurate frequency control.

As for adjustment of the automatic torque boost control, refer to *7-2-6 Automatic Torque Boost* on page 7-12.

In the V/f control with feedback (FB), a correction of PI control is conducted on the command frequency for the fed-back frequency to control the motor.

Precautions for Correct Use

- When [CA-90] = 02, Input terminals [A] and [B] are switched to the terminals for feedback control. When [CA-90] ≠ 02, terminals [EA] and [EB] of the feedback option RX2-PG01 are enabled.
- See *7-2-16 Encoder Feedback Control* on page 7-37.



Kp: proportional gain setting; Ti: integral time; s: operator; ε: deviation

Ki: integral gain setting (Ki = Ti/Kp)

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	07	To use the automatic torque boost with sensor.	00
Slip Compensation P-gain witn encoder, 1st-motor	[Hb170]	0 to 1000(%)	This is the P gain for the slip compensation of control with sensor.	100
Slip Compensation I-gain witn encoder, 1st-motor	[Hb171]	0 to 1000(%)	This is the I gain for the slip compensation of control with sensor.	100

Phenomenon	Estimated cause(s)	Estimated cause(s)Exemplar measures to be taken
The motor speed follows the command slowly.	Response of the output is slow and the change in the fed-back value is slow.	Increment the proportional (P) gain [Hb170].
The motor operates unstably.	Response to the fed-back value is too quick.	Decrement the proportional (P) gain [Hb170].
Overshoot and/or hunting occur.		
The motor speed oscillates gently.	Response to the integral operation is slow.	Increment the integral (I) gain [Hb171].
Stabilization of the operation requires a long time.		
It takes time for the command value and the motor speed to be equal to each other.	Response of the output is slow and the change in the fed-back value is slow.	Decrement the integral (I) gain [Hb171].

Precautions for Correct Use

- When the revolution of the motor is hindered by such causes as the braking or the motor lock caused by foreign objects, such hindrance may cause over current, or the like. When no such adjustment as ones mentioned above improves the state, checking the portion around the motor may sometimes improves it.
- If an application of load results in a great amount of change in the inverter's output frequency monitor [dA-01], a function to automatically change the frequencies for the overload limiting function, the momentary-stop non-stop function, the over voltage suppression function may work depending upon the settings of the functions.

7-2-16 Encoder Feedback Control

In 3G3RX2 series, input of feedback from a motor into a control circuit terminal block of the main body or into a PG option unit allows the control with sensor and the absolute position control.

Precautions for Correct Use

- When [CA-90] ≠ 00, Input terminals [A] and [B] of the main body are switched to the terminals for feedback control.
- When [CA-90] = 02, the control with sensor and the absolute position control are possible with Input terminals [A] and [B].
- When [CA-90] ≠ 02, the control with sensor and the absolute position control are possible with terminals [EAP], [EBP], [EAN], and [EBN] of the PG option unit.
- To conduct the pulse train position control, terminals [SAP], [SBP], [SAN], and [SBN] of the PG option unit are used.
- When the PG option unit was once set in a slot and was removed later, a trip occurs with a feedback option connection error [E112].
- Trips are triggered by an encoder disconnection error [E100] by setting switches on the PG option unit. For more details, see *2-3-6 Wiring for PG Option Unit* on page 2-63.

● Parameter

Item	Parameter	Data	Description	Default data
Encoder constant setting	[CA-81]	0 to 65535(pls)	Setting the encoder constant	1024
Encoder position selection	[CA-82]	00	Phase-A is leading.	00
		01	Phase-B is leading.	
Motor gear ratio Numerator	[CA-83]	1 to 10000	Setting the numerator of the gear ratio of a motor.	1
Motor gear ratio Denominator	[CA-84]	1 to 10000	Setting the denominator of the gear ratio of a motor.	1
Pulse train detection object selection	[CA-90]	00	PCNT function	00
		01	Command	
		02	Control with speed feedback	
		03	Pulse count	
Mode selection of pulse train input	[CA-91]	00	MD0: 90-degree phase difference pulse train	00
		01	MD1: Forward-backward rotation command + pulse train	
		02	MD2: Forward-rotation pulse train + backward-rotation pulse train.	
Encoder constant setting	[ob-01]	0 to 65535(pls)	Setting the encoder constant	1024
Encoder position selection	[ob-02]	00	Phase-A is leading.	00
		01	Phase-B is leading.	
Motor gear ratio Numerator	[ob-03]	1 to 10000	Setting the numerator of the gear ratio of a motor.	1
Motor gear ratio Denominator	[ob-04]	1 to 10000	Setting the denominator of the gear ratio of a motor.	1
Pulse train detection object selection	[ob-10]	00	Command	00
		01	Pulse train position command	
Mode selection of pulse train input	[ob-11]	00	MD0: 90-degree phase difference pulse train	01
		01	MD1: Forward-backward rotation command + pulse train	
		02	MD2: Forward-rotation pulse train + backward-rotation pulse train.	

Encoder’s Setting Table

	Setting description	Terminals [A] and [B] of main body	Terminals [EAP], [EBP], [EAN], and [EBN] of PG Option Unit
(1)	Encoder constant setting	[CA-81]	[ob-01]
(2)	Encoder position selection	[CA-82]	[ob-02]
(3)	Motor gear ratio Numerator	[CA-83]	[ob-03]
(4)	Motor gear ratio Denominator	[CA-84]	[ob-04]

Table (1)Encoder constant-setup sets up the actual number of pulses of the encoder based on the terminals to be used.

Table (2) encoder phase sequence selection is set up in accordance with the encoder’s phase sequence.

When [CA-90] = 02, the main-body speed feedback is enabled while [CA-90] ≠ 02, PG option unit speed feedback is enabled.

Precautions for Correct Use

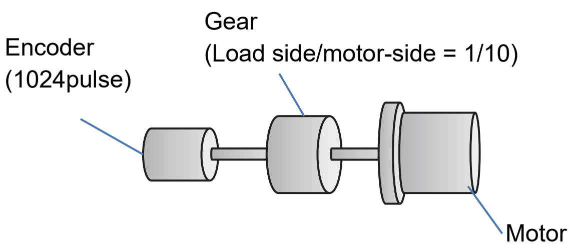
- When either [CA-82] or [ob-02] = 00, meaning that phase-A is leading, and when the operation is of forward rotation, the phase of the phase-A advances 90-degrees more than that of the phase-B in a normal case.
- When either [CA-82] or [ob-02] = 01, meaning that phase-B is leading, and when the operation is of forward rotation, the phase of the phase-B advances 90-degrees more than that of the phase-A in a normal case.
- To check if the encoder input into the main body or into PG option unit is correct, set [AA121] = 00 to 03, meaning V/f control (00), and check the monitor for the [dA-08] frequency detection values. The wiring is correct if the forward operation [FW] has a positive (+) value and if the reversal operation [RV] has a negative (-) value. If it is incorrect, either revising the wiring or switching the Encoder position selection [CA-82] or [ob-02].

Adjustment in Cases Where a Gear Exists between the Motor and the Encoder

When the encoder and the motor shaft are connected to each other by means of a gear, for Tables (3) and (4) conversion is made possible by setting up (3) Encoder gear-ratio's numerator/(4) encoder gear-ratio's denominator.

Set the values ((3)/(4)) so as to be within a range between (1/50) to (20).

An exemplar case where a gear is attached there.



When the encoder's rotating rate for the motor's standard encoder becomes 1/10 for 1024 pulses,
Table (1) Encoder constant set-up: 1024 pulses
Table (3): Encoder's gear ratio's numerator: 1.
Table (4): Encoder's gear ratio's denominator: 10
Set up as above.

Encoder's Speed Detection

To acquire the frequency that was input through the encoder, the following settings are necessary.

- Set-up of Tables (1), (3), and (4)
- Set-up of the number of motor poles

Note When the selected control mode [AA121] is the induction motor control ([AA121] = 00 to 10), async.Motor poles setting, 1st-motor [Hb103] is set as the number of motor poles.

Set-up of Functions of the Encoder Feedback

1 Check the encoder's set-up from the encoder's specifications.

(1) Check the encoder's or the pulse trains' input specs.

(2) Open collector input

Control using main body's terminals [A] and [B]
→ Set [CA-90] = 02.

(3) Line driver input

Control using PG option unit [EAP], [EAN], [EBP], and [EBN]
→ Check that [CA-90] ≠ 02.

2 Set up the control method.

(1) Check whether the speed control or the position control is to be conducted with the control with sensor.

(2) Conduct the speed control with sensor.

In accordance with the mode to be used, select one of the following three controls:

- V/f control with sensor ([AA121] = 04 to 06)
- Automatic boost with sensor ([AA121] = 07)
- Vector control with sensor ([AA121] = 10)

(see, *7-1 Overview of Motor Control Methods* on page 7-3)

Note When [AA121] = 10, the vector control mode selection [AA123] = 00.

(3) Conduct the absolute position control.

Select the vector control with sensor ([AA121] = 10), and set as the vector control mode selection [AA123] either

- 02: Absolute position control; or
- 03: High-resolution absolute position control

(See, *8-4-9 Absolute Position Control* on page 8-108)

Check Pulse Train Input Setting

This section describes a procedure for check of pulse train input setting shown in the following table.

The following table lists a function where a function of inputting the related pulse train into the main body’s terminals [A] and [B], and into the PG option unit terminals: [EAP], [EAN], [EBP], [EBN], [SAP], [SAN], [SBP], and [SBN].

<table>
<tr><th>Function to be used</th><th>Setting check</th><th>For pulse-train input</th></tr>
<tr><td>Speed control with sensor</td><td>Necessary settings
• Control with sensor ([AA121] = 04 to 07)
or
• Vector control with sensor ([AA121] = 10 and [AA123] = 00)
• Selection of target for pulse train input detection ([CA-90], See the right-hand side.)
Related section
7-1 Overview of Motor Control Methods on page 7-3</td><td rowspan="3">• Input into main body’s terminals [A] and [B] ([CA-90] = 02)
• Input into PG option unit terminals [EAP], [EAN], [EBP], and [EBN] ([CA-90] ≠ 02).</td></tr>
<tr><td>Speed-torque control with sensor</td><td>Necessary settings
• Vector control with sensor ([AA121] = 10 and [AA123] = 00)
• Selection of target for pulse train input detection ([CA-90], See the right-hand side.)
Related section
7-2-10 Vector Control with Sensor on page 7-19
7-3 Torque Control on page 7-43</td></tr>
<tr><td>Absolute position control</td><td>Necessary settings
• Vector control with sensor ([AA121] = 10 and [AA123] = 02, or [AA121] = 10 and [AA123] = 03)
• Selection of target for pulse train input detection ([CA-90], See the right-hand side.)
Related section
7-2-10 Vector Control with Sensor on page 7-19
8-4-9 Absolute Position Control on page 8-108</td></tr>
<tr><td>Pulse train position control</td><td>Necessary settings
• Vector control with sensor ([AA121] = 10 and [AA123] = 01)
• Pulse train input SA/SB ([ob-10] = 01)
Related section
8-4-7 Pulse Train Position Control on page 8-99</td><td>• To input PG option unit terminals [SAP], [SAN], [SBP], and [SBN].
The following items can be used for the motor’s vector control.
• Input into main body’s terminals [A] and [B] ([CA-90] = 02)
• Input into PG option unit terminals [EAP], [EAN], [EBP], and [EBN] ([CA-90] ≠ 02).</td></tr>
</table>

Function to be used	Setting check	For pulse-train input
Pulse train frequency command (main body)	Necessary settings • Frequency command ([AA101] = 12) • Selection of target for pulse train input detection ([CA-90] = 01) Related section *6-4-5 Case where Command Is Given through Input of Pulse String* on page 6-28	Input into main body's terminals [A] and [B].
Pulse train frequency command (PG Option Unit)	Necessary settings • Frequency command ([AA101] = 13) • Pulse train input SA/SB ([ob-10] = 00) Related section *6-4-5 Case where Command Is Given through Input of Pulse String* on page 6-28	To input PG option unit terminals [SAP], [SAN], [SBP], and [SBN].
Pulse count	Necessary settings Selection of target for pulse train input detection ([CA-90] = 03) Related section *8-10-6 Pulse Count Function* on page 8-167	Input into main body's terminals [A] and [B].

7-3 Torque Control

7-3-1 Speed Control and Torque Control

The followings show methods to control the motor's torque.

- Speed control: A method of output control by having the motor speed follow a certain frequency command and sending torque at a certain speed, and
- A method of output control with change of speed so that output torque follows a certain command torque.

In the case of controlling by torque command, 08: Sensorless vector control and 10: Sensor vector control need to be selected in the [AA121] control method.

The torque limit function in speed control can be used for 08: Sensorless vector control and 09: Sensorless vector control in the zero speed area and 10: Sensor vector control in the [AA121] control method. In the zero speed area of 09: Sensorless vector control in the zero speed area, however, control to send torque is prioritized.

Item	Speed control	Torque control
Control target	Control is done to maintain the motor speed per frequency command.	Control is done to output the motor torque per torque command.
Operation	Output will be controlled to maintain the speed when loading is changed. If loading becomes bigger, control will be done to send a lager torque. When loading becomes smaller, control will be done to send a smaller torque.	When loading is changed, output will be controlled to maintain the torque. If loading becomes bigger, control will be done to maintain the torque by raising the speed, etc. If loading becomes smaller, control will be done to maintain the torque by slowing the speed, etc.

7-3-2 Control Gain Switching Function

Control gain switching function is used when the motor's response is changed and when the gain is switched according to speed.

In the control gain switch function, two types of PI gains are switched and applied by turning ON and OFF the input terminal function [CAS].

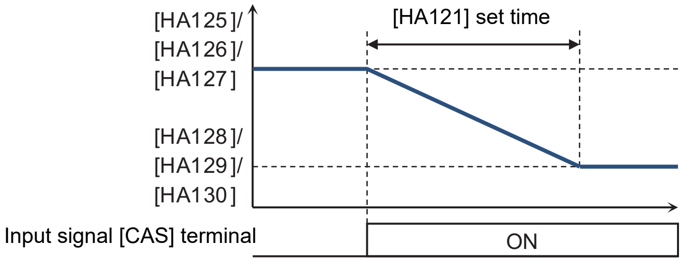
In the gain mapping function to be switched by setting, setting multiple control gains corresponding to the speed can change the gain with the speed change.

Precautions for Correct Use

- If switching is done by the [PPI] terminal when the control gain mapping function is used, [HA130] of gain mapping P control P gain 2 will be applied.
- In the case of using this function, sensorless vector control, sensorless vector control in the zero speed area, and sensor vector control need to be selected in the [AA121] control method.
- In the case of using this function in SM (PMM) control, P gain is adopted.

Control gain switching function [HA120] = 00

You can switch gains from/to [HA125][HA126] to/from [HA128][HA129] by selecting 063[CAS] Switching of control gain to the input terminal function and turning OFF/ON the signal.

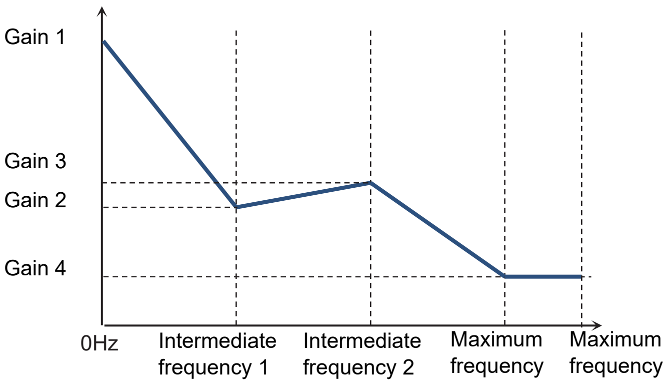


The gains to be applied by switching of the [CAS] terminal are as follows.

Terminal function	[PPI]OFF	[PPI]ON
[CAS]OFF	PI control P gain 1 [HA125] PI control I gain 1 [HA126]	P control P gain 1 [HA127]
[CAS]ON	PI control P gain 2 [HA128] PI control P gain 2 [HA129]	P control P gain 2 [HA130]

Gain mapping function [HA120] = 01

This function switches gains to the arranged settings according to the speed.



The gains to be applied by switching of the control gain mapping function are as follows.

Speed	Applied gain	[PPI] Off	[PPI] On
Zero Hz	Gain 1	PI control P gain 1 [HA125] PI control I gain 1 [HA126]	P control P gain 1 [HA127]
Intermediate frequency 1	Gain 2	PI control P gain 2 [HA128] PI control P gain 2 [HA129]	P control P gain 2 [HA130]
Intermediate frequency 2	Gain 3	PI control P gain 3 [HA131] PI control I gain 3 [HA132]	
Maximum frequency	Gain 4	PI control P gain 4 [HA133] PI control I gain 4 [HA134]	

● Parameter

Item	Parameter	Data	Description	Default data
ASR gain switching mode selection, 1st-motor	[HA120]	00	Switches gain 1 and 2 by the [CAS] terminal.	00
		01	Switches by speed based on the setting.	
ASR gain switching time setting, 1st-motor	[HA121]	0 to 10000(ms)	Switches the gain over the set time when [CAS] gain is switched.	100
ASR gain mapping intermediate speed 1, 1st-motor	[HA122]	0.00 to 590.00(Hz)	Is a frequency for which the control gain 2 of the gain mapping function is applied.	0.00
ASR gain mapping intermediate speed 2, 1st-motor	[HA123]	0.00 to 590.00(Hz)	Is a frequency for which the control gain 3 of the gain mapping function is applied.	0.00
ASR gain mapping Maximum speed, 1st-motor	[HA124]	0.00 to 590.00(Hz)	Is a frequency for the control gain 4 of the gain mapping function.	0.00
ASR gain mapping P-gain 1, 1st-motor	[HA125]	0.0 to 1000.0(%)	Sets the P gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed.	100.0
ASR gain mapping I-gain 1, 1st-motor	[HA126]	0.0 to 1000.0(%)	Sets the I gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed.	100.0
ASR gain mapping P-gain 1 at P-control, 1st-motor	[HA127]	0.0 to 1000.0(%)	Sets the P gain of P control when the [CAS] terminal is OFF or the gain mapping is at zero speed.	100.0
ASR gain mapping P-gain 2, 1st-motor	[HA128]	0.0 to 1000.0(%)	Sets the P gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1.	100.0
ASR gain mapping I-gain 2, 1st-motor	[HA129]	0.0 to 1000.0(%)	Sets the I gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1.	100.0
ASR gain mapping P-gain 2 at P-control, 1st-motor	[HA130]	0.0 to 1000.0(%)	Sets the P gain of P control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1.	100.0
ASR gain mapping P-gain 3, 1st-motor	[HA131]	0.0 to 1000.0(%)	Sets the P gain of PI control when the gain mapping intermediate speed is at 2.	100.0
ASR gain mapping I-gain 3, 1st-motor	[HA132]	0.0 to 1000.0(%)	Sets the I gain of PI control when the gain mapping intermediate speed is at 2.	100.0
ASR gain mapping P-gain 4, 1st-motor	[HA133]	0.0 to 1000.0(%)	Sets the P gain of PI control at the gain mapping maximum speed.	100.0
ASR gain mapping I-gain 4, 1st-motor	[HA134]	0.0 to 1000.0(%)	Sets the I gain of PI control at the gain mapping maximum speed.	100.0
Control gain switch	[CA-01] to [CA-11]	064	Switches gains by the [CAS] terminal.	-
PPI control switch		063	Switches PI control and P control by the [CAS] terminal.	

7-3-3 P/PI Switching Function

This switches the control gain (ASR gain) of motor control from Proportional Integral (PI) control to Proportionality (P) control.

When the motor control is switched from Proportional Integral (PI) Control to Proportionality (P) Control, the whole gain of a speed control loop lowers. That may control vibration, etc.

You can switch from/to PI control to/from P control by selecting 062[PPI] Switching of PPI control and turning OFF/ON the signal.

Use the following formula when calculating P control P gain.

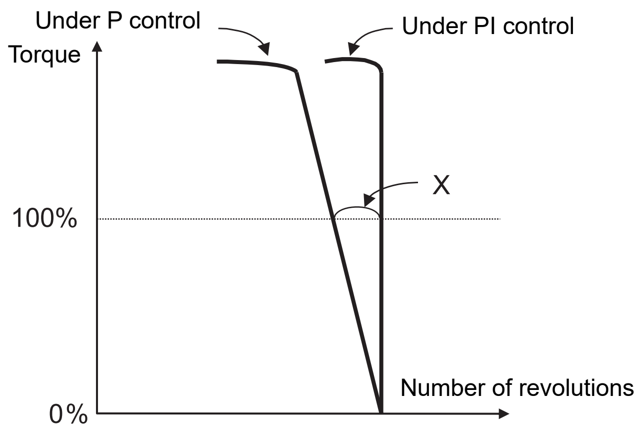
$$\text{(P control P gain)} = \frac{10}{\text{(Speed fluctuation ratio)}}\ (\%)$$

The relationship between speed fluctuation ratio and speed tolerance is calculated based on the following schematic formula.

$$\text{(Speed fluctuation ratio)} = \frac{\text{Speed tolerance at the rated torque X}(\text{min}^{-1})}{\text{Synchronous rotation at the base speed }(\text{min}^{-1})} \times 100\%$$

Precautions for Correct Use

In the case of using this function, [AA121] control method, sensorless vector control, sensorless vector control in the zero speed area, and sensor vector control need to be selected.



Control gain switching function [HA120] = 00

Terminal function	[PPI]OFF	[PPI]ON
[CAS]OFF	PI control P gain 1 [HA125] PI control I gain 1 [HA126]	P control P gain 1 [HA127]
[CAS]ON	PI control P gain 2 [HA128] PI control P gain 2 [HA129]	P control P gain 2 [HA130]

Control gain switching function [HA120] = 01

Speed	Applied gain	[PPI] Off	[PPI] On
0Hz	Gain 1	PI control P gain 1 [HA125] PI control I gain 1 [HA126]	P control P gain 1 [HA127]
Intermediate frequency 1	Gain 2	PI control P gain 2 [HA128] PI control P gain 2 [HA129]	P control P gain 2 [HA130]
Intermediate frequency 2	Gain 3	PI control P gain 3 [HA131] PI control I gain 3 [HA132]	
Maximum frequency	Gain 4	PI control P gain 4 [HA133] PI control I gain 4 [HA134]	

● Parameter

Item	Parameter	Data	Description	Default data
ASR gain switching mode selection, 1st-motor	[HA120]	00	Switches gain 1 and 2 by the [CAS] terminal.	00
		01	Switches by speed based on the setting.	
ASR gain switching time setting, 1st-motor	[HA121]	0 to 10000(ms)	Switches the gain over the set time when [CAS] gain is switched.	100
ASR gain mapping intermediate speed 1, 1st-motor	[HA122]	0.00 to 590.00(Hz)	Is speed for which the control gain 2 of the gain mapping function is applied.	0.00
ASR gain mapping intermediate speed 2, 1st-motor	[HA123]	0.00 to 590.00(Hz)	Is speed for which the control gain 3 of the gain mapping function is applied.	0.00
ASR gain mapping Maximum speed, 1st-motor	[HA124]	0.00 to 590.00(Hz)	Is speed for which the control gain 4 of the gain mapping function is applied.	0.00
ASR gain mapping P-gain 1, 1st-motor	[HA125]	0.0 to 1000.0(%)	Sets the P gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed.	100.0
ASR gain mapping I-gain 1, 1st-motor	[HA126]	0.0 to 1000.0(%)	Sets the I gain of PI control when the [CAS] terminal is OFF or the gain mapping is at zero speed.	100.0
ASR gain mapping P-gain 1 at P-control, 1st-motor	[HA127]	0.0 to 1000.0(%)	Sets the P gain of P control when the [CAS] terminal is OFF or the gain mapping is at zero speed.	100.0
ASR gain mapping P-gain 2, 1st-motor	[HA128]	0.0 to 1000.0(%)	Sets the P gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1.	100.0
ASR gain mapping I-gain 2, 1st-motor	[HA129]	0.0 to 1000.0(%)	Sets the I gain of PI control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1.	100.0
ASR gain mapping P-gain 2 at P-control, 1st-motor	[HA130]	0.0 to 1000.0(%)	Sets the P gain of P control when the [CAS] terminal is ON or the gain mapping intermediate speed is at 1.	100.0
ASR gain mapping P-gain 3, 1st-motor	[HA131]	0.0 to 1000.0(%)	Sets the P gain of PI control when the gain mapping intermediate speed is at 2.	100.0
ASR gain mapping I-gain 3, 1st-motor	[HA132]	0.0 to 1000.0(%)	Sets the I gain of PI control when the gain mapping intermediate speed is at 2.	100.0
ASR gain mapping P-gain 4, 1st-motor	[HA133]	0.0 to 1000.0(%)	Sets the P gain of PI control at the gain mapping maximum speed.	100.0
ASR gain mapping I-gain 4, 1st-motor	[HA134]	0.0 to 1000.0(%)	Sets the I gain of PI control at the gain mapping maximum speed.	100.0

Item	Parameter	Data	Description	Default data
Control gain switch	[CA-01] to [CA-11]	064	Switches gains by the [CAS] terminal.	-
PPI control switch		063	Switches PI control and P control by the [CAS] terminal.	

7-3-4 Torque Limit Function

This limits torque when the speed is controlled. Contact positioning control, etc. can limit the torque increase.

In the case of using [AA121] control method, sensorless vector control, sensorless vector control in the zero speed area, and sensor vector control, this limits output torque of the motor. However, when Zero-Hz range sensorless vector control is used, the control to output the torque is prioritized within a Zero-Hz range.

Speed control/position control/torque control are enabled.

The torque limit function is set in [bA110].

When a torque limiting signal is selected in output selection, the output terminal 022 [TRQ] torque limiting signal will be turned ON once the torque limit function above starts operation.

Precautions for Correct Use

- If the torque liming function [TL] is set to an input terminal, the torque limit function set to [bA110] will be enabled, only when [TL] is turned ON. When it is OFF, the torque limit setting will be disabled and the torque limit value will be the maximum value.
- If the torque liming function [TL] is not set to an input terminal, the torque limit function set to the torque limit selection [bA110] will be enabled constantly.
- To calculate the motor rated torque (100%) in this function, use the following formula.

  Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency

  Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm

  Therefore, the output torque varies depending on the combined motor. Note that it is not the absolute value of torque.

● Parameter

Item	Parameter	Data	Description	Default data
Torque limit selection, 1st-motor	[bA110]	00 to 11	00 (Disable/01)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)	07
Torque limit parameter mode selection, 1st-motor	[bA111]	00	Four Quadrant specific	00
		01	[TRQ] terminal switch	
Torque limit 1 Torque limit 2 Torque limit 3 Torque limit 4	[bA112] [bA113] [bA114] [bA115]	0.0 to 500.00(%)	The torque limit function will operate when output torque exceeds this set value.	150.0

● Input Terminal Function [CA-01] to [CA-11]

Item	Terminal name	Data	Description
Validation of torque limit	[TL]	060	Switches enable/disable of the torque limit function.
Torque limit switchover 1	[TRQ1]	061	Is the torque limit command switch terminal 1.
Torque limit switchover 2	[TRQ2]	062	Is the torque limit command switch terminal 2.

● Output Terminal [CC-01] to [CC-07]

Item	Terminal name	Data	Description
During torque limitation	[TRQ]	022	Signal turns ON when the torque limit function is enabled.

(a) Analog input mode

It is a mode to set a torque limit value in all operation states by applied voltage/current by setting the Ai1/Ai2/Ai3 terminal on the control terminal block in the torque limit selection [bA110].

In the case of setting torque bias, values corresponding to analog input are as follows.

- Input to Ai1/Ai2 Terminal

0 to 10 (V)/0 to 20 (mA) corresponding value
Torque command addition 0.0 to 500.0(%)

- Input to Ai3 Terminal

-10 to 10 (V) corresponding value
Torque command addition -500.0 to 500.0(%)

The setting of the ratio above can be changed by adjusting the analog input start end function. See *8-10-5 Analog Input* on page 8-163.

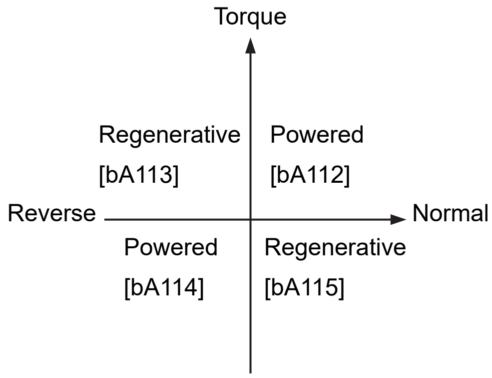
(e.g.) In the case of setting 0.0 to 50.0% to the torque command addition value for 0-10 (V)/0-20 (mA) input as [Ai1], set 10.0% for [Cb-04] to make it 50.0% against maximum 500.0%. ([Cb-03]=0.0,[Cb-04]=10.0,[Cb-05]=0.0,[Cb-06]=100.0)

(b) 4 Quadrant specific setting mode

It is a mode to set respective torque limits 1 to 4 ([bA112] to [bA115]) in the four quadrants of normal powered, normal regenerative, reverse powered, and reverse regenerative.

It will be enabled when torque limit selection [bA110] = 07 (parameter setting) and torque limit mode selection [bA111] = 00 (by each quadrant).

The relationship of four quadrants and torque limits is shown in the figure below.

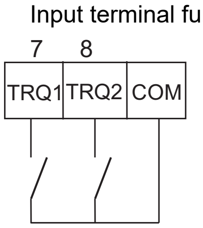


(c) Terminal switch mode

Set values of torque limits 1 to 4 ([bA112] to [bA115]) in all operation states are enabled by the combination of torque limit switch terminals 1 and 2 (TRQ1, TRQ2) set to the input terminal.

When torque limit selection [bA110] = 07 (parameter setting) or torque limit mode selection [bA111] = 01 ([TRQ] terminal switch) is selected, torque limit 1 to 4 that can be switched by switching the torque limit switch 1/2 assigned to the input terminal will be set as shown in the figure on the right.

(e.g.) When the 061 [TRQ1] torque limit switch 1 is assigned to the input terminal 7 and the 062 [TRQ2] torque limit switch 2 to the input terminal 8



OFF	OFF	→	[bA112]
ON	OFF	→	[bA113]
OFF	ON	→	[bA115]
ON	ON	→	[bA114]

Torque LAD Stop Function

This function is used to stop the limit acceleration/deceleration function (LAD) temporally when the torque limit function is operated.

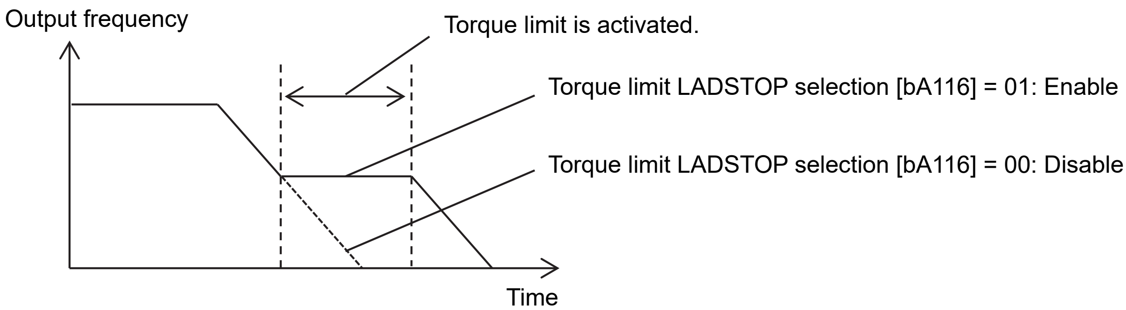
When the torque limit is operated, the frequency command is temporally held. On the other hand, when the torque limit is reset, the held frequency command is resumed.

To stabilize the motor operation after torque limit is reset, set this function enabled.

This function operates only during the deceleration on the speed control.

● Parameter

Item	Parameter	Data	Description	Default data
Torque limit LAD-STOP selection, 1st-motor	[bA116]	00	Disable	00
		01	Enable: retains frequency information when the torque limit is switched. (at the time of deceleration operation)	



Over Torque Signal Output

The output terminal 019 [OTQ] over torque signal will be turned ON when the output torque monitor [dA-17] exceeds [CE120] to [CE123].

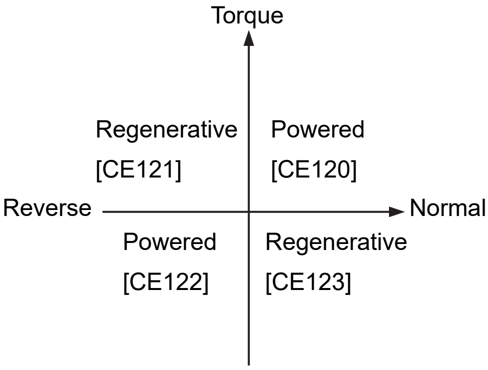
In the case of using as an under torque signal, output will be feasible when the output terminal a/b [NO/NC] setting [CC-11] to [CC-17] corresponding to the output terminal function [CC-01] to [CC-07] assigned with 019 [OTQ] is switched from 00 to 01.

To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency

Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm

This level is used when you detect lift excessive high load.



● Parameter

Item	Parameter	Data	Description	Default data
Over torque level (Forward driving), 1st motor	[CE120]	0.0 to 500.0(%)	Turns On the [OTQ] output terminal function when the output torque exceeds respective levels.	100.0
Over torque level (Reverse regenerative), 1st motor	[CE121]			
Over torque level (Reverse driving), 1st motor	[CE122]			
Over torque level (Forward regenerative), 1st motor	[CE123]			

● Output Terminal [CC-01] to [CC-07]

Item	Terminal name	Data	Description
Excessive torque	[OTQ]	019	A signal turns ON when it exceeds the over torque level.

Torque Limit Value Monitor

You can check the torque limit value switched by selection on the [dA-16] torque limit monitor.

● Parameter

Item	Parameter	Data	Description	Default data
Torque limit monitor	[dA-16]	0 to 500.0(%)	Displays the limit value of the torque limit function.	-
Output torque monitor	[dA-17]	-1000.0 to 1000.0(%)	Displays the output torque.	-

Precautions for Correct Use

Torque limit monitor cannot operate the monitoring function in the following cases:

- When setting bA110 to 00 (Disabled)
- With TL allocation, TL=OFF (deactivate by TL terminals)
- When setting bA110 to 07 (Parameter setting) and bA111 to 00 (Four quadrant specific)

7-3-5 High-torque Multi-operation Control

When high-torque multi-operation is carried out, connect an inverter to two motors with the same specification to complete sensorless vector control (IM). That enables an output of high torque.

Motor constant needs to be set as follows.

Precautions for Correct Use

- In the case of operating different loads on two motors, the load fluctuation on one motor may influence the operation status of the other and cause inappropriate control. Make sure to operate them with a load that can be considered as one load.
- See *7-1 Overview of Motor Control Methods* on page 7-3 for adjustment method.

● Motor Base Parameter

Item	Parameter	Data	Description	Default data
Async.Motor capacity setting, 1st-motor	[Hb102]	0.01 to 160.00 (kW)	Sets a 2-fold capacity of a motor in high torque multi-operation.	Varies depending on inverter models and settings of duty rating.
Async.Motor poles setting, 1st-motor	[Hb103]	2 to 48 (poles)	Sets the number of poles per motor.	4
Async.Motor Base frequency setting, 1st-motor	[Hb104]	1.00 to 590.00 (Hz)	Sets the base frequency per motor.	50.00*1
Async.Motor Maximum frequency setting, 1st-motor	[Hb105]	1.00 to 590.00 (Hz)	Sets the maximum frequency per motor.	50.00
Async.Motor rated voltage, 1st-motor	[Hb106]	1 to 1000 (V)	Sets the rated voltage per motor.	200V: 230*1 400V: 400*1

Item	Parameter	Data	Description	Default data
Async.Motor rated current, 1st-motor	[Hb108]	0.01 to 10000.00(A)	Sets a 2-fold rated current of a motor in high torque multi-operation.	Varies depending on inverter models and settings of duty rating.

*1. Default data when default data selection (UB-02) is set to 01.

● IM Motor Constant Parameter

Item	Parameter	Data	Description	Default data
Async.Motor constant R1, 1st-motor	[Hb110]	0.000001 to 1000.000000 (Ω)	Sets half of primary resistance of a motor in high torque multi-operation.	Varies depending on inverter models and settings of duty rating.
Async.Motor constant R2, 1st-motor	[Hb112]	0.000001 to 1000.000000 (Ω)	Sets half of secondary resistance of a motor in high torque multi-operation.	
Async.Motor constant L, 1st-motor	[Hb114]	0.000001 to 1000.000000 (mH)	Sets half of leaked inductance value of a motor in high torque multi-operation.	
Async.Motor constant Io, 1st-motor	[Hb116]	0.01 to 10000.00(A)	Sets a 2-fold non-load current value of a motor in high torque multi-operation.	
Async.Motor constant J, 1st-motor	[Hb118]	0.00001 to 10000.00000 (kgm^2)	Sets a 2-fold system inertia moment of a motor in high torque multi-operation.	

● Parameter

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	08: Sensorless vector control (IM) 09: Sensorless vector control in zero speed area (IM)[*1]	Uses the sensorless vector control function or sensorless vector control in the zero speed area.	00

*1. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

7-3-6 Torque Bias Function

This function is used when torque command values are increased during the operation start and the lifting.

The torque bias function operates by enabling torque bias mode selection at the time of speed control.

The torque bias function will be enabled when the [AA121] control method is set to the sensorless vector control, sensorless vector control in the zero speed area, and sensor vector control.

The torque bias function operates in either speed control or torque control.

When the 068 [TBS] torque bias enable function is set to the input terminal, the torque bias function will be enabled, only when [TBS] is turned ON. When it is OFF, the torque bias setting will be disabled and the torque addition will be 0.

In the torque bias function, switching forward/reverse can switch the adding direction.

(a) When it is per the sign [±] of [Ad-14] = 00

Regardless of the operation direction, torque will be added to the forward direction, when the torque bias value is (+), and to the reverse direction, when the torque bias is (-).

(b) When it is dependent on the operation direction [Ad-14] = 01

The sign of torque bias value and the direction of action of torque bias change based on the direction of operation command.

Forward command: Adds torque in the same direction as the torque bias value.

Reverse command: Adds torque in the reverse direction as the torque bias value.

Precautions for Correct Use

- The torque bias function increases the current because torque command is added.
- In the case of setting torque bias, values corresponding to analog inputs are as follows.
  - Input to Ai1/Ai2 Terminal

0 to 10 (V)/0 to 20 (mA) corresponding value
Torque command addition 0.0 to 500.0(%)

  - Input to Ai3 Terminal

-10 to 10 (V) corresponding value
Torque command addition -500.0 to 500.0(%)

- The setting of the ratio above can be changed by adjusting the analog input start end function.
  See *8-10-5 Analog Input* on page 8-163.

  (e.g.) In the case of setting 0.0 to 50.0% to the torque command addition value for 0-10 (V)/0-20 (mA) input as [Ai1], set 10.0% for [Cb-04] to make it 50.0% against maximum 500.0%. ([Cb-03]=0.0,[Cb-04]=10.0,[Cb-05]=0.0,[Cb-06]=100.0)

Torque Bias Command Value Monitor

Commanded torque bias value can be monitored on the [FA-16] torque bias monitor.

In the case of [Ad-11] = 07, the setting can be changed on the [FA-16] monitor.

The torque command monitor (after calculation) [dA-15] displays the value with torque bias added to the current torque command.

To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency

Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm

● Parameter

Item	Parameter	Data	Description	Default data
Torque bias input source selection	[Ad-11]	00 to 13,15	00 (Disable)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/ 11 (Option 3)/ 12 (Pulse train input: main unit)/ 13 (Pulse train input: Option)/ 15 (PID calculation)	00
Torque bias value setting	[Ad-12]	-500.0 to 500.0(%)	Adds a torque addition amount.	0.0
Polarity selection for torque bias	[Ad-13]	00 (Per sign)	Regardless of the operation direction, torque will be added to the forward direction, when the value is (+), and to the reverse direction, when the the value is (-).	00
		01 (Follow the revolution direction)	Torque bias [Ad-12] is applied to the operation direction when (+), and applied to the reverse direction when (-).	
Terminal [TBS] active	[Ad-14]	00	Disable	00
		01	Enable	
Torque bias monitor	[FA-16]	-500.00 to 500.00(%)	Is the torque bias set monitor.	-
Torque command monitor after calculation	[dA-15]	-500.00 to 500.00(%)	Is the torque command monitor calculated set value and bias value.	-
Input terminal function	[CA-01] to [CA-11]	068	[TBS]: Can switch enable/disable of bias by the terminal ON/OFF switch when [TBS] is assigned and [Ad-11] = 01. ON: Enable/OFF: Disable	-

7-3-7 Switching Function of Torque Control/Speed Control (ATR)

This function is used so that speed control and torque control are switched with contact positioning control, etc.

When turning on the input terminal function 067 [ATR] terminal, the motor is controlled by torque, and when turning off, the motor is controlled by speed.

Precautions for Correct Use

If the torque command changes in a step manner when switching from speed control to torque control, the current may rise instantaneously.

● Parameter

Item	Parameter	Data	Description	Default data
Switching time of Speed control to Torque control	[Ad-04]	0 to 1000(ms)	This function is used to switch the speed control to the torque control moderately in accordance with the set time.	100

Input Terminal Function

Item	Parameter	Data	Description
Input terminal 1 to 9, A or B selection	[CA-01] to [CA-11]	067	[ATR]: Torque command input approval

7-3-8 Torque Command

In the case of using [AA121] control method in sensorless vector control, and sensor vector control, this drives the motor based on torque command.

This function can be used not only in speed control/pulse train position control but also in torque control. It can also be applied to a winding machine.

Using the torque bias function at the time of torque control adds a torque bias amount to torque command.

In the case of operating by torque control, assign 067 [ATR] to any of the input terminals. Turning ON the [ATR] terminal switches from speed control to torque control.

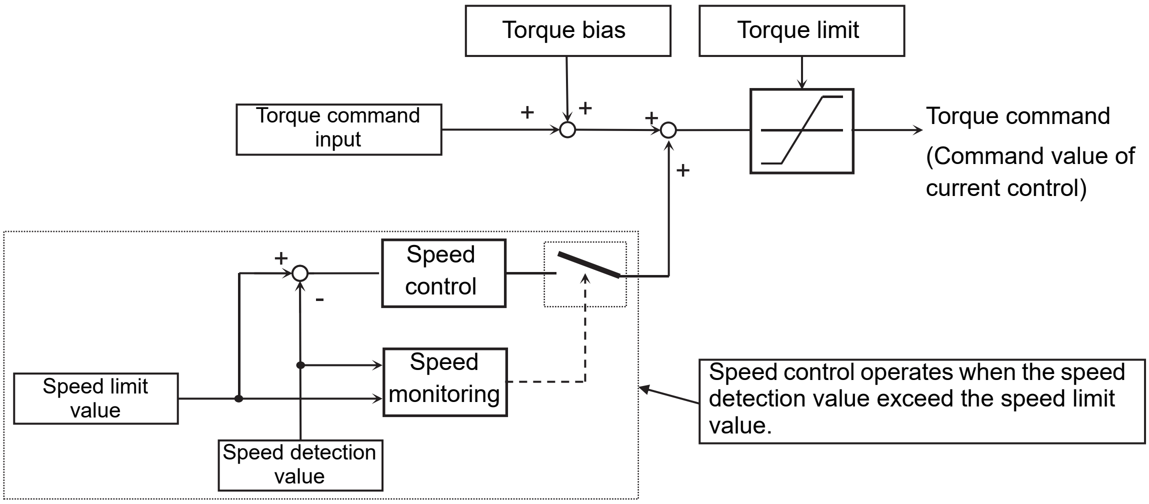
Torque command handles the input value selected in the torque command setting [Ad-01] as a command.

To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency
Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm

Precautions for Correct Use

Because the speed under torque control is decided by the balance with load, set [Ad-40] torque control speed limit value input selection for prevention of runaway. In the case of 07: Parameter setting, set the speed limit value setting [Ad-41]/[Ad-42].



● Parameter

Item	Parameter	Data	Description	Default data
Switching time of Speed control to Torque control	[Ad-04]	0 to 1000(ms)	It is a time to switch from torque command to speed control. When an error occurs while the control is switched, set the time longer than the set time.	100
Input selection for speed limit at torque control	[Ad-40]	01 to 13	01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/ 05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/ 11 (Option 3)/ 12 (Pulse train input: main unit)/ 13 (Pulse train input: Option)	07
Speed limit at torque control (at Forward rotation)	[Ad-41]	0.00 to 590.00(Hz)	Sets frequency to limit in the normal rotation during torque control.	0.00
Speed limit at torque control (at Reverse rotation)	[Ad-42]	0.00 to 590.00(Hz)	Sets frequency to limit in the reverse rotation during torque control.	0.00

Monitor Torque Command and Output Torque

The torque command monitor [FA-15] displays a current command value that has been commanded.

In the case of [Ad-01] = 07, the torque command set value can be changed on the [FA-15] monitor.

To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency
Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm

The torque command monitor (after calculation) [dA-15] displays the value with torque bias added to the current torque command.

Current output torque can be monitored on the Output torque monitor [dA-17].

To calculate the motor rated torque (100%) in this function, use the following formula.

Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency

Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm

● Parameter

Item	Parameter	Data	Description	Default data
Torque reference input source selection	[Ad-01]	01 to 13,15	01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/ 05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse train input: main unit)/ 13 (Pulse train input: Option)/ 15 (PID calculation)	07
Torque reference value setting	[Ad-02]	-500.0 to 500.0(%)	Adds a torque addition amount.	0.0
Polarity selection for torque reference	[Ad-03]	00 (Per sign)	Regardless of the operation direction, torque will be added to the forward direction, when the value is (+), and to the reverse direction, when the the value is (-).	00
		01 (Follow the revolution direction)	Changes the sign of value and the direction of torque bias action based on the operation command direction.	
Torque command monitor (after calculation)	[dA-15]	-500.00 to 500.00(%)	Is the torque command monitor calculated set value and bias value.	-
Output torque monitor	[dA-17]	-500.00 to 500.00(%)	Displays the output torque.	-
Torque reference monitor	[FA-15]	-500.00 to 500.00(%)	Is the torque command set monitor.	-

Input Terminal Function

Item	Parameter	Data	Description
Input terminal 1 to 9, A or B selection	[CA-01] to [CA-11]	067	Torque command input approval [ATR]

7-4 Reduction of Motor Noise, Noise and Inverter Heat Generation

7-4-1 Carrier Frequency

The electromagnetic noise from the motor, noise from the inverter and the heat generation in the inverter can be reduced/suppressed when you change the carrier frequency.

The carrier frequency is the frequency at which the element that controls the inverter output changes.

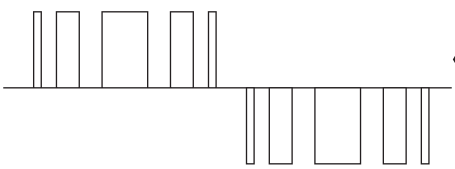
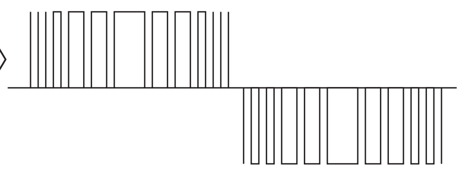
The carrier frequency can be changed using the [bb101] setting.

It is also effective in avoiding resonance of mechanical systems and motors.

Precautions for Correct Use

- With the selection using [Ub-03] Load specifications, the carrier frequency setting will be automatically restrained.
- In accordance with the figures of *Derating of Rated Output Current* on page 2-10, operate the inverter within the proper current range.
- If the [AA121] control method selection when driven by induction motor (IM) is automatic torque boost (03), sensorless vector control (08), or zero speed area sensorless vector control (09), set the carrier frequency to 2.0 kHz or higher.
- If the [AA121] control method selection is the synchronous motor/permanent magnet motor (SM/PMM) sensorless vector control (11), set the carrier frequency to 8.0 kHz or higher.
- The carrier frequency should be set to 10 times or higher of the [Hb105] IM highest frequency or [Hd105] SM (PMM) highest frequency.
  (Ex.) When [Hb105] = 60 Hz, [bb101] = 0.6 kHz (600 Hz) or higher
- When using the carrier frequency of 2.1 kHz or higher, see *2-1-3 Installation Environment* on page 2-7.

Carrier Frequency and Its Extent of the Effect

Carrier frequency	Low ←→	High
Motor electromagnetic noise	Loud	Quiet
Noise	Quiet	Loud
Inverter heat generation	Little	Great
Leakage current	Low	High
Inverter output voltage waveform example (PWM output)	Carrier frequency: Low 	Carrier frequency: High 

● Parameter

Item	Parameter	Data	Description	Default data
Carrier speed setting, 1st-motor	[bb101]	0.5 to 16.0(kHz) *1	Changes the carrier frequency.	2.0

*1. The following constraints will be applied internally.
Maximum 12.0 kHz at rated LD, maximum 10.0 kHz at rated VLD

7-4-2 Automatic Carrier Reduction

It automatically lowers the carrier frequency according to increase of output current values and temperature rise in inverter.

The automatic carrier frequency reduction selection can be changed using the [bb103] setting.

The higher the inverter carrier frequency is, the more the temperature inside the inverter tends to increase.

The Automatic carrier frequency reduction function reduces life degradation of the elements by automatically lowering the carrier frequency according to the output current or temperature.

Precautions for Correct Use

- When the automatic carrier frequency reduction function is activated, the electromagnetic noise of the motor changes.
- If the carrier frequency [bb101] is 2.0 kHz or lower, this function will not be activated.
- The operation rate when the carrier frequency was changed during operation will be 2 kHz in 1 second.
- When the automatic carrier frequency reduction function is activated, the electromagnetic noise generated by the motor changes slowly.
- The [bb102] setting is not necessary when synchronous motor and permanent magnet motor are used.

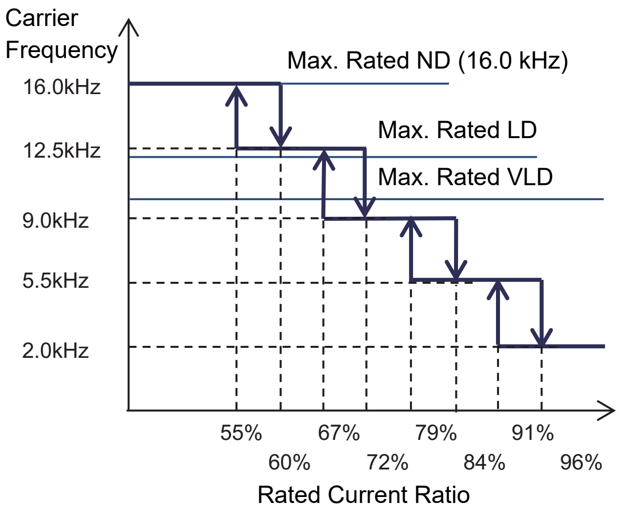
● Parameter

Item	Parameter	Data	Description	Default data
Automatic-carrier reduction selection, 1st-motor	[bb103]	00	[bb101] Follows the carrier frequency.	00
		01	Reduces the carrier frequency according to the inverter output current.	
		02	Reduces the carrier frequency according to the inverter temperature.	

Output Current-dependent ([bb103] = 01)

Carrier frequency reduction starts once the current exceeds a certain value to the rated current.

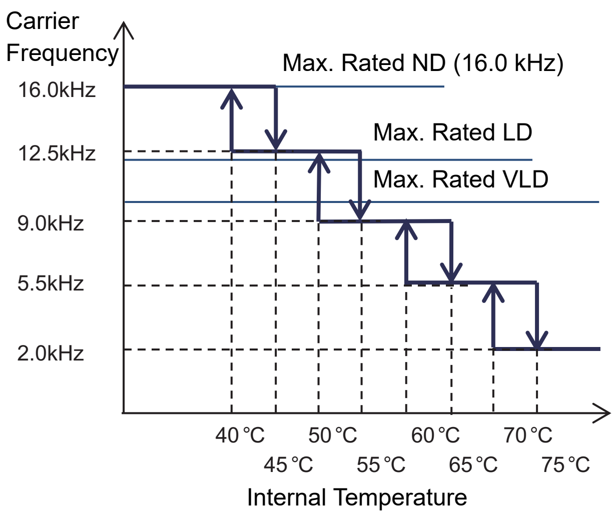
When the current decreases, the carrier frequency is automatically regained.



Cooling Fin Temperature-dependent ([bb103] = 02)

Carrier frequency reduction starts once the temperature of the internal output element exceeds a certain value.

When the temperature lowers, the carrier frequency is automatically regained.



7-4-3 Lowering Electromagnetic Noise from Motor

Changing the sprinkle carrier pattern selection cuts the electromagnetic noise of a certain area and changes the electromagnetic noise of the motor.

Sprinkle carrier pattern selection can be changed using the [bb102] setting.

The inverter carrier frequency is about the same as when output at 3 kHz.

Default data

Precautions for Correct Use

The [bb102] setting is not necessary when synchronous motor and permanent magnet motor (SM/PMM) are used.

● Parameter

Item	Parameter	Data	Description	Default data
Sprinkle carrier pattern selection, 1st-motor	[bb102]	00	Disabled (Follows other carrier frequency setting)	00
		01	Pattern 01	
		02	Pattern 02	
		03	Pattern 03	

7-5 Start Conditions

7-5-1 Selection of Reduced Voltage Startup

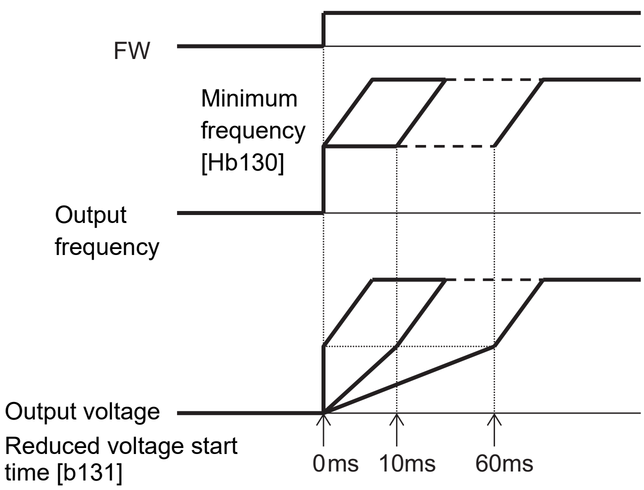
This function allows you to make the inverter increase the voltage gradually when starting the motor while outputting the minimum frequency.

The time to reach the output voltage for the reduced voltage start can be set with [Hb131].

Precautions for Correct Use

- Set a small value for the reduced voltage start selection [Hb131] if you intend to increase the start torque. On the other hand, setting a small value will cause the inverter to perform full-voltage starting and to easily trip because of overcurrent.
- This function is effective only when V/f control (constant torque characteristics, reduced torque characteristics, or free V/f control) is selected for the control method [AA121].

Item	Parameter	Data	Description	Default data
Minimum frequency adjustment, 1st-motor	[Hb130]	0.00 to 10.00(Hz)	This is the start frequency.	0.50
Reduced voltage start time setting, 1st-motor	[Hb131]	0 to 2000(ms)	Increases the output voltage over the set time, from the operation start to the voltage command equivalent to the minimum frequency.	36



7-5-2 Startup DC Injection Braking

Before outputting the frequency to the motor, apply DC braking to stop the motor rotating. And then, start operation.

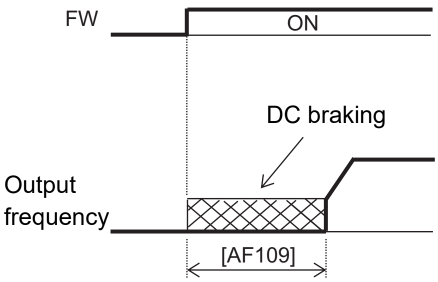
To use DC braking for starting, the following settings are required:

- Set [AF101] DC braking selection to 01
- Set [AF102] Braking mode selection to 00
- Set [AF109] DC braking time for starting to other than 0.00

DC braking for starting, DC braking is performed, after the operation command is given, for the period of time set for the DC braking time for starting [AF109].

Precautions for Correct Use

- Depending on the set braking force, the carrier frequency may automatically go down to protect the inverter.
- When setting or operating [AF108] DC braking force for starting and [AF109] DC braking time for starting, pay attention to heat generation on the motor.
- The motor could make a half-turn at the maximum.



● Parameter

Item	Parameter	Data	Description	Default data
DC braking selection, 1st-motor	[AF101]	00	Internal DC braking: Disabled	00
		01	Internal DC braking: Enabled	
		02	Internal DC braking: Enabled (operable only at the set frequency)	
Braking type selection, 1st-motor	[AF102]	00	Enables the DC braking.	00
DC braking force at start, 1st-motor	[AF108]	0 to 100(%)	Adjusts the DC braking force. The maximum braking force is achieved when set to 100%.	30
DC braking active time at start, 1st-motor	[AF109]	0.00 to 60.00(s)	Valid when the internal DC braking is enabled. Starts the DC braking when the operation command is turned on.	0.00

Precautions for Correct Use

- If [AF101] DC braking selection is set to 02, DC braking will be started when both the frequency command and the output frequency become equal to or lower than [AF103] DC braking frequency setting, regardless of whether the motor is running or stopped. See *7-6-2 DC Injection Braking Stop* on page 7-83 for details.
- If [AF102] Braking mode selection is set to other than 00, see *7-5-9 Startup DC Injection Braking (Servo Lock Control)* on page 7-80.

7-5-3 Frequency Matching Start

Frequency matching start is activated if you set the function that an inverter runs by picking up frequency while a motor is idling due to a trip or terminal function.

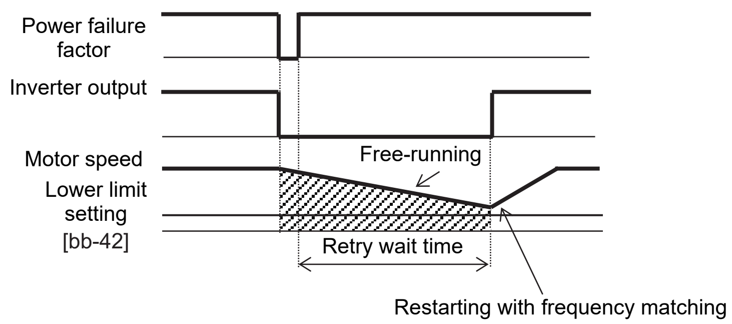
Obtain the cycle of the motor residual voltage to start operation.

Frequency matching lower limit setting [bb-42] is the parameter common to frequency matching functions.

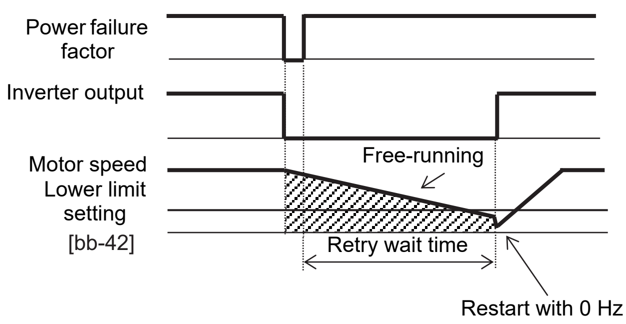
Precautions for Correct Use

- Even if frequency matching restart is selected, the inverter may restart with 0 Hz if:
  1. the output frequency is equal to or lower than 1/2 of the base frequency,
  2. the voltage induced on the induction motor quickly attenuates, or
  3. the frequency matching lower limit setting [bb-42] is set and the inverter detects a frequency equal to or lower than that.
- If the restart after free-run stop or the restart after reset is performed, the inverter will restart after the retry wait time after instantaneous power failure/under-voltage has elapsed.
- The restart after free-run stop and the restart after reset will be performed if the operation command is continuously input via a terminal command or other ways.
- If the frequency matching restart does not go well because the residual voltage rapidly decreases or for other reasons, it may go well by using the frequency pull-in restart. See *7-5-4 Frequency Pull-in Start* on page 7-69.

(Ex.1) The motor speed is equal to or more than the frequency matching lower limit setting.



(Ex.2) The motor speed is equal to or lower than the frequency matching lower limit setting



● **Parameter**

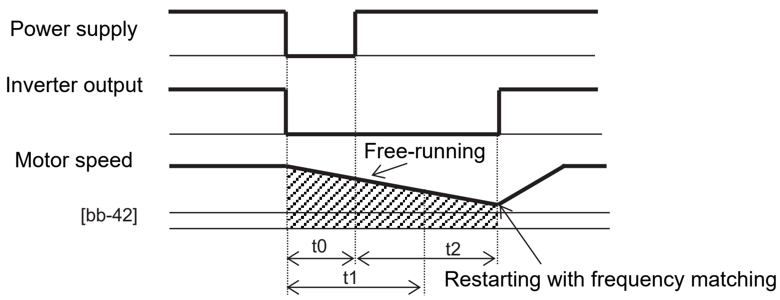
Item	Parameter	Data	Description	Default data
Restart frequency threshold	[bb-42]	0.00 to 590.00(Hz)	When the detected value is equal to or lower than the set value, the inverter restarts with 0 Hz.	0.00

Precautions for Correct Use

For the retry function, see *8-2 Tripless Functions* on page 8-40 as well.

When Instantaneous Power Failure/Under-voltage Occurs [bb-24]=01

(Ex.1) Power recovery within Allowable instantaneous power failure time [bb-25]

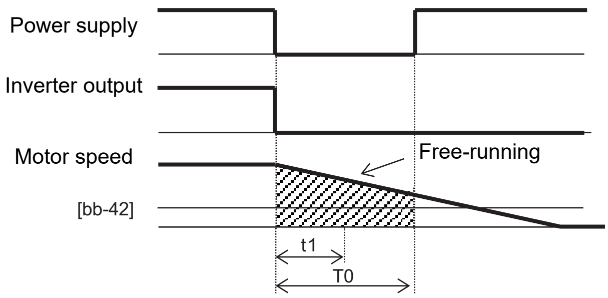


t0: Instantaneous power failure time

t1: Allowable instantaneous power failure time [bb-25]

t2: Retry wait time [bb-26]

(Ex.2) Power recovery after Allowable instantaneous power failure time [bb-25]



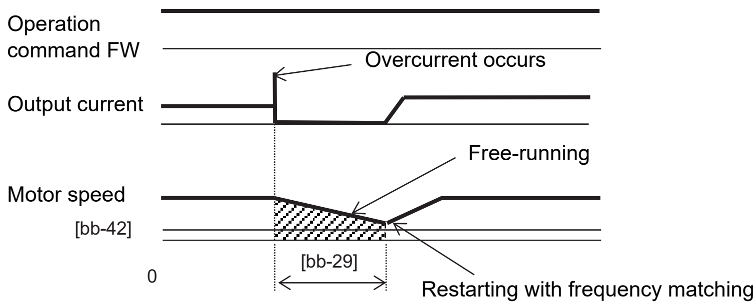
Item	Parameter	Data	Description	Default data
Selection of restart mode @Instantaneous power failure/ under-voltage trip	[bb-24]	01	Performs frequency matching restart.	01
Allowable under-voltage power failure time	[bb-25]	0.3 to 25.0(s)	Restarts the motor if it is within the allowable time.	1.0
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the power recovery.	0.3

Precautions for Correct Use

- If a power failure has occurred so that the power to the inverter's control power supply terminals (R0,T0) is lost, and then the inverter is restarted, it is considered as power-on and the inverter will operate in accordance with the restart after reset [bb-41].
- Even if the power to control power supply terminals (R0, T0) is lost, it will take time until the internal power supply is completely lost.
- Trip after instantaneous power failure/under-voltage can be switched between "enabled" and "disabled" by using [bb-27] Selection of instantaneous power failure/under-voltage trip during stopping. This will prevent the occurrence of an error during stopping. If the error is prevented, the output terminal [AL] will not turn on.
- In a system where the power to control power supply terminals (R0, T0) gradually decreases, it is possible to cause a trip when Allowable instantaneous power failure time has elapsed.
- To make the power to control power supply terminals (R0, T0) last as much as possible by the inverter alone during an instantaneous power failure, remove the J51 connector cables from terminals R0 and T0, and connect a cable from P on the main circuit terminal block to R0, and N on the main circuit terminal block to T0. Use 0.75 mm^2 or heavier wires for the connections.

Retry on Overcurrent [bb-28]=01

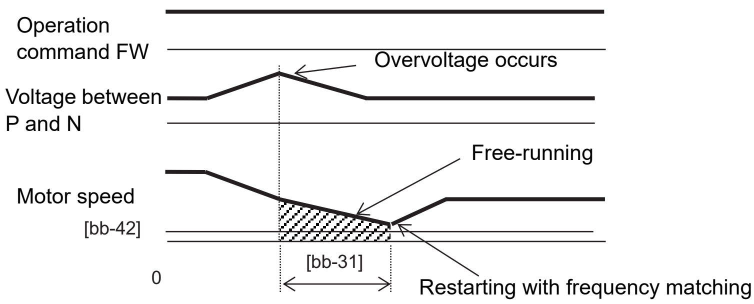
(Ex.) Retry operation on overcurrent



Item	Parameter	Data	Description	Default data
Selection of restart mode @over-current	[bb-28]	01	Performs frequency matching restart.	01
Wait time of restart @over-current	[bb-29]	0.3 to 100.0(s)	Sets the wait time after the retry operation on overcurrent.	0.3

Retry on Overvoltage [bb-30]=01

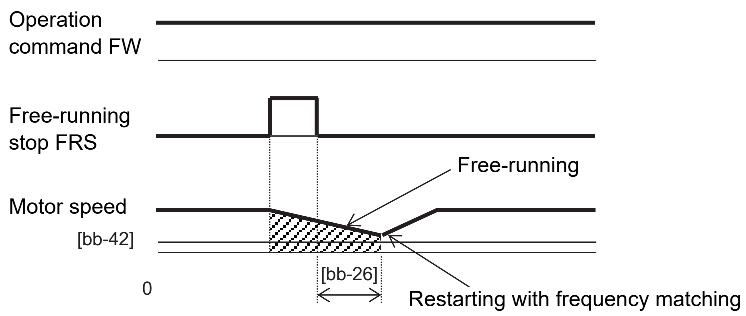
(Ex.) Retry operation on overvoltage



Item	Parameter	Data	Description	Default data
Selection of restart mode @over-voltage	[bb-30]	01	Performs frequency matching restart.	01
Wait time of restart @over-voltage	[bb-31]	0.3 to 100.0(s)	Sets the wait time after the retry operation on overvoltage.	0.3

Frequency Matching after Free-run Stop [FRS] Release [bb-40]=01

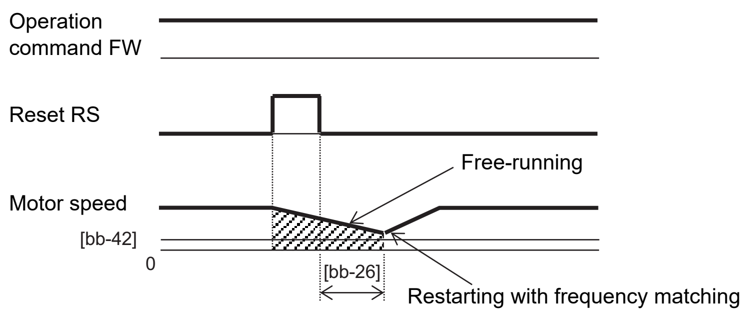
(Ex.) Frequency matching operation after free-run stop [FRS]



Item	Parameter	Data	Description	Default data
Restart mode after FRS release	[bb-40]	01	Performs frequency matching restart.	00
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the free-run stop release.	0.3

Frequency Matching After Reset [RS] [bb-41]=01

(Ex.) Frequency matching operation after reset [RS]



Item	Parameter	Data	Description	Default data
Restart mode after RS release	[bb-41]	01	Performs frequency matching restart.	00
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the reset release.	0.3

Note If the frequency matching after reset has been set, starting after power-on will also occur with frequency matching.

7-5-4 Frequency Pull-in Start

To achieve these goals when the motor is idling due to a trip or terminal function, enable the frequency pull-in function so that the inverter is started with the output frequency specified to each function.

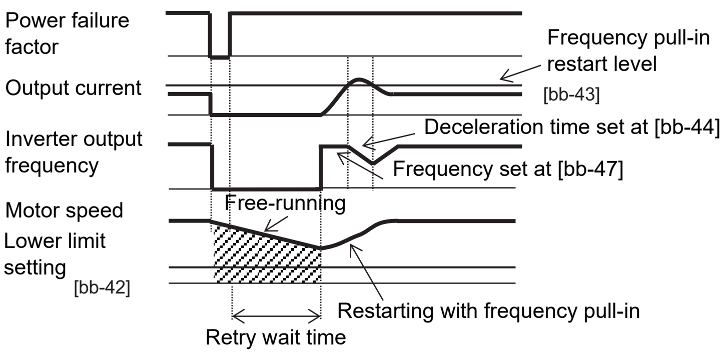
Even if a motor residual voltage is lost, the inverter will restart at the frequency selected in [bb-47] Start frequency selection for frequency pull-in restart.

When frequency pull-in with the V/f control is selected, the inverter starts with a suppressed output voltage during the time set for [bb-45] Frequency pull-in operation time (voltage). When sensorless vector control, zero-speed range sensorless vector control, or vector control with sensor is selected, the frequency is automatically pulled in while controlling the current.

If the current increases during frequency pull-in to exceed [bb-43] Restart level, the motor will decelerate over the time set for [bb-44] Frequency pull-in operation time (frequency).

If the current rapidly increases during frequency pull-in to exceed [bb-46] Overcurrent suppression level for frequency pull-in restart, the overcurrent suppression function will automatically set in.

(Ex.) How the frequency pull-in works



Precautions for Correct Use

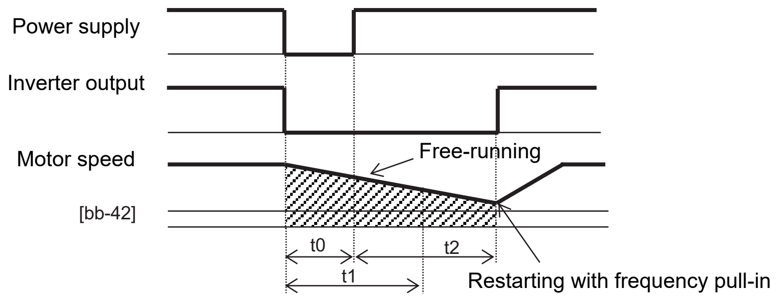
- If the restart after free-run stop or the restart after reset is performed, the inverter will restart after the retry wait time after instantaneous power failure/under-voltage has elapsed.
- The restart after free-run stop and the restart after reset will be performed when the operation command is given.
- The frequency pull-in restart function can be used only for induced motor drive. In addition, if [AA121] Control mode is set to other than the V/f control, restart may become unstable. In this case, see *7-5-3 Frequency Matching Start* on page 7-65.

● **Parameter**

Item	Parameter	Data	Description	Default data
Restart frequency threshold	[bb-42]	0.00 to 590.00(Hz)	When the detected value is equal to or lower than the set value, the inverter restarts with 0 Hz.	0.00
Restart level of Active frequency matching	[bb-43]	Inverterrated current × (0.2 to 2.0)	Determines whether or not the current has increased at restart.	1.0 × Inverter rated current
Restart constant(speed) of Active frequency matching	[bb-44]	0.10 to 30.00(s)	Sets the deceleration time for an increase in the current.	0.50
Restart constant(Voltage) of Active frequency matching	[bb-45]	0.10 to 30.00(s)	Sets the time to start with reduced output voltage.	0.50
OC-supress level of Active frequency matching	[bb-46]	Inverterrated current × (0.0 to 2.0)	Sets the level of the current at which a sudden current increase at restarting is prevented.	1.0 × Inverter rated current
Restart speed selection of Active frequency matching	[bb-47]	00	Starts at the frequency at the previous shutoff.	00
		01	Starts at the maximum frequency.	
		02	Starts at the current frequency command.	

When Instantaneous Power Failure/Under-voltage Occurs [bb-24]=02

(Ex.1) Power recovery within Allowable instantaneous power failure time [bb-25]

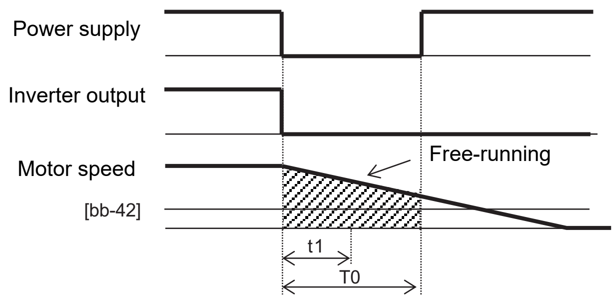


t0: Instantaneous power failure time

t1: Allowable instantaneous power failure time [bb-25]

t2: Retry wait time [bb-26]

(Ex.2) Power recovery after Allowable instantaneous power failure time [bb-25]



● Parameter

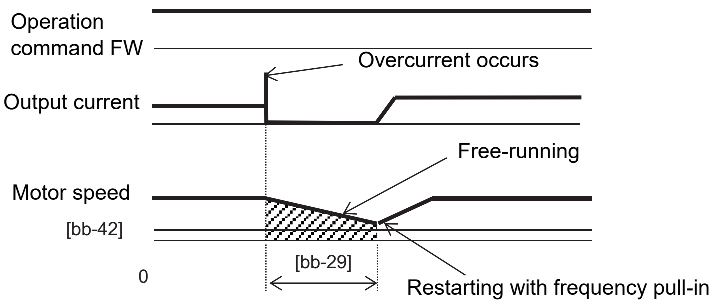
Item	Parameter	Data	Description	Default data
Selection of restart mode @Instantaneous power failure/ under-voltage trip	[bb-24]	02	Performs frequency pull-in restart.	01
Allowable under-voltage power failure time	[bb-25]	0.3 to 25.0(s)	Restarts the motor if it is within the allowable time.	1.0
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the operation command.	0.3

Precautions for Correct Use

- If a power failure has occurred so that the power to the inverter's control power supply terminals (R0,T0) is lost, and then the inverter is restarted, it is considered as power-on and the inverter will operate in accordance with the restart after reset [bb-41].
- Even if the power to control power supply terminals (R0, T0) is lost, it will take time until the internal power supply is completely lost.
- Trip after instantaneous power failure/under-voltage can be switched between "enabled" and "disabled" by using [bb-27] Selection of instantaneous power failure/under-voltage trip during stopping. This will prevent the occurrence of an error during stopping. If the error is prevented, the output terminal [AL] will not turn on.
- In a system where the power to control power supply terminals (R0, T0) gradually decreases, it is possible to cause a trip when Allowable instantaneous power failure time has elapsed.
- To make the power to control power supply terminals (R0, T0) last as much as possible by the inverter alone when an instantaneous power failure occurs, remove the J51 connector cables from terminals R0 and T0, connect the main circuit terminals P and R0 to each other, and connect the main terminals N and T0 to each other. Use 0.75 mm^2 or heavier wires for the connections.

Retry on Overcurrent [bb-28]=02

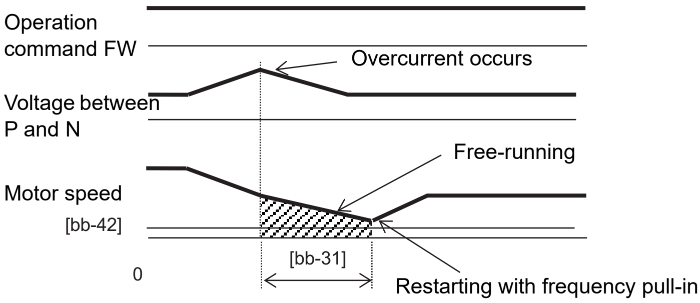
(Ex.) Retry operation on overcurrent



Item	Parameter	Data	Description	Default data
Selection of restart mode @over-current	[bb-28]	02	Performs frequency pull-in restart.	01
Wait time of restart @over-current	[bb-29]	0.3 to 100.0(s)	Sets the wait time after the operation command.	0.3

Retry on Overvoltage [bb-30]=01

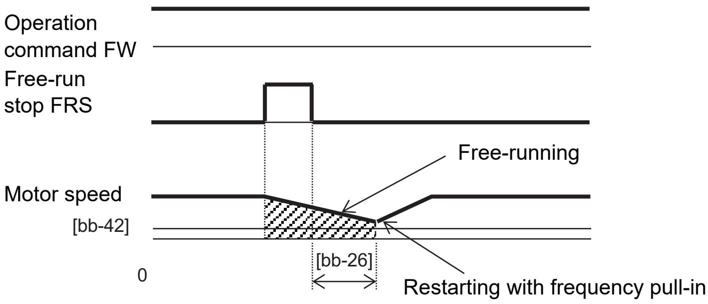
(Ex.) Retry operation on overvoltage



Item	Parameter	Data	Description	Default data
Selection of restart mode @over-voltage	[bb-30]	02	Performs frequency pull-in restart.	01
Wait time of restart @over-voltage	[bb-31]	0.3 to 100.0(s)	Sets the wait time after the operation command.	0.3

Frequency Matching After Free-run Stop [FRS] [bb-40]=02

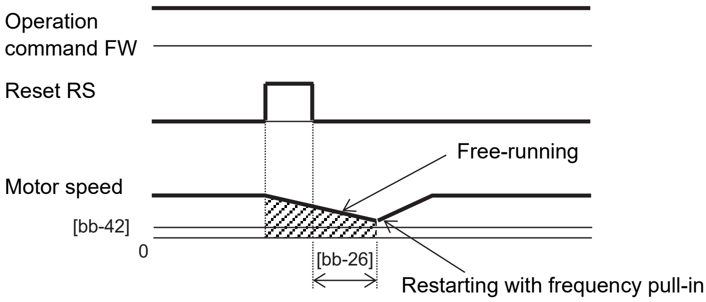
(Ex.) Frequency matching operation after free-run stop [FRS]



Item	Parameter	Data	Description	Default data
Restart mode after FRS release	[bb-40]	02	Performs frequency pull-in restart.	00
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the operation command.	0.3

Frequency Matching After Reset [RS] [bb-41]=02

(Ex.) Frequency matching operation after reset [RS]



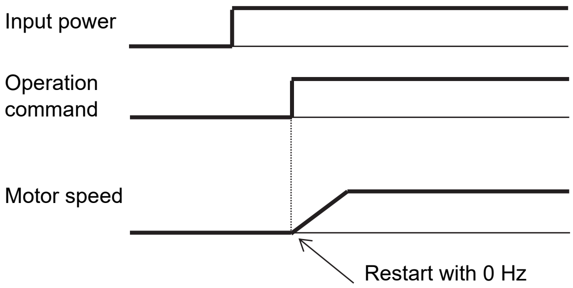
Item	Parameter	Data	Description	Default data
Restart mode after RS release	[bb-41]	02	Performs frequency pull-in restart.	00
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the operation command.	0.3

Note If the frequency matching after reset has been set, starting after power-on will also occur with frequency matching.

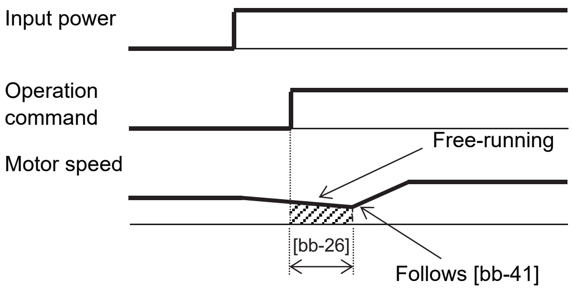
7-5-5 Starting after Power-on

Sets the start mode at power-on.

(Ex.1) Restart operation with 0 Hz: [bb-41]=00



(Ex.2) Frequency pull-in operation [bb-41]=01 to 03



Precautions for Correct Use

- The operation at power-on is the same as that of the restart after reset stop which occurs when the inverter recovers from reset.
- If the frequency pull-in restart is used, the rotational direction of the output frequency is the same as that of the frequency command.
- If a power failure lasts long and the inverter's internal power supply is lost, recovery will take place by the restart after reset instead of the restart after instantaneous power failure/under-voltage.
- In the case of [bb-41]=01, if the residual voltage generated by the motor cannot be detected, the 0 Hz restart may take place.

● Parameter

Item	Parameter	Data	Description	Default data
Restart mode after RS release	[bb-41]	00	Performs the 0 Hz restart.	00
		01	Performs frequency matching restart.*1	
		02	Performs frequency pull-in restart.*2	
		03	Restarts from the speed received from Input terminal A and B or the PG option unit.	
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the operation command.	0.3

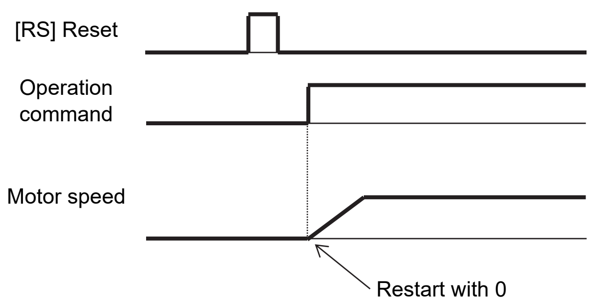
*1. See *7-5-3 Frequency Matching Start* on page 7-65.

*2. See *7-5-4 Frequency Pull-in Start* on page 7-69.

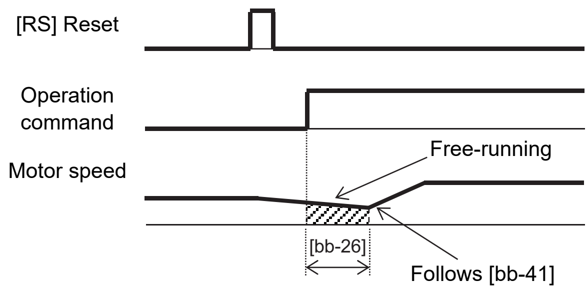
7-5-6 Restart after Releasing Reset

Set the start mode after a trip reset or a reset input via the [RS] terminal (input terminal function 028).

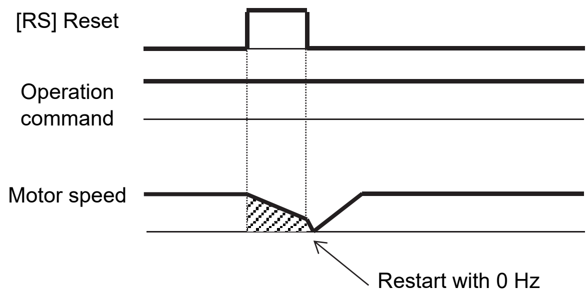
(Ex.1) Restart operation with 0 Hz: [bb-41]=00



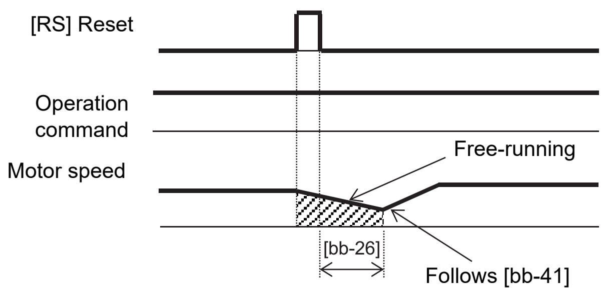
(Ex.2) Frequency pull-in [bb-41]=01 to 03



(Ex.3) Restart with 0 Hz: [bb-41]=00



(Ex.4) Frequency pull-in [bb-41]=01 to 03



Precautions for Correct Use

- The restart after reset, which occurs when the inverter recovers from a reset, is the same as the mode at power-on.
- If the frequency pull-in restart is used, the rotational direction of the output frequency is the same as the command direction at shut-off.
- If a power failure lasts long and the inverter's internal power supply is lost, recovery will take place by the restart after reset instead of the restart after instantaneous power failure/under-voltage.
- In case of the 0 Hz restart, there is no wait time.

● Parameter

Item	Parameter	Data	Description	Default data
Restart mode after RS release	[bb-41]	00	Performs the 0 Hz restart.	00
		01	Performs frequency matching restart.*1	
		02	Performs frequency pull-in restart.*2	
		03	Restarts at the speed received from Input terminal A and B or the PG option unit.	
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the operation command.	0.3

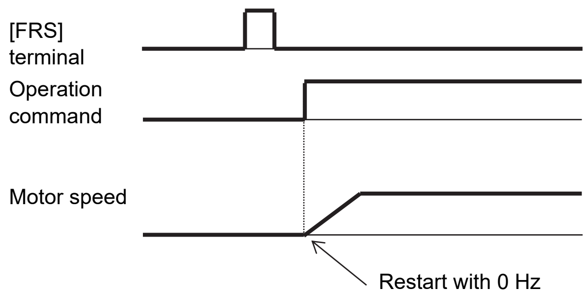
*1. See *7-5-3 Frequency Matching Start* on page 7-65.
*2. See *7-5-4 Frequency Pull-in Start* on page 7-69.

7-5-7 Starting after Free-run Stop

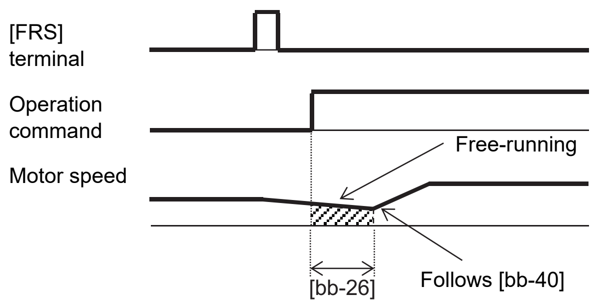
Set the start mode after free-run stop command is input via the [FRS] terminal (input terminal function 032), (Ex.1) to (Ex.4), or start mode after stop when FRS (free run to stop) is specified for [AA115] Stop mode selection, (Ex.5) and (Ex.6).

(Ex.1) to (Ex.4) below are examples where a free-run stop command is input using the [FRS] terminal.

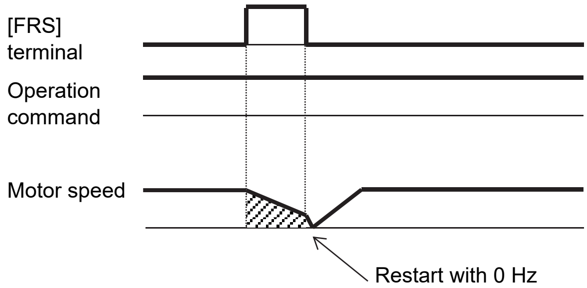
(Ex.1) Restart with 0 Hz: [bb-40]=00



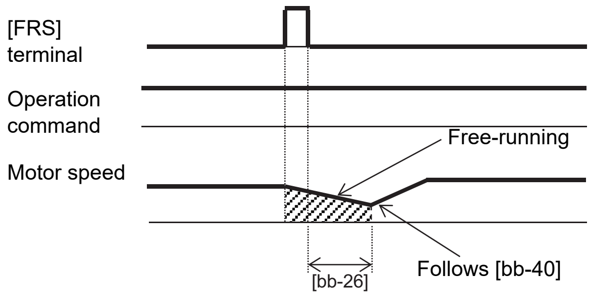
(Ex.2) Frequency pull-in [bb-40]=01 to 03



(Ex.3) Restart with 0 Hz: [bb-40]=00



(Ex.4) Frequency pull-in [bb-40]=01 to 03



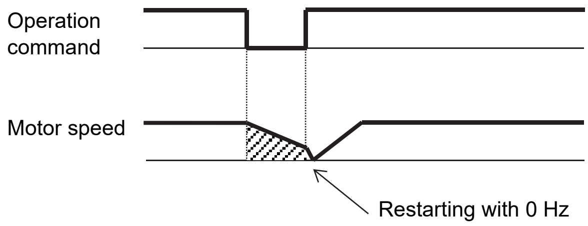
Precautions for Correct Use

- The restart after reset, which occurs when the inverter recovers from a reset, is the same as the mode at power-on.
- If the frequency pull-in restart is used, the rotational direction of the output frequency is the same as that of the frequency command.
- If a power failure lasts long and the inverter's internal power supply is lost, recovery will take place by the restart after reset instead of the restart after instantaneous power failure/under-voltage.
- At power-on, the inverter will start operation with 0 Hz.
- In case of the 0 Hz restart, there is no wait time.

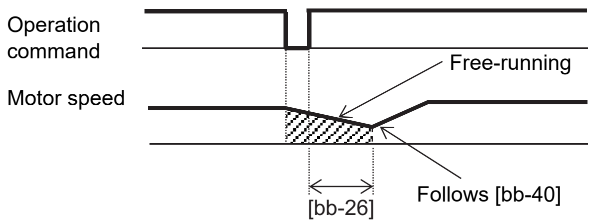
(Ex.5) and (Ex.6) below show cases where the free-run stop is performed via the operation command.

The free-run stop at stopping is used when an overvoltage error occurs at stopping, for example. However, the motor continues rotating through inertia.

(Ex.5) Restarting with 0 Hz: [bb-40]=00



(Ex.6) Frequency pull-in [bb-40]=01 to 03



● Parameter

Item	Parameter	Data	Description	Default data
Restart mode after FRS release	[bb-40]	00	Performs the 0 Hz restart.	00
		01	Performs frequency matching restart.*1	
		02	Performs frequency pull-in restart.*2	
		03	Re-starts at the speed received from the Input terminal A/B or from the PG Option Unit.	
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the power recovery.	0.3
STOP mode selection, 1st-motor	[AA115]	01	Performs the free-run stop when the operation command is off.	00

*1. See *7-5-3 Frequency Matching Start* on page 7-65.

*2. See *7-5-4 Frequency Pull-in Start* on page 7-69.

7-5-8 Forcing Function

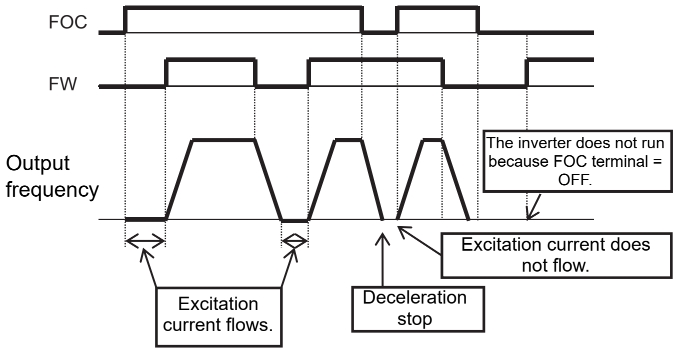
This function is to preliminarily establish magnetic flux by applying an excitation current via the forcing terminal [FOC] command.

This function operates if the input terminal function 066 [FOC] is assigned.

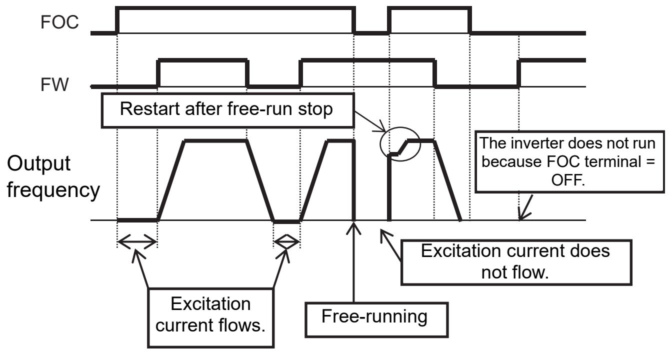
Precautions for Correct Use

- This function is effective when the IM sensorless vector control, IM zero-speed range sensor-less vector control, or IM vector control with sensor is selected for the control mode [AA121].
- If [FOC] is assigned to the input terminal function, operation will not be accepted unless [FOC] is turned on.
- If [FOC] is turned off during operation, the inverter will be operated according to [AA115] Stop mode selection. If a free run occurs, restart will take place according to the setting for the restart after free-run stop.

- When [AA115] Stop mode selection is set to 00: Deceleration stop



- When [AA115] Stop mode selection is set to 01: Free run stop



● Parameter

Item	Parameter	Data	Description	Default data
Input terminal function	[CA-01] to [CA-11]	066	Forcing function [FOC]	-
STOP mode selection, 1st-motor	[AA115]	00	Performs the deceleration stop when the operation command is off.	00
		01	Performs the free-run when the operation command is off.	
Restart mode after FRS release	[bb-40]	00	Performs the 0 Hz restart.	00
		01	Performs frequency matching restart.*1	
		02	Performs frequency pull-in restart.*2	
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Sets the wait time after the operation command.	0.3

*1. See *7-5-3 Frequency Matching Start* on page 7-65.

*2. See *7-5-4 Frequency Pull-in Start* on page 7-69.

Precautions for Correct Use

- If torque at starting is insufficient, it may improve by adjusting the boost amount at starting [HC111], [HC112] or the speed response [HA115].
- See *7-1 Overview of Motor Control Methods* on page 7-3.
- If torque at starting is insufficient, it may improve by using the torque bias function. See *7-3-6 Torque Bias Function* on page 7-54.

7-5-9 Startup DC Injection Braking (Servo Lock Control)

Before outputting the frequency to the motor, perform the servo-lock to stop the motor rotating. And then, start operation.

To apply DC braking for starting (servo-lock control), the following settings are required:

- [AA121] Control mode (see below)
- Set [AF101] DC braking selection to 01
- Set [AF102] Braking mode selection to 01 or 02.
- Set [AF109] DC braking time for starting to other than 0.0

If the DC braking for starting (servo-lock control) is enabled, DC braking (servo-lock control) will be performed after the operation command is given, for the period of time set as DC braking time for starting [AF109].

Precautions for Correct Use

- Depending on the set braking force, the carrier frequency may automatically go down to protect the inverter.
- To use the servo-lock control, it is necessary to set [AA121] Control mode. If the applicable control mode is not selected, the inverter will operate as if [AF102] has been set to 00: DC braking.

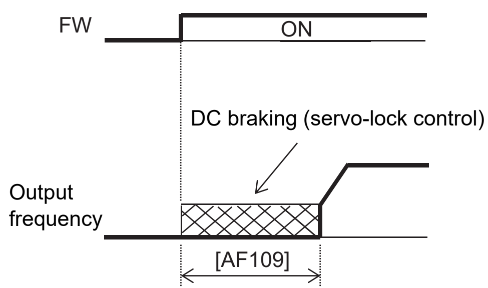
  (1)When [AF102] Braking mode selection is set to 01: Speed servo-lock

No.	[AA121] Control mode
1	09: Zero-speed range sensorless vector control
2	10: Vector control with sensor

  (2)When [AF102] Braking mode selection is set to 02: Position servo-lock

No.	[AA121] Control mode
1	10: Vector control with sensor

- For [AA121] Control mode and [AA123] Vector control mode selection, it is necessary to set . See *7-1 Overview of Motor Control Methods* on page 7-3.
- The output of the servo-lock control is automatically calculated according to the selected control mode.



● Parameter

Item	Parameter	Data	Description	Default data
DC braking selection, 1st-motor	[AF101]	00	Internal DC braking: Disabled	00
		01	Internal DC braking: Enabled	
		02	Internal DC braking: Enabled (The braking operates only with the set braking frequency.)	
Braking type selection, 1st-motor	[AF102]	01	Enables the speed servo-lock.	00
		02	Enables the position servo-lock.	
DC braking active time at start, 1st-motor	[AF109]	0.0 to 60.0(s)	Valid when the internal DC braking is enabled. Starts the servo-lock when the operation command is turned on.	0.3
Control mode selection, 1st-motor	[AA121]	08	Sensorless vector control	00
		09	Zero-speed range sensorless vector control	
		10	Vector control with sensor	

7-6 Stop Conditions

7-6-1 Selection of Stop Operation

Use [AA115] Stop mode selection to select one of the two methods of stopping the motor when the operation command is turned off. One is to stop the motor according to the deceleration time; the other is to immediately cut off the output to shut down.

If a free-run stop is to be input from a terminal, assign 032 [FRS] to an input terminal, and turn on the terminal.

If the free-run stop is selected, the restart when an operation command is given the next time will follow the selection at [bb-40] Restart after free-run stop.

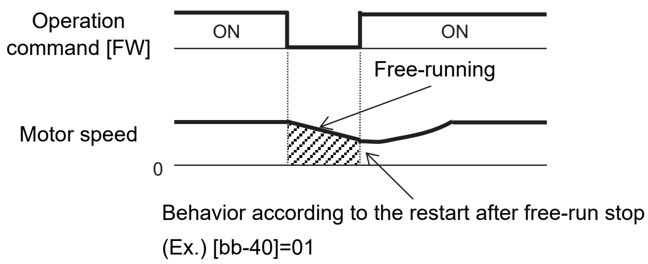
Precautions for Correct Use

If [AA115]=01 free-run stop is selected, the output will be shut off when the operation command is turned off.

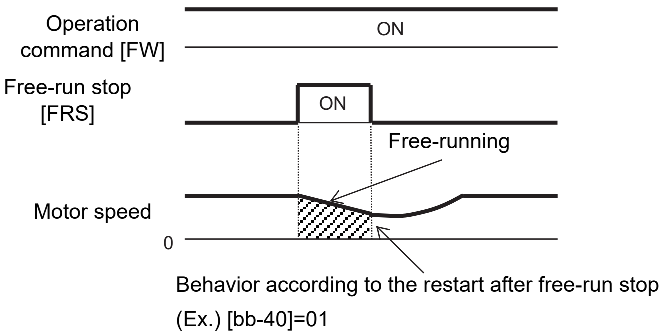
- **Parameter**

Item	Parameter	Data	Description	Default data
STOP mode selection, 1st-motor	[AA115]	00	Normal stop (deceleration → stop)	00
		01	Free-run stop	
Restart mode after FRS release	[bb-40]	00	Restart with 0 Hz	00
		01	Frequency matching restart	
		02	Frequency pull-in restart	
Input terminal selection	[CA-01] to [CA-11]	032	Uses the Free-run stop function [FRS].	-

When Free-run Stop is Selected: [AA115]=01



When the [FRS] Terminal is Used



7-6-2 DC Injection Braking Stop

To use DC braking for stopping, the following settings are required:

- Set [AF101] DC braking selection to 01
- Set [AF102] Braking mode selection to 00
- [AF105] DC braking force
- Set [AF106] DC braking time to other than 0.0

To use DC braking with frequency command, the following settings are required:

- Set [AF101] DC braking selection to 02
- Set [AF102] Braking mode to 01 or 02.
- Set [AF103] DC braking frequency setting to other than 0.00
- [AF105] DC braking force
- Set [AF106] DC braking time to other than 0.0

- How to stop the motor when a large moment of inertia makes it continue rotating even after deceleration stop

Precautions for Correct Use

- The carrier frequency during DC braking depends on [bb101], but it is limited to at maximum 5 Hz. Depending on the set braking force, the carrier frequency may automatically go down to 2 kHz.
- When the motor is stopped by using [DB] external DC braking function (input terminal function 030), a high output frequency or a high-inertia load may cause an overcurrent error or overvoltage error.

● Parameter

Item	Parameter	Data	Description	Default data
DC braking selection, 1st-motor	[AF101]	00	Internal DC braking: Disabled	00
		01	Internal DC braking: Enabled	
		02	Internal DC braking: Enabled (The braking operates only with the frequency command.)	
Braking type selection, 1st-motor	[AF102]	00	Enables the DC braking.	00
DC braking frequency, 1st-motor	[AF103]	0.00 to 590.00(Hz)	With internal DC braking enabled, DC braking is started when the output frequency reaches or becomes less than the frequency set for stopping.	0.50
DC braking delay time, 1st-motor	[AF104]	0.00 to 5.00(s)	Specifies the delay in starting DC braking while temporally shutting off the output.	0.00
DC braking force setting, 1st-motor	[AF105]	0 to 100(%)	Adjusts the DC braking force. When “0%” is specified, no braking operation will be performed.	30
DC braking active time at stop, 1st-motor	[AF106]	0.00 to 60.00(s)	Sets the duration for DC braking. This setting is valid for the [DB] terminal in edge mode or for the internal DC braking. When “0.00 second” is specified, no braking operation will be performed.	0.00
DC braking operation method selection, 1st-motor	[AF107]	00	Edge mode (Examples 1-a to 6-a)	01
		01	Level mode (Examples 1-b to 6-b)	
Input terminal function	[CA-01] to [CA-11]	030	DC braking is enabled by using the [DB] terminal. OFF: DC braking is disabled. ON: DC braking is enabled.	-

DC Braking Force for Stopping

To use the DC braking force for stopping, set [AF101] DC braking selection to 01, [AF102] Braking mode selection to 00, [AF106] DC braking time to other than 0.00 second, and [AF105] DC braking force to any any value. When the frequency output is shut off, DC braking force will be applied.

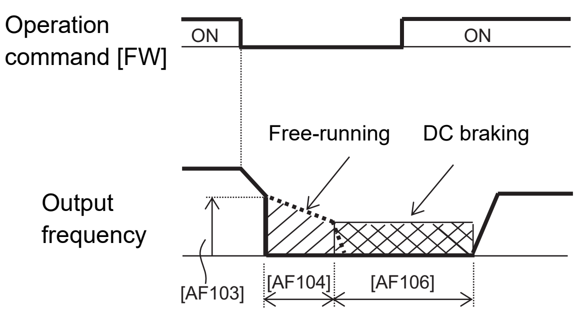
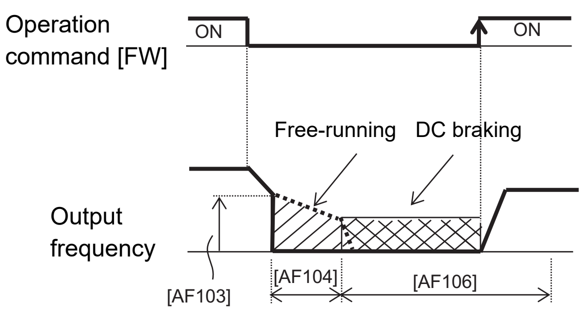
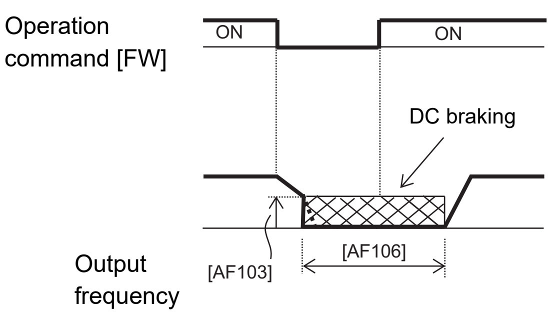
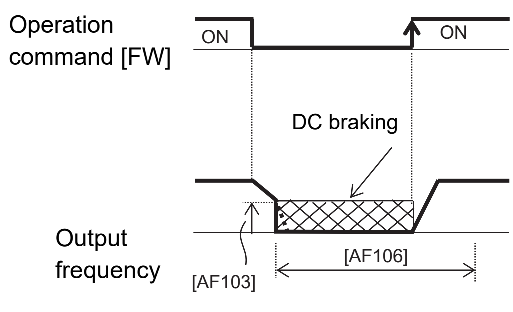
The braking force is adjusted at the [AF105] DC braking force.

When [AF104] DC braking delay time is set, and if the operation command is turned off and the decelerated frequency falls below [AF103] DC braking frequency, the output will be shut off once, and after [AF104] has elapsed, DC braking will be started.

Precautions for Correct Use

- The operation to be performed when the operation command is switched from the stop command to the start command varies depending on the setting of [AF107] DC braking/edge or level selection.
- When setting [AF105] DC braking force and [AF106] DC braking time, pay attention to the heat generation on the motor.

- Edge mode: [AF107]=00
  [AF106] DC braking time setting is given priority, and the inverter performs DC braking for the time set for [AF106]. After the operation command is turned off, if the output frequency falls below [AF103] DC braking frequency, DC braking will be applied for the time set for [AF106]. Even if the operation command is turned on during DC braking, DC braking continues until the time set for [AF106] elapses. (Ex.1), (Ex.2)
- Level mode: [AF107]=01
  Operation commands are given priority. The inverter ignores [AF106] DC braking time and transits to the normal operation. If the start command is turned on during DC braking, the inverter ignores the time set for [AF106] and returns to the normal operation. (Ex.3), (Ex.4)

<table>
<tr><th>Edge mode: [AF107]=00</th><th>Level mode: [AF107]=01</th></tr>
<tr><td>(Ex.1) When stopped ([AF104]≠0.00)

</td><td>(Ex.3) When stopped ([AF104]≠0.00)

</td></tr>
<tr><td>(Ex.2) When stopped ([AF104]=0.00)

</td><td>(Ex.4) When stopped ([AF104]=0.00)

</td></tr>
</table>

DC Braking with Frequency Command

To use the DC braking with frequency command, set [AF101] DC braking selection to 02, and [AF106] DC braking time to other than 0.0 second. DC output can be started by changing the frequency command.

The inverter starts DC braking when both the frequency set by the frequency command and the output frequency fall to [AF103] or below. (Ex.5)

This function operates only when the operation command is on.

If the operation command is turned on after the frequency command has been established (where a value larger than [AF103]+2 Hz is input), the inverter will start operation with the normal output.

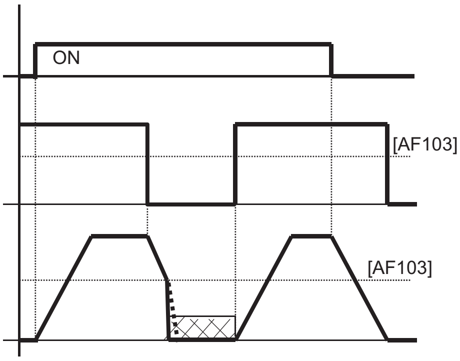
If the frequency command at starting is “0” when the operation command is given via an analog input terminal, the inverter will start operation with DC braking because both the frequency set by the frequency command and current output frequency are “0”. (Ex.6)

(Ex.5)

Operation command

Frequency command

Output frequency

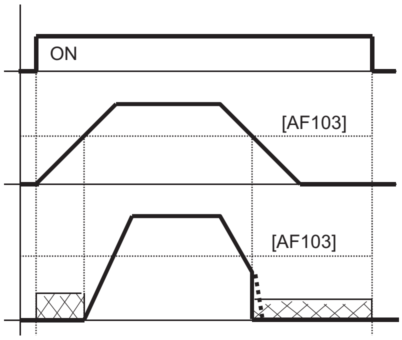


(Ex.6)

Operation command

Frequency command

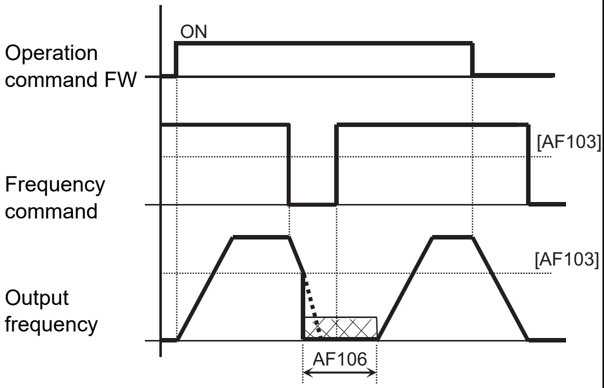
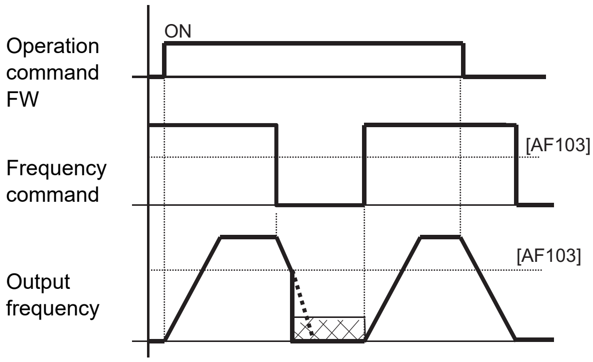
Output frequency



How the inverter returns to the normal operation varies depending on the setting of the DC braking/edge or level selection [AF107].

When “00” is specified for [AF107], the inverter returns to the normal operation after [AF106] DC braking time has elapsed. (Ex.7)

When [AF107]=01: The inverter starts acceleration when the frequency command exceeds [AF103]+2 Hz. (Ex.8)

Edge mode: [AF107]=00	Level mode: [AF107]=01
(Ex.7) 	(Ex.8) 

Precautions for Correct Use

- If the function of the DC braking with frequency command is enabled, [DB] (input terminal 030) will be disabled.
- If the function of the DC braking with frequency command is enabled, the setting of [AF102] will be disabled and DC braking with [AF102]=00 will operate.

External DC Braking via Terminal Function

Assign 030 [DB] to input terminal functions [CA-01] to [CA-11].

When [AF101]=00 or 01, DC braking will be applied depending on whether the [DB] terminal is on.

Adjust the braking force by adjusting the [AF105] DC braking force.

When you set the [AF104] DC braking delay time, the inverter output will be shut off within the set period of delay, and the motor will run freely during the period. (Ex.11), (Ex.14)

DC braking will be restarted after the set period has elapsed.

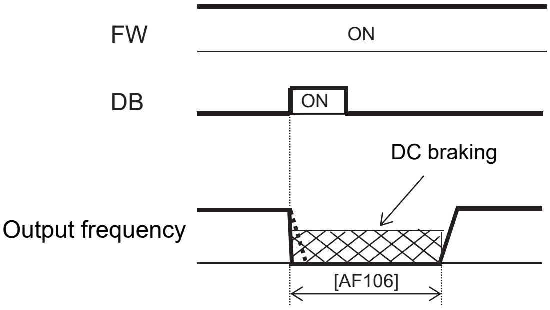
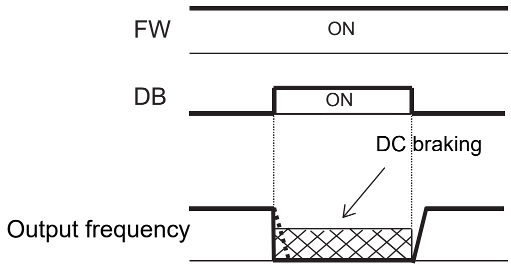
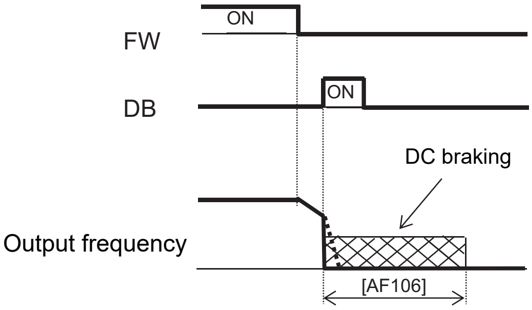
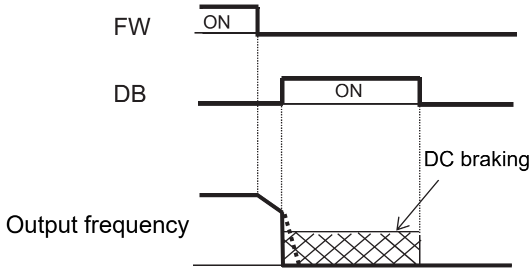
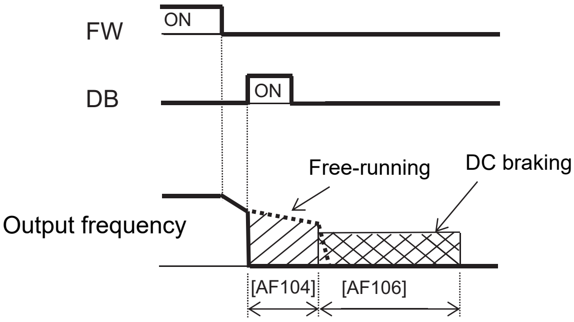
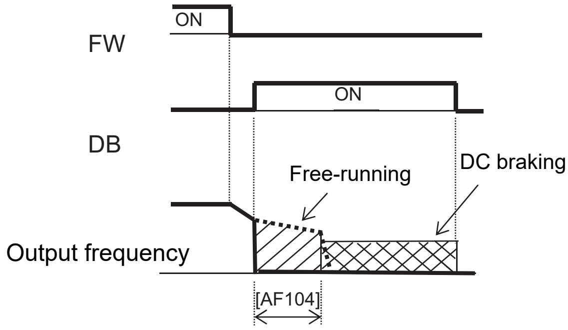
Select the braking mode by the DC braking/edge or level selection [AF107], and then make any other necessary settings suitable for your system.

When [AF107]=00: After [DB] is turned on, the inverter performs DC braking for the time set for [AF106] . (Ex.9) to (Ex.11)

When [AF107]=01: The inverter performs DC braking only when [DB] is on. (Ex.12) to (Ex.14)

Precautions for Correct Use

- When setting [AF105] DC braking force, [AF106] DC braking time, or the ON time of the [DB] terminal (input terminal function 030), pay attention to the heat generation on the motor.
- The setting for the [DB] terminal is given priority over operation commands. (Ex.9), (Ex.12)
- If the [DB] terminal is turned on when the motor speed is high, an overcurrent error or an overvoltage error may occur.
- When the [DB] terminal is turned on, DC braking mode that occurs when “00” is specified for [AF102] Braking mode selection is performed regardless of the setting for [AF102].

Edge mode: [AF107]=00	Level mode: [AF107]=01
(Ex.9)  	(Ex.12) 
(Ex.10)  	(Ex.13) 
(Ex.11)  	(Ex.14) 

7-6-3 DC Braking for Stopping (Servo Lock Control)

This function is used when a motor does not finish the rotation completely while it is stopping or when the stop position for the motor is fixed.

To use DC braking for stopping (servo-lock control), set [AA121] Control mode and [AF101] DC braking selection to 01, [AF102] Braking mode selection to 01 or 02, and [AF106] DC braking time to other than 0.00 second. DC braking will operate after the frequency output has been shut off.

When [AF104] DC braking delay time is set, and if the operation command is turned off and the decelerated frequency falls below [AF103] DC braking frequency, the output will be shut off once, and after [AF104] has elapsed, DC braking will be started.

Precautions for Correct Use

- The carrier frequency during DC braking depends on [bb101], but it is limited to at maximum 5 Hz. Depending on the set braking force, the carrier frequency may automatically go down to 2 kHz.
- To use the servo-lock control, it is necessary to set [AA121] Control mode. If the applicable control mode is not selected, the inverter will operate as if [AF102] has been set to 00: DC braking.

  (1)When [AF102] Braking mode selection is set to 01: Speed servo-lock

No.	[AA121] Control mode
1	09: 0Hz-range sensorless vector control
2	10: Vector control with sensor

  (2)When [AF102] Braking mode selection is set to 02: Position servo-lock

No.	[AA121] Control mode
1	10: Vector control with sensor

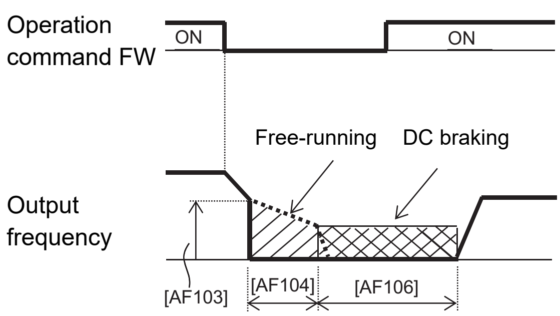
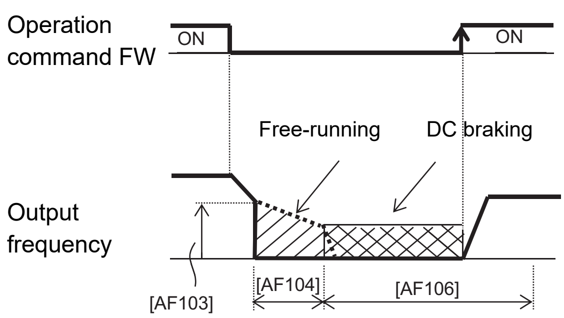
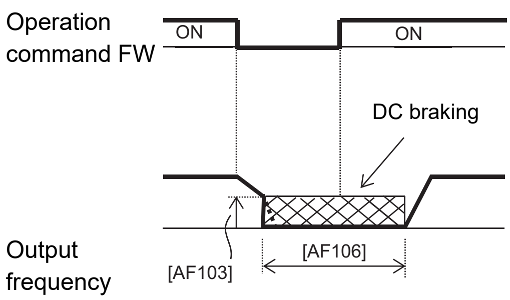
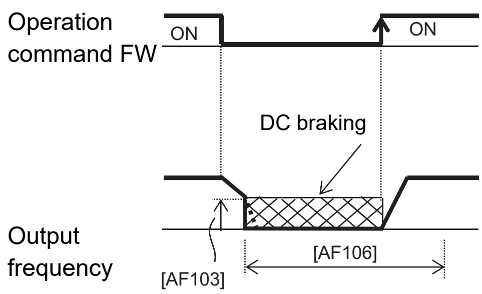
- The operation to be performed when the operation command is switched from the stop command to the start command varies depending on the setting of [AF107] DC braking/edge or level selection.
- When setting [AF106] DC braking time, pay attention to the heat generation on the motor.
- To use the servo-lock control, it is necessary to set [AA121] Control mode. See *7-1 Overview of Motor Control Methods* on page 7-3.
- The output of the servo-lock control is automatically calculated according to the selected control mode.

● Parameter

Item	Parameter	Data	Description	Default data
DC braking selection, 1st-motor	[AF101]	00	Internal DC braking: Disabled	00
		01	Internal DC braking: Enabled	
		02	Internal DC braking: Enabled (The braking operates only with the set braking frequency.)	
Braking type selection, 1st-motor	[AF102]	01	Enables the speed servo-lock.	00
		02	Enables the position servo-lock.	
DC braking frequency, 1st-motor	[AF103]	0.00 to 590.00(Hz)	With internal DC braking enabled, DC braking is started when the output frequency reaches or becomes less than the frequency set for stopping.	0.50
DC braking delay time, 1st-motor	[AF104]	0.00 to 5.00(s)	Specifies the delay in starting DC braking while temporally shutting off the output.	000
DC braking active time at stop, 1st-motor	[AF106]	0.00 to 60.00(s)	Sets the duration for DC braking. This setting is valid for the [DB] terminal in edge mode or for the internal DC braking. When “0.00 second” is specified, no braking operation will be performed.	0.00
DC braking operation method selection, 1st-motor	[AF107]	00	Edge mode (Examples 1-a to 6-a)	01
		01	Level mode (Examples 1-b to 6-b)	
Input terminal function	[CA-01] to [CA-11]	054	Controls with the servo-on mode using the [SON] terminal. OFF: Servo lock is disabled. ON: Servo lock is enabled.	-
Control mode selection, 1st-motor	[AA121]	08	Sensorless vector control	00
		09	Zero-speed range sensorless vector control	
		10	Vector control with sensor	

- Edge mode: [AF107]=00
  [AF106] DC braking time setting is given priority, and the inverter performs DC braking (servo-lock control) for the time set for [AF106]. After the operation command is turned off, if the output frequency falls below [AF103] DC braking frequency, DC braking will be applied for the time set for [AF106]. Even if the operation command is turned on during DC braking, DC braking continues until the time set for [AF106] elapses. (Ex.1), (Ex.2)

- Level mode: [AF107]=01
  Operation commands are given priority. The inverter ignores [AF106] DC braking time and transits to the normal operation. If the start command is turned on during DC braking, the inverter ignores the time set for [AF106] and returns to the normal operation. (Ex.3), (Ex.4)

Edge mode: [AF107]=00	Level mode: [AF107]=01
(Ex.1) When stopped ([AF104]≠0.00) 	(Ex.3) When stopped ([AF104]≠0.00) 
(Ex.2) When stopped ([AF104]=0.00) 	(Ex.4) When stopped ([AF104]=0.00) 

8

Applied Settings

This chapter explains the settings of the applied functions.

The parameter number structure is indicated below.
This chapter explains how to set the first setting. For the second setting, follow the same procedure. The setting value and operation are common.

AA 1 01

- 01: In-Group Number
- 1:
  - -: Always enabled in both the first setting and second setting
  - 1: Enabled in the first setting when the [SET] terminal function is OFF
  - 2: Enabled in the second setting when the [SET] terminal function is ON
- AA: Parameter Group

The function assigned to In/Output terminals is indicated as a combination of three digits numbers and alphabets, like "023[F-OP]." For more details of the functions, refer to the *<List of input terminal functions>* on page C-44 and the *<List of output terminal functions>* on page C-49.

8

8-1 PID Control

8-1-1 Function Overview

3G3RX2-series is equipped with 4 independent PID functions, and each PID can be set independently.

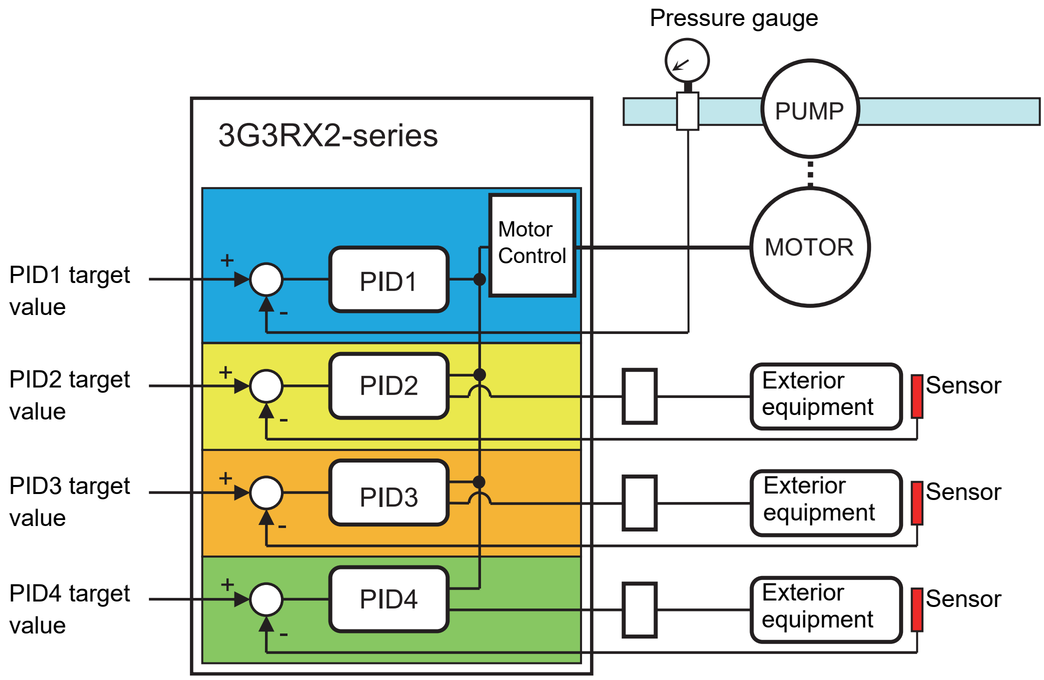
Four PID functions can be used for motor control by switching the [PIO1]/[PIO2] terminals.

PID not used for motor control can be used for operation of exterior PID not related to inverter control freely.

This helps to save space and cost because there is no need to install a separate PID controller.

PID1 can be controlled based on 3 deviations.

Connecting PID1 and PID2 can make 2-layer PID control possible.



For PID control, you can select feed-forward control to attempt stabilizing disturbance in advance, in addition to feedback control to stabilize disturbance.

To control output frequency sent to the motor by the PID function, selection of PID1-4 and setting of frequency command are required.

In the soft-start function, operating normally for a certain period of distance at the start can raise output automatically and then shift to PID control. See *8-1-3 PID Soft-start Function* on page 8-19.

Sleep operation, which is more energy saving, can be set for when the flow rate or air volume is increased. See *8-1-4 PID Sleep Function* on page 8-21.

During PID operation, PID functions are disabled and normal output is performed with the command selected as a target value, while the input terminal function [PID] signal is ON.

Multi-layer command by PID control command is feasible.

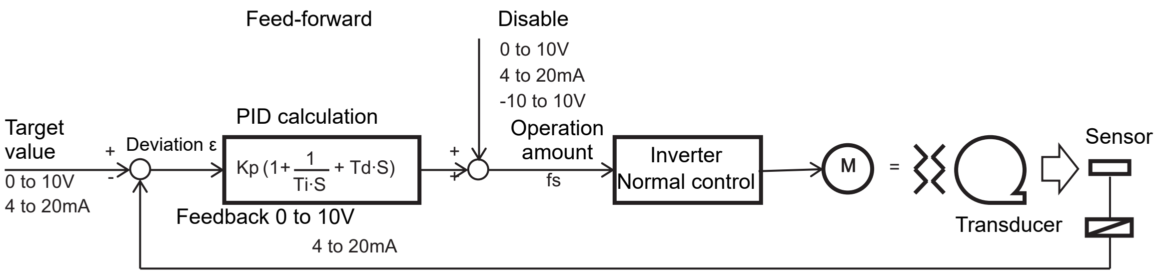
Precautions for Correct Use

- In the case of controlling the motor by PID control, frequency command destination needs to be set to PID output.
- The upper/lower limiter function operates for command frequency by PID output. It does not operate for PID target value.

e.g.) Follow the steps below to perform simple PID control by inputting a target value [Ai1] and a feed-back (FB) value [Ai2] from where parameters are default.

1. Set [AH-01] to 01 (enable)
2. Set 15 (PID calculation) to the main speed input source selection, 1st-motor [AA101]
3. Set 01 (Ai1) to the PID1 target value 1 input destination [AH-51]
4. Set 02 (Ai2) to the PID1 FB 1 input destination [AH-07]
5. Set the PID gain of PID1 to [AH-61] to [AH-63]
6. Put the run-command input source selection, 1st-motor [AA111] and start PID control

Basic Composition of PID Control



Kp: Proportional gain Ti: Integral time Td: Differential time s: Operator ε: Deviation
Ki: Integral gain setting (Ki=Ti/Kp) Kd: Differential gain setting (Kd=Kp×Td)

PID Operation

This section explains of a situation when PID target value is constant and feedback (FB) value is changed by using an example.

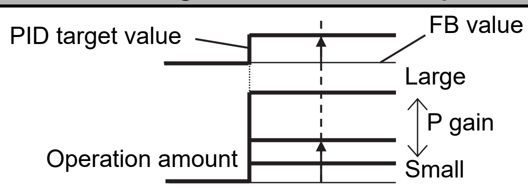
(a) P operation: P gain Kp

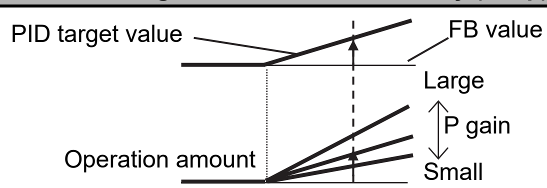
This is an operation that an operation amount of PID command value is proportional to the devia-tion between PID target value and current feedback (FB) value.

Command operation amount can be adjusted by P gain.

Deviation becomes (PID target value - FB value).

When the target value increases stepwise	When the target value increases linearly (ramp)





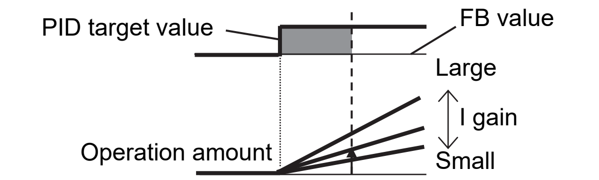
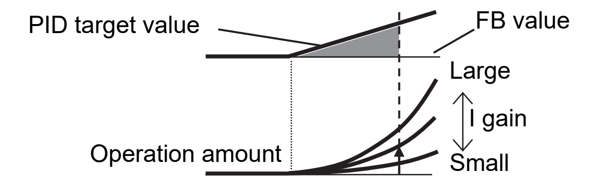
(b) I operation: I gain Ki (=Ti/Kp)

This is an operation that an operation amount of PID command value is proportional to the time integral value of the deviation between PID target value and current feedback (FB) value.

Command operation amount can be adjusted by I gain.

Integral value can be cleared by the PIDC terminal function.

Because output change becomes smaller as PID target value and FB value come closer based on an operation amount and it takes time to reach the target value in P operation, it is compensated with I operation.

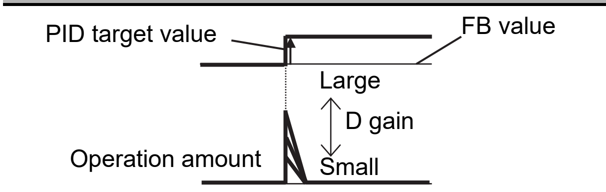
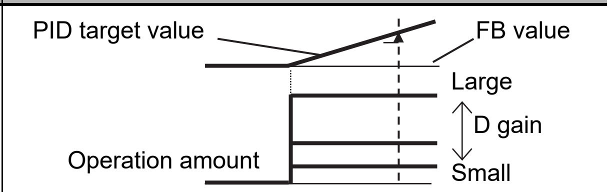
When the target value increases stepwise	When the target value increases linearly (ramp)
	

(c) D operation: D gain Kd (=Kp × Td)

This is an operation that an operation amount of PID command value is proportional to the change of the deviation between PID target value and current feedback (FB) value.

Command operation amount can be adjusted by D gain.

D operation has an effect to compensate the responsiveness of P operation and I operation.

When the target value increases stepwise	When the target value increases linearly (ramp)
	

PI operation is an operation with (a) and (b) combined.

PD operation is an operation with (a) and (c) combined.

PID operation is an operation with (a), (b) and (c) combined.

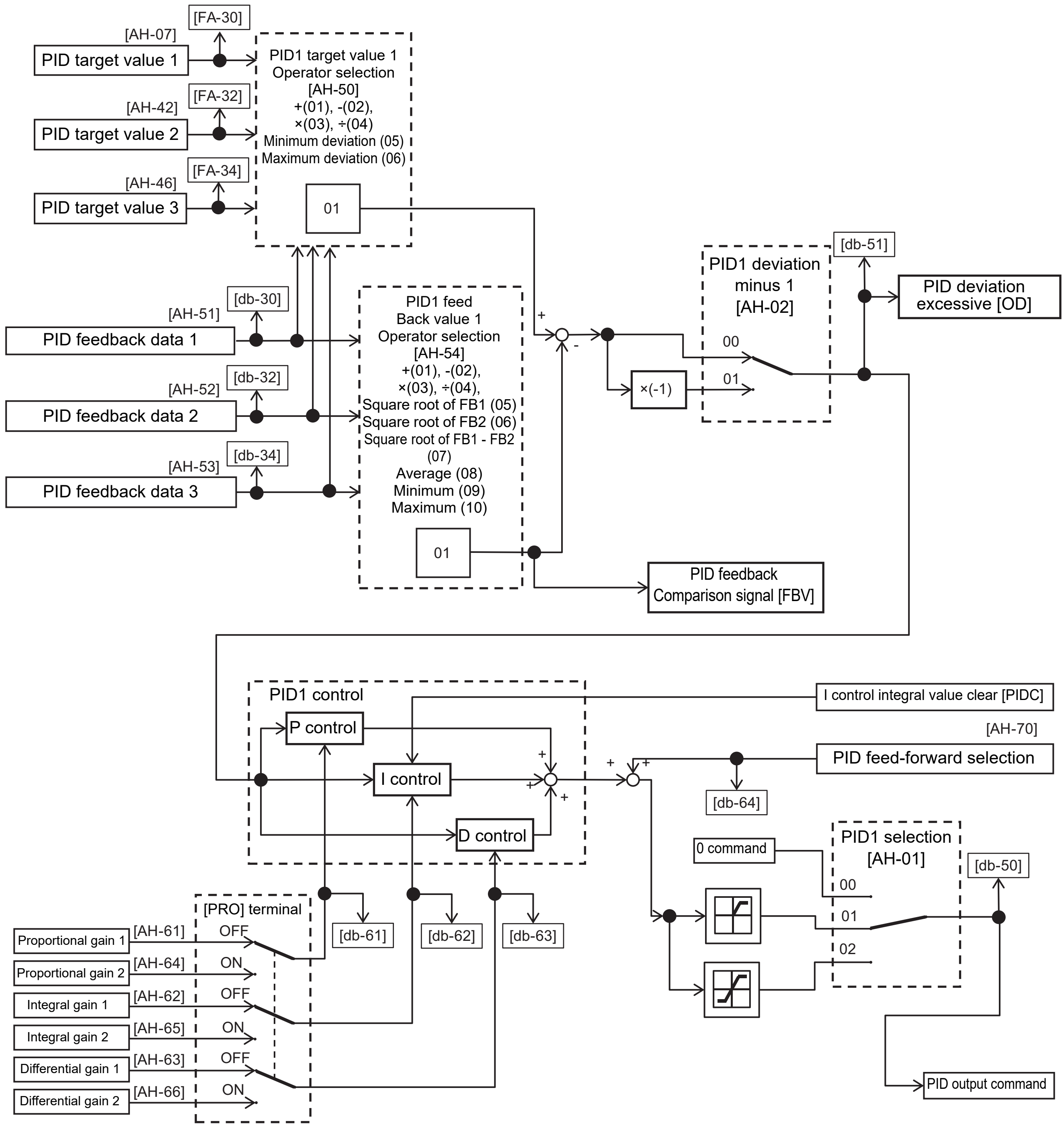
8-1-2 PID Parameter and Block Diagram

PID1 allows three inputs into PID target value and PID feedback data.

PID gain 1 and 2 can be switched by the input terminal function [PRO].

PID1 output can be used as a target value of PID2.

Block Diagram of PID1 Control



8-1 PID Control

8

8-1-2 PID Parameter and Block Diagram

● Parameter

Item	Parameter	Data	Description	Default data
PID1 enable	[AH-01]	00	Disable	00
		01	Enable (if command becomes negative, it does not output in a reverse direction)	
		02	Enable (if command becomes negative, it outputs in a reverse direction)	
PID1 deviation inverse	[AH-02]	00	Disable	00
		01	Enable (polarity inversion of deviation)	
PID1 deviation inverse	[AH-07]	00 to 13	00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-10] 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	07
Set-point-1 setting for PID1	[AH-10]	-100.00 to 100.00(%)*1	This is a set value 1 of PID1 target value 1.	0.00
Input source selection of Set-point 2 for PID1	[AH-42]	00 to 13	00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	00
Set-point 2 setting for PID1	[AH-44]	-100.00 to 100.00(%)*1	This is a set value of PID1 target value 2.	0.00
Input source selection of Set-point 3 for PID1	[AH-46]	00 to 13	00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-48], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	00
Set-point 3 setting for PID1	[AH-48]	-100.00 to 100.00(%)*1	This is a set value of PID1 target value 3.	0.00
Calculation symbol selection of Set-point 1 for PID1	[AH-50]	01	(Target value 1) + (Target value 2)	01
		02	(Target value 1) - (Target value 2)	
		03	(Target value 1) x (Target value 2)	
		04	(Target value 1) / (Target value 2)	
		05	Minimum deviation among input destinations 1, 2, and 3	
		06	Maximum deviation among input destinations 1, 2, and 3	

*1. Data range varies depending on the data from [AH-04] to [AH-06].

Item	Parameter	Data	Description	Default data
Input source selection of Process data 1 for PID1	[AH-51]	00 to 06, 08 to 13	00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	01
Input source selection of Process data 2 for PID1	[AH-52]	00 to 06, 08 to 13	00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	00
Input source selection of Process data 3 for PID1	[AH-53]	00 to 06, 08 to 13	00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	00
Calculation symbol selection of Process data for PID1	[AH-54]	01	(FB1)+(FB2)	01
		02	(FB1)-(FB2)	
		03	(FB1)×(FB2)	
		04	(FB1)÷(FB2)	
		05	Square root of FB1	
		06	Square root of FB2	
		07	Square root of (FB1 - FB2)	
		08	Average of FB1/FB2/FB3	
		09	Minimum of FB1/FB2/FB3	
		10	Maximum of FB1/FB2/FB3	
PID1 gain change method selection	[AH-60]	00	Disable (gain 1 is used)	00
		01	Switch by [PRO] terminal	
PID1 proportional gain 1	[AH-61]	0.0 to 100.0	Proportional gain	1.0
PID1 integral time constant 1	[AH-62]	0.0 to 3600.0(s)	Integral gain	1.0
PID1 derivative gain 1	[AH-63]	0.00 to 100.00(s)	Differential gain	0.00
PID proportional gain 2	[AH-64]	0.0 to 100.0	Proportional gain	0.0
PID integral time constant 2	[AH-65]	0.0 to 3600.0(s)	Integral gain	0.0
PID1 derivative gain 2	[AH-66]	0.00 to 100.00(s)	Differential gain	0.00
PID1 gain change time	[AH-67]	0 to 10000(ms)	Time for switch by [PRO] terminal operation	100
PID feed-forward selection	[AH-70]	00	Disable	00
		01	[Ai1] terminal input	
		02	[Ai2] terminal input	
		03	[Ai3] terminal input	
		04	(Reserved)	
		05	(Reserved)	
		06	(Reserved)	

Input Terminal Function

Item	Terminal name	Data	Description
PID disable function	[PID]	041	Disables the PID1 function by turning ON the terminal function. When disabled, operation is done by using the command set for target value as command frequency.
PID1 I control integral value clear	[PIDC]	042	Clears integral value of PID1 control.
Multi-layer target command terminal 1	[SVC1]	051	Switches multiple target values.
Multi-layer target command terminal 2	[SVC2]	052	
Multi-layer target command terminal 3	[SVC3]	053	
Multi-layer target command terminal 4	[SVC4]	054	
PID gain switch	[PRO]	055	Switches PID gain 1 and 2 by terminal.

Data Monitor Function

Item	Parameter	Data	Description
PID1 target value 1	[FA-30]	0.00 to 100.00(%)*1	Displays PID1 target value. Is changeable when [AH-07] = 07 or multi-layer target value 1-15 is enabled.
PID1 target value 2	[FA-32]	0.00 to 100.00(%)*1	Displays PID1 target value 2. Is changeable when [AH-42] = 07.
PID1 target value 3	[FA-34]	0.00 to 100.00(%)*1	Displays PID1 target value 3. Is changeable when [AH-46] = 07.
PID1 feedback data 1 monitor	[db-30]	-100.00 to 100.00(%)*1	Displays PID1 feedback value 1.
PID1 feedback data 2 monitor	[db-32]	-100.00 to 100.00(%)*1	Displays PID1 feedback value 2.
PID1 feedback data 3 monitor	[db-34]	-100.00 to 100.00(%)*1	Displays PID1 feedback value 3.
PID1 target value monitor after calculation	[db-42]	-100.00 to 100.00(%)*1	Displays target value after calculation by [AH-50].
PID1 feedback data	[db-44]	-100.00 to 100.00(%)*1	Displays feedback value after calculation by [AH-54].
PID1 output monitor	[db-50]	-100.00 to 100.00(%)	Displays PID1 output value.
PID1 deviation monitor	[db-51]	-200.00 to 200.00(%)	Displays PID1 deviation.
PID1 deviation 1 monitor	[db-52]	-200.00 to 200.00(%)	Monitors 3 deviations of PID1 when [AH-50] = 05 or 06.
PID1 deviation 2 monitor	[db-53]	-200.00 to 200.00(%)	
PID1 deviation 3 monitor	[db-54]	-200.00 to 200.00(%)	
PID current P gain monitor	[db-61]	0.0 to 100.0	Displays current P gain.
PID current I gain monitor	[db-62]	0.0 to 3600.0(s)	Displays current I gain.
PID current D gain monitor	[db-63]	0.00 to 100.00(s)	Displays current D gain.
PID feed-forward monitor	[db-64]	-100.00 to 100.00(%)	Displays feed-forward command value.

*1. Data range varies depending on the data from [AH-04] to [AH-06].

PID1 Target Value Selection

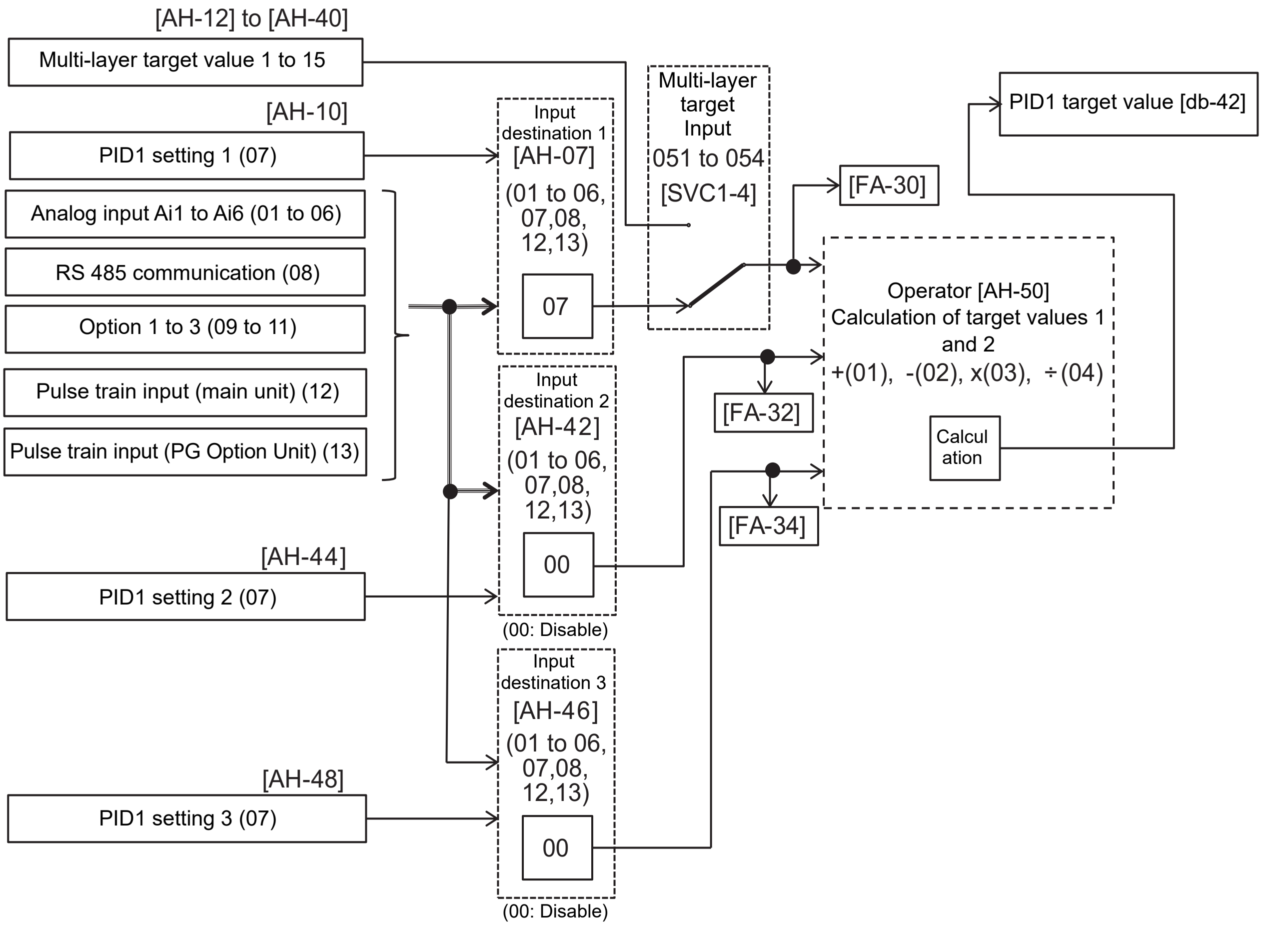
Select PID1 target value.

In the case of setting target value with one input, set 00: None to [AH-42]/[AH-46] and 01: Add to [AH-50] to disable the input destination 2/3.

Calculation result of operator [AH-50] will be restricted in a range of -100.00 to 100.00 (%).

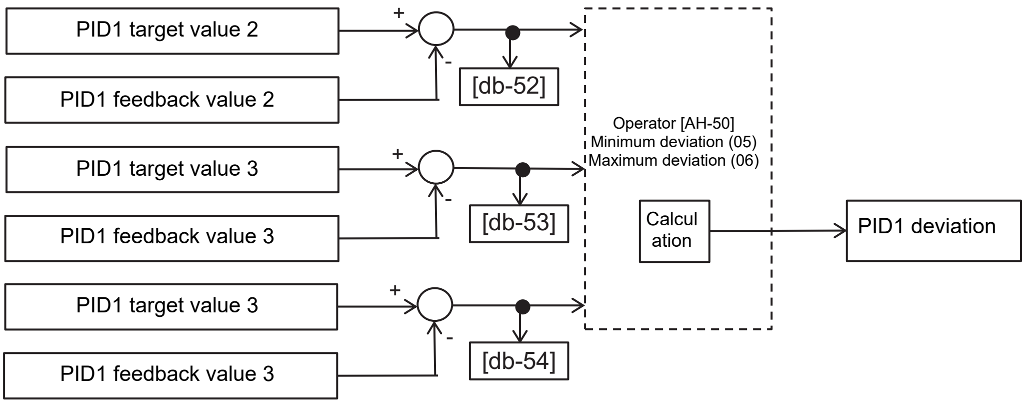
● When Operator [AH-50] is 01 to 04

When 01 to 04 is selected in operator [AH-50], calculation is targeted to target value 1 and target value 2.



● When Operator [AH-50] is 05 or 06

When 05 or 06 is selected in operator [AH-50],
(Target value 1) - (Feedback value 1)
(Target value 2) - (Feedback value 2)
(Target value 3) - (Feedback value 3)
these 3 deviations are compared and PID calculation is performed by using the deviation of minimum (05)/maximum (06).



Precautions for Correct Use

Select 00: Disable for target value and feedback value not in use.

PID Target Value Multi-layer Switch Function

PID1 multi-layer target value (0 to 15 speed) become selectable by assigning 051 to 054 ([SVC1] to [SVC4]) to input terminals 1 to 9, A or B selection [CA-01] to [CA-11].

Precautions for Correct Use

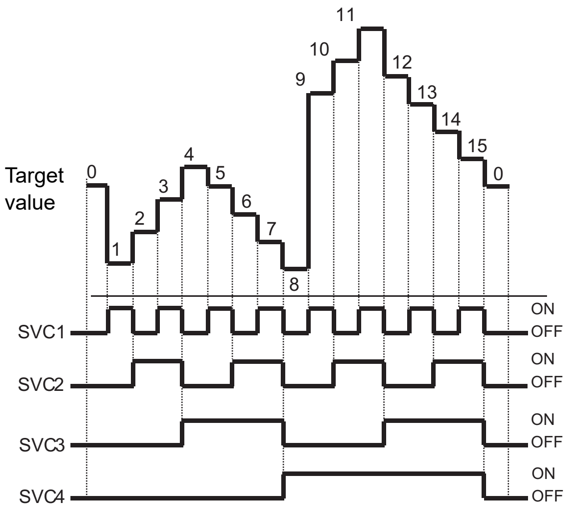
- Stand-by time until terminal input finalization is settable by multi-layer input finalize time [CA-55]. It prevents the transition status of switching terminals from being selected.
- Data is determined after the elapse of a set time for [CA-55] without input change. When you makes the set time longer, input response shows slower.

● Operation Table

Multi-layer target	SVC4	SVC3	SVC2	SVC1	Parameter
Target value 0	OFF	OFF	OFF	OFF	[AH-10]*1
Target value 1	OFF	OFF	OFF	ON	[AH-12]
Target value 2	OFF	OFF	ON	OFF	[AH-14]
Target value 3	OFF	OFF	ON	ON	[AH-16]
Target value 4	OFF	ON	OFF	OFF	[AH-18]
Target value 5	OFF	ON	OFF	ON	[AH-20]
Target value 6	OFF	ON	ON	OFF	[AH-22]
Target value 7	OFF	ON	ON	ON	[AH-24]
Target value 8	ON	OFF	OFF	OFF	[AH-26]
Target value 9	ON	OFF	OFF	ON	[AH-28]
Target value 10	ON	OFF	ON	OFF	[AH-30]
Target value 11	ON	OFF	ON	ON	[AH-32]
Target value 12	ON	ON	OFF	OFF	[AH-34]
Target value 13	ON	ON	OFF	ON	[AH-36]
Target value 14	ON	ON	ON	OFF	[AH-38]
Target value 15	ON	ON	ON	ON	[AH-40]

*1. When [AH-07] = 07. Follow the setting of [AH-07].

● Operation Graph



● Input Terminal Function

Item	Terminal name	Data	Description
Multi-layer target command terminal 1	[SVC1]	051	Switches multiple target values.
Multi-layer target command terminal 2	[SVC2]	052	
Multi-layer target command terminal 3	[SVC3]	053	
Multi-layer target command terminal 4	[SVC4]	054	

8-1 PID Control

8

8-1-2 PID Parameter and Block Diagram

● PID1 Target Value Selection

Item	Parameter	Data	Description	Default data
Input source selection of Set-point for PID1	[AH-07]	00 to 13	00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-10], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	07
Set-point-1 setting for PID1	[AH-10]	0.00 to 100.00[%]*1	Is a parameter set value.	0.00
PID1 Multi stage set-point 1 setting	[AH-12]			
PID1 Multi stage set-point 2 setting	[AH-14]			
PID1 Multi stage set-point 3 setting	[AH-16]			
PID1 Multi stage set-point 4 setting	[AH-18]			
PID1 Multi stage set-point 5 setting	[AH-20]			
PID1 Multi stage set-point 6 setting	[AH-22]			
PID1 Multi stage set-point 7 setting	[AH-24]			
PID1 Multi stage set-point 8 setting	[AH-26]			
PID1 Multi stage set-point 9 setting	[AH-28]			
PID1 Multi stage set-point 10 setting	[AH-30]			
PID1 Multi stage set-point 11 setting	[AH-32]			
PID1 Multi stage set-point 12 setting	[AH-34]			
PID1 Multi stage set-point 13 setting	[AH-36]			
PID1 Multi stage set-point 14 setting	[AH-38]			
PID1 Multi stage set-point 15 setting	[AH-40]			
Input source selection of Set-point 2 for PID1	[AH-42]	00 to 13	00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	00
Set-point 2 setting for PID1	[AH-44]	0.00 to 100.00[%]*1	Is a parameter set value.	0.00

Item	Parameter	Data	Description	Default data
Input source selection of Set-point 3 for PID1	[AH-46]	00 to 13	00: Invalid, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-48], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	00
Set-point 3 setting for PID1	[AH-48]	0.00 to 100.00[%]*1	Is a parameter set value.	0.00
Calculation symbol selection of Set-point 1 for PID1	[AH-50]	01	(Target value 1) + (Target value 2)	01
		02	(Target value 1) - (Target value 2)	
		03	(Target value 1) x (Target value 2)	
		04	(Target value 1) / (Target value 2)	
		05	Minimum of deviation 1 (Target value 1 - FB 1), deviation 2 (Target value 2 - FB 2), and deviation 3 (Target value 3 - FB 1)	
		06	Maximum of deviation 1 (Target value 1 - FB 1), deviation 2 (Target value 2 - FB 2), and deviation 3 (Target value 3 - FB 1)	

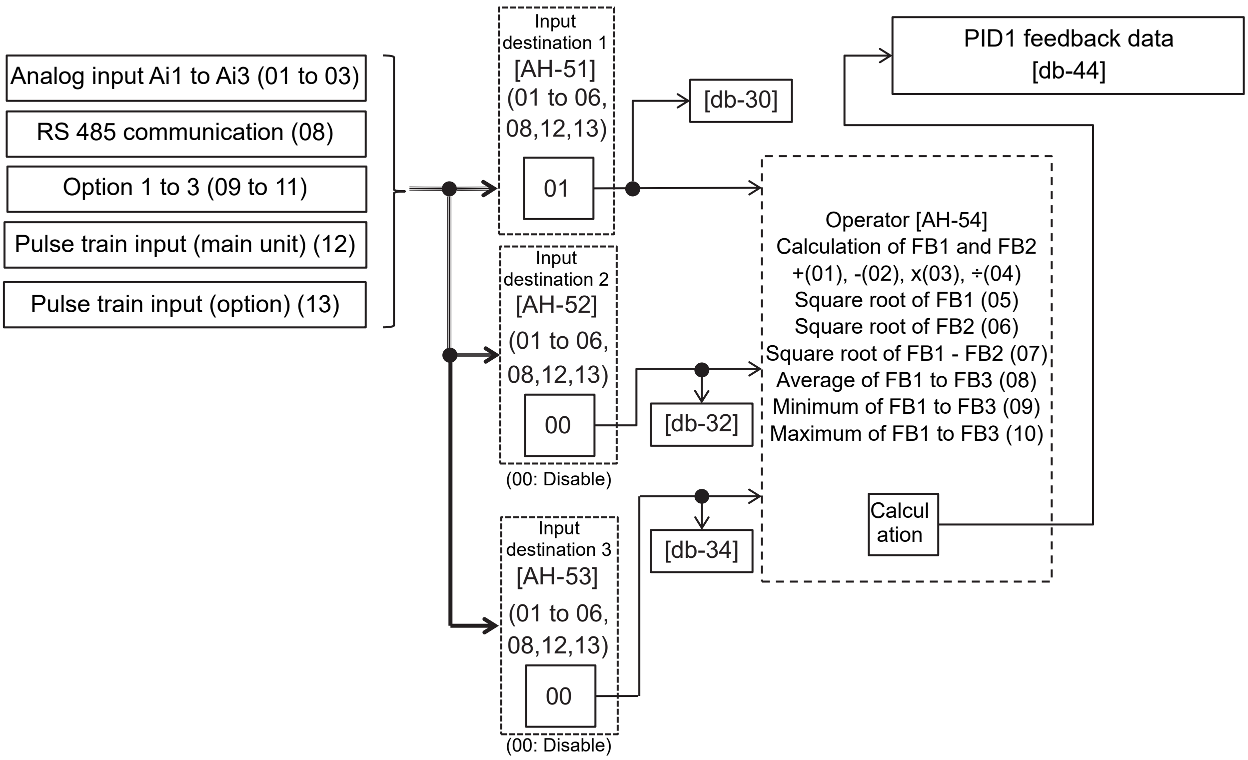
*1. Data range varies depending on the data from [AH-04] to [AH-06].

Selection of PID1 Feedback Data

This selects PID1 feedback data.

In the case of setting feedback data with one input, set 00: None to [AH-52]/[AH-53] and 01: Add to [AH-54] to disable the input destination 2/3.

Calculation result of operator [AH-54] will be restricted in a range of -100.00 to 100.00 (%).



When 01 to 07 is selected in operator [AH-54], calculation will be targeted to feedback data 1 and feedback data 2.

When 08 to 10 is selected in operator [AH-54], calculation will be targeted to feedback data 1 to 3.

Precautions for Correct Use

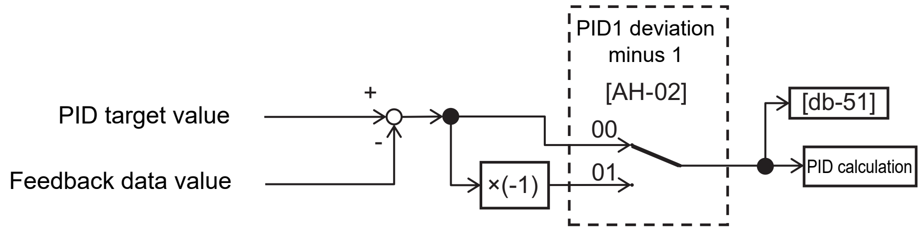
- Select 00: Disable for feedback value not in use.
- Operator [AH-54] will be available to be selected only when 01 to 04 is selected for target value operator [AH-50].

Output of ± Switching PID1 Deviation

Output is feasible by switching ± PID1 deviation.

When PID1 deviation minus [AH-02] is 00, calculation will be performed by (PID target value - FB value). With 01, it will be the same operation as (FB value - PID target value).

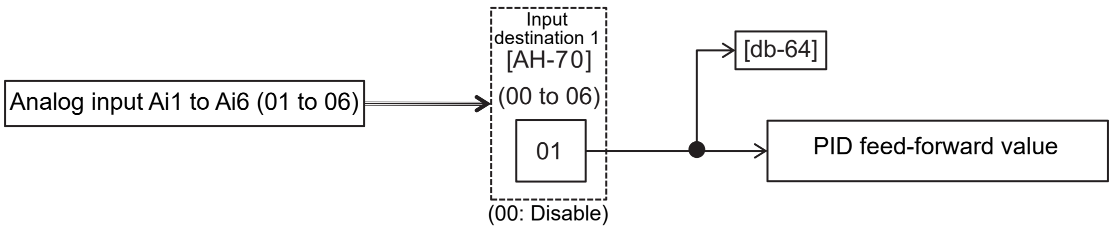
Use this when the polarity of deviation of PID target value and FB value does not much with the command from the inverter due to sensor characteristics, etc.



Selection of PID1 Feed-forward Value

Select PID1-feed forward value.

Feed-forward control operates by setting [AH-70] to anything other than 00 (None).



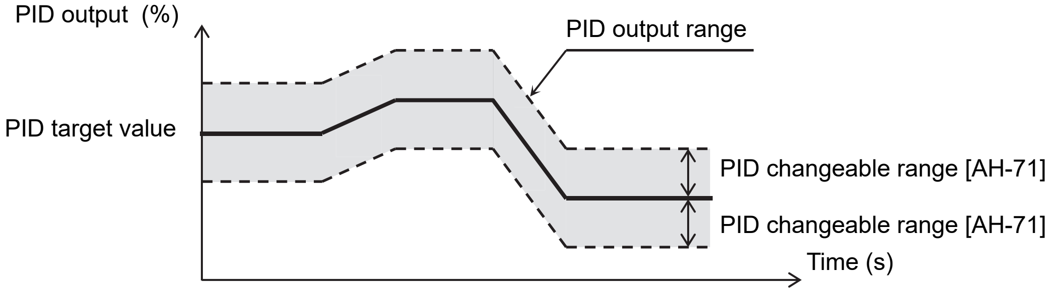
PID1 Changeable Range Limitation

PID output is restricted to a changeable range based on the target value.

When [AH-71] is 0.00, the function will be disabled.

Precautions for Correct Use

In the case of using this function, set PID1 output range [AH-71]. Restriction will be made in a range of PID target value ± [AH-71] with the maximum speed as 100%.



- **Parameter**

Item	Terminal name	Data	Description	Default data
PID1 output range	[AH-71]	0.00 to 100.00(%)	Changeable range based on the target value	00

PID1 Reverse Output

In normal PID control, the inverter does not output a negative figure for frequency command and limits at 0 Hz, when result of PID calculation was negative. If you select 02 (with reverse output) for PID1 selection [AH-01], frequency command can be output in a reverse direction, when result of PID calculation was negative.

Precautions for Correct Use

When [AH-01] is set to 02 (with reverse output), the PID changeable range limit function [AH-71] will be extended to the negative direction.

PID1 I Control Integral Reset Function [PIDC]

This is a function to clear the integral figure of PID operation.

In the case of turning ON the [PIDC] terminal, do so when PID is not in operation.

Precautions for Correct Use

Turning ON the [PIDC] terminal during PID operation clears the integral value added to the PID output command and changes the PID output command value abruptly, resulting in an over-current error.

PID1 Disable Function [PID]

Turning ON the terminal temporarily disables PID operation and performs output according to frequency command.

The figure input as PID command will be adopted for frequency command.

Adjustment of PID1 Control

When a response is not stabilized in PID function, adjust the control in accordance with the following tables.

Precautions for Correct Use

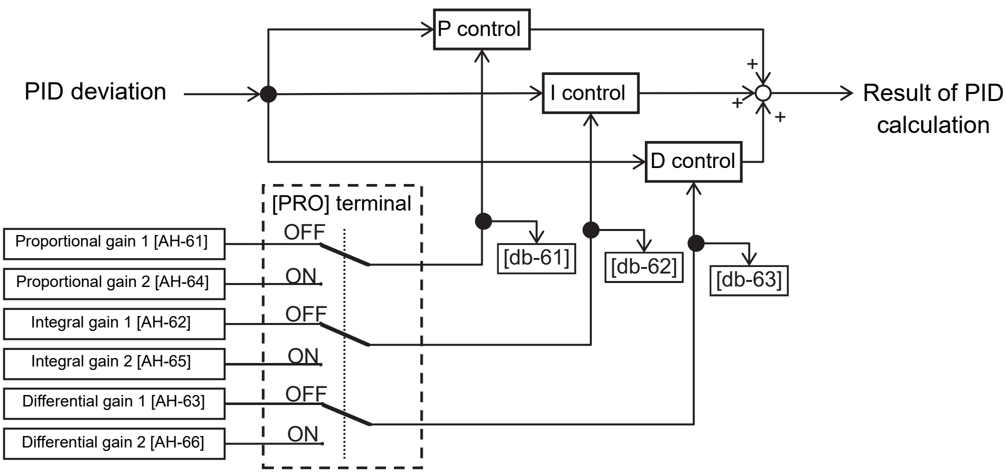
If acceleration/deceleration time is set too long, following of output frequency will be delayed and control may not be successful. In this case, set the acceleration/deceleration time short.

Phenomenon	Examples of measures
Output response is slow and feedback value does not change swiftly even if PID target value was changed.	Increase PID1 proportional (P) gain 1 [AH-61].
• Feedback value changes swiftly and is not stabilized. • Overshooting or hunting occurs.	Decrease PID1 proportional (P) gain 1 [AH-61].
• Feedback value vibrates mildly. • t takes time for operation to be stabilized.	Decrease PID1 integral (I) gain 1 [AH-62].
PID target value and feedback value do not match easily.	Increase PID1 integral (I) gain 1 [AH-62].
• Response is slow even if proportional gain was increased. • Small hunting occurs.	Increase PID1 differential (D) gain 1 [AH-63].
Response due to disturbance is large and it takes time until stabilization.	Decrease PID1 differential (D) gain 1 [AH-63].

Switching PID1 Gain

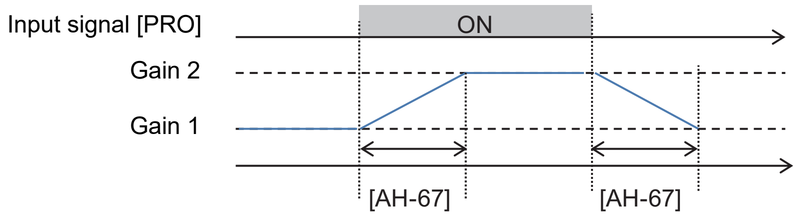
PID gain 1 and 2 can be switched by switching the input terminal function 055 [PRO].

In the case of using the [PRO] terminal, set 01 to PID1 gain switch method selection [AH-60].



PID gain is time for PID1 gain to switch [AH-67] and switches continuously.

Each gain selected for PIDs can be checked by respective monitors [db-61] to [db-63].

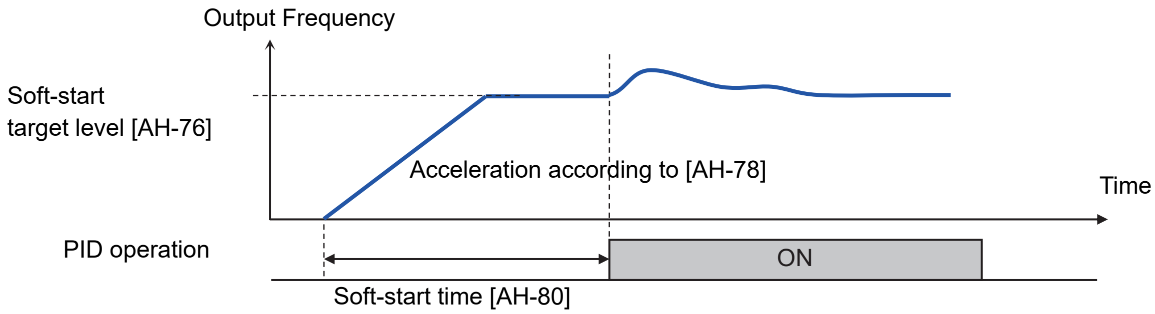


8-1-3 PID Soft-start Function

In the case of using this function, enable PID control and set 01 to the [AH-75] PID soft-start function selection.

It will move to PID control automatically after the elapse of the time set in [AH-80].

It accelerates to soft-start target level [AH-76] after start of soft-start.



● Parameter

Item	Parameter	Data	Description	Default data
PID soft start function enable	[AH-75]	00	Disable	00
		01	Enable	
PID soft start target level	[AH-76]	0.00 to 100.00(%)	It is a target value of the soft-start range with the maximum frequency as 100%.	100
Acceleration time setting for PID soft start function	[AH-78]	0.00 to 3600.00(s)	Sets acceleration time at the time of soft-start.	30.00
PID soft start time	[AH-80]	0.00 to 600.00(s)	Is soft-start operation time.	0.00

PID Start Abnormal Judgment

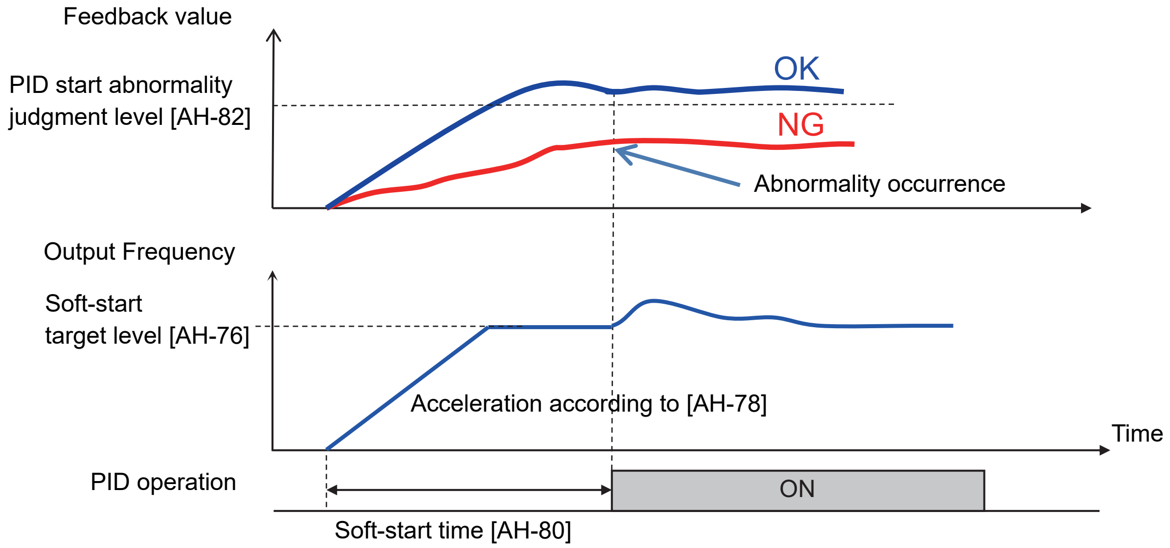
It is a function to detect breakage of pipes such as water leakage.

Abnormality will be judged when PID-FB value is lower than [AH-82] PID start abnormality judgment level after the elapse of [AH-80] soft-start time following PID soft-start.

Abnormal operations vary depending on the setting of [AH-81] PID start abnormality judgment implementation selection at the time of abnormality judgment.

- Nothing will be done when [AH-81] is 00.
- When [AH-81] is 01, it will trip with [E120] PID start abnormality error after the abnormal status elapsed the set time for [AH-80].
- When [AH-81] is 02, the [SSE] terminal will be turned ON after the abnormal status elapsed the set time of [AH-80].

  The [SSE] terminal will stay ON until it stops.



● Parameter

Item	Parameter	Data	Description	Default data
PID soft start error detection enable	[AH-81]	00	Disable	00
		01	Enable It will trip with [E120] PID start abnormality error when start abnormality is judged.	
		02	Enable The [SSE] terminal will be turned ON when start abnormality is judged.	
PID soft start error detection level	[AH-82]	0.00 to 100.00(%)	Is a level to judge start abnormality.	0.00

8-1-4 PID Sleep Function

In the case of using this function, set 01 (output low) or 02 (SLEP terminal) to PID sleep condition selection [AH-85].

You can change the start/cancel time and level of the sleep operation depending on the usage.

You can choose cancellation of the PID sleep status from 01 (deviation amount), 02 (feedback low), and 03 (WAKE terminal) of the PID wake condition selection [AH-93].

In the case of canceling the PID sleep status by deviation, cancellation will only be activated when deviation increases in a direction of lower output, even if PID1 deviation [AH-02] was set to 01 and PID deviation ± was switched.

● Parameter

Item	Parameter	Data	Description	Default data
PID sleep trigger selection	[AH-85]	00	Disable	00
		01	Starts sleep operation when output is low	
		02	Starts operation at the rising edge of the [SLEP] terminal	
PID sleep start level	[AH-86]	0.00 to 590.00(Hz)	Is a level of making a judgment of sleep operation for the output speed when [AH-85] = 01.	0.00
PID sleep active time	[AH-87]	0.00 to 100.00(s)	Is stand-by time before shifting to sleep operation.	0.00
Setpoint boost before PID sleep enable	[AH-88]	00	Disable	00
		01	Boosts target value before sleep operation.	
Setpoint boost time	[AH-89]	0.00 to 100.00(s)	Is actuation time prior to PID sleep.	0.00
Setpoint boost value	[AH-90]	0.00 to 100.00(%)	Sets a boost amount to be added to target value before sleep.	0.00
Minimum RUN time befor PID sleep	[AH-91]	0.00 to 100.00(s)	Does not start sleep operation until [AH-91] has elapsed from start.	0.00
Minimum active time of PID sleep	[AH-92]	0.00 to 100.00(s)	Retains the sleep status until [AH-92] has elapsed, once the sleep operation started.	0.00
PID sleep trigger selection	[AH-93]	01	Cancels the sleep operation when a deviation amount increases in a deceleration direction.	01
		02	Cancels the sleep operation when feedback value decreases.	
		03	Cancels the operation at the rising edge of the [WAKE] terminal	
PID wake start level	[AH-94]	0.00 to 100.00(%)	Cancels the operation when feedback value goes below the set value when [AH-93] is 02.	0.00
PID wake start time	[AH-95]	0.00 to 100.00(s)	Is stand-by time for operation cancellation when [AH-93] is 02.	0.00
PID wake start deviation value	[AH-96]	0.00 to 100.00(%)	Cancels the operation when a deviation between target value and feedback value increases when [AH-93] is 01.	0.00

● Input Terminal Function

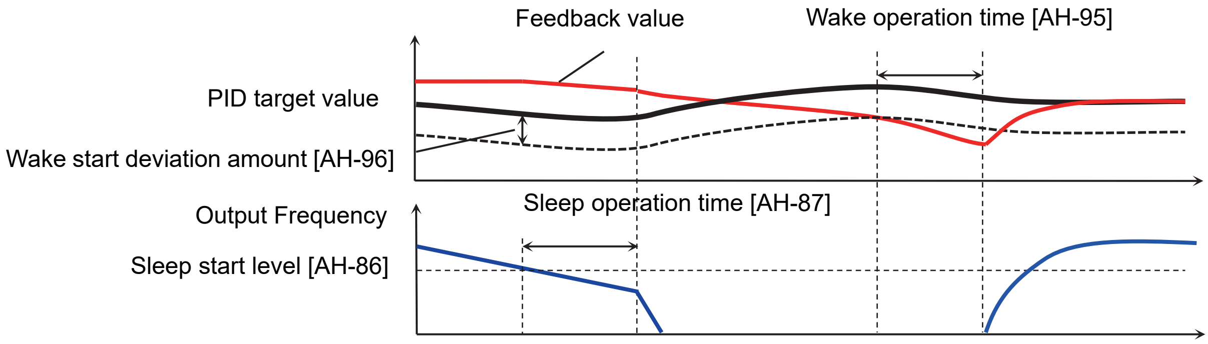
Item	Terminal name	Data	Description
PID sleep start terminal	[SLEP]	058	Starts the sleep function with the terminal when [AH-85] = 02.
PID sleep cancel terminal	[WAKE]	059	Cancels the sleep function with the terminal when [AH-93] = 03.

(Ex.1) [AH-85] sleep start: 01 (output low)

Sleep operation starts will start when the output frequency stays below the level of [AH-86] continuously for the set time of [AH-87].

[AH-93] Sleep cancel: 01 (deviation amount)

Cancel operation will start when PID deviation stays over [AH-96] continuously for the set time of [AH-95]. Deviation operates with either figure (±).

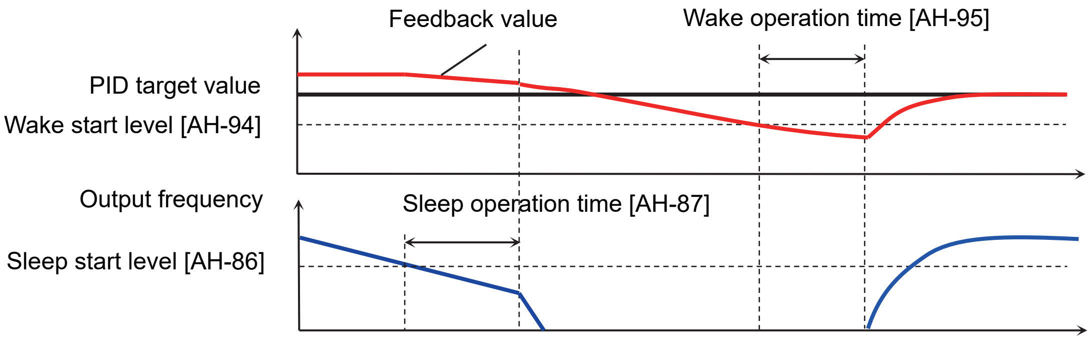


(Ex.2) [AH-85] sleep start: 01 (output low)

Sleep operation will start when the output frequency stays below [AH-86] continuously for the set time of [AH-87].

[AH-93] Sleep cancel: 02 (feedback low)

Cancel operation will start when feedback stays below [AH-94] continuously for the set time of [AH-95].

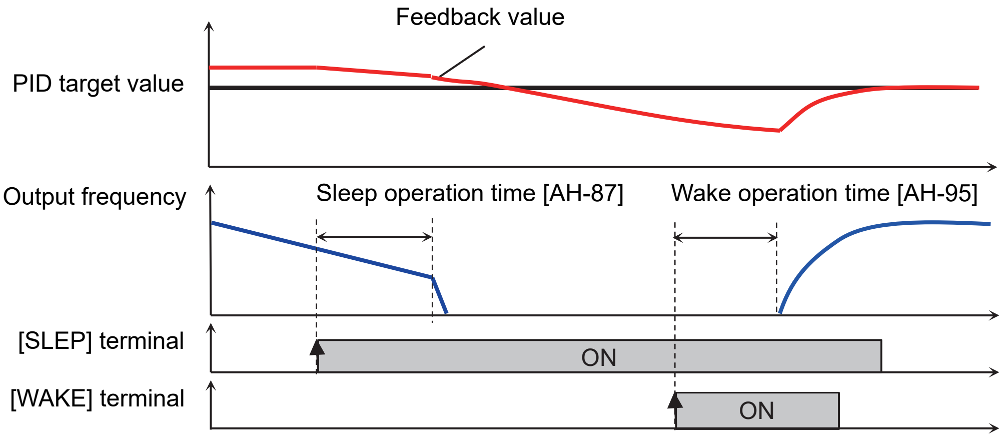


(Ex.3) [AH-85] sleep start: 02 ([SLEP] terminal)

Sleep operation starts after the elapse of [AH-87] from the ON edge of the [SLEP] terminal.

[AH-93] Sleep cancel: 03 ([WAKE] terminal)

Sleep operation will start after the elapse of [AH-95] from the ON edge of the [WAKE] terminal.



Precautions for Correct Use

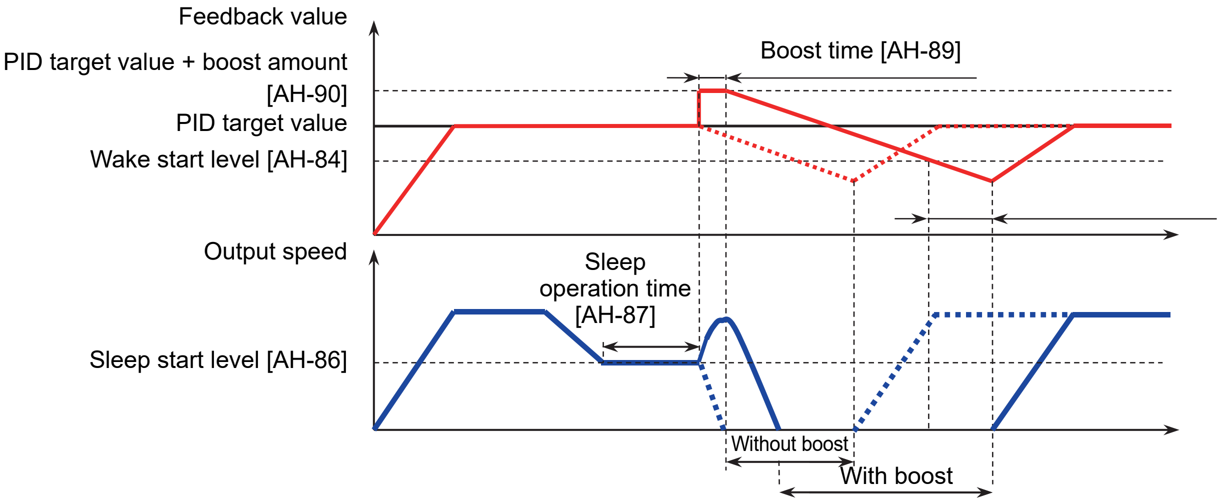
- When you use [SLEP] terminal, turn its terminal ON after wake operation is completed.
- When you use [WAKE] terminal, turn its terminal ON after sleep operation is completed.

Boost Function Prior to Sleep

This raises the PID target value before sleep and increases the feedback amount once. By this, the sleep status can be maintained for a long period of time.

The diagram below is an example when 01 is set to [AH-85] and 02 to [AH-93].

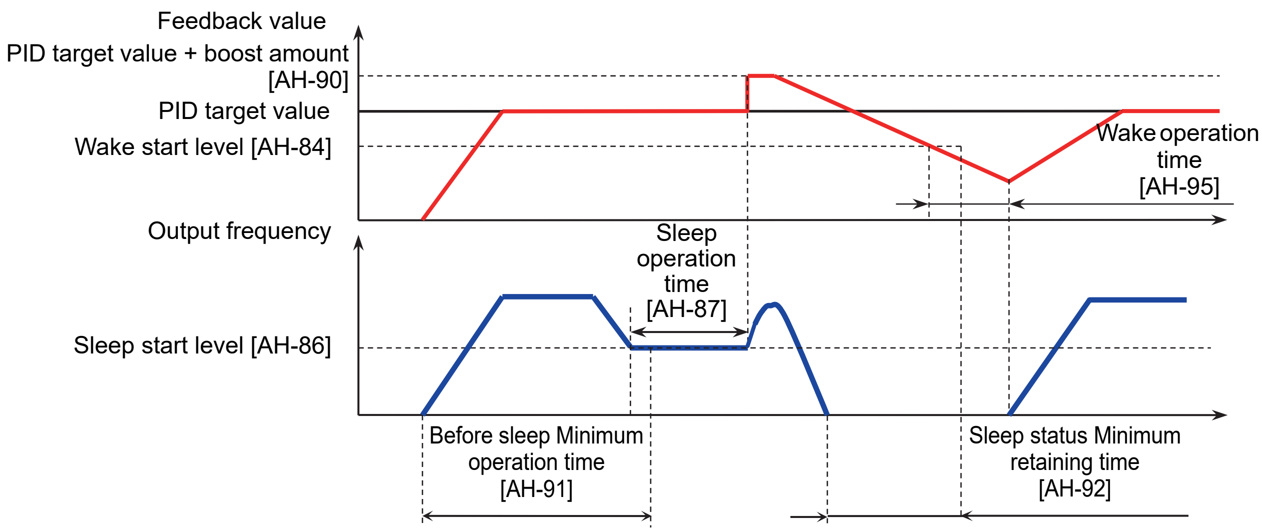
When [AH-85] is 01, the set value of [AH-90] will be added to the PID target value for the set time of [AH-89], if the output frequency stayed below [AH-86] continuously.



Sleep Function Disable Time

Minimum operation time from start to sleep [AH-91] and minimum retaining time of the sleep status [AH-92] can be set.

PID sleep operation can prevent the operation of switching between the sleep status and operation status frequently.



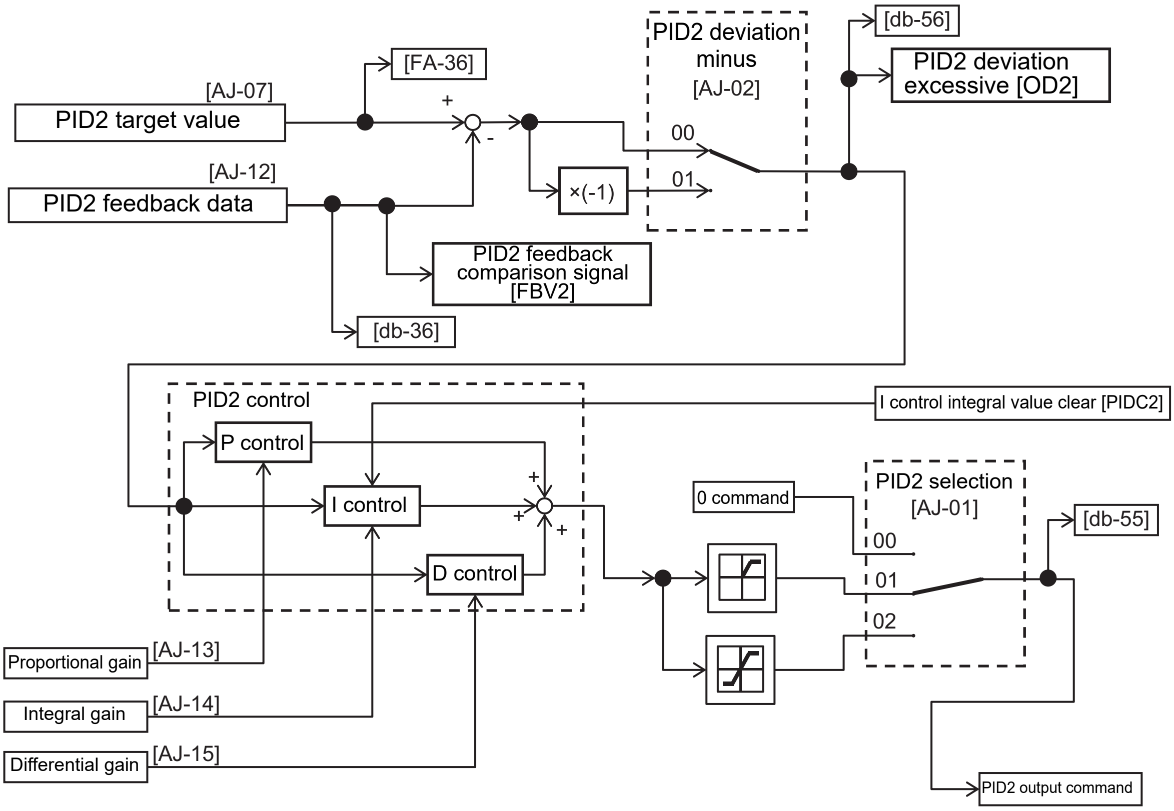
8-1-5 PID2/PID3/PID4 Control

PID1 to PID4 controls operate independently.

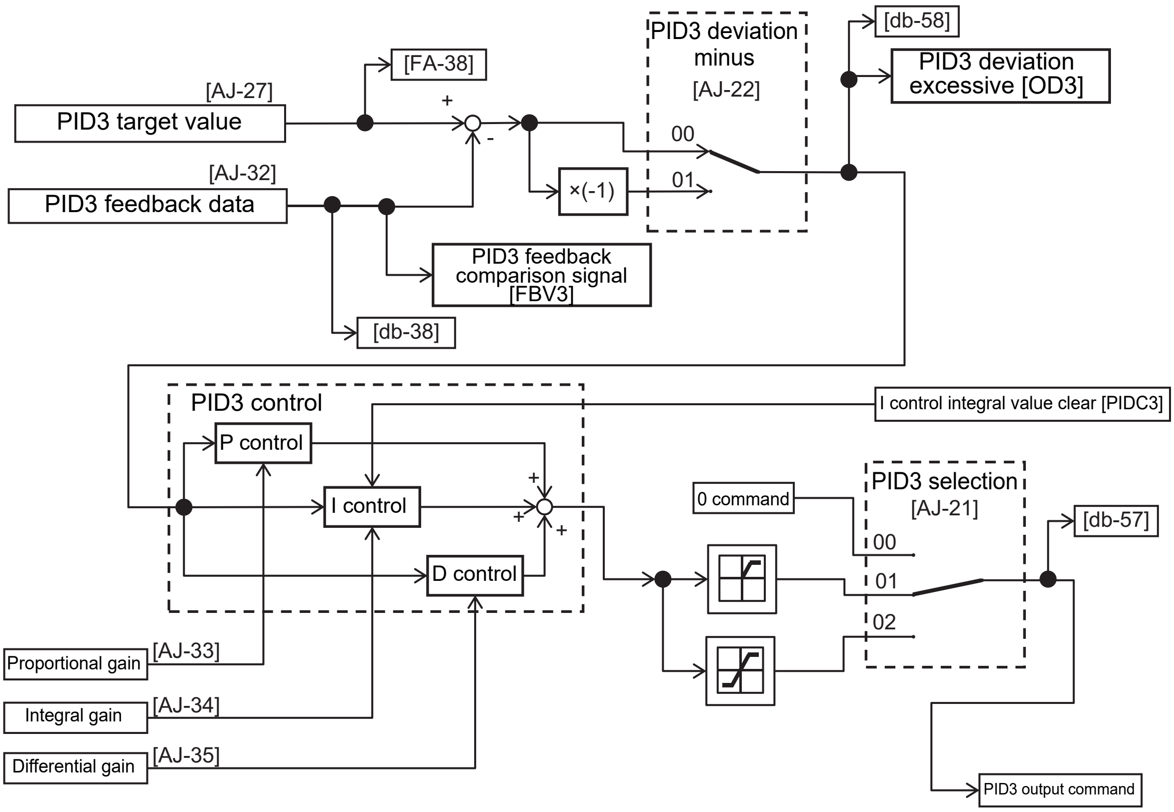
Switching PID1 to 4 by terminal enables the use for switching batch control, etc.

In PID2, selecting PID1 output to target value enables control in consideration of influences from the 2 systems.

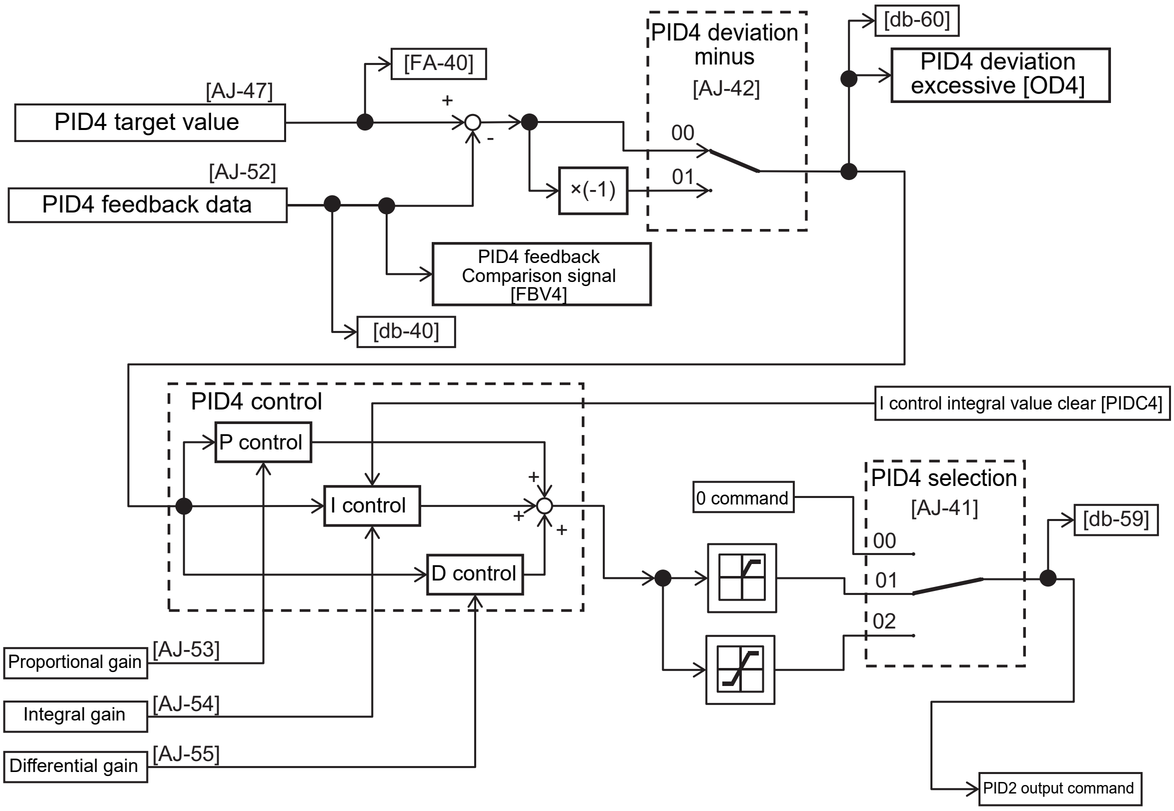
Schematic Diagram of PID2 Control



Schematic Diagram of PID3 Control

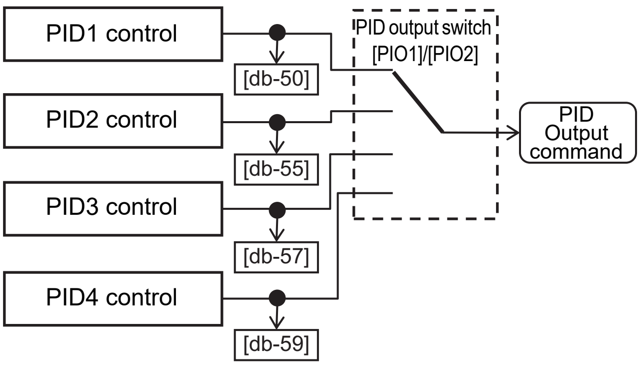


Schematic Diagram of PID4 Control



Switching PID1 to PID4

Switching the input terminal function 056[PIO1]/057[PIO2] enables switching and controlling of PID1 to PID4.



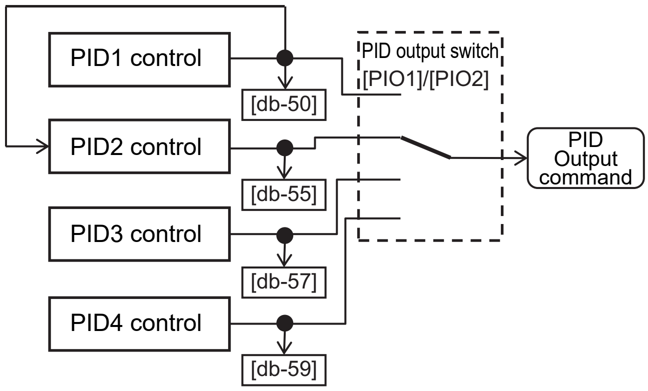
Combination of PIO1/PIO2

	[PIO2]	[PIO1]
PID1 is enabled	OFF	OFF
PID2 is enabled	OFF	ON
PID3 is enabled	ON	OFF
PID4 is enabled	ON	ON

Connection of PID1 with PID2

Setting the target value of PID2 to PID1 output ([AJ-07] = 15) enables double-layer control of PID. (PID3/PID4 cannot be selected.)

Enable PID2 output command as follows.



Combination of PIO1/PIO2

	[PIO2]	[PIO1]
PID2 is enabled	OFF	ON

● Parameter

Item	Parameter	Data	Description	Default data
PID2 enable	[AJ-01]	00	Disable	00
		01	Enable (if command becomes negative, it does not output in a reverse direction)	
		02	Enable (if command becomes negative, it outputs in a reverse direction)	
PID2 deviation inverse	[AJ-02]	00	Disable	00
		01	Enabled (polarity inversion of deviation)	
Input source selection of Set-point for PID2	[AJ-07]	00 to 15	00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option), 15: PID1 output	07
Set-point setting for PID2	[AJ-10]	0.00 to 100.00(%)*1	Is a parameter set value.	0.00
Input source selection of Process data for PID2	[AJ-12]	00 to 13	00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: P option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13:Pulse train input (option)	02
PID2 proportional gain	[AJ-13]	0.0 to 100.0	Proportional gain	0.1
PID2 integral time constant	[AJ-14]	0.0 to 3600.0(s)	Integral gain	0.1

Item	Parameter	Data	Description	Default data
PID2 derivative gain	[AJ-15]	0.00 to 100.00(s)	Differential gain	0.00
PID3 enable	[AJ-21]	00	Disable	00
		01	Enable (if command becomes negative, it does not output in a reverse direction)	
		02	Enable (if command becomes negative, it outputs in a reverse direction)	
PID3 deviation inverse	[AJ-22]	00	Disable	00
		01	Enabled (polarity inversion of deviation)	
Input source selection of Set-point for PID3	[AJ-27]	00 to 13	00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	07
Set-point setting for PID3	[AJ-30]	0.00 to 100.00(%)*2	Is a parameter set value.	0.00
Input source selection of Process data for PID3	[AJ-32]	00 to 13	00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: (Reserved), 05: (Reserved), 06: (Reserved), 07: Parameter setting [AH-44], 08: RS 485 communication, 09: Option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13: Pulse train input (option)	02
PID3 proportional gain	[AJ-33]	0.0 to 100.0	Proportional gain	1.0
PID3 integral time constant	[AJ-34]	0.0 to 3600.0(s)	Integral gain	1.0
PID3 derivative gain	[AJ-35]	0.00 to 100.00(s)	Differential gain	0.00

*1. Data range varies depending on the data from [AJ-04] to [AJ-06].

*2. Data range varies depending on the data from [AJ-24] to [AJ-26].

● Parameter

Item	Parameter	Data	Description	Default data
PID4 enable	[AJ-41]	00	Disable	0
		01	Enable (if command becomes negative, it does not output in a reverse direction)	
		02	Enable (if command becomes negative, it outputs in a reverse direction)	
PID4 deviation inverse	[AJ-42]	00	Disable	0
		01	Enable (polarity inversion of deviation)	
Input source selection of Set-point for PID4	[AJ-47]	00 to 15	00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: Ai4-L input, 05: Ai5-L input, 06: Ai6-L input, 07: Parameter setting [AH-44], 08: RS 485 communication,09: P option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13:Pulse train input (PG Option Unit)	07
Set-point setting for PID4	[AJ-50]	0.00 to 100.00(%)*1	Is a parameter set value.	0
Input source selection of Process data for PID4	[AJ-52]	00 to 13	00: Disable, 01: Ai1-L input, 02: Ai2-L input, 03: Ai3-L input, 04: Ai4-L input, 05: Ai5-L input, 06: Ai6-L input, 07: Parameter setting [AH-44], 08: RS 485 communication,09: P option 1, 10: Option 2, 11: Option 3, 12: Pulse train input (main unit), 13:Pulse train input (PG Option Unit)	02
PID4 proportional gain	[AJ-53]	0.0 to 100.0	Proportional gain	1.0
PID4 integral time constant	[AJ-54]	0.0 to 3600.0(s)	Integral gain	1.0
PID4 derivative gain	[AJ-55]	0.00 to 100.00(s)	Differential gain	0.00

*1. Data range varies depending on the data from [AJ-44] to [AJ-46].

● Input Terminal Function

Item	Terminal name	Data	Description
PID2 disable function	[PID2]	043	Disables the PID2 function by turning ON the terminal function. Frequency equivalent to the target value of PID2 will be commanded when the terminal is turned ON.
PID2 I control integral value clear	[PIDC2]	044	Clears the integral value of PID2 control.
PID3 disable function	[PID3]	045	Disables the PID3 function by turning ON the terminal function. Frequency equivalent to the target value of PID3 will be commanded when the terminal is turned ON.
PID3 I control integral value clear	[PIDC3]	046	Clears the integral value of PID3 control.
PID4 disable function	[PID4]	047	Disables the PID4 function by turning ON the terminal function. Frequency equivalent to the target value of PID4 will be commanded when the terminal is turned ON.
PID4 I control integral value clear	[PIDC4]	048	Clears the integral value of PID4 control.
PID output switch 1	[PIO1]	056	Switches PID output by a combination of PIO1 and PIO2.
PID output switch 2	[PIO2]	057	

● Data Monitor Function

Item	Parameter	Data	Description
PID2 target value	[FA-36]	-100.00 to 100.00(%)*1	Displays the target value of PID2. Changeable when [AJ-07] = 09.
PID2 feedback monitor	[db-36]	-100.00 to 100.00(%)*1	Displays the feedback value of PID2.
PID2 output monitor	[db-55]	-100.00 to 100.00(%)	Displays the output value of PID2.
PID2 deviation monitor	[db-56]	-200.00 to 200.00(%)	Displays the deviation of PID2.
PID3 target value	[FA-38]	-100.00 to 100.00(%)*2	Displays the target value of PID3. Changeable when [AJ-27] = 09.
PID3 feedback monitor	[db-38]	-100.00 to 100.00(%)*2	Displays the feedback value of PID3.
PID3 output monitor	[db-57]	-100.00 to 100.00(%)	Displays the output value of PID3.
PID3 deviation monitor	[db-58]	-200.00 to 200.00(%)	Displays the deviation of PID3.
PID4 target value	[FA-40]	-100.00 to 100.00(%)*3	Displays the target value of PID4. Changeable when [AJ-47] = 09.
PID4 feedback monitor	[db-40]	-100.00 to 100.00(%)*3	Displays the feedback value of PID4.
PID4 output monitor	[db-59]	-100.00 to 100.00(%)	Displays the output value of PID4.
PID4 deviation monitor	[db-60]	-200.00 to 200.00(%)	Displays the deviation of PID4.

*1. Data range varies depending on the data from [AJ-04] to [AJ-06].

*2. Data range varies depending on the data from [AJ-24] to [AJ-26].

*3. Data range varies depending on the data from [AJ-44] to [AJ-46].

Adjust PID2/PID3/PID4 Control

When a response is not stabilized in PID operation, adjust the control in accordance with the following tables.

Adjust respective PID gains for each PID2/PID3/PID4.

Precautions for Correct Use

If acceleration/deceleration time is set too long, following of output frequency will be delayed and control may not be successful.
In this case, set the acceleration/deceleration time short.

Phenomenon	Examples of measures
Output response is slow and feedback value does not change swiftly even if PID target value was changed.	Increase PID proportional gain according to the correspondence table [1].
• Feedback value changes swiftly and is not stabilized. • Overshooting or hunting occurs.	Decrease PID proportional gain according to the correspondence table [1].
• Feedback value vibrates mildly. • It takes time for operation to be stabilized.	Increase PID integral gain according to the correspondence table [2].
PID target value and feedback value do not match easily.	Decrease PID integral gain according to the correspondence table [2].
• Response is slow even if proportional gain was increased. • Small hunting occurs.	Increase PID differential gain according to the correspondence table [3].
Response due to disturbance is large and it takes time until stabilization.	Decrease PID differential gain according to the correspondence table [3].

Gain correspondence table

	[1] Proportional gain	[2] Integral gain	[3] Differential gain
PID2	[AJ-13]	[AJ-14]	[AJ-15]
PID3	[AJ-33]	[AJ-34]	[AJ-35]
PID4	[AJ-53]	[AJ-54]	[AJ-55]

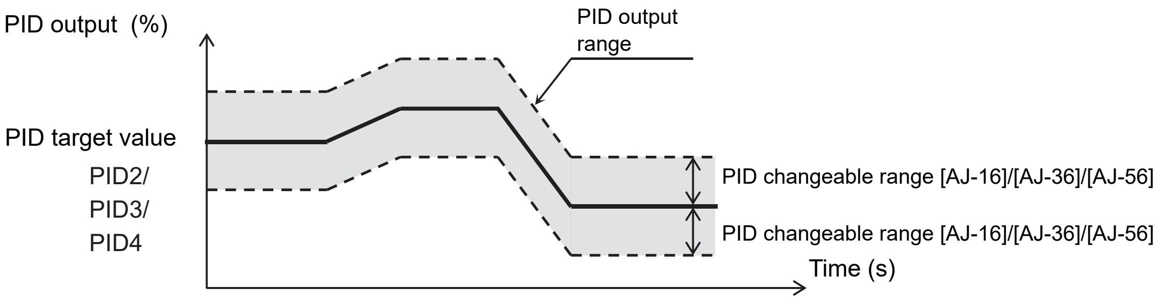
PID2/PID3/PID4 Changeable Range Limitation

PID output is restricted to a changeable range based on the target value.

The limitation function of PID for which 0.00 was set for the following changeable range will be disabled.

Precautions for Correct Use

In the case of using this function, set the corresponding PID changeable range ([AJ/16]/[AJ-36]/[AJ-56]). Restriction will be set with the maximum speed as 100% (PID target value ± changeable range).



● Parameter

Item	Terminal name	Data	Description	Default data
PID2 output range	[AJ-16]	0.00 to 100.00(%)	Changeable range based on PID2 target value	0.00
PID3 output range	[AJ-36]	0.00 to 100.00(%)	Changeable range based on PID3 target value	0.00
PID4 output range	[AJ-56]	0.00 to 100.00(%)	Changeable range based on PID4 target value	0.00

PID2/PID3/PID4 Reverse Output

In normal PID control, the inverter does not output a negative figure for frequency command and limits at 0 Hz. If you select 02 (with reverse output) for each selection [AJ-01]/[AJ-21]/[AJ-41] of PID2/PID3/PID4, frequency command can be output in a reverse direction, if the result of the corresponding PID calculation was negative.

Precautions for Correct Use

When [AJ-01]/[AJ-21]/[AJ-41] is set to 02 (with reverse output), the PID changeable range limit function [AJ-16]/[AJ-36]/[AJ-56] will be extended to the negative direction.

● Parameter

Item	Terminal name	Data	Description	Default data
PID2 enable	[AJ-01]	02	Enable (if command becomes negative, it outputs in a reverse direction)	00
PID3 enable	[AJ-21]			00
PID4 enable	[AJ-41]			0

PID2/PID3/PID4 I Control Integral Reset Function [PIDC2]/[PIDC3]/[PIDC4]

This is a function to clear an integral figure of the corresponding PID operation.

In the case of turning ON the [PIDC2]/[PIDC3]/[PIDC4] terminal, do so when the corresponding PID is not in operation.

Precautions for Correct Use

Turning ON the [PIDC2]/[PIDC3]/[PIDC4] terminal during PID operation clears the integral value added to the PID output command and changes the PID output command value abruptly, resulting in an over-current error.

PID2/PID3/PID4 Disable Function [PID2]/[PID3]/[PID4]

Turning ON the corresponding terminal disables PID operation temporarily and performs output according to frequency command.

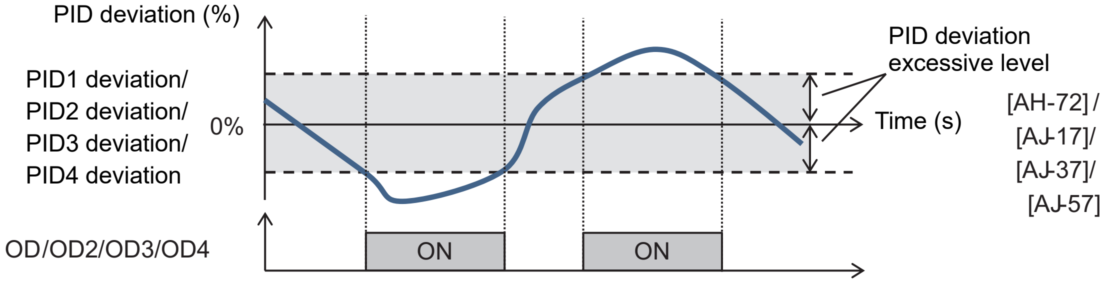
The figure input as PID command will be adopted for frequency command.

8-1-6 PID Signal Output

PID Deviation Excessive Signal (OD)

This outputs a deviation excessive signal in the case of each PID deviation exceeding the set level of the corresponding PID.

Assign output terminal 11 to 15 selection (CC-01 to CC-05) or relay output terminal (16, AL) selection (CC-06/CC-07) to 045 (OD).



8-1 PID Control
8
8-1-6 PID Signal Output

● Parameter

Item	Terminal name	Data	Description	Default data
PID1 Deviation over level	[AH-72]	0.00 to 100.00(%)	045 [OD] signal output judgment level	3.00
PID2 Deviation over level	[AJ-17]	0.00 to 100.00(%)	047 [OD2] signal output judgment level	
PID3 Deviation over level	[AJ-37]	0.00 to 100.00(%)	089 [OD3] signal output judgment level	
PID4 Deviation over level	[AJ-57]	0.00 to 100.00(%)	091 [OD4] signal output judgment level	

● Output Signal Function

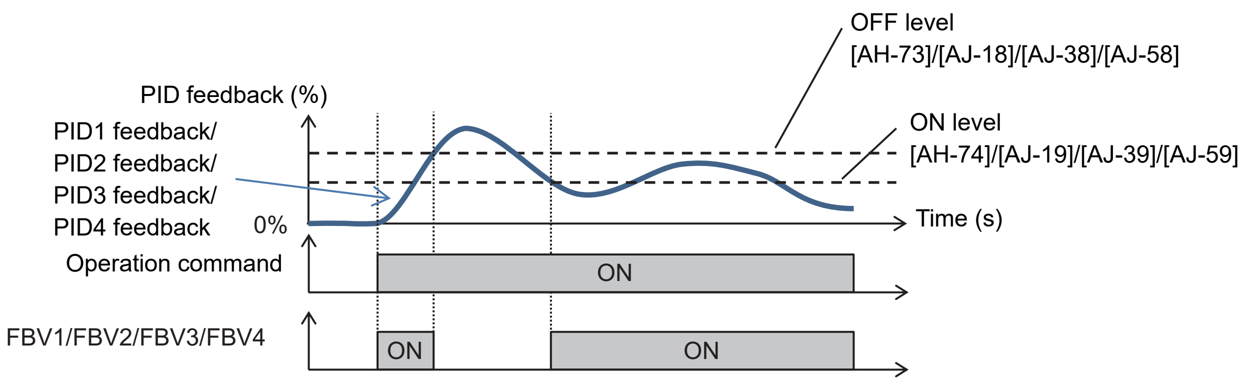
Item	Terminal name	Data	Description
PID1 deviation excessive signal	OD	045	Signal will be turned ON when the difference between PID target value and feedback value exceeds the range of PID1 deviation excessive level.
PID2 deviation excessive signal	OD2	047	Signal will be turned ON when the difference between PID target value and feedback value exceeds the range of PID2 deviation excessive level.
PID3 deviation excessive signal	OD3	089	Signal will be turned ON when the difference between PID target value and feedback value exceeds the range of PID3 deviation excessive level.
PID4 deviation excessive signal	OD4	091	Signal will be turned ON when the difference between PID target value and feedback value exceeds the range of PID4 deviation excessive level.

PID Feedback Comparison Signal (FBV)

Output terminal signal will be turned OFF when each PID feedback reaches beyond respective PID set ranges.

Precautions for Correct Use

- Set PID1 feedback to be OFF level ≥ ON level. OFF operation will be prioritized when it is set to Off level < ON level.
- Setting ON level/OFF level to be other than 0.00 starts outputting of a feedback comparison signal.



● Parameter

Item	Terminal name	Data	Description	Default data
PID1 Feedback compare signal turn-off level	[AH-73]	0.00 to 100.00(%)	FBV1 signal output OFF judgment level	100.00
PID1 Feedback compare signal turn-on level	[AH-74]	0.00 to 100.00(%)	FBV1 signal output ON judgment level	0.00
PID2 Feedback compare signal turn-off level	[AJ-18]	0.00 to 100.00(%)	FBV2 signal output OFF judgment level	100.00
PID2 Feedback compare signal turn-on level	[AJ-19]	0.00 to 100.00(%)	FBV2 signal output ON judgment level	0.00
PID3 Feedback compare signal turn-off level	[AJ-38]	0.00 to 100.00(%)	FBV3 signal output OFF judgment level	100.00
PID3 Feedback compare signal turn-on level	[AJ-39]	0.00 to 100.00(%)	FBV3 signal output ON judgment level	0.00
PID4 Feedback compare signal turn-off level	[AJ-58]	0.00 to 100.00(%)	FBV4 signal output OFF judgment level	100.00
PID4 Feedback compare signal turn-on level	[AJ-59]	0.00 to 100.00(%)	FBV4 signal output ON judgment level	0.00

● Feedback Comparison Signal

Item	Terminal name	Data	Description
PID1 feedback comparison signal	[FBV1]	046	PID1 feedback signal [FBV1] OFF: Exceeded the OFF level. ON: Went below the ON level.
PID2 feedback comparison signal	[FBV2]	048	PID2 feedback signal [FBV2] OFF: Exceeded the OFF level. ON: Went below the ON level.
PID3 feedback comparison signal	[FBV3]	090	PID3 feedback signal [FBV3] OFF: Exceeded the OFF level. ON: Went below the ON level.
PID4 feedback comparison signal	[FBV4]	092	PID4 feedback signal [FBV4] OFF: Exceeded the OFF level. ON: Went below the ON level.

8-1-7 PID Unit Change

This function enables to change the unit and scale of the following parameters.

In this setting, display descriptions of zero point and maximum point are set.

● PID1 Display Conversion Parameter

Item	Parameter
PID1 Set Value 1 monitor	[FA-30]
PID1 Set Value 2 monitor	[FA-32]
PID1 Set Value 3 monitor	[FA-34]
PID1 feedback data 1 monitor	[db-30]
PID1 feedback data 2 monitor	[db-32]
PID1 feedback data 3 monitor	[db-34]
PID1 target value monitor after calculation	[db-42]
PID1 feedback data	[db-44]
Set-point-1 setting for PID1	[AH-10]
PID1 Multi stage set-point	[AH-12] to [AH-40]
Set-point 2 setting for PID1	[AH-44]
Set-point 3 setting for PID1	[AH-48]

● PID2 Display Conversion Parameter

Item	Parameter
PID2 Set Value monitor	[FA-36]
PID2 feedback data monitor	[db-36]
Set-point setting for PID2	[AJ-10]

● PID3 Display Conversion Parameter

Item	Parameter
PID3 Set Value monitor	[FA-38]
PID3 feedback data monitor	[db-38]
Set-point setting for PID3	[AJ-30]

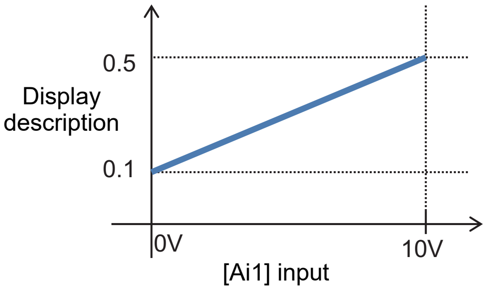
● PID4 Display Conversion Parameter

Item	Parameter
PID4 Set Value monitor	[FA-40]
PID4 feedback data monitor	[db-40]
Set-point setting for PID4	[AJ-50]

● Adjustment Example

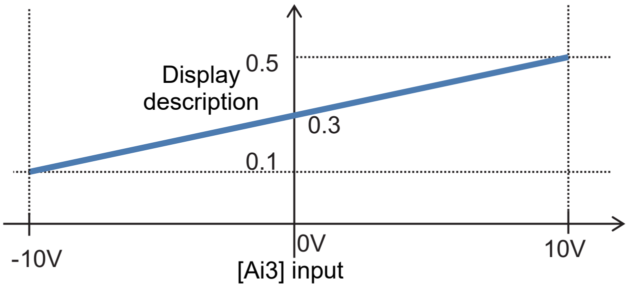
(Adjustment example 1) If you want to display 0 to 10V (0 to 100%) as 0.1 to 0.5kPa in [db-30] when the voltage is feed-backed to the analog input 1 [Ai1]

Unit [AH-03] = 56 (kPa), decimal point position [AH-06] = 02, zero point [AH-04] = 10, end point [AH-05] = 50



(Adjustment example 2) If you want to display -10 to 10V (-100 to 100%) as 0.1 to 0.5kPa in [db-30] when the voltage is feed-backed to the analog input 3 [Ai3]

Unit [AH-03] = 56 (kPa), decimal point position [AH-06] = 02, zero point [AH-04] = 30, end point [AH-05] = 50



Parameter

Item	Parameter	Data	Description	Default data
PID1 unit selection	[AH-03]	*1	Sets the unit of PID1 display conversion parameter.	1
PID1 scale adjustment (0%)	[AH-04]	-10000 to 10000	Sets the criteria of input 0% of PID1 display conversion parameter.	0
PID1 scale adjustment (100%)	[AH-05]	-10000 to 10000	Sets the criteria of input 100% of PID1 display conversion parameter.	10000
PID1 scale adjustment (point position)	[AH-06]	00	00000.	02
		01	0000.0	
		02	000.00	
		03	00.000	
		04	0.0000	
PID2 unit selection	[AJ-03]	*1	Sets the unit of PID2 display conversion parameter.	01
PID2 scale adjustment (0%)	[AJ-04]	-10000 to 10000	Sets the criteria of input 0% of PID2 display conversion parameter.	0
PID2 scale adjustment (100%)	[AJ-05]	-10000 to 10000	Sets the criteria of input 100% of PID2 display conversion parameter.	10000
PID2 scale adjustment (point position)	[AJ-06]	00	00000.	02
		01	0000.0	
		02	000.00	
		03	00.000	
		04	0.0000	
PID3 unit selection	[AJ-23]	*1	Sets the unit of PID3 display conversion parameter.	01
PID3 scale adjustment (0%)	[AJ-24]	-10000 to 10000	Sets the criteria of input 0% of PID3 display conversion parameter.	0
PID3 scale adjustment (100%)	[AJ-25]	-10000 to 10000	Sets the criteria of input 100% of PID3 display conversion parameter.	10000
PID3 scale adjustment (point position)	[AJ-26]	00	00000.	02
		01	0000.0	
		02	000.00	
		03	00.000	
		04	0.0000	
PID4 unit selection	[AJ-43]	*1	Sets the unit of PID4 display conversion parameter.	01
PID4 scale adjustment (0%)	[AJ-44]	-10000 to 10000	Sets the criteria of input 0% of PID4 display conversion parameter.	0
PID4 scale adjustment (100%)	[AJ-45]	-10000 to 10000	Sets the criteria of input 100% of PID4 display conversion parameter.	10000
PID4 scale adjustment (point position)	[AJ-46]	00	00000.	02
		01	0000.0	
		02	000.00	
		03	00.000	
		04	0.0000	

*1. Refer to the unit table in the next section.

● Unit Table

No.	Unit	No.	Unit
00	non	31	cm
01	%	32	°F
02	A	33	l/s
03	Hz	34	l/min
04	V	35	l/h
05	kW	36	m3/s
06	W	37	m3/min
07	hr	38	m3/h
08	s	39	kg/s
09	kHz	40	kg/min
10	ohm	41	kg/h
11	mA	42	t/min
12	ms	43	t/h
13	P	44	gal/s
14	kgm2	45	gal/min
15	pls	46	gal/h
16	mH	47	ft3/s
17	Vdc	48	ft3/min
18	°C	49	ft3/h
19	kWh	50	lb/s
20	mF	51	lb/min
21	mVs/rad	52	lb/h
22	Nm	53	mbar
23	min^{-1}	54	bar
24	m/s	55	Pa
25	m/min	56	kPa
26	m/h	57	PSI
27	ft/s	58	mm
28	ft/min		
29	ft/h		
30	m		

8-2 Tripless Functions

8-2-1 Overload Limit Level Function

Set [bA122] overload limit function to any value other than 00, and the output frequency automatically lowers according to overload limit time once the output current reaches [bA123] overload limit level.

When [bA122] = 01, the output current is monitored during acceleration or at constant speed. It limits the excess inertial moment during acceleration and overload state caused by sudden acceleration.

When [bA122] = 02, the output current is monitored only at constant speed. It prevents overloading caused by sudden load fluctuation at constant speed without decelerating during acceleration.

When [bA122] = 03, the output current is monitored during acceleration or at constant speed. In addition to the operation with [bA122] = 01, it accelerates to prevent overloading when regenerative load is applied at constant speed.

[bA124] overload limit time is the time to decelerate from the maximum frequency to 0 Hz or to accelerate from 0 Hz to the maximum frequency.

Set overload limit level [bA123/bA127] to 150% of the motor rated current.

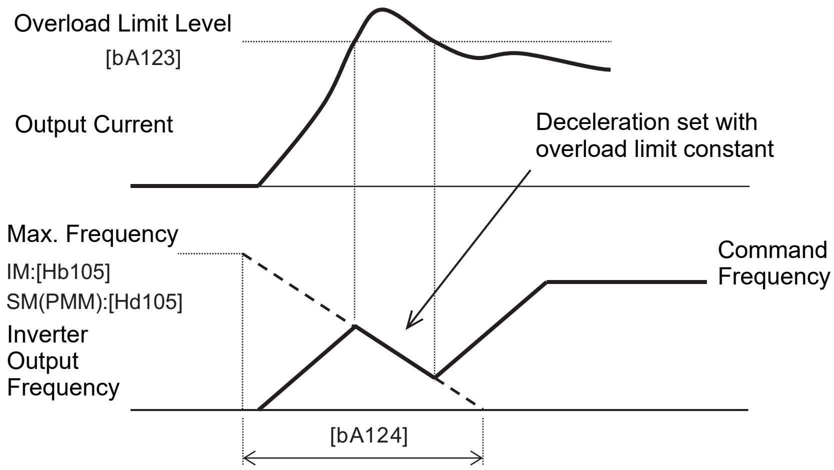
Inverter accelerates in the following conditions during regeneration in overload limit level regardless of control methods [AA121/AA221].

- Overload Limit Selection [bA122/bA126] is set to 03 (Enabled during acceleration/constant speed (Accelerated during regeneration).
- A current exceeding the overload limit level [bA123/bA127] flows during regenerative operation.

If this function is activated while the inverter is accelerating, the acceleration time will be longer than the set time.

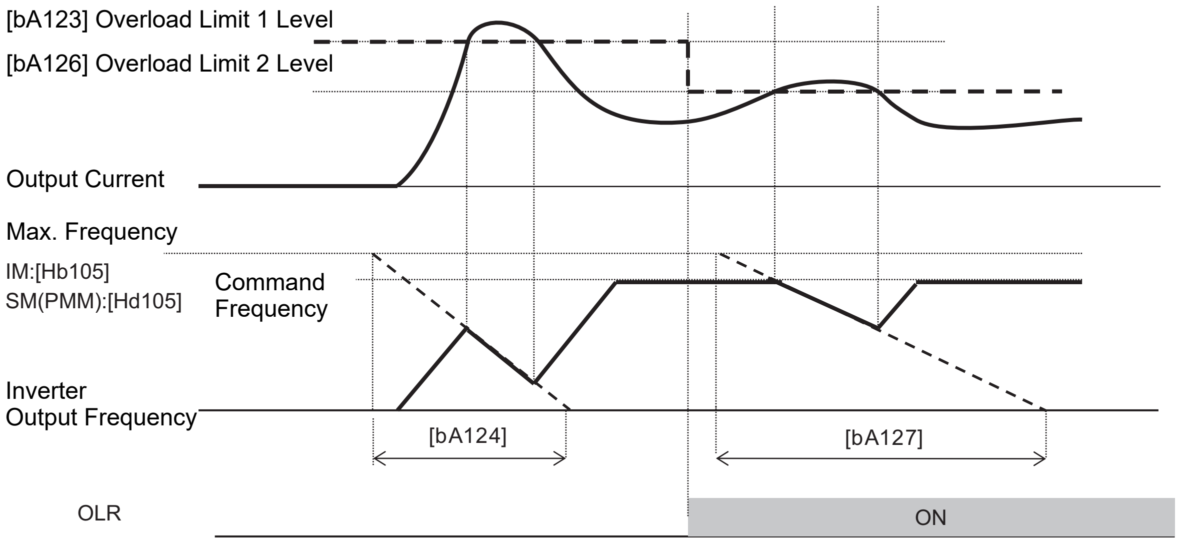
Precautions for Correct Use

- Setting the overload limit operation time to be too short will cause this function to perform automatic deceleration even during acceleration, which may lead to overvoltage tripping caused by regenerative energy from the motor.
- If this function is activated during acceleration and the frequency does not reach the target frequency, the situation can be improved with the adjustments shown below.
  - Make the acceleration time longer
  - Adjust the torque boost
  - Increase the overload limit level
- Overload limit function is not activated during speed control while it is activated during position/torque control.



Using [bA122] to [bA124] of overload limit 1 and [bA126] to [bA128] of overload limit 2, you can set two types of overload limit functions.

You can switch between overload limit 1 and overload limit 2 with the input terminal function 038[OLR].
Turning on the [OLR] enables the overload limit 2.



Parameter

Item	Parameter	Data	Description	Default data
Overload restriction 1 mode selection, 1st-motor Overload restriction 2 mode selection, 1st-motor	[bA122] [bA126]	00	Disabled	01
		01	Enabled during acceleration and at constant speed	
		02	Enabled at constant speed	
		03	Enabled during acceleration and at constant speed (Speed increases during regeneration)	
Overload restriction 1 active level, 1st-motor Overload restriction 2 active level, 1st-motor	[bA123] [bA127]	Inverter rated current × (0.2 to 2.0)*1	Overload limit function is activated when the output current exceeds this set value.	1.5× Inverter rated current
Overload restriction 1 action time, 1st-motor Overload restriction 2 Action time, 1st-motor	[bA124] [bA128]	0.10 to 3600.00(s)	Acceleration/Deceleration time when exceeded the overload limit level.	1.00

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A detected, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

Input Terminal Function

Item	Parameter	Data	Description
Input terminal function selection	[CA-01] to [CA-11]	038	[OLR] Overload limit switching OFF: Overload limit 1 enabled. ON: Overload limit 2 enabled.

8-2-2 Overcurrent Suppression Selection

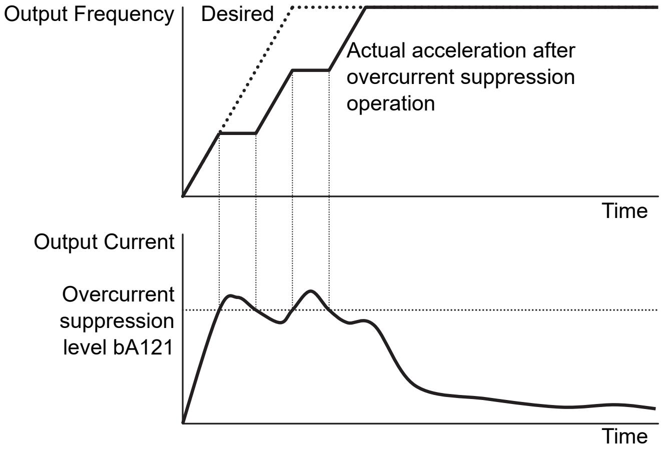
Setting [bA120] overcurrent suppression selection to 01 enables the overcurrent suppression function.

This function suppresses the overcurrent caused by steep current increase due to sudden acceleration, etc.

If the overcurrent suppression function is enabled, the overcurrent suppression function will be activated when the motor current exceeds the set value for [bA121] with momentary current increase.

Precautions for Correct Use

- Disable this function when using for elevators, etc. Suppressing the current causes insufficient torque, which may result in sliding down of the panier or anything hanging.
- The overcurrent tripping may take place even if this function is enabled if the current increases sharply due to shock load, etc.
- This function will be automatically enabled during DC braking.
- This function is enabled during position/torque control.
- This function is disabled when synchronous motor (permanent magnet motor) is used.



● Parameter

Item	Parameter	Data	Description	Default data
Over current suppress enable, 1st-motor	[bA120]	00	Disabled	1
		01	Enabled (Overcurrent suppression is activated.)	
Over current suppress Level, 1st-motor	[bA121]	Inverter rated current × (0.0 to 2.0)*1	Sets the operation level of the overcurrent suppression function.	1.8× Inverter rated current
OC-supress level of Active frequency matching	[bb-46]	Inverter rated current × (0.0 to 2.0)*1	Sets the operation level of the overcurrent suppression function when activated with frequency pull-in.*2	1.0× Inverter rated current

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
   When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
   When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

*2. See *7-5-4 Frequency Pull-in Start* on page 7-69 for details.

8-2-3 Overvoltage Suppression Function During Deceleration

This function is used to prevent overvoltage trip caused by the regenerative energy from the motor during deceleration.

[bA140] overvoltage suppression function selection allows you to enable the overvoltage suppression function.

The overvoltage suppression function will be activated when the internal DC voltage of the inverter main circuit capacitor exceeds the value set by [bA141] overvoltage suppression level.

When this function is used, set the Dynamic brake (BRD) usage rate [bA-60] to 0.0 (BDR function is not activated) and the Dynamic brake (BRD) selection [bA-61] to 00 (Disabled).

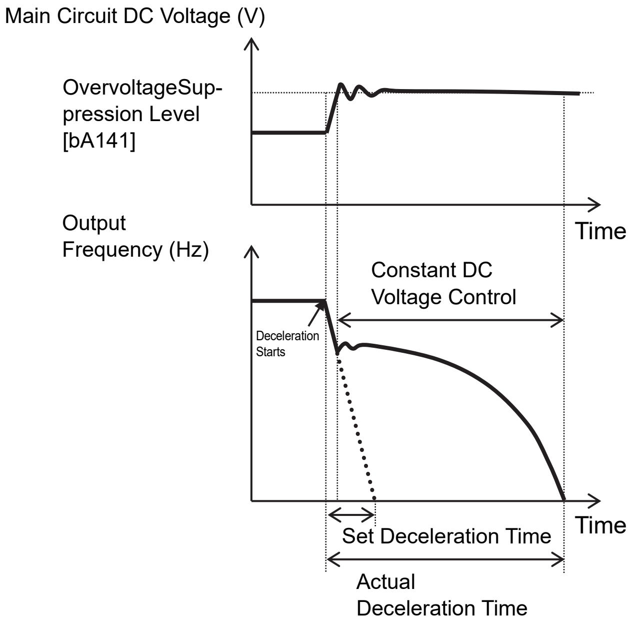
Precautions for Correct Use

- When this function is enabled, the actual deceleration time may get longer than the set value.
- When using this function, it may take long time before the motor stops depending on the motor load moment of inertia.
- Depending on the deceleration rate or load status, the overvoltage tripping may be triggered even if this function is enabled.
- Set [bA141] to be receiving voltage x √2 × 1.1 or higher. Setting a value lower than the P-N voltage in operation may prevent the motor from stopping.
- This function is not activated while the position/torque are controlled.

● Parameter

Item	Parameter	Data	Description	Default data
Over-voltage suppression enable, 1st-motor	[bA140]	00	Disabled	00
		01	Constant DC voltage-controlled deceleration	
		02	Function to avoid overvoltage acceleration (only in deceleration)	
		03	Function to avoid overvoltage acceleration	
Over-voltage suppression active level, 1st-motor	[bA141]	200 V class: 330.0 to 400.0 (V) 400 V class: 660.0 to 800.0 (V)	Sets the level at which the overvoltage suppression function starts.	(200V class) 380.0 (400V class) 760.0
Over-voltage suppression action time, 1st-motor	[bA142]	0.00 to 3600.00(s)	Acceleration time when the overvoltage suppression function is activated.	1.00
DC bus constant control proportional gain, 1st-motor	[bA144]	0.00 to 5.00	Proportional gain for PI control in constant DC voltage control.	0.20
DC bus constant control integral gain, 1st-motor	[bA145]	0.00 to 150.00	Integral gain for PI control in constant DC voltage control.	1.00

For Constant DC Voltage Control [bA140] = 01



When [bA140] is 01, PI control is performed so that the internal DC voltage will be constant.

Setting the proportional gain [bA144] to be large will accelerate the response. However, setting it to be too large will dissipate the control, tending to cause tripping.

Setting the integral gain [bA145] to be short will accelerate the response. However, setting it to be too short will tend to cause tripping.

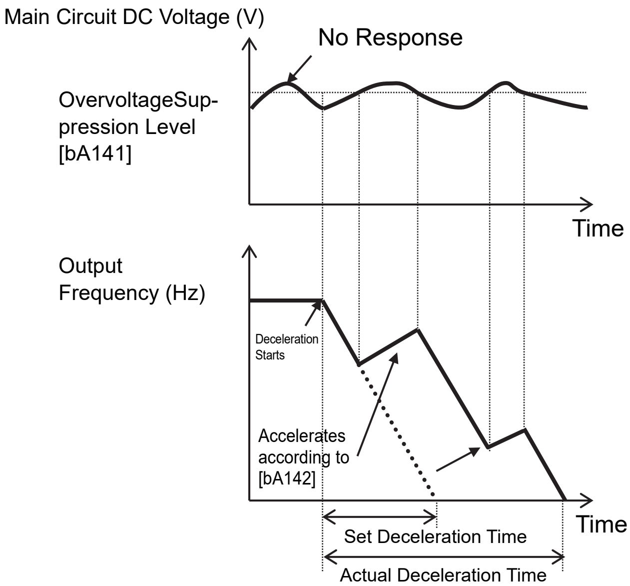
If the internal DC voltage increases when [bA140] is 02 or 03, acceleration control is performed.

The acceleration control accelerates to the highest frequency setting according to the overvoltage suppression operating time [bA142]. After the acceleration, it decelerates to the target value according to the normal deceleration time.

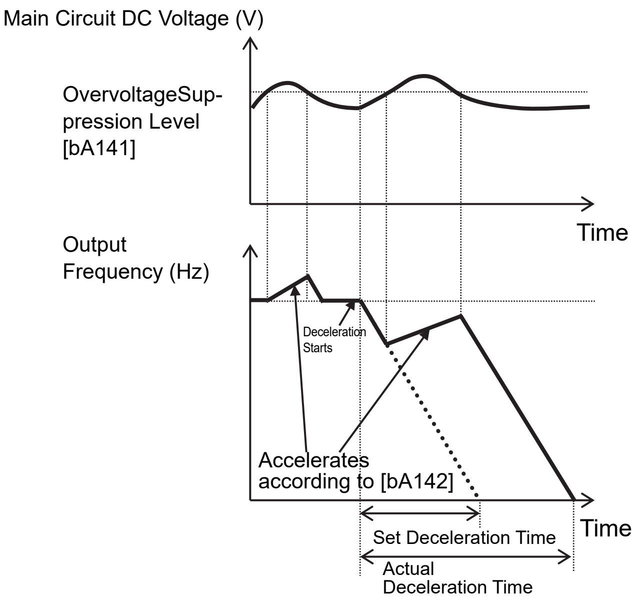
Precautions for Correct Use

If the overvoltage suppression operating time [bA142] is set to be too short, it accelerates more than decelerating and may prevent the motor from stopping. In this case, increase the setting of the overvoltage suppression level setting [bA141].

For Function to Avoid Overvoltage Acceleration (Only in Deceleration) [bA140] = 02



For Function to Avoid Overvoltage Acceleration [bA140] = 03



8-2-4 Overexcitation Function

[bA146] overexcitation function selection allows you to enable the overexcitation function.

The overexcitation function increases the motor loss and reduces energy to be regenerated in order to suppress the overvoltage and prevent tripping.

Precautions for Correct Use

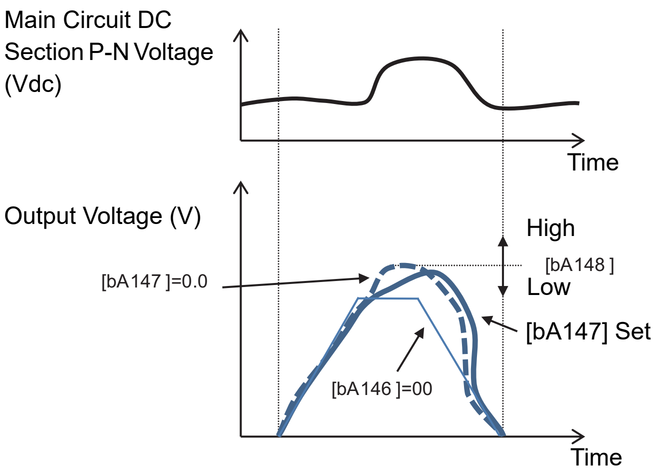
- When this function is enabled, the current may increase as the output voltage increases.
- When using this function, the motor will be overexcited and the heat generated by the motor may increase.
- Depending on the deceleration rate or load status, the overvoltage tripping may be triggered even if this function is enabled.
- The overexcitation function is activated when controlling VC characteristics of V/f control, VP characteristics, and free V/f control.

● Parameter

Item	Parameter	Data	Description	Default data
Over magnetization deceleration function selection, 1st_motor	[bA146]	00	Disabled	02
		01	Always active	
		02	Active only during deceleration	
		03	Level operation	
		04	Level operation during deceleration	
Over magnetization output filter time constant, 1st_motor	[bA147]	0.00 to 1.00(s)	Filter time constant applied to the overexcitation output.	0.30
Over magnetization voltage gain, 1st_motor	[bA148]	50 to 400(%)	Gain for the overexcitation output voltage.	100
Over magnetization level setting, 1st_motor	[bA149]	200 V class: 330.0 to 400.0 (V) 400 V class: 660.0 to 800.0 (V)	The level at which the overexcitation function starts its operation.	(200V class) 360.0 (400V class) 720.0

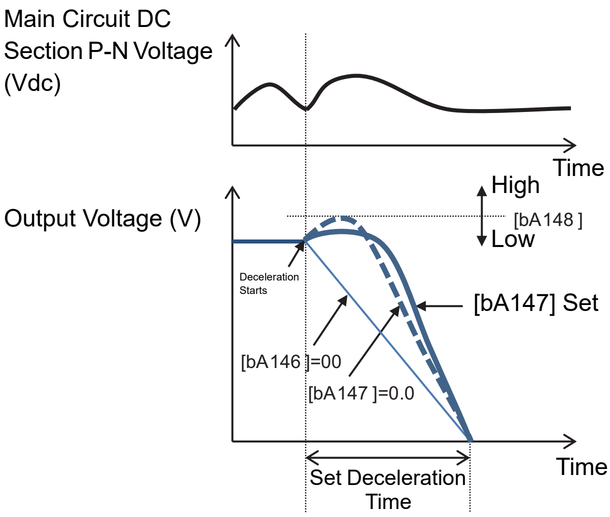
When Always Active [bA146] = 01

Always activated according to the P-N voltage



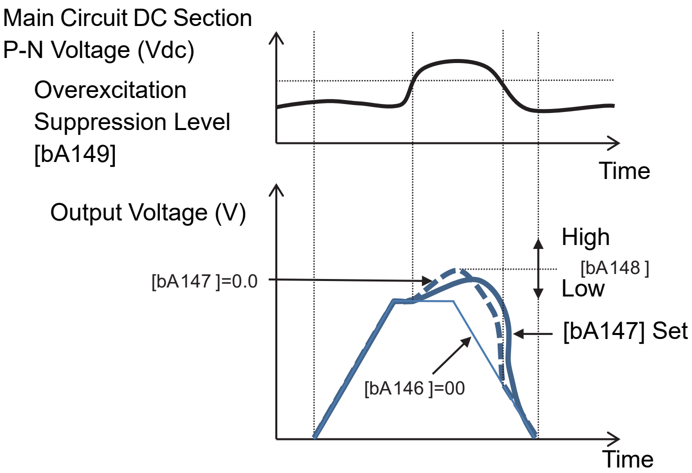
When Activated Only during Deceleration [bA146] = 02

Activated according to the P-N voltage during deceleration



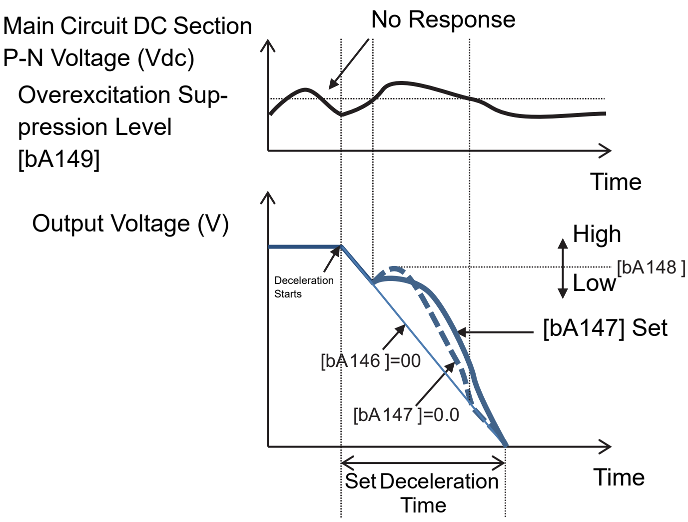
For Level Operation [bA146] = 03

Activated when the P-N voltage exceeds the set level



For Level Operation during Deceleration [bA146] = 04

Activated when the P-N voltage exceeds the set level only during deceleration



8-2-5 Regenerative Braking Function

When decelerating, generating downward movement, or being rotated by an external load (that is, when the output torque direction and the rotation direction are opposite), the motor serves as a generator and the regenerated energy is fed back to the inverter. If the motor load inertia is large, the amount of regeneration may become large, which causes an overvoltage in the inverter during rapid deceleration or when driving an elevating axis.

The regenerative braking function uses the built-in or an external regenerative braking circuit to decrease the internal DC voltage of the inverter by converting the regenerated energy from the motor into heat via external braking resistors.

Connect external braking resistors or external regenerative braking units according to the description of External Braking Resistor Connection Terminal or Regenerative Braking Unit Connection Terminal in *2-3-4 Wiring for Main Circuit Terminals* on page 2-32. The regenerative braking function is enabled only when the inverter is connected with external braking resistors or external regenerative braking units.

The following models have a built-in regenerative braking circuit. Connect external braking resistors only.

[200-V class] 3G3RX2-A2004 (0.4 kW) to 3G3RX2-A2220 (22 kW)

[400-V class] 3G3RX2-A4007 (0.75 kW) to 3G3RX2-A4370 (37 kW)

When using models other than the above or processing a large amount of regenerative energy, you need to use regenerative braking units.

When using the built-in regenerative braking function of the inverter, set BRD selection (bA-61) to Enabled.

Normally, this parameter is set to 01 (Enabled: Disabled during stop). At this time, set the usage condition (%) of the braking resistor in use in the Usage Rate of BRD (bA-60). Note that the regenerative braking function is enabled only when both bA-60 and bA-61 are set.

Be sure to set the resistance values of the connected braking resistor to Dynamic brake (BRD) resister value [bA-63]. The resistance values are used with Dynamic brake (BRD) usage rate [bA-60] when the regenerative braking function is activated.

For the Regenerative Braking ON Level (b096), you need not change the default data normally. This parameter is used for adjusting the level at which the regenerative braking function according to the input power supply voltage.

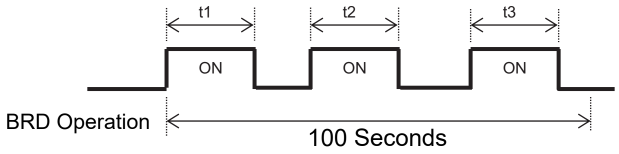
External regenerative braking units are processed on the external regenerative braking unit side. Therefore, set the Regenerative Braking Selection (bA-61) to 00 (Disabled). In this case, the bA-60 and bA-62 settings are ignored.

When using this function, set the Overvoltage Suppression Function Selection During Deceleration (bA140) to 00 (Disabled).

Precautions for Correct Use

- You can also use the optional BRD unit instead of using the built-in braking circuit (BRD). If using the BRD unit, no setting needs to be made.
- The BRD ON level is the level setting for the main circuit DC smoothing capacitor inside the inverter. It needs to be set to a value exceeding the input voltage times √2.
- See the selection and wiring of regenerative braking resistor for minimum resistance that can be connected and BRD use rate for each model.

The motor will trip when the operation rate exceeds the use rate.



$$\text{Operation Rate (\%)} = \frac{(t1+t2+t3)}{100\ \text{Seconds}} \times 100$$

● Parameter

Item	Parameter	Data	Description	Default data
Dynamic brake usage rate	[bA-60]	0.0 to 100.0(%) *) The upper limit depends on [bA-63]	If it is set to 0.0, the BRD function will not be activated. If the setting is other than 0.0, the motor will trip when [dA-41] BRD load factor monitor exceeds the BRD use rate.	10.0
Dynamic brake selection	[bA-61]	00	Disabled	00
		01	Enabled (Disable while being stopped)	
		02	Enabled (Enabled while being stopped)	
Dynamic brake active level	[bA-62]	200 V class: 330.0 to 400.0 (V) 400 V class: 660.0 to 800.0 (V)	The ON level at which the BRD is activated.	(200V class) 360.0 (400V class) 720.0
Dynamic brake resister value	[bA-63]	Minimum resistance to 600 (Ω)	Setting the BRD resistance to be connected automatically sets the maximum value for [bA-60].	minimum resistance values*1

*1. Minimum resistance values vary in inverter model.

● Monitoring

Item	Parameter	Data	Description
BRD load factor monitor	[dA-41]	0.00 to 100.00(%)	The value in accordance with the BRD use rate will be displayed.

8-2-6 Restart during Power Interruption/Undervoltage

Restart Undervoltage

You can select either tripping ([bb-21] = 00) with power supply recovery or retrying restarting ([bb-21] ≠ 00) when the main power (R, S, T) fails.

If the input power supply to the inverter is input separately to main power supply (R, S, T) and control power supply (R0, T0), the operation depends on how the power to the main power supply (R, S, T) drops.

When [bb-27] = 00, you can avoid undervoltage error if the main power supply is to be turned off for saving energy while the inverter output is being stopped.

When [bb-27] = 02, you can avoid undervoltage error caused by power shutdown during deceleration and stop.

When the Power Interruption/Undervoltage Restart Selection (bb-24) is set to one of the restart options, the inverter repeats restart operation for the number of times set in the Power Interruption Restart Count (bb-20) in the event of a power interruption, or for the number of times set in the Undervoltage Restart Count (bb-21) in the event of an undervoltage, and then trips.

When bb-20 or bb-21 is set to No limit, the inverter does not trip.

The Power Interruption/Undervoltage Restart Selection (bb-24) is set to restart condition according to your system.

You can select 0-Hz restart/Frequency matching restart/Frequency pull-in restart/Detection speed (Frequency)/Trip after frequency matching deceleration stop.

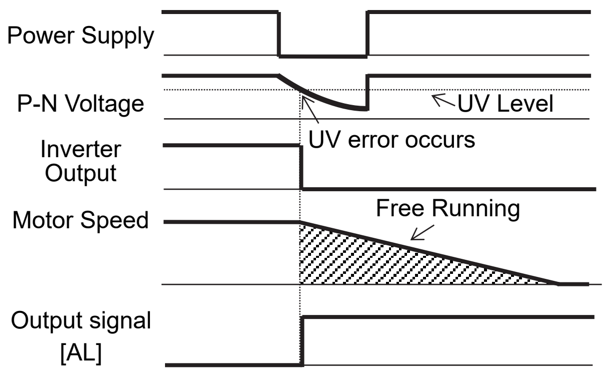
Precautions for Correct Use

- If the input power supply to the inverter is input to the control power supply (R0, T0) via main power supply (R, S, T), instantaneous power failure tripping or instantaneous power failure retry may be triggered first depending on the operating situation.
- If the control power supply has failed completely, the action to be taken is the powering on.
- After 40 seconds with the main power supply (R, S, T) failed, the undervoltage will occur and the motor will trip even if [bb-27] = 00 or 02.
- Inverter internal P-N voltage can be monitored with [dA-40].

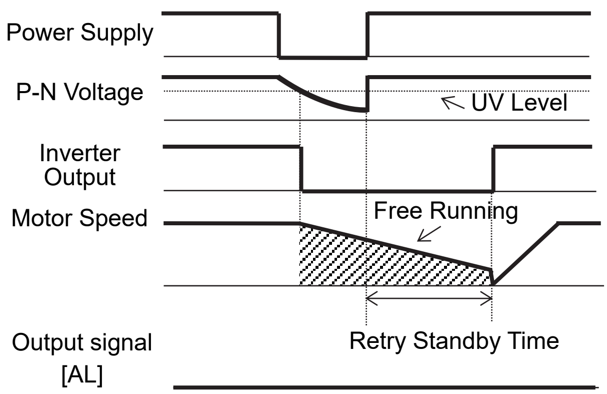
● Parameter

Item	Parameter	Data	Description	Default data
The number of retries after under voltage	[bb-21]	00 to 16/ ∞(255) (Counts)	Sets the undervoltage retry restarting counts. If this is set to 0, the motor will trip upon undervoltage.	0
Selection of restart mode @Instantaneous power failure/ under-voltage trip	[bb-24]	00	Restarts at 0 Hz	01
		01	Restarts with the frequency matching	
		02	Restarts upon frequency pull-in	
		03	Detection speed (frequency) <v2.00 or higher>	
		04	Trips after decelerating and stopping with the frequency matching	
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Starts after waiting for the set time upon power voltage recovery.	0.3
Instantaneous power failure/under-voltage trip alarm enable	[bb-27]	00	Disabled	00
		01	Enabled	
		02	Disabled during stop and deceleration stop	

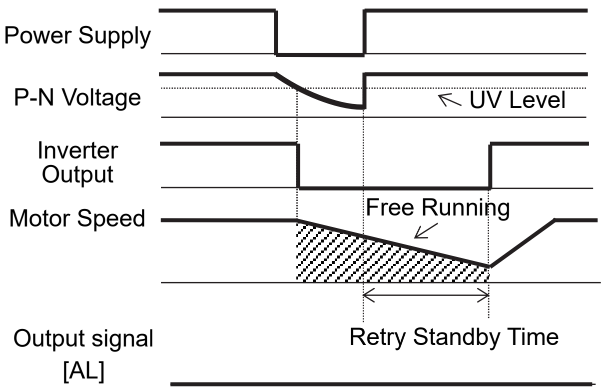
(Ex.1) When [bb-21] = 00, tripping occurs



(Ex.2) When [bb-21] ≠00 and [bb-24] = 00, it restarts at 0 Hz.

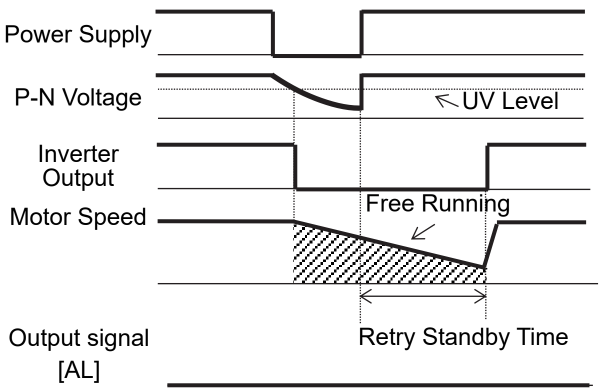


(Ex.3) When [bb-21] ≠00 and [bb-24] = 01, it restarts by picking up the frequency.



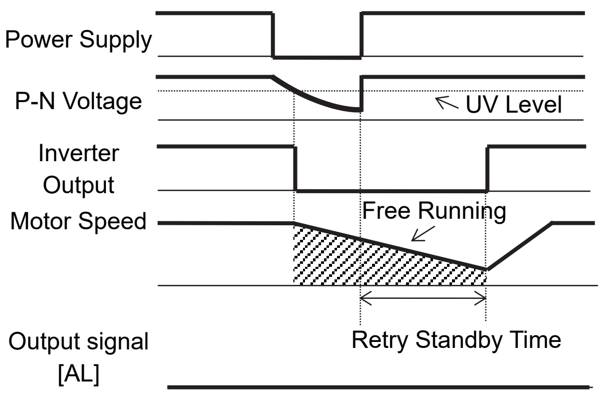
See *7-5-3 Frequency Matching Start* on page 7-65 for details.

(Ex.4) When [bb-21] ≠00 and [bb-24] = 02, it restarts with frequency pull-in.



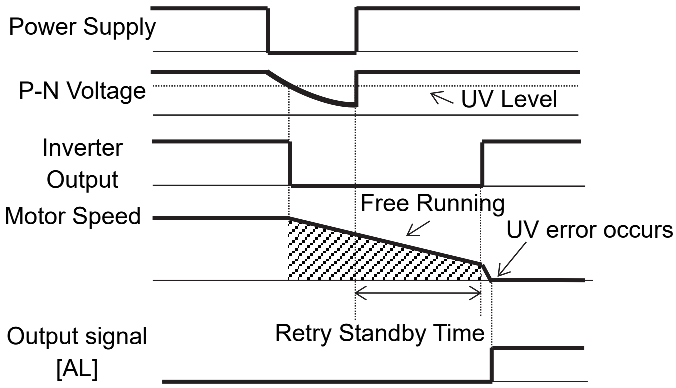
See *7-5-4 Frequency Pull-in Start* on page 7-69 for details.

(Ex.5) When [bb-21] ≠00 and [bb-24] = 03, it restarts using the motor speed feedback.



For motor speed feedback, the feedback input to the input terminals A and B, or feedback input to the optional cassette PG option unit is required.

(Ex.6) When [bb-21] ≠00 and [bb-24] = 04, it restarts by picking up frequency, and then after deceleration according to the setting, the motor trips when stopped.



Restart Power Interruption

When the power supply shows the voltage falling short of the undervoltage level, you can select either tripping ([bb-20] = 00) by recovering the power supply or retrying restarting ([bb-20] ≠ 00).

If the input power supply to the inverter is input separately to main power supply (R, S, T) and control power supply (R0, T0), the instantaneous power failure is detected based on how much the power to the main power supply (R, S, T) drops.

When [bb-27] = 00, you can avoid instantaneous power failure error before the control power supply is turned off for saving energy while the inverter output is being stopped.

When [bb-27] = 02, you can avoid instantaneous power failure error caused by power shutdown during deceleration and stop.

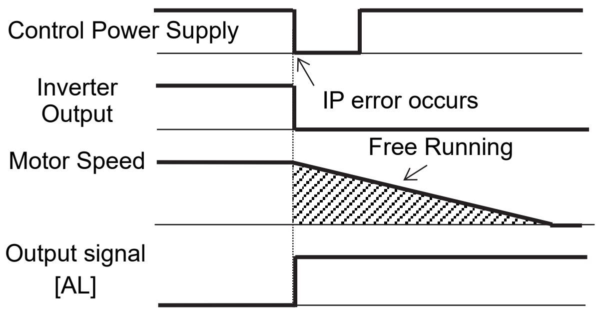
Precautions for Correct Use

- The judgement of instantaneous power failure of the inverter is based on the detection of voltage drop in the main power supply (R, S, T).
- Depending on the fluctuation rate of the main power supply (R, S, T), errors other than instantaneous power failure may occur.
- If the input power supply to the inverter is input to the control power supply (R0, T0) via main power supply (R, S, T), undervoltage tripping or undervoltage retry may be triggered first depending on the operating situation.
- When the power supplied to the control power supply (R0, T0) is shut off, the power will be lost as quick as in about 80 ms. In this case, it will be a power shutdown.

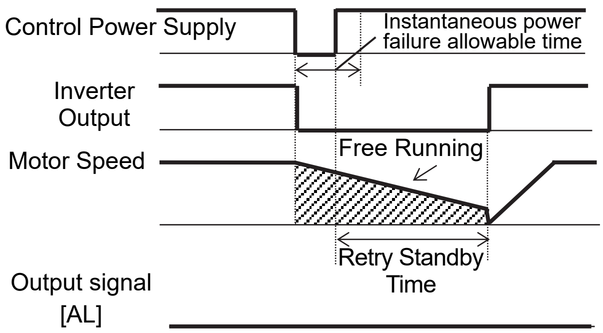
● Parameter

Item	Parameter	Data	Description	Default data
The number of retries after instantaneous power failure	[bb-20]	0 to 16/ ∞(255) (Counts)	Sets the retry counts in case of instantaneous power failure. If this is set to 0, the motor will trip upon recovery from instantaneous power failure.	0
Selection of restart mode @Instantaneous power failure/ under-voltage trip	[bb-24]	00	Restarts at 0 Hz	01
		01	Restarts with the frequency matching	
		02	Restarts upon frequency pull-in	
		03	Detection speed (frequency) <v2.00 or higher>	
		04	Trips after decelerating and stopping with the frequency matching	
Allowable under-voltage power failure time	[bb-25]	0.3 to 25.0(s)	Restarts if the instantaneous power failure time is within the set value.	1.0
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Starts after waiting for the set time upon power voltage recovery.	0.3
Instantaneous power failure/under-voltage trip alarm enable	[bb-27]	00	Disabled	00
		01	Enabled	
		02	Disabled during stop and deceleration stop	

(Ex.1) When [bb-20] = 00, tripping occurs

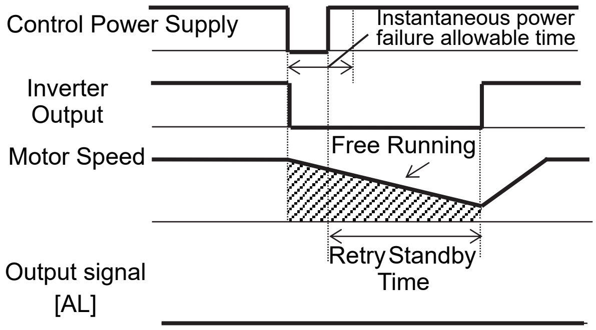


(Ex.2) When [bb-20] ≠00 and [bb-24] = 00, it restarts at 0 Hz.



Note The motor will trip after instantaneous power failure allowable time.

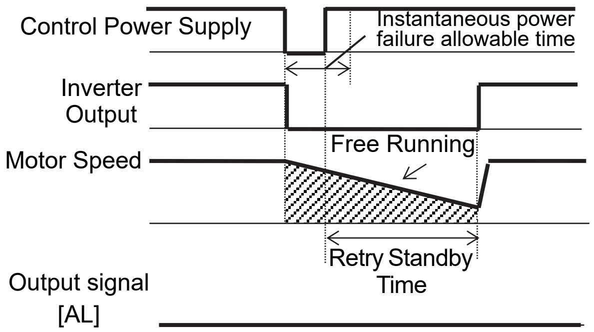
(Ex.3) When [bb-20] ≠00 and [bb-24] = 01, it restarts by picking up the frequency.



Note The motor will trip after instantaneous power failure allowable time.

See *7-5-3 Frequency Matching Start* on page 7-65 for details.

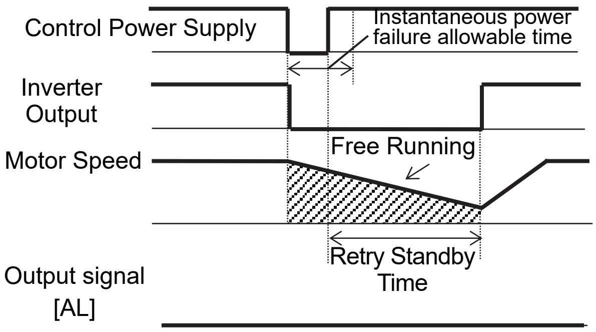
(Ex.4) When [bb-20] ≠00 and [bb-24] = 02, it restarts with frequency pull-in.



Note The motor will trip after instantaneous power failure allowable time.

See *7-5-4 Frequency Pull-in Start* on page 7-69 for details.

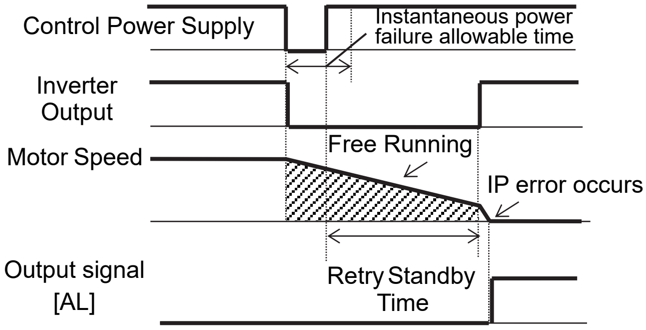
(Ex.5) When [bb-20] ≠00 and [bb-24] = 03, it restarts using the motor speed feedback.



Note The motor will trip after instantaneous power failure allowable time.

For motor speed feedback, the feedback input to the input terminals A and B, or feedback input to the optional cassette PG option unit is required.

(Ex.6) When [bb-20] ≠00 and [bb-24] = 04, it restarts by picking up the frequency, and then after deceleration according to the setting, the motor trips when stopped.



Note The motor will trip after instantaneous power failure allowable time.

8-2-7 Restart on Overvoltage/Overcurrent

Restart Overcurrent

In case of overcurrent, you can restart without causing tripping.

Precautions for Correct Use

If overcurrent continues to be observed, there are some possible causes: short acceleration time, heavy load, locked motor, etc.

● Parameter

Item	Parameter	Data	Description	Default data
Over current detection level, 1st-motor	[bb160]	Inverter ND rated current × (0.2 to 2.2)*1	Sets the level at which the overcurrent is to be detected.	2.2 × ND Rated current
The number of retries after over current	[bb-22]	0 to 5 (Counts)	Sets the retry counts in case of overcurrent. If this is set to 0, the motor will trip upon overcurrent.	0
Selection of restart mode @over-current	[bb-28]	00	Restarts at 0 Hz	01
		01	Restarts with the frequency matching	
		02	Restarts upon frequency pull-in	
		03	Detection speed (frequency) <v2.00 or higher>	
		04	Trips after decelerating and stopping with the frequency matching	
Wait time of restart @over-current	[bb-29]	0.3 to 100.0(s)	Restarts after waiting for the set time upon overcurrent.	0.3

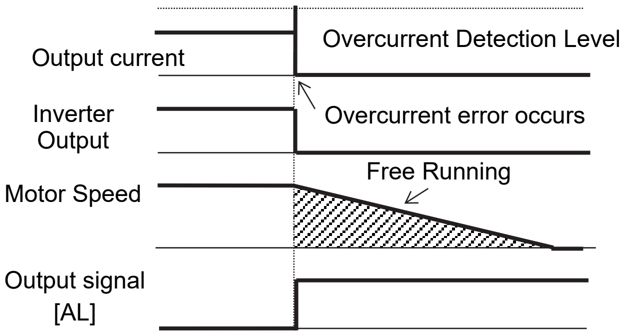
*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

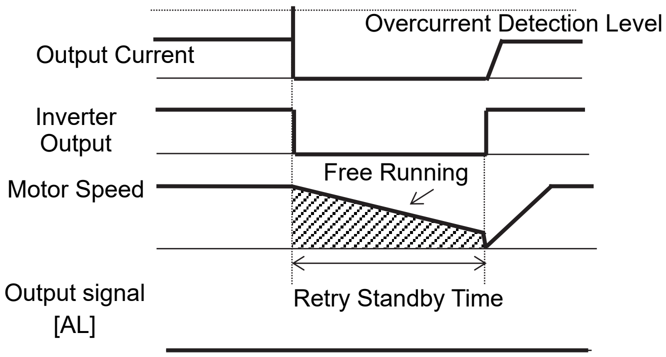
2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

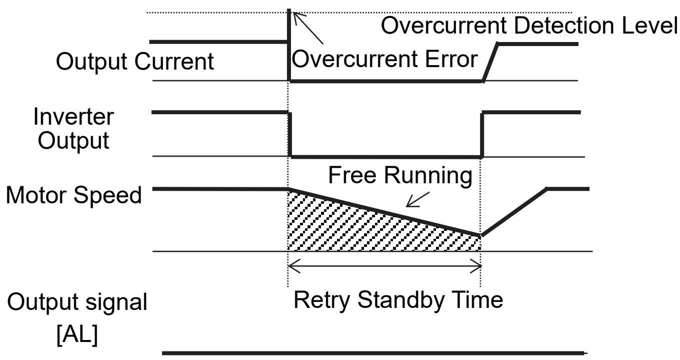
(Ex.1) When [bb-22] = 00, tripping occurs



(Ex.2) When [bb-22] ≠00 and [bb-28] = 00, it restarts at 0 Hz.

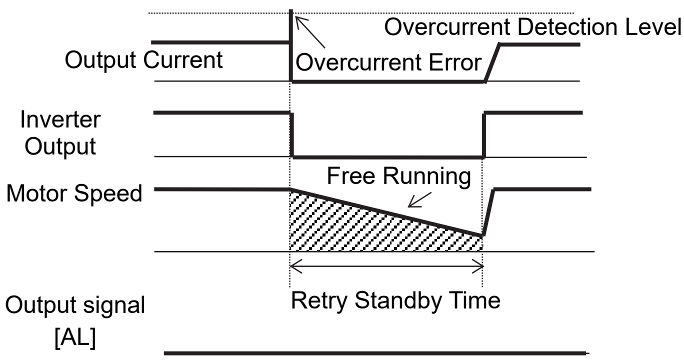


(Ex.3) When [bb-22] ≠00 and [bb-28] = 01, it restarts by picking up the frequency.



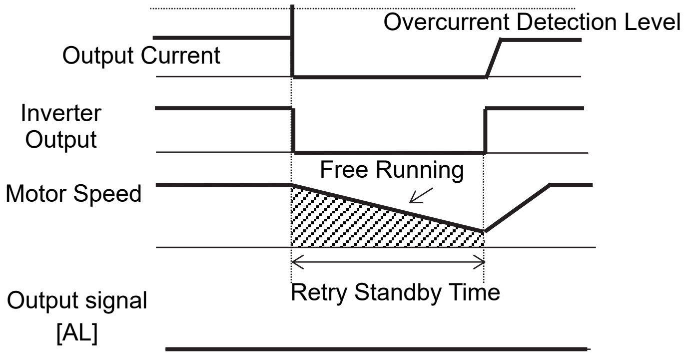
See *7-5-3 Frequency Matching Start* on page 7-65 for details.

(Ex.4) When [bb-22] ≠00 and [bb-28] = 02, it restarts with frequency pull-in.



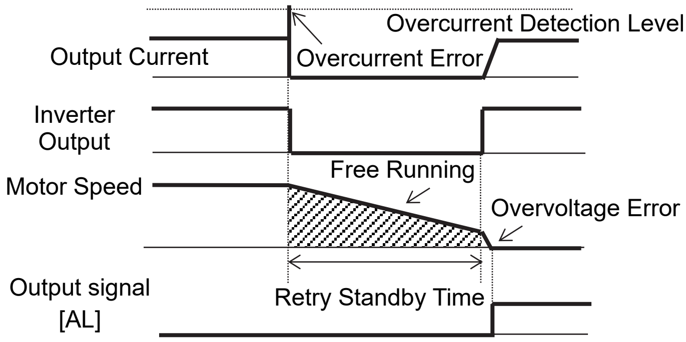
See *7-5-4 Frequency Pull-in Start* on page 7-69 for details.

(Ex.5) When [bb-22] ≠00 and [bb-28] = 03, it restarts using the motor speed feedback.



For motor speed feedback, the feedback input to the input terminals A and B, or feedback input to the optional cassette PG option unit is required.

(Ex.6) When [bb-22] ≠00 and [bb-28] = 04, it restarts by picking up the frequency, and then after deceleration according to the setting, the motor trips when stopped.



Restart Overvoltage

In case of overvoltage, you can restart without causing tripping.

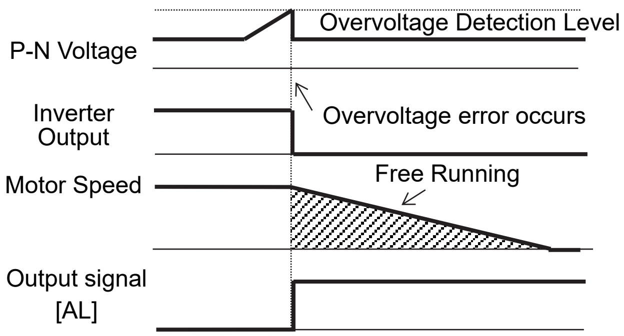
Precautions for Correct Use

If overvoltage continues to be observed, there are some possible causes: short deceleration time, heavy load, motor operated by external force, etc.

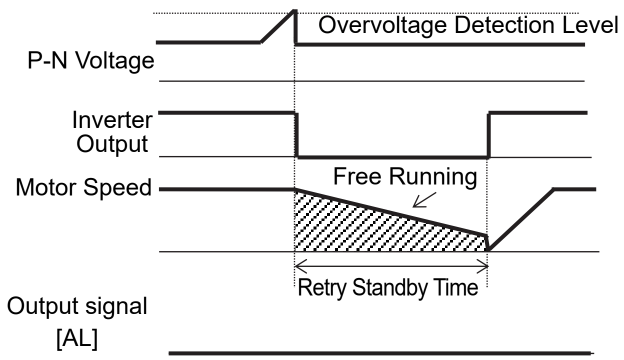
● Parameter

Item	Parameter	Data	Description	Default data
The number of retries after over voltage	[bb-23]	0 to 5 (Counts)	Sets the retry counts in case of overvoltage. If this is set to 0, the motor will trip upon overvoltage.	0
Selection of restart mode @over-voltage	[bb-30]	00	Restarts at 0 Hz	01
		01	Restarts with the frequency matching	
		02	Restarts upon frequency pull-in	
		03	Detection speed (frequency) <v2.00 or higher>	
		04	Trips after decelerating and stopping with the frequency matching	
Wait time of restart @over-voltage	[bb-31]	0.3 to 100.0(s)	Restarts after waiting for the set time upon overvoltage.	0.3

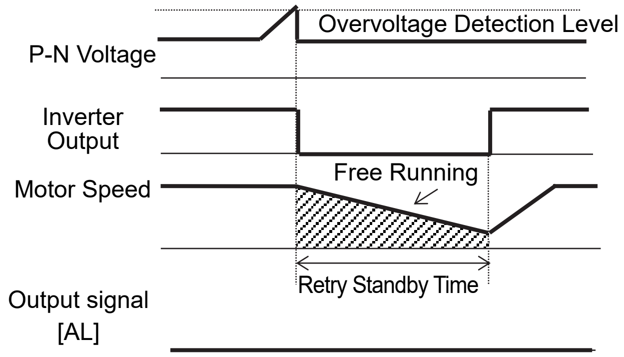
(Ex.1) When [bb-23] = 00, tripping occurs



(Ex.2) When [bb-23] ≠00 and [bb-30] = 00, it restarts at 0 Hz.

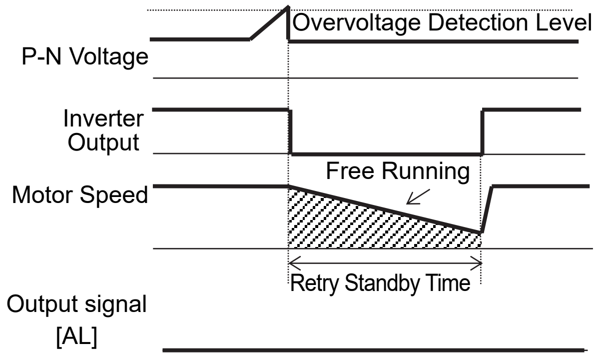


(Ex.3) When [bb-23] ≠00 and [bb-30] = 01, it restarts by picking up the frequency.



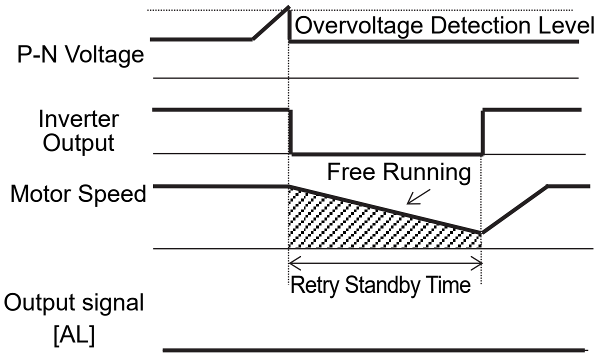
See *7-5-3 Frequency Matching Start* on page 7-65 for details.

(Ex.4) When [bb-23] ≠00 and [bb-30] = 02, it restarts with frequency pull-in.



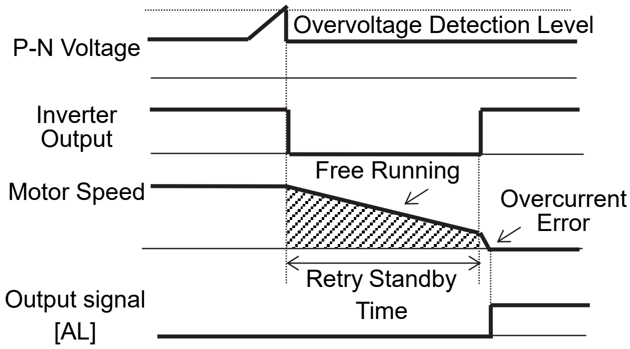
See *7-5-4 Frequency Pull-in Start* on page 7-69 for details.

(Ex.5) When [bb-23] ≠00 and [bb-30] = 03, it restarts using the motor speed feedback.



For motor speed feedback, the feedback input to the input terminals A and B, or feedback input to the optional cassette PG option unit is required.

(Ex.6) When [bb-23] ≠00 and [bb-30] = 04, it restarts by picking up the frequency, and then after deceleration according to the setting, the motor trips when stopped.



8-2-8 Non-stop on Momentary Power Interruption

This function allows deceleration and stop of the motor while maintaining the voltage under the overvoltage level when the power supply is shut down during operation.

One of the three modes can be selected with [bA-30] instantaneous power failure non-stop selection.

Precautions for Correct Use

- Instantaneous power failure non-stop operation is activated when the input to the main power supply (R, S, T) drops.
- When [bA-30] is 01 or 02, the motor decelerates and stops after the function is activated. You need to turn off the operation command and turn it on again to restart after the stop. Even if the [bA-30] is 03, you still need to turn off the operation command and turn it on again if the motor decelerated and stopped without recovery after the function is activated.
- If the control power supply (R0, T0) is not input separately from main power supply, supply the P-N voltage to the control power supply (R0, T0) to use the instantaneous power failure non-stop function. When using this function, disconnect the J51 connector line connected to the R0 and T0 terminals and connect the wire from main terminal P to R0, and N to T0. Use electrical wire of 0.75mm^2 or larger.

● Parameter

Item	Parameter	Data	Description	Default data
Deceleration-stop at power failure	[bA-30]	00	Disabled	00
		01	Decelerates and stops, and maintains the stop status.	
		02	Decelerates and stops with constant DC voltage control, and maintains the stop status.	
		03	Decelerates and stops with constant DC voltage control, and maintains the stop status. If the power supply recovers during the process, the operation continues.	
Decel-stop at power failure starting voltage	[bA-31]	(200 V class) 0.0 to 410.0(v) (400 V class) 0.0 to 820.0(v)	This is the voltage level at which the instantaneous power failure non-stop control starts when the internal power supply voltage drops.	(200V class) 220.0 (400V class) 440.0
Decel-stop at power failure control target level	[bA-32]	(200 V class) 0.0 to 410.0(v) (400 V class) 0.0 to 820.0(v)	Switches the deceleration temporarily to constant speed operation when the internal power supply voltage increases due to deceleration.	(200V class) 360.0 (400V class) 720.0
Decel-stop at power failure deceleration time	[bA-34]	0.01 to 3600.00(s)	Deceleration time setting for instantaneous power failure non-stop deceleration and stop operation.	1.00
Decel-stop at power failure freq. width at deceleration start	[bA-36]	0.00 to 10.00(Hz)	The setting for starting deceleration by lowering frequency during instantaneous power failure non-stop deceleration and stop operation.	0.00
Decel-stop at power failure DC-bus voltage constant control P-gain	[bA-37]	0.00 to 5.00	Proportional gain for PI control during constant DC voltage control.	0.20
Decel-stop at power failure DC-bus voltage constant control I-gain	[bA-38]	0.00 to 150.00(s)	Integral gain for PI control during constant DC voltage control.	1.00
Output terminal function	[CC-01] to [CC-07]	023	[IPS] Outputs the signal during instantaneous power failure non-stop deceleration. OFF: The function is not active. ON: Instantaneous power failure non-stop deceleration in function.	-

Instantaneous Power Failure Non-stop Deceleration/Stop ([bA-30] = 01)

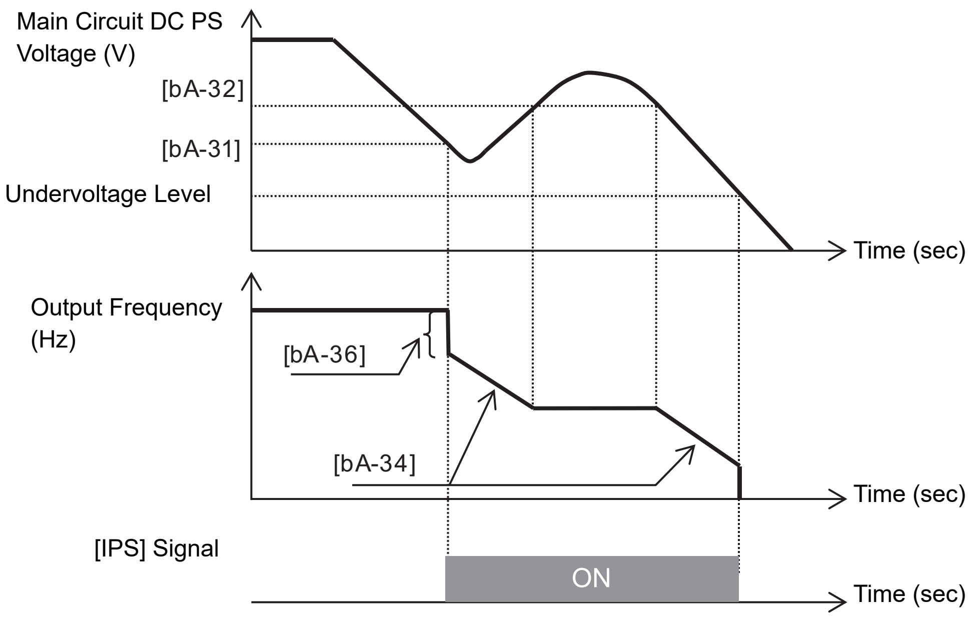
This function allows deceleration and stop of the motor while maintaining the voltage under the instantaneous power failure non-stop frequency constant voltage level [bA-32] after the power supply was shut down during operation.

If the power supply was shut down during operation, deceleration starts at the frequency lowered by deceleration starting width [bA-36] when the voltage drops to the instantaneous power failure non-stop function activating voltage [bA-31] or lower, and then decelerates for the instantaneous power failure non-stop deceleration time [bA-34].

In case of regenerative status caused by deceleration torque during deceleration and if the internal power supply voltage reaches the frequency-constant voltage level [bA-32] or higher, the motor will be at constant speed until the internal power supply voltage falls below the overfrequency-constant voltage level [bA-32].

Precautions for Correct Use

- If the frequency-constant voltage level [bA-32] < Function starting voltage [bA-31], it works by taking [bA-32] at the same level as [bA-31]. However, the set values will not be changed.
- If the frequency-constant voltage level [bA-32] is lower than the input voltage multiplied by √2, the constant speed state will be maintained and deceleration will not take place if the power recovers while this function is in operation. Power should be shut off and turned on again, or [bA-32] needs to be reset during operation. The [bA-32] must be set to a value greater than the input voltage multiplied by √2.
- This function will not be disabled until the operation stop will be completed. To recover power and restart the operation while this function is in operation, input the stop command (operation command OFF) and then input the operation command again after the motor stopped.
- If the instantaneous power failure non-stop deceleration starting range [bA-34] is too large, sudden deceleration will cause overcurrent tripping. • If the value of [bA-36] is too low or the instantaneous power failure non-stop deceleration time [bA-34] is too long, insufficient regenerative force will cause undervoltage tripping.



Instantaneous Power failure Non-stop Constant DC Voltage Control ([bA-30] = 02: No Recovery, [bA-30] = 03: Recovery)

This function maintains the main circuit DC voltage to the value set by [bA-32] instantaneous power failure non-stop level while decelerating if instantaneous power failure occurs or the main circuit DC voltage drops during operation.

The condition to activate this function is when all the conditions below are met.

- [bA-30] is 02 or 03
- In operation
- When the instantaneous power failure occurs at the control power supply or when the main circuit DC voltage drops to [bA-31] instantaneous power failure non stop function starting voltage

If the instantaneous power failure time is short, continuous operation without interrupting output is possible. However, if undervoltage is observed upon instantaneous power failure, the output is interrupted immediately and this function will be terminated. The operation after recovering from the instantaneous power failure depends on the selection of how to restart after instantaneous power failure and undervoltage.

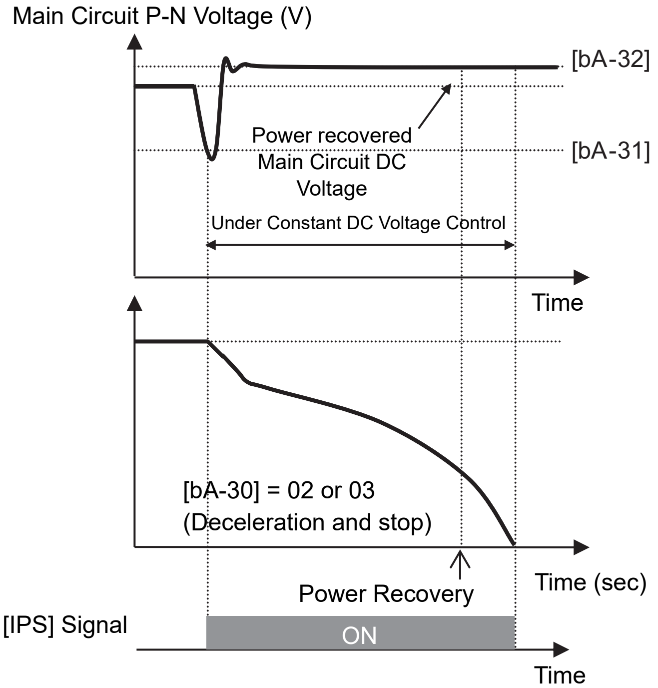
When [bA-30] is 03, the normal operation can be restored if recovered from the instantaneous power failure and the power is received before the output will be interrupted. However, it may decelerate and stop depending on the [bA-31] setting. Details are given below.

[bA-30]	[bA-31]	Action
02 (No recovery)	[bA-32] > Main circuit DC voltage upon power recovery	Deceleration stop (constant DC voltage control) (Ex.1)
	[bA-32] < Main circuit DC voltage upon power recovery	Deceleration stops (normal operation) (Ex.2)
03 (With recovery)	[bA-32] > Main circuit DC voltage upon power recovery	Deceleration stop (constant DC voltage control) (Ex.1)
	[bA-32] < Main circuit DC voltage upon power recovery	Operation (normal operation) (Ex.2)

This function is activated if the conditions to start operation mentioned above are met even if the power line for J51 connector connected to R0 and T0 terminals are disconnected to be connected from P of the main terminal to R0 and from N to T0, or even if the control power supply and main circuit power supply are powered independently.

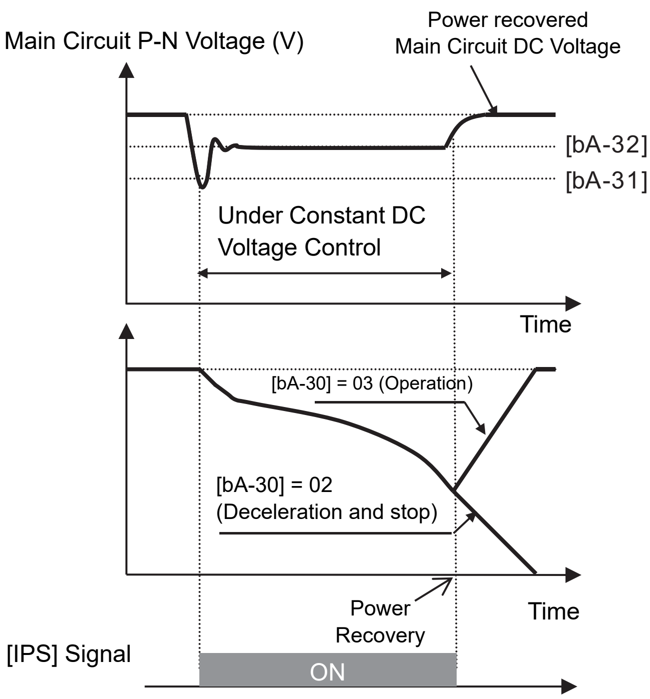
If the motor decelerates and stops as a result of this function activated, it will be forced to stop even if [FW] is ON. Verify that the power is restored before powering on [FW] again when restarting.

(Ex.1)



Note Depending on the proportional gain and integral time settings, the main circuit DC voltage level while the function is being activated may be lower than [bA-32].

(Ex.2)



Precautions for Correct Use

- Keep the settings for [bA-31] and [bA-32] to the undervoltage recovery level (P-N voltage 180 V (200 V class), 360 V (400 V class)) or higher. The function will not be activated in case of undervoltage.
- Make setting so that [bA-31] will be lower than [bA-32]. If the difference between the settings for [bA-31] and [bA-32] is great, setting the proportional gain [bA-37] to be too large may cause sudden acceleration immediately after this function is activated and may cause overcurrent.
- When [bA-30] is 02 or 03, PI control is performed so that the internal DC voltage will be constant.
- Setting the proportional gain [bA-37] to be large will accelerate the response. However, setting it to be too large will dissipate the control, tending to cause tripping.
- Setting the integral gain [bA-38] to be short will accelerate the response. However, setting it to be too short will also tend to cause tripping.
- If the proportional gain [bA-37] is small, the motor will trip due to undervoltage because the voltage will drop immediately after the function is activated.
- If you would like to retry even if the power failure may be relatively long, supply the P-N voltage to R0 and T0.

8-3 Protective Functions

8-3-1 Input Power Supply Phase Loss Protection

Enable the input phase loss protection function by using [bb-65] Input phase loss protection selection.

When the input phase loss protection function has been enabled, an input phase loss error [E024] will occur if a phase loss state due to disconnection or breakage of the input power cable continues for 1 second or more.

If an input phase loss error [E024] occurs, it is necessary to cut off the power supply to the inverter and check the state of wiring and breakers.

Precautions for Correct Use

- When 3-phase AC is not input to power supply terminals R, S, and T, such as in cases where DC voltage is input to R and T or between P and N of the inverter, this function is disabled regardless of the setting for [bb-65].
- There will be no detection during an instantaneous power failure.

● Parameter

Item	Parameter	Data	Description	Default data
Input phase loss enable	[bb-65]	00	Disabled	00
		01	Enabled	

8-3-2 Output Phase Loss Protection Function

Enable the output phase loss protection function by using [bb-66] Output phase loss protection selection.

When the output phase loss protection function has been enabled, an output phase loss error [E034] will occur if a phase loss caused by disconnection or breakage of the motor cable continues.

Precautions for Correct Use

- If the capacity of the drive motor is smaller than that of the inverter, the inverter may erroneously detect an output phase loss. In this case, decrease the value of [bb-67] or set [bb-66] to 00.
- If the carrier frequency [bb101] is low, the inverter may erroneously detect an output phase loss. It may improve by increasing the value of the carrier frequency [bb101].
- This function operates when the output speed is between 5 Hz and 100 Hz.
- Set the value of [bb-67] equal to or lower than the steadily flowing current, with the rated current being 100%.
- A phase loss will lead to the followings, which may result in an inverter malfunction:
  - The ripple current in the main capacitor will increase, which remarkably reduces the life expectancy of the inverter.
  - Under a load condition, the inverter's internal converter may be damaged.

● Parameter

Item	Parameter	Data	Description	Default data
Output phase loss enable	[bb-66]	00	Disabled	00
		01	Enabled	
Output phase loss detection sensitivity	[bb-67]	1 to 100(%)	Adjusts the sensitivity of the output phase loss	10
Carrier speed setting, 1st-motor	[bb101]	0.5 to 16.0 (kHz) *1	Changes the carrier frequency	2.0

*1. The following restriction is applied:
For LD rated capacity, 12.0 kHz at maximum
For VLD rated capacity, 10.0 kHz at maximum
3G3RX2-B4750 to 3G3RX2-B413K shall be as follows.
[Ub-03]=02: 0.5 to 10.0 (kHz)
[Ub-03]=00 or 01: 0.5 to 8.0 (kHz)

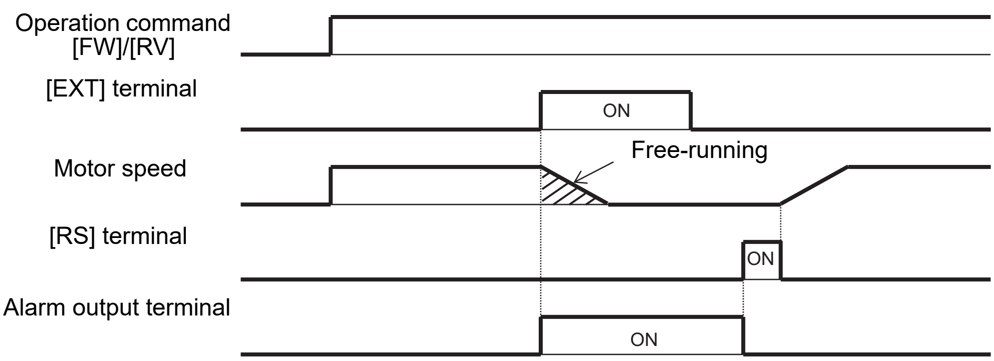
8-3-3 External Trip (EXT) Function

This function is enabled by setting 033 [EXT] as an input terminal function. When a signal connected to the applicable terminal changes, an error [E012] occurs.

Use this function when you want to trip the inverter via an error (trip) signal generated by a peripheral system.

Precautions for Correct Use

- When the inverter trips with error code [E12] displayed, the trip is not reset even if the error signal from the external equipment is reset (EXT terminal is turned off). To reset the trip, Perform the reset operation or turn the power off and on again.
- If you reset the inverter while the terminal [EXT] is turned on, [E012] will occur again.
- After the reset, the inverter follows [bb-41] Restart after reset. See *7-5-6 Restart after Releasing Reset* on page 7-74.
- When the terminal [EXT] is turned on, an error will occur even if the inverter output is turned off, and the inverter trips with [E012] displayed.



Item	Parameter	Data	Description
Input terminal function	[CA-01] to [CA-11]	033	[EXT]: When the terminal corresponding to the assigned position is turned on, an external trip occurs.

8-3-4 Power Recovery Restart Prevention Function (USP)

This function allows you to make the inverter trip with error code [E13] displayed if the inverter power is turned on when an operation command has been turned on.

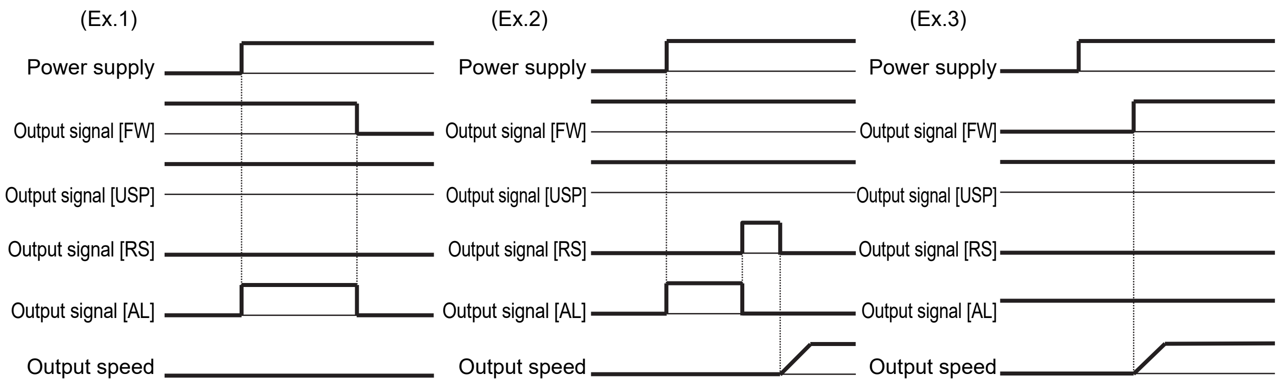
You can recover the inverter from tripping by performing the reset operation or turning the operation command off. (Ex.1)

If the inverter is recovered from tripping with the operation command left turned on, the inverter will start operation immediately after recovery. (Ex.2)

The inverter can operate normally when an operation command is turned on after the inverter power is turned on. (Ex.3)

Precautions for Correct Use

- Unlike other types of trip, the USP error [E013] automatically clears when the operation command is turned off.
- The power recovery restart prevention function operates for 2 seconds at maximum after the control power is input.



● Parameter

Item	Parameter	Data	Description
Input terminal function	[CA-01] to [CA-11]	034	[USP]: If the applicable [USP] terminal assigned to an input terminal has been turned on, the inverter will trip when the power is recovered while an operation command is present.

8-3-5 Overcurrent Detection

By the setting of the overcurrent detection level [bb160], you can adjust the threshold current value used for detecting the overcurrent error [E001].

Precautions for Correct Use

If the threshold level for overcurrent is lowered, the overcurrent error [E001] is more likely to occur. Therefore, it is necessary to lower the levels for the overload restriction function and the overcurrent suppression function. For details, see *8-2 Tripless Functions* on page 8-40.

- **Parameter**

Item	Parameter	Data	Description	Default data
Over current detection level, 1st-motor	[bb160]	Inverter ND rated current × (0.2 to 2.2)*1	Sets the threshold level used for detecting overcurrent.	2.2 × ND Rated current

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
   When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
   When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
3) Drive programming: 0.01% (Rated ratio)

8-3-6 Instantaneous Power Interruption/Undervoltage Detection

Trip after Instantaneous Power Interruption/Undervoltage

When an instantaneous power failure/undervoltage occurs, the inverter trip can be generated.

Item	Instantaneous power failure	Under-voltage
Always making the inverter trip when an instantaneous power failure/under-voltage occurs	Set [bb-20] to 0. [E016] Instantaneous power failure error	Set [bb-21] to 0. [E009] Under-voltage error
Always making the inverter retry when an instantaneous power failure/under-voltage occurs	Set [bb-20] to 255.	Set [bb-21] to 255.
Making the inverter trip after the specified number of retries are made after an instantaneous power failure/under-voltage has occurred	Set [b-20] to other than 0 or 255. [E016] Instantaneous power failure error	Set [b-21] to other than 0 or 255. [E009] Under-voltage error
Outputting the state to an output terminal	Assigns 020 [IP] Instantaneous power failure signal.	Assigns 021 [UV] Under-voltage signal.
Selecting whether to make the inverter trip when an instantaneous power failure or under-voltage occurs while the inverter is in a stopped state.	Sets [bb-27].	

Precautions for Correct Use

- When selecting a retry function, see *8-2 Tripless Functions* on page 8-40.
- When the control circuit power supply is turn off and the power is lost, the operation mode will be the same as the mode at power-on. For subsequent operations, see the explanation about the restart after reset.
- When direct current (P-N) is supplied to control power supply terminal R0 and T0, the inverter may detect under-voltage at power interruption and then trip. If there is any problem with your system, set [bb-27] to 00 or 02.
- Even if Selection of instantaneous power failure trip [bb-20] is set to other than 0 and Selection of instantaneous power failure/under-voltage trip during stopping [bb-27] is set to “Disabled” (00 or 02), [E016] Instantaneous power failure error will occur when the actual power failure time exceeds the allowable instantaneous power failure time.
- Even during a retry operation, the retry will be interrupted if the instantaneous power failure/under-voltage condition continues for about 40 seconds, and error code [E009] Under-voltage or [E016] Instantaneous power failure will be displayed.
- When connecting separate power supplies to control power supply terminals (R0 and T0), and if an instantaneous power failure occurs at the main power supply terminals (R, S, and T), it will take about 1 second of the detection time before an instantaneous power failure error and under-voltage error occur. When braking is performed by [AL] alarm signal (output terminal function 017), the braking response will be slow, and therefore use the brake control function.

● Parameter

Item	Parameter	Data	Description	Default data
The number of retries after instantaneous power failure	[bb-20]	0 to 16 / 255	Detects a decrease in the control power supply and restarts the motor when the power supply is recovered. When 0 is specified, the inverter immediately trips when an instantaneous power failure occurs.	0
The number of retries after under voltage	[bb-21]	0 to 16 / 255	Detects a decrease in the main power supply and restarts the motor when the power supply is recovered. When 0 is specified, the inverter immediately trips when an under-voltage condition occurs.	0
Selection of restart mode @Instantaneous power failure/ under-voltage trip	[bb-24]	00	Restarts with 0 Hz at retry.	01
		01	Restarts with speed matching at retry.	
		02	Restarts with frequency pull-in at retry.	
		04	Restarts with speed matching at retry, and trips after deceleration stop.	
Allowable under-voltage power failure time	[bb-25]	0.3 to 25.0 (s)	Restarts if the instantaneous power failure is within the set time.Trips if the instantaneous power failure exceeds the specified time.	1.0
Retry wait time before motor restart	[bb-26]	0.3 to 100.0 (s)	Sets the time before restarting.	0.3
Instantaneous power failure/under-voltage trip alarm enable	[bb-27]	00	Disabled	00
		01	Enabled	
		02	Disabled during stopping and during deceleration stop after the operation command has been turned off.	

Item	Parameter	Data	Description	Default data
Selection of output terminal function	[CC-01] to [CC-05]	017 020 021	017: Outputs [AL] Alarm signal. 020: Outputs [IP] Instantaneous power failure signal 021: Outputs [UV] Under-voltage signal.	-
Relay output terminal [16] function	[CC-06]			
Relay output terminal [AL] function	[CC-07]			

Alarm Output When Instantaneous Power Failure/Under-Voltage occurs during Stopping

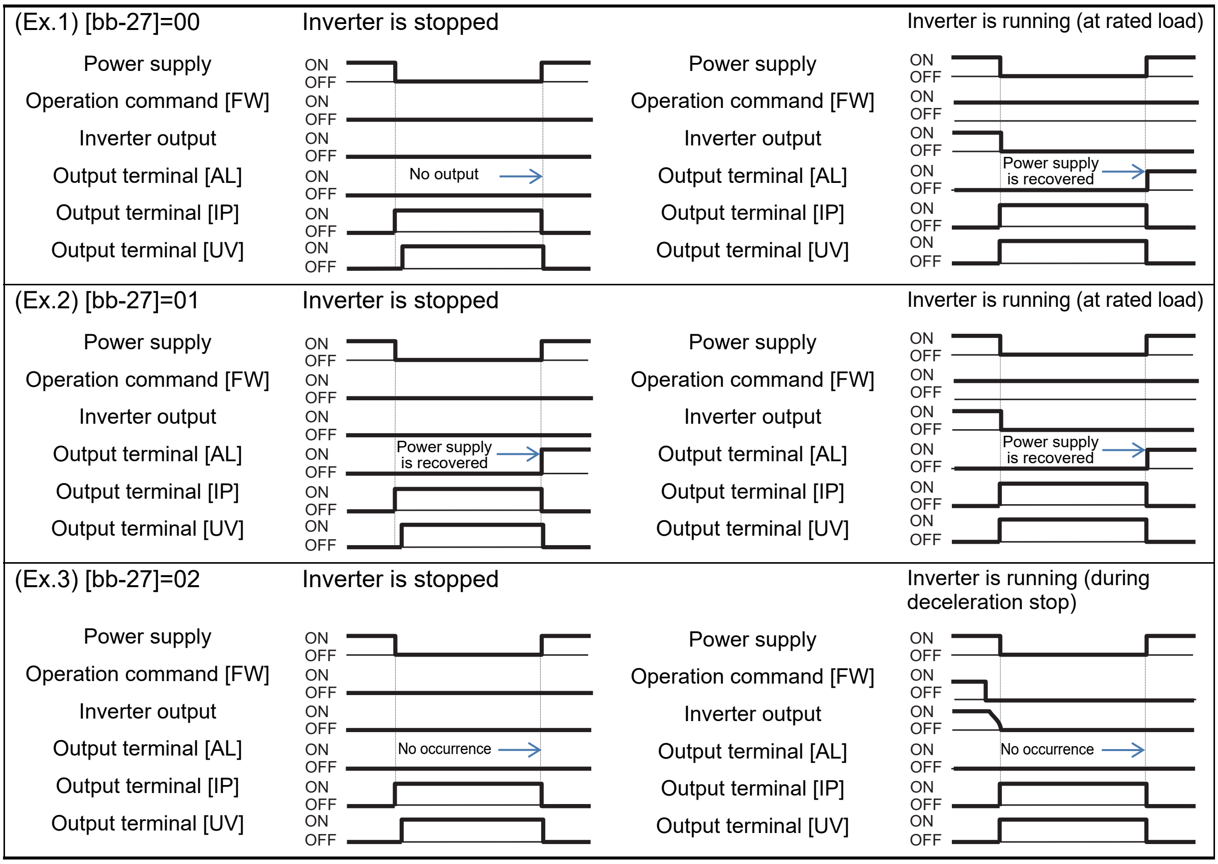
Use this function to specify whether to output [AL] Alarm signal (error output) (output terminal function 028) when an instantaneous power failure or under-voltage occurs according to [bb-27] Selection of instantaneous power failure/under-voltage trip during stopping.

Examples 1 to 6 show cases with no retry.

Precautions for Correct Use

- When the power to control power supply terminals R0 and T0 is supplied from main power supply terminals R, S, and T, and if the control power supply terminals continue to be shut off for 80 ms or more, it is considered as power failure. After the power supply is recovered, the inverter performs power-on operation.
- Depending on the load conditions of the motor driven by the inverter, an under-voltage error [E009], instead of an instantaneous power failure error [E016], may occur.
- The inverter outputs the alarm while the power to control power supply terminals R0 and T0 remains.

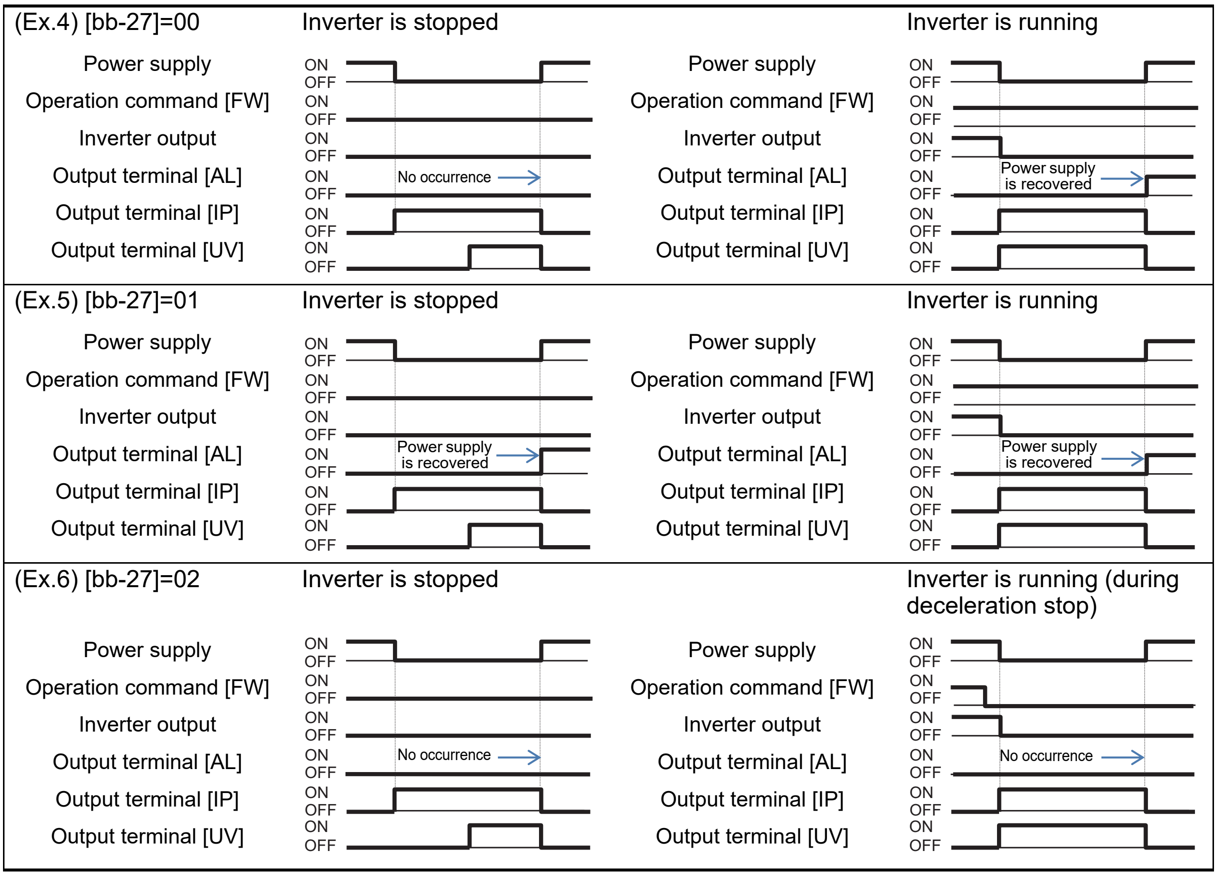
Examples of supplying the power to R0 and T0 from R, S, and T



Precautions for Correct Use

- Depending on the setting for [bb-25] Allowable instantaneous power failure time and the number of retries, the inverter's behavior varies.
- When "0" is specified for the number of retries (Error occurs)
  Power recovery within [bb-25] Allowable instantaneous power failure time
  ⇒ An error occurs.
  Power recovery after [bb-25] Allowable instantaneous power failure time has elapsed
  ⇒ An error does not occur. The same operation as when the power is turned on.
- When other than "0" is specified for the number of retries (Retry enabled)
  Power recovery within [bb-25] Allowable instantaneous power failure time
  ⇒ Retry operation
  Power recovery after [bb-25] Allowable instantaneous power failure time has elapsed
  ⇒ An error occurs.

Examples of supplying the power to R0 and T0 from P and N



Precautions for Correct Use

- [IP] signals start to be detected after 3-phase power source has been input to main power supply terminals R, S, and T.
- If direct current is supplied between P and N, [IP] signals will not be output.

8-3-7 Frequency Jump Function

Use the jump frequency function to operate the inverter while avoiding resonance points on the load-machine system.

A jump frequency can be set at 3 points.

When a jump frequency is set, the output frequency is in the upper/lower-limit frequency of the set jump frequency range, avoiding frequencies within that range.

The output frequency within the range of the jump frequency command fluctuates continuously according to normal the acceleration/deceleration time.

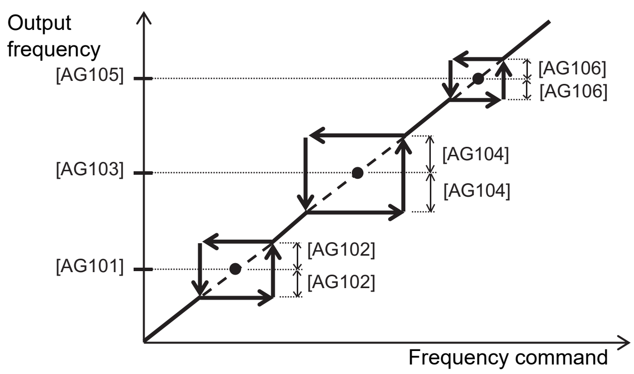
Precautions for Correct Use

The jump frequency function is a function to prevent output within the specified frequency command range. When a frequency command that is within the range of the jump frequency function is input, the output is automatically limited. While the output is limited, the LIM icon will be displayed.

● Parameter

Item	Parameter	Data	Description	Default data
Jump frequency 1, 1st-motor	[AG101]	0.00 to 590.00(Hz)	Sets the center of the frequency range at which to execute a jump If 0.00 Hz is set, the jump frequency function is disabled.	0.00
Jump frequency 2, 1st-motor	[AG103]			
Jump frequency 3, 1st-motor	[AG105]			
Jump frequency width 1, 1st-motor	[AG102]	0.00 to 10.00(Hz)	Set one-half of the frequency width in which to execute a jump. Frequencies that fall in the range of a jump frequency±jump width will be jumped.	0.00
Jump frequency width 2, 1st-motor	[AG104]			
Jump frequency width 3, 1st-motor	[AG106]			

Setting Examples



8-3-8 Speed Deviation Error Detection

The speed deviation error detection judges an error when the deviation between the output frequency and the feedback speed becomes large.

This function operates when other than “0.0” is specified for [bb-83] Speed deviation error detection level setting.

The speed deviation is the difference between [dA-12] output frequency monitor and [dA-08] speed detection monitor.

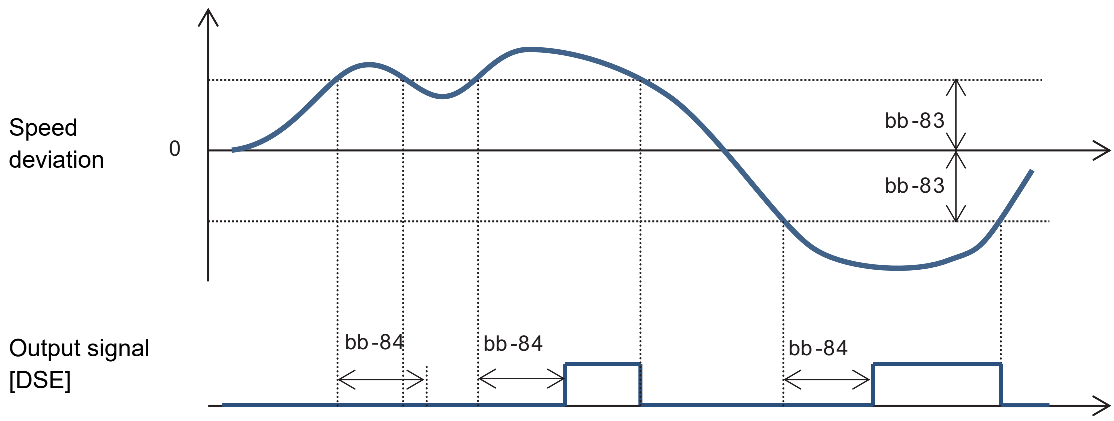
When the absolute value of speed deviation has exceeded [bb-83] Speed deviation error detection level and [bb-84] Speed deviation error detection time has elapsed, it is judged as a speed deviation error.

If “00: Warning” is specified for [bb-82] Operation for speed deviation error, the inverter turns on the Output terminal function 041 [DSE] with a speed deviation error.

If “01: Error” is specified for [bb-82] Operation for speed deviation error, the inverter turns on the Output terminal function 041 [DSE] with a speed deviation error, and trips with [E105] Speed deviation excessive error.

Precautions for Correct Use

To use this function, speed feedback by the encoder is required.



● Parameter

Item	Parameter	Data	Description	Default data
Speed deviation error mode selection	[bb-82]	00	Turns on the output terminal function 041 [DSE].	00
		01	Turns on the output terminal function 041 [DSE], and trips with [E105] Speed deviation excessive error.	
Speed deviation error detection level	[bb-83]	0.0 to 100.0(%)	Set the level at 100% to which the maximum frequency is set.	15.0
Speed deviation error detection time	[bb-84]	0.0 to 5.0(s)	Sets the time to judge the deviation to be an error after it has excessively increased.	0.5
Speed Detection Values monitor	[dA-08]	-590.00 to 590.00(Hz)	Displays data obtained through encoder feedback.	-
Output frequency monitor	[dA-12]	-590.00 to 590.00(Hz)	Displays the frequency command given by the inverter.	-

8-3-9 Overspeed Error Detection

The over-speed error detection function judges that the speed is excessive if the feedback speed exceeds the over-speed level.

This function operates when other than “0.0” is specified for [bb-80] Over-speed error detection level.

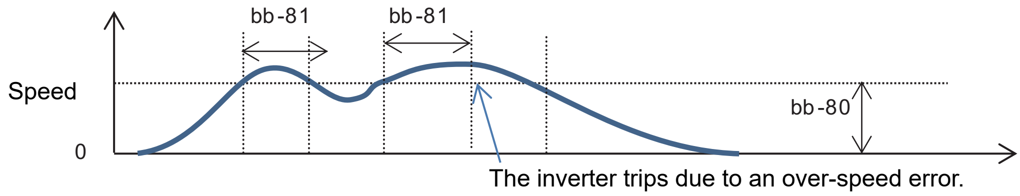
The overspeed is detected by the feedback frequencies displayed on [dA-08] speed detection monitor.

When the speed has exceeded [bb-80] Over-speed error detection level and [bb-81] Over-speed error detection time has elapsed, it is judged as an over-speed error.

When an over-speed error occurs, the inverter trips with [E107] Over-speed error.

Precautions for Correct Use

To use this function, speed feedback by the encoder is required.



● Parameter

Item	Parameter	Data	Description	Default data
Over speed detection level	[bb-80]	0.0 to 150.0(%)	Set the overspeed level at 100% to which the maximum frequency is set.	135.0
Over speed detection time	[bb-81]	0.0 to 5.0(s)	Sets the time to judge the speed to be an error after it has excessively increased. The inverter trips with [E107] Over-speed error.	0.5
Speed detection value monitor	[dA-08]	-590.00 to 590.00(Hz)	Displays the data obtained through encoder feedback.	-

8-4 Control Function

8-4-1 2nd Control (SET)

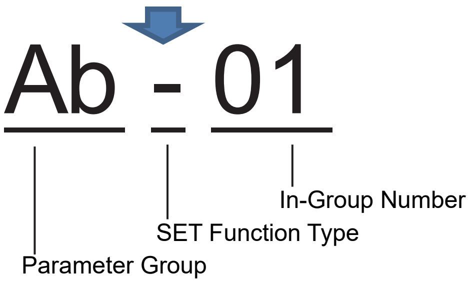
This function changes the valid parameters by assigning 024[SET] to the input terminal function and turning it on. In conjunction with [SET], the output terminal 012[SETM] is turned on.

The following is the notation for the parameters that are changed with the [SET] terminal.

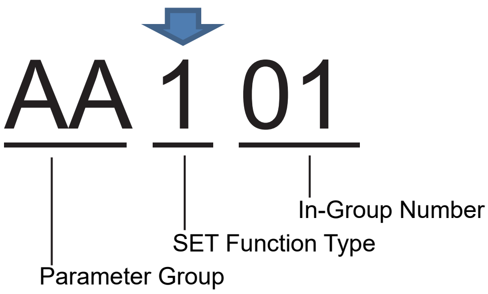
Precautions for Correct Use

- The [SET] terminal can be switched while the output of the inverter is blocked. If it is being switched during the output, it is switched after the output blockage.
- Even if you want to switch the [SET] terminal for immediate operation, take more than 1 second for the switching time.

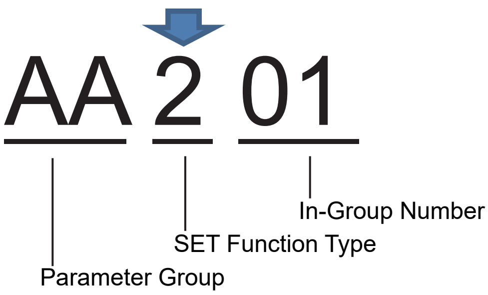
- Example of the Common Settings



- Example of the First Setting



- Example of the Second Setting



Example	SET Function Type Notation	Description
Common	The third digit of the parameter is "-": [Ab-01], [bA-30], [CC-01], etc.	The parameter is common to the first and second settings regardless of the SET function. Always valid.
First setting	The third digit of the parameter is "1": [AA101], [bC112], [Hb102], etc.	If the [SET] terminal is off or the [SET] function is not assigned (off), the first setting is applied. The data for which the third digit of the parameter is "1" are all valid.
Second setting	The third digit of the parameter is "2": [AA201], [bC212], [Hb202], etc.	If the [SET] terminal is on, the second setting is applied. The data for which the third digit of the parameter is "2" are all valid.

● Parameter

Item	Parameter	Data	Description
Input terminal function	[CA-01] to [CA-11]	024	[SET]: Second setting function OFF: The first setting is valid. ON: The second setting is valid. Note If the parameter does not have 024[SET] assigned, the first setting is valid.
Output terminal function	[CC-01] to [CC-07]	012	[SETM]: OFF when SET is OFF; ON when SET is ON.

8-4-2 Commercial Switch (CS)

This function can be used to drive the acceleration/deceleration with the inverter and drive in a constant speed with a commercial power supply for a system where the load inertia moment is large.

If the 035[CS] terminal is turned from on to off with the status where an operation command is sent, the inverter starts with the frequency matched with the motor rotation speed in free-running after the retry waiting time [bb-26]. (Starting the frequency matching.)

When the CS terminal is turned ON with the RUN command input, the inverter cuts off its output. Be sure to maintain the output while the motor sequence is switched.

Precautions for Correct Use

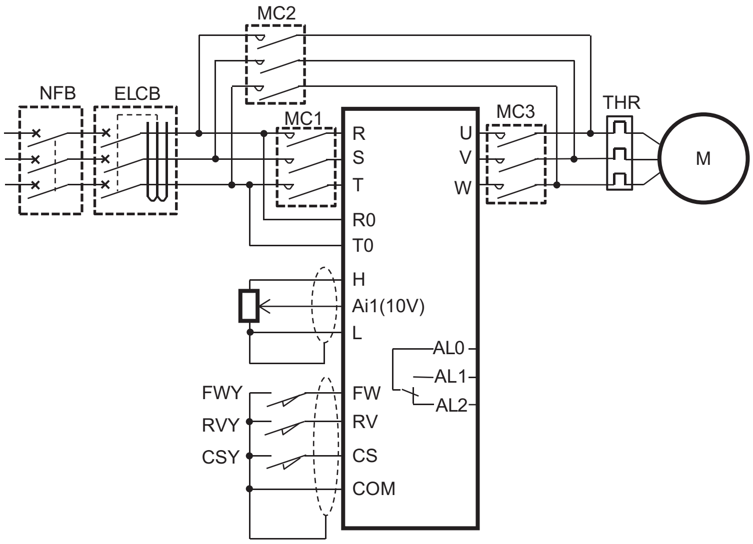
- The operation at the [CS] terminal is similar to the case when starting the frequency matching is selected. Starting at 0 Hz may occur when:
  1. The output frequency is equal to or less than one-half of the base frequency.
  2. The induced voltage of the induction motor decays early
  3. The lower limit frequency for the frequency matching [bb-42] is set and a speed not more than the set speed is detected.
- For the frequency matching, extend the retry waiting time [bb-26] when the overcurrent trip occurs.
- The operation can be also restarted automatically when the power is turned on. In this case, the reset restart function is used. For more information, refer to *7-5 Start Conditions* on page 7-63.

For the behavior of the commercial switching, refer to the following sample connection diagram for the commercial switching operation and timing.

Use light electrical relays for FWY, RVY, and CSY. The following sequence is a reference diagram for timing.

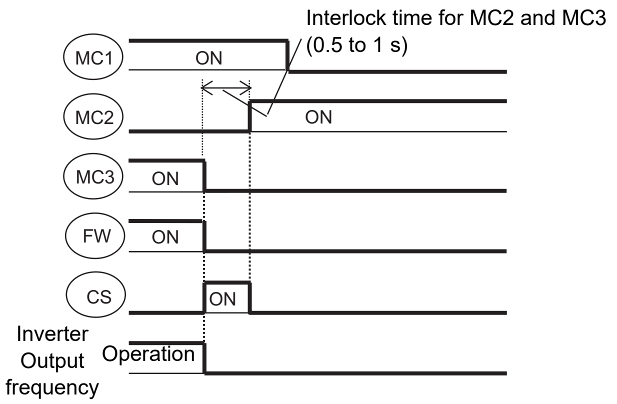
Take a mechanical interlock for MC3 and MC2. Otherwise, you run the risk of damage to the inverter.

Since the commercial circuit does not operate either when the earth leakage circuit breaker (ELCB) trips, connect the commercial circuit of another system to MC2 if the backup is required.

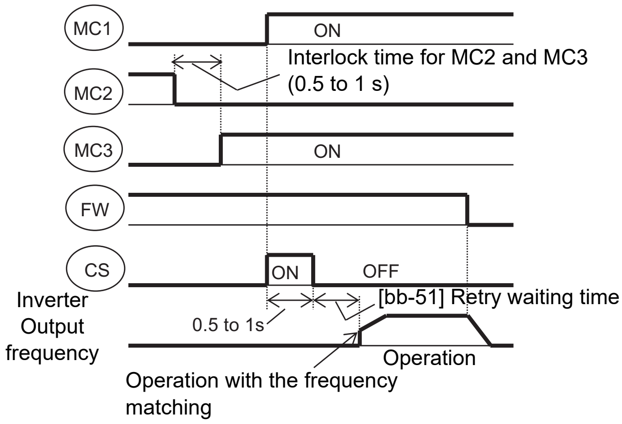


Sample connection diagram for the commercial switching operation and timing

Example of timing from INV to the commercial operation



Example of timing from the commercial operation to INV



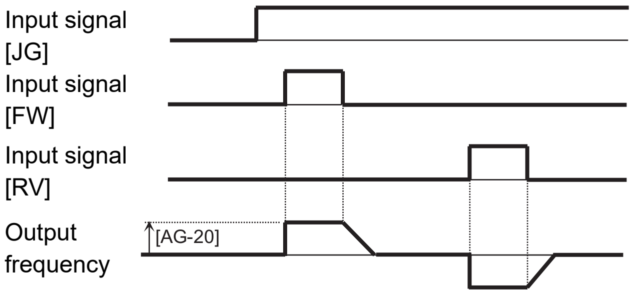
● Parameter

Item	Parameter	Data	Description	Default data
Selecting the input terminal	[CA-01] to [CA-11]	035	Used for the commercial switching [CS].	-
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Set the waiting time after an operation command.	3
Restart frequency threshold	[bb-42]	0.00 to 590.00(Hz)	Starting at 0 Hz when the detected value is equal to or less than the set value.	0.00

8-4-3 Jogging Operation Function (JG)

This function allows you to fine-tune the position where a motor stops.

The jogging operation starts when frequency commands for the operation is set to [AG-20] the jogging frequency and the [JG] terminal is turned ON.



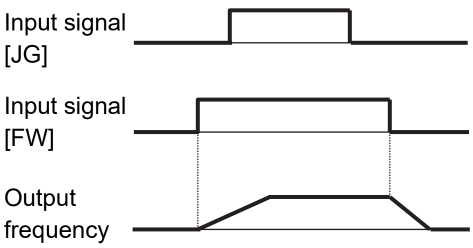
Precautions for Correct Use

- The jogging operation is likely to cause a trip as the frequency command is outputted instantaneously without acceleration time. Adjust the setting value for the jogging frequency [AG-20] to prevent the inverter trip.
- For the jogging operation, set the [AA111] operation command selection to 00, turn on the 029[JG] terminal and then put the [FW]/[RV] terminal. The operation is not allowed with the [JG] terminal alone.
- When [AG-21] = 00, 03 for the free-running at the time of the stop, the operation settings for free-running is required.
- When [AG-21] = 02, 05 for the DC-braking at the time of the stop, the settings for the DC-braking function is required. Refer to *7-6 Stop Conditions* on page 7-82 respectively.

● Parameter

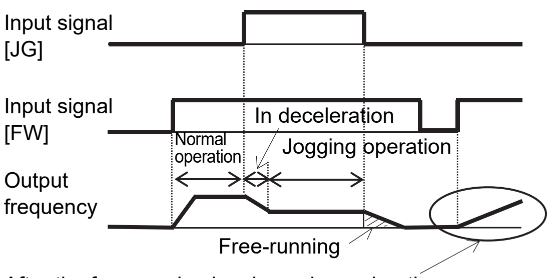
Item	Parameter	Data	Description	Default data
Jogging frequency	[AG-20]	Lowest frequency - 10.00 (Hz)	Frequency command at the time of the jogging operation command.	6.00
Jogging stop mode selection	[AG-21]	00	Invalid while operating Free-running at the time of the stop.	00
		01	Invalid while operating Decelerating stop at the time of the stop.	
		02	Invalid while operating DC braking at the time of the stop.	
		03	Valid while operating Free-running at the time of the stop.	
		04	Valid while operating Decelerating stop at the time of the stop.	
		05	Valid while operating DC braking at the time of the stop.	
Input terminal function	[CA-01] to [CA-11]	029	When the [JG] terminal function is turned on, the jogging behavior occurs at the time of operation.	-

(Ex.1)



When the setting for the jogging selection [AG-21] is 00, 01 or 02, the jogging behavior does not occur if the [FW] signal is turned on first.

(Ex.2)



After the free-running is released, acceleration occurs according to the settings for restart [bb-40].

When the setting for [AG-21] is 03, 04 or 05, the jogging behavior occurs if the [FW] signal is turned on first. However, if the [JG] signal is turned off first, the free-running stop occurs.

8-4-4 Brake Control Function (BRK)

Function to control the external brake used in a lifting system, etc. by the inverter. Changing the brake controlling function selection [AF130] enables you to select between two types of control methods.

1. Brake control 1: [AF130] = 01 or 02
   Releases and checks the brake while outputting the frequency.
2. Brake control 2: [AF130] = 03
   Controls the brake in conjunction with the servo lock control.

Precautions for Correct Use

- For using the brake control function, we recommend using controls that generate high torque when the control system [AA121] is started such as:
  Use the following brake control functions.
  08: Sensorless vector control,
  09: 0 Hz range sensorless vector control or
  10: Vector control with sensor.
- When an error occurs in the brake sequence, the inverter trips [E036], the brake control fault signal 038[BER] for the output terminal function is output.

Brake Control 1

Available in those instances where the operations vary for lifting and lowering since different operations can be set for forward and reverse rotations.

The 037[BRK] brake release signal for the output terminal function and the 037[BOK] brake check signal for the input terminal function are available.

For the brake control, a trip occurs in the following cases.

- After the brake release establishment waiting time, the output current was less than the release current.
- When the brake check signal 037[BOK] is used, [BOK] was not turned on within the brake check waiting time at start-up.
- When the brake check signal 037[BOK] is used, [BOK] was not turned off within the brake check waiting time at stop.
- When the brake check signal 037[BOK] is used, the brake release signal 037[BRK] was being output, but [BOK] was turned off.

[AF130] = 01: Brake control 1 common in forward/reverse rotation, the following parameters are valid.

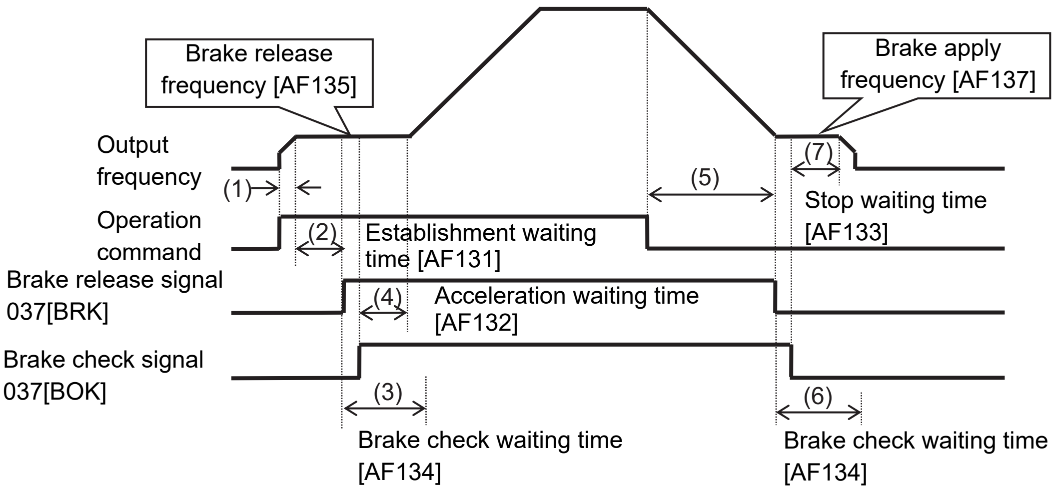
Item	Valid for both forward and reverse
Brake release establishment waiting time	[AF131]
Acceleration waiting time	[AF132]
Stop waiting time	[AF133]
Brake check waiting time	[AF134]
Brake release frequency	[AF135]
Brake release current	[AF136]
Brake apply frequency	[AF137]

[AF130] = 02: Brake control 1 forward/reverse set individually, the following parameters are valid.

Item	Forward rotation side	Reverse rotation side
Brake release establishment waiting time	[AF131]	[AF138]
Acceleration waiting time	[AF132]	[AF139]
Stop waiting time	[AF133]	[AF140]
Brake check waiting time	[AF134]	[AF141]
Brake release frequency	[AF135]	[AF142]
Brake release current	[AF136]	[AF143]
Brake apply frequency	[AF137]	[AF144]

Precautions for Correct Use

- Do not use the brake control 1 function when position/torque controls are performed.
- Do not use the brake control 1 function when the synchronous motor (permanent magnet motor) is used.



Once the inverter receives an operation command, it starts the output and accelerate to the release frequency. (1)

When the brake release establishment waiting time passes after the release frequency is reached, the inverter outputs the brake release signal 037[BRK]. (2)

Precautions for Correct Use

At this time, if the output current is less than the current set for the release current, the brake release signal is not output and the trip occurs with the [E036] brake error outputting the brake fault signal 038[BER].

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (3)

With [BOK] setting	The inverter turns on the release signal [BRK] and waits for the input (ON) for the check signal [BOK] without accelerating during the brake check waiting time. If the [BOK] is not turned on during the above time, the inverter trips with the [E036] brake error outputting the fault signal [BER].
Without [BOK] setting	After the release signal [BRK] is turned on, the process goes to the item 4 regardless of the brake check waiting time.

If the brake check signal [BOK] is not selected, when the brake release signal is output, the inverter starts accelerating again to the set frequency after the acceleration waiting time passes. (4)

Once the operation command is turned off, the inverter decelerates to the brake apply frequency and turns off the brake release signal [BRK]. (5)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (6)

With [BOK] setting	The inverter turns off the release signal [BRK] and waits for the input (OFF) for the check signal [BOK] without decelerating during the brake check waiting time. If the [BOK] is not turned off during the above time, the inverter trips with the [E036] brake error outputting the fault signal [BER].
Without [BOK] setting	After the release signal [BRK] is turned off, the process goes to the item 7 regardless of the brake check waiting time.

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (7)

With [BOK] setting	When the check signal [BOK] is turned off, the inverter decelerates again to 0 Hz after the stop waiting time passes.
Without [BOK] setting	When the release signal [BRK] is turned off, the inverter decelerates again to 0 Hz after the stop waiting time passes.

Precautions for Correct Use

If the operation command is the forward command, the parameters on the side of the forward rotation are adopted; if it is the reverse command, those on the side of the reverse rotation are adopted.

Ex: When FW is turned ON or the output frequency is positive → Forward side parameter
When FW is turned ON or the output frequency is negative → Reverse side parameter
When RV is turned ON or the output frequency is positive → Reverse side parameter
When RV is turned ON or the output frequency is negative → Forward side parameter

● Setting Items Required for the Brake Control 1 Function

Item		Parameter	Data	Description	Default data
Brake control function selection		[AF130]	00	Disabled	00
			01	Brake control 1 common in forward/reverse rotation[*1]	
			02	Brake control 1 forward/reverse set individually	
Brake release establishment waiting time	Forward rotation	[AF131]	0.00 to 5.00(s)	Sets the time after the release frequency is reached until the output current reaches the release current	0.00
	Reverse rotation	[AF138]			0.00
Acceleration waiting time	Forward rotation	[AF132]	0.00 to 5.00(s)	Sets the mechanical delay time after the release signal is sent until the brake is released	0.00
	Reverse rotation	[AF139]			0.00
Stop waiting time	Forward rotation	[AF133]	0.00 to 5.00(s)	Sets the mechanical delay time after the release signal is turned off until the brake is closed	0.00
	Reverse rotation	[AF140]			0.00
Brake check waiting time	Forward rotation	[AF134]	0.00 to 5.00(s)	Set the time not less than the time after the release signal is sent until the release completion signal output from the brake is input to the inverter.	0.00
	Reverse rotation	[AF141]			0.00

Item		Parameter	Data	Description	Default data
Brake release frequency	Forward rotation	[AF135]	0.00 to 590.0(Hz)	Setting the frequency to output the brake release signal*2	0.00
	Reverse rotation	[AF142]			0.00
Brake release current	Forward rotation	[AF136]	Inverter rated current ×(0.0 to 2.0)*3	Setting the output current to allow the brake release*4	1.0× Inverter rated current
	Reverse rotation	[AF143]			1.0× Inverter rated current
Brake apply frequency	Forward rotation	[AF137]	0.00 to 590.0(Hz)	Setting the frequency to close the brake at the time of stop*2	0.00
	Reverse rotation	[AF144]			0.00
Input terminal function		[CA-01] to [CA-11]	037	[BOK] Brake check signal OFF: Brake applied ON: Brake released	-
Output terminal function		[CC-01] to [CC-07]	037	[BRK] Brake release signal OFF: Brake application command ON: Brake release command	-
			038	[BER] Brake fault signal OFF: Brake sequence is normal ON: Brake sequence is abnormal	

*1. If [AF130] = 01, the forward rotation settings, [AF131] to [AF137] are valid for both the forward and reverse rotations.

*2. Set the time greater than the value of the minimum speed [Hb130].

*3. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

*4. Note that a low value for the setting may generate sufficient torque when releasing the brake.

Brake Control 2

The brake control by managing time is available.

The 037[BRK] brake release signal for the output terminal function and the 037[BOK] brake check signal for the input terminal function are available.

For the brake control 2, an error occurs with a trip in the following cases.

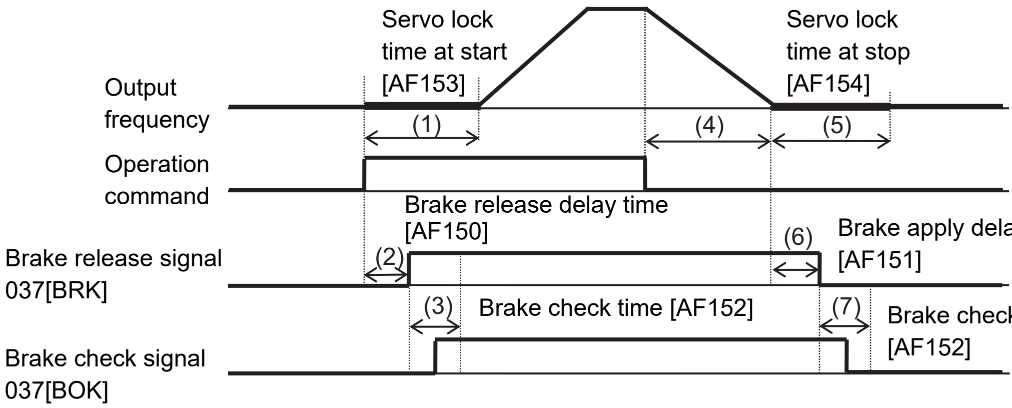
- When the brake check signal 037[BOK] is used, [BOK] was not turned on within the brake check waiting time at start-up.
- When the brake check signal 037[BOK] is used, [BOK] was not turned off within the brake check waiting time at stop.
- When the brake check signal 037[BOK] is used, the brake release signal 037[BRK] was being output, but [BOK] was turned off.

[AF130] = 03: Brake control 2, the following parameters are valid.

Item	Valid for both forward and reverse
Brake release delay time	[AF150]
Brake apply delay time	[AF154]
Brake check time	[AF152]
Servo lock time at start	[AF153]
Servo lock time at stop	[AF154]

Precautions for Correct Use

- Since the brake control 2 generates the servo lock status when the brake is on, use 09: zero speed range sensorless vector control or 10: vector control with sensor for the [AA121] control method.
- Selecting the control methods other than the above will replace the operation part of the servo lock with the DC braking operation. Servo lock time is applied at start/stop operation even when this is a DC injection braking.



The inverter starts the output and performs the servo lock for the servo lock time at start.
(If the [AA121] control method is neither 09: zero speed range sensorless vector control nor 10: vector control with sensor, the DC braking is applied.) (1)

After the brake release delay time passes, the brake release signal 037[BRK] is turned on. (2)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function.
After the servo lock time at start passes, there is an acceleration. (3)

With [BOK] setting	If the 037[BOK] is not turned on during the brake check time, the inverter trips with the [E036] brake error outputting the fault signal 038[BER].
Without [BOK] setting	After the release signal 037[BRK] signal is turned on, there is a waiting for the servo lock time at start to pass.

Once the operation command is turned off, the inverter decelerates and perform the servo lock. (4)

The servo lock is kept for the servo lock time at stop. (5)

After the brake apply delay waiting time passes, the brake release signal 037[BRK] is turned on. (6)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function.
There is a waiting for the servo lock time to pass. (7)

With [BOK] setting	The inverter turns off the release signal 037[BOK], and if the 037[BOK] is not turned off during the brake check time, the inverter trips with the [E036] brake error outputting the fault signal 038[BER].
Without [BOK] setting	After the release signal [BRK] signal is turned off, there is a waiting for the servo lock time at stop to pass.

● Setting Items Required for Brake Control2

Item	Parameter	Data	Description	Default data
Brake Control Enable, 1st-motor	[AF130]	00	Disabled	00
		01	Brake control 1 enabled	
		02	Brake control 1 enabled (forward/reverse set individually)	
		03	Brake control 2 enabled	
Brake open delay time, 1st-motor	[AF150]	0.00 to 2.00(s)	Set the brake release delay time.	0.20
Brake close delay time, 1st-motor	[AF151]	0.00 to 2.00(s)	Set the brake apply delay time.	0.20
Brake answer back check time, 1st-motor	[AF152]	0.00 to 5.00(s)	Set the time to check the brake.	0.10
Servo lock/ DC injection time at start, 1st-motor	[AF153]	0.00 to 10.00(s)	Set the servo lock time at start.	0.60
Servo lock/ DC injection time at stop, 1st-motor	[AF154]	0.00 to 10.00(s)	Set the servo lock time at stop.	0.60
DC braking force setting, 1st-motor	[AF105]	0 to 100(%)	If the control method is neither 09: zero speed range sensorless vector control nor 10: vector control with sensor, the DC braking is applied. Set the braking force (at the time of stop).	30
DC braking force at start, 1st-motor	[AF108]	0 to 100(%)	If the control method is neither 09: zero speed range sensorless vector control nor 10: vector control with sensor, the DC braking is applied. Set the braking force (at the time of start).	30

8-4-5 Contactor Control (CON)

For performing the contactor operation, set the [AF120] contactor control selection to 01.

The 039[CON] contactor control signal for the output terminal function and the 107[COK] contactor check signal for the input terminal function are available.

For the contactor control, a trip occurs in the following cases.

- When the contactor check signal 107[COK] is used, [COK] is not turned on within the contactor check time at start-up.
- When the contactor check signal 107[COK] is used, [COK] is not turned off within the contactor check time at stop.
- When the contactor check signal 107[COK] is used, [COK] is turned off while the contactor control signal 039[CON] is on

Precautions for Correct Use

- The contactor control requires this function because operating a contactor during the inverter output generates a surge causing damage to the inverter.
- When an error occurs in the contactor sequence, the inverter trips at [E110].

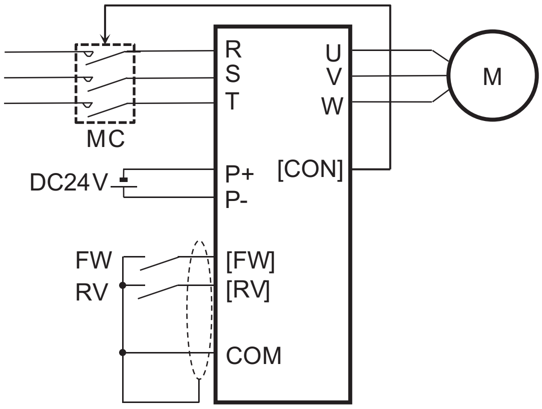
Setting Items Required for the Contactor Control

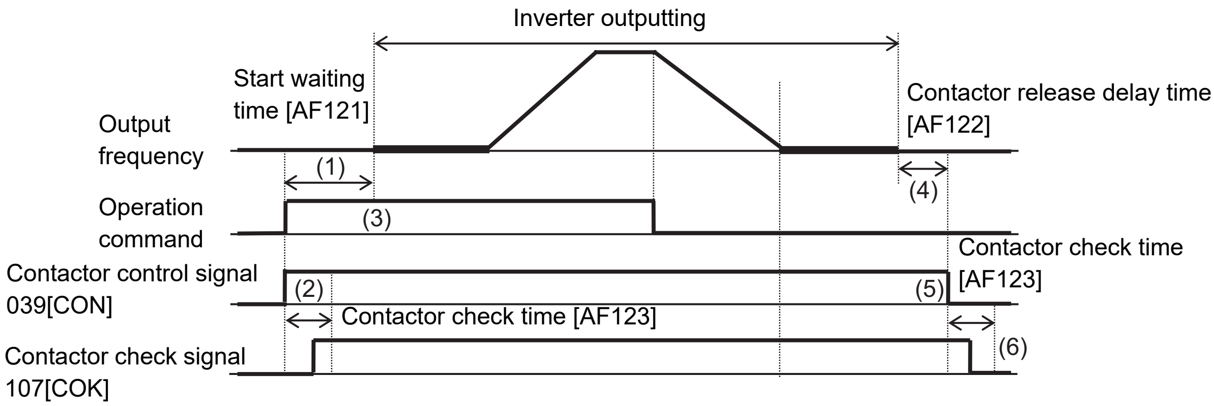
Item	Parameter	Data	Description	Default data
Contactor Control Enable, 1st-motor	[AF120]	00	Disabled	00
		01	Enabled (primary side) Place a contactor on the primary side of the inverter to reduce standby power.	
		02	Enabled (secondary side) Place a contactor on the secondary side of the inverter to implement the function as a brake sequence.	
Run delay time, 1st-motor	[AF121]	0.00 to 2.00(s)	Set the waiting time from the input of an operation command to the start of the inverter output.	0.20
Contactor off delay time, 1st-motor	[AF122]	0.00 to 2.00(s)	Set the time from the output shutoff of the inverter to the control of the contactor.	0.10
Contactor answer back check time, 1st-motor	[AF123]	0.00 to 5.00(s)	Set the time from the operation command to the control of the contactor.	0.10
Input terminal function	[CA-01] to [CA-11]	107	[COK] Contactor check signal OFF: Contactor released ON: Contactor in operation	-
Output terminal function	[CC-01] to [CC-07]	039	[CON] Contactor control signal OFF: Contactor release command ON: Contactor operation command	-

Example of Energy Saving on the Primary Side Contactor (AF120 = 01: Enabled (Primary Side)

Reduce standby power in combination with the control power supply DC24V input.

Connecting the auxiliary contact MC for the main circuit power supply to the setting terminal of the output terminal function [CON] shuts off the power input to the inverter main circuit while the inverter output is suspended to implement the operation sequence for energy saving.





The inverter waits for the output until the start waiting time passes. (1)

It turns on the contactor control signal 039[CON] at the same time.
The operation varies depending on whether the contactor check signal 107[COK] is set to the input terminal function. (2)

With [COK] setting	If the 107[COK] is not turned on during the contactor check time, the inverter trips with the [E110] contactor error.
Without [COK] setting	After the contactor control signal 039[CON] is turned on, there is a waiting time for the start waiting time to pass.

After the start waiting time passes, there is an acceleration. (3)

After the inverter stops the output, there is a waiting time for the contactor release delay time to pass. (4)

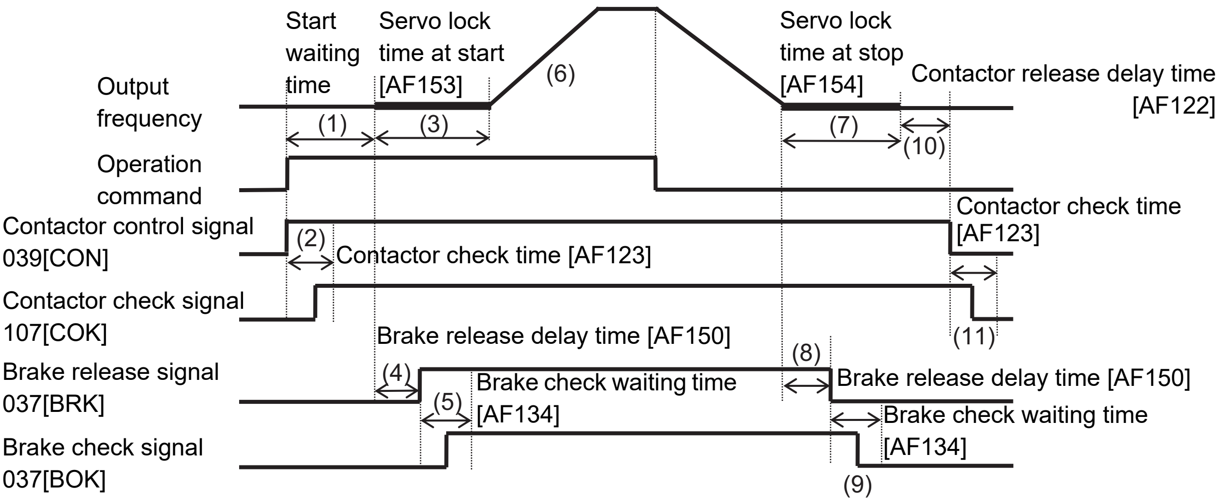
After the contactor release delay time passes, the contactor control signal 039[CON] is turned off. (5)

The operation varies depending on whether the contactor check signal 107[COK] is set to the input terminal function. (6)

With [COK] setting	If the 107[COK] is not turned off during the contactor check time, the inverter trips with the [E110] contactor error.
Without [COK] setting	The inverter still does nothing.

Example of the Control on the Secondary Side (AF120 = 02: Enabled (secondary side))

When Enabled (secondary side) is selected, using in combination with the brake control 2 is available.



Once the operation command is received, the inverter turns on the control signal 039[CON]. (1)

The operation varies depending on whether the contactor check signal 107[COK] is set to the input terminal function. (2)

With [COK] setting	The inverter turns on the control signal 039[CON] and, if the 107[COK] is not turned on during the contactor check time, the inverter trips with the [Er110] contactor error.
Without [COK] setting	After the control signal 039[CON] is turned on, there is a waiting time for the start waiting time to pass.

The inverter starts the output and is in the servo lock status at the present location for the servo lock time at start. (3)

After the brake release delay time passes, the brake release signal 037[BRK] is turned on. (4)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (5)

With [BOK] setting	If the 037[BOK] is not turned on during the brake check waiting time, the inverter trips with the [E036] brake error outputting the fault signal 038[BER].
Without [BOK] setting	After the release signal 037[BRK] signal is turned on, there is a waiting for the servo lock time at start to pass.

After the servo lock time at start passes, there is an acceleration. (6)

Once the operation command is turned off, the inverter decelerates and is in the position servo lock status for the servo lock time at stop. (7)

After the brake release delay time passes, the brake release signal 037[BRK] is turned off. (8)

The operation varies depending on whether the brake check signal 037[BOK] is set to the input terminal function. (9)

With [BOK] setting	The inverter turns off the release signal 037[BOK], and if the 037[BOK] is not turned off during the brake check time, the inverter trips with the [E036] brake error outputting the fault signal 038[BER].
Without [BOK] setting	After the release signal [BRK] signal is turned off, there is a waiting for the servo lock time at stop to pass.

The inverter shuts off the output and, after the contactor release delay time passes, the control signal 039[CON] is turned off. (10)

The operation varies depending on whether the contactor check signal 107[COK] is set to the input terminal function. (11)

With [COK] setting	If the 107[COK] is not turned off during the contactor check time, the inverter trips with the [E110] contactor error.
Without [COK] setting	The inverter still does nothing.

8-4-6 Forced Operation

Forced Operation Mode

In this mode, the motor runs at a fixed speed without interrupting the output of the inverter.

Set the [PA-01] forced operation to enabled 01 and turn on the [EMF] emergency forced operation terminal (input terminal: 105) to enter the forced operation mode.

The command for the forced operation mode is set to [PA-02] the forced operation frequency setting and [PA-03] the forced operation rotation direction command.

Precautions for Correct Use

- Once the forced operation mode is turned on, the inverter keeps operating until the power is off.
- When using the forced operation mode, make sure that the system is safe if the operation continues.
- Enabling the overcurrent retry, overvoltage retry, undervoltage retry or instantaneous power failure retry requires a separate setting.
- After the [EMF] emergency forced operation terminal (input terminal: 105) is turned on, the input terminal function except for the following are disabled.
  ⇒ [COK]: Contactor check signal

● Parameter Setting

Item	Parameter	Data	Description	Default data
Mode selection for Emergency-force drive	[PA-01]	00	Disabled	00
		01	Enabled	
Frequency reference setting at Emergency-force drive	[PA-02]	0.00 to 590.00(Hz)	Set the frequency command in the forced operation mode.	0.00
Direction command at Emergency-force drive	[PA-03]	00	Forward rotation command	00
		01	Reverse rotation command	

● Input Terminal Setting

Item	Parameter	Data	Description
Selecting the input terminal	[CA-01] to [CA-11]	105	[EMF] emergency forced operation terminal. OFF: Disabled ON: Forced operation mode (when [PA-01] = 01)

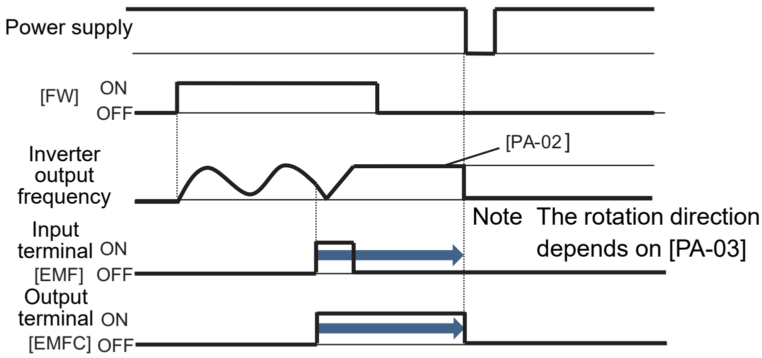
● Output Terminal Setting

Item	Parameter	Data	Description
Selecting the output terminal	[CC-01] to [CC-07]	076	[EMFC] Signal in Forced Operation. OFF: Disabled ON: In the forced operation mode

● Behavior in the Forced Operation

Turn on the [EMF] emergency forced operation terminal (input terminal: 105) to enter the forced operation mode.

The inverter performs the output at the frequency set to the [PA-02] Forced Operation Frequency Setting and rotation direction set to the rotation direction command in the [PA-03] Forced Operation Rotation Direction Command until the power-off.



Precautions for Correct Use

- In the forced operation mode, the following functions are operating automatically.

(1) Soft lock status (equivalent to [UA-16] = 01) The parameters can be no longer changed. To restore the settings, turn off [EMF], restore the power and then change the parameters.

(2) Auto-reset (equivalent to [bb-10] = 02) When a trip that can be released occurs, the reset is performed automatically to restart.

(3) STOP key disabled (equivalent to [AA-13] = 00) Disable the STOP/RESET keys on the LCD Operator.

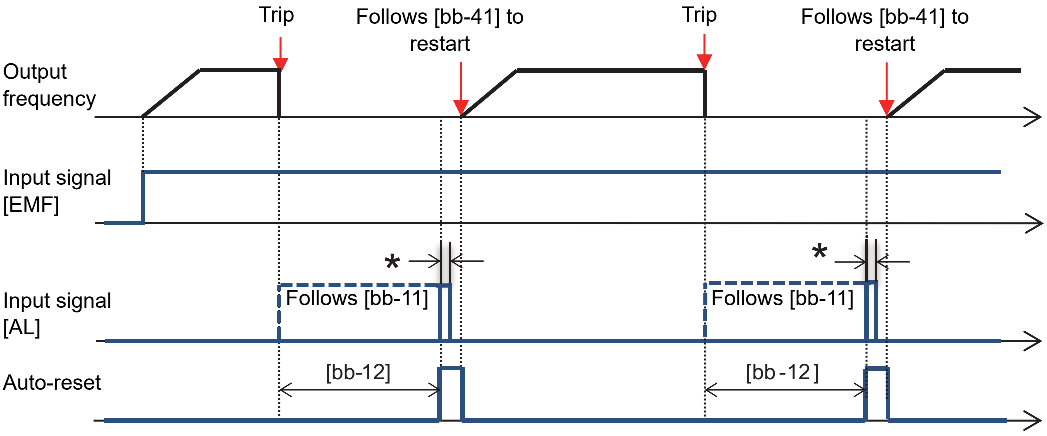
(4) Operation enabled during the optional start ([oA-13] = 01, [oA-23] = 01, [oA-33] = 01) The operation is allowed even in the optional start-up.

- The functions except for the above operate according to the settings.
- The parameters are changed before forced operation starts.

  Note that some parameters which are not saved returns to the values before forced operation starts when auto-reset is activated.

● Auto-Reset Behavior in the Forced Operation

When an error occurs during the forced operation and the inverter trips, the reset equivalent to the one at power-on is performed.



* 000000000For the AL relay terminal, due to the MCU reset (equivalent to Power ON reset), on for a moment no matter what is assigned.

The auto-reset at the forced operation shows the following operation. The parameter isn't changed.

Item	Equivalent Parameter	At the Forced Behavior	Description	Default data
Auto-reset selection	-	Reset the entire error with [bb-10] = 02.	Forcibly same behavior as [bb-10] = 02 regardless the settings. (02: Enabled (performed after the [bb-12] setting time)).	-
Alarm signal selection at Automatic error reset is active	[bb-11]	Follows the setting for [bb-11]	Parameter setting is enabled. However, due to the system reset, AL is turned on for a moment even if AL is set for the output.	00
Automatic error reset wait time	[bb-12]	Follows the setting for [bb-12]	Parameter setting is enabled.	2
Automatic error reset number	[bb-13]	Change to no limit	Forcibly reset an infinite number of times regardless the settings.	3
Restart mode after RS release	[bb-41]	Follows the setting for [bb-41]	Parameter setting is enabled. For other retry settings ([bb-20] to [bb-31]), the parameter settings are enabled.	00

Commercial Operation Mode (Bypass Mode)

When the [PA-04] bypass function selection is set to 01: Enabled, switching to the commercial operation mode (bypass mode) is allowed if the specified operation mode is not entered during the forced operation.

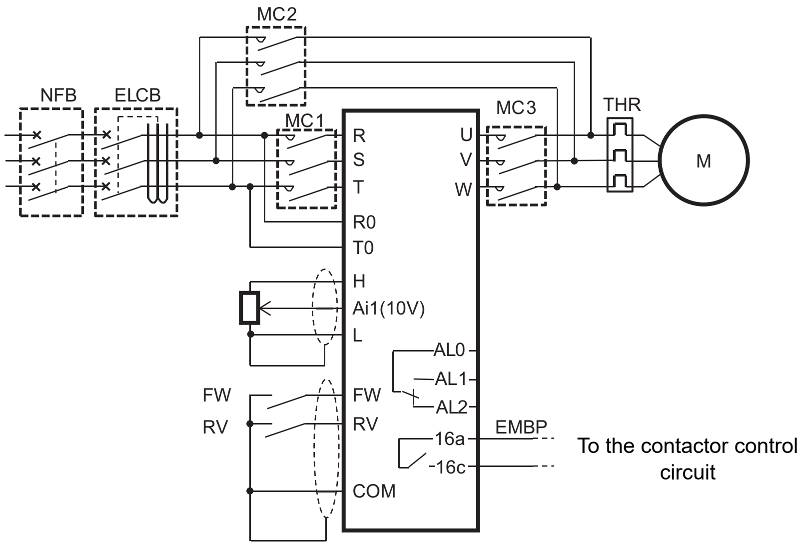
In the bypass mode, [EMBP] bypass mode signal (output terminal: 076) is turned on and the inverter output is shut off.

For the behavior in the bypass mode, refer to the following sample connection diagram for the commercial switching operation and timing.

Perform the contactor control based on the [EMBP] bypass mode signal (output terminal: 076).

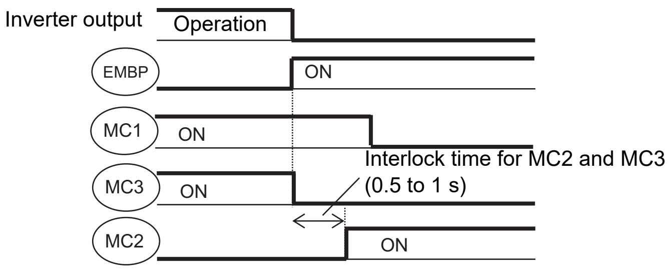
Precautions for Correct Use

- For using the bypass mode, it is necessary to implement a interlock taking into consideration the operation delay of the contactor when shifting to the commercial operation. •Make sure that the system operation is safe in using the mode.
- The timing of the contactor control can be taken using the [EMBP] bypass mode signal (output terminal: 076) as the contactor control signal. Take a interlock between the contactor on the commercial power supply side and that on the inverter output side.
- Since the commercial circuit does not operate either when the earth leakage circuit breaker (ELCB) trips, connect the commercial circuit of another system to MC2 if the backup is required.



Sample connection diagram when shifting to the commercial operation and timing

Example of timing from INV to the commercial operation



● Parameter Setting

Item	Parameter	Data	Description	Default data
Commercial power supply bypass function selection	[PA-04]	00	Disabled	00
		01	Enabled	
Delay time of Bypass function	[PA-05]	0.0 to 1000.0(s)	Set the delay time until the bypass mode operation.	5.0

● **Output Terminal Setting**

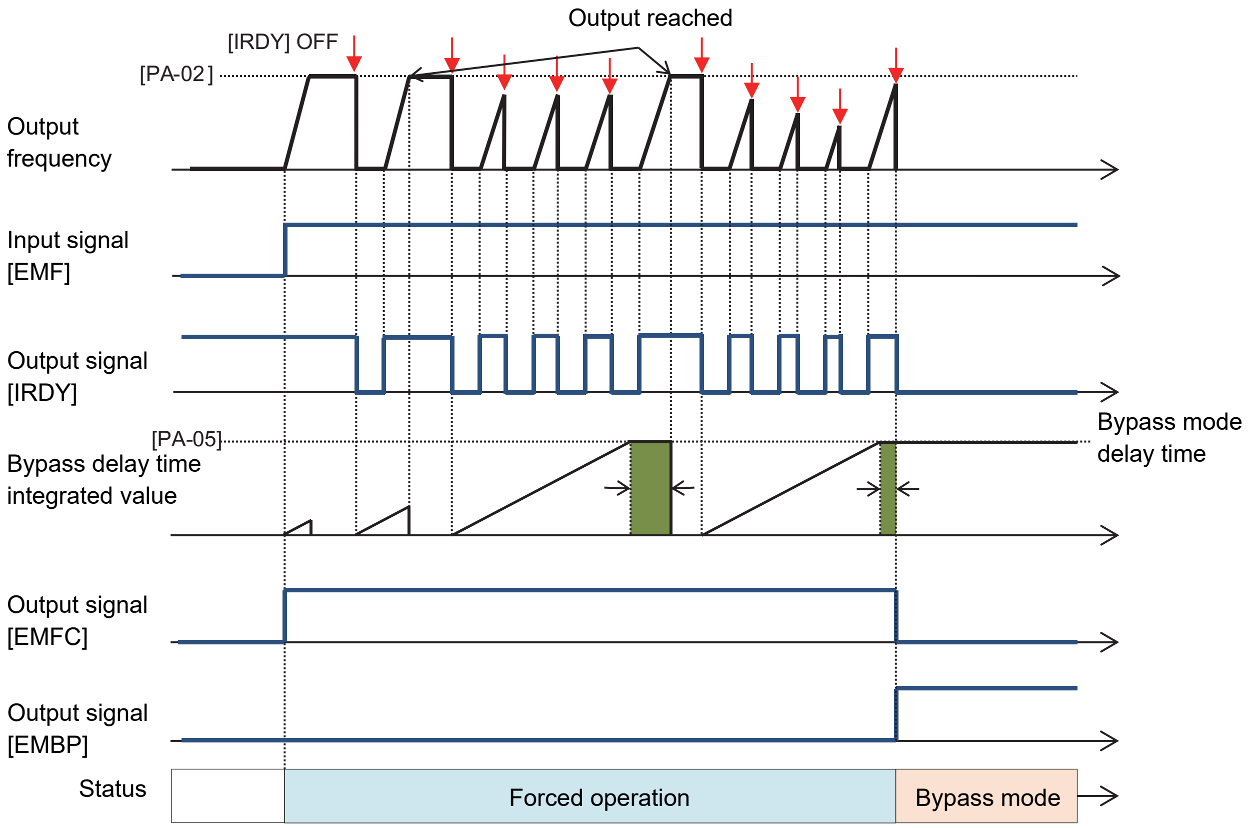
Item	Parameter	Data	Description
Selecting the output terminal	[CC-01] to [CC-07]	076	[EMBP] bypass mode signal. OFF: Disabled ON: In the bypass mode

● **Decision for Switching to the Bypass Mode**

When the [PA-04] bypass function selection is set to 01: Enabled, if the [PA-05] bypass function delay time passes during the forced operation without reaching the forced operation frequency setting [PA-02] and the inverter enters the operation ready incomplete status (output terminal [IRDY] is OFF), it operates in the commercial operation mode (bypass mode).

Precautions for Correct Use

- Once the bypass mode is turned on, the inverter keeps shutting off until the power is off.
- While the inverter is operating immediately after the reset, the output terminal [IRDY] is turned off for about a second, however, the bypass mode is not entered for that period.
- When a value of the Frequency reference setting at Emergency-force drive [PA-02] cannot be reached while the upper limiter function is in operation, the delay time of the bypass function is integrated.



Precautions for Correct Use

- In the bypass mode, the following functions are operating automatically.

(1) Soft lock status (equivalent to [UA-16] = 01)
The parameters can be no longer changed. To restore the settings, turn off [EMF], restore the power and then change the parameters.

(2) Auto-reset (equivalent to [bb-10] = 00)
Auto-reset is disabled.

(3) STOP key disabled (equivalent to [AA-13] = 00)
Disable the STOP/RESET keys on the LCD operator.

(4) Operation enabled during the optional start ([oA-13] = 01, [oA-23] = 01, [oA-33] = 01)
The operation is allowed even in the optional start-up.

- The functions except for the above operate according to the settings.

8-4-7 Pulse Train Position Control

The pulse train can be input to the SA/SB terminal of the PG option unit to perform the position control.

In the pulse train position control mode, the acceleration/deceleration time is disabled.
The inverter output is performed in accordance with the speed command.
The larger the position loop back gain is, the shorter the acceleration/deceleration time becomes.

Start the input of the pulse train by assigning the 073[STAT] pulse train position command input permission to the input terminal and turning on the terminal.

The speed command in the pulse train position control mode is calculated by the following formula.

$$\text{Speed command (Hz)} = \frac{P}{2} \times Kv \times \frac{\Delta P}{4 \times ENC}$$

P : Number of motor poles

Kv : Position loop gain

ENC : Number of encoder pulses

ΔP : Position deviation

See also *7-2-16 Encoder Feedback Control* on page 7-37.

Precautions for Correct Use

Using this function requires the following settings.

- [AA121] Control method 10: Vector control with sensor
- [AA123] Vector control mode
  01: Pulse train position control mode
- [ob-10] Pulse train input SA/SB (Option) mode selection
  01: Pulse train position command
- In the pulse train position control mode, [POK] terminal is not turned ON.
- Only when Ub-03=02 (ND), you can select the vector control with a sensor by AA121/AA221.

● Setting Items for the Pulse Train Position Control

Item	Parameter	Data	Description	Default data
Control mode selection, 1st-motor	[AA121]	10	Vector control with sensor	00
Vector control mode selection, 1st-motor	[AA123]	01	Pulse train position control mode	00
Pulse train detection object selection	[ob-10]	00	Pulse train frequency command	00
		01	Pulse train position command	
Mode selection of pulse train input	[ob-11]	00	MD0: 90° phase difference pulse train	01
		01	MD1: Forward/reverse rotation command + pulse train	
		02	MD2: Forward rotation pulse train + reverse rotation pulse train	
Electronic gear setting point selection	[AE-01]	00	FB: Feedback side	00
		01	REF: Command side	
Electronic gear ratio numerator	[AE-02]	1 to 9999	Numerator of th electronic gear	1
Electronic gear ratio denominator	[AE-03]	1 to 9999	Denominator of th electronic gear	1
Position feed-forward gain setting*1	[AE-06]	0.00 to 655.35	Position feed forward gain.	0.00
Position loop gain setting*2	[AE-07]	0.00 to 100.00	Position loop gain.	0.50
Position bias setting	[AE-08]	-2048 to 2048	Set the bias value of the position.	0
Add frequency setting, 1st-motor	[AA106]	-590.00 to 590.00(Hz)	Frequency added when the [ADD] terminal is turned on.	0.00
Position deviation error mode selection	[bb-85]	00	The excessive position deviation signal [PDD] is output.	00
		01	The output of the excessive position deviation signal [PDD] and the position deviation error [E106] cause a trip.	
Position deviation error detection level	[bb-86]	0 to 65535 (×100pls)	The level for deciding an abnormal position deviation.	4096
Position deviation error detection time	[bb-87]	0.0 to 5.0(s)	Set the time until [PDD] is outputted or an error occurs.	0.5
Selecting the input terminal	[CA-01] to [CA-11]	014	ADD: Set speed addition	-
		072	PCLR: Position deviation clear	
		073	STAT: Input permission of the pulse train position command	
		074	PUP: Adding the position bias	
		075	PDN: Subtracting the position bias	
Selecting the output terminal	[CC-01] to [CC-07]	042	PDD: Excessive position deviation signal	-
Pulse train position deviation monitor	[dA-26]	-2147483647 to 2147483647	Displays the position deviation for the position command and position feedback.	-

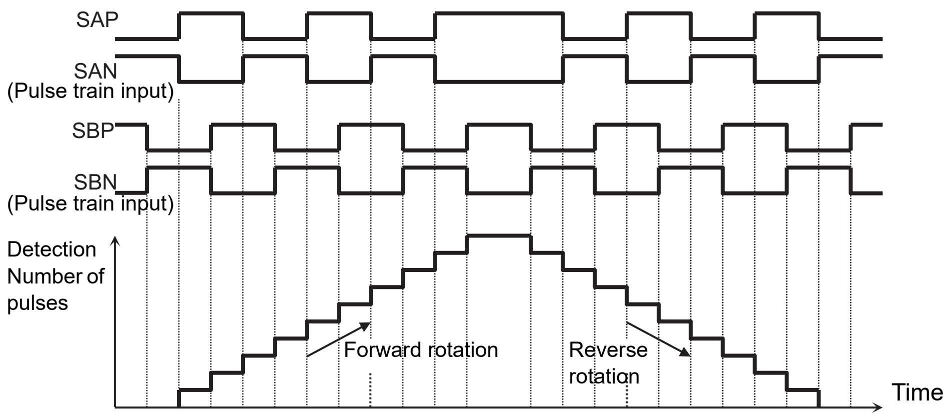
*1. It is recommended to start position control feedforward gain adjustment with AE-06 set to 2.00. To reduce the position deviation between the main and sub motors, increase the feedforward gain. If motor hunting occurs, reduce the feedforward gain.

*2. It is recommended to start position loop gain adjustment with AE-07 set to 2.00. To increase the positioning accuracy and the holding power, increase the position loop gain. If the position loop gain is set too high and causes hunting, decrease the position loop gain.

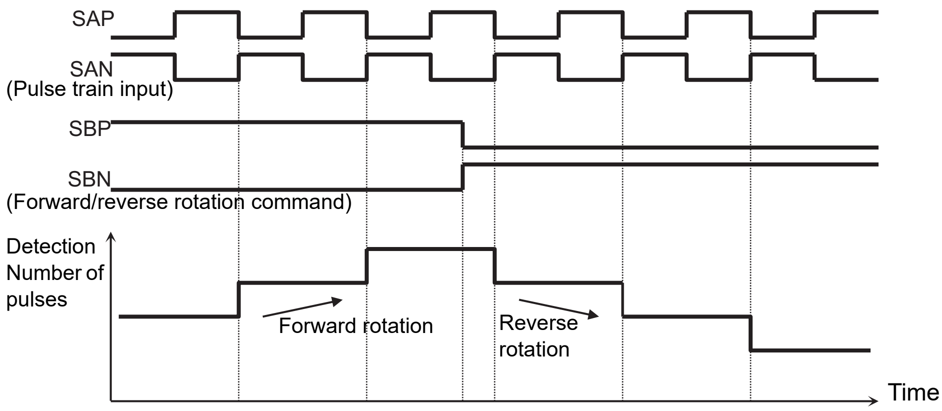
Input Mode for the Pulse Train Position Control

For more information about the pulse train input mode, refer to the following.

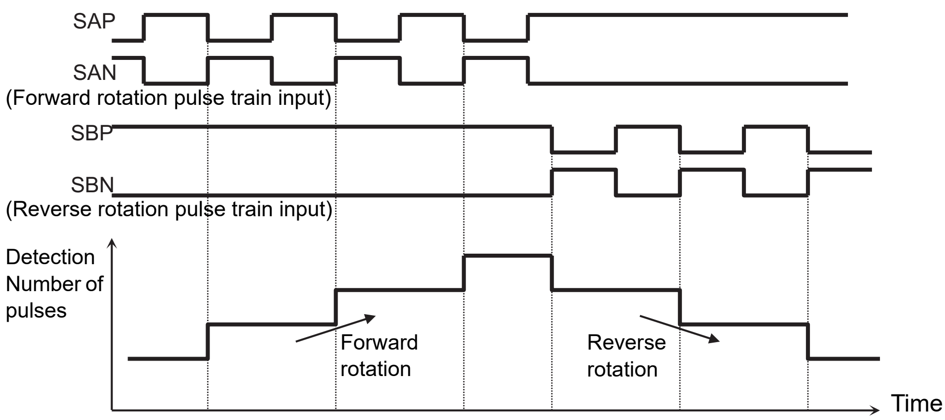
1. MD0: 90° phase difference pulse train



2. MD1: Forward/reverse rotation command + pulse train



3. MD2: Forward rotation pulse train + reverse rotation pulse train



8-4 Control Function

8

8-4-7 Pulse Train Position Control

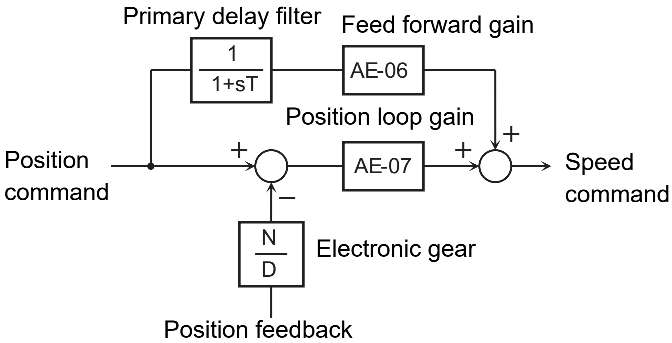
Electronic Gear Function

This function enables you to set the gain for the position command or position feedback to change the rotation ratio of the main and sub motors when performs the synchronous operation.

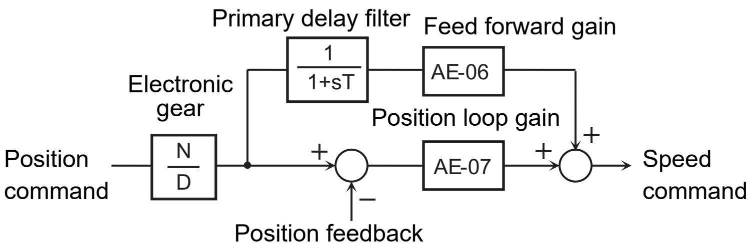
Precautions for Correct Use

Make sure that the setting of N/D is in the range of 1/50 ≤ N/D ≤ 20.
N: [AE-02] Electronic gear ratio numerator
D: [AE-03] Electronic gear ratio denominator

[AE-01] = 00 (feedback side)



[AE-01] = 01 (command side)



The filter time constant of the first-order lag filter is fixed to 10ms.

Synchronous Operation between Master and Slave

The master unit is operable with any control methods ([AA121]).

The salve unit performs the pulse train position control with vector control.
([AA121]=10,[AA123]=01,[ob-10]=01)
Assign the 073[STAT] pulse train position command input permission to an unused input terminal and turn on the terminal.
When the 073[STAT] is off, the pulse train input is not accepted.

<Setting Examples>

- Main motor: Number of encoder pulses is 1024
- Sub motor: Number of encoder pulses is 3000
- Main motor rotation speed : sub motor rotation speed =2 : 1

  For the operation with the above conditions, set the following data to the slave unit.

  [ob-11] Pulse train input mode selection : 00
  [AE-01] Electronic gear installation position : 01 (REF)
  [AE-02]Electronic gear ratio numerator : 3000
  [AE-03]Electronic gear ratio denominator : 1024 × 2 = 2048

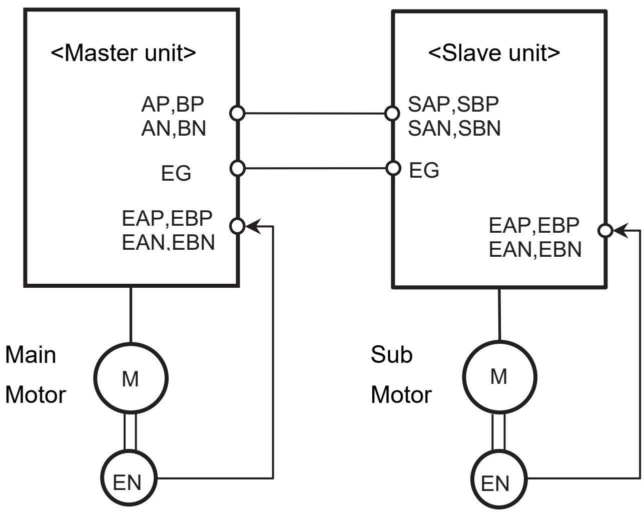
The encoder output [AP][BP][AN][BN] of the main motor is retrieved as the pulse train position command [SAP][SBP][SAN] [SBN] of the slave unit.

When the main motor speed is high, the change amount of the pulse per unit time is getting large and the speed command of the slave unit is also getting large. •When the main motor speed is low, the speed command of the slave unit is also getting small.

This causes the sub motor follows the main motor to operate.

Precautions for Correct Use

- It is recommended to start position control feedforward gain adjustment with AE-06 set to 2.00. To reduce the position deviation between the main and sub motors, increase the feedforward gain. If motor hunting occurs, reduce the feedforward gain.
- It is recommended to start position loop gain adjustment with AE-07 set to 2.00. To increase the positioning accuracy and the holding power, increase the position loop gain. If the position loop gain is set too high and causes hunting, decrease the position loop gain.



Position Bias Function

Used to apply a bias to the position command for the pulse train position control.

Add/subtract the set number of pulses to the change amount every 1 ms. Used to adjust the phase of the synchronization point during the synchronous operation, etc.

Set the bias amount to the [AE-08] position bias amount.

Assign either 074(PUP) or 075(PDN) of the input terminal function.
The bias amount is added while the PUP terminal is on and is subtracted while the PDN terminal is on.

Speed Bias Function

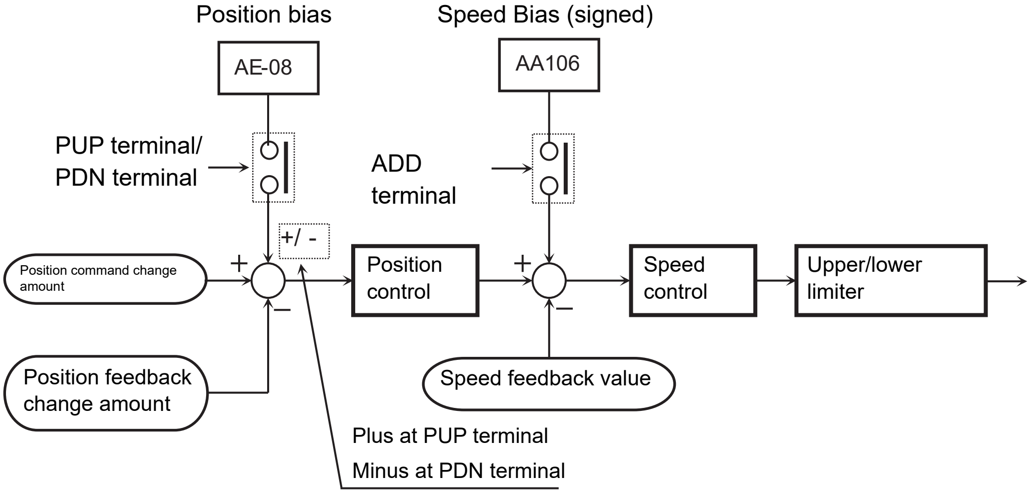
The function to apply a speed command bias when the pulse train position control is performed.

This function adds the set speed command bias at the start of the positioning process to enable quick startup.

Set the bias amount to the [AA106] adding frequency setting.

Assign 014(ADD) to any of the input terminal function. The bias amount is added/subtracted to the speed command while the ADD terminal is on.

Clear the speed command bias amount before the positioning process is completed. If the speed bias amount is added during stop, the stop position will be misaligned accordingly.



Detecting Excessive Position Deviation

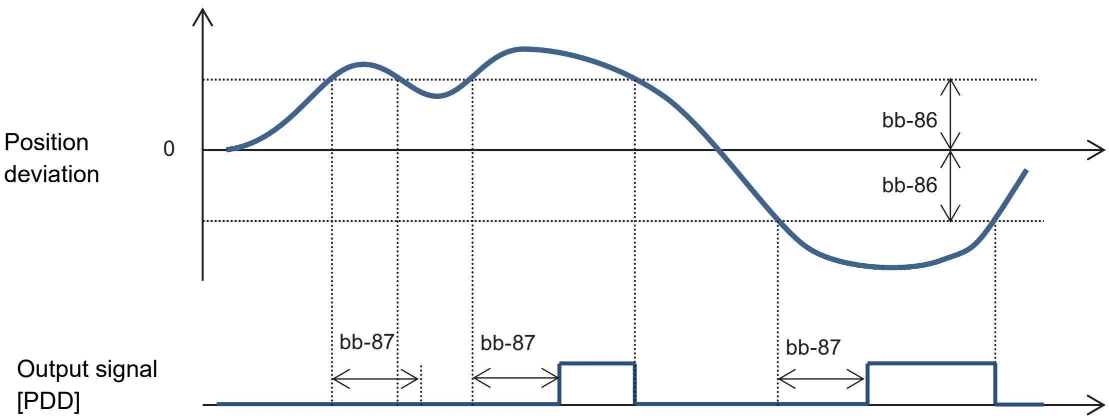
When the [bb-87] abnormal position deviation time passes with the deviation of the position feedback against the position command exceeding 100 pls of the [bb-86] abnormal position deviation detection level, it is determined to be abnormal.

The position deviation can be checked with the [dA-26] pulse train position deviation monitor.

When the behavior of the abnormal position deviation [bb-85] is 00, the output terminal [PDD] is turned on.

When the behavior of the abnormal position deviation [bb-85] is 01, the output terminal [PDD] is turned on and there is a trip with the [E106] position deviation error.

The position deviation is cleared with on/off of the input terminal 072[PCLR] position deviation clear or the trip reset.



8-4-8 Orientation Control

When [ORT] terminal is turned ON, the orientation control is activated.

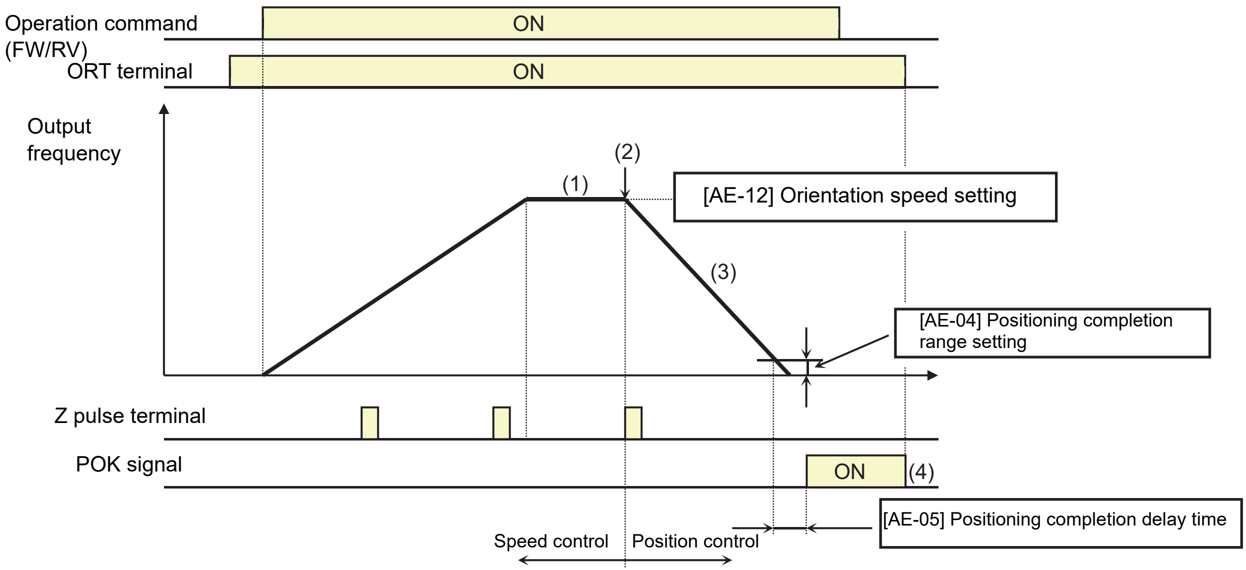
The orientation control is available for the pulse train position control.

Used with the [AA121] control method set to 10: vector control with sensor and the [AA123] vector control mode set to 00: speed torque control mode or 01: pulse train position control mode.

This function enables you to determine the position at any point within one rotation of the motor. This can be used for replacing the main axis of a machine tool, etc.

Precautions for Correct Use

- For using this function, it is required to set the [AA121] control method to 10: vector control with sensor and use the encoder feedback.
- See also *7-2-16 Encoder Feedback Control* on page 7-37.
- The Z pulse (one rotation position signal) is used as the reference signal for the positioning.
  (1) When the encoder is connected to the PG option unit:
  Input the Z pulse between EZP-EZN.
  (2) When the encoder is connected to the control circuit terminal block:
  Assign the input terminal function 109:PLZ to any of the input terminal and input the Z pulse.



(1) When the operation command is turned on while the [ORT] terminal is on, there is an acceleration until the [AE-12] orientation speed and a constant speed is entered.
(During the operation, the speed is shifted to the orientation speed as soon as the ORT terminal is tuned on.)

(2) After the orientation speed is reached, there is a shift to the position control when the first Z pulse is detected.

(3) The position control is operated at the [AE-11] orientation stop position + one rotation for the forward rotation and the [AE-11] orientation stop position - two rotations for the reverse rotation as a target value.
The larger the [AE-07] position loop gain is, the shorter the deceleration time becomes.
(The deceleration time setting is not followed.)

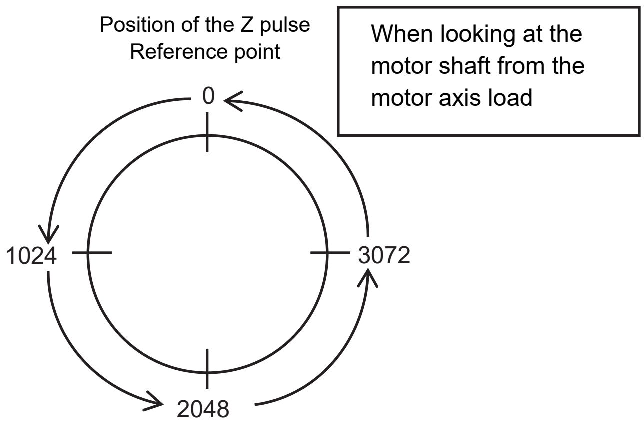
(4) When the [AE-05] positioning completion delay time passes after the remaining number of pulses enters the [AE-04] positioning completion range setting, the [POK] signal is output.
(The output continues until the ORT terminal is turned off.)
After the positioning completes, the servo lock status continues until the operation command is turned off.

● Parameter

Item	Function Code	Data/ Data Range	Description	Default data
Control mode selection, 1st-motor	[AA121]	10	Vector control with sensor	00
Vector control mode selection, 1st-motor	[AA123]	00	Speed/Torque control mode	00
		01	Pulse train position control mode	
Pulse train detection object selection	[CA-90]	00	Disabled	00
		01	Pulse train frequency command	
		02	Speed feedback	
		03	Pulse count	
Encoder constant setting	[CA-81]	32 to 65535	Setting of the number of pulses.	1024
Encoder position selection	[CA-82]	00	A phase precedes	00
		01	B phase precedes	
Encoder constant setting	[ob-01]	32 to 65535	Setting of the number of pulses.	1024
Encoder position selection	[ob-02]	00	A phase precedes	00
		01	B phase precedes	
Stop position selection of Home search function	[AE-10]	00	Parameter setting	00
		01	Option 1	
		02	Option 2	
		03	Option 3	
Stop position of Home search function	[AE-11]	0 to 4095	Note 2)	0
Speed reference of Home search function	[AE-12]	0.00 to 120.00(Hz)	Note 1)	0.00
Direction of Home search function	[AE-13]	00	Forward rotation	00
		01	Reverse rotation	
Positioning complete range setting	[AE-04]	0 to 10000(pls)	Set the value equivalent to encoder 4 multiplication	5
Positioning complete delay time setting	[AE-05]	0.00 to 10.00(s)	Set the time from the positioning completion to the output of the [POK] signal.	0.00
Position feed-forward gain setting	[AE-06]	0 to 655.35	Position feed forward gain.	0.00
Position loop gain setting	[AE-07]	0.00 to 100.00(rad/s)	Position loop gain.	0.50
Input terminal	[CA-01] to [CA-11]	069	ORT: Orientation	-
		109	PLZ: Pulse train input Z	
Output terminal	[CC-01] to [CA-06]	043	POK: Positioning completion	-
Relay output terminal	[CA-07]			

Precautions for Correct Use

- Do not set the orientation speed setting to a high frequency value because the inverter decelerates and completes positioning within 2 rotations. Decelerating to stop causes a rapid movement and gives a large impact on the equipment. The overvoltage protection may cause a trip.
- Set the orientation stop position by dividing one rotation to 4095 (0 to 4095) in the forward rotation direction starting the reference point. (4096 division regardless of the number of pulses for the encoder.)
- When ORT terminal with the orientation control is turned OFF during motor operation, the motor is decelerated/stopped and the output is cut off. When the motor is operated again, turn the operation command OFF.
  The reference point is where the pulse is input between EZP-EZN and the stop target position is located in a layout shown in the diagram to the left from the viewpoint of the motor axis load. (For a positive phase connection)
  Do not start the positioning process until the output frequency reaches the orientation speed setting.



Adjustment of Stop Position at the Positioning Control

Adjusting the stop position at the positioning operation

Occurrence	Workaround Examples
Stop position is short Position shortens	• Adjust by increasing [AE-64] by 5%. or • Adjust by increasing [AE-65] by 5%.
Stop position is short Position shortens	• Adjust by decreasing [AE-64] by 5%. or • Adjust by decreasing [AE-65] by 5%.

● Parameter

Item	Function Code	Data/ Data Range	Description	Default data
Deceleration stop distance calculation Gain	[AE-64]	50.00 to 200.00(%)	Adjust against the stop distance.	100.00
Deceleration stop distance calculation Bias	[AE-65]	0.00 to 655.35(%)	Adjust the output frequency for the positioning operation.	0.00

Adjustment of Gain at the Positioning Control

Adjusting the control gain at the positioning operation

Occurrence	Workaround Examples
The follow-up for the positioning stop is bad.	• Adjust by increasing [AE-07] by 5%. or • Adjust by increasing [AE-67] and [AE-66] by 1%.
An abrupt behavior occurs at the positioning stop.	• Adjust by decreasing [AE-07] by 5%. or • Adjust by decreasing [AE-67] and [AE-66] by 1%.
An axis vibrates during the stop	Adjust by decreasing [AE-07] by 5%.

● Parameter

Item	Function Code	Data/ Data Range	Description	Default data
Position loop gain setting	[AE-07]	0.00 to 100.00	Adjust the position loop gain.	0.50
Speed Limit in APR control	[AE-66]	0.00 to 100.00(%)	Limit the output at the positioning.	1.00
APR start speed	[AE-67]	0.00 to 100.00(%)	Set the speed at the positioning start.	0.20

Precautions for Correct Use

- Set [AE-66] and [AE-67] to the ratios against the [Hb105] maximum frequency.
- Once the positioning operation is entered, the control starts at the speed set to the [AE-67] APR start speed.
- During the positioning operation, the speed is limited to that set to the [AE-66] APR control speed limit. During the positioning, the acceleration/deceleration time is 0 and the output follows the internal position control results.
- For the positioning operation, specify the stop behavior with the following functions
  - Absolute value control
  - Zero return
  - Orientation
  - SON terminal operation (at position servo)
  - DC braking (at position servo lock control)

8-4-9 Absolute Position Control

For the absolute position control, there is a move to a target position according to

(1) position command,

(2) speed command (frequency command),

(3) acceleration time, deceleration time, and then the position servo lock status is entered. (The servo lock status is kept until the operation command is turned off.)

For the frequency command and acceleration/deceleration command at the absolute position control, those selected at that time are followed.

When the position command is small, there may be the deceleration and then positioning without reaching the speed command value.

The direction of the operation command(FW, RV) in the absolute position control mode does not have a meaning as the rotation direction. They behave as the signals for operating/stopping. The rotation direction specifies the forward rotation if (target position - current position) is plus and the reverse rotation if minus.

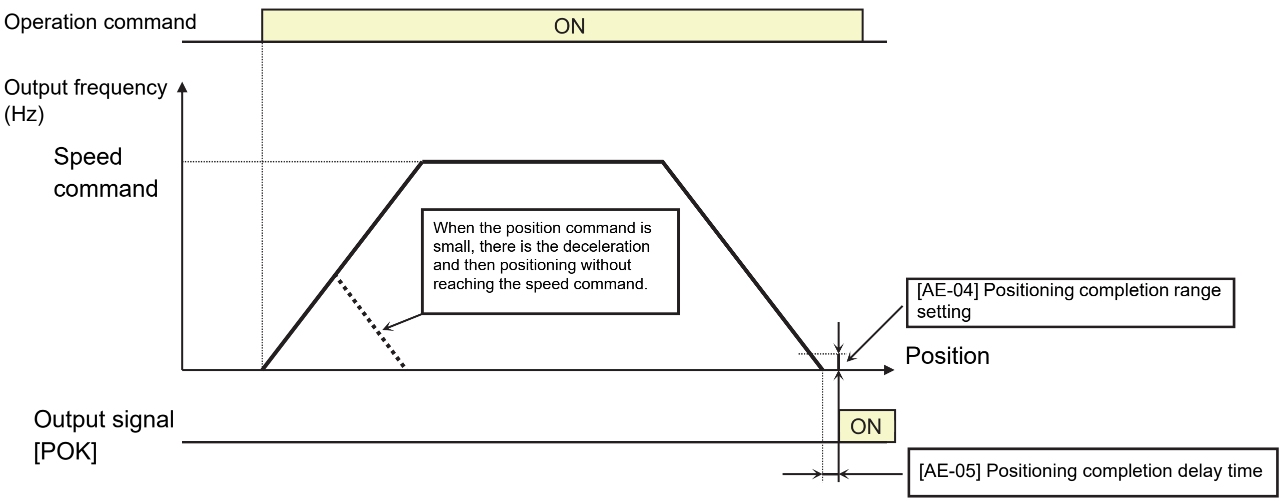
When the zero return operation (as discussed later) is not performed, if the [AE-61] current position memory at power-off is 00, the position at power-on is treated as the origin (position = 0). •If the [AE-61] is 01, the position at the previous power-off is treated as the (position = 0).

When the deviation between the position command and current position is 0, if the operation command is turned on, the positioning operation is performed immediately.

The current position command can be monitored with the [FA-20] position command monitor.

Precautions for Correct Use

- For using this function, set the [AA121] control method to 10 (vector control with sensor, and set the [AA123] vector control mode selection to 02: absolute position control or 03: high resolution absolute position control.
- This function requires using the encoder feedback
- See also *7-2-16 Encoder Feedback Control* on page 7-37.
- When the [AA123] vector control mode selection is set to 03: high resolution absolute position control, the control is performed with the 4 multiplication number of pulses used for the internal calculation.
  (Set the multistage position command and position range designation with the 4 multiplication accuracy.)
- The position command can be switched at a maximum of 16 stages in combination of the input terminals.
- The trip reset or reset signal input does not clear the current position monitor.
- When the PCLR terminal is assigned, turning on the PCLR terminal clears the current position monitor.
- In the absolute position control mode, the ATR terminal is disabled. (The torque control does not operate.)
- In the absolute position control mode, the STAT terminal is disabled. (The pulse train position control does not operate.)
- When the absolute position control is enabled (AA123=02, 03), the orientation function is disabled.



Shortest Position Control

When the [AE-56] positioning mode selection is set to 01 (without limit), the rotation direction is determined so that the moving distance to a target position is the shortest for applications such as a turntable.

(Application example) A turntable with eight positioning points

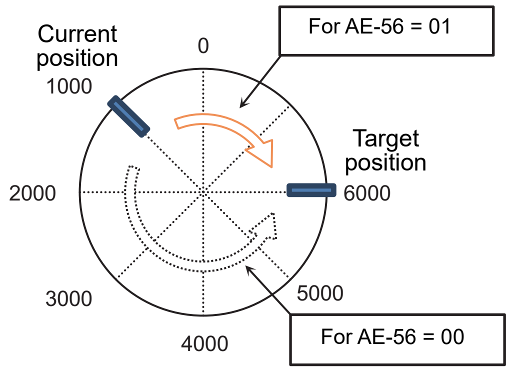
Assume a case of moving from the current position (1000 pulse) to the target position (6000 pulse).

When [AE-56] = 00 (with limit), Since (target position) - (current position) = +5000 pulse, the rotation is in the forward direction.

When [AE-56] = 01 (without limit), the move is in the reverse direction with the shorter moving distance comparing the forward and reverse directions.

Moving distance in the forward direction: +5000 pulse

Moving distance in the reverse direction: -3000 pulse

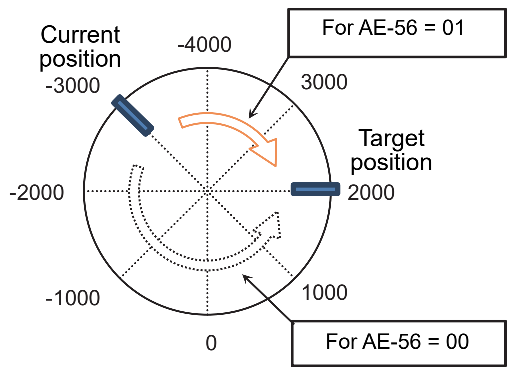


For the above example, Set the [AE-52] forward rotation side position range designation = 7999 and [AE-54] reverse rotation side position rang designation = 0.
Also, each positioning point is required to be set in this range.

Depending on the setting for the position range designation, the following settings are also allowed.

[AE-52]=3999

[AE-53]=-4000



Precautions for Correct Use

- When [AE-56] = 01, the [E104] position control range error does not occur.
- In the upper case, when moving the position of 7000 pulse to that of 1000 pulse, the forward rotation side position range (7999) is exceeded, however, the current position monitor gets back to 0.

Multistage Position Switching Function

By combining 076 to 079 ([CP1] terminal to [CP4] terminal), the multistage position commands 0 to 15 can be switched.

For setting the position command, use the multistage position command 0 to 15 ([AE-20] to [AE-50]).

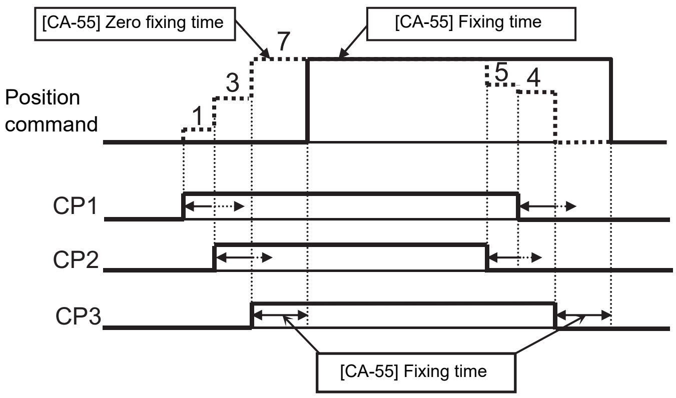
When there no terminal assignments, the multistage position command 0 ([AE-20]) becomes the position command.

Position command	CP4	CP3	CP2	CP1
Multistage position 0	OFF	OFF	OFF	OFF
Multistage position 1	OFF	OFF	OFF	ON
Multistage position 2	OFF	OFF	ON	OFF
Multistage position 3	OFF	OFF	ON	ON
Multistage position 4	OFF	ON	OFF	OFF
Multistage position 5	OFF	ON	OFF	ON
Multistage position 6	OFF	ON	ON	OFF
Multistage position 7	OFF	ON	ON	ON
Multistage position 8	ON	OFF	OFF	OFF
Multistage position 9	ON	OFF	OFF	ON
Multistage position 10	ON	OFF	ON	OFF
Multistage position 11	ON	OFF	ON	ON
Multistage position 12	ON	ON	OFF	OFF
Multistage position 13	ON	ON	OFF	ON
Multistage position 14	ON	ON	ON	OFF
Multistage position 15	ON	ON	ON	ON

Precautions for Correct Use

- When inputting the multistage position command, the waiting time until the terminal input is fixed can be set. The transition state before the input is fixed can be prevented from being adopted as the input.
- With the [CA-55] multistage input fixing time, the fixing time can be adjusted. Finally, after the [CA-55] setting time passes without any changes of the input, the data is fixed. (Note that a longer fixing time causes a bad performance of the input response.)

Example using [CP1] to [CP3] as the input terminals



Speed/Position Switching Function

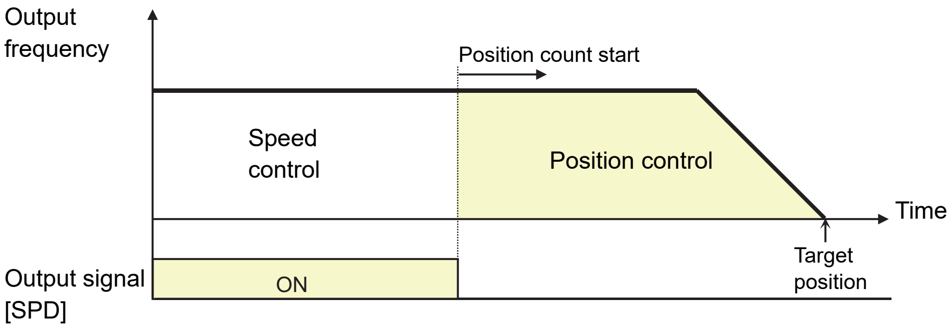
This function is used to switch the speed control and the position control. Allocate any of the input terminal functions to 084 (SPD: (Speed/Position switching)).

Turn on this terminal when the speed control operation is performed in the absolute position control mode.

While the 084[SPD] terminal is on, the current position monitor is 0. Therefore, when the [SPD] terminal is turned off during the operation, the position control operation starts at that time. (Speed/position switching)

Precautions for Correct Use

- When switching the speed to position, if the deviation between the position command and current position is 0, the stop operation is performed immediately.
  (Depending on the position loop gain, there is a possibility of hunting)
- Also, while the [SPD] terminal is on, there is a move in the direction depending on the operation command. For switching the speed to position, note the sign of the command.



Teaching Function

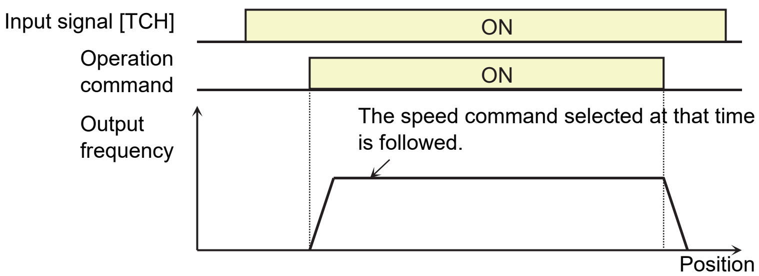
Function to rotate and stop a motor and store the position as a position command at any position command area.

Assign 110[TCH].
When the [AA123] vector control mode selection is 02 (absolute position control) or 03 (high resolution absolute position control), the teaching terminal is functioning.

(a) Select the position command to set at the [AE-60] teaching selection.

(b) Operate the work.

Enter the operation command while the [TCH] terminal is on. • For the speed command and acceleration/deceleration command at this time, those selected at that time are followed.



(c) Once the desired position is reached, press the save (2 key) on the LCD operator.

(d) The current position is set in the are corresponding to the position command destination set to the [AE-60] teaching selection. (However, [AE-60] itself is not saved. After power-off or the reset, it becomes 00 (X00).)

[AE-60] setting value	Position command to be set
00	[AE-20]: Multistage position command 0
01	[AE-22]: Multistage position command 1
02	[AE-24]: Multistage position command 2
03	[AE-26]: Multistage position command 3
04	[AE-28]: Multistage position command 4
05	[AE-30]: Multistage position command 5
06	[AE-32]: Multistage position command 6
07	[AE-34]: Multistage position command 7
08	[AE-36]: Multistage position command 8
09	[AE-38]: Multistage position command 9
10	[AE-40]: Multistage position command 10
11	[AE-42]: Multistage position command 11
12	[AE-44]: Multistage position command 12
13	[AE-46]: Multistage position command 13
14	[AE-48]: Multistage position command 14
15	[AE-50]: Multistage position command 15

If the power supply of the inverter control circuit (R0,T0) is input, the teaching is allowed. Since operating the work with an external unit, etc. also enables the current position monitor to work, the teaching is allowed even if the operation is performed without an inverter.

Precautions for Correct Use

However, make sure that the power supply of the inverter power circuit (R, S, T) is shut off. •Or make sure that the connection between the output of the inverter (U, V, W) and the motor is shut off. Otherwise, you run the risk of injury and damage.

Zero Return Function

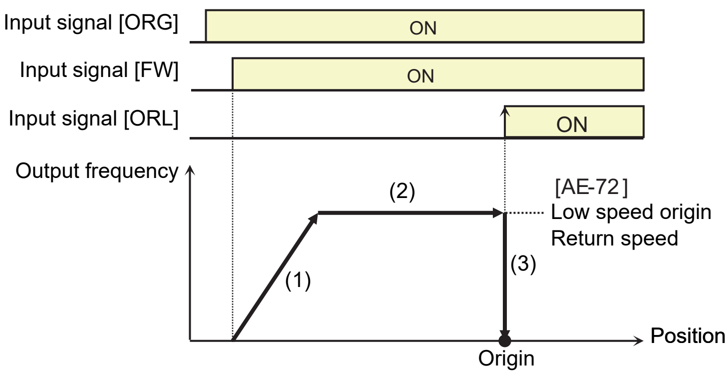
With the [AE-70] zero return mode selection, three types of zero return operations are performed. Once the zero return completes, the current position is cleared (= 0).

The direction of the [AE-71] zero return is selected with the zero return direction selection.

When the zero return is not performed, the position at power-on follows the [AE-61] current position memory at power-off and the position control is performed.

The Zero Return Function is activated only in absolute position control. When ORG terminal is turned OFF while the zero return operation, the operation is shifted to absolute position control. Allocate any of input terminal function to 65 (SON (Servo ON)). After turning [SON] terminal ON, start the zero return function.

● Low Speed Zero Return ([AE-70] = 00)

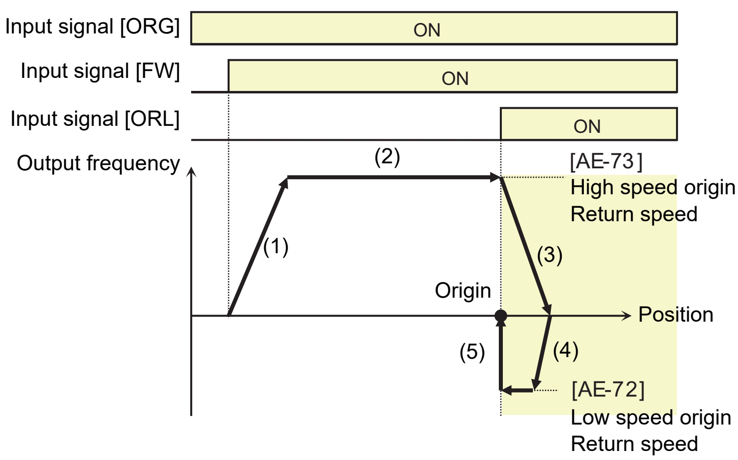


Follows the acceleration time to accelerate to the low speed zero return speed. (1)

Operates at the low speed zero return speed. (2)

Positioning when the ORL signal is input. (3)

● High Speed Zero Return 1 ([AE-70] = 01)



Follows the acceleration time to accelerate to the high speed zero return speed. (1)

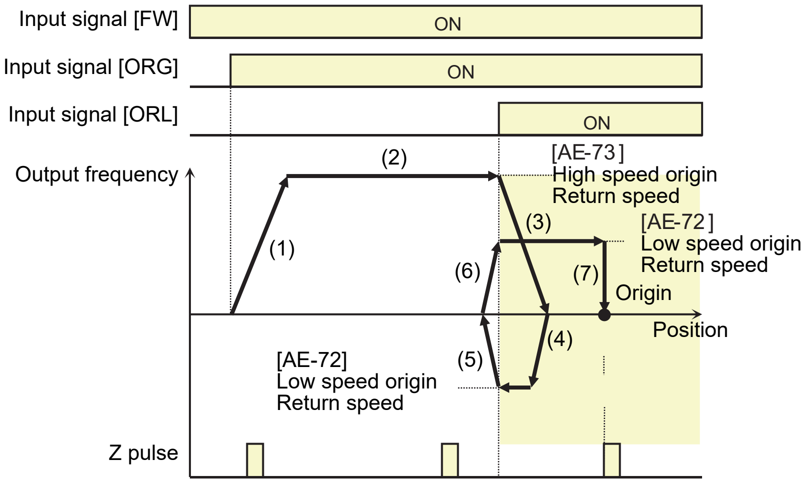
Operates at the high speed zero return speed. (2)

Starts the deceleration when the ORL signal is turned on. (3)

Operates in the reverse rotation direction at the low speed zero return speed. (4)

Positioning when the ORL signal is turned off. (5)

● High Speed Zero Return 2 ([AE-70] = 02)



Follows the acceleration time to accelerate to the high speed zero return speed. (1)

Operates at the high speed zero return speed. (2)

Starts the deceleration when the ORL signal is turned on. (3)

Operates in the reverse rotation direction at the low speed zero return speed. (4)

Starts the deceleration when the ORL signal is turned off. (5)

Operates in the forward rotation direction at the low speed zero return speed. (6)

Positioning at the first Z pulse after the ORL signal is turned on. (7)

Forward/Reverse Drive Stop Function (FOT/ROT)

Function to prevent the operation range from being deviated using the signal from the control range limit switch.

The torque limit is restricted to 10% on the forward rotation side when the 082[FOT] terminal is input and on the reverse rotation side when the 083[ROT] terminal is input. This is applicable as the limit switch at the edge of the machine.

At both ends of the machine edge, provide a mechanical mechanism such as a stopper.

Position Range Designation Function

Specify the position control range at the [AE-52] position range designation (forward rotation side) /[AE-54] position range designation (reverse rotation side).

When the current position monitor exceeds this setting, there is a trip with the position control range error (E104) and the inverter becomes the free-running status.

The multi-step position command set in the Multi-step Position Command 0 to 7 (AE-20 to AE-50) is subject to these upper limit setting.

You cannot set a position command value over the position limit setting.

Position Control Related Parameters

Item	Function Code	Data/Data Range	Description
Control Method	[AA121]	10	Vector control with sensor*1
Vector control mode selection	[AA123]	02	Absolute position control
		03	High resolution absolute position control
Multistage position command 0	[AE-20]	[AE-54] to [AE-52]	Set the position command for the multistage speed command to each.
Multistage position command 1	[AE-22]	[AE-54] to [AE-52]	
Multistage position command 2	[AE-24]	[AE-54] to [AE-52]	
Multistage position command 3	[AE-26]	[AE-54] to [AE-52]	
Multistage position command 4	[AE-28]	[AE-54] to [AE-52]	
Multistage position command 5	[AE-30]	[AE-54] to [AE-52]	
Multistage position command 6	[AE-32]	[AE-54] to [AE-52]	
Multistage position command 7	[AE-34]	[AE-54] to [AE-52]	
Multistage position command 8	[AE-36]	[AE-54] to [AE-52]	
Multistage position command 9	[AE-38]	[AE-54] to [AE-52]	
Multistage position command 10	[AE-40]	[AE-54] to [AE-52]	
Multistage position command 11	[AE-42]	[AE-54] to [AE-52]	
Multistage position command 12	[AE-44]	[AE-54] to [AE-52]	
Multistage position command 13	[AE-46]	[AE-54] to [AE-52]	
Multistage position command 14	[AE-48]	[AE-54] to [AE-52]	
Multistage position command 15	[AE-50]	[AE-54] to [AE-52]	
Position range designation (forward rotation side)	[AE-52]	Condition 1: 0 to +268435455 Condition 2: 0 to +1073741823	Condition 1: Except for the condition 2 Condition 2: [AA121] = 10, [AA123] = 03
Position range designation (reverse rotation side)	[AE-54]	Condition 1: -268435455 to 0 Condition 2: -1073741823 to 0	Condition 1: Except for the condition 2 Condition 2: [AA121] = 10, [AA123] = 03
Position command monitor	[FA-20]	Condition 1: -268435455 to +268435455 Condition 2: -1073741823 to +1073741823	Condition 1: Except for the condition 2 Condition 2: [AA121] = 10, [AA123] = 03

*1. When the sensor vector control is used, set load specification selection (Set Ub-03 to 02).

Position Memory at Power-Off

This function is used to set the current position to the current position monitor when the power supply of an inverter is cycled after the position data is stored in EEPROM at inverter power-off. The home position fixed with the homing function can be used after the power supply is cycled.

By setting the [AE-61] current position memory at power-off to 01, the current position data at power-off can be stored.

Use this for the application where the shaft of the motor is locked at power-off.

Precautions for Correct Use

- For the machine of which the shaft idles at power-off, there is likely to be a gap between the stored position and the current position when the power is turned on again.
- This function is used to provide memory for position when a power supply in a main circuit is cut off. Note that the position when the power is cut off during the operation only in control power supply at 24 V can not be stored.
- Motor's rotation at the power-off may cause a gap between the stored position and the current position since the rotation amount is not counted. When the power supply of the inverter is turned off, take the action to disallow the rotation with a brake.
- If the motor rotates after the power supply of the inverter is turned OFF, operate an inverter after a homing position is determined with the homing function.
- Even if a brake stops the motor rotation at the power-off, there is likely a gap corresponding to the backlash for the brake. The gap accumulates every power-off/on and ends up the expansion. So, reset the gap once several times with the homing function.

Position Data Preset

When the 085[PSET] terminal is turned on, the current position monitor (can be monitored with [dA-20]) is overwritten with the value set to the [AE-62] preset position data.

Available for restarting in the middle of the positioning process, etc. (Data is overwritten at the ON edge of the [PSET] terminal.)

Position Control Related Parameters

Item	Function Code	Data/ Data Range	Description	Default data
Position control mode selection	[AE-56]	00	With limit	00
		01	Without limit	
Teach-in function target selection	[AE-60]	00	Multistage position command 0 (AE-20)	00
		01	Multistage position command 1 (AE-22)	
		02	Multistage position command 2 (AE-24)	
		03	Multistage position command 3 (AE-26)	
		04	Multistage position command 4 (AE-28)	
		05	Multistage position command 5 (AE-30)	
		06	Multistage position command 6 (AE-32)	
		07	Multistage position command 7 (AE-34)	
		08	Multistage position command 8 (AE-36)	
		09	Multistage position command 9 (AE-38)	
		10	Multistage position command 10 (AE-40)	
		11	Multistage position command 11 (AE-42)	
		12	Multistage position command 12 (AE-44)	
		13	Multistage position command 13 (AE-46)	
		14	Multistage position command 14 (AE-48)	
		15	Multistage position command 15 (AE-50)	
Current position saving at power-off	[AE-61]	00	Disabled	00
		01	Enabled	
Preset position data	[AE-62]	Condition 1: -268435455 to +268435455 Condition 2: -1073741823 to +1073741823	Condition 1: Except for the condition 2 Condition 2: [AA121] = 10, [AA123] = 03	0
Reset selection	[CA-72]	02	Enabled Only at Trip (On to Release)	-
		03	Enabled Only at Trip (Off to Release)	
Input terminal function	[CA-01] to [CA-11]	072	PCLR: Position deviation clear	-
		076	CP1: Position command selection 1	
		077	CP2: Position command selection 2	
		078	CP3: Position command selection 3	
		079	CP4: Position command selection 4	

Zero Return Related Parameters

Item	Function Code	Data/ Data Range	Description	Default data
Homing function selection	[AE-70]	00	Low speed zero return	00
		01	High speed zero return 1	
		02	High speed zero return 2	
Direction of homing function	[AE-71]	00	Forward rotation	00
		01	Reverse rotation	
Low-speed of homing function	[AE-72]	0.00 to 10.00(Hz)	Speed in the low speed zero return mode.	0.00
High-Speed of homing function	[AE-73]	0.00 to 590.00(Hz)	Speed in the high speed zero return mode.	0.00
Input terminal function	[CA-01] to [CA-11]	072	PCLR: Position deviation clear	-
		076	CP1: Position command selection 1	
		077	CP2: Position command selection 2	
		078	CP3: Position command selection 3	
		079	CP4: Position command selection 4	
		080	ORL: Origin limit signal	
		081	ORG: Zero return start signal	
		082	FOT: Forward rotation drive stop	
		083	ROT: Reverse rotation drive stop	
		084	SPD: Speed/position switching	
		085	PSET: Position data preset	
		110	TCH: Teaching	

8-4-10 Servo Lock (SON)

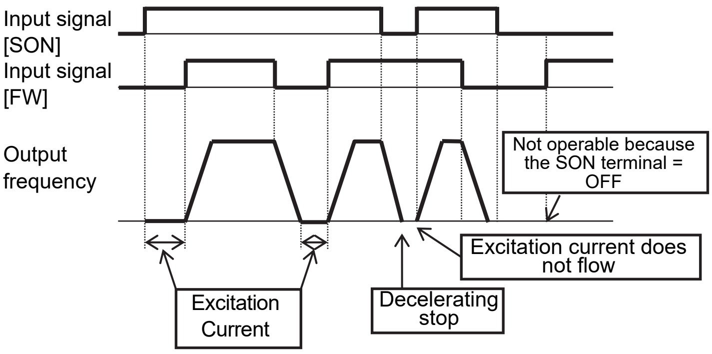
This function makes a motor the servo lock status with the servo lock terminal [SON] command.

Assigning the input terminal function 054[SON] triggers this function.

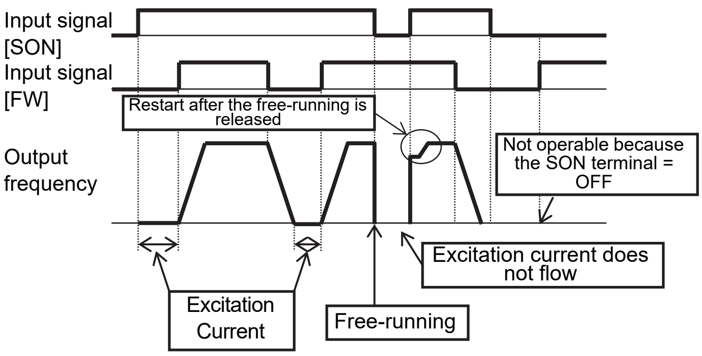
Precautions for Correct Use

- Inputting the servo ON (SON) signal causes the motor shaft to be locked.
  To make a motor the servo lock status, set Control Method [AA121] to 10 (Sensor vector control), [AA123] Vector Control Mode Selection to 02 (Absolute position control) or to 03 (High-resolution absolute position control).
  When you select the setting other than mentioned earlier, this is a speed servo lock. The stop position will be misaligned when the speed is offset.
- This is valid when the control method [AA121] is 09: IM 0 Hz range sensorless vector control or 10: IM vector control with sensor.
- When [SON] is assigned to the input terminal function, the operation is not accepted unless [SON] is turned on.
- During the operation, when [SON] is turned off, there is an operation according to the [AA115] stop method selection. If the free-running occurs, the settings for the restart after releasing the free-running is followed at the time of restart.
- When the backup excitation function [FOC] is assigned to the input terminal, the servo lock function [SON] does not operate.

- For the [AA115] stop method selection is 00



- For the [AA115] stop method selection is 01



● Parameter

Item	Parameter	Data	Description	Default data
Input terminal function	[CA-01] to [CA-11]	054	Servo lock function [SON]	-
STOP mode selection, 1st-motor	[AA115]	00	Perform the deceleration stop when the operation command is off.	00
		01	Perform the free-running when the operation command is off.	
Restart mode after FRS release	[bb-40]	00	Perform the 0 Hz restart.	00
		01	Perform the frequency matching restart.*1	
		02	Perform the frequency pull-in restart.*2	
		03	XXXXXX	
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	Set the waiting time after an operation command.	0.3

*1. Refer to *7-5-3 Frequency Matching Start* on page 7-65.

*2. Refer to *7-5-4 Frequency Pull-in Start* on page 7-69.

Precautions for Correct Use

- If the torque at the time of start is insufficient, it may be improved by adjusting the starting boost amount [HC111][HC112] or speed response [HA115].
  Refer to *7-2 Selection of Motor Control Methods* on page 7-5.
- If the torque at the time of start is insufficient, it may be improved by using the torque bias function.
  Refer to *7-3-6 Torque Bias Function* on page 7-54.

8-5 Cooling Fan Control

[bA-70] Setting the selection of the cooling fan operation allows you to set the operation of the cooling fan.

For [bA-70]=00, the cooling fan runs all the time.

For [bA-70]=01, the cooling fan runs when the inverter becomes the output status. The fan runs for three minutes after the operation stops.

For [bA-70]=02, the cooling fan runs depending on the temperature of the head sink detected by the inverter.

Precautions for Correct Use

When the instantaneous power failure or power-off occurs while the cooling fan is running, it is suspended regardless of the [bA-70] cooling fan operation, and automatically resumes after the restoration of power.

● Parameter

Item	Parameter	Data	Description	Default data
Cooling FAN control method selection	[bA-70]	00	Running all the time: The fan runs all the time.	00
		01	Running in operation: The fan runs automatically when the inverter becomes the operating status. The fan continuously runs for three minutes after the operation stops and then automatically stops. The cooling fan runs when the head sink temperature of the inverter exceeds 60°C. If the head sink temperature is under 50°C for more than three minutes, the cooling fan is allowed to be stopped.	
		02	Running depending on the temperature: The cooling fan runs when the head sink temperature of the inverter exceeds 40°C. If the head sink temperature is under 40°C for more than three minutes, the cooling fan automatically stops.	

- For checking the head sink temperature, see *5-7 Cooling Fin Temperature Monitor* on page 5-14.
- For the replacement timing of the cooling fan, see *5-9 Life Monitor* on page 5-17.

8-6 Alarm Signal

8-6-1 Alarm Signal (AL)

If an overcurrent, overvoltage, or some other error occurs, the inverter shuts off its output and generates an alarm signal. This is called a “Trip”.

A trip state can be canceled by resetting the inverter, by which the alarm signal also turns OFF.

To reset the inverter, press the STOP/RESET key or input the reset terminal. However, you may not be able to reset some trip factors by using these methods. In such case, cycle the power supply.

The [AL] function is assigned in the initial state to the contact c relay [CC-07] of AL1-AL0 and AL2-AL0.

You can set the output specifications of contacts a and b to output terminals 11-15, relay output terminals 16A-16C, AL1-AL0, and AL2-AL0 individually.

Precautions for Correct Use

When an inverter outputs error by an interruption of its power supply, in some cases, changes of wirings and contact selections may alleviate this symptom.

Alarm Relay AL

The operations of AL1-AL0 and AL2-AL0 are as follows.

[CC-17]	Control power	Inverter error output	Output terminal state	
			AL1-AL0	AL2-AL0
00	On	Abnormal	Close	Open
		Normal	Open	Close
	Off	-	Open	Close
01	On	Abnormal	Open	Close
		Normal	Close	Open
	Off	-	Open	Close

The specifications of the relay contacts AL1-AL0 and AL2-AL0 are as follows.

		Resistive load	Inductive load
AL1-AL0	Maximum contact capacity	AC250V,2A DC30V,3A	AC250V,0.2A DC30V,0.6A
	Minimum contact capacity	AC100V,10mA DC5V,100mA	
AL2-AL0	Maximum contact capacity	AC250V,1A DC30V,1A	AC250V,0.2A DC30V,0.2A
	Minimum contact capacity	AC100V,10mA DC5V,100mA	

Relay Output 16C

The operations of 16C are as follows.

[CC-16]	Control power	Functional operation	Output terminal state
00	On	ON	Close
		OFF	Open
	Off	-	Open
01	On	ON	Open
		OFF	Close
	Off	-	Open

The specifications of the relay contact 16C are as follows.

		Resistive load	Inductive load
16C	Maximum contact capacity	AC250V,2A	AC250V,1A
	Minimum contact capacity	AC250V,1mA	

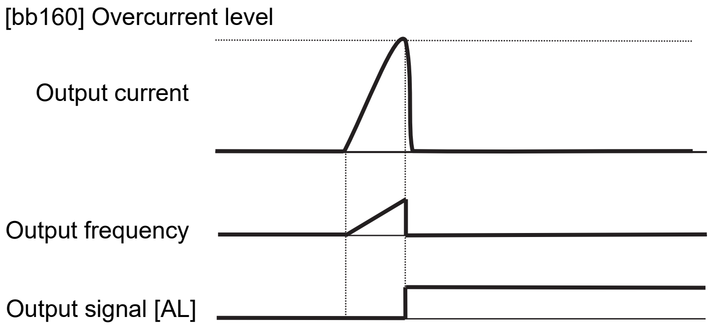
● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	017	An alarm signal is output to the output terminal to which 017 [AL] has been assigned. ON: When an alarm has occurred OFF: When no alarm has occurred
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		
Output terminal function selection	[CC-11] to [CC-15]	00	Operates as contact a (NO).
		01	Operates as contact b (NC).
1a relay output terminal function selection a/b (NO/NC) selection	[CC-16]	00	Operates as contact a (NO).
		01	Operates as contact b (NC).
1c relay output terminal function selection a/b (NO/NC) selection	[CC-17]	00	See the table at the upper left.
		01	

Contact a:
The contact closes when the functional operation is ON and opens when OFF.

Contact b:
The contact closes when the functional operation is OFF and opens when ON.

Example: [E001] occurred when the current reached the overcurrent level.



8-6-2 Fatal Fault Signal (MJA)

The following table shows signals that are output when any of trips occurs. It is different form the Output signal 017 (AL) that will be output for all trips.

This signal converts the trips caused by a hardware failure.

Trips that are evaluated as serious faults are as follows.

Precautions for Correct Use

The inverter hardware may have a fault when this signal is output. Check the error history and deal with the situation appropriately.

Error code	Name	Description
E008	Memory element error	The memory element of the inverter is under an abnormal condition.
E010	Current detector error	The current detector of the inverter is under an abnormal condition.
E011	CPU error	The drive CPU of the inverter is under an abnormal condition.
E014	Ground fault error	The inverter has a ground fault.
E019	Temperature detector error	The temperature detector of the inverter is under an abnormal condition.
E020	Cooling fan rotation speed reduction error	The cooling fan rotation speed of the inverter has reduced, preventing the inverter from dissipating heat.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	018	The signal will be output when a serious fault error occurs in the output terminal to which 018 [AL] has been assigned. OFF: No serious fault has occurred. ON: A serious fault has occurred.
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		

8-6-3 Alarm Code

Alarm code is used to output the inverter trip factor as a 3-bit or 4-bit code signal.

Assign the output terminal functions 084 [AC0] to 087 [AC3] alarm code to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

Assign 084 [AC0] to 087 [AC3] to the output terminal functions [CC-01] to [CC-07].

The 4-bit output mode is selected when 087 [AC3] is assigned to the output terminal function, whereas the 3-bit output mode is selected when it is not assigned.

The table below shows the alarm codes to be output.

Precautions for Correct Use

- The output state switches depending on whether 087 [AC3] has been set to [CC-01] to [CC-07]. The 4-bit output mode is selected when 087 [AC3] has been set, and the signals 084 [AC0], 085 [AC1], 086 [AC2], and 087[AC3] will be output in accordance with the table below even when all of them have not been set.
- The signals will be output in the 3-bit mode when one of or any pair from 084 [AC0], 085 [AC1], and 086 [AC2] have been set. The signals 084 [AC0], 085 [AC1], and 086 [AC2] will be output in accordance with the table below even when all of them have not been set.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	084 to 087	084: [AC0] alarm code 0 085: [AC1] alarm code 1 086: [AC2] alarm code 2 087: [AC3] alarm code 3 The signal is output when a trip occurs at the output terminal assigned.
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		

Alarm Code

Output terminal function				When a 4-bit code is selected (with [AC3])		When a 3-bit code is selected (without [AC3])	
AC3	AC2	AC1	AC0	Cause code	Trip description	Cause code	Trip description
0	0	0	0	Normal	Normal	Normal	Normal
0	0	0	1	E001	Overcurrent error	E001	Overcurrent error
0	0	1	0	E005,E038, E039	Motor overload error, low-speed range overload error, controller overload error	E005,E038, E039	Motor overload error, low-speed range overload error, controller overload error
0	0	1	1	E007,E015	Overvoltage, incoming overvoltage error	E007,E015	Overvoltage, incoming overvoltage error
0	1	0	0	E009	Undervoltage error	E009	Undervoltage error
0	1	0	1	E016	Momentary interruption error	E016	Momentary interruption error
0	1	1	0	E030	IGBT error	E030	IGBT error
0	1	1	1	E006	Braking resistor overload error	-	Other than above

Output terminal function				When a 4-bit code is selected (with [AC3])		When a 3-bit code is selected (without [AC3])	
AC3	AC2	AC1	AC0	Cause code	Trip description	Cause code	Trip description
1	0	0	0	E008,E011	Memory element error, CPU error	-	-
1	0	0	1	E010	Detector error	-	-
1	0	1	0	E012,E013, E035,E036	External error, USP error, thermistor error, break fault	-	-
1	0	1	1	E014	Ground fault protection	-	-
1	1	0	0	E040,E041, E042,E043, E044,E045	Keypad communication error, RS485 communication error, RTC error, EzSQ executive instruction error, overflow error, illegal instruction error	-	-
1	1	0	1	E020,E021	Abnormal temperature error caused by reduced rotation speed of the cooling fan, abnormal temperature error	-	-
1	1	1	0	E024,E034	Input open-phase error, output open-phase error	-	-
1	1	1	1	Other than above	EzSQ assignment error 0 to 9, etc.	-	-

8-6-4 Overload Warning Function (OL/OL2)

The overload warning function can be set so that the inverter outputs an overload warning if the load is too large, before it causes an overload trip.

Assign the output terminal functions 035 [OL] and 036 [OL2] overload prewarning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The overload prewarning signals [OL] and [OL2] will be output when the output currents exceed the corresponding overload prewarning level.

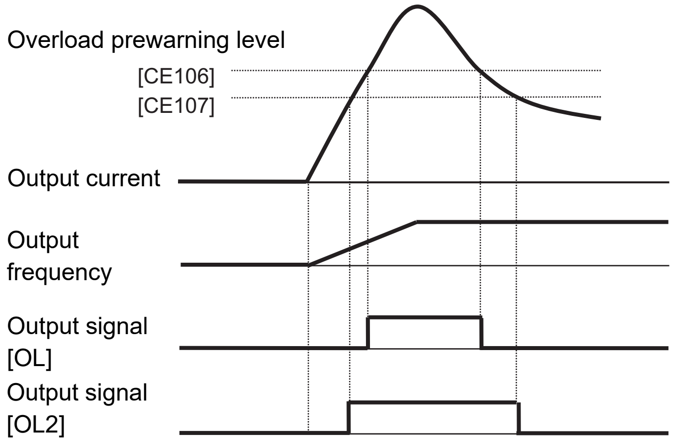
You can output the signal in accordance with the operating state by changing the overload prewarning signal output mode selection [CE105].

This function is effective, especially for conveyors, to prevent machine failure that may occur when the load increases because an excessive number of packages are loaded, or to prevent carrier lines from stopping because of an overload error of the inverter.

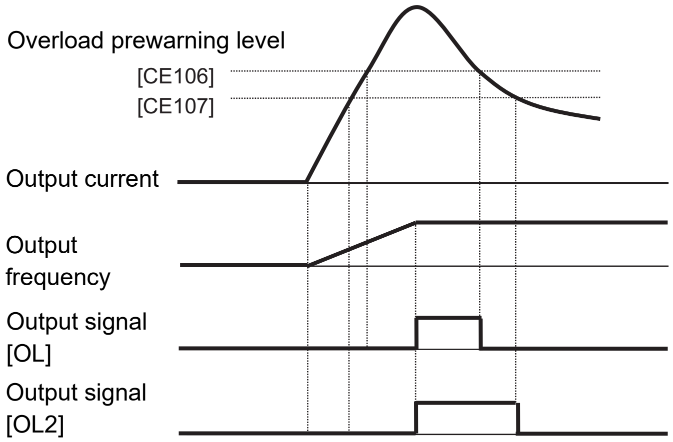
Precautions for Correct Use

- An overcurrent error may occur before the signal is output when the overload prewarning level has been set to an excessively high value. In this case, reduce the overload prewarning level.
- Small fluctuations in the frequency input may hinder the speed from being determined as constant when an analog input is used as the frequency command. In this case, change the overload prewarning signal output mode selection [CE105] to 00 (valid in operation).

When [CE105] = 00



When [CE105] = 01



- **Parameter**

Item	Parameter	Data	Description	Default data
Output terminal function selection 11-15	[CC-01] to [CC-05]	035 036	035 [OL]: Overload prewarning signal 1 is output. 036 [OL2]: Overload prewarning signal 2 is output. OFF: Less than or equal to the overload prewarning signal level ON: More than or equal to the overload prewarning signal level	-
Relay output terminal function selection 16A-16C	[CC-06]			-
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]			-
Over current signal output mode selection, 1st motor	[CE105]	00	Valid in operation	01
		01	Valid only in constant speed operation	
Over current detection level 1, 1st motor	[CE106]	(0.0 to 2.0) x inverter rated current*1	Specify the current level at which the overload prewarning signal is output. The signal will be output when the current exceeds the overload prewarning signal level.	1.0× Inverter rated current
[FM] monitor bias adjustment	[CE107]			1.0× Inverter rated current

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
   When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
   When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
3) Drive programming: 0.01% (Rated ratio)

8-6-5 Low Current Signal (LOC)

This signal is output when the output current falls to or below the Low Current Detection Level (CE102).

The low current detection signal can be output when the load has reduced.

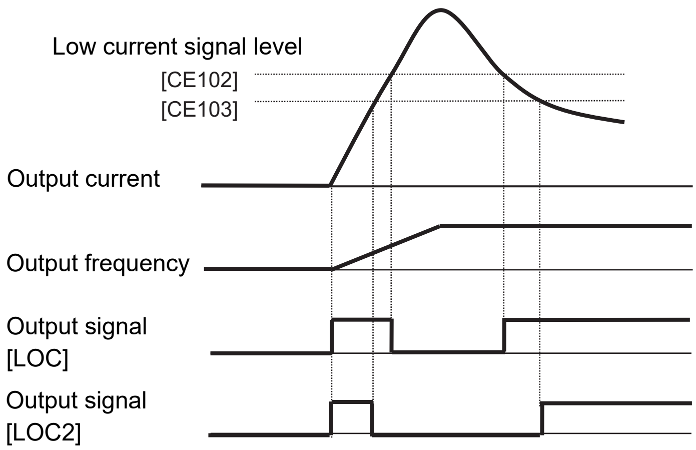
The low current signals 033 [LOC] and 034 [LOC2] will be output when the output currents becomes lower than the low current detection levels [CE102] and [CE103], respectively.

You can output the signal in accordance with the operating state by changing the low current signal output mode selection [CE101].

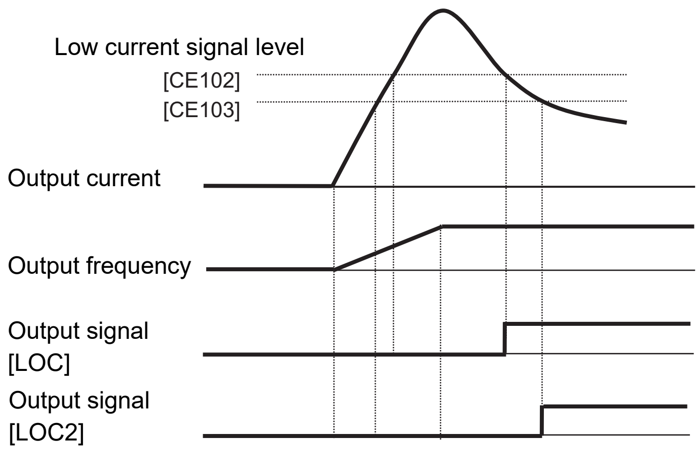
Precautions for Correct Use

Small fluctuations in the frequency input may hinder the speed from being determined as constant when an analog input is used as the frequency command. In this case, change the low current signal output mode selection [CE101] to 00 (valid in operation).

When [CE101] = 00



When [CE101] = 01



● Parameter

Item	Parameter	Data	Description	Default data
Output terminal function selection 11-15	[CC-01] to [CC-05]	033 034	033 [LOC]: Low current signal 1 is output. 034 [LOC2]: Low current signal 2 is output. OFF: Less than or equal to the low current signal level ON: More than or equal to the low current signal level	-
Relay output terminal function selection 16A-16C	[CC-06]			-
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]			-
Low current signal output mode selection, 1st motor	[CE101]	00	Valid in operation	01
		01	Valid only in constant speed operation	
Low current detection level 1, 1st motor	[CE102]	(0.0 to 2.0) x inverter rated current*1	Specify the current level at which the low current prewarning signal is output. The signal will be output when the current becomes lower than the low current prewarning detection level.	1.0× Inverter rated current
Low current detection level 2, 1st motor	[CE103]			1.0× Inverter rated current

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1A or 0.1V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1A, 0.1V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

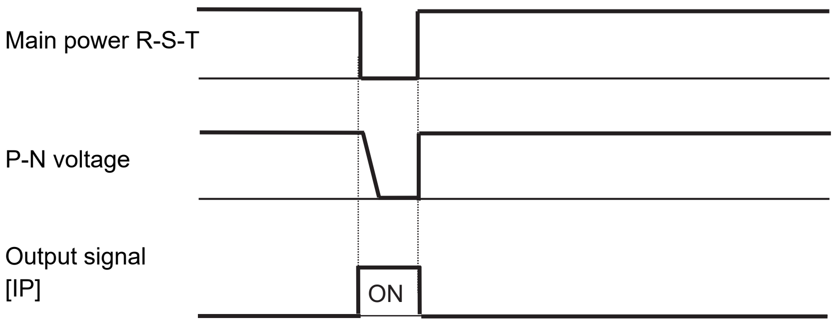
8-6-6 Momentary Power Interruption Signal (IP)

Assign the output terminal function 020 [IP] under momentary interruption signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The momentary interruption signal can be output when a momentary interruption occurs in the inverter main power.

An interruption in the main power can be output as a signal when the control power is supplied via a separate line.

Example of a momentary interruption



Precautions for Correct Use

- The momentary interruption signal [IP] is valid when the main power is input from R-S-T.
- The momentary interruption signal [IP] is output while the control power of the inverter remains (including when a 24-V power supply is used).
- To set errors that will be generated when a momentary interruption occurs, refer to *8-3-6 Instantaneous Power Interruption/Undervoltage Detection* on page 8-72.
- To perform retry restart operation without generating errors when a momentary interruption occurs, refer to *8-2-6 Restart during Power Interruption/Undervoltage* on page 8-52.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	020	The momentary interruption signal [IP] is output. OFF: Input power to R-S-T has been established. ON: Input power to R-S-T was established and then interrupted.
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		

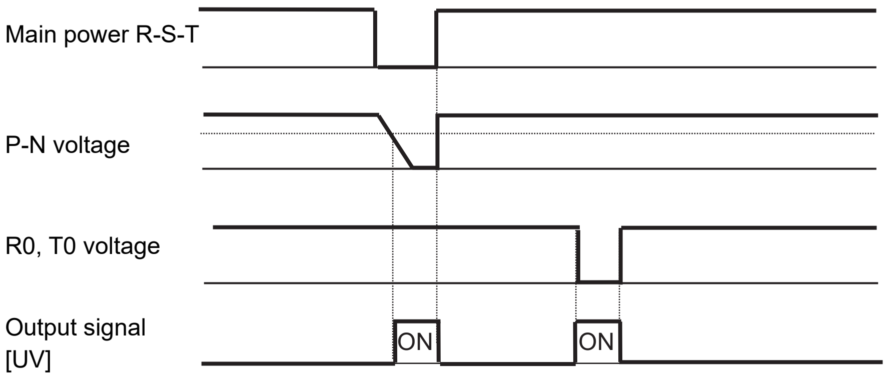
8-6-7 Signal during Undervoltage (UV)

Assign the output terminal function 021 [UV] undervoltage signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The undervoltage signal can be output when a power failure occurs in the main power and control power.

You can output the signal by assigning the undervoltage signal 021 [UV] to the output terminal selection.

Example of an undervoltage (R0 and T0/24V are supplied from a separate power)



Precautions for Correct Use

- The undervoltage signal [UV] is output while the control power of the inverter remains (including when a 24-V power supply is used).
- To set errors that will be generated when an undervoltage occurs, refer to *8-3-6 Instantaneous Power Interruption/Undervoltage Detection* on page 8-72.
- To perform retry restart operation without generating errors when an undervoltage occurs, refer to *8-2-6 Restart during Power Interruption/Undervoltage* on page 8-52.
- The [UV] signal is output under an undervoltage state irrespective of the occurrence of a trip.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	021	The undervoltage signal [UV] is output. OFF: Internal PN voltage and control power have been established. ON: Internal PN voltage or control power is insufficient.
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		

8-6-8 Motor Thermal Warning Signal (THM)

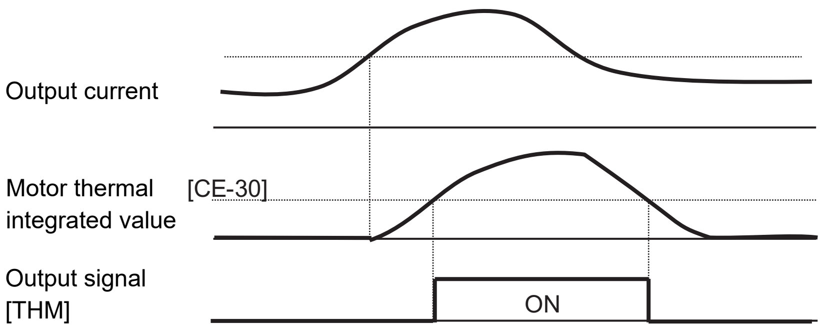
Assign the output terminal function 026 [THM] motor thermal warning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

You can understand the state from the signal before the motor overload error [E005] is generated by the electronic thermal function.

Precautions for Correct Use

- The motor overload error [E005] will be generated when the motor thermal integrated value reaches 100.00%.
- For the settings of motor electronic thermal, refer to *6-6-1 Electronic Thermal Setting* on page 6-48.

Example Operation (When Thermal Subtractions Enabled)



- **Parameter**

Item	Parameter	Data	Description	Default data
Output terminal function selection 11-15	[CC-01] to [CC-05]	026	The thermal warning signal [THM] of the motor is output. OFF: The motor thermal integrated value is smaller than the level. ON: The motor thermal integrated value is equal to or larger than the level.	-
Relay output terminal function selection 16A-16C	[CC-06]			
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]			
Electronic thermal warning level (MTR)	[CE-30]	0.00 to 100.00(%)	The signal [THM] is turned on when the thermal integrated value of the motor is equal to or larger than the set level. This function does not work when this level has been set to 0.00.	80.0

8-6-9 Inverter Thermal Warning Signal (THC)

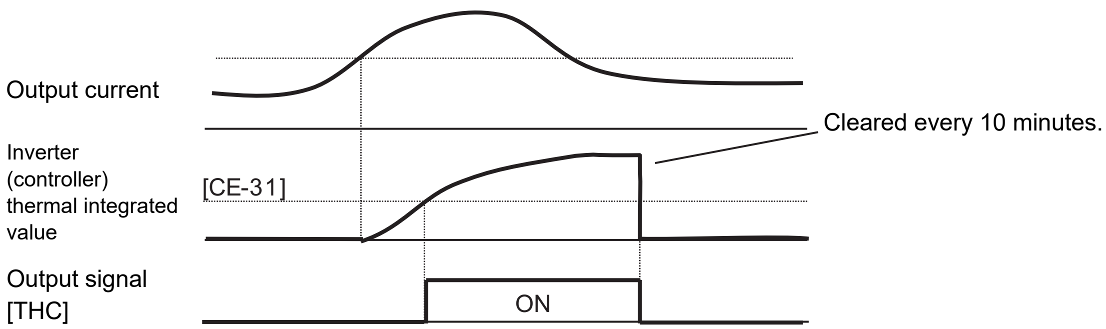
Assign the output terminal function 027 [THC] controller (inverter) thermal warning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

You can understand the state from the signal before the controller overload error [E039] is generated by the electronic thermal function.

Precautions for Correct Use

- The controller overload error [E039] will be generated when the inverter thermal integrated value reaches 100.00%.
- For the protection of inverters, electronic thermal characteristics of inverters are fixed and specific to the type.
- Inverter thermal values are cleared every 10 minutes. However, integration is processed in a dual-redundant system, so that the value may not be cleared when the current is high and the integrated value increases.

Operation Example



● Parameter

Item	Parameter	Data	Description	Default data
Output terminal function selection 11-15	[CC-01] to [CC-05]	027	The thermal warning signal [THC] of the inverter is output. OFF: The inverter thermal integrated value is smaller than the level. ON: The inverter thermal integrated value is equal to or larger than the level.	-
Relay output terminal [16] function	[CC-06]			
Relay output terminal [AL] function	[CC-07]			
Electronic thermal warning level (CTL)	[CE-31]	0.00 to 100.00(%)	The signal [THC] is turned on when the thermal integrated value of the inverter is equal to or larger than the set level.	80.0

8-6-10 Cooling Fin Overheat Warning Signal (OHF)

This signal is output when the output current falls to or below the Low Current Detection Level (CE102).

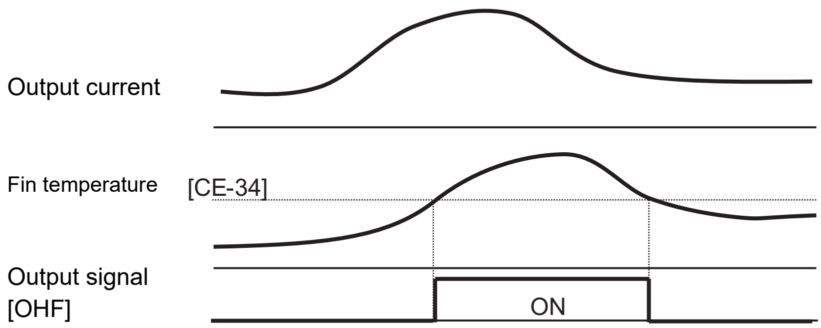
Assign the output terminal function 032 [OHF] cooling fin heating prewarning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

You can understand the state from the signal before the temperature error [E021] is generated by the cooling fin heating prewarning level function.

Precautions for Correct Use

The temperature error [E021] is generated when the cooling fin temperature exceeds 120°C.

Operation Example



- **Parameter**

Item	Parameter	Data	Description	Default data
Output terminal function selection 11-15	[CC-01] to [CC-05]	032	The cooling fin heating prewarning signal [OHF] is output. OFF: Fin temperature is lower than the prewarning level. ON: Fin temperature is equal to or higher than the prewarning level.	-
Relay output terminal function selection 16A-16C	[CC-06]			
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]			
Cooling FAN over-heat warning level	[CE-34]	0 to 200(°C)	The signal [OHF] is turned on when the cooling fin temperature is equal to or higher than the set level.	120

8-6-11 Capacitor Life Warning Signal (WAC)

Assign the output terminal function 029 [WAC] capacitor life prewarning signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The life spans of the capacitors on the circuit board are diagnosed from the temperature inside the inverter and the energized time.

The state of this signal can be monitored by using the life diagnostic monitor. Refer to *5-9 Life Monitor* on page 5-17.

A warning will also be displayed in the display icons on the LCD operator.

Precautions for Correct Use

You are recommended to replace or repair the inverter when a warning about capacitor lives is generated.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	029	The capacitor life prewarning signal (on board) [WAC] is output. OFF: No warning ON: Time to replace the circuit board because the capacitors has reached their life spans
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		
Life diagnostic monitor	[dC-16]	LL to HH	The monitors become H at the end of the life spans. The monitor on the right indicates the lives of the capacitors on the circuit board, whereas that on the left indicates the life of the cooling fan.

8-6-12 Cooling Fan Life Warning Signal (WAF)

This signal will be output when the rotation speed of the inverter's built-in cooling fan decreases to 75% or less.

Assign the output terminal function 030 [WAF] cooling fan rotation speed reduction signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The signal is output when it is detected that the rotation speed of the cooling fan incorporated in the inverter has decreased to 75% or less.

The state of this signal can be monitored by using the life diagnostic monitor. Refer to *5-9 Life Monitor* on page 5-17.

A warning will also be displayed in the display icons on the LCD operator.

Precautions for Correct Use

- Check the cooling fan for clogging when this signal is output.
- When the Cooling Fan Operation (bA-70) is set to 01 (Enabled during RUN (including 3 minutes after power on/stop), this signal will not be output while the fan is stopped.

● **Parameter**

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	030	The cooling fan rotation speed reduction signal [WAF] is output. OFF: No warning ON: Fan rotation speed has decreased
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		
Life diagnostic monitor	[dC-16]	LL to HH	The monitors become H at the end of the life spans. The monitor on the right indicates the lives of the capacitors on the circuit board, whereas that on the left indicates the life of the cooling fan.

8-6-13 RUN Time Over Signal (RNT)

If the total RUN time or ON time of the inverter exceeds the RUN Time/Power ON Time level (CE-36), the inverter will output a RUN time over (RNT).

Assign the output terminal function 024 [RNT] RUN time over signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

Specify the RUN time/power-on time level [CE-36].

Precautions for Correct Use

When specifying the time level as a guideline for replacement, use a number with an adequate margin.

● **Parameter**

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	024	The RUN time over signal [RNT] is output. OFF: Less than or equal to the RUN time level ON: More than the RUN time level
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		
RUN time/power-on time level	[CE-36]	0 to 100000[hour]	This function does not work when this level has been set to 0. Specify 1 to 100,000 hours.
Cumulative operating hours monitor during RUN	[dC-22]	0 to 100000[hour]	The number of hours when the inverter outputs is stored for monitoring.

8-6-14 Power ON Time Over Signal

If the total RUN time or ON time of the inverter exceeds the RUN Time/Power ON Time level (CE-36), the inverter will output a Power ON time over (ONT).

Assign the output terminal function 025 [ONT] power-on time over signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

Assign 025 (ONT) to the output terminal.

Specify the power-on time level [CE-36].

Precautions for Correct Use

When specifying the time level as a guideline for replacement, use a number with an adequate margin.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	025	The power-on time over [ONT] is output. OFF: Less than or equal to the power-on time level ON: More than the power-on time level
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		
RUN time/power-on time level	[CE-36]	0 to 100000[hour]	This function does not work when this level has been set to 0. Specify 1 to 100,000 hours.
Cumulative power-on time monitor	[dC-24]	0 to 100000[hour]	The number of hours when the inverter has been turned on is stored for monitoring.

8-6-15 Incoming Overvoltage Signal (OVS)

Assign the output terminal function 081 [OVS] incoming overvoltage signal to one of [CC-01] to [CC-17] that corresponds to the output terminal and output the signal.

The incoming overvoltage signal [OVS] turns on when the PN voltage of the main circuit exceeds the voltage level specified with the incoming overvoltage level selection [bb-62] for 100 s continuously.

When incoming overvoltage level [bb-61] is set to 00, the signal [OVS] will be output.

When incoming overvoltage level [bb-61] is set to 01, the signal [OVS] will be output, while a trip being made due to incoming overvoltage error [E015].

Precautions for Correct Use

This function performs detection only when the inverter is stopped. This function does not work while the inverter is in operation.

● Parameter

Item	Parameter	Data	Description	Default data
Output terminal function selection 11-15	[CC-01] to [CC-05]	081	The signal [OVS] is output when the incoming voltage is high. OFF: Less than or equal to the incoming overvoltage level ON: More than the incoming overvoltage level	-
Relay output terminal function selection 16A-16C	[CC-06]			
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]			
Power supply over voltage selection	[bb-61]	00	The signal [OVS] will be output.	00
		01	The signal [OVS] will be output, while a trip being made due to incoming overvoltage error [E015].	
Power supply over voltage level setting	[bb-62]	(200-V class) 300.0Vdc to 410.0Vdc (400-V class) 600.0Vdc to 820.0Vdc	The number of hours when the inverter has been turned on is stored for monitoring.	(200V class) 390.0 (400V class) 780.0

8-7 Terminal Output During Run

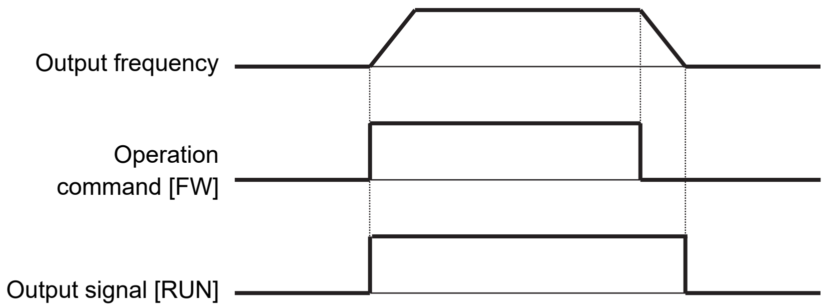
8-7-1 Signal during RUN (RUN)

This signal is output while an inverter operates.

Assign the output terminal function 001 [RUN] running signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The timing chart is as follows.

Run signal is output until a motor stops even if the operation command (FW) is OFF.



Precautions for Correct Use

- The signal becomes ON not only when the motor is operating at normal rotation but also when a voltage is output to the motor as a function such as DC breaking.
- The signal [RUN] will not be output when the inverter is waiting for a retry or DC breaking.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	001	The signal [RUN] is output to the output terminal assigned.
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		

8-7-2 Signal during RUN (FWR/RVR)

Forward Run Signal (FWR)

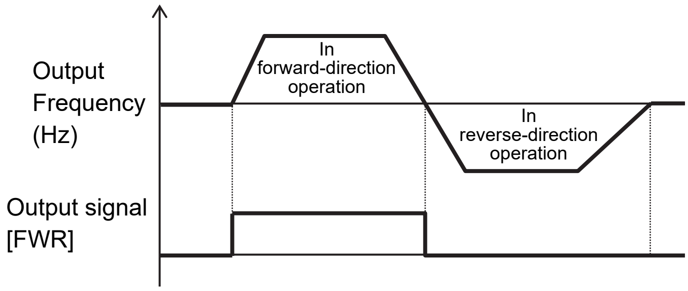
Assign the output terminal function 008 [FWR] forward-direction operating signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

You can output the signal only when the inverter is operating in the forward direction by assigning 008 [FWR] to the output terminal function selection.

This signal is output while the inverter performs the forward operation.

While the inverter performs the reverse operation or when stopped, this signal is not output.

The timing chart is as follows.



Reverse Run Signal (RVR)

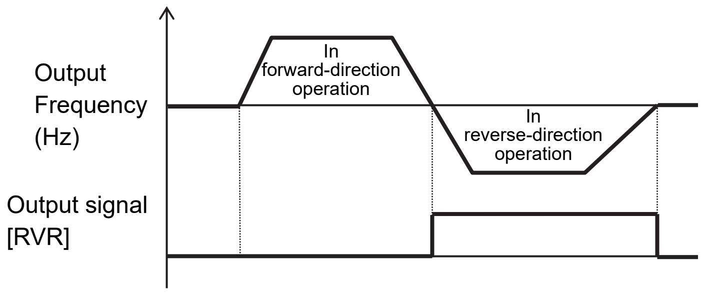
Assign the output terminal function 009 [RVR] reverse-direction operating signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

You can output the signal only when the inverter is operating in the reverse direction by assigning 009 [RVR] to the output terminal function selection.

This signal is output while the inverter performs the reverse operation.

While the inverter performs the reverse operation or when stopped, this signal is not output.

The timing chart is as follows.



Precautions for Correct Use

[FWR] and [RVR] will not be output during DC breaking or when the servo is on.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	008	[FWR]: The forward-direction operation signal is output to the output terminal assigned.
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]	009	[RVR]: The reverse-direction operation signal is output to the output terminal assigned.

8-7-3 Starting Contact Signal

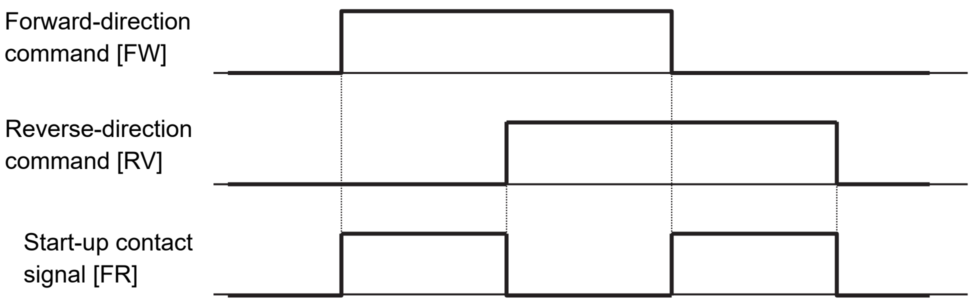
Assign the output terminal function 031 [FR] start-up contact signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The start-up contact signal 031 [FR] is output while the inverter accepts operation commands.

The start-up contact signal [FR] is output in accordance with the state how the operation command is accepted even when the destination of the operation command is not a contact.

The timing chart is as follows.

(Ex.) In the case of a terminal command



Precautions for Correct Use

- When the inverter is operated by using terminal commands, simultaneous inputs of the forward-direction command [FW] and the reverse-direction command [RV] will cause a command mismatch, which is interpreted as the stop command. In this case, the [FR] signal will not be output.
- The signal becomes ON not only when the motor is operating at normal rotation but also when a voltage is output to the motor as a function such as DC breaking.
- When the operation enable signal 101 [REN] has been assigned and set to OFF, the signal [FR] becomes OFF because the inverter cannot be operated.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	031	[FR]: The start-up contact signal is output to the output terminal assigned.
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		

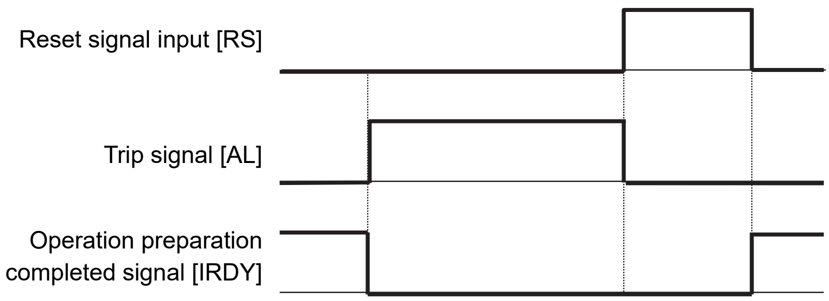
8-7-4 Operation Ready (IRDY)

Assign the output terminal function 007 [IRDY] operation preparation completed signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

The operation preparation completed signal 007 [IRDY] is output when the inverter can accept operation commands.

The timing chart is as follows.

(Ex.) In the case of a terminal command



Precautions for Correct Use

- When this signal is not output, the inverter cannot be operated even if operation commands are input.
- This signal is turned OFF in the following cases or a condition:
  - During operation ready with power-ON.
  - When undervoltage of the R-S-T input voltage occurs
  - While the inverter has been tripped
  - Under a free run stop command

● Parameter

Item	Parameter	Data	Description
Output terminal function selection 11-15	[CC-01] to [CC-05]	007	[IRDY]: The operation preparation completed signal is output to the output terminal assigned.
Relay output terminal function selection 16A-16C	[CC-06]		
Relay output terminal function selection AL1-AL0/AL2-AL0	[CC-07]		

8-8 Frequency Arrival Signal (FA1 to FA5)

These frequency arrival signals will be output when the output frequency reaches the set level.

Allocate output terminals 11 to 15 (CC-01 to CC-05) or relay output 16 AL (CC-06, CC-07) to 002 (FA1: Constant speed arrival signal), 003 (FA2: Set frequency exceeded signal), 004 (FA3: Set frequency only signal), 005 (FA4: Set frequency exceeded signal 2), 006 (FA5: Set frequency only signal 2).

Below is the hysteresis of the frequency arrival signal:

ON: Set frequency - 1% of maximum frequency [Hz]

OFF: Set frequency - 2% of maximum frequency [Hz]

When the above parameter is set to 04 (FA3) and 06 (FA5), the hysteresis during acceleration is:

ON: Set frequency - 1% of maximum frequency [Hz]

OFF: Set frequency - 2% of maximum frequency [Hz]

And the hysteresis during deceleration is:

ON: Set frequency - 1% of maximum frequency [Hz]

OFF: Set frequency - 2% of maximum frequency [Hz]

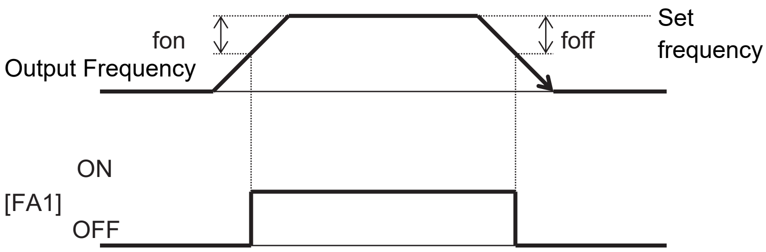
8-8-1 Output Signal on Constant Speed Arrival (FA1)

The signal will be output when the frequency has reached the enabled frequency command.

Assign the output terminal function 002 [FA1]constant-speed reaching output signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

Precautions for Correct Use

The signal [FA1] may not be output stably when the frequency command fluctuates because an analog input command is used. In this case, the symptom may be alleviated by using the ON/OFF delay function of the output terminal.



fon: 1% of the maximum frequency
foff: 2% of the maximum frequency

(Operation example)
Maximum frequency: 60 Hz
Set frequency: 50 Hz

- fon=60×0.01=0.6Hz
- foff=60×0.02=1.2Hz
- In acceleration: On at 50 - 0.6 = 49.4 Hz
- In deceleration: On at 50 - 1.2 = 48.8 Hz

● Parameter

Item	Parameter	Data	Description
Output terminal function selection	[CC-01] to [CC-05]	002	[FA1]:The constant-speed reaching output will be output as a signal to the output terminal assigned.
Relay output terminal function selection	[CC-06]		
Relay output terminal function selection	[CC-07]		

8-8-2 Set Frequency Exceeded Signal (FA2/FA4)

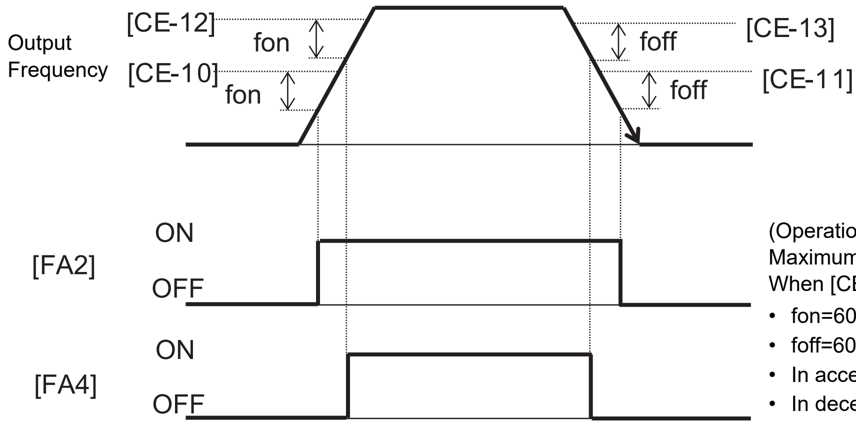
FA2 will be output when the output frequency exceeds the Arrival Frequency During Acceleration/Deceleration 1 (CE-10/CE-11); F4 will be output when the output frequency exceeds the Arrival Frequency During Acceleration/Deceleration 2 (CE-12/CE-13).

Assign the output terminal functions 003 [FA2] and 005 [FA4] exceeding set frequency signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signals.

The signals [FA2] and [FA4] can be output to output terminal functions individually as the exceeding set frequency output signal.

Precautions for Correct Use

- The operation of [FA2] can be set through [CE-10] and [CE-11].
- The operation of [FA4] can be set through [CE-12] and [CE-13].



fon: 1% of the maximum frequency
foff: 2% of the maximum frequency

(Operation example)
Maximum frequency: 60 Hz
When [CE-10] = [CE-11] = 50 Hz

- fon=60×0.01=0.6Hz
- foff=60×0.02=1.2Hz
- In acceleration: On at 50 - 0.6 = 49.4 Hz
- In deceleration: On at 50 - 1.2 = 48.8 Hz

● Parameter

Item	Parameter	Data	Description
Output terminal function selection	[CC-01] to [CC-05]	003 005	003 [FA2]: The exceeding set frequency signal will be output to the output terminal assigned. 005 [FA4]: The exceeding set frequency signal 2 will be output to the output terminal assigned.
Relay output terminal function selection	[CC-06]		
Relay output terminal function selection	[CC-07]		
Acceleration reaching frequency 1	[CE-10]	0.00 to 590.00(Hz)	The frequency to judge that the frequency has been reached in acceleration and output the signal [FA2].
Deceleration reaching frequency 1	[CE-11]	0.00 to 590.00(Hz)	The frequency to judge that the frequency has been reached in deceleration and output the signal [FA2].
Acceleration reaching frequency 2	[CE-12]	0.00 to 590.00(Hz)	The frequency to judge that the frequency has been reached in acceleration and output the signal [FA4].
Deceleration reaching frequency 2	[CE-13]	0.00 to 590.00(Hz)	The frequency to judge that the frequency has been reached in deceleration and output the signal [FA4].

8-8-3 Set Frequency Matched Signal (FA3/FA5)

FA3 outputs signals when the output frequency during acceleration/deceleration reaches the value of Arrival Frequency Setting During Acceleration/Deceleration 1 (CE-10, CE-11).

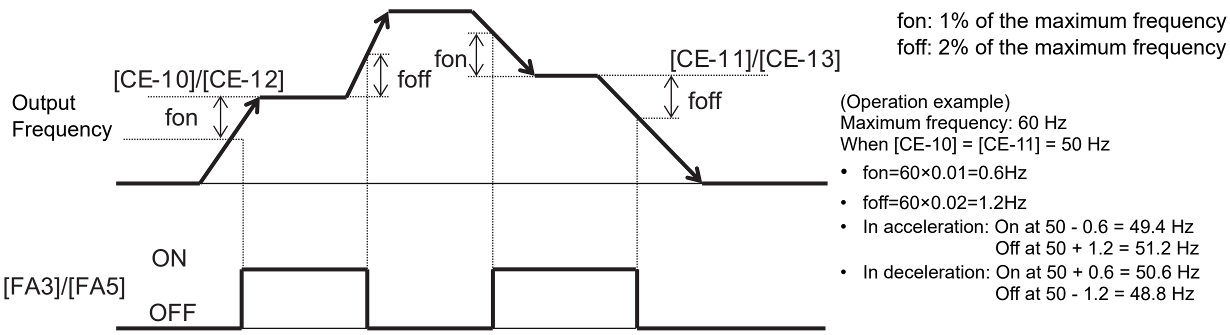
FA5 outputs signals when the output frequency during acceleration/deceleration reaches the value of Arrival Frequency Setting During Acceleration/Deceleration 2 (CE-12, CE-13).

Assign the output terminal functions 004 [FA3] and 006 [FA5] set frequency only output signals to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signals.

The signals [FA3] and [FA5] can be output individually.

Precautions for Correct Use

- The operation of [FA3] can be set through [CE-10] and [CE-11].
- The operation of [FA5] can be set through [CE-12] and [CE-13].



● Parameter

Item	Parameter	Data	Description	Default data
Output terminal function selection	[CC-01] to [CC-05]	004 006	[FA3]: The set frequency only reaching signal will be output to the output terminal assigned. [FA5]: The set frequency only reaching signal 2 will be output to the output terminal assigned.	-
Relay output terminal function selection	[CC-06]			
Relay output terminal function selection	[CC-07]			
Arrival frequency setting during acceleration 1	[CE-10]	0.00 to 590.00(Hz)	The frequency to judge that the frequency has been reached in acceleration and output the signal [FA3].	0.00
Arrival frequency setting during deceleration 1	[CE-11]	0.00 to 590.00(Hz)	The frequency to judge that the frequency has been reached in deceleration and output the signal [FA3].	0.00
Arrival frequency setting during acceleration 2	[CE-12]	0.00 to 590.00(Hz)	The frequency to judge that the frequency has been reached in acceleration and output the signal [FA5].	0.00
Arrival frequency setting during deceleration 2	[CE-13]	0.00 to 590.00(Hz)	The frequency to judge that the frequency has been reached in deceleration and output the signal [FA5].	0.00

8-8-4 0-Hz Detection Signal (ZS)

Assign the output terminal function 040 [ZS] 0-Hz detection signal to one of [CC-01] to [CC-07] that corresponds to the output terminal and output the signal.

This function is to output a signal when the output frequency of the inverter becomes lower than the level specified with the 0-Hz detection value level [CE-33].

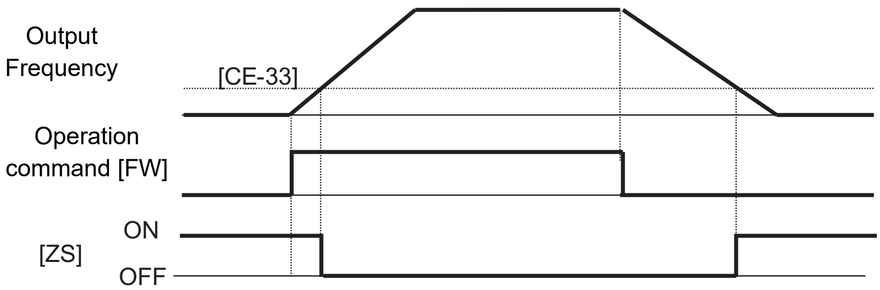
When the feedback circuit board is used, the actual frequency of the motor is evaluated for outputting the signal.

ZS Signal is switched only by existence or non-existence of speed detection at any control modes in the following way:

Without speed detection: Output frequency monitor (dA-01)
With speed detection: Frequency detection monitor Absolute values of (dA-08)

Precautions for Correct Use

While the operation is stopped, the [ZS] signal becomes ON state because the frequency is 0 Hz.



● Parameter

Item	Parameter	Data	Description	Default data
Output terminal function selection	[CC-01] to [CC-05]	040	[ZS]: The 0-Hz signal is output to the output terminal assigned.	-
Relay output terminal function selection	[CC-06]			
Relay output terminal function selection	[CC-07]			
Zero speed detection level	[CE-33]	0.00 to 100.00(Hz)	The frequency setting value to estimate 0-Hz state when [ZS] is output.	0.50

8-9 Applied Output

8-9-1 Analog Disconnection Signal

Assign the output terminal functions 050 [Ai1Dc], 051 [Ai2Dc], and 052 [Ai3Dc] analog break signals to one of [CC-01] to [CC-17] that corresponds to the output terminal and output the signals.

The signals will be output when the input values of the analog inputs [Ai1], [Ai2], and [Ai3] are within the range from the lower limit level to the upper limit level of the window comparators. The analog inputs can be monitored at any value, so that this function can be used for detecting breaks, for example.

A hysteresis width can be specified to the upper and lower limit levels of the window comparator.

A level and a hysteresis width can be specified to each of the analog inputs [Ai1], [Ai2], and [Ai3] individually.

Precautions for Correct Use

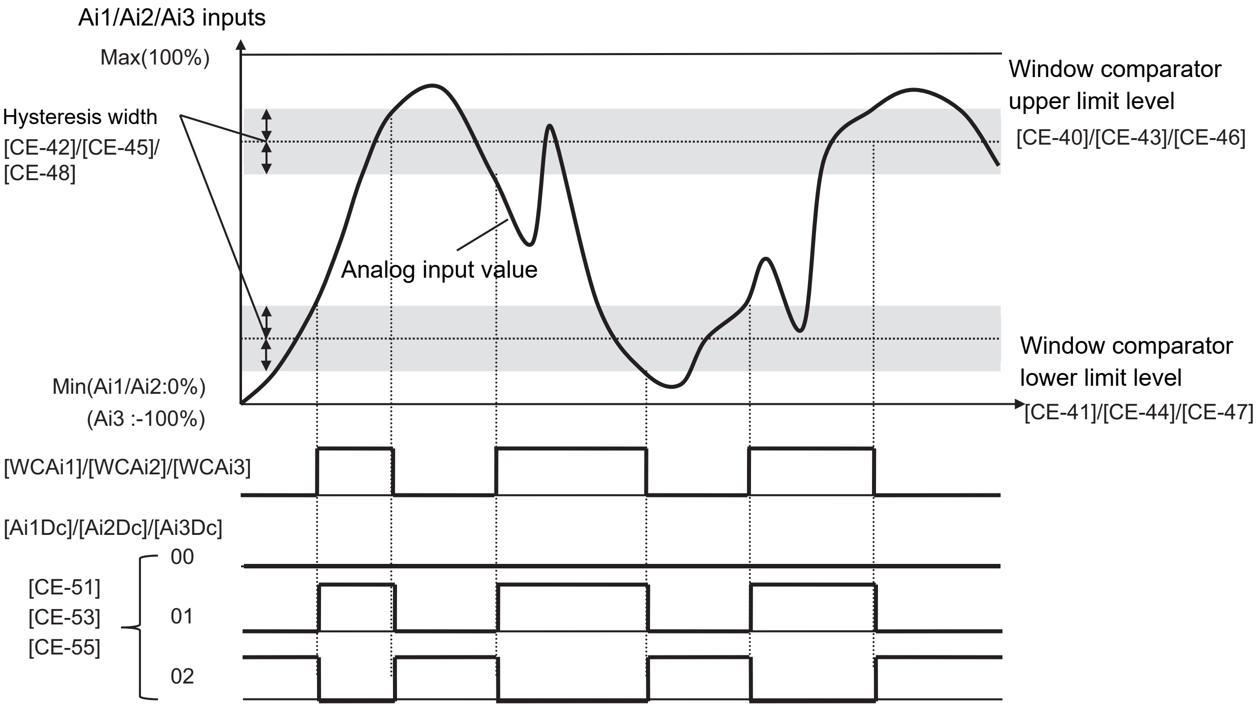
- When the signal [WCAi1], [WCAi2], or [WCAi3] is output, the value adopted to the analog input can be fixed to any value. Specify the value using the break operation level [Ai1], [Ai2], or [Ai3].
- When the analog hold function [AHD] is enabled, the input being held has higher priority.

● Parameter

<table>
<tr><th>Item</th><th>Parameter</th><th>Data</th><th>Description</th></tr>
<tr><td>Output terminal function selection 11-15</td><td>[CC-01] to [CC-05]</td><td rowspan="3">050
051
052</td><td rowspan="3">The signals 050 [Ai1Dc], 051 [Ai2Dc], and 052 [Ai3Dc] will be output to the output terminal assigned.</td></tr>
<tr><td>Relay output terminal function selection 16A-16C</td><td>[CC-06]</td></tr>
<tr><td>Relay output terminal function selection AL1-AL0/AL2-AL0</td><td>[CC-07]</td></tr>
<tr><td>Output terminal function selection 11-15</td><td>[CC-01] to [CC-05]</td><td rowspan="3">056
057
058</td><td rowspan="3">The signals 056 [WCAi1], 057 [WCAi2], and 058 [WCAi3] will be output to the output terminal assigned.</td></tr>
<tr><td>Relay output terminal function selection 16A-16C</td><td>[CC-06]</td></tr>
<tr><td>Relay output terminal function selection AL1-AL0/AL2-AL0</td><td>[CC-07]</td></tr>
<tr><td rowspan="2">Window comparator Ai1/Ai2/Ai3 upper limit level</td><td>Ai1:[CE-40]
Ai2:[CE-43]</td><td>0 to 100(%)</td><td rowspan="2">Specify the upper limits of the analog inputs. The setting ranges are limited to the lower limits or greater.</td></tr>
<tr><td>Ai3:[CE-46]</td><td>-100 to 100(%)</td></tr>
<tr><td rowspan="2">Window comparator Ai1/Ai2/Ai3 lower limit level</td><td>Ai1:[CE-41]
Ai2:[CE-44]</td><td>0 to 100(%)</td><td rowspan="2">Specify the lower limits of the analog inputs. The setting ranges are limited to the upper limits or smaller.</td></tr>
<tr><td>Ai3:[CE-47]</td><td>-100 to 100(%)</td></tr>
<tr><td>Window comparator Ai1/Ai2/Ai3 hysteresis width</td><td>Ai1:[CE-42]
Ai2:[CE-45]
Ai3:[CE-48]</td><td>0 to 10(%)</td><td>The maxim hysteresis widths are limited to (upper limit level - lower limit level)/2.</td></tr>
<tr><td rowspan="2">Ai1/Ai2/Ai3 abnormal condition analog operation level</td><td>Ai1:[CE-50]
Ai2:[CE-52]</td><td>0 to 100(%)</td><td rowspan="2">Specify the input values when the input become within the ranges according to their operation level selection.</td></tr>
<tr><td>Ai3:[CE-54]</td><td>-100 to 100(%)</td></tr>
</table>

Item	Parameter	Data	Description
Ai1/Ai2/Ai3 abnormal condition analog operation level selection	Ai1:[CE-51] Ai2:[CE-53] Ai3:[CE-55]	00	Disabled
		01	When the enabled WC signal is in operation (within the range)
		02	When the enabled WC signal is out of operation (beyond the range)

Window Comparator Operation



In the window comparator function, the signal will be output when the input level is within the specified range.

In the break detection function, the signal will be output when the input level is out of the specified range.

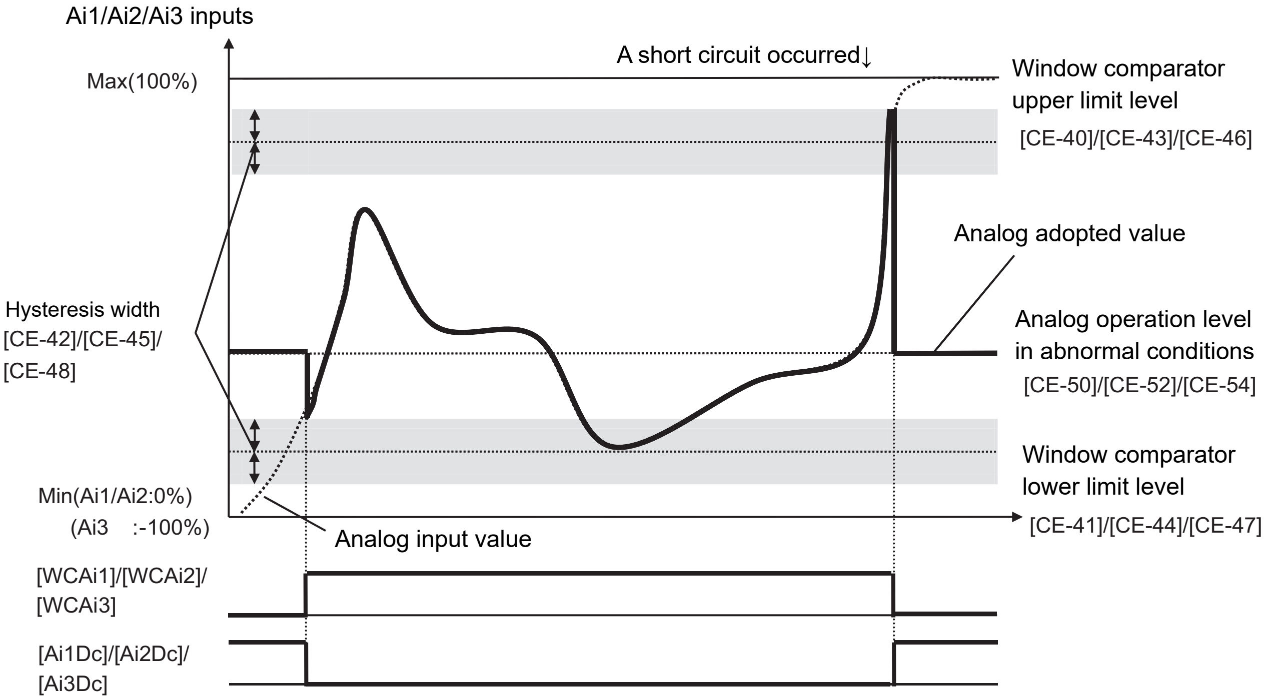
The logical values of the output signals can be modified through [CC-11] to [CC-17].

Specify the analog operation level to maintain the output level when the analog input becomes the maximum value because of a short circuit or when the analog input becomes 0 V because of a break.

To prevent the signal from being output at power-on, specify the on delay times [CC-20], [CC-22], [CC-24], [CC-26], [CC-28], [CC-30], and [CC-32] of the output terminals.

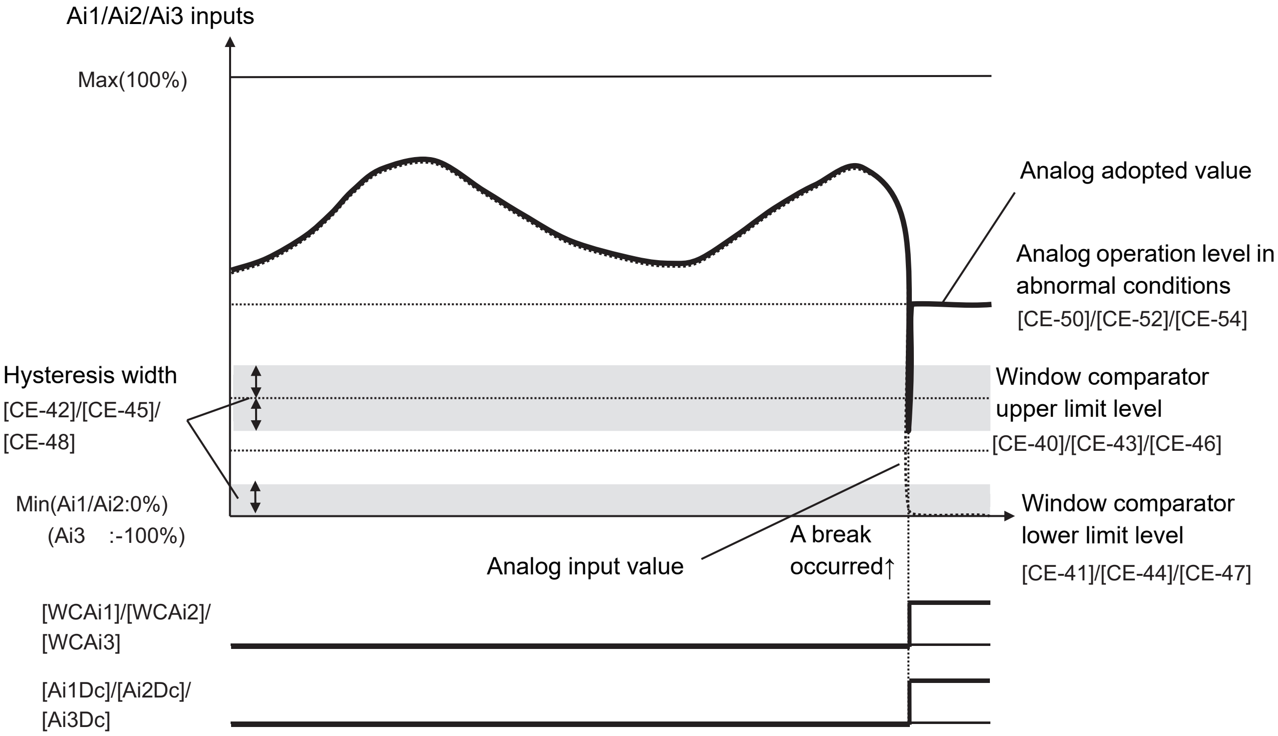
Output Operation in Abnormal Conditions

Example when [CE-51]/[CE-53]/[CE-55] = 02

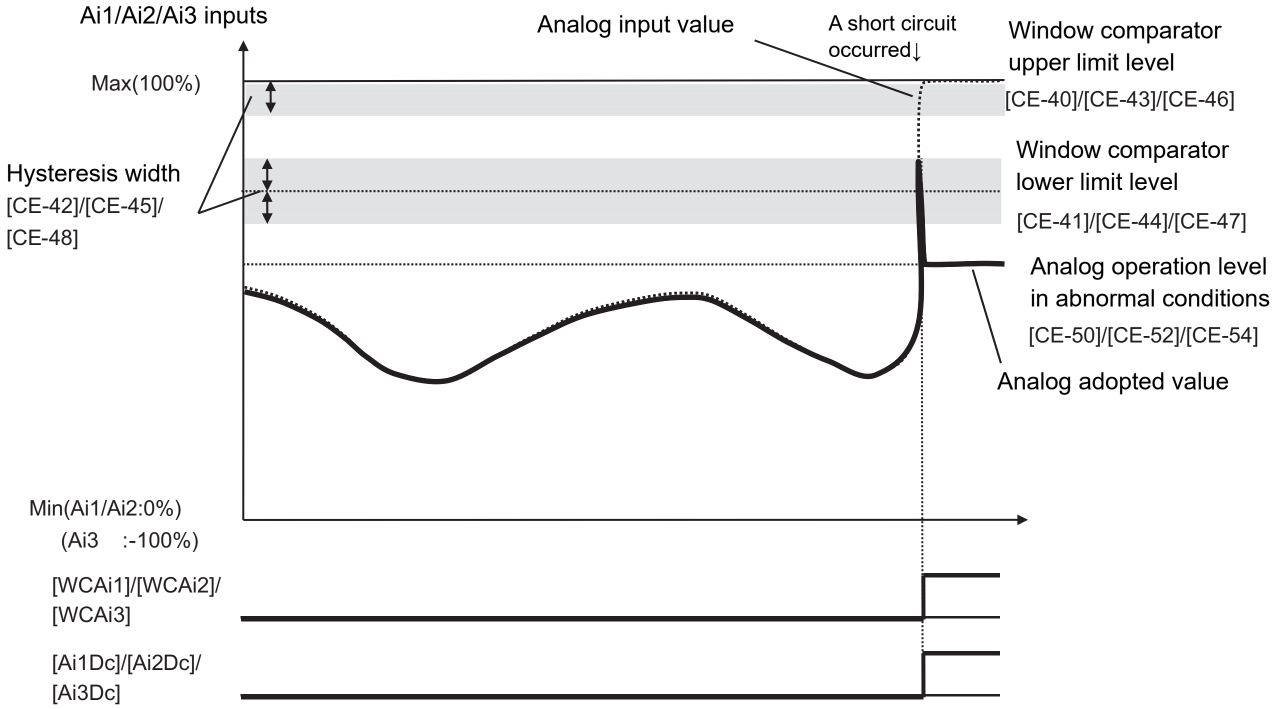


Example when [CE-51]/[CE-53]/[CE-55] = 01

• When the analog input becomes the minimum value (Min) because of a break in the input wire



- When the analog input becomes the maximum value (Max) because of a short circuit in the input wire



8-9-2 Logical Output Signal

You can combine the operation of the output terminal function to perform a logical operation for output signals in the inverter to output various signals.

You can select three types of operators: AND, OR, and XOR.

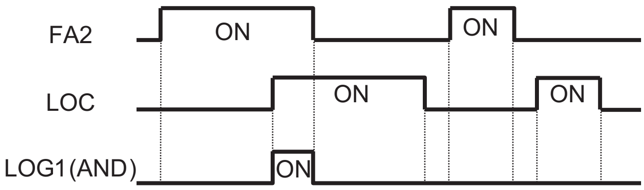
Precautions for Correct Use

All output signals are subject to operation. However, you are not able to include the results of logical operations [LOG1] to [LOG7] into the targets of arithmetic operation.

Selected signal	Arithmetic operation target 1 selection	Arithmetic operation target 2 selection	Operator selection
068: Logical output signal 1 (LOG1)	[CC-40]	[CC-41]	[CC-42]
069: Logical output signal 2 (LOG2)	[CC-43]	[CC-44]	[CC-45]
070: Logical output signal 3 (LOG3)	[CC-46]	[CC-47]	[CC-48]
071: Logical output signal 4 (LOG4)	[CC-49]	[CC-50]	[CC-51]
072: Logical output signal 5 (LOG5)	[CC-52]	[CC-53]	[CC-54]
073: Logical output signal 6 (LOG6)	[CC-55]	[CC-56]	[CC-57]
074: Logical output signal 7 (LOG7)	[CC-58]	[CC-59]	[CC-60]

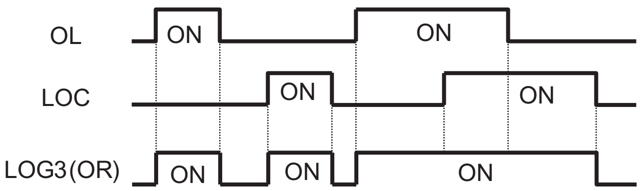
(Ex.1) Use a signal for which an AND operation has been performed with a frequency equal to or above the set frequency (003: FA2) and a low current signal (033: LOC), and, when a current lowers after the frequency has been determined, output the signal as Logical output 1 (LOG1) to Output terminal function 1.

- Output terminal function 1 [CC-01]: 062 (LOG1)
- Logical output signal 1 selection 1 [CC-40]: 003 (FA2)
- Logical output signal 1 selection 2 [CC-41]: 033 (LOC)
- Logical output signal 1 operator [CC-42]: 00 (AND)



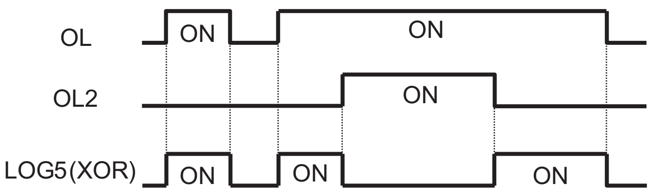
(Ex.2) Use a signal for which an OR operation has been performed with an overload advance notice signal (035: OL) and a thermal warning signal (026: THM), and, when a current falls outside the range, output the signal as Logical output 3 (LOG3) to Output terminal function 2.

- Output terminal function 2 [CC-02]: 063 (LOG3)
- Logical output signal 3 selection 1 [CC-43]: 035 (OL)
- Logical output signal 3 selection 2 [CC-44]: 026 (THM)
- Logical output signal 3 operator [CC-45]: 01 (OR)



(Ex.3) Use a signal for which an XOR operation has been performed with an overload advance notice signal (035: OL) and an overload advance notice signal 2 (036: OL2), and, when a current falls within a certain range, output the signal as Logical output 5 (LOG5) to Output terminal function 3.

- Output terminal function 3 [CC-03]: 066 (LOG5)
- Logical output signal 5 selection 1 [CC-46]: 035 (OL)
- Logical output signal 5 selection 2 [CC-47]: 036 (OL2)
- Logical output signal 5 operator [CC-48]: 02 (XOR)



● Parameter

Item	Parameter	Data	Description
Output terminal function selection Relay output terminal function selection	[CC-01] to [CC-05]	062 063 064 065 066 067 068	LOG1: Result of logical operation 1 LOG2: Result of logical operation 2 LOG3: Result of logical operation 3 LOG4: Result of logical operation 4 LOG5: Result of logical operation 5 LOG6: Result of logical operation 6 LOG7: Result of logical operation 7
16C relay output terminal function selection	[CC-06]		
AL relay output terminal function selection	[CC-07]		
Logical output signal selection 1	[CC-40], [CC-43], [CC-46], [CC-49], [CC-52], [CC-55], [CC-58]	Select from the output terminal function selection data (excluding LOG1 to LOG7)	Select Arithmetic operation target 1
Logical output signal selection 2	[CC-41], [CC-44], [CC-47], [CC-50], [CC-53], [CC-56], [CC-59]	Select from the output terminal function selection data (excluding LOG1 to LOG7)	Select Arithmetic operation target 2
Logical output signal operator selection	[CC-42], [CC-45], [CC-48], [CC-51], [CC-54], [CC-57], [CC-60]	00	AND
		01	OR
		02	XOR

8-10 Input Terminal Function

8-10-1 Overview

Input terminals 1 to 9, A, and B are open collector inputs. Pulse inputting is possible for Terminals A and B.

For the content of an input signal, by allocating the functions that you want to operate to [CA-01] to [CA-11], you will be able to operate the functions with a corresponding input terminal operation.

You can switch a contact for an input signal with the Contacts a/b selection functions of [CA-21] to [CA-31].

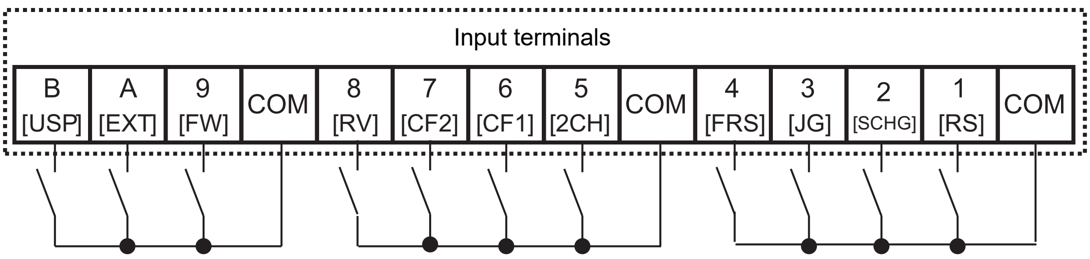
When a function is selected for many targets, the targets will be set to 00 [without allocation], excluding the finally set function selection.

● Parameter

Item	Parameter	Data	Description
Input terminal function selection	[CA-01] to [CA-11]	Next item: Table of input terminal selections	Outputs the allocated function to the corresponding input terminal.
Selection of Input terminals a/b (NO/NC)	[CA-21] to [CA-31]	00	Operates as Contact a (NO).
		01	Operates as Contact b (NC).

● Terminals corresponding to parameters

Terminal block symbol	Function setting destination parameter
1	[CA-01]
2	[CA-02]
3	[CA-03]
4	[CA-04]
5	[CA-05]
6	[CA-06]
7	[CA-07]
8	[CA-08]
9	[CA-09]
A	[CA-10]
B	[CA-11]



● Input Terminal Selections

Function No.	Abbreviation	Function name	Page
000	no	Without allocation	-
001	FW	Normal rotation	P. 6-20
002	RV	Reverse rotation	P. 6-20
003	CF1	Multistage speed 1	P. 6-38
004	CF2	Multistage speed 2	P. 6-38
005	CF3	Multistage speed 3	P. 6-38
006	CF4	Multistage speed 4	P. 6-38
007	SF1	Multistage speed bit 1	P. 6-39
008	SF2	Multistage speed bit 2	P. 6-39
009	SF3	Multistage speed bit 3	P. 6-39
010	SF4	Multistage speed bit 4	P. 6-39
011	SF5	Multistage speed bit 5	P. 6-39
012	SF6	Multistage speed bit 6	P. 6-39
013	SF7	Multistage speed bit 7	P. 6-39
014	ADD	Addition of frequency	P. 6-41
015	SCHG	Switching of instruction	P. 6-35
016	STA	3-wire starting up	P. 6-21
017	STP	3-wire stopping	P. 6-21
018	F/R	3-wire normal and reverse	P. 6-21
019	AHD	Retention of analog instruction	P. 6-42
020	FUP	Acceleration through remote operation	P. 6-41
021	FDN	Deceleration through remote operation	P. 6-41
022	UDC	Clearing of remote operation data	P. 6-41
023	F-OP	Forced switching of instruction	P. 6-43
024	SET	Second control	P. 8-80
028	RS	Reset	P. 8-159
029	JG	Jogging	P. 8-83
030	DB	Braking with external direct current	P. 7-83
031	2CH	2-step acceleration/deceleration	P. 6-58
032	FRS	Stopping of free running	P. 7-82
033	EXT	External abnormality	P. 8-70
034	USP	Prevention of power restoration restarting	P. 8-71
035	CS	Commercial switch	P. 8-81
036	SFT	Soft-lock	P. 3-33
037	BOK	Brake check	P. 8-85
038	OLR	Switching of overload limit	P. 8-40
039	KHC	Clearing of integrated input power	P. 5-15
040	OKHC	Clearing of integrated output power	P. 5-16
041	PID	PID1 invalidation	P. 8-18
042	PIDC	Resetting of PID1 integration	P. 8-17
043	PID2	PID2 invalidation	P. 8-33
044	PIDC2	Resetting of PID2 integration	P. 8-33
045	PID3	PID3 invalidation	P. 8-33
046	PIDC3	Resetting of PID3 integration	P. 8-33
047	PID4	PID4 invalidation	P. 8-33
048	PIDC4	Resetting of PID4 integration	P. 8-33
051	SVC1	PID1 multistage target value 1	P. 8-12
052	SVC2	PID1 multistage target value 2	P. 8-12
053	SVC3	PID1 multistage target value 3	P. 8-12
054	SVC4	PID1 multistage target value 4	P. 8-12
055	PRO	Switching of PID gain	P. 8-18
056	PIO1	Switching of PID output	P. 8-26

Function No.	Abbreviation	Function name	Page
057	PIO2	Switching of PID2 output	P. 8-26
058	SLEP	Satisfaction of SLEEP condition	P. 8-21
059	WAKE	Satisfaction of WAKE condition	P. 8-21
060	TL	Validation of torque limit	P. 7-48
061	TRQ1	Torque limit switchover 1	P. 7-48
062	TRQ2	Torque limit switchover 2	P. 7-48
063	PPI	Switching of PPI control	P. 7-43
064	CAS	Switching of control gain	P. 7-43
065	SON	Servo ON	P. 8-120
066	FOC	Auxiliary excitation	P. 7-78
067	ATR	Validation of torque control	P. 7-56
068	TBS	Validation of torque bias	P. 7-54
069	ORT	Orientation	P. 8-105
071	LAC	Cancellation of LAD	P. 6-70
072	PCLR	Clearing of positional deviation	P. 8-99
073	STAT	Permission to inputting of pulse string position instruction	P. 8-99
074	PUP	Addition of positional bias	P. 8-99
075	PDN	Subtraction of positional bias	P. 8-99
076	CP1	Positional instruction selection 1	P. 8-111
077	CP2	Positional instruction selection 2	P. 8-111
078	CP3	Positional instruction selection 3	P. 8-111
079	CP4	Positional instruction selection 4	P. 8-111
080	ORL	Origin limit signal	P. 8-114
081	ORG	Return-to-origin start up signal	P. 8-114
082	FOT	Stopping of normal rotation driving	P. 8-115
083	ROT	Stopping of reverse rotation driving	P. 8-115
084	SPD	Switching of speed position	P. 8-112
085	PSET	Presetting of positional data	P. 8-117
086	Mi1	General purpose input 1	P. 8-154
087	Mi2	General purpose input 2	P. 8-154
088	Mi3	General purpose input 3	P. 8-154
089	Mi4	General purpose input 4	P. 8-154
090	Mi5	General purpose input 5	P. 8-154
091	Mi6	General purpose input 6	P. 8-154
092	Mi7	General purpose input 7	P. 8-154
093	Mi8	General purpose input 8	P. 8-154
094	MI9	General purpose input 9	P. 8-154
095	MI10	General purpose input 10	P. 8-154
096	MI11	General purpose input 11	P. 8-154
097	PCC	Clearing of pulse counter	P. 8-167
098	ECOM	Starting up of EzCOM	P. 9-101
099	PRG	Starting of EzSQ program	P. 8-154
100	HLD	Stopping of acceleration/deceleration	P. 6-66
101	REN	Operation permission signal	P. 6-46
102	DISP	Fixation of display	P. 3-47
103	PLA	Pulse string input A	P. 8-167
104	PLB	Pulse string input B	P. 8-167
105	EMF	Emergency forced operation	P. 8-94
107	COK	Contactor check signal	P. 8-91
109	PLZ	Pulse string input Z	P. 8-105
110	TCH	Teaching signal	P. 8-112

8-10-2 Input Terminal Selections

You can set input specifications for Contact a or Contact b separately for Input terminals 1 to 9, A, and B.

Precautions for Correct Use

Even when the “Selection of Input terminals a/b” is used, a terminal allocated with a “028 [RS] signal” always operates as Contact a (NO).

● Parameter

Item	Parameter	Data	Description
Input terminal function selection	[CA-01] to [CA-11]	Next item: Table of input terminal selections	Outputs the allocated function to the corresponding input terminal.
Selection of Input terminals a/b (NO/NC)	[CA-21] to [CA-31]	00	Operates as Contact a (NO).
		01	Operates as Contact b (NC).

- Contact a: Closes with “ON,” and opens with “OFF.”
- Contact b: Closes with “OFF,” and opens with “ON.”

Input terminal	Switching between Contact a and Contact b
1	[CA-21]
2	[CA-22]
3	[CA-23]
4	[CA-24]
5	[CA-25]
6	[CA-26]
7	[CA-27]
8	[CA-28]
9	[CA-29]
A	[CA-30]
B	[CA-31]

8-10-3 Input Terminal Response Time

You can set a response time per input terminal.

This function is effective for removing noise caused by chattering, etc.

If stable terminal input is not secured due to chattering, increase the set value. However, increasing the set value results in a slow response.

For the correspondence between input terminals and parameters, please refer to the table shown on the below.

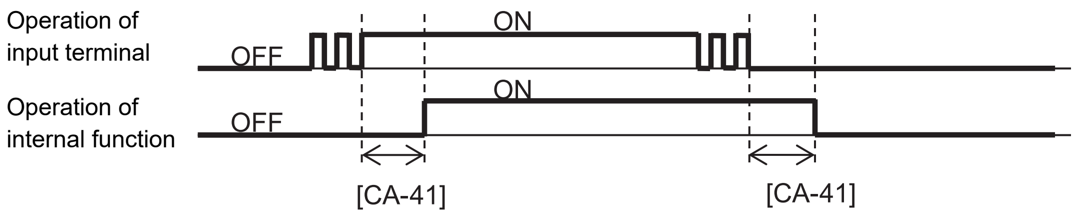
Input terminal	Response time
1	[CA-41]
2	[CA-42]
3	[CA-43]
4	[CA-44]
5	[CA-45]
6	[CA-46]
7	[CA-47]
8	[CA-48]
9	[CA-49]
A	[CA-50]
B	[CA-51]

● Parameter

Item	Parameter	Data	Description
Input terminal response time	[CA-41]/[CA-42]/[CA-43]/[CA-44]/[CA-45]/[CA-46]/[CC-47]/[CA-48]/[CA-49]/[CA-50]/[CA-51]	0 to 400(ms)*1	Sets a response time.

*1. When setting to 0, the operation starts about at 1 ms.

(Ex.) Operation of Input terminal 1



8-10-4 Reset

You can cancel the tripped inverter.

For resetting, press the Stop/Reset key on the LCD operator or turn on the [RS] reset terminal.

To use the reset terminal, allocate the “028 [RS] reset” to the input terminal function.

Regardless of the settings, the reset terminal is set to serve as Contact a (NO).

With the “Reset selection [CA-72],” you can select a timing for cancelling the trip with the RS terminal. You can make the “[RS] terminal” valid only at a timing for cancelling the trip in the event of an abnormality.

Precautions for Correct Use

- Do not use the “[RS] reset terminal” in order to interrupt the output of the inverter. To interrupt the output of the inverter with a signal input, use the “[FRS] free run stopping terminal” of the input terminal function.
- When a reset signal is input during retry stand-by, the operation starts with the frequency at the time of interruption kept un-cleared.

● Parameter

Item	Parameter	Data	Description	Default data
Reset mode selection	[CA-72]	00	At ON, cancels the trip (Ex.1). At normal: Interrupts the output. At abnormal: Cancels the trip.	00
		01	At OFF, cancels the trip (Ex.2). At normal: Interrupts the output. At abnormal: Cancels the trip.	
		02	At ON, cancels the trip (Ex.1 and Ex.3). At normal: Invalid At abnormal: Cancels the trip.	
		03	At OFF, cancels the trip (Ex.2 and Ex.4). At normal: Invalid At abnormal: Cancels the trip.	
Restart mode after RS release	[bb-41]	00	Starts with 0 Hz	00
		01	Starts frequency adjustment	
		02	Restarts frequency acquisition	
Input terminals 1 to 9, A, and B	[CA-01] to [CA-11]	028	RS: Reset function	-
Retry wait time before motor restart	[bb-26]	0.3 to 100.0(s)	A stand-by time for restarting after resetting, and after an operation instruction has been given	0.3
Restart frequency threshold	[bb-42]	0.00 to 590.00(Hz)	The lower limit frequency setting for restarting	0.00
Restart level of Active frequency matching	[bb-43]	(0.2 to 2.0) × Inverter rated current*1	The current limit level when restarting frequency acquisition	1.0× Inverter rated current
Restart constant(speed) of Active frequency matching	[bb-44]	0.10 to 30.00 (sec)	The deceleration rate at the time of frequency acquisition	0.5

Item	Parameter	Data	Description	Default data
Constant (voltage) for frequency acquisition restarting	[bb-45]	0.10 to 30.00 (sec)	The start time of frequency acquisition	0.5
Excessive current prevention level at the time of frequency acquisition	[bb-46]	(0.2 to 2.0) × Inverter rated current*1	The limit current value setting for the excessive current prevention level at the time of frequency acquisition	1.0× Inverter rated current
Start frequency selection at the time of frequency acquisition	[bb-47]	00	Frequency at the time of interruption	00
		01	Maximum frequency	
		02	Set frequency	

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

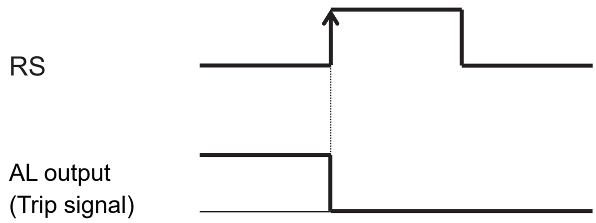
1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

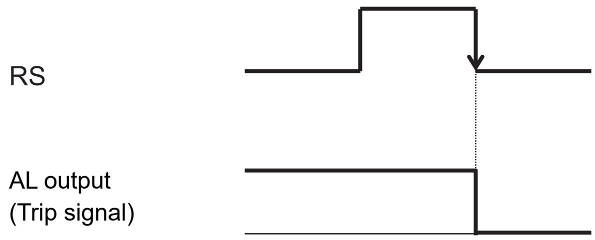
3) Drive programming: 0.01% (Rated ratio)

Examples of Resetting Operations

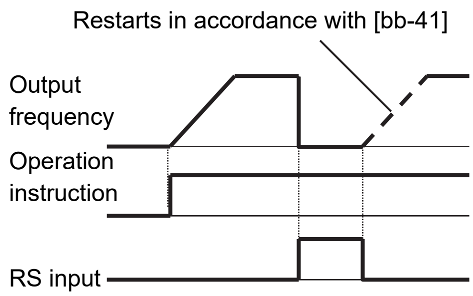
(Ex.1) Cancelling the trip at ON ([CA-72]=00,02)



(Ex.2) Cancelling the trip at OFF ([CA-72]=01,03)

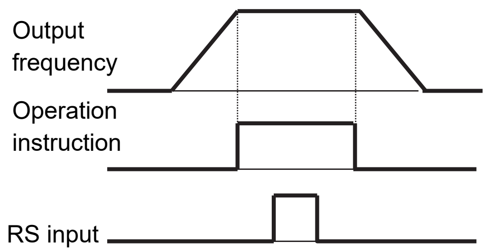


(Ex.3) Validating resetting at normal ([CA-72]=00,01)



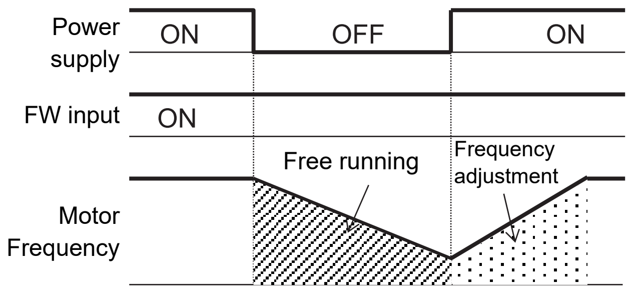
(Ex.4) Invalidating resetting at normal ([CA-72]=02,03)

Resetting is invalidated during operation.



Examples of Restarting When Resetting

(Ex.5) When frequency adjustment restarting is selected ([bb-41]=01)



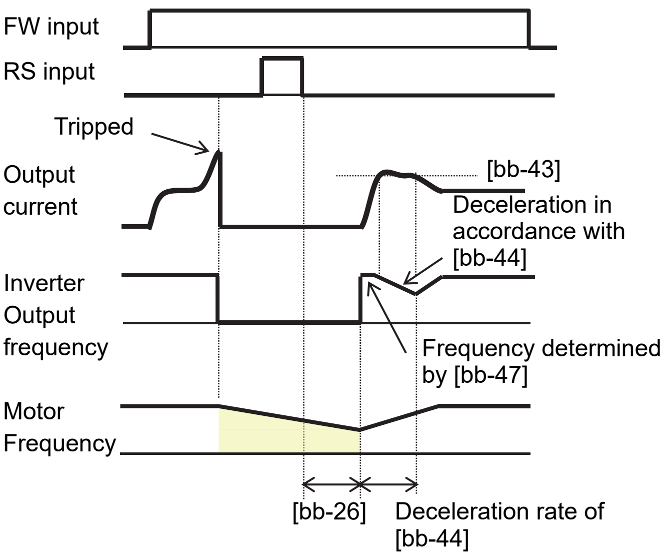
In the “Reset restarting selection [bb-41],” selecting “01 (frequency adjustment restarting)” allows you to perform the frequency adjustment restarting when turning on the power supply again. When “00 (Restarting with 0 Hz)” is set, the operation starts from 0 Hz without waiting for the “Retry stand-by time for instantaneous power failure and insufficient voltage [bb-26].”

Precautions for Correct Use

Even when the frequency adjustment restarting is selected, the “Restarting with 0 Hz” occurs in the cases shown below.

- When an output frequency is 1/2 of a base frequency or below
- When the induced voltage of the motor quickly attenuates
- When the “Lower limit setting for frequency adjustment [bb-42]” is set, and a frequency equal to or below this set frequency is detected

(Ex.6) When frequency acquisition restarting is selected ([bb-41]=02)



- After the “Retry stand-by time for instantaneous power failure and insufficient voltage [bb-26]” has elapsed, the output starts at a frequency conforming to the “Constant (frequency) for frequency acquisition restarting [bb-44].” After that, during a time of the “Constant (voltage) for restarting [bb-45],” the motor speed is acquired. At that time, to reduce the output current with the “Restarting level of acquisition [bb-43],” deceleration occurs in accordance with the “Constant (frequency) for restarting [bb-44].”
- When the output current lowers below the “Restarting level of acquisition [bb-43],” acceleration starts. If a trip occurs due to an excessive current even in this method, lower the “Restarting level of acquisition [bb-43]” or the “Excessive current prevention level [bb-46].”

Precautions for Correct Use

When the “Start frequency selection [bb-47]” is set to “00 (Frequency at the time of interruption),” the operation starts at a frequency at the time of the previous interruption even when a reset signal is input during retry stand-by.

8-10-5 Analog Input

Output frequency to the following analog input (frequency command) is set.

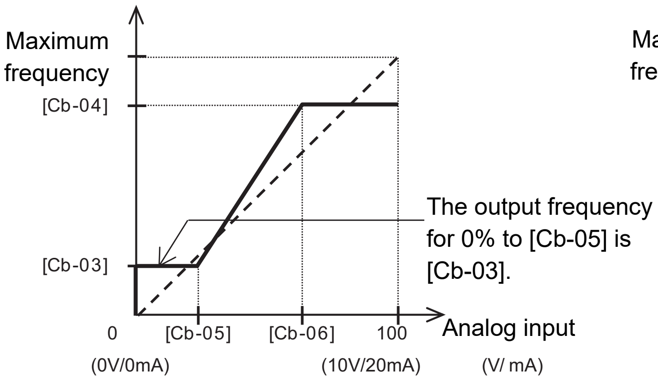
- Ai1 (0 to 10 V/0 to 20 mA)
- Ai2 (0 to 10 V/0 to 20 mA)
- Ai3 (-10 to 10 V)

Relation between Analog Input Ai1 and Frequency Command

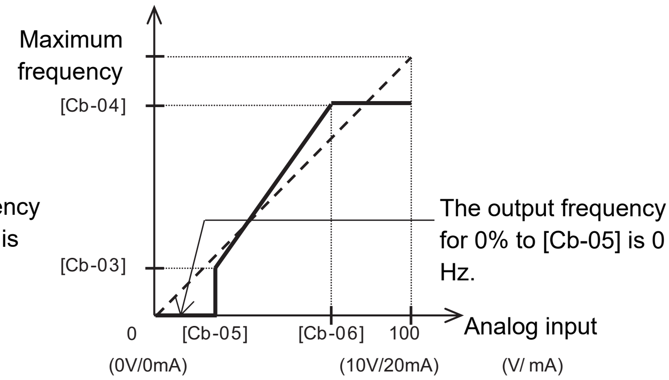
The following table is a relation between Analog Input Ai1 and Frequency Command.

Item	Parameter	Data	Description	Default data
Filter time constant of Terminal [Ai1]	[Cb-01]	1 to 500(ms)	Filters the input.	16
Start value of Terminal [Ai1]	[Cb-03]	0.00 to 100.00(%)	Sets a frequency instruction ratio when setting a start ratio for analog input.	0.00
End value of Terminal [Ai1]	[Cb-04]	0.00 to 100.00(%)	Sets a frequency instruction ratio when setting an end ratio for analog input.	100.00
Start rate of Terminal [Ai1]	[Cb-05]	0.0 to [Cb-06](%)	With respect to a minimum ratio for analog input for 0 to 10 V/0 to 20 mA, sets a start ratio.	0.0
End rate of Terminal [Ai1]	[Cb-06]	[Cb-05] to 100.0(%)	With respect to an external frequency instruction for 0 to 10 V, 0 to 20 mA, sets an end ratio.	100.0
Start point selection of Terminal [Ai1]	[Cb-07]	00	For an instruction for a value of one of 0.00% to the “Start amount [Cb-03]” and to the “End amount [Cb-04],” whichever is lower, one of the values of the “Start amount [Cb-03]” and the “End amount [Cb-04],” whichever is lower, is output.	01
		01	For an instruction for a value of one of 0.00% to the “Start amount [Cb-03]” and to the “End amount [Cb-04],” whichever is lower, a value of 0.00% is output.	

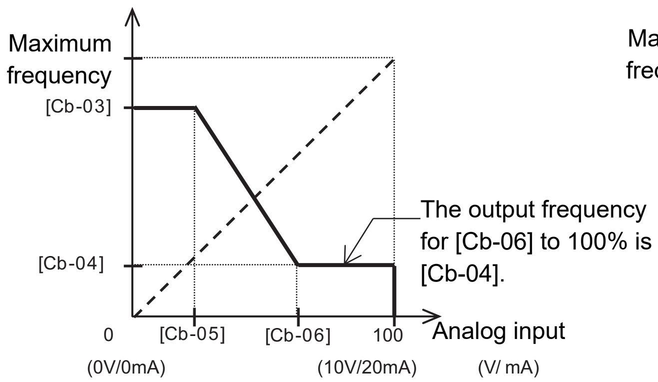
(Ex.1-1) [Cb-07]=00



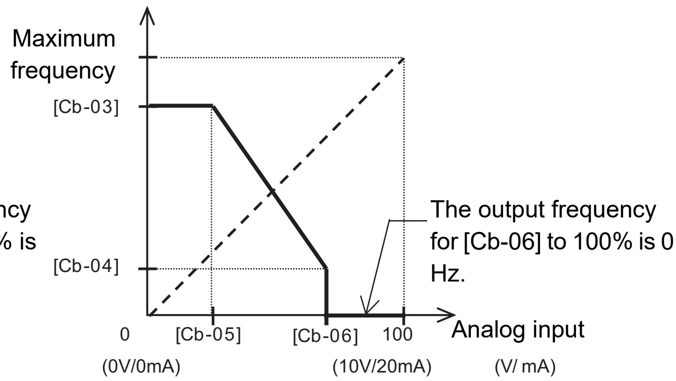
(Ex.2-1) [Cb-07]=01



(Ex.1-2) [Cb-07]=00



(Ex.2-2) [Cb-07]=01

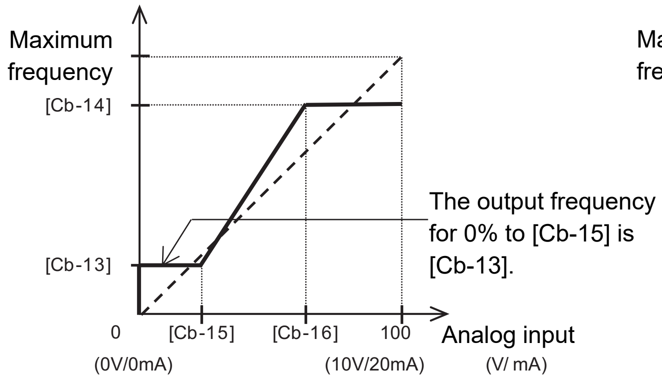


Relation between Analog Input Ai2 and Frequency Command

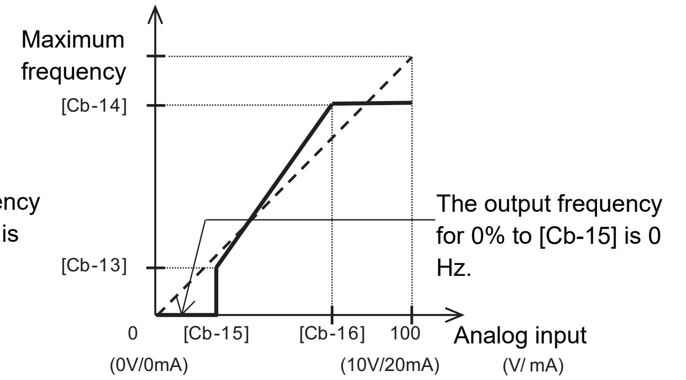
The following table is a relation between Analog Input Ai2 and Frequency Command.

Item	Parameter	Data	Description	Default data
Filter time constant of Terminal [Ai2]	[Cb-11]	1 to 500(ms)	Filters the input.	16
Start value of Terminal [Ai2]	[Cb-13]	0.00 to 100.00(%)	Sets a frequency instruction ratio when setting a start ratio for analog input.	0.00
End value of Terminal [Ai2]	[Cb-14]	0.00 to 100.00(%)	Sets a frequency instruction ratio when setting an end ratio for analog input.	100.00
Start rate of Terminal [Ai2]	[Cb-15]	0.0 to [Cb-16](%)	With respect to a minimum ratio for analog input for 0 to 10 V/0 to 20 mA, sets a start ratio.	20.0
End rate of Terminal [Ai2]	[Cb-16]	[Cb-17] to 100.0(%)	With respect to an external frequency instruction for 0 to 10 V, 0 to 20 mA, sets an end ratio.	100.0
Start point selection of Terminal [Ai2]	[Cb-17]	00	For an instruction for a value of one of 0.00% to the “Start amount [Cb-13]” and to the “End amount [Cb-14],” whichever is lower, one of the values of the “Start amount [Cb-13]” and the “End amount [Cb-14],” whichever is lower, is output.	01
		01	For an instruction for a value of one of 0.00% to the “Start amount [Cb-13]” and to the “End amount [Cb-14],” whichever is lower, a value of 0.00% is output.	

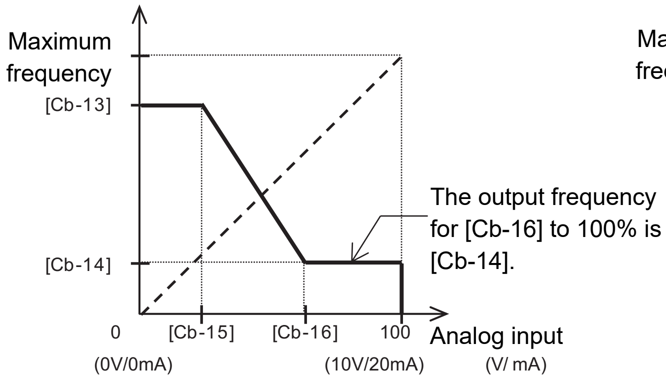
(Ex.1-1) [Cb-17]=00



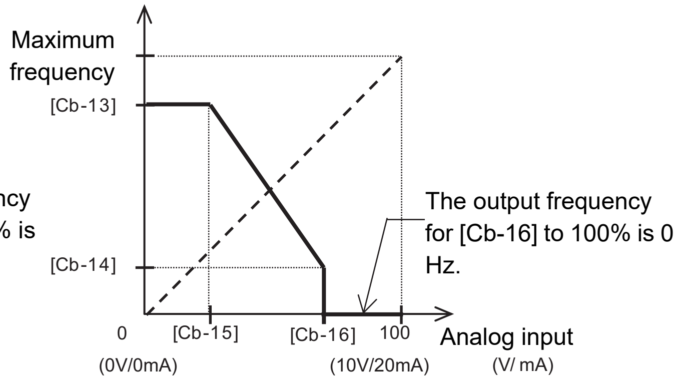
(Ex.2-1) [Cb-18]=01



(Ex.1-2) [Cb-17]=00



(Ex.2-2) [Cb-17]=01

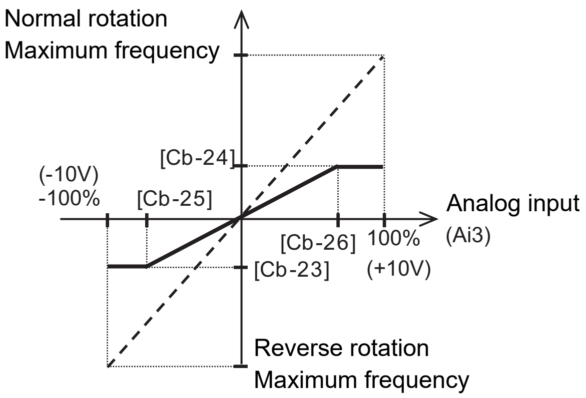


Relation between Analog Input Ai3 and Frequency Command

The following table is a relation between Analog Input Ai3 and Frequency Command.

Item	Parameter	Data	Description	Default data
Filter time constant of Terminal [Ai3]	[Cb-21]	1 to 500(ms)	Filters the input.	16
Terminal [Ai3] selection	[Cb-22]	00	Individual	00
		01	Added to [Ai1]/[Ai2], with reversibility	
		02	Added to [Ai1]/[Ai2], without reversibility	
Start value of Terminal [Ai3]	[Cb-23]	-100.00 to 100.00(%)	Sets a frequency instruction ratio when setting a start ratio for analog input.	-100.00
End value of Terminal [Ai3]	[Cb-24]	-100.00 to 100.00(%)	Sets a frequency instruction ratio when setting an end ratio for analog input.	100.00
Start rate of Terminal [Ai3]	[Cb-25]	-100.0 to [Cb-26](%)	With respect to a minimum ratio for analog input for -10 to 10V, sets a start ratio.	-100.00
End rate of Terminal [Ai3]	[Cb-26]	[Cb-25] to 100.0(%)	With respect to an external frequency instruction for -10 to 10 V, sets an end ratio.	100.00

(Ex.3)

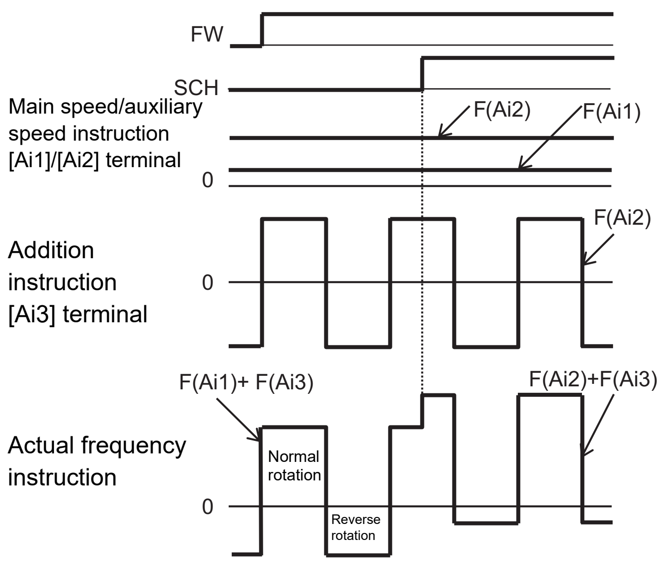


Adding Analog Input [Ai3] to [Ai1][Ai2]

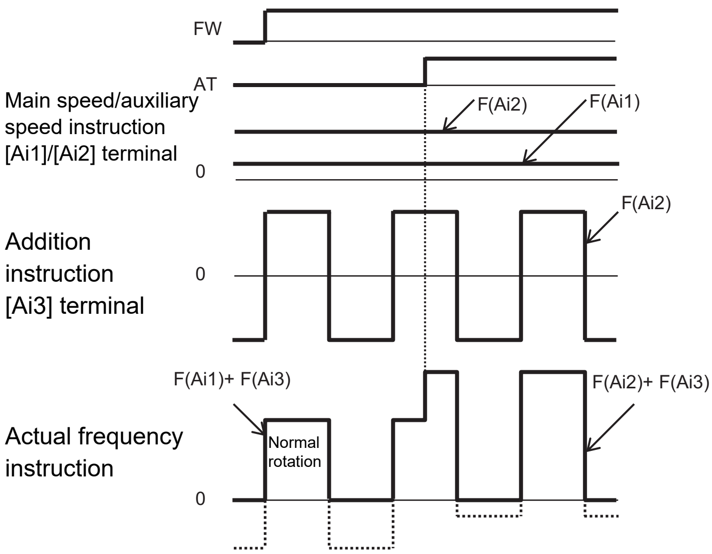
You can forcibly add an input of the [Ai3] terminal to [Ai1]/[Ai2].

You are able to make an input of ±10 V to the [Ai3] terminal. Use [Cb-22] to select whether the output of reversibility for normal rotation or reverse rotation is possible after making an addition.

(Ex.4-1) [Cb-22]=01 (with reversibility)



(Ex.4-2) [Cb-22]=02 (without reversibility)



Analog Input Filter Settings

To give a frequency instruction with an external analog signal, you can set a sampling time for voltage input or current input.

This feature is effective for removing noise from the frequency setting circuit.

Increase the set value if noise negatively affects a stable operation. Note that the greater the set value, the lower the responsiveness. When this feature is used for a PID instruction, and a filter is set, the filter would affect the feedback, and therefore a fine operation would not be achieved.

Item	Parameter	Data	Description	Default data
Filter time constant of Terminal [Ai1]	[Cb-01]	1. to 500.(ms)	Sets a time constant for the input filter.	16
Filter time constant of Terminal [Ai2]	[Cb-11]	1. to 500.(ms)	Sets a time constant for the input filter.	16
Filter time constant of Terminal [Ai3]	[Cb-21]	1. to 500.(ms)	Sets a time constant for the input filter.	16

8-10-6 Pulse Count Function

For the pulse counting function, the terminal input monitoring mode and the phase coefficient monitoring mode are available.

When the “Selection of targets for pulse string input detection [CA-90]” ranges from 00 to 02, the terminal input monitoring mode becomes valid. When [CA-90] is set to “03 (pulse count),” the phase coefficient monitoring mode becomes valid.

You can monitor the acquired pulses with the pulse counter monitor served as an accumulation counter.

By turning on [PCC] (Clearing of pulse counter), you can clear the accumulated counter value.

Precautions for Correct Use

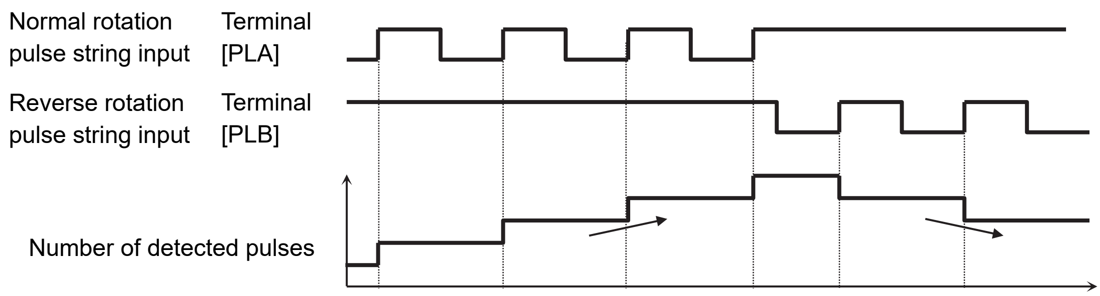
- The maximum input pulse in the phase coefficient monitoring mode becomes a maximum of 32 kpps. (When the duty ratio is approximately 50%)
- An accumulation counter value cannot be stored. After the power supply is turned on, the value becomes zero.
- The maximum input pulse in the terminal input monitoring mode depends on the settings of the input terminal response functions [CA-41] to [CA-51].

● Parameter

Item	Parameter	Data	Description	Default data
Input terminal function	[CA-01] to [CA-11]	103	[PLA]: Accepts a pulse input.	-
		104	[PLB]: Accepts a pulse input.	
		097	[PCC]: Clears the integrated value.	
Output terminal function	[CC-01] to [CC-07]	091	[PCMP]: Outputs pulse compare-match signals.	-
Pulse train detection object selection	[CA-90]	00	Disabled	00
		01	Frequency command	
		02	Speed feedback	
		03	Pulse count	
Mode selection of pulse train input	[CA-91]	00	90° phase difference	00
		01	forward/reverse rotation command and rotation direction	
		02	forward/reverse rotation pulse string	
Comparing match output ON-level for Pulse count	[CA-97]	0 to 65535	When the number of pulses reaches this set value, Turn on [PCMP].	0
Comparing match output OFF-level for Pulse count	[CA-98]	0 to 65535	When the number of pulses reaches this set value, Turn off [PCMP].	0
Comparing match output Maximum value for Pulse count	[CA-99]	0 to 65535	A one-shot pulse can be achieved when the value is 0. When the number of pulses reaches the set value, the internal counter is cleared.	0
Pulse counter monitor	[dA-28]	0 to 2147483647	Displays the counter integrated value.	-

Terminal Input Monitoring Mode

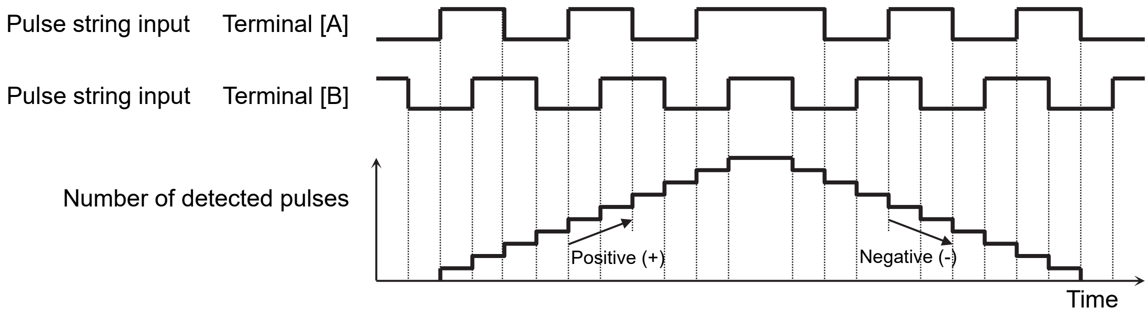
Monitors whether the input terminal functions [PLA] and [PLB] are turned on.



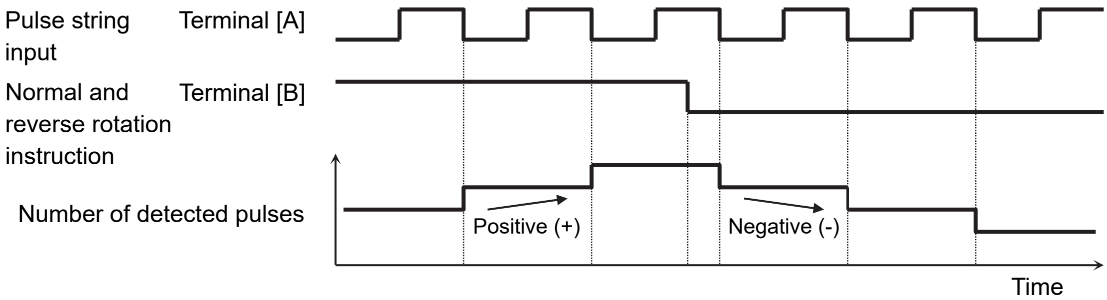
Phase Coefficient Monitoring Mode

Input terminals [A] and [B] become available for pulse string inputs.

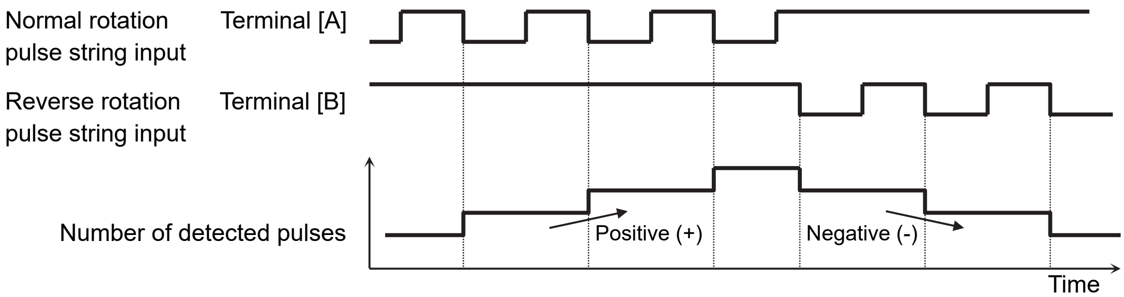
(a) Mode 0: [CA-91]=00 90° Phase difference pulse string



(b) Mode 1: [CA-91]=01 Normal and reverse rotation instruction + Pulse string



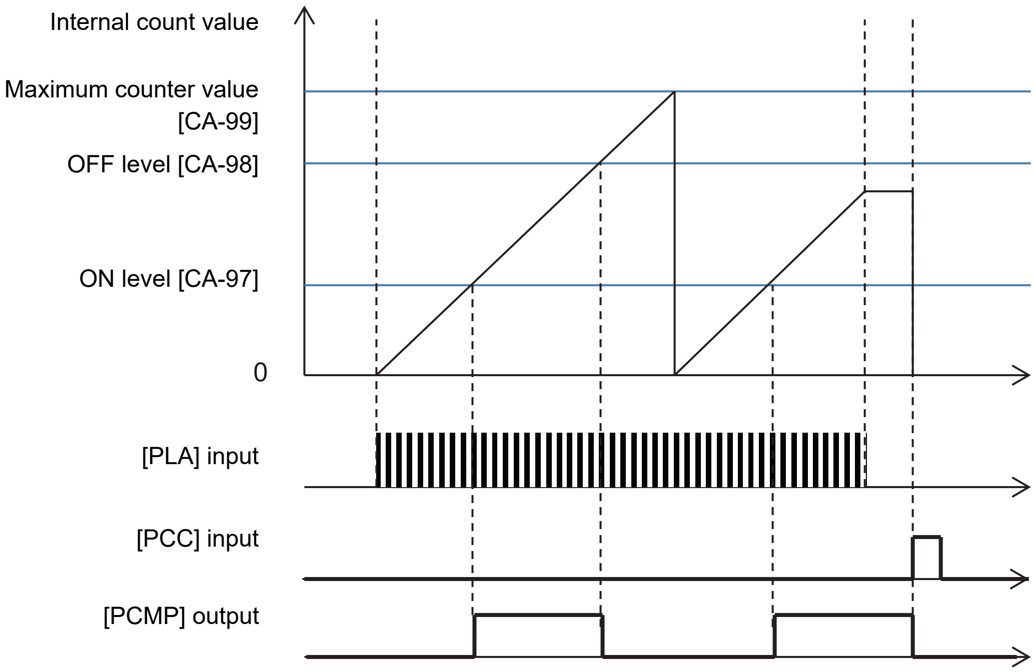
(c) Mode 2: [CA-91]=02 Normal rotation pulse string + Reverse rotation pulse string



Example of Pulse Counter Operation

The following shows how the pulse counter operates.

You can monitor the acquired pulses with the pulse counter monitor [dA-28] served as an accumulation counter.



8-10-7 Automatic Reset Function

When the “[bb-10] automatic reset selection” is set to 01, resetting is performed after the “[bb-12] automatic resetting stand-by time” has elapsed from when an operation instruction has been turned off.

When the “[bb-10] automatic reset selection” is set to 02, resetting is performed after the “[bb-12] automatic resetting stand-by time” has elapsed from when an error has occurred.

By setting the “Alarm output selection [bb-11]” to 01 while automatic resetting is valid, you can invalidate the output of the “Alarm [AL]” during automatic resetting operation.

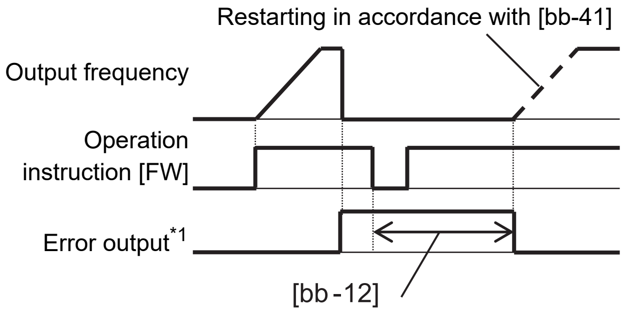
Upon automatic resetting has been performed for the number of times set with the “[bb-13] automatic resetting count setting,” no error will be cancelled, but a trip occurs.

Precautions for Correct Use

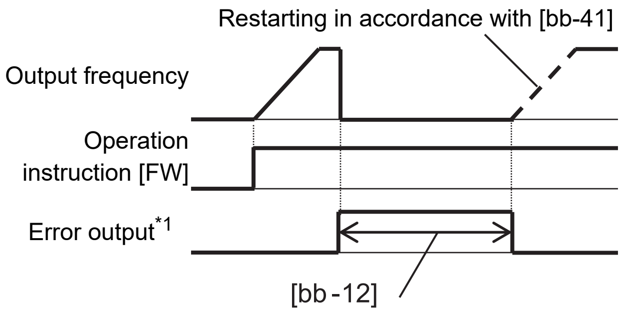
- When the “[bb-10] automatic reset selection” is set to 01, resetting starts when the STOP/RESET key is pressed as long as an instruction is given through the LCD operator.
- When resetting is performed manually, and a control power supply is turned on again, the number of automatic resetting counted internal is cleared.

The following is an example of operation of automatic resetting.

(Ex.1) When [bb-10]=01



(Ex.2) When [bb-10]=02



*1. When [bb-11]=00, the error output becomes the “[AL] output.”

● Parameter

Item	Parameter	Data	Description	Default data
Automatic reset selection	[bb-10]	00	Invalid	00
		01	Resetting starts when the operation instruction is turned off.	
		02	Resetting starts after the set time has elapsed.	
Alarm signal selection at Automatic error reset is active	[bb-11]	00	Outputting is available.	00
		01	Outputting is not available.	
Automatic error reset wait time	[bb-12]	0 to 600(s)	Sets a stand-by time from when resetting starts to when actual resetting starts.	2
Automatic error reset number	[bb-13]	0 to 10 (times)	Sets the number of automatic resetting.	3

● Automatic Reset target

Error No.	Error Name	Target
E001	Overcurrent error	Yes
E005	Motor overload error	Yes
E006	Braking resistor overload error	Yes
E007	Overvoltage error	Yes
E008	Memory error	
E009	Undervoltage error	Yes
E010	Current detector error	
E011	CPU error	
E012	External trip error	
E013	USP error	
E014	Ground fault error	
E015	Incoming overvoltage error	
E016	Instantaneous power failure error	Yes
E019	Temperature detector error	Yes
E020	Cooling fan rotation speed reduction temperature error	Yes
E021	Temperature error	Yes
E024	Input open-phase error	Yes
E030	IGBT error	Yes
E034	Output open-phase error	Yes
E035	Thermistor error	
E036	Brake error	Yes
E038	Low-speed range overload error	Yes
E039	Controller overload error	Yes
E040	Operator keypad disconnection error	Yes
E041	RS485 communication error	Yes
E042	RTC error	Yes
E043	EzSQ illegal instruction error	
E044	EzSQ nest count error	
E045	Executive instruction error	
E050	EzSQ user-assigned error 0	
E051	EzSQ user-assigned error 1	
E052	EzSQ user-assigned error 2	
E053	EzSQ user-assigned error 3	
E054	EzSQ user-assigned error 4	
E055	EzSQ user-assigned error 5	
E056	EzSQ user-assigned error 6	
E057	EzSQ user-assigned error 7	
E058	EzSQ user-assigned error 8	
E059	EzSQ user-assigned error 9	
E060	Option 1 error 0	Yes
E061	Option 1 error 1	Yes
E062	Option 1 error 2	Yes
E063	Option 1 error 3	Yes
E064	Option 1 error 4	Yes
E065	Option 1 error 5	Yes
E066	Option 1 error 6	Yes
E067	Option 1 error 7	Yes
E068	Option 1 error 8	Yes
E069	Option 1 error 9	
E070	Option 2 error 0	Yes
E071	Option 2 error 1	Yes
E072	Option 2 error 2	Yes
E073	Option 2 error 3	Yes
E074	Option 2 error 4	Yes
E075	Option 2 error 5	Yes
E076	Option 2 error 6	Yes
E077	Option 2 error 7	Yes
E078	Option 2 error 8	Yes
E079	Option 2 error 9	
E080	Option 3 error 0	Yes
E081	Option 3 error 1	Yes
E082	Option 3 error 2	Yes
E083	Option 3 error 3	Yes
E084	Option 3 error 4	Yes
E085	Option 3 error 5	Yes
E086	Option 3 error 6	Yes
E087	Option 3 error 7	Yes
E088	Option 3 error 8	Yes
E089	Option 3 error 9	
E090	STO shutoff error	
E091	STO internal error	
E092	STO path 1 error	
E093	STO path 2 error	
E094	FS option internal error	
E095	FS option path 1 error	
E096	FS option path 2 error	
E097	FS option connection error	
E100	Encoder disconnection error	
E104	Position control range error	Yes
E105	Speed deviation error	Yes
E106	Position deviation error	Yes
E107	Over-speed error	Yes
E110	Contactor error	Yes
E112	FB option connection error	
E120	PID Startup error	Yes

8-11 Output Terminal Function

8-11-1 Overview

Output terminals 11 to 15 are used for open collector output, and Relay output terminals 16 and 17 are used for relay output. Relay output 16 serves as a contact a relay, and Relay output 17 serves as a contact c relay.

For the content of an output signal, by allocating the functions that you want to output to [CC-01] to [CC-07], you will be able to allow the corresponding output terminal contacts to operate.

You can switch an output signal level with the Contacts a/b selection functions of [CC-11] to [CC-17].

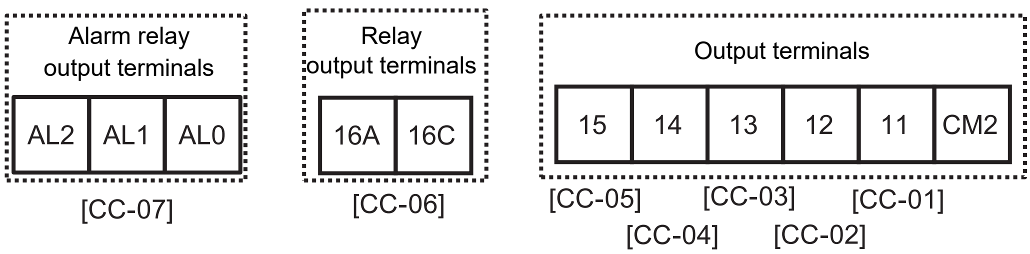
Precautions for Correct Use

To use the contact c relay, please check the control circuit power supply and the relay output terminals whether they are turned on or off.

● Parameter

Item	Parameter	Data	Description
Output terminal function selection	[CC-01] to [CC-05]	Next item: Table of output terminal selections	Outputs the allocated function to the corresponding output terminal.
Relay output terminal function selection	[CC-06]		
Relay output terminal function selection	[CC-07]		
Output terminal function selection	[CC-11] to [CC-15]	00	Operates as Contact a (NO).
Relay output terminal function selection a/b (NO/NC) selection	[CC-16]	01	Operates as Contact b (NC).
Relay output terminal function selection a/b (NO/NC) selection	[CC-17]		

● Terminals Corresponding to Parameters



● Output Terminal Selections

Function No.	Abbreviation	Function name	Page
000	no	Without allocation	-
001	RUN	During operation	P. 8-140
002	FA1	When the constant speed is attained	P. 8-144
003	FA2	Equal to or above the set frequency	P. 8-145
004	FA3	Set frequency only	P. 8-146
005	FA4	Equal to or above the set frequency 2	P. 8-145
006	FA5	Set frequency only 2	P. 8-146
007	IRDY	Operation ready completion	P. 8-143
008	FWR	During normal rotation operation	P. 8-141
009	RVR	During reverse rotation operation	P. 8-141
010	FREF	Frequency command panel	P. 6-26
011	REF	Operation command panel	P. 6-26
012	SETM	Second control under selection	P. 8-80
016	OPO	Optional output	P. 8-63
017	AL	Alarm signal	P. 8-123
018	MJA	Severe failure signal	P. 8-125
019	OTQ	Excessive torque	P. 7-51
020	IP	During instantaneous power failure	P. 8-131
021	UV	Under insufficient voltage	P. 8-132
022	TRQ	During torque limitation	P. 7-48
023	IPS	During power failure deceleration	P. 8-63
024	RNT	RUN time elapsed	P. 8-137
025	ONT	Power supply ON time elapsed	P. 8-138
026	THM	Electronic thermal warning (motor)	P. 8-133
027	THC	Electronic thermal warning (inverter)	P. 8-134
029	WAC	Capacitor life advance notice	P. 8-136
030	WAF	Fan life advance notice	P. 8-136
031	FR	Operation command signal	P. 8-142
032	OHF	Cooling fin heating advance notice	P. 8-135
033	LOC	Low current signal	P. 8-129
034	LOC2	Low current signal 2	P. 8-129
035	OL	Overload advance notice	P. 8-127
036	OL2	Overload advance notice 2	P. 8-127
037	BRK	Brake release	P. 8-85
038	BER	Brake abnormality	P. 8-85
039	CON	Contactor control	P. 8-91
040	ZS	0 Hz detection signal	P. 8-147
041	DSE	Excessive speed deviation	P. 8-78
042	PDD	Excessive positional deviation	P. 8-104
043	POK	Positioning completed	P. 8-108
044	PCMP	Pulse count compare-match	P. 8-167
045	OD	PID excessive deviation	P. 8-33
046	FBV	PID feedback comparison	P. 8-34
047	OD2	PID2 excessive deviation	P. 8-33
048	FBV2	PID2 feedback comparison	P. 8-34
049	NDc	Communication disconnection	P. 9-2
050	Ai1Dc	Analog disconnection Ai1	P. 8-148
051	Ai2Dc	Analog disconnection Ai2	P. 8-148
052	Ai3Dc	Analog disconnection Ai3	P. 8-148
056	WCAi1	Window comparator Ai1	P. 8-148
057	WCAi2	Window comparator Ai2	P. 8-148
058	WCAi3	Window comparator Ai3	P. 8-148

Function No.	Abbreviation	Function name	Page
062	LOG1	Result of logical operation 1	P. 8-151
063	LOG2	Result of logical operation 2	P. 8-151
064	LOG3	Result of logical operation 3	P. 8-151
065	LOG4	Result of logical operation 4	P. 8-151
066	LOG5	Result of logical operation 5	P. 8-151
067	LOG6	Result of logical operation 6	P. 8-151
068	LOG7	Result of logical operation 7	P. 8-151
069	MO1	General purpose output 1	P. 8-173
070	MO2	General purpose output 2	P. 8-173
071	MO3	General purpose output 3	P. 8-173
072	MO4	General purpose output 4	P. 8-173
073	MO5	General purpose output 5	P. 8-173
074	MO6	General purpose output 6	P. 8-173
075	MO7	General purpose output 7	P. 8-173
076	EMFC	Forced operation in process signal	P. 8-94
077	EMBP	During-bypass-mode signal	P. 8-96
080	LBK	Flat battery of LCD operator	P. 3-48
081	OVS	Excessive voltage of accepted power	P. 8-139
084	AC0	Alarm code bit 0	P. 8-126
085	AC1	Alarm code bit 1	P. 8-126
086	AC2	Alarm code bit 2	P. 8-126
087	AC3	Alarm code bit 3	P. 8-126
089	OD3	PID3 excessive deviation	P. 8-33
090	FBV3	PID3 feedback comparison	P. 8-34
091	OD4	PID4 excessive deviation	P. 8-33
092	FBV4	PID4 feedback comparison	P. 8-34
093	SSE	PID soft start abnormality	P. 8-20

8-11-2 Output Terminal NO/NC Selections

You can set output specifications for Contact a or Contact b separately for Output terminals 11 to 15 and Relay output terminals 16 and 17.

● Parameter

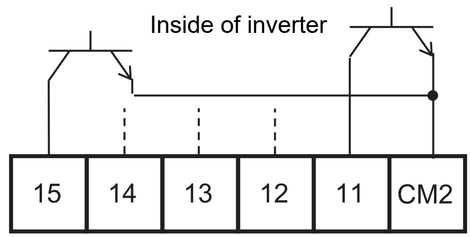
Item	Parameter	Data	Description
Output terminal function selection	[CC-11] to [CC-15]	00, 01	00: Contact a (normally open) operation 01: Contact b (normally closed) operation
Relay output terminal function selection a/b (NO/NC) selection	[CC-16]		
Relay output terminal function selection a/b (NO/NC) selection	[CC-17]		

- Contact a: Closes with “ON,” and opens with “OFF.”
- Contact b: Closes with “OFF,” and opens with “ON.”

Open Collector Output Terminals

The specifications of Output terminals 11 to 15 are as shown below. The same specifications are applied.

	Electrical characteristics
Terminals (11 to 15)-CM2	Voltage drop at ON: 4 V or below Allowable maximum voltage: DC 27 V Allowable maximum current: 50 mA

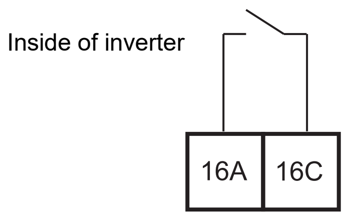


The open collector output operation is as shown below.

[CC-11] to [CC-15]	Control power supply	Output of inverter function	Open collector operation
00 (Contact a)	On	ON	Close
		OFF	Open
	Off	-	-
01 (Contact b)	On	ON	Open
		OFF	Close
	Off	-	-

Relay 1a Output Terminals

The specifications of Relay 1a output terminals 16A to 16C are as shown below.



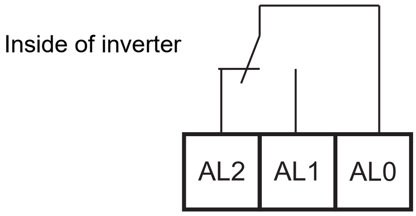
	Electrical characteristics
16A-16C	Voltage drop at ON: 4 V or below Allowable maximum voltage: DC 27 V Allowable maximum current: 50 mA

The operations of 16A to 16C are as shown below.

[CC-16]	Control power supply	Output of inverter function	Relay operation
00 (Contact a)	On	ON	Close
		OFF	Open
	Off	-	Open
01 (Contact b)	On	ON	Open
		OFF	Close
	Off	-	Open

Relay 1c Output Terminals

The specification of Relay 1c output terminals AL1 to AL0/AL2 to AL0 are as shown below.



		Resistance load	Induced load
AL1-AL0	Maximum contact capacity	AC250V, 2A DC30V, 3A	AC250V, 0.2A DC30V, 0.6A
	Minimum contact capacity	AC100V, 10mA DC5V, 100mA	
AL2-AL0	Maximum contact capacity	AC250V, 1A DC30V, 1A	AC250V, 0.2A DC30V, 0.2A
	Minimum contact capacity	AC100V, 10mA DC5V, 100mA	

• The operations of AL1 to AL0/AL2 to AL0 are as shown below.

[CC-17]	Control power supply	Output of inverter function	Output terminal state	
			AL1-AL0	AL2-AL0
00	On	ON	Close	Open
		OFF	Open	Close
	Off	-	Open	Close
01 (Initial value)	On	ON	Open	Close
		OFF	Close	Open
	Off	-	Open	Close

8-11-3 Output Terminal ON Delay/OFF Delay

You can set an on-delay/off-delay time per output terminal.

You can make a setting per output terminal. For the correspondence between output terminals and parameters, please refer to the table shown on the below.

Precautions for Correct Use

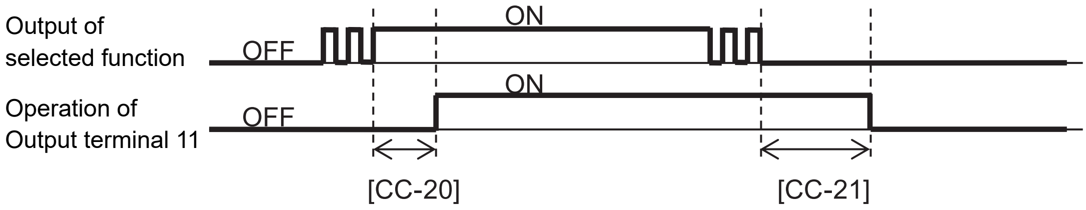
All output signals immediately turn ON/OFF upon a condition is satisfied. Chattering could occur depending on a selected signal. This function is available for retaining/delaying such a signal.

Output terminals	On-delay time	Off-delay time
11	[CC-20]	[CC-21]
12	[CC-22]	[CC-23]
13	[CC-24]	[CC-25]
14	[CC-26]	[CC-27]
15	[CC-28]	[CC-29]
16A-16C	[CC-30]	[CC-31]
AL1-AL0/AL2-AL0	[CC-32]	[CC-33]

- **Parameter**

Item	Parameter	Data	Description
Output on-delay time	[CC-20]/[CC-22]/[CC-24]/ [CC-26]/[CC-28]/[CC-30]/ [CC-32]	0.00 to 100.00(s)	Sets an on-delay time.
Output off-delay time	[CC-21]/[CC-23]/[CC-25]/ [CC-27]/[CC-29]/[CC-31]/ [CC-33]	0.00 to 100.00(s)	Sets an off-delay time.

(Ex.) Operation of Output terminal 11



8-11-4 Analog Output Terminal Adjustment

You can select, using some parameter codes, data to be output to the Analog output Ao1-L and Ao2-L terminals and the Digital pulse output FM-CM1 terminal.

Selectable Parameter Codes

The below table shows selectable parameter codes.

The output scale ranges are specified when bias settings are each set to 0.0%, and gain settings are each set to 100.0%.

You can adjust the output scale ranges with bias settings and gain settings.

Using the bias function, you can output, from data that can output “(±) data,” “(-) data” in a range from which outputting is available.

When selecting the output monitor, set the registered number of each code. For example, when using dA-02 of output current monitor via [Ao1] terminal, set “10002(2712h)” to Cd-04.

Code	Name	Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%)	Remarks
dA-01	Output frequency monitor	0.00 to Maximum speed (Hz)	
dA-02	Output current monitor	(0.00 to 2.00) × Inverter rated current (A)	
dA-04	Frequency command	0.00 to Maximum speed (Hz)	Outputting is possible with (±).
dA-08	Detected speed value monitor	0.00 to Maximum speed (Hz)	Outputting is possible with (±).
dA-12	Output frequency monitor (with sign)	0.00 to Maximum speed (Hz)	Outputting is possible with (±).
dA-14	Frequency upper limit monitor	0.00 to Maximum speed (Hz)	
dA-15	Torque command monitor	0 to Motor rated torque × 500% (Nm)*1	Outputting is possible with (±).
dA-16	Torque limit monitor	0 to Motor rated torque × 500% (Nm)*1	Outputting is possible with (±).
dA-17	Output torque monitor	0 to Motor rated torque × 500% (Nm)*1	Outputting is possible with (±).

Code	Name	Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%)	Remarks
dA-18	Output voltage monitor	0 to Rated voltage × 133% (V)	
dA-30	Input power monitor	0.00 to Rated power × 200% (kW)	
dA-34	Output power monitor	0.00 to Rated power × 200% (kW)	Outputting is possible with (±). Outputting with (+) at powered state and with (−) at regenerative state.
dA-38	Motor temperature monitor	-20.0 to 200.0(°C)	
dA-40	DC voltage monitor	(200 V class) 0.0 to 400.0 (Vdc) (400 V class) 0.0 to 800.0 (Vdc)	
dA-41	Braking circuit (BRD) duty ratio monitor	0.00 to 100.00(%)	
dA-42	Electronic thermal duty ratio monitor (motor)	0.00 to 100.00(%)	
dA-43	Electronic thermal duty ratio monitor (inverter)	0.00 to 100.00(%)	
dA-61	Analog input [Ai1] monitor	0.00 to 100.00(%)	
dA-62	Analog input [Ai2] monitor	0.00 to 100.00(%)	
dA-63	Analog input [Ai3] monitor	-100.00 to 100.00(%)	Outputting is possible with (±).
dA-70	Pulse string input monitor (main body)	-100.00 to 100.00(%)	Outputting is possible with (±).
dA-71	Pulse string input monitor (option)	-100.00 to 100.00(%)	Outputting is possible with (±).

*1. To calculate the motor rated torque (100%), use the following formula.
Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency
Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm

Precautions for Correct Use

Data with (±) will be applied to [FM], [Ao1], and [Ao2] when [Cd-12], [Cd-22], and [Cd-32] are 01, respectively. If [Cd-12], [Cd-22], and [Cd-32] are 00, respectively, data with (−) is output as the absolute value with (+).

Code	Name	Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%)	Remarks
db-18	Analog output monitor YA1	0.00 to 10000	
db-19	Analog output monitor YA2	0.00 to 10000	
db-20	Analog output monitor YA3	0.00 to 10000	
db-21	Analog output monitor YA4	0.00 to 10000	
db-22	Analog output monitor YA5	0.00 to 10000	
db-23	Analog output monitor YA6	0.00 to 10000	
db-30	PID1 feedback data 1 monitor	-100.00 to 100.00(%)*1	Outputting is possible with (±).
db-32	PID1 feedback data 2 monitor	-100.00 to 100.00(%)*1	Outputting is possible with (±).
db-34	PID1 feedback data 3 monitor	-100.00 to 100.00(%)*1	Outputting is possible with (±).
db-36	PID2 feedback data monitor	-100.00 to 100.00(%)*2	Outputting is possible with (±).
db-38	PID3 feedback data monitor	-100.00 to 100.00(%)*3	Outputting is possible with (±).
db-40	PID4 feedback data monitor	-100.00 to 100.00(%)*4	Outputting is possible with (±).
db-42	PID1 target value monitor	-100.00 to 100.00(%)*1	Outputting is possible with (±).

Code	Name	Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%)	Remarks
db-44	PID1 feedback data monitor	-100.00 to 100.00(%)*1	Outputting is possible with (±).
db-50	PID1 output monitor	-100.00 to 100.00(%)	Outputting is possible with (±).
db-51	PID1 deviation monitor	-200.00 to 200.00(%)	Outputting is possible with (±).
db-52	PID1 deviation 1 monitor	-200.00 to 200.00(%)	Outputting is possible with (±).
db-53	PID1 deviation 2 monitor	-200.00 to 200.00(%)	Outputting is possible with (±).
db-54	PID1 deviation 3 monitor	-200.00 to 200.00(%)	Outputting is possible with (±).
db-55	PID2 output monitor	-100.00 to 100.00(%)	Outputting is possible with (±).
db-56	PID2 deviation monitor	-200.00 to 200.00(%)	Outputting is possible with (±).
db-57	PID3 output monitor	-100.00 to 100.00(%)	Outputting is possible with (±).
db-58	PID3 deviation monitor	-200.00 to 200.00(%)	Outputting is possible with (±).
db-59	PID4 output monitor	-100.00 to 100.00(%)	Outputting is possible with (±).
db-60	PID4 deviation monitor	-200.00 to 200.00(%)	Outputting is possible with (±).
db-64	PID feedforward monitor	0.00 to 100.00(%)	
dC-15	Cooling fin temperature monitor	-20.0 to 200.0(°C)	

*1. Data range varies depending on the data from [AH-04] to [AH-06].

*2. Data range varies depending on the data from [AJ-04] to [AJ-06].

*3. Data range varies depending on the data from [AJ-24] to [AJ-26].

*4. Data range varies depending on the data from [AJ-44] to [AJ-46].

Code	Name	Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA / 0 to 100%)	Remarks
FA-01	Main speed command monitor	0.00 to 590.00(Hz)	
FA-02	Auxiliary speed command monitor	0.00 to 590.00(Hz)	
FA-15	Torque command monitor	Motor rated torque × (-500.0 to 500.0(%))*1	Outputting is possible with (±).
FA-16	Torque bias command monitor	Motor rated torque × (-500.0 to 500.0(%))*1	Outputting is possible with (±).
FA-30	PID1 target value 1	0.00 to 100.00(%)*2	
FA-32	PID1 target value 2	0.00 to 100.00(%)*2	
FA-34	PID1 target value 3	0.00 to 100.00(%)*2	
FA-36	PID2 target value	0.00 to 100.00(%)*3	
FA-38	PID3 target value	0.00 to 100.00(%)*4	
FA-40	PID4 target value	0.00 to 100.00(%)*5	

*1. To calculate the motor rated torque (100%), use the following formula.
Motor rated torque = 79.58 × Motor capacity × Number of poles/Base frequency
Example: Motor rated torque = 79.58 × 5.5 (kW) × 4 (P)/50 (Hz) ≈ 35 Nm

*2. Data range varies depending on the data from [AH-04] to [AH-06].

*3. Data range varies depending on the data from [AJ-04] to [AJ-06].

*4. Data range varies depending on the data from [AJ-24] to [AJ-26].

*5. Data range varies depending on the data from [AJ-44] to [AJ-46].

8-11-5 Analog Output Terminal Switch Settings

With Analog output terminals Ao1 and Ao2, you can select voltage output or current output by operating Switches SW3 and SW4 on the substrate.

Precautions for Correct Use

- In the switch setting on the substrate during factory setting, [A01] is output voltage; [A02] is output current.
- Operate the switches on the substrate while the inverter power supply is turned off.
- When [Cd-10]=01 is set, [FM], [Ao1], and [Ao2] respectively perform outputs in accordance with values of [Cd-15], [Cd-25], and [Cd-35].

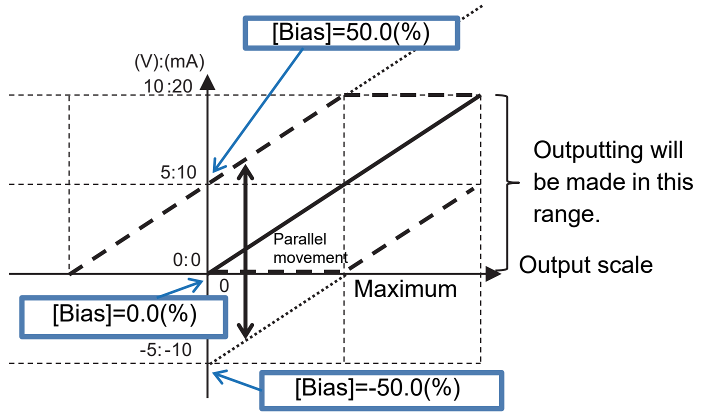
● Parameter

Item	Parameter	Data	Description	Default data
[Ao1] monitor output selection	[Cd-04]	Parameter number for *8-11-4 Analog Output Terminal Adjustment* on page 8-178.	Sets a parameter number.	[dA-01]
[Ao2] monitor output selection	[Cd-05]			[dA-01]
Analog monitor adjust mode enable	[Cd-10]	00	Invalid.	00
		01	Valid. Outputs to terminals output levels in the adjustment mode.	
Filter time constant of [Ao1] monitor	[Cd-21]	1 to 500[ms]	Filters and outputs the selected data.	100
[Ao1] Data type selection	[Cd-22]	00	Outputs the absolute value of data.	00
		01	Outputs data with a symbol as is.	
[Ao1] monitor bias adjustment	[Cd-23]	-100.0 to 100.0[%]	Biases data to adjust Point 0 of data.	0.0
[Ao1] monitor gain adjustment	[Cd-24]	-1000.0 to 1000.0[%]	Apply a gain to data to adjust an inclination in data.	100.0
Output level setting at [Ao1] monitor adjust mode	[Cd-25]	-100.0 to 100.0[%]	Sets output in the adjustment mode. It selects the maximum output (at 100.0%), the minimum output (at 0.0%) ([Cd-22]=00), or the minimum output (at -100.0%) ([Cd-22]=01).	100.0
Filter time constant of [Ao2] monitor	[Cd-31]	1 to 500[ms]	Filters and outputs the selected data.	100
[Ao2] Data type selection	[Cd-32]	00	Outputs the absolute value of data.	0
		01	Outputs data with a symbol as is.	
[Ao2] monitor bias adjustment	[Cd-33]	-100.0 to 100.0[%]	Biases data to adjust Point 0 of data.	20.0
[Ao2] monitor gain adjustment	[Cd-34]	-1000.0 to 1000.0[%]	Apply a gain to data to adjust an inclination in data.	80.0
Output level setting at [Ao2] monitor adjust mode	[Cd-35]	-100.0 to 100.0[%]	Sets output in the adjustment mode. It selects the maximum output (at 100.0%), the minimum output (at 0.0%) ([Cd-32]=00), or the minimum output (at -100.0%) ([Cd-32]=01).	100.0

Bias Adjustment of Analog Output

Terminal	Current/voltage	Bias parameter
Ao1	Common to voltage/current	[Cd-23]
Ao2	Common to voltage/current	[Cd-33]

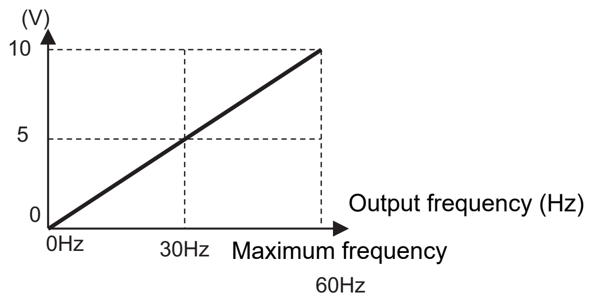
You can bias Point 0 as shown in the below figure.



(Ex.) Outputting information on the "[dA-01] output frequency monitor" to [Ao1] in a voltage range from 0 to 10 V

Output in a range from 0 Hz to the maximum frequency (60 Hz).

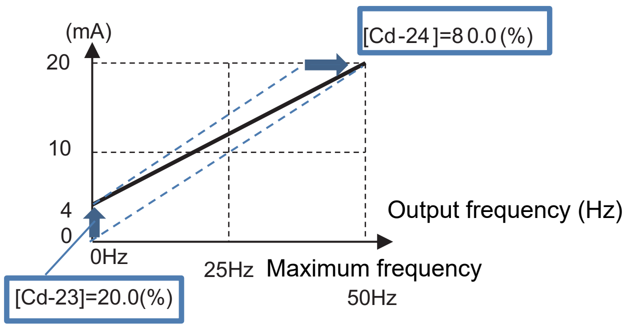
[Cd-23]=0.0%, [Cd-24]=100.0%



(Ex.) Outputting information on the output frequency monitor to [Ao1] in a current range from 4 to 20 mA

Output in a range from 0 Hz to the maximum frequency (50 Hz).

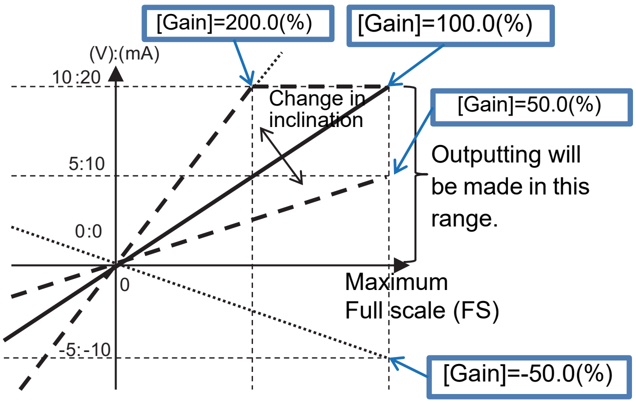
[Cd-23]=20.0%, [Cd-24]=80.0%



Gain Adjustment of Analog Output

Terminal	Current/voltage	Gain parameter
Ao1	Common to voltage/current	[Cd-24]
Ao2	Common to voltage/current	[Cd-34]

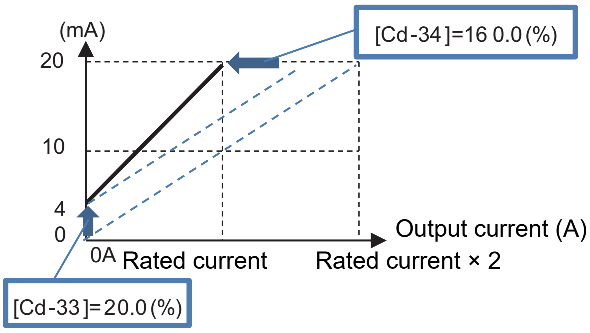
You can change an inclination as shown in the below figure.



(Ex.) Outputting information on the output current monitor to [Ao2] in a current range from 4 to 20 mA

Monitor the current in a range from 0 A to the inverter rated current.

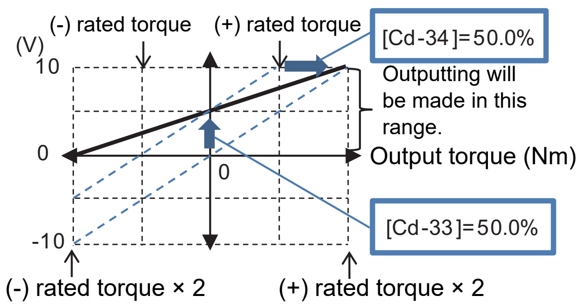
[Cd-33]=20.0%, [Cd-34]=160.0%



(Ex.) Outputting information on the output torque monitor to [Ao2] in a voltage range from 0 to 10 V

Set a voltage output range from 0 to 10 V in a torque range from -200 to 200%.

[Cd-32]=01, [Cd-33]=50.0%, [Cd-34]=50.0%



Note When [Cd-32]=00 is set in the above described example, corresponding values in a range from 5 to 10 V will be output for a range from 0 to -200% on the "(-) rated torque" side.

Analog Monitor Adjustment Mode: [Ao1] and [Ao2] Output

Setting the analog monitor adjustment mode [Cd-10] to 01 fixes the outputs of the [Ao1] and [Ao2] output terminals.

With the output fixed with [Ao1], an output set with [Cd-25] is made for the full-scale value of the monitor selected with [Cd-04].

With the output fixed with [Ao2], an output set with [Cd-35] is made for the full-scale value of the monitor selected with [Cd-05].

(Ex.) Outputting from [Ao1] information on the output current monitor in a range from 4 to 20 mA

I want to perform outputting in a range from 4 to 20 mA when a current ranging from 0 A to a current value of Inverter rated current × 2 flows.

(The standard points are a current in a range from 0 A to a current value of Inverter rated current × 2)

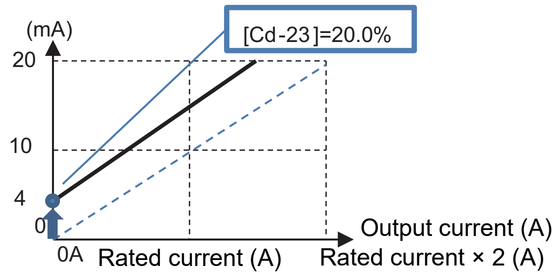
Code	Name	Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA)
dA-02	Output current monitor	(0.00 to 2.00) × Inverter rated current (A)

1 Check that [SW3] on the substrate is set to a current of 20 mA, and then turn on the power supply.

Set [Cd-04]=(dA-02). Setting [Cd-10] to 01 and [Cd-25] to 0.0% sets the output from the [Ao1] terminal to 0 mA.

2 When the standard point you want to output is 0 A, and when you want to output 4 mA from [Ao1], adjust [Cd-23] to approximately 20.0%, and check if 4 mA is output.

(For example, see and wait with a range from 15.0% to 25.0%.)

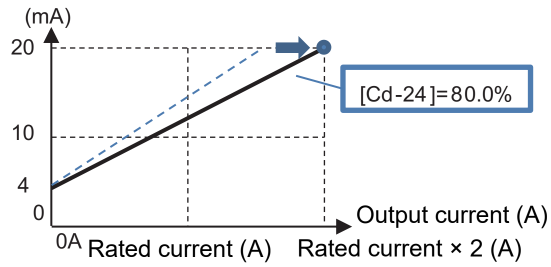


3 Setting [Cd-25] to 100.0% sets the output from the [Ao2] terminal to approximately 20 mA.

4 Adjust the inclination with [Cd-24]. Change [Cd-24] to make an adjustment immediately before the point at which [Ao2] begins lowering from 20 mA.

(For example, see and wait with a range from 75.0 to 85.0%.)

[Cd-23]=20.0%, [Cd-24]=80.0%



5 Returning [Cd-10] to 00 starts current output of [Ao1] that is adjusted.

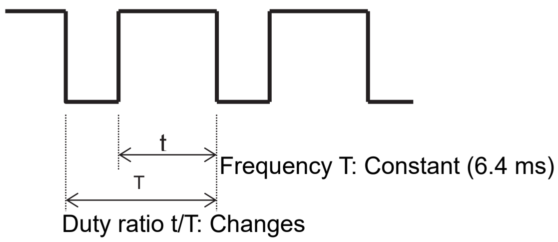
8-11-6 Output Functions (FM)

With the FM output function, you can make selections from the PWM output in which a duty ratio changes and the digital frequency output in which a frequency changes.

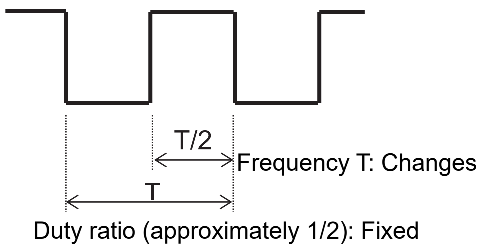
Precautions for Correct Use

- The finally determined output does not exceed an output range of the [FM] output terminal.
- When [Cd-10]=01 is set, [FM], [Ao1], and [Ao2] respectively perform outputs in accordance with the values of [Cd-15], [Cd-25], and [Cd-35].

(Ex.1) [Cd-01]=00 PWM output



(Ex.2) [Cd-01]=01 Digital frequency output



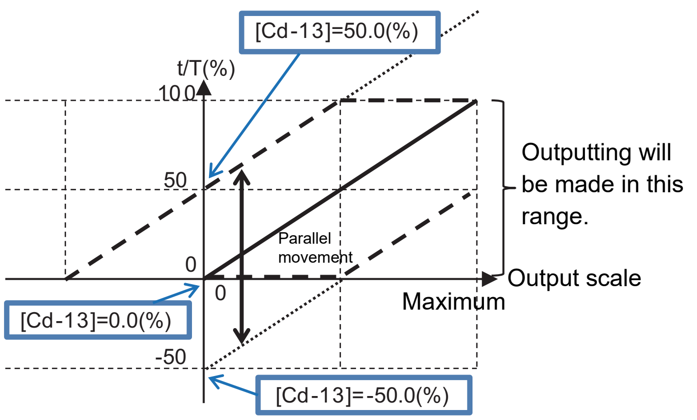
● Parameter

When selecting the output monitor, set the registered number of each code. For example, when using dA-02 of output current monitor via [FM] output terminal, set “10002(2712h)” to [Cd-03].

Item	Parameter	Data	Description	Default data
[FM] monitor output wave form selection	[Cd-01]	00	PWM output (Frequency: 6.4 ms)	00
		01	Digital frequency output	
[FM] monitor output base frequency (at PWM output)	[Cd-02]	0 to 3600[Hz]	[FM] terminal output frequency in the full scale.	2880
[FM] monitor output selection	[Cd-03]	Parameter number for *8-11-4 Analog Output Terminal Adjustment* on page 8-178.	Sets a parameter number.	[dA-01]
Analog monitor adjust mode enable	[Cd-10]	00	Invalid.	00
		01	Valid. Outputs to terminals output levels in the adjustment mode.	
Filter time constant of [FM] monitor	[Cd-11]	1 to 500[ms]	Filters FM output data.	100
[FM] Data type selection	[Cd-12]	00	Outputs the absolute value of data.	00
		01	Outputs data with a symbol.	
[FM] monitor bias adjustment	[Cd-13]	-100.0 to 100.0[%]	Biases data to adjust Point 0 of data.	0.0
[FM] monitor gain adjustment	[Cd-14]	-1000.0 to 1000.0[%]	Apply a gain to data to adjust an inclination in data.	100.0
Output level setting at [FM] monitor adjust mode	[Cd-15]	-100.0 to 100.0[%]	Sets output in the adjustment mode. It selects the maximum output (at 100.0%), the minimum output (at 0.0%) ([Cd-12]=00), or the minimum output (at -100.0%) ([Cd-12]=01).	100.0

[Cd-01] [FM] Terminal Output Form Selection is Set to 00

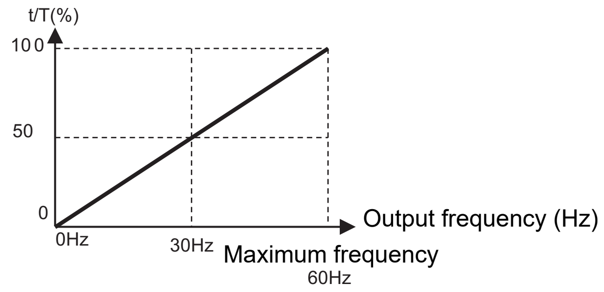
With the “Bias adjustment [Cd-13]” of the “PWM output,” you can bias Point 0 as shown in the below figure.



(Ex.) PWM-outputting [dA-01] output frequency monitor

Output until a current reaches the maximum frequency when the PWM output is 100%.

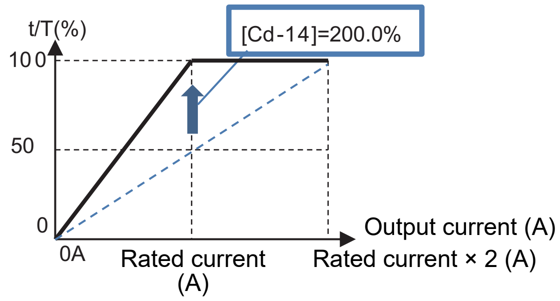
[Cd-13]=0.0%, [Cd-14]=100.0%



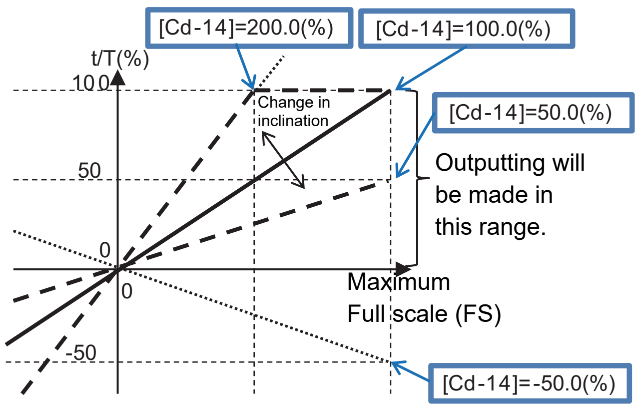
(Ex.) PWM-outputting [dA-02] output current monitor

Output until a current reaches the inverter rated current when the PWM output is 100%.

[Cd-13]=0.0%, [Cd-14]=200.0%



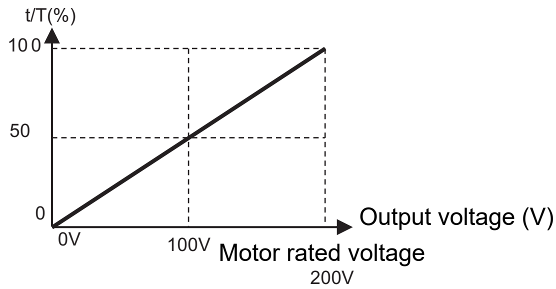
With the “Gain adjustment [Cd-14]” of the “PWM output,” you can change an inclination as shown in the below figure.



(Ex.) PWM-outputting [dA-18] output voltage monitor

Monitoring of Output Voltage

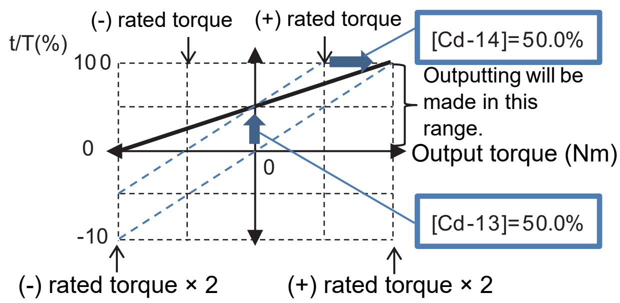
[Cd-13]=0.0%, [Cd-14]=133.0%



(Ex.) PWM-outputting [dA-17] output torque monitor

Set PWM output range from 0 to 100% in a torque range from -200 to 200%.

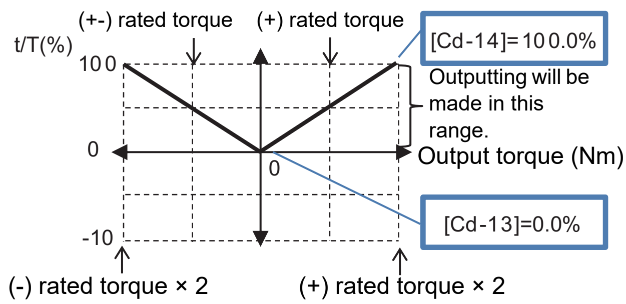
[Cd-12]=01, [Cd-13]=50.0%, [Cd-14]=50.0%



(Ex.) PWM-outputting [dA-17] output torque monitor

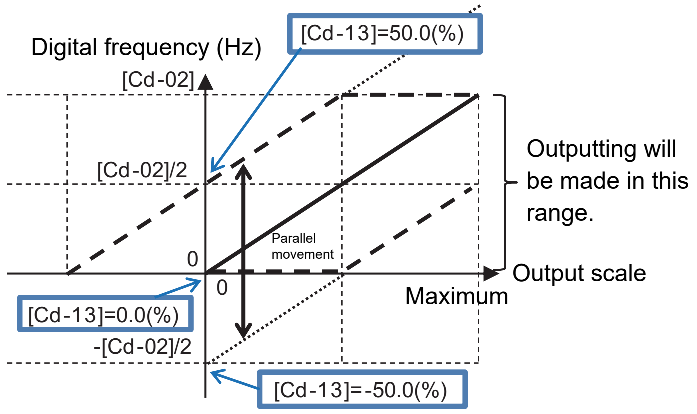
Set PWM output range from 0 to 100% in a torque range from 0 to ±200%.

[Cd-12]=00, [Cd-13]=0.0%, [Cd-14]=100.0%



[Cd-01] [FM] Terminal Output Form Selection is Set to 01

With the “Bias adjustment [Cd-13]” of the “Digital frequency output,” you can bias Point 0 as shown in the below figure.

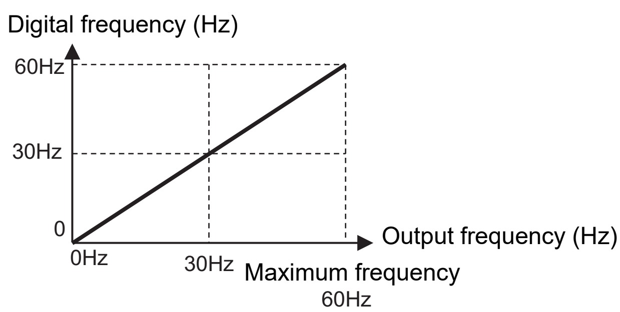


(Ex.) Digital-frequency-outputting information on [dA-01] output frequency monitor

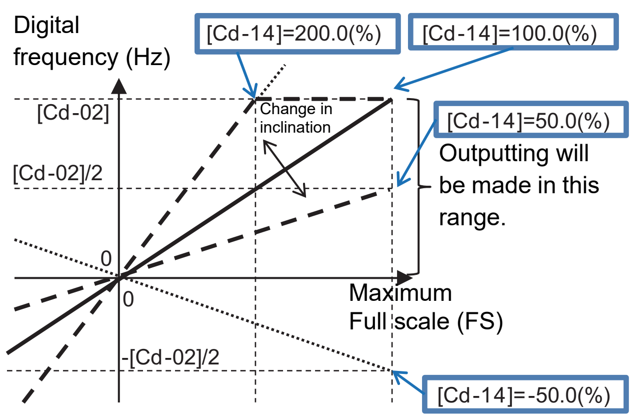
Output so that the maximum values of the digital frequency output corresponds to the maximum frequency.

When the maximum frequency is 60 Hz, set [Cd-02]=60Hz.

[Cd-13]=0.0%, [Cd-14]=100.0%



With the “Gain adjustment [Cd-14]” of the “Digital frequency output,” you can change an inclination as shown in the below figure.



8-11 Output Terminal Function

8

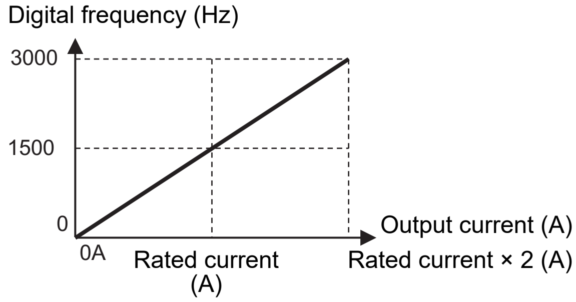
8-11-6 Output Functions (FM)

(Ex.) Digital-frequency-outputting information on [dA-02] output current monitor

When a current equivalent to inverter rated current flows, provide output at 1,500 Hz.

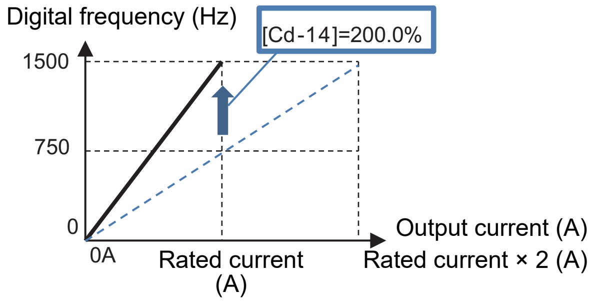
Set [Cd-02]=3000Hz.

[Cd-13]=0.0%, [Cd-14]=100.0%



Set [Cd-02]=1500Hz.

[Cd-13]=0.0%, [Cd-14]=200.0%



Analog Monitor Adjustment Mode: [FM] Output

Setting the analog monitor adjustment mode [Cd-10] to 01 fixes the output of the [FM] output terminal.

With the fixed output, an output set with [Cd-12] is made for the full-scale value of the monitor selected with [Cd-03].

(Ex.) Outputting the output current monitor with the PWM output

When a current equivalent to inverter rated current flows, provide output with a PWM output at 100%. (The standard point is the inverter rated current.)

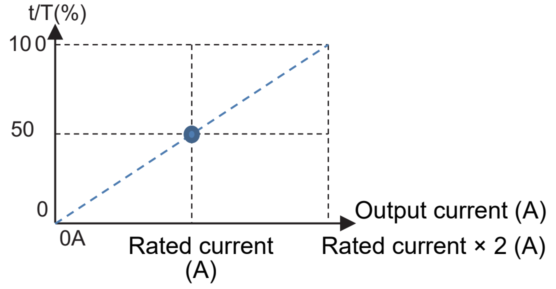
Code	Name	Output scale range (Corresponding to 0 to 10 V / 0 to 20 mA)
dA-02	Output current monitor	(0.00 to 2.00) × Inverter rated current (A)

1 Set [Cd-01]=00 and [Cd-03]=(dA-02).

Setting [Cd-10] to 01 outputs PWM from the [FM] terminal in accordance with [Cd-12].

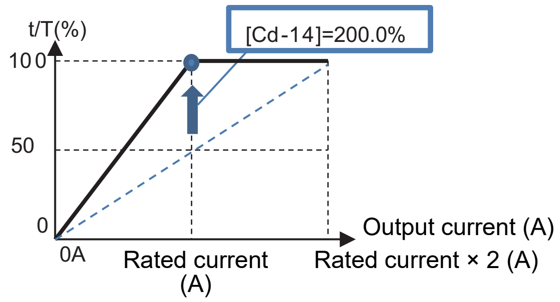
2 When the standard point at which you want to perform outputs is the rated current value, since the rated current has a maximum scale of Rated current × 2.00, set a point that is half of it. First set [Cd-12] to 50.0% (corresponding to the inverter rated current).

In this state, since the full scale of the output current monitor is Rated current × 2.00, the [FM] terminal outputs PWM of 50% duty, which is an output at the rated current (= Rated current × 2.00 × 50.0%).



3 Adjust the inclination with [Cd-14]. Change [Cd-14] to make an adjustment toward the point from which PWM of 100% duty is output.
(For example, see and wait with a range from 190.0% to 210.0%.)

[Cd-13]=0.0%, [Cd-14]=200.0%



4 Returning [Cd-10] to 00 starts the PWM output of [FM] that is adjusted.

9

Communications Functions

This section describes the communications functions.

9-1 Communication Specifications

The 3G3RX2 Series has an RS485 communications capability that enables the inverter to communicate with an external controller from its RS485 communication terminal block on the control terminal block PCB.

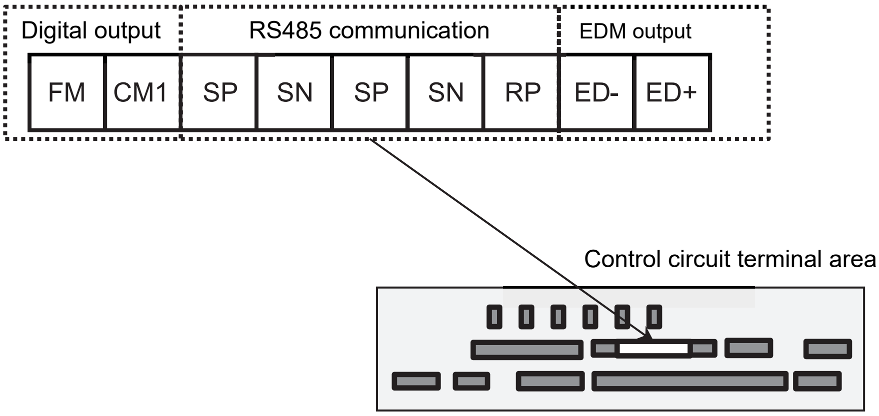
Communications Specifications

Item	Modbus mode	Remarks
Transmission speed	2,400/4,800/9,600/19,200/38,400/57,600/76,800/115,200 bps	Selectable via Digital Operator
Communications method	Half duplex communication method	
Synchronous mode	Non-synchronous mode	
Transmission code	Binary	
Transmission method	Transmission starts with Least Significant Bit (LSB first)	
Applicable interface	RS-485	
Data bit length	8 bits	
Parity	No/Even/Odd	Selectable via Digital Operator
Stop bit length	1/2 bits	Selectable via Digital Operator
Start mode	Half side start mode by host side command	
Waiting time	0 to 1,000 [ms]	Selectable via Digital Operator
Connection form	1:N (N=32)	Selectable via Digital Operator
Error check	Overrun/Framing/CRC-16/Horizontal parity	

RS485 Port Specifications and Connections

The RS485 communications function uses RS485 communication terminal block for terminals of the control circuit.

Wire the RS485 communications terminal block as follows.



Abbreviated Terminal Name	Description	Function
SP	RS485 Sending/receiving terminal + side	At + side of Sending/receiving signal of RS485 communications
SN	RS485 Sending/receiving terminal - side	At - side of Sending/receiving signal of RS485 communications
RP	Enable terminating resistor terminal	A terminal which enables internal terminating resistor (100Ω). The internal terminating resistor can be enabled when you connect – side of RS485 communication sending/receiving terminal (for connecting terminating resistor) to RP.
(SN)	RS485 Sending/receiving terminal - side (for connecting terminating resistors)	
(CM1)	Signal ground	You can connect a signal ground of an external communication device. (Also for FM terminal)

The wire size and tightening torque recommended for RS485 communication terminal block are as follows.

Screw size	Tightening torque [N·m]	Wire type	Wire size [mm^2]
M2	0.22 to 0.25	Solid wire	0.14 to 1.5 (If two equal-sized wires are connected to one pole: 0.14 to 0.5)
		Stranded wire	0.14 to 1.0 (If two equal-sized wires are connected to one pole: 0.14 to 0.2)
		Stranded wire with ferrule	0.25 to 0.5 (Example: PC-1.25F7 1.25=3AF from JST Mfg. Co., Ltd.)

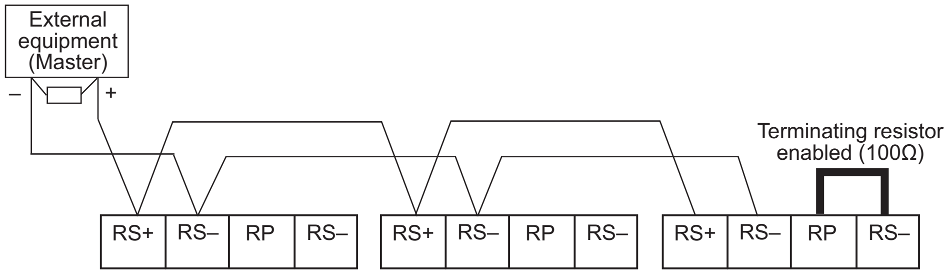
Connections

Connect the inverters parallel to each other as shown below. For termination, enable the terminating resistor only for the terminal Inverter.

Use the terminating resistor even if you have only one Inverter connected.

Selecting a terminating resistor that matches the cable impedance improves the terminating effect.

For the 3G3RX2 Series Inverter, shorting the RP and RS terminals enables the built-in terminating resistor (100 Ω).



Settings

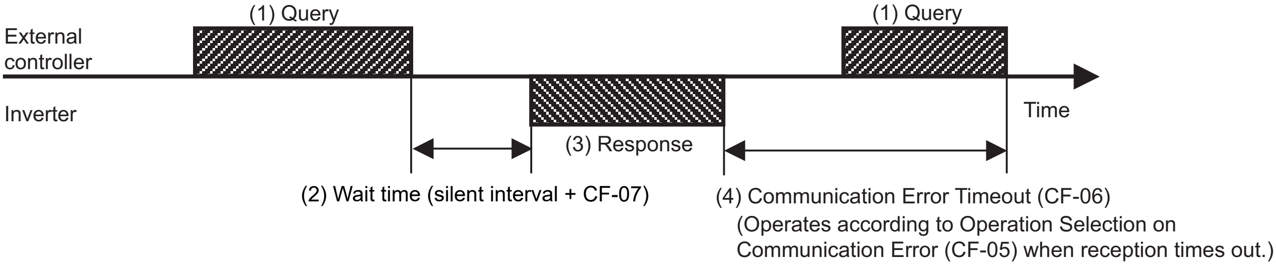
To configure the 3G3RX2 Series Inverter for RS485 communications, the following settings are required.

Parameter No.	Function name	Data		Default data	Unit
CF-01	RS485 communication baud rate selection	03:	2400 bps	05	
		04:	4800 bps		
		05:	9600 bps		
		06:	19200 bps		
		07:	38400 bps		
		08:	57600 bps		
		09:	76800 bps		
		10:	115200 bps		
CF-02	RS485 communication Node allocation	1. to 247.:	Allocate each inverter's station number. Set station numbers to control several inverters simultaneously.	1.	
CF-03	RS485 communication parity selection	00: 01: 02:	Without parity Even number parity Odd number parity	00	
CF-04	RS485 communication stop-bit selection	01:	1 bit	01	
		02:	2 bit		
CF-05	RS485 communication error selection	00: 01: 02: 03: 04:	Error Trip after deceleration stop Ignore Free run Deceleration stop	02	
CF-06	RS485 communication timeout setting	0.00:	Function disabled	0.00	s
		0.01 to 100.00:	Length of time to occurrence of a communications timeout		
CF-07	RS485 communication wait time setting	0 to 1000:	Time to wait for response from the inverter	2	ms
CF-08	RS485 communication mode selection	01: 02: 03:	Modbus-RTU EzCOM EzCOM management	01	
CC-01 to CC-07	Output Terminal Function	049:	[NDc] signal is turned ON when a communication disconnection occurs. Turn the signal OFF by resetting errors.	-	

9-2 Modbus Method

Communications Procedure

The inverter communicates with an external controller as follows.



(1) Frame (Query) that is sent from the external control device to the inverter

(2) After receiving a query frame, the inverter waits for the total time of the Silent Interval and the Communication Wait Time (CF-07), before returning a response.
Silent Interval
The wait time that is specified on Modbus communication; its data length is 3.5 characters (3.5 bytes).
It depends on the Modbus communication speed setting.

(3) Frame (Response) that is sent from the inverter back to the external controller

(4) After sending a response, the inverter monitors the time until it completes receiving the query frame from the external control device. The inverter judges it as a communications error if it receives no response within the Communication Error Timeout Time (CF-06).
Then, the inverter operates according the Operation Selection on Communication Error (CF-05), while waiting for the reception of the first data again.
The monitoring of the Communication Error Timeout Time starts from the first sending/receiving operation is established after the power supply is cycled or after the inverter is reset.
The inverter does not recognize as a communications error timeout if the sending/receiving operation is not established at all.
For setting details, refer to the following information.

Parameter No.	Function name	Data		Default data	Unit
CF-05	RS485 communication error selection	00: 01: 02: 03: 04:	Error Trip after deceleration stop Ignore Free run (Deceleration stop)	02	
CF-06	RS485 communication timeout setting	0.00:	Function disabled	0.00	s
		0.01 to 100.00:	Length of time to occurrence of a communications error timeout		
CF-07	RS485 communication wait time setting	0 to 1000:	Time to wait for response from the inverter (exclude silent inverter)	2	ms

Query Frame Configuration

The format of a query frame (command) is as follows.

Slave address
Function code
Data
Error check

<Slave Address>

- A serial number from 1 to 32 preset for each inverter (slave). Only the inverter that matches the slave address specified in the query will capture that query.
- Set the slave address to 0 to perform broadcasting (distributing a query to all slave addresses at a time).
- During a broadcast, you cannot perform data call or loop-back operation.

<Function Code>

This specifies the function to be performed by the inverter.

Function Code

Function code	Function	Maximum number of data bytes per message	Maximum number of coils/registers per message
01 hex	Reads out the state of coil	4	32 coils (bitwise)
03 hex	Reads out the content of retention register	32	16 registers (in bytes)
05 hex	Writes to coil	2	1 coil (bitwise)
06 hex	Writes to retention register	2	1 register (in bytes)
08 hex	Loopback test	–	–
0F hex	Writes to multiple coils	4	32 coils (bitwise)
10 hex	Writes to multiple retention registers	32	16 registers (in bytes)

<Data>

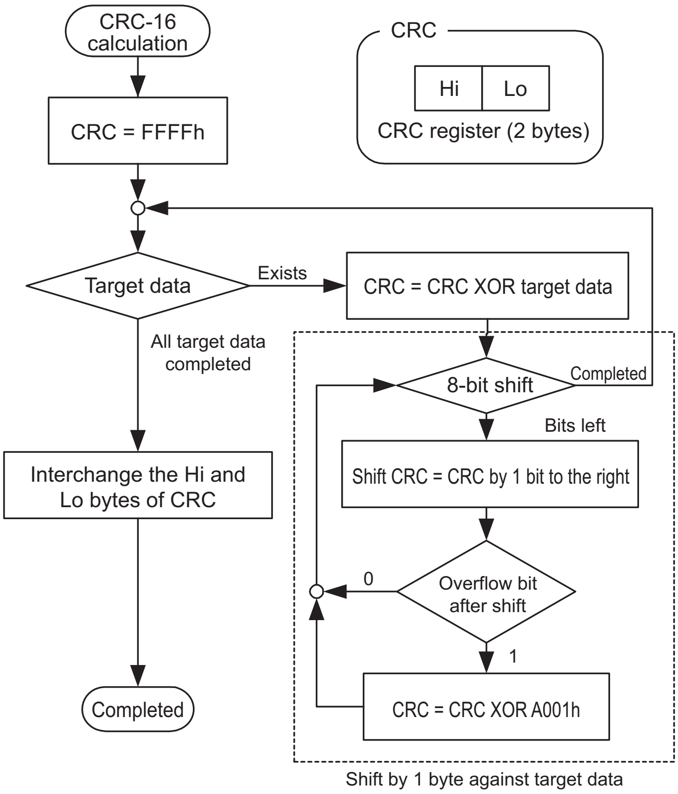
- This sends the function command.
- The data format differs depending on the function code.

Data name	Description
Coil	Two values can be read and written (1 bit length).
Holding register	Data with 16 bit length can be read and written.

<Error Check>

- CRC (Cyclic Redundancy Check) is used for error checking.
- The CRC code is 16-bit data generated for any data block with a data length in 8-bit unit.
- For CRC code generation, the following generator polynomial is used: CRC-16 ($X^{16} + X^{15} + X^2 + 1$).

CRC-16 Polynomial Calculation Example



<Header/Trailer (Silent Interval)>

- The silent interval is the length of time during which the inverter waits after receiving a query from the master, before sending back a response to it.
- Be sure to include a silent interval of 3.5 characters (3.5 bytes) as the wait time. If less than 3.5 characters, the inverter will send no response.
- The actual wait time during communications is the sum of the silent interval (3.5 characters) and the Communication Wait Time (CF-07).

Response Frame Configuration

<Required Communications Time>

- The time that the inverter takes to send a response after receiving a query is the sum of the silent interval (3.5 characters) and the Communication Wait Time (CF-07).
- After receiving a response from an inverter, be sure to include an interval equivalent to the silent interval (3.5 characters) or more before sending the next query to the inverter.

<Normal Response>

- If a query includes the loop-back function code (08 hex), the inverter sends back a response with the same content as that of the query.
- If a query includes a function code for writing data to a holding register/coil (05 hex, 06 hex, 0F hex, 10 hex), the inverter returns the query as a response.
- If a query includes a function code for reading data from a holding register/coil (01 hex, 03 hex), the inverter sends back a response that includes the same slave address and function code as the query, with the read data.

<Abnormal Response>

Field Configuration

Slave address
Function code
Exception code
CRC-16

- If an error (except for a communications error) is found in the query content, the inverter will return an exception response without performing any operation.
- For the cause of an error, check the function code for the response. The function code for an exception response is the sum of the function code for the query and 80 hex.
- For the cause of an error, check the exceptional code.

Exception code

Code	Description
01 hex	An unsupported function is specified.
02 hex	The specified address does not exist.
03 hex	The specified data is in an unacceptable format.
21 hex	Writing to a holding register is specified, but the data is out of the range allowed for the inverter.
22 hex	The inverter does not allow this function because: • Inverter is in an operation busy state. • Function attempts to change a register that cannot be changed during RUN. • Function attempts to issue the Enter command during RUN (in an undervoltage state). • Function attempts to write data to a register during trip (in an undervoltage state). • Function attempts to write data to a read-only register (coil).

23h The writing function code is used in read-only function parameter.

26h While data is being written into the inverter, or the inverter's data is being initialized, some data is written into the inverter.

27h There was an access to only the higher side register of 2 register long parameter.

<No Response>

The inverter will ignore the query and send back no response if:

- It receives a broadcast query.
- It detects a communications error in receiving a query.
- The slave address specified in a query does not match the inverter’s slave address setting.
- The length of the time interval set for the inverter to receive the next data of the message after receiving a message is less than 3.5 characters.
- The data length of a query is inappropriate.
- The length of the reception interval in a frame exceeds the 1.5 characters.
- The error check code specified in a query does not match (CRC error).
- When it received query of slave address 250 to 254

Note Provide a timer on the master side for monitoring the response and set it to resend the same query if no response is received within the set time.

9-3 Explanation of Each Function Code

Read Coil Status [01 hex]

Reads the coil status (ON/OFF).

Precautions for Correct Use

The byte order was changed when data over 1 bite is processed with reading function of several coils via Modbus communication.

Receive data in the data layout as shown below, according to the number of data bytes to be read.

- Data received as 1-byte data (1 to 8 coils)

Coil 8 to Coil 1	

- Data received as 2-byte data (9 to 16 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9

- Data received as 3-byte data (17 to 24 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9	Coil 24 to Coil 17

- Data received as 4-byte data (25 to 32 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9	Coil 24 to Coil 17	Coil 32 to Coil 25

Example

When inverter's input terminal function 1 to 6 with slave address 8 is read out, the input terminal status is shown as below table.

Item	Data					
Input terminal No.	1	2	3	4	5	6
Coil number	0005 hex	0006 hex	0007 hex	0008 hex	0009 hex	000A hex
Terminal status	ON	ON	ON	OFF	ON	OFF

Coil numbers 000B hex and 000C hex are OFF.

Query

No.	Field name	Example [hex]	Remarks
1	Slave address*1	08	
2	Function code	01	
3	Coil start number (MSB)*2	00	(Coil address) = (Coil number) – 1
4	Coil start number (LSB)*2	04	
5	Number of coils (MSB)*3	00	
6	Number of coils (LSB)*3	06	
7	CRC-16 (MSB)	5C	
8	CRC-16 (LSB)	90	

Response

No.	Field name	Example [hex]	Remarks
1	Slave address	08	
2	Function code	01	
3	Number of data bytes	01	
4	Coil data*4	17	17 hex = 0 0 0 1 0 1 1 1 Input terminal 6 Input terminal 1
5	CRC-16 (MSB)	12	
6	CRC-16 (LSB)	1A	

*1. Broadcasting cannot be performed.

*2. Note that the coil start number is 0004, which is 1 less than the coil number 0005.

*3. If the number of coils to be read is set to 0 or more than 32, an error code (03 hex) will be returned.

*4. Data as much as the number of data bytes will be transferred.

Data received to a response shows status of coil No. 0007h to 000Eh (Input terminal 1 to 8).

Therefore, the received data “17 hex = 00010111 binary” can be read from the LSB that shows the status of coil number 0007 hex, as follows:

Coil No.	00Fh	00Eh	00Dh	00Ch	00Bh	00Ah	009h	008h	007h	006h	005h
Coil Status	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON	ON	ON
Input Terminal No.	B	A	9	8	7	6	5	4	3	2	1

If, in the last coil data, the read coil exceeds the defined coil range, such out-of-range coil data will be transferred as 0.

If the Read Coil Status function is not executed normally, refer to *Exception Response* on page 9-18.

Read from Holding Register [03 hex]

Reads the contents of consecutive holding registers. From the specified holding register, the specified number of holding registers can be read.

Example

<u>To read past trip data from the inverter with slave address 5.</u>

(Read out factors of trip monitor 1 and output frequency.)

Item	Previous factor	Previous inverter status
Holding register number	03E9h	03EAh, 03EBh
Data	Data Overvoltage (E007) (0007h)	60.00Hz (0000h, 1770h)

Query

No.	Field Name	Example (hex)	Remarks
1	Slave address*1	05	
2	Function code	03	
3	Register starting number (high)*2	03	(Register address) = (Register number) –1
4	Register starting number (low)*2	E8	
5	The number of retention registers (high)	00	3 registers
6	The number of retention registers (low)	03	
7	CRC-16 (high)	84	
8	CRC-16 (low)	3F	

*1. Broadcasting cannot be performed.

*2. Note that the register start number is 03E8h hex, which is 1 less than the register number 03E9h hex.

Response

No.	Field Name	Example (hex)	Remarks
1	Slave address	05	
2	Function code	03	
3	Data bytes*1	06	
4	Register starting number (high)	00	0007 hex → 07 decimal → E07 (Factor: Overvoltage)
5	Register starting number (low)	07	
6	Register starting number+1 (high)	00	60.00Hz (000h, 1770h)
7	Register starting number+1 (low)	00	
8	Register starting number+2 (high)	17	
9	Register starting number+2 (low)	70	
10	CRC-16 (high)	A8	
11	CRC-16 (low)	61	

*1. Data as much as the number of data bytes will be transferred. In this example, the inverter sends back 4 bytes of data from two holding registers.

If the Read from Holding Register function is executed normally, refer to *Exception Response* on page 9-18.

Write to Coil [05 hex]

Writes the ON/OFF status to a single coil. The coil status changes as shown in the table below.

Data	Coil status	
	OFF to ON	ON to OFF
Written data (MSB)	FF hex	00 hex
Written data (LSB)	00 hex	00 hex

Example

To issue the RUN command to the inverter with slave address 10.

To operate the inverter, you need to set AA111 to 03. Write the RUN command to the coil number 0001.

Query

No.	Field name	Example [hex]	Remarks
1	Slave address*1	0A	
2	Function code	05	
3	Coil start number (MSB)*2	00	(Coil address) = (Coil number) – 1
4	Coil start number (LSB)*2	00	
5	Written data (MSB)	FF	OFF to ON: FF00 hex
6	Written data (LSB)	00	
7	CRC-16 (MSB)	8D	
8	CRC-16 (LSB)	41	

Response

No.	Field name	Example [hex]
1	Slave address	0A
2	Function code	05
3	Coil start number (MSB)	00
4	Coil start number (LSB)	00
5	Written data (MSB)	FF
6	Written data (LSB)	00
7	CRC-16 (MSB)	8D
8	CRC-16 (LSB)	41

*1. During a broadcast, no response will be sent back.

*2. Note that the coil start number is 0000, which is 1 less than the coil number 0001.

If the Write to Coil function is not executed normally, refer to *Exception Response* on page 9-18.

Write to Holding Register [06 hex]

Writes data to the specified holding register.

Example

To write 50 Hz to the inverter with slave address as the 1st Base Frequency value.

Because the holding register 2F4E hex for the Multispeed-0 setting, 1st-motor (Ab110) has a data resolution of 0.01 Hz, to set 50 Hz, set the written data to 5000 (1388 hex).

Query

No.	Field Name	Example (hex)
1	Slave address*1	01
2	Function code	06
3	Register starting number (high)*2	2F
4	Register starting number (low)*2	4D
5	Data to be changed (high)	13
6	Data to be changed (low)	88
7	CRC-16 (high)	1C
8	CRC-16 (low)	5F

*1. During a broadcast, no response will be sent back.

*2. Note that the register start number is 2F4D hex, which is 1 less than the register number 2F4E hex.

Response

No.	Field Name	Example (hex)
1	Slave address	01
2	Function code	06
3	Register starting number (high)	2F
4	Register starting number (low)	4D
5	Data to be changed (high)	13
6	Data to be changed (low)	88
7	CRC-16 (high)	1C
8	CRC-16 (low)	5F

Note that, except for FA-01, changing the parameter value on the data display does not update the displayed data realtime.

To view the updated value, once return to the parameter display and then display the data again.

If the Write to Holding Register function is executed normally, refer to *Exception Response* on page 9-18.

Loop-back Test [08 hex]

Checks the communications between the master and the slave. Any value can be used for test data.

Example

To perform a loop-back test on the inverter with slave address 1.

Query

No.	Field name	Example [hex]
1	Slave address*1	01
2	Function code	08
3	Test sub code (MSB)	00
4	Test sub code (LSB)	00
5	Data (MSB)	Any
6	Data (LSB)	Any
7	CRC-16 (MSB)	CRC
8	CRC-16 (LSB)	CRC

Response

No.	Field name	Example [hex]
1	Slave address*1	01
2	Function code	08
3	Test sub code (MSB)	00
4	Test sub code (LSB)	00
5	Data (MSB)	Any
6	Data (LSB)	Any
7	CRC-16 (MSB)	CRC
8	CRC-16 (LSB)	CRC

*1. Broadcasting cannot be performed.

The test sub code supports the Echo Query Data command (00 hex, 00 hex) only. Other commands are not supported.

Write to Multiple Coils [0F hex]

Rewrites the ON/OFF status to consecutive multiple coils.

Precautions for Correct Use

The byte order was changed when data over 1 byte is processed with writing function of several coils via Modbus. In addition, due to the specifications of Modbus communication, the inverter cannot process any odd number of bytes.

If the data to be written has an odd number of bytes, add 1 byte of padding data.

Send data in the data layout for an even number of bytes as shown below, according to the number of data bytes to be written.

- Data sent as 1-byte data (1 to 8 coils)

Coil 8 to Coil 1	(Padding data)

- Data sent as 2-byte data (9 to 16 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9

- Data sent as 3-byte data (17 to 24 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9	Coil 24 to Coil 17	(Padding data)

- Data sent as 4-byte data (25 to 32 coils)

Coil 8 to Coil 1	Coil 16 to Coil 9	Coil 24 to Coil 17	Coil 32 to Coil 25

Note, however, that this Inverter does not send data of 2 bytes or more because it can write to coil numbers 0001 hex to 000F hex.

Example

Change Inverter's input terminals 1 to 6 for slave address 5.

Change input terminals into statuses shown below table.

Item	Data					
Multi-function input terminal	1	2	3	4	5	6
Coil number	0005 hex	0006 hex	0007 hex	0008 hex	0009 hex	000A hex
Terminal status	ON	ON	ON	OFF	ON	OFF

Query

No.	Field name	Example [hex]	Remarks
1	Slave address*1	05	
2	Function code	0F	
3	Coil start number (MSB)*2	00	(Coil address) = (Coil number) – 1
4	Coil start number (LSB)*2	04	
5	Number of coils (MSB)	00	
6	Number of coils (LSB)	06	
7	Number of bytes*3	02	
8	Change data (MSB)*3	17	17 hex = 0 0 0 1 0 1 1 1 Input terminal 6 Input terminal 1
9	Change data (LSB)*3	00	
10	CRC-16 (MSB)	DB	
11	CRC-16 (LSB)	3E	

Response

No.	Field name	Example [hex]
1	Slave address	05
2	Function code	0F
3	Coil start number (MSB)	00
4	Coil start number (LSB)	04
5	Number of coils (MSB)	00
6	Number of coils (LSB)	06
7	CRC-16 (MSB)	34
8	CRC-16 (LSB)	4C

*1. During a broadcast, no response will be sent back.

*2. Note that the coil start number is 0004, which is 1 less than the coil number 0005.

*3. Since the change data comprises both MSB and LSB as a set, make the byte to be an even number by adding 1, even if the byte which actually needs to be changed is an odd number.

Input terminal is recognized as ON when either the terminal block input or the communications setting turns ON.

If the Write to Holding Register function is not executed normally, refer to *Exception Response* on page 9-18.

Write to Multiple Holding Registers [10 hex]

Writes data to consecutive multiple holding registers.

Example

To write 3,000 seconds to the inverter with slave address 1 as the 1st Acceleration Time 1 (FA-10) value.

Because the holding registers 2B02 hex to 2B03 hex for the 1st Acceleration Time (FA-10) has a data resolution of 0.01 seconds, to set 3,000 seconds, set the written data to 300000 (493E0 hex).

Query

No.	Field name	Example [hex]	Remarks
1	Slave address*1	01	
2	Function code	10	
3	Register start address (MSB)*2	2B	(Register address) = (Register number) – 1
4	Register start address (LSB)*2	01	
5	Number of holding registers (MSB)	00	
6	Number of holding registers (LSB)	02	
7	Number of bytes*3	04	
8	Written data 1 (MSB)	00	000493E0 hex → 300000 decimal → 3,000.00 s
9	Written data 1 (LSB)	04	
10	Written data 2 (MSB)	93	
11	Written data 2 (LSB)	E0	
12	CRC-16 (MSB)	9E	
13	CRC-16 (LSB)	9F	

Response

No.	Field name	Example [hex]
1	Slave address	01
2	Function code	10
3	Register start address (MSB)	2B
4	Register start address (LSB)	01
5	Number of holding registers (MSB)	00
6	Number of holding registers (LSB)	02
7	CRC-16 (MSB)	E5
8	CRC-16 (LSB)	34

*1. During a broadcast, no response will be sent back.

*2. Note that the register start address is 2B01 hex, which is 1 less than the register number 2B02 hex.

*3. This is not the number of holding registers, but the number of bytes to be changed actually.

If the Write to Holding Register function is not executed normally, refer to *Exception Response* on page 9-18.

Exception Response

The broadcast and master request for response. Although the slave Inverter normally returns a response to the query, it will return an exception response if the query has an error.

A exception response has the following field configuration.

Field Configuration
Slave address
Function code
Exception code
CRC-16

The details of the field configuration are as shown below. An exception response will have a function code, which is the sum of the function code value of the query and 80 hex. A exception code shows the reason why the exception response is returned.

Function code

Query	Exception response
01 hex	81 hex
03 hex	83 hex
05 hex	85 hex
06 hex	86 hex
0F hex	8F hex
10 hex	90 hex

Exception code

Code	Description
01 hex	An unsupported function was specified
02 hex	The specified address does not exist
03 hex	The specified data is in an unacceptable format
21 hex	Writing to a holding register is specified, but the data is out of the range allowed for the inverter.
22 hex	The inverter is in the state that it doesn’t permit functions to be executed as following:
	A register for which changes are inhibited during running was about to be changed.
	Data was written to a register to which soft-lock has been applied.
	An ENTER instruction was executed during running.
	An ENTER instruction was executed during undervoltage.
	Data was about to be written to a register when auto-tuning is enable; and so on.
23 hex	A function code for writing was used to the parameter specialized for readout
26 hex	Data was written during data writing or execution of data initialization.
27 hex	There was an access to only the higher side register of 2 register long parameter.

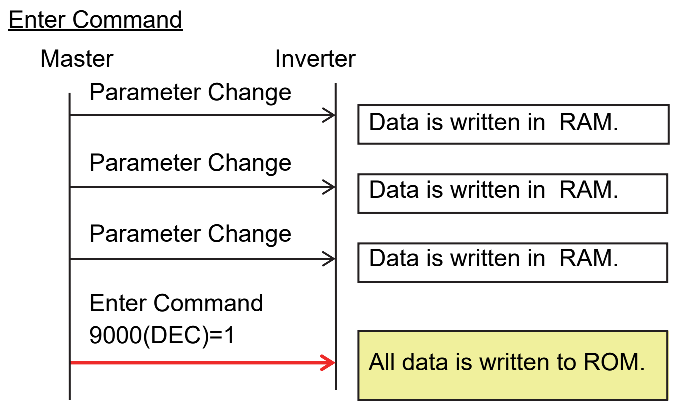
9-4 Saving a Change to Holding Register (Enter Command)

The Write to Holding Register (06 hex) or Write to Consecutive Holding Registers (10 hex) function is used to enable the new data. However, the new data is not stored in the EEPROM of the inverter and is restored to the previous value when the inverter power supply is shut off.

To store a change to holding registers in the inverter's EEPROM memory, issue the Enter command according to the following procedure. In addition, after changing a control parameter, you need to recalculate the motor parameters. In this case, also use the Enter command to execute recalculation.

How to Issue Enter Command

Write 1 to Holding Register (9000(DEC) with writing command (06h) to Holding Register.



Data Write Mode

To change to the data write mode, use the Write to Holding Register (06 hex) command to write 1 in the holding register (9002 (DEC)).

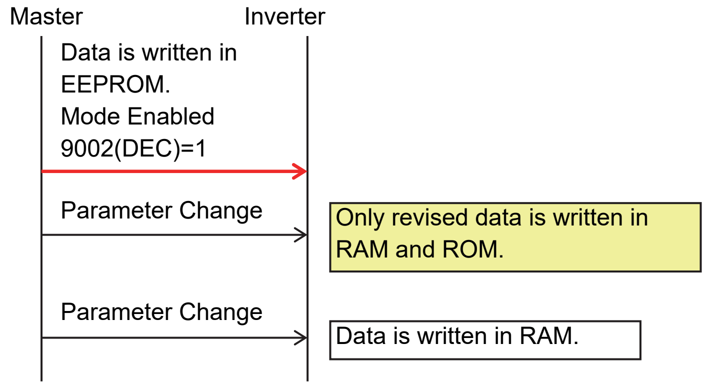
The new data that is changed using the Write to Holding Register (06 hex) command in the data write mode is stored in both the temporary RAM and non-volatile ROM. Concurrently, the data write mode is canceled.

If a command other than the Write to Holding Register (06 hex) is received in the data write mode, the data write mode is canceled.

Precautions for Correct Use

- After receiving the Enter command, the inverter returns a response to the host and writes the value to the EEPROM memory. You can monitor the during data write signal (Coil No. 0049 hex) to check whether the data is written.
- Since the inverter's EEPROM memory has a limit for the number of rewrites (approximately 100,000 times), the inverter life may be shortened if the Enter command is frequently used.

Data Writing Mode



Re-calculation of Control Processing Internal Variable

Control processing internal variable is calculated when 1 is written to Holding Register (9010(DEC)) with writing command (06h) to Holding Register.

9-5 Modbus Communication Register Number List

9-5-1 Coil Number List

R/W in the list shows whether data can be read from, or written to, the coil or holding register.

R: Read only
R/W: Read and Write enabled

Precautions for Correct Use

- The “Coil No.” in the table header shows the coil number used inside the inverter.
- The “Modbus coil spec. No.” in the table header shows the coil number used to actually specify the coil in the Modbus communication process.
  This coil number is 1 less than the inverter “Coil No.” according to the Modbus communication specifications.

Coil Number List

Coil No.	Modbus coil spec. No.	Item	R/W	Description
0000h		(Reserved)		
0001h	0000h	Operation command	R/W	1: Run 0: Stop (enabled when AA111/AA211=03)
0002h	0001h	Rotation direction command	R/W	1: Reverse 0: Normal (enabled when AA111/AA211=03)
0003h	0002h	External trip [EXT]	R/W	1: Trip 0: Not trip
0004h	0003h	Trip reset [RS]	R/W	1: Reset 0: Not reset
0005h	0004h	Input terminal 1	R/W	1: ON 0: OFF*1
0006h	0005h	Input terminal 2	R/W	1: ON 0: OFF*1
0007h	0006h	Input terminal 3	R/W	1: ON 0: OFF*1
0008h	0007h	Input terminal 4	R/W	1: ON 0: OFF*1
0009h	0008h	Input terminal 5	R/W	1: ON 0: OFF*1
000Ah	0009h	Input terminal 6	R/W	1: ON 0: OFF*1
000Bh	000Ah	Input terminal 7	R/W	1: ON 0: OFF*1
000Ch	000Bh	Input terminal 8	R/W	1: ON 0: OFF*1
000Dh	000Ch	Input terminal 9	R/W	1: ON 0: OFF*1
000Eh	000Dh	Input terminal A	R/W	1: ON 0: OFF*1

Coil No.	Modbus coil spec. No.	Item	R/W	Description
000Fh	000Eh	Input terminal B	R/W	1: ON 0: OFF*1
0010h	000Fh	(Reserved)		
0011h	0010h	(Reserved)		
0012h	0011h	(Reserved)		
0013h	0012h	(Reserved)		
0014h	0013h	(Reserved)		
0015h	0014h	Operating status	R	1: Rotating in normal direction, rotating in reverse direction 0: Other than rotating in normal/reverse rotation (linked with dA-03)
0016h	0015h	Rotation direction	R	1: Rotating in reverse direction 0: Rotating in normal direction (linked with dA-03)
0017h	0016h	Inverter operation ready completion	R	1: Ready 0: Not ready
0018h	0017h	(Reserved)		
0019h	0018h	Output terminal 11	R	1: ON 0: OFF
001Ah	0019h	Output terminal 12	R	1: ON 0: OFF
001Bh	001Ah	Output terminal 13	R	1: ON 0: OFF
001Ch	001Bh	Output terminal 14	R	1: ON 0: OFF
001Dh	001Ch	Output terminal 15	R	1: ON 0: OFF
001Eh	001Dh	Output terminal 16	R	1: ON 0: OFF
001Fh	001Eh	Output terminal AL	R	1: ON 0: OFF
0020h to 0048h	001Fh to 0047h	(Reserved)		
0049h	0048h	Data being written	R	1: Being written 0: Normal state
004Ah	0049h	CRC error	R	1: With error 0: No error*2
004Bh	004Ah	Overrun error	R	1: With error 0: No error*2
004Ch	004Bh	Framing error	R	1: With error 0: No error*2
004Dh	004Ch	Parity error	R	1: With error 0: No error*2
004Eh	004Dh	Sum check error	R	1: With error 0: No error*2
004Fh	004Eh	(Reserved)		

*1. While either the control circuit terminal block or the coil is ON, an inverter becomes ON. The input of the control circuit terminal block is prioritized. In some cases, the coil ON status cannot be reset from the master due to communication disconnection. To turn the coil OFF, change the control circuit terminal block from ON to OFF.

*2. Communication errors are kept until an error reset is input. The reset can be available during the operation.

9-5-2 Group d Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2711h	2710h	Output frequency monitor	dA-01	R	0 to 59000	0.01(Hz)
2712h	2711h	Output current monitor	dA-02	R	0 to 65535	0.01(A)
2713h	2712h	Operation direction monitor	dA-03	R	00: o (Stopped) 01: d (0Hz output) 02: F (Normal rotation in process) 03: r (Reverse rotation in process)	-
2714h	2713h	Frequency command after calculation	dA-04 (HIGH)	R	-59000 to 59000	0.01(Hz)
2715h	2714h		dA-05 (LOW)	R		
2716h	2715h	Output frequency conversion monitor	dA-06 (HIGH)	R	0 to 5900000	0.01
2717h	2716h		dA-07 (LOW)	R		
2718h	2717h	Speed detection value monitor	dA-08 (HIGH)	R	-59000 to 59000	0.01(Hz)
2719h	2718h		dA-09 (LOW)	R		
271Ch	2719h	Output frequency monitor (with sign)	dA-12 (HIGH)	R	-59000 to 59000	0.01(Hz)
271Dh	271Ch		dA-13 (LOW)	R		
271Eh	271Dh	Frequency upper limit monitor	dA-14	R	0 to 59000	0.01(Hz)
271Fh	271Eh	Torque command monitor after calculation	dA-15	R	-10000 to 10000	0.1(%)
2720h	271Fh	Torque limit monitor	dA-16	R	0 to 5000	0.1(%)
2721h	2720h	Output torque monitor	dA-17	R	-10000 to 10000	0.1(%)
2722h	2721h	Output voltage monitor	dA-18	R	0 to 8000	0.1(V)
2724h	2723h	Current position monitor	dA-20 (HIGH)	R	In the case of AA121=10 and AA123=03, data range -2147483648 to 2147483647.	1(pls)
2725h	2724h		dA-21 (LOW)	R	In the case of the condition mentioned above, data range -536870912 to 536870911	
272Ah	2729h	Pulse train position deviation monitor	dA-26 (HIGH)	R	-2147483647 to 2147483647	1(pls)
272Bh	272Ah		dA-27 (LOW)	R		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
272Ch	272Bh	Pulse counter monitor	dA-28 (HIGH)	R	0 to 2147483647	1(pls)
272Dh	272Ch		dA-29 (LOW)	R		
272Eh	272Dh	Input power monitor	dA-30	R	0 to 60000 (to 132kW) 0 to 20000 (160 kW to)	0.01(kWh) 0.1(kWh)
2730h	273Fh	Integrated input power moni-tor	dA-32 (HIGH)	R	0 to 10000000	0.1(kWh)
2731h	2730h		dA-33 (LOW)	R		
2732h	2731h	Output power monitor	dA-34	R	0 to 60000 (to 132 kW) 0 to 20000 (160 kW to)	0.01(kWh) 0.1(kWh)
2734h	2733h	Integrated output power monitor	dA-36 (HIGH)	R	0 to 10000000	0.1(kWh)
2735h	2734h		dA-37 (LOW)	R		
2736h	2735h	Motor temperature monitor	dA-38	R	-200 to 2000	0.1(°C)
2738h	2737h	DC voltage monitor	dA-40	R	0 to 10000	0.1(Vdc)
2739h	2738h	BRD load factor monitor	dA-41	R	0 to 10000	0.01(%)
273Ah	2739h	Electronic thermal duty ratio monitor MTR	dA-42	R	0 to 10000	0.01(%)
273Bh	273Ah	Electronic thermal duty ratio monitor CTL	dA-43	R	0 to 10000	0.01(%)
273Dh	273Ch	Integrated output power monitor	dA-45	R	00: no input 01: P-1A 02: P-2A 03: P-1b 04: P-2b 05: P-1C 06: P-2C 07: STO	-
2742h	2741h	Terminal block option mounted state	dA-50	R	00:STD-TM1 (fixed value)	-
2743h	2742h	Input terminal monitor	dA-51	R	LLLLLLLLLLL to HHHHHHHHHHH [L:OFF/H:ON] [Left side] (terminal B) (terminal A) (terminal 9) - (termianl1) [Right side]	1
2746h	2725h	Output terminal monitor	dA-54	R	LLLLLLL-HHHHHHH [L:OFF/H:ON] [Left side] (terminal AL) (terminal 16C) (terminal 15) - (terminal 11) [Right side]	1
274Ch	274Bh	Analog I/O selection monitor	dA-60	R	AAAAAAAA- VVVVVVVV [A: current/V: voltage] [Left side] (Reserved)(Reserved) (Reserved) (terminal Ai3 (Ii3/Vi3)) (terminal Ao2) (terminal Ao1) (terminal Ai2) (terminal Ai1) [Right side]	1
274Dh	274Ch	Analog input [Ai1] monitor	dA-61	R	0 to 10000	0.01(%)
274Eh	274Dh	Analog input [Ai2] monitor	dA-62	R	0 to 10000	0.01(%)
274Fh	274Eh	Analog input [Ai3] monitor	dA-63	R	-10000 to 10000	0.01(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2756h	2755h	Pulse string input monitor main body	dA-70	R	-10000 to 10000	0.01(%)
2757h	2756h	Pulse string input monitor option	dA-71	R	-10000 to 10000	0.01(%)
2761h	2760h	Option slot 1 mounted state	dA-81	R	00: None	-
2762h	2761h	Option slot 2 mounted state	dA-82	R	00: None 33: RX2-PG	-
2763h	2762h	Option slot 3 mounted state	dA-83	R	00: None	-
2775h	2774h	Program download monitor	db-01	R	00: Without a program 01: With a program	-
2776h	2775h	Program No. monitor	db-02	R	0 to 9999	1
2777h	2776h	Program counter (Task-1)	db-03	R	1 to 1024	1
2778h	2777h	Program counter (Task-2)	db-04	R	1 to 1024	1
2779h	2778h	Program counter (Task-3)	db-05	R	1 to 1024	1
277Ah	2779h	Program counter (Task-4)	db-06	R	1 to 1024	1
277Bh	277Ah	Program counter (Task-5)	db-07	R	1 to 1024	1
277Ch	277Bh	User monitor 0	db-08 (HIGH)	R	-2147483647 to 2147483647	1
277Dh	277Ch		db-09 (LOW)	R		
277Eh	277Dh	User monitor 1	db-10 (HIGH)	R	-2147483647 to 2147483647	1
277Fh	277Eh		db-11 (LOW)	R		
2780h	277Fh	User monitor 2	db-12 (HIGH)	R	-2147483647 to 2147483647	1
2781h	2780h		db-13 (LOW)	R		
2782h	2781h	User monitor 3	db-14 (HIGH)	R	-2147483647 to 2147483647	1
2783h	2782h		db-15 (LOW)	R		
2784h	2783h	User monitor 4	db-16 (HIGH)	R	-2147483647 to 2147483647	1
2785h	2784h		db-17 (LOW)	R		
2786h	2785h	Analog output monitor YA0	db-18	R	0 to 10000	0.01(%)
2787h	2786h	Analog output monitor YA1	db-19	R	0 to 10000	0.01(%)
2788h	2787h	Analog output monitor YA2	db-20	R	0 to 10000	0.01(%)
2792h	2791h	PID1 feedback data 1 monitor	db-30 (HIGH)	R	-10000 to 10000*1	Unit differs depending on setting [AH-03] [AH-06].
2793h	2792h		db-31 (LOW)	R		
2794h	2793h	PID1 feedback data 2 monitor	db-32 (HIGH)	R	-10000 to 10000*1	Unit differs depending on setting [AH-03] [AH-06].
2795h	2794h		db-33 (LOW)	R		
2796h	2795h	PID1 feedback data 3 monitor	db-34 (HIGH)	R	-10000 to 10000*1	Unit differs depending on setting [AH-03] [AH-06].
2797h	2796h		db-35 (LOW)	R		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2798h	2797h	PID2 feedback data monitor	db-36 (HIGH)	R	-10000 to 10000*2	Unit differs depending on setting [AJ-03] [AJ-06].
2799h	2798h		db-37 (LOW)	R		
279Ah	2799h	PID3 feedback data monitor	db-38 (HIGH)	R	-10000 to 10000*3	Unit differs depending on setting [AJ-23] [AJ-26].
279Bh	279Ah		db-39 (LOW)	R		
279Ch	279Bh	PID4 feedback data monitor	db-40 (HIGH)	R	-10000 to 10000*4	Unit differs depending on setting [AJ-43] [AJ-46].
279Dh	279Ch		db-41 (LOW)	R		
279Eh	279Dh	PID1 target value monitor after calculation	db-42 (HIGH)	R	-10000 to 10000*1	Unit differs depending on setting [AH-03] [AH-06].
279Fh	279Eh		db-43 (LOW)	R		
27A0h	279Fh	PID1 feedback data	db-44 (HIGH)	R	-10000 to 10000*1	Unit differs depending on setting [AH-03] [AH-06].
27A1h	27A0h		db-45 (LOW)	R		
27A6h	27A5h	PID1 output monitor	db-50	R	-10000 to 10000	0.01(%)
27A7h	27A6h	PID1 deviation monitor	db-51	R	-20000 to 20000	0.01(%)
27A8h	27A7h	PID1 deviation 1 monitor	db-52	R	-20000 to 20000	0.01(%)
27A9h	27A8h	PID1 deviation 2 monitor	db-53	R	-20000 to 20000	0.01(%)
27AAh	27A9h	PID1 deviation 3 monitor	db-54	R	-20000 to 20000	0.01(%)
27ABh	27AAh	PID2 output monitor	db-55	R	-10000 to 10000	0.01(%)
27ACh	27ABh	PID2 deviation monitor	db-56	R	-20000 to 20000	0.01(%)
27ADh	27ACh	PID3 output monitor	db-57	R	-10000 to 10000	0.01(%)
27AEh	27ADh	PID3 deviation monitor	db-58	R	-20000 to 20000	0.01(%)
27AFh	27AEh	PID4 output monitor	db-59	R	-10000 to 10000	0.01(%)
27B0h	27AFh	PID4 deviation monitor	db-60	R	-20000 to 20000	0.01(%)
27B1h	27B0h	PID current P gain monitor	db-61	R	0 to 1000	0.1(%)
27B2h	27B1h	PID current I gain monitor	db-62	R	0 to 36000	0.1(s)
27B3h	27B2h	PID current D gain monitor	db-63	R	0 to 10000	0.01(s)
27B4h	27B3h	PID feed-forward monitor	db-64	R	0 to 10000	0.01(%)
27D9h	27D8h	Inverter load type selection monitor	dC-01	R	00: very low duty 01: low duty 02: normal duty	-
27DAh	27D9h	Rated current monitor	dC-02	R	0 to 65535	0.1(A)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
27DFh	27DEh	Speed command destination monitor (main)	dC-07	R	00: disabled 01: Ai1 02: Ai2 03: Ai3 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Multistage speed 0 08: Sub speed 09: Multistage speed 1 10: Multistage speed 2 11: Multistage speed 3 12: Multistage speed 4 13: Multistage speed 5 14: Multistage speed 6 15: Multistage speed 7 16: Multistage speed 8 17: Multistage speed 9 18: Multistage speed 10 19: Multistage speed 11 20: Multistage speed 12 21: Multistage speed 13 22: Multistage speed 14 23: Multistage speed 15 24: JG 25: RS485 26: Option 1 27: Option 2 28: Option 3 29: Pulse array (Inverter) 30: Pulse array (Option) 31: Drive Programming 32: PID 33: (Reserved) 34: AHD retention speed	-
28DFh	27DFh	Speed command destination monitor (auxiliary)	dC-08	R		-
27E2h	27E1h	Operation command destination monitor	dC-10	R	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on operator keypad 03: RS485 setting 04: Option 1 05: Option 2 06: Option 3	-
27E7h	27E6h	Cooling fin temperature monitor	dC-15	R	-200 to 2000	0.1(°C)
27E8h	27E7h	Life diagnostic monitor	dC-16	R	0 to 0xFF	1
27ECh	27EBh	Total start-up count	dC-20	R	1 to 65535	1
27EDh	27ECh	Power-on count	dC-21	R	1 to 65535	1
27EEh	27EDh	Cumulative operating hours monitor during RUN	dC-22 (HIGH)	R	0 to 1000000	1(hr)
27EFh	27EEh		dC-23 (LOW)			
27F0h	27EFh	Cumulative power-on time	dC-24 (HIGH)	R	0 to 1000000	1(hr)
27F1h	27F0h		dC-25 (LOW)			

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
27F2h	27F1h	Cumulative operating time of cooling fan	dC-26 (HIGH)	R	0 to 1000000	1(hr)
27F3h	27F2h		dC-27 (LOW)			
27FDh	27F3h	Detailed monitor for icon 2 LIM	dC-37	R	00: Condition other than below 01: Overcurrent suppression in process 02: Overload being limited 03: Overvoltage suppression in process 04: Torque being limited 05: Upper/lower limit and jump frequency setting being limited 06: Setting of minimum frequency being limited	-
27FEh	27FDh	Detailed monitor for icon 2 ALT	dC-38	R	00: Condition other than below 01: Overload advance notice 02: Motor thermal advance notice 03: Controller thermal advance notice 04: Motor overheat advance notice	-
27FFh	27FEh	Detailed monitor for icon 2 RETRY	dC-39	R	00: Condition other than below 01: Retry standby 02: Restart standby	-
2800h	27FFh	Detailed monitor for icon 2 NRDY	dC-40	R	00: Preparation completed condition other than below IRDY=OFF 01: Trip occurred 02: Power supply abnormality 03: Resetting 04: STO 05: Standby 06: Data inconsistency Others (including no FB, consistency ofsettings of A and B phases, etc.) 07: Sequence abnormality 08: Free run 09: Forced stop	-
2805h	2804h	IM/SM monitor	dC-45	R	00: Induction motor IM being selected 01: Synchronous motor SM (permanent magnet motor PMM) being selected	-
280Ah	2809h	Firmware Ver. monitor	dC-50	R	0 to 0xFFFF Upper 1 byte: Major version no lower 1 byte : Minorversion no	1
280Dh	280Ch	Firmware Gr. monitor	dC-53	R	00 (Standard)	1
03E8h	03E7h	Trip count monitor	dE-01	R	0 to 65535	1

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
03E9h	03E8h	Trip monitor 1 Factor	dE-11	R	1 to 255	1
03EAh	03E9h	Trip monitor 1 Output frequency			-59000 to 59000	0.01(Hz)
03EBh	03EAh	(with sign)				
03ECh	03EBh	Trip monitor 1 Output current			0 to 65535	0.01(A)
03EDh	03ECh	Trip monitor 1 P-N DC voltage			0 to 10000	0.1(Vdc)
03EEh	03EDh	Trip monitor 1 Inverter state			0 to 8*5	1
03EFh	03EEh	Trip monitor 1 LAD state			0 to 5*5	1
03F0h	03EFh	Trip monitor 1 INV control mode			0 to 11*5	1
03F1h	03F0h	Trip monitor 1 Limit state			0 to 6*5	1
03F2h	03F1h	Trip monitor 1 Special state			0 to 6*5	1
03F4h	03F3h	Trip monitor 1 RUN time			0 to 1000000	1(hr)
03F5h	03F4h					
03F6h	03F5h	Trip monitor 1 Power ON time			0 to 1000000	1(hr)
03F7h	03F6h					
03F8h	03F7h	Trip monitor 1 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	1
03F9h	03F8h	Trip monitor 1 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	1
03FAh	03F9h	Trip monitor 1 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	1
03FDh	03FCh	Trip monitor 2 Factor	dE-12	R	1 to 255	1
03FEh	03FDh	Trip monitor 2 Output frequency			-59000 to 59000	0.01(Hz)
03FFh	03FEh	(with sign)				
0400h	03FFh	Trip monitor 2 Output current			0 to 65535	0.01(A)
0401h	0400h	Trip monitor 2 P-N DC voltage			0 to 10000	0.1(Vdc)
0402h	0401h	Trip monitor 2 Inverter state			0 to 8*5	1
0403h	0402h	Trip monitor 2 LAD state			0 to 5*5	1
0404h	0403h	Trip monitor 2 INV control mode			0 to 11*5	1
0405h	0404h	Trip monitor 2 Limit state			0 to 6*5	1
0406h	0405h	Trip monitor 2 Special state			0 to 6*5	1
0408h	0407h	Trip monitor 2 RUN time			0 to 1000000	1(hr)
0409h	0408h					
040Ah	0409h	Trip monitor 2 Power ON time			0 to 1000000	1(hr)
040Bh	040Ah					
040Ch	040Bh	Trip monitor 2 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
040Dh	040Ch	Trip monitor 2 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
040Eh	040Dh	Trip monitor 2 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0411h	0410h	Trip monitor 3 Factor	dE-13	R	1 to 255	-
0412h	0411h	Trip monitor 3 Output frequency			-59000 to 59000	0.01(Hz)
0413h	0412h	(with sign)				
0414h	0413h	Trip monitor 3 Output current			0 to 65535	0.01(A)
0415h	0414h	Trip monitor 3 P-N DC voltage			0 to 10000	0.1(Vdc)
0416h	0415h	Trip monitor 3 Inverter state			0 to 8*5	1
0417h	0416h	Trip monitor 3 LAD state			0 to 5*5	1
0418h	0417h	Trip monitor 3 INV control mode			0 to 11*5	1
0419h	0418h	Trip monitor 3 Limit state			0 to 6*5	1
041Ah	0419h	Trip monitor 3 Special state			0 to 6*5	1
041Ch	041Bh	Trip monitor 3 RUN time			0 to 1000000	1(hr)
041Dh	041Ch					
041Eh	041Dh	Trip monitor 3 Power ON time			0 to 1000000	1(hr)
041Fh	041Eh					
0420h	041Fh	Trip monitor 3 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0421h	0420h	Trip monitor 3 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0422h	0421h	Trip monitor 3 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
0425h	0424h	Trip monitor 4 Factor	dE-14	R	1 to 255	1
0426h	0425h	Trip monitor 4 Output frequency			-59000 to 59000	0.01(Hz)
0427h	0426h	(with sign)				
0428h	0427h	Trip monitor 4 Output current			0 to 65535	0.01(A)
0429h	0428h	Trip monitor 4 P-N DC voltage			0 to 10000	0.1(Vdc)
042Ah	0429h	Trip monitor 4 Inverter state			0 to 8*5	1
042Bh	042Ah	Trip monitor 4 LAD state			0 to 5*5	1
042Ch	042Bh	Trip monitor 4 INV control mode			0 to 11*5	1
042Dh	042Ch	Trip monitor 4 Limit state			0 to 6*5	1
042Eh	042Dh	Trip monitor 4 Special state			0 to 6*5	1
0430h	042Fh	Trip monitor 4 RUN time			0 to 1000000	1(hr)
0431h	0430h					
0432h	0431h	Trip monitor 4 Power ON time			0 to 1000000	1(hr)
0433h	0432h					
0434h	0433h	Trip monitor 4 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0435h	0434h	Trip monitor 4 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0436h	0435h	Trip monitor 4 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0439h	0438h	Trip monitor 5 Factor			1 to 255	1
043Ah	0439h	Trip monitor 5 Output frequency			-59000 to 59000	0.01(Hz)
043Bh	043Ah	(with sign)				
043Ch	043Bh	Trip monitor 5 Output current			0 to 65535	0.01(A)
043Dh	043Ch	Trip monitor 5 P-N DC voltage			0 to 10000	0.1(Vdc)
043Eh	043Dh	Trip monitor 5 Inverter state			0 to 8*5	1
043Fh	043Eh	Trip monitor 5 LAD state			0 to 5*5	1
0440h	043Fh	Trip monitor 5 INV control mode			0 to 11*5	1
0441h	0440h	Trip monitor 5 Limit state	dE-15	R	0 to 6*5	1
0442h	0441h	Trip monitor 5 Special state			0 to 6*5	1
0444h	0443h	Trip monitor 5 RUN time			0 to 1000000	1(hr)
0445h	0444h					
0446h	0445h	Trip monitor 5 Power ON time			0 to 1000000	1(hr)
0447h	0446h					
0448h		Trip monitor 5 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0449h	0448h	Trip monitor 5 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
044Ah	0449h	Trip monitor 5 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
044Dh	044Ch	Trip monitor 6 Factor			1 to 255	1
044Eh	044Dh	Trip monitor 6 Output frequency			-59000 to 59000	0.01(Hz)
044Fh	044Eh	(with sign)				
0450h	044Fh	Trip monitor 6 Output current			0 to 65535	0.01(A)
0451h	0450h	Trip monitor 6 P-N DC voltage			0 to 10000	0.1(Vdc)
0452h	0451h	Trip monitor 6 Inverter state			0 to 8*5	1
0453h	0452h	Trip monitor 6 LAD state			0 to 5*5	1
0454h	0453h	Trip monitor 6 INV control mode			0 to 11*5	1
0455h	0454h	Trip monitor 6 Limit state	dE-16	R	0 to 6*5	1
0456h	0455h	Trip monitor 6 Special state			0 to 6*5	1
0458h	0457h	Trip monitor 6 RUN time			0 to 1000000	1(hr)
0459h	0458h					
045Ah	0459h	Trip monitor 6 Power ON time			0 to 1000000	1(hr)
045Bh	045Ah					
045Ch	045Bh	Trip monitor 6 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
045Dh	045Ch	Trip monitor 6 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
045Eh	045Dh	Trip monitor 6 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0461h	0460h	Trip monitor 7 Factor	dE-17	R	1 to 255	1
0462h	0461h	Trip monitor 7 Output frequency			-59000 to 59000	0.01(Hz)
0463h	0462h	(with sign)				
0464h	0463h	Trip monitor 7 Output current			0 to 65535	0.01(A)
0465h	0464h	Trip monitor 7 P-N DC voltage			0 to 10000	0.1(Vdc)
0466h	0465h	Trip monitor 7 Inverter state			0 to 8*5	1
0467h	0466h	Trip monitor 7 LAD state			0 to 5*5	1
0468h	0467h	Trip monitor 7 INV control mode			0 to 11*5	1
0469h	0468h	Trip monitor 7 Limit state			0 to 6*5	1
046Ah	0469h	Trip monitor 7 Special state			0 to 6*5	1
046Ch	046Ah	Trip monitor 7 RUN time			0 to 1000000	1(hr)
046Dh	046Ch					
046Eh	046Dh	Trip monitor 7 Power ON time			0 to 1000000	1(hr)
046Fh	046Eh					
0470h	046Fh	Trip monitor 7 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0471h	0470h	Trip monitor 7 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0472h	0471h	Trip monitor 7 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
0475h	0474h	Trip monitor 8 Factor	dE-18	R	1 to 255	1
0476h	0475h	Trip monitor 8 Output frequency			-59000 to 59000	0.01(Hz)
0477h	0476h	(with sign)				
0478h	0477h	Trip monitor 8 Output current			0 to 65535	0.01(A)
0479h	0478h	Trip monitor 8 P-N DC voltage			0 to 10000	0.1(Vdc)
047Ah	0479h	Trip monitor 8 Inverter state			0 to 8*5	1
047Bh	047Ah	Trip monitor 8 LAD state			0 to 5*5	1
047Ch	047Bh	Trip monitor 8 INV control mode			0 to 11*5	1
047Dh	047Ch	Trip monitor 8 Limit state			0 to 6*5	1
047Eh	047Dh	Trip monitor 8 Special state			0 to 6*5	1
0480h	047Eh	Trip monitor 8 RUN time			0 to 1000000	1(hr)
0481h	0480h					
0482h	0481h	Trip monitor 8 Power ON time			0 to 1000000	1(hr)
0483h	0482h					
0484h	0483h	Trip monitor 8 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0485h	0484h	Trip monitor 8 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0486h	0485h	Trip monitor 8 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0489h		Trip monitor 9 Factor	dE-19	R	1 to 255	1
048Ah	0489h	Trip monitor 9 Output frequency			-59000 to 59000	0.01(Hz)
048Bh	048Ah	(with sign)				
048Ch	048Bh	Trip monitor 9 Output current			0 to 65535	0.01(A)
048Dh	048Ch	Trip monitor 9 P-N DC voltage			0 to 10000	0.1(Vdc)
048Eh	048Dh	Trip monitor 9 Inverter state			0 to 8*5	1
048Fh	048Eh	Trip monitor 9 LAD state			0 to 5*5	1
0490h	048Fh	Trip monitor 9 INV control mode			0 to 11*5	1
0491h	0490h	Trip monitor 9 Limit state			0 to 6*5	1
0492h	0491h	Trip monitor 9 Special state			0 to 6*5	1
0494h	0493h	Trip monitor 9 RUN time			0 to 1000000	1(hr)
0495h	0494h					
0496h	0495h	Trip monitor 9 Power ON time			0 to 1000000	1(hr)
0497h	0496h					
0498h	0497h	Trip monitor 9 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0499h	0498h	Trip monitor 9 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
049Ah	0499h	Trip monitor 9 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
049Dh	049Ch	Trip monitor 10 Factor	dE-20	R	1 to 255	1
049Eh	049Dh	Trip monitor 10 Output frequency			-59000 to 59000	0.01(Hz)
049Fh	049Eh	(with sign)				
04A0h	049Fh	Trip monitor 10 Output current			0 to 65535	0.01(A)
04A1h	04A0h	Trip monitor 10 P-N DC voltage			0 to 10000	0.1(Vdc)
04A2h	04A1h	Trip monitor 10 Inverter state			0 to 8*5	1
04A3h	04A2h	Trip monitor 10 LAD state			0 to 5*5	1
04A4h	04A3h	Trip monitor 10 INV control mode			0 to 11*5	1
04A5h	04A4h	Trip monitor 10 Limit state			0 to 6*5	1
04A6h	04A5h	Trip monitor 10 Special state			0 to 6*5	1
04A8h	04A7h	Trip monitor 10 RUN time			0 to 1000000	1(hr)
04A9h	04A8h					
04AAh	04A9h	Trip monitor 10 Power ON time			0 to 1000000	1(hr)
04ABh	04AAh					
04ACh	04ABh	Trip monitor 10 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04ADh	04ACh	Trip monitor 10 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04AEh	04ADh	Trip monitor 10 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
04B1h	04B1h	Retry monitor 1 Factor	dE-31	R	1 to 255	1
04B2h	04B1h	Retry monitor 1 Output frequency			-59000 to 59000	0.01(Hz)
04B3h	04B2h	(with sign)				
04B4h	04B3h	Retry monitor 1 Output current			0 to 65535	0.01(A)
04B5h	04B4h	Retry monitor 1 P-N DC voltage			0 to 10000	0.1(Vdc)
04B6h	04B5h	Retry monitor 1 Inverter state			0 to 8*5	1
04B7h	04B6h	Retry monitor 1 LAD state			0 to 5*5	1
04B8h	04B7h	Retry monitor 1 INV control mode			0 to 11*5	1
04B9h	04B8h	Retry monitor 1 Limit state			0 to 6*5	1
04BAh	04B9h	Retry monitor 1 Special state			0 to 6*5	1
04BCh	04BBh	Retry monitor 1 RUN time			0 to 1000000	1(hr)
04BDh	04BCh					
04BEh	04BDh	Retry monitor 1 Power ON time			0 to 1000000	1(hr)
04BFh	04BEh					
04C0h	04BFh	Retry monitor 1 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04C1h	04C0h	Retry monitor 1 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04C2h	04C1h	Retry monitor 1 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
04C5h	04C4h	Retry monitor 2 Factor	dE-32	R	1 to 255	1
04C6h	04C5h	Retry monitor 2 Output frequency			-59000 to 59000	0.01(Hz)
04C7h	04C6h	(with sign)				
04C8h	04C7h	Retry monitor 2 Output current			0 to 65535	0.01(A)
04C9h	04C8h	Retry monitor 2 P-N DC voltage			0 to 10000	0.1(Vdc)
04CAh	04C9h	Retry monitor 2 Inverter state			0 to 8*5	1
04CBh	04CAh	Retry monitor 2 LAD state			0 to 5*5	1
04CCh	04CBh	Retry monitor 2 INV control mode			0 to 11*5	1
04CDh	04CCh	Retry monitor 2 Limit state			0 to 6*5	1
04CEh	04CDh	Retry monitor 2 Special state			0 to 6*5	1
04D0h	04CFh	Retry monitor 2 RUN time			0 to 1000000	1(hr)
04D1h	04D0h					
04D2h	04D1h	Retry monitor 2 Power ON time			0 to 1000000	1(hr)
04D3h	04D2h					
04D4h	04D3h	Retry monitor 2 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04D5h	04D4h	Retry monitor 2 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04D6h	04D5h	Retry monitor 2 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
04D9h	04D8h	Retry monitor 3 Factor	dE-33	R	1 to 255	1
04DAh	04D9h	Retry monitor 3 Output frequency			-59000 to 59000	0.01(Hz)
04DBh	04DAh	(with sign)				
04DCh	04DBh	Retry monitor 3 Output current			0 to 65535	0.01(A)
04DDh	04DCh	Retry monitor 3 P-N DC voltage			0 to 10000	0.1(Vdc)
04DEh	04DDh	Retry monitor 3 Inverter state			0 to 8*5	1
04DFh	04DEh	Retry monitor 3 LAD state			0 to 5*5	1
04E0h	04DFh	Retry monitor 3 INV control mode			0 to 11*5	1
04E1h	04E0h	Retry monitor 3 Limit state			0 to 6*5	1
04E2h	04E1h	Retry monitor 3 Special state			0 to 6*5	1
04E4h	04E3h	Retry monitor 3 RUN time			0 to 1000000	1(hr)
04E5h	04E4h					
04E6h	04E5h	Retry monitor 3 Power ON time			0 to 1000000	1(hr)
04E7h	04E6h					
04E8h	04E7h	Retry monitor 3 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04E9h	04E8h	Retry monitor 3 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04EAh	04E9h	Retry monitor 3 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
04EDh	04ECh	Retry monitor 4 Factor	dE-34	R	1 to 255	1
04EEh	04EDh	Retry monitor 4 Output frequency			-59000 to 59000	0.01(Hz)
04EFh	04EEh	(with sign)				
04F0h	04EFh	Retry monitor 4 Output current			0 to 65535	0.01(A)
04F1h	04F0h	Retry monitor 4 P-N DC voltage			0 to 10000	0.1(Vdc)
04F2h	04F1h	Retry monitor 4 Inverter state			0 to 8*5	1
04F3h	04F2h	Retry monitor 4 LAD state			0 to 5*5	1
04F4h	04F3h	Retry monitor 4 INV control mode			0 to 11*5	1
04F5h	04F4h	Retry monitor 4 Limit state			0 to 6*5	1
04F6h	04F5h	Retry monitor 4 Special state			0 to 6*5	1
04F8h	04F7h	Retry monitor 4 RUN time			0 to 1000000	1(hr)
04F9h	04F8h					
04FAh	04F9h	Retry monitor 4 Power ON time			0 to 1000000	1(hr)
04FBh	04FAh					
04FCh	04FBh	Retry monitor 4 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
04FDh	04FCh	Retry monitor 4 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
04FEh	04FDh	Retry monitor 4 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0501h		Retry monitor 5 Factor	dE-35	R	1 to 255	1
0502h	0501h	Retry monitor 5 Output frequency			-59000 to 59000	0.01(Hz)
0503h	0502h	(with sign)				
0504h	0503h	Retry monitor 5 Output current			0 to 65535	0.01(A)
0505h	0504h	Retry monitor 5 P-N DC voltage			0 to 10000	0.1(Vdc)
0506h	0505h	Retry monitor 5 Inverter state			0 to 8*5	1
0507h	0506h	Retry monitor 5 LAD state			0 to 5*5	1
0508h	0507h	Retry monitor 5 INV control mode			0 to 11*5	1
0509h	0508h	Retry monitor 5 Limit state			0 to 6*5	1
050Ah	0509h	Retry monitor 5 Special state			0 to 6*5	1
050Ch	050Bh	Retry monitor 5 RUN time			0 to 1000000	1(hr)
050Dh	050Ch					
050Eh	050Dh	Retry monitor 5 Power ON time			0 to 1000000	1(hr)
050Fh	050Eh					
0510h	050Fh	Retry monitor 5 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0511h	0510h	Retry monitor 5 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0512h	0511h	Retry monitor 5 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
0515h	0514h	Retry monitor 6 Factor	dE-36	R	1 to 255	1
0516h	0515h	Retry monitor 6 Output frequency			-59000 to 59000	0.01(Hz)
0517h	0516h	(with sign)				
0518h	0517h	Retry monitor 6 Output current			0 to 65535	0.01(A)
0519h	0518h	Retry monitor 6 P-N DC voltage			0 to 10000	0.1(Vdc)
051Ah	0519h	Retry monitor 6 Inverter state			0 to 8*5	1
051Bh	051Ah	Retry monitor 6 LAD state			0 to 5*5	1
051Ch	051Bh	Retry monitor 6 INV control mode			0 to 11*5	1
051Dh	051Ch	Retry monitor 6 Limit state			0 to 6*5	1
051Eh	051Dh	Retry monitor 6 Special state			0 to 6*5	1
0520h	051Fh	Retry monitor 6 RUN time			0 to 1000000	1(hr)
0521h	0520h					
0522h	0521h	Retry monitor 6 Power ON time			0 to 1000000	1(hr)
0523h	0522h					
0524h	0523h	Retry monitor 6 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0525h	0524h	Retry monitor 6 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0526h	0525h	Retry monitor 6 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0529h	0528h	Retry monitor 7 Factor	dE-37	R	1 to 255	1
052Ah	0529h	Retry monitor 7 Output frequency			-59000 to 59000	0.01(Hz)
052Bh	052Ah	(with sign)				
052Ch	052Bh	Retry monitor 7 Output current			0 to 65535	0.01(A)
052Dh	052Ch	Retry monitor 7 P-N DC voltage			0 to 10000	0.1(Vdc)
052Eh	052Dh	Retry monitor 7 Inverter state			0 to 8*5	1
052Fh	052Eh	Retry monitor 7 LAD state			0 to 5*5	1
0530h	052Fh	Retry monitor 7 INV control mode			0 to 11*5	1
0531h	0530h	Retry monitor 7 Limit state			0 to 6*5	1
0532h	0531h	Retry monitor 7 Special state			0 to 6*5	1
0534h	0533h	Retry monitor 7 RUN time			0 to 1000000	1(hr)
0535h	0534h					
0536h	0535h	Retry monitor 7 Power ON time			0 to 1000000	1(hr)
0537h	0536h					
0538h	0537h	Retry monitor 7 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0539h	0538h	Retry monitor 7 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
053Ah		Retry monitor 7 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
053Dh	053Ch	Retry monitor 8 Factor	dE-38	R	1 to 255	1
053Eh	053Dh	Retry monitor 8 Output frequency			-59000 to 59000	0.01(Hz)
053Fh	053Eh	(with sign)				
0540h	053Fh	Retry monitor 8 Output current			0 to 65535	0.01(A)
0541h	0540h	Retry monitor 8 P-N DC voltage			0 to 10000	0.1(Vdc)
0542h	0541h	Retry monitor 8 Inverter state			0 to 8*5	1
0543h	0542h	Retry monitor 8 LAD state			0 to 5*5	1
0544h	0543h	Retry monitor 8 INV control mode			0 to 11*5	1
0545h	0544h	Retry monitor 8 Limit state			0 to 6*5	1
0546h	0545h	Retry monitor 8 Special state			0 to 6*5	1
0548h	0547h	Retry monitor 8 RUN time			0 to 1000000	1(hr)
0549h	0548h					
054Ah	0549h	Retry monitor 8 Power ON time			0 to 1000000	1(hr)
054Bh	054Ah					
054Ch	054Bh	Retry monitor 8 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
054Dh	054Ch	Retry monitor 8 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
054Eh	054Dh	Retry monitor 8 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
0551h	0550h	Retry monitor 9 Factor	dE-39	R	1 to 255	1
0552h	0551h	Retry monitor 9 Output frequency			-59000 to 59000	0.01(Hz)
0553h	0552h	(with sign)				
0554h	0553h	Retry monitor 9 Output current			0 to 65535	0.01(A)
0555h	0554h	Retry monitor 9 P-N DC voltage			0 to 10000	0.1(Vdc)
0556h	0555h	Retry monitor 9 Inverter state			0 to 8*5	1
0557h	0556h	Retry monitor 9 LAD state			0 to 5*5	1
0558h	0557h	Retry monitor 9 INV control mode			0 to 11*5	1
0559h	0558h	Retry monitor 9 Limit state			0 to 6*5	1
055Ah	0559h	Retry monitor 9 Special state			0 to 6*5	1
055Ch	055Bh	Retry monitor 9 RUN time			0 to 1000000	1(hr)
055Dh	055Ch					
055Eh	055Dh	Retry monitor 9 Power ON time			0 to 1000000	1(hr)
055Fh	055Eh					
0560h	055Fh	Retry monitor 9 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0561h	0560h	Retry monitor 9 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0562h	0561h	Retry monitor 9 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-
0565h	0564h	Retry monitor 10 Factor	dE-40	R	1 to 255	1
0566h	0565h	Retry monitor 10 Output frequency			-59000 to 59000	0.01(Hz)
0567h	0566h	(with sign)				
0568h	0567h	Retry monitor 10 Output current			0 to 65535	0.01(A)
0569h	0568h	Retry monitor 10 P-N DC voltage			0 to 10000	0.1(Vdc)
056Ah	0569h	Retry monitor 10 Inverter state			0 to 8*5	1
056Bh	056Ah	Retry monitor 10 LAD state			0 to 5*5	1
056Ch	056Bh	Retry monitor 10 INV control mode			0 to 11*5	1
056Dh	056Ch	Retry monitor 10 Limit state			0 to 6*5	1
056Eh	056Dh	Retry monitor 10 Special state			0 to 6*5	1
0570h	056Fh	Retry monitor 10 RUN time			0 to 1000000	1(hr)
0571h	0570h					
0572h	0571h	Retry monitor 10 Power ON time			0 to 1000000	1(hr)
0573h	0572h					
0574h	0573h	Retry monitor 10 Absolute time (year, month)			00 to 99 (BCD code) 01 to 12 (BCD code)	-
0575h	0574h	Retry monitor 10 Absolute time (day, day of the week)			01 to 31 (BCD code) 00 to 06 (BCD code)	-
0576h	0575h	Retry monitor 10 Absolute time (hour, minute)			00 to 23 (BCD code) 00 to 59 (BCD code)	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
05DCh	050Bh	Warning monitor	dE-50	R	0 to 65535	1
2328h	2327h	ENTER instruction (Writing to Data Flash)	-	W	01: writing all parameters	-
232Ah	2329h	1 register writing mode	-	W	01: enabled	-
2332h	2321h	Motor constant recalculation (motor constant standard data not to be developed)	-	W	01: enabled	-
2906h	2905h	RS485 Set frequency	-	R/W	-59000 to + 59000	0.01(Hz)
2907h	2906h	(Signed) (Common to main speed and auxiliary speed)	-	R/W		
291Eh	291Dh	RS485 Torque command	-	R/W	-5000 to 5000	0.1(%)
2922h	2921h	RS485 Torque bias	-	R/W	-5000 to 5000	0.1(%)
2926h	2925h	RS485 Torque control speed limit value (for normal rotation)	-	R/W	0 to 59000	0.01(Hz)
2927h	2926h	RS485 Torque control speed limit value (for reverse rotation)	-	R/W	0 to 59000	0.01(Hz)
2932h	2931h	RS485 PID target value	-	R/W	-10000 to 10000	0.01(%)
2933h	2932h		-	R/W		
293Ah	2939h	RS485 PID feedback data	-	R/W	-10000 to 10000	0.01(%)
293Bh	293Ah		-	R/W		
2946h	2945h	RS485 Torque limit	-	R/W	0 to 5000	0.1(%)
3EB5h	3EB4h	Output terminal function option output (OPO output)	-	R/W	0 to 0x7F	1
3EBCh	3EBBh	Coil data 0 (coil No. 0001h - 000Fh)	-	R/W	0 to 0xFFFF	1
3EBDh	3EBCh	Coil data 1 (coil No. 0010h - 001Fh)	-	R	0 to 0xFFFF	1
3EBEh	3EDDh	Coil data 2 (coil No. 0020h - 002Fh)	-	R	0 to 0xFFFF	1
3EBFh	3EDEh	Coil data 3 (coil No. 0030h - 003Fh)	-	R	0 to 0xFFFF	1
3EC0h	3EBFh	Coil data 4 (coil No. 0040h - 004Fh)	-	R	0 to 0xFFFF	1
		Reserved	dA-46, dA-47			

*1. Data range varies in [AH-04] to [AH-06].

*2. Data range varies in [AJ-04] to [AJ-06].

*3. Data range varies in [AJ-24] to [AJ-26].

*4. Data range varies in [AJ-44] to [AJ-46].

*5. For the detail, see C Table of Parameters *Details of Trip Retry* on page C-18.

9-5-3 Group F Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2AF9h	2AF8h	Main Speed reference monitor	FA-01	R/W	0 to 59000	0.01Hz
2AFAh	2AF9h	Sub Speed reference monitor	FA-02 (HIGH)	R/W	-59000 to +59000 (monitor) 0 to 59000 (setting)	0.01(Hz)
2AFBh	2AFAh		FA-03 (LOW)	R/W		
2B02h	2B01h	Acceleration time monitor	FA-10 (HIGH)	R/W	0 to 360000	0.01(s)
2B03h	2B02h		FA-11 (LOW)	R/W		
2B04h	2B03h	Deceleration time monitor	FA-12 (HIGH)	R/W	0 to 360000	0.01(s)
2B05h	2B04h		FA-13 (LOW)	R/W		
2B07h	2B06h	Torque reference monitor	FA-15	R/W	-5000 to 5000	0.1(%)
2B08h	2B07h	Torque bias monitor	FA-16	R/W	-5000 to 5000	0.1(%)
2B0Ch	2B0Bh	Position reference monitor	FA-20 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1
2B0Dh	2B0Ch		FA-21 (LOW)	R/W		
2B16h	2B15h	PID1 Set Value 1 monitor	FA-30 (HIGH)	R/W	0 to 10000*1	Unit differs depending on setting [AH-03] [AH-06].
2B17h	2B16h		FA-31 (LOW)	R/W		
2B18h	2B17h	PID1 Set Value 2 monitor	FA-32 (HIGH)	R/W	0 to 10000*1	Unit differs depending on setting [AH-03] [AH-06].
2B19h	2B18h		FA-33 (LOW)	R/W		
2B1Ah	2B19h	PID1 Set Value 3 monitor	FA-34 (HIGH)	R/W	0 to 10000*1	Unit differs depending on setting [AH-03] [AH-06].
2B1Bh	2B1Ah		FA-35 (LOW)	R/W		
2B1Ch	2B1Bh	PID2 Set Value monitor	FA-36 (HIGH)	R/W	0 to 10000*2	Unit differs depending on setting [AJ-03] [AJ-06].
2B1Dh	2B1Ch		FA-37 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2B1Eh	2B1Dh	PID3 Set Value monitor	FA-38 (HIGH)	R/W	0 to 10000*3	Unit differs depending on setting [AJ-23] [AJ-26].
2B1Fh	2B1Eh		FA-39 (LOW)	R/W		
2B20h	2B1Fh	PID4 Set Value monitor	FA-40 (HIGH)	R/W	0 to 10000*4	Unit differs depending on setting [AJ-43] [AJ-46].
2B21h	2B20h		FA-41 (LOW)	R/W		

*1. Data range varies in [AH-04] to [AH-06].

*2. Data range varies in [AJ-04] to [AJ-06].

*3. Data range varies in [AJ-24] to [AJ-26].

*4. Data range varies in [AJ-44] to [AJ-46].

9-5-4 Group A Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

<table>
<tr><th>Register No.</th><th>Modbus register spec. No.</th><th>Function name</th><th>Parameter No.</th><th>R/W</th><th>Monitor or setting data</th><th>Resolution</th></tr>
<tr><td>2EE1h</td><td>2EF0h</td><td>Main speed input source selection, 1st-motor</td><td>AA101</td><td>R/W</td><td>01: Ai1 terminal input
02: Ai2 terminal input
03: Ai3 terminal input
04: (Reserved)
05: (Reserved)
06: (Reserved)
07: Parameter setting
08: RS 485
09: Option 1
10: Option 2
11: Option 3
12: Pulse string input: Inverter
13: Pulse string input: Option
14: Program function
15: PID calculation
16: (Reserved)</td><td>-</td></tr>
<tr><td>2EE2h</td><td>2EE1h</td><td>Sub frequency input source selection, 1st-motor</td><td>AA102</td><td>R/W</td><td>00: Disabled
01: Ai1 terminal input
02: Ai2 terminal input
03: Ai3 terminal input
04: (Reserved)
05: (Reserved)
06: (Reserved)
07: Parameter setting
08: RS 485
09: Option 1
10: Option 2
11: Option 3
12: Pulse string input: Inverter
13: Pulse string input: Option
14: Program function
15: PID calculation
16: (Reserved)</td><td>-</td></tr>
<tr><td>2EE4h</td><td>2EE3h</td><td>Sub speed setting, 1st-motor</td><td>AA104</td><td>R/W</td><td>0 to 59000</td><td>0.01(Hz)</td></tr>
<tr><td>2EE5h</td><td>2EE4h</td><td>Calculation symbol selection for Speed reference, 1st-motor</td><td>AA105</td><td>R/W</td><td>00: Disabled
01: Addition
02: Subtraction
03: Multiplication</td><td>-</td></tr>
<tr><td>2EE6h</td><td>2EE5h</td><td rowspan="2">Add frequency setting, 1st-motor</td><td>AA106 (HIGH)</td><td>R/W</td><td rowspan="2">-59000 to 59000</td><td rowspan="2">0.01(Hz)</td></tr>
<tr><td>2EE7h</td><td>2EE6h</td><td>AA107 (LOW)</td><td>R/W</td></tr>
</table>

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2EEBh	2EEAh	Run-command input source selection, 1st-motor	AA111	R/W	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on operator LCD Operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	-
2EECh	2EEBh	RUN-key Direction of LCD operator, 1st-motor	AA-12	R/W	00: Normal rotation 01: Reverse rotation	-
2EEDh	2EECh	STOP-key enable at RUN-command from terminal, 1st-motor	AA-13	R/W	00: Disabled 01: Enabled 02: Only reset is enabled	-
2EEEh	2EEDh	RUN-direction restriction, 1st-motor	AA114	R/W	00 (No limitation)/01 (Only normal rotation)/ 02 (Only reverse rotation)	-
2EEFh	2EEEh	STOP mode selection, 1st-motor	AA115	R/W	00 (Deceleration stop)/ 01 (Free run stop)	-
2EF5h	2EF4h	Control mode selection, 1st-motor	AA121	R/W	00 ([V/f] Fixed torque characteristics (IM))/ 01 ([V/f] Reducing torque characteristics (IM))/ 02 ([V/f] Free V/f (IM))/ 03 ([V/f] Auto torque boost (IM))/ 04 ([V/f with sensor] Fixed torque characteristics (IM)/ 05 ([V/f with sensor] Reduced torque characteristics (IM)/ 06 ([V/f with sensor] Free V/f (IM)/ 07 ([V/f with sensor] Auto torque boost (IM)/ 08 (Sensorless vector control (IM))/ 09 (Zero-Hz range sensorless vector control (IM)) *1/ 10 (Vector control with sensor (IM)) *1/ 11 (Synchronous start type sensorless vector control (SM/PMM))/ 12 (IVMS start type sensorless vector control (SM/PMM)) *2	-
2EF7h	2EF6h	Vector control mode selection, 1st-motor	AA123	R/W	00 (Speed/torque control mode)/ 01 (Pulse string position control mode)/ 02 (Absolute position control mode)/ 03 (High-resolution absolute position control mode)	-
2F45h	2F44h	Frequency conversion gain	Ab-01	R/W	1 to 10000	0.01
2F47h	2F46h	Multispeed operation selection	Ab-03	R/W	00 (16th speed: binary (CF1 to CF4))/ 01 (8th speed: bit (SF1-SF7))	-
2F4Eh	2F4Dh	Multispeed-0 setting, 1st-motor	Ab110	R/W	0 to 59000	0.01(Hz)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2F4Fh	2F4Eh	Multispeed-1 setting	Ab-11	R/W	0 to 59000	0.01(Hz)
2F50h	2F4Fh	Multispeed-2 setting	Ab-12	R/W	0 to 59000	0.01(Hz)
2F51h	2F50h	Multispeed-3 setting	Ab-13	R/W	0 to 59000	0.01(Hz)
2F52h	2F51h	Multispeed-4 setting	Ab-14	R/W	0 to 59000	0.01(Hz)
2F53h	2F52h	Multispeed-5 setting	Ab-15	R/W	0 to 59000	0.01(Hz)
2F54h	2F53h	Multispeed-6 setting	Ab-16	R/W	0 to 59000	0.01(Hz)
2F55h	2F54h	Multispeed-7 setting	Ab-17	R/W	0 to 59000	0.01(Hz)
2F56h	2F55h	Multispeed-8 setting	Ab-18	R/W	0 to 59000	0.01(Hz)
2F57h	2F56h	Multispeed-9 setting	Ab-19	R/W	0 to 59000	0.01(Hz)
2F58h	2F57h	Multispeed-10 setting	Ab-20	R/W	0 to 59000	0.01(Hz)
2F59h	2F58h	Multispeed-11 setting	Ab-21	R/W	0 to 59000	0.01(Hz)
2F5Ah	2F59h	Multispeed-12 setting	Ab-22	R/W	0 to 59000	0.01(Hz)
2F5Bh	2F5Ah	Multispeed-13 setting	Ab-23	R/W	0 to 59000	0.01(Hz)
2F5Ch	2F5Bh	Multispeed-14 setting	Ab-24	R/W	0 to 59000	0.01(Hz)
2F5Dh	2F5Ch	Multispeed-15 setting	Ab-25	R/W	0 to 59000	0.01(Hz)
2FA9h	2FA8h	Acceleration/ Deceleration Time input selection	AC-01	R/W	00: Parameter setting 01: Option 1 02: Option 2 03: Option 3 04: DriveProgramming	-
2FAAh	2FA9h	Acceleration/ Deceleration Selection	AC-02	R/W	00: Common 01: Multi-stage accelera-tion/deceleration	-
2FABh	2FAAh	Acceleration curve selection	AC-03	R/W	00: Linear 01: S-shaped 02: U-shaped 03: Reverse U-shaped 04: Elevator S-shaped	-
2FACh	2FABh	Deceleration curve selection	AC-04	R/W	00: Linear 01: S-shaped 02: U-shaped 03: Reverse U-shaped 04: Elevator S-shaped	-
2FADh	2FACh	Acceleration curve constant setting	AC-05	R/W	1 to 10	1
2FAEh	2FADh	Deceleration curve constant setting	AC-06	R/W	1 to 10	1
2FB0h	2FAFh	EL-S-curve ratio @start of acceleration	AC-08	R/W	0 to 100	1(%)
2FB1h	2FB0h	EL-S-curve ratio @end of acceleration	AC-09	R/W	0 to 100	1(%)
2FB2h	2FB1h	EL-S-curve ratio @start of deceleration	AC-10	R/W	0 to 100	1(%)
2FB3h	2FB2h	EL-S-curve ratio @end of deceleration	AC-11	R/W	0 to 100	1(%)
2FB7h	2FB6h	Select method to switch to Accel2/Decel2 Profile, 1st-motor	AC115	R/W	00: [2CH] terminal 01: Parameter setting 02: Switching normal/reverse rotation	-
2FB8h	2FB7h	Accel1 to Accel2 Frequency transition point, 1st-motor	AC116	R/W	0 to 59000	0.01(Hz)
2FB9h	2FB8h	Decel1 to Decel2 Frequency transition point, 1st-motor	AC117	R/W	0 to 59000	0.01(Hz)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2FBCh	2FBBh	Acceleration time setting 1, 1st-motor	AC120 (HIGH)	R/W	0 to 360000	0.01(s)
2FBDh	2FBCh		AC121 (LOW)	R/W		
2FBEh	2FBDh	Deceleration time setting 1, 1st-motor	AC122 (HIGH)	R/W	0 to 360000	0.01(s)
2FBFh	2FBEh		AC123 (LOW)	R/W		
2FC0h	2FBFh	Acceleration time setting 2, 1st-motor	AC124 (HIGH)	R/W	0 to 360000	0.01(s)
2FC1h	2FC0h		AC125 (LOW)	R/W		
2FC2h	2FC1h	Deceleration time setting 2, 1st-motor	AC126 (HIGH)	R/W	0 to 360000	0.01(s)
2FC3h	2FC2h		AC127 (LOW)	R/W		
2FC6h	2FC5h	Acceleration time setting for Multispeed-1	AC-30 (HIGH)	R/W	0 to 360000	0.01(s)
2FC7h	2FC6h		AC-31 (LOW)	R/W		
2FC8h	2FC7h	Deceleration time setting for Multispeed-1	AC-32 (HIGH)	R/W	0 to 360000	0.01(s)
2FC9h	2FC8h		AC-33 (LOW)	R/W		
2FCAh	2FC9h	Acceleration time setting for Multispeed-2	AC-34 (HIGH)	R/W	0 to 360000	0.01(s)
2FCBh	2FCAh		AC-35 (LOW)	R/W		
2FCCh	2FCBh	Deceleration time setting for Multispeed-2	AC-36 (HIGH)	R/W	0 to 360000	0.01(s)
2FCDh	2FCCh		AC-37 (LOW)	R/W		
2FCEh	2FCDh	Acceleration time setting for Multispeed-3	AC-38 (HIGH)	R/W	0 to 360000	0.01(s)
2FCFh	2FCEh		AC-39 (LOW)	R/W		
2FD0h	2FCFh	Deceleration time setting for Multispeed-3	AC-40 (HIGH)	R/W	0 to 360000	0.01(s)
2FD1h	2FD0h		AC-41 (LOW)	R/W		
2FD2h	2FD1h	Acceleration time setting for Multispeed-4	AC-42 (HIGH)	R/W	0 to 360000	0.01(s)
2FD3h	2FD2h		AC-43 (LOW)	R/W		
2FD4h	2FD3h	Deceleration time setting for Multispeed-4	AC-44 (HIGH)	R/W	0 to 360000	0.01(s)
2FD5h	2FD4h		AC-45 (LOW)	R/W		
2FD6h	2FD5h	Acceleration time setting for Multispeed-5	AC-46 (HIGH)	R/W	0 to 360000	0.01(s)
2FD7h	2FD6h		AC-47 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2FD8h	2FD7h	Deceleration time setting for Multispeed-5	AC-48 (HIGH)	R/W	0 to 360000	0.01(s)
2FD9h	2FD8h		AC-49 (LOW)	R/W		
2FDAh	2FD9h	Acceleration time setting for Multispeed-6	AC-50 (HIGH)	R/W	0 to 360000	0.01(s)
2FDBh	2FDAh		AC-51 (LOW)	R/W		
2FDCh	2FDBh	Deceleration time setting for Multispeed-6	AC-52 (HIGH)	R/W	0 to 360000	0.01(s)
2FDDh	2FDCh		AC-53 (LOW)	R/W		
2FDEh	2FDDh	Acceleration time setting for Multispeed-7	AC-54 (HIGH)	R/W	0 to 360000	0.01(s)
2FDFh	2FDEh		AC-55 (LOW)	R/W		
2FE0h	2FDFh	Deceleration time setting for Multispeed-7	AC-56 (HIGH)	R/W	0 to 360000	0.01(s)
2FE1h	2FE0h		AC-57 (LOW)	R/W		
2FE2h	2FE1h	Acceleration time setting for Multispeed-8	AC-58 (HIGH)	R/W	0 to 360000	0.01(s)
2FE3h	2FE2h		AC-59 (LOW)	R/W		
2FE4h	2FE3h	Deceleration time setting for Multispeed-8	AC-60 (HIGH)	R/W	0 to 360000	0.01(s)
2FE5h	2FE4h		AC-61 (LOW)	R/W		
2FE6h	2FE5h	Acceleration time setting for Multispeed-9	AC-62 (HIGH)	R/W	0 to 360000	0.01(s)
2FE7h	2FE6h		AC-63 (LOW)	R/W		
2FE8h	2FE7h	Deceleration time setting for Multispeed-9	AC-64 (HIGH)	R/W	0 to 360000	0.01(s)
2FE9h	2FE8h		AC-65 (LOW)	R/W		
2FEAh	2FE9h	Acceleration time setting for Multispeed-10	AC-66 (HIGH)	R/W	0 to 360000	0.01(s)
2FEBh	2FEAh		AC-67 (LOW)	R/W		
2FECh	2FEBh	Deceleration time setting for Multispeed-10	AC-68 (HIGH)	R/W	0 to 360000	0.01(s)
2FEDh	2FECh		AC-69 (LOW)	R/W		
2FEEh	2FEDh	Acceleration time setting for Multispeed-11	AC-70 (HIGH)	R/W	0 to 360000	0.01(s)
2FEFh	2FEEh		AC-71 (LOW)	R/W		
2FF0h	2FEFh	Deceleration time setting for Multispeed-11	AC-72 (HIGH)	R/W	0 to 360000	0.01(s)
2FF1h	2FF0h		AC-73 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
2FF2h	2FF1h	Acceleration time setting for Multispeed-12	AC-74 (HIGH)	R/W	0 to 360000	0.01(s)
2FF3h	2FF2h		AC-75 (LOW)	R/W		
2FF4h	2FF3h	Deceleration time setting for Multispeed-12	AC-76 (HIGH)	R/W	0 to 360000	0.01(s)
2FF5h	2FF4h		AC-77 (LOW)	R/W		
2FF6h	2FF5h	Acceleration time setting for Multispeed-13	AC-78 (HIGH)	R/W	0 to 360000	0.01(s)
2FF7h	2FF6h		AC-79 (LOW)	R/W		
2FF8h	2FF7h	Deceleration time setting for Multispeed-13	AC-80 (HIGH)	R/W	0 to 360000	0.01(s)
2FF9h	2FF8h		AC-81 (LOW)	R/W		
2FFAh	2FF9h	Acceleration time setting for Multispeed-14	AC-82 (HIGH)	R/W	0 to 360000	0.01(s)
2FFBh	2FFAh		AC-83 (LOW)	R/W		
2FFCh	2FFBh	Deceleration time setting for Multispeed-14	AC-84 (HIGH)	R/W	0 to 360000	0.01(s)
2FFDh	2FFCh		AC-85 (LOW)	R/W		
2FFEh	2FFDh	Acceleration time setting for Multispeed-15	AC-86 (HIGH)	R/W	0 to 360000	0.01(s)
2FFFh	2FFEh		AC-87 (LOW)	R/W		
3000h	2FFFh	Deceleration time setting for Multispeed-15	AC-88 (HIGH)	R/W	0 to 360000	0.01(s)
3001h	3000h		AC-89 (LOW)	R/W		
300Dh	300Ch	Torque reference input source selection	Ad-01	R/W	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-
300Eh	300Dh	Torque reference value setting	Ad-02	R/W	-500.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	0.1(%)
300Fh	300Eh	Polarity selection for torque reference	Ad-03	R/W	00: As per the sign 01: Follow the revolution direction	-
3010h	300Fh	Switching time of Speed control to Torque control	Ad-04	R/W	0 to 1000	1(ms)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3017h	3016h	Torque bias input source selection	Ad-11	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-
3018h	3017h	Torque bias value setting	Ad-12	R/W	-500.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	0.1(%)
3019h	3018h	Polarity selection for torque bias	Ad-13	R/W	00: As per the sign 01: Follow the revolution direction	-
301Ah	3019h	Terminal [TBS] active	Ad-14	R/W	00: Disabled 01: Enabled	-
3034h	3033h	Input selection for speed limit at torque control	Ad-40	R/W	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
3035h	3034h	Speed limit at torque control (at Forward rotation)	Ad-41	R/W	0 to 59000	0.01(Hz)
3036h	3035h	Speed limit at torque control (at Reverse rotation)	Ad-42	R/W	0 to 59000	0.01(Hz)
3071h	3070h	Electronic gear setting point selection	AE-01	R/W	00: Feedback side 01: Command side	-
3072h	3071h	Electronic gear ratio numerator	AE-02	R/W	1 to 10000	1
3073h	3072h	Electronic gear ratio denominator	AE-03	R/W	1 to 10000	1
3074h	3073h	Positioning complete range setting	AE-04	R/W	0 to 10000	1(pls)
3075h	3074h	Positioning complete delay time setting	AE-05	R/W	0 to 1000	0.01(s)
3076h	3075h	Position feed-forward gain setting	AE-06	R/W	0 to 65535	0.01
3077h	3076h	Position loop gain setting	AE-07	R/W	0 to 10000	0.01
3078h	3077h	Position bias setting	AE-08	R/W	-2048 to 2048	1(pls)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
307Ah	3078h	Stop position selection of Home search function	AE-10	R/W	00: Parameter setting 01: Option 1 02: Option 2 03: Option 3	-
307Bh	307Ah	Stop position of Home search function	AE-11	R/W	0 to 4095	1
307Ch	307Bh	Speed reference of Home search function	AE-12	R/W	0.00 to 120.00	0.01(Hz)
307Dh	307Ch	Direction of Home search function	AE-13	R/W	00: Normal rotation 01: Reverse rotation	-
3084h	3083h	Position reference 0 setting	AE-20 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
3085h	3084h		AE-21 (LOW)	R/W		
3086h	3085h	Position reference 1 setting	AE-22 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
3087h	3086h		AE-23 (LOW)	R/W		
3088h	3087h	Position reference 2 setting	AE-24 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
3089h	3088h		AE-25	R/W		
308Ah	3089h	Position reference 3 setting	AE-26 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
308Bh	308Ah		AE-27 (LOW)	R/W		
308Ch	308Bh	Position reference 4 setting	AE-28 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
308Dh	308Ch		AE-29 (LOW)	R/W		
308Eh	308Dh	Position reference 5 setting	AE-30 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
308Fh	308Eh		AE-31 (LOW)	R/W		
3090h	308Fh	Position reference 6 setting	AE-32 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
3091h	3090h		AE-33 (LOW)	R/W		
3092h	3091h	Position reference 7 setting	AE-34 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
3093h	3092h		AE-35 (LOW)	R/W		
3094h	3093h	Position reference 8 setting	AE-36 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
3095h	3094h		AE-37 (LOW)	R/W		
3096h	3095h	Position reference 9 setting	AE-38 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
3097h	3096h		AE-39 (LOW)	R/W		
3098h	3097h	Position reference 10 setting	AE-40 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
3099h	3098h		AE-41 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
309Ah	3099h	Position reference 11 setting	AE-42 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
309Bh	309Ah		AE-43 (LOW)	R/W		
309Ch	309Bh	Position reference 12 setting	AE-44 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
309Dh	309Ch		AE-45 (LOW)	R/W		
309Eh	309Dh	Position reference 13 setting	AE-46 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
309Fh	309Eh		AE-47 (LOW)	R/W		
30A0h	309Fh	Position reference 14 setting	AE-48 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
30A1h	30A0h		AE-49 (LOW)	R/W		
30A2h	30A1h	Position reference 15 setting	AE-50 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
30A3h	30A2h		AE-51 (LOW)	R/W		
30A4h	30A3h	Position control range setting(forward)	AE-52 (HIGH)	R/W	0 to 268435455 In high resolution mode: 0 to 1073741823	1(pls)
30A5h	30A4h		AE-53 (LOW)	R/W		
30A6h	30A5h	Position control range setting(reverse)	AE-54 (HIGH)	R/W	-268435455 to 0 In high resolution mode: -1073741823 to 0	1(pls)
30A7h	30A6h		AE-55 (LOW)	R/W		
30A8h	30A7h	Position control mode selection	AE-56	R/W	00: With limit 01: Without limit	-
30Ach	30ABh	Teach-in function target selection	AE-60	R/W	00 (X00) to 15 (X15)	-
30Adh	30ACh	Current position saving at power-off	AE-61	R/W	00: Disabled 01: Enabled	-
30Aeh	30ADh	Preset position data	AE-62 (HIGH)	R/W	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	1(pls)
30Afh	30AEh		AE-63 (LOW)	R/W		
30B0h	30AFh	Deceleration stop distance calculation Gain	AE-64	R/W	5000 to 20000	0.01(%)
30B1h	30B0h	Deceleration stop distance calculation Bias	AE-65	R/W	0 to 65535	0.01(%)
30B2h	30B1h	Speed Limit in APR control	AE-66	R/W	0 to 10000	0.01(%)
30B3h	30B2h	APR start speed	AE-67	R/W	0 to 10000	0.01(%)
30B6h	30B5h	Homing function selection	AE-70	R/W	00: Low speed zero return 01: High speed zero return 02: High speed zero return 2	-
30B7h	30B6h	Direction of homing function	AE-71	R/W	00: Normal rotation 01: Reverse rotation	-
30B8h	30B7h	Low-speed of homing function	AE-72	R/W	0 to 1000	0.01(Hz)
30B9h	30B8h	High-Speed of homing function	AE-73	R/W	0 to 59000	0.01(Hz)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
30D5h	30D4h	DC braking selection, 1st-motor	AF101	R/W	00: Disabled 01: Enabled 02: Frequency command	-
30D6h	30D5h	Braking type selection, 1st-motor	AF102	R/W	00: DC braking 01: Speed servo lock 02: Position servo lock	-
30D7h	30D6h	DC braking frequency, 1st-motor	AF103	R/W	0 to 59000	0.01(Hz)
30D8h	30D7h	DC braking delay time, 1st-motor	AF104	R/W	0 to 500	0.01(s)
30D9h	30D8h	DC braking force setting, 1st-motor	AF105	R/W	0 to 100	1(%)
30Dah	30D9h	DC braking active time at stop, 1st-motor	AF106	R/W	0 to 6000	0.01(s)
30DBh	30DAh	DC braking operation method selection, 1st-motor	AF107	R/W	00: Edge mode 01: Level mode	-
30DCh	30DBh	DC braking force at start, 1st-motor	AF108	R/W	0 to 100	1(%)
30DDh	30DCh	DC braking active time at start, 1st-motor	AF109	R/W	0 to 6000	0.01(s)
30E8h	30E7h	ContactorControl Enable, 1st-motor	AF120	R/W	00: Disabled 01: Enabled: primary side 02: Enabled: secondary side	-
30E9h	30E8h	Run delay time, 1st-motor	AF121	R/W	0 to 200	0.01(s)
30Eah	30E9h	Contactor off delay time, 1st-motor	AF122	R/W	0 to 200	0.01(s)
30Ebh	30Eah	Contactor answer back check time, 1st-motor	AF123	R/W	0 to 500	0.01(s)
30F2h	30F1h	Brake Control Enable, 1st-motor	AF130	R/W	00: Disabled 01: Brake control 1 common in forward/reverse rotation 02: Brake control 1 forward/reverse set individually 03: Brake control 2	-
30F3h	30F2h	Brake Wait Time for Release, 1st-motor (Forward side)	AF131	R/W	0 to 500	0.01(s)
30F4h	30F3h	Brake Wait Time for Accel., 1st-motor (Forward side)	AF132	R/W	0 to 500	0.01(s)
30F5h	30F4h	Brake Wait Time for Stopping, 1st-motor (Forward side)	AF133	R/W	0 to 500	0.01(s)
30F6h	30F5h	Brake Wait Time for Confirmation, 1st-motor (Forward side)	AF134	R/W	0 to 500	0.01(s)
30F7h	30F6h	Brake Release Frequency Setting, 1st-motor (Forward side)	AF135	R/W	0 to 59000	0.01(Hz)
30F8h	30F7h	Brake Release Current Setting, 1st-motor (Forward side)	AF136	R/W	(0.0 to 2.0) × Inverter rated current*3	0.1(A)
30F9h	30F8h	Braking Frequency, 1st-motor (Forward side)	AF137	R/W	0 to 59000	0.01(Hz)
30Fah	30F9h	Brake Wait Time for Release, 1st-motor (Reverse side)	AF138	R/W	0 to 500	0.01(s)
30FBh	30FAh	Brake Wait Time for Accel., 1st-motor (Reverse side)	AF139	R/W	0 to 500	0.01(s)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
30FCh	30FBh	Brake Wait Time for Stopping, 1st-motor (Reverse side)	AF140	R/W	0 to 500	0.01(s)
30FDh	30FCh	Brake Wait Time for Confirmation, 1st-motor (Reverse side)	AF141	R/W	0 to 500	0.01(s)
30Feh	30FDh	Brake Release Frequency Setting, 1st-motor (Reverse side)	AF142	R/W	0 to 59000	0.01(Hz)
30FFh	30FEh	Brake Release Current Setting, 1st-motor (Reverse side)	AF143	R/W	(0.0 to 2.0) × Inverter rated current*3	0.1(A)
3100h	30FFh	Braking Frequency, 1st-motor (Reverse side)	AF144	R/W	0 to 59000	0.01(Hz)
3106h	3105h	Brake open delay time, 1st-motor	AF150	R/W	0 to 200	0.01(s)
3107h	3106h	Brake close delay time, 1st-motor	AF151	R/W	0 to 200	0.01(s)
3108h	3107h	Brake answer back check time, 1st-motor	AF152	R/W	0 to 500	0.01(s)
3109h	3108h	Servo lock/ DC injection time at start, 1st-motor	AF153	R/W	0 to 1000	0.01(s)
310Ah	3109h	Servo lock/ DC injection time at stop, 1st-motor	AF154	R/W	0 to 1000	0.01(s)
3139h	3138h	Jump frequency 1, 1st-motor	AG101	R/W	0 to 59000	0.01(Hz)
313Ah	3139h	Jump frequency width 1, 1st-motor	AG102	R/W	0 to 1000	0.01(Hz)
313Bh	313Ah	Jump frequency 2, 1st-motor	AG103	R/W	0 to 59000	0.01(Hz)
313Ch	313Bh	Jump frequency width 2, 1st-motor	AG104	R/W	0 to 1000	0.01(Hz)
313Dh	313Ch	Jump frequency 3, 1st-motor	AG105	R/W	0 to 59000	0.01(Hz)
313Eh	313Dh	Jump frequency width 3, 1st-motor	AG106	R/W	0 to 1000	0.01(Hz)
3142h	3141h	Acceleration stop frequency setting, 1st-motor	AG110	R/W	0 to 59000	0.01(Hz)
3143h	3142h	Acceleration stop time setting, 1st-motor	AG111	R/W	0 to 600	0.1(s)
3144h	3143h	Deceleration stop frequency setting, 1st-motor	AG112	R/W	0 to 59000	0.01(Hz)
3145h	3144h	Deceleration stop time setting, 1st-motor	AG113	R/W	0 to 600	0.1(s)
314Ch	314Bh	Jogging frequency	AG-20	R/W	0 to 1000	0.01(Hz)
314Dh	314Ch	Jogging stop mode selection	AG-21	R/W	00: Disabled during FRS operation at stop 01: Disabled during deceleration stop operation 02: Disabled during DB operation at stop 03: Enabled during FRS operation at stop 04: Enabled during deceleration stop operation 05: Enabled during DB operation at stop	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
319Dh	319Ch	PID1 enable	AH-01	R/W	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-
319Eh	319Dh	PID1 deviation inverse	AH-02	R/W	00: Disabled 01: Enabled	-
319Fh	319Eh	Unit selection for PID1	AH-03	R/W	See *<Unit options>* on page C-70 at the end of Appendices C	1
31A0h	319Fh	PID1 scale adjustment (at 0%)	AH-04	R/W	-10000 to 10000	1
31A1h	31A0h	PID1 scale adjustment (at 100%)	AH-05	R/W	-10000 to 10000	1
31A2h	31A1h	PID1 scale adjustment (point position)	AH-06	R/W	00:0000. 01:0000.0 02:000.00 03:00.000 04:0.0000	-
31A3h	31A2h	Input source selection of Set-point for PID1	AH-07	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
31A6h	31A5h	Set-point-1 setting for PID1	AH-10 (HIGH)	R/W	-100.00 to 100.00[*4]	Unit differs depending on setting [AH-03] [AH-06].
31A7h	31A6h		AH-11 (LOW)	R/W		
31A8h	31A7h	PID1 Multi stage set-point 1 setting	AH-12 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31A9h	31A8h		AH-13 (LOW)	R/W		
31Aah	31A9h	PID1 Multi stage set-point 2 setting	AH-14 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31Abh	31Aah		AH-15 (LOW)	R/W		
31Ach	31Abh	PID1 Multi stage set-point 3 setting	AH-16 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31Adh	31Ach		AH-17 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
31Aeh	31Adh	PID1 Multi stage set-point 4 setting	AH-18 (HIGH)	R/W	-100.00 to 100.00*4	Unit differs depending on setting [AH-03] [AH-06].
31Afh	31Aeh		AH-19 (LOW)	R/W		
31B0h	31Afh	PID1 Multi stage set-point 5 setting	AH-20 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31B1h	31B0h		AH-21 (LOW)	R/W		
31B2h	31B1h	PID1 Multi stage set-point 6 setting	AH-22 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31B3h	31B2h		AH-23 (LOW)	R/W		
31B4h	31B3h	PID1 Multi stage set-point 7 setting	AH-24 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31B5h	31B4h		AH-25 (LOW)	R/W		
31B6h	31B5h	PID1 Multi stage set-point 8 setting	AH-26 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31B7h	31B6h		AH-27 (LOW)	R/W		
31B8h	31B7h	PID1 Multi stage set-point 9 setting	AH-28 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31B9h	31B8h		AH-29 (LOW)	R/W		
31Bah	31B9h	PID1 Multi stage set-point 10 setting	AH-30 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31BBh	31Bah		AH-31 (LOW)	R/W		
31BCh	31BBh	PID1 Multi stage set-point 11 setting	AH-32 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31BDh	31BCh		AH-33 (LOW)	R/W		
31Beh	31BDh	PID1 Multi stage set-point 12 setting	AH-34 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31BFh	31Beh		AH-35 (LOW)	R/W		
31C0h	31BFh	PID1 Multi stage set-point 13 setting	AH-36 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31C1h	31C0h		AH-37 (LOW)	R/W		
31C2h	31C1h	PID1 Multi stage set-point 14 setting	AH-38 (HIGH)	R/W		Unit differs depending on setting [AH-03] [AH-06].
31C3h	31C2h		AH-39 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
31C4h	31C3h	PID1 Multi stage set-point 15 setting	AH-40 (HIGH)	R/W	-100.00 to 100.00*4	Unit differs depending on setting [AH-03] [AH-06].
31C5h	31C4h		AH-41 (LOW)	R/W		
31C6h	31C5h	Input source selection of Set-point 2 for PID1	AH-42	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
31C8h	31C7h	Set-point 2 setting for PID1	AH-44 (HIGH)	R/W	-100.00 to 100.00*4	Unit differs depending on setting [AH-03] [AH-06].
31C9h	31C8h		AH-45 (LOW)	R/W		
31Cah	31C9h	Input source selection of Set-point 3 for PID1	AH-46	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
31CCh	31CBh	Set-point 3 setting for PID1	AH-48 (HIGH)	R/W	-100.00 to 100.00*4	Unit differs depending on setting [AH-03] [AH-06].
31CDh	31CCh		AH-49 (LOW)	R/W		
31Ceh	31CDh	Calculation symbol selection of Set-point 1 for PID1	AH-50	R/W	01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Minimum deviation 06: Maximum deviation	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
31CFh	31CEh	Input source selection of Process data 1 for PID1	AH-51	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
31D0h	31CFh	Input source selection of Process data 2 for PID1	AH-52	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
31D1h	31D0h	Input source selection of Process data 3 for PID1	AH-53	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
31D2h	31D1h	Calculation symbol selection of Process data for PID1	AH-54	R/W	01: Addition 02: Subtraction 03: Multiplication 04: Division 05: Square root of FB1 06: Square root of FB2 07: Square root of (FB1-FB2 08: Average of PV-1 to PV-3 09: Minimum data of PV-1 to PV-3 10: Maximum data of PV-1 to PV-3	-
31D8h	31D7h	PID1 gain change method selection	AH-60	R/W	00: Only gain 1 01: [PRO] terminal switch	-
31D9h	31D8h	PID1 proportional gain 1	AH-61	R/W	0 to 1000	0.1
31Dah	31D9h	PID1 integral time constant 1	AH-62	R/W	0 to 36000	0.1(s)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
31DBh	31DAh	PID1 derivative gain 1	AH-63	R/W	0 to 10000	0.01(s)
31DCh	31DBh	PID proportional gain 2	AH-64	R/W	0 to 1000	0.1
31DDh	31DCh	PID integral time constant 2	AH-65	R/W	0 to 36000	0.1(s)
31Deh	31DDh	PID1 derivative gain 2	AH-66	R/W	0 to 10000	0.01(s)
31DFh	31DEh	PID1 gain change time	AH-67	R/W	0 to 10000	1(ms)
31E2h	31E1h	PID feed-forward selection	AH-70	R/W	00 (Disabled) 01 Ai1 terminal input 02 Ai2 terminal input 03 Ai3 terminal input 04 (Reserved) 05 (Reserved) 06 (Reserved)	-
31E3h	31E2h	PID1 output range	AH-71	R/W	0 to 10000	0.01(%)
31E4h	31E3h	PID1 Deviation over level	AH-72	R/W	0 to 10000	0.01(%)
31E5h	31E4h	PID1 Feedback compare signal turn-off level	AH-73	R/W	0 to 10000	0.01(%)
31E6h	31E5h	PID1 Feedback compare signal turn-on level	AH-74	R/W	0 to 10000	0.01(%)
31E7h	31E6h	PID soft start function enable	AH-75	R/W	00: Disabled 01: Enabled	-
31E8h	31E7h	PID soft start target level	AH-76	R/W	0 to 10000	0.01(%)
31Eah	31E9h	Acceleration time setting for PID soft start function	AH-78 (HIGH)	R/W	0 to 360000	0.01(s)
31Ebh	31EAh		AH-79 (LOW)	R/W		
31Ech	31EBh	PID soft start time	AH-80	R/W	0 to 60000	0.01(s)
31Edh	31ECh	PID soft start error detection enable	AH-81	R/W	00: Disabled 01: Enabled: error output 02: Enabled: warning	-
31Eeh	31EDh	PID soft start error detection level	AH-82	R/W	0 to 10000	0.01(%)
31F1h	31F0h	PID sleep trigger selection	AH-85	R/W	00: Disabled 01: Low output 02: [SLEP] terminal	-
31F2h	31F1h	PID sleep start level	AH-86	R/W	0 to 59000	0.01(Hz)
31F3h	31F2h	PID sleep active time	AH-87	R/W	0 to 10000	0.01(s)
31F4h	31F3h	Setpoint boost before PID sleep enable	AH-88	R/W	00: Disabled 01: Enabled	-
31F5h	31F4h	Setpoint boost time	AH-89	R/W	0 to 10000	0.01(s)
31F6h	31F5h	Setpoint boost value	AH-90	R/W	0 to 10000	0.01(%)
31F7h	31F6h	Minimum RUN time befor PID sleep	AH-91	R/W	0 to 10000	0.01(s)
31F8h	31F7h	Minimum active time of PID sleep	AH-92	R/W	0 to 10000	0.01(s)
31F9h	31F8h	PID sleep trigger selection	AH-93	R/W	01: Deviation amount 02: Low feedback 03: ([WAKE] terminal	-
31Fah	31F9h	PID wake start level	AH-94	R/W	0 to 10000	0.01(%)
31FBh	31FAh	PID wake start time	AH-95	R/W	0 to 10000	0.01(s)
31FCh	31FBh	PID wake start deviation value	AH-96	R/W	0 to 10000	0.01(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3201h	3200h	PID2 enable	AJ-01	R/W	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	-
3202h	3201h	PID2 deviation inverse	AJ-02	R/W	00: Disabled 01: Enabled	-
3203h	3202h	PID2 unit selection	AJ-03	R/W	See <*Unit options*> on page C-70 at the end of Appendices C	-
3204h	3203h	PID2 scale adjustment (at 0%)	AJ-04	R/W	-10000 to 10000	1
3205h	3204h	PID2 scale adjustment (at 100%)	AJ-05	R/W	-10000 to 10000	1
3206h	3205h	PID2 scale adjustment (point position)	AJ-06	R/W	00:0000. 01:0000.0 02:000.00 03:00.000 04:0.0000	-
3207h	3206h	Input source selection of Set-point for PID2	AJ-07	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 15: PID calculation	-
320Ah	3209h	Set-point setting for PID2	AJ-10 (HIGH)	R/W	-100.00 to 100.00*1	Unit differs depending on setting [AJ-03] [AJ-06].
320Bh	320Ah		AJ-11 (LOW)	R/W		
320Ch	320Bh	Input source selection of Process data for PID2	AJ-12	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
320Dh	320Ch	PID2 proportional gain	AJ-13	R/W	0 to 1000	0.1
320Eh	320Dh	PID2 integral time constant	AJ-14	R/W	0 to 36000	0.1(s)
320Fh	320Eh	PID2 derivative gain	AJ-15	R/W	0 to 10000	0.01(s)
3210h	320Fh	PID2 output range	AJ-16	R/W	0 to 10000	0.01(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3211h	3210h	PID2 Deviation over level	AJ-17	R/W	0 to 10000	0.01(%)
3212h	3211h	PID2 Feedback compare signal turn-off level	AJ-18	R/W	0 to 10000	0.01(%)
3213h	3212h	PID2 Feedback compare signal turn-on level	AJ-19	R/W	0 to 10000	0.01(%)
3215h	3214h	PID3 enable	AJ-21	R/W	00 (Disabled)/ 01 (Enabled Without reverse output)/ 02 (Enabled With reverse output)	-
3216h	3215h	PID3 deviation inverse	AJ-22	R/W	00: Disabled 01: Enabled	-
3217h	3216h	PID3 unit selection	AJ-23	R/W	See *<Unit options>* on page C-70 at the end of Appendices C	-
3218h	3217h	PID3 scale adjustment (at 0%)	AJ-24	R/W	-10000 to 10000	1
3219h	3218h	PID3 scale adjustment (at 100%)	AJ-25	R/W	-10000 to 10000	1
321Ah	3219h	PID3 scale adjustment (point position)	AJ-26	R/W	00:0000. 01:0000.0 02:000.00 03:00.000 04:0.0000	-
321Bh	321Ah	Input source selection of Set-point for PID3	AJ-27	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
321Eh	321Dh	Set-point setting for PID3	AJ-30 (HIGH)	R/W	-100.00 to 100.00*4	Unit differs depending on setting [AJ-23] [AJ-26].
321Fh	321Eh		AJ-31 (LOW)	R/W		
3220h	321Fh	Input source selection of Process data for PID3	AJ-32	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3221h	3220h	PID3 proportional gain	AJ-33	R/W	0 to 1000	0.1
3222h	3221h	PID3 integral time constant	AJ-34	R/W	0 to 36000	0.1(s)
3223h	3222h	PID3 derivative gain	AJ-35	R/W	0 to 10000	0.01(s)
3224h	3223h	PID3 output range	AJ-36	R/W	0 to 10000	0.01(%)
3225h	3224h	PID3 Deviation over level	AJ-37	R/W	0 to 10000	0.01(%)
3226h	3225h	PID3 Feedback compare signal turn-off level	AJ-38	R/W	0 to 10000	0.01(%)
3227h	3226h	PID3 Feedback compare signal turn-on level	AJ-39	R/W	0 to 10000	0.01(%)
3229h	3228h	PID4 enable	AJ-41	R/W	00: Disabled 01: Enabled Without reverse output 02: Enabled With reverse output	1
322Ah	3229h	PID4 deviation inverse	AJ-42	R/W	00: Disabled 01: Enabled	1
322Bh	322Ah	PID4 unit selection	AJ-43	R/W	See *<Unit options>* on page C-70 at the end of Appendices C	1
322Ch	322Bh	PID4 scale adjustment (at 0%)	AJ-44	R/W	-10000 to 10000	1
322Dh	322Ch	PID4 scale adjustment (at 100%)	AJ-45	R/W	-10000 to 10000	1
322Eh	322Dh	PID4 scale adjustment (point position)	AJ-46	R/W	0:00000. 01:0000.0 02:000.00 03:00.000 04:0.0000	-
322Fh	322Eh	Input source selection of Set-point for PID4	AJ-47	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
3232h	3221h	Set-point setting for PID4	AJ-50 (HIGH)	R/W	-100.00 to 100.00[*4]	Unit differs depending on setting [AJ-43] [AJ-46].
3233h	3232h		AJ-51 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3234h	3233h	Input source selection of Process data for PID4	AJ-52	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
3235h	3234h	PID4 proportional gain	AJ-53	R/W	0 to 1000	0.1
3236h	3235h	PID4 integral time constant	AJ-54	R/W	0 to 36000	0.1(s)
3237h	3236h	PID4 derivative gain	AJ-55	R/W	0 to 10000	0.01(s)
3238h	3237h	PID4 output range	AJ-56	R/W	0 to 10000	0.01(%)
3239h	3238h	PID4 Deviation over level	AJ-57	R/W	0 to 10000	0.01(%)
323Ah	3239h	PID4 Feedback compare signal turn-off level	AJ-58	R/W	0 to 10000	0.01(%)
323Bh	323Ah	PID4 Feedback compare signal turn-on level	AJ-59	R/W	0 to 10000	0.01(%)
55F1h	55F0h	Main speed input source selection, 2nd-motor	AA201	R/W	same as AA101	-
55F2h	55F1h	Sub speed input source selection, 2nd-motor	AA202	R/W	same as AA102	-
55F4h	55F3h	Sub speed setting, 2nd-motor	AA204	R/W	same as AA104	0.01(Hz)
55F5h	55F4h	Calculation symbol selection for Speed reference, 2nd-motor	AA205	R/W	same as AA105	-
55F6h	55F5h	Add frequency setting, 2nd-motor	AA206 (HIGH)	R/W	same as AA106	0.01(Hz)
55F7h	55F6h		AA207 (LOW)	R/W		
55FBh	55FAh	Run-command input source selection, 2nd-motor	AA211	R/W	same as AA111	-
55FEh	55FDh	RUN-direction restriction, 2nd-motor	AA214	R/W	same as AA114	-
55FFh	55FEh	STOP mode selection, 2nd-motor	AA215	R/W	same as AA115	-
5605h	5604h	Control mode selection, 2nd-motor	AA221	R/W	Same as AA121, except 12	-
5607h	5606h	Vector control mode selection, 2nd-motor	AA223	R/W	same as AA123	-
565Eh	565Dh	Multispeed-0 setting, 2nd-motor	Ab210	R/W	0 to 59000	0.01(Hz)
56C7h	56C6h	Select method to switch to Accel2/Decel2 Profile, 2nd-motor	AC215	R/W	same as AC115	-
56C8h	56C7h	Accel1 to Accel2 Frequency transition point, 2nd-motor	AC216	R/W	same as AC116	0.01(Hz)
56C9h	56C8h	Decel1 to Decel2 Frequency transition point, 2nd-motor	AC217	R/W	same as AC117	0.01(Hz)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
56CCh	56CBh	Acceleration time setting 1, 2nd-motor	AC220 (HIGH)	R/W	same as AC120	0.01(s)
56CDh	56CCh		AC221 (LOW)	R/W		
56Ceh	56CDh	Deceleration time setting 1, 2nd-motor	AC222 (HIGH)	R/W	same as AC122	0.01(s)
56CFh	56Ceh		AC223 (LOW)	R/W		
56D0h	56CFh	Acceleration time setting 2, 2nd-motor	AC224 (HIGH)	R/W	same as AC124	0.01(s)
56D1h	56D0h		AC225 (LOW)	R/W		
56D2h	56D1h	Deceleration time setting 2, 2nd-motor	AC226 (HIGH)	R/W	same as AC126	0.01(s)
56D3h	56D2h		AC227 (LOW)	R/W		
57E5h	57E4h	DC braking selection, 2nd-motor	AF201	R/W	same as AF101	-
57E6h	57E5h	Braking type selection, 2nd-motor	AF202	R/W	same as AF102	-
57E7h	57E6h	DC braking frequency, 2nd-motor	AF203	R/W	same as AF103	0.01(Hz)
57E8h	57E7h	DC braking delay time, 2nd-motor	AF204	R/W	same as AF104	0.01(s)
57E9h	57E8h	DC braking force setting, 2nd-motor	AF205	R/W	same as AF105	1(%)
57Eah	57E9h	DC braking active time at stop, 2nd-motor	AF206	R/W	same as AF106	0.01(s)
57Ebh	57EAh	DC braking operation method selection, 2nd-motor	AF207	R/W	same as AF107	-
57Ech	57EBh	DC braking force at start, 2nd-motor	AF208	R/W	same as AF108	1(%)
57Edh	57ECh	DC braking active time at start, 2nd-motor	AF209	R/W	same as AF109	0.01(s)
57F8h	57EDh	ContactorControl Enable, 2nd-motor	AF220	R/W	same as AF120	-
57F9h	57F8h	Run delay time, 2nd-motor	AF221	R/W	same as AF121	0.01(s)
57Fah	57F9h	Contactor off delay time, 2nd-motor	AF222	R/W	same as AF122	0.01(s)
57FBh	57FAh	Contactor answer back check time, 2nd-motor	AF223	R/W	same as AF123	0.01(s)
5802h	5801h	Brake Control Enable, 2nd-motor	AF230	R/W	same as AF130	-
5803h	5802h	Brake Wait Time for Release, 2nd-motor (Forward side)	AF231	R/W	same as AF131	0.01(s)
5804h	5803h	Brake Wait Time for Accel., 2nd-motor (Forward side)	AF232	R/W	same as AF132	0.01(s)
5805h	5804h	Brake Wait Time for Stopping, 2nd-motor (Forward side)	AF233	R/W	same as AF133	0.01(s)
5806h	5805h	Brake Wait Time for Confir-mation, 2nd-motor (Forward side)	AF234	R/W	same as AF134	0.01(s)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
5807h	5806h	Brake Release Frequency Setting, 2nd-motor (Forward side)	AF235	R/W	same as AF135	0.01(Hz)
5808h	5807h	Brake Release Current Setting, 2nd-motor (Forward side)	AF236	R/W	same as AF136	0.1(A)
5809h	5808h	Braking Frequency, 2nd-motor (Forward side)	AF237	R/W	same as AF137	0.01(Hz)
580Ah	5809h	Brake Wait Time for Release, 2nd-motor (Reverse side)	AF238	R/W	same as AF138	0.01(s)
580Bh	580Ah	Brake Wait Time for Accel., 2nd-motor (Reverse side)	AF239	R/W	same as AF139	0.01(s)
580Ch	580Bh	Brake Wait Time for Stopping, 2nd-motor (Reverse side)	AF240	R/W	same as AF140	0.01(s)
580Dh	580Ch	Brake Wait Time for Confirmation, 2nd-motor (Reverse side)	AF241	R/W	same as AF141	0.01(s)
580Eh	580Dh	Brake Release Frequency Setting, 2nd-motor (Reverse side)	AF242	R/W	same as AF142	0.01(Hz)
580Fh	580Eh	Brake Release Current Setting, 2nd-motor (Reverse side)	AF243	R/W	same as AF143	0.1(A)
5810h	580Fh	Braking Frequency, 2nd-motor (Reverse side)	AF244	R/W	same as AF144	0.01(Hz)
5816h	5815h	Brake open delay time, 2nd-motor	AF250	R/W	same as AF150	0.01(s)
5817h	5816h	Brake close delay time, 2nd-motor	AF251	R/W	same as AF151	0.01(s)
5818h	5817h	Brake answer back check time, 2nd-motor	AF252	R/W	same as AF152	0.01(s)
5819h	5818h	Servo lock/ DC injection time at start, 2nd-motor	AF253	R/W	same as AF153	0.01(s)
581Ah	5819h	Servo lock/ DC injection time at stop, 2nd-motor	AF254	R/W	same as AF154	0.01(s)
5849h	5848h	Jump frequency 1, 2nd-motor	AG201	R/W	same as AG101	0.01(Hz)
584Ah	5849h	Jump frequency width 1, 2nd-motor	AG202	R/W	same as AG102	0.01(Hz)
584Bh	584Ah	Jump frequency 2, 2nd-motor	AG203	R/W	same as AG103	0.01(Hz)
584Ch	584Bh	Jump frequency width 2, 2nd-motor	AG204	R/W	same as AG104	0.01(Hz)
584Dh	584Ch	Jump frequency 3, 2nd-motor	AG205	R/W	same as AG105	0.01(Hz)
584Eh	584Dh	Jump frequency width 3, 2nd-motor	AG206	R/W	same as AG106	0.01(Hz)
5852h	5851h	Acceleration stop frequency setting, 2nd-motor	AG210	R/W	same as AG110	0.01(Hz)
5853h	5852h	Acceleration stop time setting, 2nd-motor	AG211	R/W	same as AG111	0.1(s)
5854h	5853h	Deceleration stop frequency setting, 2nd-motor	AG212	R/W	same as AG112	0.01(Hz)
5854h	5853h	Deceleration stop time setting, 2nd-motor	AG213	R/W	same as AG113	0.1(s)

*1. Cannot be selected if [Ub-03] load type selection is 01 (LD) or 00 (VLD).

*2. Cannot be selected if [Ub-03] load type selection is 00 (VLD).

*3. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A, V). When the data of [CF-11] Resister data selection is not set to 00 (A, V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A, V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

*4. Data range differs depending on [AH-04] - [AH-06].

9-5-5 Group b Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
32C9h	32C8h	Frequency limit selection, 1st-motor	bA101	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option	-
32Cah	32C9h	Upper Frequency limit, 1st-motor	bA102	R/W	0 to 59000	0.01(Hz)
32CBh	32CAh	Lower Frequency limit, 1st-motor	bA103	R/W	0 to 59000	0.01(Hz)
32D2h	32D1h	Torque limit selection, 1st-motor	bA110	R/W	00: Disabled 01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3	-
32D3h	32D2h	Torque limit parameter mode selection, 1st-motor	bA111	R/W	00: Four quadrant specific 01: [TRQ] terminal switch	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
32D4h	32D3h	Torque limit 1 (Forward driving), 1st-motor	bA112	R/W	0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	0.1(%)
32D5h	32D4h	Torque limit 2 (Reverse regenerative), 1st-motor	bA113	R/W	0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	0.1(%)
32D6h	32D5h	Torque limit 3 (Reverse driving), 1st-motor	bA114	R/W	0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	0.1(%)
32D7h	32D6h	Torque limit 4 (Forward regenerative), 1st-motor	bA115	R/W	0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	0.1(%)
32D8h	32D7h	Torque limit LADSTOP selection, 1st-motor	bA116	R/W	00: Disabled 01: Enabled	-
32DCh	32DBh	Over current suppress enable, 1st-motor	bA120	R/W	00: Disabled 01: Enabled	-
32DDh	32DCh	Over current suppress Level, 1st-motor	bA121	R/W	(0.0 to 2.0) × Inverter rated current[*1]	0.1(A)
32Deh	32DDh	Overload restriction 1 mode selection, 1st-motor	bA122	R/W	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/Increase speed at regeneratio:n	-
32DFh	32Deh	Overload restriction 1 active level, 1st-motor	bA123	R/W	(0.2 to 2.0) × Inverter rated current[*1]	0.1(A)
32E0h	32DFh	Overload restriction 1 action time, 1st-motor	bA124 (HIGH)	R/W	10 to 360000	0.01(s)
32E1h	32E0h		bA125 (LOW)	R/W		
32E2h	32E1h	Overload restriction 2 mode selection, 1st-motor	bA126	R/W	00: Disabled 01: Accelerate at constant speed 02: Only constant speed 03: Accelerate at constant speed/Increase speed at regeneratio:n	-
32E3h	32E2h	Overload restriction 2 active level, 1st-motor	bA127	R/W	(0.2 to 2.0) × Inverter rated current[*1]	0.1(A)
32E4h	32E3h	Overload restriction 2 Action time, 1st-motor	bA128 (HIGH)	R/W	10 to 360000	0.01(s)
32E5h	32E4h		bA129 (LOW)	R/W		
32E6h	32E5h	Deceleration-stop at power failure	bA-30	R/W	00 (Disabled)/ 01 (Enabled: deceleration stop)/ 02 (Enabled: no recovery)/ 03 (Enabled: with recovery)	-
32E7h	32E6h	Decel-stop at power failure starting voltage	bA-31	R/W	(200V class) 0- 4100 (400V class) 0- 8200	0.1(Vdc)
32E8h	32E7h	Decel-stop at power failure control target level	bA-32	R/W	(200V class) 0- 4100 (400V class) 0- 8200	0.1(Vdc)
32Eah	32E9h	Decel-stop at power failure deceleration time	bA-34 (HIGH)	R/W	1 to 360000	0.01(s)
32Ebh	32EAh		bA-35 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parame-ter No.	R/W	Monitor or setting data	Resolution
32Ech	32EBh	Decel-stop at power failure freq. width at deceleration start	bA-36	R/W	0 to 1000	0.01(Hz)
32Edh	32ECh	Decel-stop at power failure DC-bus voltage constant control P-gain	bA-37	R/W	0 to 500	0.01
32Eeh	32EDh	Decel-stop at power failure DC-bus voltage constant control I-gain	bA-38	R/W	0 to 15000	0.01(s)
32F0h	32EFh	Over-voltage suppression enable, 1st-motor	bA140	R/W	00: Disabled 01: DC voltage constant deceleration 02: Acceleration only at deceleration 03: Acceleration at constant speed/deceleration	-
32F1h	32F0h	Over-voltage suppression active level, 1st-motor	bA141	R/W	(200Vclass) 3300 to 4000 (400Vclass) 6600 to 8000	0.1(Vdc)
32F2h	32F1h	Over-voltage suppression action time, 1st-motor	bA142 (HIGH)	R/W	0 to 360000	0.01(s)
32F3h	32F2h	Over-voltage suppression action time, 1st-motor	bA143 (LOW)	R/W	0 to 360000	0.01(s)
32F4h	32F3h	DC bus constant control proportional gain, 1st-motor	bA144	R/W	0 to 500	0.01
32F5h	32F4h	DC bus constant control integral gain, 1st-motor	bA145	R/W	0 to 15000	0.01(s)
32F6h	32F5h	Over magnetization deceleration function selection, 1st_motor	bA146	R/W	00: Disabled 01: Regular operation 02: Operation only at deceleration 03: Level mode 04: Level mode only at deceleration	-
32F7h	32F6h	Over magnetization output filter time constant, 1st_motor	bA147	R/W	0 to 100	0.01(s)
32F8h	32F7h	Over magnetization voltage gain, 1st_motor	bA148	R/W	50 to 400	1(%)
32F9h	32F8h	Over magnetization level setting, 1st_motor	bA149	R/W	(200V class) 3300 - 4000 (400V class) 6600 - 8000	0.1(Vdc)
3304h	3303h	Dynamic brake usage rate	bA-60	R/W	0.0 - 10.0×([bA-63]/minimum resistance)^2[*2]	0.1(%)
3305h	3304h	Dynamic brake selection	bA-61	R/W	00: Disabled 01: Enabled: disabled at stop 02: Enabled: enabled at stop	-
3306h	3305h	Dynamic brake active level	bA-62	R/W	(200V class) 3300 - 4000 (400V class) 6600 - 8000	0.1(Vdc)
3307h	3306h	Dynamic brake resister value	bA-63	R/W	Minimum resistance - 600[*2]	0.1(Ω)
330Eh	330Dh	Cooling FAN control method selection	bA-70	R/W	00: Always ON 01: ON during operation 02: Temperature dependent	-
330Fh	330Eh	Cooling FAN accumulation running time clear selection	bA-71	R/W	00: Disabled 01: Clear	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
332Dh	332Ch	Carrier speed setting, 1st-motor	bb101	R/W	[Ub-03]=02: ND 0.5 to 16.0 (kHz) [Ub-03]=01: LD 0.5 to 12.0 (kHz) [Ub-03]=00: VLD 0.5 to 10.0 (kHz) *3	0.1kHz
332Eh	332Dh	Sprinkle carrier pattern selection, 1st-motor	bb102	R/W	00: Disabled 01: Pattern 1 enabled 02: Pattern 2 enabled 03: Pattern 3 enabled	-
332Fh	332Eh	Automatic-carrier reduction selection, 1st-motor	bb103	R/W	00: Disabled 01: Enabled: current 02: Enabled: temperature	-
3336h	3335h	Automatic error reset selection	bb-10	R/W	00: Disabled 01: Enabled with operation command OFF 02: Enable after the setting time	-
3337h	3336h	Alarm signal selection at Automatic error reset is active	bb-11	R/W	00: Output 01: Not output	-
3338h	3337h	Automatic error reset wait time	bb-12	R/W	0 to 600	1(s)
3339h	3338h	Automatic error reset number	bb-13	R/W	0 to 10	1
3340h	3339h	The number of retries after instantaneous power failure	bb-20	R/W	0 to 16 / 255	1
3341h	3340h	The number of retries after under voltage	bb-21	R/W	0 to 16 / 255	1
3342h	3341h	The number of retries after over current	bb-22	R/W	0 to 5	1
3343h	3342h	The number of retries after over voltage	bb-23	R/W	0 to 5	1
3344h	3343h	Selection of restart mode @Instantaneous power failure/ under-voltage trip	bb-24	R/W	00: 0Hz 01: (Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop	-
3345h	3344h	Allowable under-voltage power failure time	bb-25	R/W	3 to 250	0.1(s)
3346h	3345h	Retry wait time before motor restart	bb-26	R/W	3 to 1000	0.1(s)
3347h	3346h	Instantaneous power failure/under-voltage trip alarm enable	bb-27	R/W	00: Disabled 01: Enabled at stop 02: Disabled at stop and deceleration stop	-
3348h	3347h	Selection of restart mode @over-current	bb-28	R/W	00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop	-
3349h	3348h	Wait time of restart @over-current	bb-29	R/W	3 to 1000	0.1(s)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
334Ah	3349h	Selection of restart mode @over-voltage	bb-30	R/W	00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed 04: Trip after frequency matching deceleration stop	-
334Bh	334Ah	Wait time of restart @over-voltage	bb-31	R/W	0.3 to 100.0 (s)	0.1(s)
3354h	3353h	Restart mode after FRS release	bb-40	R/W	00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed*4	-
3355h	3354h	Restart mode after RS release	bb-41	R/W	00: 0Hz 01: Frequency matching 02: Frequency entrainment 03: Detection speed*4	
3356h	3355h	Restart frequency threshold	bb-42	R/W	0 to 59000	0.01(Hz)
3357h	3356h	Restart level of Active frequency matching	bb-43	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1(A)
3358h	3357h	Restart constant(speed) of Active frequency matching	bb-44	R/W	10 to 3000	0.01(s)
3359h	3358h	Restart constant(Voltage) of Active frequency matching	bb-45	R/W	10 to 3000	0.01(s)
335Ah	3359h	OC-supress level of Active frequency matching	bb-46	R/W	(0.0 to 2.0) × Inverter rated current*1	0.1(A)
335Bh	335Ah	Restart speed selection of Active frequency matching	bb-47	R/W	00: Cutoff frequency 01: Maximum frequency 02: Setting frequency	-
3368h	3367h	Over current detection level, 1st-motor	bb160	R/W	(0.2 to 2.2) x Inverter ND rated current*1	0.1(A)
3369h	3368h	Power supply over voltage selection	bb-61	R/W	00: Warning 01: Error	-
336Ah	3369h	Power supply over voltage level setting	bb-62	R/W	(200V class) 3000 - 4100 (400V class) 6000 - 8200	0.1(Vdc)
336Ch	336Bh	Ground fault selection	bb-64	R/W	00: Disabled 01: Enabled	-
336Dh	336Ch	Input phase loss enable	bb-65	R/W	00: Disabled 01: Enabled	-
336Eh	336Dh	Output phase loss enable	bb-66	R/W	00: Disabled 01: Enabled	-
336Fh	336Eh	Output phase loss detection sensitivity	bb-67	R/W	1 to 100	1(%)
3372h	3371h	Thermistor error level	bb-70	R/W	0 to 10000	1(Ω)
337Ch	377Bh	Over speed detection level	bb-80	R/W	0 to 1500	0.1(%)
337Dh	337Ch	Over speed detection time	bb-81	R/W	0 to 50	0.1(s)
337Eh	337Dh	Speed deviation error mode selection	bb-82	R/W	00: Warning 01: Error	-
337Fh	337Eh	Speed deviation error detection level	bb-83	R/W	0 to 1000	0.1(%)
3380h	337Fh	Speed deviation error detection time	bb-84	R/W	0 to 50	0.1(s)
3381h	3380h	Position deviation error mode selection	bb-85	R/W	00: Warning 01: Error	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3382h	3381h	Position deviation error detection level	bb-86	R/W	0 to 65535 (×100pls)	1(×100pls)
3383h	3382h	Position deviation error detection time	bb-87	R/W	0 to 50	0.1(s)
33F5h	33F4h	STO input display selection	bd-01	R/W	00: With indication 01: Without indication 02: Trip	-
33F6h	33F5h	STO input change time	bd-02	R/W	0 to 6000	0.01(s)
33F7h	33F6h	Display selection at STO input change time	bd-03	R/W	00: With indication 01: Without indication	-
33F8h	33F7h	Action selection after STO input change time	bd-04	R/W	00: Retain only the condition 01: Disabled 02: Trip	-
59D9h	59D8h	Frequency limit selection, 2nd motor	bA201	R/W	Same as bA101	-
59Dah	59D9h	Upper frequency limit, 2nd motor	bA202	R/W	Same as bA102	0.01(Hz)
59DBh	59DAh	Lower frequency limit, 2nd motor	bA203	R/W	Same as bA103	0.01(Hz)
59E2h	59E1h	Torque limit selection, 2nd-motor	bA210	R/W	Same as bA110	-
59E3h	59E2h	Torque limit parameter mode selection, 2nd-motor	bA211	R/W	Same as bA111	-
59E4h	59E3h	Torque limit 1 (Forward driving), 2nd-motor	bA212	R/W	Same as bA112	0.1(%)
59E5h	59E4h	Torque limit 2 (Reverse regenerative), 2nd-motor	bA213	R/W	Same as bA113	0.1(%)
59E6h	59E5h	Torque limit 3 (Reverse driving), 2nd-motor	bA214	R/W	Same as bA114	0.1(%)
59E7h	59E6h	Torque limit 4 (Forward regenerative), 2nd motor	bA215	R/W	Same as bA115	0.1(%)
59E8h	59E7h	Torque limit LADSTOP selection, 2nd-motor	bA216	R/W	Same as bA116	-
59Ech	59EBh	Over current suppress enable, 2nd-motor	bA220	R/W	Same as bA120	1
59Edh	59ECh	Over current suppress Level, 2nd-motor	bA221	R/W	Same as bA121	0.1(A)
59Eeh	59EDh	Overload restriction 1 mode selection, 2nd-motor	bA222	R/W	Same as bA122	-
59Efh	59EEh	Overload restriction 1 active level, 2nd-motor	bA223	R/W	Same as bA123	0.1(A)
59F0h	59EFh	Overload restriction 1 action time, 2nd-motor	bA224 (HIGH)	R/W	Same as bA124	0.01(s)
59F1h	59F0h		bA225 (LOW)	R/W		
59F2h	59F1h	Overload restriction 2 mode selection, 2nd-motor	bA226	R/W	Same as bA126	-
59F3h	59F2h	Overload restriction 2 active level, 2nd-motor	bA227	R/W	Same as bA127	0.1(A)
59F4h	59F3h	Overload restriction 2 action time, 2nd-motor	bA228 (HIGH)	R/W	Same as bA128	0.01(s)
59F5h	59F4h		bA229 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
5A00h	59FFh	Over-voltage suppression enable, 2nd-motor	bA240	R/W	Same as bA140	-
5A01h	5A00h	Over-voltage suppression active level, 2nd-motor	bA241	R/W	Same as bA141	0.1(Vdc)
5A02h	5A01h	Over-voltage suppression action time, 2nd-motor	bA242 (HIGH)	R/W	Same as bA142	0.01(s)
5A03h	5A02h		bA243 (LOW)	R/W		
5A04h	5A03h	DC bus constant control proportional gain, 2nd-motor	bA244	R/W	Same as bA144	0.01
5A05h	5A04h	DC bus constant control integral gain, 2nd-motor	bA245	R/W	Same as bA145	0.01(s)
5A06h	5A05h	Over magnetization function selection, 2nd-motor	bA246	R/W	Same as bA146	-
5A07h	5A06h	Over magnetization output filter time constant, 2nd-motor	bA247	R/W	Same as bA147	0.01(s)
5A08h	5A07h	Over magnetization voltage gain, 2nd-motor	bA248	R/W	Same as bA148	1(%)
5A09h	5A08h	Over magnetization level setting, 2nd-motor	bA249	R/W	Same as bA149	0.1(Vdc)
5A3Dh	5A3Ch	Carrier speed setting, 2nd-motor	bb201	R/W	Same as bb101	0.1(kHz)
5A3Eh	5A3Dh	Sprinkle carrier pattern selection, 2nd-motor	bb202	R/W	Same as bb102	-
5A3Fh	5A3Eh	Automatic-carrier reduction selection, 2nd-motor	bb203	R/W	Same as bb103	-
5A78h	5A77h	Over current detection level, 2nd-motor	bb260	R/W	Same as bb160	0.1(A)
339Ah	3399h	Electronic thermal level setting, 1st-motor	bC110	R/W	(0.0 - 3.0) × Inverter rated current*1	0.1(A)
339Bh	339Ah	Electronic thermal characteristic selection, 1st-motor	bC111	R/W	00: Reduction characteristics 01: Constant torque characteristics 02: Arbitrary setting	-
339Ch	339Bh	Electronic thermal Subtraction function enable, 1st-motor	bC112	R/W	00: Disabled 01: Enabled	-
339Dh	339Ch	Electronic thermal Subtraction time, 1st-motor	bC113	R/W	1 to 1000	1(s)
339Eh	339Dh	Electronic thermal counter memory selection at Power-off	bC-14	R/W	00: Disabled 01: Enabled	-
33A4h	33A3h	Free electronic thermal frequency-1, 1st-motor	bC120	R/W	0.00 to [bC122] (Hz)	0.01(Hz)
33A5h	33A4h	Free electronic thermal current-1, 1st-motor	bC121	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1(A)
33A6h	33A5h	Free electronic thermal frequency-2, 1st-motor	bC122	R/W	[bC120] to [bC124] (Hz)	0.01(Hz)
33A7h	33A6h	Free electronic thermal current-2, 1st-motor	bC123	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1(A)
33A8h	33A7h	Free electronic thermal frequency-3, 1st-motor	bC124	R/W	[bC122] to 590.00 (Hz)	0.01(Hz)
33A9h	33A8h	Free electronic thermal current-3, 1st-motor	bC125	R/W	(0.0 to 3.0) × Inverter rated current*1	0.1(A)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
5AAAh	33A9h	Electronic thermal level setting, 2nd-motor	bC210	R/W	Same as bb110	0.1(A)
5AABh	5AAAh	Electronic thermal characteristic selection, 2nd-motor	bC211	R/W	Same as bb111	-
5AACh	5AABh	Electronic thermal Subtraction function enable, 2nd-motor	bC212	R/W	Same as bC112	-
5AADh	5AACh	Electronic thermal Subtraction time, 2nd-motor	bC213	R/W	Same as bC113	1(s)
5AB4h	5AB3h	Free electronic thermal frequency-1, 2nd-motor	bC220	R/W	0.00 to [bC222] (Hz)	0.01(Hz)
5AB5h	5AB4h	Free electronic thermal current-1, 2nd-motor	bC221	R/W	Same as bC121	0.1(A)
5AB6h	5AB5h	Free electronic thermal frequency-2, 2nd-motor	bC222	R/W	[bC220] to [bC224] (Hz)	0.01(Hz)
5AB7h	5AB6h	Free electronic thermal current-2, 2nd-motor	bC223	R/W	Same as bC123	0.1(A)
5AB8h	5AB7h	Free electronic thermal frequency-3, 2nd-motor	bC224	R/W	[bC222] to 590.00 (Hz)	0.01(Hz)
5AB9h	5AB8h	Free electronic thermal current-3, 2nd-motor	bC225	R/W	Same as bC125	0.1(A)

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A, V). When the data of [CF-11] Resister data selection is not set to 00 (A, V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A, V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

*2. Minimum resistance values vary in inverter model.

*3. 3G3RX2-B4750 to 3G3RX2-B413K shall be as follows.
[Ub-03]=02: 0.5 to 10.0(kHz)
[Ub-03]=00 or 01: 0.5 to 8.0(kHz)

*4. The feedback input to input terminals A and B and the feedback input to option cassette RX2-PG are necessary.

9-5-6 Group C Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
36B1h	36B0h	Input terminal [1] function	CA-01	R/W	See *<List of input terminal functions>* on page C-44.	-
36B2h	36B1h	Input terminal [2] function	CA-02	R/W		
36B3h	36B2h	Input terminal [3] function	CA-03	R/W		
36B4h	36B3h	Input terminal [4] function	CA-04	R/W		
36B5h	36B4h	Input terminal [5] function	CA-05	R/W		
36B6h	36B5h	Input terminal [6] function	CA-06	R/W		
36B7h	36B6h	Input terminal [7] function	CA-07	R/W		
36B8h	36B7h	Input terminal [8] function	CA-08	R/W		
36B9h	36B8h	Input terminal [9] function	CA-09	R/W		
36Bah	36B9h	Input terminal [A] function	CA-10	R/W		
36BBh	36BAh	Input terminal [B] function	CA-11	R/W		
36C5h	36C4h	Input terminal [1] active state	CA-21	R/W	00: Normally open: NO 01: Normally closed: NC	-
36C6h	36C5h	Input terminal [2] active state	CA-22	R/W		
36C7h	36C6h	Input terminal [3] active state	CA-23	R/W		
36C8h	36C7h	Input terminal [4] active state	CA-24	R/W		
36C9h	36C8h	Input terminal [5] active state	CA-25	R/W		
36Cah	36C9h	Input terminal [6] active state	CA-26	R/W		
36CBh	36CAh	Input terminal [7] active state	CA-27	R/W		
36CCh	36CBh	Input terminal [8] active state	CA-28	R/W		
36CDh	36CCh	Input terminal [9] active state	CA-29	R/W		
36Ceh	36CDh	Input terminal [A] active state	CA-30	R/W		
36CFh	36CEh	Input terminal [B] active state	CA-31	R/W		
36D9h	36D8h	Input terminal [1] response time	CA-41	R/W	0 to 400	1(ms)
36Dah	36D9h	Input terminal [2] response time	CA-42	R/W		1(ms)
36DBh	36Dah	Input terminal [3] response time	CA-43	R/W		1(ms)
36DCh	36DBh	Input terminal [4] response time	CA-44	R/W		1(ms)
36DDh	36DCh	Input terminal [5] response time	CA-45	R/W		1(ms)
36Deh	36DDh	Input terminal [6] response time	CA-46	R/W		1(ms)
36DFh	36DEh	Input terminal [7] response time	CA-47	R/W		1(ms)
36E0h	36DFh	Input terminal [8] response time	CA-48	R/W		1(ms)
36E1h	36E0h	Input terminal [9] response time	CA-49	R/W		1(ms)
36E2h	36E1h	Input terminal [A] response time	CA-50	R/W		1(ms)
36E3h	36E2h	Input terminal [B] response time	CA-51	R/W		1(ms)
36E7h	36E6h	Multistage input determination time	CA-55	R/W	0 to 2000	1(ms)
36Ech	36EBh	FUP/FDN overwrite target selection	CA-60	R/W	00: Frequency command 01: PID1	-
36Edh	36ECh	FUP/FDN data save enable	CA-61	R/W	00: Not save 01: Save	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
36Eeh	36EDh	FUP/FDN UDC selection	CA-62	R/W	00: 0Hz 01: saved data	-
36F0h	36EFh	Acceleration time setting for FUP/FDN function	CA-64 (HIGH)	R/W	0 to 360000	0.01(s)
36F1h	36F0h		CA-65 (LOW)	R/W		
36F2h	36F1h	Deceleration time setting for FUP/FDN function	CA-66 (HIGH)	R/W	0 to 360000	0.01(s)
36F3h	36F2h		CA-67 (LOW)	R/W		
36F6h	36F5h	Speed reference source selection at [F-OP] is active	CA-70	R/W	01: Ai1 terminal input 02: Ai2 terminal input 03: Ai3 terminal input 04: (Reserved) 05: (Reserved) 06: (Reserved) 07: Parameter setting 08: RS 485 09: Option 1 10: Option 2 11: Option 3 12: Pulse string input: Inverter 13: Pulse string input: Option 14: Program function 15: PID calculation 16: (Reserved)	-
36F7h	36F6h	RUN command source selection at [F-OP] is active	CA-71	R/W	00: [FW]/[RV] terminal 01: 3 wire 02: RUN key on LCD operator 03: RS485 04: Option 1 05: Option 2 06: Option 3	-
36F8h	36F7h	Reset mode selection	CA-72	R/W	00: On to Release Trip 01: Off to Release Trip 02: On to Release at Trip 03: Of to Release at Trip	-
3701h	3700h	Encoder constant setting	CA-81	R/W	32 to 65535	1(pls)
3702h	3701h	Encoder position selection	CA-82	R/W	00: Phase-A is leading 01: Phase-B is leading	-
3703h	3702h	Motor gear ratio Numerator	CA-83	R/W	1 to 10000	1
3704h	3703h	Motor gear ratio Denominator	CA-84	R/W	1 to 10000	1
370Ah	3709h	Pulse train detection object selection	CA-90	R/W	00: Disabled 01: Frequency command 02: Speed feedback 03: Pulse count	-
370Bh	370Ah	Mode selection of pulse train input	CA-91	R/W	00: 90° phase difference 01: forward/reverse rotation command and rotation direction 02: forward/reverse rotation pulse string	-
370Ch	370Bh	Pulse train frequency Scale	CA-92	R/W	5 to 3200	0.01(kHz)
370Dh	370Ch	Pulse train frequency Filter time constant	CA-93	R/W	1 to 200	0.01(s)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
370Eh	370Dh	Pulse train frequency Bias value	CA-94	R/W	-1000 to 1000	0.1(%)
370Fh	370Eh	Pulse train frequency High Limit	CA-95	R/W	0 to 1000	0.1(%)
3710h	370Fh	Pulse train frequency detection low level	CA-96	R/W	0 to 1000	0.1(%)
3711h	3710h	Comparing match output ON-level for Pulse count	CA-97	R/W	0 to 65535	1
3712h	3711h	Comparing match output OFF-level for Pulse count	CA-98	R/W	0 to 65535	1
3713h	3712h	Comparing match output Maximum value for Pulse count	CA-99	R/W	0 to 65535	1
3715h	3714h	Filter time constant of Terminal [Ai1]	Cb-01	R/W	1 to 500	1(ms)
3717h	3716h	Start value of Terminal [Ai1]	Cb-03	R/W	0 to 10000	0.01(%)
3718h	3717h	End value of Terminal [Ai1]	Cb-04	R/W	0 to 10000	0.01(%)
3719h	3718h	Start rate of Terminal [Ai1]	Cb-05	R/W	0 to 1000 (Cb-06)	0.1(%)
371Ah	3719h	End rate of Terminal [Ai1]	Cb-06	R/W	(Cb-05) 0 to 1000	0.1(%)
371Bh	371Ah	Start point selection of Terminal [Ai1]	Cb-07	R/W	00: Start amount 01: 0%	-
371Fh	371Eh	Filter time constant of Terminal [Ai2]	Cb-11	R/W	1 to 500	1(ms)
3721h	3720h	Start value of Terminal [Ai2]	Cb-13	R/W	0 to 10000	0.01(%)
3722h	3721h	End value of Terminal [Ai2]	Cb-14	R/W	0 to 10000	0.01(%)
3723h	3722h	Start rate of Terminal [Ai2]	Cb-15	R/W	0 to 1000 (Cb-16)	0.1(%)
3724h	3723h	End rate of Terminal [Ai2]	Cb-16	R/W	(Cb-15) 0 to 1000	0.1(%)
3725h	3724h	Start point selection of Terminal [Ai2]	Cb-17	R/W	00: Start amount 01: 0%	-
3729h	3728h	Filter time constant of Terminal [Ai3]	Cb-21	R/W	1 to 500	1(ms)
372Ah	3729h	Terminal [Ai3] selection	Cb-22	R/W	00: Single 01: Added to Ai1/Ai2: with reversibility 02: Added to Ai1/Ai2: without reversibility	-
372Bh	372Ah	Start value of Terminal [Ai3]	Cb-23	R/W	-10000 to 10000	0.01%
372Ch	372Bh	End value of Terminal [Ai3]	Cb-24	R/W	-10000 to 10000	0.01%
372Dh	372Ch	Start rate of Terminal [Ai3]	Cb-25	R/W	-1000 to 1000 (Cb-26)	0.1(%)
372Eh	372Dh	End rate of Terminal [Ai3]	Cb-26	R/W	(Cb-25)-1000 to 1000	0.1(%)
3732h	3731h	[Ai1] Voltage/Current zero-gain adjustment	Cb-30	R/W	-10000 to 10000	0.01(%)
3733h	3732h	[Ai1] Voltage/Current gain adjustment	Cb-31	R/W	0 to 20000	0.01(%)
3734h	3733h	[Ai2] Voltage/Current zero-gain adjustment	Cb-32	R/W	-10000 to 10000	0.01(%)
3735h	3734h	[Ai2] Voltage/Current gain adjustment	Cb-33	R/W	0 to 20000	0.01(%)
3736h	3735h	[Ai3] Voltage/Current zero-gain adjustment	Cb-34	R/W	-10000 to 10000	0.01(%)
3737h	3736h	[Ai3] Voltage gain adjustment	Cb-35	R/W	0 to 20000	0.01(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
373Ch	373Bh	Thermistor selection	Cb-40	R/W	00: Disabled 01: PTC resistance value enabled 02: NTC resistance value enabled	-
373Dh	373Ch	Thermistor gain adjustment	Cb-41	R/W	0 to 10000	0.1
3779h	3778h	Output terminal [11] function	CC-01	R/W	See *<List of output terminal functions>* on page C-49.	-
377Ah	3779h	Output terminal [12] function	CC-02	R/W		
377Bh	377Ah	Output terminal [13] function	CC-03	R/W		
377Ch	377Bh	Output terminal [14] function	CC-04	R/W		
377Dh	377Ch	Output terminal [15] function	CC-05	R/W		
377Eh	377Dh	Relay output terminal [16] function	CC-06	R/W		
377Fh	377Eh	Relay output terminal [AL] function	CC-07	R/W		
3783h	3782h	Output terminal [11] active state	CC-11	R/W	00: Normally open: NO 01: Normally closed: NC	-
3784h	3783h	Output terminal [12] active state	CC-12	R/W		
3785h	3784h	Output terminal [13] active state	CC-13	R/W		
3786h	3785h	Output terminal [14] active state	CC-14	R/W		
3787h	3786h	Output terminal [15] active state	CC-15	R/W		
3788h	3787h	Output terminal [16] active state	CC-16	R/W		
3789h	3788h	Output terminal [AL] active state	CC-17	R/W		
378Ch	378Bh	Output terminal [11] on-delay time	CC-20	R/W	0 to 10000	0.01(s)
378Dh	378Ch	Output terminal [11] off-delay time	CC-21	R/W	0 to 10000	0.01(s)
378Eh	378Dh	Output terminal [12] on-delay time	CC-22	R/W	0 to 10000	0.01(s)
378Fh	378Eh	Output terminal [12] off-delay time	CC-23	R/W	0 to 10000	0.01(s)
3790h	378Fh	Output terminal [13] on-delay time	CC-24	R/W	0 to 10000	0.01(s)
3791h	3790h	Output terminal [13] off-delay time	CC-25	R/W	0 to 10000	0.01(s)
3792h	3791h	Output terminal [14] on-delay time	CC-26	R/W	0 to 10000	0.01(s)
3793h	3792h	Output terminal [14] off-delay time	CC-27	R/W	0 to 10000	0.01(s)
3794h	3793h	Output terminal [15] on-delay time	CC-28	R/W	0 to 10000	0.01(s)
3795h	3794h	Output terminal [15] off-delay time	CC-29	R/W	0 to 10000	0.01(s)
3796h	3795h	Output relay [16] on-delay time	CC-30	R/W	0 to 10000	0.01(s)
3797h	3796h	Output relay [16] off-delay time	CC-31	R/W	0 to 10000	0.01(s)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3798h	3797h	Output relay [AL] on-delay time	CC-32	R/W	0 to 10000	0.01(s)
3799h	3798h	Output relay [AL] off-delay time	CC-33	R/W	0 to 10000	0.01(s)
37A0h	379Fh	Logical calculation target 1 selection of LOG1	CC-40	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37A1h	37A0h	Logical calculation target 2 selection of LOG1	CC-41	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37A2h	37A1h	Logical calculation symbol selection of LOG1	CC-42	R/W	00:AND 01:OR 02:XOR	-
37A3h	37A2h	Logical calculation target 1 selection of LOG2	CC-43	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37A4h	37A3h	Logical calculation target 2 selection of LOG2	CC-44	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37A5h	37A4h	Logical calculation symbol selection of LOG2	CC-45	R/W	00:AND 01:OR 02:XOR	-
37A6h	37A5h	Logical calculation target 1 selection of LOG3	CC-46	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37A7h	37A6h	Logical calculation target 2 selection of LOG3	CC-47	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37A8h	37A7h	Logical calculation symbol selection of LOG3	CC-48	R/W	00:AND 01:OR 02:XOR	-
37A9h	37A8h	Logical calculation target 1 selection of LOG4	CC-49	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37Aah	37A9h	Logical calculation target 2 selection of LOG4	CC-50	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37Abh	37AAh	Logical calculation symbol selection of LOG4	CC-51	R/W	00:AND 01:OR 02:XOR	-
37Ach	37ABh	Logical calculation target 1 selection of LOG5	CC-52	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37Adh	37ACh	Logical calculation target 2 selection of LOG5	CC-53	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37Aeh	37ADh	Logical calculation symbol selection of LOG5	CC-54	R/W	00:AND 01:OR 02:XOR	-
37Afh	37AEh	Logical calculation target 1 selection of LOG6	CC-55	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
37B0h	37AFh	Logical calculation target 2 selection of LOG6	CC-56	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37B1h	37B0h	Logical calculation symbol selection of LOG6	CC-57	R/W	00:AND 01:OR 02:XOR	-
37B2h	37B1h	Logical calculation target 1 selection of LOG7	CC-58	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37B3h	37B2h	Logical calculation target 2 selection of LOG7	CC-59	R/W	See <List of output terminal functions> 062: LOG1 to 068: LOG7 cannot be selected.	-
37B4h	37B3h	Logical calculation symbol selection of LOG7	CC-60	R/W	00:AND 01:OR 02:XOR	-
37DDh	37DCh	[FM] monitor output wave form selection	Cd-01	R/W	00: PWM 01: frequency	-
37Deh	37DDh	[FM] monitor output base frequency (at PWM output)	Cd-02	R/W	0 to 3600	1(Hz)
37DFh	37DEh	[FM] monitor output selection	Cd-03	R/W	See the List of output monitor functions*1	1
37E0h	37DFh	[Ao1] monitor output selection	Cd-04	R/W	See the List of output monitor functions*1	1
37E1h	37E0h	[Ao2] monitor output selection	Cd-05	R/W	See the List of output monitor functions*1	1
37E6h	37E5h	Analog monitor adjust mode enable	Cd-10	R/W	00: Disabled 01: Enabled	-
37E7h	37E6h	Filter time constant of [FM]monitor	Cd-11	R/W	1 to 500	1(ms)
37E8h	37E7h	[FM] Data type selection	Cd-12	R/W	00: absolute value 01: with sign	-
37E9h	37E8h	[FM] monitor bias adjustment	Cd-13	R/W	-1000 to 1000	0.1(%)
37Eah	37E9h	[FM] monitor gain adjustment	Cd-14	R/W	-10000 to 10000	0.1(%)
37Ebh	37EAh	Output level setting at [FM] monitor adjust mode	Cd-15	R/W	-1000 to 1000	0.1(%)
37F1h	37F0h	Filter time constant of [Ao1] monitor	Cd-21	R/W	1 to 500	1(ms)
37F2h	37F1h	[Ao1] Data type selection	Cd-22	R/W	00: absolute value 01: with sign	-
37F3h	37F2h	[Ao1] monitor bias adjustment	Cd-23	R/W	-1000 to 1000	0.1(%)
37F4h	37F3h	[Ao1] monitor gain adjustment	Cd-24	R/W	-10000 to 10000	0.1(%)
37F5h	37F4h	Output level setting at [Ao1] monitor adjust mode	Cd-25	R/W	-1000 to 1000	0.1(%)
37FBh	37FAh	Filter time constant of [Ao2] monitor	Cd-31	R/W	1 to 500	1(ms)
37FCh	37FBh	[Ao2] Data type selection	Cd-32	R/W	00: absolute value 01: with sign	-
37FDh	37FCh	[Ao2] monitor bias adjustment	Cd-33	R/W	-1000 to 1000	0.1(%)
37Feh	37FDh	[Ao2] monitor gain adjustment	Cd-34	R/W	-10000 to 10000	0.1(%)
37FFh	37FEh	Output level setting at [Ao2] monitor adjust mode	Cd-35	R/W	-1000 to 1000	0.1(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3841h	3840h	Low current signal output mode selection, 1st motor	CE101	R/W	00: During acceleration/deceleration, at constant speed 01: Only at constant speed	-
3842h	3841h	Low current detection level 1, 1st motor	CE102	R/W	(0.0 to 2.0) × Inverter rated current*2	0.1(A)
3843h	3842h	Low current detection level 2, 1st motor	CE103	R/W	(0.0 to 2.0) × Inverter rated current*2	0.1(A)
3845h	3844h	Over current signal output mode selection, 1st motor	CE105	R/W	00: During acceleration/deceleration, at constant speed 01: Only at constant speed	-
3846h	3845h	Over current detection level 1, 1st motor	CE106	R/W	(0.0 to 2.0) × Inverter rated current*2	0.1(A)
3847h	3846h	Over current detection level 2, 1st motor	CE107	R/W	(0.0 to 2.0) × Inverter rated current*2	0.1(A)
384Ah	3849h	Arrival frequency setting during acceleration 1	CE-10	R/W	0 to 59000	0.01(Hz)
384Bh	384Ah	Arrival frequency setting during deceleration 1	CE-11	R/W	0 to 59000	0.01(Hz)
384Ch	384Bh	Arrival frequency setting during acceleration 2	CE-12	R/W	0 to 59000	0.01(Hz)
384Dh	384Ch	Arrival frequency setting during deceleration 2	CE-13	R/W	0 to 59000	0.01(Hz)
3854h	3853h	Over torque level (Forward driving), 1st motor	CE120	R/W	0 to 5000	0.1(%)
3855h	3854h	Over torque level (Reverse regenerative), 1st motor	CE121	R/W	0 to 5000	0.1(%)
3856h	3855h	Over torque level (Reverse driving), 1st motor	CE122	R/W	0 to 5000	0.1(%)
3857h	3856h	Over torque level (Forward regenerative), 1st motor	CE123	R/W	0 to 5000	0.1(%)
385Eh	385Dh	Electronic thermal warning level (MTR)	CE-30	R/W	0 to 10000	0.01(%)
385Fh	385Eh	Electronic thermal warning level (CTL)	CE-31	R/W	0 to 10000	0.01(%)
3861h	3860h	Zero speed detection level	CE-33	R/W	0 to 10000	0.01(Hz)
3862h	3861h	Cooling FAN over-heat warning level	CE-34	R/W	0 to 200	1(°C)
3864h	3863h	Accum.RUN (RNT)/Accum.Power-on (ONT) time setting	CE-36 (HIGH)	R/W	0 to 100000	1(hr)
3865h	3864h		CE-37 (LOW)	R/W		
3868h	3867h	Window comparator for [Ai1] higher level	CE-40	R/W	0 to 100	1(%)
3869h	3868h	Window comparator for [Ai1] lower level	CE-41	R/W	0 to 100	1(%)
386Ah	3869h	Window comparator for [Ai1] hysteresis width	CE-42	R/W	0 to 10	1(%)
386Bh	386Ah	Window comparator for [Ai2] higher level	CE-43	R/W	0 to 100	1(%)
386Ch	386Bh	Window comparator for [Ai2] lower level	CE-44	R/W	0 to 100	1(%)
386Dh	386Ch	Window comparator for [Ai2] hysteresis width	CE-45	R/W	0 to 10	1(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
386Eh	386Dh	Window comparator for [Ai3] higher level	CE-46	R/W	-100 to 100	1(%)
386Fh	386Eh	Window comparator for [Ai3] lower level	CE-47	R/W	-100 to 100	1(%)
3870h	386Fh	Window comparator for [Ai3] hysteresis width	CE-48	R/W	0 to 10	1(%)
3872h	3871h	Operation level at [Ai1] dis-connection	CE-50	R/W	0 to 100	1(%)
3873h	3872h	Operation level selection at [Ai1] disconnection	CE-51	R/W	00: Disabled 01: Enabled: out of range 02: Enabled: within the range	-
3874h	3873h	Operation level at [Ai2] dis-connection	CE-52	R/W	0 to 100	1(%)
3875h	3874h	Operation level selection at [Ai2] disconnection	CE-53	R/W	00: Disabled 01: Enabled: out of range 02: Enabled: within the range	-
3876h	3875h	Operation level at [Ai3] dis-connection	CE-54	R/W	-100 to 100	1(%)
3877h	3876h	Operation level selection at [Ai3] disconnection	CE-55	R/W	00: Disabled 01: Enabled: out of range 02: Enabled: within the range	-
38A5h	38A4h	RS485 communication baud rate selection	CF-01	R/W	03:2400bps 04:4800bps 05:9600bps 06:19.2kbps 07:38.4kbps 08:57.6kbps 09:76.8kbps 10:115.2kbps	-
38A6h	38A5h	RS485 communication Node allocation	CF-02	R/W	1 to 247	1
38A7h	38A6h	RS485 communication parity selection	CF-03	R/W	00: Without parity 01: Even number parity 02: Odd number parity	-
38A8h	38A7h	RS485 communication stop-bit selection	CF-04	R/W	01: 1bit 02: 2bit	-
38A9h	38A8h	RS485 communication error selection	CF-05	R/W	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: (Deceleration stop)	-
38Aah	38A9h	RS485 communication time-out setting	CF-06	R/W	0 to 10000 (0:Disable Communication Time-out)	0.01(s)
38Abh	38AAh	RS485 communication wait time setting	CF-07	R/W	0 to 1000	1(ms)
38Ach	38ABh	RS485 communication mode selection	CF-08	R/W	01: Modbus-RTU 02: EzCOM 03: EzCOM management	-
38AFh	38AEh	Resister data selection	CF-11	R/W	00: A,V 01: %	-
38B8h	38B7h	EzCOM Start node No.	CF-20	R/W	01 to 08	1
38B9h	38B8h	EzCOM End node No.	CF-21	R/W	01 to 08	1

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
38Bah	38B9h	EzCOM Start method selection	CF-22	R/W	00: ECOM terminal 01: (Modbus spec)	-
38BBh	38BAh	EzCOM data size	CF-23	R/W	01 to 05	1
38BCh	38BBh	EzCOM destination address 1	CF-24	R/W	1 to 47	1
38BDh	38BCh	EzCOM destination resister 1	CF-25	R/W	0000 to FFFF	1
38Beh	38BDh	EzCOM source resister 1	CF-26	R/W	0000 to FFFF	1
38BFh	38BEh	EzCOM destination address 2	CF-27	R/W	1 to 247	1
38C0h	38BFh	EzCOM destination resister 2	CF-28	R/W	0000 to FFFF	1
38C1h	38C0h	EzCOM source resister 2	CF-29	R/W	0000 to FFFF	1
38C2h	38C1h	EzCOM destination address 3	CF-30	R/W	1 to 247	1
38C3h	38C2h	EzCOM destination resister 3	CF-31	R/W	0000 to FFFF	1
38C4h	38C3h	EzCOM source resister 3	CF-32	R/W	0000 to FFFF	1
38C5h	38C4h	EzCOM destination address 4	CF-33	R/W	1 to 247	1
38C6h	38C5h	EzCOM destination resister 4	CF-34	R/W	0000 to FFFF	1
38C7h	38C6h	EzCOM source resister 4	CF-35	R/W	0000 to FFFF	1
38C8h	38C7h	EzCOM destination address 5	CF-36	R/W	1 to 247	1
38C9h	38C8h	EzCOM destination resister 5	CF-37	R/W	0000 to FFFF	1
38Cah	38C9h	EzCOM source resister 5	CF-38	R/W	0000 to FFFF	1
38D6h	38D5h	USB communication Node allocation	CF-50	R/W	1 to 247	1
5F51h	5F50h	Low current signal output mode selection, 2nd-motor	CE201	R/W	Same as CE101	-
5F52h	5F51h	Low current detection level 1, 2nd-motor	CE202	R/W	Same as CE102	0.1(A)
5F53h	5F52h	Low current detection level 2, 2nd-motor	CE203	R/W	Same as CE103	0.1(A)
5F55h	5F54h	Over current signal output mode selection, 2nd-motor	CE205	R/W	Same as CE105	-
5F56h	5F55h	Over current detection level 1, 2nd-motor	CE206	R/W	Same as CE106	0.1(A)
5F57h	5F56h	Over current detection level 2, 2nd-motor	CE207	R/W	Same as CE107	0.1(A)
5F64h	5F63h	Over torque level (Forward driving), 2nd-motor	CE220	R/W	Same as CE120	0.1(%)
5F65h	5F64h	Over torque level (Reverse regenerative), 2nd-motor	CE221	R/W	Same as CE121	0.1(%)
5F66h	5F65h	Over torque level (Reverse driving), 2nd-motor	CE222	R/W	Same as CE122	0.1(%)
5F67h	5F66h	Over torque level (Forward regenerative), 2nd motor	CE223	R/W	Same as CE123	0.1(%)

*1. 0 to 65535 (Register No. of d, F code)

*2. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A, V). When the data of [CF-11] Resister data selection is not set to 00 (A, V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A, V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

9-5-7 Group H Register List

Precautions for Correct Use

- The "Register No." in the table header shows the register number used inside the inverter.
- The "Modbus register spec. No." in the table header shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter "Register No." according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3A99h	3A98h	Auto-tuning selection	HA-01	R/W	00: Disabled 01: Non-rotation 02: Rotation 03: IVMS	-
3A9Ah	3A99h	RUN command selection at Auto-tuning	HA-02	R/W	00: RUN key on LCD operator 01: [AA111]/[AA211]	-
3A9Bh	3A9Ah	Online auto-tuning selection	HA-03	R/W	00: Disabled 01: Enabled	-
3AA2h	3AA1h	Stabilization constant, 1st-motor	HA110	R/W	0 to 1000	1(%)
3AA7h	3AA6h	Speed response for Async. M, 1st-motor	HA115	R/W	0 to 1000	1(%)
3AACh	3AABh	ASR gain switching mode selection, 1st-motor	HA120	R/W	00: [CAS] terminal 01: setting switch	-
3AADh	3AACh	ASR gain switching time setting, 1st-motor	HA121	R/W	0 to 10000	1(ms)
3AAEh	3AADh	ASR gain mapping intermediate speed 1, 1st-motor	HA122	R/W	0 to 59000	0.01(Hz)
3AAFh	3AAEh	ASR gain mapping intermediate speed 2, 1st-motor	HA123	R/W	0 to 59000	0.01(Hz)
3AB0h	3AAFh	ASR gain mapping Maximum speed, 1st-motor	HA124	R/W	0 to 59000	0.01(Hz)
3AB1h	3AB0h	ASR gain mapping P-gain 1, 1st-motor	HA125	R/W	0 to 10000	0.1(%)
3AB2h	3AB1h	ASR gain mapping I-gain 1, 1st-motor	HA126	R/W	0 to 10000	0.1(%)
3AB3h	3AB2h	ASR gain mapping P-gain 1 at P-control, 1st-motor	HA127	R/W	0 to 10000	0.1(%)
3AB4h	3AB3h	ASR gain mapping P-gain 2, 1st-motor	HA128	R/W	0 to 10000	0.1(%)
3AB5h	3AB4h	ASR gain mapping I-gain 2, 1st-motor	HA129	R/W	0 to 10000	0.1(%)
3AB6h	3AB5h	ASR gain mapping P-gain 2 at P-control, 1st-motor	HA130	R/W	0 to 10000	0.1(%)
3AB7h	3AB6h	ASR gain mapping P-gain 3, 1st-motor	HA131	R/W	0 to 10000	0.1(%)
3AB8h	3AB7h	ASR gain mapping I-gain 3, 1st-motor	HA132	R/W	0 to 10000	0.1(%)
3AB9h	3AB8h	ASR gain mapping P-gain 4, 1st-motor	HA133	R/W	0 to 10000	0.1(%)
3ABAh	3AB9h	ASR gain mapping I-gain 4, 1st-motor	HA134	R/W	0 to 10000	0.1(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3AFEh	3AFDh	Async. Motor capacity setting, 1st-motor	Hb102	R/W	1 to 16000	0.01(kW)
3AFFh	3AFEh	Async. Motor poles setting, 1st-motor	Hb103	R/W	2 to 48 (poles)	1
3B00h	3AFFh	Async. Motor Base frequency setting, 1st-motor	Hb104	R/W	10.00 to 590.00 (Hz)	0.01(Hz)
3B01h	3B00h	Async. Motor Maximum frequency setting, 1st-motor	Hb105	R/W	10.00 to 590.00 (Hz)	0.01(Hz)
3B02h	3B01h	Async. Motor rated voltage, 1st-motor	Hb106	R/W	1 to 1000 (V)	1(V)
3B04h	3B03h	Async. Motor rated current, 1st-motor	Hb108 (HIGH)	R/W	1 to 1000000	0.01(A)
3B05h	3B04h		Hb109 (LOW)	R/W		
3B06h	3B05h	Async. Motor constant R1, 1st-motor	Hb110 (HIGH)	R/W	1 to 1000000000	0.000001 (Ω)
3B07h	3B06h		Hb111 (LOW)	R/W		
3B08h	3B07h	Async. Motor constant R2, 1st-motor	Hb112 (HIGH)	R/W	1 to 1000000000	0.000001 (Ω)
3B09h	3B08h		Hb113 (LOW)	R/W		
3B0Ah	3B09h	Async. Motor constant L, 1st-motor	Hb114 (HIGH)	R/W	1 to 1000000000	0.000001 (mH)
3B0Bh	3B0Ah		Hb115 (LOW)	R/W		
3B0Ch	3B0Bh	Async. Motor constant Io, 1st-motor	Hb116 (HIGH)	R/W	1 to 1000000	0.01(A)
3B0Dh	3B0Ch		Hb117 (LOW)	R/W		
3B0Eh	3B0Dh	Async. Motor constant J, 1st-motor	Hb118 (HIGH)	R/W	1 to 1000000000	0.00001 (kg·m$^{2)}$
3B0Fh	3B0Eh		Hb119 (LOW)	R/W		
3B1Ah	3B19h	Minimum frequency adjustment, 1st-motor	Hb130	R/W	10 to 1000	0.01(Hz)
3B1Bh	3B1Ah	Reduced voltage start time setting, 1st-motor	Hb131	R/W	0 to 2000	1(ms)
3B24h	3B23h	Manual torque boost operational mode selection, 1st-motor	Hb140	R/W	00: Disabled 01: Always enabled 02: Enabled only for forward revolution 03: Enabled only for reverse revolution	-
3B25h	3B24h	Manual torque boost value, 1st-motor	Hb141	R/W	0 to 200	0.1(%)
3B26h	3B25h	Manual torque boost Peak speed, 1st-motor	Hb142	R/W	0 to 500	0.1(%)
3B29h	3B28h	Eco drive enable, 1st-motor	Hb145	R/W	00: Disabled 01: Enabled	-
3B2Ah	3B29h	Eco drive response adjustment, 1st-motor	Hb146	R/W	0 to 100	1(%)
3B2Eh	3B2Dh	Free-V/f frequency 1 setting, 1st-motor	Hb150	R/W	0 to 59000 (Hb152)	0.01(Hz)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3B2Fh	3B2Eh	Free-V/f Voltage 1 setting, 1st-motor	Hb151	R/W	0 to 10000	0.1(V)
3B30h	3B2Fh	Free-V/f frequency 2 setting, 1st-motor	Hb152	R/W	0 to 59000(Hb150) to (Hb154)	0.01(Hz)
3B31h	3B30h	Free-V/f Voltage 2 setting, 1st-motor	Hb153	R/W	0 to 10000	0.1(V)
3B32h	3B31h	Free-V/f frequency 3 setting, 1st-motor	Hb154	R/W	0 to 59000(Hb152) to (Hb156)	0.01(Hz)
3B33h	3B32h	Free-V/f Voltage 3 setting, 1st-motor	Hb155	R/W	0 to 10000	0.1(V)
3B34h	3B33h	Free-V/f frequency 4 setting, 1st-motor	Hb156	R/W	0 to 59000(Hb154) to (Hb158)	0.01(Hz)
3B35h	3B34h	Free-V/f Voltage 4 setting, 1st-motor	Hb157	R/W	0 to 10000	0.1(V)
3B36h	3B35h	Free-V/f frequency 5 setting, 1st-motor	Hb158	R/W	0 to 59000(Hb156) to (Hb160)	0.01(Hz)
3B37h	3B36h	Free-V/f Voltage 5 setting, 1st-motor	Hb159	R/W	0 to 10000	0.1(V)
3B38h	3B37h	Free-V/f frequency 6 setting, 1st-motor	Hb160	R/W	0 to 59000(Hb158) to (Hb162)	0.01(Hz)
3B39h	3B38h	Free-V/f Voltage 6 setting, 1st-motor	Hb161	R/W	0 to 10000	0.1(V)
3B3Ah	3B39h	Free-V/f frequency 7 setting, 1st-motor	Hb162	R/W	0 to 59000(Hb160) to (Hb104)	0.01(Hz)
3B3Bh	3B3Ah	Free-V/f Voltage 7 setting, 1st-motor	Hb163	R/W	0 to 10000	0.1(V)
3B42h	3B41h	Slip Compensation P-gain witn encoder, 1st-motor	Hb170	R/W	0 to 1000	1(%)
3B43h	3B42h	Slip Compensation I-gain witn encoder, 1st-motor	Hb171	R/W	0 to 1000	1(%)
3B4Ch	3B4Bh	Output voltage gain, 1st-motor	Hb180	R/W	0 to 255	1(%)
3B61h	3B60h	Automatic torque boost voltage compensation gain, 1st-motor	HC101	R/W	0 to 255	1(%)
3B62h	3B61h	Automatic torque boost slip compensation gain, 1st-motor	HC102	R/W	0 to 255	1(%)
3B6Ah	3B69h	Zero speed area limit for Async.M-0SLV, 1st-motor	HC110	R/W	0 to 100	1(%)
3B6Bh	3B6Ah	Boost value at start for Async.M-SLV/IM-CLV, 1st-motor	HC111	R/W	0 to 50	1(%)
3B6Ch	3B6Bh	Boost value at start for Async.M-0SLV, 1st-motor	HC112	R/W	0 to 50	1(%)
3B6Dh	3B6Ch	Secondary resistance correction, 1st-motor	HC113	R/W	00: Disabled 01: Enabled	-
3B6Eh	3B6Dh	Counter direction run protection selection, 1st-motor	HC114	R/W	00: Disabled 01: Enabled	-
3B74h	3B73h	Torque current reference filter time constant, 1st-motor	HC120	R/W	0 to 100	1(ms)
3B75h	3B74h	Speed feedforward compensation gain, 1st-motor	HC121	R/W	0 to 1000	1(%)
3BC6h	3BC5h	Sync. Motor capacity setting, 1st-motor	Hd102	R/W	1 to 16000	0.01(kW)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3BC7h	3BC6h	Sync. Motor poles setting, 1st-motor	Hd103	R/W	2 to 48 (poles)	1
3BC8h	3BC7h	Sync. Base frequency setting, 1st-motor	Hd104	R/W	1000 to 59000	0.01(Hz)
3BC9h	3BC8h	Sync. Maximum frequency setting, 1st-motor	Hd105	R/W	1000 to 59000	0.01(Hz)
3BCAh	3BC9h	Sync. Motor rated voltage, 1st-motor	Hd106	R/W	1 to 1000	1(V)
3BCCh	3BCBh	Sync. Motor rated current, 1st-motor	Hd108 (HIGH)	R/W	1 to 1000000	0.01(A)
3BCDh	3BCCh		Hd109 (LOW)	R/W		
3BCEh	3BCDh	Sync. Motor constant R, 1st-motor	Hd110 (HIGH)	R/W	1 to 1000000000	0.000001 (Ω)
3BCFh	3BCEh		Hd111 (LOW)	R/W		
3BD0h	3BCFh	Sync. Motor constant Ld, 1st-motor	Hd112 (HIGH)	R/W	1 to 1000000000	0.000001 (mH)
3BD1h	3BD0h		Hd113 (LOW)	R/W		
3BD2h	3BD1h	Sync. Motor constant Lq, 1st-motor	Hd114 (HIGH)	R/W	1 to 1000000000	0.000001 (mH)
3BD3h	3BD2h		Hd115 (LOW)	R/W		
3BD4h	3BD3h	Sync. Motor constant Ke, 1st-motor	Hd116 (HIGH)	R/W	1 to 1000000	0.1m (Vs/rad)
3BD5h	3BD4h		Hd117 (LOW)	R/W		
3BD6h	3BD5h	Sync. Motor constant J, 1st-motor	Hd118 (HIGH)	R/W	1 to 1000000000	0.00001 ($kg\cdot m^{2}$)
3BD7h	3BD6h		Hd119 (LOW)	R/W		
3BE2h	3BE1h	Minimum Frequency for Sync. M-SLV, 1st-motor	Hd130	R/W	0 to 50	1(%)
3BE3h	3BE2h	No-Load current for Sync. M-SLV, 1st-motor	Hd131	R/W	0 to 100	1(%)
3BE4h	3BE3h	Starting Method for Sync. M, 1st-motor	Hd132	R/W	00: Position estimation disabled 01: Position estimation enabled	-
3BE5h	3BE4h	IMPE 0V wait number for Sync. M, 1st-motor	Hd133	R/W	0 to 255	1
3BE6h	3BE5h	IMPE detect wait number for Sync. M, 1st-motor	Hd134	R/W	0 to 255	1
3BE7h	3BE6h	IMPE detect number for Sync. M, 1st-motor	Hd135	R/W	0 to 255	1
3BE8h	3BE7h	IMPE voltage gain for Sync. M, 1st-motor	Hd136	R/W	0 to 200	1(%)
3BE9h	3BE8h	IMPE Mg-pole position offset, 1st-motor	Hd137	R/W	0 to 359	1(deg)
3BEDh	3BECh	Carrier frequency at IVMS	Hd-41	R/W	5 to 160	0.01(Hz)
3BEEh	3BEDh	Filter gain of current detection at IVMS	Hd-42	R/W	0 to 1000	1

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3BEFh	3BEEh	Open phase voltage detection gain	Hd-43	R/W	00: Gain 0 01: Gain 1 02: Gain 2 03: Gain 3	-
3BF0h	3BEFh	Open phase switching threshold compensation	Hd-44	R/W	00: Disabled 01: Enabled	-
3BF1h	3BF0h	P-Gain for speed control, SM(PMM)-IVMS	Hd-45	R/W	0 to 1000	1
3BF2h	3BF1h	I-Gain for speed control, SM(PMM)-IVMS	Hd-46	R/W	0 to 10000	1
3BF3h	3BF2h	Wait time for open phase switching, SM(PMM)-IVMS	Hd-47	R/W	0 to 1000	1
3BF4h	3BF3h	Limitation of decision about the drive direction, SM(PMM)-IVMS	Hd-48	R/W	00: Disabled 01: Enabled	-
3BF5h	3BF4h	Open phase voltage detection timing adjustment, SM(PMM)-IVMS	Hd-49	R/W	0 to 1000	1
3BF6h	3BF5h	Minimum pulse width adjustment, SM(PMM)-IVMS	Hd-50	R/W	0 to 1000	1
3BF7h	3BF6h	IVMS Current Limit for threshold	Hd-51	R/W	0 to 255	1
3BF8h	3BF7h	IVMS Threshold Gain	Hd-52	R/W	0 to 255	1
3BFEh	3BFDh	IVMS Carrier frequency start/end point	Hd-58	R/W	0 to 50	1(%)
61B2h	61B1h	Stabilization constant, 2nd-motor	HA210	R/W	Same as HA110	1(%)
61B7h	61B6h	Speed response for Async.M, 2nd-motor	HA215	R/W	Same as HA115	1(%)
61BCh	61BBh	ASR gain switching mode selection, 2nd-motor	HA220	R/W	Same as HA115	1
61BDh	61BCh	ASR gain switching time setting, 2nd-motor	HA221	R/W	Same as HA121	1(ms)
61Beh	61BDh	ASR gain mapping intermidiate speed 1, 2nd-motor	HA222	R/W	Same as HA122	0.01(Hz)
61BFh	61BEh	ASR gain mapping intermidiate speed 2, 2nd-motor	HA223	R/W	Same as HA123	0.01(Hz)
61C0h	61BFh	ASR gain mapping Maximum speed, 2nd-motor	HA224	R/W	Same as HA124	0.01(Hz)
61C1h	61C0h	ASR gain mapping P-gain 1, 2nd-motor	HA225	R/W	Same as HA125	0.1(%)
61C2h	61C1h	ASR gain mapping I-gain 1, 2nd-motor	HA226	R/W	Same as HA126	0.1(%)
61C3h	61C2h	ASR gain mapping P-gain 1 at P-control, 2nd-motor	HA227	R/W	Same as HA127	0.1(%)
61C4h	61C3h	ASR gain mapping P-gain 2, 2nd-motor	HA228	R/W	Same as HA128	0.1(%)
61C5h	61C4h	ASR gain mapping I-gain 2, 2nd-motor	HA229	R/W	Same as HA129	0.1(%)
61C6h	61C5h	ASR gain mapping P-gain 2 at P-control, 2nd-motor	HA230	R/W	Same as HA130	0.1(%)
61C7h	61C6h	ASR gain mapping P-gain 3, 2nd-motor	HA231	R/W	Same as HA131	0.1(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
61C8h	61C7h	ASR gain mapping I-gain 3, 2nd-motor	HA232	R/W	Same as HA132	0.1(%)
61C9h	61C8h	ASR gain mapping P-gain 4, 2nd-motor	HA233	R/W	Same as HA133	0.1(%)
61Cah	61C9h	ASR gain mapping I-gain 4, 2nd-motor	HA234	R/W	Same as HA134	0.1(%)
620Eh	620Dh	Async. Motor capacity setting, 2nd-motor	Hb202	R/W	Same as Hb102	0.01(kW)
620Fh	620Eh	Async. Motor poles setting, 2nd-motor	Hb203	R/W	Same as Hb103	1
6210h	620Fh	Async. Motor Base frequency setting, 2nd-motor	Hb204	R/W	Same as Hb104	0.01(Hz)
6211h	6210h	Async. Motor Maximum frequency setting, 2nd-motor	Hb205	R/W	Same as Hb105	0.01(Hz)
6212h	6211h	Async. Motor rated voltage, 2nd-motor	Hb206	R/W	Same as Hb106	1(V)
6214h	6213h	Async. Motor rated current, 2nd-motor	Hb208 (HIGH)	R/W	Same as Hb108	0.01(A)
6215h	6214h		Hb209 (LOW)	R/W		
6216h	6215h	Async. Motor constant R1, 2nd-motor	Hb210 (HIGH)	R/W	Same as Hb110	0.000001 (Ω)
6217h	6216h		Hb211 (LOW)	R/W		
6218h	6217h	Async. Motor constant R2, 2nd-motor	Hb212 (HIGH)	R/W	Same as Hb112	0.000001 (Ω)
6219h	6218h		Hb213 (LOW)	R/W		
621Ah	6219h	Async. Motor constant L, 2nd-motor	Hb214 (HIGH)	R/W	Same as Hb114	0.000001 (mH)
621Bh	621Ah		Hb215 (LOW)	R/W		
621Ch	621Bh	Async. Motor constant Io, 2nd-motor	Hb216 (HIGH)	R/W	Same as Hb116	0.01(A)
621Dh	621Ch		Hb217 (LOW)	R/W		
621Eh	621Dh	Async. Motor constant J, 2nd-motor	Hb218 (HIGH)	R/W	Same as Hb118	0.00001 (kg·m^{2})
621Fh	621Eh		Hb219 (LOW)	R/W		
622Ah	6229h	Minimum frequency adjustment, 2nd-motor	Hb230	R/W	Same as Hb130	0.01(Hz)
622Bh	622Ah	Reduced voltage start time setting, 2nd-motor	Hb231	R/W	Same as Hb131	1(ms)
6234h	6233h	Manual torque boost operational mode selection, 2nd-motor	Hb240	R/W	Same as Hb140	-
6235h	6234h	Manual torque boost value, 2nd-motor	Hb241	R/W	Same as Hb141	0.1(%)
6236h	6235h	Manual torque boost Peak speed, 2nd-motor	Hb242	R/W	Same as Hb142	0.1(%)
6239h	6238h	Eco drive enable, 2nd-motor	Hb245	R/W	Same as Hb145	-
623Ah	6239h	Eco drive response adjustment, 2nd-motor	Hb246	R/W	Same as Hb146	1(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
623Eh	623Dh	Free-V/f frequency 1 setting, 2nd-motor	Hb250	R/W	0 to 59000 (Hb252)	0.01(Hz)
623Fh	623Eh	Free-V/f Voltage 1 setting, 2nd-motor	Hb251	R/W	Same as Hb151	0.1(V)
6240h	623Fh	Free-V/f frequency 2 setting, 2nd-motor	Hb252	R/W	0 to 59000(Hb250) to (Hb254)	0.01(Hz)
6241h	6240h	Free-V/f Voltage 2 setting, 2nd-motor	Hb253	R/W	Same as Hb153	0.1(V)
6242h	6241h	Free-V/f frequency 3 setting, 2nd-motor	Hb254	R/W	0 to 59000(Hb252) to (Hb256)	0.01(Hz)
6243h	6242h	Free-V/f Voltage 3 setting, 2nd-motor	Hb255	R/W	Same as Hb155	0.1(V)
6244h	6243h	Free-V/f frequency 4 setting, 2nd-motor	Hb256	R/W	0 to 59000(Hb254) to (Hb258)	0.01(Hz)
6245h	6244h	Free-V/f Voltage 4 setting, 2nd-motor	Hb257	R/W	Same as Hb157	0.1(V)
6246h	6245h	Free-V/f frequency 5 setting, 2nd-motor	Hb258	R/W	0 to 59000(Hb256) to (Hb260)	0.01(Hz)
6247h	6246h	Free-V/f Voltage 5 setting, 2nd-motor	Hb259	R/W	Same as Hb159	0.1(V)
6248h	6247h	Free-V/f frequency 6 setting, 2nd-motor	Hb260	R/W	0 to 59000(Hb258) to (Hb262)	0.01(Hz)
6249h	6248h	Free-V/f Voltage 6 setting, 2nd-motor	Hb261	R/W	Same as Hb161	0.1(V)
624Ah	6249h	Free-V/f frequency 7 setting, 2nd-motor	Hb262	R/W	0 to 59000(Hb260) to (Hb204)	0.01(Hz)
624Bh	624Ah	Free-V/f Voltage 7 setting, 2nd-motor	Hb263	R/W	Same as Hb163	0.1(V)
6252h	6251h	Slip Compensation P-gain witn encoder, 2nd-motor	Hb270	R/W	Same as Hb170	1(%)
6253h	6252h	Slip Compensation I-gain witn encoder, 2nd-motor	Hb271	R/W	Same as Hb171	1(%)
625Ch	625Bh	Output voltage gain, 2nd-motor(V/f)	Hb280	R/W	Same as Hb180	1(%)
6271h	6270h	Automatic torque boost voltage compensation gain, 2nd-motor	HC201	R/W	Same as HC101	1(%)
6272h	6271h	Automatic torque boost slip compensation gain, 2nd-motor	HC202	R/W	Same as HC102	1(%)
627Ah	6279h	Zero speed area limit for Async.M-0SLV, 2nd-motor	HC210	R/W	Same as HC110	1(%)
627Bh	627Ah	Boost value at start for Async. M-SLV/IM-CLV, 2nd-motor	HC211	R/W	Same as HC111	1(%)
627Ch	627Bh	Boost value at start for Async.M-0SLV, 2nd-motor	HC212	R/W	Same as HC112	1(%)
627Dh	627Ch	Secondary resistance correction, 2nd-motor	HC213	R/W	Same as HC113	-
627Eh	627Dh	Counter direction run protection selection, 2nd-motor	HC214	R/W	Same as HC114	-
6284h	6283h	Torque current reference filter time constant, 2nd-motor	HC220	R/W	Same as HC120	1ms
6285h	6284h	Speed feedforward compensation gain, 2nd-motor	HC221	R/W	Same as HC121	1(%)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
62D6h	62D5h	Sync. Motor capacity setting, 2nd-motor	Hd202	R/W	Same as Hd102	0.01(kW)
62D7h	62D6h	Sync. Motor poles setting, 2nd-motor	Hd203	R/W	Same as Hd103	1
62D8h	62D7h	Sync. Base frequency setting, 2nd-motor	Hd204	R/W	Same as Hd104	0.01(Hz)
62D9h	62D8h	Sync. Maximum frequency setting, 2nd-motor	Hd205	R/W	Same as Hd105	0.01(Hz)
62Dah	62D9h	Sync. Motor rated voltage, 2nd-motor	Hd206	R/W	Same as Hd106	1(V)
62DCh	62DBh	Sync. Motor rated current, 2nd-motor	Hd208 (HIGH)	R/W	Same as Hd108	0.01(A)
62DDh	62DCh		Hd209 (LOW)	R/W		
62Deh	62DDh	Sync. Motor constant R, 2nd-motor	Hd210 (HIGH)	R/W	Same as Hd110	0.000001 (Ω)
62DFh	62DEh		Hd211 (LOW)	R/W		
62E0h	62DFh	Sync. Motor constant Ld, 2nd-motor	Hd212 (HIGH)	R/W	Same as Hd112	0.000001 (mH)
62E1h	62E0h		Hd213 (LOW)	R/W		
62E2h	62E1h	Sync. Motor constant Lq, 2nd-motor	Hd214 (HIGH)	R/W	Same as Hd114	0.000001 (mH)
62E3h	62E2h		Hd215 (LOW)	R/W		
62E4h	62E3h	Sync. Motor constant Ke, 2nd-motor	Hd216 (HIGH)	R/W	Same as Hd116	0.1m (Vs/rad)
62E5h	62E4h		Hd217 (LOW)	R/W		
62E6h	62E5h	Sync. Motor constant J, 2nd-motor	Hd218 (HIGH)	R/W	Same as Hd118	0.00001 (kg·m$^{2)}$
62E7h	62E6h		Hd219 (LOW)	R/W		
62F2h	62F1h	Minimum Frequency for Sync. M-SLV, 2nd-motor	Hd230	R/W	Same as Hd130	1(%)
62F3h	62F2h	No-Load current for Sync. M-SLV, 2nd-motor	Hd231	R/W	Same as Hd131	1(%)
62F4h	62F3h	Starting Method for Sync. M, 2nd-motor	Hd232	R/W	Same as Hd132	-
62F5h	62F4h	IMPE 0V wait number for Sync. M, 2nd-motor	Hd233	R/W	Same as Hd133	1
62F6h	62F5h	IMPE detect wait number for Sync. M, 2nd-motor	Hd234	R/W	Same as Hd134	1
62F7h	62F6h	IMPE detect number for Sync. M, 2nd-motor	Hd235	R/W	Same as Hd135	1
62F8h	62F7h	IMPE voltage gain for Sync. M, 2nd-motor	Hd236	R/W	Same as Hd136	1(%)
62F9h	62F8h	IMPE Mg-pole position offset, 2nd-motor	Hd237	R/W	Same as Hd137	1(deg)

9-5-8 Group P Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
4269h	4268h	Mode selection for Emergency-force drive	PA-01	R/W	00: Disabled 01: Enabled	-
426Ah	4269h	Frequency reference setting at Emergency-force drive	PA-02	R/W	0 to 59000	0.01(Hz)
426Bh	426Ah	Direction command at Emergency-force drive	PA-03	R/W	00: Normal rotation 01: Reverse rotation	-
426Ch	426Bh	Commercial power supply bypass function selection	PA-04	R/W	00: Disabled 01: Enabled	-
426Dh	426Ch	Delay time of Bypass function	PA-05	R/W	0 to 10000	0.1(s)
427Ch	427Bh	Simulation mode enable	PA-20	R/W	00: Disabled 01: Enabled	-
427Dh	427Ch	Error code selection for Alarm test	PA-21	R/W	0 to 255	1
427Eh	427Dh	Output current monitor optional output enable	PA-22	R/W	00: Disabled 01: Enabled: parameter setting [PA-23] 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
427Fh	427Eh	Output current monitor optional output value setting	PA-23	R/W	0.0 to 3.0 × Inverter rated current*1	0.1(A)
4280h	427Fh	DC-bus voltage monitor optional output enable	PA-24	R/W	00: Disabled 01: Enabled: parameter setting [PA-25] 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
4281h	4280h	DC-bus voltage monitor optional value output	PA-25	R/W	200V class: 0 to 4500 400V class: 0 to 9000	0.1(Vdc)

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
4282h	4281h	Output voltage monitor optional output enable	PA-26	R/W	00: Disabled 01: Enabled: parameter setting [PA-27] 02: (Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: (Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
4283h	4282h	Output voltage monitor optional output value setting	PA-27	R/W	200V class: 0-3000 400V class: 0-6000	0.1(V)
4284h	4283h	Output torque monitor optional output enable	PA-28	R/W	00: Disabled 01: Enabled: parameter setting [PA-29] 02: (Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: (Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
4285h	4284h	Output torque monitor optional output value setting	PA-29	R/W	-5000 to 5000	0.1(%)
4286h	4285h	Start with frequency matching optional Setting enable	PA-30	R/W	00: Disabled 01: Enabled: parameter setting [PA-31] 02: Enabled: set from [Ai1] 03: Enabled: set from [Ai2] 04: Enabled: set from [Ai3] 05: (Reserved) 06: (Reserved) 07: (Reserved)	-
4287h	4286h	Start with frequency matching optional value setting	PA-31	R/W	0 to 59000	0.01(Hz)

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

9-5-9 Group U Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
-	-	Password input for display selection	UA-01	−	−	-
-	-	Soft-lock password input	UA-02	−	−	-
465Ah	4659h	Display restriction selection	UA-10	R/W	00: Full display 01: By function 02: User setting 03: Conveyor display 04: Only monitor display	-
465Ch	465Bh	Accumulation input power monitor clear	UA-12	R/W	00: Disabled 01: Clear	-
465Dh	465Ch	Display gain for Accumulation input power monitor	UA-13	R/W	1 to 1000	1
465Eh	465Dh	Accumulation output power monitor clear	UA-14	R/W	00: Disabled 01: Clear	-
465Fh	465Eh	Display gain for Accumulation output power monitor	UA-15	R/W	1 to 1000	1
4660h	465Fh	Soft Lock selection	UA-16	R/W	00: [SFT] terminal 01: Always enabled	-
4661h	4660h	Soft Lock target selection	UA-17	R/W	00: All data cannot be changed 01: Data other than set frequency cannot be changed	-
4662h	4661h	Data R/W selection	UA-18	R/W	00: R/W enabled 01: R/W disabled	-
4663h	4662h	Low battery warning enable	UA-19	R/W	00: Disabled 01: Warning 02: Error	-
4664h	4663h	Action selection at Keypad disconnection	UA-20	R/W	00: Error 01: Error after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-
4665h	4664h	2nd-motor parameter display selection	UA-21	R/W	00: Not display 01: Display	-
4666h	4665h	Option parameter display selection	UA-22	R/W	00: Not display 01: Display	1
466Eh	466Dh	User parameter auto setting function enable	UA-30	R/W	00: Disabled 01: Enabled	-
466Fh	466Eh	User parameter 1 selection	UA-31	R/W	no/***** (select a parameter)	1
4670h	466Fh	User parameter 12 selection	UA-42	R/W	no/***** (select a parameter)	1
4671h	4670h	User parameter 2 selection	UA-32	R/W	no/***** (select a parameter)	1
4672h	4671h	User parameter 3 selection	UA-33	R/W	no/***** (select a parameter)	1
4673h	4672h	User parameter 4 selection	UA-34	R/W	no/***** (select a parameter)	1

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
4674h	4673h	User parameter 5 selection	UA-35	R/W	no/***** (select a parameter)	1
4675h	4674h	User parameter 6 selection	UA-36	R/W	no/***** (select a parameter)	1
4676h	4675h	User parameter 7 selection	UA-37	R/W	no/***** (select a parameter)	1
4677h	4676h	User parameter 8 selection	UA-38	R/W	no/***** (select a parameter)	1
4678h	4677h	User parameter 9 selection	UA-39	R/W	no/***** (select a parameter)	1
4679h	4678h	User parameter 10 selection	UA-40	R/W	no/***** (select a parameter)	1
467Ah	4679h	User parameter 11 selection	UA-41	R/W	no/***** (select a parameter)	1
467Bh	467Ah	User parameter 13 selection	UA-43	R/W	no/***** (select a parameter)	1
467Ch	467Bh	User parameter 14 selection	UA-44	R/W	no/***** (select a parameter)	1
467Dh	467Ch	User parameter 15 selection	UA-45	R/W	no/***** (select a parameter)	1
467Eh	467Dh	User parameter 16 selection	UA-46	R/W	no/***** (select a parameter)	1
467Fh	467Eh	User parameter 17 selection	UA-47	R/W	no/***** (select a parameter)	1
4680h	467Fh	User parameter 18 selection	UA-48	R/W	no/***** (select a parameter)	1
4681h	4680h	User parameter 19 selection	UA-49	R/W	no/***** (select a parameter)	1
4682h	4681h	User parameter 20 selection	UA-50	R/W	no/***** (select a parameter)	1
4683h	4682h	User parameter 21 selection	UA-51	R/W	no/***** (select a parameter)	1
4684h	4683h	User parameter 22 selection	UA-52	R/W	no/***** (select a parameter)	1
4685h	4684h	User parameter 23 selection	UA-53	R/W	no/***** (select a parameter)	1
4686h	4685h	User parameter 24 selection	UA-54	R/W	no/***** (select a parameter)	1
4687h	4686h	User parameter 25 selection	UA-55	R/W	no/***** (select a parameter)	1
4688h	4687h	User parameter 26 selection	UA-56	R/W	no/***** (select a parameter)	1
4689h	4688h	User parameter 27 selection	UA-57	R/W	no/***** (select a parameter)	1
468Ah	4689h	User parameter 28 selection	UA-58	R/W	no/***** (select a parameter)	1
468Bh	468Ah	User parameter 29 selection	UA-59	R/W	no/***** (select a parameter)	1
468Ch	468Bh	User parameter 30 selection	UA-60	R/W	no/***** (select a parameter)	1
468Dh	468Ch	User parameter 31 selection	UA-61	R/W	no/***** (select a parameter)	1
468Eh	468Dh	User parameter 32 selection	UA-62	R/W	no/***** (select a parameter)	1
46B5h	46B4h	Initialize Mode selection	Ub-01	R/W	00: Disabled 01: Trip history 02: Parameter initialization 03: Trip history + parameters 04: Trip history + parameters + DriveProgramming 05: Other than terminal function 06: Other than communication function 07: Other than terminal&commu-nication functions 08: Only DriveProgramming	-
46B6h	46B5h	Initialize Data selection	Ub-02	R/W	00: Mode 0 01: Mode 1 02: Mode 2 03: Mode 3	-
46B7h	46B6h	Load type selection	Ub-03	R/W	00: VLD 01: LD 02: ND	-
46B9h	46B8h	Initialize Enable	Ub-05	R/W	00: Disabled 01: Start initialization	-
4719h	4718h	Debug mode enable	UC-01	R/W	(do not change)	1
47E1h	47E0h	EzSQ operation cycle	UE-01	R/W	00: 1ms 01: 2ms	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
47E2h	47E1h	EzSQ function enable	UE-02	R/W	00: Disabled 01: [PRG] terminal 02: Always	-
47EAh	47E9h	EzSQ user parameter U (00)	UE-10	R/W	0 to 65535	1
47EBh	47EAh	EzSQ user parameter U (01)	UE-11	R/W	0 to 65535	1
47ECh	47EBh	EzSQ user parameter U (02)	UE-12	R/W	0 to 65535	1
47EDh	47ECh	EzSQ user parameter U (03)	UE-13	R/W	0 to 65535	1
47EEh	47EDh	EzSQ user parameter U (04)	UE-14	R/W	0 to 65535	1
47EFh	47EEh	EzSQ user parameter U (05)	UE-15	R/W	0 to 65535	1
47F0h	47EFh	EzSQ user parameter U (06)	UE-16	R/W	0 to 65535	1
47F1h	47F0h	EzSQ user parameter U (07)	UE-17	R/W	0 to 65535	1
47F2h	47F1h	EzSQ user parameter U (08)	UE-18	R/W	0 to 65535	1
47F3h	47F2h	EzSQ user parameter U (09)	UE-19	R/W	0 to 65535	1
47F4h	47F3h	EzSQ user parameter U (10)	UE-20	R/W	0 to 65535	1
47F5h	47F4h	EzSQ user parameter U (11)	UE-21	R/W	0 to 65535	1
47F6h	47F5h	EzSQ user parameter U (12)	UE-22	R/W	0 to 65535	1
47F7h	47F6h	EzSQ user parameter U (13)	UE-23	R/W	0 to 65535	1
47F8h	47F7h	EzSQ user parameter U (14)	UE-24	R/W	0 to 65535	1
47F9h	47F8h	EzSQ user parameter U (15)	UE-25	R/W	0 to 65535	1
47FAh	47F9h	EzSQ user parameter U (16)	UE-26	R/W	0 to 65535	1
47FBh	47FAh	EzSQ user parameter U (17)	UE-27	R/W	0 to 65535	1
47FCh	47FBh	EzSQ user parameter U (18)	UE-28	R/W	0 to 65535	1
47FDh	47FCh	EzSQ user parameter U (19)	UE-29	R/W	0 to 65535	1
47FEh	47FDh	EzSQ user parameter U (20)	UE-30	R/W	0 to 65535	1
47FFh	47FEh	EzSQ user parameter U (21)	UE-31	R/W	0 to 65535	1
4800h	47FFh	EzSQ user parameter U (22)	UE-32	R/W	0 to 65535	1
4801h	4800h	EzSQ user parameter U (23)	UE-33	R/W	0 to 65535	1
4802h	4801h	EzSQ user parameter U (24)	UE-34	R/W	0 to 65535	1
4803h	4802h	EzSQ user parameter U (25)	UE-35	R/W	0 to 65535	1
4804h	4803h	EzSQ user parameter U (26)	UE-36	R/W	0 to 65535	1
4805h	4804h	EzSQ user parameter U (27)	UE-37	R/W	0 to 65535	1
4806h	4805h	EzSQ user parameter U (28)	UE-38	R/W	0 to 65535	1
4807h	4806h	EzSQ user parameter U (29)	UE-39	R/W	0 to 65535	1
4808h	4807h	EzSQ user parameter U (30)	UE-40	R/W	0 to 65535	1
4809h	4808h	EzSQ user parameter U (31)	UE-41	R/W	0 to 65535	1
480Ah	4809h	EzSQ user parameter U (32)	UE-42	R/W	0 to 65535	1
480Bh	480Ah	EzSQ user parameter U (33)	UE-43	R/W	0 to 65535	1
480Ch	480Bh	EzSQ user parameter U (34)	UE-44	R/W	0 to 65535	1
480Dh	480Ch	EzSQ user parameter U (35)	UE-45	R/W	0 to 65535	1
480Eh	480Dh	EzSQ user parameter U (36)	UE-46	R/W	0 to 65535	1
480Fh	480Eh	EzSQ user parameter U (37)	UE-47	R/W	0 to 65535	1
4810h	480Fh	EzSQ user parameter U (38)	UE-48	R/W	0 to 65535	1
4811h	4810h	EzSQ user parameter U (39)	UE-49	R/W	0 to 65535	1
4812h	4811h	EzSQ user parameter U (40)	UE-50	R/W	0 to 65535	1
4813h	4812h	EzSQ user parameter U (41)	UE-51	R/W	0 to 65535	1
4814h	4813h	EzSQ user parameter U (42)	UE-52	R/W	0 to 65535	1
4815h	4814h	EzSQ user parameter U (43)	UE-53	R/W	0 to 65535	1
4816h	4815h	EzSQ user parameter U (44)	UE-54	R/W	0 to 65535	1
4817h	4816h	EzSQ user parameter U (45)	UE-55	R/W	0 to 65535	1
4818h	4817h	EzSQ user parameter U (46)	UE-56	R/W	0 to 65535	1
4819h	4818h	EzSQ user parameter U (47)	UE-57	R/W	0 to 65535	1
481Ah	4819h	EzSQ user parameter U (48)	UE-58	R/W	0 to 65535	1

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
481Bh	481Ah	EzSQ user parameter U (49)	UE-59	R/W	0 to 65535	1
481Ch	481Bh	EzSQ user parameter U (50)	UE-60	R/W	0 to 65535	1
481Dh	481Ch	EzSQ user parameter U (51)	UE-61	R/W	0 to 65535	1
481Eh	481Dh	EzSQ user parameter U (52)	UE-62	R/W	0 to 65535	1
481Fh	481Eh	EzSQ user parameter U (53)	UE-63	R/W	0 to 65535	1
4820h	481Fh	EzSQ user parameter U (54)	UE-64	R/W	0 to 65535	1
4821h	4820h	EzSQ user parameter U (55)	UE-65	R/W	0 to 65535	1
4822h	4821h	EzSQ user parameter U (56)	UE-66	R/W	0 to 65535	1
4823h	4822h	EzSQ user parameter U (57)	UE-67	R/W	0 to 65535	1
4824h	4823h	EzSQ user parameter U (58)	UE-68	R/W	0 to 65535	1
4825h	4824h	EzSQ user parameter U (59)	UE-69	R/W	0 to 65535	1
4826h	4825h	EzSQ user parameter U (60)	UE-70	R/W	0 to 65535	1
4827h	4826h	EzSQ user parameter U (61)	UE-71	R/W	0 to 65535	1
4828h	4827h	EzSQ user parameter U (62)	UE-72	R/W	0 to 65535	1
4829h	4828h	EzSQ user parameter U (63)	UE-73	R/W	0 to 65535	1
4846h	4845h	EzSQ user parameter UL (00)	UF-02 (HIGH)	R/W	-2147483647 to 2147483647	1
4847h	4846h		UF-03 (LOW)	R/W		
4848h	4847h	EzSQ user parameter UL (01)	UF-04 (HIGH)	R/W	-2147483647 to 2147483647	1
4849h	4848h		UF-05 (LOW)	R/W		
484Ah	4849h	EzSQ user parameter UL (02)	UF-06 (HIGH)	R/W	-2147483647 to 2147483647	1
484Bh	484Ah		UF-07 (LOW)	R/W		
484Ch	484Bh	EzSQ user parameter UL (03)	UF-08 (HIGH)	R/W	-2147483647 to 2147483647	1
484Dh	484Ch		UF-09 (LOW)	R/W		
484Eh	484Dh	EzSQ user parameter UL (04)	UF-10 (HIGH)	R/W	-2147483647 to 2147483647	1
484Fh	484Eh		UF-11 (LOW)	R/W		
4850h	484Fh	EzSQ user parameter UL (05)	UF-12 (HIGH)	R/W	-2147483647 to 2147483647	1
4851h	4850h		UF-13 (LOW)	R/W		
4852h	4851h	EzSQ user parameter UL (06)	UF-14 (HIGH)	R/W	-2147483647 to 2147483647	1
4853h	4852h		UF-15 (LOW)	R/W		
4854h	4853h	EzSQ user parameter UL (07)	UF-16 (HIGH)	R/W	-2147483647 to 2147483647	1
4855h	4854h		UF-17 (LOW)	R/W		
4856h	4855h	EzSQ user parameter UL (08)	UF-18 (HIGH)	R/W	-2147483647 to 2147483647	1
4857h	4856h		UF-19 (LOW)	R/W		

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
4858h	4857h	EzSQ user parameter UL (09)	UF-20 (HIGH)	R/W	-2147483647 to 2147483647	1
4859h	4858h		UF-21 (LOW)	R/W		
485Ah	4859h	EzSQ user parameter UL (10)	UF-22 (HIGH)	R/W	-2147483647 to 2147483647	1
485Bh	485Ah		UF-23 (LOW)	R/W		
485Ch	485Bh	EzSQ user parameter UL (11)	UF-24 (HIGH)	R/W	-2147483647 to 2147483647	1
485Dh	485Ch		UF-25 (LOW)	R/W		
485Eh	485Dh	EzSQ user parameter UL (12)	UF-26 (HIGH)	R/W	-2147483647 to 2147483647	1
485Fh	485Eh		UF-27 (LOW)	R/W		
4860h	485Fh	EzSQ user parameter UL (13)	UF-28 (HIGH)	R/W	-2147483647 to 2147483647	1
4861h	4860h		UF-29 (LOW)	R/W		
4862h	4861h	EzSQ user parameter UL (14)	UF-30 (HIGH)	R/W	-2147483647 to 2147483647	1
4863h	4862h		UF-31 (LOW)	R/W		
4864h	4863h	EzSQ user parameter UL (15)	UF-32 (HIGH)	R/W	-2147483647 to 2147483647	1
4865h	4864h		UF-33 (LOW)	R/W		

9-5-10 Group o Register List

Precautions for Correct Use

- The “Register No.” in the table header shows the register number used inside the inverter.
- The “Modbus register spec. No.” in the table header shows the register number used to actually specify the register in the Modbus communication process.
  This register number is 1 less than the inverter “Register No.” according to the Modbus communication specifications.

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3E8Ah	3E89h	Operation mode on option card error (SLOT-1)	oA-10	R/W	00: Error 01: Continue operation	-
3E8Bh	3E8Ah	Communication Watch Dog Timer	oA-11	R/W	0 to 10000	0.01(s)
3E8Ch	3E8Bh	Action selection at communication error	oA-12	R/W	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-

Register No.	Modbus register spec. No.	Function name	Parameter No.	R/W	Monitor or setting data	Resolution
3E8Dh	3E8Ch	run command enable option during the option card (SLOT-1) start-up	oA-13	R/W	00: Operation command disabled 01: Operation command enabled	-
3E94h	3E93h	Operation mode on option card error (SLOT-2)	oA-20	R/W	00: Error 01: Continue operation	-
3E95h	3E94h	Communication Watch Dog Timer	oA-21	R/W	0 to 10000	0.01(s)
3E96h	3E95h	Action selection at communication error	oA-22	R/W	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-
3E97h	3E96h	run command enable option during the option card (SLOT-2) start-up	oA-23	R/W	00 (Operation command disabled)/ 01 (Operation command enabled)	-
3E9Eh	3E9Dh	Operation mode on option card error (SLOT-3)	oA-30	R/W	00: Error 01: Continue operation	-
3E9Fh	3E9Eh	Communication Watch Dog Timer	oA-31	R/W	0 to 10000	0.01(s)
3EA0h	3E9Fh	Action selection at communication error	oA-32	R/W	00: Error 01: Trip after deceleration stop 02: Ignore 03: Free run 04: Deceleration stop	-
3EA1h	3EA0h	run command enable option during the option card (SLOT-3) start-up	oA-33	R/W	00: Operation command disabled 01: Operation command enabled	-
3EE5h	3EE4h	Encoder constant setting	ob-01	R/W	32 to 65535	1(pls)
3EE6h	3EE5h	Encoder position selection	ob-02	R/W	00: Phase-A is leading 01: Phase-B is leading	-
3EE7h	3EE6h	Motor gear ratio Numerator	ob-03	R/W	1 to 10000	1
3EE8h	3EE7h	Motor gear ratio Denominator	ob-04	R/W	1 to 10000	1
3EEEh	3EEDh	Pulse train detection object selection	ob-10	R/W	00: Command 01: Pulse string position command	-
3EEFh	3EEEh	Mode selection of pulse train input	ob-11	R/W	00: 90° phase difference 01: forward/reverse rotation command and rotation direction 02: forward/reverse rotation pulse string	-
3EF0h	3EEFh	Pulse train frequency Scale	ob-12	R/W	5 to 20000	0.01 (kHz)
3EF1h	3EF0h	Pulse train frequency Filter time constant	ob-13	R/W	1 to 200	0.01(s)
3EF2h	3EF1h	Pulse train frequency Bias value	ob-14	R/W	-1000 to 1000	0.1(%)
3EF3h	3EF2h	Pulse train frequency High Limit	ob-15	R/W	0 to 1000	0.1(%)
3EF4h	3EF3h	Pulse train frequency detection low level	ob-16	R/W	0 to 1000	0.1(%)

9-6 Inter-inverter Communication

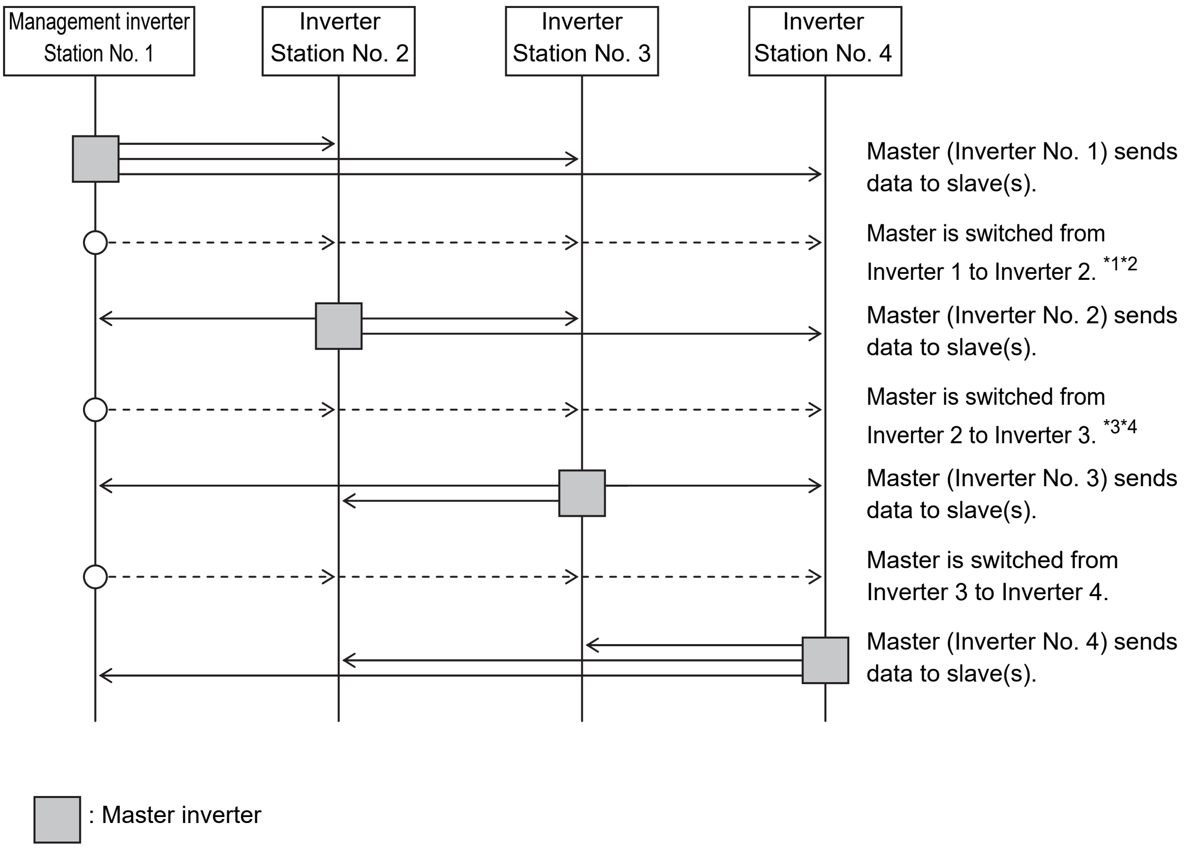
In addition to the standard Modbus communication (slave), the 3G3RX2 Series Inverter provides the co-inverter communication function, which enables more than one 3G3RX2 Series Inverter to communicate mutually without master equipment such as a computer or PLC.

In Inter-inverter Communication, the inverters are assigned as “management inverter,” “master inverter,” and “slave inverter”. The master inverter is specified by the management inverter according to the user settings. The others are slave inverters. The management inverter is always fixed, but the master inverter is switched sequentially. Therefore, the management inverter may serve as the master or a slave inverter. Other conditions are as follows.

- One management inverter is required within a network.
- Up to 11 inverters can serve as the master inverter.
- Up to 247 inverters can be connected within the entire network (32 inverters without repeaters in compliance with the RS485 specifications).

In co-inverter communication, be sure to assign the station No. 1, which serves as the management inverter.

The master inverter can write data to the holding registers on any slave inverter. At this time, up to five different station numbers and holding registers can be specified at once. On completion of each data transmission session between the master and a slave (or slaves), the master inverter is switched to the next in a sequential manner. In this way, data transmission is repeated according to the settings for each master inverter.



*1. Switching of the master is performed automatically by the management inverter.

*2. The management inverter sends the master switching command from Inverter No. 01 to 02 after data is sent from Inverter 01 (master) to a slave (or slaves), with a wait time of “silent interval + Communication Wait Time.

*3. After receiving data from the master inverter, the management inverter sends the next master switching command with a wait time of “silent interval + Communication Wait Time. If the management inverter cannnot receive the data sent from the master inverter within the Communication Error Timeout Time, a communication timeout occurs and the management inverter follows the operation set in the Operation Selection on Communication Error.

*4. Be sure to enable the Communication Error Timeout Time setting (= 0.01 to 99.99) on the management inverter. When this setting is disabled (= 0), the co-inverter communication will stop if the management inverter cannot receive data from the master. In this case, cycle the power supply for the management inverter, or reset the management inverter (by turning ON/OFF the terminal RS).

9-6-1 Inter-inverter Communication Parameters

The parameters required to establish Inter-inverter communication are shown in the table below.

Parameter No.	Function name	Data	Default data	Unit	Setting target[*1]
CF-02[*2]	Communication Station No. Selection	1 to 247[*3]	1	–	ALL[*4]
CF-05[*5]	Operation Selection on Communication Error	00: Trip 01: Trip after deceleration stop 02: Ignore 03: Free-run stop 04: Deceleration stop	02	–	ALL
CF-06	Communication Error Timeout Time	0.00: Timeout disabled 0.01 to 99.99	0.00	s	ALL
CF-07	Communication Wait Time	0 to 1000	0	ms	ALL
CF-08[*2]	Communication Selection	00: Modbus communication 01: EzCom communication 02: EzCom communication (management inverter)	00	–	– B A
CF-20[*2]	EzCom Communication Starting Station Number	1 to 8 Setting required only for management inverter[*6]	1	–	A
CF-21[*2]	EzCom Communication Ending Station Number	1 to 8 Setting required only for management inverter[*6]	1	–	A
CF-22[*2]	EzCom Communication Start Selection	00: Start via input terminal[*7] 01: Constant communication[*8]	00	–	A A
CF-23	Number of Sent Data of All Stations in EzCom Communication	1 to 5	5	–	M
CF-24	Recipient Station Number of All Stations in EzCom Communication 1	1 to 247[*9]	1	–	M
CF-25	Recipient Register of All Stations in EzCom Communication 1	0000 to FFFF	0	–	M

Parameter No.	Function name	Data	Default data	Unit	Setting target*1
CF-26	Sender Register of All Stations in EzCom Communication 1	0000 to FFFF	0000	–	M
CF-27	Recipient Station Number of All Stations in EzCom Communication 2	1 to 247	2	–	M
CF-28	Recipient Register of All Stations in EzCom Communication 2	0000 to FFFF	0000	–	M
CF-29	Sender Register of All Stations in EzCom Communication 2	0000 to FFFF	0000	–	M
CF-30	Recipient Station Number of All Stations in EzCom Communication 3	1 to 247	3	–	M
CF-31	Recipient Register of All Stations in EzCom Communication 3	0000 to FFFF	0000	–	M
CF-32	Sender Register of All Stations in EzCom Communication 3	0000 to FFFF	0000	–	M
CF-33	Recipient Station Number of All Stations in EzCom Communication 4	1 to 247	4	–	M
CF-34	Recipient Register of All Stations in EzCom Communication 4	0000 to FFFF	0000	–	M
CF-35	Sender Register of All Stations in EzCom Communication 4	0000 to FFFF	0000	–	M
CF-36	Recipient Station Number of All Stations in EzCom Communication 5	1 to 247	5	–	M
CF-37	Recipient Register of All Stations in EzCom Communication 5	0000 to FFFF	0000	–	M
CF-38	Sender Register of All Stations in EzCom Communication 5	0000 to FFFF	0000	–	M
CA-01 to CA-07	Input terminal 1 to 9, A, B	98: EzCom start*7	–	–	A

*1. Below are the details of the setting target.
ALL: Setting required for all connected inverters
A: Setting required only for management inverter (Station No. 1)
B: Setting required for inverters other than management inverter (Station No. 1)
M: Setting required only for inverters set in CF-20 to CF-21 (= Inverters assigned with master role)

*2. After changing any of the CF-02, CF-08, and CF-20 to CF-22 data on the management inverter, be sure to cycle the power supply to apply the changes. For inverters other than the management inverter, these changes will be applied immediately.

*3. To switch the master inverter among more than one inverter, be sure to set sequential station numbers. If the set station numbers include any skipped number, communications cannot be established.

*4. For the management inverter, set the station number to 1 (CF-02= 1).

*5. When the Operation Selection on Communication Error (CF-05) is set to 02 (Ignore) on the management inverter, the co-inverter communication session will stop if a communications timeout error occurs on the management inverter. In this case, cycle the power supply of the management inverter.

*6. Set these parameters so that CF-20 is equal to or less than CF-21.

*7. Assign 98 (EzCom start) to any of input terminals 1 to 9, A and B (CA-01 to CA-11) when you set 00 (EzCom terminals) in Inverter Communication Start Selection (CF-22).

*8. When the Co-inverter Communication Start Selection is set to 01 (Constant communication), the management inverter starts sending data as soon as the power supply is turned on. At this time, if the next master inverter is delayed in the startup and cannot receive the master switching command, the master inverter cannot send the data, which results in a communications timeout error on the management inverter.

When you set CF-22 to 01, check that the startup of the other inverters is completed and power on the management inverter finally.

*9. Although, in master-to-slave communications, you set recipient slave's station number, actually, data is sent to all stations via broadcast communications (Station No. 00). Slaves that are not specified as the recipient on the master side discard the received data.

9-6-2 Communication Settings

- On each inverter, set the station number in the Communication Station No. Selection so that they do not overlap among the inverters. Do not forget to set the station No. 1, which serves as the management inverter.
- Set Management Inverter Communication Method Selection (CF-08) to 03 (Inter-inverter Communication (Management). Set Other Management Inverter Communication Method Selection (CF-08) to 02 (Inter-inverter Communication).
- Set a station number 1 to 8 on inverters that serve as the master inverter. To switch the master inverter among more than one inverter, the station numbering must be sequential. On the management inverter, set the smallest master station number in the Co-inverter Communication Starting Station Number (CF-20) and the largest master station number in the Co-inverter Communication Ending Station Number (CF-21).
- In the Co-inverter Communication Start Selection, set how to start inverter communications. When Inter-inverter Communication Start Selection is set to 00 (Start via input terminal), assign 98 (EzCom start) to one of the Multi-function Input S1 to S7 Selection (CA-01 to CA-07).
- In CF-23 to CF-38, set the following parameters, which are required when the master inverter writes data: the number of sent data, recipient station number, recipient register address, and sender register address.

Inter-inverter Communication Operation

(1) **The master inverter sends data to one or more slave inverters according to the settings for that master inverter.**

(This data is also sent to the management inverter that does not serve as the master inverter.)

(2) **The management inverter sends the master switching command and the master inverter is switched accordingly.**

(3) **The next master inverter sends data to one or more slave inverters in the same manner as explained in step (1).**

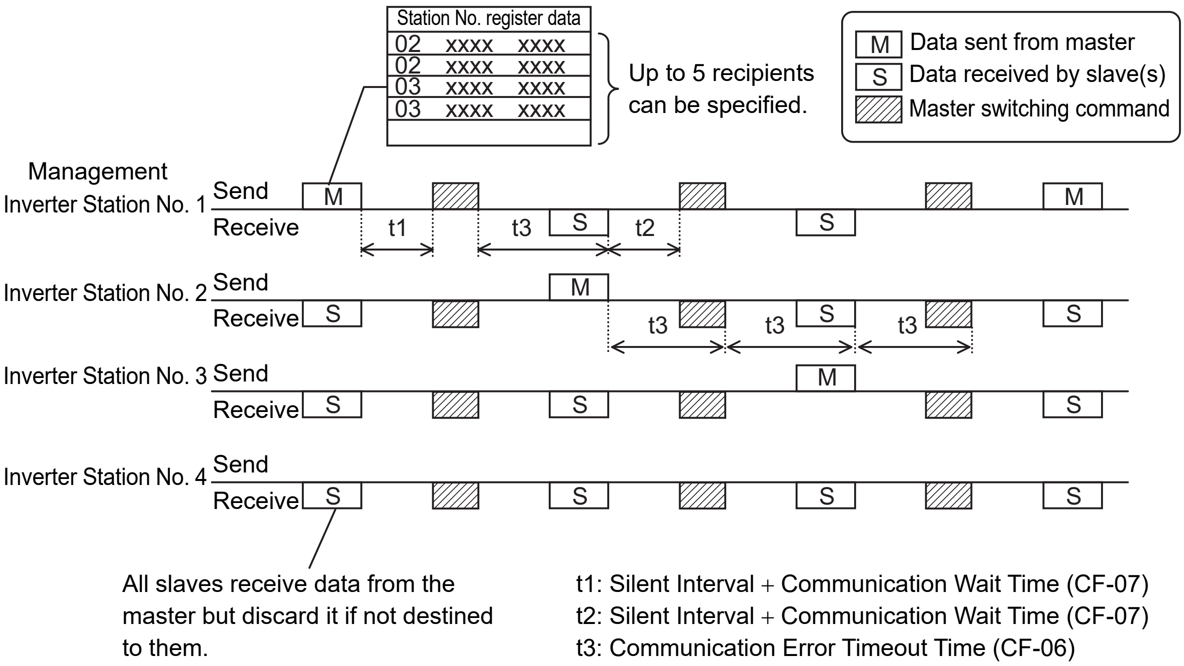
(This data is also sent to the management inverter that does not serve as the master inverter.)

(4) **Steps (2) and (3) are followed repeatedly.**

Note Because this inverter is designed to establish co-inverter communication as broadcast communications (Station No. 00), communications data is sent to all stations. Therefore, slaves that are not specified as the recipient on the master side receive the data once, but discard internally the data not addressed to them.

Example of Inter-inverter Communication Sequence

The sequence diagram below shows co-inverter communication among four inverters with station numbers from 1 to 4, where Stations No. 1 to 3 are set as the master inverter.



- Be sure to set the Communication Error Timeout Time (CF-06) to other than 0.00 (1 second or longer is recommended) on the management inverter. When this parameter is set to 0.00, the inverter's communications function will stop if no data is received from the master. If it stops working, cycle the power supply of the management inverter.
- The communications error timeout timer starts when the inverter starts waiting for data reception and times out when it cannot complete data reception within the set time. If a timeout occurs, the inverter performs the operation set in the Operation Selection on Communication Error (CF-05). (t3 in above diagram)
- When the management inverter is the master, the master switching command will be sent with a wait time of "silent interval + Communication Wait Time (CF-07) after the master sends data. (t1 in above diagram)
- When an inverter other than the management inverter is the master, the master switching command will be sent with a wait time of "silent interval + Communication Wait Time (CF-07) after receipt of data sent from the master inverter. (t2 in above diagram)
- When the Co-inverter Communication Start Selection (C100) is set to 01 (Constant communication), the management inverter starts sending data as soon as the power supply is turned on. Therefore, if the power-on timing of any other inverter is delayed, the communications cannot be established normally, which results in a communications timeout error on the management inverter. When you set this to 01 (Constant communication), check that the startup of the other inverters is completed and power on the management inverter finally.
- Do not set (EEPROM Write) or (EEPROM Write Mode Selection) in the recipient registers. Doing so causes the co-inverter communication session to stop in the EEPROM write process.
- After changing any of the CF-08, CF-20 to CF-22 data, be sure to cycle the power supply to apply the changes.

10

DriveProgramming

This section describes the features of the DriveProgramming.

10-1 Overview of DriveProgramming

The 3G3RX2 Series Inverter has the built-in simple sequence function (DriveProgramming), which enables a stand-alone inverter to perform simple sequence control.

You can create programs easily by using the CX-Drive. The user programs you created can be downloaded onto the inverter for programmed inverter operation.

Features of DriveProgramming

- The DriveProgramming supports both flowchart and text language method programming.
- Five tasks can be processed in parallel.
- ON/OFF by input terminals enables a start of user programs.
- The user programs enable the input terminals and output terminals to use reading and writing functions.
- The LCD Operator enables you to change the settings of the output frequency, acceleration/deceleration time, and other parameters that require on-site adjustment by specifying the user parameters (UE-10 to UE-73), without connecting the computer.
- Because user programs are stored in the internal EEPROM of the inverter, you can start a program immediately after the inverter power supply is turned on.
- Connecting the optional LCD Operator enables the control of the inverter by using the LCD Operator's clock command.

Precautions for Safe Use

- If the clock command is used in DriveProgramming, an unexpected operation may occur due to weak battery. Take measures such as detecting a weak battery by [E042] RTC Error and stopping the inverter or programs. When the LCD Operator is removed or disconnected, DriveProgramming is in a waiting status by the clock command.
- If the DriveProgramming stops during multi-function output, the output status is held. Take safety precautions such as stopping peripheral devices.

DriveProgramming Function

The details of the main DrvieProgramming function are as follows.

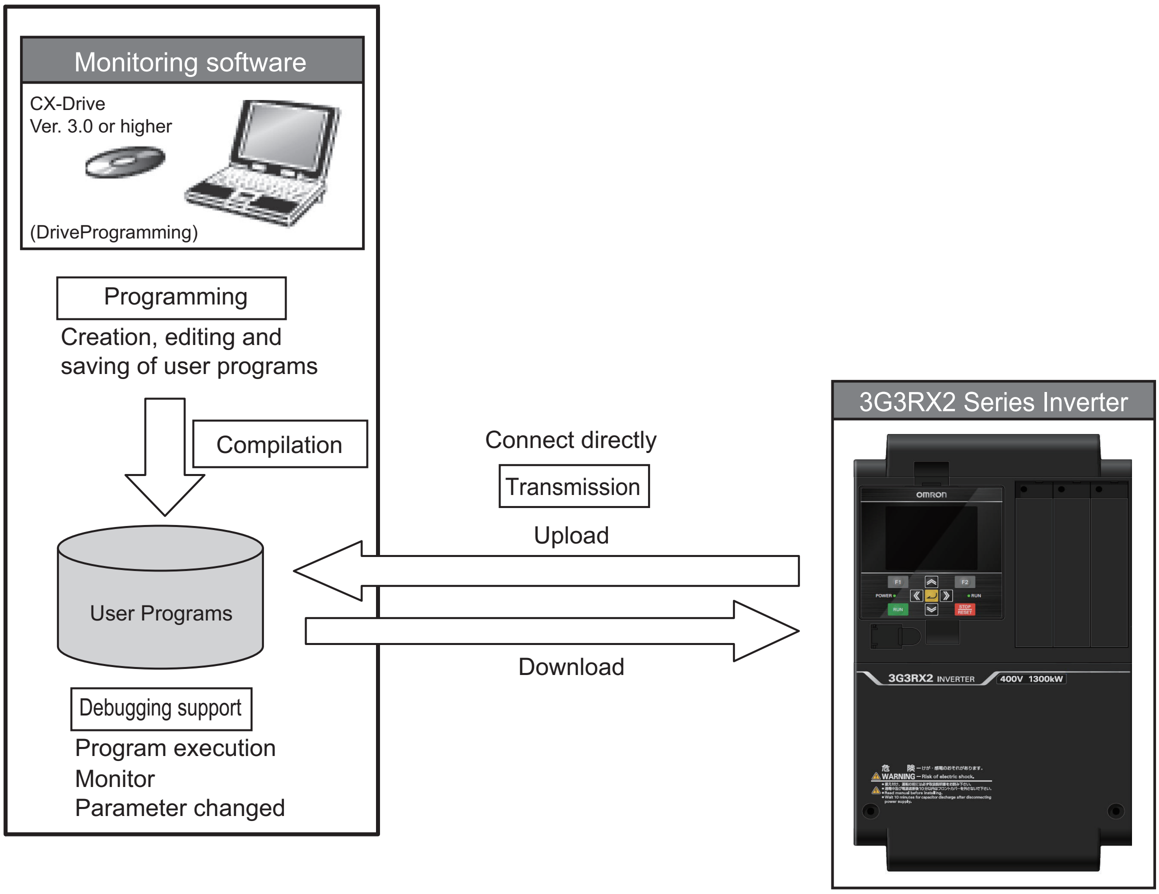
Item		Specifications
Program specifications	Programming language	Flowchart and text language method
	Input device	Windows Personnel Computer (As for supported operation system, refer to the *CX-One User's Manual* (Cat. No. W463).
	Program capacity	1024 steps max.: 6 KB (1024 steps max. for a total of 5 tasks)
	Programming support function	Functions supported in Inverter/Servo support tool CX-Drive • Program editing and display • Program compilation (Program syntax check) • Program downloading, uploading, and all clear
	Execution format	• Execution by interpreter • Execution cycle: 2 ms/step (5 commands executable through 5-task parallel processing) • Subroutine call supported (Nesting in 8 levels max.)

The main functions of the DriveProgramming Editor available in CX-Drive are as shown below.

Function	Description
Programming	Supports the creation, editing, saving, reading, and printing of user programs.
Compilation	Compiles a user programs.*1
Transfer	Downloads a user program to the inverter, or uploads a user program from the inverter.
Debugging support	Starts and stops the execution of a program. This allows the user to check the inverter status monitor etc.

*1. Compilation is the process to generate an intermediate code after a program check.

For details, refer to the *DriveProgramming User's Manual* (Cat. No. I622).


Monitoring software
CX-Drive
Ver. 3.0 or higher
(DriveProgramming)
Programming
Creation, editing and saving of user programs
Compilation
User Programs
Debugging support
Program execution
Monitor
Parameter changed
Connect directly
Transmission
Upload
Download
3G3RX2 Series Inverter

11

Options

This section describes the specifications and external dimension of peripheral equipment.

11-1 Overview of Optional Equipment

This section provides an overview of the optional equipment available with the 3G3RX2 Series Inverter. For details, refer to the manual for each optional product.

11-1-1 Part Names and Descriptions

Regenerative Braking Unit (Model: 3G3AX-RBU□□)/ Braking Resistor (Model: 3G3AX-RBA/RBB/RBC□□□□)

These products absorb the regenerative energy generated when a load decelerates or an elevating axis descends to prevent overvoltage trip of the inverter.

For details, refer to *External Braking Resistor Connection Terminal (P, RB)/ Regenerative Braking Unit Connection Terminal (P, N)* on page 2-55.

DC Reactor (Model: 3G3AX-DL□□□□)/ AC Reactor (Model: 3G3AX-AL□□□□)

Use these reactors to suppress harmonics generated from the inverter.

The AC reactor is used when the power supply voltage unbalance factor is 3% or more, the inverter capacity is 500 kVA or more, or rapid change in the power supply voltage occurs to reduce its effect.

The DC/AC reactor also has an effect of improving the power factor.

For details, refer to *2-3-4 Wiring for Main Circuit Terminals* on page 2-32 and *Harmonic Current Measures and DC/AC Reactor Wiring (PD, P)* on page 2-49.

Input Noise Filter (Model: 3G3AX-NFI□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to power supply lines.

For details, refer to *Installing Input Noise Filter* on page 2-48.

Output Noise Filter (Model: 3G3AX-NFO□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to the motor side wires.

For details, refer to *Installing Output Noise Filter* on page 2-53.

Radio Noise Filter (Model: 3G3AX-ZCL□)

Use this filter to reduce the radiated noise generated in the inverter and emitted from the power-supply line side and motor side wires.

For details, refer to *Measures against Radio Noise* on page 2-53.

EMC Noise Filter (Model: 3G3AX-EFI□□)

Use this filter to reduce the conductive noise generated in the inverter and transmitted to power supply lines for compliance with European EC Directives.

For details, refer to *2-3-10 Conditions of Conformity of EU Directives* on page 2-75.

11-2 Regenerative Braking Unit (Model: 3G3AX-RBU□□)

11-2-1 Specifications

Built-in Resistor Type (Model: 3G3AX-RBU21/RBU22/RBU41)

Applicable voltage class		3-phase 200-V class		3-phase 400-V class
Model		3G3AX-RBU21	3G3AX-RBU22	3G3AX-RBU41*1
Connection resistance		17 Ω min.	17 Ω min.	34 Ω min.
Operating voltage (ON/OFF)		ON: 362.5 ± 5 V OFF: 355 ± 5 V (–5% or –10% setting available)		ON: 725 ± 5 V OFF: 710 ± 5 V (–5% or –10% setting available)
Operation indication		LED ON (Lit)		
Maximum number of units for parallel interlocking operation*2		5 units		
Built-in resistor	Internal resistance	120 W, 180 Ω	120 W, 20 Ω	120 W, 180 Ω x 2 in series
	Allowable continuous ON time	10 s max.	0.5 s max.	10 s max.
	Allowable operation cycle	Cycle 1/10 (ON for 10 s/OFF for 90 s)	Cycle 1/80 (ON for 0.5 s/OFF for 40 s)	Cycle 1/10 (ON for 10 s/OFF for 90 s)
	Power consumption	Instantaneous: 0.73 kW Short-time rating: 120 W	Instantaneous: 6.6 kW Short-time rating: 120 W	Instantaneous: 1.46 kW Short-time rating: 240 W
Protective function	Built-in resistor overheat protection	Built-in relay specifications · Built-in resistor temperature: Relay is activated at approximately 200°C or higher and reset at approximately 170°C or lower. · Built-in thermal fuse (No resetting)*3 · Contact rating: 250 VAC 200 mA (R load) 12 VAC 500 mA (R load) 42 VDC 200 mA (R load) · Minimum load: 1 mA		
Operating environment	Operating ambient temperature	–10 to 50°C		
	Storage ambient temperature	–20 to 65°C		
	Operating ambient humidity	20% to 90% (with no condensation)		
	Vibration resistance	5.9 m/s^2 (0.6 G) 10 to 55 Hz		
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)		
Paint color		Munselle 5Y7/1 (except for cooling fan with aluminum base color)		

*1. To use the braking resistor (Model: 3G3AX-RAB/RBB/RBC) for the 400-V class regenerative braking unit, be sure to remove the built-in resistor and connect two resistors of the same model in series. Using a 400-V class regenerative braking unit with only a single braking resistor connected may cause damage to the braking resistor.

*2. Use DIP switches to set the number of connected units.

*3. The built-in resistor has a thermal fuse. If the alarm terminals are not connected, the fuse may blow out in order to prevent the resistor from burning due to overheating. If the fuse blows out, the built-in resistor must be replaced.

External Resistor Type (Model: 3G3AX-RBU23/RBU24/RBU42/RBU43)

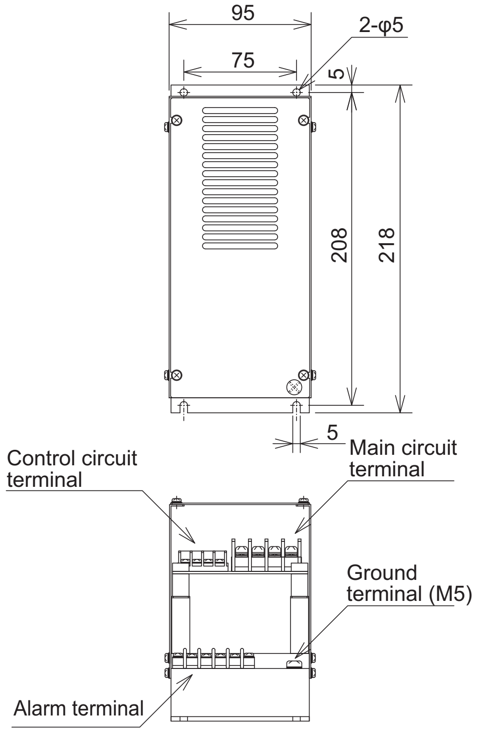
Applicable voltage class		3-phase 200-V class		3-phase 400-V class	
Model		3G3AX-RBU23	3G3AX-RBU24	3G3AX-RBU42*1	3G3AX-RBU43*1
Connection resistance	Continuous operation	6 Ω min.	4 Ω min.	24 Ω min.	12 Ω min.
	Short-time operation/ Allowable operation cycle/ Allowable continuous ON time	4 Ω min. Cycle 1/5 (ON for 2 min/ OFF for 8 min) 2 min	2 Ω min. Cycle 1/5 (ON for 2 min/ OFF for 8 min) 2 min	10 Ω min. Cycle 1/10 (ON for 10 s/ OFF for 90 s) 10 s	6 Ω min. Cycle 1/5 (ON for 2 min/ OFF for 8 min) 2 min
Operating voltage (ON/OFF)		ON: 362.5 ± 5 V, OFF: 355 ± 5 V (–5% or –10% setting available)		ON: 725 ± 5 V, OFF: 710 ± 5 V (–5% or –10% setting available)	
Operation indication		LED ON (Lit)			
Maximum number of units for parallel interlocking operation*2		2 units			
Protective function	Internal power module overheat protection	Built-in relay specifications · Cooling fin temperature: Relay operates at approximately 100°C or higher. · Contact rating: 240 VAC 3A (R load) 36 VDC 2A (R load) · Minimum load: 5 VDC 50 mA (R load)			
Operating environment	Operating ambient temperature	–10 to 50°C			
	Storage ambient temperature	–20 to 65°C			
	Operating ambient humidity	20% to 90% (with no condensation)			
	Vibration resistance	4.9 m/s^2 (0.5 G), 10 to 55 Hz			
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)			
Paint color		Munselle 5Y7/1 (except for cooling fan with aluminum base color)			

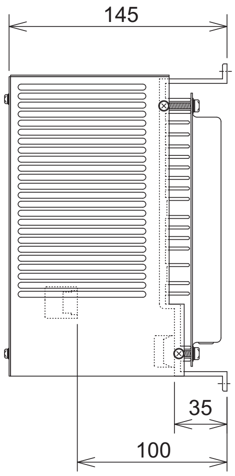
*1. To use the braking resistor (3G3AX-RAB/RBB/RBC) for the 400-V class regenerative braking unit, be sure to remove the built-in resistor and connect two resistors of the same model in series. Using a 400-V class regenerative braking unit with only a single braking resistor connected may cause damage to the braking resistor.

*2. Use DIP switches to set the number of connected units.

11-2-2 External Dimensions

3G3AX-RBU21/RBU22/RBU41





Main circuit terminal
Terminal width 9, M4 screw

N	RB	P	P

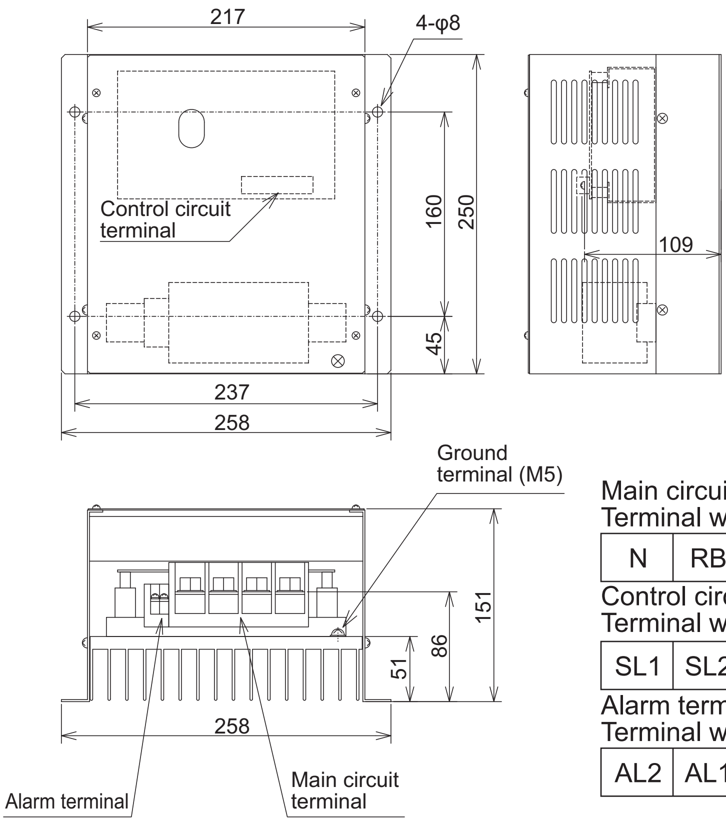
Control circuit terminal
Terminal width 6, M3 screw

SL1	SL2	MA1	MA2

Ground terminal
Terminal width 7, M3 screw

AL1	AL2	R1	R2

3G3AX-RBU23



Main circuit terminal
Terminal width 23, M8 screw

N	RB	P	P

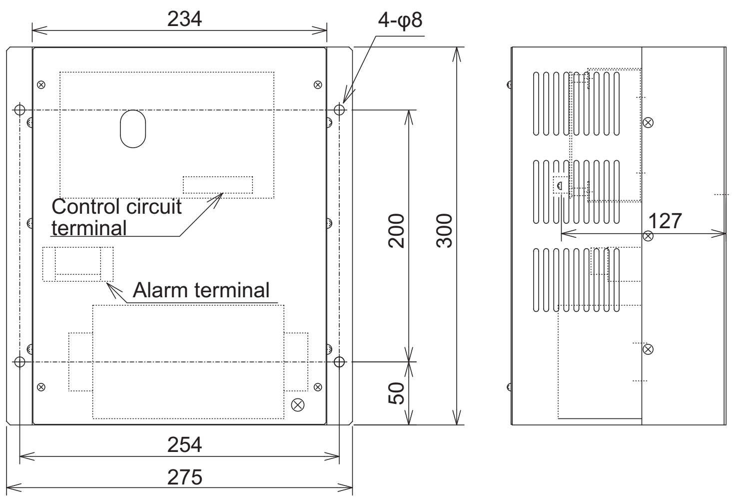
Control circuit terminal
Terminal width 6.4, M3 screw

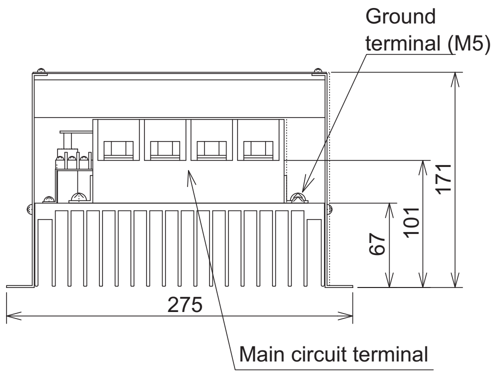
SL1	SL2	MA1	MA2

Alarm terminal
Terminal width 5.9, M3 screw

AL2	AL1

3G3AX-RBU24





Main circuit terminal
Terminal width 33, M10 screw

N	RB	P	P

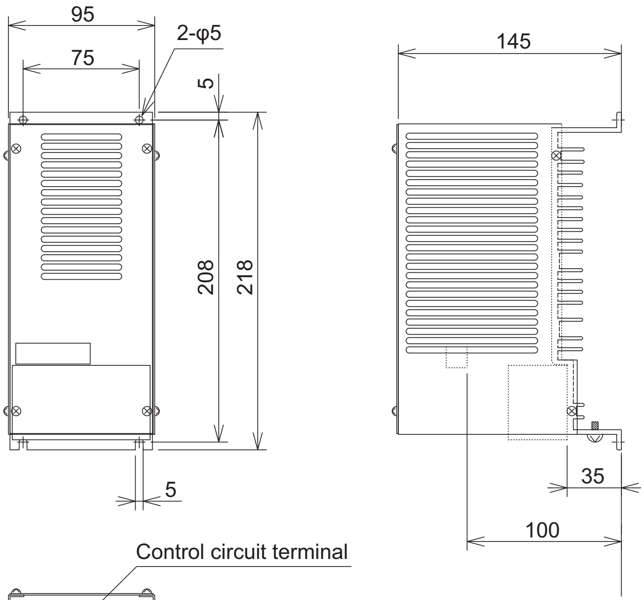
Control circuit terminal
Terminal width 6.4, M3 screw

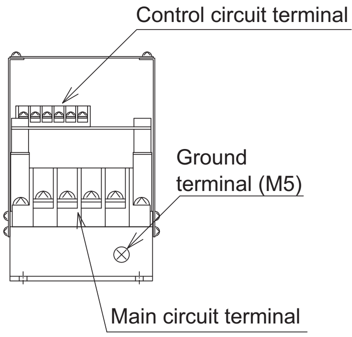
SL1	SL2	MA1	MA2

Alarm terminal
Terminal width 7.5, M3 screw

AL2	AL1

3G3AX-RBU42





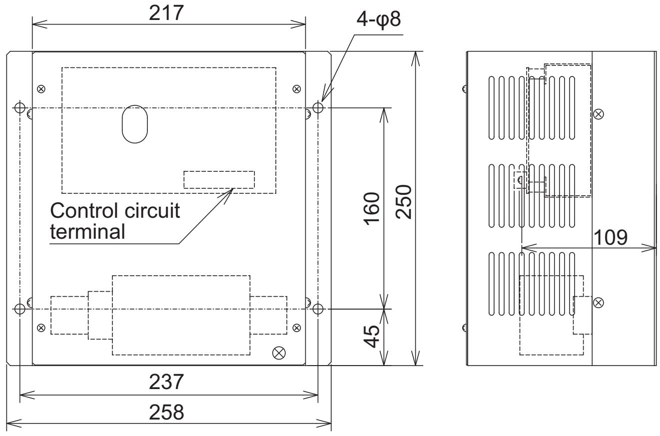
Main circuit terminal
Terminal width 13, M5 screw

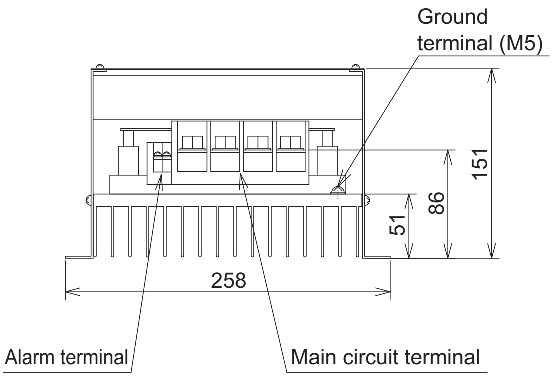
N	RB	P	P

Control circuit terminal
Terminal width 6, M3 screw

SL1	SL2	MA1	MA2	AL1	AL2

3G3AX-RBU43





Main circuit terminal
Terminal width 23, M8 screw

N	RB	P	P

Control circuit terminal
Terminal width 6.4, M3 screw

SL1	SL2	MA1	MA2

Alarm terminal
Terminal width 5.9, M3 screw

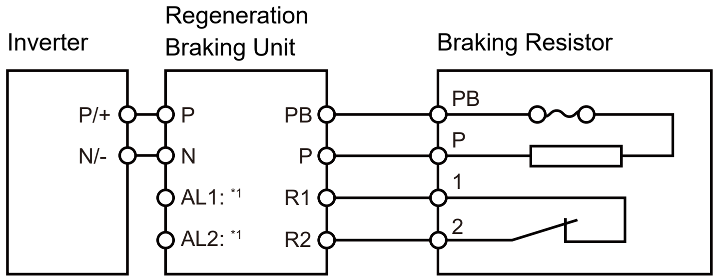
AL2	AL1

11-2-3 Connection Examples

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P, RB)/ Regenerative Braking Unit Connection Terminal (P, N)* on page 2-55 in this manual.

When you desire to shorten a motor deceleration time, use an inverter combined with a braking resistor.

Example of Connection



*1. Alarm output terminal for the regeneration braking unit
When a thermal relay for its built-in resistor or the braking resistor as an option is operated, set a circuit to shut the power supply of the inverter at the primary side.

Precautions for Correct Use

A thermal fuse is built in the braking resistor (RBA, RBB and RBC). After an alarm is issued from the thermal relay between terminals 1 and 2, overheat may result in a breakage of the thermal fuse. If the fuse is broken, the braking resistor can’t be restored. Replace the braking resistor with new one.

Wire the alarm output terminals properly. When thermal abnormality is detected, stop the inverter operation and cool the braking resistor thoroughly. After that, start the inverter.

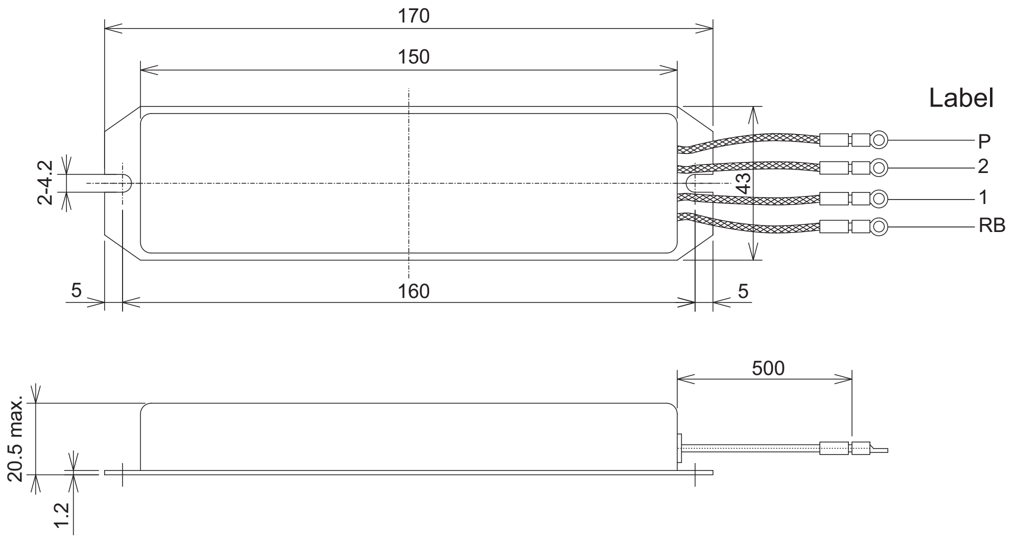
11-3 Braking Resistor (Model: 3G3AX-RBA/RBB/RBC□□□□)

11-3-1 Specifications

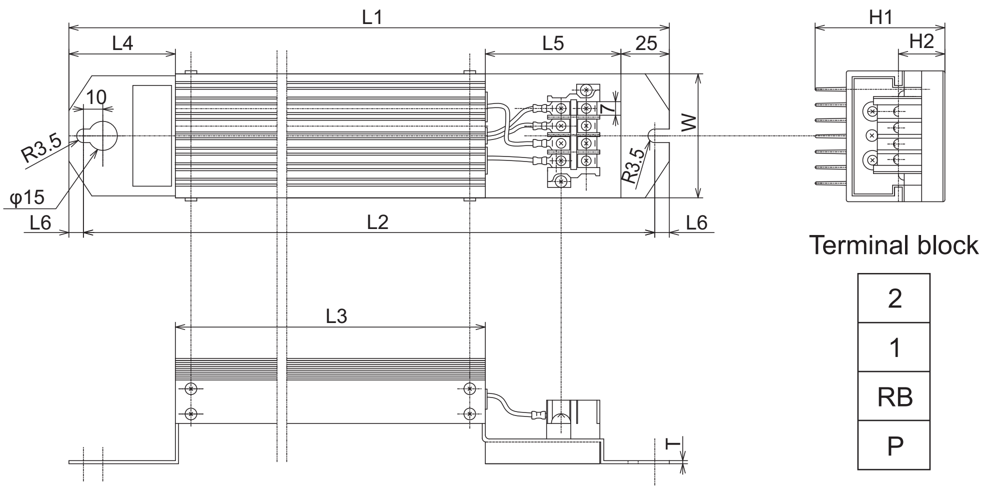
Model		Compact type (Model: 3G3AX-RBA□□□□)				Standard type (Model: 3G3AX-RBB□□□□)				Medium capacity type (Model: 3G3AX-RBC□□□□)		
		1201	1202	1203	1204	2001	2002	3001	4001	4001	6001	12001
Resistance	Capacity	120 W				200 W		300 W	400 W	400 W	600 W	1200 W
	Resistance [Ω]	180	100	50	35	180	100	50	35	50	35	17
Allowable braking frequency [%]		5	2.5	1.5	1.0	10	7.5	7.5	7.5	10		
Allowable continuous braking time [s]		20	12	5	3	30			20	10		
Weight [kg]		0.27				0.97		1.68	2.85	2.5	3.6	6.5
Error detection function		Built-in thermal (Contact capacity: 240 VAC 2A max., minimum current: 5 mA) Normally ON (NC contact) Built-in thermal fuse (No resetting)								Built-in thermal relay: Normally ON (NC contact) Contact capacity: 240 VAC 3 A (resistance load) 0.2 A (L load), 36 VDC 2 A (resistance load)		
General specifications	Operating ambient temperature	–10 to 50°C										
	Storage ambient temperature	–20 to 65°C										
	Operating ambient humidity	20% to 90% (with no condensation)										
	Vibration resistance	5.9 m/s^2 (0.6 G) 10 to 55 Hz										
	Location	At a maximum altitude of 1,000 m (without corrosive gases or dust)										
	Cooling method	Self-cooling										

11-3-2 External Dimensions

3G3AX-RBA□□□□

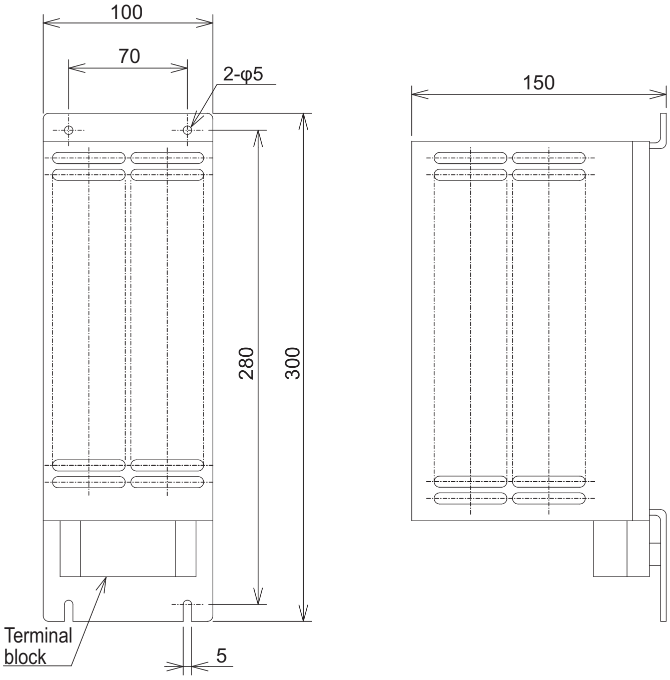


3G3AX-RBB□□□□



Model	Rated capac-ity [W]	Resis-tance [Ω]	Dimensions [mm]										Weight [kg]	Termi-nal screw
			L1	L2	L3	L4	L5	L6	H1	H2	W	T		
3G3AX-RBB2001	200	180	310	295	160	55	70	7.5	67	12	64	1.6	0.97	M3.5
3G3AX-RBB2002	200	100	310	295	160	55	70	7.5	67	12	64	1.6	0.97	
3G3AX-RBB3001	300	50	470	455	320	55	70	7.5	67	12	64	1.6	1.68	
3G3AX-RBB4001	400	35	435	422	300	50	60	6.5	94	15	76	2	2.85	

3G3AX-RBC4001

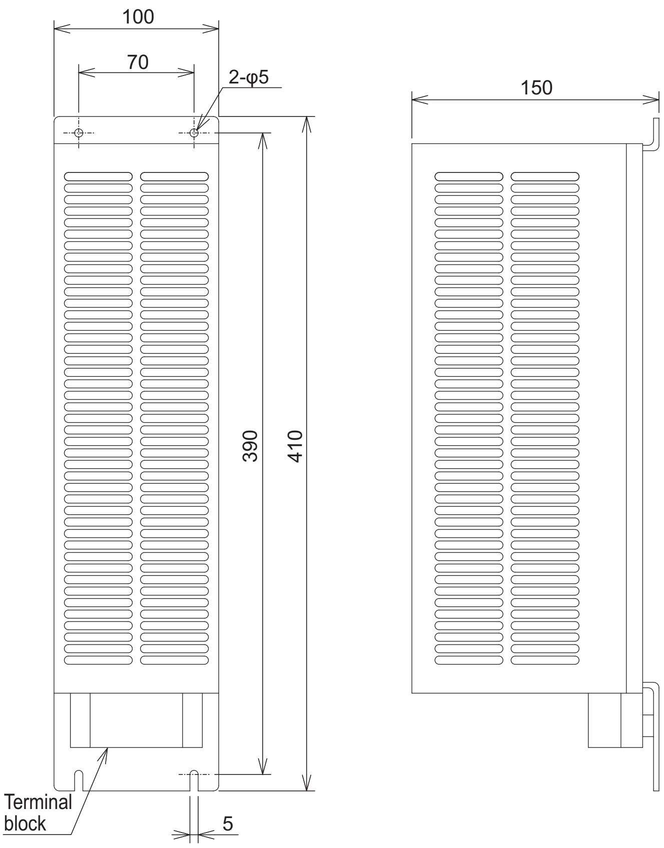


Terminal block

P	RB	AL1	AL2

Terminal width 9 mm
Screw M4

3G3AX-RBC6001

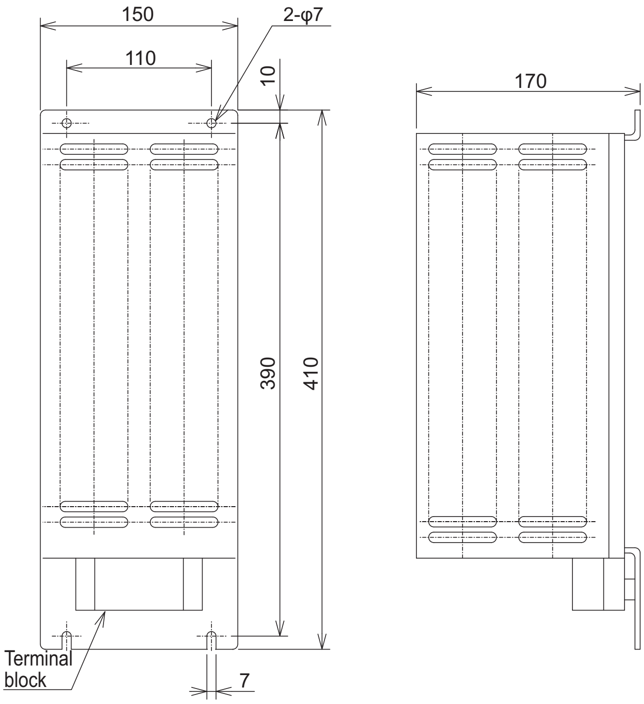


Terminal block

P	RB	AL1	AL2

Terminal width 9 mm
Screw M4

3G3AX-RBC12001



Terminal block

P	RB	AL1	AL2

Terminal width 9 mm
Screw M4

11-3-3 Connection Example

For how to connect regenerative braking unit(s), refer to *External Braking Resistor Connection Terminal (P, RB)/ Regenerative Braking Unit Connection Terminal (P, N)* on page 2-55 in this manual.

11-4 Regenerative Braking Unit and Braking Resistor Combination Selection Table

Select the combination of the regenerative braking unit(s) and the braking resistor(s) as follows, according to your inverter.

If the usage rate exceeds 10% ED, or if you need a torque larger than the approximate braking torque, you need to follow the instruction provided in *A-3 Overview of Inverter Selection* on page A-25.

- Inverter:
  Select the model of your inverter.
  The table below assumes that your inverter is used in the heavy load mode and connected to a single motor with the same capacity.
  Make sure that the approximate braking torque in the table shows the assumed value per a motor with the same capacity at ND mode. When using this inverter at LD or VLD mode, you need to calculate the torque value by dividing VLD by ND.
- Operating conditions:
  Show the torque during deceleration and the deceleration time (in % ED) calculated as a percentage of the cycle time for 1 cycle of operation including the stop time.
- Braking unit/Braking resistor:
  Show the required model and number of units.
- Connection form:
  Shows the configuration of the regenerative braking unit(s) and braking resistor(s) illustrated in the connection form table below.
- Restrictions:
  Show the maximum deceleration time allowable for the combination shown here and the minimum resistance that can be connected to the inverter's built-in regenerative braking circuit or external regenerative braking unit(s).

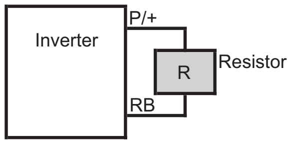
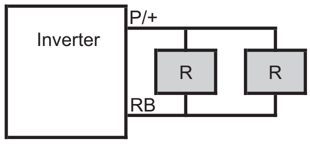
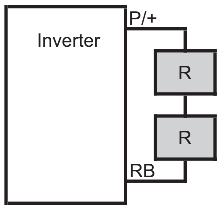
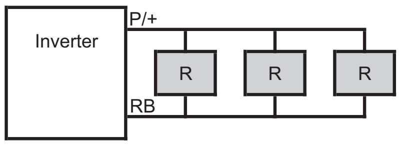
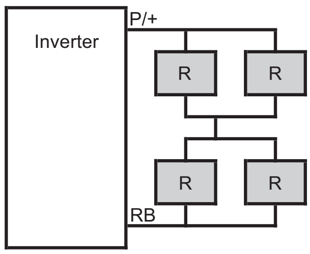
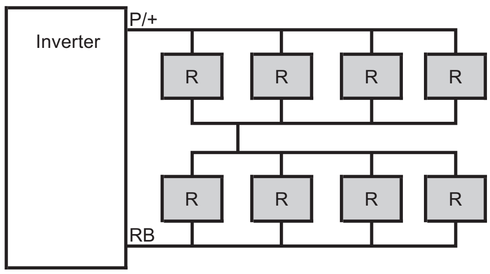
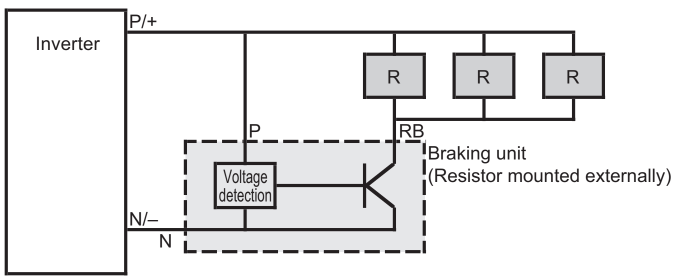
Inverter			Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
200-V class	0.4	3G3RX2-A2004	3%	220%	Built into unit	–	3G3AX-RBA1201	1	1	20	50
			10.0%	220%		–	3G3AX-RBB2001	1	1	30	50
	0.75	3G3RX2-A2007	3.0%	120%	Built into unit	–	3G3AX-RBA1201	1	1	20	50
			10.0%	120%		–	3G3AX-RBB2001	1	1	30	50
	1.5	3G3RX2-A2015	2.5%	110%	Built into unit	–	3G3AX-RBA1202	1	1	12	35
			10.0%	215%		–	3G3AX-RBC4001	1	1	10	35
	2.2	3G3RX2-A2022	3.0%	150%	Built into unit	–	3G3AX-RBB3001	1	1	30	35
			10.0%	150%		–	3G3AX-RBC4001	1	1	10	35

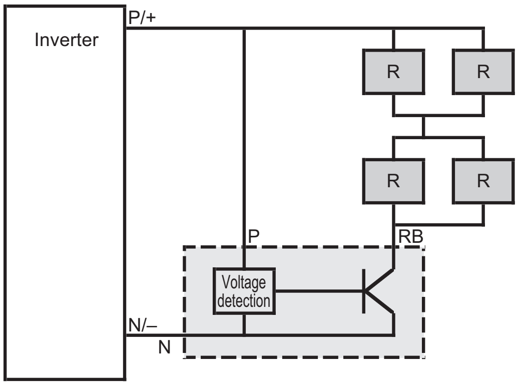
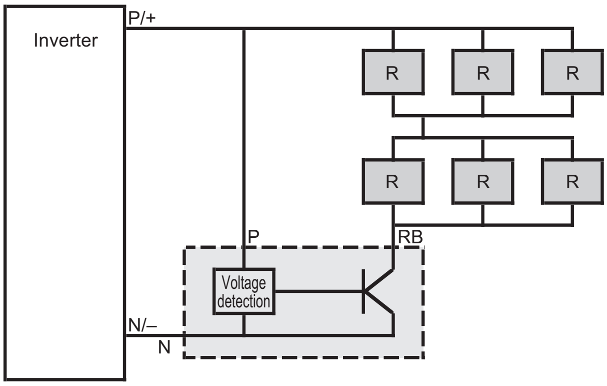
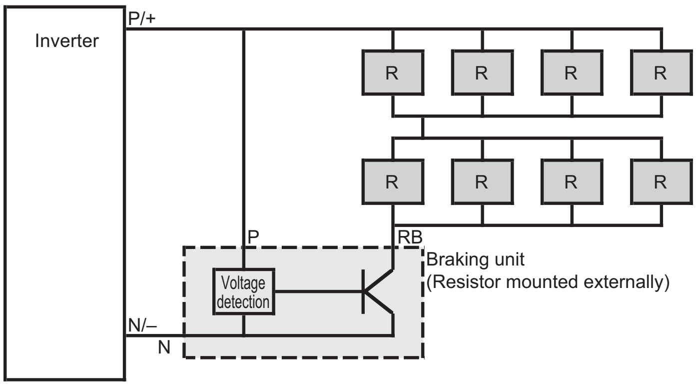
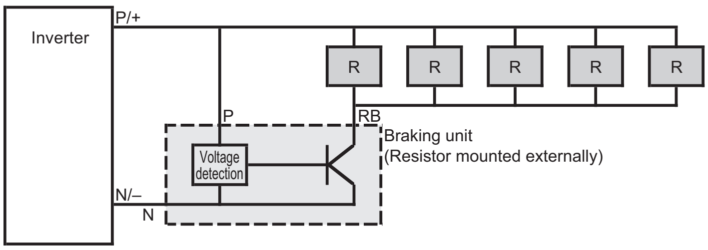
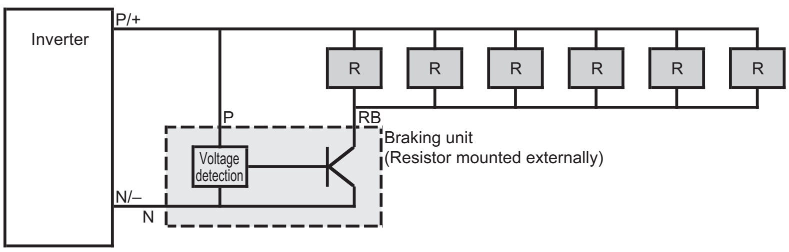
Inverter			Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
200-V class	3.7	3G3RX2-A2037	3.0%	125%	Built into unit	–	3G3AX-RBB4001	1	1	20	35
			10.0%	125%		–	3G3AX-RBC6001	1	1	10	35
	5.5	3G3RX2-A2055	3%	120%	Built into unit	–	3G3AX-RBB3001	2	2	30	16
			10.0%	120%		–	3G3AX-RBC4001	2	2	10	16
	7.5	3G3RX2-A2075	3.0%	125%	Built into unit	–	3G3AX-RBB4001	2	2	20	10
			10.0%	125%		–	3G3AX-RBC6001	2	2	10	10
	11	3G3RX2-A2110	3.0%	125%	Built into unit	–	3G3AX-RBB4001	3	4	20	10
			10.0%	125%		–	3G3AX-RBC6001	3	4	10	10
	15	3G3RX2-A2150	3.0%	130%	Built into unit	–	3G3AX-RBC12001	2	2	10	7.5
			10.0%	130%		–	3G3AX-RBC12001	2	2	10	7.5
	18.5	3G3RX2-A2185	3.0%	105%	Built into unit	–	3G3AX-RBC12001	2	2	10	7.5
			10.0%	105%		–	3G3AX-RBC12001	2	2	10	7.5
	22	3G3RX2-A2220	3.0%	130%	Built into unit	–	3G3AX-RBC12001	3	4	10	5
			10.0%	130%		–	3G3AX-RBC12001	3	4	10	5
	30	3G3RX2-A2300	3.0%	160%	3G3AX-RBU24	1	3G3AX-RBC12001	5	11	10	2
			10.0%	160%	3G3AX-RBU24	1	3G3AX-RBC12001	5	11	10	2
	37	3G3RX2-A2370	3.0%	130%	3G3AX-RBU24	1	3G3AX-RBC12001	5	11	10	2
			10.0%	130%	3G3AX-RBU24	1	3G3AX-RBC12001	5	11	10	2
	45	3G3RX2-A2450	3.0%	130%	3G3AX-RBU24	1	3G3AX-RBC12001	6	12	10	2
			10.0%	130%	3G3AX-RBU24	1	3G3AX-RBC12001	6	12	10	2
	55	3G3RX2-A2550	3.0%	120%	3G3AX-RBU24	1	3G3AX-RBC12001	7	13	10	2
			10.0%	120%	3G3AX-RBU24	1	3G3AX-RBC12001	7	13	10	2

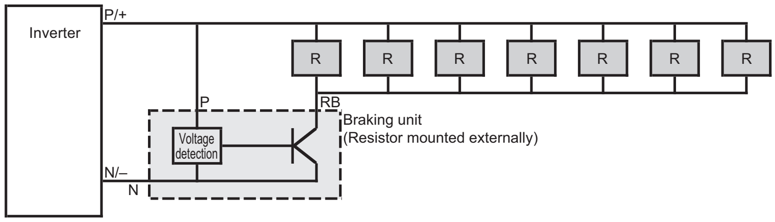
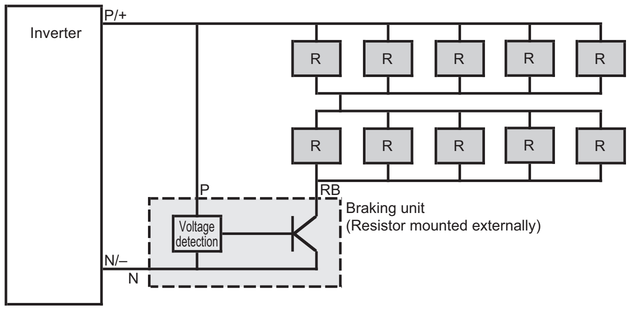
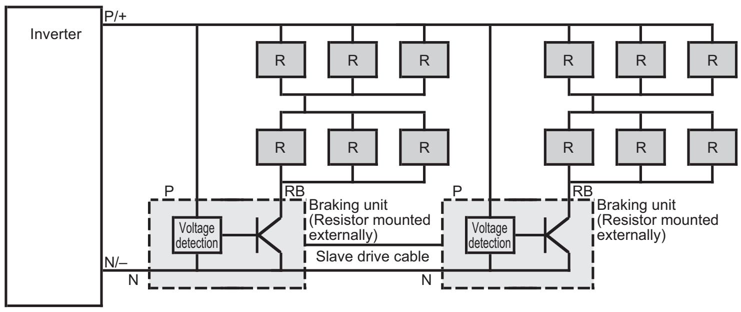
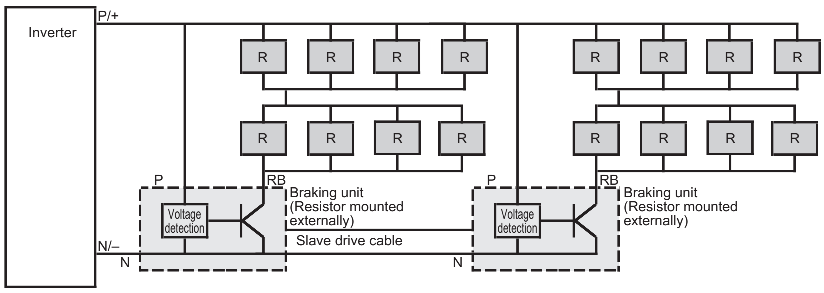
Inverter			Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
400-V class	0.75	3G3RX2-A4007	3.0%	220%	Built into unit	–	3G3AX-RBA1201	2	3	20	100
			10.0%	220%		–	3G3AX-RBB2001	2	3	30	100
	1.5	3G3RX2-A4015	3.0%	120%	Built into unit	–	3G3AX-RBA1201	2	3	20	100
			10.0%	120%		–	3G3AX-RBB2001	2	3	30	100
	2.2	3G3RX2-A4022	2.5%	150%	Built into unit	–	3G3AX-RBA1202	2	3	12	100
			10.0%	220%		–	3G3AX-RBC4001	2	3	10	100
	3.7	3G3RX2-A4037	3.0%	175%	Built into unit	–	3G3AX-RBB3001	2	3	30	70
			10.0%	175%		–	3G3AX-RBC4001	2	3	10	70
	5.5	3G3RX2-A4055	3.0%	120%	Built into unit	–	3G3AX-RBB3001	2	3	30	70
			10.0%	120%		–	3G3AX-RBC4001	2	3	10	70
	7.5	3G3RX2-A4075	3.0%	125%	Built into unit	–	3G3AX-RBB4001	2	3	20	35
			10.0%	125%		–	3G3AX-RBC6001	2	3	10	35
	11	3G3RX2-A4110	3.0%	120%	Built into unit	–	3G3AX-RBB3001	4	5	30	35
			10.0%	120%		–	3G3AX-RBC4001	4	5	10	35
	15	3G3RX2-A4150	3.0%	125%	Built into unit	–	3G3AX-RBB4001	4	5	20	24
			10.0%	125%		–	3G3AX-RBC6001	4	5	10	24
	18.5	3G3RX2-A4185	3.0%	140%	Built into unit	–	3G3AX-RBB3001	8	6	30	24
			10.0%	140%		–	3G3AX-RBC4001	8	6	10	24
	22	3G3RX2-A4220	3.0%	120%	Built into unit	–	3G3AX-RBB3001	8	6	30	20
			10.0%	120%		–	3G3AX-RBC4001	8	6	10	20
	30	3G3RX2-A4300	10.0%	100%	Built into unit	1	3G3AX-RBC12001	4	5	10	15
			10.0%	150%	3G3AX-RBU42	1	3G3AX-RBC12001	6	9	10	10
	37	3G3RX2-A4370	3.0%	100%	Built into unit	1	3G3AX-RBC12001	4	5	10	15
			10.0%	155%	3G3AX-RBU43	1	3G3AX-RBC12001	6	9	10	6

Inverter			Operating conditions		Braking unit		Braking resistor		Connection form	Restrictions	
Voltage class	Max. applicable motor capacity [kW]	Model	%ED [%]	Approximate braking torque [%]	Model	No. of units	Model	No. of units		Allowable continuous ON time [s]	Min. connection resistance [Ω]
400-V class	45	3G3RX2-A4450	3.0%	130%	3G3AX-RBU43	1	3G3AX-RBC12001	6	9	10	6
			10.0%	130%	3G3AX-RBU43	1	3G3AX-RBC12001	6	9	10	6
	55	3G3RX2-A4550	3.0%	140%	3G3AX-RBU43	1	3G3AX-RBC12001	8	10	10	6
			10.0%	140%	3G3AX-RBU43	1	3G3AX-RBC12001	8	10	10	6
	75	3G3RX2-B4750	3.0%	130%	3G3AX-RBU43	1	3G3AX-RBC12001	10	14	10	6
			10.0%	130%	3G3AX-RBU43	1	3G3AX-RBC12001	10	14	10	6
	90	3G3RX2-B4900	3.0%	105%	3G3AX-RBU43	1	3G3AX-RBC12001	10	14	10	6
			10.0%	105%	3G3AX-RBU43	1	3G3AX-RBC12001	10	14	10	6
	110	3G3RX2-B411K	3.0%	105%	3G3AX-RBU43	2	3G3AX-RBC12001	12	15	10	6
			10.0%	105%	3G3AX-RBU43	2	3G3AX-RBC12001	12	15	10	6
	132	3G3RX2-B413K	3.0%	115%	3G3AX-RBU43	2	3G3AX-RBC12001	16	16	10	6
			10.0%	115%	3G3AX-RBU43	2	3G3AX-RBC12001	16	16	10	6

Connection Form Table

No.	Connection form	
1	1 resistor unit	
2	2 resistor units connected in paral-lel	
3	2 resistor units series-connected	
4	3 resistor units connected in paral-lel	
5	2 groups of 2 parallel resistor units are series-connected	
6	2 groups of 4 parallel resistor units are series-connected	
7	1 braking unit and 3 resistor units connected in paral-lel	

No.	Connection form	
8	1 Braking unit and 2 groups of 2 parallel resistor units are series-connected	
9	1 Braking unit and 2 groups of 3 parallel resistor units are series-connected	
10	1 Braking unit and 2 groups of 4 parallel resistor units are series-connected	
11	1 Braking unit and 5 resistor units connected in paral-lel	
12	1 Braking unit and 6 resistor units connected in paral-lel	

No.		Connection form
13	1 Braking unit and 7 resistor units connected in parallel	
14	1 Braking unit and 2 groups of 5 parallel resistor units are series-connected	
15	2 Braking units and 2 groups of 3 parallel resistor units are each series-connected	
16	2 Braking units and 2 groups of 4 parallel resistor units are each series-connected	

11-5 DC Reactor (Model: 3G3AX-DL□□□□)

11-5-1 Specifications

Inverter						DC reactor specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Inductance [mH]	Heat generation [W]	Operating ambient temperature/ humidity	Location
200-V class	0.4	3G3RX2-A2004	ND	0.4	3.3	3G3AX-DL2004	10.7	8	–10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			LD	0.75	3.9	3G3AX-DL2007	6.75	15		
			VLD	0.75	3.9					
	0.75	3G3RX2-A2007	ND	0.75	5.5					
			LD	1.5	7.2	3G3AX-DL2015	3.51	25		
			VLD	1.5	7.2					
	1.5	3G3RX2-A2015	ND	1.5	8.3					
			LD	2.2	10.8	3G3AX-DL2022	2.51	35		
			VLD	2.2	10.8					
	2.2	3G3RX2-A2022	ND	2.2	12					
			LD	3.7	13.9	3G3AX-DL2037	1.60	45		
			VLD	3.7	13.9					
	3.7	3G3RX2-A2037	ND	3.7	18					
			LD	5.5	23	3G3AX-DL2055	1.11	55		
			VLD	5.5	23					
	5.5	3G3RX2-A2055	ND	5.5	26					
			LD	7.5	37	3G3AX-DL2075	0.84	95		
			VLD	7.5	37					
	7.5	3G3RX2-A2075	ND	7.5	35					
			LD	11	48	3G3AX-DL2110	0.59	80		
			VLD	11	48					
	11	3G3RX2-A2110	ND	11	51					
			LD	15	64	3G3AX-DL2150	0.44	135		
			VLD	15	64					
	15	3G3RX2-A2150	ND	15	70					
			LD	18.5	80	3G3AX-DL2220	0.30	200		
			VLD	18.5	80					
	18.5	3G3RX2-A2185	ND	18.5	84					
			LD	22	94					
			VLD	22	94					
	22	3G3RX2-A2220	ND	22	105					
			LD	30	120	3G3AX-DL2300	0.23	220		
			VLD	30	120					
	30	3G3RX2-A2300	ND	30	133					
			LD	37	150	3G3AX-DL2370	0.19	275		
			VLD	37	150					
	37	3G3RX2-A2370	ND	37	160					
			LD	45	186	3G3AX-DL2450	0.16	335		
			VLD	45	186					
	45	3G3RX2-A2450	ND	45	200					
			LD	55	240	3G3AX-DL2550	0.13	360		
			VLD	55	240					
	55	3G3RX2-A2550	ND	55	242					
			LD	75	280	–	–	–	–	–
			VLD	75	280					

Inverter						DC reactor specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Inductance [mH]	Heat generation [W]	Operating ambient temperature/ humidity	Location
400-V class	0.75	3G3RX2-A4007	LD	1.5	4.3	3G3AX-DL4015	14.0	25	–10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			VLD	1.5	4.3					
	1.5	3G3RX2-A4015	ND	1.5	4.2					
			LD	2.2	5.9	3G3AX-DL4022	10.1	35		
			VLD	2.2	5.9					
	2.2	3G3RX2-A4022	ND	2.2	5.8					
			LD	3.7	8.1	3G3AX-DL4037	6.4	45		
			VLD	3.7	8.1					
	3.7	3G3RX2-A4037	ND	3.7	9.8					
			LD	5.5	13.3	3G3AX-DL4055	4.41	55		
			VLD	5.5	13.3					
	5.5	3G3RX2-A4055	ND	5.5	15					
			LD	7.5	20	3G3AX-DL4075	3.35	95		
			VLD	7.5	20					
	7.5	3G3RX2-A4075	ND	7.5	21					
			LD	11	24	3G3AX-DL4110	2.33	80		
			VLD	11	24					
	11	3G3RX2-A4110	ND	11	28					
			LD	15	32	3G3AX-DL4150	1.75	135		
			VLD	15	32					
	15	3G3RX2-A4150	ND	15	35					
			LD	18.5	41	3G3AX-DL4220	1.20	200		
			VLD	18.5	41					
	18.5	3G3RX2-A4185	ND	18.5	42					
			LD	22	47					
			VLD	22	47					
	22	3G3RX2-A4220	ND	22	53					
			LD	30	63	3G3AX-DL4300	0.92	230		
			VLD	30	63					
	30	3G3RX2-A4300	ND	30	64					
			LD	37	77	3G3AX-DL4370	0.74	275		
			VLD	37	77					
	37	3G3RX2-A4370	ND	37	83					
			LD	45	94	3G3AX-DL4450	0.61	340		
			VLD	45	94					
	45	3G3RX2-A4450	ND	45	100					
			LD	55	116	3G3AX-DL4550	0.5	400		
			VLD	55	116					
	55	3G3RX2-A4550	ND	55	121					
			LD	75	149	–	–	–	–	–
			VLD	75	149					

11-5-2 External Dimensions

Inverter input power supply	Model	Fig. No.	Applicable motor capacity [kW]	Dimensions [mm]									Weight [kg]	Standard applicable wire
				W	D	H	A	B	X	Y	C	K		
3/1-phase 200 VAC	3G3AX-DL2002	Fig. 1	0.2	66	90	98	–	85	56	72	5.2 × 8	M4	0.8	1.25 mm^2 min.
	3G3AX-DL2004		0.4	66	90	98	–	95	56	72	5.2 × 8	M4	1.0	1.25 mm^2 min.
	3G3AX-DL2007		0.75	66	90	98	–	105	56	72	5.2 × 8	M4	1.3	2 mm^2 min.
	3G3AX-DL2015		1.5	66	90	98	–	115	56	72	5.2 × 8	M4	1.6	2 mm^2 min.
	3G3AX-DL2022		2.2	86	100	116	–	105	71	80	6 × 9	M4	2.1	2 mm^2 min.
	3G3AX-DL2037		3.7	86	100	118	–	120	71	80	6 × 9	M4	2.6	3.5 mm^2 min.
	3G3AX-DL2055	Fig. 2	5.5	111	100	210	–	110	95	80	7 × 11	M5	3.6	8 mm^2 min.
	3G3AX-DL2075		7.5	111	100	212	–	120	95	80	7 × 11	M6	3.9	14 mm^2 min.
	3G3AX-DL2110		11	146	120	252	–	110	124	96	7 × 11	M6	6.5	22 mm^2 min.
	3G3AX-DL2150		15	146	120	256	–	120	124	96	7 × 11	M8	7.0	38 mm^2 min.
	3G3AX-DL2220	Fig. 3	18.5, 22	120	175	356	140	145	98	151	7 × 11	M8	9.0	60 mm^2 min.
	3G3AX-DL2300		30	120	175	386	155	150	98	151	7 × 11	M8	13.0	38 mm^2 x 2 min.
	3G3AX-DL2370		37	120	175	390	155	150	98	151	7 × 11	M10	13.5	38 mm^2 x 2 min.
	3G3AX-DL2450		45	160	190	420	180	150	120	168	7 × 11	M10	19.0	60 mm^2 x 2 min.
	3G3AX-DL2550		55	160	190	424	180	180	120	168	7 × 11	M12	24.0	80 mm^2 x 2 min.
3-phase 400 VAC	3G3AX-DL4007	Fig. 1	0.75	66	90	98	–	95	56	72	5.2 × 8	M4	1.1	1.25 mm^2 min.
	3G3AX-DL4015		1.5	66	90	98	—	115	56	72	5.2 × 8	M4	1.6	2 mm^2 min.
	3G3AX-DL4022		2.2	86	100	116	–	105	71	80	6 × 9	M4	2.1	2 mm^2 min.
	3G3AX-DL4037		3.7	86	100	116	—	120	71	80	6 × 9	M4	2.6	2 mm^2 min.
	3G3AX-DL4055		5.5	111	100	138	–	110	95	80	7 × 11	M4	3.6	3.5 mm^2 min.
	3G3AX-DL4075		7.5	111	100	138	–	115	95	80	7 × 11	M4	3.9	3.5 mm^2 min.

Inverter input power supply	Model	Fig. No.	Applica-ble motor capacity [kW]	Dimensions [mm]									Weight [kg]	Standard appli-cable wire
				W	D	H	A	B	X	Y	C	K		
3-phase 400 VAC	3G3AX-DL4110	Fig. 2	11	146	120	250	–	105	124	96	7 × 11	M5	5.2	5.5 mm^2 min.
	3G3AX-DL4150		15	146	120	252	–	120	124	96	7 × 11	M6	7.0	14 mm^2 min.
	3G3AX-DL4220	Fig. 3	18.5, 22	120	175	352	140	145	98	151	7 × 11	M6	9.5	22 mm^2 min.
	3G3AX-DL4300		30	120	175	356	140	145	98	151	7 × 11	M8	9.5	30 mm^2 min.
	3G3AX-DL4370		37	120	175	386	155	150	98	151	7 × 11	M8	13.5	38 mm^2 min.
	3G3AX-DL4450		45	160	190	416	180	145	120	168	7 × 11	M8	16.5	60 mm^2 min.
	3G3AX-DL4550		55	160	190	416	190	170	120	168	7 × 11	M8	23.0	38 mm^2 x 2 min.

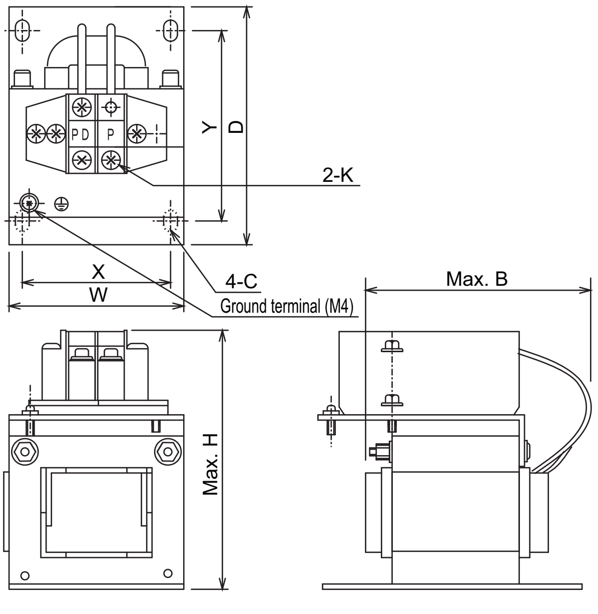


Fig. 1

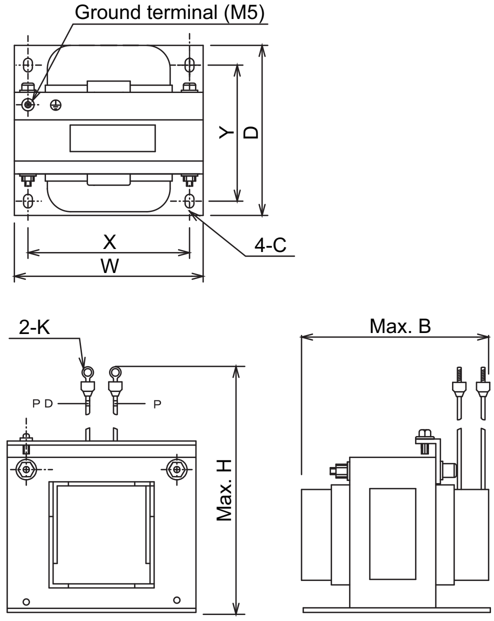


Fig. 2

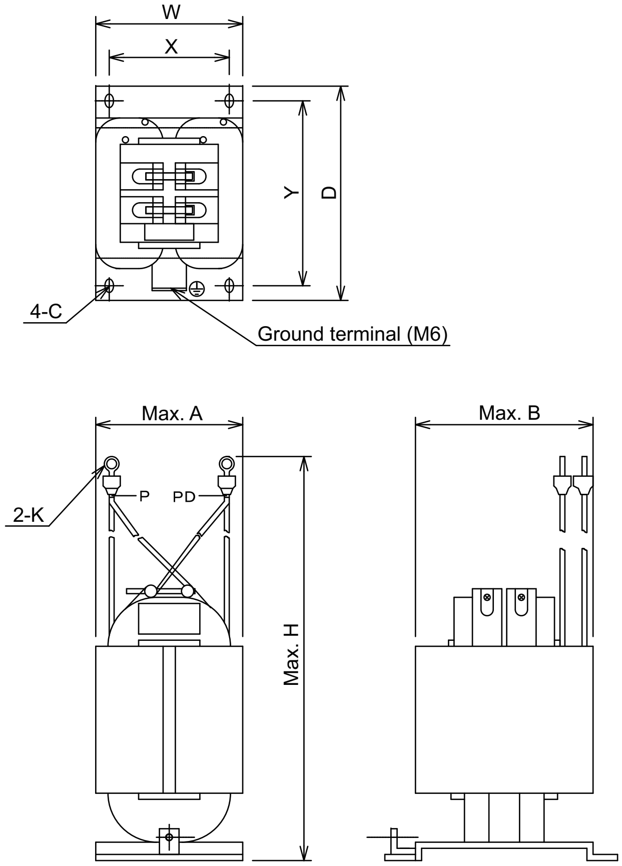
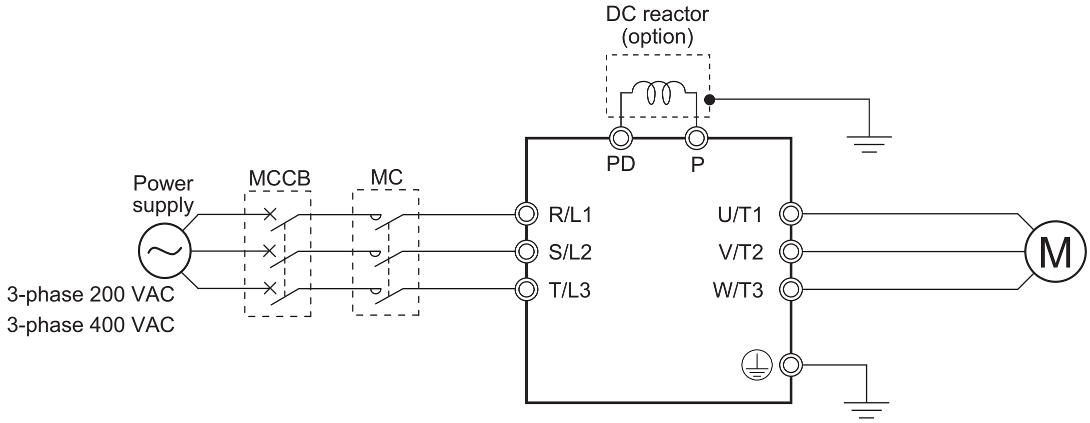


Fig. 3

11-5-3 Connection Examples



DC Reactor Connection Terminals (PD, P)

- These terminals are used to connect the optional DC reactor for power factor improvement.
  By factory setting, a short-circuit bar is connected between the terminals PD and P. Before connecting the DC reactor, remove this short-circuit bar.
- The length of the DC reactor connection cable must be 5 m or shorter.
- The DC reactor has no polarity.

Precautions for Correct Use

Remove the short-circuit bar only if you connect the DC reactor for use.

If you remove the short-circuit bar with the DC reactor unconnected, the inverter cannot operate because no power is supplied to its main circuit.

11-6 AC Reactor (Model: 3G3AX-AL□□□□)

11-6-1 Specifications

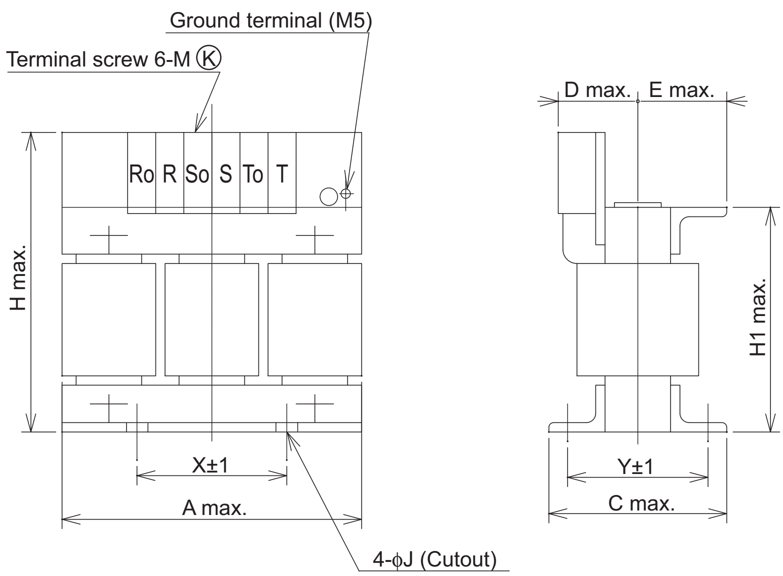
Inverter						AC reactor specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Inductance [mH]	Heat generation [W]	Operating ambient temperature/ humidity	Location
200-V class	0.4	3G3RX2-A2004	ND	0.4	3.3	3G3AX-AL2025	2.8	12	–10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			LD	0.75	3.9					
			VLD	0.75	3.9					
	0.75	3G3RX2-A2007	ND	0.75	5.5					
			LD	1.5	7.2					
			VLD	1.5	7.2					
	1.5	3G3RX2-A2015	ND	1.5	8.3					
			LD	2.2	10.8	3G3AX-AL2055	0.88	25		
			VLD	2.2	10.8					
	2.2	3G3RX2-A2022	ND	2.2	12					
			LD	3.7	13.9					
			VLD	3.7	13.9					
	3.7	3G3RX2-A2037	ND	3.7	18					
			LD	5.5	23	3G3AX-AL2110	0.35	50		
			VLD	5.5	23					
	5.5	3G3RX2-A2055	ND	5.5	26					
			LD	7.5	37					
			VLD	7.5	37					
	7.5	3G3RX2-A2075	ND	7.5	35					
			LD	11	48	3G3AX-AL2220	0.18	50		
			VLD	11	48					
	11	3G3RX2-A2110	ND	11	51					
			LD	15	64					
			VLD	15	64					
	15	3G3RX2-A2150	ND	15	70					
			LD	18.5	80	3G3AX-AL2330	0.09	85		
			VLD	18.5	80					
	18.5	3G3RX2-A2185	ND	18.5	84					
			LD	22	94					
			VLD	22	94					
	22	3G3RX2-A2220	ND	22	105					
			LD	30	120	3G3AX-AL2500	0.071	95		
			VLD	30	120					
	30	3G3RX2-A2300	ND	30	133					
			LD	37	150					
			VLD	37	150					
	37	3G3RX2-A2370	ND	37	160					
			LD	45	186	3G3AX-AL2750	0.046	100		
			VLD	45	186					
	45	3G3RX2-A2450	ND	45	200					
			LD	55	240					
			VLD	55	240					
	55	3G3RX2-A2550	ND	55	242					
			LD	75	280	–	–	–	–	–
			VLD	75	280					

Inverter						AC reactor specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Inductance [mH]	Heat generation [W]	Operating ambient temperature/ humidity	Location
400-V class	0.75	3G3RX2-A4007	ND	0.75	2.8	3G3AX-AL4025	7.7	12	–10 to 50°C 20% to 90%	At an altitude of 1,000 m max.; indoors (without corrosive gases or dust)
			LD	1.5	4.3					
			VLD	1.5	4.3					
	1.5	3G3RX2-A4015	ND	1.5	4.2					
			LD	2.2	5.9	3G3AX-AL4055	3.5	25		
			VLD	2.2	5.9					
	2.2	3G3RX2-A4022	ND	2.2	5.8					
			LD	3.7	8.1					
			VLD	3.7	8.1					
	3.7	3G3RX2-A4037	ND	3.7	9.8					
			LD	5.5	13.3	3G3AX-AL4110	1.3	50		
			VLD	5.5	13.3					
	5.5	3G3RX2-A4055	ND	5.5	15					
			LD	7.5	20					
			VLD	7.5	20					
	7.5	3G3RX2-A4075	ND	7.5	21					
			LD	11	24	3G3AX-AL4220	0.74	60		
			VLD	11	24					
	11	3G3RX2-A4110	ND	11	28					
			LD	15	32					
			VLD	15	32					
	15	3G3RX2-A4150	ND	15	35					
			LD	18.5	41	3G3AX-AL4330	0.36	90		
			VLD	18.5	41					
	18.5	3G3RX2-A4185	ND	18.5	42					
			LD	22	47					
			VLD	22	47					
	22	3G3RX2-A4220	ND	22	53					
			LD	30	63	3G3AX-AL4500	0.29	95		
			VLD	30	63					
	30	3G3RX2-A4300	ND	30	64					
			LD	37	77					
			VLD	37	77					
	37	3G3RX2-A4370	ND	37	83					
			LD	45	94	3G3AX-AL4750	0.19	100		
			VLD	45	94					
	45	3G3RX2-A4450	ND	45	100					
			LD	55	116					
			VLD	55	116					
	55	3G3RX2-A4550	ND	55	121					
			LD	75	149	–	–	–	–	–
			VLD	75	149					

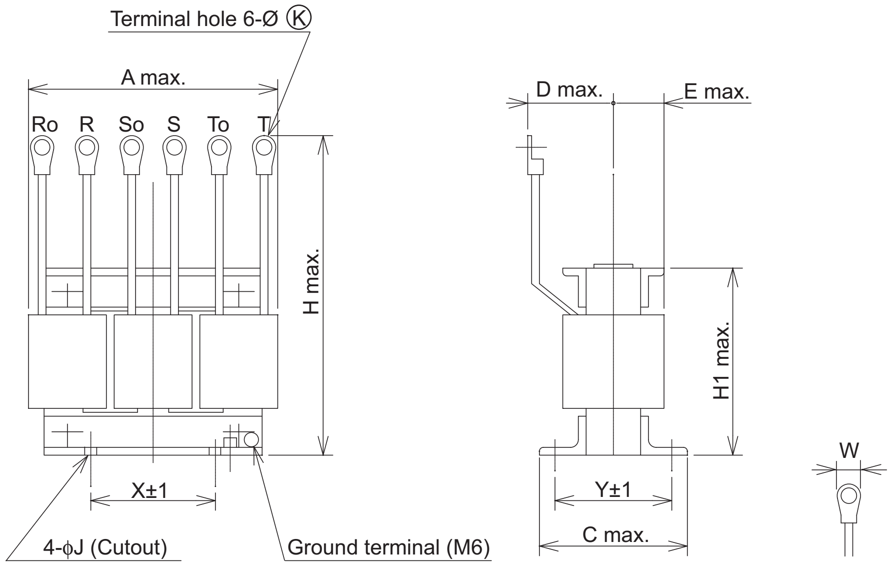
11-6-2 External Dimensions

Inverter input power supply	Model	Applicable motor capacity [kW]	Dimensions [mm]											Weight [kg]
			A	C	D	E	H	H1	X	Y	J	K	W	
3-phase 200 VAC	3G3AX-AL2025	0.2 to 1.5	120	82	60	40	150	94	50	67	6	4.0	9.5	2.8
	3G3AX-AL2055	2.2, 3.7	120	98	60	40	150	94	50	75	6	4.0	9.5	4.0
	3G3AX-AL2110	5.5, 7.5	150	103	70	55	170	108	60	80	6	5.3	12.0	5.0
	3G3AX-AL2220	11, 15	180	113	75	55	190	140	90	90	6	8.4	16.5	10.0
	3G3AX-AL2330	18.5, 22	180	113	85	60	230	140	125	90	6	8.4	22.0	11.0
	3G3AX-AL2500	30, 37	260	113	85	60	290	202	100	90	7	8.4	27.0	19.0
	3G3AX-AL2750	45, 55	260	144	110	80	290	207	125	112	7	8.4	28.5	25.0
3-phase 400 VAC	3G3AX-AL4025	0.4 to 1.5	130	82	60	40	150	94	50	67	6	4	9.5	2.7
	3G3AX-AL4055	2.2, 3.7	130	98	60	40	150	94	50	75	6	5	12.5	4.0
	3G3AX-AL4110	5.5, 7.5	150	116	75	55	170	106	60	98	6	5	12.5	6.0
	3G3AX-AL4220	11, 15	180	103	75	55	190	140	100	80	6	5.3	12.0	10.0
	3G3AX-AL4330	18.5, 22	180	123	85	60	230	140	100	100	6	6.4	16.5	11.5
	3G3AX-AL4500	30, 37	260	113	85	60	290	202	100	90	7	8.4	22.0	19.0
	3G3AX-AL4750	45, 55	260	146	110	80	290	207	125	112	7	8.4	22.0	25.0

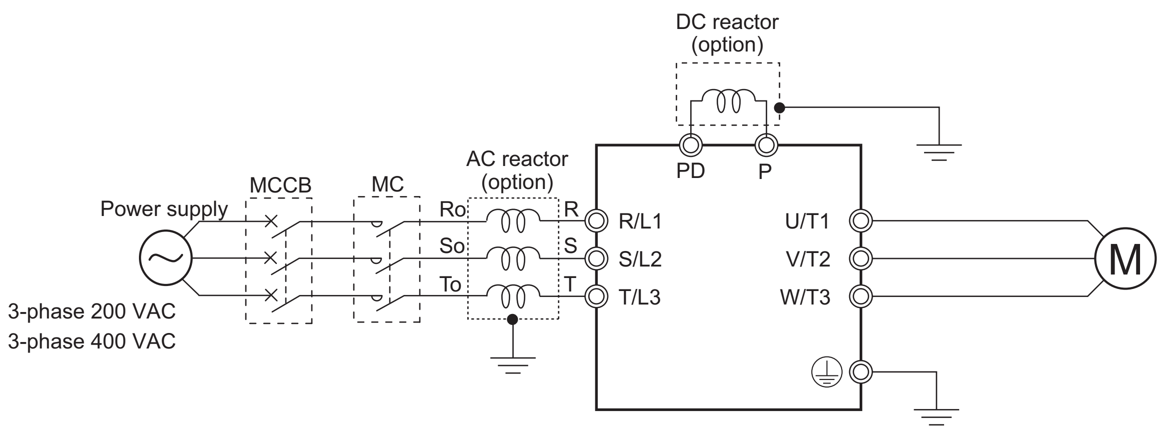
3G3AX-AL2025/AL2055/AL4025/AL4055/AL4110



3G3AX-AL2110/AL2220/AL2330/AL2500/AL2750/AL4220/AL4330/AL4500/AL4750



11-6-3 Connection Examples



11-7 Input Noise Filter (Model: 3G3AX-NFI□□)

11-7-1 Specifications

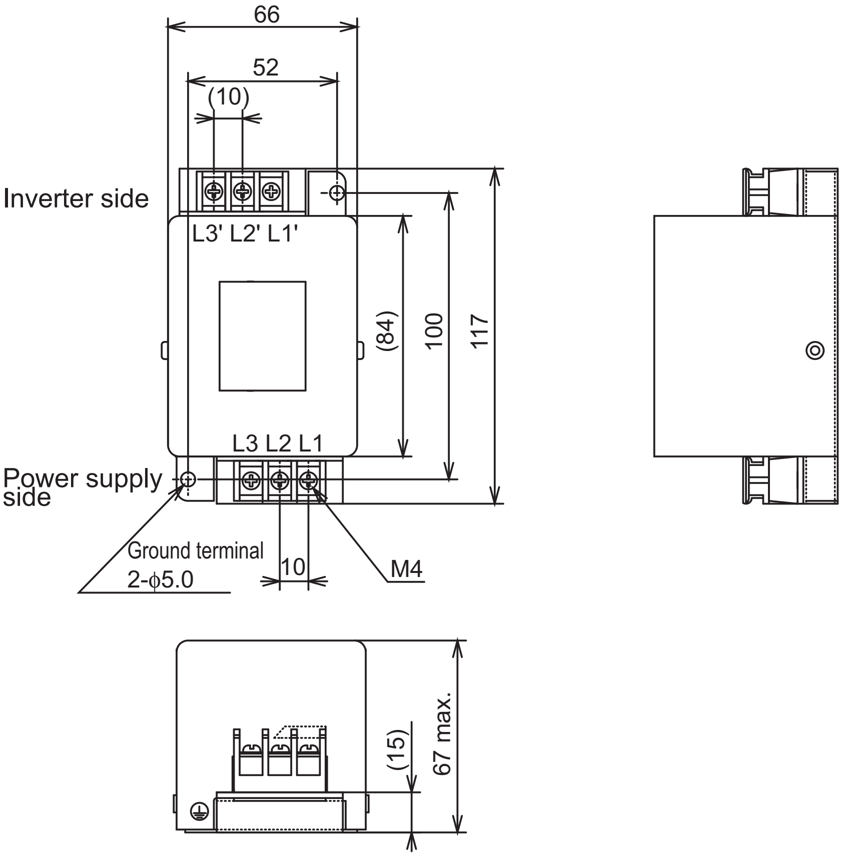
Inverter						Input noise filter specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current (at 50°C)	Heat generation [W]	Leakage current (at 60 Hz)
200-V class	0.4	3G3RX2-A2004	ND	0.4	3.3	3G3AX-NFI21	250 VAC +10%	6A	3	1.5 mA max. (250 VAC)
			LD	0.75	3.9					
			VLD	0.75	3.9					
	0.75	3G3RX2-A2007	ND	0.75	5.5					
			LD	1.5	7.2	3G3AX-NFI22		10A	4	
			VLD	1.5	7.2					
	1.5	3G3RX2-A2015	ND	1.5	8.3					
			LD	2.2	10.8	3G3AX-NFI23		20A	6	
			VLD	2.2	10.8					
	2.2	3G3RX2-A2022	ND	2.2	12					
			LD	3.7	13.9					
			VLD	3.7	13.9					
	3.7	3G3RX2-A2037	ND	3.7	18					
			LD	5.5	23	3G3AX-NFI24		30A	9	
			VLD	5.5	23					
	5.5	3G3RX2-A2055	ND	5.5	26					
			LD	7.5	37	3G3AX-NFI25		40A	12	
			VLD	7.5	37					
	7.5	3G3RX2-A2075	ND	7.5	35					
			LD	11	48	3G3AX-NFI26		60A	17	
			VLD	11	48					
	11	3G3RX2-A2110	ND	11	51					
			LD	15	64	3G3AX-NFI27		80A	21	
			VLD	15	64					
	15	3G3RX2-A2150	ND	15	70					
			LD	18.5	80	3G3AX-NFI28		100A	23	
			VLD	18.5	80					
	18.5	3G3RX2-A2185	ND	18.5	84					
			LD	22	94	3G3AX-NFI29		150A	45	
			VLD	22	94					
	22	3G3RX2-A2220	ND	22	105					
			LD	30	120					
			VLD	30	120					
	30	3G3RX2-A2300	ND	30	133					
			LD	37	150	3G3AX-NFI2A		200A	50	
			VLD	37	150					
	37	3G3RX2-A2370	ND	37	160					
			LD	45	186	3G3AX-NFI2B		250A	68	
			VLD	45	186					
	45	3G3RX2-A2450	ND	45	200					
			LD	55	240	3G3AX-NFI2C		300A	56	
			VLD	55	240					
	55	3G3RX2-A2550	ND	55	242					
			LD	75	280	–	–	–	–	–
			VLD	75	280					

Inverter						Input noise filter specifications				
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current (at 50°C)	Heat generation [W]	Leakage current (at 60 Hz)
400-V class	0.75	3G3RX2-A4007	ND	0.75	2.8	3G3AX-NFI41	480 VAC +10%	7A	2	7.5 mA max. (480 VAC)
			LD	1.5	4.3					
			VLD	1.5	4.3					
	1.5	3G3RX2-A4015	ND	1.5	4.2					
			LD	2.2	5.9					
			VLD	2.2	5.9					
	2.2	3G3RX2-A4022	ND	2.2	5.8					
			LD	3.7	8.1	3G3AX-NFI42		10A	4	
			VLD	3.7	8.1					
	3.7	3G3RX2-A4037	ND	3.7	9.8					
			LD	5.5	13.3	3G3AX-NFI43		20A	6	
			VLD	5.5	13.3					
	5.5	3G3RX2-A4055	ND	5.5	15					
			LD	7.5	20					
			VLD	7.5	20					
	7.5	3G3RX2-A4075	ND	7.5	21					
			LD	11	24	3G3AX-NFI44		30A	9	
			VLD	11	24					
	11	3G3RX2-A4110	ND	11	28					
			LD	15	32	3G3AX-NFI45		40A	12	
			VLD	15	32					
	15	3G3RX2-A4150	ND	15	35					
			LD	18.5	41	3G3AX-NFI46		50A	15	
			VLD	18.5	41					
	18.5	3G3RX2-A4185	ND	18.5	42					
			LD	22	47	3G3AX-NFI47		60A	17	
			VLD	22	47					
	22	3G3RX2-A4220	ND	22	53					
			LD	30	63	3G3AX-NFI48		80A	21	
			VLD	30	63					
	30	3G3RX2-A4300	ND	30	64					
			LD	37	77	3G3AX-NFI49		100A	23	
			VLD	37	77					
	37	3G3RX2-A4370	ND	37	83					
			LD	45	94	3G3AX-NFI4A		150A	45	
			VLD	45	94					
	45	3G3RX2-A4450	ND	45	100					
			LD	55	116					
			VLD	55	116					
	55	3G3RX2-A4550	ND	55	121					
			LD	75	149	–	–	–	–	–
			VLD	75	149					

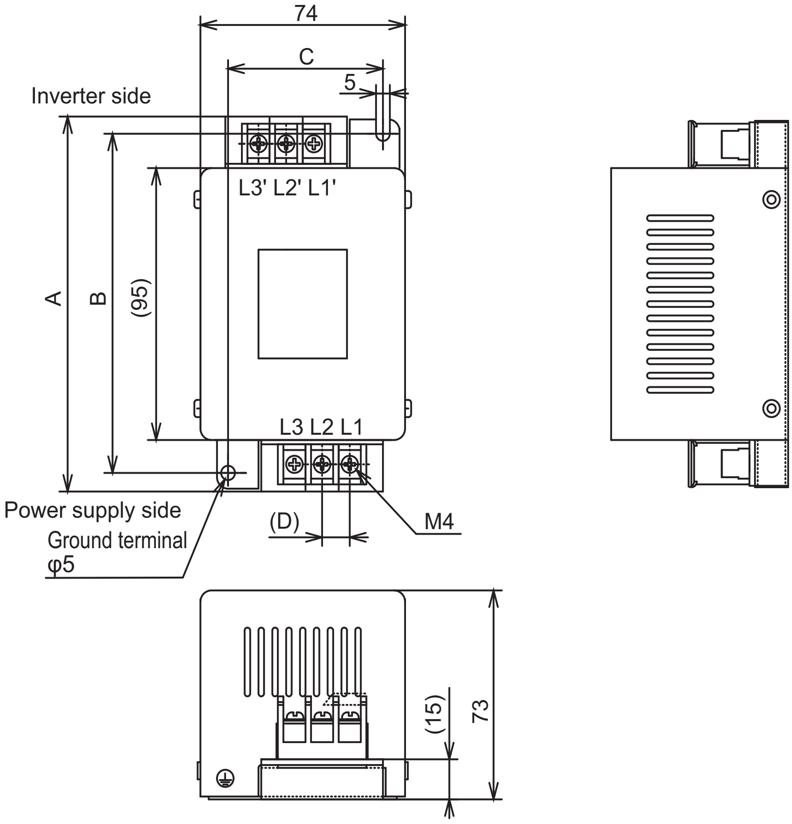
11-7-2 External Dimensions

Model	Case, enclosure rating	Terminal size	Wire diameter	Weight [kg]
G3AX-NFI21	Plastic, IP00	M4	1.25 mm^2	0.5
3G3AX-NFI22	Plastic, IP00	M4	2 mm^2	0.6
3G3AX-NFI23	Plastic, IP00	M4	2 mm^2, 3.5 mm^2	0.7
3G3AX-NFI24	Plastic, IP00	M4	5.5 mm^2	0.8
3G3AX-NFI25	Plastic, IP00	M5	8 mm^2	1.4
3G3AX-NFI26	Plastic, IP00	M5	14 mm^2	1.8
3G3AX-NFI27	Metal, IP00	M6	22 mm^2	3.6
3G3AX-NFI28	Metal, IP00	M8	30 mm^2	4.6
3G3AX-NFI29	Metal, IP00	M8	38 mm^2, 60 mm^2	9.0
3G3AX-NFI2A	Metal, IP00	M10	100 mm^2 or 38 mm^2, 2 wires parallel	16
3G3AX-NFI2B	Metal, IP00	M10	100 mm^2 or 38 mm^2, 2 wires parallel	16
3G3AX-NFI2C	Metal, IP00	M10	150 mm^2 or 60 mm^2, 2 wires parallel	23
3G3AX-NFI41	Plastic, IP00	M4	1.25 mm^2, 2 mm^2	0.7
3G3AX-NFI42	Plastic, IP00	M4	2 mm^2	0.7
3G3AX-NFI43	Plastic, IP00	M4	2 mm^2, 3.5 mm^2	0.7
3G3AX-NFI44	Plastic, IP00	M4	5.5 mm^2	0.8
3G3AX-NFI45	Plastic, IP00	M5	8 mm^2	1.4
3G3AX-NFI46	Plastic, IP00	M5	14 mm^2	1.6
3G3AX-NFI47	Plastic, IP00	M5	14 mm^2	1.8
3G3AX-NFI48	Metal, IP00	M6	22 mm^2	3.6
3G3AX-NFI49	Metal, IP00	M8	38 mm^2	4.6
3G3AX-NFI4A	Metal, IP00	M8	38 mm^2, 60 mm^2	9.0

3G3AX-NFI21/NFI22

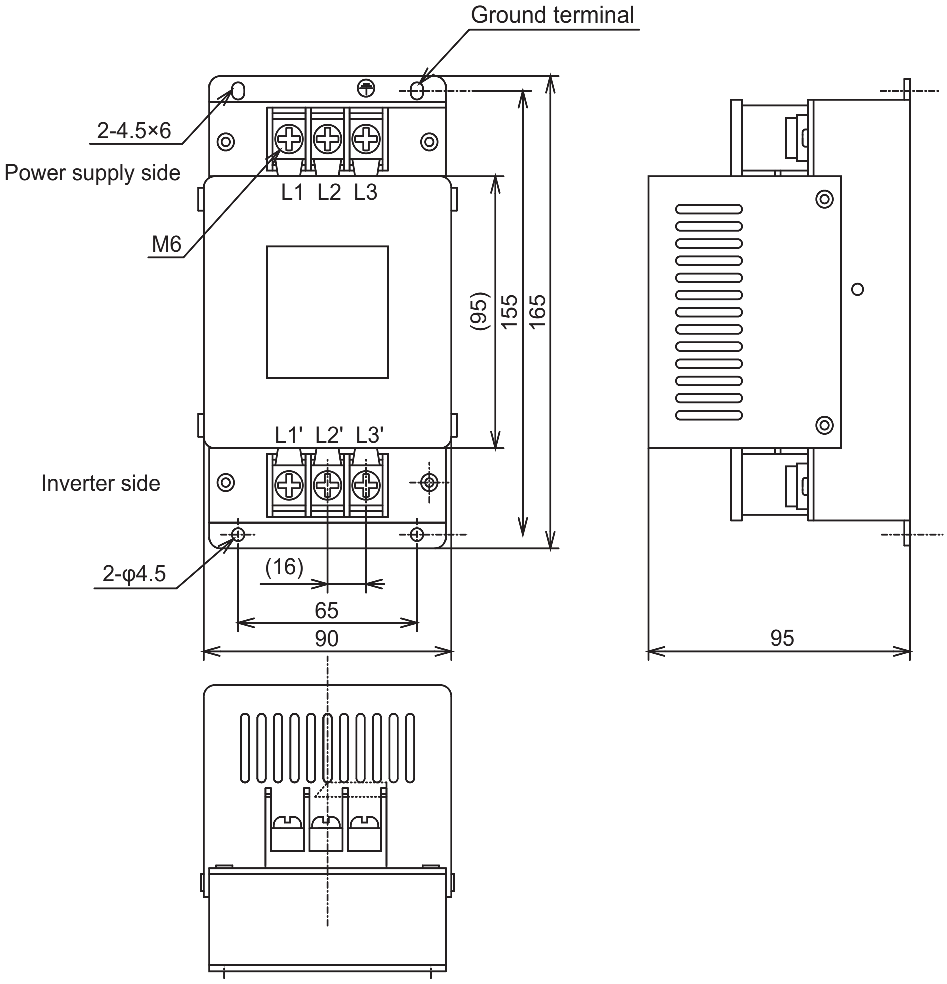


3G3AX-NFI23/NFI24/NFI41/NFI42/NFI43/NFI44

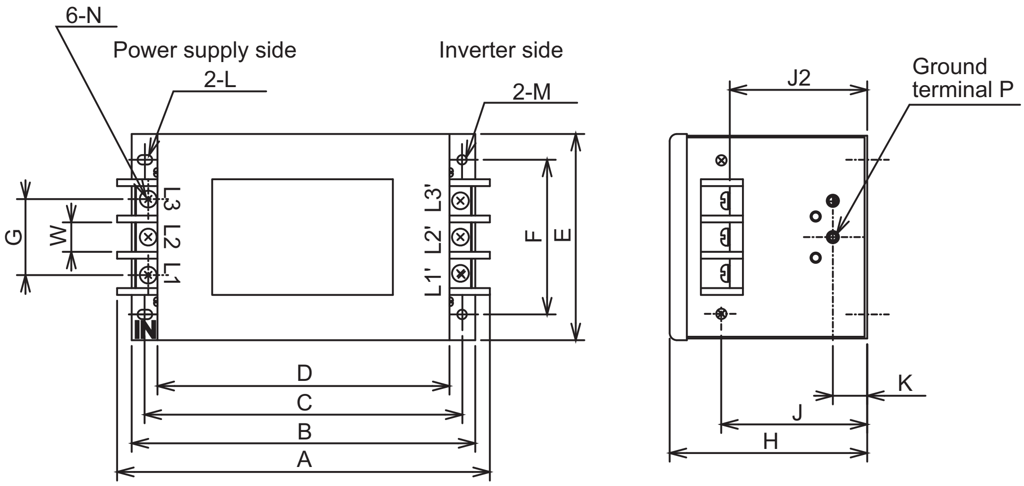


Model	Dimensions [mm]			
	A	B	C	D
3G3AX-NFI23	128	118	56	10
3G3AX-NFI24	144	130	56	11
3G3AX-NFI41	144	130	56	11
3G3AX-NFI42	144	130	56	11
3G3AX-NFI43	144	130	56	11
3G3AX-NFI44	144	130	56	11

3G3AX-NFI25/NFI26/NFI45/NFI46/NFI47

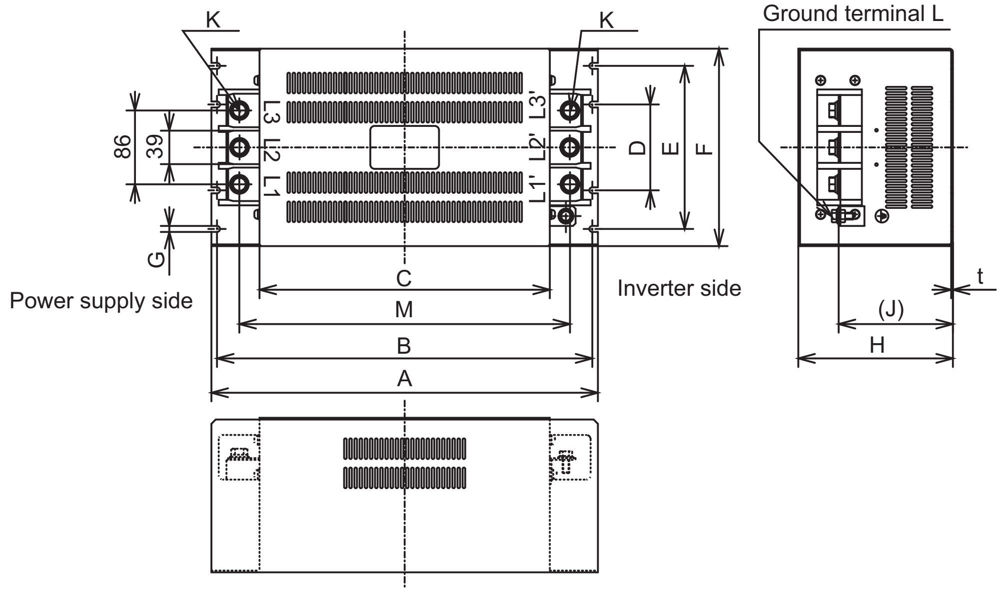


3G3AX-NFI27/NFI28/NFI29/NFI48/NFI49/NFI4A



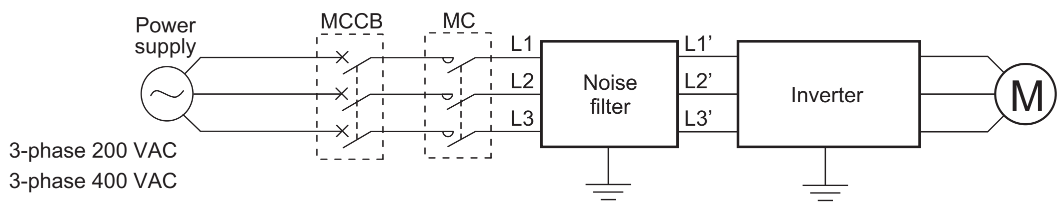
Model	Dimensions [mm]														
	A	B	C	D	E	F	G	H	J	J2	K	L	M	N	P	W
3G3AX-NFI27	217	200	185	170	120	90	44	115	85	82	20	R2.75 Length 7	5.5 dia.	M6	M4	17
3G3AX-NFI28	254	230	215	200	150	120	57	115	80	75	30	R3.75 Length 8	6.5 dia.	M8	M6	23
3G3AX-NFI29	314	300	280	260	200	170	57	130	90	85	35	R3.75 Length 8	6.5 dia.	M8	M6	23
3G3AX-NFI48	217	200	185	170	120	90	44	115	85	85	20	R2.75 Length 7	5.5 dia.	M6	M4	17
3G3AX-NFI49	254	230	215	200	150	120	57	115	80	75	30	R3.75 Length 8	6.5 dia.	M8	M6	23
3G3AX-NFI4A	314	300	280	260	200	170	57	130	90	85	35	R3.75 Length 8	6.5 dia.	M8	M6	23

3G3AX-NFI2A/NFI2B/NFI2C



Model	Dimensions [mm]												
	A	B	C	D	E	F	G	H	J	K	L	M	t
3G3AX-NFI2A	450	430	338	100	190	230	7	180	(133)	M10	M8	385	1.0
3G3AX-NFI2B	450	430	338	100	190	230	7	180	(133)	M10	M8	385	1.0
3G3AX-NFI2C	500	475	400	–	160	200	12	180	(133)	M10	M8	445	1.2

11-7-3 Connection Examples



11-8 Output Noise Filter (Model: 3G3AX-NFO□□)

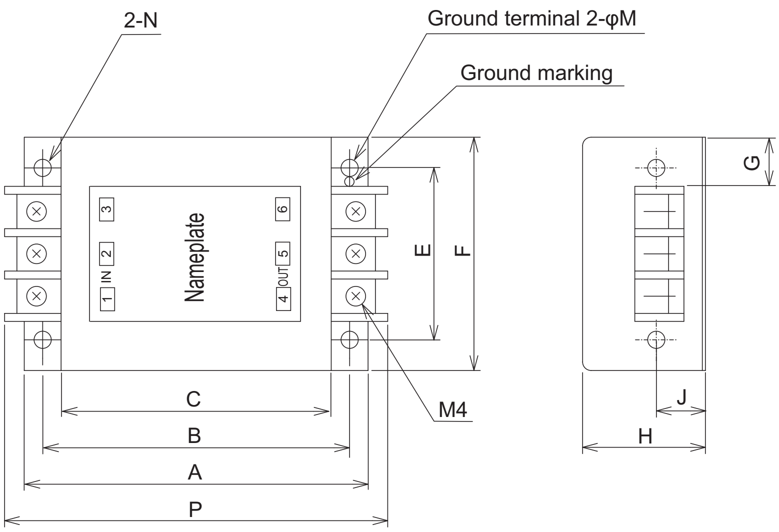
11-8-1 Specifications

Inverter						Output noise filter specifications			
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated output current [A]	Model	Rated voltage	Rated input current [A]	Weight [kg]
200-V class	0.4	3G3RX2-A2004	ND	0.4	3.0	3G3AX-NFO01	500 VAC	6	0.7
			LD	0.75	3.7				
			VLD	0.75	3.7				
	0.75	3G3RX2-A2007	ND	0.75	5.0				
			LD	1.5	6.3	3G3AX-NFO02		12	0.9
			VLD	1.5	6.3				
	1.5	3G3RX2-A2015	ND	1.5	7.5				
			LD	2.2	9.4				
			VLD	2.2	9.4				
	2.2	3G3RX2-A2022	ND	2.2	10.5				
			LD	3.7	12	3G3AX-NFO03		25	2.1
			VLD	3.7	12				
	3.7	3G3RX2-A2037	ND	3.7	16.5				
			LD	5.5	19.6				
			VLD	5.5	19.6				
	5.5	3G3RX2-A2055	ND	5.5	24				
			LD	7.5	30	3G3AX-NFO04		50	3.7
			VLD	7.5	30				
	7.5	3G3RX2-A2075	ND	7.5	32				
			LD	11	44				
			VLD	11	44				
	11	3G3RX2-A2110	ND	11	46				
			LD	15	58	3G3AX-NFO05		75	5.7
			VLD	15	58				
	15	3G3RX2-A2150	ND	15	64				
			LD	18.5	73	3G3AX-NFO06		100	8.4
			VLD	18.5	73				
	18.5	3G3RX2-A2185	ND	18.5	76				
			LD	22	85				
			VLD	22	85				
	22	3G3RX2-A2220	ND	22	95				
			LD	30	113	3G3AX-NFO07		150	9.0
			VLD	30	113				
	30	3G3RX2-A2300	ND	30	121				
			LD	37	140				
			VLD	37	140				
	37	3G3RX2-A2370	ND	37	145				
			LD	45	169	–	–	–	–
			VLD	45	169				

Inverter						Output noise filter specifications			
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated output current [A]	Model	Rated voltage	Rated input current [A]	Weight [kg]
400-V class	0.75	3G3RX2-A4007	ND	0.75	2.5	3G3AX-NFO01	500 VAC	6	0.7
			LD	1.5	3.1				
			VLD	1.5	3.1				
	1.5	3G3RX2-A4015	ND	1.5	3.8				
			LD	2.2	4.8				
			VLD	2.2	4.8				
	2.2	3G3RX2-A4022	ND	2.2	5.3				
			LD	3.7	6.7	3G3AX-NFO02		12	0.9
			VLD	3.7	6.7				
	3.7	3G3RX2-A4037	ND	3.7	9.0				
			LD	5.5	11.1	3G3AX-NFO03		25	2.1
			VLD	5.5	11.1				
	5.5	3G3RX2-A4055	ND	5.5	14				
			LD	7.5	16				
			VLD	7.5	16				
	7.5	3G3RX2-A4075	ND	7.5	19				
			LD	11	22				
			VLD	11	22				
	11	3G3RX2-A4110	ND	11	25				
			LD	15	29	3G3AX-NFO04		50	3.7
			VLD	15	29				
	15	3G3RX2-A4150	ND	15	32				
			LD	18.5	37				
			VLD	18.5	37				
	18.5	3G3RX2-A4185	ND	18.5	38				
			LD	22	43				
			VLD	22	43				
	22	3G3RX2-A4220	ND	22	48				
			LD	30	57	3G3AX-NFO05		75	5.7
			VLD	30	57				
	30	3G3RX2-A4300	ND	30	58				
			LD	37	70				
			VLD	37	70				
	37	3G3RX2-A4370	ND	37	75				
			LD	45	85	3G3AX-NFO06		100	8.4
			VLD	45	85				
	45	3G3RX2-A4450	ND	45	91				
			LD	55	105	3G3AX-NFO07		150	9.0
			VLD	55	105				
	55	3G3RX2-A4550	ND	55	112				
			LD	75	135				
			VLD	75	135				
	75	3G3RX2-A4750	ND	75	149				
			LD	90	160	–	–	–	–
			VLD	90	160				

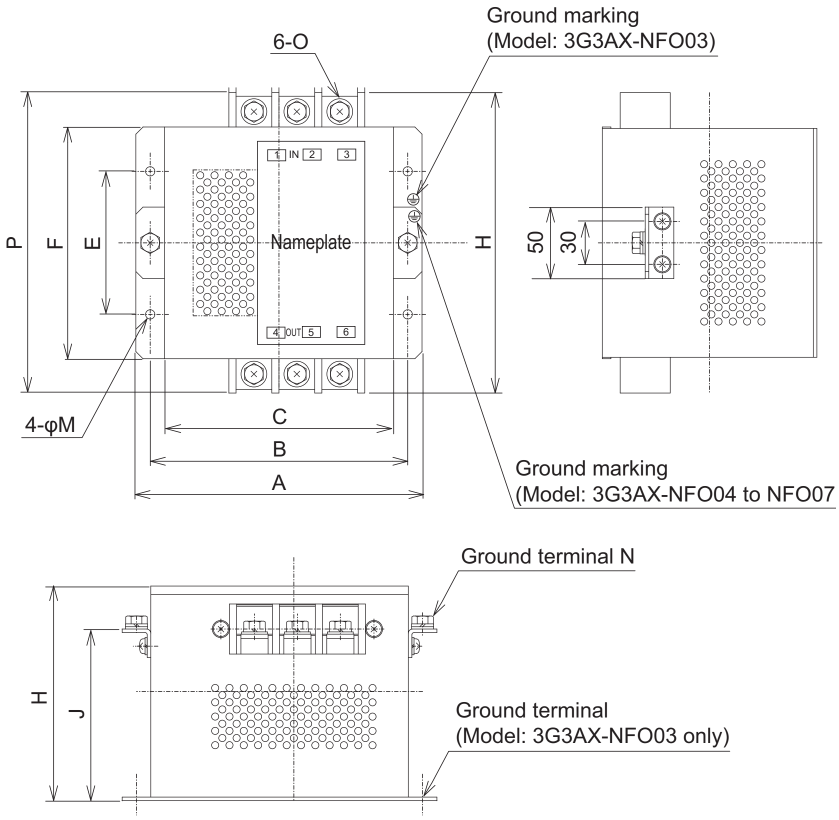
11-8-2 External Dimensions

3G3AX-NFO01/NFO02



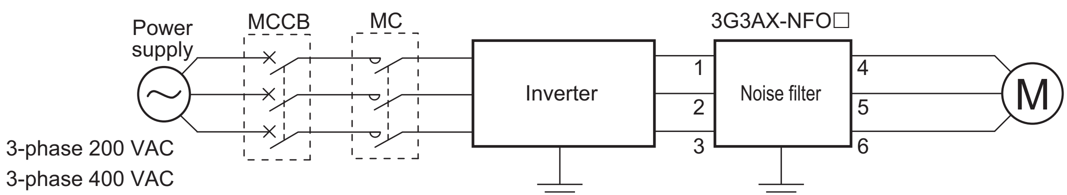
Model	Dimensions [mm]									
	A	B	C	E	F	G	H	J	M	P	N
3G3AX-NFO01	140	125	110	70	95	22	50	20	4.5	156	2-R2.25 Length 6
3G3AX-NFO02	160	145	130	80	110	30	70	25	5.5	176	2-R2.75 Length 7

3G3AX-NFO03/NFO04/NFO05/NFO06/NFO07



Model	Dimensions [mm]									
	A	B	C	E	F	H	J	M	N	O	P
3G3AX-NFO03	160	145	130	80	112	120	–	6.5 dia.	–	M4	154
3G3AX-NFO04	200	180	160	100	162	150	120	6.5 dia.	M5	M5	210
3G3AX-NFO05	220	200	180	100	182	170	140	6.5 dia.	M6	M6	230
3G3AX-NFO06	220	200	180	100	182	170	140	6.5 dia.	M8	M8	237
3G3AX-NFO07	240	220	200	150	202	170	140	6.5 dia.	M8	M8	257

11-8-3 Connection Example



11-9 Radio Noise Filter (Model: 3G3AX-ZCL□)

11-9-1 Specifications

Select the radio noise filter according to the applicable motor capacity for the heavy/light load mode of the inverter.

When using at ND mode, you need to select the maximum motor capacity; at LD or VLD mode, select one larger in capacity to meet with the motor capacity (kW).

3G3AX-ZCL1

Applicable motor capacity [kW]	200-V class				400-V class			
	Input side		Output side		Input side		Output side	
	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns
0.2	1	4	1	4	1	4	1	4
0.4	1	4	1	4	1	4	1	4
0.75	1	4	1	4	1	4	1	4
1.5	1	4	1	4	1	4	1	4
2.2	1	4	1	4	1	4	1	4
3.0	1	4	1	4	1	4	1	4
3.7	1	4	1	4	1	4	1	4
4.0	1	4	1	4	1	4	1	4
5.5	1	4	1	4	1	4	1	4
7.5	1	4	1	4	1	4	1	4
11	1	4	1	4	1	4	1	4
15	1	4	1	4	1	4	1	4

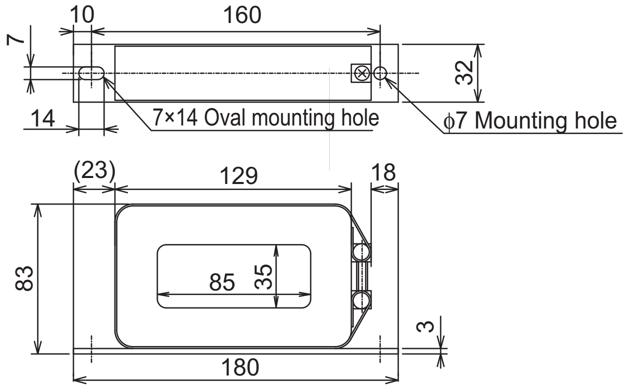
3G3AX-ZCL2

Applicable motor capacity [kW]	200-V class				400-V class			
	Input side		Output side		Input side		Output side	
	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns	Quantity	No. of turns
0.1	1	4	1	4	1	4	1	4
0.2	1	4	1	4	1	4	1	4
0.4	1	4	1	4	1	4	1	4
0.75	1	4	1	4	1	4	1	4
1.5	1	4	1	4	1	4	1	4
2.2	1	4	1	4	1	4	1	4
3.0	1	4	1	4	1	4	1	4
3.7	1	4	1	4	1	4	1	4
4.0	1	4	1	4	1	4	1	4
5.5	1	4	1	4	1	4	1	4
7.5	1	4	1	4	1	4	1	4

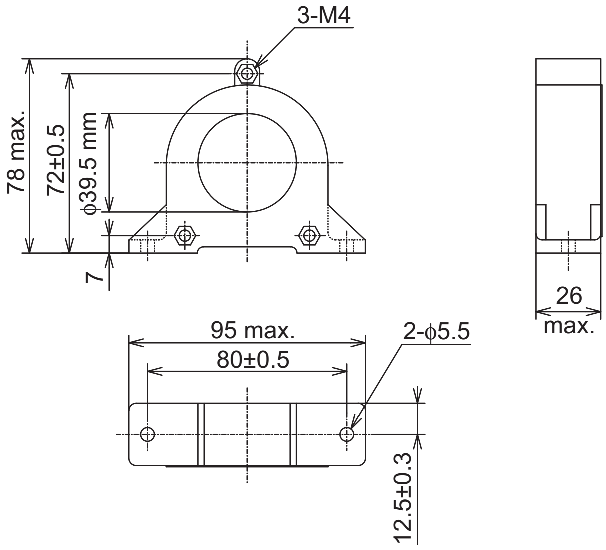
At LD or VLD mode, select one larger in capacity to meet with the motor capacity (kW).

11-9-2 External Dimensions

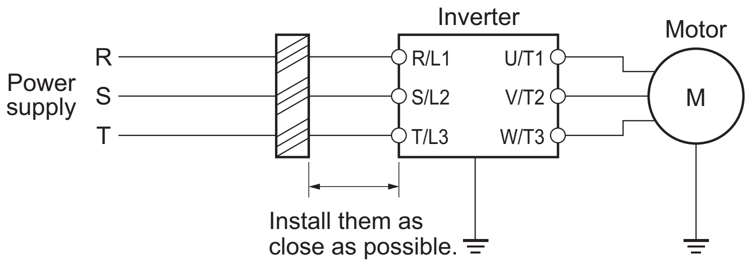
3G3AX-ZCL1



3G3AX-ZCL2



11-9-3 Connection Example



Precautions for Correct Use

- Wind the phase R/S/T wire in the same direction.
- This noise filter can be used in the same manner on both the input and output side of the inverter.

11-10 EMC Noise Filter (Model: 3G3AX-EFI□□)

11-10-1 Specifications

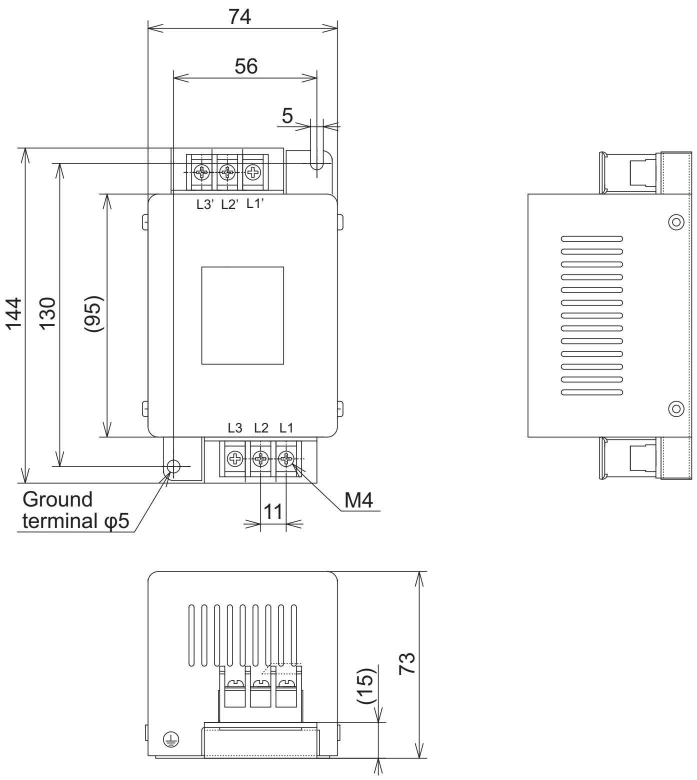
Inverter						EMC noise filter specifications					
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current [A]	Heat generation [W]	Leakage current (at 480 VAC 60 Hz)	Class
200-V class	0.4	3G3RX2-A2004	ND	0.4	3.3	3G3AX-EFI41	480 VAC +10%	7	4	150 mA max.	A
			LD	0.75	3.9						
			VLD	0.75	3.9						
	0.75	3G3RX2-A2007	ND	0.75	5.5						
			LD	1.5	7.2	3G3AX-EFI42		10	4	150 mA max.	
			VLD	1.5	7.2						
	1.5	3G3RX2-A2015	ND	1.5	8.3						
			LD	2.2	10.8	3G3AX-EFI43		20	8	170 mA max.	
			VLD	2.2	10.8						
	2.2	3G3RX2-A2022	ND	2.2	12						
			LD	3.7	13.9						
			VLD	3.7	13.9						
	3.7	3G3RX2-A2037	ND	3.7	18						
			LD	5.5	23	3G3AX-EFI44		30	9	170 mA max.	
			VLD	5.5	23						
	5.5	3G3RX2-A2055	ND	5.5	26						
			LD	7.5	37	3G3AX-EFI45		40	15	170 mA max.	
			VLD	7.5	37						
	7.5	3G3RX2-A2075	ND	7.5	35						
			LD	11	48	3G3AX-EFI47		60	15	250 mA max.	
			VLD	11	48						
	11	3G3RX2-A2110	ND	11	51						
			LD	15	64	3G3AX-EFI48		80	21	250 mA max.	
			VLD	15	64						
	15	3G3RX2-A2150	ND	15	70						
			LD	18.5	80	3G3AX-EFI49		100	23	250 mA max.	
			VLD	18.5	80						
	18.5	3G3RX2-A2185	ND	18.5	84						
			LD	22	94	3G3AX-EFI4A		150	45	250 mA max.	
			VLD	22	94						
	22	3G3RX2-A2220	ND	22	105						
			LD	30	120						
			VLD	30	120						
	30	3G3RX2-A2300	ND	30	133						
			LD	37	150	3G3AX-EFI4B		200	50	250 mA max.	
			VLD	37	150						
	37	3G3RX2-A2370	ND	37	160						
			LD	45	186	–	–	–	–	–	–
			VLD	45	186						

Inverter						EMC noise filter specifications					
Voltage class	Max. applicable motor capacity [kW]	Model	Load specification selection	Max. applicable motor capacity [kW]	Rated input current [A]	Model	Max. input voltage	Rated input current [A]	Heat generation [W]	Leakage current (at 480 VAC 60 Hz)	Class
400-V class	0.75	3G3RX2-A4007	LD	1.5	4.3	3G3AX-EFI41	480 VAC +10%	7	4	150 mA max.	A
			VLD	1.5	4.3						
	1.5	3G3RX2-A4015	ND	1.5	4.2						
			LD	2.2	5.9						
			VLD	2.2	5.9						
	2.2	3G3RX2-A4022	ND	2.2	5.8						
			LD	3.7	8.1	3G3AX-EFI42		10	4	150 mA max.	
			VLD	3.7	8.1						
	3.7	3G3RX2-A4037	ND	3.7	9.8						
			LD	5.5	13.3	3G3AX-EFI43		20	8	170 mA max.	
			VLD	5.5	13.3						
	5.5	3G3RX2-A4055	ND	5.5	15						
			LD	7.5	20						
			VLD	7.5	20						
	7.5	3G3RX2-A4075	ND	7.5	21						
			LD	11	24	3G3AX-EFI44		30	9	170 mA max.	
			VLD	11	24						
	11	3G3RX2-A4110	ND	11	28						
			LD	15	32	3G3AX-EFI45		40	15	170 mA max.	
			VLD	15	32						
	15	3G3RX2-A4150	ND	15	35						
			LD	18.5	41	3G3AX-EFI46		50	15	250 mA max.	
			VLD	18.5	41						
	18.5	3G3RX2-A4185	ND	18.5	42						
			LD	22	47	3G3AX-EFI47		60	15	250 mA max.	
			VLD	22	47						
	22	3G3RX2-A4220	ND	22	53						
			LD	30	63	3G3AX-EFI48		80	21	250 mA max.	
			VLD	30	63						
	30	3G3RX2-A4300	ND	30	64						
			LD	37	77	3G3AX-EFI49		100	23	250 mA max.	
			VLD	37	77						
	37	3G3RX2-A4370	ND	37	83						
			LD	45	94	3G3AX-EFI4A		150	45	250 mA max.	
			VLD	45	94						
	45	3G3RX2-A4450	ND	45	100						
			LD	55	116						
			VLD	55	116						
	55	3G3RX2-A4550	ND	55	121						
			LD	75	149	3G3AX-EFI4B		200	50	250 mA max.	
			VLD	75	149						
	75	3G3RX2-A4750	ND	75	164						
			LD	90	176						
			VLD	90	176						
	90	3G3RX2-A4900	ND	90	194						
			LD	110	199	–	–	–	–	–	–
			VLD	110	199						

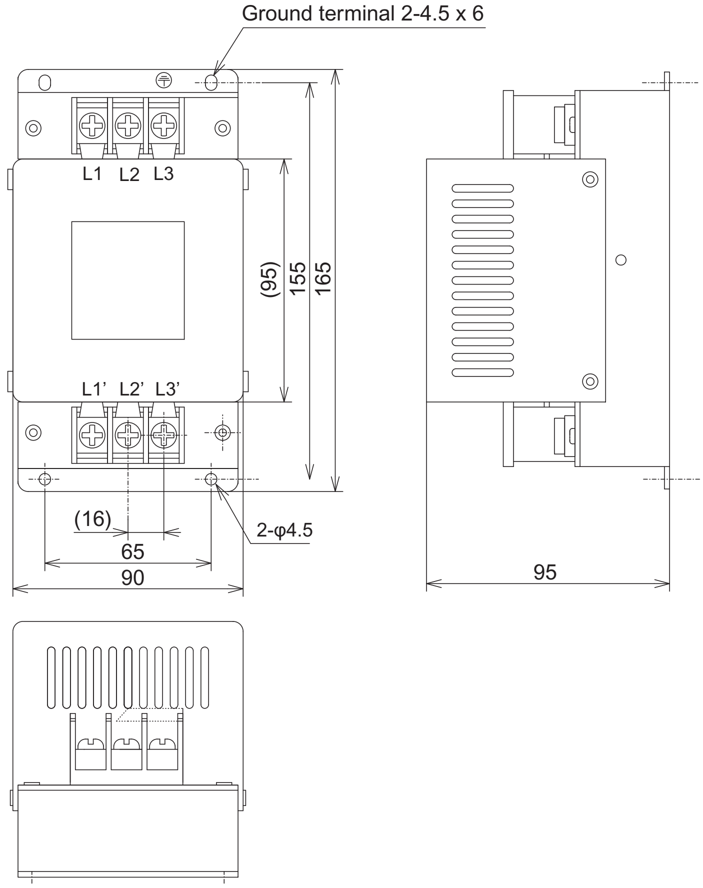
11-10-2 External Dimensions

3G3AX-EFI41/EFI42

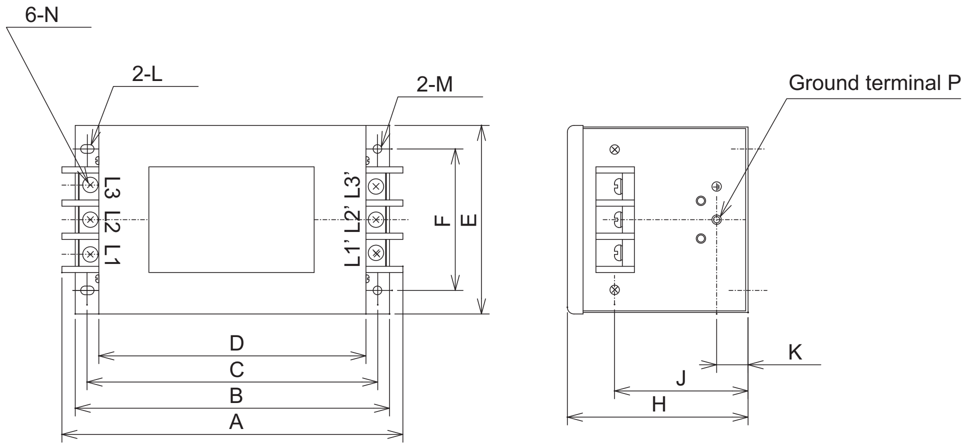
Model	Case, enclosure rating	Screw size	Wire size	Weight [kg]
3G3AX-EFI41	Plastic, IP00	M4	1.25 mm^2, 2 mm^2	0.7
3G3AX-EFI42			2 mm^2	0.7
3G3AX-EFI43		M5	2 mm^2, 3.5 mm^2	1.0
3G3AX-EFI44			5.5 mm^2	1.3
3G3AX-EFI45			8 mm^2	1.4
3G3AX-EFI46	Metal, IP00	M6	14 mm^2	2.9
3G3AX-EFI47			14 mm^2	3.0
3G3AX-EFI48			22 mm^2	3.6
3G3AX-EFI49		M8	30 mm^2, 38 mm^2	4.3
3G3AX-EFI4A			38 mm^2, 60 mm^2	9.0
3G3AX-EFI4B		M10	100 mm^2 or 38 mm^2, 2 wires parallel	16.0



3G3AX-EFI43/EFI44/EFI45

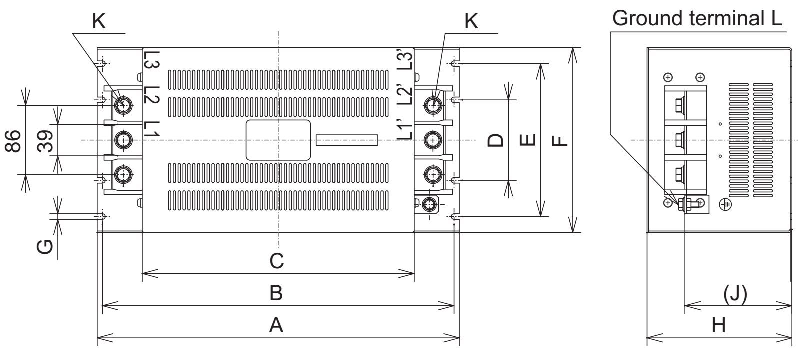


3G3AX-EFI46/EFI47/EFI48/EFI49/EFI4A



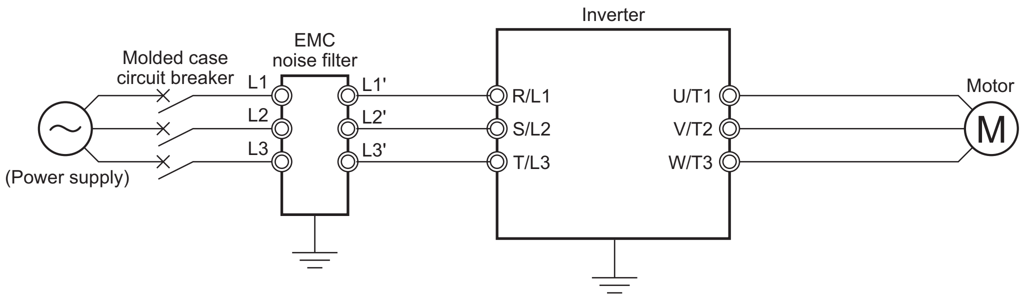
Model	Dimensions [mm]												
	A	B	C	D	E	F	H	J	K	L	M	N	P
3G3AX-EFI46 3G3AX-EFI47 3G3AX-EFI48	217	220	185	170	120	90	115	85	20	R2.75, Length 7	5.5 dia.	M6	M4
3G3AX-EFI49	254	230	215	200	150	120	115	80	30	R3.25, Length 8	6.5 dia.	M8	M6
3G3AX-EFI4A	314	300	280	260	200	170	130	90	35	R3.25, Length 8	6.5 dia.	M8	M6

3G3AX-EFI4B



Model	Dimensions [mm]										
	A	B	C	D	E	F	G	H	J	K	L
3G3AX-EFI4B	450	430	338	100	190	230	7	180	(133)	M10	M8

11-10-3 Connection Example



11-11 Digital Operator Cable (Model: 3G3AX-OPCN□)

11-11-1 Specifications

Item	Model	
	3G3AX-OPCN1	3G3AX-OPCN3
Connector	RJ45 connector	
Cable	EIA568-compliant cable (UTP category 5)	
Cable length [m]	1	3

12

Troubleshooting

12-1 Checking Alarm Display

12-1-1 Checking Trip Information

Up to 10 trips in the past is displayed as the trip history.

The latest trip history is displayed on the trip monitor 1.

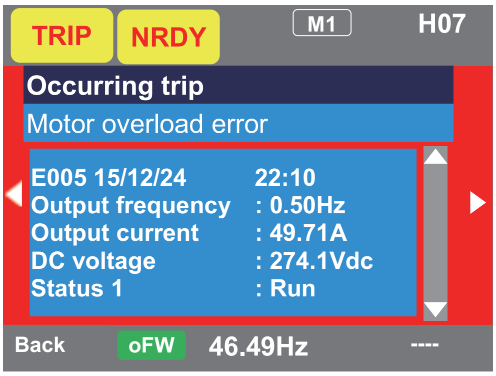
The following data items are displayed on the monitor:

(a) Error factor for trip
(b) Output frequency (Hz) at trip
(c) Output current (A) at trip
(d) Main circuit DC voltage (V) at trip
(e) Operation state at trip
(f) Cumulative inverter operating time (h) before trip
(g) Cumulative inverter power-on time (h) before trip

Precautions for Correct Use

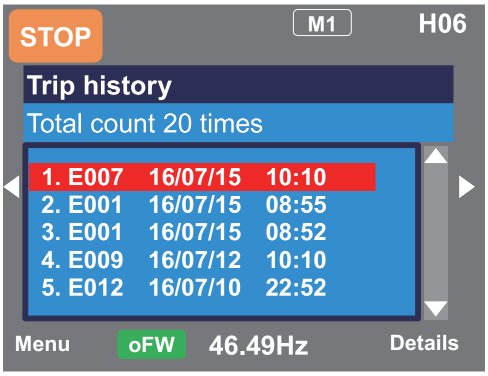
- The information of the moment of error occurrence may not be fetched properly if the inverter is forcibly turned OFF by its hardware.
- Values of respective data items may be reset to 0 when an error occurred and the inverter entered the trip condition.
- For a ground fault or a momentary overcurrent event, the current may be recorded in a value lower than the actual value.
- The trip monitor and the trip count monitor can be cleared by initialization of the trip history.

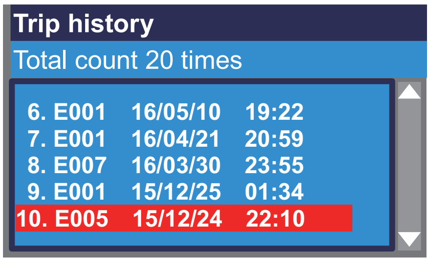
Display of Occurring Trip

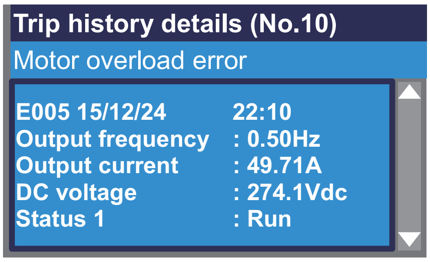


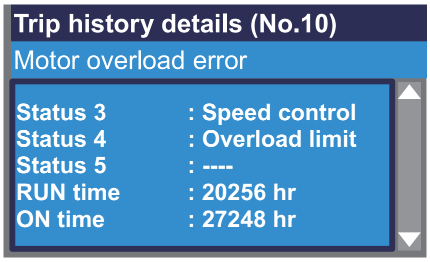
Checking Trip History

You can look through the history with the arrow Enter keys.









12-1-2 Checking Retry Information

The last 10 retry histories are displayed.

The latest retry history is displayed on the retry monitor 1.

The following data items are displayed on the monitor:

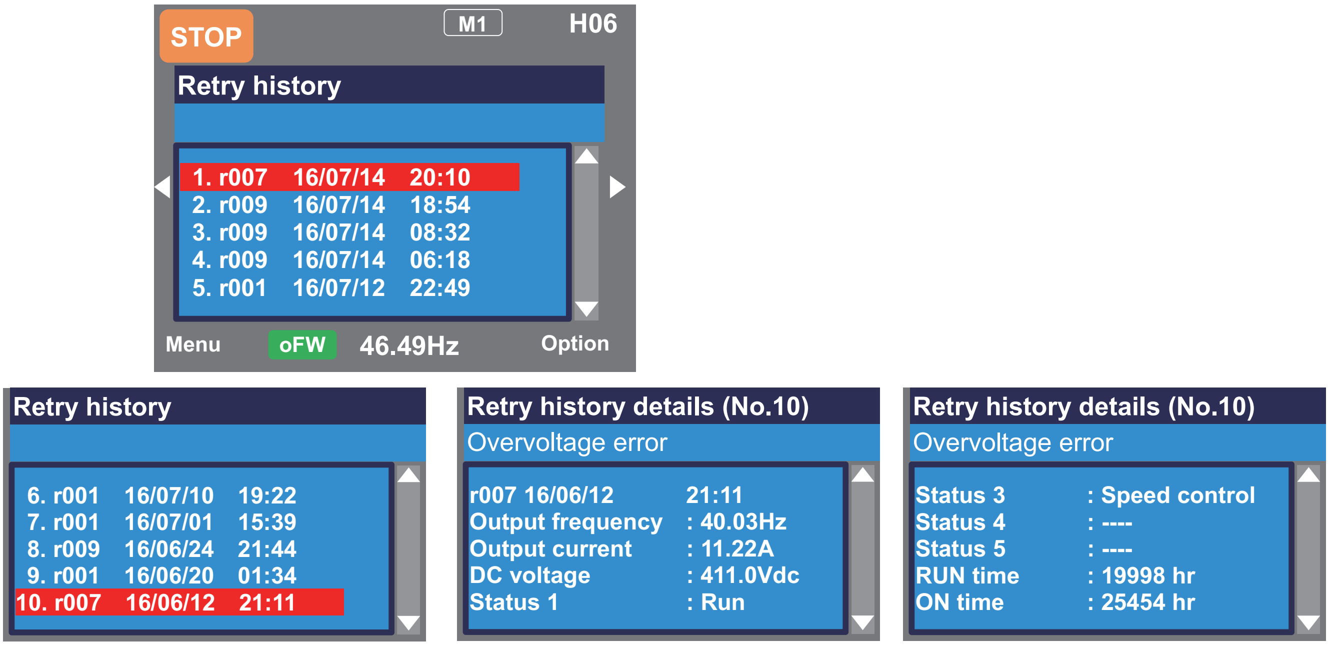
(a) Error factor for retry
(b) Output frequency (Hz) at retry
(c) Output current (A) at retry
(d) Main circuit DC voltage (V) at retry
(e) Operation state at retry
(f) Cumulative inverter operating time (h) before retry
(g) Cumulative inverter power-on time (h) before retry

Precautions for Correct Use

- While a retry is underway, the inverter tries to continue running. For a trip after a retry, the trip information is recorded on the trip history.
- The information of the moment of error occurrence may not be fetched properly if the inverter is forcibly turned OFF by its hardware.
- For a momentary overcurrent event, the current may be recorded in a value lower than the actual value.
- To display time in retry history, you need to configure clock settings.
- To use the clock function, you need an optional battery that is separately sold (CR2032, 3V). See *3-1-5 How to Set Battery and the Time Setting* on page 3-12 for details.

Checking the Retry History

You can look through the history with the arrow Enter keys.



12-1-3 Procedure for Resetting Trip State

Press Stop/Reset key of a panel or turn [RS] reset terminal ON to reset a trip. When the reset terminal is used, assign 028 [RS] to an input terminal function. Note that the reset terminal at that time is NO contact whatever the settings are.

For Reset Selection (CA-72), you can select a timing for resetting a trip state by RS terminal.

Only at the timing of the resetting when an error occurs, the RS terminal can be enabled.

Some trips cannot be reset. It depends on the factors of the trip.

In such case, turn a power supply OFF, and then cycle the power supply.

Precautions for Correct Use

- Do not use RS terminals to shut off the inverter output.
  When you cut off the inverter output with signals, use Free-run Stop (FRS) terminal, which is an input terminal function.
- Even if the reset signal is input, internal data is not removed.
- When the reset signal is input while waiting for retry, the resetting starts without removal of frequency of shutoff time.

12-2 Error No. and Its Measure

12-2-1 Error No. Table

You need to take a measure according to the error number and the type of error.

Refer to the explanation pages shown in the table below.

Error No.	Error Name	Explanation Page
E001	Overcurrent error	P. 12-7
E005	Motor overload error *2	P. 12-8
E006	Braking resistor overload error	P. 12-9
E007	Overvoltage error	P. 12-10
E008	Memory error	P. 12-10
E009	Undervoltage error	P. 12-11
E010	Current detector error *1	P. 12-11
E011	CPU error *1	P. 12-11
E012	External trip error	P. 12-12
E013	USP error	P. 12-12
E014	Ground fault error *1	P. 12-12
E015	Incoming overvoltage error	P. 12-13
E016	Instantaneous power failure error	P. 12-13
E019	Temperature detector error *1	P. 12-13
E020	Cooling fan rotation speed reduction temperature error *1	P. 12-14
E021	Temperature error	P. 12-14
E024	Input open-phase error	P. 12-14
E030	IGBT error	P. 12-15
E034	Output open-phase error	P. 12-15
E035	Thermistor error	P. 12-16
E036	Brake error	P. 12-16
E038	Low-speed range overload error	P. 12-16
E039	Controller overload error *2	P. 12-17
E040	Operator keypad disconnection error	P. 12-17
E041	RS485 communication error	P. 12-18
E042	RTC error	P. 12-18
E043	EzSQ illegal instruction error	P. 12-18
E044	EzSQ nest count error	P. 12-18
E045	Executive instruction error	P. 12-19
E050	EzSQ user-assigned error 0	P. 12-19
E051	EzSQ user-assigned error 1	P. 12-19
E052	EzSQ user-assigned error 2	P. 12-19
E053	EzSQ user-assigned error 3	P. 12-19
E054	EzSQ user-assigned error 4	P. 12-19
E055	EzSQ user-assigned error 5	P. 12-19
E056	EzSQ user-assigned error 6	P. 12-19
E057	EzSQ user-assigned error 7	P. 12-19

*1. When a serious fault error occurred, it cannot be released by a reset operation.

*2. When a controller overload error occurred, or a motor overload error occurred in the condition that [bC112] had been set to 00, the inverter does not accept a reset input for 10 seconds. Wait for a while before performing a reset operation.

Error No.	Error Name	Explanation Page
E058	EzSQ user-assigned error 8	P. 12-19
E059	EzSQ user-assigned error 9	P. 12-19
E060	Option 1 error 0	P. 12-19
E061	Option 1 error 1	P. 12-19
E062	Option 1 error 2	P. 12-19
E063	Option 1 error 3	P. 12-19
E064	Option 1 error 4	P. 12-19
E065	Option 1 error 5	P. 12-19
E066	Option 1 error 6	P. 12-19
E067	Option 1 error 7	P. 12-19
E068	Option 1 error 8	P. 12-19
E069	Option 1 error 9	P. 12-19
E070	Option 2 error 0	P. 12-19
E071	Option 2 error 1	P. 12-19
E072	Option 2 error 2	P. 12-19
E073	Option 2 error 3	P. 12-19
E074	Option 2 error 4	P. 12-19
E075	Option 2 error 5	P. 12-19
E076	Option 2 error 6	P. 12-19
E077	Option 2 error 7	P. 12-19
E078	Option 2 error 8	P. 12-19
E079	Option 2 error 9	P. 12-19
E080	Option 3 error 0	P. 12-20
E081	Option 3 error 1	P. 12-20
E082	Option 3 error 2	P. 12-20
E083	Option 3 error 3	P. 12-20
E084	Option 3 error 4	P. 12-20
E085	Option 3 error 5	P. 12-20
E086	Option 3 error 6	P. 12-20
E087	Option 3 error 7	P. 12-20
E088	Option 3 error 8	P. 12-20
E089	Option 3 error 9	P. 12-20
E090	STO shutoff error	P. 12-20
E091	STO internal error	P. 12-20
E092	STO path 1 error	P. 12-20
E093	STO path 2 error	P. 12-20
E100	Encoder disconnection error	P. 12-20
E104	Position control range error	P. 12-21
E105	Speed deviation error	P. 12-21
E106	Position deviation error	P. 12-21
E107	Over-speed error	P. 12-22
E110	Contactor error	P. 12-22
E112	PG option unit connection error	P. 12-22
E120	PID Abnormal Start Error	P. 12-22

12-2-2 Details about Errors

E001 Overcurrent Error

A large current flowing in the inverter results in a failure. To prevent this, the inverter turns OFF its output. By setting the parameter, you can perform retries for a fixed number of times without generating an error. Overcurrent level can be set in the [bb160].

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred abruptly during operation.	A steep load change occurred.	• Overcurrent suppression function and Overload limit function are effective to suppress overcurrent. • When the vector control is used, the situation may be improved by adjusting the response to control in [HA115].
	Hunting of motor	• The situation may be improved by setting the IM motor capacity in [Hb102], the number of IM poles in [Hb103], or the auto-tuning selection in [HA-01]. • The situation may be improved by adjusting stabilization control gain in [HA110].
Error occurred during acceleration.	• Insufficient acceleration time • Insufficient acceleration torque • Load inertia is large. • Friction torque is large.	• Setting longer acceleration time in [FA-10] can ease the insufficient acceleration torque. • When acceleration torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and making adjustments with control method in [AA121]. • Re-examination of load condition may improve the situation.
Error occurred during deceleration.	• Insufficient deceleration time • Insufficient regenerative torque • Load inertia is large.	• Setting longer deceleration time in [FA-12] can ease the insufficient regenerative torque. • When regenerative torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and making adjustments with control method in [AA121]. • Re-examination of load condition may improve the situation.
Error occurred right after an operation command input.	• A ground fault has occurred. • Output line is short-circuited or in open phase. • Output element failure	• The inverter may be broken if the error persists even when the power of inverter only is turned ON again after the power was turned OFF and the output line to the motor was removed. • If the issue is solved when the output line to the motor is removed, you need to check the wiring and/or motor.
	• Motor is locked. • Load inertia is large.	• Error may occur when the motor rotation is locked. • The situation may be improved by taking a measure for the case “Error occurred during acceleration”.
Error occurred right after power was turned ON.	• Output element failure • Current detector failure	Failure output element or current detector may be the cause. An investigation and repair are required.
Error occurred after long hours of use.	System environment changes	The situation may be improved by reducing the motor load, or performing a system maintenance (e.g., cleaning the fan to be driven and removing clogging in the duct).
	Aging deterioration	If the issue is not solved by reduction of the load and system maintenance, aging deterioration of a life-limited component may be the cause. A repair is required.

E005 Motor Overload Error

The built-in electronic thermal function monitors the output current of the inverter and when a motor overload is detected, the inverter turns OFF its output. The inverter trips according to the setting of the motor electronic thermal function.

When a motor overload error occurred, the inverter does not accept a reset input for 10 seconds.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after a fixed period of operation.	Operation under heavy load condition has continued.	Re-examination of operation condition or correction of load condition may improve the situation.
	Thermal level is set high.	When the motor thermal level setting in [bC110] is not appropriate, re-examination of the setting may improve the situation.
Error occurred during acceleration.	• Insufficient acceleration torque • Load inertia is large. • Friction torque is large.	• Setting longer acceleration time in [FA-10] can ease the insufficient acceleration torque. • When acceleration torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and making adjustments with control method in [AA121]. • Re-examination of load condition may improve the situation.
	A function to suppress overcurrent is at work.	A factor for overcurrent may have been occurred. Re-examination of acceleration time or load condition is required.
Error occurred during deceleration.	Load inertia is large.	• Setting longer deceleration time in [FA-12] can ease the insufficient regenerative torque. • When regenerative torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and adjusting with control method in [AA121]. • Re-examination of load condition may improve the situation.
	A function to suppress overvoltage is at work.	Current may increase as a result of suppressing overvoltage. Re-examination of deceleration time or load condition in [FA-12] is required.
Error occurred after long hours of use.	System environment changes	The situation may be improved by reducing the motor load, or performing a system maintenance (e.g., cleaning the fan to be driven and removing clogging in the duct).
	Aging deterioration	If the issue is not solved by reduction of the load and system maintenance, aging deterioration of a life-limited component may be the cause. A repair is required.

E006 Braking Resistor Overload Error

When the use rate of inverter's braking resistor operation circuit (BRD) exceeds the use rate set beforehand in [bA-60], the inverter turns OFF its output.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred during deceleration.	• Insufficient deceleration time • Load inertia is large. • Capacity of braking resistor is small.	Setting longer deceleration time in [FA-12] may improve the situation that the motor is rapidly decelerated. If deceleration time cannot be shortened, choice of resistor must be re-examined.
Error occurred during operation.	• Continuous regenerative operation • Capacity of braking resistor is small.	The resistor may not be able to fully consume the power because the regenerative power returned from the motor is high. Load condition or choice of resistor must be re-examined.
	Rotated by external force.	The resistor may not be able to fully consume the power because the fan is rotated by a strong wind, or because the regenerative power returned from the motor increases when loads are lowered by a crane or the like. Load condition or choice of resistor must be re-examined.
Error occurred during repetitive operations.	Repetition cycle of operation is high.	Reduction of repetition cycle of operation may improve the situation. Adjustment of deceleration time in [FA-12] and re-examination of choice of resistor may also improve the situation.

E007 Overvoltage Error

Too high P-N voltage results in a failure. To prevent this, the inverter turns OFF its output. When P-N voltage exceeds approx. 410 Vdc (200 V class) or approx. 820 Vdc (400 V class), the output is turned OFF. By setting the parameter, you can perform retries for a fixed number of times without generating an error.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred during deceleration.	• Insufficient deceleration time • Load inertia is large.	Setting longer deceleration time in [FA-12] may improve the situation that the motor is rapidly decelerated. If deceleration time cannot be shortened, you need to re-examine load condition, activate overvoltage suppression function, or use a braking resistor, braking unit, or regenerative converter.
Error occurred during operation.	Load inertia is large.	If load inertia is large, high regenerative power returns from the motor; hence an overvoltage is likely to occur. You need to re-examine load condition, activate overvoltage suppression function, or use a braking resistor, braking unit, or regenerative converter.
	Rotated by external force (fan, crane).	An overvoltage is likely to occur if motor rotation speed exceeds the output frequency (rotation speed) of inverter. You need to re-examine load condition, activate overvoltage suppression function, or use a braking resistor, braking unit, or regenerative converter.
Error occurred during stop.	Abnormality of PS voltage	Power supply voltage may be raised or fluctuated. Re-examination of power supply environment or use of an AC reactor may improve the situation.
Error occurred during drooping control	Mutual interference caused by 2 inverters trying to control motors strictly.	When 2 motors driving a same shaft are controlled by 2 inverters, both the inverters attempt to generate torques, which may result in control divergence. The situation may be improved by setting one of the inverters to P control. See *7-3-3 P/PI Switching Function* on page 7-46.

E008 Memory Error

If the built-in memory has problems, the inverter turns OFF its output. CPU error may be issued instead.

The inverter recovers by re-turning ON the power; however, you need to check that there is no problem in parameters. The data which has been backed up on the operator keypad beforehand may be restored.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred some time after the power was turned ON.	Noise is mixed.	A physical countermeasure such as placing a shielding plate may be required to avoid external noises.
Power has been unintentionally turned OFF before.	Power-off during memory access	You need to restore the data by using the data which has been backed up on the operator keypad beforehand. If the data cannot be restored, initialization is required. See *6-1-2 Inverter Initialization* on page 6-5. If the data cannot be restored by initialization, a repair is required.

E009 Undervoltage Error

A decrease of the main power supply of inverter results in a circuit breakage. To prevent this, the inverter turns OFF its output. When P-N voltage falls below approx. 160Vdc (200V class) or approx. 320VDC (400V class), the output is turned OFF. By setting the parameter, you can perform retries for a fixed number of times without generating an error. Furthermore, undervoltage error during stop can be disabled by setting.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
There was a power failure.	PS voltage decreased.	If the internal power supply hasn't been fully turned OFF, it is possible to re-start the inverter after the power supply is recovered, by setting the retry function while it is still on.
Error occurred with the start of operation.	• PS voltage decreased. • PS capacity is insufficient.	When power supply voltage decreases or power supply capacity is insufficient, re-examination of power supply environment is required.
The inverter doesn't start.	PS voltage is insufficient.	Perform power supplying in accordance with the inverter voltage class.
Error occurred after long hours of use.	• System environment changes • Capacitor deterioration • Circuit failure	If an undervoltage occurs frequently, the inverter may have reached its end of life or be broken down. A repair is required.

E010 Current Detector Error

If the built-in current detector has problems, the inverter turns OFF its output.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after power was turned ON.	Current detector circuit is broken.	If the error recurs after a reset operation, the current detector circuit may be broken down. A repair is required.
	A noise source is nearby.	When there is a noise source nearby, the situation may be improved by taking a noise countermeasure such as keeping the noise source away or placing a shielding plate.
Error occurred after long hours of use.	Current detector circuit is broken.	If the error recurs after a reset operation, the current detector circuit may be broken down. A repair is required.

E011 CPU Error

When a malfunction or problem occurs in the built-in CPU, the inverter turns OFF its output and then displays the error.

If the inverter doesn't recover by re-turning ON the power, the CPU is likely to be broken.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred abruptly.	The internal CPU is broken.	• The inverter may recover by a reset operation, re-turning ON the power, or initialization operation. When the inverter recovered, an initialization must be executed. • If the inverter doesn't recover, the CPU may be broken down. A repair is required.
	A noise source is nearby.	Where there is a noise source nearby, the situation may be improved by taking a noise countermeasure such as keeping the noise source away or placing a shielding plate.
Error occurred during data writing.	Data is inconsistent.	The inverter may recover by a reset operation, re-turning ON the power, or initialization operation. When the inverter recovered, an initialization must be executed. See *6-1-2 Inverter Initialization* on page 6-5.

E012 External Trip Error

When the inverter accepted a signal commanded by an external device or equipment, the inverter turns OFF its output. (When external trip function is selected.)

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred unintentionally.	• Terminal logics are reversed. • Wiring is wrong.	• You need to check the state of operations related to external devices or external equipment, and re-examine the assignment of external trip terminal to the inverter input terminal, the setting of a/b contact, the external trip command via communication, etc. • A/b contact of terminal can be changed by inverter setting.

E013 USP Error

This error occurs if an operation command has been input to the inverter when the power supply is turned ON. Operation command detection is carried out for 1 second after the power supply is turned ON. (When USP function is selected.)

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred unintentionally.	Operation command was entered too early.	Re-examination of the sequence to enter operation command is required. You need to wait for 2 seconds or longer to enter operation command after turning ON the power supply.
	Operation command isn't released.	You need to release an operation command when turning ON the power supply.
	You tried to operate with commands other than terminal commands.	When USP is enabled, commands of the operator keypad and communication commands are treated as errors. You need to wait for 2 seconds or longer to enter operation command after turning ON the power supply.

E014 Ground Fault Error

This is a function to protect the inverter by the detection of ground faults between the inverter output and the motor at power-on.

The function doesn't work when there is a voltage induced in the motor due to idling or when the inverter trips.

When the control circuit power (R0, T0, or 24 V power supply) has been turned ON prior to the main circuit power R, S, or T, the function is activated at the time the main circuit power is turned ON.

Setting the ground fault detection selection [bb-64] to 00 disables the ground fault function. Setting it to 01 enables the function.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred as the power supply was turned ON.	• Ground faults of wires or the motor • Motor insulation deterioration	• Turn OFF the power, remove the wires connected to the motor, and then check the motor and the wires. A ground fault may have been occurred. • Turning ON the power supply in a ground fault state results in a failure. Do not turn ON the power when you check the motor and motor wires.

E015 Incoming Overvoltage Error

This error occurs if high incoming voltage level is held for 100 seconds continuously while the inverter output is stopped when incoming overvoltage level [bb-61] is set to 01. It occurs when the P-N voltage exceeds the voltage level set in the incoming overvoltage level selection [bb-62] due to incoming voltage.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after power was turned ON.	Incoming voltage is high.	Re-examination of the power supply environment is required.
Error occurred after long hours of use.	Power supply has become unstable.	The power supply environment may have been changed due to facility replacement or the like. Re-examination of the power supply environment is required.

E016 Instantaneous Power Failure Error

At the time of an instantaneous power failure, the inverter turns OFF its output. If the power failure continues, the event is regarded as a normal power-off.

Decrease in the main power R, S, or T generates this error. Decrease in the voltage of control circuit power supply R0 or T0 doesn't generate the error if the J51 connector has been removed and the R0 and T0 are input via a separate system.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after long hours of use.	PS voltage decreased.	If the power is turned OFF due to an external factor such as power failure, the inverter can be restarted by using the retry function when the power is restored.
	There was a contact fault in circuit breaker.	Failure of magnetic contactor or earth-leakage breaker may be the cause. Although the inverter may recover, a repair is required.
Error occurred with the start of operation.	PS voltage decreased.	If an instantaneous power failure hasn't occurred, insufficient capacity of power supply may be the cause. Re-examination of the power supply environment is required.

E019 Temperature Detector Error

This error occurs if there is a problem in the temperature detector circuit such as disconnection.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after use.	The temperature detector circuit is disconnected or broken down.	The temperature detector circuit is broken down. A repair is required.

E020 Temperature Error from Cooling Fan Rotation Speed Reduction

If the temperature of inverter gets high due to deterioration of cooling ability resulted from decrease in fan rotation speed, the inverter turns OFF its output. Refer to E021 also.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Cooling fan stopped.	A foreign object is stuck.	If there is a foreign object stuck in the fan, the inverter may recover by removing it.
	It is the end of cooling fan life.	The cooling fan needs to be replaced.
The cooling fan is working.	Cooling fan is approaching the end of its life.	The cooling ability has been deteriorated. The cooling fan needs to be replaced.

E021 Temperature Error

When the temperature of inverter gets high, the inverter turns OFF its output.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred during operation.	Carrier frequency is high.	The higher the carrier frequency is, the more the temperature inside the inverter tends to increase. Lower the carrier frequency setting.
	There is clogging in the fin.	The cooling ability is deteriorated. Cleaning the fin may improve the situation.
	• Used in high temperature environment. • Cooling of the surroundings is insufficient.	Enhancing the use environment or cooling environment may improve the situation.
	The formal installation condition is not satisfied.	Improper installation of the inverter may results in the inverter failure. Install the inverter properly in accordance with the instruction manual.
Error occurred during stop.	The temperature detector circuit broke down.	The temperature detector circuit is broken down if the error is generated consecutively even after a reset. A repair is required.

E024 Input Open-phase Error

When [bb-65] input phase loss selection is set to 01, when a missing phase is detected in input line, the inverter turns OFF its output.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after power was turned ON.	An input line or the motor has a loose connection or is disconnected.	You need to turn OFF the power supply and check the input lines and the wiring condition of breaker. This error may also occur due to PS voltage defect, contact defect, screw tightening failure, etc.
	Single-phase input is used.	For input lines, use three-phase connection.
Error occurred after long hours of use.	An input line or breaker has a loose connection or is disconnected.	The situation may be improved by mending loose connections due to loosening of screws or the breaker problems.

E030 IGBT Error

At the time of an instantaneous overcurrent or the main element failure, the inverter turns OFF its output to protect the main element.

Overcurrent error may be issued instead.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred right after the operation started.	• A ground fault has occurred. • Output line is short-circuited.	After the power is turned OFF, you need to check the wires connected to the motor, motor disconnection, and the like. If the error occurs after removal of the motor wires, the inverter is broken down. It needs to be repaired.
	Motor rotation is locked.	A large current may flow when the motor rotation is locked during operation. The cause needs to be removed.
	Output element is broken down.	If output element is broken down, it needs to be repaired.
Error occurred right after power was turned ON.	Output element is broken down.	If output element is broken down, it needs to be repaired.
Error occurred during operation.	Motor rotation is locked.	A large current may flow when the motor rotation is locked during operation. The cause needs to be removed.

E034 Output Open-phase Error

When the output phase loss selection [bb-66] is set to 01, when a loose connection or disconnection of output line, disconnection inside the motor, etc. is detected, the inverter turns OFF its output. Detection of phase loss state is executed in the section between 5 Hz to 100 Hz.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred right after the operation started.	An output line or the motor has a loose connection or is disconnected.	You need to turn OFF the power supply and check the output lines and the wiring condition of motor. This error can also occur due to motor insulation breakdown or screw tightening failure.
	Single-phase output is used.	For output lines, use three-phase connection.
Error occurred after long hours of operation.	An output line or the motor has a loose connection or is disconnected.	You need to turn OFF the power supply and check the output lines and the wiring condition of motor. If there is a loosened screw, the situation may be improved by re-tightening the screw.

E035 Thermistor Error

If an abnormal temperature is observed during detection of resistor level change in an external thermistor, the inverter turns OFF its output. (When thermistor function is enabled.)

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Motor is heated.	The motor hasn't been cooled sufficiently.	The cooling environment needs to be improved.
	Heavy load has been applied for a long time.	The motor's driving environment needs to be re-examined.
Motor is not heated.	Inadequate thermistor function setting	Re-examination of the thermistor function setting may improve the situation.
	The thermistor is broken down.	The thermistor needs to be repaired.
	Malfunction due to noise	The situation may be improved by taking a noise countermeasure such as wiring separation.

E036 Brake Error

This error occurs when the inverter can not detect whether the brake check signal is ON or OFF during waiting time after the inverter has output a brake releasing signal. (When brake function is enabled.)

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after operation.	Disconnection of signal line.	Check the wiring of brake check signal and whether the signal is ON or OFF.
	Brake function setting	The situation may be improved by re-examination of brake check waiting time or input terminal logics according to the sequence of the signal.

E038 Low-speed Range Overload Error

This error occurs to protect the main element if the inverter has output at a low frequency of 0.2 Hz or below.

When such a low frequency is detected by the built-in electronic thermal function, the inverter turns OFF its output.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred during output at low speed.	The motor load is heavy.	Load at low-speed range needs to be reduced. If the error occurs frequently, you need to select an inverter with a capacity large enough for the motor.

E039 Controller (Inverter) Overload Error

The built-in electronic thermal function monitors the output current of the inverter (controller) and when inverter overload is detected, the inverter turns OFF its output.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after a fixed period of operation.	Operation under heavy load condition has continued.	Re-examination of operation condition or correction of load condition may improve the situation.
Error occurred during acceleration.	• Insufficient acceleration torque • Load inertia is large. • Friction torque is large.	• Setting longer acceleration time in [FA-10] can ease the insufficient acceleration torque. • When acceleration torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and making adjustments with control method in [AA121]. • Re-examination of load condition may improve the situation.
	A function to suppress overvoltage is at work.	A factor for overcurrent may have been occurred. Re-examination of acceleration time or load condition is required.
Error occurred during deceleration.	Load inertia is large.	• Insufficient rotation regeneration torque can be eased by setting longer deceleration time in [FA-12]. • When regenerative torque is required, the situation may be improved by adjusting the manual torque boost function, or by operating the inverter and adjusting with control method in [AA121]. • Re-examination of load condition may improve the situation.
	A function to suppress overcurrent is at work.	Current may increase as a result of suppressing overvoltage. Re-examination of deceleration time or load condition is required.
Error occurred after long hours of use.	System environment changes	The situation may be improved by reducing the motor load, or performing a system maintenance (e.g., cleaning the fan to be driven and removing clogging in the duct).
	Aging deterioration	If the issue is not solved by reduction of the load and system maintenance, aging deterioration of a life-limited component may be the cause. A repair is required.

E040 Keypad Communication Error

The inverter displays this error when timeout occurs because of a malfunction due to noises, loose connection or disconnection of circuit for communication with the LCD Operator.

This error function can be enabled and disabled by setting of the operation selection at disconnection of operator keypad [UA-20].

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after communication is started.	• Loose connection • Disconnection	Check the wiring to see whether the connection is properly made.
	Noise is mixed.	The situation may be improved by taking a noise countermeasure such as wiring separation.

E041 RS485 Communication Error

The inverter displays this error only when timeout occurs because of a malfunction due to noises, loose connection or disconnection of circuit for RS485 communication (such as Modbus-RTU).

This error function can be enabled and disabled by setting of the communication error selection [CF-05].

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred after communication is started.	• Loose connection • Disconnection	Check the wiring to see whether or not the connection is properly made.
	Noise is mixed.	The situation may be improved by taking a noise countermeasure such as wiring separation.

E042 RTC Error

The error is generated if the data of RTC incorporated in the operator keypad is returned to the initial data.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred at power-on.	A battery in the operator runs out.	Replacement of the battery and setting of the date solve the issue. The error occurs when the power supply is turned ON with a dead battery.

E043 EzSQ Illegal Instruction Error

This error is output when an invalid instruction is detected in operation of a program which is downloaded to the inverter while the programing function EzSQ is used.

The error is also output if the program is put into action in the condition that the program hasn't been written.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred when the program was about to put into action.	Writing error due to noise	There is a possibility of EzSQ program writing error and if there is a noise source nearby, the situation may be improved by taking a noise countermeasure such as keeping the noise source away and writing the program.
	Program hasn't been entered.	EzSQ program needs to be written in the factory default setting condition and after initialization. Write in the program.

E044 EzSQ Nest Count Error

This error is output when the nesting frequency of a subroutine, "for" statement, "next" statement, etc. on a program exceeds 8 times while the programing function EzSQ is used.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred when the program was put into action.	Program structure is too complicated.	The program has deep nesting of a subroutine, "for" statement, "next" statement, etc., with its nesting frequency exceeding 8 times. Improvement of the program structure is required.

E045 EzSQ Executive Instruction Error

During operation of a program which is downloaded to the inverter while the programing function EzSQ is used, if execution of the program is turned OFF due to an error, the inverter generates E045 error.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred when the program was put into action.	Program flow is inadequate.	This error is output if there is no nest starting statement such as “for” at the point when “goto” statement refers to, or if a nest ending statement such as “next” precedes the nest starting statement. Check the structure of “for” statement and “next” statement and make amendments as needed.
	There is a problem in the data.	There may be an overflow, underflow, or division by zero in four arithmetic operations. Check the result of operations and amend the operations as needed.
		This error is output if a non-existing parameter is referred to or a setting is made beyond the setting range in “chg param” or “mon param” instruction. Check the content of instruction and make amendments as needed.

E050 to E059 EzSQ User-assigned Errors 0 to 9

The inverter generates these errors when the corresponding user-assigned tripping programs are executed during operation of a program which is downloaded to the inverter while the programing function EzSQ is used.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred when the program was put into action.	The program has an error instruction.	If a user-assigned error occurs unintentionally, check the content of trip instruction of the program and make amendments as needed.

E060 to E069 Option 1 Errors 0 to 9

Errors occurring in an option mounted in the option slot 1 (to the observer’s left) are detected.

For details, refer to the instruction manual provided together with the option mounted.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred when an option is mounted.	The option isn’t securely mounted.	The option may not be securely mounted. Check the mounting state.
	The option is used in the wrong way.	The type of error varies depending on options. For details, refer to the instruction manuals provided together with the respective options.

E070 to E079 Option 2 Errors 0 to 9

Errors occurring in an option mounted in the option slot 2 (to the observer’s center) are detected.

For details, refer to the instruction manual provided together with the option mounted.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred when an option is mounted.	The option isn’t securely mounted.	The option may not be securely mounted. Check the mounting state.
	The option is used in the wrong way.	The type of error varies depending on options. For details, refer to the instruction manuals provided together with the respective options.

E080 to E089 Option 3 Errors 0 to 9

Errors occurring in an option mounted in the option slot 3 (to the observer's right) are detected.

For details, refer to the instruction manual provided together with the option mounted.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred when an option is mounted.	The option isn't securely mounted.	The option may not be securely mounted. Check the mounting state.
	The option is used in the wrong way.	The type of error varies depending on options. For details, refer to the instruction manuals provided together with the respective options.

E090 to E093 STO Error FS Option Error

When there is a path error in functional safety circuit, an inverter outputs the error.

For details about E090 to E093, refer to *Section B Appendices B STO Function*.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
The safety function is used.	The safety function system has problems.	Refer to *Section B Appendices B STO Function*.

E100 Encoder Disconnection Error

This is an error related to feedback options.

When you set a switch on the PG option unit of feedback options, [E100] encoder disconnection error can generate the inverter trip.

For the setting procedure, refer to *2-3-6 Wiring for PG Option Unit* on page 2-63.

Error cases	Cause	Examples of Measures
This error occurred when turning a power supply ON.	Error on encoder wiring or encoder	• Check encoder signal and the wiring. • Check that there is not any delay when the encoder power supply rather than inverter one is turned ON and the power is supplied.
This error suddenly occurred during the operation.	Error on encoder wiring or encoder	Check encoder signals and the wiring.
This error occurred when cutting off the power supply. Or whenever the power supply was turned ON, this error history was added.	Error on a power supply inside inverter or an encoder power supply	• Check that inverter failure or overload of the encoder power supply. • Check that there is not power loss on the encoder power supply rather than the inverter one when you use the encoder power supply.

E104 Position Control Range Error

When the current position counter exceeds the position control ranges for normal/reverse rotation in the setting of [AE-52] position range (normal) or [AE-54] position range (reverse), the inverter turns OFF its output and displays the error.

Related pages found herein: P. 8-110

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred during operation.	Recheck the setting of electronic gear.	Re-examination of operation condition or correction of load condition may improve the situation.
	A slip occurs due to improper encoder setting.	Check the encoder mounting state. If any, re-examine factors for slipping.
	Improper encoder setting	Check the setting of encoder constant and the like.
	Improper electronic gear setting	Recheck the setting of electronic gear.

E105 Speed Deviation Error

When the deviation between the frequency command and the feedback speed exceeds the [bb-83] speed deviation error detection level setting, the inverter judges it as an error. If “01: Error” is specified for [bb-82] Operation for speed deviation error, the inverter turns ON the output terminal function 041 [DSE] with a speed deviation error, turns OFF the inverter output, and displays this error.

Related pages found herein: P. 8-78

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred during operation.	Recheck the setting of electronic gear.	Re-examination of operation condition or correction of load condition may improve the situation.
	A slip occurs due to improper encoder setting.	Check the encoder mounting state. If any, re-examine factors for slipping.
	Improper encoder setting	Check the setting of encoder constant and the like.
	Improper electronic gear setting	Recheck the setting of electronic gear.

E106 Position Deviation Error

When the [bb-87] abnormal position deviation time passes with the deviation of the position feedback against the position command exceeding the [bb-86] abnormal position deviation detection level, it is determined to be abnormal. When the behavior of the abnormal position deviation [bb-85] has been set to 01, the output terminal [PDD] is turned ON, the output is turned OFF, and the error is displayed.

Related pages found herein: P. 8-100

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred during operation.	Recheck the setting of electronic gear.	Re-examination of operation condition or correction of load condition may improve the situation.
	A slip occurs due to improper encoder setting.	Check the encoder mounting state. If any, re-examine factors for slipping.
	Improper encoder setting	Check the setting of encoder constant and the like.
	Improper electronic gear setting	Recheck the setting of electronic gear.

E107 Over-speed Error

When the speed has exceeded [bb-80] Over-speed error detection level and [bb-81] Over-speed error detection time has elapsed, the output is turned OFF and the error is displayed.

Related pages found herein: P. 8-79

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred during operation.	Recheck the setting of electronic gear.	Re-examination of operation condition or correction of load condition may improve the situation.
	Improper encoder setting	Check the setting of encoder constant and the like.
	Improper electronic gear setting	Recheck the setting of electronic gear.

E110 Contactor Error

When an error occurs in the contactor sequence, the output is turned OFF.

Related pages found herein: P. 8-91

Occurrence	Estimated cause(s)	Exemplar measures to be taken
[COK] was not turned ON within the contactor check time at start-up.	Wiring defect	Check the setting and wiring of input terminal function.
	Contactor response defect	Check the operation of contactor including its response time.
[COK] was not turned OFF within the contactor check time at stop.	Wiring defect	Check the setting and wiring of input terminal function.
	Contactor response defect	Check the operation of contactor including its response time.

E112 PG Option Unit Connection Error

This is an error related to feedback options.

When the PG option unit is taken off the slot after being set, [E112] PG option unit connection error can generate inverter trip.

Error cases	Cause	Examples of Measures
This error suddenly occurred during the operation.	There is a possibility that a connector was taken off the PG option unit.	• Check that the screw fixed in the PG option unit was not loosen. • Check the connector to be fit into PG option unit and to have no dust.

E120 PID Abnormal Start Error

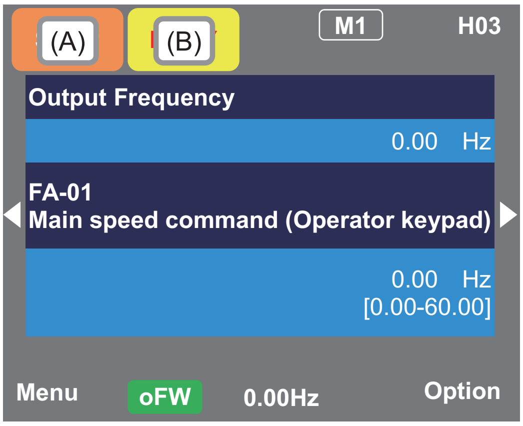
If PID is performed while the operation is started when [AH-75] PID soft-start function selection and [AH-81] PID start abnormal judgment implement selection are set to 01, this error occurs when the PID feedback value does not reach [AH-82] PID start abnormality judgment level after the elapse of [AH-80] soft-start time.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Error occurred during operation.	The target value is too low.	Re-examination of [AH-76] PID soft-start target level may improve the situation.
	Wires are disconnected.	Input PID feedback data may not be appropriate. Check the wiring and [db-44] PID1 feedback monitor.

12-3 Alarm Display and Its Measures

12-3-1 Checking Alarm Display

The status of the inverter is shown in the following table for LCD operator.



Indication (A) Main Operating Status Display

No.	Indication	Description
A1	RUN FW	Icon shown during normal rotation operation. Some parameters cannot be changed while the inverter is running.
A2	RUN RV	Icon shown during reverse rotation operation. Some parameters cannot be changed while the inverter is running.
A3	RUN 0Hz	Icon shown during outputting under a zero-Hz command. It is also shown while DB, FOC, SON function is working. Some parameters cannot be changed while the inverter is running.
A4	TRIP	Icon shown when an error occurred and the inverter is in trip state. Releasable errors can be released by a reset operation. ⇒ *12-1 Checking Alarm Display* on page 12-2
A5	WARN	Icon shown when a setting inconsistency exists. Eliminate the inconsistency. ⇒ *12-3-2 Checking Inconsistent Settings* on page 12-29
A6	STOP	Icon shown while the inverter is forced stop by the following functions although operation command is entered. • An operation command was entered under 0Hz frequency command. • Operation command was entered from a source other than the operation keypad and the operation was stopped with STOP key on the operation keypad. • The inverter stops by instantaneous power failure non-stop function. RUN lamp flashes during this.
A7	STOP	Inverter is stopped because no operation command is given. The inverter cannot be operated if the input terminal functions such as [RS] and [FRS] or the STO function is ON.

Indication (B) Warning Status Display

No.	Indication	Description
B1	LIM	Icon shown while the following functions are working. [dC-37] • Under overload limit. • Under torque limit. • Under overcurrent suppression. • Under overvoltage suppression. • Under upper/lower limit operation. • Under jump frequency operation. • Under minimum frequency limit.
B2	ALT	Icon shown while the following functions are working. [dC-38] • Overload advance notice • Motor thermal advance notice • Inverter thermal advance notice • Motor overheat advance notice
B3	RETRY	Icon shown during retry standby or restart standby. [dC-39]
B4	NRDY	The inverter cannot be operated even when the operation command is entered. [dC-40] • The main power is under insufficient voltage supply. • The inverter is operating only with 24V power supply. • Under reset operation. • The inverter is OFF as the [REN] terminal function is enabled.
B5	FAN	Icon shown in fan life advance notice state.
B6	C	Icon shown in on-board capacitor life advance notice state.
B7	F/ C	Icon shown in fan life advance notice and on-board capacitor life advance notice state.
B8	(None)	A state other than those above.

You can see the detailed warning by pressing UP key on the three-lined monitor screen.

STOP (in red)

When “Stop” is indicated in red, the state goes into the followings.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
RUN key on the keypad was pressed. [FW] terminal was turned ON. Operation command was entered.	If LIM icon is lit, the command is below the minimum frequency and the following reasons are conceivable. • Operation command is entered but not frequency command. • Frequency command destination selection is wrong.	• Check that [FA-01] main speed command is not set to 0.00Hz. • Check whether the command is entered from the command destination indicated on the right of the main speed command [FA-01]. • Check [AA101] Main speed input source selection.
After STOP key on keypad is pressed, inverter doesn’t operate with RUN key.	STOP key on the LCD Operator was pressed when the operation command had been entered from a source other than the operation keypad.	Cancel the command entered to the operation command destination.
Instantaneous power failure occurred.	The inverter stopped by the instantaneous power failure non-stop function.	To start operation, turn off the command entered to the operation command destination and turn on again.

WARN

When “WARN” is indicated, the state goes into the followings.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
A setting was configured.	There is an inconsistency in the parameter setting	Refer to *12-3-2 Checking Inconsistent Settings* on page 12-29.

Icon 2 LIM

When LIM is shown, the inverter is in the following condition(s).

You can see the status of LIM by pressing UP key on the three-lined monitor or on [dC-37].

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Output current was high, and [dC-37] LIM was set to 01.	[bA120] overcurrent suppression function was enabled and the current increased due to the load or other factors.	Remove the factor for the increased load. (E.g., by cleaning a clogged channel, re-examining the load)
	The current was increased by the high ratio of motor rotation during DC braking that was caused by the selection of [DB] terminal or [AF101] DC braking.	• Reduce the DC braking force in [AF105] or [AF108]. • For stopping, set longer time for [AF106] DC braking delay time at the time of the stop. • For retry operation at the start, set longer delay time according to the factors. [bb-26] [bb-29] [bb-31]
	[FA-10] acceleration time is too short.	Make the acceleration time longer in [FA-10].
Output current was high, and [dC-37] LIM was set to 02.	[bA122] overload limit function or similar function was enabled and the current increased due to the load or other factors.	Remove the factor for the increased load. (E.g., by cleaning a clogged channel, re-examining the load)
	[bA122] overload limit function or similar function was enabled and [FA-10] acceleration time was too short.	Make the acceleration time longer in [FA-10].
Error occurred during deceleration. [dC-37] LIM was set to 03.	[bA140] overvoltage suppression function was enabled and P-N voltage increased due to regenerative load or the like.	Remove the factor for the increased regenerative load. (E.g., by re-examining the state of the motor being rotated by external force, and by re-examining the load)
	[bA122] overload limit function or similar function was enabled and [FA-12] deceleration time was too short.	Make the deceleration time longer in [FA-12].
Error occurred during sudden acceleration. [dC-37] LIM was set to 03.	[bA140] overvoltage suppression function was enabled and P-N voltage increased due to regenerative load or the like.	Remove the factor for the increased regenerative load. (E.g., by re-examining the state of the motor being rotated by external force, and by re-examining the load)
Output current was high, and [dC-37] LIM was set to 04.	[bA110] torque limit function or similar function was enabled and the current increased due to the load or other factors.	Remove the factor for the increased load. (E.g., by cleaning a clogged channel, re-examining the load)
	[bA110] torque limit function or similar function was enabled and [FA-10] acceleration time was too short.	Make the acceleration time longer in [FA-10].
Error occurred during operation. [dC-37] LIM was set to 05.	The normal limiting was performed according to the settings of [bA102] upper limiter, [bA103] lower limiter, and [AG101] and other jump frequencies.	Re-examine the settings of the upper/lower limiter or jump frequencies if necessary.
Error occurred during operation. [dC-37] LIM was set to 06.	The frequency command at below the minimum frequency [Hb130] has been input.	Set the frequency command at the minimum frequency or higher in [FA-01].

Icon 2 ALT

When ALT is shown, the inverter is in the following condition(s).

You can see the status of ALT by pressing UP key on the three-lined monitor or on [dC-38].

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Output current was high, and [dC-38] ALT was set to 01.	The current increased due to load or other factors, exceeding the overload prewarning levels set in [CE106] or the similar parameter.	• Remove the factor for the increased load. (E.g., by cleaning a clogged channel) • Enable overload limit function or similar function.
Output current was high, and [dC-38] ALT was set to 02.	The electronic thermal function of motor was activated due to increase in current and the load exceeded the electronic thermal warning level (MTR) set in [CE-30].	• Remove the factor for the increased load. (E.g., by cleaning a clogged channel) • Re-examine the electric thermal settings or the similar parameter.
Output current was high, and [dC-38] ALT was set to 03.	The electronic thermal function of inverter was activated due to increase in current and the load exceeded the electronic thermal warning level (CTL) set in [CE-31].	Remove the factor for the increased load. (E.g., by cleaning a clogged channel)

Icon 2 RETRY

When RETRY is shown, the inverter is in the following condition(s).

You can see the status of RETRY by pressing UP key on the three-lined monitor or on [dC-39].

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Output was turned OFF and [dC-39] RETRY was set to 01.	The inverter is in the waiting mode after a trip retry operation due to increased current or P-N voltage fluctuation.	• If the wait time become longer, the following delay time become shorter. [bb-26] [bb-29] [bb-31] • If this error is generated consecutively, make the wait time longer. [bb-26] [bb-29] [bb-31]
Output was turned OFF and [dC-39] RETRY was set to 02.	The inverter is in the waiting mode before restart after power-off by [RS], [FRS], or [CS] terminal.	If the wait time become longer, the following delay time become shorter. [bb-26]

Icon 2 NRDY

When NRDY is shown, the inverter is in the following condition(s).

You can see the status of NRDY by pressing UP key on the three-lined monitor or on [dC-40].

Occurrence	Estimated cause(s)	Exemplar measures to be taken
TRIP display was shown and [dC-40] NRDY was set to 01.	There was an error factor, which caused the inverter to trip.	Remove the error factor. Consult this chapter.
The CTRL icon was shown and [dC-40] NRDY was set to 02.	The control power supply (R0, T0) has been input, whereas the main circuit power supply R-S-T hasn't been input.	Check the input of main circuit power supply and examine the breaker, wiring, and so on.
The 24V icon was shown and [dC-40] NRDY was set to 02.	Only 24V has been input to the backup power supply P+-P-.	Check the input of main circuit power supply and the control power supply, and examine the breaker, wiring, and so on.
[dC-40] NRDY was set to 03.	[RS] terminal is ON and the inverter is under reset operation.	Check the wiring and operation state of [RS] terminal.
[dC-40] NRDY was set to 04.	The STO circuit is turned OFF or broken.	Check ST1/ST2 terminals.
[dC-40] NRDY was set to 05.	The inverter is checking the internal circuit, operator keypad, options, etc.	If this error is not released, check the operator keypad for contact failure or other problem.
[dC-40] NRDY was set to 06.	There is an inconsistency in the setting	Although [AA121] is set to 10 (Vector control with sensor), the option RX2-PG01 is not attached.
		Refer to *12-3-2 Checking Inconsistent Settings* on page 12-29.
[dC-40] NRDY was set to 07.	There is a sequence operation problem in the brake control.	Check the setting and signal operation of [AF130] brake control or the similar parameter.
[dC-40] NRDY was set to 08.	• [FRS] terminal or [CS] terminal was turned ON. • [FRS] or [CS] command was entered from the communication.	Check the signal operation of input terminal for [FRS] or [CS].
[dC-40] NRDY was set to 09.	Operation command isn't permitted.	The [REN] terminal has been assigned and is turned OFF.
	Forced stop is being issued. (Deceleration stop behavior)	STOP key was pressed when commands had been entered from a source other than the operation keypad.

12-3-2 Checking Inconsistent Settings

You need to take a measure according to the warning number and the type of warning. Refer to the table below.

The induction motor (IM) control and synchronous motor (permanent magnetic motor) (SM (PMM)) control can be switched in [AA121].

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Warning was generated - 102	(First Max. frequency) < (first upper limiter) IM: [Hb105] < [bA102] SM (PMM): [Hd105] < [bA102]	• Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the upper limiter [bA102].
Warning was generated - 103	(First Max. frequency) < (first lower limiter) IM: [Hb105] < [bA103] SM (PMM): [Hd105] < [bA103]	• Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the lower limiter [bA103].
Warning was generated - 106	(First Max. frequency) < (first main speed command) IM: [Hb105] < [Ab110] SM (PMM): [Hd105] < [Ab110]	• Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the main speed command [Ab110].
Warning was generated - 107	(First Max. frequency) < (first auxiliary speed command) IM: [Hb105] < [AA104] SM (PMM): [Hd105] < [AA104]	• Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the auxiliary speed command [AA104].
Warning was generated - 202	(Second Max. frequency) < (second upper limiter) IM: [Hb205] < [bA202] SM (PMM): [Hd205] < [bA202]	• Increase the Max. frequency [Hb205]/[Hd205]. • Decrease the upper limiter [bA202].
Warning was generated - 203	(Second Max. frequency) < (second lower limiter) IM: [Hb205] < [bA203] SM (PMM): [Hd205] < [bA203]	• Increase the Max. frequency [Hb105]/[Hd105]. • Decrease the lower limiter [bA103].
Warning was generated - 206	(Second Max. frequency) < (second main speed command) IM: [Hb205] < [Ab210] SM (PMM): [Hd205] < [Ab210]	• Increase the Max. frequency [Hb205]/[Hd205]. • Decrease the main speed command [Ab210].
Warning was generated - 207	(Second Max. frequency) < (second auxiliary speed command) IM: [Hb205] < [AA204] SM (PMM): [Hd205] < [AA204]	• Increase the Max. frequency [Hb205]/[Hd205]. • Decrease the auxiliary speed command [AA204].

12-3-3 Checking Message

A message appears in an event like communication error, insufficient voltage, or result of auto-tuning.

Even when there is an error, you can exit the error screen with the Enter key; however, you still need to remove the error factor separately.

“XX key” in the table is the ENTER key of the LCD operator.

Message	Estimated cause(s)	Exemplar measures to be taken
Warning xxxxxxxxxxxxxxx Press the XX key.	Warning of setting inconsistency was generated. There is inconsistency of setting shown in the warning message.	The warning will be canceled by amending the indicated parameter setting.
Auto-tuning (non-revolving) completed. xxxxxxxxxxxxxxx Press the XX key.	Non-revolving auto-tuning process is finished.	See *6-2-3 Auto-tuning of Motor* on page 6-14.
Auto-tuning (revolving) completed. xxxxxxxxxxxxxxx Press the XX key.	Revolving auto-tuning process is finished.	See *6-2-3 Auto-tuning of Motor* on page 6-14.
Auto-tuning failed. Re-examine the setting and wiring. Press the XX key.	Revolving auto-tuning process is disturbed and not finished.	See *6-2-3 Auto-tuning of Motor* on page 6-14 for troubleshooting.
Initializing... Please wait.	The inverter is being initialized.	The initialization completion screen will appear after a while.
Clearing history... Please wait.	The inverter is being initialized.	The history clearance completion screen will appear after a while.
Initialization completed !! Target:#:xxxxxxxxxxxx Selection of initial values (Ub-02) xxxxxxxxxxxxx Load type selection Ub-03 xxxxxxxxxxxxx Press the XX key.	The initialization is completed.	Press Enter key to exit the initialization completion screen.
History clearance completed !! Trip history cleared. Press the XX key.	The history clearance is completed.	Press Enter key to exit the history clearance completion screen.
Operation command is limited. Please check operation command.	• Operation command of command direction is limited by the setting of [AA114] operation direction limit. • The rotation direction is reversed from the command direction limited according to the setting of [AA114] operation direction limit because the frequency command is turned negative due to calculation of main speed or auxiliary speed.	• Check the setting of [AA114] operation direction limit. • Check the terminal command FW/RW and the command direction of communication command. • Check whether the calculated frequency command is negative or not.
Resetting. Inverter is being reset. Press the XX key.	• [RS] terminal is ON. • Trip reset was performed. (The screen is transited automatically at trip reset.)	The inverter is in the condition that [RS] terminal is ON. Re-examine the state of input terminal.

Message	Estimated cause(s)	Exemplar measures to be taken
Retrying. Retrying and restarting. Press the XX key.	• The inverter is waiting for restart. (This mode is released after the set wait time has elapsed.) • The inverter may not start if the incoming voltage is low.	• If the wait time for restart is long, the message will continue to be indicated. See *7-5 Start Conditions* on page 7-63. • If the incoming voltage is low, check the input voltage.
Main circuit under instantaneous power failure. Power of main circuit is turned OFF. Press the XX key.	The main circuit power supply (R, S, T) is turned OFF due to lightning strikes, power supply environment, or other factors.	• Check the state of input power supply. • The inverter will recover when the power supply returns.
Main circuit under insufficient voltage. Please check the main circuit power. Press the XX key.	The control circuit power supply (R0, T0) has been input, whereas the main circuit power supply (R, S, T) has been cut.	• Check the state of input power supply. • The inverter will recover when the power supply of main circuit returns.
POWER OFF POWER OFF Press the XX key.	The power supply to the inverter is turned OFF.	• Check the state of input power supply. • The inverter will recover when the power supply returns.
Control power under insufficient voltage. Please check the control power supply. Press the XX key.	The control circuit power supply (R0, T0) is turned OFF.	• Check the state of input power supply. • The inverter will recover when the power supply of control circuit returns.
Power feeding by external 24 Vdc. Only external 24 Vdc is feeding power. Press the XX key.	The inverter is operating only with 24V power supply input to P+ and P- terminals.	If the input power supply is input, check its state.
Changing load type... Please wait.	The load type of inverter is being changed.	The load type change completion screen will appear after a while.
Load type change completion !! Load type selection Ub-03 Rated current value changed. Check current-related parameters. Press the XX key.	The load type change is completed.	Press Enter key to exit the load type change completion screen.

12-4 Troubleshooting

When there are failures or errors on operations, conduct the survey of the causes and take the appropriate measures.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
LCD Operator doesn't turn ON	The power supply is not turned ON.	• Check that the power supply which satisfies the specification is turned ON. • When different powers are supplied to the control power supplies R0 and T0, and to P+ and P- terminals, check that R0, T0, or 24V power supply is turned ON.
	LCD Operator is about to come off.	The issue will be solved by remounting the LCD Operator.
	The J51 connector is disconnected.	The J51 connector supplies power to the control power supplies R0 and T0 from the main power supplies R, S, and T. Keep the connector connected if you do not supply power to the control power supply with a different system.
	• The power supply input path is disconnected. • 200V power is supplied to R0 and T0 for 400V class.	• The breaker or wires may be disconnected. You need to re-examine the wiring. • When different power is supplied to the control power supplies R0 and T0, you also need to re-examine R0 and T0.
LCD Operator doesn't turn ON	LCD Operator is in the automatic extinction mode.	• The screen is lit by pressing a key on the LCD Operator. • The automatic extinction function can be disabled in the LCD Operator system setting.
	The brightness of LCD Operator display is set to low.	The brightness of the display is adjustable by changing the light control setting in the LCD Operator system setting.
	LCD Operator is about to come off.	The issue will be solved by remounting the LCD Operator. (Check the RJ45 connector.)
	The liquid crystal has reached the end of its life.	Replacement of the LCD Operator is required.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
The motor doesn't rotate although an operation command was entered.	The inverter is tripping.	• When the inverter trips due to an error, you need to remove the error factor and reset the inverter. • See *12-2 Error No. and Its Measure* on page 12-5 in this chapter.
	A warning is issued.	• If a warning is issued, you need to eliminate the data inconsistency. • See *12-3-2 Checking Inconsistent Settings* on page 12-29 in this chapter.
	The operation command isn't entered.	The operation command destination may be wrong, or the operation command may not be accepted. ⇒ Proceed to Operation command destination or operation command is wrong.
	The frequency command destination isn't entered.	The frequency command destination may be wrong, or the frequency command may be 0. ⇒ Proceed to Frequency command destination or frequency command is wrong.
	A shutoff function is at work.	The function safety terminal, terminal function [RS], or [FRS] terminal may be enabled, or [ROK] terminal may be disabled. ⇒ Proceed to A shutoff function is at work.
	A limit function is at work.	The command direction may be limited by the rotation direction limit function. ⇒ Proceed to A limit function is at work.
	Motor is locked.	If the motor shaft is locked by something which hinders the brake or the motor revolution (e.g., clogging), the cause needs to be removed.
	Wiring or the like is disconnected.	Check for abnormalities such as disconnection of the output line to the motor or disconnection within the motor.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Operation command destination or operation command is wrong.	Even though the operation command is entered, the motor does not drive.	If the LED for RUN on the LCD Operator is lit or the operation display appears, the operation command has been entered normally. There is another factor for why the motor is not driven. ⇒ Return to The motor doesn't rotate although an operation command was entered.
	The operation command destination and the operation command input are not the same.	Check the operation command destination. Check [AA111] and the terminal function. See *6-3 Operation Command Settings* on page 6-19 for details.
	You want to make operation from the LCD Operator but had made the different setting.	Confirm that "oFW" or "oRV" is shown on the LCD Operator. If it is not shown, then confirm that the operation command selection [AA111] is set to 02 RUN key on operator keypad. If it is shown, the terminal function needs to be checked.
	You want to make operation from the [FW] terminal but had made the different setting.	Set the operation command selection [AA111] to 00 [FW/RV] terminal. If RUN is not shown when the [FW] terminal is turned ON, other terminal functions need to be checked.
	There is a cause other than the operation command.	• If the LCD Operator doesn't show RUN, a shutoff function or the main power supply may not be turned ON. • There is another factor for why the motor is not driven. ⇒ Return to The motor doesn't rotate although an operation command was entered.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Frequency command destination or frequency command is wrong.	• Frequency command is 0. • [dA-04] has been 0.	The frequency command destination may be wrong, or the setting of the command destination or the input voltage of frequency setter may be 0. Set the value other than 0 for the setting destination.
	⇩	
	Frequency command destination is wrong.	Check the frequency command destination. Check [AA101] and the terminal function. See *6-4 Frequency Command Settings* on page 6-25 for details.
	⇩	
	You want to set the frequency command but [FA-01] has been 0.	Set the operation command selection [AA101] to 02: Key on LCD Operator, and then change the setting of [Ab110].
	⇩	
	[FA-01] has been 0 even though the frequency setter is operated.	Set the main speed command selection [AA101] to 07: Parameter setting, and change [FA-01] from the LCD Operator.
	⇩	
	[FA-01] is not 0, and there is a cause other than the frequency command.	• If data appears in [FA-01], the frequency command is normal. • There is another factor for why the motor is not driven. ⇒ Return to The motor doesn't rotate although an operation command was entered.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
A shutoff function is at work.	The main power supply is not turned ON.	When the power supply is separated to R, S, T and R0, T0 (J51 connector section), the inverter can not be operated if the R, S, T, side power is down. The power supply check is required.
	↓	
	[RS] terminal is ON.	If the [RS] terminal is ON, the inverter enters the reset mode and does not accept operation commands. The [RS] terminal needs to be turned OFF.
	↓	
	[FRS] terminal is ON.	If the [FRS] terminal is ON, the inverter enters the free-run stop mode and does not accept operation commands. The [FRS] terminal needs to be turned OFF.
	↓	
	[CS] terminal is ON.	If the [CS] terminal is ON, the inverter enters the mode switched to commercial power supply shutoff and does not accept operation commands. Check the commercial switching function.
	↓	
	The [ROK] terminal has been assigned and is turned OFF.	When the [ROK] terminal is used, if the terminal function is OFF, the inverter does not accept operation commands. Check the operation permission signal.
	↓	
	STO terminal is not wired or is in OFF state.	If you do not use the function of STO terminal, you need to attach a short-circuit wire to it.
	↓	
	The inverter is tripping.	When the inverter is tripping, it does not accept operation commands. Identify the factors for trip.
	↓	
	Shutoff functions are not on.	If shutoff functions are not on and the motor is not driven, there is another factor. ⇒ Return to The motor doesn’t rotate although an operation command was entered.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
A limit function is at work.	The operation permission signal has been assigned to the input terminal function and the signal is turned OFF.	When the operation permission signal has been assigned, the operation permission signal needs to be turned ON.
	The command is given to the direction the operation is limited.	Check the operation command direction limit.
	Both [FW] terminal and [RV] terminals are turned ON by operation command from input terminal.	If both [FW] terminal and [RV] terminal are turned ON, input inconsistency is generated and the inverter stops. Use only either one of them to operate the inverter.
Motor speed doesn't rise.	The overload limit function is at work.	• The overload limit function suppresses the current by dropping the frequency when the output current exceeds the overload limit level. • Raising the setting level may improve the situation.
	The frequency command is limited.	If the upper limiter and the maximum frequency is set to low level, the situation will be improved by setting them to higher level. To limit frequencies, use the upper limiter function instead of the maximum frequency.
	The frequency command is low.	The command becomes lower when a more prioritized frequency command such as for jogging or multi-speed command is entered. Re-examination of the terminal function and frequency command destination are required.
	Acceleration time is long.	If the acceleration time is set long, acceleration becomes slow. Set the acceleration time short.
The parameter you are looking for is not shown.	The display limit has been set.	Display limit function may be working. Cancel the display limit selection [UA-10].
	The display is fixed.	Operation on the LCD Operator isn't accepted if the input terminal function 102 [DISP] is ON. Turn OFF the terminal.
Keypad operator cannot be operated.	The display is fixed.	Operation on the LCD Operator isn't accepted if the input terminal function 102 [DISP] is ON. Turn OFF the terminal.
Setting cannot be made.	Inverter is running.	Some parameters cannot be changed while the inverter is running. If that is the case, turn OFF the inverter once.

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Motor rotates in a reverse direction.	The wires connected to the motor are in wrong phase sequence.	Swapping two phases of wires connected to the motor changes the direction of rotation.
	When the RUN key on the LCD Operator is used, the rotation direction setting is wrong.	[AA-12] RUN key direction needs to be switched.
	When the 3-wire function is used, the input of input terminal function F/R is reversed.	Check the logic of 3-wire normal rotation / reverse rotation terminal (018[F/R]).
Noises of motor and machines are noisy.	Carrier frequency is set low.	Raise the carrier frequency setting [bb101]. However, this may increase noise generated in the inverter and leakage currents from the inverter. In addition, derating is required to the output current depending on the models.
	The revolution frequency of motor and the natural frequency of machines resonate.	Change the set frequency. If a resonance occurs during acceleration/deceleration, avoid the resonance frequency in settings of the frequency jump functions [AG101] to [AG106].
Output frequency becomes unstable.	Inadequate parameters are used.	Find out the basic parameter settings for motor and set them accordingly.
	Load fluctuates significantly.	Re-examination of capacity of both motor and inverter may be required.
	PS voltage fluctuates.	Use of the optional reactor ALI or DCL, or a noise filter on the input side to minimize the power fluctuation may improve the situation.
Torque is not generated.	V/f control is used.	Use torque boost, sensorless vector control, or other control instead.
	The inverter is used for lowering.	Use a braking resistor or regenerative braking unit if the torque is not sufficient for regenerative operation.
	The load is too heavy.	Re-examination of capacity of both motor and inverter may be required.
LCD operator disconnection error is issued.	Operation selection at disconnection of operator is inappropriate.	Set the operation selection at disconnection of operator to 02 (Ignore).

Occurrence	Estimated cause(s)	Exemplar measures to be taken
Operation/setting of Modbus communication cannot be made.	Changes made to communication parameters haven't been reflected.	If you changed [CF-01] to [CF-38], turn OFF the control power supply and restart.
	The operation command selection is not set to RS485.	Check that operation command selection [AA111] is set to 03 (RS485).
	The frequency command selection is not set to RS485.	Check that the main speed command selection [AA111] is set to 03 (RS485).
	The communication speed setting is wrong.	Set the correct value in [CF-01], then turn OFF the control power supply and restart.
	Station numbers are wrongly set or overlapping each other.	Set the correct value in [CF-02], then turn OFF the control power supply and restart.
	The communication parity setting is wrong.	Set the correct value in [CF-03], then turn OFF the control power supply and restart.
	The communication stop bit setting is wrong.	Set the correct value in [CF-04], then turn OFF the control power supply and restart.
	Wiring is wrong.	Connect wires properly to the SP and SN terminals on the control circuit terminal block.
The earth leakage circuit breaker is activated as the inverter is operated.	Leakage currents in the inverter are large.	• Lower the carrier frequency [bb101]. • Raise the sensitivity current in the earth leakage circuit breaker, or replace the breaker with the one with higher sensitivity current.
DC braking is disabled.	The DC braking force is not set.	Set DC braking force at the time of the stop [AF105] and DC braking force at the start [AF108].
	The DC braking time is not set.	Set DC braking time at the time of the stop [AF106] and DC braking time at the start [AF109].
Noises enter a TV and radio near the inverter.	Radiation noise from the inverter	• Locate the inverter wires as far as possible from a TV and radio. • Install ZCL to the main power supply input of the inverter and the inverter output.

13

Maintenance and Inspection

13

13-1 Daily Inspection

Check the followings while the inverter is running.

No.	Description	Check
1	The motor operates according to the settings	□
2	There is no abnormality in the environment where the device is installed.	□
3	There is no abnormality in the cooling system.	□
4	No abnormal vibration or sound is observed.	□
5	No abnormal overheat or discoloration is observed.	□
6	No abnormal smell is observed.	□

While the inverter is running, check the input voltage of inverter using a tester, etc.

No.	Description	Check
1	There is no frequent occurrence of variation of power supply voltage.	□
2	Line voltage keeps a good balance.	□

13-2 Periodic Inspection

Check sections that cannot be inspected unless operation is stopped and sections requiring periodic inspection.

No.	Description	Check
1	There is no abnormality in the cooling system. Cleaning of the air filter and other components	□
2	Checking tightness and re-tightening Due to effects of vibration or temperature change, tightened portions of screws or bolts may loosen. Make sure to carefully check and perform the work.	□
3	No corrosion or damage is observed on the conductors and insulators.	□
4	Measurement of insulation resistance	□
5	Checking and replacing the cooling fan, smoothing capacitor, and relay	□

13-3 Inspection Items

Target section	Item	Details	Interval			Method	Criteria	Measurement instrument
			Daily	Periodic 1 year	Periodic 2 years			
General	Ambient environment	Check the ambient temperature, humidity, dust, etc.	○			See the installation method.	The ambient temperature and humidity are within the usable range. No freezing, condensation, dust, corrosive gas, explosive gas, flammable gas, mist of grinding fluid, hydrogen sulfide, and salts are permissible	Thermometer Hydrometer Recorder
	Entire device	No abnormal vibration or sound is observed.	○			By visual check and hearing	There must be no abnormality.	
	Power supply voltage	The main circuit voltage is normal.	○			Measure line voltage between inverter main circuit terminals R, S, and T.	They are within the allowable variation range of AC voltage.	Tester and digital multimeter

Target section	Item	Details	Interval: Daily	Interval: Periodic 1 year	Interval: Periodic 2 years	Method	Criteria	Measurement instrument
Main circuit	General	(1) Megger check (between the main circuit terminals and earth terminals)		○		Remove the input/output wires of main circuit terminal block of the inverter, remove the control terminal block board, then, remove the short bar for switching the functions of filter included in the inverter. Then, using a megger, perform measurement between each portion where R, S, T, U, V, W, P, PD, N, RB, R0, and T0 terminals are shorted and earth terminal.	The measured value shall be 5 MΩ or above.	500-VDC class megger
		(2) Fastened portions are not loosened.		○		Re-tighten the portion.	There must be no abnormality.	
		(3) No residual mark of overheat is observed on each component.		○		By visual check.	There must be no abnormality.	
	Connected conductor and wire	(1) The conductor is not distorted.		○		By visual check.	There must be no abnormality.	
		(2) The coatings of wires are not torn.		○				
	Terminal block	It is not damaged.		○		By visual check.	There must be no abnormality.	
	Inverter Converter (including resistor)	Check resistance between each terminal			○	Remove the wires of the main circuit terminal block of inverter, and perform measurement between terminals R, S, T and terminals P, N, and between terminals U, V, W and terminals P, N at the range of tester ×1 Ω.	See *13-5-3 Checking Method of Inverter and Converter* on page 13-10. Appropriate replacement interval of inverter, converter, and thyristor Start/stop: 10^6 cycles *1	Analog tester
	Smoothing capacitor	(1) There is no leakage of fluid.	○			By visual check.	There must be no abnormality. Appropriate service years for replacement: 10 years *1 *2 *3	
		(2) The belly (safety valve) shall not stick and there shall be no bump.		○				
	Relay	(1) There shall be no beat noise during operation.		○		By hearing.	There must be no abnormality.	
		(2) There are no worn contacts.		○		By visual check.	There must be no abnormality.	

Target section	Item	Details	Interval			Method	Criteria	Measurement instrument
			Daily	Periodic				
				1 year	2 years			
Control circuit Protective circuit	Operation check	(1) Through unit operation of inverter, check balance of output voltage between each phase.		○		Measure line voltage between inverter main circuit terminals U, T, and W.	Inter-phase voltage balance 200 V class: To be within 4 V. 400 V class: To be within 8 V.	Digital multimeter Flowmeter Voltmeter
		(2) By conducting the sequence protective operation test, check there is no abnormality in protective operation and display circuit.		○		Simulate short or open condition of the protective circuit output of inverter.	The error is generated on the sequence.	
Cooling system	Cooling fan	(1) No abnormal vibration or sound is observed.	○			By hearing and visual check. (Warning indication on the operator keypad)	To rotate smoothly. There must be no abnormality. Wind brows in upper section. Appropriate service years for replacement: 10 years *1 *4 *5	
		(2) Connections are not loosened.		○		By visual check.		
	Cooling fin	There is no clogging.		○		By visual check.	There is no clogging.	
Indication	Indication	(1) The LED lamp and screen display are normal.	○			By visual check.	Check the lamp/display lights up.	
		(2) Cleaning.		○		Clean with a waste cloth.		
	External meter	The indicated values are normal.	○			Check indicated values of the meters on the boards.	Satisfy the specification values and control values.	Voltmeter, ammeter, etc.
Motor	General	(1) No abnormal vibration or sound is observed.	○			By hearing, sensing, and visual check.	There must be no abnormality.	
		(2) No abnormal smell is observed.	○			Check for abnormal smell due to overheat, damage, etc.	There must be no abnormality.	
	Insulation resistance	Megger check (between the main circuit terminals and earth terminals)			*6	Disconnect U, V, and W inverter main circuit terminals, short the motor line (for three phases), and perform measurement between the motor wire and earth terminal using a megger.	The measured value shall be 5 MΩ or above.	500-VDC class megger

*1. The replacement period (number of years/cycles) and *13-5-5 Smoothing Capacitor Life Curve* on page 13-13 are based on the designed expected life, which is not a guaranteed value.

*2. The service life of smoothing capacitor is affected by the ambient temperature. See *13-5-5 Smoothing Capacitor Life Curve* on page 13-13 to determine replacement period.

*3. When you replace with a capacitor that has passed storage period more than three years, perform aging in the following conditions before using it.
   - Initially apply 80% of rated voltage of capacitor for one hour in normal temperature
   - Then, increase the voltage to 90% and apply for one hour
   - Lastly, apply rated voltage for five hours in normal temperature

*4. The life of cooling fan varies depending on the environment conditions such as ambient temperature and dust. Check operating conditions by daily inspection.

*5. If the cooling fan is locked due to dust, etc., it takes about 5 to 10 seconds until re-rotation is enabled even if dust is removed.

*6. Perform inspection in accordance with the instruction manual of motor.

13-4 Cleaning

Make sure to always keep the inverter clean for operation.

No.	Description	Check
1	For cleaning, lightly wipe off dirt with a soft cloth dampened with neutral detergent.	□
2	Solvents such as acetone, benzene, toluene, and alcohol may cause the inverter surface to dissolve or its coating to peel off, therefore, do not use them.	□
3	Do not clean the display section including the operator keypad using a detergent or alcohol.	□

13-5 Test Methods

13-5-1 Megger Test

When conducting megger test on the external circuit, remove all terminals of the inverter to avoid applying the test voltage is not applied to the inverter.

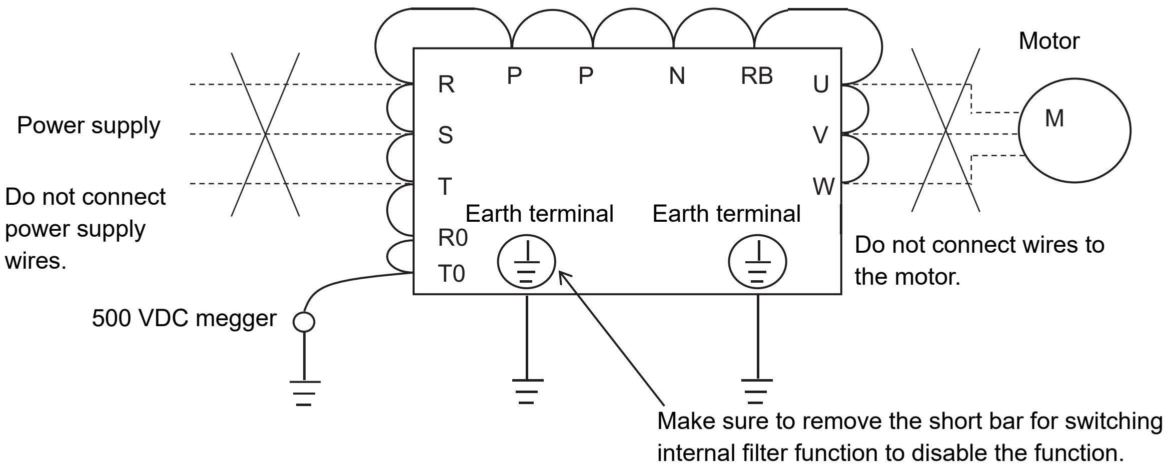
For energization test on the control circuit, use a tester (high-resistance range), and do not use a megger or buzzer.

Conduct megger test for the inverter itself only on the main circuit, and do not perform megger test on the control circuit.

For megger test, use a 500 VDC megger.

Before conducting a megger test on the inverter main circuit, make sure to remove the short bar for switching the filtering function included in the inverter, and short terminals R, S, T, U, V, W, P, PD, N, RB, R0, and T0 as shown in the figure below.

After megger test, remove the wires on which R, S, T, U, V, W, P, PD, N, RB, R0, and T0 terminals that are shorted, and connect the short bar for switching the filter function included in the inverter to the original position.



13-5-2 Pressure Test

Do not perform pressure test.
If pressure test is conducted, it is dangerous because the components inside the inverter may be damaged or deteriorated.

13-5-3 Checking Method of Inverter and Converter

Using a tester, you can check the condition of inverter and converter if it is good or bad.

(preparation)

1. Remove the power lines connected from an external source (R, S, T), wires connecting to the motor (U, V, W), and regenerative braking resistor (P, RB).

2. Prepare a tester. (The range used is 1Ω resistance measurement range.)

(Checking method) *1

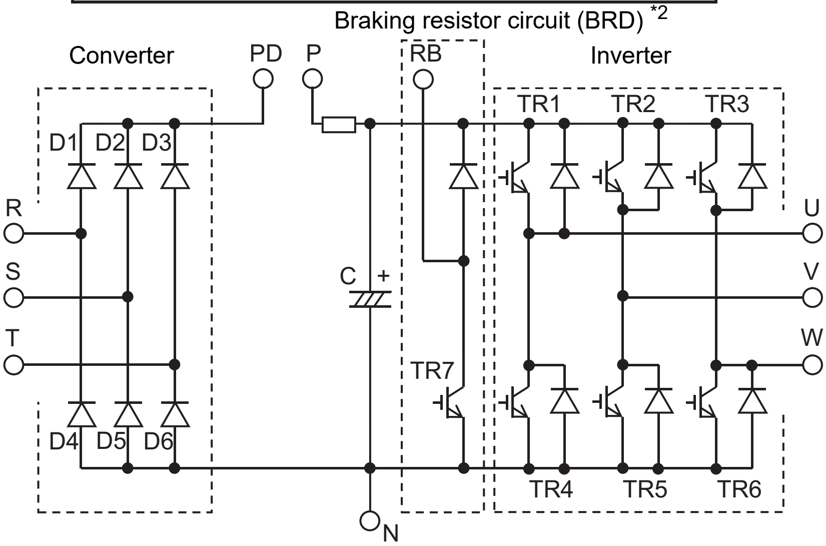
You can determine the good-or-bad condition of conduction status of terminals on the inverter main circuit terminal block R, S, T, U, V, W, RB, P, and N by alternately changing the polarity of tester for measurement.

*1. By measuring the voltage between P and N in the DC voltage range, check that electricity is fully discharged from the smoothing capacitor before performing check.

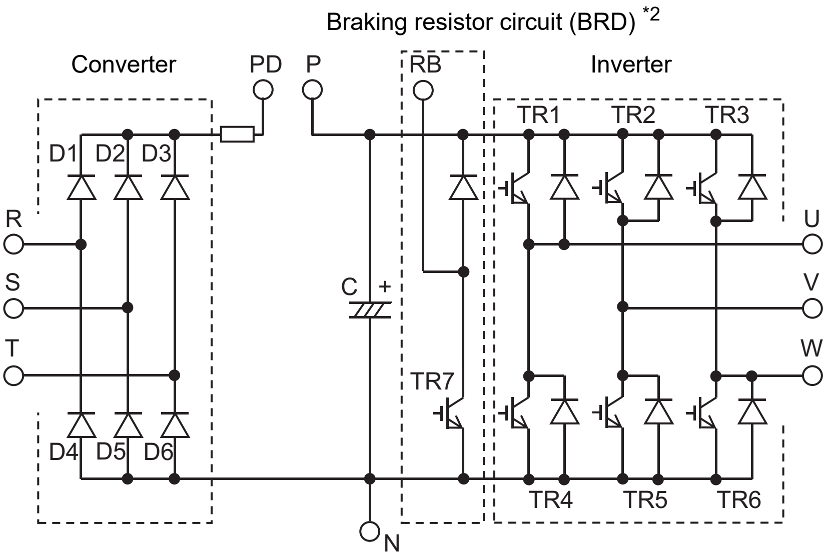
		Tester polarity		Measured value *1
		⊕ (Red)	⊖ (Black)	
Converter	D1	R	PD	Non-conductive
		PD	R	Conductive
	D2	S	PD	Non-conductive
		PD	S	Conductive
	D3	T	PD	Non-conductive
		PD	T	Conductive
	D4	R	N	Conductive
		N	R	Non-conductive
	D5	S	N	Conductive
		N	S	Non-conductive
	D6	T	N	Conductive
		N	T	Non-conductive
Inverter	TR1	U	P	Non-conductive
		P	U	Conductive
	TR2	V	P	Non-conductive
		P	V	Conductive
	TR3	W	P	Non-conductive
		P	W	Conductive
	TR4	U	N	Conductive
		N	U	Non-conductive
	TR5	V	N	Conductive
		N	V	Non-conductive
	TR6	W	N	Conductive
		N	W	Non-conductive
BRD	TR7	RB	P	Non-conductive
		P	RB	Conductive
		RB	N	Non-conductive

*1. When electricity is not conducted, a nearly infinite value is demonstrated. Due to effects of the smoothing capacitor, electricity may be conducted instantly, not showing an infinite value. When electricity is conducted, a numeric value range will be indicated from some to dozens in a unit of Ω. The values vary depending on the element type, tester, type, etc. However, it is acceptable if numeric values obtained for each item are nearly the same. The measured value may be varied some degree in Ω by the reason of the preventing inrush current of current limiting resistor.

Model 3G3RX2-*****
200V class: A2004 to A2110 400V class: A4007 to B411K



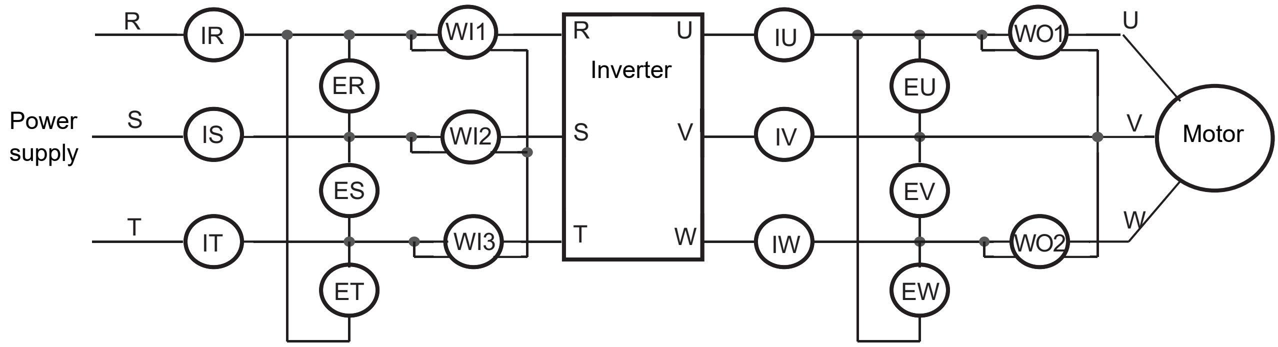
Model 3G3RX2-*****
200V class: A2150 to A2550 400V class: A4150 to B413K



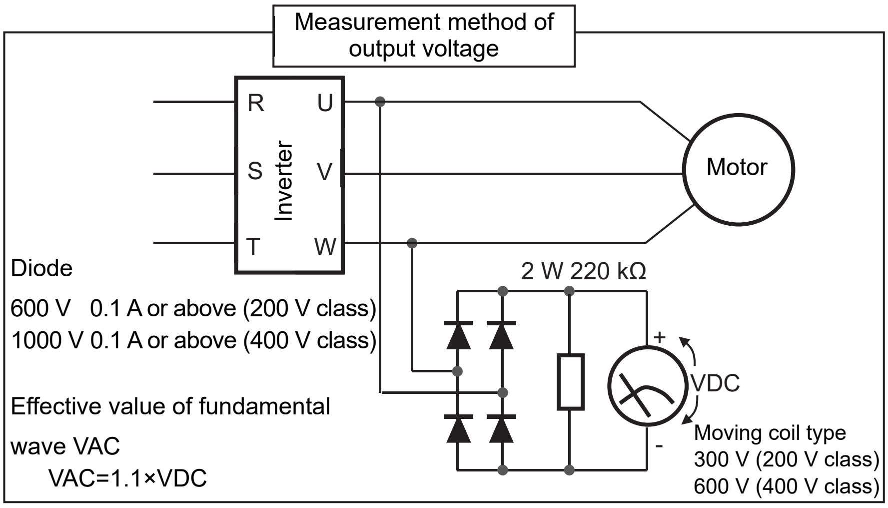
*2. The braking circuit (BRD) section is equipped as standard on the following models:
3G3RX2-A2004 to 3G3RX2-A2220
3G3RX2-A4007 to 3G3RX2-A4370

13-5-4 Measurement Method of I/O Voltage, Current, and Power

The following shows general measurement instruments used for measurement of input/output voltage, current, and power.



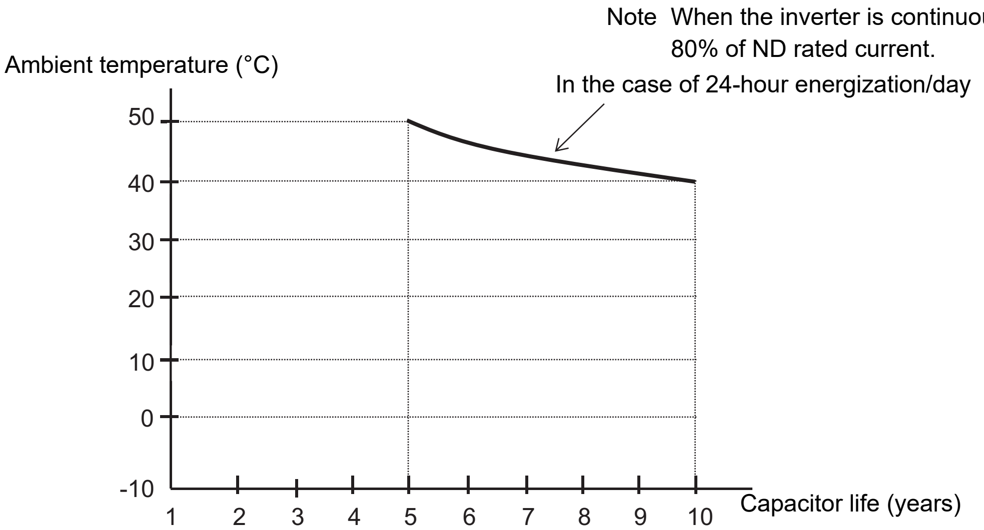
Measure-ment item	Target section	Measurement instrument	Remarks	Criteria
Power supply voltage E_{IN}	Between R-S, S-T, and T-R (E_R), (E_S), (E_T)	Moving iron voltmeter or Rectifier type voltmeter	All effective values	200 V class: 200-240 V 50/60 Hz 400 V class: 380-500 V 50/60 Hz
Power supply current I_{IN}	Current of R, S, and T (I_R), (I_S), (I_T)	Moving iron ammeter	All effective values	If input current is imbalanced $I_{IN}=(I_R+I_S+I_T)/3$
Power from power supply W_{IN}	Between R-S, S-T, and T-R (W_{I1})+(W_{I2})+(W_{I3})	Electrodynamometer type wattmeter	All effective values	Three wattmeter method
Power rate of power supply P_{fIN}	This value is calculated using measurement values of power supply voltage E_{IN}, power supply current I_{IN}, and power supply power W_{IN}. $P_{fIN}=\frac{W_{IN}}{\sqrt{3}\cdot E_{IN}\cdot I_{IN}}\times 100$			
Output voltage E_{OUT}	Between U-V, V-W, and W-U (E_U), (E_V), (E_W)	See the figure below or Rectifier type voltmeter	Effective value of funda-mental wave	
Output current I_{OUT}	Current of U, V, and W (I_U), (I_V), (I_W)	Moving iron ammeter	All effective values	
Output power W_{OUT}	Between U-V and V-W (W_{O1})+(W_{O2})	Electrodynamometer type wattmeter	All effective values	Two wattmeter method (or three wattmeter method)
Output power factor P_{fOUT}	This value is calculated using measurement values of output voltage E_{OUT}, output current I_{OUT}, and output power W_{OUT}. $P_{fOUT}=\frac{W_{OUT}}{\sqrt{3}\cdot E_{OUT}\cdot I_{OUT}}\times 100$			



Note 1. Use an instrument that indicates effective values of fundamental wave for output voltage, and use instruments that indicate all effective values for current and power.

2. The output waveform of inverter generates errors especially at low frequency because it is a waveform control by PWM. Take care because a tester (general-purpose product) may not be adapted due to noise.

13-5-5 Smoothing Capacitor Life Curve



Note 1. The ambient temperature is a temperature measured at a position about 5 cm from the bottom center of the inverter. (atmospheric temperature)
If the inverter is stored inside the panel, it is in-panel temperature.

2. The smoothing capacitor is a finite life component which occurs chemical reaction inside, replacement is required after 10 years of use (It is a designed expected life, not a guaranteed value).
However, if the inverter is used in an environment at high temperature or in a heavy-load environment where the its rated current is exceeded, the life is significantly shortened.

13-5-6 Life Alarming Output

When the life a component (smoothing capacitor or cooling fan on the board, excluding the main circuit smoothing capacitor) is near its end, an alarm can be generated based on self-diagnosis. Use this alarm as a sign of part replacement period. For details, see the life diagnosis monitor [dC-16] and output terminal function selection [CC-01] to [CC-07]. Note that alarms are generated based on diagnosis of designed expected life (not a guaranteed value). There will be differences due to use environments, operating conditions, etc. Please conduct maintenance in advance.

A

Appendices A Technical Information

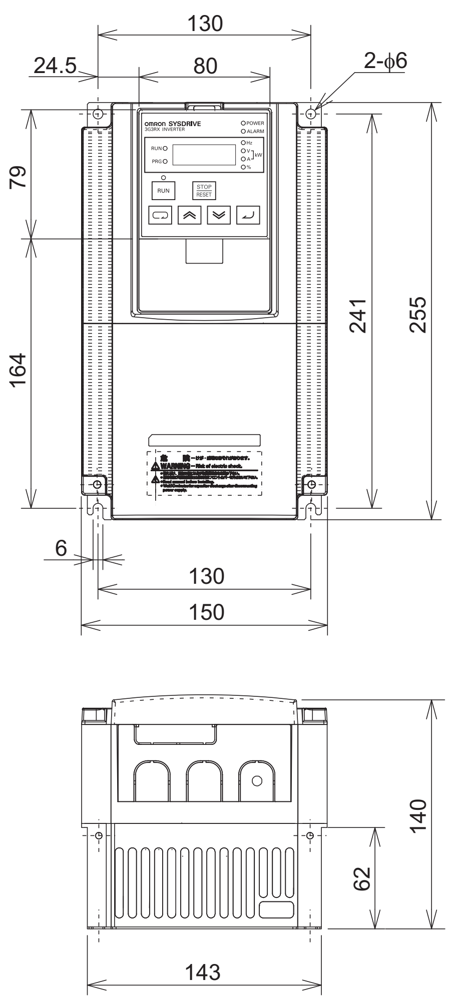
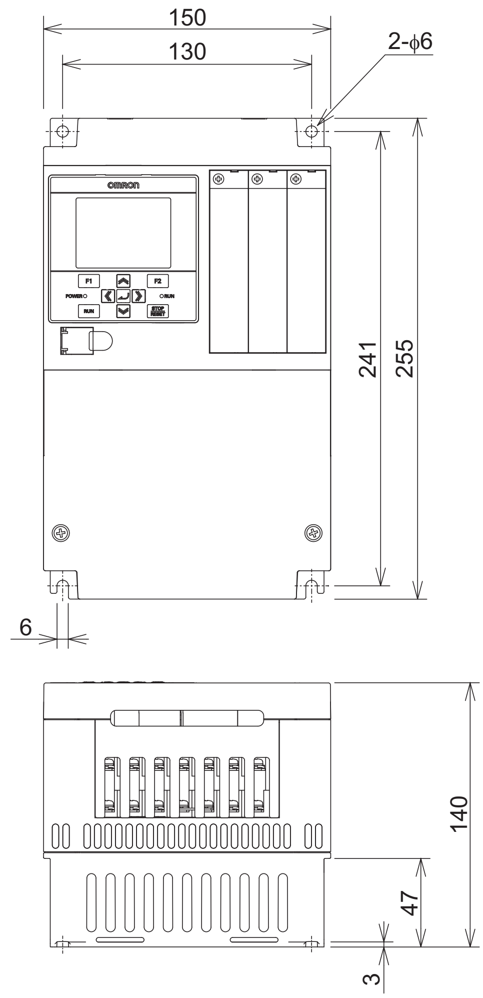
A-1 Comparison of External Dimensions

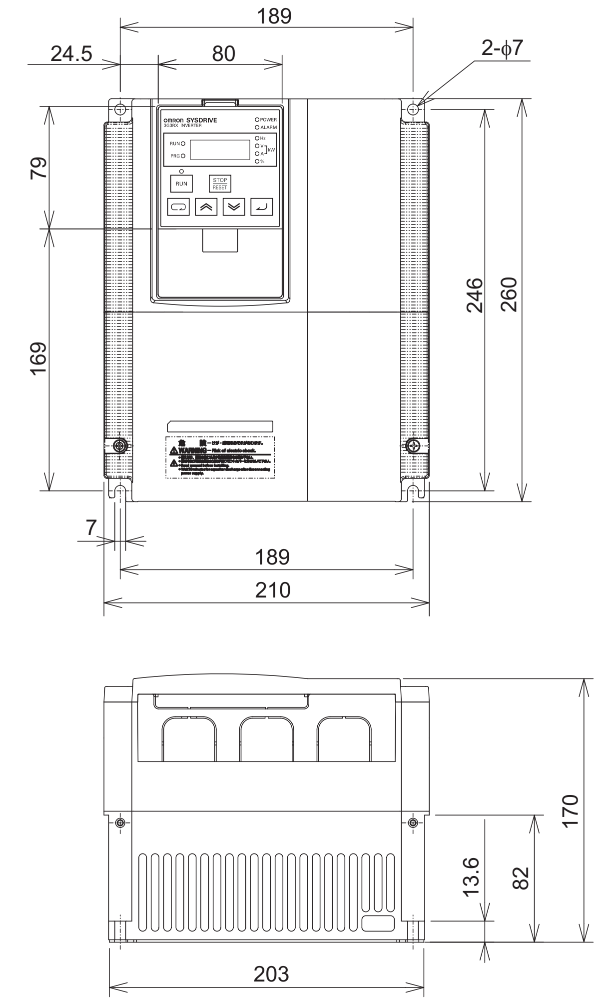
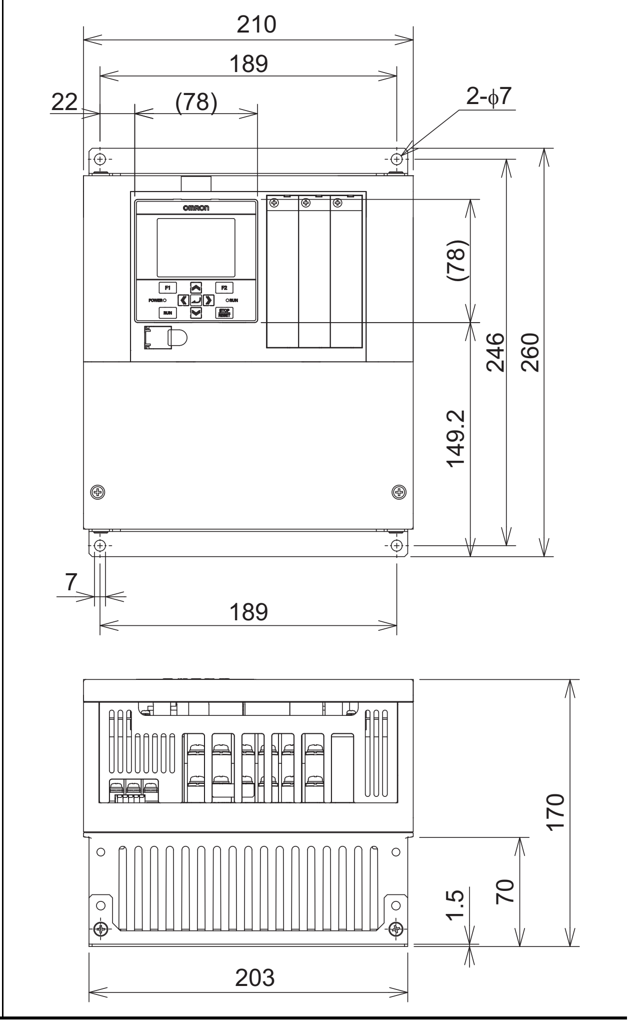
- A pitch for 3G3RX series V1 is compatible with one for 3G3RX2 series. When replacing, the pitch installation is available without the change of dimension.
- When installing 3G3RX2 series, refer to *1-3-4 External Dimensions* on page 1-13.

Precautions for Correct Use

You can change the duty rating (ND/LD/VLD) on [Ub-03] Duty type selection.

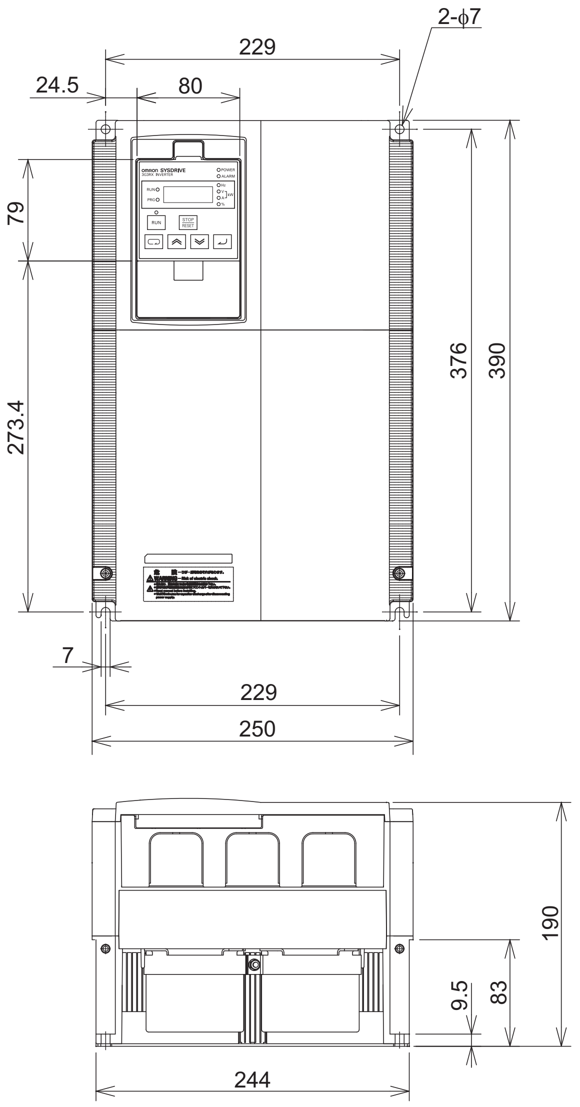
3G3RX-series V1 and 3G3RX2-series

3G3RX-series V1 type	→	3G3RX2-series
3G3RX-A2004- V1	→	3G3RX2-A2004
3G3RX-A2007- V1	→	3G3RX2-A2007
3G3RX-A2015- V1	→	3G3RX2-A2015
3G3RX-A2022- V1	→	3G3RX2-A2022
3G3RX-A2037- V1	→	3G3RX2-A2037
3G3RX-A4007- V1	→	3G3RX2-A4007
3G3RX-A4015- V1	→	3G3RX2-A4015
3G3RX-A4022- V1	→	3G3RX2-A4022
3G3RX-A4037- V1	→	3G3RX2-A4037
	→	

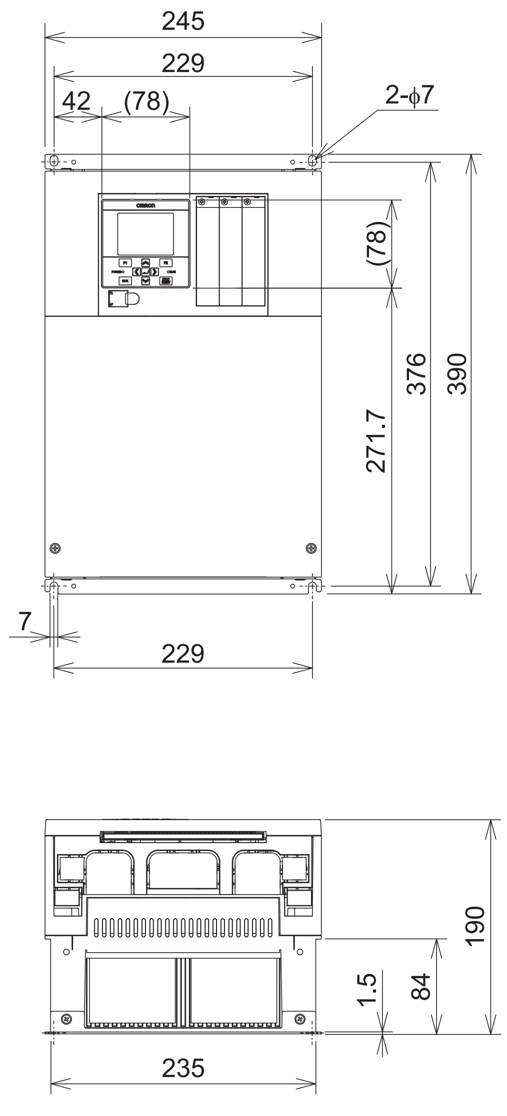
3G3RX-series V1 type	→	3G3RX2-series
3G3RX-A2055- V1	→	3G3RX2-A2055
3G3RX-A2075- V1	→	3G3RX2-A2075
3G3RX-A2110- V1	→	3G3RX2-A2110*1
3G3RX-A4055- V1	→	3G3RX2-A4055
3G3RX-A4075- V1	→	3G3RX2-A4075
3G3RX-A4110- V1	→	3G3RX2-A4110
	→	

*1. When these series are used with 3G3RX2-A2110(LD)(VLD), the depth dimention gets large. As for the detail, refer to *2-1-2 Precaution for Installation* on page 2-4.

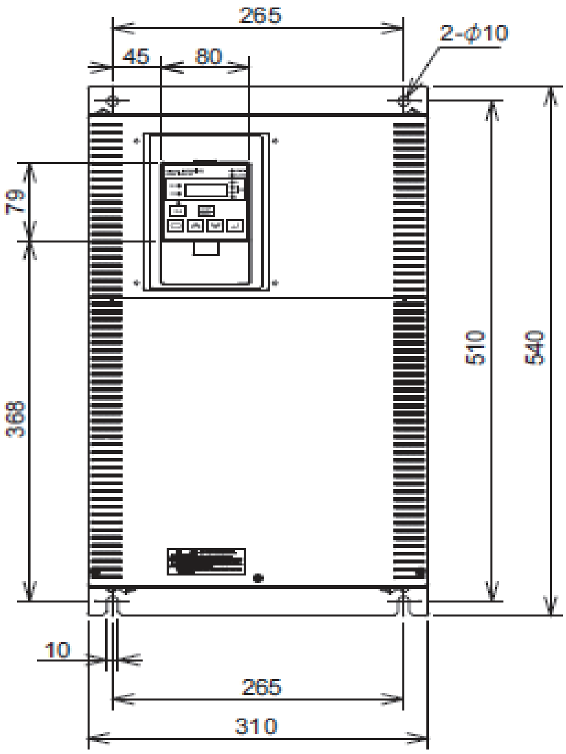
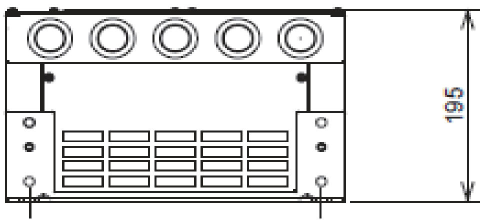
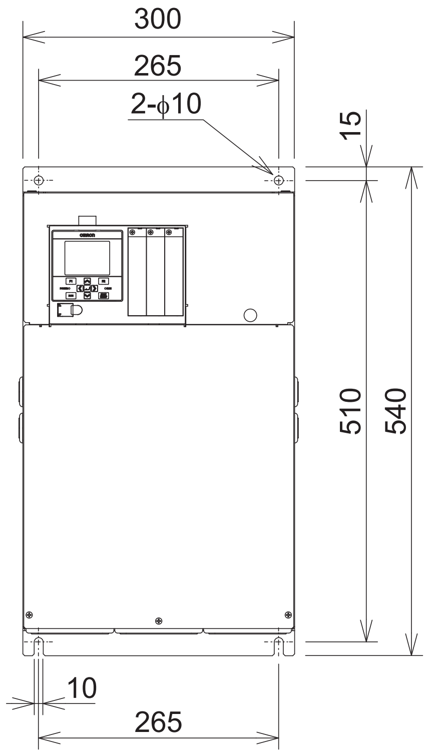
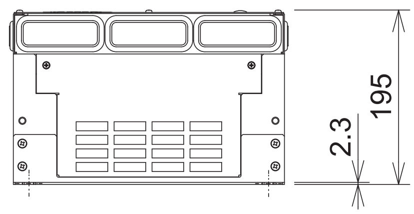
3G3RX-series V1 type	→	3G3RX2-series
3G3RX-A2150- V1	→	3G3RX2-A2150
3G3RX-A2185- V1	→	3G3RX2-A2185
3G3RX-A2220- V1	→	3G3RX2-A2220*1
3G3RX-A4150- V1	→	3G3RX2-A4150
3G3RX-A4185- V1	→	3G3RX2-A4185
3G3RX-A4220- V1	→	3G3RX2-A4220



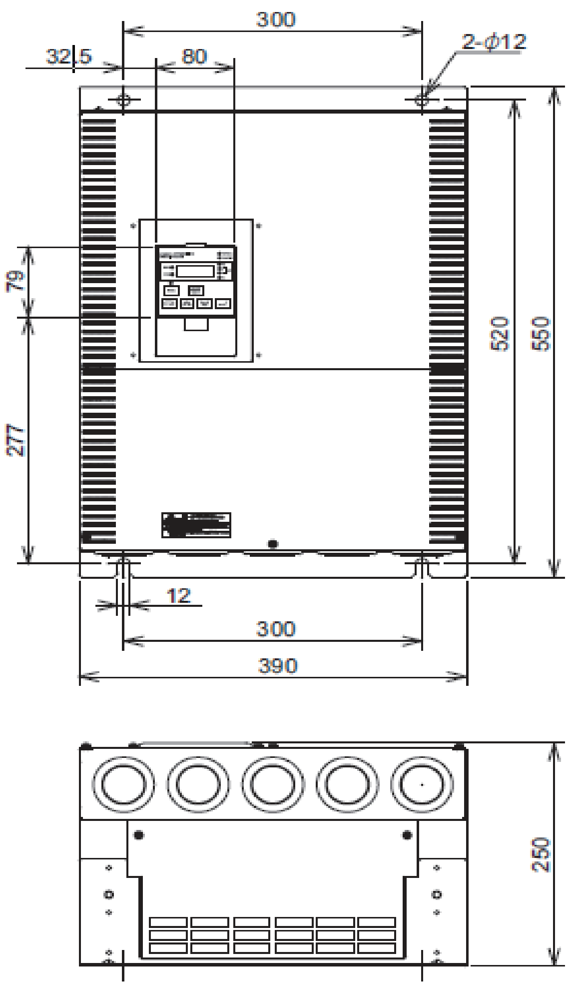
→



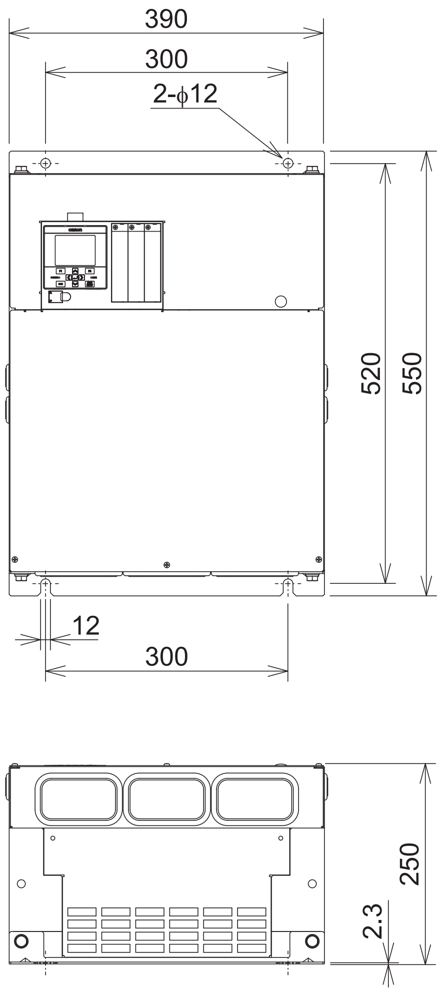
*1. When these series are used with 3G3RX2-A2220(VLD), the depth dimention gets large. As for the detail, refer to *2-1-2 Precaution for Installation* on page 2-4.

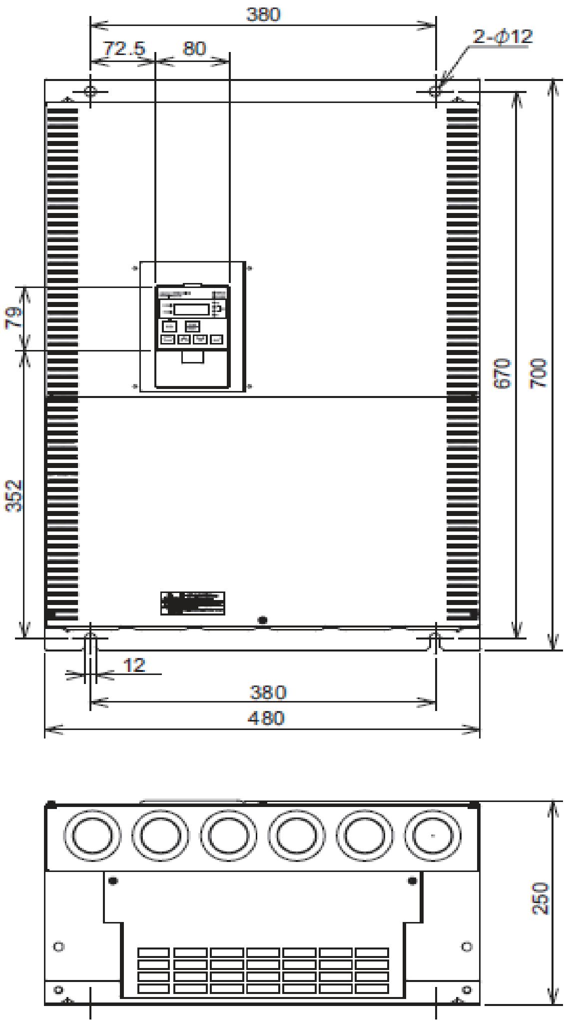
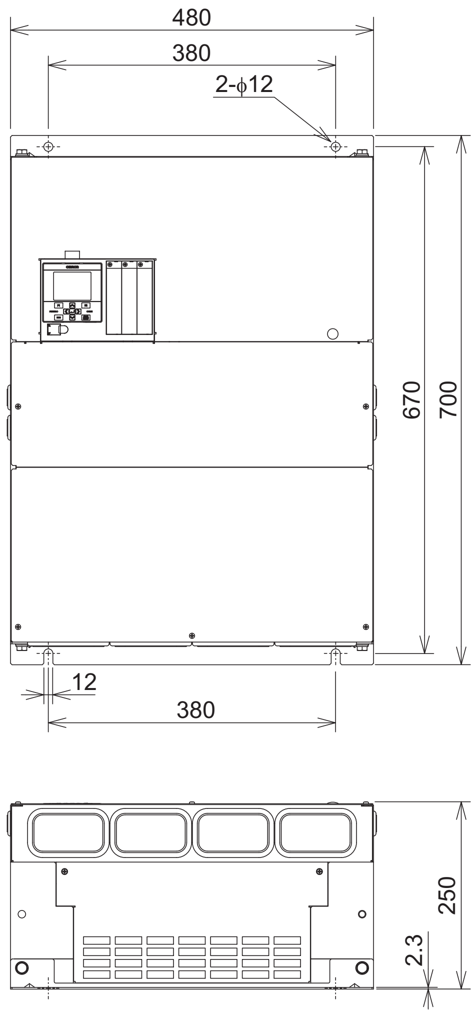
3G3RX-series V1 type	→	3G3RX2-series
3G3RX-A2300 - V1	→	3G3RX2-A2300
3G3RX-A4300 - V1	→	3G3RX2-A4300
 	→	 

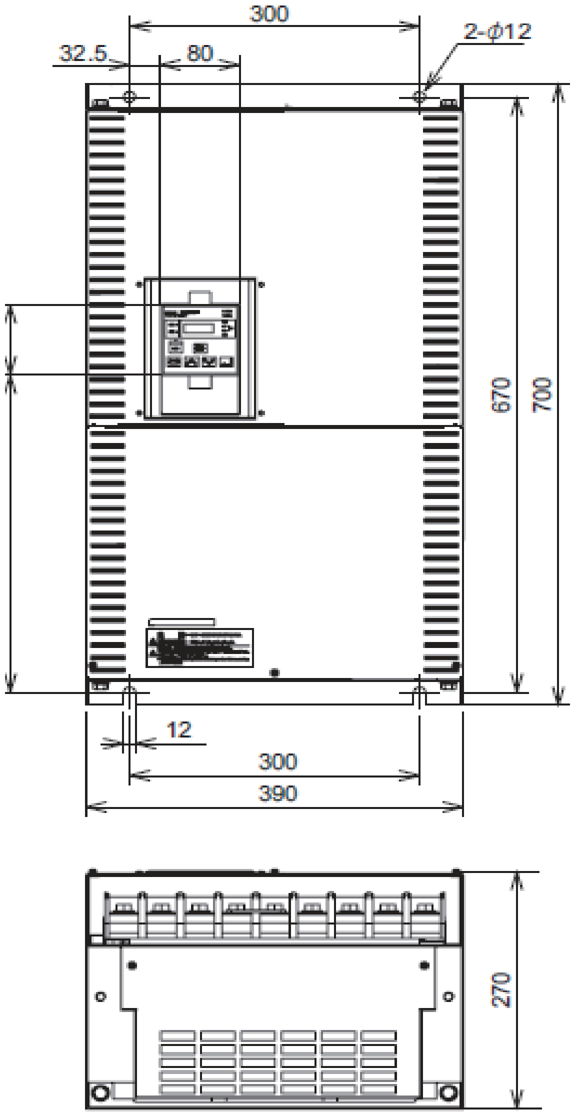
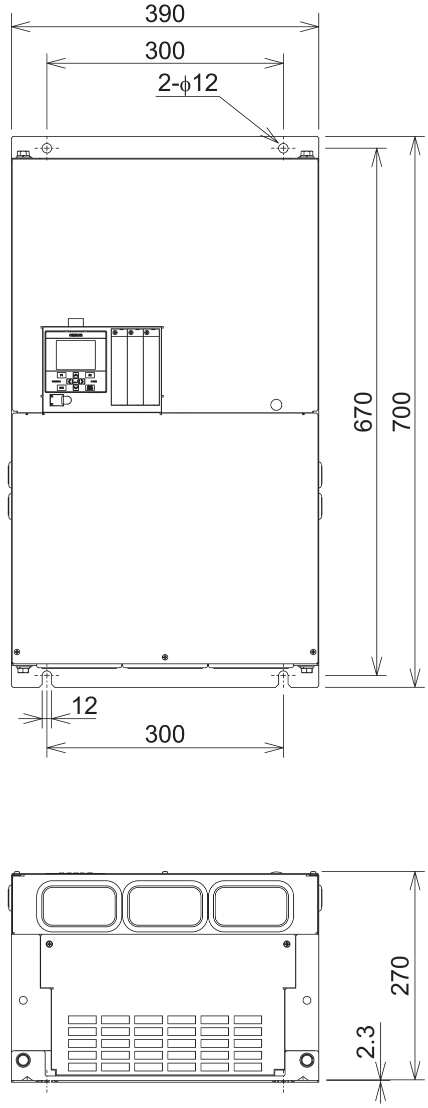
3G3RX-series V1 type	→	3G3RX2-series
3G3RX-A2370- V1	→	3G3RX2-A2370
3G3RX-A2450- V1	→	3G3RX2-A2450
3G3RX-A4370- V1	→	3G3RX2-A4370
3G3RX-A4450- V1	→	3G3RX2-A4450
3G3RX-A4550- V1	→	3G3RX2-A4550

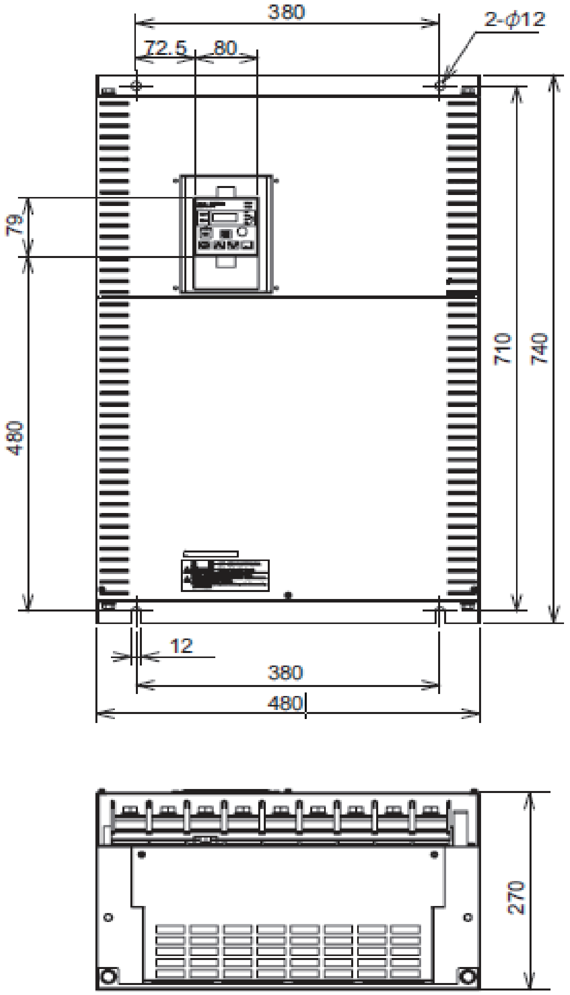
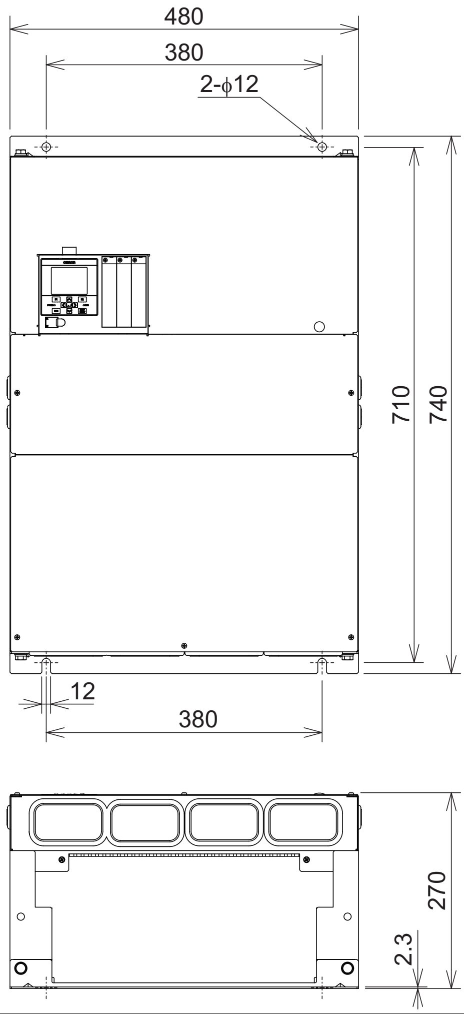


→



<table>
<tr><th>3G3RX-series V1 type</th><th>→</th><th>3G3RX2-series</th></tr>
<tr><td>3G3RX-A2550- V1</td><td>→</td><td>3G3RX2-A2550</td></tr>
<tr><td>
</td><td>→</td><td>
</td></tr>
</table>

3G3RX-series V1 type	→	3G3RX2-series
3G3RX-B4750- V1	→	3G3RX2-B4750
3G3RX-B4900- V1	→	3G3RX2-B4900
	→	

3G3RX-series V1 type	→	3G3RX2-series
3G3RX-B411K- V1	→	3G3RX2-B411K
3G3RX-B413K- V1	→	3G3RX2-B413K
	→	

A-2 Parameter Comparison

In some cases, contents about parameters are different between 3G3RX-series V1 and 3G3RX2-series. After checking the descriptions about functions, set the parameters.

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
d001	Output frequency monitor	dA-01	
d002	Output current monitor	dA-02	
d003	Operation direction monitor	dA-03	
d004	PID feedback monitor	db-30	
d005	Intelligent input monitor	dA-51	
d006	Intelligent output monitor	dA-54	
d007	Frequency conversion monitor	dA-06	
d008	Real frequency monitor	dA-08	
d009	Torque command monitor	FA-15	
d010	Torque bias monitor	FA-16	
d012	Output torque monitor	dA-17	
d013	Output voltage monitor	dA-18	
d014	Input power monitor	dA-30	
d015	Integrated power monitor	dA-32	
d016	Cumulative operating hours monitor during RUN	dC-22	
d017	Cumulative power-on time	dC-24	
d018	Cooling fin temperature monitor	dC-15	
d019	Motor temperature monitor	dA-38	
d022	Life diagnostic monitor	dC-16	
d023	Program counter	db-03	
d024	Program number monitor	db-02	
d025	User monitor 0	db-08	
d026	User monitor 1	db-10	
d027	User monitor 2	db-12	
d028	Pulse counter monitor	dA-28	
d029	Position command monitor	FA-20	
d030	Current position monitor	dA-20	
d060	Inverter mode monitor	dC-01 dC-45	The monitor can be checked with dC-01: duty type and dC-45: IM/SM.
d080	Trip frequency monitor		Display function is equipped on the LCD Operator
d081	Trip history monitor 1		Display function is equipped on the LCD Operator
d082	Trip history monitor 2		Display function is equipped on the LCD Operator
d083	Trip history monitor 3		Display function is equipped on the LCD Operator
d084	Trip history monitor 4		Display function is equipped on the LCD Operator
d085	Trip history monitor 5		Display function is equipped on the LCD Operator
d086	Trip history monitor 6		Display function is equipped on the LCD Operator
d090	Warning monitor		Display function is equipped on the LCD Operator

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
d102	DC voltage monitor	dA-40	
d103	BRD load factor monitor	dA-41	
d104	BRD thermal load factor monitor	dA-42	
F001	Output frequency setting	FA-01	
F002	First acceleration time setting	AC120	
F202	Second acceleration time setting	AC220	
F302	Third acceleration time setting		Abolition of third control
F003	First deceleration time setting	AC122	
F203	Second deceleration time setting	AC222	
F303	Third deceleration time setting		Abolition of third control
F004	Operation direction selection	AA-12	
A001	Frequency command selection	AA101	Addition of individual settings for second control
A002	Operation command selection	AA111	
A003	First base frequency	Hb104/Hd104	Hb104: IM, Hd104: SM(PMM)
A203	Second base frequency	Hb204/Hd204	Hb204: IM, Hd204: SM(PMM)
A303	Third base frequency		Abolition of third control
A004	First maximum frequency	Hb105/Hd105	Hb105: IM, Hd105: SM(PMM)
A204	Second maximum frequency	Hb205/Hd205	Hb205: IM, Hd205: SM(PMM)
A304	Third maximum frequency		Abolition of third control
A005	AT terminal selection		This function is substituted by the setting of AA101/AA102 and SCHG (input terminal 015)
A006	O2 selection		This function is substituted by the setting of Cb-22
A011	0 start	Cb-03	For Ai1
A012	0 end	Cb-04	For Ai1
A013	0 start ratio	Cb-05	For Ai1
A014	0 end ratio	Cb-06	For Ai1
A015	0 start selection	Cb-07	For Ai1
A016	Analog input filter	Cb-01	For Ai1 (Ai2: Cb-11, Ai3: Cb-21)
A017	Simplified sequence function selection	UE-02	
A019	Multistep speed selection	Ab-03	
A020	0th speed of the 1st multi-step speed	Ab110	
A220	0th speed of the 2nd multi-step speed	Ab210	
A320	0th speed of the 3rd multi-step speed		Abolition of third control
A021	1st speed of the multi-step speed	Ab-11	
A022	2nd speed of the multi-step speed	Ab-12	
A023	3rd speed of the multi-step speed	Ab-13	
A024	4th speed of the multi-step speed	Ab-14	
A025	5th speed of the multi-step speed	Ab-15	
A026	6th speed of the multi-step speed	Ab-16	
A027	7th speed of the multi-step speed	Ab-17	
A028	8th speed of the multi-step speed	Ab-18	
A029	9th speed of the multi-step speed	Ab-19	
A030	10th speed of the multi-step speed	Ab-20	
A031	11th speed of the multi-step speed	Ab-21	
A032	12th speed of the multi-step speed	Ab-22	
A033	13th speed of the multi-step speed	Ab-23	
A034	14th speed of the multi-step speed	Ab-24	
A035	15th speed of the multi-step speed	Ab-25	
A038	Jogging frequency	AG-20	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
A039	Jogging selection	AG-21	
A041	First torque boost selection	AA121	When A041 is set to 01, select 03: automatic boost for AA121.
A241	Second torque boost selection	AA221	When A241 is set to 01, select 03: automatic boost for AA221.
A042	First manual torque boost volume	Hb141	* Re-confirmation is required for setting.
A242	Second manual torque boost volume	Hb241	* Re-confirmation is required for setting.
A342	Third manual torque boost volume		Abolition of third control
A043	First manual torque boost break point	Hb142	* Re-confirmation is required for setting.
A243	Second manual torque boost break point	Hb242	* Re-confirmation is required for setting.
A343	Third manual torque boost break point		Abolition of third control
A044	First control mode	AA121	* Re-confirmation is required for setting.
A244	Second control mode	AA221	* Re-confirmation is required for setting.
A344	Third control mode		Abolition of third control
A045	Output voltage gain	Hb180	Addition of individual settings for second control
A046	First voltage compensation gain for automatic torque boost	HC101	
A246	Second voltage compensation gain for automatic torque boost	HC201	
A047	First slip compensation gain for automatic torque boost	HC102	
A247	Second slip compensation gain for automatic torque boost	HC202	
A051	DC braking selection	AF101	Addition of individual settings for second control
A052	DC braking frequency	AF103	Addition of individual settings for second control
A053	DC braking delay time	AF104	Addition of individual settings for second control
A054	DC braking force	AF105	Addition of individual settings for second control
A055	DC braking time	AF106	Addition of individual settings for second control
A056	DC braking edge/level selection	AF107	Addition of individual settings for second control
A057	DC braking force at the start	AF108	Addition of individual settings for second control
A058	DC braking time at the start	AF109	Addition of individual settings for second control
A059	DC braking carrier frequency		Integrated into bb101
A061	First frequency upper limiter	bA102	
A261	Second frequency upper limiter	bA202	
A062	First frequency lower limiter	bA103	
A262	Second frequency lower limiter	bA203	
A063	Jump frequency 1	AG101	Addition of individual settings for second control

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
A064	Jump frequency width 1	AG102	Addition of individual settings for second control
A065	Jump frequency 2	AG103	Addition of individual settings for second control
A066	Jump frequency width 2	AG104	Addition of individual settings for second control
A067	Jump frequency 3	AG105	Addition of individual settings for second control
A068	Jump frequency width 3	AG106	Addition of individual settings for second control
A069	Acceleration stop frequency	AG110	Addition of individual settings for second control
A070	Acceleration stop time	AG111	Addition of individual settings for second control
A071	PID selection	AH-01	
A072	PID P gain	AH-61	
A073	PID I gain	AH-62	
A074	PID D gain	AH-63	
A075	PID scale		Configured with AH-04 - AH-06
A076	PID feedback selection	AH-51	
A077	PID deviation reverse output	AH-02	
A078	PID changeable range	AH-71	
A079	PID feed forward selection	AH-70	
A081	AVR selection	bA146	Second control extension * 00→00, 01→01, 02→02 The same values are used for equivalent operations.
A082	Motor incoming voltage selection	Hb106/Hd106	Configured with Hb106 (IM)/Hd106 (SM/PMM).
A085	Operation mode selection	Hb145	Addition of individual settings for second control
A086	Energy-saving response/accuracy adjustment	Hb146	Addition of individual settings for second control
A092	First acceleration time 2	AC124	
A292	Second acceleration time 2	AC224	
A392	Second acceleration time 3		Abolition of third control
A093	First deceleration time 2	AC126	
A293	Second deceleration time 2	AC226	
A393	Second deceleration time 3		Abolition of third control
A094	First 2-step acceleration/deceleration selection	AC115	
A294	Second 2-step acceleration/deceleration selection	AC215	
A095	First 2-stage acceleration frequency	AC116	
A295	Second 2-stage acceleration frequency	AC216	
A096	First 2-stage deceleration frequency	AC117	
A296	Second 2-stage deceleration frequency	AC217	
A097	Acceleration pattern selection	AC-03	
A098	Deceleration pattern selection	AC-04	
A101	OI start	Cb-13	For Ai2
A102	OI end	Cb-14	For Ai2
A103	OI start ratio	Cb-15	For Ai2
A104	OI end ratio	Cb-16	For Ai2

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
A105	OI start selection	Cb-17	For Ai2
A111	O2 start	Cb-23	For Ai3
A112	O2 end	Cb-24	For Ai3
A113	O2 start ratio	Cb-25	For Ai3
A114	O2 end ratio	Cb-26	For Ai3
A131	Acceleration curve constant	AC-05	
A132	Deceleration curve constant	AC-06	
A141	Operation frequency selection 1	AA101	Integrated into main speed/auxiliary speed command. Addition of individual settings for second control
A142	Arithmetic operation frequency selection 2	AA102	Integrated into main speed/auxiliary speed command. Addition of individual settings for second control
A143	Arithmetic operation operator selection	AA105	Addition of individual settings for second control
A145	Additional frequency setting	AA106	Addition of individual settings for second control
A146	Additional frequency sign selection		You can change the sign by setting AA106 with ±.
A150	Curvature 1 for EL-S-shaped acceleration	AC-08	
A151	Curvature 2 for EL-S-shaped acceleration	AC-09	
A152	Curvature 1 for EL-S-shaped deceleration	AC-10	
A153	Curvature 2 for EL-S-shaped deceleration	AC-11	
b001	Selection of instantaneous power failure/ undervoltage restart	bb-24	Specify b001=00 (trip) with retry count (instantaneous power failure [bb-20]/undervoltage [bb-21]) with zero.
b002	Allowable instantaneous power failure time	bb-25	
b003	Retry stand-by time for instantaneous power failure and insufficient voltage	bb-26	
b004	Instantaneous power failure/undervoltage tripping selection during stop	bb-27	
b005	Selection of instantaneous power failure retry count	bb-20	0: trip, 255: infinite
b006	Input phase loss selection	bb-65	
b007	f matching lower limit frequency setting	bb-42	
b008	Trip retry selection	bb-28	Specify b008=00 (trip) with retry count (overvoltage [bb-22]/undercurrent [bb-23]) with zero.
b009	Selection of undervoltage retry count	bb-21	0: trip, 255: infinite
b010	Selection of overvoltage/overcurrent retry count	bb-22 bb-23	Specify overvoltage [bb-22] and overcurrent [bb-23] individually.
b011	Trip retry standby time	bb-29	
b012	First electronic thermal level	bC110	
b212	Second electronic thermal level	bC210	
b312	Third electronic thermal level		Abolition of third control
b013	Selection of first electronic thermal characteristics	bC111	
b213	Selection of second electronic thermal characteristics	bC211	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
b313	Selection of third electronic thermal characteristics		Abolition of third control
b015	Free electronic thermal frequency 1	bC120	Addition of individual settings for second control
b016	Free electronic thermal current 1	bC121	Addition of individual settings for second control
b017	Free electronic thermal frequency 2	bC122	Addition of individual settings for second control
b018	Free electronic thermal current 2	bC123	Addition of individual settings for second control
b019	Free electronic thermal frequency 3	bC124	Addition of individual settings for second control
b020	Free electronic thermal current 3	bC125	Addition of individual settings for second control
b021	Overload limit selection	bA122	Addition of individual settings for second control
b022	Overload limit level	bA123	Addition of individual settings for second control
b023	Overload limit constant	bA124	Addition of individual settings for second control
b024	Overload limit selection 2	bA126	Addition of individual settings for second control
b025	Overload limit level 2	bA127	Addition of individual settings for second control
b026	Overload limit constant 2	bA128	Addition of individual settings for second control
b027	Overcurrent suppression selection	bA120	Addition of individual settings for second control
b028	Frequency pull-in restart level	bb-43	
b029	Frequency pull-in restart constant	bb-44	
b030	Start frequency selection for frequency pull-in restart	bb-47	
b031	Soft-lock selection	UA-16	
b034	RUN time/power supply ON time level	CE-36	
b035	Operation direction limit selection	AA114	Addition of individual settings for second control
b036	Reduced voltage start selection	Hb131	Addition of individual settings for second control
b037	Display selection	UA-10	
b038	Initial screen selection	UA-91	For the LCD Operator, you can select an initial screen in System settings of LCD Operator.
b039	User parameter automatic setting function	UA-30	
b040	Torque limit selection	bA110	Addition of individual settings for second control
b041	Torque limit 1 (Four-quadrant mode normal powered)	bA112	Addition of individual settings for second control
b042	Torque limit 2 (Four-quadrant mode reverse regenerative)	bA113	Addition of individual settings for second control
b043	Torque limit 3 (Four-quadrant mode reverse powered)	bA114	Addition of individual settings for second control
b044	Torque limit 4 (Four-quadrant mode normal regenerative)	bA115	Addition of individual settings for second control

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
b045	Torque LADSTOP selection	bA116	Addition of individual settings for second control
b046	Selection of reversal prevention	HC114	Addition of individual settings for second control
b050	Instantaneous power failure non-stop selection	bA-30	
b051	Instantaneous power failure non-stop starting voltage	bA-31	
b052	Instantaneous power failure non-stop OV-LADSTOP level (target voltage level)	bA-32	
b053	Instantaneous power failure non-stop deceleration time	bA-34	
b054	Instantaneous power failure non-stop deceleration start range	bA-36	
b055	Instantaneous power failure non-stop proportional gain setting	bA-37	
b056	Instantaneous power failure non-stop integrated time setting	bA-38	
b060	Window comparator O upper limit	CE-40	
b061	Window comparator O lower limit	CE-41	
b062	Window comparator O hysteresis width	CE-42	
b063	Window comparator OI upper limit level	CE-43	
b064	Window comparator OI lower limit level	CE-44	
b065	Window comparator OI hysteresis width	CE-45	
b066	Window comparator O2 upper limit level	CE-46	
b067	Window comparator O2 lower limit level	CE-47	
b068	Window comparator O2 hysteresis width	CE-48	
b070	O operation level at disconnection	CE-50	
b071	OI operation level at disconnection	CE-52	
b072	O2 operation level at disconnection	CE-54	
b078	Deletion of integrated power	UA-12	
b079	Integrated power display gain	UA-13	
b082	Starting frequency	Hb130	Addition of individual settings for second control
b083	Carrier frequency	bb101	Addition of individual settings for second control
b084	Selection of initialization	Ub-01	
b085	Initialization data selection	Ub-02	
b086	Frequency conversion coefficient	Ab-01	
b087	Stop key selection	AA-13	
b088	Free-run stop selection	bb-40	
b089	Automatic carrier reduction	bb103	Addition of individual settings for second control
b090	BRD use rate	bA-60	
b091	Stop mode selection	AA115	Addition of individual settings for second control
b092	Cooling fan operation selection	bA-70	
b095	BRD selection	bA-61	
b096	BRD on level	bA-62	
b098	Thermistor selection	Cb-40	
b099	Thermistor error level	bb-70	
b100	Free V/f frequency 1	Hb150	Addition of individual settings for second control

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
b101	Free V/f voltage 1	Hb151	Addition of individual settings for second control
b102	Free V/f frequency 2	Hb152	Addition of individual settings for second control
b103	Free V/f voltage 2	Hb153	Addition of individual settings for second control
b104	Free V/f frequency 3	Hb154	Addition of individual settings for second control
b105	Free V/f voltage 3	Hb155	Addition of individual settings for second control
b106	Free V/f frequency 4	Hb156	Addition of individual settings for second control
b107	Free V/f voltage 4	Hb157	Addition of individual settings for second control
b108	Free V/f frequency 5	Hb158	Addition of individual settings for second control
b109	Free V/f voltage 5	Hb159	Addition of individual settings for second control
b110	Free V/f frequency 6	Hb160	Addition of individual settings for second control
b111	Free V/f voltage 6	Hb161	Addition of individual settings for second control
b112	Free V/f frequency 7	Hb162	Addition of individual settings for second control
b113	Free V/f voltage 7	Hb163	Addition of individual settings for second control
b120	Brake control selection	AF130	Addition of individual settings for second control
b121	Establishment waiting time	AF131	Addition of individual settings for second control
b122	Acceleration waiting time	AF132	Addition of individual settings for second control
b123	Stop waiting time	AF133	Addition of individual settings for second control
b124	Brake check waiting time	AF134	Addition of individual settings for second control
b125	Brake release frequency	AF135	Addition of individual settings for second control
b126	Brake release current	AF136	Addition of individual settings for second control
b127	Brake apply frequency	AF137	Addition of individual settings for second control
b130	Overvoltage suppression function selection	bA140	Addition of individual settings for second control
b131	Overvoltage suppression level	bA141	Addition of individual settings for second control
b132	Overvoltage suppression constant	bA142	Addition of individual settings for second control
b133	Overvoltage suppression proportional gain setting	bA144	Addition of individual settings for second control
b134	Overvoltage suppression integrated time setting	bA145	Addition of individual settings for second control
C001	Selection of intelligent input terminal 1	CA-01	
C002	Selection of intelligent input terminal 2	CA-02	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
C003	Selection of intelligent input terminal 3	CA-03	
C004	Selection of intelligent input terminal 4	CA-04	
C005	Selection of intelligent input terminal 5	CA-05	
C006	Selection of intelligent input terminal 6	CA-06	
C007	Selection of intelligent input terminal 7	CA-07	
C008	Selection of intelligent input terminal 8	CA-08	
C011	Selection of intelligent input terminal 1a/b (NO/NC)	CA-21	
C012	Selection of intelligent input terminal 2a/b (NO/NC)	CA-22	
C013	Selection of intelligent input terminal 3a/b (NO/NC)	CA-23	
C014	Selection of intelligent input terminal 4a/b (NO/NC)	CA-24	
C015	Selection of intelligent input terminal 5a/b (NO/NC)	CA-25	
C016	Selection of intelligent input terminal 6a/b (NO/NC)	CA-26	
C017	Selection of intelligent input terminal 7a/b (NO/NC)	CA-27	
C018	Selection of intelligent input terminal 8a/b (NO/NC)	CA-28	
C019	Selection of FW terminal a/b (NO/NC)	CA-29	For CA-09 = FW (input terminal 001)
C021	Selection of intelligent output terminal 11	CC-01	
C022	Selection of intelligent output terminal 12	CC-02	
C023	Selection of intelligent output terminal 13	CC-03	
C024	Selection of intelligent output terminal 14	CC-04	
C025	Selection of intelligent output terminal 15	CC-05	
C026	Selection of intelligent relay terminal	CC-07	
C027	FM selection	Cd-03	
C028	AM selection	Cd-04	
C029	AMI selection	Cd-05	
C030	Reference value of digital current monitor		Configured with Cd-02 (settings need to be checked)
C031	Selection of intelligent output terminal 11a/b (NO/NC)	CC-11	
C032	Selection of intelligent output terminal 12a/b (NO/NC)	CC-12	
C033	Selection of intelligent output terminal 13a/b (NO/NC)	CC-13	
C034	Selection of intelligent output terminal 14a/b (NO/NC)	CC-14	
C035	Selection of intelligent output terminal 15a/b (NO/NC)	CC-15	
C036	Selection of intelligent relay a/b (NO/NC)	CC-17	
C038	Low current signal output mode selection	CE101	Addition of individual settings for second control
C039	Low current detection level	CE102	Addition of individual settings for second control
C040	Overload advance notice signal output mode selection	CE105	Addition of individual settings for second control
C041	Overload advance notice level	CE106	Addition of individual settings for second control

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
C042	Acceleration reaching frequency	CE-10	
C043	Deceleration reaching frequency	CE-11	
C044	PID excessive deviation level	AH-72	
C045	Acceleration reaching frequency 2	CE-12	
C046	Deceleration reaching frequency 2	CE-13	
C052	Feedback comparison signal OFF level	AH-73	
C053	Feedback comparison signal ON level	AH-74	
C055	Overtorque level (normal rotation powered)	CE120	Addition of individual settings for second control
C056	Overtorque level (reverse rotation regenerative)	CE121	Addition of individual settings for second control
C057	Overtorque level (reverse rotation powered)	CE122	Addition of individual settings for second control
C058	Overtorque level (normal rotation regenerative)	CE123	Addition of individual settings for second control
C061	Thermal warning level	CE-30	
C062	Alarm code selection		This function is enabled when an alarm code (084-087) is set to an input terminal.
C063	0Hz detection level	CE-33	
C064	Cooling fin overheat advance notice level	CE-34	
C071	Communication transmission speed selection	CF-01	
C072	Communication station number selection	CF-02	
C073	Communication bit length selection		Abolished due to Modbus communication
C074	Communication parity selection	CF-03	
C075	Communication stop bit selection	CF-04	
C076	Communication error selection	CF-05	
C077	Communication trip time	CF-06	
C078	Stop waiting time	CF-07	
C079	Communication method selection		Abolished due to Modbus communication
C081	O adjustment		Adjusted with Cb-30 or Cb-31
C082	OI adjustment		Adjusted with Cb-32 or Cb-33
C083	O2 adjustment		Adjusted with Cb-34 or Cb-35
C085	Thermistor adjustment	Cb-41	
C091	Debug mode selection	UC-01	
C101	UP/DWN memory selection	CA-61	
C102	Reset selection	CA-72	
C103	Reset f matching selection	bb-41	
C105	FM gain setting	Cd-14	
C106	AM gain setting	Cd-24	
C107	AMI gain setting	Cd-34	
C109	AM bias setting	Cd-23	
C110	AMI bias setting	Cd-33	
C111	Overload advance notice level 2	CE107	
C121	O zero adjustment	Cb-30/Cb-31	Adjusted with Cb-30 or Cb-31
C122	OI zero adjustment	Cb-32/Cb-33	Adjusted with Cb-32 or Cb-33
C123	O2 zero adjustment	Cb-34/Cb-35	Adjusted with Cb-34 or Cb-35
C130	Output 11 on-delay time	CC-20	
C131	Output 11 off-delay time	CC-21	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
C132	Output 12 on-delay time	CC-22	
C133	Output 12 off-delay time	CC-23	
C134	Output 13 on-delay time	CC-24	
C135	Output 13 off-delay time	CC-25	
C136	Output 14 on-delay time	CC-26	
C137	Output 14 off-delay time	CC-27	
C138	Output 15 on-delay time	CC-28	
C139	Output 15 off-delay time	CC-29	
C140	Output RY on-delay time	CC-32	
C141	Output RY off-delay time	CC-33	
C142	Logical output signal 1 selection 1	CC-40	
C143	Logical output signal 1 selection 2	CC-41	
C144	Logical output signal 1 operator selection	CC-42	
C145	Logical output signal 2 selection 1	CC-43	
C146	Logical output signal 2 selection 2	CC-44	
C147	Logical output signal 2 operator selection	CC-45	
C148	Logical output signal 3 selection 1	CC-46	
C149	Logical output signal 3 selection 2	CC-47	
C150	Logical output signal 3 operator selection	CC-48	
C151	Logical output signal 4 selection 1	CC-49	
C152	Logical output signal 4 selection 2	CC-50	
C153	Logical output signal 4 operator selection	CC-51	
C154	Logical output signal 5 selection 1	CC-52	
C155	Logical output signal 5 selection 2	CC-53	
C156	Logical output signal 5 operator selection	CC-54	
C157	Logical output signal 6 selection 1	CC-55	
C158	Logical output signal 6 selection 2	CC-56	
C159	Logical output signal 6 operator selection	CC-57	
C160	Input terminal response time 1	CA-41	
C161	Input terminal response time 2	CA-42	
C162	Input terminal response time 3	CA-43	
C163	Input terminal response time 4	CA-44	
C164	Input terminal response time 5	CA-45	
C165	Input terminal response time 6	CA-46	
C166	Input terminal response time 7	CA-47	
C167	Input terminal response time 8	CA-48	
C168	Input terminal response time FW	CA-49	
C169	Multistage speed/position determination time	CA-55	
H001	Auto-tuning selection	HA-01	
H002	First motor constant selection		Abolition of selection (setting of IE3 motor)
H202	Second motor constant selection		Abolition of selection (setting of IE3 motor)
H003	First motor capacity selection	Hb102	
H203	Second motor capacity selection	Hb202	
H004	First selection of the number of motor poles	Hb103	
H204	Second selection of the number of motor poles	Hb203	
H005	First speed response	HA115	* Adjustment may be required.
H205	Second speed response	HA215	* Adjustment may be required.
H006	First stability constant	HA110	* Adjustment may be required.

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
H206	Second stability constant	HA210	* Adjustment may be required.
H306	Third stability constant		Abolition of third control
H020	First motor R1	Hb110	* Adjustment may be required.
H220	Second motor R1	Hb210	* Adjustment may be required.
H021	First motor R2	Hb112	* Adjustment may be required.
H221	Second motor R2	Hb212	* Adjustment may be required.
H022	First motor L	Hb114	* Adjustment may be required.
H222	Second motor L	Hb214	* Adjustment may be required.
H023	First motor I0	Hb116	* Adjustment may be required.
H223	Second motor I0	Hb216	* Adjustment may be required.
H024	First motor J	Hb118	* Adjustment may be required.
H224	Second motor J	Hb218	* Adjustment may be required.
H030	First motor R1 (auto-tuning data)		Hb110: Integration of setting location
H230	Second motor R1 (auto-tuning data)		Hb210: Integration of setting location
H031	First motor R2 (auto-tuning data)		Hb112: Integration of setting location
H231	Second motor R2 (auto-tuning data)		Hb212: Integration of setting location
H032	First motor L (auto-tuning data)		Hb114: Integration of setting location
H232	Second motor L (auto-tuning data)		Hb214: Integration of setting location
H033	First motor I0 (auto-tuning data)		Hb116: Integration of setting location
H233	Second motor I0 (auto-tuning data)		Hb216: Integration of setting location
H034	First motor J (auto-tuning data)		Hb118: Integration of setting location
H234	Second motor J (auto-tuning data)		Hb218: Integration of setting location
H050	First PI proportional gain	HA125	* Adjustment may be required.
H250	Second PI proportional gain	HA225	* Adjustment may be required.
H051	First PI integrated gain	HA126	* Adjustment may be required.
H251	Second PI integrated gain	HA226	* Adjustment may be required.
H052	First P proportional gain	HA127	* Adjustment may be required.
H252	Second P proportional gain	HA227	* Adjustment may be required.
H060	First 0Hz range limiter	HC110	
H260	Second 0Hz range limiter	HC210	
H061	First 0Hz range SLV start boost volume	HC112	
H261	Second 0Hz range SLV start boost volume	HC212	
H070	For switching PI proportional gain	HA128	* Adjustment may be required.
H071	For switching PI integrated gain	HA129	* Adjustment may be required.
H072	For switching P proportional gain	HA130	* Adjustment may be required.
H073	Gain switch time	HA121	
P001	Selection of operation at option 1 error	oA-12	
P002	Selection of operation at option 2 error	oA-22	
P011	Number of pulses of encoder	ob-01	
P012	V2 control mode selection	AA123	
P013	Pulse string mode selection	ob-11	
P014	Orientation stop position	AE-11	
P015	Orientation speed setting	AE-12	
P016	Orientation direction setting	AE-13	
P017	Positioning completion range setting	AE-04	
P018	Positioning completion delay time setting	AE-05	
P019	Electronic gear installation position selection	AE-01	
P020	Numerator of electronic gear ratio	AE-02	
P021	Denominator of electronic gear ratio	AE-03	
P022	Positioning control feed forward gain	AE-06	
P023	Position loop gain	AE-07	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
P024	Position bias volume	AE-08	
P025	Selection of whether a secondary-resistance correction is to be conducted.	HC113	Addition of individual settings for second control
P026	Overspeed error detection level	bb-80	
P027	Overspeed deviation error detection level	bb-81	
P028	Numerator of motor gear ratio	ob-03	
P029	Denominator of motor gear ratio	ob-04	
P031	Acceleration or deceleration time input type	AC-01	
P032	Orientation stop position input type	AE-10	
P033	Torque command input selection	Ad-01	
P034	Torque command setting	Ad-02	
P035	Selection of pole at torque command by O2	Ad-03	Not limited to Ai3.
P036	Torque bias mode	Ad-11	
P037	Torque bias value	Ad-12	
P038	Torque bias polarity selection	Ad-13	
P039	Torque control speed limit value (for normal rotation)	Ad-41	
P040	Torque control speed limit value (for reverse rotation)	Ad-42	
P044	Timer setting for monitoring of DeviceNet operation command	oA-11	
P045	Operation setting at the time of communication error	oA-12	
P046	OUTPUT assembly instance No. setting	(reserved)	
P047	INPUT assembly instance No. setting	(reserved)	
P048	Operation setting at the time of detection of idle mode	(reserved)	
P049	Setting of the number of poles for rotation speed		Integrated to Hb103 (IM)/Hd103 (SM/PMM)
P055	Pulse string frequency scale	ob-12	
P056	Pulse string frequency time constant	ob-13	
P057	Position string bias volume	ob-14	
P058	Pulse string limit	ob-15	
P060	Position command 0	AE-20	
P061	Position command 1	AE-22	
P062	Position command 2	AE-24	
P063	Position command 3	AE-26	
P064	Position command 4	AE-28	
P065	Position command 5	AE-30	
P066	Position command 6	AE-32	
P067	Position command 7	AE-34	
P068	Zero return mode	AE-70	
P069	Zero return direction selection	AE-71	
P070	Low speed zero return frequency	AE-72	
P071	High speed zero return frequency	AE-73	
P072	Position range designation (forward rotation side)	AE-52	
P073	Position range designation (reverse rotation side)	AE-54	
P074	Teaching selection	AE-60	
P100	Simplified sequence function user parameter U (00)	UE-10	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
P101	Simplified sequence function user parameter U (01)	UE-11	
P102	Simplified sequence function user parameter U (02)	UE-12	
P103	Simplified sequence function user parameter U (03)	UE-13	
P104	Simplified sequence function user parameter U (04)	UE-14	
P105	Simplified sequence function user parameter U (05)	UE-15	
P106	Simplified sequence function user parameter U (06)	UE-16	
P107	Simplified sequence function user parameter U (07)	UE-17	
P108	Simplified sequence function user parameter U (08)	UE-18	
P109	Simplified sequence function user parameter U (09)	UE-19	
P110	Simplified sequence function user parameter U (10)	UE-20	
P111	Simplified sequence function user parameter U (11)	UE-21	
P112	Simplified sequence function user parameter U (12)	UE-22	
P113	Simplified sequence function user parameter U (13)	UE-23	
P114	Simplified sequence function user parameter U (14)	UE-24	
P115	Simplified sequence function user parameter U (15)	UE-25	
P116	Simplified sequence function user parameter U (16)	UE-26	
P117	Simplified sequence function user parameter U (17)	UE-27	
P118	Simplified sequence function user parameter U (18)	UE-28	
P119	Simplified sequence function user parameter U (19)	UE-29	
P120	Simplified sequence function user parameter U (20)	UE-30	
P121	Simplified sequence function user parameter U (21)	UE-31	
P122	Simplified sequence function user parameter U (22)	UE-32	
P123	Simplified sequence function user parameter U (23)	UE-33	
P124	Simplified sequence function user parameter U (24)	UE-34	
P125	Simplified sequence function user parameter U (25)	UE-35	
P126	Simplified sequence function user parameter U (26)	UE-36	
P127	Simplified sequence function user parameter U (27)	UE-37	

3G3RX-series V1		3G3RX2-series	Remarks
Display code	Function name	New code	
P128	Simplified sequence function user parameter U (28)	UE-38	
P129	Simplified sequence function user parameter U (29)	UE-39	
P130	Simplified sequence function user parameter U (30)	UE-40	
P131	Simplified sequence function user parameter U (31)	UE-41	
U001	User 1 selection	UA-31	
U002	User 2 selection	UA-32	
U003	User 3 selection	UA-33	
U004	User 4 selection	UA-34	
U005	User 5 selection	UA-35	
U006	User 6 selection	UA-36	
U007	User 7 selection	UA-37	
U008	User 8 selection	UA-38	
U009	User 9 selection	UA-39	
U010	User 10 selection	UA-40	
U011	User 11 selection	UA-41	
U012	User 12 selection	UA-42	

A-3 Overview of Inverter Selection

Motor Capacity Selection

Before selecting an inverter, first the motor should be chosen. In selecting the motor, calculate the load inertia appropriate to the application, and then calculate the required capacity and torque.

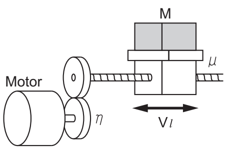
■ Simplified Selection Method (Required Output Calculation)

This method of calculation helps you select a motor by calculating the output (kW) required by the motor to maintain its steady rotations. To use this method for motor selection, make allowance for the calculated result because it does not include acceleration/deceleration and other transient state calculations. The simplified selection method is suitable for fan, conveyor, mixer, and other applications where a constant state continues for a while.

* The simplified selection method cannot be used for the following applications. For these applications, use the detailed selection method.

- Those requiring rapid startup (acceleration).
- Those that frequently repeat run and stop.
- Those that have a large inertia at the power transfer part.
- Those that have an inefficient power transfer part.

- For linear motion: Steady power P0 [kW]

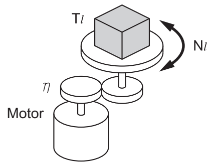


$$P_0\,[\text{kW}] = \frac{\mu \cdot Mg \cdot V_l}{60 \cdot \eta} \times 10^{-3}$$

μ : Friction coefficient
M : Mass of linear motion part [kg]
g : Acceleration of gravity (g≈9.8 [m/s^2])
V_l : Speed of linear motion part [m/min]
η : Efficiency of transfer part ($\eta \leq 1$)

* The same calculating formula is applicable to belt conveyors.

- For rotation motion: Steady power P0 [kW]



$$P_0\,[\text{kW}] = \frac{2\pi \cdot T_l \cdot N_l}{60 \cdot \eta} \times 10^{-3}$$

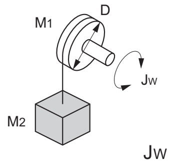
T_l : Load torque (Load shaft) [N·m]
N_l : Rotation speed of load shaft [r/min]
η : Efficiency of transfer part ($\eta \leq 1$)

■ Detailed Selection Method (RMS Calculation)

This method helps you select a motor by calculating the effective torque and maximum torque values required to achieve a certain pattern of operation for the application. It selects a motor that is optimal for a particular operation pattern.

- Calculation of load inertia and motor-shaft conversion inertia
  Depending on the type of the motor transfer system, calculate the inertia for all parts and convert it into the motor-shaft inertia.

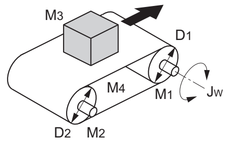
• Example in hoist application



$$J_W\,[\text{kg}\cdot\text{m}^2] = J_1 + J_2 = \left(\frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4}\right) \times 10^{-6}$$

J_W : Shaft conversion inertia [kg·m^2]
J_1 : Inertia of cylinder (Shaft conversion) [kg·m^2]
J_2 : Inertia of workpiece (Shaft conversion) [k·m^2]
M_1 : Mass of cylinder [kg]
M_2 : Mass of workpiece [kg]
D : Diameter of cylinder [mm]

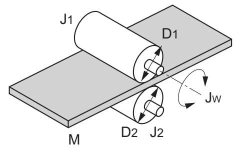
• Example in conveyor application



$$J_W\,[\text{kg}\cdot\text{m}^2] = J_1 + J_2 + J_3 + J_4 = \left(\frac{M_1 \cdot D_1^2}{8} + \frac{M_2 \cdot D_2^2}{8} \cdot \frac{D_1^2}{D_2^2} + \frac{M_3 \cdot D_1^2}{4} + \frac{M_4 \cdot D_1^2}{4}\right) \times 10^{-6}$$

J_W : Shaft conversion inertia (Cylinder-1-shaft conversion) [kg·m^2]
J_1 : Inertia of cylinder 1 (Cylinder-1-shaft conversion) [kg·m^2]
J_2 : Inertia of cylinder 2 (Cylinder-1-shaft conversion) [kg·m^2]
J_3 : Inertia of workpiece (Cylinder-1-shaft conversion) [kg·m^2]
J_4 : Inertia of belt (Cylinder-1-shaft conversion) [kg·m^2]
M_1 : Mass of cylinder 1 [kg]
M_2 : Mass of cylinder 2 [kg]
M_3 : Mass of workpiece [kg]
M_4 : Mass of belt [kg]
D_1 : Diameter of cylinder 1 [mm]
D_2 : Diameter of cylinder 2 [mm]

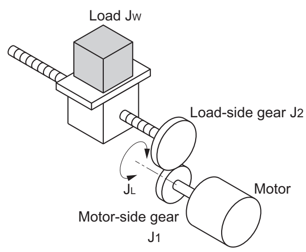
• Example in roller application



$$J_W\,[\text{kg}\cdot\text{m}^2] = J_1 + \left(\frac{D_1^2}{D_2^2}\right) J_2 + \frac{M \cdot D_1^2}{4} \times 10^{-6}$$

J_W : Shaft conversion inertia (Roller-1-shaft conversion) [kg·m^2]
J_1 : Inertia of roller 1 (Roller-1-shaft conversion) [kg·m^2]
J_2 : Inertia of roller 2 (Roller-2-shaft conversion) [kg·m^2]
M : Mass of workpiece [kg]
D_1 : Diameter of roller 1 [mm]
D_2 : Diameter of roller 2 [mm]

• Example of conversion into motor-shaft inertia



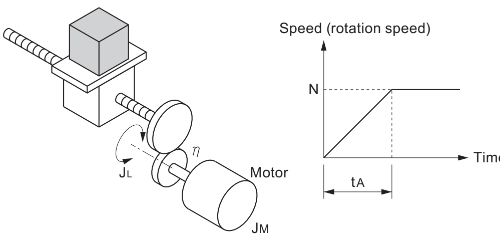
J_L: [kg·m^2]$=J_1+G^2(J_2+J_W)$

J_L : Motor-shaft conversion inertia [kg·m^2]
J_W : Load inertia (Load-side gear-shaft conversion) [kg·m^2]
J_1 : Inertia of motor-side gear [kg·m^2]
J_2 : Inertia of load-side gear [kg·m^2]
Z_1 : Number of motor-side gear teeth
Z_2 : Number of load-side gear teeth
G : Gear ratio (Speed reduction ratio) = Z1 / Z2

- Calculation of motor-shaft conversion torque and effective torque

Calculate the acceleration torque from the motor-shaft conversion load inertia, the motor-rotor inertia, and the acceleration. Then, calculate the load torque from the external force (gravity and tension) and friction force applied to the load. Finally, combine these calculation results to calculate the torque required for the motor.

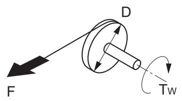
• Calculation of acceleration torque (TA)



$$T_A\,[\mathrm{N\cdot m}] = \frac{2\pi \cdot N}{60 \cdot t_A}\left(J_M + \frac{J_L}{\eta}\right)$$

T_A : Acceleration torque [N·m]
J_L : Motor-shaft conversion load inertia [kg·m^2]
J_M : Motor-rotor inertia [kg·m^2]
η : Efficiency of transfer part ($\eta \leq 1$)
t_A : Acceleration time [s]
N : Motor rotation speed [r/min]

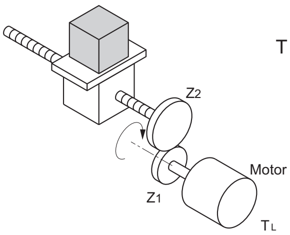
• Calculation of motor-shaft conversion load torque (TL)



$$T_W\,[\mathrm{N\cdot m}] = F \cdot \frac{D}{2} \times 10^{-3}$$

T_W : Load torque (Load-shaft conversion) [N·m]
F : External force [N]
D : Diameter of cylinder [mm]

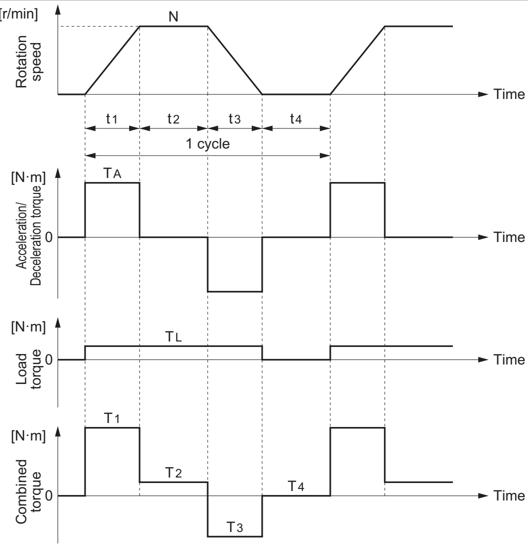
(Generally, the friction force can be calculated as:
F= μMg [N], where
μ : Coefficient of friction
M : Mass of motion part [kg]
g : Acceleration of gravity (g≈9.8 [m/s^2])



$$T_L\,[\mathrm{N\cdot m}] = T_W \cdot \frac{G}{\eta}$$

T_L : Motor-shaft conversion load torque [N·m]
T_W : Load torque (Load-shaft conversion) [N·m]
Z_1 : Number of motor-side gear teeth
Z_2 : Number of load-side gear teeth
G : Gear ratio (Speed reduction ratio) =Z_1/Z_2

• Calculation of combined torque and effective torque



· Effective torque T_{RMS} [N·m]

$$= \sqrt{\frac{\sum (T_i{}^2 \cdot t_i)}{\sum t_i}}$$

$$= \sqrt{\frac{T_1{}^2 \cdot t_1 + T_2{}^2 \cdot t_2 + T_3{}^2 \cdot t_3 + T_4{}^2 \cdot t_4}{t_1 + t_2 + t_3 + t_4}}$$

· Maximum torque T_{MAX} [N·m] =T_1 =T_A +T_L

- Motor selection

Based on the above calculation results, select the motor capacity by using the following formulae.
Select the larger of the two calculated values as the motor capacity. Also, when selecting a motor, take into consideration the errors in calculation and modeling. Select a motor whose capacity is at least approximately 20% larger.

• Motor capacity conversion to effective torque

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{RMS} \cdot N}{60} \times 10^{-3}$$ N: Maximum rotation speed [r/min]

• Motor capacity required for maximum torque output

$$\text{Motor capacity [kW]} = \frac{2\pi \cdot T_{MAX} \cdot N}{60 \times 1.5} \times 10^{-3}$$ N: Maximum rotation speed [r/min]

* The above calculation formulae assume that the maximum motor toque is 150% of the rated torque.

Inverter Capacity Selection

Select an inverter that can be used with the motor you selected based on the result of motor capacity selection. Basically, select an inverter which fits the maximum applicable motor capacity of the selected motor.
After selecting an inverter, check if it meets the both of the following conditions. If not, select an inverter that has a one class larger capacity and check again.

Rated motor current ≤ Rated output current of inverter
Max. continuous torque output time for application ≤ 1 min

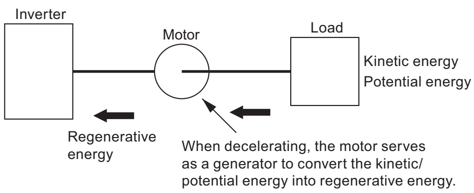
Note 1. In the light load mode, the overload capacity of the inverter is 150% of the rated torque for 5 seconds. Use the 5-seconds rating when determining the maximum continuous torque.
2. If you want to use 0-Hz sensorless vector control, need a holding torque at a rotation speed of 0 (r/min), or frequently require 150% of the rated torque or more, use an inverter with a one class larger capacity than the one selected by the above method.

Overview of Braking Resistor Selection

■ Requirement of Braking Resistor

If the regenerative energy generated in deceleration or descent in an application is too great, the main circuit voltage in the inverter may increase, which results in damage to the inverter.
Normally, the inverter has a built-in overvoltage protection function, which detects an overvoltage (0 V) in the main circuit to prevent inverter damage. However, because it detects a fault to cause the motor to stop, stable and continuous operation will be prevented.
Therefore, you need to use one or more braking resistors/ regenerative braking units to absorb this regenerative energy outside the inverter.

- What is Regenerative Energy?
  The load connected to a motor has kinetic energy when rotating, and potential energy when it is subject to the gravity. When the motor decelerates, or when the load descends, the energy is fed back to an inverter. This phenomenon is known as regeneration, and the energy is called regenerative energy.



- Preventing an overvoltage (0 V) in main circuit without use of braking resistors
  The following are methods to prevent the occurrence of an overvoltage (0 V) in the main circuit without connection of braking resistors.
  Since these methods prolong the deceleration time, check that the selected method will not cause application problems.

• Enable the Overvoltage Suppression Function during Deceleration

The Overvoltage Suppression Function during Deceleration is enabled by factory default.
It automatically increases the deceleration time to prevent the occurrence of an overvoltage in the main circuit.

• Set a longer deceleration time

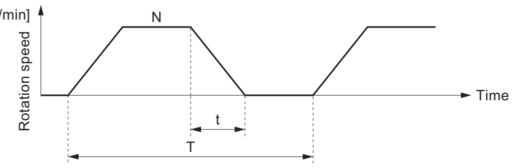
Increase the deceleration time to prevent the occurrence of an overvoltage in the main circuit.
This decreases the amount of regenerative energy per unit time.

• Select free-run stop

This prevents the regenerative energy from being fed back to the inverter.

■ Simplified Braking Resistor Selection

This is a simple method to select an appropriate braking resistor based on the percentage of the time in which regenerative energy is produced in a normal operation pattern.



• Usage rate [%ED] = 100 x t/T
t: Deceleration time (regenerative time) [s]
T: 1cycle operation time [s]

- For models with built-in regenerative braking circuit
  (3G3RX2 200 V with a capacity of 22 kW or lower,
  3G3RX2 400 V with a capacity of 37 kW or lower)

Select a braking resistor based on the usage rate calculated from the operation pattern.
Connect a braking resistor suitable for your inverter according to the braking resistor list provided in the inverter manual/catalog.

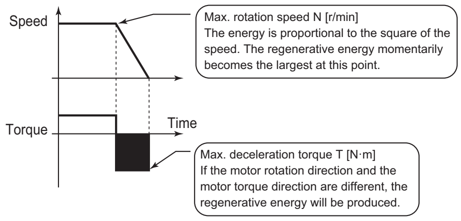
- For models without built-in regenerative braking circuit
  (3G3RX2 200 V with a capacity of 30 kW or higher,
  3G3RX2 400 V with a capacity of 45 kW or higher)

Select an appropriate regenerative braking unit and braking resistor.
Connect a regenerative braking unit and braking resistor suitable for your inverter according to the regenerative braking unit/braking resistor list provided in the inverter manual and catalog.

Detailed Braking Resistor Selection

When the usage rate of the braking resistor selected on the previous page exceeds 10% ED, or when an extremely large braking torque is required, use the method below to calculate a regenerative energy and make your selection.

- Calculation of Required Braking Resistance



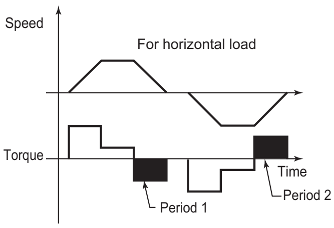
Resistance of braking resistor: $R \leq \dfrac{60 \times V^2}{2\pi \cdot (T - 0.2 \times Tm) \cdot N}$

V : 200-V class inverter 362.5 [V]
400-V class inverter 725 [V]
T : Maximum braking torque [N·m]
Tm : Motor rating torque [N·m]
N : Maximum rotation speed [r/min]

Note: Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section.

- Calculation of average regenerative energy

Regenerative energy is produced when the motor rotation direction and the torque direction are opposite. Use the following formula to calculate the regenerative energy for each period in a cycle.



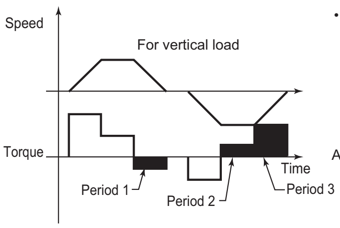
$P_i = N \times T \times t \times 1.047 \times 10^{-1}$

P_i: Regenerative energy in Period 1 [J] i

N: Motor rotation speed [r/min]
When the number of rotations changes, take an average value.
ex. For linear deceleration (N max+N min)/2

T: Deceleration torque [N·m]

t: Deceleration time [s]



- For the average regenerative energy, calculate the time average by adding the regenerative energy for all periods in a cycle and dividing it by the cycle time, as shown below.

Average regenerative energy [W] = $\dfrac{(P1 + P2 + \cdots + Pi)[J]}{1 \text{ cycle time [s]}}$

Note)
1. For Speed, the forward rotation direction is indicated as positive. For Torque, the torque in the forward rotation direction is indicated as positive.
2. Calculate a braking torque according to Inverter Capacity Selection in the Motor Capacity Selection section.

- Braking Resistor Selection

Select a braking resistor from the required braking resistance and the average regenerative energy on the left.

- Required braking resistance ≥ Resistance of braking resistor ≥ Min. connection resistance of inverter or regenerative braking unit
- Average regenerative energy ≤ Resistance capacity of braking resistor

Note)
1. Connecting a braking resistor whose resistance is less than the minimum connection resistance value of the inverter or regenerative braking unit results in damage to the internal braking transistor. If the required braking resistance is less than the minimum connection resistance, change the inverter or regenerative braking unit to one having a larger capacity and ensure that the required braking resistance is not less than the minimum connection resistance.
2. Two or more regenerative braking units can be connected in parallel. Refer to the following formula to know the braking resistance value in such a case: Braking resistance [Ω] = (Required braking resistance calculated as above) x (No. of units)
3. Make allowance for the resistance capacity of the braking resistor. Select a braking resistor whose capacity is at least 20% larger than the calculated value. Otherwise, it may be overheated.

B

Appendices B STO Function

B

B-1 Overview of STO Function

3G3RX2-series is an inverter built- in STO (Safe torque off) function defined in IEC 61800-5-2.

STO Function is used to shut off the motor current with input signals from a safety controller and to stop the motor.

This function is equivalent to stop category 0 defined in EN/IEC60204-1.

Precautions for Correct Use

Design

- The 3G3RX2-series does not feature a function to retain STO status. When STO input is reset, the inverter goes into a state of operation enabled and starts the operation when operation command is input.
- Design a system to disallow hazardous status when STO input is reset with consideration mentioned earlier.
- In default data set before shipment, STO function is disabled by short-circuit wires.

Installment

- Qualified engineers that have enough knowledge about function/safety shall install the inverter.

Wiring

- The 3G3RX2-series does not feature a function to carry out diagnosis of STO input signals. Be sure to design a system that can provide 2 inputs normally. As necessary, carry out error diagnosis for input path with EDM signal output.
- STO input signals via two channels outside the inverter shall be separated and protected appropriately. No interruption shall be made on each signal.
- The cable length for signals connected to ST1/ST2 or EDM terminal shall be each 20m or less.

Test Run

- Be sure to conduct a test run to verify safety system and check the validity. The safety system without this check shall not be regarded as “Safe”.

Maintenance

- STO function does not cut off the power supplies for the inverter main circuit and its peripheral circuit. When you make maintenance, be sure to separate a safety system away from the main power supply or devices like permanent magnet motors or capacitors to which voltage is likely supplied.
- Be sure to carry out the followings before the maintenance:
  - Wait for ten minutes or more*1 or fifteen minutes or more*2 after cutting off power supply.
  - Check that voltage between PN terminals is 45V or less after a charge LED goes out.
- Be sure to conduct periodic function test every year.

Others

- Never modify the inverter. The modified inverter is out of conformity with criteria and product guarantee.

*1 In the case of 3G3RX2-A2004 to -A2220 / -A4007 to -A4220

*2 In the case of 3G3RX2-A2300 to -A2550/ -A4300 to -A4550/ -B4750/ -B4900/ -B411K/ -B413K

B-1-1 Response Time

Response time is defined as duration from input of an operation command for safety function to an activation of the function. In the case of STO function, the response time is duration until the power to the Servomotor is shut off after STO signal is input.

In the case of 3G3RX2-series, the STO response time is 10ms or less.

Design a system to disallow devices that trigger hazardous conditions with consideration of this response time.

B-1-2 Self-diagnosis of Internal Path

The 3G3RX2-series features a function to diagnose errors of internal safety path.

When the function is used to detect the errors internal safety path, it holds a state with outputs to motor being cut off regardless of STO signal status.

B-1-3 STO Input

To input STO signal, the redundant double signals are needed to input. Also, the separated double STO signals are needed to input external inverter. When both inputs are not used, the inputs can not conform to criteria/standard.

B-1-4 Monitoring Output (EDM Output) of STO Status

When you monitor the input status of STO signals or the detection status of errors internal safety path from external devices, use EDM output terminals.

B-1-5 Periodic Function Test

The periodic function test is carried out to verify STO function properly. You need to conduct the test once a year or more in order to keep SIL/PL level prescribed in function safety system.

In this STO function test, check that output status to input ST1/ST2 and EDM signal status comply with Status 1 to Status 4 of Signal Matrix Table in C-2-3 STO Confirmation Signal Output (EDM) Signal.

B-1-6 Safety Function

Function	Criteria
STO (Safe Torque Off)	IEC61800-5-2:2016 EN61800-5-2:2007
Stop category 0	EN 60204-1: 2006/A1:2009

B-1-7 Response Time

Function	Value	Notes
STO response time	10ms	Time until the power to Servomotor is shut off after ST1/ST2 signals go into STO status
EDM response time	20ms	Time until EDM signals are turned ON after ST1/ST2 signals go into STO status

B-1-8 Safety Related Parameter

Parameter	Data	Criteria
PL	e	EN ISO 13849-1:2015
CAT.	4	
MTTFd	100 years	
DCavg	99.8%	
SIL	3	IEC61508: 2010 IEC61800-5-2:2016 EN61800-5-2:2007 IEC/EN62061:2012
HFT	1	
SFF	99.9%	
PFH	1.18×10^{-9}	
PFD	1.03×10^{-4}	

B-2 Procedure for Use of STO Function

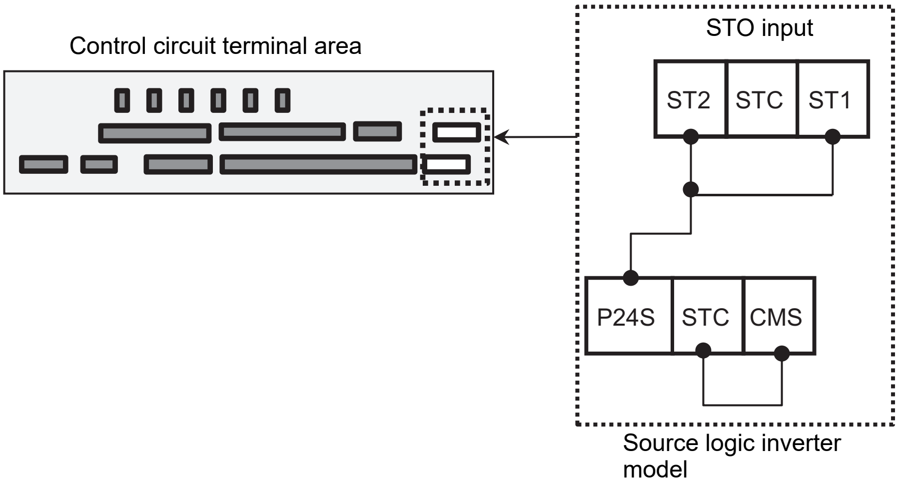
B-2-1 STO Signal Input

STO Input Terminal

Input of STO signal is performed by redundant input of STO terminals ST1 and ST2.

When voltage is applied to each input terminal and current flows, operation of safety path is enabled. When shipped from the factory, the operation status is always enabled with short circuit wiring shown as below.

If voltage is not applied to at least one of the input terminals, the corresponding blocking path shuts off output of the inverter.



Terminal Specifications

<table>
<tr><th>Terminal symbol</th><th>Terminal name</th><th>Description</th><th>Electrical characteristics</th></tr>
<tr><td>P24S</td><td>24 V output terminal (for STO input only)</td><td>A 24 VDC power supply for contact signals dedicated for ST1/ST2 terminals.
The common terminal is CMS.</td><td rowspan="2">Maximum output current: 100 mA</td></tr>
<tr><td>CMS</td><td>24 V output terminal common (for STO input only)</td><td>A common terminal for 24 VDC power supply for contact signals dedicated for ST1/ST2 terminals.</td></tr>
<tr><td>STC</td><td>Input logic switching terminal</td><td>A logic switching terminal for STO input.
You can change the input logic changing the connecting point of short-circuit line.
When an external power supply is used, remove the short-circuit line and use this terminal as the input common for ST1/ST2.</td><td>Short-circuit line: Connect between CMS and STC</td></tr>
<tr><td>ST1/ST2</td><td>STO input terminal</td><td>An input terminal of STO.</td><td>Voltage between ST1 and STC/ST1 and STC
• ON voltage: Min.15 VDC
• OFF voltage Max. 5 VDC
• Maximum allowable voltage 27 VDC
• Load current 5.8 mA (at 27 VDC)
Internal resistance: 4.7 kΩ</td></tr>
<tr><td>ED+</td><td>EDM signal output terminal (+)</td><td>A plus terminal of EDM signal (STO status monitoring).</td><td rowspan="2">Open collector output
• Between ED+ and ED-
• Voltage drop at ON: 4 V or less
• Maximum allowable voltage: 27 V
• Maximum allowable current: 50 mA</td></tr>
<tr><td>ED-</td><td>EDM signal output terminal (-)</td><td>A minus terminal of EDM signal (STO status monitoring).</td></tr>
</table>

B-2-2 Retaining Requirements of STO Status

The retention function that retains the blocked status of internal safety path even if STO input is canceled is not implemented as a safety circuit.

Therefore, if an operation command is input after cancellation of STO input or STO input is canceled while it is input, the inverter starts output to the motor.

Hence, to satisfy the requirement about cancellation of emergency stop specified in EN/IEC60204-1, you need to take either of the following measures.

(a) When STO is enabled, this function is used to stop an operation command given to an inverter. It gives the operation command to the inverter when a user intentionally requires inverter restart.

(b) Design a system in which STO input is reset when a user intentionally requires inverter restart.

Precautions for Correct Use

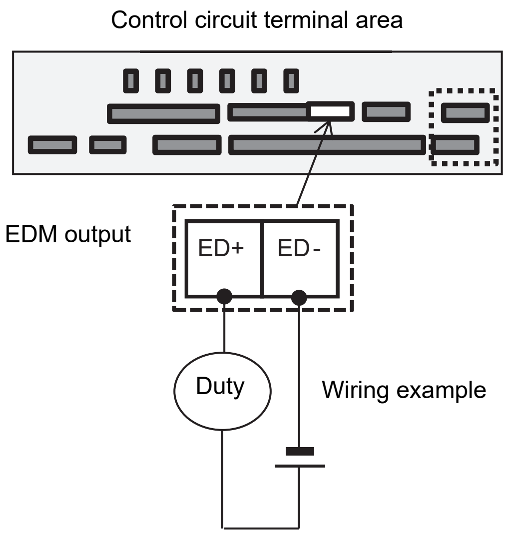
By setting parameters of the main unit, you can select the following operations.

- Trip the inverter by STO input. In this case, the inverter is tripped and output is stopped until power is shut off or the error reset signal for the inverter is input.
- If two STO input systems to the inverter are not input at the same time, the inverter is shut off and enters standby mode until STO input for the two systems is input.

B-2-3 STO Confirmation Signal Output (EDM Signal)

The STO confirmation signal output (EDM output) is the output signal for monitoring the input status of STO signal and failure detection status on the internal safety path.

EDM Output (ED+ / ED-) and Wiring Example



Refer to *Signal Matrix* in the next section when you see output for STO confirmation signal to operations of ST1/ST2 or error detection status. Turn EDM ON only when both ST1 and ST2 are input correctly and internal errors are not detected.

Signal Matrix

Signal	Status 1	Status 2	Status 3	Status 4	Status 5
ST1 *1	STO	Operation permitted	STO	Operation permitted	*2
ST2 *1	STO	STO	Operation permitted	Operation permitted	*2
Failure detection	None	None	None	None	Detected
EDM	ON	OFF	OFF	OFF	OFF
Output to the motor	Cut off	Cut off	Cut off	Output permitted	Cut off

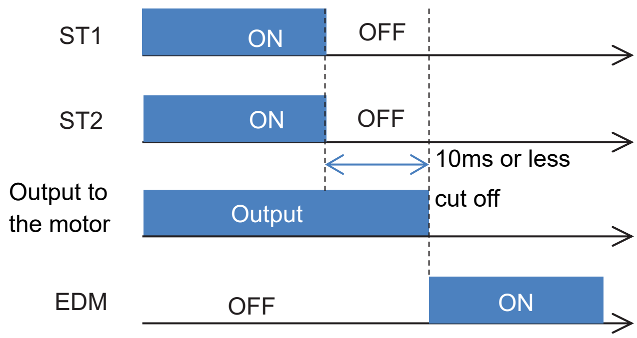
*1. The following table shows the correspondence between the input status of ST1/ST2 described in the table above and status of contact points.

*2. Regardless of signals for ST1/ST2, the status goes into Status 5 when internal errors are detected.

Input status	Contact point
STO	OFF
Operation permitted	ON

B-2-4 Timing Chart

The following shows the timing diagram of output to the motor and output of EDM signals for STO inputs ST1/ST2.



B-2-5 Status Indication Function

STO input status can be displayed on LCD operator when you set parameters shown below table.

You can also check the status by checking the monitor parameter [dA-45].

Parameters Related to STO Function Indication

Item	Parameter	Data	Description
STO input indication selection	[bd-01]	00	If input of both ST1 and ST2 is STO (input contact point is OFF), “STO” is shown on the control panel screen.
		01	Also if input of both ST1 and ST2 is STO (input contact point is OFF), “STO” is not shown on the control panel.
		02	If input of both ST1 and ST2 is STO (input contact point is OFF), [E090] error occurs.*1
STO allowable input switch time	[bd-02]	0.00 to 60.00 (s)	Set the allowable time during which input status of ST1 and ST2 is different (e.g., input contact point: ST1=ON, ST2=OFF). If there is a difference between the switching time of ST1 and that of ST2, set the maximum allowable time the difference can be generated. If it is set to 0.00, the determination of allowable time becomes invalid.
STO indication selection within allowable input time	[bd-03]	00	Displays a warning at the time difference of status occurs between ST1 and ST2 until the STO allowable input switch time configured in [bd-02] has elapsed.
		01	Does not display a warning at the time difference of status occurs between ST1 and ST2 until the STO allowable input switch time configured in [bd-02] has elapsed.
STO operation selection after allowable input time	[bd-04]	00	Displays a warning after the STO allowable input switch time configured in [bd-02] has elapsed.
		01	Does not display a warning after the STO allowable input switch time configured in [bd-02] has elapsed.
		02	After the STO allowable input switch time configured in [bd-02] has elapsed, [E092] or [E093] error occurs.

*1. Even if either ST1 and ST2 is set to STO, [E090] error does not occur.

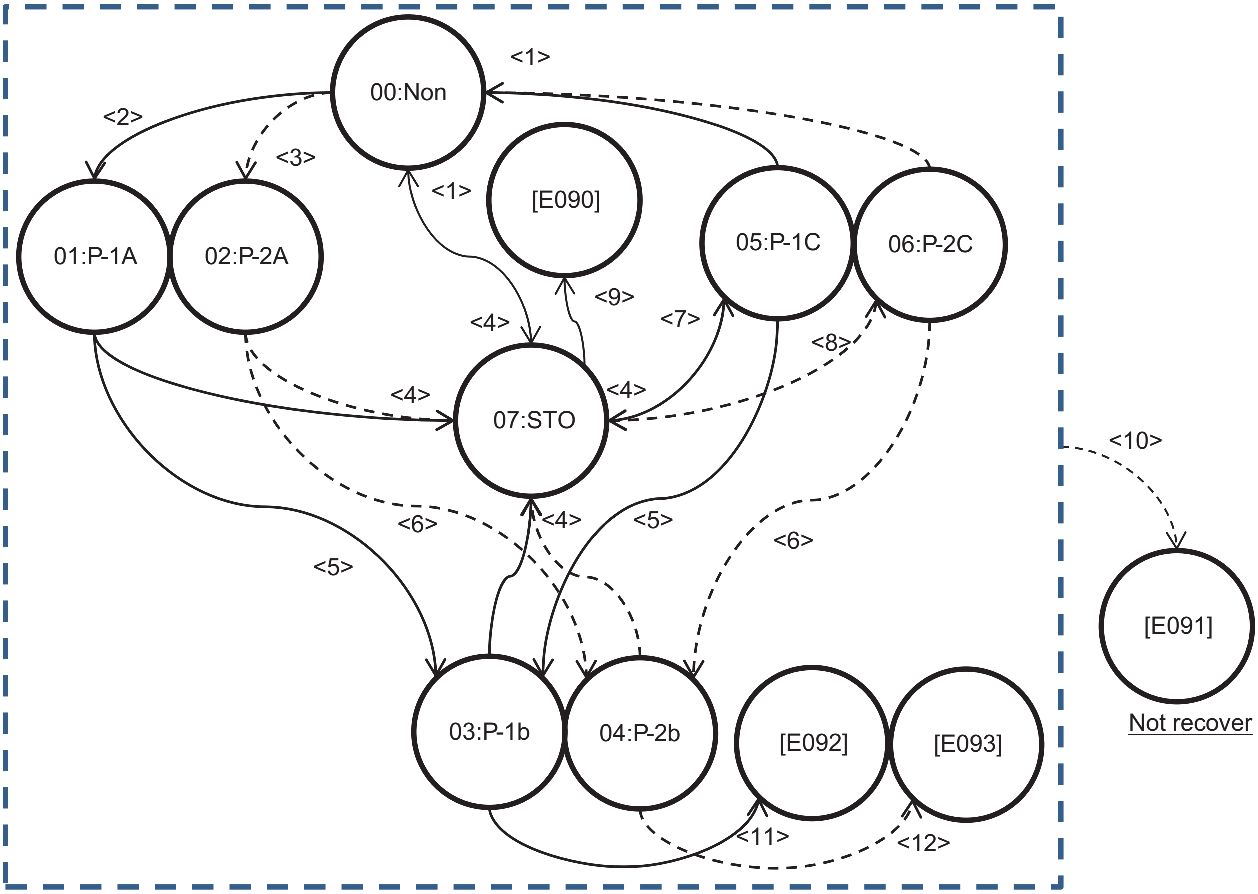
STO Monitor [dA-45] and Status Indication on the Upper Right of the Operator Keypad

STO monitor [dA-45] data display contents	Status indication on the upper right of the operator keypad	Condition	Description
00:Non	(No indication)	<1>	Operation is permitted on both ST1 and ST2 (contact point is ON) and inverter output is available.
01:P-1A	P-1A	<2>	When operation is permitted on both ST1 and ST2 (contact point is ON), only ST2 changes to STO (contact point is OFF). Then, operation is permitted (contact point is ON) on ST1 again for the entire STO switch allowable time [bd-02].
02:P-2A	P-2A	<3>	When operation is permitted on both ST1 and ST2 (contact point is ON), only ST1 changes to STO (contact point is OFF). Then, operation is permitted (contact point is ON) on ST1 again for the entire STO switch allowable time [bd-02].
03:P-1b	P-1b	<5>	(1) The P-1A or P-1b status is kept until the STO switch allowable time [bd-02] has elapsed. (2) When operation is permitted on both ST1 and ST2 (contact point is ON), only ST2 changes to STO (contact point is OFF), and then the operation is permitted (contact point is ON) again.
04:P-2b	P-2b	<6>	(1) The P-12 or P-2b status is kept until the STO switch allowable time [bd-02] has elapsed. (2) When operation is permitted on both ST1 and ST2 (contact point is ON), only ST1 changes to STO (contact point is OFF), and then the operation is permitted (contact point is ON) again.
05:P-1C	P-1C	<7>	From the status that both ST1 and ST2 is STO (contact point is ON), operation is permitted (contact point is ON) only on ST2. Then, ST1 is at STO (contact point is OFF) again for the entire STO switch allowable time [bd-02].
06:P-2C	P-2C	<8>	From the status that both ST1 and ST2 is STO (contact point is ON), operation is permitted (contact point is ON) only on ST2. Then, ST1 is at STO (contact point is OFF) again for the entire STO switch allowable time [bd-02].
07:STO	STO	<4>	Both ST1 and ST2 are at STO (contact point is OFF).

Error Indication

Item	Error	Condition	Description
STO shut-off error	[E090]	<9>	If [bd-01] is set to 02, the error occurs when both ST1 and ST2 are input.
STO internal error	[E091]	<10>	The error occurs when internal failure is found. It cannot be canceled by reset operation.
STP path 1 error	[E092]	<11>	If [bd-04] is set to 02, the error occurs at [P-1b].
STP path 2 error	[E093]	<12>	If [bd-04] is set to 02, the error occurs at [P-2b].

Status Transition



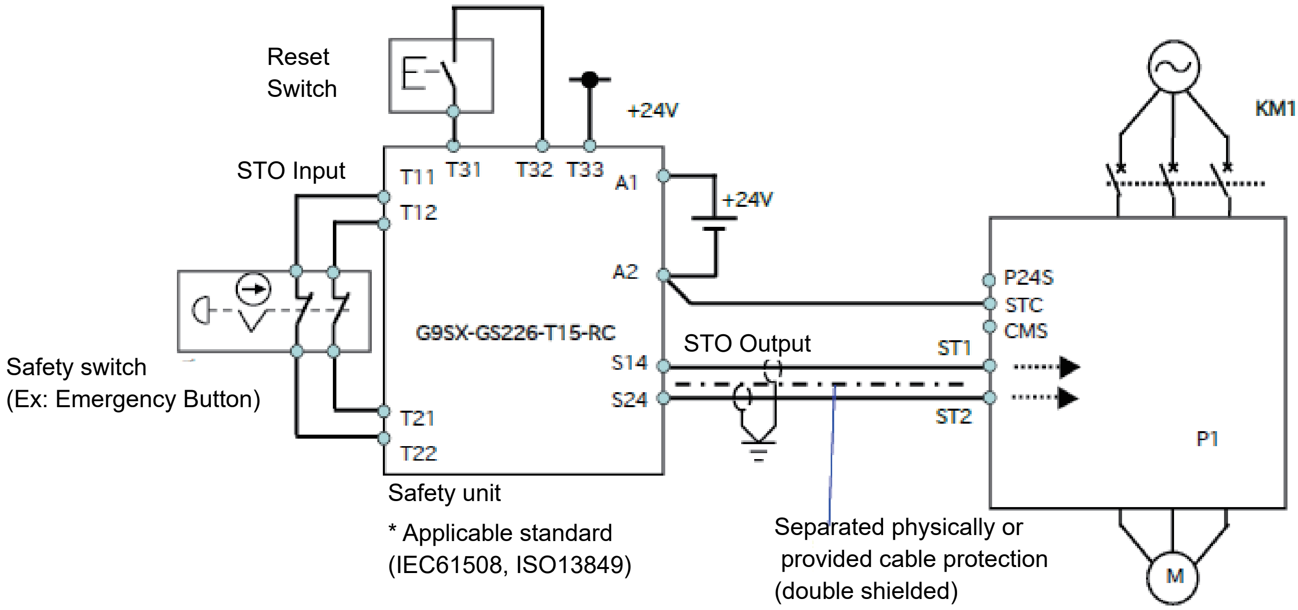
B-3 Example of Use

B-3-1 Example of Wiring

Procedure for connecting STO input to a safety controller is shown as an example.

The condition for use is the followings:

- Use external power supply as one for STO input.
- Never use EDM output.



B-3-2 External Device

Power supply connected to control terminals in 3G3RX2-series is needed to comply with SELV and PELV.

Each ST1/ST2 signal must be separated physically and protected appropriately.

Device for communication of STO signals shall comply with safety standards like ISO13849-1 and IEC61508, etc.

A safety system includes 3G3RX2-series must fulfill CAT.3, PL e /SIL3. Therefore, the 3G3RX2-series must be combined with external safety devices that meet PL e/SIL3.

Test pulse input to ST1/ST2 shall be 300 us or less.

Combination of 3G3RX2-series with external safety devices is shown as below.

Manufacturer	Product Model	Applicable standard/criteria
OMRON	G9SA-301	ISO13849-1 cat4, SIL3
OMRON	G9SX-GS226-T15-RC	IEC61508 SIL1 to 3
OMRON	NE1A-SCPU01-V1	IEC61508 SIL3
OMRON	G9SP-N□□□	IEC61508 SIL3

C

Appendices C
Table of Parameters

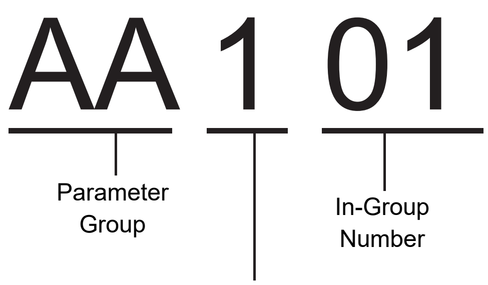
This chapter describes lists of monitors and parameters as well as setting range of each parameter and their initial values.

C

C-1 Parameter Notation

Structure of Parameter Number

- A parameter consists of a parameter group, switch recognition number assigned by the 024[SET] terminal function, and an in-group number.
- If the switch recognition number assigned by 024[SET] terminal function is "-", it is enabled in both first setting and second setting.
- If the 024[SET] function is not set to the input terminal functions [CA-01] to [CA-11], the first setting is valid.



-: Always enabled in both the first setting and second setting
1: Enabled in the first setting when the [SET] terminal function is OFF
2: Enabled in the second setting when the [SET] terminal function is ON

About Monitor Mode

Code	Name	Data range
XX-01	Monitor name	Data Range

About Parameter Mode

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
YY101	-	Parameter name	Data range	Default data Ub-02:01	(Write down the setting value)
YY-02	○*1	Parameter name	(200 V class) data range (400 V class) data range	(200 V class) VV (400 V class) WW	(Write down the setting value)

*1. Shows that the codes can be changed during operation.

- The voltage class is shown by 200 V/400 V.
- In some cases, a default value depends on Default Value Selection (Ub-02). As for the value, default values to Ub-02 mode are shown.

- Parameters other than those changeable during operation can be changed only when the device is stopped. The user can change the parameter that cannot be changed during operation after the device decelerates and stops and output is stopped. However, it cannot be changed if the soft-lock function is activated.

Notes on Setting Parameters

Precautions for Correct Use

- When setting parameters, we expect you to fully understand various points to be noted.
- Make sure to check and set the following parameters to protect the motor.
  - [Hb102] to [Hb108] (for IM)
  - [Hd102] to [Hd108] (for SM/PMM)
  - [bC110] (electronic thermal level) → for motor overload protection current
  - [bb160] (overcurrent level)

When setting the thermal subtraction characteristics, set a value in accordance with the characteristics of motor. Otherwise, the motor may be burned.

After configuring settings for motor protection, choose the frequency command destination and operation command destination to run the device.

- With [AA101], choose a frequency command destination.
- With [AA111], choose an operation command destination.
- With [FA-01], check that the frequency command is received.

To run the inverter, a frequency command and operation command are required. If commands are sent using V/f control, there is no output if the frequency command is 0 Hz.

C-2 Monitor List

Monitors Related to Output

Code	Name	Data range
dA-01	Output frequency monitor	0.00 to 590.00 (Hz)
dA-02	Output current monitor	0.0 to 655.35 (A)
dA-03	Operation direction monitor	F (Normal rotation in process)/ r (Reverse rotation in process)/ d (0Hz output)/ o (Stopped)
dA-04	Frequency command after calculation	-590.00 to 590.00 (Hz)
dA-06	Output frequency conversion monitor	0.00 to 59000.00 (Hz)
dA-08	Speed detection value monitor	-590.00 to 590.00 (Hz)
dA-12	Output frequency monitor (with sign)	-590.00 to 590.00 (Hz)
dA-14	Frequency upper limit monitor	0.00 to 590.00 (Hz)
dA-15	Torque command monitor after calculation	-1000.0 to 1000.0 (%)
dA-16	Torque limit monitor	0.0 to 500.0 (%)
dA-17	Output torque monitor	-1000.0 to 1000.0 (%)
dA-18	Output voltage monitor	0.0 to 800.0 (V)
dA-20	Current position monitor	In the case of AA121=10 and AA123=03, data range -2147483648 to 2147483647 (pls) In the case of the condition mentioned above, data range -536870912 to 536870911 (pls)
dA-26	Pulse train position deviation monitor	-2147483647 to +2147483647 (pls)
dA-28	Pulse counter monitor	0 to 2147483647 (pls)
dA-30	Input power monitor	0.00 to 600.00 (kW)
dA-32	Integrated input power monitor	0.0 to 1000000.0 (kW)
dA-34	Output power monitor	0.00 to 600.00 (kW)
dA-36	Integrated output power monitor	0.0 to 1000000.0 (kW)
dA-38	Motor temperature monitor	-20.0 to 200.0 (°C)
dA-40	DC voltage monitor	0.0 to 1000.0 (V)
dA-41	BRD load factor monitor	0.00 to 100.00 (%)
dA-42	Electronic thermal duty ratio monitor (motor)	0.00 to 100.00 (%)
dA-43	Electronic thermal duty ratio monitor (controller (inverter))	0.00 to 100.00 (%)

Monitors Related to Control Circuit

Code	Name	Data range
dA-45	Integrated output power monitor	00 (no input)/ 01 (P-1A)/ 02 (P-2A)/ 03 (P-1b)/04 (P-2b)/ 05 (P-1C)/06 (P-2C)/ 07 (STO)
dA-50	Terminal block option mounted state	00 (STD-TM1 (fixed value))
dA-51	Input terminal monitor	LLLLLLLLLLL to HHHHHHHHHHH [L:OFF/H:ON] [Left side] (terminal B) (terminal A) (terminal 9) to (termianl1) [Right side]
dA-54	Output terminal monitor	LLLLLLL to HHHHHHH [L:OFF/H:ON] [Left side] (terminal AL) (terminal 16C) (terminal 15) to (terminal 11) [Right side]
dA-60	Analog I/O selection monitor	AAAAAAAA to VVVVVVVV [A: current/V: voltage][Left side] (Reserved) (Reserved) (Reserved) (terminal Ai3 (Ii3/Vi3)) (terminal Ao2) (terminal Ao1) (terminal Ai2) (terminal Ai1) [Right side]
dA-61	Analog input [Ai1] monitor	0.00 to 100.00 (%)
dA-62	Analog input [Ai2] monitor	0.00 to 100.00 (%)
dA-63	Analog input [Ai3] monitor	-100.00 to 100.00 (%)
dA-70	Pulse string input monitor (main body)	-100.00 to 100.00 (%)
dA-71	Pulse string input monitor (Option)	-100.00 to 100.00 (%)
dA-46,47	Reserved	-
dA-64 to dA-66	Reserved	-

Option Slot Monitor

Code	Name	Data range
dA-81	Option slot 1 mounted state	00: (none)/ <hereafter only da-82 is indicated>33: (RX2-PG)
dA-82	Option slot 2 mounted state	
dA-83	Option slot 3 mounted state	

Monitors Related to the Program Function EzSQ

Code	Name	Data range
db-01	Program download monitor	00 (Without a program)/01 (With a program)
db-02	Program number monitor	0000 to 9999
db-03	Program counter (Task-1)	1 to 1024
db-04	Program counter (Task-2)	1 to 1024
db-05	Program counter (Task-3)	1 to 1024
db-06	Program counter (Task-4)	1 to 1024
db-07	Program counter (Task-5)	1 to 1024
db-08	User monitor 0	-2147483647 to 2147483647
db-10	User monitor 1	-2147483647 to 2147483647
db-12	User monitor 2	-2147483647 to 2147483647
db-14	User monitor 3	-2147483647 to 2147483647
db-16	User monitor 4	-2147483647 to 2147483647
db-18	Analog output monitor YA0	0 to 10000
db-19	Analog output monitor YA1	0 to 10000
db-20	Analog output monitor YA2	0 to 10000
db-21 to db-23	Reserved	-

Monitors Related to PID Function

Code	Name	Data range
db-30	PID1 feedback data 1 monitor	0.00 to 100.00 (%) (adjustable in [AH-04][AH-05][AH-06])
db-32	PID1 feedback data 2 monitor	
db-34	PID1 feedback data 3 monitor	
db-36	PID2 feedback data monitor	0.00 to 100.00 (%) (adjustable in [AJ-04][AJ-05][AJ-06])
db-38	PID3 feedback data monitor	0.00 to 100.00 (%) (adjustable in [AJ-24][AJ-25][AJ-26])
db-40	PID4 feedback data monitor	0.00 to 100.00 (%) (adjustable in [AJ-44][AJ-45][AJ-46])
db-42	PID1 target value monitor after calculation	0.00 to 100.00 (%)(adjustable in [AH-04][AH-05][AH-06])
db-44	PID1 feedback data	
db-50	PID1 output monitor	-100.00 to 100.00 (%)
db-51	PID1 deviation monitor	-200.00 to 200.00 (%)
db-52	PID1 deviation 1 monitor	-200.00 to 200.00 (%)
db-53	PID1 deviation 2 monitor	-200.00 to 200.00 (%)
db-54	PID1 deviation 3 monitor	-200.00 to 200.00 (%)
db-55	PID2 output monitor	-100.00 to 100.00 (%)
db-56	PID2 deviation monitor	-200.00 to 200.00 (%)
db-57	PID3 output monitor	-100.00 to 100.00 (%)
db-58	PID3 deviation monitor	-200.00 to 200.00 (%)
db-59	PID4 output monitor	-100.00 to 100.00 (%)
db-60	PID4 deviation monitor	-200.00 to 200.00 (%)
db-61	PID current P gain monitor	0 to 100.00 (%)
db-62	PID current I gain monitor	0.0 to 3600.0 (s)
db-63	PID current D gain monitor	0.00 to 100.00 (s)
db-64	PID feed-forward monitor	-100.00 to 100.00 (%)

Monitors for Checking Internal Condition

Code	Name	Data range
dC-01	Inverter load type selection monitor	00 (very low duty)/01 (low duty/02 (normal duty)
dC-02	Rated current monitor	0.0 to 6553.5 (A)
dC-07	Speed command destination monitor (main)	00 (disabled)/01 (Ai1)/02 (Ai2)/03 (Ai3)/04 (Reserved)/ 05 (Reserved)/06 (Reserved)/07 (Multistage speed 0)/ 08 (auxiliary speed)/09 (Multistage speed 1)/ 10 (Multistage speed 2)/11 (Multistage speed 3)/ 12 (Multistage speed 4)/13 (Multistage speed 5)/ 14 (Multistage speed 6)/15 (Multistage speed 7)/ 16 (Multistage speed 8)/17 (Multistage speed 9)/ 18 (Multistage speed 10)/19 (Multistage speed 11)/ 20 (Multistage speed 12)/21 (Multistage speed 13)/ 22 (Multistage speed 14)/23 (Multistage speed 15)/ 24 (JG)/25 (RS485)/26 (Option 1)/27 (Option 2)/ 28 (Option 3)/29 (Pulse array (main unit))/ 30 (Pulse array (Option))/31 (DriveProgramming)/ 32 (PID)/33 (Reserved)/34 (AHD retention speed)
dC-08	Speed command destination monitor (auxiliary)	
dC-10	Operation command destination monitor	00 ([FW]/[RV] terminal)/01 (3 wire)/ 02 (RUN key on operator keypad)/03 (RS485 setting)/ 04 (Option 1)/05 (Option 2)/06 (Option 3)
dC-15	Cooling fin temperature monitor	-20.0 to 200.0 (°C)
dC-16	Life diagnostic monitor	LL to HH [L: normal/H: reduction of life] [Left side] (FAN life) (lives of the capacitors on the circuit board) [Right side]
dC-20	Total start-up count	1 to 65535 (Counts)
dC-21	Power-on count	1 to 65535 (Counts)
dC-22	Cumulative operating hours monitor during RUN	1 to 1000000 (hr)
dC-24	Cumulative power-on time	1 to 1000000 (hr)
dC-26	Cumulative operating time of cooling fan	1 to 1000000 (hr)
dC-37	Detailed monitor for icon 2LIM	00 (Condition other than below)/ 01 (Overcurrent suppression in process)/ 02 (Overload being limited)/ 03 (Overvoltage suppression in process)/ 04 (Torque being limited)/ 05 (Upper/lower limit and jump frequency setting being limited)/ 06 (Setting of minimum frequency being limited)
dC-38	Detailed monitor for icon 2ALT	00 (Condition other than below)/ 01 (Overload advance notice)/ 02 (Motor thermal advance notice)/ 03 (Controller thermal advance notice)/ 04 (Motor overheat advance notice)
dC-39	Detailed monitor for icon 2RETRY	00 (Condition other than below)/ 01 (Retry standby)/02 (Restart standby)
dC-40	Detailed monitor for icon 2NRDY	00 (Preparation completed condition other than below IRDY=OFF)/ 01 (Trip occurred)/02 (Power supply abnormality)/ 03 (Resetting)/04 (STO)/05 (Standby)/ 06 (Data inconsistency Others (including no FB, consistency of settings of A and B phases, etc.))/ 07 (Sequence abnormality)/08 (Free run)/ 09 (Forced stop)

Code	Name	Data range
dC-45	IM/SM (PMM) monitor	00 (Induction motor IM being selected)/ 01 (Synchronous motor SM (permanent magnet motor PMM) being selected)
dC-50	Firmware version monitor	0.000 to 99.255
dC-53	Firmware grade monitor	00 (Standard)

Monitor of Trip State

Code	Name	Data range
dE-01	Trip count monitor	0 to 65535
dE-11	Trip monitor 1 Factor	1 to 255
	Trip monitor 1 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 1 Output frequency(with sign)(LOW)	
	Trip monitor 1 Output current	0 to 65535
	Trip monitor 1 P-N DC voltage	0 to 10000
	Trip monitor 1 Inverter state	0 to 8*1
	Trip monitor 1 LAD state	0 to 5*1
	Trip monitor 1 INV control mode	0 to 11*1
	Trip monitor 1 Limit state	0 to 6*1
	Trip monitor 1 Special state	0 to 6*1
	Trip monitor 1 RUN time(HIGH)	0 to 1000000
	Trip monitor 1 RUN time(LOW)	
	Trip monitor 1 Power ON time(HIGH)	0 to 1000000
	Trip monitor 1 Power ON time(LOW)	
	Trip monitor 1 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 1 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 1 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-12	Trip monitor 2 Factor	1 to 255
	Trip monitor 2 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 2 Output frequency(with sign)(LOW)	
	Trip monitor 2 Output current	0 to 65535
	Trip monitor 2 P-N DC voltage	0 to 10000
	Trip monitor 2 Inverter state	0 to 8*1
	Trip monitor 2 LAD state	0 to 5*1
	Trip monitor 2 INV control mode	0 to 11*1
	Trip monitor 2 Limit state	0 to 6*1
	Trip monitor 2 Special state	0 to 6*1
	Trip monitor 2 RUN time(HIGH)	0 to 1000000
	Trip monitor 2 RUN time(LOW)	
	Trip monitor 2 Power ON time(HIGH)	0 to 2000000
	Trip monitor 2 Power ON time(LOW)	
	Trip monitor 2 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 2 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 2 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

Code	Name	Data range
dE-13	Trip monitor 3 Factor	1 to 255
	Trip monitor 3 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 3 Output frequency(with sign)(LOW)	
	Trip monitor 3 Output current	0 to 65535
	Trip monitor 3 P-N DC voltage	0 to 10000
	Trip monitor 3 Inverter state	0 to 8*1
	Trip monitor 3 LAD state	0 to 5*1
	Trip monitor 3 INV control mode	0 to 11*1
	Trip monitor 3 Limit state	0 to 6*1
	Trip monitor 3 Special state	0 to 6*1
	Trip monitor 3 RUN time(HIGH)	0 to 1000000
	Trip monitor 3 RUN time(LOW)	
	Trip monitor 3 Power ON time(HIGH)	0 to 1000000
	Trip monitor 3 Power ON time(LOW)	
	Trip monitor 3 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 3 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 3 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-14	Trip monitor 4 Factor	1 to 255
	Trip monitor 4 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 4 Output frequency(with sign)(LOW)	
	Trip monitor 4 Output current	0 to 65545
	Trip monitor 4 P-N DC voltage	0 to 10000
	Trip monitor 4 Inverter state	0 to 8*1
	Trip monitor 4 LAD state	0 to 5*1
	Trip monitor 4 INV control mode	0 to 11*1
	Trip monitor 4 Limit state	0 to 6*1
	Trip monitor 4 Special state	0 to 6*1
	Trip monitor 4 RUN time(HIGH)	0 to 1000000
	Trip monitor 4 RUN time(LOW)	
	Trip monitor 4 Power ON time(HIGH)	0 to 1000000
	Trip monitor 4 Power ON time(LOW)	
	Trip monitor 4 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 4 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 4 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

Code	Name	Data range
dE-15	Trip monitor 5 Factor	1 to 255
	Trip monitor 5 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 5 Output frequency(with sign)(LOW)	
	Trip monitor 5 Output current	0 to 65535
	Trip monitor 5 P-N DC voltage	0 to 10000
	Trip monitor 5 Inverter state	0 to 8*1
	Trip monitor 5 LAD state	0 to 5*1
	Trip monitor 5 INV control mode	0 to 11*1
	Trip monitor 5 Limit state	0 to 6*1
	Trip monitor 5 Special state	0 to 6*1
	Trip monitor 5 RUN time(HIGH)	0 to 1000000
	Trip monitor 5 RUN time(LOW)	
	Trip monitor 5 Power ON time(HIGH)	0 to 1000000
	Trip monitor 5 Power ON time(LOW)	
	Trip monitor 5 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 5 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 5 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-16	Trip monitor 6 Factor	1 to 255
	Trip monitor 6 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 6 Output frequency(with sign)(LOW)	
	Trip monitor 6 Output current	0 to 65535
	Trip monitor 6 P-N DC voltage	0 to 10000
	Trip monitor 6 Inverter state	0 to 8*1
	Trip monitor 6 LAD state	0 to 5*1
	Trip monitor 6 INV control mode	0 to 11*1
	Trip monitor 6 Limit state	0 to 6*1
	Trip monitor 6 Special state	0 to 6*1
	Trip monitor 6 RUN time(HIGH)	0 to 1000000
	Trip monitor 6 RUN time(LOW)	
	Trip monitor 6 Power ON time(HIGH)	0 to 1000000
	Trip monitor 6 Power ON time(LOW)	
	Trip monitor 6 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 6 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 6 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

Code	Name	Data range
dE-17	Trip monitor 7 Factor	1 to 255
	Trip monitor 7 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 7 Output frequency(with sign)(LOW)	
	Trip monitor 7 Output current	0 to 65535
	Trip monitor 7 P-N DC voltage	0 to 10000
	Trip monitor 7 Inverter state	0 to 8*1
	Trip monitor 7 LAD state	0 to 5*1
	Trip monitor 7 INV control mode	0 to 11*1
	Trip monitor 7 Limit state	0 to 6*1
	Trip monitor 7 Special state	0 to 6*1
	Trip monitor 7 RUN time(HIGH)	0 to 1000000
	Trip monitor 7 RUN time(LOW)	
	Trip monitor 7 Power ON time(HIGH)	0 to 1000000
	Trip monitor 7 Power ON time(LOW)	
	Trip monitor 7 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 7 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 7 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-18	Trip monitor 8 Factor	1 to 255
	Trip monitor 8 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 8 Output frequency(with sign)(LOW)	
	Trip monitor 8 Output current	0 to 65535
	Trip monitor 8 P-N DC voltage	0 to 10000
	Trip monitor 8 Inverter state	0 to 8*1
	Trip monitor 8 LAD state	0 to 5*1
	Trip monitor 8 INV control mode	0 to 11*1
	Trip monitor 8 Limit state	0 to 6*1
	Trip monitor 8 Special state	0 to 6*1
	Trip monitor 8 RUN time(HIGH)	0 to 1000000
	Trip monitor 8 RUN time(LOW)	
	Trip monitor 8 Power ON time(HIGH)	0 to 1000000
	Trip monitor 8 Power ON time(LOW)	
	Trip monitor 8 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 8 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 8 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

Code	Name	Data range
dE-19	Trip monitor 9 Factor	1 to 255
	Trip monitor 9 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 9 Output frequency(with sign)(LOW)	
	Trip monitor 9 Output current	0 to 65535
	Trip monitor 9 P-N DC voltage	0 to 10000
	Trip monitor 9 Inverter state	0 to 8*1
	Trip monitor 9 LAD state	0 to 5*1
	Trip monitor 9 INV control mode	0 to 11*1
	Trip monitor 9 Limit state	0 to 6*1
	Trip monitor 9 Special state	0 to 6*1
	Trip monitor 9 RUN time(HIGH)	0 to 1000000
	Trip monitor 9 RUN time(LOW)	
	Trip monitor 9 Power ON time(HIGH)	0 to 1000000
	Trip monitor 9 Power ON time(LOW)	
	Trip monitor 9 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 9 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 9 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-20	Trip monitor 10 Factor	1 to 255
	Trip monitor 10 Output frequency(with sign)(HIGT)	-59000 to 59000
	Trip monitor 10 Output frequency(with sign)(LOW)	
	Trip monitor 10 Output current	0 to 65535
	Trip monitor 10 P-N DC voltage	0 to 10000
	Trip monitor 10 Inverter state	0 to 8*1
	Trip monitor 10 LAD state	0 to 5*1
	Trip monitor 10 INV control mode	0 to 11*1
	Trip monitor 10 Limit state	0 to 6*1
	Trip monitor 10 Special state	0 to 6*1
	Trip monitor 10 RUN time(HIGH)	0 to 1000000
	Trip monitor 10 RUN time(LOW)	
	Trip monitor 10 Power ON time(HIGH)	0 to 1000000
	Trip monitor 10 Power ON time(LOW)	
	Trip monitor 10 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Trip monitor 10 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Trip monitor 10 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

*1. Details of Trip Retry

Monitor of Retry State

Code	Name	Data range
dE-31	Retry monitor 1 Factor	1 to 255
	Retry monitor 1 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 1 Output frequency(with sign)(LOW)	
	Retry monitor 1 Output current	0 to 65535
	Retry monitor 1 P-N DC voltage	0 to 10000
	Retry monitor 1 Inverter state	0 to 8[*1]
	Retry monitor 1 LAD state	0 to 5[*1]
	Retry monitor 1 INV control mode	0 to 11[*1]
	Retry monitor 1 Limit state	0 to 6[*1]
	Retry monitor 1 Special state	0 to 6[*1]
	Retry monitor 1 RUN time(HIGT)	0 to 1000000
	Retry monitor 1 RUN time(LOW)	
	Retry monitor 1 Power ON time(HIGT)	0 to 1000000
	Retry monitor 1 Power ON time(LOW)	
	Retry monitor 1 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 1 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 1 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-32	Retry monitor 2 Factor	1 to 255
	Retry monitor 2 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 2 Output frequency(with sign)(LOW)	
	Retry monitor 2 Output current	0 to 65535
	Retry monitor 2 P-N DC voltage	0 to 10000
	Retry monitor 2 Inverter state	0 to 8[*1]
	Retry monitor 2 LAD state	0 to 5[*1]
	Retry monitor 2 INV control mode	0 to 11[*1]
	Retry monitor 2 Limit state	0 to 6[*1]
	Retry monitor 2 Special state	0 to 6[*1]
	Retry monitor 2 RUN time(HIGT)	0 to 2000000
	Retry monitor 2 RUN time(LOW)	
	Retry monitor 2 Power ON time(HIGT)	0 to 2000000
	Retry monitor 2 Power ON time(LOW)	
	Retry monitor 2 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 2 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 2 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

Code	Name	Data range
dE-33	Retry monitor 3 Factor	1 to 255
	Retry monitor 3 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 3 Output frequency(with sign)(LOW)	
	Retry monitor 3 Output current	0 to 65535
	Retry monitor 3 P-N DC voltage	0 to 10000
	Retry monitor 3 Inverter state	0 to 8*1
	Retry monitor 3 LAD state	0 to 5*1
	Retry monitor 3 INV control mode	0 to 11*1
	Retry monitor 3 Limit state	0 to 6*1
	Retry monitor 3 Special state	0 to 6*1
	Retry monitor 3 RUN time(HIGT)	0 to 1000000
	Retry monitor 3 RUN time(LOW)	
	Retry monitor 3 Power ON time(HIGT)	0 to 1000000
	Retry monitor 3 Power ON time(LOW)	
	Retry monitor 3 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 3 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 3 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-34	Retry monitor 4 Factor	1 to 255
	Retry monitor 4 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 4 Output frequency(with sign)(LOW)	
	Retry monitor 4 Output current	0 to 65535
	Retry monitor 4 P-N DC voltage	0 to 10000
	Retry monitor 4 Inverter state	0 to 8*1
	Retry monitor 4 LAD state	0 to 5*1
	Retry monitor 4 INV control mode	0 to 11*1
	Retry monitor 4 Limit state	0 to 6*1
	Retry monitor 4 Special state	0 to 6*1
	Retry monitor 4 RUN time(HIGT)	0 to 1000000
	Retry monitor 4 RUN time(LOW)	
	Retry monitor 4 Power ON time(HIGT)	0 to 1000000
	Retry monitor 4 Power ON time(LOW)	
	Retry monitor 4 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 4 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 4 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

Code	Name	Data range
dE-35	Retry monitor 5 Factor	1 to 255
	Retry monitor 5 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 5 Output frequency(with sign)(LOW)	
	Retry monitor 5 Output current	0 to 65535
	Retry monitor 5 P-N DC voltage	0 to 10000
	Retry monitor 5 Inverter state	0 to 8*1
	Retry monitor 5 LAD state	0 to 5*1
	Retry monitor 5 INV control mode	0 to 11*1
	Retry monitor 5 Limit state	0 to 6*1
	Retry monitor 5 Special state	0 to 6*1
	Retry monitor 5 RUN time(HIGT)	0 to 1000000
	Retry monitor 5 RUN time(LOW)	
	Retry monitor 5 Power ON time(HIGT)	0 to 1000000
	Retry monitor 5 Power ON time(LOW)	
	Retry monitor 5 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 5 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 5 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-36	Retry monitor 6 Factor	1 to 255
	Retry monitor 6 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 6 Output frequency(with sign)(LOW)	
	Retry monitor 6 Output current	0 to 65535
	Retry monitor 6 P-N DC voltage	0 to 10000
	Retry monitor 6 Inverter state	0 to 8*1
	Retry monitor 6 LAD state	0 to 5*1
	Retry monitor 6 INV control mode	0 to 11*1
	Retry monitor 6 Limit state	0 to 6*1
	Retry monitor 6 Special state	0 to 6*1
	Retry monitor 6 RUN time(HIGT)	0 to 1000000
	Retry monitor 6 RUN time(LOW)	
	Retry monitor 6 Power ON time(HIGT)	0 to 1000000
	Retry monitor 6 Power ON time(LOW)	
	Retry monitor 6 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 6 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 6 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

Code	Name	Data range
dE-37	Retry monitor 7 Factor	1 to 255
	Retry monitor 7 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 7 Output frequency(with sign)(LOW)	
	Retry monitor 7 Output current	0 to 65535
	Retry monitor 7 P-N DC voltage	0 to 10000
	Retry monitor 7 Inverter state	0 to 8*1
	Retry monitor 7 LAD state	0 to 5*1
	Retry monitor 7 INV control mode	0 to 11*1
	Retry monitor 7 Limit state	0 to 6*1
	Retry monitor 7 Special state	0 to 6*1
	Retry monitor 7 RUN time(HIGT)	0 to 1000000
	Retry monitor 7 RUN time(LOW)	
	Retry monitor 7 Power ON time(HIGT)	0 to 1000000
	Retry monitor 7 Power ON time(LOW)	
	Retry monitor 7 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 7 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 7 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-38	Retry monitor 8 Factor	1 to 255
	Retry monitor 8 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 8 Output frequency(with sign)(LOW)	
	Retry monitor 8 Output current	0 to 65535
	Retry monitor 8 P-N DC voltage	0 to 10000
	Retry monitor 8 Inverter state	0 to 8*1
	Retry monitor 8 LAD state	0 to 5*1
	Retry monitor 8 INV control mode	0 to 11*1
	Retry monitor 8 Limit state	0 to 6*1
	Retry monitor 8 Special state	0 to 6*1
	Retry monitor 8 RUN time(HIGT)	0 to 1000000
	Retry monitor 8 RUN time(LOW)	
	Retry monitor 8 Power ON time(HIGT)	0 to 1000000
	Retry monitor 8 Power ON time(LOW)	
	Retry monitor 8 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 8 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 8 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

Code	Name	Data range
dE-39	Retry monitor 9 Factor	1 to 255
	Retry monitor 9 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 9 Output frequency(with sign)(LOW)	
	Retry monitor 9 Output current	0 to 65535
	Retry monitor 9 P-N DC voltage	0 to 10000
	Retry monitor 9 Inverter state	0 to 8*1
	Retry monitor 9 LAD state	0 to 5*1
	Retry monitor 9 INV control mode	0 to 11*1
	Retry monitor 9 Limit state	0 to 6*1
	Retry monitor 9 Special state	0 to 6*1
	Retry monitor 9 RUN time(HIGT)	0 to 1000000
	Retry monitor 9 RUN time(LOW)	
	Retry monitor 9 Power ON time(HIGT)	0 to 1000000
	Retry monitor 9 Power ON time(LOW)	
	Retry monitor 9 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 9 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 9 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)
dE-40	Retry monitor 10 Factor	1 to 255
	Retry monitor 10 Output frequency(with sign)(HIGT)	-59000 to 59000
	Retry monitor 10 Output frequency(with sign)(LOW)	
	Retry monitor 10 Output current	0 to 65535
	Retry monitor 10 P-N DC voltage	0 to 10000
	Retry monitor 10 Inverter state	0 to 8*1
	Retry monitor 10 LAD state	0 to 5*1
	Retry monitor 10 INV control mode	0 to 11*1
	Retry monitor 10 Limit state	0 to 6*1
	Retry monitor 10 Special state	0 to 6*1
	Retry monitor 10 RUN time(HIGT)	0 to 1000000
	Retry monitor 10 RUN time(LOW)	
	Retry monitor 10 Power ON time(HIGT)	0 to 1000000
	Retry monitor 10 Power ON time(LOW)	
	Retry monitor 10 Absolute time (year, month)	00 to 99 (BCD code)
		01 to 12 (BCD code)
	Retry monitor 10 Absolute time (day, day of the week)	01 to 31 (BCD code)
		00 to 06 (BCD code)
	Retry monitor 10 Absolute time (hour, minute)	00 to 23 (BCD code)
		00 to 59 (BCD code)

*1. Details of Trip Retry

Details of Trip Retry

Function name	code	mode	LCD operator
Inverter state	0	During power supply turned ON, reset, customer-initializing	INIT.
	1	Ground fault detecting	GND fault
	2	During stop	Stop
	3	Operation standby (contactor applied)	Run PREP.1
	4	Operation ready (magnetic position detecting)	Run PREP.2
	5	During RUN (including DB, Servo ON, forcing)	Run
	6	Stop Standby (contactor open)	Stop PREP.
	7	Retry waiting	Retry PREP.
	8	During retry	Retry
LAD state	0	Zero (output shut off, DB, Servo On, forcing)	-
	1	At startup, forward/reverse switching,voltage reducing start	MIN.
	2	During acceleration	ACCEL.
	3	During deceleration	DECEL.
	4	During constant speed	CONST.
	5	During restart	Restart
INV control mode	0	Power shut off	-
	1	During speed control	SPD CNTL
	2	During startup	Starting
	3	During DB	DB
	4	During forcing	Forcing
	5	During Servo ON	Servo ON
	6	During position control	POS CNTL
	7	During torque control	TRQ CNTL
	8	During restart	Restarting
	9	During detection of magnetic pole position	Axis POS
	10	During ground fault detection	GND fault
	11	During measurement of auto-tuning R1R2L	Tuning
Limit state	0	Not limited status	-
	1	During overcurrent suppression (priority order of display is high)	OC SUPPR
	2	During overload suppression	OL SUPPR
	3	During overvoltage suppression	OV SUPPR
	4	During torque limit (priority order of display is low)	TRQ Limit
	5	During setting limitation of upper and lower limit and jump frequency	Freq Limit
	6	During setting limitation of minimum frequency	Min.Freq

Function name	code	mode	LCD operator
Special state	0	Not particular status	-
	1	During auto-tuning	Tuning
	2	During simulation mode	Simulation
	3	(Reserved)	-
	4	During forced emergency operation	Force Run
	5	During bypass mode	Bypass
	6	(Reserved)	-

Monitors and Parameters for Changing the Current Commands *1

Code	Codes that can be changed during operation	Name	Data range	Note
FA-01	○	Main Speed reference monitor	0.00 to 590.00 (Hz)	
FA-02	○	Sub Speed reference monitor	-590.00 to 590.00 (Hz) (for monitoring) 0.00 to 590.00 (Hz) (for setting)	
FA-10	○	Acceleration time monitor	0.00 to 3600.00 (s)	
FA-12	○	Deceleration time monitor	0.00 to 3600.00 (s)	
FA-15	○	Torque reference monitor	-500.0 to 500.0 (%)	
FA-16	○	Torque bias monitor	-500.0 to 500.0 (%)	
FA-20	○	Position reference monitor	When [AA121]≠10 or [AA123]≠03 -268435455 to +268435455 (pls)/ When [AA121]=10 and [AA123]=03 -1073741823 to +1073741823 (pls)	
FA-30	○	PID1 Set Value 1 monitor	0.00 to 100.00 (%) (adjustable in [AH-04][AH-05][AH-06])	
FA-32	○	PID1 Set Value 2 monitor		
FA-34	○	PID1 Set Value 3 monitor		
FA-36	○	PID2 Set Value monitor	0.00 to 100.00 (%) (adjustable in [AJ-04][AJ-05][AJ-06])	
FA-38	○	PID3 Set Value monitor	0.00 to 100.00 (%) (adjustable in [AJ-24][AJ-25][AJ-26])	
FA-40	○	PID4 Set Value monitor	0.00 to 100.00 (%) (adjustable in [AJ-44][AJ-45][AJ-46])	

*1. FA parameter indicates the current command value, and automatically displays data of the command destination that is being adopted.

Example 1: If the command destination is the operator keypad, it can be changed using the arrow keys.

Example 2: If the command destination is the analog input Ai1, it can be changed by changing input to the terminal [Ai1].

C-3 Parameter List

Parameter Mode (Code A)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AA101	-	Main speed input source selection, 1st-motor	01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)/14 (Program function)/ 15 (PID calculation)/16 (Reserved)	01*1	
AA102	-	Sub frequency input source selection, 1st-motor	00 (Disabled)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)/14 (Program function)/ 15 (PID calculation)/16 (Reserved)	00	
AA104	○	Sub speed setting, 1st-motor	0.00 to 590.00 (Hz)	0.00	
AA105	-	Calculation symbol selection for Speed reference, 1st-motor	00 (Disabled)/01 (Addition)/02 (Subtraction)/ 03 (Multiplication)	00	
AA106	○	Add frequency setting, 1st-motor	-590.00 to 590.00 (Hz)	0.00	
AA111	-	Run-command input source selection, 1st-motor	00 ([FW]/[RV] terminal)/01 (3 wire)/ 02 (RUN key on LCD operator)/03 (RS485)/ 04 (Option 1)/05 (Option 2)/06 (Option 3)	00*1	
AA-12	○	RUN-key Direction of LCD operator, 1st-motor	00 (Normal rotation)/01 (Reverse rotation)	00	
AA-13	-	STOP-key enable at RUN-command from terminal, 1st-motor	00 (Disabled)/01 (Enabled)/ 02 (Only reset is enabled)	01	
AA114	-	RUN-direction restriction, 1st-motor	00 (No limitation)/01 (Only normal rotation)/ 02 (Only reverse rotation)	00	
AA115	-	STOP mode selection, 1st-motor	00 (Deceleration stop)/01 (Free run stop)	00	
AA121	-	Control mode selection, 1st-motor	00 ([V/f] Fixed torque characteristics (IM))/ 01 ([V/f] Reducing torque characteristics (IM))/ 02 ([V/f] Free V/f (IM))/03 ([V/f] Auto torque boost (IM))/ 04 ([V/f with sensor] Fixed torque characteristics (IM)/ 05 ([V/f with sensor] Reduced torque characteristics (IM)/ 06 ([V/f with sensor] Free V/f (IM)/ 07 ([V/f with sensor] Auto torque boost (IM)/ 08 (Sensorless vector control (IM))/ 09 (Zero-Hz range sensorless vector control (IM)) *2/ 10 (Vector control with sensor (IM)) *2/ 11 (Synchronous start type sensorless vector control (SM/PMM))/ 12 (IVMS start type sensorless vector control (SM/PMM)) *3	00	
AA123	-	Vector control mode selection, 1st-motor	00 (Speed/torque control mode)/ 01 (Pulse string position control mode)/ 02 (Absolute position control mode)/ 03 (High-resolution absolute position control mode)	00	
AA201	-	Main speed input source selection, 2nd-motor	01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)/14 (Program function)/ 15 (PID calculation)/16 (Reserved)	00*1	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AA202	-	Sub speed input source selection, 2nd-motor	00 (Disabled)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)/14 (Program function)/ 15 (PID calculation)/16 (Reserved)	00	
AA204	○	Sub speed setting, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
AA205	-	Calculation symbol selection for Speed reference, 2nd-motor	00 (Disabled)/01 (Addition)/02 (Subtraction)/ 03 (Multiplication)	00	
AA206	○	Add frequency setting, 2nd-motor	-590.00 to 590.00 (Hz)	0.00	
AA211	-	Run-command input source selection, 2nd-motor	00 ([FW]/[RV] terminal)/01 (3 wire)/ 02 (RUN key on LCD operator)/03 (RS485)/ 04 (Option 1)/05 (Option 2)/06 (Option 3)	00*1	
AA214	-	RUN-direction restriction, 2nd-motor	00 (No limitation)/01 (Only normal rotation)/ 02 (Only reverse rotation)	00	
AA215	-	STOP mode selection, 2nd-motor	00 (Deceleration stop)/01 (Free run stop)	00	
AA221	-	Control mode selection, 2nd-motor	00 ([V/f] Fixed torque characteristics (IM))/ 01 ([V/f] Reducing torque characteristics (IM))/ 02 ([V/f] Free V/f (IM))/03 ([V/f] Auto torque boost (IM))/ 04 ([V/f with sensor] Fixed torque characteristics (IM)/ 05 ([V/f with sensor] Reduced torque characteristics (IM)/ 06 ([V/f with sensor] Free V/f (IM)/ 07 ([V/f with sensor] Auto torque boost (IM)/ 08 (Sensorless vector control (IM))/ 09 (Zero-Hz range sensorless vector control (IM)) *2/ 10 (Vector control with sensor (IM)) *2/ 11 (Synchronous start type sensorless vector control (SM/PMM))/ 12 (IVMS start type sensorless vector control (SM/PMM)) *3	00	
AA223	-	Vector control mode selection, 2nd-motor	00 (Speed/torque control mode)/ 01 (Pulse string position control mode)/ 02 (Absolute position control mode)/ 03 (High-resolution absolute position control mode)	00	

*1. It is a default value when Default Value Selection (Ub-02) is set to 01.

*2. Cannot be selected if [Ub-03] duty spec selection is 01 (LD) or 00 (VLD).

*3. Cannot be selected if [Ub-03] duty spec selection is 00 (VLD).

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Ab-01	-	Frequency conversion gain	0.01 to 100.00	1.00	
Ab-03	-	Multistep speed selection	00 (16th speed: binary (CF1 to CF4))/ 01 (8th speed: bit (SF1 to SF7))	00	
Ab110	○	Multispeed-0 setting, 1st-motor	0.00 to 590.00 (Hz)	0.00	
Ab-11	○	Multispeed-1 setting	0.00 to 590.00 (Hz)	0.00	
Ab-12	○	Multispeed-2 setting	0.00 to 590.00 (Hz)	0.00	
Ab-13	○	Multispeed-3 setting	0.00 to 590.00 (Hz)	0.00	
Ab-14	○	Multispeed-4 setting	0.00 to 590.00 (Hz)	0.00	
Ab-15	○	Multispeed-5 setting	0.00 to 590.00 (Hz)	0.00	
Ab-16	○	Multispeed-6 setting	0.00 to 590.00 (Hz)	0.00	
Ab-17	○	Multispeed-7 setting	0.00 to 590.00 (Hz)	0.00	
Ab-18	○	Multispeed-8 setting	0.00 to 590.00 (Hz)	0.00	
Ab-19	○	Multispeed-9 setting	0.00 to 590.00 (Hz)	0.00	
Ab-20	○	Multispeed-10 setting	0.00 to 590.00 (Hz)	0.00	
Ab-21	○	Multispeed-11 setting	0.00 to 590.00 (Hz)	0.00	
Ab-22	○	Multispeed-12 setting	0.00 to 590.00 (Hz)	0.00	
Ab-23	○	Multispeed-13 setting	0.00 to 590.00 (Hz)	0.00	
Ab-24	○	Multispeed-14 setting	0.00 to 590.00 (Hz)	0.00	
Ab-25	○	Multispeed-15 setting	0.00 to 590.00 (Hz)	0.00	
Ab210	○	Multispeed-0 setting, 2nd-motor	0.00 to 590.00 (Hz)	0.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AC-01	-	Acceleration/ Deceleration time input selection	00 (Parameter setting)/01 (Option 1)/ 02 (Option 2)/03 (Option 3)/04 (DriveProgramming)	00	
AC-02	-	Acceleration/ Deceleration Selection	00 (Common)/ 01 (Multi-stage acceleration/deceleration)	00	
AC-03	-	Acceleration curve selection	00 (Linear)/01 (S-shaped)/02 (U-shaped)/ 03 (Reverse U-shaped)/04 (Elevator S-shaped)	00	
AC-04	-	Deceleration curve selection	00 (Linear)/01 (S-shaped)/02 (U-shaped)/ 03 (Reverse U-shaped)/04 (Elevator S-shaped)	00	
AC-05	-	Acceleration curve constant setting	1 to 10	2	
AC-06	-	Deceleration curve constant setting	1 to 10	2	
AC-08	-	EL-S-curve ratio @start of acceleration	0 to 100	25	
AC-09	-	EL-S-curve ratio @end of acceleration	0 to 100	25	
AC-10	-	EL-S-curve ratio @start of deceleration	0 to 100	25	
AC-11	-	EL-S-curve ratio @end of deceleration	0 to 100	25	
AC115	-	Select method to switch to Accel2/Decel2 Profile, 1st-motor	00 ([2CH] terminal)/01 (Parameter setting)/ 02 (Switching normal/reverse rotation)	00	
AC116	○	Accel1 to Accel2 Frequency transition point, 1st-motor	0.00 to 590.00 (Hz)	0.00	
AC117	○	Decel1 to Decel2 Frequency transition point, 1st-motor	0.00 to 590.00 (Hz)	0.00	
AC120	○	Acceleration time setting 1, 1st-motor	0.00 to 3600.00 (s)	30.00	
AC122	○	Deceleration time setting 1, 1st-motor	0.00 to 3600.00 (s)	30.00	
AC124	○	Acceleration time setting 2, 1st-motor	0.00 to 3600.00 (s)	15.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AC126	○	Deceleration time setting 2, 1st-motor	0.00 to 3600.00 (s)	15.00	
AC-30	○	Acceleration time setting for multi-speed 1	0.00 to 3600.00 (s)	0.00	
AC-32	○	Deceleration time setting for multi-speed 1	0.00 to 3600.00 (s)	0.00	
AC-34	○	Acceleration time setting for multi-speed 2	0.00 to 3600.00 (s)	0.00	
AC-36	○	Deceleration time setting for multi-speed 2	0.00 to 3600.00 (s)	0.00	
AC-38	○	Acceleration time setting for multi-speed 3	0.00 to 3600.00 (s)	0.00	
AC-40	○	Deceleration time setting for multi-speed 3	0.00 to 3600.00 (s)	0.00	
AC-42	○	Acceleration time setting for multi-speed 4	0.00 to 3600.00 (s)	0.00	
AC-44	○	Deceleration time setting for multi-speed 4	0.00 to 3600.00 (s)	0.00	
AC-46	○	Acceleration time setting for multi-speed 5	0.00 to 3600.00 (s)	0.00	
AC-48	○	Deceleration time setting for multi-speed 5	0.00 to 3600.00 (s)	0.00	
AC-50	○	Acceleration time setting for multi-speed 6	0.00 to 3600.00 (s)	0.00	
AC-52	○	Deceleration time setting for multi-speed 6	0.00 to 3600.00 (s)	0.00	
AC-54	○	Acceleration time setting for multi-speed 7	0.00 to 3600.00 (s)	0.00	
AC-56	○	Deceleration time setting for multi-speed 7	0.00 to 3600.00 (s)	0.00	
AC-58	○	Acceleration time setting for multi-speed 8	0.00 to 3600.00 (s)	0.00	
AC-60	○	Deceleration time setting for multi-speed 8	0.00 to 3600.00 (s)	0.00	
AC-62	○	Acceleration time setting for multi-speed 9	0.00 to 3600.00 (s)	0.00	
AC-64	○	Deceleration time setting for multi-speed 9	0.00 to 3600.00 (s)	0.00	
AC-66	○	Acceleration time setting for multi-speed 10	0.00 to 3600.00 (s)	0.00	
AC-68	○	Deceleration time setting for multi-speed 10	0.00 to 3600.00 (s)	0.00	
AC-70	○	Acceleration time setting for multi-speed 11	0.00 to 3600.00 (s)	0.00	
AC-72	○	Deceleration time setting for multi-speed 11	0.00 to 3600.00 (s)	0.00	
AC-74	○	Acceleration time setting for multi-speed 12	0.00 to 3600.00 (s)	0.00	
AC-76	○	Deceleration time setting for multi-speed 12	0.00 to 3600.00 (s)	0.00	
AC-78	○	Acceleration time setting for multi-speed 13	0.00 to 3600.00 (s)	0.00	
AC-80	○	Deceleration time setting for multi-speed 13	0.00 to 3600.00 (s)	0.00	
AC-82	○	Acceleration time setting for multi-speed 14	0.00 to 3600.00 (s)	0.00	
AC-84	○	Deceleration time setting for multi-speed 14	0.00 to 3600.00 (s)	0.00	
AC-86	○	Acceleration time setting for multi-speed 15	0.00 to 3600.00 (s)	0.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AC-88	○	Deceleration time setting for multi-speed 15	0.00 to 3600.00 (s)	0.00	
AC215	-	Select method to switch to Accel2/Decel2 Profile, 2nd-motor	00 ([2CH] terminal)/01 (Parameter setting)/ 02 (Switching normal/reverse rotation)	00	
AC216	○	Accel1 to Accel2 Frequency transition point, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
AC217	○	Decel1 to Decel2 Frequency transition point, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
AC220	○	Acceleration time setting 1, 2nd-motor	0.00 to 3600.00 (s)	30.00	
AC222	○	Deceleration time setting 1, 2nd-motor	0.00 to 3600.00 (s)	30.00	
AC224	○	Acceleration time setting 2, 2nd-motor	0.00 to 3600.00 (s)	15.00	
AC226	○	Deceleration time setting 2, 2nd-motor	0.00 to 3600.00 (s)	15.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Ad-01	-	Torque reference input source selection	01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)/15 (PID calculation)	07	
Ad-02	○	Torque reference value setting	-500.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	0.0	
Ad-03	-	Polarity selection for torque reference	00 (As per the sign)/ 01 (Follow the revolution direction)	00	
Ad-04	○	Switching time of Speed control to Torque control	0 to 1000 (ms)	100	
Ad-11	-	Torque bias input source selection	00 (Disabled)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)/15 (PID calculation)	00	
Ad-12	○	Torque bias value setting	-500.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	0.0	
Ad-13	-	Polarity selection for torque bias	00 (As per the sign)/ 01 (Follow the revolution direction)	00	
Ad-14	-	Terminal [TBS] active	00 (Disabled)/01 (Enabled)	00	
Ad-40	-	Input selection for speed limit at torque control	01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	07	
Ad-41	○	Speed limit at torque control (at Forward rotation)	0.00 to 590.00 (Hz)	0.00	
Ad-42	○	Speed limit at torque control (at Reverse rotation)	0.00 to 590.00 (Hz)	0.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AE-01	-	Electronic gear setting point selection	00 (Feedback side)/01 (Command side)	00	
AE-02	-	Electronic gear ratio numerator	1 to 10000	1	
AE-03	-	Electronic gear ratio denominator	1 to 10000	1	
AE-04	-	Positioning completion range setting	0 to 1000 (ms)	5	
AE-05	-	Positioning completion delay time setting	0.00 to 10.00 (s)	0.00	
AE-06	-	Position feed-forward gain setting	0.00 to 655.35	0.00	
AE-07	-	Position loop gain setting	0.00 to 100.00	0.50	
AE-08	-	Position bias setting	-2048 to 2048	0	
AE-10	-	Stop position selection of Home search function	00 (Parameter setting)/01 (Option 1)/ 02 (Option 2)/03 (Option 3)	00	
AE-11	○	Stop position of Home search function	0 to 4095	0	
AE-12	○	Speed reference of Home search function	0.00 to 120.00	0.00	
AE-13	-	Direction of Home search function	00 (Normal rotation)/01 (Reverse rotation)	00	
AE-20	○	Position reference 0 setting	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	0	
AE-22	○	Position reference 1 setting		0	
AE-24	○	Position reference 2 setting		0	
AE-26	○	Position reference 3 setting		0	
AE-28	○	Position reference 4 setting		0	
AE-30	○	Position reference 5 setting		0	
AE-32	○	Position reference 6 setting		0	
AE-34	○	Position reference 7 setting		0	
AE-36	○	Position reference 8 setting		0	
AE-38	○	Position reference 9 setting		0	
AE-40	○	Position reference 10 setting		0	
AE-42	○	Position reference 11 setting		0	
AE-44	○	Position reference 12 setting		0	
AE-46	○	Position reference 13 setting		0	
AE-48	○	Position reference 14 setting		0	
AE-50	○	Position reference 15 setting		0	
AE-52	○	Position control range setting (forward)	0 to 268435455 In high resolution mode: 0 to 1073741823	268435455	
AE-54	○	Position control range setting (reverse)	-268435455 to 0 In high resolution mode: -1073741823 to 0	-268435455	
AE-56	-	Position control mode selection	00 (With limit)/01 (Without limit)	00	
AE-60	○	Teach-in function target selection	00 (X00) to 15 (X15)	00	
AE-61	-	Current position saving at power-off	00 (Disabled)/01 (Enabled)	00	
AE-62	○	Preset position data	-268435455 to 268435455 In high resolution mode: -1073741823 to 1073741823	0	
AE-64	○	Deceleration stop distance calculation Gain	50.00 to 200.00	100.00	
AE-65	○	Deceleration stop distance calculation Bias	0.00 to 655.35	0.00	
AE-66	○	Speed Limit in APR control	0.00 to 100.00	1.00	
AE-67	○	APR start speed	0.00 to 100.00	0.20	
AE-70	-	Homing function selection	00 (Low speed zero return)/ 01 (High speed zero return)/ 02 (High speed zero return 2)	00	
AE-71	-	Direction of homing function	00 (Normal rotation)/01 (Reverse rotation)	00	
AE-72	○	Low-speed of homing function	0.00 to 10.00 (Hz)	0.00	
AE-73	○	High-Speed of homing function	0.00 to 590.00 (Hz)	0.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AF101	-	DC braking selection, 1st-motor	00 (Disabled)/01 (Enabled)/ 02 (Frequency command)	00	
AF102	-	Braking type selection, 1st-motor	00 (DC braking)/01 (Speed servo lock)/ 02 (Position servo lock)	00	
AF103	○	DC braking frequency, 1st-motor	0.00 to 590.00 (Hz)	0.50	
AF104	○	DC braking delay time, 1st-motor	0.00 to 5.00 (s)	0.00	
AF105	○	DC braking force setting, 1st-motor	0 to 100 (%) (with internal limitation)	30	
AF106	○	DC braking active time at stop, 1st-motor	0.00 to 60.00 (s)	0.00	
AF107	○	DC braking operation method selection, 1st-motor	00 (Edge mode)/01 (Level mode)	01	
AF108	○	DC braking force at start, 1st-motor	0 to 100 (%) (with internal limitation)	30	
AF109	○	DC braking active time at start, 1st-motor	0.00 to 60.00 (s)	0.00	
AF120	-	ContactorControl Enable, 1st-motor	00 (Disabled)/01 (Enabled: primary side)/ 02 (Enabled: secondary side)	00	
AF121	○	Run delay time, 1st-motor	0.00 to 2.00 (s)	0.20	
AF122	○	Contactor off delay time, 1st-motor	0.00 to 2.00 (s)	0.10	
AF123	○	Contactor answer back check time, 1st-motor	0.00 to 5.00 (s)	0.10	
AF130	-	Brake Control Enable, 1st-motor	00 (Disabled)/ 01 (Brake control 1 common in forward/ reverse rotation)/ 02 (Brake control 1 forward/reverse set individually)/ 03 (Brake control 2)	00	
AF131	○	Brake Wait Time for Release, 1st-motor (Forward side)	0.00 to 5.00 (s)	0.00	
AF132	○	Brake Wait Time for Accel. , 1st-motor (Forward side)	0.00 to 5.00 (s)	0.00	
AF133	○	Brake Wait Time for Stopping, 1st-motor (Forward side)	0.00 to 5.00 (s)	0.00	
AF134	○	Brake Wait Time for Confirmation, 1st-motor (Forward side)	0.00 to 5.00 (s)	0.00	
AF135	○	Brake Release Frequency Setting, 1st-motor (Forward side)	0.00 to 590.00 (Hz)	0.00	
AF136	○	Brake Release Current Setting, 1st-motor (Forward side)	(0.0 to 2.0) × Inverter rated current (A)*1	1.0 × Inverter rated current	
AF137	○	Braking Frequency, 1st-motor (Forward side)	0.00 to 590.00 (Hz)	0.00	
AF138	○	Brake Wait Time for Release, 1st-motor (Reverse side)	0.00 to 5.00 (s)	0.00	
AF139	○	Brake Wait Time for Accel. , 1st-motor (Reverse side)	0.00 to 5.00 (s)	0.00	
AF140	○	Brake Wait Time for Stopping, 1st-motor (Reverse side)	0.00 to 5.00 (s)	0.00	
AF141	○	Brake Wait Time for Confirmation, 1st-motor (Reverse side)	0.00 to 5.00 (s)	0.00	
AF142	○	Brake Release Frequency Setting, 1st-motor (Reverse side)	0.00 to 590.00 (Hz)	0.00	
AF143	○	Brake Release Current Setting, 1st-motor (Reverse side)	(0.0 to 2.0) × Inverter rated current (A)*1	1.0 × Inverter rated current	
AF144	○	Braking Frequency, 1st-motor (Reverse side)	0.00 to 590.00 (Hz)	0.00	
AF150	○	Brake open delay time, 1st-motor	0.00 to 2.00 (s)	0.20	
AF151	○	Brake close delay time, 1st-motor	0.00 to 2.00 (s)	0.20	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AF152	○	Brake answer back check time, 1st-motor	0.00 to 5.00 (s)	0.10	
AF153	○	Servo lock/ DC injection time at start, 1st-motor	0.00 to 10.00 (s)	0.60	
AF154	○	Servo lock/ DC injection time at stop, 1st-motor	0.00 to 10.00 (s)	0.60	
AF201	-	DC braking selection, 2nd-motor	00 (Disabled)/01 (Enabled)/ 02 (Frequency command)	00	
AF202	-	Braking type selection, 2nd-motor	00 (DC braking)/01 (Speed servo lock)/ 02 (Position servo lock)	00	
AF203	○	DC braking frequency, 2nd-motor	0.00 to 590.00 (Hz)	0.50	
AF204	○	DC braking delay time, 2nd-motor	0.00 to 5.00 (s)	0.00	
AF205	○	DC braking force setting, 2nd-motor	0 to 100 (%) (with internal limitation)	30	
AF206	○	DC braking active time at stop, 2nd-motor	0.00 to 60.00 (s)	0.00	
AF207	○	DC braking operation method selection, 2nd-motor	00 (Edge mode)/01 (Level mode)	01	
AF208	○	DC braking force at start, 2nd-motor	0 to 100 (%) (with internal limitation)	30	
AF209	○	DC braking active time at start, 2nd-motor	0.00 to 60.00 (s)	0.00	
AF220	-	ContactorControl Enable, 2nd-motor	00 (Disabled)/01 (Enabled: primary side)/ 02 (Enabled: secondary side)	00	
AF221	○	Run delay time, 2nd-motor	0.00 to 2.00 (s)	0.20	
AF222	○	Contactor off delay time, 2nd-motor	0.00 to 2.00 (s)	0.10	
AF223	○	Contactor answer back check time, 2nd-motor	0.00 to 5.00 (s)	0.10	
AF230	-	Brake Control Enable, 2nd-motor	00 (Disabled)/ 01 (Brake control common in forward/ reverse rotation)/ 02 (Brake control 1 forward/reverse set individually)	00	
AF231	○	Brake Wait Time for Release, 2nd-motor (Forward side)	0.00 to 5.00 (s)	0.00	
AF232	○	Brake Wait Time for Accel. , 2nd-motor (Forward side)	0.00 to 5.00 (s)	0.00	
AF233	○	Brake Wait Time for Stopping, 2nd-motor (Forward side)	0.00 to 5.00 (s)	0.00	
AF234	○	Brake Wait Time for Confirmation, 2nd-motor (Forward side)	0.00 to 5.00 (s)	0.00	
AF235	○	Brake Release Frequency Setting, 2nd-motor (Forward side)	0.00 to 590.00 (Hz)	0.00	
AF236	○	Brake Release Current Setting, 2nd-motor (Forward side)	(0.0 to 2.0) × Inverter rated current (A)*1	1.0 × Inverter rated current	
AF237	○	Braking Frequency, 2nd-motor (Forward side)	0.00 to 590.00 (Hz)	0.00	
AF238	○	Brake Wait Time for Release, 2nd-motor (Reverse side)	0.00 to 5.00 (s)	0.00	
AF239	○	Brake Wait Time for Accel. , 2nd-motor (Reverse side)	0.00 to 5.00 (s)	0.00	
AF240	○	Brake Wait Time for Stopping, 2nd-motor (Reverse side)	0.00 to 5.00 (s)	0.00	
AF241	○	Brake Wait Time for Confirmation, 2nd-motor (Reverse side)	0.00 to 5.00 (s)	0.00	
AF242	○	Brake Release Frequency Setting, 2nd-motor (Reverse side)	0.00 to 590.00 (Hz)	0.00	
AF243	○	Brake Release Current Setting, 2nd-motor (Reverse side)	(0.0 to 2.0) × Inverter rated current (A)*1	1.0 × Inverter rated current	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AF244	○	Braking Frequency, 2nd-motor (Reverse side)	0.00 to 590.00 (Hz)	0.00	
AF250	○	Brake open delay time, 2nd-motor	0.00 to 2.00 (s)	0.20	
AF251	○	Brake close delay time, 2nd-motor	0.00 to 2.00 (s)	0.20	
AF252	○	Brake answer back check time, 2nd-motor	0.00 to 5.00 (s)	0.10	
AF253	○	Servo lock/ DC injection time at start, 2nd-motor	0.00 to 10.00 (s)	0.60	
AF254	○	Servo lock/ DC injection time at stop, 2nd-motor	0.00 to 10.00 (s)	0.60	

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AG101	○	Jump frequency 1, 1st-motor	0.00 to 590.00 (Hz)	0.00	
AG102	○	Jump frequency width 1, 1st-motor	0.00 to 10.00 (Hz)	0.00	
AG103	○	Jump frequency 2, 1st-motor	0.00 to 590.00 (Hz)	0.00	
AG104	○	Jump frequency width 2, 1st-motor	0.00 to 10.00 (Hz)	0.00	
AG105	○	Jump frequency 3, 1st-motor	0.00 to 590.00 (Hz)	0.00	
AG106	○	Jump frequency width 3, 1st-motor	0.00 to 10.00 (Hz)	0.00	
AG110	○	Acceleration stop frequency setting, 1st-motor	0.00 to 590.00 (Hz)	0.00	
AG111	○	Acceleration stop time setting, 1st-motor	0.0 to 60.0 (s)	0.0	
AG112	○	Deceleration stop frequency setting, 1st-motor	0.00 to 590.00 (Hz)	0.00	
AG113	○	Deceleration stop time setting, 1st-motor	0.0 to 60.0 (s)	0.0	
AG-20	○	Jogging frequency	0.00 to 10.00 (Hz)	6.00	
AG-21	-	Jogging stop mode selection	00 (Disabled during FRS operation at stop)/ 01 (Disabled during deceleration stop operation)/ 02 (Disabled during DB operation at stop)/ 03 (Enabled during FRS operation at stop)/ 04 (Enabled during deceleration stop operation)/ 05 (Enabled during DB operation at stop)	00	
AG201	○	Jump frequency 1, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
AG202	○	Jump frequency width 1, 2nd-motor	0.00 to 10.00 (Hz)	0.00	
AG203	○	Jump frequency 2, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
AG204	○	Jump frequency width 2, 2nd-motor	0.00 to 10.00 (Hz)	0.00	
AG205	○	Jump frequency 3, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
AG206	○	Jump frequency width 3, 2nd-motor	0.00 to 10.00 (Hz)	0.00	
AG210	○	Acceleration stop frequency setting, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
AG211	○	Acceleration stop time setting, 2nd-motor	0.0 to 60.0 (s)	0.0	
AG212	○	Deceleration stop frequency setting, 2nd-motor	0.00 to 590.00 (Hz)	0.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AG213	○	Deceleration stop time setting, 2nd-motor	0.0 to 60.0 (s)	0.0	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AH-01	-	PID1 enable	00 (Disabled)/ 01 (Enabled Without reverse output)/ 02 (Enabled With reverse output)	00	
AH-02	-	PID1 deviation inverse	00 (Disabled)/01 (Enabled)	00	
AH-03	-	Unit selection for PID1	See <*Unit options*> on page C-70 at the end of Appendices C	01	
AH-04	○	PID1 scale adjustment (0%)	-10000 to 10000	0	
AH-05	○	PID1 scale adjustment (100%)	-10000 to 10000	10000	
AH-06	○	PID1 scale adjustment (point position)	0 to 4	2	
AH-07	-	Input source selection of Set-point for PID1	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	07	
AH-10	○	Set-point-1 setting for PID1	-100.00 to 100.00 *1	0.00	
AH-12	○	PID1 Multi stage set-point 1 setting	-100.00 to 100.00 *1	0.00	
AH-14	○	PID1 Multi stage set-point 2 setting	-100.00 to 100.00 *1	0.00	
AH-16	○	PID1 Multi stage set-point 3 setting	-100.00 to 100.00 *1	0.00	
AH-18	○	PID1 Multi stage set-point 4 setting	-100.00 to 100.00 *1	0.00	
AH-20	○	PID1 Multi stage set-point 5 setting	-100.00 to 100.00 *1	0.00	
AH-22	○	PID1 Multi stage set-point 6 setting	-100.00 to 100.00 *1	0.00	
AH-24	○	PID1 Multi stage set-point 7 setting	-100.00 to 100.00 *1	0.00	
AH-26	○	PID1 Multi stage set-point 8 setting	-100.00 to 100.00 *1	0.00	
AH-28	○	PID1 Multi stage set-point 9 setting	-100.00 to 100.00 *1	0.00	
AH-30	○	PID1 Multi stage set-point 10 setting	-100.00 to 100.00 *1	0.00	
AH-32	○	PID1 Multi stage set-point 11 setting	-100.00 to 100.00 *1	0.00	
AH-34	○	PID1 Multi stage set-point 12 setting	-100.00 to 100.00 *1	0.00	
AH-36	○	PID1 Multi stage set-point 13 setting	-100.00 to 100.00 *1	0.00	
AH-38	○	PID1 Multi stage set-point 14 setting	-100.00 to 100.00 *1	0.00	
AH-40	○	PID1 Multi stage set-point 15 setting	-100.00 to 100.00 *1	0.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AH-42	-	Input source selection of Set-point 2 for PID1	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	00	
AH-44	○	Set-point 2 setting for PID1	-100.00 to 100.00 (%) *1	0.00	
AH-46	-	Input source selection of Set-point 3 for PID1	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	00	
AH-48	○	Set-point 3 setting for PID1	-100.00 to 100.00 (%) *1	0.00	
AH-50	-	Calculation symbol selection of Set-point 1 for PID1	01 (Addition)/02 (Subtraction)/03 (Multiplication)/ 04 (Division)/05(Minimum deviation)/ 06(Maximum deviation)	01	
AH-51	-	Input source selection of Process data 1 for PID1	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/08 (RS 485)/09 (Option 1)/10 (Option 2)/ 11 (Option 3)/12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	01	
AH-52	-	Input source selection of Process data 2 for PID1		00	
AH-53	-	Input source selection of Process data 3 for PID1		00	
AH-54	-	Calculation symbol selection of Process data for PID1	01 (Addition)/02 (Subtraction)/03 (Multiplication)/ 04 (Division)/05(Square root of FB1)/ 06(Square root of FB2)/07(Square root of (FB1-FB2))/ 08(Average of PV-1 to PV-3)/ 09(Minimum data of PV-1 to PV-3)/ 10(Maximum data of PV-1 to PV-3)	01	
AH-60	-	PID1 gain change method selection	00 (Only gain 1)/01 ([PRO] terminal switch)	00	
AH-61	○	PID1 proportional gain 1	0.0 to 100.0	1.0	
AH-62	○	PID1 integral time constant 1	0.0 to 3600.0 (s)	1.0	
AH-63	○	PID1 derivative gain 1	0.00 to 100.00 (s)	0.00	
AH-64	○	PID1 proportional gain 2	0.0 to 100.0	0.0	
AH-65	○	PID1 integral time constant 2	0.00 to 3600.0 (s)	0.0	
AH-66	○	PID1 derivative gain 2	0.00 to 100.00 (s)	0.00	
AH-67	○	PID1 gain change time	0 to 10000 (ms)	100	
AH-70	-	PID feed-forward selection	00 (Disabled)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)	00	
AH-71	○	PID1 output range	0.00 to 100.00 (%)	0.00	
AH-72	○	PID1 deviation over level	0.00 to 100.00 (%)	3.00	
AH-73	○	PID1 feedback compare signal turn-off level	0.00 to 100.00 (%)	100.00	
AH-74	○	PID1 feedback compare signal turn-on level	0.00 to 100.00 (%)	0.00	
AH-75	-	PID soft-start function enable	00 (Disabled)/01 (Enabled)	00	
AH-76	○	PID soft-start target level	0.00 to 100.00 (%)	100.00	
AH-78	○	Acceleration time setting for PID soft-start function	0.00 to 3600.00 (s)	30.00	
AH-80	○	PID soft-start time	0.00 to 100.00 (s)	0.00	
AH-81	-	PID soft start error detection enable	00 (Disabled)/01 (Enabled: error output)/ 02 (Enabled: warning)	00	
AH-82	○	PID soft start error detection level	0.00 to 100.00 (%)	0.00	
AH-85	-	PID sleep trigger selection	00 (Disabled)/01 (Low output)/02 ([SLEP] terminal)	00	
AH-86	○	PID sleep start level	0.00 to 590.00 (Hz)	0.00	
AH-87	○	PID sleep active time	0.00 to 100.00 (s)	0.00	
AH-88	-	Setpoint boost before PID sleep enable	00 (Disabled)/01 (Enabled)	00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AH-89	○	Setpoint boost time	0.00 to 100.00 (s)	0.00	
AH-90	○	Setpoint boost value	0.00 to 100.00 (%)	0.00	
AH-91	○	Minimum RUN time befor PID sleep	0.00 to 100.00 (s)	0.00	
AH-92	○	Minimum active time of PID sleep	0.00 to 100.00 (s)	0.00	
AH-93	-	PID sleep trigger selection	01 (Deviation amount)/02 (Low feedback)/ 03 ([WAKE] terminal)	01	
AH-94	○	PID wake start level	0.00 to 100.00 (%)	0.00	
AH-95	○	PID wake start time	0.00 to 100.00 (s)	0.00	
AH-96	○	PID wake start deviation value	0.00 to 100.00 (%)	0.00	

*1. Data range differs depending on [AH-04] to [AH-06].

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AJ-01	-	PID2 enable	00 (Disabled)/ 01 (Enabled Without reverse output)/ 02 (Enabled With reverse output)	00	
AJ-02	-	PID2 deviation inverse	00 (Disabled)/01 (Enabled)	00	
AJ-03	-	PID2 unit selection	See <*Unit options*> on page C-70 at the end of Appendices C	01	
AJ-04	○	PID2 scale adjustment (0%)	-10000 to 10000	0	
AJ-05	○	PID2 scale adjustment (100%)	-10000 to 10000	10000	
AJ-06	○	PID2 scale adjustment (point position)	0 to 4	2	
AJ-07	-	Input source selection of Set-point for PID2	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)/15 (PID1 output)	07	
AJ-10	○	Set-point setting for PID2	-100.00 to 100.00 (%) *1	0.00	
AJ-12	-	Input source selection of Process data for PID2	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	02	
AJ-13	○	PID2 proportional gain	0.0 to 100.0	1.0	
AJ-14	○	PID2 integral time constant	0.0 to 3600.0 (s)	1.0	
AJ-15	○	PID2 derivative gain	0.00 to 100.00 (s)	0.00	
AJ-16	○	PID2 output range	0.00 to 100.00 (%)	0.00	
AJ-17	○	PID2 deviation over level	0.00 to 100.00 (%)	3.00	
AJ-18	○	PID2 feedback compare signal turn-OFF level	0.00 to 100.00 (%)	100.00	
AJ-19	○	PID2 feedback compare signal turn-ON level	0.00 to 100.00 (%)	0.00	
AJ-21	-	PID3 enable	00 (Disabled)/ 01 (Enabled Without reverse output)/ 02 (Enabled With reverse output)	00	
AJ-22	-	PID3 deviation inverse	00 (Disabled)/01 (Enabled)	00	
AJ-23	-	PID3 unit selection	See <*Unit options*> on page C-70 at the end of Appendices C	01	
AJ-24	○	PID3 scale adjustment (0%)	-10000 to 10000	0	
AJ-25	○	PID3 scale adjustment (100%)	-10000 to 10000	10000	
AJ-26	○	PID3 scale adjustment (point position)	0 to 4	2	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
AJ-27	-	Input source selection of Set-point for PID3	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	07	
AJ-30	○	Set-point setting for PID3	-100.00 to 100.00 (%) *2	0.00	
AJ-32	-	Input source selection of Process data for PID3	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	01	
AJ-33	○	PID3 proportional gain	0.0 to 100.0	1.0	
AJ-34	○	PID3 integral time constant	0.00 to 3600.0 (s)	1.0	
AJ-35	○	PID3 derivative gain	0.0 to 100.00 (s)	0.00	
AJ-36	○	PID3 output range	0.00 to 100.00 (%)	0.00	
AJ-37	○	PID3 deviation over level	0.00 to 100.00 (%)	3.00	
AJ-38	○	PID3 feedback compare signal turn-OFF level	0.00 to 100.00 (%)	100.00	
AJ-39	○	PID3 feedback compare signal turn-ON level	0.00 to 100.00 (%)	0.00	
AJ-41	-	PID4 enable	00 (Disabled)/ 01 (Enabled Without reverse output)/ 02 (Enabled With reverse output)	00	
AJ-42	-	PID4 deviation inverse	00 (Disabled)/01 (Enabled)	00	
AJ-43	-	PID4 unit selection	See *<Unit options>* on page C-70 at the end of Appendices C	01	
AJ-44	○	PID4 scale adjustment (0%)	-10000 to 10000	0	
AJ-45	○	PID4 scale adjustment (100%)	-10000 to 10000	10000	
AJ-46	○	PID4 scale adjustment (point position)	0 to 4	2	
AJ-47	-	Input source selection of Set-point for PID4	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	07	
AJ-50	○	Set-point setting for PID4	-100.00 to 100.00 (%) *3	0.00	
AJ-52	-	Input source selection of Process data for PID4	00 (None)/01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/05 (Reserved)/ 06 (Reserved)/07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)	01	
AJ-53	○	PID4 proportional gain	0.0 to 100.0	1.0	
AJ-54	○	PID4 integral time constant	0.00 to 3600.0 (s)	1.0	
AJ-55	○	PID4 derivative gain	0.0 to 100.00 (s)	0.00	
AJ-56	○	PID4 output range	0.00 to 100.00 (%)	0.00	
AJ-57	○	PID4 deviation over level	0.00 to 100.00 (%)	3.00	
AJ-58	○	PID4 feedback compare signal turn-OFF level	0.00 to 100.00 (%)	100.00	
AJ-59	○	PID4 feedback compare signal turn-ON level	0.00 to 100.00 (%)	0.00	

*1. Data range differs depending on [AJ-04] to [AJ-06].

*2. Data range differs depending on [AJ-24] to [AJ-26].

*3. Data range differs depending on [AJ-44] to [AJ-46].

Parameter Mode (Code B)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
bA101	-	Frequency limit selection, 1st-motor	00 (Disabling)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS485)/09 (Option 1)/ 10 (Option 2)/11 (Option 3)/ 12 (Pulse string input (main body))/ 13 (Pulse string input Option)	00	
bA102	○	Upper Frequency limit, 1st-motor	0.00 to 590.00 (Hz)	0.00	
bA103	○	Lower Frequency limit, 1st-motor	0.00 to 590.00 (Hz)	0.00	
bA110	-	Torque limit selection, 1st-motor	00 (Disable)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)	07	
bA111	-	Torque limit parameter mode selection, 1st-motor	00 (Four quadrant specific)/ 01 ([TRQ] terminal switch)	00	
bA112	○	Torque limit 1 (Forward driving), 1st-motor	0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	150.0	
bA113	○	Torque limit 2 (Reverse regenerative), 1st-motor	0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	150.0	
bA114	○	Torque limit 3 (Reverse driving), 1st-motor	0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	150.0	
bA115	○	Torque limit 4 (Forward regenerative), 1st-motor	0.0 to 500.0 (%) (Limited at a torque equivalent to 200% of inverter ND rating)	150.0	
bA116	-	Torque limit LADSTOP selection, 1st-motor	00 (Disabled)/01 (Enabled)	00	
bA120	-	Over current suppress enable, 1st-motor	00 (Disabled)/01 (Enabled)	01	
bA121	-	Over current suppress Level, 1st-motor	(0.0 to 2.0) × Inverter rated current (A)*1	*2	
bA122	-	Overload restriction 1 mode selection, 1st-motor	00 (Disabled)/ 01 (Accelerate at constant speed)/ 02 (Only constant speed)/ 03 (Accelerate at constant speed/Increase speed at regeneration)	01	
bA123	○	Overload restriction 1 active level, 1st-motor	(0.2 to 2.0) × Inverter rated current (A)*1	*3	
bA124	○	Overload restriction 1 action time, 1st-motor	0.10 to 3600.00 (s)	1.00	
bA126	-	Overload restriction 2 mode selection, 1st-motor	00 (Disabled)/ 01 (Accelerate at constant speed)/ 02 (Only constant speed)/ 03 (Accelerate at constant speed/Increase speed at regeneration)	01	
bA127	○	Overload restriction 2 active level, 1st-motor	(0.2 to 2.0) × Inverter rated current (A)*1	*3	
bA128	○	Overload restriction 2 Action time, 1st-motor	0.10 to 3600.00 (s)	1.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
bA-30	-	Deceleration-stop at power failure	00 (Disabled)/ 01 (Enabled: deceleration stop)/ 02 (Enabled: no recovery)/ 03 (Enabled: with recovery)	00	
bA-31	○	Decel-stop at power failure starting voltage	(200 V class) 0.0 to 410.0 (V) (400 V class) 0.0 to 820.0 (V)	(200 V class) 220.0 (400 V class) 440.0	
bA-32	○	Decel-stop at power failure control target level	(200 V class) 0.0 to 410.0 (V) (400 V class) 0.0 to 820.0 (V)	(200 V class) 360.0 (400 V class) 720.0	
bA-34	○	Decel-stop at power failure deceleration time	0.01 to 3600.00 (s)	1.00	
bA-36	○	Decel-stop at power failure freq. width at deceleration start	0.00 to 10.00 (Hz)	0.00	
bA-37	○	Decel-stop at power failure DC-bus voltage constant control P-gain	0.00 to 5.00	0.20	
bA-38	○	Decel-stop at power failure DC-bus voltage constant control I-gain	0.00 to 150.00 (s)	1.00	
bA140	○	Over-voltage suppression enable, 1st-motor	00 (Disabled)/ 01 (DC voltage constant deceleration) 02 (Acceleration only at deceleration)/ 03 (Acceleration at constant speed/deceleration)	00	
bA141	○	Over-voltage suppression active level, 1st-motor	(200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V)	(200 V class) 380.0 (400 V class) 760.0	
bA142	○	Over-voltage suppression action time, 1st-motor	0.00 to 3600.00 (s)	1.00	
bA144	○	DC bus constant control proportional gain, 1st-motor	0.00 to 5.00	0.20	
bA145	○	DC bus constant control integral gain, 1st-motor	0.00 to 150.00 (s)	1.00	
bA146	○	Over magnetization deceleration function selection, 1st_motor	00 (Disabled)/01 (Regular operation)/ 02 (Operation only at deceleration)/ 03 (Level mode)/ 04 (Level mode only at deceleration)	02	
bA147	○	Over magnetization output filter time constant, 1st_motor	0.00 to 1.00(s)	0.30	
bA148	○	Over magnetization voltage gain, 1st_motor	50 to 400 (%)	100	
bA149	○	Over magnetization level setting, 1st_motor	(200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V)	(200 V class) 360.0 (400 V class) 720.0	
bA-60	○	Dynamic brake usage rate	0.0 to 10.0 × ([bA-63]/minimum resistance)^2 (%) *4	10.0	
bA-61	-	Dynamic brake selection	00 (Disabled)/ 01 (Enabled: disabled at stop)/ 02 (Enabled: enabled at stop)	00	
bA-62	-	Dynamic brake active level	(200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V)	(200 V class) 360.0 (400 V class) 720.0	
bA-63	-	Dynamic brake resister value	Minimum resistance to 600 (Ω)*4	Minimum resistance *4	
bA-70	○	Cooling FAN control method selection	00 (Always ON)/ 01 (ON during operation)/ 02 (Temperature dependent)	00	
bA-71	-	Cooling FAN accumulation running time clear selection	00 (Disabled)/01 (Clear)	00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
bA201	-	Frequency limit selection, 2nd motor	00 (Disabling)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS485)/09 (Option 1)/ 10 (Option 2)/11 (Option 3)/ 12 (Pulse string input (main body))/ 13 (Pulse string input Option)	00	
bA202	○	Upper frequency limit, 2nd motor	0.00 to 590.00 (Hz)	0.00	
bA203	○	Lower frequency limit, 2nd motor	0.00 to 590.00 (Hz)	0.00	
bA210	-	Torque limit selection, 2nd-motor	00 (Disable)/01 (Ai1 terminal input)/ 02 (Ai2 terminal input)/03 (Ai3 terminal input)/ 04 (Reserved)/05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/ 09 (Option 1)/10 (Option 2)/11 (Option 3)	07	
bA211	-	Torque limit parameter mode selection, 2nd-motor	00 (Four quadrant specific)/ 01 ([TRQ] terminal switch)	00	
bA212	○	Torque limit 1 (Forward driving), 2nd-motor	0.0 to 500.0 (%) (Limited at at torque equivalent to 200% of inverter ND rating)	150.0 (%)	
bA213	○	Torque limit 2 (Reverse regenerative), 2nd-motor	0.0 to 500.0 (%) (Limited at at torque equivalent to 200% of inverter ND rating)	150.0 (%)	
bA214	○	Torque limit 3 (Reverse driving), 2nd-motor	0.0 to 500.0 (%) (Limited at at torque equivalent to 200% of inverter ND rating)	150.0 (%)	
bA215	○	Torque limit 4 (Forward regenerative), 2nd motor	0.0 to 500.0 (%) (Limited at at torque equivalent to 200% of inverter ND rating)	150.0 (%)	
bA216	-	Torque limit LADSTOP selection, 2nd-motor	00 (Disabled)/01 (Enabled)	00	
bA220	-	Over current suppress enable, 2nd-motor	00 (Disabled)/01 (Enabled)	01	
bA221	-	Over current suppress Level, 2nd-motor	(0.0 to 2.0) × Inverter rated current (A)*1	*2	
bA222	-	Overload restriction 1 mode selection, 2nd-motor	00 (Disabled)/ 01 (Accelerate at constant speed)/ 02 (Only constant speed)/ 03 (Accelerate at constant speed/Increase speed at regeneration)	01	
bA223	○	Overload restriction 1 active level, 2nd-motor	(0.2 to 2.0) × Inverter rated current (A)*1	*3	
bA224	○	Overload restriction 1 action time, 2nd-motor	0.10 to 3600.00 (s)	1.00	
bA226	-	Overload restriction 2 mode selection, 2nd-motor	00 (Disabled)/ 01 (Accelerate at constant speed)/ 02 (Only constant speed)/ 03 (Accelerate at constant speed/Increase speed at regeneration)	01	
bA227	○	Overload restriction 2 active level, 2nd-motor	(0.2 to 2.0) × Inverter rated current (A)*1	*3	
bA228	○	Second overload limit 2 operation time	0.10 to 3600.00 (s)	1.00	
bA240	○	Over-voltage suppression enable, 2nd-motor	00 (Disabled)/ 01 (DC voltage constant deceleration)/ 02 (Acceleration only at deceleration)/ 03 (Acceleration at constant speed/deceleration)	00	
bA241	○	Over-voltage suppression active level, 2nd-motor	(200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V)	(200 V class) 380.0 (400 V class) 760.0	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
bA242	○	Over-voltage suppression action time, 2nd-motor	0.00 to 3600.00 (s)	1.00	
bA244	○	DC bus constant control proportional gain, 2nd-motor	0.00 to 5.00	0.20	
bA245	○	DC bus constant control integral gain, 2nd-motor	0.00 to 150.00 (s)	1.00	
bA246	○	Over magnetization function selection, 2nd-motor	00 (Disabled)/01 (Regular operation)/ 02 (Operation only at deceleration)/ 03 (Level mode)/ 04 (Level mode only at deceleration)	02	
bA247	○	Over magnetization output filter time constant, 2nd-motor	0.00 to 1.00 (s)	0.30	
bA248	○	Over magnetization voltage gain, 2nd-motor	50 to 400 (%)	100	
bA249	○	Over magnetization level setting, 2nd-motor	(200 V class) 330.0 to 400.0 (V) (400 V class) 660.0 to 800.0 (V)	(200 V class) 360.0 (400 V class) 720.0	

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.
1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
3) Drive programming: 0.01% (Rated ratio)

*2. 1.8 × Inverter rated current (A)

*3. 1.5 × Inverter rated current (A)

*4. Minimum resistance values vary in inverter model.

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
bb101	○	Carrier speed setting, 1st-motor	[Ub-03]=02: Normal duty 0.5 to 16.0 (kHz) [Ub-03]=01: Low duty 0.5 to 12.0 (kHz) [Ub-03]=00: Very low duty 0.5 to 10.0 (kHz) *1	2.0	
bb102	-	Sprinkle carrier pattern selection, 1st-motor	00 (Disabled)/01 (Pattern 1 enabled)/ 02 (Pattern 2 enabled)/03 (Pattern 3 enabled)/	00	
bb103	○	Automatic-carrier reduction selection, 1st-motor	00 (Disabled)/01 (Enabled: current)/ 02 (Enabled: temperature)	00	
bb-10	-	Automatic error reset selection	00 (Disabled)/ 01 (Enabled with operation command OFF)/ 02 (Enable after the setting time)	00	
bb-11	-	Alarm signal selection at Automatic error reset is active	00 (Output)/01 (Not output)	00	
bb-12	-	Automatic error reset wait time	0 to 600 (s)	2	
bb-13	-	Automatic error reset number	0 to 10	3	
bb-20	-	The number of retries after instantaneous power failure	0 to 16/255	0	
bb-21	-	The number of retries after under voltage	0 to 16/255	0	
bb-22	-	The number of retries after over current	0 to 5	0	
bb-23	-	The number of retries after over voltage	0 to 5	0	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
bb-24	-	Selection of restart mode @Instantaneous power failure/ under-voltage trip	00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)/ 04 (Trip after frequency matching deceleration stop)	01	
bb-25	-	Allowable under-voltage power failure time	0.3 to 25.0 (s)	1.0	
bb-26	-	Retry wait time before motor restart	0.3 to 100.0 (s)	0.3	
bb-27	-	Instantaneous power failure/under-voltage trip alarm enable	00 (Disabled)/01 (Enabled at stop)/ 02 (Disabled at stop and deceleration stop)	00	
bb-28	-	Selection of restart mode @over-current	00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)/ 04 (Trip after frequency matching deceleration stop)	01	
bb-29	-	Wait time of restart @over-current	0.3 to 100.0 (s)	0.3	
bb-30	-	Selection of restart mode @over-voltage	00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)/ 04 (Trip after frequency matching deceleration stop)	01	
bb-31	-	Wait time of restart @over-voltage	0.3 to 100.0 (s)	0.3	
bb-40	○	Restart mode after FRS release	00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)*2	00	
bb-41	○	Restart mode after RS release	00 (0Hz)/01 (Frequency matching)/ 02 (Frequency entrainment)/ 03 (Detection speed)*2	00	
bb-42	○	Restart frequency threshold	0.00 to 590.00 (Hz)	0.00	
bb-43	○	Restart level of Active frequency matching	(0.0 to 2.0) × Inverter rated current (A)*3	1.0 × Inverter rated current	
bb-44	○	Restart constant(speed) of Active frequency matching	0.10 to 30.00 (s)	0.50	
bb-45	○	Restart constant(Voltage) of Active frequency matching	0.10 to 30.00 (s)	0.50	
bb-46	○	OC-supress level of Active frequency matching	(0.2 to 2.0) × Inverter rated current (A)*3	1.0 × Inverter rated current	
bb-47	○	Restart speed selection of Active frequency matching	00 (Cutoff frequency)/ 01 (Maximum frequency)/02 (Setting frequency)	00	
bb160	-	Over current detection level, 1st-motor	(0.2 to 2.2) x Inverter ND rated current (A)*3	2.2 × Inverter ND rated current	
bb-61	○	Power supply over voltage selection	00 (Warning)/01 (Error)	00	
bb-62	○	Power supply over voltage level setting	(200 V class) 300.0 to 410.0 (V) (400 V class) 600.0 to 820.0 (V)	(200 V class) 390.0 (400 V class) 780.0	
bb-64	-	Ground fault selection	00 (Disabled)/01 (Enabled)	01	
bb-65	○	Input phase loss enable	00 (Disabled)/01 (Enabled)	00	
bb-66	○	Output phase loss enable	00 (Disabled)/01 (Enabled)	00	
bb-67	○	Output phase loss detection sensitivity	1 to 100 (%)	10	
bb-70	○	Thermistor error level	0 to 10000 (Ω)	3000	
bb-80	○	Over-speed detection level	0.0 to 150.0 (%)	135.0	
bb-81	○	Over-speed detection time	0.0 to 5.0 (s)	0.5	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
bb-82	-	Speed deviation error mode selection	00 (Warning)/01 (Error)	00	
bb-83	-	Speed deviation error detection level	0.0 to 100.0 (%)	15.0	
bb-84	-	Speed deviation error detection time	0.0 to 5.0 (s)	0.5	
bb-85	-	Position deviation error mode selection	00 (Warning)/01 (Error)	00	
bb-86	-	Position deviation error detection level	0.0 to 65535 (×100pls)	4096	
bb-87	-	Position deviation error detection time	0.0 to 5.0 (s)	0.5	
bb201	○	Carrier speed setting, 2nd-motor	[Ub-03]=02: Normal duty 0.5 to 16.0 (kHz) [Ub-03]=01: Low duty 0.5 to 12.0 (kHz) [Ub-03]=00: Very low duty 0.5 to 10.0 (kHz) *1	2.0	
bb202	-	Sprinkle carrier pattern selection, 2nd-motor	00 (Disabled)/01 (Pattern 1 enabled)/ 02 (Pattern 2 enabled)/03 (Pattern 3 enabled)/	00	
bb203	○	Automatic-carrier reduction selection, 2nd-motor	00 (Disabled)/01 (Enabled: current)/ 02 (Enabled: temperature)	00	
bb260	-	Over current detection level, 2nd-motor	(0.2 to 2.2) x Inverter ND rated current (A)*3	2.2 × Inverter rated current	

*1. 3G3RX2-B4750 to 3G3RX2-B413K shall be as follows.
[Ub-03]=02: 0.5 to 10.0 (kHz)
[Ub-03]=00 or 01: 0.5 to 8.0 (kHz)

*2. Feedback input to the followings is required:
- Input Terminal A and B
- Optional cassette RX2-PG

*3. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.
1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)
2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)
3) Drive programming: 0.01% (Rated ratio)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
bC110	○	Electronic thermal level setting, 1st-motor	(0.0 to 3.0) × Inverter rated current*1	1.0 × Inverter rated current	
bC111	○	Electronic thermal characteristic selection, 1st-motor	00 (Reduction characteristics)/ 01 (Constant torque characteristics)/ 02 (Arbitrary setting)	00*2	
bC112	○	Electronic thermal Subtraction function enable, 1st-motor	00 (Disabled)/01 (Enabled)	01	
bC113	○	Electronic thermal Subtraction time, 1st-motor	1 to 1000 (s)	600	
bC-14	○	Electronic thermal counter memory selection at Power-off	00 (Disabled)/01 (Enabled)	01	
bC120	○	Free electronic thermal frequency-1, 1st-motor	0.00 to [bC122] (Hz)	0.00	
bC121	○	Free electronic thermal current-1, 1st-motor	(0.0 to 3.0) × Inverter rated current*1	0.0	
bC122	○	Free electronic thermal frequency-2, 1st-motor	[bC120] to [bC124] (Hz)	0.00	
bC123	○	Free electronic thermal current-2, 1st-motor	(0.0 to 3.0) × Inverter rated current*1	0.0	
bC124	○	Free electronic thermal frequency-3, 1st-motor	[bC122] to 590.00 (Hz)	0.00	
bC125	○	Free electronic thermal current-3, 1st-motor	(0.0 to 3.0) × Inverter rated current*1	0.0	
bC210	○	Electronic thermal level setting, 2nd-motor	(0.0 to 3.0) × Inverter rated current*1	1.0 × Inverter rated current	
bC211	○	Electronic thermal characteristic selection, 2nd-motor	00 (Reduction characteristics)/ 01 (Constant torque characteristics)/ 02 (Arbitrary setting)	01*2	
bC212	○	Electronic thermal Subtraction function enable, 2nd-motor	00 (Disabled)/01 (Enabled)	01	
bC213	○	Electronic thermal Subtraction time, 2nd-motor	1 to 1000 (s)	600	
bC220	○	Free electronic thermal frequency-1, 2nd-motor	0.00 to [bC222] (Hz)	0.00	
bC221	○	Free electronic thermal current-1, 2nd-motor	(0.0 to 3.0) × Inverter rated current*1	0.0	
bC222	○	Free electronic thermal frequency-2, 2nd-motor	[bC220] to [bC224] (Hz)	0.00	
bC223	○	Free electronic thermal current-2, 2nd-motor	(0.0 to 3.0) × Inverter rated current*1	0.0	
bC224	○	Free electronic thermal frequency-3, 2nd-motor	[bC222] to 590.00 (Hz)	0.00	
bC225	○	Free electronic thermal current-3, 2nd-motor	(0.0 to 3.0) × Inverter rated current*1	0.0	

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

*2. It is a default value when Default Value Selection (Ub-02) is set to 01.

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
bd-01	-	STO input display selection	00 (With indication)/01 (Without indication)/02 (Trip)	00	
bd-02	-	STO input change time	0.00 to 60.00 (s)	1.00	
bd-03	-	Display selection at STO input change time	00 (With indication)/01 (Without indication)	00	
bd-04	-	Action selection after STO input change time	00 (Retain only the condition)/01 (Disabled)/02 (Trip)	00	

Parameter Mode (Code C)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
CA-01	○	Input terminal [1] function	See <*List of input terminal functions*> on page C-44	028	
CA-02	○	Input terminal [2] function		015	
CA-03	○	Input terminal [3] function		029	
CA-04	○	Input terminal [4] function		032	
CA-05	○	Input terminal [5] function		031	
CA-06	○	Input terminal [6] function		003	
CA-07	○	Input terminal [7] function		004	
CA-08	○	Input terminal [8] function		002	
CA-09	○	Input terminal [9] function		001	
CA-10	○	Input terminal [A] function		033	
CA-11	○	Input terminal [B] function		034	
CA-21	○	Selection of Input terminal [1] active state	00 (Normally open)/ 01 (Normally closed)	00	
CA-22	○	Selection of Input terminal [2] active state		00	
CA-23	○	Selection of Input terminal [3] active state		00	
CA-24	○	Selection of Input terminal [4] active state		00	
CA-25	○	Selection of Input terminal [5] active state		00	
CA-26	○	Selection of Input terminal [6] active state		00	
CA-27	○	Selection of Input terminal [7] active state		00	
CA-28	○	Selection of Input terminal [8] active state		00	
CA-29	○	Selection of Input terminal [9] active state		00	
CA-30	○	Selection of Input terminal [A] active state		00	
CA-31	○	Selection of Input terminal [B] active state		00	
CA-41	○	Input terminal [1] response time	0 to 400 (ms)	2	
CA-42	○	Input terminal [2] response time		2	
CA-43	○	Input terminal [3] response time		2	
CA-44	○	Input terminal [4] response time		2	
CA-45	○	Input terminal [5] response time		2	
CA-46	○	Input terminal [6] response time		2	
CA-47	○	Input terminal [7] response time		2	
CA-48	○	Input terminal [8] response time		2	
CA-49	○	Input terminal [9] response time		2	
CA-50	○	Input terminal [A] response time		2	
CA-51	○	Input terminal [B] response time		2	
CA-55	○	Multistage input determination time	0 to 2000 (ms)	0	
CA-60	○	FUP/FDN overwrite target selection	00 (Frequency command)/01 (PID1)	00	
CA-61	○	FUP/FDN data save enable	00 (Not save)/01 (Save)	00	
CA-62	○	FUP/FDN UDC selection	00 (0Hz)/01 (saved data)	00	
CA-64	○	Acceleration time setting for FUP/FDN functions	0.00 to 3600.00 (s)	30.00	
CA-66	○	Deceleration time setting for FUP/FDN functions	0.00 to 3600.00 (s)	30.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
CA-70	○	Speed reference source selection at [F-OP] is active	01 (Ai1 terminal input)/02 (Ai2 terminal input)/ 03 (Ai3 terminal input)/04 (Reserved)/ 05 (Reserved)/06 (Reserved)/ 07 (Parameter setting)/08 (RS 485)/09 (Option 1)/ 10 (Option 2)/11 (Option 3)/ 12 (Pulse string input: main unit)/ 13 (Pulse string input: Option)/14 (Program function)/ 15 (PID calculation)/16 (Reserved)	01	
CA-71	○	RUN command source selection at [F-OP] is active	00 ([FW]/[RV] terminal)/01 (3 wire)/ 02 (RUN key on operator keypad)/ 03 (RS485)/04 (Option 1)/05 (Option 2)/06 (Option 3)/	00	
CA-72	-	Reset mode selection	00 (On to Release Trip)/01 (Off to Release Trip)/ 02 (On to Release at Trip)/03 (Off to Release at Trip)	00	
CA-81	-	Encoder constant setting	32 to 65535 (pls)	1024	
CA-82	-	Encoder position selection	00 (Phase-A is leading)/ 01 (Phase-B is leading)	00	
CA-83	-	Motor gear ratio Numerator	1 to 10000	1	
CA-84	-	Motor gear ratio Denominator	1 to 10000	1	
CA-90	-	Pulse train detection object selection	00 (Disabled)/01 (Frequency command)/ 02 (Speed feedback)/03 (Pulse count)	00	
CA-91	-	Mode selection of pulse train input	00 (90° phase difference)/ 01 (forward/reverse rotation command and rotation direction)/ 02 (forward/reverse rotation pulse string)	00	
CA-92	○	Pulse train frequency Scale	0.05 to 32.00 (kHz)	25.00	
CA-93	○	Pulse train frequency Filter time constant	0.01 to 2.00 (s)	0.10	
CA-94	○	Pulse train frequency Bias value	-100.0 to 100.0 (%)	0.0	
CA-95	○	Pulse train frequency High Limit	0.0 to 100.0 (%)	100.0	
CA-96	○	Pulse train frequency detection low level	0.0 to 100.0 (%)	0.0	
CA-97	○	Comparing match output ON-level for Pulse count	0 to 65535	0	
CA-98	○	Comparing match output OFF-level for Pulse count	0 to 65535	0	
CA-99	○	Comparing match output Maximum value for Pulse count	0 to 65535	65535	

<List of input terminal functions>

Function No.	Abbreviation	Function name
000	no	Without allocation
001	FW	Normal rotation
002	RV	Reverse rotation
003	CF1	Multistage speed 1
004	CF2	Multistage speed 2
005	CF3	Multistage speed 3
006	CF4	Multistage speed 4
007	SF1	Multistage speed bit 1
008	SF2	Multistage speed bit 2
009	SF3	Multistage speed bit 3
010	SF4	Multistage speed bit 4
011	SF5	Multistage speed bit 5
012	SF6	Multistage speed bit 6
013	SF7	Multistage speed bit 7
014	ADD	Addition of frequency
015	SCHG	Switching of command
016	STA	3-wire starting up
017	STP	3-wire stopping
018	F/R	3-wire normal and reverse
019	AHD	Retention of analog command
020	FUP	Acceleration through remote operation
021	FDN	Deceleration through remote operation
022	UDC	Clearing of remote operation data
023	F-OP	Forced switching of command
024	SET	Second control
028	RS	Reset
029	JG	Jogging
030	DB	Braking with external direct current
031	2CH	2-step acceleration/deceleration
032	FRS	Free-run stop
033	EXT	External abnormality
034	USP	Prevention of power restoration restarting
035	CS	Commercial switch
036	SFT	Soft-lock
037	BOK	Brake check
038	OLR	Switching of overload limit
039	KHC	Clearing of integrated input power
040	OKHC	Clearing of integrated output power
041	PID	PID1 disabled
042	PIDC	Resetting of PID1 integration
043	PID2	PID2 disabled
044	PIDC2	Resetting of PID2 integration
045	PID3	PID3 disabled
046	PIDC3	Resetting of PID3 integration
047	PID4	PID4 disabled
048	PIDC4	Resetting of PID4 integration
051	SVC1	PID1 multistage target value 1
052	SVC2	PID1 multistage target value 2
053	SVC3	PID1 multistage target value 3
054	SVC4	PID1 multistage target value 4
055	PRO	Switching of PID gain
056	PIO1	Switching of PID output

Function No.	Abbreviation	Function name
057	PIO2	Switching of PID output 2
058	SLEP	Satisfaction of SLEEP condition
059	WAKE	Satisfaction of WAKE condition
060	TL	Validation of torque limit
061	TRQ1	Torque limit switchover 1
062	TRQ2	Torque limit switchover 2
063	PPI	PPI control switch
064	CAS	Control gain switch
065	SON	Servo ON
066	FOC	Auxiliary excitation
067	ATR	Validation of torque control
068	TBS	Validation of torque bias
069	ORT	Orientation
071	LAC	Cancellation of LAD
072	PCLR	Clearing of positional deviation
073	STAT	Permission to inputting of Pulse string position command
074	PUP	Addition of positional bias
075	PDN	Subtraction of positional bias
076	CP1	Positional command selection 1
077	CP2	Positional command selection 2
078	CP3	Positional command selection 3
079	CP4	Positional command selection 4
080	ORL	Origin limit signal
081	ORG	Return-to-origin start up signal
082	FOT	Stopping of normal rotation driving
083	ROT	Stopping of reverse rotation driving
084	SPD	Switching of speed position
085	PSET	Presetting of positional data
086	MI1	General purpose input 1
087	MI2	General purpose input 2
088	MI3	General purpose input 3
089	MI4	General purpose input 4
090	MI5	General purpose input 5
091	MI6	General purpose input 6
092	MI7	General purpose input 7
093	MI8	General purpose input 8
094	MI9	General purpose input 9
095	MI10	General purpose input 10
096	MI11	General purpose input 11
097	PCC	Clearing of pulse counter
098	ECOM	Starting up of EzCOM
099	PRG	Starting of EzSQ program
100	HLD	Stopping of acceleration/deceleration
101	REN	Operation permission signal
102	DISP	Fixation of display
103	PLA	Pulse string input A
104	PLB	Pulse string input B
105	EMF	Emergency forced operation
107	COK	Contactor check signal
109	PLZ	Pulse string input Z
110	TCH	Teaching signal

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Cb-01	○	Filter time constant of Terminal [Ai1]	1 to 500 (ms)	16	
Cb-03	○	Start value of Terminal [Ai1]	0.00 to 100.00 (%)	0.00	
Cb-04	○	End value of Terminal [Ai1]	0.00 to 100.00 (%)	100.00	
Cb-05	○	Start rate of Terminal [Ai1]	0.0 to [Cb-06] (%)	0.0	
Cb-06	○	End rate of Terminal [Ai1]	[Cb-05] to 100.0 (%)	100.0	
Cb-07	○	Start point selection of Terminal [Ai1]	00 (Start amount)/01 (0%)	01	
Cb-11	○	Filter time constant of Terminal [Ai2]	1 to 500 (ms)	16	
Cb-13	○	Start value of Terminal [Ai2]	0.00 to 100.00 (%)	0.00	
Cb-14	○	End value of Terminal [Ai2]	0.00 to 100.00 (%)	100.00	
Cb-15	○	Start rate of Terminal [Ai2]	0.0 to [Cb-16] (%)	20.0	
Cb-16	○	End rate of Terminal [Ai2]	[Cb-15] to 100.0 (%)	100.0	
Cb-17	○	Start point selection of Terminal [Ai2]	00 (Start amount)/01 (0%)	01	
Cb-21	○	Filter time constant of Terminal [Ai3]	1 to 500 (ms)	16	
Cb-22	-	Terminal [Ai3] selection	00 (Single)/ 01 (Added to Ai1/Ai2: with reversibility)/ 02 (Added to Ai1/Ai2: without reversibility)	00	
Cb-23	○	Start value of Terminal [Ai3]	-100.00 to 100.00 (%)	-100.00	
Cb-24	○	End value of Terminal [Ai3]	-100.00 to 100.00 (%)	100.00	
Cb-25	○	Start rate of Terminal [Ai3]	-100.0 to [Cb-26]	-100.0	
Cb-26	○	End rate of Terminal [Ai3]	[Cb-25] to 100.0	100.0	
Cb-30	-	[Ai1] Voltage/Current zero-gain adjustment	-100.00 to 100.00	0.00	
Cb-31	-	[Ai1] Voltage/Current gain adjustment	0 to 200.00	100.00	
Cb-32	-	[Ai2] Voltage/Current zero-gain adjustment	-100.00 to 100.00	0.00	
Cb-33	-	[Ai2] Voltage/Current gain adjustment	0 to 200.00	100.00	
Cb-34	-	[Ai3] Voltage/Current zero-gain adjustment	-100.00 to 100.00	0.00	
Cb-35	-	[Ai3] Voltage gain adjustment	0 to 200.00	100.00	
Cb-40	○	Thermistor selection	00 (Disabled)/ 01 (PTC resistance value enabled)/ 02 (NTC resistance value enabled)	00	
Cb-41	-	Thermistor gain adjustment	0.0 to 1000.0	100.0	
Cb-51 to Cb-57	-	Reserved	-		

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
CC-01	○	Output terminal [11] function	See <*List of output terminal functions*> on page C-49	001	
CC-02	○	Output terminal [12] function		002	
CC-03	○	Output terminal [13] function		003	
CC-04	○	Output terminal [14] function		007	
CC-05	○	Output terminal [15] function		035	
CC-06	○	Output terminal [16] function		000	
CC-07	○	Output terminal [AL] function		017	
CC-11	○	Output terminal [11] function	00 (Normally open)/ 01 (Normally closed)	00	
CC-12	○	Output terminal [12] function		00	
CC-13	○	Output terminal [13] function		00	
CC-14	○	Output terminal [14] function		00	
CC-15	○	Output terminal [15] function		00	
CC-16	○	Output terminal [16] function		00	
CC-17	○	Output terminal [AL] function		01	
CC-20	○	Output terminal [11] on-delay time	0.00 to 100.00 (s)	0.00	
CC-21	○	Output terminal [11] off-delay time	0.00 to 100.00 (s)	0.00	
CC-22	○	Output terminal [12] on-delay time	0.00 to 100.00 (s)	0.00	
CC-23	○	Output terminal [12] off-delay time	0.00 to 100.00 (s)	0.00	
CC-24	○	Output terminal [13] on-delay time	0.00 to 100.00 (s)	0.00	
CC-25	○	Output terminal [13] off-delay time	0.00 to 100.00 (s)	0.00	
CC-26	○	Output terminal [14] on-delay time	0.00 to 100.00 (s)	0.00	
CC-27	○	Output terminal [14] off-delay time	0.00 to 100.00 (s)	0.00	
CC-28	○	Output terminal [15] on-delay time	0.00 to 100.00 (s)	0.00	
CC-29	○	Output terminal [15] off-delay time	0.00 to 100.00 (s)	0.00	
CC-30	○	Output terminal [16] on-delay time	0.00 to 100.00 (s)	0.00	
CC-31	○	Output terminal [16] off-delay time	0.00 to 100.00 (s)	0.00	
CC-32	○	Output terminal [AL] on-delay time	0.00 to 100.00 (s)	0.00	
CC-33	○	Output terminal [AL] off-delay time	0.00 to 100.00 (s)	0.00	
CC-40	○	Logical calculation target 1 selection of LOG1	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-41	○	Logical calculation target 2 selection of LOG1	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-42	○	Logical calculation symbol selection of LOG1	00 (AND)/01 (OR)/02 (XOR)	00	
CC-43	○	Logical calculation target 1 selection of LOG2	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-44	○	Logical calculation target 2 selection of LOG2	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-45	○	Logical calculation symbol selection of LOG2	00 (AND)/01 (OR)/02 (XOR)	00	
CC-46	○	Logical calculation target 1 selection of LOG3	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-47	○	Logical calculation target 2 selection of LOG3	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-48	○	Logical calculation symbol selection of LOG3	00 (AND)/01 (OR)/02 (XOR)	00	
CC-49	○	Logical calculation target 1 selection of LOG4	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-50	○	Logical calculation target 2 selection of LOG4	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-51	○	Logical calculation symbol selection of LOG4	00 (AND)/01 (OR)/02 (XOR)	00	
CC-52	○	Logical calculation target 1 selection of LOG5	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-53	○	Logical calculation target 2 selection of LOG5	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
CC-54	○	Logical calculation symbol selection of LOG5	00 (AND)/01 (OR)/02 (XOR)	00	
CC-55	○	Logical calculation target 1 selection of LOG6	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-56	○	Logical calculation target 2 selection of LOG6	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-57	○	Logical calculation symbol selection of LOG6	00 (AND)/01 (OR)/02 (XOR)	00	
CC-58	○	Logical calculation target 1 selection of LOG7	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-59	○	Logical calculation target 2 selection of LOG7	See <*List of output terminal functions*> on page C-49 062: LOG1 to 068: LOG7 cannnot be selected.	000	
CC-60	○	Logical calculation symbol selection of LOG7	00 (AND)/01 (OR)/02 (XOR)	00	

<List of output terminal functions>

Function No.	Abbreviation	Function name
000	no	Without allocation
001	RUN	During operation
002	FA1	When the constant speed is attained
003	FA2	Equal to or above the set frequency
004	FA3	Set frequency only
005	FA4	Equal to or above the set frequency 2
006	FA5	Set frequency only 2
007	IRDY	Operation ready completion
008	FWR	During normal rotation operation
009	RVR	During reverse rotation operation
010	FREF	Frequency command panel
011	REF	Operation command panel
012	SETM	Second control under selection
016	OPO	Optional output
017	AL	Alarm signal
018	MJA	Severe failure signal
019	OTQ	Excessive torque
020	IP	During instantaneous power failure
021	UV	Under insufficient voltage
022	TRQ	During torque limitation
023	IPS	During power failure deceleration
024	RNT	RUN time elapsed
025	ONT	Power ON time elapsed
026	THM	Electronic thermal warning
027	THC	Electronic thermal warning
029	WAC	Capacitor life advance notice
030	WAF	Fan life advance notice
031	FR	Operation command signal
032	OHF	Cooling fin heating advance notice
033	LOC	Low current signal
034	LOC2	Low current signal 2
035	OL	Overload advance notice
036	OL2	Overload advance notice 2
037	BRK	Brake release
038	BER	Brake abnormality
039	CON	Contactor control
040	ZS	0 Hz detection signal
041	DSE	Excessive speed deviation
042	PDD	Excessive positional deviation
043	POK	Positioning completed
044	PCMP	Pulse count compare-match output
045	OD	PID excessive deviation
046	FBV	PID feedback comparison
047	OD2	PID2 excessive deviation
048	FBV2	PID2 feedback comparison
049	NDc	Communication disconnection
050	Ai1Dc	Analog disconnection Ai1
051	Ai2Dc	Analog disconnection Ai2
052	Ai3Dc	Analog disconnection Ai3
056	WCAi1	Window comparator Ai1
057	WCAi2	Window comparator Ai2
058	WCAi3	Window comparator Ai3

Function No.	Abbreviation	Function name
062	LOG1	Result of logical operation 1
063	LOG2	Result of logical operation 2
064	LOG3	Result of logical operation 3
065	LOG4	Result of logical operation 4
066	LOG5	Result of logical operation 5
067	LOG6	Result of logical operation 6
068	LOG7	Result of logical operation 7
069	MO1	General purpose output 1
070	MO2	General purpose output 2
071	MO3	General purpose output 3
072	MO4	General purpose output 4
073	MO5	General purpose output 5
074	MO6	General purpose output 6
075	MO7	General purpose output 7
076	EMFC	Forced operation in process signal
077	EMBP	During-bypass-mode signal
080	LBK	Operation panel battery insufficient
081	OVS	Excessive voltage of accepted power
084	AC0	Alarm code bit 0
085	AC1	Alarm code bit 1
086	AC2	Alarm code bit 2
087	AC3	Alarm code bit 3
089	OD3	PID3 excessive deviation
090	FBV3	PID3 feedback comparison
091	OD4	PID4 excessive deviation
092	FBV4	PID4 feedback comparison
093	SSE	PID soft start abnormality
053 to 055		Reserved
059 to 061		Reserved

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Cd-01	-	[FM] monitor output wave form selection	00 (PWM)/01 (frequency)	00	
Cd-02	-	[FM] monitor output base frequency (at PWM output)	0 to 3600 (Hz)	2880	
Cd-03	○	[FM] monitor output selection	See the *<List of output monitor functions>* on page C-52	[dA-01]	
Cd-04	○	[Ao1] monitor output selection	See the *<List of output monitor functions>* on page C-52	[dA-01]	
Cd-05	○	[Ao2] monitor output selection	See the *<List of output monitor functions>* on page C-52	[dA-01]	
Cd-10	-	Analog monitor adjustment mode enable	00 (Disabled)/01 (Enabled)	00	
Cd-11	-	Filter time constant of [FM]monitor	1 to 500 (ms)	100	
Cd-12	-	[FM] Data type selection	00 (absolute value)/01 (with sign)	00	
Cd-13	○	[FM] monitor bias adjustment	-100.0 to 100.0 (%)	0.0	
Cd-14	○	[FM] monitor gain adjustment	-1000.0 to 1000.0 (%)	100.0	
Cd-15	○	Output level setting at [FM] monitor adjust mode	-100.0 to 100.0 (%)	100.0	
Cd-21	-	Filter time constant of [Ao1] monitor	1 to 500 (ms)	100	
Cd-22	-	[Ao1] Data type selection	00 (absolute value)/01 (with sign)	00	
Cd-23	○	[Ao1] monitor bias adjustment	-100.0 to 100.0 (%)	0.0	
Cd-24	○	[Ao1] monitor gain adjustment	-1000.0 to 1000.0 (%)	100.0	
Cd-25	○	Output level setting at [Ao1] monitor adjust mode	-100.0 to 100.0 (%)	100.0	
Cd-31	-	Filter time constant of [Ao2] monitor	1 to 500 (ms)	100	
Cd-32	-	[Ao2] data type selection	00 (absolute value)/01 (with sign)	00	
Cd-33	○	[Ao2] monitor bias adjustment	-100.0 to 100.0 (%)	20.0	
Cd-34	○	[Ao2] monitor gain adjustment	-1000.0 to 1000.0 (%)	80.0	
Cd-35	○	Output level setting at [Ao2] monitor adjust mode	-100.0 to 100.0 (%)	100.0	

<List of output monitor functions>

Monitor No.	Function	Modbus No.	Register No. 0 to 65535 (Register No. of d, F code)
dA-01	Output frequency monitor	2711h	10001
dA-02	Output current monitor	2712h	10002
dA-04	Frequency command after calculation	2714h	10004
dA-08	Speed detection value monitor	2718h	10008
dA-12	Output frequency monitor (with sign)	271Ch	10012
dA-14	Frequency upper limit monitor	271Eh	10014
dA-15	Torque command monitor after calculation	271Fh	10016
dA-16	Torque limit monitor	2720h	10017
dA-17	Output torque monitor	2721h	10018
dA-18	Output voltage monitor	2722h	10020
dA-30	Input power monitor	272Eh	10030
dA-34	Output power monitor	2732h	10034
dA-38	Motor temperature monitor	2736h	10038
dA-40	DC voltage monitor	2738h	10040
dA-41	BRD load factor monitor	2739h	10041
dA-42	Electronic thermal duty ratio monitor MTR	273Ah	10042
dA-43	Electronic thermal duty ratio monitor CTL	273Bh	10043
dA-61	Analog input [Ai1] monitor	274Dh	10061
dA-62	Analog input [Ai2] monitor	274Eh	10062
dA-63	Analog input [Ai3] monitor	274Fh	10063
dA-70	Pulse string input monitor main body	2756h	10070
dA-71	Pulse string input monitor option	2757h	10071
db-18	Analog output monitor YA0	2786h	10118
db-19	Analog output monitor YA1	2787h	10119
db-20	Analog output monitor YA2	2788h	10120
db-30	PID1 feedback data 1 monitor	2792h	10130
db-32	PID1 feedback data 2 monitor	2794h	10132
db-34	PID1 feedback data 3 monitor	2796h	10134
db-36	PID2 feedback data monitor	2798h	10136
db-38	PID3 feedback data monitor	279Ah	10138
db-40	PID4 feedback data monitor	279Ch	10140
db-42	PID1 target value monitor after calculation	279Eh	10142
db-44	PID1 feedback data	27A0h	10144
db-50	PID1 output monitor	27A6h	10150
db-51	PID1 deviation monitor	27A7h	10151
db-52	PID1 deviation 1 monitor	27A8h	10152
db-53	PID1 deviation 2 monitor	27A9h	10153
db-54	PID1 deviation 3 monitor	27AAh	10154
db-55	PID2 output monitor	27ABh	10155
db-56	PID2 deviation monitor	27ACh	10156
db-57	PID3 output monitor	27ADh	10157
db-58	PID3 deviation monitor	27AEh	10158
db-59	PID4 output monitor	27AFh	10159
db-60	PID4 deviation monitor	27B0h	10160
db-64	PID feed-forward monitor	27B4h	10164
dC-15	Cooling fin temperature monitor	27E7h	10215
FA-01	Main Speed reference monitor	2AF9h	11001
FA-02	Sub Speed reference monitor	2AFAh	11002
FA-15	Torque reference monitor	2B07h	11015
FA-16	Torque bias monitor	2B08h	11016

Monitor No.	Function	Modbus No.	Register No. 0 to 65535 (Register No. of d, F code)
FA-30	PID1 Set Value 1 monitor	2B16h	11030
FA-32	PID1 Set Value 2 monitor	2B18h	11032
FA-34	PID1 Set Value 3 monitor	2B1Ah	11034
FA-36	PID2 Set Value monitor	2B1Ch	11036
FA-38	PID3 Set Value monitor	2B1Eh	11038
FA-40	PID4 Set Value monitor	2B20h	11040

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
CE101	○	Low current signal output mode selection, 1st motor	00 (During acceleration/deceleration, at constant speed)/ 01 (Only at constant speed)	01	
CE102	○	Low current detection level 1, 1st motor	(0.0 to 2.0) × Inverter rated current*1	1.0 × Inverter rated current	
CE103	○	Low current detection level 2, 1st motor	(0.0 to 2.0) × Inverter rated current*1	1.0 × Inverter rated current	
CE105	○	Over current signal output mode selection, 1st motor	00 (During acceleration/deceleration, at constant speed)/ 01 (Only at constant speed)	01	
CE106	○	Over current detection level 1, 1st motor	(0.0 to 2.0) × Inverter rated current*1	1.0 × Inverter rated current	
CE107	○	Over current detection level 2, 1st motor	(0.0 to 2.0) × Inverter rated current*1	1.0 × Inverter rated current	
CE-10	○	Arrival frequency setting during acceleration 1	0.00 to 590.00 (Hz)	0.00	
CE-11	○	Arrival frequency setting during deceleration 1	0.00 to 590.00 (Hz)	0.00	
CE-12	○	Arrival frequency setting during acceleration 2	0.00 to 590.00 (Hz)	0.00	
CE-13	○	Arrival frequency setting during deceleration 2	0.00 to 590.00 (Hz)	0.00	
CE120	○	Over torque level (Forward driving), 1st motor	0.0 to 500.0 (%)	100.0	
CE121	○	Over torque level (Reverse regenerative), 1st motor	0.0 to 500.0 (%)	100.0	
CE122	○	Over torque level (Reverse driving), 1st motor	0.0 to 500.0 (%)	100.0	
CE123	○	Over torque level (Forward regenerative), 1st motor	0.0 to 500.0 (%)	100.0	
CE-30	○	Electronic thermal warning level (MTR)	0.00 to 100.00 (%)	80.00	
CE-31	○	Electronic thermal warning level (CTL)	0.00 to 100.00 (%)	80.00	
CE-33	○	Zero speed detection level	0.00 to 100.00 (%)	0.50	
CE-34	○	Cooling FAN over-heat warning level	0 to 200 (°C)	120	
CE-36	○	Accum.RUN(RNT)/Accum.Power-on (ONT) time setting	0 to 100000 (hr)	0	
CE-40	○	Window comparator for [Ai1] higher level	0 to 100 (%)	100	
CE-41	○	Window comparator for [Ai1] lower level	0 to 100 (%)	0	
CE-42	○	Window comparator for [Ai1] hysteresis width	0 to 10 (%)	0	
CE-43	○	Window comparator for [Ai2] higher level	0 to 100 (%)	100	
CE-44	○	Window comparator for [Ai2] lower level	0 to 100 (%)	0	
CE-45	○	Window comparator for [Ai2] hysteresis width	0 to 10 (%)	0	
CE-46	○	Window comparator for [Ai3] higher level	-100 to 100 (%)	100	
CE-47	○	Window comparator for [Ai3] lower level	-100 to 100 (%)	-100	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
CE-48	○	Window comparator for [Ai3] hysteresis width	0 to 10 (%)	0	
CE-50	○	Operation level at [Ai1] disconnection	0 to 100 (%)	0	
CE-51	○	Operation level selection at [Ai1] disconnection	00 (Disabled)/01 (Enabled: out of range) 02 (Enabled: within the range)	00	
CE-52	○	Operation level at [Ai2] disconnection	0 to 100(%)	0	
CE-53	○	Operation level selection at [Ai2] disconnection	00 (Disabled)/01 (Enabled: out of range)/ 02 (Enabled: within the range)	00	
CE-54	○	Operation level at [Ai3] disconnection	-100 to 100(%)	0	
CE-55	○	Operation level selection at [Ai3] disconnection	00 (Disabled)/01 (Enabled: out of range)/ 02 (Enabled: within the range)	00	
CE201	○	Low current signal output mode selection, 2nd-motor	00 (During acceleration/deceleration, at constant speed)/ 01 (Only at constant speed)	01	
CE202	○	Low current detection level 1, 2nd-motor	(0.0 to 2.0) × Inverter rated current*1	1.0 × Inverter rated current	
CE203	○	Low current detection level 2, 2nd-motor	(0.0 to 2.0) × Inverter rated current*1	1.0 × Inverter rated current	
CE205	○	Over current signal output mode selection, 2nd-motor	00 (During acceleration/deceleration, at constant speed)/ 01 (Only at constant speed)	01	
CE206	○	Over current detection level 1, 2nd-motor	(0.0 to 2.0) × Inverter rated current*1	1.0 × Inverter rated current	
CE207	○	Over current detection level 2, 2nd-motor	(0.0 to 2.0) × Inverter rated current*1	1.0 × Inverter rated current	
CE220	○	Over torque level (Forward driving), 2nd-motor	0.0 to 500.0 (%)	100.0	
CE221	○	Over torque level (Reverse regenerative), 2nd-motor	0.0 to 500.0 (%)	100.0	
CE222	○	Over torque level (Reverse driving), 2nd-motor	0.0 to 500.0 (%)	100.0	
CE223	○	Over torque level (Forward regenerative), 2nd motor	0.0 to 500.0 (%)	100.0	

*1. On the parameter about the current and the voltage, the figures and the units to be handled vary in the setting path.

1) Operator or CX-Drive: 0.1 A or 0.1 V (When CX-Drive is operated, set [CF-11] Resister data selection to 00 (A,V). When the data of [CF-11] Resister data selection is not set to 00 (A,V), it is not set or displayed correctly.)

2) Modbus: The current and the voltage vary, depending on the setting of Resister data selection [CF-11].
When [CF-11] Resister data selection is set to 00 (A,V), 0.1 A, 0.1 V
When [CF-11] Resister data selection is set to 01 (%), 0.01% (Rated ratio)

3) Drive programming: 0.01% (Rated ratio)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
CF-01	-	RS485 communication baud rate selection	03 (2400bps)/04 (4800bps)/05 (9600bps)/06 (19.2kbps)/ 07 (38.4kbps)/08 (57.6kbps)/09 (76.8kbps)/ 10 (115.2kbps)	05	
CF-02	○	RS485 communication Node allocation	1 to 247	1	
CF-03	○	RS485 communication parity selection	00 (Without parity)/ 01 (Even number parity)/02 (Odd number parity)	00	
CF-04	○	RS485 communication stop-bit selection	01 (1bit)/02 (2bit)	01	
CF-05	○	RS485 communication error selection	00 (Error)/01 (Trip after deceleration stop)/02 (Ignore)/ 03 (Free run)/04 (Deceleration stop)	02	
CF-06	○	RS485 communication timeout setting	0.00 to 100.00 (s)	0.00	
CF-07	○	RS485 communication wait time setting	0 to 1000 (ms)	2	
CF-08	○	RS485 communication mode selection	01 (Modbus-RTU)/02 (EzCOM)/ 03 (EzCOM management)	01	
CF-11	-	Resister data selection	00 (A,V)/01 (%)	00	
CF-20	-	EzCOM start node No.	01 to 08	1	
CF-21	-	EzCOM End node No.	01 to 08	1	
CF-22	-	EzCOM start method selection	00 (ECOM) terminal)/01 (Modbus spec)	00	
CF-23	○	EzCOM data size	01 to 05	5	
CF-24	○	EzCOM destination address 1	1 to 247	1	
CF-25	○	EzCOM destination register 1	0000 to FFFF	0000	
CF-26	○	EzCOM source register 1	0000 to FFFF	0000	
CF-27	○	EzCOM destination address 2	1 to 247	2	
CF-28	○	EzCOM destination register 2	0000 to FFFF	0000	
CF-29	○	EzCOM source register 2	0000 to FFFF	0000	
CF-30	○	EzCOM destination address 3	1 to 247	3	
CF-31	○	EzCOM destination register 3	0000 to FFFF	0000	
CF-32	○	EzCOM source register 3	0000 to FFFF	0000	
CF-33	○	EzCOM destination address 4	1 to 247	4	
CF-34	○	EzCOM destination register 4	0000 to FFFF	0000	
CF-35	○	EzCOM source register 4	0000 to FFFF	0000	
CF-36	○	EzCOM destination address 5	1 to 247	5	
CF-37	○	EzCOM destination register 5	0000 to FFFF	0000	
CF-38	○	EzCOM source register 5	0000 to FFFF	0000	
CF-50	○	USB communication Node allocation	1 to 247	1	

Parameter Mode (Code H)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
HA-01	-	Auto-tuning selection	00 (Disabled)/01 (Non-rotation)/ 02 (Rotation)/03 (IVMS)	00	
HA-02	-	RUN command selection at Auto-tuning	00 (RUN key on the LCD operator)/ 01 ([AA111]/[AA211])	00	
HA-03	-	Online auto-tuning selection	00 (Disabled)/01 (Enabled)	00	
HA110	○	Stabilization constant, 1st-motor	0 to 1000 (%)	100	
HA115	○	Speed response for Async.M, 1st-motor	0 to 1000 (%)	100	
HA120	○	ASR gain switching mode selection, 1st-motor	00 ([CAS] terminal)/ 01 (setting switch)	00	
HA121	○	ASR gain switching time setting, 1st-motor	0 to 10000 (ms)	100	
HA122	○	ASR gain mapping intermediate speed 1, 1st-motor	0.00 to 590.00 (Hz)	0.00	
HA123	○	ASR gain mapping intermediate speed 2, 1st-motor	0.00 to 590.00 (Hz)	0.00	
HA124	○	ASR gain mapping Maximum speed, 1st-motor	0.00 to 590.00 (Hz)	0.00	
HA125	○	ASR gain mapping P-gain 1, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA126	○	ASR gain mapping I-gain 1, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA127	○	ASR gain mapping P-gain 1 at P-control, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA128	○	ASR gain mapping P-gain 2, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA129	○	ASR gain mapping I-gain 2, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA130	○	ASR gain mapping P-gain 2 at P-control, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA131	○	ASR gain mapping P-gain 3, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA132	○	ASR gain mapping I-gain 3, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA133	○	ASR gain mapping P-gain 4, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA134	○	ASR gain mapping I-gain 4, 1st-motor	0.0 to 1000.0 (%)	100.0	
HA210	○	Stabilization constant, 2nd-motor	0 to 1000 (%)	100	
HA215	○	Speed response for Async.M, 2nd-motor	0 to 1000 (%)	100	
HA220	○	ASR gain switching mode selection, 2nd-motor	00 ([CAS] terminal)/ 01 (setting switch)	00	
HA221	○	ASR gain switching time setting, 2nd-motor	0 to 10000 (ms)	100	
HA222	○	ASR gain mapping intermediate speed 1, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
HA223	○	ASR gain mapping intermediate speed 2, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
HA224	○	ASR gain mapping Maximum speed, 2nd-motor	0.00 to 590.00 (Hz)	0.00	
HA225	○	ASR gain mapping P-gain 1, 2nd-motor	0.0 to 1000.0 (%)	100.0	
HA226	○	ASR gain mapping I-gain 1, 2nd-motor	0.0 to 1000.0 (%)	100.0	
HA227	○	ASR gain mapping P-gain 1 at P-control, 2nd-motor	0.0 to 1000.0 (%)	100.0	
HA228	○	ASR gain mapping P-gain 2, 2nd-motor	0.0 to 1000.0 (%)	100.0	
HA229	○	ASR gain mapping I-gain 2, 2nd-motor	0.0 to 1000.0 (%)	100.0	
HA230	○	ASR gain mapping P-gain 2 at P-control, 2nd-motor	0.0 to 1000.0 (%)	100.0	
HA231	○	ASR gain mapping P-gain 3, 2nd-motor	0.0 to 1000.0 (%)	100.0	
HA232	○	ASR gain mapping I-gain 3, 2nd-motor	0.0 to 1000.0 (%)	100.0	
HA233	○	ASR gain mapping P-gain 4, 2nd-motor	0.0 to 1000.0 (%)	100.0	
HA234	○	ASR gain mapping I-gain 4, 2nd-motor	0.0 to 1000.0 (%)	100.0	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Hb102	-	Async.Motor capacity setting, 1st-motor	0.01 to 160.00 (kW)	*1	
Hb105	-	Async.Motor Maximum frequency setting, 1st-motor	10.00 to 590.00 (Hz)	50.00*2	
Hb106	-	Async.Motor rated voltage, 1st-motor	1 to 1000 (V)	200 V class: 230 400 V class: 400*2 460 (*FUF)	
Hb108	-	Async.Motor rated current, 1st-motor	0.01 to 10000.00 (A)	*1	
Hb110	-	Async.Motor constant R1, 1st-motor	0.000001 to 1000.000000 (Ω)	*1	
Hb112	-	Async.Motor constant R2, 1st-motor	0.000001 to 1000.000000 (Ω)	*1	
Hb114	-	Async.Motor constant L, 1st-motor	0.000001 to 1000.000000 (mH)	*1	
Hb116	-	Async.Motor constant Io, 1st-motor	0.01 to 10000.00 (A)	*1	
Hb118	-	Async.Motor constant J, 1st-motor	0.00001 to 10000.00000 (kgm^2)	*1	
Hb130	-	Minimum frequency adjustment, 1st-motor	0.10 to 10.00 (Hz)	0.50	
Hb131	○	Reduced voltage start time setting, 1st-motor	0 to 2000 (ms)	36	
Hb140	-	Manual torque boost operational mode selection, 1st-motor	00 (Disabled)/ 01 (Always enabled)/ 02 (Enabled only for forward revolution)/ 03 (Enabled only for reverse revolution)	01	
Hb141	○	Manual torque boost value, 1st-motor	0.0 to 20.0 (%)	0.0	
Hb142	○	Manual torque boost Peak speed, 1st-motor	0.0 to 50.0 (%)	0.0	
Hb145	-	Eco drive enable, 1st-motor	00 (Disabled)/01 (Enabled)	00	
Hb146	○	Eco drive response adjustment, 1st-motor	0.0 to 100.0(%)	50.0	
Hb150	-	Free-V/f frequency 1 setting, 1st-motor	0.00 to [Hb152] (Hz)	0.00	
Hb151	-	Free-V/f Voltage 1 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	
Hb152	-	Free-V/f frequency 2 setting, 1st-motor	[Hb150] to [Hb154] (Hz)	0.00	
Hb153	-	Free-V/f Voltage 2 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	
Hb154	-	Free-V/f frequency 3 setting, 1st-motor	[Hb152] to [Hb156] (Hz)	0.00	
Hb155	-	Free-V/f Voltage 3 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	
Hb156	-	Free-V/f frequency 4 setting, 1st-motor	[Hb154] to [Hb158] (Hz)	0.00	
Hb157	-	Free-V/f Voltage 4 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	
Hb158	-	Free-V/f frequency 5 setting, 1st-motor	[Hb156] to [Hb160] (Hz)	0.00	
Hb159	-	Free-V/f Voltage 5 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	
Hb160	-	Free-V/f frequency 6 setting, 1st-motor	[Hb158] to [Hb162] (Hz)	0.00	
Hb161	-	Free-V/f Voltage 6 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Hb162	-	Free-V/f frequency 7 setting, 1st-motor	[Hb160] to [Hb104] (Hz)	0.00	
Hb163	-	Free-V/f Voltage 7 setting, 1st-motor	0.0 to 1000.0 (V)	0.0	
Hb170	○	Slip Compensation P-gain with encoder, 1st-motor	0 to 1000 (%)	100	
Hb171	○	Slip Compensation I-gain with encoder, 1st-motor	0 to 1000 (%)	100	
Hb180	○	Output voltage gain, 1st-motor	0 to 255 (%)	100	
Hb202	-	Async.Motor capacity setting, 2nd-motor	0.01 to 160.00 (kW)	*1	
Hb203	-	Async.Motor poles setting, 2nd-motor	2 to 48 (poles)	4	
Hb204	-	Async.Motor Base frequency setting, 2nd-motor	10.00 to 590.00 (Hz)	50.00*2	
Hb205	-	Async.Motor Maximum frequency setting, 2nd-motor	10.00 to 590.00 (Hz)	50.00*2	
Hb206	-	Async.Motor rated voltage, 2nd-motor	1 to 1000 (V)	200 V class: 230 400 V class: 400*2	
Hb208	-	Async.Motor rated current, 2nd-motor	0.01 to 10000.00 (A)	*1	
Hb210	-	Async.Motor constant R1, 2nd-motor	0.000001 to 1000.000000 (Ω)	*1	
Hb212	-	Async.Motor constant R2, 2nd-motor	0.000001 to 1000.000000 (Ω)	*1	
Hb214	-	Async.Motor constant L, 2nd-motor	0.000001 to 1000.000000 (mH)	*1	
Hb216	-	Async.Motor constant Io, 2nd-motor	0.01 to 10000.00 (A)	*1	
Hb218	-	Async.Motor constant J, 2nd-motor	0.00001 to 10000.00000 (kgm^2)	*1	
Hb230	-	Minimum frequency adjustment, 2nd-motor	0.10 to 10.00 (Hz)	0.50	
Hb231	○	Reduced voltage start time setting, 2nd-motor	0 to 2000 (ms)	36	
Hb240	-	Manual torque boost operational mode selection, 2nd-motor	00 (Disabled)/ 01 (Always enabled)/ 02 (Enabled only for forward revolution)/ 03 (Enabled only for reverse revolution)	01	
Hb241	○	Manual torque boost value, 2nd-motor	0.0 to 20.0 (%)	0.0	
Hb242	○	Manual torque boost Peak speed, 2nd-motor	0.0 to 50.0 (%)	0.0	
Hb245	-	Eco drive enable, 2nd-motor	00 (Disabled)/01 (Enabled)	00	
Hb246	○	Eco drive response adjustment, 2nd-motor	0.0 to 100.0 (%)	50.0	
Hb250	-	First free V/f frequency 2	0.00 to [Hb252] (Hz)	0	
Hb251	-	Free-V/f Voltage 1 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	
Hb252	-	Free-V/f frequency 2 setting, 2nd-motor	[Hb250] to [Hb254] (Hz)	0.00	
Hb253	-	Free-V/f Voltage 2 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	
Hb254	-	Free-V/f frequency 3 setting, 2nd-motor	[Hb252] to [Hb256] (Hz)	0.00	
Hb255	-	Free-V/f Voltage 3 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	
Hb256	-	Free-V/f frequency 4 setting, 2nd-motor	[Hb254] to [Hb258] (Hz)	0.00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Hb257	-	Free-V/f Voltage 4 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	
Hb258	-	Free-V/f frequency 5 setting, 2nd-motor	[Hb256] to [Hb260] (Hz)	0.00	
Hb259	-	Free-V/f Voltage 5 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	
Hb260	-	Free-V/f frequency 6 setting, 2nd-motor	[Hb258] to [Hb262] (Hz)	0.00	
Hb261	-	Free-V/f Voltage 6 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	
Hb262	-	Free-V/f frequency 7 setting, 2nd-motor	[Hb260] to [Hb204] (Hz)	0.00	
Hb263	-	Free-V/f Voltage 7 setting, 2nd-motor	0.0 to 1000.0 (V)	0.0	
Hb270	○	Slip Compensation P-gain with encoder, 2nd-motor	0 to 1000 (%)	100	
Hb271	○	Slip Compensation I-gain with encoder, 2nd-motor	0 to 1000 (%)	100	
Hb280	○	Output voltage gain, 2nd-motor(V/f)	0 to 255 (%)	100	

*1. Varies depending on inverter models and settings of duty rating.

*2. It is a default value when Default Value Selection (Ub-02) is set to 01.

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
HC101	○	Automatic torque boost voltage compensation gain, 1st-motor	0 to 255 (%)	100	
HC102	○	Automatic torque boost slip compensation gain, 1st-motor	0 to 255 (%)	100	
HC110	○	Zero speed area limit for Async.M-0SLV, 1st-motor	0 to 100 (%)	80	
HC111	○	Boost value at start for Async.M-SLV/IM-CLV, 1st-motor	0 to 50 (%)	0	
HC112	○	Boost value at start for Async.M-0SLV, 1st-motor	0 to 50 (%)	10	
HC113	-	Secondary resistance correction, 1st-motor	00 (Disabled)/01 (Enabled)	00	
HC114	○	Counter direction run protection selection, 1st-motor	00 (Disabled)/01 (Enabled)	00	
HC120	○	Torque current reference filter time constant, 1st-motor	0 to 100 (ms)	2	
HC121	○	Speed feedforward compensation gain, 1st-motor	0 to 1000	0	
HC201	○	Automatic torque boost voltage compensation gain, 2nd-motor	0 to 255 (%)	100	
HC202	○	Automatic torque boost slip compensation gain, 2nd-motor	0 to 255 (%)	100	
HC210	○	Zero speed area limit for Async.M-0SLV, 2nd-motor	0 to 100 (%)	80	
HC211	○	Boost value at start for Async.M-SLV/IM-CLV, 2nd-motor	0 to 50 (%)	0	
HC212	○	Boost value at start for Async.M-0SLV, 2nd-motor	0 to 50 (%)	10	
HC213	-	Secondary resistance correction, 2nd-motor	00 (Disabled)/01 (Enabled)	00	
HC214	○	Counter direction run protection selection, 2nd-motor	00 (Disabled)/01 (Enabled)	00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
HC220	○	Torque current reference filter time constant, 2nd-motor	0 to 100 (ms)	2	
HC221	○	Speed feedforward compensation gain, 2nd-motor	0 to 1000	0	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Hd102	-	Sync.Motor capacity setting, 1st-motor	0.01 to 160.00 (kW)	*1	
Hd103	-	Sync.Motor poles setting, 1st-motor	2 to 48 (poles)	*1	
Hd104	-	Sync.Base frequency setting, 1st-motor	10.00 to 590.00 (Hz)	*1	
Hd105	-	Sync.Maximum frequency setting, 1st-motor	10.00 to 590.00 (Hz)	*1	
Hd106	-	Sync.Motor rated voltage, 1st-motor	1 to 1000 (V)	*1	
Hd108	-	Sync.Motor rated current, 1st-motor	0.01 to 10000.00 (A)	*1	
Hd110	-	Sync.Motor constant R, 1st-motor	0.000001 to 1000.000000 (Ω)	*1	
Hd112	-	Sync.Motor constant Ld, 1st-motor	0.000001 to 1000.000000 (mH)	*1	
Hd114	-	Sync.Motor constant Lq, 1st-motor	0.000001 to 1000.000000 (mH)	*1	
Hd116	-	Sync.Motor constant Ke, 1st-motor	0.1 to 100000.0 (mVs/rad)	*1	
Hd118	-	Sync.Motor constant J, 1st-motor	0.00001 to 10000.00000 (kgm^2)	*1	
Hd130	○	Minimum Frequency for Sync.M-SLV, 1st-motor	0 to 50 (%)	8	
Hd131	○	No-Load current for Sync.M-SLV, 1st-motor	0 to 100 (%)	10	
Hd132	-	Starting Method for Sync.M, 1st-motor	00 (Position estimation disabled)/ 01 (Position estimation enabled)	00	
Hd133	-	IMPE 0V wait number for Sync.M, 1st-motor	0 to 255	10	
Hd134	-	IMPE detect wait number for Sync.M, 1st-motor	0 to 255	10	
Hd135	-	IMPE detect number for Sync.M, 1st-motor	0 to 255	30	
Hd136	-	IMPE voltage gain for Sync.M, 1st-motor	0 to 200 (%)	100	
Hd137	-	IMPE Mg-pole position offset, 1st-motor	0 to 359 (deg)	0	
Hd-41	○	Carrier frequency at IVMS	0.5 to 16.0 (kHz)	2.0	
Hd-42	○	Filter gain of current detection at IVMS	0 to 1000	100	
Hd-43	-	Open phase voltage detection gain	00 (Gain 0)/01 (Gain 1)/02 (Gain 2)/03 (Gain 3)	00	
Hd-44	○	Open phase switching threshold compensation	00 (Disabled)/01 (Enabled)	01	
Hd-45	○	P-Gain for speed control, SM(PMM)-IVMS	0 to 1000	100	
Hd-46	○	I-Gain for speed control, SM(PMM)-IVMS	0 to 10000	100	
Hd-47	○	Wait time for open phase switching, SM(PMM)-IVMS	0 to 1000	15	
Hd-48	○	Limitation of decision about the drive direction, SM(PMM)-IVMS	00 (Disabled)/01 (Enabled)	01	
Hd-49	○	Open phase voltage detection timing adjustment, SM(PMM)-IVMS	0 to 1000	10	
Hd-50	○	Minimum pulse width adjustment, SM(PMM)-IVMS	0 to 1000	100	
Hd-51	○	IVMS Current Limit for threshold	0 to 255	100	
Hd-52	○	IVMS threshold gain	0 to 255	100	
Hd-58	○	IVMS carrier-frequency start/end point	0 to 50 (%)	5	
Hd202	-	Sync.Motor capacity setting, 2nd-motor	0.01 to 160.00 (kW)	*1	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Hd203	-	Sync.Motor poles setting, 2nd-motor	2 to 48 (poles)	*1	
Hd204	-	Sync.Base frequency setting, 2nd-motor	10.00 to 590.00 (Hz)	*1	
Hd205	-	Sync.Maximum frequency setting, 2nd-motor	10.00 to 590.00 (Hz)	*1	
Hd206	-	Sync.Motor rated voltage, 2nd-motor	1 to 1000 (V)	*1	
Hd208	-	Sync.Motor rated current, 2nd-motor	0.01 to 10000.00 (A)	*1	
Hd210	-	Sync.Motor constant R, 2nd-motor	0.000001 to 1000.000000 (Ω)	*1	
Hd212	-	Sync.Motor constant Ld, 2nd-motor	0.000001 to 1000.000000 (mH)	*1	
Hd214	-	Sync.Motor constant Lq, 2nd-motor	0.000001 to 1000.000000 (mH)	*1	
Hd216	-	Sync.Motor constant Ke, 2nd-motor	0.1 to 100000.0 (mVs/rad)	*1	
Hd218	-	Sync.Motor constant J, 2nd-motor	0.00001 to 10000.00000 (kgm^2)	*1	
Hd230	○	Minimum Frequency for Sync.M-SLV, 2nd-motor	0 to 50 (%)	8	
Hd231	○	No-Load current for Sync.M-SLV, 2nd-motor	0 to 100 (%)	10	
Hd232	-	Starting Method for Sync.M, 2nd-motor	00 (Position estimation disabled)/ 01 (Position estimation enabled)	00	
Hd233	-	IMPE 0V wait number for Sync.M, 2nd-motor	0 to 255	10	
Hd234	-	IMPE detect wait number for Sync.M, 2nd-motor	0 to 255	10	
Hd235	-	IMPE detect number for Sync.M, 2nd-motor	0 to 255	30	
Hd236	-	IMPE voltage gain for Sync.M, 2nd-motor	0 to 200 (%)	100	
Hd237	-	IMPE Mg-pole position offset, 2nd-motor	0 to 359 (deg)	0	

*1. Varies depending on inverter models and settings of duty rating.

Parameter Mode (Code o)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
oA-10	○	Operation mode on option card error (SLOT-1)	00 (Error)/01 (Continue operation)	00	
oA-11	○	Communication Watch Dog Timer	0.00 to 100.00 (s)	1.00	
oA-12	-	Action selection at communication error	00 (Error)/ 01 (Trip after deceleration stop)/02 (Ignore)/ 03 (Free run)/04 (Deceleration stop)	01	
oA-13	-	Run command enable option during the option card (SLOT-1) start-up	00 (Operation command disabled)/ 01 (Operation command enabled)	00	
oA-20	○	Operation mode on option card error (SLOT-2)	00 (Error)/01 (Continue operation)	00	
oA-21	○	Communication Watch Dog Timer	0.00 to 100.00 (s)	1.00	
oA-22	-	Action selection at communication error	00 (Error)/ 01 (Trip after deceleration stop)/02 (Ignore)/ 03 (Free run)/04 (Deceleration stop)	01	
oA-23	-	Run command enable option during the option card (SLOT-2) start-up	00 (Operation command disabled)/ 01 (Operation command enabled)	00	
oA-30	○	Operation mode on option card error (SLOT-3)	00 (Error)/01 (Continue operation)	00	
oA-31	○	Communication Watch Dog Timer	0.00 to 100.00 (s)	1.00	
oA-32	-	Action selection at communication error	00 (Error)/ 01 (Trip after deceleration stop)/02 (Ignore)/ 03 (Free run)/04 (Deceleration stop)	01	
oA-33	-	Run command enable option during the option card (SLOT-3) start-up	00 (Operation command disabled)/ 01 (Operation command enabled)	00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
ob-01	-	Encoder constant setting	32 to 65535 (pls)	1024	
ob-02	-	Encoder position selection	00 (Phase-A is leading)/ 01 (Phase-B is leading)	00	
ob-03	-	Motor gear ratio numerator	1 to 10000	1	
ob-04	-	Motor gear ratio denominator	1 to 10000	1	
ob-10	-	Pulse train detection object selection	00 (Command)/ 01 (Pulse string position command)	00	
ob-11	-	Mode selection of pulse train input	00 (90° phase difference)/ 01 (forward/reverse rotation command and rotation direction)/ 02 (forward/reverse rotation pulse string)	01	
ob-12	○	Pulse train frequency Scale	0.05 to 200.0 (kHz)	25.00	
ob-13	○	Pulse train frequency Filter time constant	0.01 to 2.00 (s)	0.10	
ob-14	○	Pulse train frequency Bias value	-100.0 to 100.0 (%)	0.0	
ob-15	○	Pulse train frequency High Limit	0.0 to 100.0 (%)	100.0	
ob-16	○	Pulse train frequency detection low level	0.0 to 100.0 (%)	0.0	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
oC-01 to oC-28	-	Reserved	-		
oE-01 to oE-70	-	Reserved	-		
oH-01 to oH-34	-	Reserved	-		
oJ-01 to oJ-60	-	Reserved	-		
oL-01 to oL-76	-	Reserved	-		

Parameter Mode (Code P)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
PA-01	-	Mode selection for Emergency-force drive	00 (Disabled)/01 (Enabled)	00	
PA-02	-	Frequency reference setting at Emergency-force drive	0.00 to 590.00 (Hz)	0.00	
PA-03	-	Direction command at Emergency-force drive	00 (Normal rotation)/01 (Reverse rotation)	00	
PA-04	-	Commercial power supply bypass function selection	00 (Disabled)/01 (Enabled)	00	
PA-05	-	Delay time of Bypass function	0.0 to 1000.0 (s)	5.0	
PA-20	-	Simulation mode selection	00 (Disabled)/01 (Enabled)	00	
PA-21	-	Error code selection for Alarm test	000 to 255	000	
PA-22	○	Output current monitor optional output enable	00 (Disabled)/01 (Enabled: parameter setting [PA-23]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved)	01	
PA-23	○	Output current monitor optional output value setting	0.0 to 3.0 × Inverter rated current (A)	0.0	
PA-24	○	DC-bus voltage monitor optional output enable	00 (Disabled)/01 (Enabled: parameter setting [PA-25]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved)	01	
PA-25	○	DC-bus voltage monitor optional value output	200 V class: 0.0 to 450.0 (Vdc) 400 V class: 0.0 to 900.0 (Vdc)	200 V class: 270.0 400 V class: 540.0	
PA-26	○	Output voltage monitor optional output enable	00 (Disabled)/01 (Enabled: parameter setting [PA-27]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved)	01	
PA-27	○	Output voltage monitor optional output value setting	200 V class: 0.0 to 300.0 (V) 400 V class: 0.0 to 600.0 (V)	0.0	
PA-28	○	Output torque monitor optional output enable	00 (Disabled)/01 (Enabled: parameter setting [PA-29]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved)	01	
PA-29	○	Output torque monitor optional output value setting	-500.0 to +500.0 (%)	0.0	
PA-30	○	Start with frequency matching optional Setting enable	00 (Disabled)/01 (Enabled: parameter setting [PA-31]) 02 (Enabled: set from [Ai1])/03 (Enabled: set from [Ai2])/ 04 (Enabled: set from [Ai3])/05 (Reserved)/ 06 (Reserved)/07 (Reserved)	01	
PA-31	○	Start with frequency matching optional value setting	0.0 to 590.00 (Hz)	0.00	

Parameter Mode (Code U)

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
UA-01	-	Password input for display selection	-	0000	
UA-02	-	Soft-lock password input	-	0000	
UA-10	-	Display restriction selection	00 (Full display)/01 (By function)/02 (User setting)/ 03 (Conveyor display)/04 (Only monitor display)	00	
UA-12	○	Accumulation input power monitor clear	00 (Disabled)/01 (Clear)	00	
UA-13	○	Display gain for Accumulation input power monitor	1 to 1000	1	
UA-14	○	Accumulation output power monitor clear	00 (Disabled)/01 (Clear)	00	
UA-15	○	Display gain for Accumulation output power monitor	1 to 1000	1	
UA-16	○	Soft-lock selection	00 ([SFT] terminal)/01 (Always enabled)	00	
UA-17	○	Soft-lock target selection	00 (All data cannot be changed)/ 01 (Data other than set frequency cannot be changed)	00	
UA-18	-	Data R/W selection	00 (R/W enabled)/01 (R/W disabled)	00	
UA-19	-	Low battery warning enable	00 (Disabled)/01 (Warning)/02 (Error)	00	
UA-20	-	Action selection at Keypad disconnection	00 (Error)/01 (Error after deceleration stop)/02 (Ignore)/ 03 (Free run)/04 (Deceleration stop)	02	
UA-21	-	2nd-motor parameter display selection	00 (Not display/01 (Display)	01	
UA-22	-	Option parameter display selection	00 (Not display/01 (Display)	01	
UA-30	-	User parameter auto setting function enable	00 (Disabled)/01 (Enabled)	00	
UA-31	○	User parameter 1 selection	no/***** (select a parameter)	no	
UA-32	○	User parameter 2 selection	no/***** (select a parameter)	no	
UA-33	○	User parameter 3 selection	no/***** (select a parameter)	no	
UA-34	○	User parameter 4 selection	no/***** (select a parameter)	no	
UA-35	○	User parameter 5 selection	no/***** (select a parameter)	no	
UA-36	○	User parameter 6 selection	no/***** (select a parameter)	no	
UA-37	○	User parameter 7 selection	no/***** (select a parameter)	no	
UA-38	○	User parameter 8 selection	no/***** (select a parameter)	no	
UA-39	○	User parameter 9 selection	no/***** (select a parameter)	no	
UA-40	○	User parameter 10 selection	no/***** (select a parameter)	no	
UA-41	○	User parameter 11 selection	no/***** (select a parameter)	no	
UA-42	○	User parameter 12 selection	no/***** (select a parameter)	no	
UA-43	○	User parameter 13 selection	no/***** (select a parameter)	no	
UA-44	○	User parameter 14 selection	no/***** (select a parameter)	no	
UA-45	○	User parameter 15 selection	no/***** (select a parameter)	no	
UA-46	○	User parameter 16 selection	no/***** (select a parameter)	no	
UA-47	○	User parameter 17 selection	no/***** (select a parameter)	no	
UA-48	○	User parameter 18 selection	no/***** (select a parameter)	no	
UA-49	○	User parameter 19 selection	no/***** (select a parameter)	no	
UA-50	○	User parameter 20 selection	no/***** (select a parameter)	no	
UA-51	○	User parameter 21 selection	no/***** (select a parameter)	no	
UA-52	○	User parameter 22 selection	no/***** (select a parameter)	no	
UA-53	○	User parameter 23 selection	no/***** (select a parameter)	no	
UA-54	○	User parameter 24 selection	no/***** (select a parameter)	no	
UA-55	○	User parameter 25 selection	no/***** (select a parameter)	no	
UA-56	○	User parameter 26 selection	no/***** (select a parameter)	no	
UA-57	○	User parameter 27 selection	no/***** (select a parameter)	no	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
UA-58	○	User parameter 28 selection	no/***** (select a parameter)	no	
UA-59	○	User parameter 29 selection	no/***** (select a parameter)	no	
UA-60	○	User parameter 30 selection	no/***** (select a parameter)	no	
UA-61	○	User parameter 31 selection	no/***** (select a parameter)	no	
UA-62	○	User parameter 32 selection	no/***** (select a parameter)	no	
UA-90 to UA-94	-	Reserved	-		

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Ub-01	-	Initialize Mode selection	00 (Disabled)/01 (Trip history)/02 (Parameter initialization)/ 03 (Trip history + parameters)/ 04 (Trip history + parameters + DriveProgramming) 05 (Other than terminal function)/ 06 (Other than communication function)/ 07 (Other than terminal&communication functions)/ 08 (DriveProgramming)	00	
Ub-02	-	Initialize Data selection	00 (Mode 0)/01 (Mode 1)/02 (Mode 2)/03 (Mode 3)	01	
Ub-03	-	Load type selection	00 (VLD)/01 (LD)/02 (ND)	02	
Ub-05	-	Initialize Enable	00 (Disabled)/01 (Start initialization)	00	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
UC-01	○	Debug mode enable	(do not change)	00	-

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
Ud-01 to Ud-60	-	Reserved	-		

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
UE-01	-	EzSQ operation cycle	00 (1 ms)/01 (2 ms)	00	
UE-02	○	EzSQ function enable	00 (Disabled)/01 ([PRG] terminal)/02 (Always)	00	
UE-10	○	EzSQ user parameter U (00)	0 to 65535	0	
UE-11	○	EzSQ user parameter U (01)	0 to 65535	0	
UE-12	○	EzSQ user parameter U (02)	0 to 65535	0	
UE-13	○	EzSQ user parameter U (03)	0 to 65535	0	
UE-14	○	EzSQ user parameter U (04)	0 to 65535	0	
UE-15	○	EzSQ user parameter U (05)	0 to 65535	0	
UE-16	○	EzSQ user parameter U (06)	0 to 65535	0	
UE-17	○	EzSQ user parameter U (07)	0 to 65535	0	
UE-18	○	EzSQ user parameter U (08)	0 to 65535	0	
UE-19	○	EzSQ user parameter U (09)	0 to 65535	0	
UE-20	○	EzSQ user parameter U (10)	0 to 65535	0	
UE-21	○	EzSQ user parameter U (11)	0 to 65535	0	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
UE-22	○	EzSQ user parameter U (12)	0 to 65535	0	
UE-23	○	EzSQ user parameter U (13)	0 to 65535	0	
UE-24	○	EzSQ user parameter U (14)	0 to 65535	0	
UE-25	○	EzSQ user parameter U (15)	0 to 65535	0	
UE-26	○	EzSQ user parameter U (16)	0 to 65535	0	
UE-27	○	EzSQ user parameter U (17)	0 to 65535	0	
UE-28	○	EzSQ user parameter U (18)	0 to 65535	0	
UE-29	○	EzSQ user parameter U (19)	0 to 65535	0	
UE-30	○	EzSQ user parameter U (20)	0 to 65535	0	
UE-31	○	EzSQ user parameter U (21)	0 to 65535	0	
UE-32	○	EzSQ user parameter U (22)	0 to 65535	0	
UE-33	○	EzSQ user parameter U (23)	0 to 65535	0	
UE-34	○	EzSQ user parameter U (24)	0 to 65535	0	
UE-35	○	EzSQ user parameter U (25)	0 to 65535	0	
UE-36	○	EzSQ user parameter U (26)	0 to 65535	0	
UE-37	○	EzSQ user parameter U (27)	0 to 65535	0	
UE-38	○	EzSQ user parameter U (28)	0 to 65535	0	
UE-39	○	EzSQ user parameter U (29)	0 to 65535	0	
UE-40	○	EzSQ user parameter U (30)	0 to 65535	0	
UE-41	○	EzSQ user parameter U (31)	0 to 65535	0	
UE-42	○	EzSQ user parameter U (32)	0 to 65535	0	
UE-43	○	EzSQ user parameter U (33)	0 to 65535	0	
UE-44	○	EzSQ user parameter U (34)	0 to 65535	0	
UE-45	○	EzSQ user parameter U (35)	0 to 65535	0	
UE-46	○	EzSQ user parameter U (36)	0 to 65535	0	
UE-47	○	EzSQ user parameter U (37)	0 to 65535	0	
UE-48	○	EzSQ user parameter U (38)	0 to 65535	0	
UE-49	○	EzSQ user parameter U (39)	0 to 65535	0	
UE-50	○	EzSQ user parameter U (40)	0 to 65535	0	
UE-51	○	EzSQ user parameter U (41)	0 to 65535	0	
UE-52	○	EzSQ user parameter U (42)	0 to 65535	0	
UE-53	○	EzSQ user parameter U (43)	0 to 65535	0	
UE-54	○	EzSQ user parameter U (44)	0 to 65535	0	
UE-55	○	EzSQ user parameter U (45)	0 to 65535	0	
UE-56	○	EzSQ user parameter U (46)	0 to 65535	0	
UE-57	○	EzSQ user parameter U (47)	0 to 65535	0	
UE-58	○	EzSQ user parameter U (48)	0 to 65535	0	
UE-59	○	EzSQ user parameter U (49)	0 to 65535	0	
UE-60	○	EzSQ user parameter U (50)	0 to 65535	0	
UE-61	○	EzSQ user parameter U (51)	0 to 65535	0	
UE-62	○	EzSQ user parameter U (52)	0 to 65535	0	
UE-63	○	EzSQ user parameter U (53)	0 to 65535	0	
UE-64	○	EzSQ user parameter U (54)	0 to 65535	0	
UE-65	○	EzSQ user parameter U (55)	0 to 65535	0	
UE-66	○	EzSQ user parameter U (56)	0 to 65535	0	
UE-67	○	EzSQ user parameter U (57)	0 to 65535	0	
UE-68	○	EzSQ user parameter U (58)	0 to 65535	0	
UE-69	○	EzSQ user parameter U (59)	0 to 65535	0	
UE-70	○	EzSQ user parameter U (60)	0 to 65535	0	
UE-71	○	EzSQ user parameter U (61)	0 to 65535	0	
UE-72	○	EzSQ user parameter U (62)	0 to 65535	0	
UE-73	○	EzSQ user parameter U (63)	0 to 65535	0	

Code	Codes that can be changed during operation	Name	Data range	Initial value	Note
UF-02	○	EzSQ user parameter UL (00)	-2147483647 to 2147483647	0	
UF-04	○	EzSQ user parameter UL (01)	-2147483647 to 2147483647	0	
UF-06	○	EzSQ user parameter UL (02)	-2147483647 to 2147483647	0	
UF-08	○	EzSQ user parameter UL (03)	-2147483647 to 2147483647	0	
UF-10	○	EzSQ user parameter UL (04)	-2147483647 to 2147483647	0	
UF-12	○	EzSQ user parameter UL (05)	-2147483647 to 2147483647	0	
UF-14	○	EzSQ user parameter UL (06)	-2147483647 to 2147483647	0	
UF-16	○	EzSQ user parameter UL (07)	-2147483647 to 2147483647	0	
UF-18	○	EzSQ user parameter UL (08)	-2147483647 to 2147483647	0	
UF-20	○	EzSQ user parameter UL (09)	-2147483647 to 2147483647	0	
UF-22	○	EzSQ user parameter UL (10)	-2147483647 to 2147483647	0	
UF-24	○	EzSQ user parameter UL (11)	-2147483647 to 2147483647	0	
UF-26	○	EzSQ user parameter UL (12)	-2147483647 to 2147483647	0	
UF-28	○	EzSQ user parameter UL (13)	-2147483647 to 2147483647	0	
UF-30	○	EzSQ user parameter UL (14)	-2147483647 to 2147483647	0	
UF-32	○	EzSQ user parameter UL (15)	-2147483647 to 2147483647	0	

<Unit options>

No.	Unit
00	non
01	%
02	A
03	Hz
04	V
05	kW
06	W
07	hr
08	s
09	kHz
10	ohm
11	mA
12	ms
13	P
14	kgm^2
15	pls
16	mH
17	Vdc
18	°C
19	kWh
20	mF
21	mVs/rad
22	Nm
23	min^{-1}
24	m/s
25	m/min
26	m/h
27	ft/s
28	ft/min
29	ft/h
30	m
31	cm
32	°F
33	l/s
34	l/min
35	l/h
36	m^3/s
37	m^3/min
38	m^3/h
39	kg/s
40	kg/min
41	kg/h
42	t/min
43	t/h
44	gal/s
45	gal/min
46	gal/h
47	ft^3/s
48	ft^3/min
49	ft^3/h
50	lb/s
51	lb/min
52	lb/h
53	mbar
54	bar
55	Pa
56	kPa
57	PSI
58	mm

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