

USER'S MANUAL



OMNUC G5 SERIES

R88M-K□

(AC Servomotors)

R88D-KT□

(AC Servo Drives)

AC SERVOMOTORS/SERVO DRIVES

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Introduction

Thank you for purchasing an OMNUC G5-series Servo Drive. This manual explains how to install and wire the Servo Drive, set parameters needed to operate the Servo Drive, and remedies to be taken and inspection methods to be used should problems occur.

Intended Readers

This manual is intended for the following individuals.

Those having electrical knowledge (certified electricians or individuals having equivalent knowledge) and also being qualified for one of the following:

- Introducing FA equipment
- Designing FA systems
- Managing FA sites

Notice

This manual contains information you need to know to correctly use the Servo Drive and peripheral equipment.

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

After you finished reading the 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.

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Warranty, Limitations of Liability

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Disclaimers

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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 OmronÅfs test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the OmronÅfs 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 OmronÅfs representative at any time to confirm actual specifications of purchased Product.

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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.

Items Requiring Acknowledgment

1. Terms of Warranty

(1) Warranty period

The warranty period of this product is 1 year after its purchase or delivery to the specified location.

(2) Scope of warranty

If the product fails during the above warranty period due to design, material or workmanship, we will provide a replacement unit or repair the faulty product free of charge at the location where you purchased the product.

Take note, however, that the following failures are excluded from the scope of warranty.

- a) Failure due to use or handling of the product in any condition or environment not specified in the catalog, operation manual, etc.
- b) Failure not caused by this product
- c) Failure caused by any modification or repair not carried out by OMRON
- d) Failure caused by any use not intended for this product
- e) Failure that could not be predicted with the level of science and technology available when the product was shipped from OMRON
- f) Failure caused by a natural disaster or any other reason for which OMRON is not held responsible

Take note that this warranty applies to the product itself, and losses induced by a failure of the product are excluded from the scope of warranty.

2. Limited Liability

- (1) OMRON shall not assume any responsibility whatsoever for any special damage, indirect damage or passive damage arising from this product.
- (2) OMRON shall not assume any responsibility for programming done by individuals not belonging to OMRON, if the product is programmable, or outcomes of such programming.

3. Conditions for Intended Application

- (1) If this product is combined with other product, the customer must check the standards and regulations applicable to such combination. The customer must also check the compatibility of this product with any system, machinery or device used by the customer. If the above actions are not taken, OMRON shall not assume any responsibility regarding the compatibility of this product.
- (2) If the product is used in the following applications, consult your OMRON sales representative to check the necessary items according to the specification sheet, etc. Also make sure the product is used within the specified ratings and performance ranges with an ample margin and implement safety measures, such as designing a safety circuit, to minimize danger should the product fail.
 - a) Used in any outdoor application, application subject to potential chemical contamination or electrical interference, or in any condition or environment not specified in the catalog, operation manual, etc.
 - b) Nuclear power control equipment, incineration equipment, railway, aircraft and vehicle equipment, medical machinery, entertainment machinery, safety system or any other device controlled by an administrative agency or industry regulation
 - c) System, machinery or device that may threaten human life or property
 - d) Gas, water or electricity supply system, system operated continuously for 24 hours or any other equipment requiring high reliability
 - e) Any other application where a high level of safety corresponding to a) to d) above is required
- (3) If the customer wishes to use this product in any application that may threaten human life or property, be sure to confirm beforehand that the entire system is designed in

such a way to notify dangers or ensure the necessary level of safety via design redundancy, and that the product is wired and installed appropriately in the system according to the intended application.

- (4) Sample applications explained in the catalog, etc. are provided for reference purposes only. When adopting any of these samples, check the function and safety of each equipment or device.
- (5) Understand all prohibited items and notes on use provided herein, so that this product will be used correctly and that customers or third parties will not suffer unexpected losses.

4. Specification Change

The product specifications and accessories explained in the catalog, operation manual, etc. are subject to change, if necessary, for the reasons of improvement, etc. Contact your OMRON sales representative to check the actual specifications of this product.

5. Scope of Service

The price of this product excludes costs of service such as dispatching engineers. If you have any request regarding service, consult your OMRON sales representative.

6. Scope of Application

The above paragraphs are based on the assumption that this product is traded and used in Japan.

If you wish to trade or use this product outside Japan, consult your OMRON sales representative.

Safety Precautions

- ■To ensure that the OMNUC G5-series Servomotor and Servo Drive as well as peripheral equipment are used safely and correctly, be sure to read this Safety Precautions section and the main text before using the product in order to learn items you should know 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.

Explanation of Display

- ■The precautions explained in this section describe important information regarding safety and must be followed without fail.
- ■The display of precautions in this manual and their meanings are explained below.



Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Additionally, there may be severe property damage.



Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Even those items denoted by the caution symbol may lead to a serious outcome depending on the situation. Accordingly, be sure to observe all safety precautions.



Precautions for Safe Use

Indicates precautions on what to do and what not to do to ensure using the product safely.



Precautions for Correct Use

Indicates precautions on what to do and what not to do to ensure proper operation and performance.



Reference

Indicates an item that helps deepen your understanding of the product or other useful tip.

Explanation of Symbols

Example of symbols



This symbol indicates danger and caution.

The specific instruction is described using an illustration or text inside or near The symbol shown to the left indicates "beware of electric shock".





This symbol indicates a prohibited item (item you must not do).

The specific instruction is described using an illustration or text inside or near \bigcirc . The symbol shown to the left indicates "disassembly prohibited".



This symbol indicates a compulsory item (item that must be done).

The specific instruction is described using an illustration or text inside or near The symbol shown to the left indicates "grounding required".

For Safe Use of This Product

- ■Illustrations contained in this manual sometimes depict conditions without covers and safety shields for the purpose of showing the details. When using this product, be sure to install the covers and shields as specified and use the product according to this manual.
- ■If the product has been stored for an extended period of time, contact your OMRON sales representative.

Danger



Always connect the frame ground terminals of a 100 V or 200 V type drive and motor to a type-D or higher ground. Always connect the ground terminals of a 400 V type to a type-C or higher ground. Improper grounding may result in electrical shock.



Never touch the parts inside the Servo Drive.

Electric shock may result.



While the power is supplied, do not remove the front cover, terminal covers, cables and options.

Electric shock may result.



Installation, operation and maintenance or inspection by unauthorized personnel is prohibited.

Electric shock or injury may result.



Before carrying out wiring or inspection, turn OFF the power supply and wait for at least 15 minutes.

Electric shock may result.



Do not damage, pull, stress strongly, or pinch the cables or place heavy articles on them. Electric shock, stopping of Servo Drive operation, or burn damage may result.



Never touch the rotating part of the Servomotor during operation. Injury may result.



Never modify the Servo Drive.

Injury or equipment damage may result.



Install a stopping device on the machine to ensure safety.

* The holding brake is not a stopping device to ensure safety. Injury may result.



Install an immediate stop device externally to the machine so that the operation can be stopped and the power supply cut off immediately. Injury may result.



When the power is restored after a momentary power interruption, the machine may restart suddenly. Never come close to the machine when restarting power.

* Implement measures to ensure safety of people nearby even when the machine is restarted.

Injury may result.



After an earthquake, be sure to conduct safety checks.

Electric shock, injury or fire may result.



Never drive the Servomotor using an external drive source. Fire may result.

A Danger



Do not place flammable materials near the Servomotor, Servo Drive, or Regeneration Resistor.

Fire may result.



Install the Servomotor, Servo Drive, and Regeneration Resistor on non-flammable materials such as metals.

Fire may result.



When you perform a system configuration using the safety function, be sure to fully understand the relevant safety standards and the information in the operation manual, and apply them to the system design.

Injury or damage may result.



Do not use the cable when it is laying in oil or water.

Electric shock, injury, or fire may result.



Never connect a commercial power supply directly to the Servomotor.

Fire or failure may result.



Do not perform wiring or any operation with wet hands.

Electric shock, injury, or fire may result.



Do not touch the key grooves with bare hands if a motor with shaft-end key grooves is being

Injury may result.

\bigwedge

Caution



Use the Servomotor and Servo Drive in a specified combination. Fire or equipment damage may result.



Do not store or install the Servo Drive in the following locations:

Location subject to direct sunlight

Location where the ambient temperature exceeds the specified level

Location where the relative humidity exceeds the specified level

Location subject to condensation due to rapid temperature changes

Location subject to corrosive or flammable gases

Location subject to higher levels of dust, salt content, or iron dust

Location subject to splashes of water, oil, chemicals, etc.

Location where the Servo Drive may receive vibration or impact directly

Installing or storing the Servo Drive in these locations may result in fire, electric shock, or equipment damage.



The Servo Drive radiator, Regeneration Resistor, Servomotor, etc. may become hot while the power is supplied or remain hot for a while even after the power supply is cut off. Never touch these components.

A burn injury may result.

Storage and Transportation





When transporting the Servo Drive, do not hold it by the cables or Servomotor shaft. Injury or failure may result.



Do not overload the Servo Drive or Servomotor. (Follow the instruction on the product label.) Injury or failure may result.



Use the motor eye-bolts only when transporting the Servomotor. Do not use them to transport the machine. Injury or failure may result.



When lifting a 15 kW or higher Servo Drive during moving or installation, always have two people lift the product by grasping a metal part. Do not grasp a plastic part. Risk of injury or product damage.

Installation and Wiring

\triangle

Caution



Do not step on the Servo Drive or place heavy articles on it. Injury may result.



Do not block the intake or exhaust openings. Do not allow foreign objects to enter the product.

Fire may result.



Be sure to observe the mounting direction.

Failure may result.



Provide the specified clearance between the Servo Drive and the inner surface of the control panel or other equipment.

Fire or failure may result.



Do not apply strong impact on the Servomotor shaft or Servo Drive. Failure may result.



Wire the cables correctly and securely.

Runaway motor, injury, or failure may result.



Securely tighten the mounting screws, terminal block screws, and cable screws. Failure may result.



Use crimp terminals for wiring.

If simple twisted wires are connected directly to the protective ground terminal, fire may result.



Only use the power supply voltage specified in this manual.

Burn damage may result.



In locations where the power supply infrastructure is poor, make sure the rated voltage can be supplied.

Equipment damage may result.



Provide safety measures, such as a breaker, to protect against short circuiting of external wiring.

Fire may result.



If the Servo Drive is used in the following locations, provide sufficient shielding measures.

Location subject to noise generates due to static electricity, etc.

Location subject to a strong electric or magnetic field

Location where exposure to radioactivity may occur

Location near power supply lines

Using the Servo Drive in these locations may result in equipment damage.



Connect an immediate stop relay in series with the brake control relay. Injury or failure may result.



When connecting the battery, make sure the polarity is correct.

Battery damage or explosion may result.

Operation and Adjustment



Caution



Conduct a test operation after confirming that the equipment is not affected. Equipment damage may result.



Before operating the Servo Drive in an actual environment, check if it operates correctly based on the parameters you have set.

Equipment damage may result.



Never adjust or set parameters to extreme values, as it will make the operation unstable. Injury may result.



Separate the motor from the mechanical system and check its operation before installing the motor to the machine.

Injury may result.



If an alarm generated, remove the cause of the alarm and ensure safety, and then reset the alarm and restart the operation.

Injury may result.



Do not use the built-in brake of the motor for normal braking operation. Failure may result.



Do not operate the Servomotor connected to an excessive load inertia. Failure may result.



Install safety devices to prevent idle running or lock of the electromagnetic brake or the gear head, or leakage of grease from the gear head.

Injury, damage, or taint damage may result.



If the Servo Drive fails, cut off the power supply to the Servo Drive at the power supply. Fire may result.



Do not turn ON and OFF the main Servo Drive power supply frequently. Failure may result.

Maintenance and Inspection

\bigwedge

Caution



After replacing the Servo Drive, transfer to the new Servo Drive all data needed to resume operation, before restarting the operation. Equipment damage may result.



Never repair the Servo Drive by disassembling it. Electric shock or injury may result.

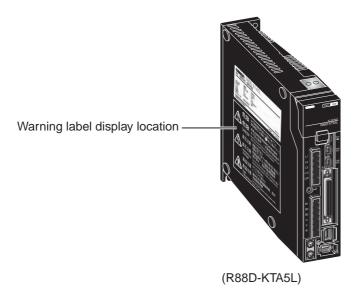


Be sure to turn OFF the power supply when the Servo Drive is not going to be used for a prolonged period of time.

Injury may result.

Location of Warning Label

The Servo Drive bears a warning label at the following location to provide handling warnings. When handling the Servo Drive, be sure to observe the instructions provided on this label.



Instructions on Warning Label



Disposal

- When disposing of the battery, insulate it using tape and dispose of it by following the applicable ordinance of your local government.
- Dispose of the Servo Drive as an industrial waste.

Items to Check after Unpacking

After unpacking, check the following items.

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

Accessories of This Product

Safety Precautions document × 1 copy

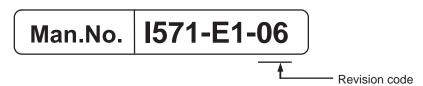
- Connectors, mounting screws, mounting brackets, and other accessories other than those in the table below are not supplied. They must be prepared by the customer.
- •The safety bypass connector is required when the safety function is not used. To use the safety function, provide a Safety I/O Signal Connector separately.
- If any item is missing or a problem is found such as Servo Drive damage, contact the OMRON dealer or sales office where you purchased your product.

| Specifications | | Connector for main circuit power supply terminals and control circuit power supply terminals | Connector for External Regeneration Resistor connection terminals and motor connection terminals | Safety bypass connector | Mounting Brackets |
|---------------------|--------|--|--|-------------------------------|----------------------|
| Single- phase | 50 W | | | | |
| | 100 W | | | | |
| 100 VAC | 200 W | | | | |
| | 400 W | | | | |
| | 100 W | | | | _ |
| Cinalo | 200 W | Included | | | _ |
| Single- phase/3- | 400 W | | | | |
| phase 200 VAC | 750 W | | | | |
| 200 VAC | 1 kW | | | | |
| | 1.5 kW | | | | |
| | 2 kW | | | | |
| | 3 kW | | | Included | |
| 3-phase 200 VAC | 5 kW | | | | Included |
| 200 VAO | 7.5 kW | _ | | | |
| | 15 kW | | | | |
| - | 600 W | | | | |
| 3-phase 400 VAC | 1 kW | | | | _ |
| | 1.5 kW | Included | | | |
| | 2 kW | | | | |
| | 3 kW | | | | l |
| | 5 kW | | | | Included |
| | 7.5 kW | _ | | | |
| | 15 kW | | | | _ |

Revision History

The manual revision symbol is an alphabet appended at the end of the manual number found in the bottom left-hand corner of the front or back cover.

Example



| Revision code | Revision date | Revised content |
|---------------|----------------|---|
| 01 | September 2009 | Original production |
| 02 | June 2010 | Made corrections and added explanations. |
| 03 | January 2011 | Added models and made corrections. |
| 04 | September 2011 | Added DC input ratings for the R88D-KT75H/-KT150H and made corrections. |
| 05 | September 2015 | Made corrections and added explanations. |
| 06 | January 2018 | Made corrections and added explanations. |

Structure of This Document

This manual consists of the following chapters. Read the necessary chapter or chapters referring to the following table.

| | | Outline |
|------------|---|---|
| Chapter 1 | Features and System Configuration | This chapter explains the features of the Servo Drive, name of each part, and applicable EC Directives and UL standards. |
| Chapter 2 | Standard Models and External Dimensions | This chapter explains the models of Servo Drives, Servomotors, and peripheral equipment, and provides the external dimensions and mounting dimensions. |
| Chapter 3 | Specifications | This chapter provides the general specifications, characteristics, connector specifications, and I/O circuits of the Servo Drives as well as the general specifications, characteristics, encoder specifications of the Servomotors and other peripheral devices. |
| Chapter 4 | System Design | This chapter explains the installation conditions for the Servo Drive and Servomotor, wiring methods including wiring conforming to EMC Directives and regenerative energy calculation methods as well as the performance of External Regeneration Resistors. |
| Chapter 5 | Basic Control Modes | This chapter explains an outline of operations available in various control modes and explains the contents of setting. |
| Chapter 6 | Applied Functions | This chapter gives outline of applied functions such as damping control, electronic gears, gain switching and disturbance observer, and explains the contents of setting. |
| Chapter 7 | Safety Function | This function stops the Servomotor based on a signal from a safety controller or safety sensor. An outline of the function is given together with operation and connection examples. |
| Chapter 8 | Parameters Details | This chapter explains the set value and contents of setting of each parameter. |
| Chapter 9 | Operation | This chapter gives the operating procedures and explains how to operate in each mode. |
| Chapter 10 | Adjustment Functions | This chapter explains the functions, setting methods, and items to note regarding various gain adjustments. |
| Chapter 11 | Error and Maintenance | This chapter explains the items to check when problems occur, error diagnosis using the alarm LED display and measures, error diagnosis based on the operating condition and measures, and periodic maintenance. |
| Chapter 12 | Appendix | This chapter provides connection examples using OMRON's PLC and Position Controller, as well as a list of parameters. |

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Features and System Configuration

This chapter explains the features of the Servo Drive, name of each part, and applicable EC Directives and UL standards.

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1-1 Outline

Outline of the OMNUC G5 Series

With the OMNUC G5 Series, you can perform fully-closed control in addition to position control, speed control and torque control.

Various models are available supporting wide-ranging motor capacities from 50 W to 15 kW and input power supplies from 100 to 400 V. You will surely find a model that best suits your application. Motors with high-resolution 20-bit incremental encoders and 17-bit absolute/incremental encoders are available as standard models.

The OMNUC G5 Series features realtime autotuning function and adaptive filter function that automatically perform complicated gain adjustments. A notch filter can also be automatically set to suppress machine vibration by reducing machine resonance during operation.

The damping control function of the Servomotor and Servo Drive realizes stable stopping performance in a mechanism which vibrates because of the low rigidity of the load.

Features of OMNUC G5-series Servo Drives

OMNUC G5-series Servo Drives have the following features.

Switching between Seven Control Modes

You can switch between seven control modes: 1) Position Control Mode, 2) Speed Control Mode, 3) Torque Control Mode, 4) Position and Speed Control Mode, 5) Position and Torque Control Mode, 6) Speed and Torque Control Mode, and 7) Fully-closed Control Mode. Desired modes can be selected with the flexible drive according to your need. A single drive supports various applications.

Achievement of Accurate Positioning by Fully-closed Control

Feedbacks from the external encoder connected to the motor is used to accurately control positions. Accordingly, position control is not affected by deviation caused by ball screws or temperature.

Wide Range of Power Supplies to Meet Any Need

The OMNUC G5 Series now has models supporting 400 V for use with large equipment, at overseas facilities and in wide-ranging applications and environment. Since the utilization ratio of facility equipment also increases, the TCO (total cost of ownership) will come down.

Safe Torque OFF (STO) Function to Ensure Safety

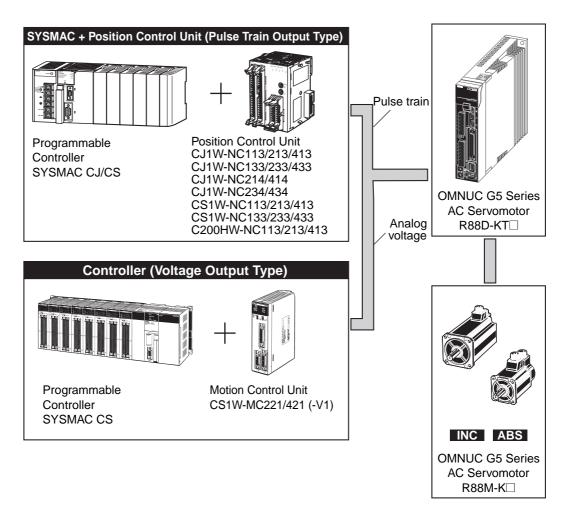
You can cut off the motor current to stop the motor based on a signal from an emergency stop button or other safety equipment. This can be used for an emergency stop circuit that is compliant with safety standards without using an external contactor.

Suppressing Vibration of Low-rigidity Mechanisms during Acceleration/Deceleration

The damping control function suppresses vibration of low-rigidity mechanisms or devices whose tips tend to vibrate.

Two damping filters are provided to enable switching the damping frequency automatically according to the rotation direction and also via an external signal. In addition, the settings can be made easily by setting the damping frequency and filter values.

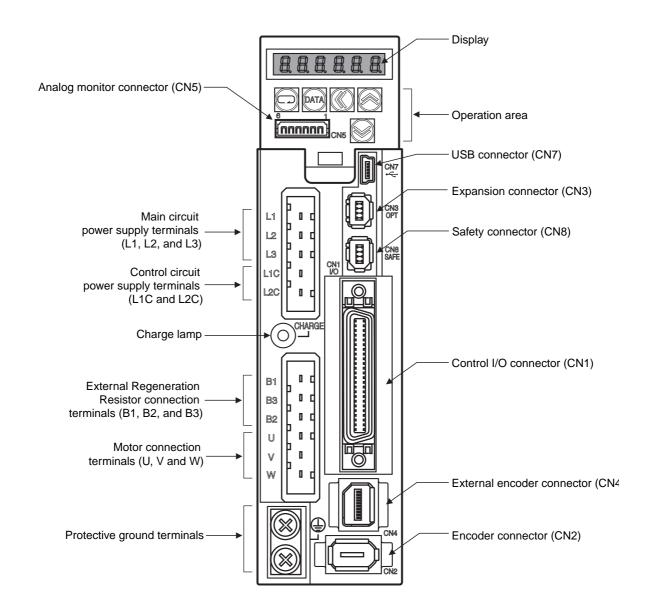
1-2 System Configuration



 The following units support a motor with absolute encoder: CJ1W-NC214/414 CJ1W-NC234/434 CS1W-MC221/421 (-V1)

Names and Functions

Servo Drive Part Names



Servo Drive Functions

Display

A 6-digit 7-segment LED display shows the drive status, alarm codes, parameters, and other information.

Operation Area

Monitors the parameter setting and drive condition.

Charge Lamp

Lights when the main circuit power supply is turned ON.

Control I/O Connector (CN1)

Used for command input signals and I/O signals.

Encoder Connector (CN2)

Connector for the encoder installed in the Servomotor.

Expansion Connector (CN3)

A spare connector for expansion. Do not connect anything.

External Encoder Connector (CN4)

Connector for an encoder signal used during fully-closed control.

Analog monitor Connector (CN5)

You can use a special cable to monitor values, such as the motor rotation speed, torque command value, etc.

USB Connector (CN7)

Communications connector for the computer.

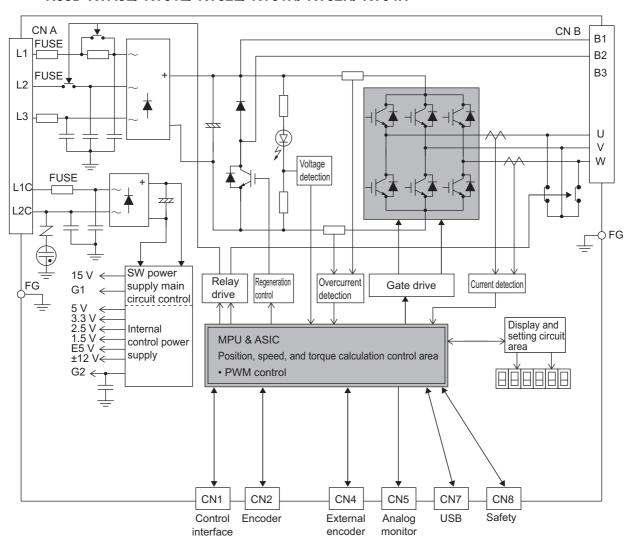
Safety Connector (CN8)

Connector for safety devices.

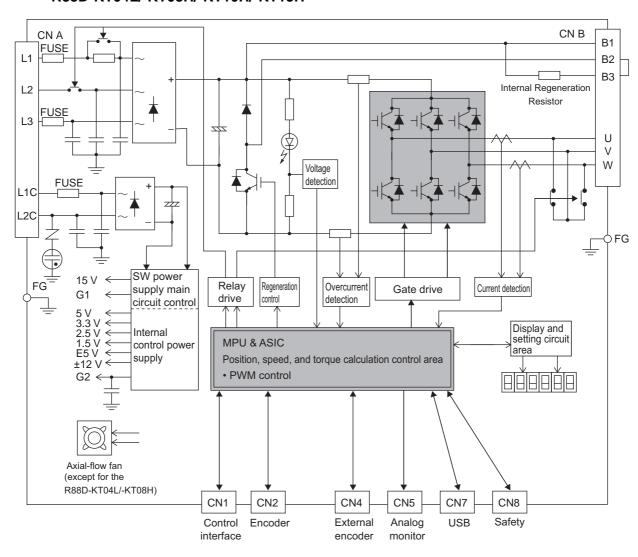
If no safety devices are used, keep the factory-set safety bypass connector installed.

1-4 System Block Diagrams

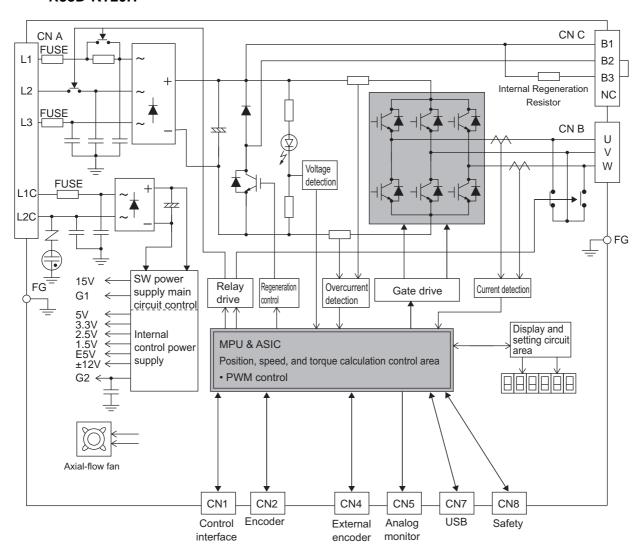
R88D-KTA5L/-KT01L/-KT02L/-KT01H/-KT02H/-KT04H



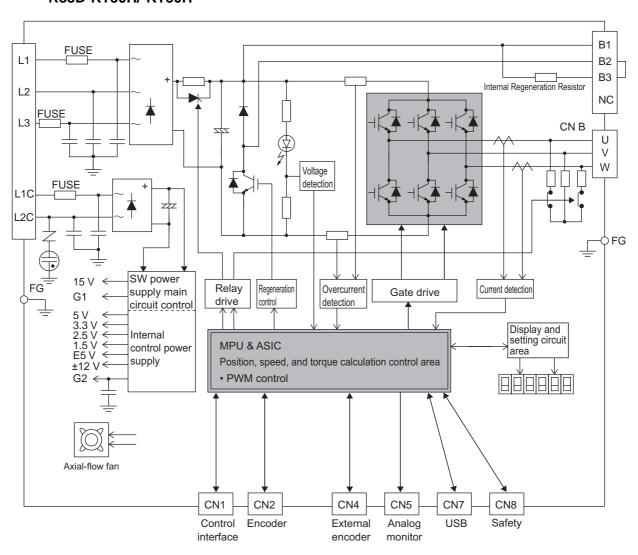
R88D-KT04L/-KT08H/-KT10H/-KT15H



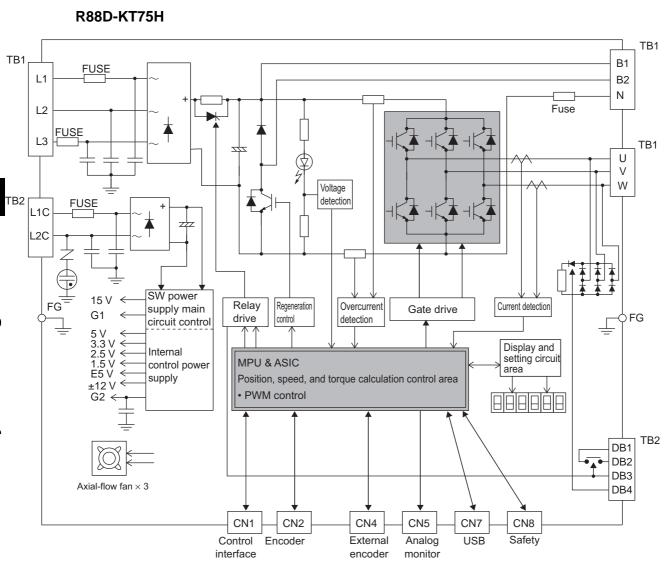
R88D-KT20H

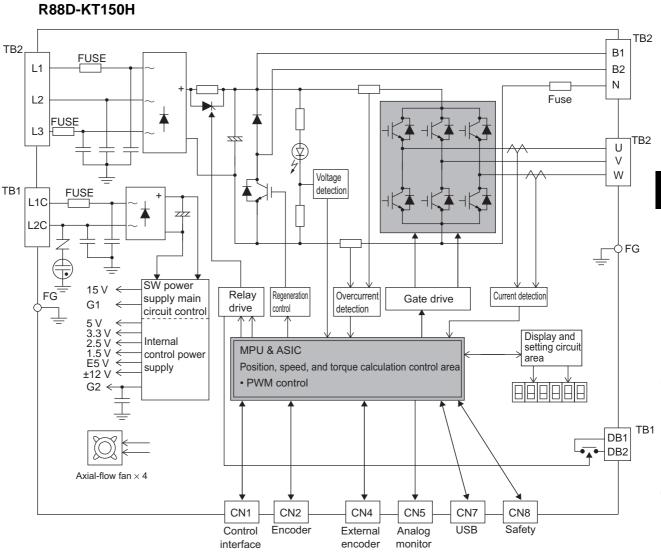


R88D-KT30H/-KT50H

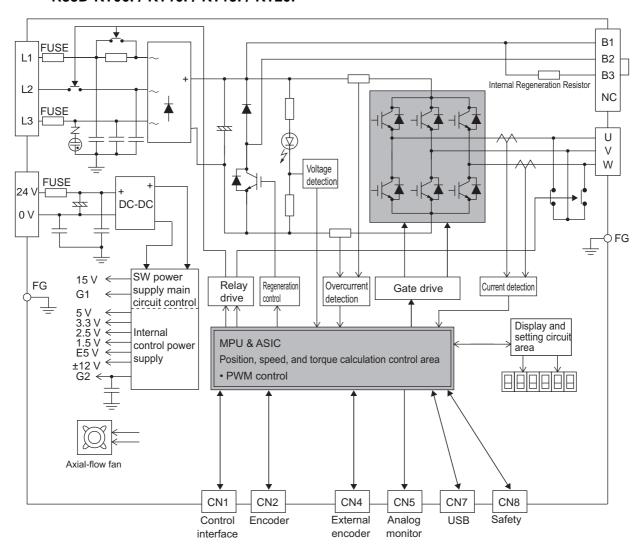


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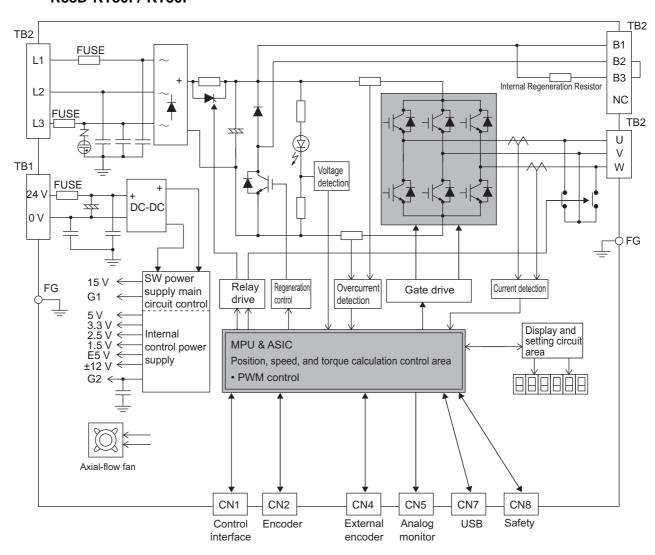




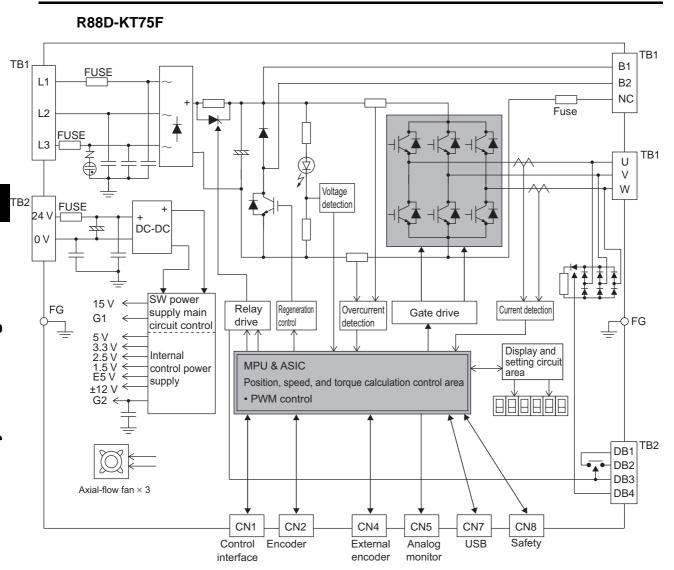
R88D-KT06F/-KT10F/-KT15F/-KT20F

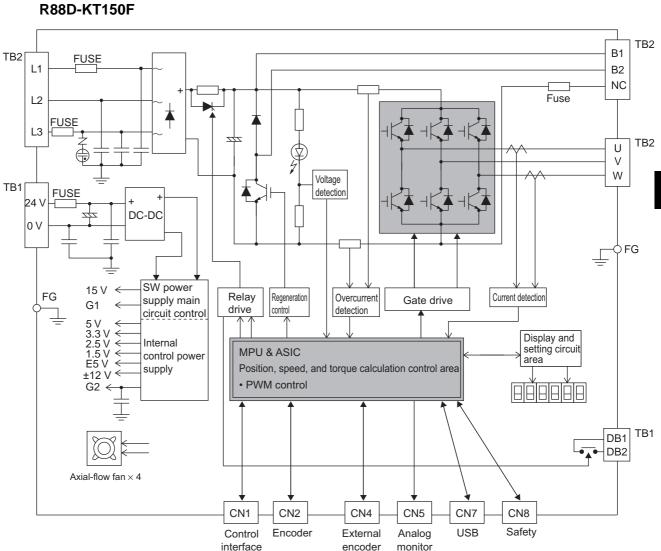


R88D-KT30F/-KT50F



1





1-5 Applicable Standards

EC Directives

| EC Directives | Product | Applicable standards | | |
|------------------------|----------------|---|--|--|
| Low | AC Servo Drive | EN 61800-5-1 | | |
| Voltage Directive | AC Servomotor | EN60034-1/-5 | | |
| EMC | AC Servo Drive | EN 55011 class A group 1 | | |
| Directives | | IEC61800-3 | | |
| | | EN61000-6-2 | | |
| Machinery Directive | AC Servo Drive | EN954-1 (Category 3) EN ISO13849-1: 2008 (Category 3) (PLc,d) ISO13849-1: 2006 (Category 3) (PLc,d) EN61508 (SIL2) EN62061 (SIL2) EV61800-5-2 (STO) IEC61326-3-1 (SIL2) | | |

Note. To conform to EMC directives, the Servomotor and Servo Drive must be installed under the conditions described in "4-3 Wiring Conforming to EMC Directives" (P.4-33).

UL and cUL Standards

| Standard | Product | Applicable standards | File number |
|-----------------|----------------|----------------------|-----------------------|
| UL standards | AC Servo Drive | UL508C | E179149 ^{*1} |
| Stariuarus | AC Servomotor | UL1004-1 | E331224 |
| | | UL1004-1, UL1004-6 | E331224 ^{*2} |
| CSA | AC Servo Drive | CSA C22.2 No. 14 | E179149 |
| standards | AC Servomotor | CSA C22.2 No. 100 | E331224 |

^{*1:} The R88D-KT20□ and lower capacity Servo Drives are UL-listed.

The R88D-KT30□ and higher capacity Servo Drives are UL-recognized.

^{*2:} Applies to 1,500-r/min Servomotors of 7.5 to 15 kW and 1,000-r/min Servomotors of 4.5 to 6 kW.

The Servo Drives and Servomotors comply with UL 508C (file No. E179149) as long as the following installation conditions 1 and 2 are met.

- (1) Use the Servo Drive in a pollution degree 1 or 2 environment as defined in IEC 60664-1 (example: installation in an IP54 control panel).
- (2) Be sure to connect a circuit breaker or fuse, which is a UL-listed product with LISTED and (I) mark, between the power supply and noise filter.

Refer to the following table for the rated current of the circuit breaker or fuse. Use copper wiring with a temperature rating of 75°C or higher.

| Drive model | Circuit breaker (rated current) (A) |
|-------------|-------------------------------------|
| R88D-KT01L | 10 |
| R88D-KT02L | 10 |
| R88D-KT04L | 10 |
| R88D-KT01H | 10 |
| R88D-KT02H | 10 |
| R88D-KT04H | 10 |
| R88D-KT08H | 15 |
| R88D-KT10H | 15 |
| R88D-KT15H | 20 |
| R88D-KT20H | 30 |
| R88D-KT30H | 50 |
| R88D-KT50H | 50 |
| R88D-KT75H | 60 |
| R88D-KT150H | 100/125 * ¹ |
| R88D-KT06F | 15 |
| R88D-KT10F | 15 |
| R88D-KT15F | 15 |
| R88D-KT20F | 20 |
| R88D-KT30F | 30 |
| R88D-KT50F | 30 |
| R88D-KT75F | 30 |
| R88D-KT150F | 50/60 * ² |

^{*1: 100} A when used in combination with the R88M-K11K015T-□. 125A when used in combination with the R88M-K15K015T-□.

Korean Radio Regulations (KC)

- •The G5-series Servo Drives comply with the Korean Radio Regulations (KC).
- •The G5-series Servomotors and Linear Motors are exempt from the Korean Radio Regulations (KC).

^{*2: 50} A when used in combination with the R88M-K11K015C-□. 60 A when used in combination with the R88M-K15K015C-□.

SEMI F47

- Some Servo Drives conform to the SEMI F47 standard for momentary power interruptions (voltage sag immunity) for no-load or light-load operation.
- This standard applies to semiconductor manufacturing equipment.
- Note 1. It does not apply to Servo Drivers with single-phase 100-V specifications or with 24-VDC specifications for the control power input.
- Note 2. Always perform evaluation testing for SEMI F47 compliance in the actual system.

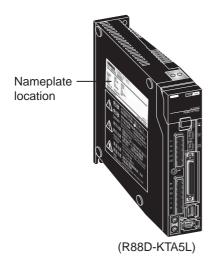
1-6 Unit Versions

The G5-series Servo Drive uses unit versions.

Unit versions are used to manage differences in supported functions when product upgrades are made.

Confirmation Method

The unit version of a G5-series Servo Drive is given on the product's nameplate as shown below.



Product Nameplate



Unit Version Here, the unit version is 1.2.

Unit Versions

| Unit version | Upgraded content | Supported CX-Drive versions |
|--|--|--------------------------------|
| Not indicated | New release | Ver. 1.80 or higher |
| Ver.1.1 | Alarm 27.2 detection conditions have been changed to support the increase of encoder resolution in the G series. | Ver. 1.80 or higher |
| Ver.1.2 European area compliance No changes to existing Ver. 1.1 functions | | Ver. 1.80 or higher |

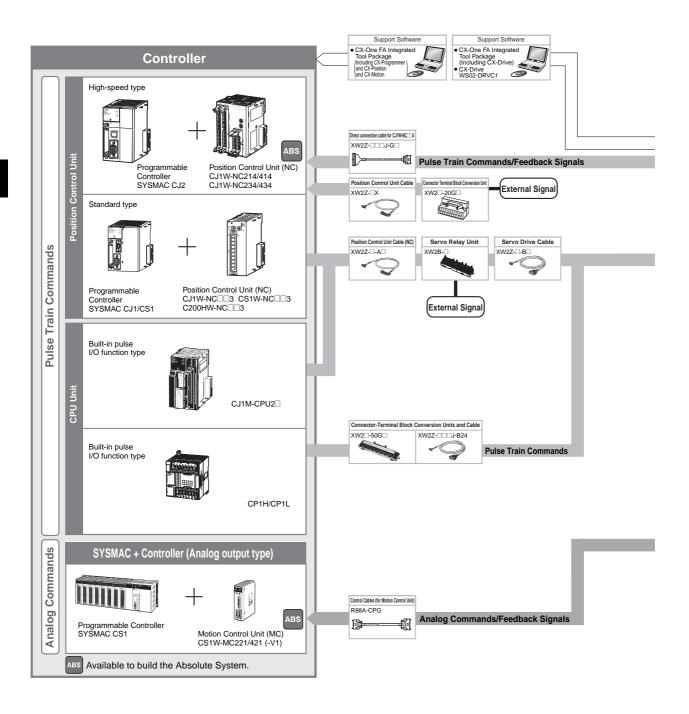


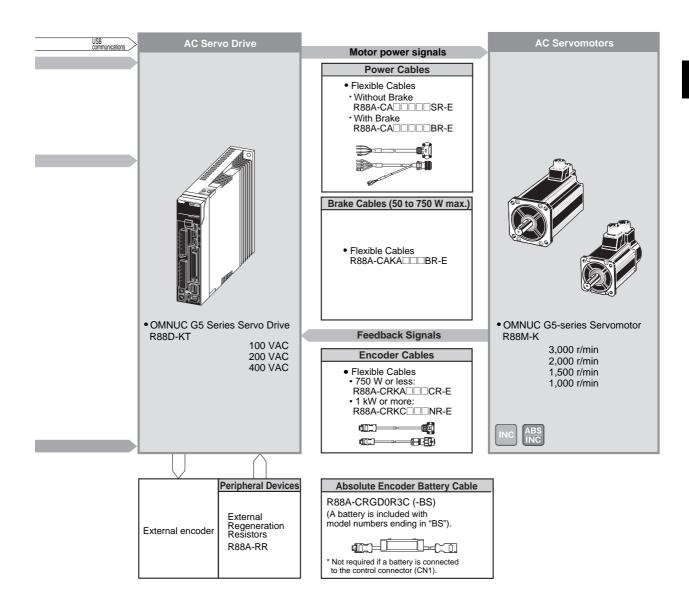
Standard Models and External Dimensions

This chapter explains the models of Servo Drives, Servomotors, and peripheral equipment, and provides the external dimensions and mounting dimensions.

| 2-1 | Servo System Configuration | 2-1 |
|-----|---|------|
| 2-2 | How to Read Model Numbers | 2-3 |
| | Servo Drive | |
| 2-3 | Standard Model Tables | |
| | Servo Drive Model Table | |
| | Servo Drive and Servomotor Combination Tables Peripheral Equipment and Cable Model Tables | 2-11 |
| 2-4 | External and Mounting Dimensions | 2-25 |
| | Servo Drive Dimensions | 2-43 |
| 2-5 | EMC Filter Dimensions | |
| | | |
| ∠-6 | Dimensions of Mounting Brackets (L-Brackets for Rack Mounting) | 2-72 |

2-1 Servo System Configuration





2

2-2 How to Read Model Numbers

Servo Drive

The Servo Drive model number tells the Servo Drive type, applicable Servomotor capacity, power supply voltage, etc.

R88D-KT01H OMNUC G5-series Servo Drive -Drive Type T: Pulse/analog type Maximum Applicable Servomotor Capacity -A5 : 50 W 01:100 W 02:200 W 04:400 W 06:600 W 08:750 W 10 : 1 kW 15:1.5 kW 20:2 kW 30 : 3 kW 50 : 5 kW 75 : 7.5 kW 150:15 kW Power Supply Voltage -

L: 100 VAC H: 200 VAC F: 400 VAC

Servomotor

| | R88M-K10030H-BOS |
|---|------------------|
| OMNUC G5-series Servomotor | |
| Servomotor Capacity 050 : 50 W 100 : 100 W 200 : 200 W 400 : 400 W 600 : 600 W 750 : 750 W 900 : 900 W 1K0 : 1 kW 1K5 : 1.5 kW 2K0 : 2 kW 3K0 : 3 kW 4K0 : 4 kW 4K5 : 4.5 kW 5K0 : 5 kW 6K0 : 6 kW 7K5 : 7.5 kW 11K0: 11 kW 15K0: 15 kW Rated Rotation Speed 10 : 1,000 r/min 15 : 1,500 r/min 20 : 2,000 r/min | |
| 30 : 3,000 r/min Applied Voltage F : 400 VAC (incremental encoder specifications) H : 200 VAC (incremental encoder specifications) L : 100 VAC (incremental encoder specifications) C : 400 VAC (absolute encoder specifications) T : 200 VAC (absolute encoder specifications) S : 100 VAC (absolute encoder specifications) | |

Blank: Straight shaft, no key

B : With brakeO : With oil sealS2 : With key and tap

2-3 Standard Model Tables

Servo Drive Model Table

| Specifications | | Model |
|------------------------------|--------|-------------|
| Single-phase 100 VAC | 50 W | R88D-KTA5L |
| | 100 W | R88D-KT01L |
| | 200 W | R88D-KT02L |
| | 400 W | R88D-KT04L |
| Single-phase/3-phase 200 VAC | 100 W | R88D-KT01H |
| | 200 W | R88D-KT02H |
| | 400 W | R88D-KT04H |
| | 750 W | R88D-KT08H |
| | 1 kW | R88D-KT10H |
| | 1.5 kW | R88D-KT15H |
| 3-phase 200 VAC | 2 kW | R88D-KT20H |
| | 3 kW | R88D-KT30H |
| | 5 kW | R88D-KT50H |
| | 7.5 kW | R88D-KT75H |
| | 15 kW | R88D-KT150H |
| 3-phase 400 VAC | 600 W | R88D-KT06F |
| | 1 kW | R88D-KT10F |
| | 1.5 kW | R88D-KT15F |
| | 2 kW | R88D-KT20F |
| | 3 kW | R88D-KT30F |
| | 5 kW | R88D-KT50F |
| | 7.5 kW | R88D-KT75F |
| | 15 kW | R88D-KT150F |

Servomotor Model Tables

3,000-r/min Servomotors

| Specifications | | Model | | | | |
|----------------|--------|----------------------------|---------------------------------|----------------------------|---------------------------------|--|
| | | With incremental encoder | | With abso | olute encoder | |
| | | Straight shaft without key | Straight shaft with key and tap | Straight shaft without key | Straight shaft with key and tap | |
| | 50 W | R88M-K05030H | R88M-K05030H-S2 | R88M-K05030T | R88M-K05030T-S2 | |
| 100 V | 100 W | R88M-K10030L | R88M-K10030L-S2 | R88M-K10030S | R88M-K10030S-S2 | |
| 100 V | 200 W | R88M-K20030L | R88M-K20030L-S2 | R88M-K20030S | R88M-K20030S-S2 | |
| | 400 W | R88M-K40030L | R88M-K40030L-S2 | R88M-K40030S | R88M-K40030S-S2 | |
| | 50 W | R88M-K05030H | R88M-K05030H-S2 | R88M-K05030T | R88M-K05030T-S2 | |
| | 100 W | R88M-K10030H | R88M-K10030H-S2 | R88M-K10030T | R88M-K10030T-S2 | |
| | 200 W | R88M-K20030H | R88M-K20030H-S2 | R88M-K20030T | R88M-K20030T-S2 | |
| | 400 W | R88M-K40030H | R88M-K40030H-S2 | R88M-K40030T | R88M-K40030T-S2 | |
| | 750 W | R88M-K75030H | R88M-K75030H-S2 | R88M-K75030T | R88M-K75030T-S2 | |
| ي 200 V | 1 kW | R88M-K1K030H | R88M-K1K030H-S2 | R88M-K1K030T | R88M-K1K030T-S2 | |
| Without brakes | 1.5 kW | R88M-K1K530H | R88M-K1K530H-S2 | R88M-K1K530T | R88M-K1K530T-S2 | |
| out b | 2 kW | R88M-K2K030H | R88M-K2K030H-S2 | R88M-K2K030T | R88M-K2K030T-S2 | |
| Vitho | 3 kW | R88M-K3K030H | R88M-K3K030H-S2 | R88M-K3K030T | R88M-K3K030T-S2 | |
| > | 4 kW | R88M-K4K030H | R88M-K4K030H-S2 | R88M-K4K030T | R88M-K4K030T-S2 | |
| | 5 kW | R88M-K5K030H | R88M-K5K030H-S2 | R88M-K5K030T | R88M-K5K030T-S2 | |
| | 750 W | R88M-K75030F | R88M-K75030F-S2 | R88M-K75030C | R88M-K75030C-S2 | |
| | 1 kW | R88M-K1K030F | R88M-K1K030F-S2 | R88M-K1K030C | R88M-K1K030C-S2 | |
| | 1.5 kW | R88M-K1K530F | R88M-K1K530F-S2 | R88M-K1K530C | R88M-K1K530C-S2 | |
| 400 V | 2 kW | R88M-K2K030F | R88M-K2K030F-S2 | R88M-K2K030C | R88M-K2K030C-S2 | |
| | 3 kW | R88M-K3K030F | R88M-K3K030F-S2 | R88M-K3K030C | R88M-K3K030C-S2 | |
| | 4 kW | R88M-K4K030F | R88M-K4K030F-S2 | R88M-K4K030C | R88M-K4K030C-S2 | |
| | 5 kW | R88M-K5K030F | R88M-K5K030F-S2 | R88M-K5K030C | R88M-K5K030C-S2 | |

Note. Models with oil seals are also available.

| Specifications | | | Model | | | | |
|----------------|-------|--------|----------------------------|---------------------------------|----------------------------|---------------------------------|--|
| | | ations | With incremental encoder | | With absol | ute encoder | |
| - CP | | | Straight shaft without key | Straight shaft with key and tap | Straight shaft without key | Straight shaft with key and tap | |
| | | 50 W | R88M-K05030H-B | R88M-K05030H-BS2 | R88M-K05030T-B | R88M-K05030T-BS2 | |
| | 100 V | 100 W | R88M-K10030L-B | R88M-K10030L-BS2 | R88M-K10030S-B | R88M-K10030S-BS2 | |
| | 100 V | 200 W | R88M-K20030L-B | R88M-K20030L-BS2 | R88M-K20030S-B | R88M-K20030S-BS2 | |
| | | 400 W | R88M-K40030L-B | R88M-K40030L-BS2 | R88M-K40030S-B | R88M-K40030S-BS2 | |
| | | 50 W | R88M-K05030H-B | R88M-K05030H-BS2 | R88M-K05030T-B | R88M-K05030T-BS2 | |
| | | 100 W | R88M-K10030H-B | R88M-K10030H-BS2 | R88M-K10030T-B | R88M-K10030T-BS2 | |
| | | 200 W | R88M-K20030H-B | R88M-K20030H-BS2 | R88M-K20030T-B | R88M-K20030T-BS2 | |
| | | 400 W | R88M-K40030H-B | R88M-K40030H-BS2 | R88M-K40030T-B | R88M-K40030T-BS2 | |
| | | 750 W | R88M-K75030H-B | R88M-K75030H-BS2 | R88M-K75030T-B | R88M-K75030T-BS2 | |
| | 200 V | 1 kW | R88M-K1K030H-B | R88M-K1K030H-BS2 | R88M-K1K030T-B | R88M-K1K030T-BS2 | |
| kes | | 1.5 kW | R88M-K1K530H-B | R88M-K1K530H-BS2 | R88M-K1K530T-B | R88M-K1K530T-BS2 | |
| With brakes | | 2 kW | R88M-K2K030H-B | R88M-K2K030H-BS2 | R88M-K2K030T-B | R88M-K2K030T-BS2 | |
| With | | 3 kW | R88M-K3K030H-B | R88M-K3K030H-BS2 | R88M-K3K030T-B | R88M-K3K030T-BS2 | |
| | | 4 kW | R88M-K4K030H-B | R88M-K4K030H-BS2 | R88M-K4K030T-B | R88M-K4K030T-BS2 | |
| | | 5 kW | R88M-K5K030H-B | R88M-K5K030H-BS2 | R88M-K5K030T-B | R88M-K5K030T-BS2 | |
| | | 750 W | R88M-K75030F-B | R88M-K75030F-BS2 | R88M-K75030C-B | R88M-K75030C-BS2 | |
| | | 1 kW | R88M-K1K030F-B | R88M-K1K030F-BS2 | R88M-K1K030C-B | R88M-K1K030C-BS2 | |
| | | 1.5 kW | R88M-K1K530F-B | R88M-K1K530F-BS2 | R88M-K1K530C-B | R88M-K1K530C-BS2 | |
| | 400 V | 2 kW | R88M-K2K030F-B | R88M-K2K030F-BS2 | R88M-K2K030C-B | R88M-K2K030C-BS2 | |
| | | 3 kW | R88M-K3K030F-B | R88M-K3K030F-BS2 | R88M-K3K030C-B | R88M-K3K030C-BS2 | |
| | | 4 kW | R88M-K4K030F-B | R88M-K4K030F-BS2 | R88M-K4K030C-B | R88M-K4K030C-BS2 | |
| | | 5 kW | R88M-K5K030F-B | R88M-K5K030F-BS2 | R88M-K5K030C-B | R88M-K5K030C-BS2 | |

Note. Models with oil seals are also available.

1,500-r/min and 2,000-r/min Servomotors

| Specifications | | Model | | | | |
|----------------|--------|----------------------------|---------------------------------|----------------------------|---------------------------------|--|
| | | With incremental encoder | | With abs | olute encoder | |
| | | Straight shaft without key | Straight shaft with key and tap | Straight shaft without key | Straight shaft with key and tap | |
| T | 1 kW | R88M-K1K020H | R88M-K1K020H-S2 | R88M-K1K020T | R88M-K1K020T-S2 | |
| | 1.5 kW | R88M-K1K520H | R88M-K1K520H-S2 | R88M-K1K520T | R88M-K1K520T-S2 | |
| | 2 kW | R88M-K2K020H | R88M-K2K020H-S2 | R88M-K2K020T | R88M-K2K020T-S2 | |
| | 3 kW | R88M-K3K020H | R88M-K3K020H-S2 | R88M-K3K020T | R88M-K3K020T-S2 | |
| 200 V | 4 kW | R88M-K4K020H | R88M-K4K020H-S2 | R88M-K4K020T | R88M-K4K020T-S2 | |
| | 5 kW | R88M-K5K020H | R88M-K5K020H-S2 | R88M-K5K020T | R88M-K5K020T-S2 | |
| | 7.5 kW | | | R88M-K7K515T | R88M-K7K515T-S2 | |
| | 11 kW | | | R88M-K11K015T | R88M-K11K015T-S2 | |
| 3 | 15 kW | | | R88M-K15K015T | R88M-K15K015T-S2 | |
| | 400 W | R88M-K40020F | R88M-K40020F-S2 | R88M-K40020C | R88M-K40020C-BS2 | |
| | 600 W | R88M-K60020F | R88M-K60020F-S2 | R88M-K60020C | R88M-K60020C-BS2 | |
| | 1 kW | R88M-K1K020F | R88M-K1K020F-S2 | R88M-K1K020C | R88M-K1K020C-S2 | |
| | 1.5 kW | R88M-K1K520F | R88M-K1K520F-S2 | R88M-K1K520C | R88M-K1K520C-S2 | |
| | 2 kW | R88M-K2K020F | R88M-K2K020F-S2 | R88M-K2K020C | R88M-K2K020C-S2 | |
| 400 V | 3 kW | R88M-K3K020F | R88M-K3K020F-S2 | R88M-K3K020C | R88M-K3K020C-S2 | |
| | 4 kW | R88M-K4K020F | R88M-K4K020F-S2 | R88M-K4K020C | R88M-K4K020C-S2 | |
| | 5 kW | R88M-K5K020F | R88M-K5K020F-S2 | R88M-K5K020C | R88M-K5K020C-S2 | |
| | 7.5 kW | | | R88M-K7K515C | R88M-K7K515C-S2 | |
| | 11 kW | | | R88M-K11K015C | R88M-K11K015C-S2 | |
| | 15 kW | | | R88M-K15K015C | R88M-K15K015C-S2 | |

Note 1. Models with oil seals are also available.

Note 2. The rated rotation speed of Servomotors of 7.5 to 15 kW is 1,500 r/min.

| | | | Model | | | | |
|-------------|----------------|--------|----------------------------|---------------------------------|----------------------------|---------------------------------|--|
| s | Specifications | | With increm | nental encoder | With abso | lute encoder | |
| | | | Straight shaft without key | Straight shaft with key and tap | Straight shaft without key | Straight shaft with key and tap | |
| | | 1 kW | R88M-K1K020H-B | R88M-K1K020H-BS2 | R88M-K1K020T-B | R88M-K1K020T-BS2 | |
| | | 1.5 kW | R88M-K1K520H-B | R88M-K1K520H-BS2 | R88M-K1K520T-B | R88M-K1K520T-BS2 | |
| | | 2 kW | R88M-K2K020H-B | R88M-K2K020H-BS2 | R88M-K2K020T-B | R88M-K2K020T-BS2 | |
| | | 3 kW | R88M-K3K020H-B | R88M-K3K020H-BS2 | R88M-K3K020T-B | R88M-K3K020T-BS2 | |
| | 200 V | 4 kW | R88M-K4K020H-B | R88M-K4K020H-BS2 | R88M-K4K020T-B | R88M-K4K020T-BS2 | |
| | | 5 kW | R88M-K5K020H-B | R88M-K5K020H-BS2 | R88M-K5K020T-B | R88M-K5K020T-BS2 | |
| | | 7.5 kW | | | R88M-K7K515T-B | R88M-K7K515T-BS2 | |
| | | 11 kW | | | R88M-K11K015T-B | R88M-K11K015T-S2 | |
| | | 15 kW | | | R88M-K15K015T-B | R88M-K15K015T-S2 | |
| akes | | 400 W | R88M-K40020F-B | R88M-K40020F-BS2 | R88M-K40020C-B | R88M-K40020C-BS2 | |
| With brakes | | 600 W | R88M-K60020F-B | R88M-K60020F-BS2 | R88M-K60020C-B | R88M-K60020C-BS2 | |
| Χ | | 1 kW | R88M-K1K020F-B | R88M-K1K020F-BS2 | R88M-K1K020C-B | R88M-K1K020C-BS2 | |
| | | 1.5 kW | R88M-K1K520F-B | R88M-K1K520F-BS2 | R88M-K1K520C-B | R88M-K1K520C-BS2 | |
| | | 2 kW | R88M-K2K020F-B | R88M-K2K020F-BS2 | R88M-K2K020C-B | R88M-K2K020C-BS2 | |
| | 400 V | 3 kW | R88M-K3K020F-B | R88M-K3K020F-BS2 | R88M-K3K020C-B | R88M-K3K020C-BS2 | |
| | | 4 kW | R88M-K4K020F-B | R88M-K4K020F-BS2 | R88M-K4K020C-B | R88M-K4K020C-BS2 | |
| | | 5 kW | R88M-K5K020F-B | R88M-K5K020F-BS2 | R88M-K5K020C-B | R88M-K5K020C-BS2 | |
| | | 7.5 kW | | | R88M-K7K515C-B | R88M-K7K515C-BS2 | |
| | | 11 kW | | | R88M-K11K015C-B | R88M-K11K015C-BS2 | |
| | | 15 kW | | | R88M-K15K015C-B | R88M-K15K015C-BS2 | |

Note 1. Models with oil seals are also available.

Note 2. The rated rotation speed of Servomotors of 7.5 to 15 kW is 1,500 r/min.

1,000-r/min Servomotors

| | | | Model | | | | | | |
|----------------|----------------|--------|---|------------------|----------------------------|---------------------------------|--|--|--|
| S | Specifications | | With incren | nental encoder | With absolute encoder | | | | |
| | | | Straight shaft without key with key and tap | | Straight shaft without key | Straight shaft with key and tap | | | |
| | | 900 kW | R88M-K90010H | R88M-K90010H-S2 | R88M-K90010T | R88M-K90010T-S2 | | | |
| | | 2 kW | R88M-K2K010H | R88M-K2K010H-S2 | R88M-K2K010T | R88M-K2K010T-S2 | | | |
| | 200 V | 3 kW | R88M-K3K010H | R88M-K3K010H-S2 | R88M-K3K010T | R88M-K3K010T-S2 | | | |
| S | | 4.5 kW | | | R88M-K4K510T | R88M-K4K510T-S2 | | | |
| rake | | 6 kW | | | R88M-K6K010T | R88M-K6K010T-S2 | | | |
| out b | | 900 kW | R88M-K90010F | R88M-K90010F-S2 | R88M-K90010C | R88M-K90010C-S2 | | | |
| Without brakes | | 2 kW | R88M-K2K010F | R88M-K2K010F-S2 | R88M-K2K010C | R88M-K2K010C-S2 | | | |
| | 400 V | 3 kW | R88M-K3K010F | R88M-K3K010F-S2 | R88M-K3K010C | R88M-K3K010C-S2 | | | |
| | | 4.5 kW | | | R88M-K4K510C | R88M-K4K510C-S2 | | | |
| | | 6 kW | | | R88M-K6K010C | R88M-K6K010C-S2 | | | |
| | | 900 kW | R88M-K90010H-B | R88M-K90010H-BS2 | R88M-K90010T-B | R88M-K90010T-BS2 | | | |
| | | 2 kW | R88M-K2K010H-B | R88M-K2K010H-BS2 | R88M-K2K010T-B | R88M-K2K010T-BS2 | | | |
| | 200 V | 3 kW | R88M-K3K010H-B | R88M-K3K010H-BS2 | R88M-K3K010T-B | R88M-K3K010T-BS2 | | | |
| " | | 4.5 kW | | | R88M-K4K510T-B | R88M-K4K510T-BS2 | | | |
| With brakes | | 6 kW | | | R88M-K6K010T-B | R88M-K6K010T-BS2 | | | |
| th br | | 900 kW | R88M-K90010F-B | R88M-K90010F-BS2 | R88M-K90010C-B | R88M-K90010C-BS2 | | | |
| Š | | 2 kW | R88M-K2K010F-B | R88M-K2K010F-BS2 | R88M-K2K010C-B | R88M-K2K010C-BS2 | | | |
| | 400 V | 3 kW | R88M-K3K010F-B | R88M-K3K010F-BS2 | R88M-K3K010C-B | R88M-K3K010C-BS2 | | | |
| | | 4.5 kW | | | R88M-K4K510C-B | R88M-K4K510C-BS2 | | | |
| | | 6 kW | | | R88M-K6K010C-B | R88M-K6K010C-BS2 | | | |

Note. Models with oil seals are also available.

Servo Drive and Servomotor Combination Tables

The tables in this section show the possible combinations of OMNUC G5-series Servo Drives and Servomotors. The Servomotors and Servo Drives can only be used in the listed combinations.

"- \square " at the end of the motor model number is for options, such as the shaft type, brake, oil seal and key.

3,000-r/min Servomotors and Servo Drives

| | | Servomoto | r | |
|--------------------------------|--------------|--------------------------|-----------------------|-------------|
| Voltage | Rated output | With incremental encoder | With absolute encoder | Servo Drive |
| Single-phase | 50 W | R88M-K05030H-□ | R88M-K05030T-□ | R88D-KTA5L |
| 100 V | 100 W | R88M-K10030L- | R88M-K10030S-□ | R88D-KT01L |
| Single-phase/ | 200 W | R88M-K20030L-□ | R88M-K20030S-□ | R88D-KT02L |
| 3-phase 100 V | 400 W | R88M-K40030L-□ | R88M-K40030S-□ | R88D-KT04L |
| | 50 W* | R88M-K05030H-□ | R88M-K05030T-□ | R88D-KT01H |
| | 100 W | R88M-K10030H-□ | R88M-K10030T-□ | R88D-KT01H |
| | 200 W | R88M-K20030H-□ | R88M-K20030T-□ | R88D-KT02H |
| Single-phase/ 3-phase 200 V | 400 W | R88M-K40030H-□ | R88M-K40030T-□ | R88D-KT04H |
| | 750 W | R88M-K75030H-□ | R88M-K75030T-□ | R88D-KT08H |
| | 1 kW* | R88M-K1K030H-□ | R88M-K1K030T-□ | R88D-KT15H |
| | 1.5 kW | R88M-K1K530H-□ | R88M-K1K530T-□ | R88D-KT15H |
| | 2 kW | R88M-K2K030H-□ | R88M-K2K030T-□ | R88D-KT20H |
| 3-phase 200 V | 3 kW | R88M-K3K030H-□ | R88M-K3K030T-□ | R88D-KT30H |
| 3-priase 200 v | 4 kW* | R88M-K4K030H-□ | R88M-K4K030T-□ | R88D-KT50H |
| | 5 kW | R88M-K5K030H-□ | R88M-K5K030T-□ | R88D-KT50H |
| | 750 W* | R88M-K75030F-□ | R88M-K75030C-□ | R88D-KT10F |
| | 1 kW* | R88M-K1K030F-□ | R88M-K1K030C-□ | R88D-KT15F |
| | 1.5 kW | R88M-K1K530F-□ | R88M-K1K530C-□ | R88D-KT15F |
| 3-phase 400 V | 2 kW | R88M-K2K030F-□ | R88M-K2K030C-□ | R88D-KT20F |
| | 3 kW | R88M-K3K030F-□ | R88M-K3K030C-□ | R88D-KT30F |
| | 4 kW* | R88M-K4K030F-□ | R88M-K4K030C-□ | R88D-KT50F |
| | 5 kW | R88M-K5K030F-□ | R88M-K5K030C-□ | R88D-KT50F |

^{*} Use these combination with caution because the Servo Drive and Servomotor have different capacities.

1,500-r/min and 2,000-r/min Servomotors and Servo Drives

| | | Servomoto | | |
|---------------|-----------------------------------|--------------------------|-----------------------|-------------|
| Voltage | Rated output | With incremental encoder | With absolute encoder | Servo Drive |
| Single-phase/ | 1 kW | R88M-K1K020H-□ | R88M-K1K020T-□ | R88D-KT10H |
| 3-phase 200 V | 1.5 kW | R88M-K1K520H-□ | R88M-K1K520T-□ | R88D-KT15H |
| | 2 kW | R88M-K2K020H-□ | R88M-K2K020T-□ | R88D-KT20H |
| | 3 kW | R88M-K3K020H-□ | R88M-K3K020T-□ | R88D-KT30H |
| | 4 kW* | R88M-K4K020H-□ | R88M-K4K020T-□ | R88D-KT50H |
| 3-phase 200 V | 5 kW | R88M-K5K020H-□ | R88M-K5K020T-□ | R88D-KT50H |
| | 7.5 kW | | R88M-K7K515T-□ | R88D-KT75H |
| | 11 kW* | | R88M-K11K015T-□ | R88D-KT150H |
| | 15 kW | | R88M-K15K015T-□ | R88D-KT150H |
| | 400 W* | R88M-K40020F-□ | R88M-K40020C-□ | R88D-KT06F |
| | 600 W | R88M-K60020F-□ | R88M-K60020C-□ | R88D-KT06F |
| | 1 kW | R88M-K1K020F-□ | R88M-K1K020C-□ | R88D-KT10F |
| | 1.5 kW | R88M-K1K520F-□ | R88M-K1K520C-□ | R88D-KT15F |
| | 2 kW R88M-K2K020F-□ R88M-K2K020C- | R88M-K2K020C-□ | R88D-KT20F | |
| 3-phase 400 V | 3 kW | R88M-K3K020F-□ | R88M-K3K020C-□ | R88D-KT30F |
| | 4 kW* | R88M-K4K020F-□ | R88M-K4K020C-□ | R88D-KT50F |
| | 5 kW | R88M-K5K020F-□ | R88M-K5K020C-□ | R88D-KT50F |
| | 7.5 kW | | R88M-K7K515C-□ | R88D-KT75F |
| | 11 kW* | | R88M-K11K015C-□ | R88D-KT150F |
| | 15 kW | | R88M-K15K015C-□ | R88D-KT150F |

^{*} Use these combination with caution because the Servo Drive and Servomotor have different capacities.

1,000-r/min Servomotors and Servo Drives

| Voltage | Rated output | With incremental encoder | With absolute encoder | Servo Drive | |
|--------------------------------|--------------|--------------------------|-----------------------|-------------|--|
| Single-phase/ 3-phase 200 V | 900 W* | R88M-K90010H-□ | R88M-K90010T- | R88D-KT15H | |
| | 2 kW* | R88M-K2K010H-□ | R88M-K2K010T-□ | R88D-KT30H | |
| 3-phase 200 V | 3 kW* | R88M-K3K010H-□ | R88M-K3K010T-□ | R88D-KT50H | |
| 3-priase 200 v | 4.5 kW* | | R88M-K4K510T-□ | R88D-KT50H | |
| | 6 kW* | | R88M-K6K010T-□ | R88D-KT75H | |
| | 900 W* | R88M-K90010F-□ | R88M-K90010C-□ | R88D-KT15F | |
| | 2 kW* | R88M-K2K010F-□ | R88M-K2K010C-□ | R88D-KT30F | |
| 3-phase 400 V | 3 kW* | R88M-K3K010F-□ | R88M-K3K010C-□ | R88D-KT50F | |
| | 4.5 kW* | | R88M-K4K510C-□ | R88D-KT50F | |
| | 6 kW* | | R88M-K6K010C-□ | R88D-KT75F | |

^{*} Use these combination with caution because the Servo Drive and Servomotor have different capacities.

Peripheral Equipment and Cable Model Tables

Encoder Cables (European Flexible Cables)

| Specifications | Model | |
|--|-------|--------------------|
| [100 V and 200 V] | 1.5 m | R88A-CRKA001-5CR-E |
| For 3,000-r/min Servomotors of 50 to 750 W (for both absolute encoders and incremental encoders) | 3 m | R88A-CRKA003CR-E |
| , | 5 m | R88A-CRKA005CR-E |
| | 10 m | R88A-CRKA010CR-E |
| | 15 m | R88A-CRKA015CR-E |
| | 20 m | R88A-CRKA020CR-E |
| [100 V and 200 V] | 1.5 m | R88A-CRKC001-5NR-E |
| 3,000-r/min Servomotors of 1.0 kW or more For 2,000-r/min Servomotors | 3 m | R88A-CRKC003NR-E |
| For 1,000-r/min Servomotors | 5 m | R88A-CRKC005NR-E |
| [400 V] | 10 m | R88A-CRKC010NR-E |
| For 3,000-r/min Servomotors For 2,000-r/min Servomotors | 15 m | R88A-CRKC015NR-E |
| For 1,000-r/min Servomotors | 20 m | R88A-CRKC020NR-E |

Motor Power Cables (European Flexible Cables)

| Specifications | | Mod | lel |
|---|-------|-------------------------|----------------------|
| Specifications | | For motor without brake | For motor with brake |
| [100 V and 200 V] | 1.5 m | R88A-CAKA001-5SR-E | |
| For 3,000-r/min Servomotors of 50 to 750 W | 3 m | R88A-CAKA003SR-E | |
| | 5 m | R88A-CAKA005SR-E | (See note 1.) |
| | 10 m | R88A-CAKA010SR-E | (Gee note 1.) |
| | 15 m | R88A-CAKA015SR-E | |
| | 20 m | R88A-CAKA020SR-E | |
| [200 V] | 1.5 m | R88A-CAGB001-5SR-E | R88A-CAGB001-5BR-E |
| For 3,000-r/min Servomotors of 1 to 2 kW | 3 m | R88A-CAGB003SR-E | R88A-CAGB003BR-E |
| For 2,000-r/min Servomotors of 1 to | 5 m | R88A-CAGB005SR-E | R88A-CAGB005BR-E |
| 2 kW For 1,000-r/min Servomotors of 900 W | 10 m | R88A-CAGB010SR-E | R88A-CAGB010BR-E |
| | 15 m | R88A-CAGB015SR-E | R88A-CAGB015BR-E |
| | 20 m | R88A-CAGB020SR-E | R88A-CAGB020BR-E |
| [400 V] | 1.5 m | R88A-CAGB001-5SR-E | R88A-CAKF001-5BR-E |
| For 3,000-r/min Servomotors of 750 W to 2 kW | 3 m | R88A-CAGB003SR-E | R88A-CAKF003BR-E |
| For 2,000-r/min Servomotors of 400 W | 5 m | R88A-CAGB005SR-E | R88A-CAKF005BR-E |
| to 2 kW For 1,000-r/min Servomotors of 900 W | 10 m | R88A-CAGB010SR-E | R88A-CAKF010BR-E |
| | 15 m | R88A-CAGB015SR-E | R88A-CAKF015BR-E |
| | 20 m | R88A-CAGB020SR-E | R88A-CAKF020BR-E |
| For 3,000-r/min Servomotors of 3 to | 1.5 m | R88A-CAGD001-5SR-E | R88A-CAGD001-5BR-E |
| 5 kW For 2,000-r/min Servomotors of 3 to | 3 m | R88A-CAGD003SR-E | R88A-CAGD003BR-E |
| 5 kW | 5 m | R88A-CAGD005SR-E | R88A-CAGD005BR-E |
| For 1,000-r/min Servomotors of 2 to 4.5 kW | 10 m | R88A-CAGD010SR-E | R88A-CAGD010BR-E |
| | 15 m | R88A-CAGD015SR-E | R88A-CAGD015BR-E |
| | 20 m | R88A-CAGD020SR-E | R88A-CAGD020BR-E |

Note 1.: Different connectors are used for the motor power and the brake on 100-V and 200-V, 3,000-r/min Servomotors of 50 to 750 W and Servomotors of 6 to 15 kW. When using a Servomotor with a brake, two cables are required: a Power Cable without Brake and a Brake Cable.

Note 2.: For flexible power cables for Servomotors of 11 to 15 kW, refer to 4-2 Wiring (P. 4-7) and make your own cable.

For flexible power cables for Servomotors of 6 to 7.5 kW, refer to 3-4 Cable and Connector Specifications and make your own power cable.

Brake Cables (European Flexible Cables)

| Specifications | | Model |
|--|-------|--------------------|
| [100 V and 200 V] | 1.5 m | R88A-CAKA001-5BR-E |
| For 3,000-r/min Servomotors of 50 to 750 W | 3 m | R88A-CAKA003BR-E |
| | 5 m | R88A-CAKA005BR-E |
| | 10 m | R88A-CAKA010BR-E |
| | 15 m | R88A-CAKA015BR-E |
| | 20 m | R88A-CAKA020BR-E |

Note: For flexible brake cables for Servomotors of 6 to 15 kW, refer to 3-4 Cable and Connector Specifications and make your own brake cable.

Encoder Cables (Global Non-Flexible Cables)

| Specifications | Model | |
|--|-------|---------------|
| [100 V and 200 V] | 3 m | R88A-CRKA003C |
| For 3,000-r/min Servomotors of 50 to 750 W (for both absolute encoders and incremental encoders) | 5 m | R88A-CRKA005C |
| | 10 m | R88A-CRKA010C |
| | 15 m | R88A-CRKA015C |
| | 20 m | R88A-CRKA020C |
| | 30 m | R88A-CRKA030C |
| | 40 m | R88A-CRKA040C |
| | 50 m | R88A-CRKA050C |
| [100 V and 200 V] | 3 m | R88A-CRKC003N |
| 3,000-r/min Servomotors of 1.0 kW or more For 2,000-r/min Servomotors | 5 m | R88A-CRKC005N |
| For 1,500-r/min Servomotors | 10 m | R88A-CRKC010N |
| For 1,000-r/min Servomotors | 15 m | R88A-CRKC015N |
| [400 V] | 20 m | R88A-CRKC020N |
| For 3,000-r/min Servomotors For 2,000-r/min Servomotors | 30 m | R88A-CRKC030N |
| For 1,500-r/min Servomotors For 1,000-r/min Servomotors | 40 m | R88A-CRKC040N |
| For 1,000-1/IIIII Servoniolois | 50 m | R88A-CRKC050N |

Motor Power Cables (Global Non-Flexible Cables)

| | | Mo | odel |
|--|------|-------------------------|----------------------|
| Specifications | | For motor without brake | For motor with brake |
| [100 V and 200 V] | 3 m | R88A-CAKA003S | (See note 1.) |
| For 3,000-r/min Servomotors of 50 to 750 W | 5 m | R88A-CAKA005S | † |
| | 10 m | R88A-CAKA010S | † |
| | 15 m | R88A-CAKA015S | † |
| | 20 m | R88A-CAKA020S | † |
| | 30 m | R88A-CAKA030S | † |
| | 40 m | R88A-CAKA040S | |
| | 50 m | R88A-CAKA050S | † |
| [200 V] | 3 m | R88A-CAGB003S | R88A-CAGB003B |
| For 3,000-r/min Servomotors of 1 to 2 kW For 2,000-r/min Servomotors of 1 to 2 kW | 5 m | R88A-CAGB005S | R88A-CAGB005B |
| For 1,000-r/min Servomotors of 900 W | 10 m | R88A-CAGB010S | R88A-CAGB010B |
| | 15 m | R88A-CAGB015S | R88A-CAGB015B |
| | 20 m | R88A-CAGB020S | R88A-CAGB020B |
| | 30 m | R88A-CAGB030S | R88A-CAGB030B |
| | 40 m | R88A-CAGB040S | R88A-CAGB040B |
| | 50 m | R88A-CAGB050S | R88A-CAGB050B |
| [400 V] | 3 m | R88A-CAGB003S | R88A-CAKF003B |
| For 3,000-r/min Servomotors of 750 W to 2 kW | 5 m | R88A-CAGB005S | R88A-CAKF005B |
| For 2,000-r/min Servomotors of 400 W to 2 | 10 m | R88A-CAGB010S | R88A-CAKF010B |
| kW For 1,000-r/min Servomotors of 900 W | 15 m | R88A-CAGB015S | R88A-CAKF015B |
| | 20 m | R88A-CAGB020S | R88A-CAKF020B |
| | 30 m | R88A-CAGB030S | R88A-CAKF030B |
| | 40 m | R88A-CAGB040S | R88A-CAKF040B |
| | 50 m | R88A-CAGB050S | R88A-CAKF050B |
| For 3,000-r/min Servomotors of 3 to 5 kW | 3 m | R88A-CAGD003S | R88A-CAGD003B |
| For 2,000-r/min Servomotors of 3 to 5 kW For 1,000-r/min Servomotors of 2 to 4.5 | 5 m | R88A-CAGD005S | R88A-CAGD005B |
| kW | 10 m | R88A-CAGD010S | R88A-CAGD010B |
| | 15 m | R88A-CAGD015S | R88A-CAGD015B |
| | 20 m | R88A-CAGD020S | R88A-CAGD020B |
| | 30 m | R88A-CAGD030S | R88A-CAGD030B |
| | 40 m | R88A-CAGD040S | R88A-CAGD040B |
| _ | 50 m | R88A-CAGD050S | R88A-CAGD050B |

| | Model | | |
|---------------------------------------|-------|-------------------------|----------------------|
| Specifications | | For motor without brake | For motor with brake |
| For 2,000-r/min Servomotors of 7.5 kW | 3 m | R88A-CAGE003S | - |
| For 1,000-r/min Servomotors of 6 kW | 5 m | R88A-CAGE005S | - |
| | 10 m | R88A-CAGE010S | - |
| | 15 m | R88A-CAGE015S | - |
| | 20 m | R88A-CAGE020S | - |
| | 30 m | R88A-CAGE030S | - |
| | 40 m | R88A-CAGE040S | - |
| | 50 m | R88A-CAGE050S | - |

Note 1.: Different connectors are used for the motor power and the brake on 100-V and 200-V, 3,000-r/min Servomotors of 50 to 750 W and Servomotors of 6 to 15 kW. When using a Servomotor with a brake, two cables are required: a Power Cable without Brake and a Brake Cable.

Brake Cables (Global Non-Flexible Cables)

| Specifications | | Model |
|---|------|---------------|
| [100 V and 200 V] | 3 m | R88A-CAKA003B |
| For 3,000-r/min Servomotors of 50 to 750 W | 5 m | R88A-CAKA005B |
| | 10 m | R88A-CAKA010B |
| | 15 m | R88A-CAKA015B |
| | 20 m | R88A-CAKA020B |
| | 30 m | R88A-CAKA030B |
| | 40 m | R88A-CAKA040B |
| | 50 m | R88A-CAKA050B |
| For 1,500-r/min Servomotors of 7.5 to 15 kW | 3 m | R88A-CAGE003B |
| For 1,000-r/min Servomotors of 6 kW | 5 m | R88A-CAGE005B |
| | 10 m | R88A-CAGE010B |
| | 15 m | R88A-CAGE015B |
| | 20 m | R88A-CAGE020B |
| | 30 m | R88A-CAGE030B |
| | 40 m | R88A-CAGE040B |
| | 50 m | R88A-CAGE050B |

Note 2.: For non-flexible power cables for Servomotors of 11 or 15 kW, refer to *4-2 Wiring* (P. 4-7) and make your own cable.

Encoder Cables (Global Flexible Cables)

| Specifications | Model | |
|--|-------|----------------|
| [100 V and 200 V] | 3 m | R88A-CRKA003CR |
| For 3,000-r/min Servomotors of 50 to 750 W (for both absolute encoders and incremental encoders) | 5 m | R88A-CRKA005CR |
| | 10 m | R88A-CRKA010CR |
| | 15 m | R88A-CRKA015CR |
| | 20 m | R88A-CRKA020CR |
| | 30 m | R88A-CRKA030CR |
| | 40 m | R88A-CRKA040CR |
| | 50 m | R88A-CRKA050CR |
| [100 V and 200 V] | 3 m | R88A-CRKC003NR |
| 3,000-r/min Servomotors of 1.0 kW or more For 2,000-r/min Servomotors | 5 m | R88A-CRKC005NR |
| For 1,500-r/min Servomotors | 10 m | R88A-CRKC010NR |
| For 1,000-r/min Servomotors | 15 m | R88A-CRKC015NR |
| [400 V] | 20 m | R88A-CRKC020NR |
| For 3,000-r/min Servomotors For 2,000-r/min Servomotors | 30 m | R88A-CRKC030NR |
| For 1,500-r/min Servomotors | 40 m | R88A-CRKC040NR |
| For 1,000-r/min Servomotors | 50 m | R88A-CRKC050NR |

Motor Power Cables (Global Flexible Cables)

| | | Model | | |
|--|------|-------------------------|----------------------|--|
| Specifications | | For motor without brake | For motor with brake | |
| [100 V and 200 V] | 3 m | R88A-CAKA003SR | | |
| For 3,000-r/min Servomotors of 50 to 750 W | 5 m | R88A-CAKA005SR | | |
| | 10 m | R88A-CAKA010SR | | |
| | 15 m | R88A-CAKA015SR | (See note 1.) | |
| | 20 m | R88A-CAKA020SR | (See note 1.) | |
| | 30 m | R88A-CAKA030SR | | |
| | 40 m | R88A-CAKA040SR | | |
| | 50 m | R88A-CAKA050SR | | |
| [200 V] | 3 m | R88A-CAGB003SR | R88A-CAGB003BR | |
| For 3,000-r/min Servomotors of 1 to 2 kW For 2,000-r/min Servomotors of 1 to 2 kW | 5 m | R88A-CAGB005SR | R88A-CAGB005BR | |
| For 1,000-r/min Servomotors of 900 W | 10 m | R88A-CAGB010SR | R88A-CAGB010BR | |
| | 15 m | R88A-CAGB015SR | R88A-CAGB015BR | |
| | 20 m | R88A-CAGB020SR | R88A-CAGB020BR | |
| | 30 m | R88A-CAGB030SR | R88A-CAGB030BR | |
| | 40 m | R88A-CAGB040SR | R88A-CAGB040BR | |
| | 50 m | R88A-CAGB050SR | R88A-CAGB050BR | |

| Specifications | | Model | | |
|---|------|-------------------------|----------------------|--|
| | | For motor without brake | For motor with brake | |
| [400 V] | 3 m | R88A-CAGB003SR | R88A-CAKF003BR | |
| For 3,000-r/min Servomotors of 750 W to 2 kW | 5 m | R88A-CAGB005SR | R88A-CAKF005BR | |
| For 2,000-r/min Servomotors of 400 W to | 10 m | R88A-CAGB010SR | R88A-CAKF010BR | |
| 2 kW For 1,000-r/min Servomotors of 900 W | 15 m | R88A-CAGB015SR | R88A-CAKF015BR | |
| | 20 m | R88A-CAGB020SR | R88A-CAKF020BR | |
| | 30 m | R88A-CAGB030SR | R88A-CAKF030BR | |
| | 40 m | R88A-CAGB040SR | R88A-CAKF040BR | |
| | 50 m | R88A-CAGB050SR | R88A-CAKF050BR | |
| For 3,000-r/min Servomotors of 3 to 5 kW | 3 m | R88A-CAGD003SR | R88A-CAGD003BR | |
| For 2,000-r/min Servomotors of 3 to 5 kW For 1,000-r/min Servomotors of 2 to 4.5 kW | 5 m | R88A-CAGD005SR | R88A-CAGD005BR | |
| | 10 m | R88A-CAGD010SR | R88A-CAGD010BR | |
| | 15 m | R88A-CAGD015SR | R88A-CAGD015BR | |
| | 20 m | R88A-CAGD020SR | R88A-CAGD020BR | |
| | 30 m | R88A-CAGD030SR | R88A-CAGD030BR | |
| | 40 m | R88A-CAGD040SR | R88A-CAGD040BR | |
| | 50 m | R88A-CAGD050SR | R88A-CAGD050BR | |

Note 1.: Different connectors are used for the motor power and the brake on 100-V and 200-V, 3,000-r/min Servomotors of 50 to 750 W and Servomotors of 6 to 15 kW. When using a Servomotor with a brake, two cables are required: a Power Cable without Brake and a Brake Cable.

Note 2.: For flexible power cables for Servomotors of 11 to 15 kW, refer to 4-2 Wiring (P. 4-7) and make your own cable.

For flexible power cables for Servomotors of 6 to 7.5 kW, refer to *Motor Power Cable Specifications on page 3-100* and make your own power cable.

Brake Cables (Global Flexible Cables)

| Specifications | | Model |
|--|------|----------------|
| For 3,000-r/min Servomotors of 50 to 750 W | 3 m | R88A-CAKA003BR |
| | 5 m | R88A-CAKA005BR |
| | 10 m | R88A-CAKA010BR |
| | 15 m | R88A-CAKA015BR |
| | 20 m | R88A-CAKA020BR |
| | 30 m | R88A-CAKA030BR |
| | 40 m | R88A-CAKA040BR |
| | 50 m | R88A-CAKA050BR |

Note: For flexible brake cables for Servomotors of 6 to 15 kW, refer to 3-4 Cable and Connector Specifications and make your own brake cable.

Absolute Encoder Battery Cables

| Specifications | Model | |
|---|-------|------------------|
| Absolute Encoder Battery Cable (battery not supplied) | 0.3 m | R88A-CRGD0R3C |
| Absolute Encoder Battery Cable (R88A-BAT01G battery × 1 supplied) | 0.3 m | R88A-CRGD0R3C-BS |

Absolute Encoder Backup Battery

| Specifications | Model |
|------------------|-------------|
| 2,000 mA•h 3.6 V | R88A-BAT01G |

Analog Monitor Cable

| Specifications | | Model | |
|----------------------|-----|--------------|--|
| Analog monitor cable | 1 m | R88A-CMK001S | |

Connectors

| Specifi | Model | |
|--|--|-------------|
| Motor connector for encoder cable | [100 V and 200 V] For 3,000-r/min of 50 to 750 W | R88A-CNK02R |
| | [100 V and 200 V] For 3,000-r/min of 1 to 5 kW For 2,000 r/min, 1,000 r/min [400 V] For 3,000 r/min, 2,000 r/min and 1,000 r/min | R88A-CNK04R |
| Control I/O connector (CN1) | | R88A-CNU11C |
| Encoder connector (CN2) | | R88A-CNW01R |
| External encoder connector (CN4) | | R88A-CNK41L |
| Safety connector (CN8) | | R88A-CNK81S |
| Power cable connector (for 750 W max.) | | R88A-CNK11A |
| Brake cable connector (for 750 W max | (.) | R88A-CNK11B |

Servo Relay Units (for CN1)

| | Specifications | Model |
|------------------|---|------------------------------|
| Servo Relay Unit | For CS1W-NC113/-NC133 For CJ1W-NC113/-NC133 For C200HW-NC113 | XW2B-20J6-1B |
| | For CS1W-NC213/-NC413/-NC233/-NC433 For CJ1W-NC213/-NC413/-NC233/-NC433 For C200HW-NC213/-NC413 | XW2B-40J6-2B |
| | For CJ1M-CPU21/-CPU22/-CPU23 | XW2B-20J6-8A XW2B-40J6-9A |
| | For CQM1-CPU43-V1 For CQM1H-PLB21 | XW2B-20J6-3B |

Servo Relay Unit Cables for Servo Drives

| Specifications | | | Model |
|---|---|---------------|---------------|
| | 1 m | XW2Z-100J-B25 | |
| | NC133, C200HW-NC113 (XW2B-20J6-1B) For CS1W-NC213/-NC413/-NC233/-NC433, CJ1W-NC213/-NC413/-NC233/-NC433, C200HW-NC213/-NC413 (XW2B-40J6-2B) For CQM1-CPU43-V1 or CQM1H-PLB21 (XW2B-20J6-3B) | 2 m | XW2Z-200J-B25 |
| For CJ1M-CPU21/-CPU22/-CPU23 (XW2B-20J6-8A/XW2B-40J6-9A) | 1 m | XW2Z-100J-B31 | |
| | ((\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | 2 m | XW2Z-200J-B31 |

Note: Do not use a Servo Relay Unit Cable for line receiver inputs (+CWLD: CN1 pin 44, -CWLD: CN1 pin 45, +CCWLD: CN1 pin 46, -CCWLD: CN1 pin 47).

Use a General-purpose Control Cable (R88A-CPG□S) and prepare wiring suited for the controller to be connected.

Servo Relay Unit Cables for Position Control Units

| Specifications | | | Model |
|------------------------------|--|-------|---------------|
| | For CQM1H-PLB21 (XW2B-20J6-3B) | | XW2Z-050J-A3 |
| | | 1 m | XW2Z-100J-A3 |
| | For CS1W-NC113, C200HW-NC113 (XW2B- | 0.5 m | XW2Z-050J-A6 |
| | 20J6-1B) | 1 m | XW2Z-100J-A6 |
| | For CS1W-NC213/-NC413, C200HW-NC213/- | 0.5 m | XW2Z-050J-A7 |
| | NC413 (XW2B-20J6-2B) | 1 m | XW2Z-100J-A7 |
| | For CS1W-NC133 (XW2B-20J6-1B) | 0.5 m | XW2Z-050J-A10 |
| | | 1 m | XW2Z-100J-A10 |
| | For CS1W-NC233/-NC433 (XW2B-20J6-2B) | 0.5 m | XW2Z-050J-A11 |
| Position Control Unit cables | | 1 m | XW2Z-100J-A11 |
| | For CJ1W-NC113 (XW2B-20J6-1B) | 0.5 m | XW2Z-050J-A14 |
| | | 1 m | XW2Z-100J-A14 |
| | For CJ1W-NC213/-NC413 (XW2B-20J6-2B) | 0.5 m | XW2Z-050J-A15 |
| | | 1 m | XW2Z-100J-A15 |
| | For CJ1W-NC133 (XW2B-20J6-1B) | 0.5 m | XW2Z-050J-A18 |
| | | 1 m | XW2Z-100J-A18 |
| | For CJ1W-NC233/-NC433 (XW2B-20J6-2B) | 0.5 m | XW2Z-050J-A19 |
| | | 1 m | XW2Z-100J-A19 |
| | For CJ1M-CPU21/-CPU22/-CPU23 (XW2B-20J6-8A/XW2B-40J6-9A) | 0.5 m | XW2Z-050J-A33 |
| | | 1 m | XW2Z-100J-A33 |

Control Cables

| Specifications | | | Model |
|--|--------------------------------|---------|---------------|
| Specified cables for Position Control Unit | | 1 m | XW2Z-100J-G9 |
| (line-driver output for 1 axis) CJ1W-NC234/-NC434 | | 5 m | XW2Z-500J-G9 |
| | | 10 m | XW2Z-10MJ-G9 |
| Specified cables for Position Control Unit | | 1 m | XW2Z-100J-G13 |
| (open collector output for 1 axis) CJ1W-NC214/-NC414 | | 3 m | XW2Z-300J-G13 |
| Specified cables for Position Control Unit | | 1 m | XW2Z-100J-G1 |
| (line-driver output for 2 axes) CJ1W-NC234/-NC434 | | 5 m | XW2Z-500J-G1 |
| | | 10 m | XW2Z-10MJ-G1 |
| Specified cables for Position Control Unit | | 1 m | XW2Z-100J-G5 |
| (open collector output for 2 axes) CJ1W-NC214/-NC414 | | 3 m | XW2Z-300J-G5 |
| Specified cables for Motion Control Unit (for 1 axis) | | 1 m | R88A-CPG001M1 |
| CS1W-MC221-V1/-MC421-V1 | | 2 m | R88A-CPG002M1 |
| | | 3 m | R88A-CPG003M1 |
| | | 5 m | R88A-CPG005M1 |
| Specified cables for Motion Control Unit (for 2 axes) | | 1 m | R88A-CPG001M2 |
| CS1W-MC221-V1/-MC421-V1 | | 2 m | R88A-CPG002M2 |
| | | 3 m | R88A-CPG003M2 |
| | | 5 m | R88A-CPG005M2 |
| General control cables (with connector on one end) | | 1 m | R88A-CPG001S |
| | | 2 m | R88A-CPG002S |
| Connector-terminal block cables | | 1 m | XW2Z-100J-B24 |
| | | 2 m | XW2Z-200J-B24 |
| Connector-terminal block M3 screw and for terminals M3.5 screw and for round terminals | | oin | XW2B-50G4 |
| | | r fork/ | XW2B-50G5 |
| | M3 screw and for for terminals | k/round | XW2D-50G6 |

External Regeneration Resistors

| Specifications | Model |
|---|----------------|
| Regeneration process capacity: 20 W, 50 Ω (with 150°C thermal sensor) | R88A-RR08050S |
| Regeneration process capacity: 20 W, 100 Ω (with 150°C thermal sensor) | R88A-RR080100S |
| Regeneration process capacity: 70 W, 47 Ω (with 150°C thermal sensor) | R88A-RR22047S1 |
| Regeneration process capacity: 180 W, 20 Ω (with 200°C thermal sensor) | R88A-RR50020S |

Mounting Brackets (L-Brackets for Rack Mounting)

| Specifications | Model |
|--|------------|
| R88D-KTA5L/-KT01L/-KT01H/-KT02H | R88A-TK01K |
| R88D-KT02L/-KT04H | R88A-TK02K |
| R88D-KT04L/-KT08H | R88A-TK03K |
| R88D-KT10H/-KT15H/-KT06F/-KT10F/-KT15F | R88A-TK04K |

2-4 External and Mounting Dimensions

Servo Drive Dimensions

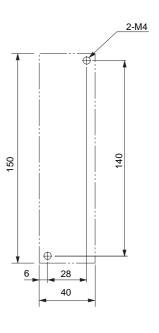
Single-phase 100 VAC: R88D-KTA5L/-KT01L (50 to 100 W)
Single-phase/3-phase 200 VAC: R88D-KT01H/-KT02H (100 to 200 W)

Wall Mounting

External dimensions

40 70 130

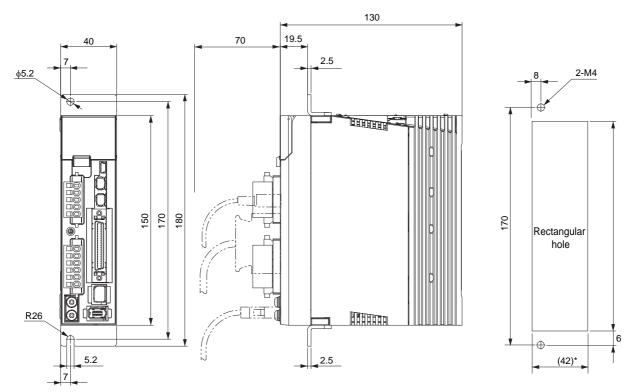
Mounting dimensions



Front Mounting (Using Front Mounting Brackets)

External dimensions

Mounting dimensions

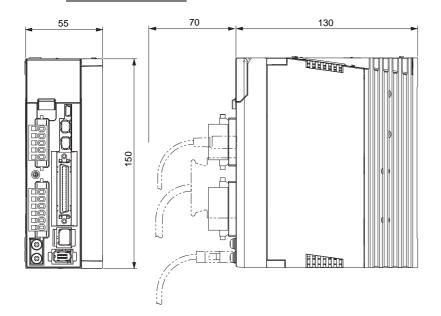


^{*} Rectangular hole dimensions are reference values.

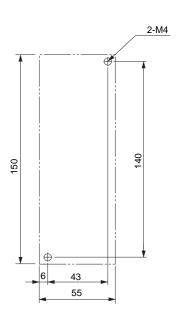
Single-phase/3-phase 100 VAC: R88D-KT02L (200 W) Single-phase/3-phase 200 VAC: R88D-KT04H (400 W)

Wall Mounting

External dimensions



Mounting dimensions



Mounting dimensions

(158)*

6

Front Mounting (Using Front Mounting Brackets)

External dimensions

70 130 19.5 2.5 Rectangular hole

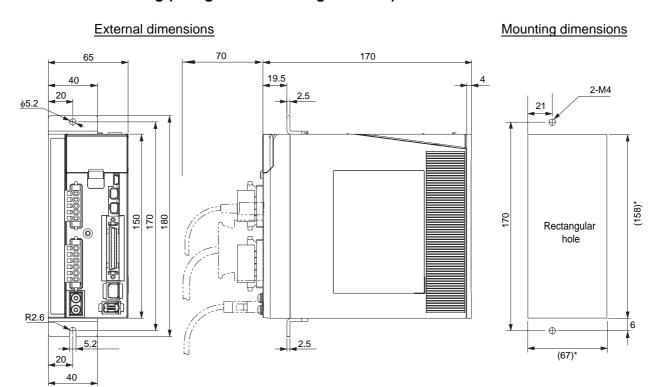
* Rectangular hole dimensions are reference values.

Single-phase/3-phase 100 VAC: R88D-KT04L (400 W)
Single-phase/3-phase 200 VAC: R88D-KT08H (750 W)

Wall Mounting

External dimensions Mounting dimensions 4 2-M4 7.5 65 65

Front Mounting (Using Front Mounting Brackets)



^{*} Rectangular hole dimensions are reference values.

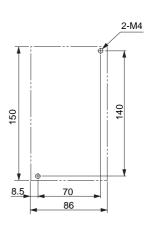
Single-phase/3-phase 200 VAC: R88D-KT10H/-KT15H (900 W to 1.5 kW)

Wall Mounting

External dimensions

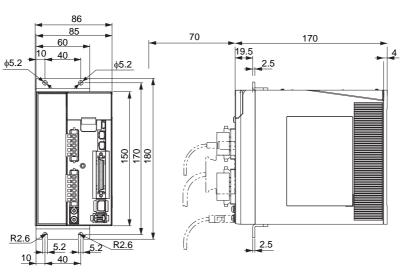
70 170

Mounting dimensions

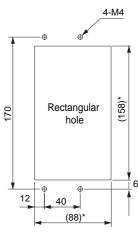


Front Mounting (Using Front Mounting Brackets)

External dimensions



Mounting dimensions

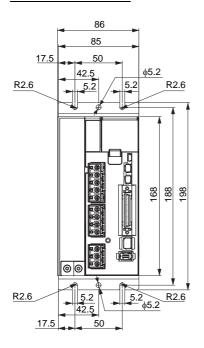


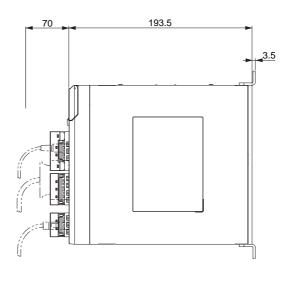
^{*} Rectangular hole dimensions are reference values.

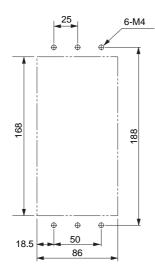
3-phase 200 VAC: R88D-KT20H (2 kW)

Wall Mounting

External dimensions

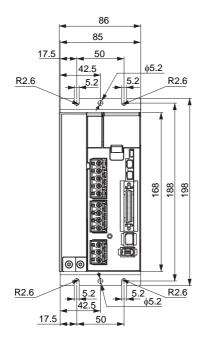


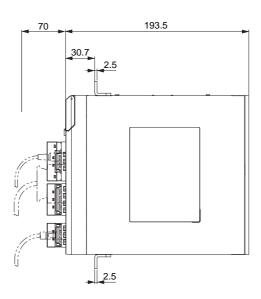


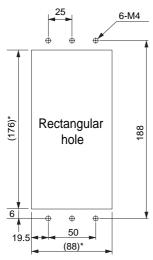


Front Mounting (Using Front Mounting Brackets)

External dimensions





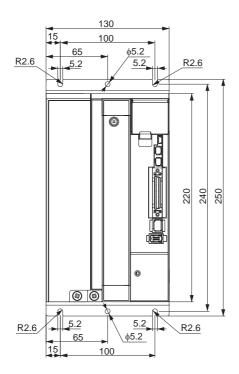


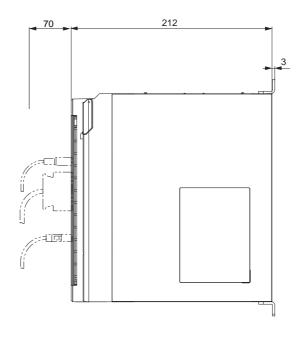
^{*} Rectangular hole dimensions are reference values.

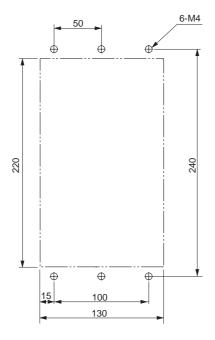
3-phase 200 VAC: R88D-KT30H/-KT50H (3 to 5 kW)

Wall Mounting

External dimensions

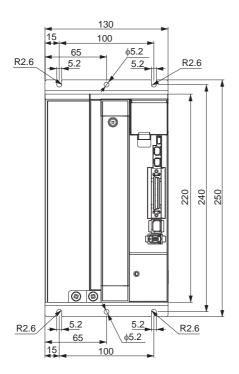


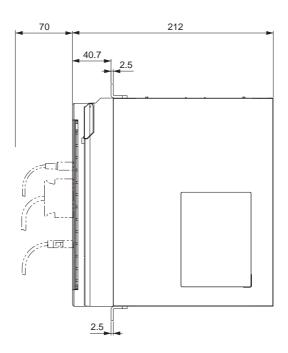


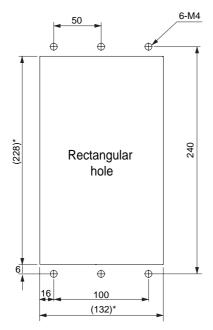


Front Mounting (Using Front Mounting Brackets)

External dimensions





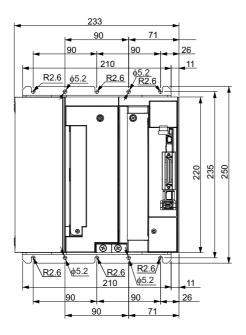


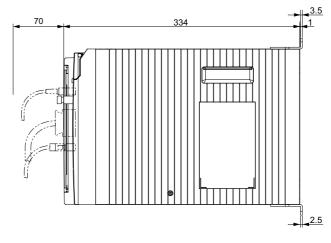
^{*} Rectangular hole dimensions are reference values.

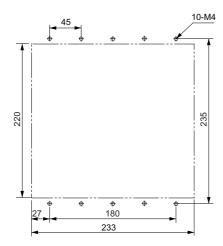
3-phase 200 VAC: R88D-KT75H (7.5 kW)

Wall Mounting

External dimensions

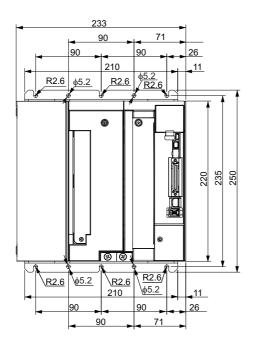


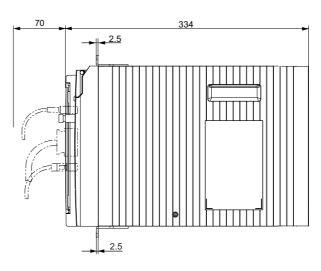


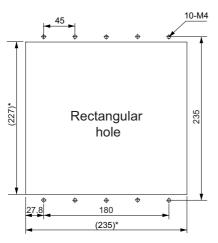


Front Mounting (Using Front Mounting Brackets)

External dimensions





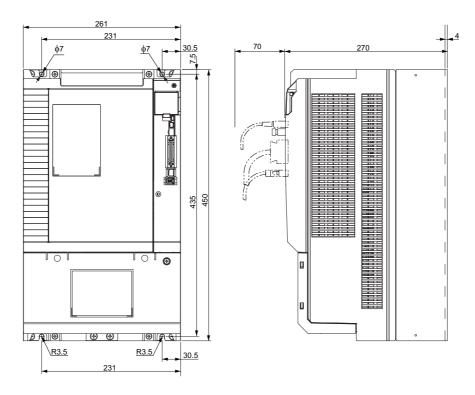


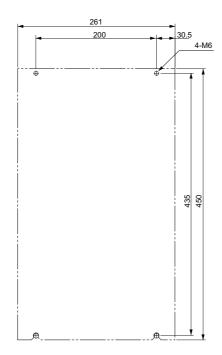
^{*} Rectangular hole dimensions are reference values.

3-phase 200 VAC: R88D-KT150H (15 kW)

Wall Mounting

External dimensions

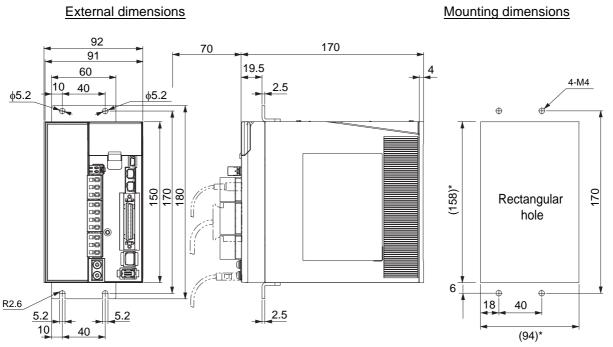




3-phase 400 VAC: R88D-KT06F/-KT10F/-KT15F (600 W to 1.5 kW)

Wall Mounting

Front Mounting (Using Front Mounting Brackets)



70

92

14.5

3-phase 400 VAC: R88D-KT20F (2 kW)

Wall Mounting

00

R2.6

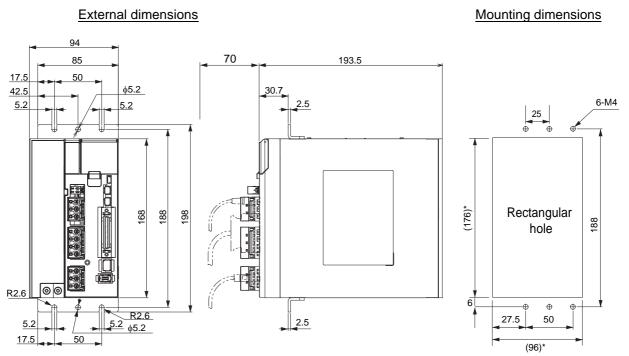
17.5

External dimensions Mounting dimensions 17.5 42.5 5.2 70 193.5 1.5 6-M4

Front Mounting (Using Front Mounting Brackets)

R2.6

5.2 _{\$\phi 5.2}



^{*} Rectangular hole dimensions are reference values.

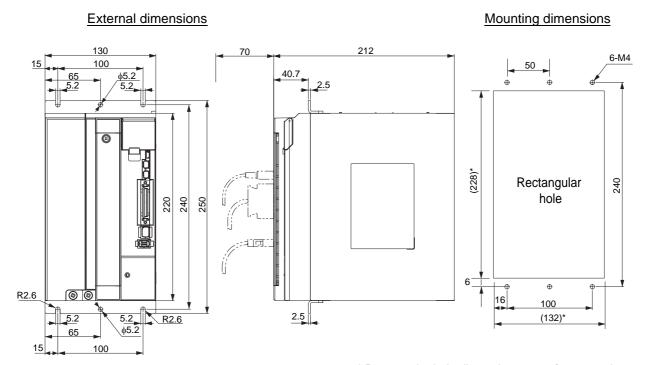
26.5

50

3-phase 400 VAC: R88D-KT30F/-KT50F (3 to 5 kW)

Wall Mounting

Front Mounting (Using Front Mounting Brackets)

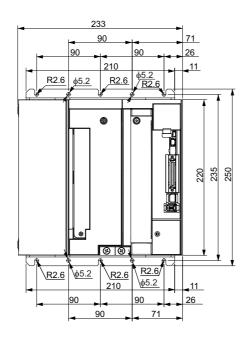


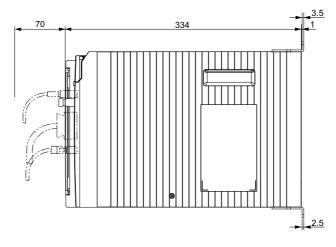
^{*} Rectangular hole dimensions are reference values.

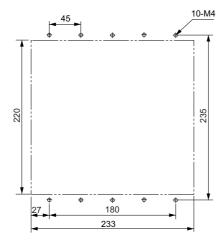
3-phase 400 VAC: R88D-KT75F (7.5 kW)

Wall Mounting

External dimensions

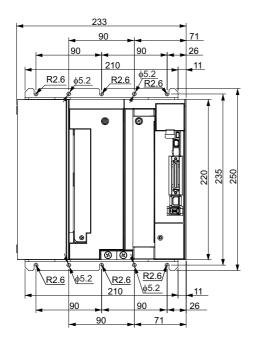


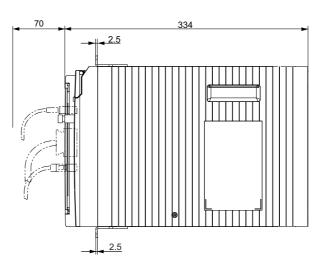


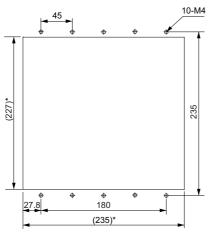


Front Mounting (Using Front Mounting Brackets)

External dimensions





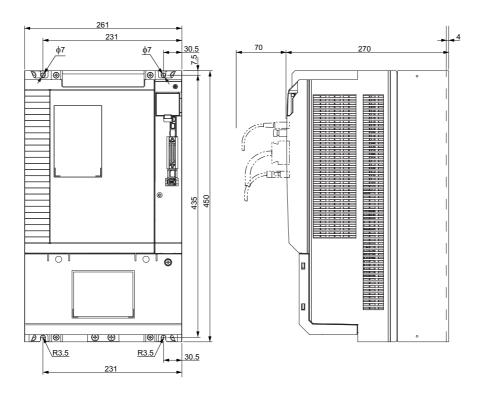


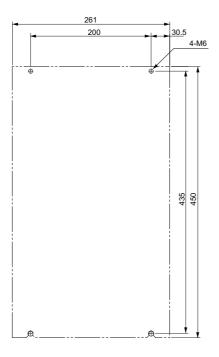
^{*} Rectangular hole dimensions are reference values.

3-phase 400 VAC: R88D-KT150F (15 kW)

Wall Mounting

External dimensions





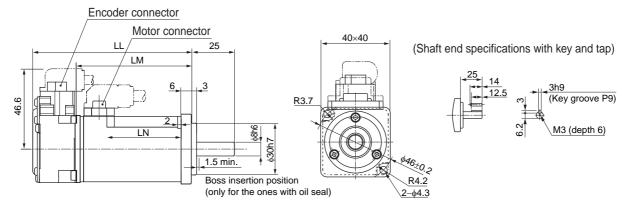
Servomotor Dimensions

3,000-r/min Servomotors (100 V and 200 V)

50 W/100 W (without Brake)

R88M-K05030H (-S2)/-K10030L (-S2) INC

R88M-K05030T (-S2)/-K10030S (-S2) ABS

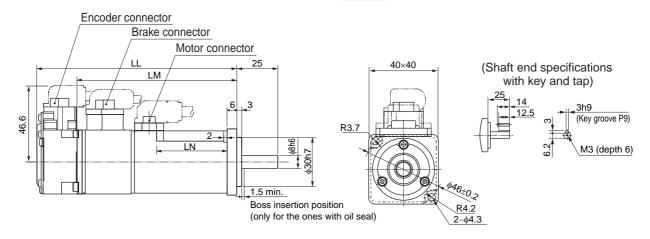


| Model | Dimensions (mm) | | | | |
|--------------|-----------------|----|----|--|--|
| Model | LL | LM | LN | | |
| R88M-K05030□ | 72 | 48 | 23 | | |
| R88M-K10030□ | 92 | 68 | 43 | | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

50 W/100 W (with Brake)

R88M-K05030H-B (S2)/-K10030L-B (S2) INC R88M-K05030T-B (S2)/-K10030S-B (S2) ABS

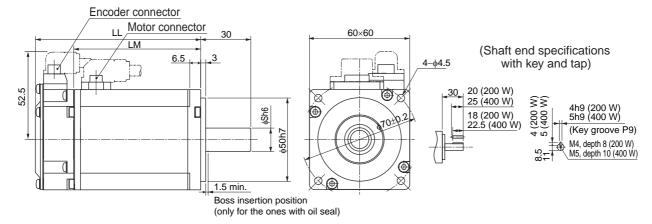


| Model | Dimensions (mm) | | | | |
|-----------------|-----------------|----|----|--|--|
| iniodei | LL | LM | LN | | |
| R88M-K05030□-Bx | 102 | 78 | 23 | | |
| R88M-K10030□-Bx | 122 | 98 | 43 | | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

200 W/400 W (without Brake)

R88M-K20030 (-S2)/-K40030 (-S2) INC R88M-K20030 (-S2)/-K40030 (-S2) ABS



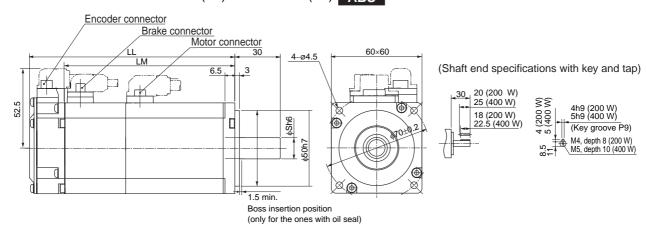
| Model | Dimensions (mm) | | | | |
|--------------|-----------------|------|----|--|--|
| Model | LL | S | | | |
| R88M-K20030□ | 79.5 | 56.5 | 11 | | |
| R88M-K40030□ | 99 | 76 | 14 | | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

Models with an oil seal are indicated with O at the end of the model number. The motor dimensions do not change.

200 W/400 W (with Brake)

R88M-K20030 -B (S2)/-K40030 -B (S2) INC
R88M-K20030 -B (S2)/-K40030 -B (S2) ABS



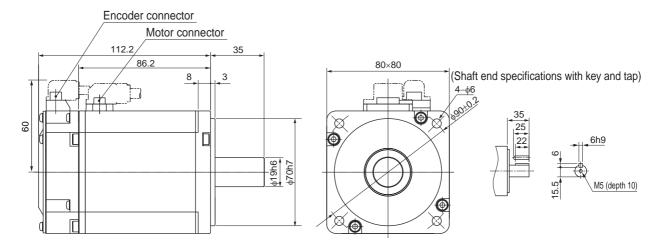
| Model | Dimensions (mm) | | | | |
|-----------------|-----------------|-------|----|--|--|
| Model | LL | LM | S | | |
| R88M-K20030□-B□ | 116 | 93 | 11 | | |
| R88M-K40030□-B□ | 135.5 | 112.5 | 14 | | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

750 W (without Brake)

R88M-K75030H (-S2) INC

R88M-K75030T (-S2) ABS



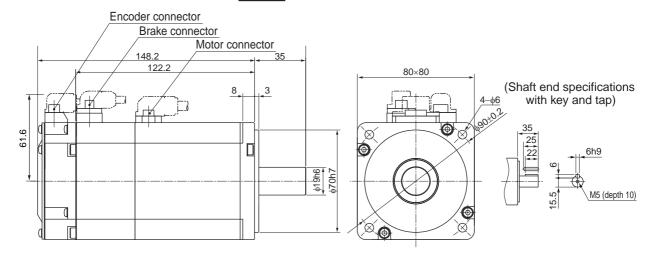
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

Models with an oil seal are indicated with O at the end of the model number. The motor dimensions do not change.

750 W (with Brake)

R88M-K75030H-B (S2) INC

R88M-K75030T-B (S2) ABS



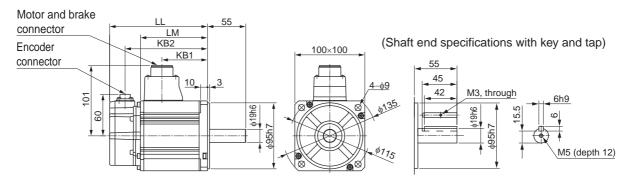
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

1 kW/1.5 kW/2 kW (without Brake)

R88M-K1K030H (-S2)/-K1K530H (-S2)/-K2K030H (-S2) INC R88M-K1K030T (-S2)/-K1K530T (-S2)/-K2K030T (-S2) ABS

1 kW/1.5 kW/2 kW (with Brake)

R88M-K1K030H-B (S2)/-K1K530H-B (S2)/-K2K030H-B (S2) INC R88M-K1K030T-B (S2)/-K1K530T-B (S2)/-K2K030T-B (S2) ABS



| Model | Dimensions (mm) | | | |
|-----------------|-----------------|-------|-------|-------|
| Model | LL | LL LM | | KB2 |
| R88M-K1K030□ | 141 | 97 | 66 | 119 |
| R88M-K1K530□ | 159.5 | 115.5 | 84.5 | 137.5 |
| R88M-K2K030□ | 178.5 | 134.5 | 103.5 | 156.5 |
| R88M-K1K030□-B□ | 168 | 124 | 66 | 146 |
| R88M-K1K530□-B□ | 186.5 | 142.5 | 84.5 | 164.5 |
| R88M-K2K030□-B□ | 205.5 | 161.5 | 103.5 | 183.5 |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

3 kW (without Brake)

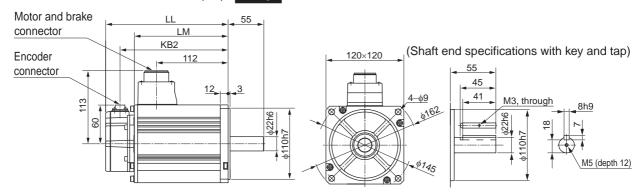
R88M-K3K030H (-S2) INC

R88M-K3K030T (-S2) ABS

3 kW (with Brake)

R88M-K3K030H-B (S2) INC

R88M-K3K030T-B (S2) ABS



| Model | Dimensions (mm) | | | | |
|-----------------|-----------------|-----|-----|--|--|
| Model | LL | LM | KB2 | | |
| R88M-K3K030□ | 190 | 146 | 168 | | |
| R88M-K3K030□-B□ | 215 | 171 | 193 | | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

4 kW/5 kW (without Brake)

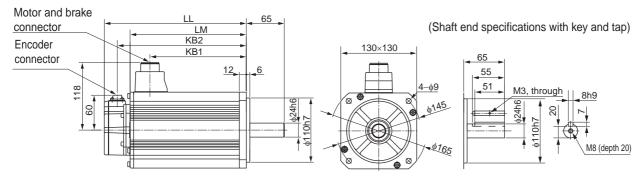
R88M-K4K030H (-S2)/-K5K030H (-S2) INC

R88M-K4K030T (-S2)/-K5K030T (-S2) ABS

4 kW/5 kW (with Brake)

R88M-K4K030H-B (S2)/-K5K030H-B (S2) INC

R88M-K4K030T-B (S2)/-K5K030T-B (S2) ABS



| Model | | Dimension | ons (mm) | | |
|-----------------|-----|-----------|----------|-----|--|
| Model | LL | LM | KB1 | KB2 | |
| R88M-K4K030□ | 208 | 164 | 127 | 186 | |
| R88M-K5K030□ | 243 | 199 | 162 | 221 | |
| R88M-K4K030□-B□ | 236 | 192 | 127 | 214 | |
| R88M-K5K030□-B□ | 271 | 227 | 162 | 249 | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

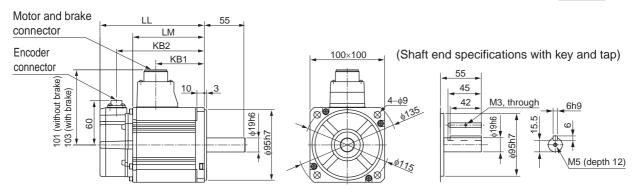
3,000-r/min Servomotors (400 V)

750 W/1 kW/1.5 kW/2 kW (without Brake)

R88M-K75030F (-S2)/-K1K030F (-S2)/-K1K530F (-S2)/-K2K030F (-S2) INC
R88M-K75030C (-S2)/-K1K030C (-S2)/-K1K530C (-S2)/-K2K030C (-S2) ABS

750 W/1 kW/1.5 kW/2 kW (with Brake)

R88M-K75030F-B (S2)/-K1K030F-B (S2)/-K1K530F-B (S2)/-K2K030F-B (S2) INC
R88M-K75030C-B (S2)/-K1K030C-B (S2)/-K1K530C-B (S2)/-K2K030C-B (S2)
ABS



| Model | Dimensions (mm) | | | |
|-----------------|-----------------|-------|-------|-------|
| Model | LL | | KB1 | KB2 |
| R88M-K75030□ | 131.5 | 87.5 | 56.5 | 109.5 |
| R88M-K1K030□ | 141 | 97 | 66 | 119 |
| R88M-K1K530□ | 159.5 | 115.5 | 84.5 | 137.5 |
| R88M-K2K030□ | 178.5 | 134.5 | 103.5 | 156.5 |
| R88M-K75030□-B□ | 158.5 | 114.5 | 53.5 | 136.5 |
| R88M-K1K030□-B□ | 168 | 124 | 63 | 146 |
| R88M-K1K530□-B□ | 186.5 | 142.5 | 81.5 | 164.5 |
| R88M-K2K030□-B□ | 205.5 | 161.5 | 100.5 | 183.5 |

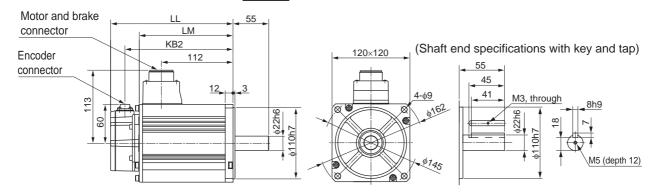
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

3 kW (without Brake)

R88M-K3K030F (-S2) INC R88M-K3K030C (-S2) ABS

3 kW (with Brake)

R88M-K3K030F-B (S2) INC R88M-K3K030C-B (S2) ABS



| Model | Dimensions (mm) | | | | |
|-----------------|-----------------|-----|-----|--|--|
| Model | LL | LM | KB2 | | |
| R88M-K3K030□ | 190 | 146 | 168 | | |
| R88M-K3K030□-B□ | 215 | 171 | 193 | | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

4 kW/5 kW (without Brake)

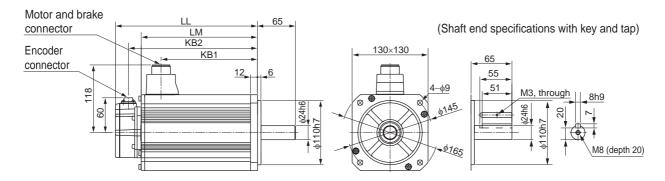
R88M-K4K030F (-S2)/-K5K030F (-S2) INC

R88M-K4K030C (-S2)/-K5K030C (-S2) ABS

4 kW/5 kW (with Brake)

R88M-K4K030F-B (S2)/-K5K030F-B (S2) INC

R88M-K4K030C-B (S2)/-K5K030C-B (S2) ABS



| Model | | Dimensi | ons (mm) | |
|-----------------|-----|---------|----------|-----|
| Model | LL | LM | KB1 | KB2 |
| R88M-K4K030□ | 208 | 164 | 127 | 186 |
| R88M-K5K030□ | 243 | 199 | 162 | 221 |
| R88M-K4K030□-B□ | 236 | 192 | 127 | 214 |
| R88M-K5K030□-B□ | 271 | 227 | 162 | 249 |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

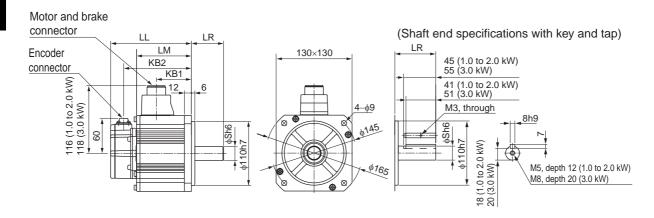
1,500-r/min and 2,000-r/min Servomotors (200 V)

1 kW/1.5 kW/2 kW/3 kW (without Brake)

R88M-K1K020H (-S2)/-K1K520H (-S2)/-K2K020H (-S2)/-K3K020H (-S2) INC
R88M-K1K020T (-S2)/-K1K520T (-S2)/-K2K020T (-S2)/-K3K020T (-S2)
ABS

1 kW/1.5 kW/2 kW/3 kW (with Brake)

R88M-K1K020H-B (S2)/-K1K520H-B (S2)/-K2K020H-B (S2)/-K3K020H-B (S2) INC R88M-K1K020T-B (S2)/-K1K520T-B (S2)/-K2K020T-B (S2)/-K3K020T-B (S2) ABS



| Model | Dimensions (mm) | | | | | |
|-----------------|-----------------|----|-------|----|------|-------|
| Model | LL | LR | LM | S | KB1 | KB2 |
| R88M-K1K020□ | 138 | 55 | 94 | 22 | 60 | 116 |
| R88M-K1K520□ | 155.5 | 55 | 111.5 | 22 | 77.5 | 133.5 |
| R88M-K2K020□ | 173 | 55 | 129 | 22 | 95 | 151 |
| R88M-K3K020□ | 208 | 65 | 164 | 24 | 127 | 186 |
| R88M-K1K020□-B□ | 166 | 55 | 122 | 22 | 60 | 144 |
| R88M-K1K520□-B□ | 183.5 | 55 | 139.5 | 22 | 77.5 | 161.5 |
| R88M-K2K020□-B□ | 201 | 55 | 157 | 22 | 95 | 179 |
| R88M-K3K020□-B□ | 236 | 65 | 192 | 24 | 127 | 214 |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

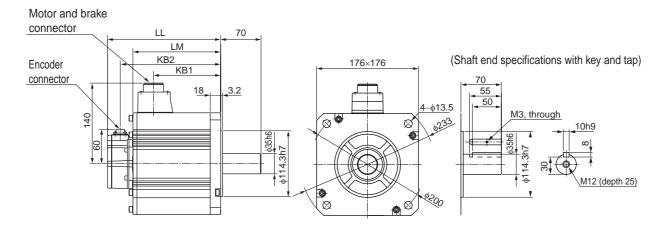
4 kW/5 kW (without Brake)

R88M-K4K020H (-S2)/-K5K020H (-S2) INC

R88M-K4K020T (-S2)/-K5K020T (-S2) ABS

4 kW/5 kW (with Brake)

R88M-K4K020H-B (S2)/-K5K020H-B (S2) INC R88M-K4K020T-B (S2)/-K5K020T-B (S2) ABS



| Model | | Dimension | ons (mm) | |
|-----------------|-----|-----------|----------|-----|
| Model | LL | KB1 | KB2 | |
| R88M-K4K020□ | 177 | 133 | 96 | 155 |
| R88M-K5K020□ | 196 | 152 | 115 | 174 |
| R88M-K4K020□-B□ | 206 | 162 | 96 | 184 |
| R88M-K5K020□-B□ | 225 | 181 | 115 | 203 |

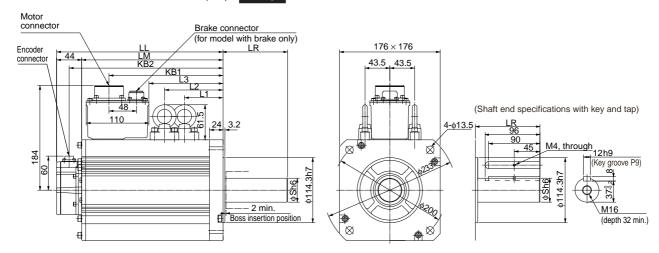
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

7.5 kW (without Brake)

R88M-K7K515T (-S2) ABS

7.5 kW (with Brake)

R88M-K7K515T-B (S2) ABS



| Model | Dimensions (mm) | | | | | | | | | |
|-----------------|-----------------|-----|-----|----|-----|-----|-------|-------|-----|--|
| | LL | LR | LM | S | KB1 | KB2 | L1 | L2 | L3 | |
| R88M-K7K515T□ | 312 | 113 | 268 | 42 | 219 | 290 | 117.5 | 117.5 | 149 | |
| R88M-K7K515T-B□ | 337 | 113 | 293 | 42 | 253 | 315 | 117.5 | 152.5 | 183 | |

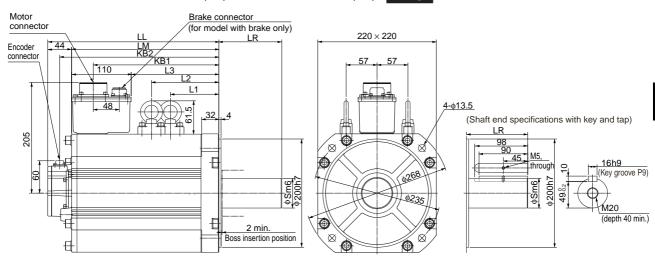
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

11 kW/15 kW (without Brake)

R88M-K11K015T (-S2)/-K15K015T (-S2) ABS

11 kW/15 kW (with Brake)

R88M-K11K015T-B (S2)/R88M-K15K015T-B (S2) ABS



| Model | | Dimensions (mm) | | | | | | | | | |
|------------------|-----|-----------------|-----|----|-----|-----|-------|-------|-----|--|--|
| | LL | LR | LM | S | KB1 | KB2 | L1 | L2 | L3 | | |
| R88M-K11K015T□ | 316 | 116 | 272 | 55 | 232 | 294 | 124.5 | 124.5 | 162 | | |
| R88M-K15K015T□ | 384 | 116 | 340 | 55 | 300 | 362 | 158.5 | 158.5 | 230 | | |
| R88M-K11K015T-B□ | 364 | 116 | 320 | 55 | 266 | 342 | 124.5 | 159.5 | 196 | | |
| R88M-K15K015T-B□ | 432 | 116 | 388 | 55 | 334 | 410 | 158.5 | 193.5 | 264 | | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

Standard Models and External Dimensions

1,500-r/min and 2,000-r/min Servomotors (400 V)

400 W/600 W (without Brake)

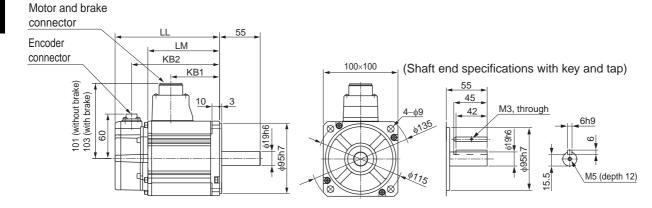
R88M-K40020F (-S2)/-K60020F (-S2) INC

R88M-K40020C (-S2)/-K60020C (-S2) ABS

400 W/600 W (with Brake)

R88M-K40020F-B (S2)/-K60020F-B (S2) INC

R88M-K40020C-B (S2)/-K60020C-B (S2) ABS



| Model | | Dimensions (mm) | | | | | | | |
|-----------------|-------|-----------------|------|-------|--|--|--|--|--|
| Model | LL | LM | KB1 | KB2 | | | | | |
| R88M-K40020□ | 131.5 | 87.5 | 56.5 | 109.5 | | | | | |
| R88M-K60020□ | 141 | 97 | 66 | 119 | | | | | |
| R88M-K40020□-B□ | 158.5 | 114.5 | 53.5 | 136.5 | | | | | |
| R88M-K60020□-B□ | 168 | 124 | 63 | 146 | | | | | |

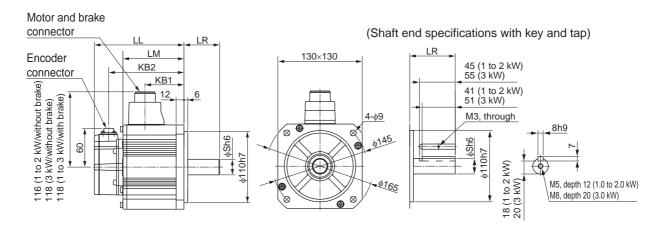
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

1 kW/1.5 kW/2 kW/3 kW (without Brake)

R88M-K1K020F (-S2)/-K1K520F (-S2)/-K2K020F (-S2)/-K3K020F (-S2) INC
R88M-K1K020C (-S2)/-K1K520C (-S2)/-K2K020C (-S2)/-K3K020C (-S2) ABS

1 kW/1.5 kW/2 kW/3 kW (with Brake)

R88M-K1K020F-B (S2)/-K1K520F-B (S2)/-K2K020F-B (S2)/-K3K020F-B (S2) INC
R88M-K1K020C-B (S2)/-K1K520C-B (S2)/-K2K020C-B (S2)/-K3K020C-B (S2)
ABS



| Model | | | Dimensi | ons (mm) | | |
|-----------------|-------|----|---------|----------|------|-------|
| Model | LL | LR | LM | S | KB1 | KB2 |
| R88M-K1K020□ | 138 | 55 | 94 | 22 | 60 | 116 |
| R88M-K1K520□ | 155.5 | 55 | 111.5 | 22 | 77.5 | 133.5 |
| R88M-K2K020□ | 173 | 55 | 129 | 22 | 95 | 151 |
| R88M-K3K020□ | 208 | 65 | 164 | 24 | 127 | 186 |
| R88M-K1K020□-B□ | 166 | 55 | 122 | 22 | 57 | 144 |
| R88M-K1K520□-B□ | 183.5 | 55 | 139.5 | 22 | 74.5 | 161.5 |
| R88M-K2K020□-B□ | 201 | 55 | 157 | 22 | 92 | 179 |
| R88M-K3K020□-B□ | 236 | 65 | 192 | 24 | 127 | 214 |

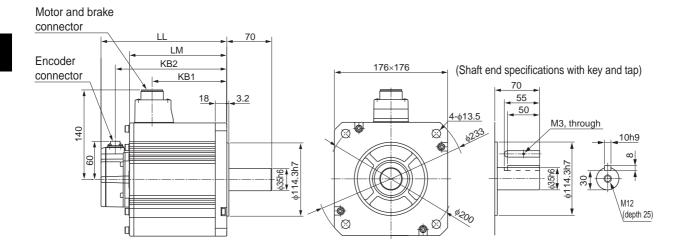
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

4 kW/5 kW (without Brake)

R88M-K4K020F (-S2)/-K5K020F (-S2) INC R88M-K4K020C (-S2)/-K5K020C (-S2) ABS

4 kW/5 kW (with Brake)

R88M-K4K020F-B (S2)/-K5K020F-B (S2) INC R88M-K4K020C-B (S2)/-K5K020C-B (S2) ABS



| Model | Dimensions (mm) | | | | | | | |
|-----------------|-----------------|-----|-----|-----|--|--|--|--|
| Model | LL | LM | KB1 | KB2 | | | | |
| R88M-K4K020□ | 177 | 133 | 96 | 155 | | | | |
| R88M-K5K020□ | 196 | 152 | 115 | 174 | | | | |
| R88M-K4K020□-B□ | 206 | 162 | 96 | 184 | | | | |
| R88M-K5K020□-B□ | 225 | 181 | 115 | 203 | | | | |

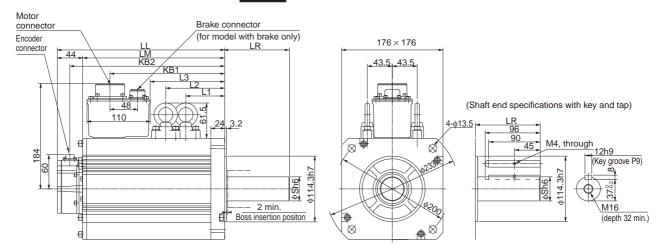
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

7.5 kW (without Brake)

R88M-K7K515C (-S2) ABS

7.5 kW (with Brake)

R88M-K7K515C-B (S2) ABS



| Model | | Dimensions (mm) | | | | | | | |
|-----------------|-----|-----------------|-----|----|-----|-----|-------|-------|-----|
| | LL | LR | LM | S | KB1 | KB2 | L1 | L2 | L3 |
| R88M-K7K515C□ | 312 | 113 | 268 | 42 | 219 | 290 | 117.5 | 117.5 | 149 |
| R88M-K7K515C-B□ | 337 | 113 | 293 | 42 | 253 | 315 | 117.5 | 152.5 | 183 |

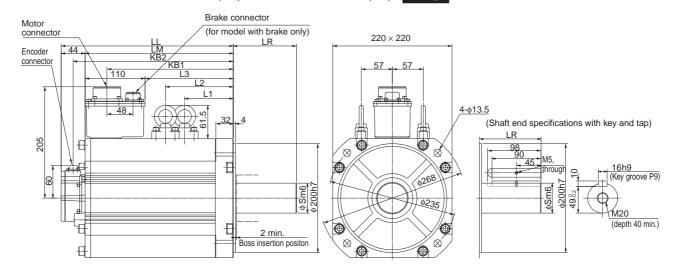
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

11 kW/15 kW (without Brake)

R88M-K11K015C (-S2)/-K15K015C (-S2) ABS

11 kW/15 kW (with Brake)

R88M-K11K015C-B (S2)/R88M-K15K015C-B (S2) ABS



| Model | Dimensions (mm) | | | | | | | | | |
|------------------|-----------------|-----|-----|----|-----|-----|-------|-------|-----|--|
| | LL | LR | LM | S | KB1 | KB2 | L1 | L2 | L3 | |
| R88M-K11K015C□ | 316 | 116 | 272 | 55 | 232 | 294 | 124.5 | 124.5 | 162 | |
| R88M-K15K015C□ | 384 | 116 | 340 | 55 | 300 | 362 | 158.5 | 158.5 | 230 | |
| R88M-K11K015C-B□ | 364 | 116 | 320 | 55 | 266 | 342 | 124.5 | 159.5 | 196 | |
| R88M-K15K015C-B□ | 432 | 116 | 388 | 55 | 334 | 410 | 158.5 | 193.5 | 264 | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

1,000-r/min Servomotors (200 V)

900 W (without Brake)

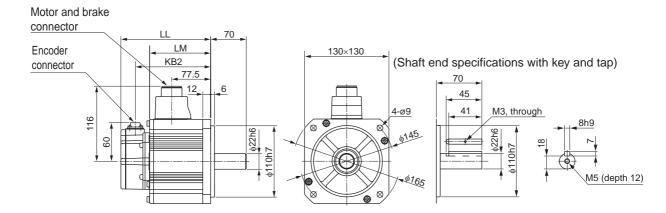
R88M-K90010H (-S2) INC

R88M-K90010T (-S2) ABS

900 W (with Brake)

R88M-K90010H-B (S2) INC

R88M-K90010T-B (S2) ABS



| Model | Dimensions (mm) | | | | | | |
|-----------------|-----------------|-------|-------|--|--|--|--|
| Model | LL | LM | KB2 | | | | |
| R88M-K90010□ | 155.5 | 111.5 | 133.5 | | | | |
| R88M-K90010□-B□ | 183.5 | 139.5 | 161.5 | | | | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

2 kW/3 kW (without Brake)

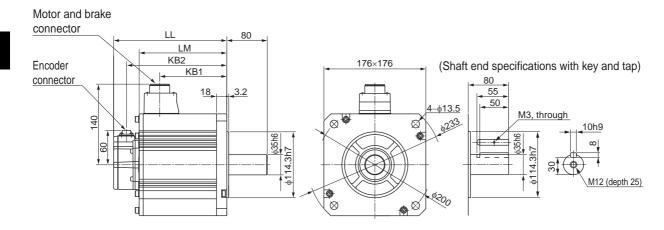
R88M-K2K010H (-S2)/-K3K010H (-S2) INC

R88M-K2K010T (-S2)/-K3K010T (-S2) ABS

2 kW/3 kW (with Brake)

R88M-K2K010H-B (S2)/-K3K010H-B (S2) INC

R88M/-K2K010T-B (S2)/-K3K010T-B (S2) ABS



| Model | | Dimensions (mm) | | | | | | | |
|-----------------|-------|-----------------|-------|-------|--|--|--|--|--|
| model | LL | LM | KB1 | KB2 | | | | | |
| R88M-K2K010□ | 163.5 | 119.5 | 82.5 | 141.5 | | | | | |
| R88M-K3K010□ | 209.5 | 165.5 | 128.5 | 187.5 | | | | | |
| R88M-K2K010□-B□ | 192.5 | 148.5 | 82.5 | 170.5 | | | | | |
| R88M-K3K010□-B□ | 238.5 | 194.5 | 128.5 | 216.5 | | | | | |

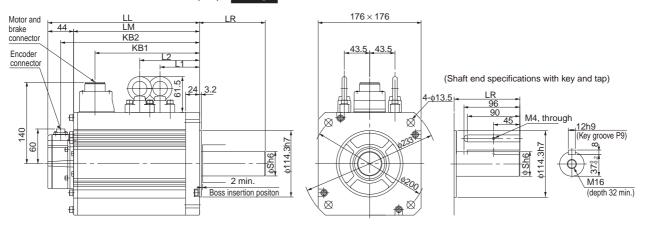
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

4.5 kW (without Brake)

R88M-K4K510T (-S2) ABS

4.5 kW (with Brake)

R88M-K4K510T-B (S2) ABS



| Model | Dimensions (mm) | | | | | | | |
|-----------------|-----------------|-----|-----|----|-----|-----|----|-----|
| | LL | LR | LM | S | KB1 | KB2 | L1 | L2 |
| R88M-K4K510T□ | 266 | 113 | 222 | 42 | 185 | 244 | 98 | 98 |
| R88M-K4K510T-B□ | 291 | 113 | 247 | 42 | 185 | 269 | 98 | 133 |

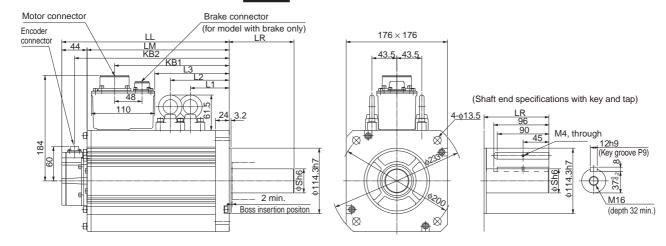
Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

6 kW (without Brake)

R88M-K6K010T (-S2) ABS

6 kW (with Brake)

R88M-K6K010T-B (S2) ABS



| Model | | Dimensions (mm) | | | | | | | | |
|-----------------|-----|-----------------|-----|----|-----|-----|-------|-------|-----|--|
| | LL | LR | LM | S | KB1 | KB2 | L1 | L2 | L3 | |
| R88M-K6K010T□ | 312 | 113 | 268 | 42 | 219 | 290 | 117.5 | 117.5 | 149 | |
| R88M-K6K010T-B□ | 337 | 113 | 293 | 42 | 253 | 315 | 117.5 | 152.5 | 183 | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

1,000-r/min Servomotors (400 V)

900 W (without Brake)

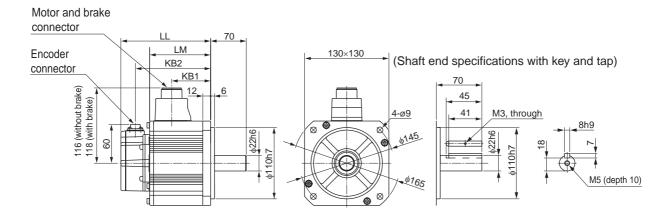
R88M-K90010F (-S2) INC

R88M-K90010C (-S2) ABS

900 W (with Brake)

R88M-K90010F-B (S2) INC

R88M-K90010C-B (S2) ABS



| Model | | Dimension | ons (mm) | |
|-----------------|-------|-----------|----------|-------|
| Model | LL | LM | KB1 | KB2 |
| R88M-K90010□ | 155.5 | 111.5 | 77.5 | 133.5 |
| R88M-K90010□-B□ | 183.5 | 139.5 | 74.5 | 161.5 |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

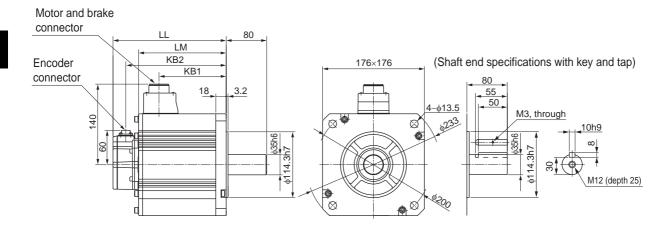
Models with an oil seal are indicated with O at the end of the model number. The motor dimensions do not change.

2 kW/3 kW (without Brake)

R88M-K2K010F (-S2)/-K3K010F (-S2) INC R88M-K2K010C (-S2)/-K3K010C (-S2) ABS

2 kW/3 kW (with Brake)

R88M-K2K010F-B (S2)/-K3K010F-B (S2) INC R88M-K2K010C-B (S2)/-K3K010C-B (S2) ABS



| Model | | Dimensions (mm) | | | | |
|-----------------|-------|-----------------|-------|-------|--|--|
| Wiodei | LL | LM | KB1 | KB2 | | |
| R88M-K2K010□ | 163.5 | 119.5 | 82.5 | 141.5 | | |
| R88M-K3K010□ | 209.5 | 165.5 | 128.5 | 187.5 | | |
| R88M-K2K010□-B□ | 192.5 | 148.5 | 82.5 | 170.5 | | |
| R88M-K3K010□-B□ | 238.5 | 194.5 | 128.5 | 216.5 | | |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

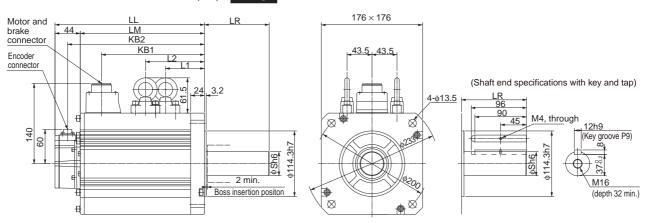
Models with an oil seal are indicated with O at the end of the model number. The motor dimensions do not change.

4.5 kW (without Brake)

R88M-K4K510C (-S2) ABS

4.5 kW (with Brake)

R88M-K4K510C-B (S2) ABS



| Model | | | [| Dimensio | ons (mm | 1) | | |
|-----------------|-----|-----|-----|----------|---------|-----|----|-----|
| model | LL | LR | LM | S | KB1 | KB2 | L1 | L2 |
| R88M-K4K510C□ | 266 | 113 | 222 | 42 | 185 | 244 | 98 | 98 |
| R88M-K4K510C-B□ | 291 | 113 | 247 | 42 | 185 | 269 | 98 | 133 |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

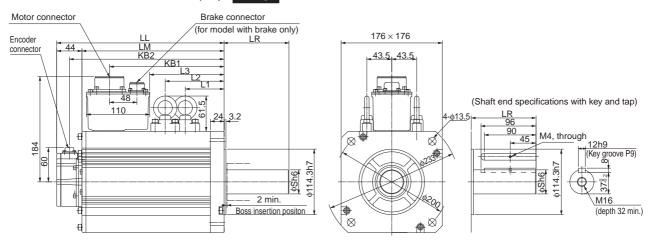
Models with an oil seal are indicated with O at the end of the model number. The motor dimensions do not change.

6 kW (without Brake)

R88M-K6K010C (-S2) ABS

6 kW (with Brake)

R88M-K6K010C-B (S2) ABS



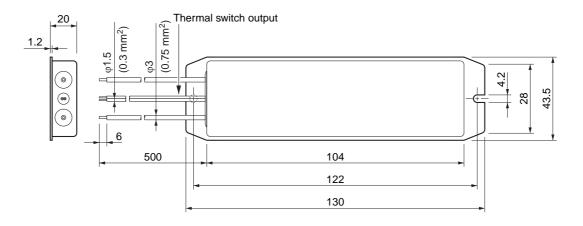
| Model | | | | Dime | ensions | (mm) | | | |
|-----------------|-----|-----|-----|------|---------|------|-------|-------|-----|
| | LL | LR | LM | S | KB1 | KB2 | L1 | L2 | L3 |
| R88M-K6K010C□ | 312 | 113 | 268 | 42 | 219 | 290 | 117.5 | 117.5 | 149 |
| R88M-K6K010C-B□ | 337 | 113 | 293 | 42 | 253 | 315 | 117.5 | 152.5 | 183 |

Note. The standard models have a straight shaft. Models with a key and tap are indicated with S2 at the end of the model number.

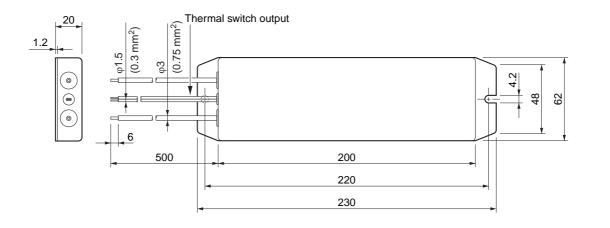
Models with an oil seal are indicated with O at the end of the model number. The motor dimensions do not change.

External Regeneration Resistor Dimensions

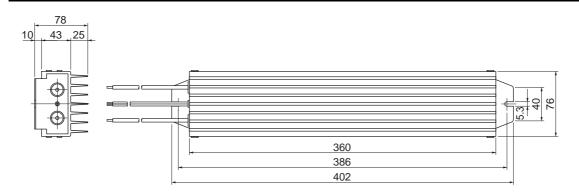
R88A-RR08050S/-RR080100S



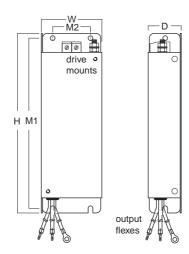
R88A-RR22047S1



R88A-RR50020S



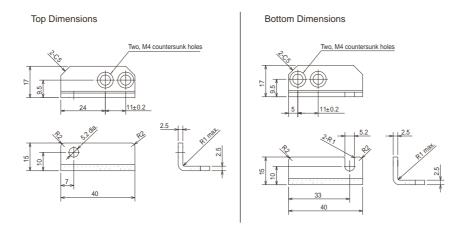
2-5 EMC Filter Dimensions



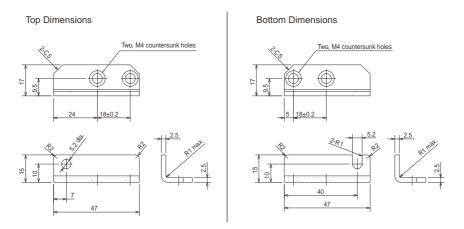
| Filter model | Ext | ernal dimensi | ons | Mount dimensions | | |
|-----------------|-----|---------------|-----|------------------|-----|--|
| i iitei iiiouei | Н | W | D | M1 | M2 | |
| R88A-FIK102-RE | 190 | 42 | 44 | 180 | 20 | |
| R88A-FIK104-RE | 190 | 57 | 30 | 180 | 30 | |
| R88A-FIK107-RE | 190 | 64 | 35 | 180 | 40 | |
| R88A-FIK114-RE | 190 | 86 | 35 | 180 | 60 | |
| R88A-FIK304-RE | 190 | 86 | 40 | 180 | 60 | |
| R88A-FIK306-RE | 245 | 94 | 40 | 235 | 60 | |
| R88A-FIK312-RE | 290 | 130 | 45 | 280 | 100 | |

2-6 Dimensions of Mounting Brackets (L-Brackets for Rack Mounting)

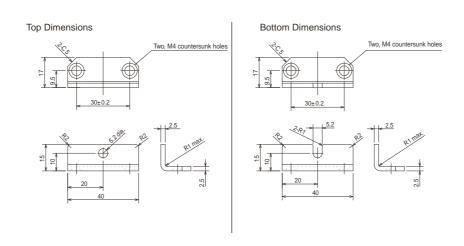
R88A-TK01K



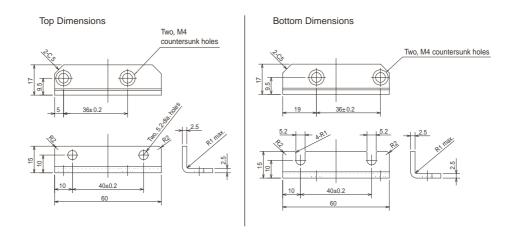
R88A-TK02K



R88A-TK03K



R88A-TK04K





Specifications

This chapter provides the general specifications, characteristics, connector specifications, and I/O circuits of the Servo Drives as well as the general specifications, characteristics, encoder specifications of the Servomotors and other peripheral devices.

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| EMC Filter Specifications | |
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3-1 Servo Drive Specifications

Select a Servo Drive that matches the Servomotor to be used. Refer to "Servo Drive and Servomotor Combination Tables" (P.2-11).

The same OMNUC G5-Series AC Servo Drive can be used for either a pulse train input or analog input. You can change the control mode according to the controller. (The default setting is for position control with pulse train commands.)

General Specifications

| | Ite | m | Specifications | | | | |
|-----------------------|--|--------------------------|---|--|--|--|--|
| ten | bient operat nperature an nidity | | 0 to +55°C, 20 to 85% max. (with no condensation) | | | | |
| | rage ambier d humidity | t temperature | -20 to +65°C, 20 to 85% max. (with no condensation) Maximum allowable temperature: 80°C for 72 hours maximum (with no condensation) | | | | |
| | erating and s | storage | No corrosive gases | | | | |
| Vib | ration resista | ance | 10 to 60 Hz and at an acceleration of 5.88 m/s ² or less (Not to be run continuously at the resonance point) | | | | |
| Ins | ulation resis | tance | Between power supply terminals/power terminals and FG terminal: 0.5 M Ω min. (at 500 VDC) | | | | |
| Die | lectric stren | gth | Between power supply terminals/power line terminals and FG terminal: 1,500 VAC for 1 min at 50/60 Hz | | | | |
| Pro | tective struc | ture | Built into panel | | | | |
| | EC Directives | EMC Directive | EN 55011, EN 61000-6-2, IEC 61800-3 | | | | |
| idard | | Low Voltage Directive | EN 61800-5-1 | | | | |
| nternational standard | | Machinery Directive | EN954-1 (Category 3), EN ISO 13849-1: 2008 (Category 3) (PLc,d), ISO 13849-1: 2006 (Category 3) (PLc,d), EN61508 (SIL2), EN62061 (SIL2), EN61800-5-2 (STO), IEC61326-3-1 (SIL2) | | | | |
| ernat | UL standards | | UL 508C | | | | |
| Inte | CSA standards | | CSA C22.2 No. 14 | | | | |
| | Korean Radio Regulations (KC) | | Compliant | | | | |

Note 1. The above items reflect individual evaluation testing. The results may differ under compound conditions.

Note 3. Some Servo Drive parts will require maintenance. For details, refer to "11-5 Periodic Maintenance" (P.11-27).

Note 2. Disconnect all connections to the Servo Drive before attempting a megameter test (insulation resistance measurement) on a Servo Drive. Failure to follow this guideline may result in damaging the Servo Drive. Never perform a dielectric strength test on the Servo Drive. Failure to follow this guideline may result in damaging the internal elements.

Characteristics

100-VAC Input Models

| | Item | | R88D-KTA5L | R88D-KT01L | R88D-KT02L | R88D-KT04L | | |
|--------------------------|--|-----------------------|--|---------------------|---------------------|----------------|--|--|
| Continuous ou | utput curren | t (rms) | 1.2 A | 1.7 A | 2.5 A | 4.6 A | | |
| Input power supply | Main circuit | Power supply capacity | 0.4 KVA | 0.4 KVA | 0.5 KVA | 0.9 KVA | | |
| | | Power supply voltage | Single-phase 100 to 120 VAC (85 to 132 V) 50/60 Hz | | | | | |
| | | Rated current | 1.7 A | 2.6 A | 4.3 A | 7.6 A | | |
| | | Heat value*1 | 11 W | 16.6 W | 21 W | 25 W | | |
| | Control circuit | Power supply voltage | Single-phase 100 to 120 VAC (85 to 132 V) 50/60 Hz | | | | | |
| | | Heat value*1 | 4 W | 4 W | 4 W | 4 W | | |
| Weight | | | Approx. 0.8 kg | Approx. 0.8 kg | Approx. 1.0 kg | Approx. 1.6 kg | | |
| Maximum app | licable moto | or capacity | 50 W | 100 W | 200 W | 400 W | | |
| Applicable Servomotor | 3,000 r/ min | INC | K05030H | K10030L | K20030L | K40030L | | |
| (R88M-) | | ABS | K05030T | K10030S | K20030S | K40030S | | |
| | 2,000-r/ min | ABS | _ | - | _ | _ | | |
| | 1,000-r/ min | ABS | _ | - | _ | - | | |
| Performance | Speed cor | ntrol range | 1:5000 | • | | • | | |
| | Speed var characteris | iation (load stic) | 0.01% max. from 0% to 100% (percentage of rated speed) | | | | | |
| | Speed variation (voltage characteristic) | | 0% at rated voltage ±10% (percentage of rated speed) | | | | | |
| | Temperatu (temperatu characteris | | ±0.01% max. (per | centage of rated sp | eed) from 0 to 50°C | ; | | |
| | Torque co repeatabili | | ±1% | | | | | |

^{*1:} The heat value is given for rated operation.

200-VAC Input Models

| | Item | | R88D- KT01H | R88D- KT02H | R88D- KT04H | R88D- KT08H | R88D- KT10H | R88D- KT15H | |
|--------------------------|--|--|--|--|--------------------------|--------------------------|--------------------------|--------------------|--|
| Continuous o | utput current | (rms) | 1.2 A | 1.6 A | 2.6 A | 4.1 A | 5.9 A | 9.4 A | |
| Input power supply | Main circuit | Power supply capacity | 0.5 KVA | 0.5 KVA | 0.9 KVA | 1.3 KVA | 1.8 KVA | 2.3KVA | |
| | | Power supply voltage | Single-phase or 3-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz | | | | | | |
| | | Rated current | 1.6/0.9 A * ¹ | 2.4/1.3 A * ¹ | 4.1/2.4 A * ¹ | 6.6/3.6 A * ¹ | 9.1/5.2 A * ¹ | 14.2/8.1 A *1 | |
| | | Heat value*2 | 14.3/13.7 W * ¹ | 23/19 W * ¹ | 33/24 W * ¹ | 30/35.5 W *1 | 57/49 W * ¹ | 104/93 W *1 | |
| | Control circuit | Power supply voltage | Single-phas | e 200 to 240 | VAC (170 to | 264 V) 50/60 | Hz | | |
| | | Heat value*2 | 4 W | 4 W | 4 W | 4 W | 7 W | 7 W | |
| Weight | | - | Approx. 0.8 kg | Approx. 0.8 kg | Approx. 1.0 kg | Approx. 1.6 kg | Approx. 1.8 kg | Approx. 1.8 kg | |
| Maximum app | olicable moto | r capacity | 100 W | 200 W | 400 W | 750 W | 1 kW | 1.5 kW | |
| Applicable Servomotor | 3,000-r/ min | INC | K05030H K10030H | K20030H | K40030H | K75030H | _ | K1K030H K1K530H | |
| (R88M-) | | ABS | K05030T K10030T | K20030T | K40030T | K75030T | _ | K1K030T K1K530T | |
| | 2,000-r/ min | INC | _ | _ | _ | _ | K1K020H | K1K520H | |
| | | ABS | _ | _ | _ | _ | K1K020T | K1K520T | |
| | 1,000-r/ min | INC | _ | _ | _ | _ | _ | K90010H | |
| | | ABS | _ | _ | _ | _ | _ | K90010T | |
| Performance | Speed cont | | 1:5000 | | | | | | |
| | Speed varia characterist | • | 0.01% max. | from 0% to 1 | 00% (percen | tage of rated | speed) | | |
| | | Speed variation (voltage characteristic) | | 0% at rated voltage ±10% (percentage of rated speed) | | | | | |
| | Temperature variation (temperature characteristic) | | ±0.01% max. (percentage of rated speed) from 0 to 50°C | | | | | | |
| | Torque con repeatability | | ±1% | | | | | | |

^{*1.} The first value is for single-phase input power and the second value is for 3-phase input power.

^{*2.} The heat value is given for rated operation.

| | Item | | R88D- KT20H | R88D- KT30H | R88D- KT50H | R88D- KT75H | R88D- KT150H | |
|-----------------------------------|-----------------------|--------------------------------------|--|-------------------|--------------------|--------------------|----------------------|--|
| Continuous o | utput current | (rms) | 13.4 A | 18.7 A | 33.0 A | 44.0 A | 66.1 A | |
| Input power supply | Main circuit | Power supply capacity | 3.3 KVA | 4.5 KVA | 7.5 KVA | 11.0 KVA | 22.0 KVA | |
| | | Power supply voltage | 3-phase 200 | to 230 VAC (1 | 70 to 253 V) 5 | 0/60 Hz*2 | | |
| | | Rated current | 11.8 A | 15.1 A | 21.6 A | 32.0 A | 58.0 A | |
| | | Heat value*1 | 139 W | 108 W | 328 W | 381 W | 720 W | |
| | Control circuit | Power supply voltage | Single-phase 200 to 230 VAC (170 to 253 V) 50/60 Hz*2 | | | | | |
| | | Heat value*1 | 10 W | 13 W | 13 W | 15 W | 17 W | |
| Weight | 1 | | Approx. 2.7 kg | Approx. 4.8 kg | Approx. 4.8 kg | Approx. 13.5 kg | Approx. 21.0 kg | |
| Maximum applicable motor capacity | | | 2 kW | 3 kW | 5 kW | 7.5 kW | 15 kW | |
| Applicable Servomotor | 3,000-r/ min | INC | K2K030H | K3K030H | K4K030H K5K030H | | | |
| (R88M-) | | ABS | K2K030T | K3K030T | K4K030T K5K030T | | | |
| | 2000-r/ min, | INC | K2K020H | K3K020H | K4K020H K5K020H | | | |
| | 1500-r/ min | ABS | K2K020T | K3K020T | K4K020T K5K020T | K7K515T | K11K015T K15K015T | |
| | 1,000-r/ min | INC | _ | K2K010H | K3K010H | | | |
| | | ABS | _ | K2K010T | K3K010T K4K510T | K6K010T | | |
| Performance | Speed cor | ntrol range | 1:5000 | | | | | |
| | Speed var characteris | iation (load stic) | 0.01% max. from 0% to 100% (percentage of rated speed) | | | | | |
| | Speed var characteris | iation (voltage stic) | 0% at rated v | oltage ±10% (| percentage of | rated speed) | | |
| _ | • | ure variation ure characteristic) | ±0.01% max. (percentage of rated speed) from 0 to 50°C | | | | | |
| | Torque co | ntrol repeatability | ±2% | | | | | |

^{*1.} The heat value is given for rated operation.

^{*2.} You can use either an AC power supply or DC power supply with the R88D-KT75H and R88D-KT150H. The DC power supply must be 280 to 325 VDC (238 to 357 VDC).

400-VAC Input Models

| | Item | | R88D-KT06F | R88D-KT10F | R88D-KT15F | R88D-KT20F | | |
|--------------------------|---------------------------------|-----------------------|--|--|---------------------|----------------|--|--|
| Continuous o | utput current (ı | ms) | 1.5 A | 2.9 A | 4.7 A | 6.7 A | | |
| | Main circuit | Power supply capacity | 1.2 KVA | 1.8 KVA | 2.3 KVA | 3.8 KVA | | |
| | | Power supply voltage | 3-phase 380 to 4 | 480 VAC (323 to 5 | 528 V) 50/60 Hz | | | |
| Input power | | Rated current | 2.1 A | 2.8 A | 3.9 A | 5.9 A | | |
| supply | | Heat value*1 | 32.2 W | 48 W | 49 W | 65 W | | |
| | Control circuit | Power supply voltage | 24 VDC (20.4 to 27.6 V) | | | | | |
| | | Heat value*1 | 7 W | 7 W | 7 W | 10 W | | |
| Weight | | | Approx. 1.9 kg | Approx. 1.9 kg | Approx. 1.9 kg | Approx. 2.7 kg | | |
| Maximum app | olicable motor | capacity | 600 W | 1 kW | 1.5 kW | 2 kW | | |
| Applicable Servomotor | 3,000-r/min | INC | - | K75030F | K1K030F K1K530F | K2K030F | | |
| (R88M-) | | ABS | - | K75030C | K1K030C K1K530C | K2K030C | | |
| | 2000-r/min | INC | K40020F K60020F | K1K020F | K1K520F | K2K020F | | |
| | | ABS | K40020C K60020C | K1K020C | K1K520C | K2K020C | | |
| | 1,000-r/min | INC | - | - | K90010F | - | | |
| | | ABS | - | - | K90010C | - | | |
| Performance | Speed control | range | 1:5000 | | | | | |
| | Speed variation characteristic) | | 0.01% max. from 0% to 100% (percentage of rated speed) | | | | | |
| | Speed variation characteristic) | ` • | 0% at rated voltag | 0% at rated voltage ±10% (percentage of rated speed) | | | | |
| | Temperature (| | ±0.01% max. (per | centage of rated spe | eed) from 0 to 50°C | | | |
| | Torque contro | l repeatability | ±1% | ±1% | | | | |

^{*1.} The heat value is given for rated operation.

| | Item | | R88D-KT30F | R88D-KT50F | R88D-KT75F | R88D-KT150F | | |
|--------------------------|---------------------------------|-----------------------|--|--------------------|-----------------|----------------------|--|--|
| Continuous o | utput current (ı | ms) | 9.4 A | 16.5 A | 22.0 A | 33.4 A | | |
| | Main circuit | Power supply capacity | 4.5 KVA | 6.0 KVA | 11.0 KVA | 22.0 KVA | | |
| | | Power supply voltage | 3-phase 380 to 480 VAC (323 to 528 V) 50/60 Hz | | | | | |
| Input power | | Rated current | 7.6 A | 12.1 A | 16.0 A | 29.0 A | | |
| supply | | Heat value*1 | 108 W | 200 W | 300 W | 590 W | | |
| | Control circuit | Power supply voltage | 24 VDC (20.4 to 27.6 V) | | | | | |
| | | Heat value*1 | 13 W | 13 W | 15 W | 22 W | | |
| Weight | П | | Approx. 4.7 kg | Approx. 4.7 kg | Approx. 13.5 kg | Approx. 21.0 kg | | |
| Maximum app | olicable motor | capacity | 3 kW | 5 kW | 7.5 kW | 15 kW | | |
| Applicable Servomotor | 3,000-r/min | INC | K3K030F | K4K030F K5K030F | | | | |
| (R88M-) | | ABS | K3K030C | K4K030C K5K030C | | | | |
| | 2000-r/min, 1500-r/min | INC | K3K020F | K4K020F K5K020F | | | | |
| | | ABS | K3K020C | K4K020C K5K020C | K7K515C | K11K015C K15K015C | | |
| | 1,000-r/min | INC | K2K010F | K3K010F | | | | |
| | | ABS | K2K010C | K3K010C K4K510C | K6K010C | | | |
| Performance | Speed control | range | 1:5000 | | | | | |
| | Speed variation characteristic) | ` | 0.01% max. from 0% to 100% (percentage of rated speed) | | | | | |
| | Speed variation characteristic) | | 0% at rated voltage ±10% (percentage of rated speed) | | | | | |
| | Temperature (temperature o | | ±0.01% max. (percentage of rated speed) from 0 to 50°C | | | | | |
| | Torque contro | l repeatability | ±2% | ±2% | | | | |

^{*1.} The heat value is given for rated operation.

Protective Functions

| Error detected | Description |
|---|--|
| Control power supply undervoltage | The DC voltage of the control power supply fell below the specified value. |
| Overvoltage | The DC voltage of the main circuit exceeded the specified value. |
| Main power supply undervoltage | The DC voltage of the main circuit is low. |
| Overcurrent | Overcurrent flowed to the IGBT. Motor power line ground fault or short circuit. |
| Servo Drive overheat | The temperature of the drive radiator exceeded the specified value. |
| Overload | Operation was performed with torque significantly exceeding the rating for several seconds to several tens of seconds. |
| Regeneration overload | The regenerative energy exceeded the regeneration absorption capacity of the Regeneration Resistor. |
| Encoder communications error | The encoder wiring is disconnected. |
| Encoder communications data error | Communications cannot be performed between the encoder and the drive. |
| Error counter overflow | The number of accumulated pulses in the error counter exceeded the set value for the Error Counter Overflow Level (Pn014). |
| Excessive hybrid error | During fully-closed control, difference between position of load from external encoder and position of motor due to encoder was larger than the number of pulses set by Internal/External Feedback Pulse Error Counter Overflow Level (Pn328). |
| Overspeed | The motor rotation speed exceeded the maximum number of rotations. |
| Electronic gear setting error | The set value for the Electronic Gear Ratio (Pn009 to Pn010, Pn500 to Pn503) is not appropriate. |
| Error counter overflow | Error counter value based on the encoder pulse reference exceeded 2 ²⁹ (536870912). |
| Interface I/O setting error | An error was detected in the interface I/O signal. |
| Overrun limit error | The motor exceeded the allowable operating range set in the Overrun Limit Setting (Pn514) with respect to the position command input. |
| Parameter error | Data in the Parameter Save area was corrupted when the power supply was turned ON and data was read from the EEPROM. |
| Parameters destruction | The checksum for the data read from the EEPROM when the power supply was turned ON does not match. |
| Drive prohibition input error | The forward drive prohibition and reverse drive prohibition inputs are both turned OFF. |
| Excessive analog input | A current exceeding the Excessive Analog Input (Pn424, Pn427 or Pn430) was applied to the analog command input (pin 14). |
| Absolute encoder system down error | The voltage supplied to the absolute encoder is lower than the specified value. |
| Absolute encoder counter overflow error | The multi-rotation counter of the absolute encoder exceeds the specified value. |
| Absolute encoder overspeed error | The motor rotation speed exceeds the specified value when only the battery power supply of the absolute encoder is used. |
| Absolute encoder 1-rotation counter | A 1-turn counter error was detected. |
| Absolute encoder multi-rotation counter error ABS | A multi-rotation counter error or phase-AB signal error was detected. |

| Error detected | Description |
|---------------------------------------|--|
| Absolute encoder status error ABS | The rotation of the absolute encoder is higher than the specified value. |
| Encoder phase-Z error | A phase Z pulse was not detected regularly. |
| Encoder CS signal error | A logic error was detected in the CS signal. |
| External encoder communications error | An error was detected in external encoder connection and communications data. |
| External encoder status error | An external encoder alarm code was detected. |
| Phases-A, B and Z connection error | An error was generated for connection of phases A, B, and Z of external encoder. |
| Motor non-conformity | The combination of the Servomotor and Servo Drive is not appropriate. |

Main Circuit and Motor Connections

When wiring the main circuit, use proper wire sizes, grounding systems, and noise resistance.

R88D-KTA5L/-KT01L/-KT02L/-KT04L R88D-KT01H/KT02H/-KT04H/-KT08H/-KT10H/-KT15H

Main Circuit Connector Specifications (CNA)

| Symbol | Name | Function |
|--------|-----------------------|--|
| L1 | Main circuit power | R88D-KT□L |
| L2 | supply input | (50 to 400 W) : Single-phase 100 to 120 VAC (85 to 132 V) 50/60 Hz R88D-KT□H |
| | | (100 W to 1.5 kW) : Single-phase: 200 to 240 VAC (170 to 264 V) 50/ 60 Hz |
| L3 | | (100 W to 1.5 kW) : 3-phase: 200 to 240 VAC (170 to 264 V) 50/60 Hz |
| | | Note. Single-phase should connect to L1 and L3. |
| L1C | Control circuit power | R88D-KT□L: Single-phase 100 to 120 VAC (85 to 132 V) 50/60 Hz |
| L2C | supply input | R88D-KT□H : Single-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz |

Motor Connector Specifications (CNB)

| Symbol | Name | | Function |
|--------|--|--|---|
| B1 | | | 5L/-KT01L/-KT02L/-KT01H/-KT02H/-KT04H: |
| В3 | External | If there is h | lo not short B1 and B2. Doing so may cause malfunctions. igh regenerative energy, connect an External |
| B2 | Regeneration Resistor connection terminals | R88D-KT0- Normally B may cause the short-ci | on Resistor between B1 and B2. 4L/-KT08H/-KT10H/-KT15H: 2 and B3 are shorted. Do not short B1 and B2. Doing so malfunctions. If there is high regenerative energy, remove ircuit bar between B2 and B3 and connect an External on Resistor between B1 and B2. |
| U | Motor connection | Phase U | These are the output terminals to the Servomotor. |
| V | terminals | Phase V | Be sure to wire them correctly. |
| W | | Phase W | |



Precautions for Correct Use

• Tighten the ground screws to the torque of 0.7 to 0.8 N•m (M4) or 1.4 to 1.6 N•m (M5).

R88D-KT20H

Main Circuit Connector Specifications (CNA)

| Symbol | Name | Function |
|--------|-----------------------|---|
| L1 | Main circuit power | R88D-KT□H (2 kW) : |
| L2 | supply input | 3-phase: 200 to 230 VAC (170 to 253 V) 50/60 Hz |
| L3 | | |
| L1C | Control circuit power | R88D-KT□H: Single-phase 200 to 230 VAC (170 to 253 V) 50/60 |
| L2C | supply input | Hz |

Motor Connector Specifications (CNB)

| Symbol | Name | | Function |
|--------|------------------|---------|---|
| U | Motor connection | Phase U | These are the output terminals to the Servomotor. |
| V | terminals | Phase V | Be sure to wire them correctly. |
| W | | Phase W | |

External Regeneration Resistor Connector Specifications (CNC)

| Symbol | Name | Function |
|--------|---|--|
| B1 | External Regeneration Resistor connection | Normally B2 and B3 are shorted. Do not short B1 and B2. Doing so may cause malfunctions. |
| B3 | terminals | If there is high regenerative energy, remove the short-circuit bar |
| B2 | | between B2 and B3 and connect an External Regeneration Resistor between B1 and B2. |
| NC | Do not connect. | |



- Tighten the ground screws to the torque of 0.7 to 0.8 N•m (M4) or 1.4 to 1.6 N•m (M5).
- Never connect an External Regeneration Resistor between the B1 and NC terminals.

R88D-KT30H/R88D-KT50H

Main Circuit Terminal Block Specifications

| Symbol | Name | Function | |
|--------|-------------------------------|--|---|
| L1 | Main circuit power | |]H (3 to 5 kW): |
| L2 | supply input | 3-phase 20 | 00 to 230 VAC (170 to 253 V) 50/60 Hz |
| L3 | | | |
| L1C | Control circuit power | | H: Single-phase 200 to 230 VAC (170 to 253 V) 50/60 |
| L2C | supply input | Hz | |
| B1 | External Regeneration | Normally B2 and B3 are connected. Do not short B1 and B2. Doing | |
| В3 | Resistor connection terminals | so may cause malfunctions. If there is high regenerative energy, remove the short-circuit bar between B2 and B3 and connect an | |
| B2 | | External R | egeneration Resistor between B1 and B2. |
| NC | Do not connect. | | |
| U | Motor connection | Phase U | These are the output terminals to the Servomotor. |
| V | terminals | Phase V | Be sure to wire them correctly. |
| W | | Phase W | |



- Tighten the terminal block screws to the torque of 0.75 N•m (M4) or 1.5 N•m (M5).
- If the torque for terminal block screws exceeds 1.2 N•m (M4) or 2.0 N•m (M5), the terminal block may be damaged.
- Tighten the fixing screw of the terminal block cover to the torque of 0.2 N•m (M3).
- Tighten the ground screws to the torque of 0.7 to 0.8 N•m (M4) or 1.4 to 1.6 N•m (M5).
- Never connect an External Regeneration Resistor between the B1 and NC terminals.

R88D-KT75H

Terminal Block Specifications, Left Terminal Block (TB1)

| Symbol | Name | Function |
|----------|---------------------------------|---|
| L1 | | R88D-KT□H (7.5 kW): 3-phase 200 to 230 VAC (170 to 253 V) 50/ |
| L2 | Main circuit power supply input | 60 Hz |
| L3 | | 280 to 325 VDC (238 to 357 VDC) |
| B1 | External Regeneration | Connect an External Regeneration Resistor between B1 and B2. |
| B2 | Resistor connection terminals | |
| N (NC) | | |
| U | | These are the output terminals to the Servomotor. |
| V | Motor connection terminals | Be sure to wire them correctly. |
| W | | |
| = | | |

Terminal Block Specifications, Right Terminal Block (TB2)

| Symbol | Name | Function |
|----------|----------------------------------|--|
| L1C | Control circuit power | R88D-KT□H: Single-phase 200 to 230 VAC (170 to 253 V) 50/60 |
| L2C | supply input | Hz 280 to 325 VDC (238 to 357 VDC) |
| DB1 | Dynamic brake resistance control | These terminals are used to control the MC for externally connected |
| DB2 | terminals | dynamic brake resistance. The output contact specifications are 1 A max. at 300 VAC/100 VDC max. Connect them if required. |
| DB3 | | Normally DB3 and DB4 are connected. When using an externally |
| DB4 | | connected Dynamic Brake Resistor, remove the short bar from between DB3 and DB4. |
| = | Frame ground | This is the ground terminal. Ground to 100 Ω or less. |



- Tighten the terminal block screws to the torque of 1.5 N•m (M5).
- If the torque for terminal block screws exceeds 2.0 Nom (M5), the terminal block may be damaged.
- Tighten the fixing screw of the terminal block cover to the torque of 0.2 Nem (M3).
- Tighten the ground screws to the torque of 1.4 to 1.6 N•m (M5).
- Never connect an External Regeneration Resistor between the B1 and N (NC) terminals

R88D-KT150H

Terminal Block Specifications, Top Terminal Block (TB1)

| Symbol | Name | Function |
|--------|------------------------------|--|
| L1C | Control circuit power | R88D-KT□H: Single-phase 200 to 230 VAC (170 to 253 V) 50/60 |
| L2C | supply input | Hz 280 to 325 VDC (238 to 357 VDC) |
| DB1 | Dynamic brake | These terminals are used to control the MC for externally connected |
| DB2 | resistance control terminals | dynamic brake resistance. The output contact specifications are 1 A max. at 300 VAC/100 VDC max. Connect them if required. |

Terminal Block Specifications, Bottom Terminal Block (TB2)

| Symbol | Name | Function |
|--------|---------------------------------|--|
| L1 | | R88D-KT□H (15 kW): 3-phase 200 to 230 VAC (170 to 253 V) 50/ |
| L2 | Main circuit power supply input | 60 Hz |
| L3 | | 280 to 325 VDC (238 to 357 VDC) |
| B1 | External Regeneration | Connect an External Regeneration Resistor between B1 and B2. |
| B2 | Resistor connection terminals | |
| N (NC) | tominalo | |
| U | | These are the output terminals to the Servomotor. |
| V | Motor connection | Be sure to wire them correctly. |
| W | terminals | |
| (=) | | |
| (‡) | Frame ground | This is the ground terminal. Ground to 100 Ω or less. |



- Tighten the terminal block screws to the torque of 1.5 N•m (M5) or 2.5 N•m (M6).
- If the torque for terminal block screws exceeds 2.0 N•m (M5) or 3.0 N•m (M6), the terminal block may be damaged.
- Tighten the fixing screw of the terminal block cover to the torque of 0.4 N•m (M5).
- Tighten the ground screws to the torque of 2.4 to 2.6 Nem (M6).
- Never connect an External Regeneration Resistor between the B1 and N (NC) terminals

R88D-KT06F/R88D-KT10F/R88D-KT20F

Main Circuit Connector Specifications (CNA)

| Symbol | Name | Function |
|--------|--------------------|---|
| L1 | Main circuit power | R88D-KT□F |
| L2 | supply input | (600 W to 2 kW) : 3-phase: 380 to 480 VAC (323 to 528 V) 50/60 Hz |
| L3 | | |

Motor Connector Specifications (CNB)

| Symbol | Name | Function | | | | | |
|--------|------------------|----------|---|--|--|--|--|
| U | Motor connection | Phase U | These are the output terminals to the Servomotor. | | | | |
| V | terminals | Phase V | Be sure to wire them correctly. | | | | |
| W | | Phase W | | | | | |

Control Circuit Connector Specifications (CNC)

| Symbol | Name | Function |
|--------|-----------------------|--------------|
| 24 V | Control circuit power | 24 VDC ± 15% |
| 0 V | supply input | |

External Regeneration Resistor Connector Specifications (CND)

| Symbol | Name | Function |
|--------|---|--|
| B1 | External Regeneration Resistor connection | Normally B2 and B3 are connected. Do not short B1 and B2. Doing so may cause malfunctions. |
| B3 | terminals | If there is high regenerative energy, remove the short-circuit bar |
| B2 | | between B2 and B3 and connect an External Regeneration Resistor between B1 and B2. |
| NC | Do not connect. | |



- Tighten the ground screws to the torque of 0.7 to 0.8 N•m (M4) or 1.4 to 1.6 N•m (M5).
- Never connect an External Regeneration Resistor between the B1 and NC terminals.

R88D-KT30F/R88D-KT50F

Main Circuit Terminal Block Specifications (TB1)

| Symbol | Name | Function |
|--------|-----------------------|--------------|
| 24 V | Control circuit power | 24 VDC ± 15% |
| 0 V | supply input | |

Main Circuit Terminal Block Specifications (TB2)

| Symbol | Name | | Function | | | | |
|--------|---------------------------|--|---|--|--|--|--|
| L1 | Main circuit power supply | | R88D-KT□F (3 to 5 kW): | | | | |
| L2 | input | 3-phase 3 | 80 to 480 VAC (323 to 528 V) 50/60 Hz | | | | |
| L3 | | | | | | | |
| B1 | External Regeneration | Normally B2 and B3 are connected. Do not short B1 and B2. Doing so may cause malfunctions. | | | | | |
| В3 | Resistor connection | If there is high regenerative energy, remove the short-circuit bar | | | | | |
| B2 | terminals | between B2 and B3 and connect an External Regeneration Resistor between B1 and B2. | | | | | |
| NC | Do not connect. | | | | | | |
| U | Motor connection | Phase U | These are the output terminals to the Servomotor. | | | | |
| V | terminals | Phase V | Be sure to wire them correctly. | | | | |
| W | | Phase W | | | | | |



- Tighten the terminal block screws to the torque of 0.75 N•m (M4) or 1.5 N•m (M5).
- If the torque for terminal block screws exceeds 1.2 N•m (M4) or 2.0 N•m (M5), the terminal block may be damaged.
- Tighten the fixing screw of the terminal block cover to the torque of 0.2 Nem (M3).
- Tighten the ground screws to the torque of 0.7 to 0.8 N•m (M4) or 1.4 to 1.6 N•m (M5).
- Never connect an External Regeneration Resistor between the B1 and NC terminals.

R88D-KT75F

Terminal Block Specifications, Left Terminal Block (TB1)

| Symbol | Name | | Function | | |
|--------|---|-------------------|---|--|--|
| L1 | | | | | |
| L2 | Main circuit power supply input | R88D-K 60 Hz | R88D-KT□F (7.5 kW): 3-phase 380 to 480 VAC (323 to 528 V) 50/ | | |
| L3 | | 00112 | | | |
| B1 | External Regeneration Resistor connection | Connect | Connect an External Regeneration Resistor between B1 and B2. | | |
| B2 | terminals | | | | |
| NC | Do not connect. | l. | | | |
| U | | Red | These are the output terminals to the Servomotor. | | |
| V | Motor connection | White | Be sure to wire them correctly. | | |
| W | terminals | Blue | | | |
| (1) | | Green/ Yellow | | | |

Terminal Block Specifications, Right Terminal Block (TB2)

| Symbol | Name | Function |
|------------|--|--|
| 24 V | Control circuit power | 24 VDC±15% |
| 0 V | supply input | |
| DB1 | Dynamic brake resistance control terminals | These terminals are used to control the MC for externally connected dynamic brake resistance. The output contact |
| DB2 | Control terminals | specifications are 1 A max. at 300 VAC/100 VDC max. Connect them if required. |
| DB3 | | Normally DB3 and DB4 are connected. When using an externally |
| DB4 | | connected Dynamic Brake Resistor, remove the short bar from between DB3 and DB4. |
| (±) | Frame ground | This is the ground terminal. Ground to 10 Ω or less. |



- Tighten the terminal block screws to the torque of 1.5 N•m (M5).
- \bullet If the torque for terminal block screws exceeds 2.0 Nem (M5), the terminal block may be damaged.
- Tighten the fixing screw of the terminal block cover to the torque of 0.2 N•m (M3).
- Tighten the ground screws to the torque of 1.4 to 1.6 N•m (M5).
- Never connect an External Regeneration Resistor between the B1 and NC terminals

R88D-KT150F

Terminal Block Specifications, Top Terminal Block (TB1)

| Symbol | Name | Function |
|--------|--|--|
| 24 V | Control circuit power | 24 VDC±15% |
| 0 V | supply input | |
| DB1 | | These terminals are used to control the MC for externally |
| DB2 | Dynamic brake resistance control terminals | connected dynamic brake resistance. The output contact specifications are 1 A max. at 300 VAC/100 VDC max. Connect them if required. |

Terminal Block Specifications, Bottom Terminal Block (TB2)

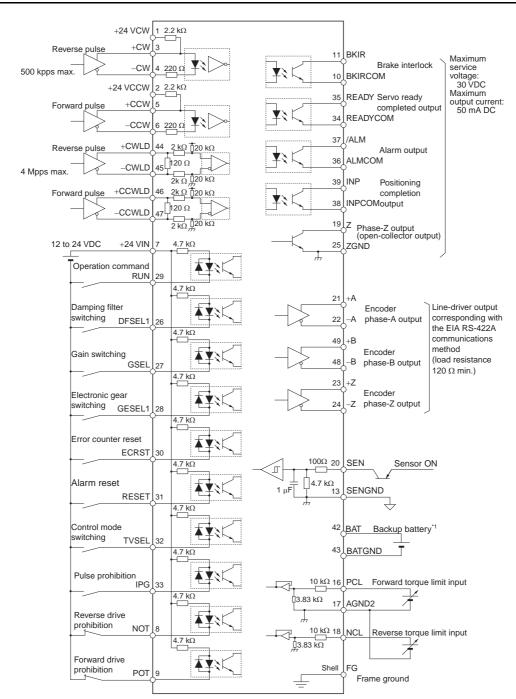
| Symbol | Name | | Function | | | |
|-------------|---------------------------------|---|---|--|--|--|
| L1 | | | R88D-KT□F (15 kW): 3-phase 380 to 480 VAC (323 to 528 V) 50/ 60 Hz | | | |
| L2 | Main circuit power supply input | R88D-K 60 Hz | | | | |
| L3 | | | | | | |
| B1 | External Regeneration | Connect | Connect an External Regeneration Resistor between B1 and B2. | | | |
| B2 | Resistor connection terminals | | | | | |
| NC | Do not connect. | | | | | |
| U | | Red | These are the output terminals to the Servomotor. | | | |
| V | Motor connection | White | Be sure to wire them correctly. | | | |
| W | terminals | Blue | | | | |
| | | Green/ Yellow | | | | |
| (±) | Frame ground | This is the ground terminal. Ground to 10 Ω or less. | | | | |



- Tighten the terminal block screws to the torque of 1.5 N•m (M5) or 2.5 N•m (M6).
- If the torque for terminal block screws exceeds 2.0 N•m (M5) or 3.0 N•m (M6), the terminal block may be damaged.
- Tighten the fixing screw of the terminal block cover to the torque of 0.4 Nem (M5).
- Tighten the ground screws to the torque of 2.4 to 2.6 Nem (M6).
- Never connect an External Regeneration Resistor between the B1 and NC terminals

Control I/O Connector Specifications (CN1)

Control I/O Signal Connections and External Signal Processing for Position Control



^{*1.} A cable equipped with a battery is not required if a backup battery is connected.

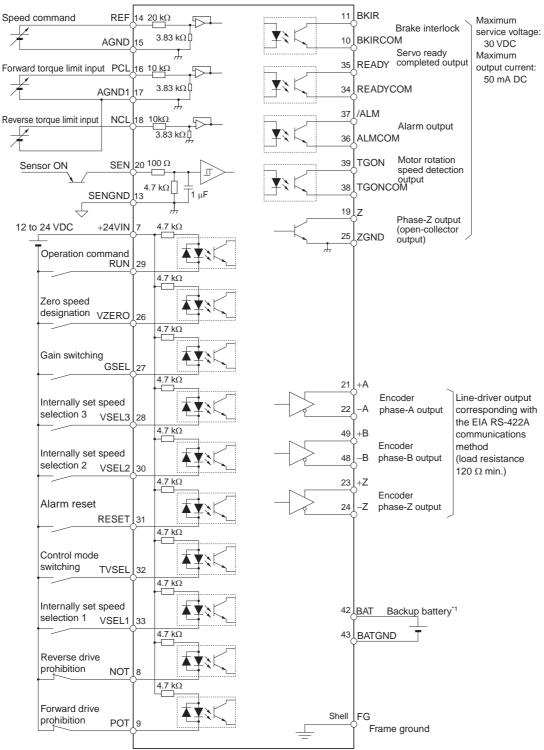
Note 1. The inputs of pins 8, 9 and 26 to 33, and outputs of pins 10, 11, 34, 35, 38 and 39, can be changed via parameter settings.

Note 2. Pins 13, 20, 42 and 43 represent signals which are applicable when an absolute encoder is used.

Note 3. If pins 21, 22, 49, 48, 23, and 24 are used for the encoder output, use pin 25 (ZGND) to wire the ground.

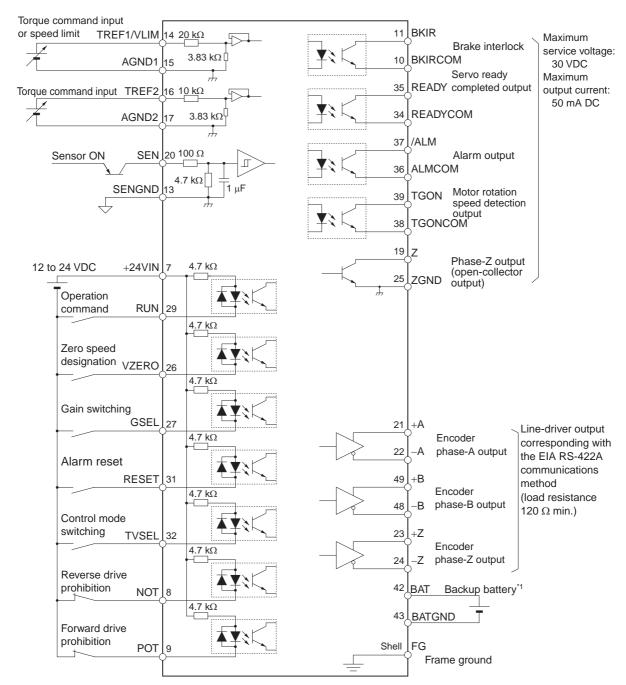
Note 4. It is not necessary to wire input pins that are not being used.

Control I/O Signal Connections and External Signal Processing for Speed Control



- *1. A cable equipped with a battery is not required if a backup battery is connected.
- Note 1. The inputs of pins 8, 9 and 26 to 33, and outputs of pins 10, 11, 34, 35, 38 and 39, can be changed via parameter settings.
- Note 2. Pins 13, 20, 42 and 43 represent signals which are applicable when an absolute encoder is used.
- Note 3. If pins 21, 22, 49, 48, 23, and 24 are used for the encoder output, use pin 25 (ZGND) to wire the ground.
- Note 4. It is not necessary to wire input pins that are not being used.

Control I/O Signal Connections and External Signal Processing for Torque Control



- *1. A cable equipped with a battery is not required if a backup battery is connected.
- Note 1. The inputs of pins 8, 9 and 26 to 33, and outputs of pins 10, 11, 34, 35, 38 and 39, can be changed via parameter settings.
- Note 2. Pins 13, 20, 42 and 43 represent signals which are applicable when an absolute encoder is used.
- Note 3. If pins 21, 22, 49, 48, 23, and 24 are used for the encoder output, use pin 25 (ZGND) to wire the ground.
- Note 4. It is not necessary to wire input pins that are not being used.

Control I/O Signal List

CN1 Control Inputs

| Pin | | Name | Function and interface | Control mode | | | |
|--------|--------------------|---|--|--------------|----------|----------|------------------|
| number | Symbol | | | Position | Speed | Torque | Fully- closed |
| 1 | +24VCW | 24-V open-collector | Input terminals for position command | | | | |
| 2 | +24VCCW | input for command pulse | pulses for both line driver and open collector. | | | | |
| 3 | +CW/ +PULS/+FA | Reverse pulse, feed pulse, or 90° phase | Changes to enable (set value: 0 <default setting="">) according to the setting of Command Pulse Input Selection</default> | | | | |
| 4 | -CW/-PULS/ -FA | difference signal (phase A) | (Pn005). | √ | | | \checkmark |
| 5 | +CCW/ +SIGN/+FB | Forward pulse, direction signal, or 90° | | | | | |
| 6 | -CCW/-SIGN/ -FB | phase difference signal (phase B) | | | | | |
| 44 | +CWLD | Reverse pulse (input for | Input terminals for position command | | | | |
| 45 | -CWLD | line driver only) | pulses dedicated to the line-driver output. | | | | , |
| 46 | +CCWLD | Forward pulse (input for | Changes to enable (set value: 1) | | | | V |
| 47 | -CCWLD | line driver only) | according to the setting of Command Pulse Input Selection (Pn005). | | | | |
| 20 | SEN | Sensor ON Input ABS | This performs serial transmission of multi-rotation data of the absolute encoder and also outputs 1-rotation data as the initial incremental pulses. This input is enabled by setting the Operation Switch when Using Absolute Encoder (Pn015) to 0 or 2. | √ | √ | √ | |
| 13 | SENGND | Signal ground | This is a sensor ON signal ground. | | | | |
| 42 | BATGND | Backup battery input ABS | These are the backup battery connection terminals used when the absolute encoder power is interrupted. (Connection to this terminal is not necessary if you use the absolute encoder battery cable for backup.) | V | V | V | V |
| | REF | Speed command input | This is an analog input terminal for speed command. Use the Speed Command Scale (Pn302) to change the rotation speed scale for the command input. | | V | | |
| 14 | TREF1 | Torque command input 1 | Provides a torque command input (set value: 0 or 2) according to the setting of Torque Command/Speed Limit Selection (Pn317). Use the Torque Command Scale (Pn319) to change the rotation speed scale for the command input. | | | V | |

| Pin | | | | Control mode | | | |
|----------------|----------------|---------------------------------|---|--------------|----------|----------|------------------|
| number | Symbol | Name | Function and interface | Position | Speed | Torque | Fully- closed |
| 14 | VLIM | Speed limit input | Provides a speed limit input (set value: 1) according to the setting of Torque Command/Speed Limit Selection (Pn317). Use the Speed Command Scale (Pn302) to change the limit speed scale for the analog input. | | | V | |
| 15 | AGND1 | Analog ground 1 | This is an analog signal ground. | | | | |
| | PCL | Forward torque limit input | Provides a forward torque limit input (set value: 0 or 4) or forward/reverse torque limit input (set value: 5) according to the setting of Torque Limit Selection (Pn521). | 1 | √ | | √ |
| 16 | TREF2 | Torque command input 2 | Provides a torque command input (set value: 1) according to the setting of Torque Command/Speed Limit Selection (Pn317). Use the Torque Command Scale (Pn319) to change the rotation speed scale for the command input. | | | V | |
| 17 | AGND1 | Analog ground 1 | This is an analog signal ground. | | | | |
| 18 | NCL | Reverse torque limit input | Provides a reverse torque limit input (set value: 0 or 4) according to the setting of Torque Limit Selection (Pn521). | V | 1 | | √ |
| 7 | +24VIN | 12 to 24-VDC power supply input | The positive input terminal of the external power supply (12 to 24 VDC) for sequence inputs | V | V | V | √ |
| | SI1 to SI10 | Sequence input signal | These allocate the following function and settings of Input Signal Selection 1 to 10 | | | | e |
| | NOT [8] | Reverse drive prohibition input | This performs the drive prohibition input in the reverse direction. Changes to enable (set value: 0 or 2) according to the setting of Drive Prohibition Input Selection (Pn504). | √ | √ | √ | √ |
| | POT [9] | Forward drive prohibition input | This performs the drive prohibition input in the forward direction. Changes to enable (set value: 0 or 2) according to the setting of Drive Prohibition Input Selection (Pn504). | V | √ | √ | V |
| 8, 9, 26 to 33 | DFSEL1 [26] | Damping filter switching 1 | Changes to enable (set value: 1 or 2) according to the setting of Damping Filter Selection (Pn213). If the set value of Damping Filter Selection (Pn213) is 2, switching between 4 settings is possible by combining this with the damping filter switching input 2 (DFSEL2). | V | | | √ |

| D:u | | | | | Contro | l mode | • | | | | |
|----------------|----------------|----------------------------------|---|----------|----------|----------|------------------|--|--|--|--|
| Pin number | Symbol | Name | Function and interface | Position | Speed | Torque | Fully- closed | | | | |
| | GSEL [27] | | This changes to enable (set value: 2) according to the setting of the Gain Switching Mode (Pn115 for position control, Pn120 for speed control, or Pn124 for torque control). When the signal is OFF and ON, gain 1 and gain 2 change to enable, respectively. | √ | 1 | V | √ | | | | |
| | GESEL1 [28] | Electronic gear switching 1 | Switches the numerator for electronic gear ratio. You can switch maximum 4 electronic gear ratio numerators by combining with electronic gear switching input 2 (GESEL2). | V | | | V | | | | |
| | RUN [29] | Operation command input | This turns ON the servo (motor power supply starts). | V | V | V | V | | | | |
| | ECRST [30] | Error counter reset input | Resets the position error counter. An edge (set value: 0) or level (set value: 1) can be selected according to the setting of Error Counter Reset Condition Selection (Pn517). | √ | | | √ | | | | |
| | RESET [31] | Alarm reset input | Release the alarm status. The error counter is reset when the alarm is reset. Some alarms cannot be reset with this input. | √ | √ | V | √ | | | | |
| | TVSEL [32] | Control mode switching input | This signal switches the control mode for Servo Drive. Changes to enable (set value: 3 to 5) according to the setting of Control Mode Selection (Pn001). | √ | √ | √ | | | | | |
| | IPG [33] | Pulse prohibition input | Prohibits the position command pulse. Changes to enable (set value: 0) according to the setting of Command Pulse Prohibition Input Setting (Pn518). | √ | | | | | | | |
| | VSEL1 [33] | Internally set speed selection 1 | Use this input to select a desired Speed Setting (Pn304 to 311) during the | | | | | | | | |
| | VSEL2 [30] | Internally set speed selection 2 | internally set speed operation. | | √ | | | | | | |
| | VSEL3 [28] | Internally set speed selection 3 | | | | | | | | | |
| | TLSEL | Torque limit switching | Switches the torque limit value via ON/OFF. Changes to enable (set value: 3 or 6) according to the setting of Torque Limit Selection (Pn521). The torque limit value and operating direction vary according to the set value. | V | V | | √ | | | | |
| 8, 9, 26 to 33 | DFSEL2 | Damping filter switching 2 | Changes to enable (set value: 2) according to the setting of Damping Filter Selection (Pn213). Switching between 4 settings is possible by combining this with the damping filter switching input 1 (DFSEL1). | V | | | √ | | | | |

| Pin | | | | | Contro | l mode | |
|----------------|--------|-------------------------------|---|----------|----------|------------------|----------|
| number | Symbol | Name | Position | Speed | Torque | Fully- closed | |
| | GESEL2 | Electronic gear switching 2 | You can switch maximum 4 electronic gear ratio numerators by combining with electronic gear switching input 1 (GESEL1). | V | | | V |
| | VZERO | Zero speed designation input | This signal forcibly sets the speed command to 0. Changes to enable (set value: 1 to 3) according to the setting of Zero Speed Designation Selection (Pn315). | | √ | √ | |
| | VSIGN | Speed command sign input | Designates the motor rotation direction for speed commands. Changes to enable (set value: 1) according to the setting of Speed Command Direction Selection (Pn301). | | √ | | |
| | TSIGN | Torque command sign input | This signal designates the motor rotation direction for torque commands. Changes to enable (set value: 1) according to the setting of Torque Command Direction Selection (Pn318). | | | √ | V |
| 8, 9, 26 to 33 | STOP | Emergency stop input | This is an emergency stop input. When input, this becomes an emergency stop input error and thereby stop the motor. | V | V | V | V |
| | JSEL | Inertia ratio switching input | This signal switches between inertia ratio 1 and inertia ratio 2. | V | 1 | V | V |

- Be cautious that allocatable pin numbers are fixed for the following functions. Error counter reset input (ECRST): Pin 30 only Command pulse input prohibition input (IPG): Pin 33 only
- The number in brackets indicates the pin number (allocation) at default setting. (The allocations vary according to the control mode.)

CN1 Control Outputs

| Pin | | | | | Control mode | | |
|--------------------|----|----------------------------|---|----------|--------------|--------|------------------|
| number Symbol Name | | Name | Function and interface | Position | Speed | Torque | Fully- closed |
| 21 | +A | Encoder phase A +output | Encoder signals (or external encoder signals during fully-closed control) are | | | | |
| 22 | -A | Encoder phase A - output | output according to the setting of Encoder Dividing Numerator (Pn011). This is the line-driver output (equivalent | | | | |
| 49 | +B | Encoder phase B +output | to RS-422). The maximum output frequency is 4 Mpps. | V | V | V | V |
| 48 | -В | Encoder phase B - output | Phase Z is output for encoder signals (or external encoder signals during fully- | ` | • | ` | V |
| 23 | +Z | Encoder phase Z +output | closed control). This is the line-driver output (equivalent to RS-422). | | | | |
| 24 | -Z | Encoder phase Z - output | | | | | |

| Pin | | | | | Contro | l mode | |
|------------------|------------------------------|---|---|----------|----------|----------|------------------|
| number | Symbol | Name | Function and interface | Position | Speed | Torque | Fully- closed |
| 19 | Z ZGND | Encoder phase-Z output Encoder phase-Z output common | V | V | V | √ | |
| | SO1 to SO4 | Sequence output signal | These signals allocate the following functions settings of Output Signal Selections 1 to | | | | |
| | BKIR [11] BKIRCOM [10] | Brake interlock output | Outputs the timing signal for operating the electromagnetic brake on a motor. | 1 | V | V | V |
| | READY [35] READYCO M [34] | Servo ready completed | This output signal indicates the Drive is ready to be energized. It is turned ON when the control and main power supply is established and not in alarm status. | √ | √ | √ | √ |
| | /ALM [37] ALMCOM [36] | Servo alarm | The output is OFF when an alarm is generated for the Servo Drive. | 1 | 1 | 1 | 1 |
| | INP1 [39] | Positioning completion | If the position error is equal to | | | | |
| | INP1COM [38] | output 1 | Positioning Completion Range 1 (Pn431) or less, this output turns ON according to the setting condition of Positioning Completion Condition Selection (Pn432). | V | | | √ |
| | TGON [39] TGONCOM [38] | Motor rotation speed detection output | This output turns ON when the motor rotation speed reaches the speed set in Rotation Speed for Motor Rotation Detection (Pn436). | | V | V | |
| | TLIMT TLIMTCOM | Torque limit output | This output turns ON while the torque is limited. | 1 | V | | V |
| | ZSP ZSPCOM | Zero speed detection signal | This output turns ON when the motor rotation speed is equal to Zero Speed Detection (Pn434) or less. | V | V | V | V |
| | VCMP | Speed conformity output | This output turns ON when the command speed corresponds to the motor rotation speed. This output turns ON when the difference between the command speed and motor rotation speed is inside the setting range of Speed Conformity Detection Width (Pn435). | | √ | √ | |
| t to 39 | INP2 | Positioning completion output 2 | If the position error is equal to Positioning Completion Range 2 (Pn442) or less, this output turns ON according to the setting condition of Positioning Completion Condition Selection (Pn432). | V | | | V |
| 10, 11, 34 to 39 | WARN1 WARN1COM | Warning output 1 | This output turns ON according to the setting condition of Warning Output Selection 1 (Pn440). | 1 | V | V | V |

| Pin | | | | | l mode | e | |
|------------------|----------------|-----------------------|--|----------|--------|----------|------------------|
| number | Symbol | Name | Function and interface | Position | Speed | Torque | Fully- closed |
| - | WARN2 | Warning output 2 | This output turns ON according to the | V | ما | V | V |
| | WARN2COM | | setting condition of Warning Output Selection 1 (Pn440). | V | V | | |
| | P-CMD | Position command | This output turns ON when a positioning | | | | |
| | P- | status output | command is input. | V | | | $\sqrt{}$ |
| | CMDCOM | | | | | | |
| | V-LIMIT | Speed limiting output | This turns ON during torque control or | | | | |
| | V- | | speed limit status. | | | √ | |
| | LIMITCOM | | | | | | |
| | ALM-ATB | Alarm clear attribute | This output turns ON when an alarm | | | | |
| 10, 11, 34 to 39 | ALM- ATBCOM | output | occurs or the alarm can be cleared. | √ | √ | 1 | $\sqrt{}$ |
| | V-CMD | Speed command status | This output turns ON during speed | | | | |
| | V- CMDCOM | output | control or when a speed command is input. | | V | | |

- You cannot change the allocation for servo alarm output (/ALM). (The allocation is fixed.)
- The number in brackets indicates the pin number (allocation) at default setting. (The allocations vary according to the control mode.)

CN1 Pin Arrangement

| | | | 1 | PCOM | 24-V open-collector | L. | | | 26 | SI3 ^{*2} | General-purpose |
|----|-------------------|---|----|---------------------|---|----|---------------|---------------------------------------|----|--------------------|----------------------------------|
| 2 | PCOM | 24-V open-collector input for | Ľ | r colvi | input for command pulse | 27 | SI4 | General-purpose input 4 | | | input 3*2 |
| | | command pulse Reverse pulses. | 3 | +CW/ +PULS/+FA | Reverse pulses, feed pulses, or 90° phase difference | | (GSEL) | (gain switching) | 28 | SI5 ^{*2} | General-purpose input 5*2 |
| 4 | -CW/ -PULS/-FA | feed pulses, or 90° phase difference | | +CCW/ | signal (phase A) Forward pulse, | 29 | SI6 (RUN) | General-purpose input 6 (operation | | | 1 |
| | -CCW/ | signal (phase A) Forward pulse, direction signal, or | 5 | +CCVV/ +SIGN/+FB | direction signal, or 90°phase difference signal (phase B) | | SI8 | command) General-purpose | 30 | SI7 ^{*2} | General-purpose input 7*2 |
| 6 | -SIGN/-FB | 90a phase difference signal (phase B) | 7 | +24VIN | 12 to 24-VDC | 31 | (RESET) | input 8 (alarm reset input) | 32 | SI9 | General-purpose input 9 (control |
| 8 | SI1 | General-purpose input 1 (reverse drive | Ľ | | power supply input | 33 | SI10*2 | General-purpose | 32 | (TVSEL) | mode switching) |
| Ľ | (NOT) | prohibition input) | 9 | SI2 (POT) | General-purpose input 2 (forward drive | _ | | input10*2 | 34 | SO2COM | General-purpose output 2 |
| 10 | SO1COM | General-purpose output 1 | | (POT) | prohibition input) | 35 | SO2 | General-purpose output 2 (servo ready | | | common Alarm output |
| | | common | 11 | SO1 (BKIR) | General-purpose input 1 (brake | | (READY) | completed output) Alarm output | 36 | ALMCOM [SO3COM] | common [general-purpose |
| 12 | | *1 | | | interlock output) | 37 | /ALM [SO3] | [general-purpose output 3] | | | output 3 common] General-purpose |
| | REF/TREF1/ | Speed command input, torque | 13 | SENGND | Signal ground | | 10 | General-purpose | 38 | SO4COM | output 4 common |
| 14 | VLIM | command input 1, speed limit input | 15 | AGND1 | Analog | 39 | SO4*2 | output 4*2 | 40 | | "1 |
| 16 | PCL/TREF2 | Forward torque limit input, | | ground 1 | | 41 | *1 | | 40 | | |
| | | torque command input 2 | 17 | AGND2 | Analog ground 2 | | | Absolute | 42 | BAT | Absolute encoder backup |
| 18 | NCL | Reverse torque limit input | | | Phase-Z | 43 | BATGND | encoder backup | | | battery input Reverse pulse |
| | | 0 ON | 19 | Z | output (open collector) | | | battery input Reverse pulse | 44 | +CWLD | (input for line driver only) |
| 20 | SEN | Sensor ON undefined | | | Encoder | 45 | -CWLD | (input for line driver only) | | | Forward pulse |
| | -A | Encoder | 21 | + A | phase A+output | 47 | 0014/1.5 | Forward pulse (input for line | 46 | +CCWLD | (input for line driver only) |
| 22 | -A | phase A-output | 23 | +Z | Encoder | 47 | -CCWLD | driver only) | 48 | -B | Encoder |
| 24 | -Z | Encoder phase Z-output | | | phase Z+output | 49 | +B | Encoder phase B+output | 70 | -5 | phase B-output |
| | | priase Z-output | 25 | ZGND | Phase-Z (open collector) | | | priase b+output | 50 | | *1 |
| | | | | | common | | | | | | |

Note.Do not connect anything to unused pins (*1).

For general-purpose inputs 1 to 10 (SI1 to 10) and general-purpose outputs (SO1, SO2 and SO4), use user parameters Pn400 to Pn409 (Input Signal Selections 1 to 10) and Pn410 to Pn413 (Output Signal Selections 1 to 4) to set the function allocations.

The alarm output (/ALM) is fixed to general-purpose output 3. This is indicated with square brackets in the above figure.

The function that is allocated by default is given in parentheses. "*2" indicates terminals that have different default functions depending on the control mode.

Refer to "6-9 Sequence I/O Signal" (P.6-35) for details on allocations.

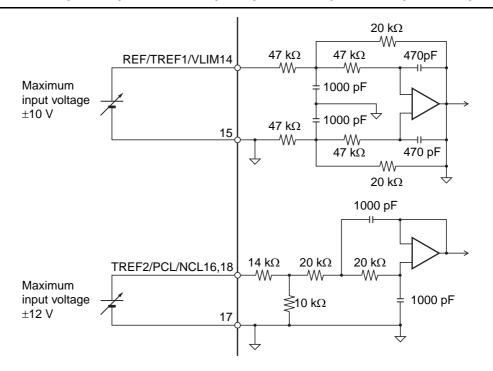
To use an absolute encoder, connect a battery to either Pin 42 which is the backup battery input, or 43 which is the battery holder for absolute encoder cable. (Never connect to both.)

Connectors for CN1 (Pin 50)

| Name | Model | Manufacturer | OMRON model number | | | |
|------------------------|----------------|---------------|--------------------|--|--|--|
| Cable plug | 10150-3000PE | Sumitomo 3M | R88A-CNU11C | | | |
| Cable case (shell kit) | 10350-52A0-008 | Garmonio Sivi | TROOM SING THE | | | |

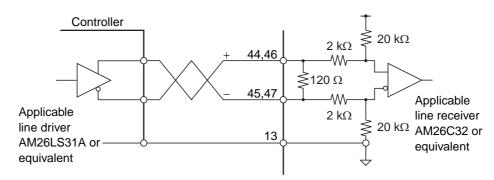
Control Input Circuits

Speed Command Input, Torque Command Input, Speed Limit Input and Torque Limit Input



Position Command Pulse (Line Receiver Input)

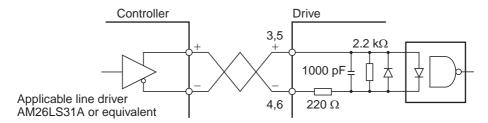
When connecting with a line driver and a line receiver, up to 4 Mpps will be available. (+CWLD: 44, -CWLD: 45, +CCWLD: 46, -CCWLD: 47)



• The shielded twisted-pair cable should not exceed 10 m in length.

Position Command Pulse (Photocoupler Input)

When connecting with a line driver and a photocoupler, the maximum speed will be 500 kpps. (+CW: 3, -CW: 4, +CCW: 5, -CCW: 6)



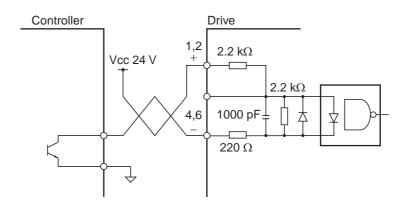
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Precautions for Correct Use

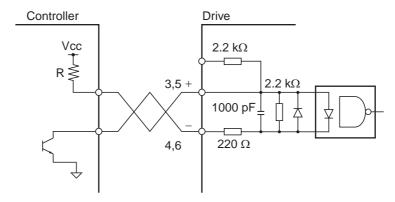
• The shielded twisted-pair cable should not exceed 10 m in length.

Open Collector Input

• External 24-V power supply without a Current Limit Resistor (200 kpps maximum) (+24 VCW: 1, -CW: 4, +24 VCCW: 2, -CCW: 6)



• External control power supply (200 kpps maximum) (+CW: 3, -CW: 4, +CCW: 5, -CCW: 6)



Select a Current Limit Resistor (R) appropriate for Vcc.

$$\frac{\text{Vcc} - 1.5}{\text{R} + 220}$$
 $\approx 10 \text{mA}$ (7 to 15 mA)

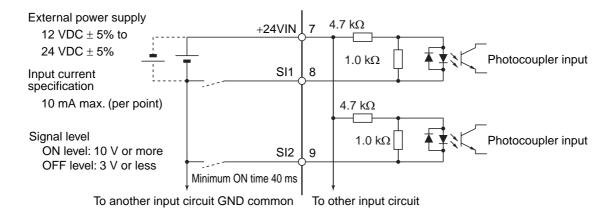
| vcc | R |
|------|--------------|
| 24 V | 2 kΩ (1/2 W) |
| 12 V | 1 kΩ (1/2 W) |
| 5 V | 0 Ω (short) |



Precautions for Correct Use

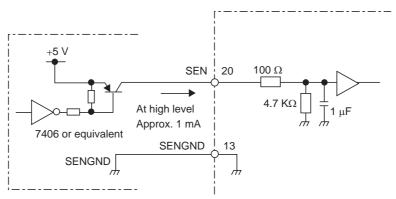
• The open collector wiring should not exceed 3 m in length.

General-purpose Input



Sensor Input

Sensor ON Input ABS



- A PNP transistor is recommended.
- The signal level is as follows.
 H level: 2.0 V or more, L level: 0.8 V or less

Control Input Details

Details on the input pins for the CN1 connector are described here.

High-speed Photocoupler Input

- Pin 3: +Reverse pulse (+CW), +feed pulse (+PULS), or +phase A (+FA)
- Pin 4: -Reverse pulse (-CW), -feed pulse (-PULS), or -phase A (-FA)
- Pin 5: +Forward pulse (+CCW), +direction signal (+SIGN), or +phase B (+FB)
- Pin 6: -Forward pulse (-CCW), -direction signal (-SIGN), or -phase B (-FB)

Function

• The functions of these signals depend on the settings of the Command Pulse Rotation Direction Switching Selection (Pn006) and the Command Pulse Mode Selection (Pn007).

| Pn005 Set value | Pn006 Set value | Pn007 Set value | Command pulse mode | Input pins | Motor forward command | Motor reverse command |
|-----------------------|-----------------------|-----------------------|---|--|-----------------------|-----------------------|
| | | 0/2 | 90° phase difference signals (quadruple multiplier) | 3: +FA 4: -FA 5: +FB 6: -FB | | |
| 0 | 0 | 1 | Reverse pulse/forward pulse | 3: +CW 4: -CW 5: +CCW 6: -CCW | | |
| | | 3 | Feed pulse/ direction signal | 3: +PULS 4: -PULS 5: +SIGN 6: -SIGN | | |

Note 1. If the Command Pulse Rotation Direction Switching Selection (Pn006) is set to 1, the rotation direction will be reversed.

Note 2. If the photocoupler LED is turned ON, each signal will go high as shown above.

Command Pulse Timing for Photocoupler Inputs

| Command pulse mode | Timing | | | | | |
|--|---|--|--|--|--|--|
| Feed pulse/direction signal Maximum input frequency Line driver: | Forward command Reverse command Direction signal | | | | | |
| 500 kpps Open collector: 200 kpps | Feed pulse T | | | | | |
| | At 200 kpps At 500 kpps $t1 \le 0.5 \ \mu s \qquad t1 \le 0.1 \ \mu s$ $t2 > 2.5 \ \mu s \qquad t2 > 1.0 \ \mu s$ $τ \ge 2.5 \ \mu s \qquad τ \ge 1.0 \ \mu s$ $T \ge 5.0 \ \mu s \qquad T \ge 2.0 \ \mu s$ | | | | | |
| Reverse pulse/forward pulse | $(\tau/T)\times 100 \leq 50 \; (\%) \qquad \qquad (\tau/T)\times 100 \leq 50 \; (\%)$ Forward command | | | | | |
| Maximum input frequency Line driver: 500 kpps Open collector: 200 kpps | Forward pulse t1 t1 | | | | | |
| | At 200 kpps At 500 kpps $t1 \leq 0.5 \ \mu s \qquad t1 \leq 0.1 \ \mu s$ $t2 > 2.5 \ \mu s \qquad t2 > 1.0 \ \mu s$ $\tau \geq 2.5 \ \mu s \qquad \tau \geq 1.0 \ \mu s$ $T \geq 5.0 \ \mu s \qquad T \geq 2.0 \ \mu s$ | | | | | |
| 90° phase difference | $(\tau/T)\times 100 \leq 50 \ (\%) \qquad \qquad (\tau/T)\times 100 \leq 50 \ (\%)$ Forward command Reverse command | | | | | |
| signals Maximum input frequency Line driver: | Phase-A pulse t1 | | | | | |
| 500 kpps Open collector: 200 kpps | Phase-B pulse T | | | | | |
| | At 200 kpps At 500 kpps $t1 \leq 0.5 \ \mu s \qquad t1 \leq 0.1 \ \mu s$ $\tau \geq 10 \ \mu s \qquad \tau \geq 4.0 \ \mu s$ $T \geq 20 \ \mu s \qquad T \geq 8.0 \ \mu s$ | | | | | |
| | $(\tau/T) \times 100 \le 50 \text{ (\%)}$ $(\tau/T) \times 100 \le 50 \text{ (\%)}$ | | | | | |

Line Receiver Input

Pin 44: +Reverse pulse (+CW), +feed pulse (+PULS), or +phase A (+FA) Pin 45: -Reverse pulse (-CW), -feed pulse (-PULS), or -phase A (-FA)

Pin 46: +Forward pulse (+CCW), +direction signal (+SIGN), or +phase B (+FB)

Pin 47: –Forward pulse (–CCW), –direction signal (–SIGN), or –phase B (–FB)

Function

• The functions of these signals depend on the settings of the Command Pulse Rotation Direction Switching Selection (Pn006) and the Command Pulse Mode Selection (Pn007).

| Pn005 Set value | Pn006 Set value | Pn007 Set value | Command pulse mode | Input pins | Motor forward command | Motor reverse command |
|-----------------------|-----------------------|-----------------------|---|--|-----------------------|-----------------------|
| | | 0/2 | 90° phase difference signals (quadruple multiplier) | 44: +FA 45: -FA 46: +FB 47: -FB | | |
| 1 | 0 | 1 | Reverse pulse/ forward pulse | 44: +CW 45: -CW 46: +CCW 47: -CCW | | |
| | | 3 | Feed pulse/ direction signal | 44: +PULS 45: -PULS 46: +SIGN 47: -SIGN | | |

Note 1. If the Command Pulse Rotation Direction Switching Selection (Pn006) is set to 1, the rotation direction will be reversed.

Command Pulse Timing for Line Receiver Inputs

| Command pulse mode | Timing |
|---|---|
| Feed pulse/direction signal Maximum input frequency Line driver: 4 Mpps | Forward command Reverse command Direction signal $t1 \le 20 \text{ ns}$ $t2 > 125 \text{ ns}$ $t \ge 125 \text{ ns}$ |
| | T \geq 250 ns $(\tau/T) \times 100 \leq 50$ (%) |
| Reverse pulse/forward pulse Maximum input frequency Line driver: 4 Mpps | Forward command Reverse command Reverse pulse |
| 90° phase difference signals Maximum input frequency Line driver: 4 Mpps | Phase-B pulse $t1 \leq 20 \text{ ns}$ $\tau \geq 500 \mu\text{s}$ $T \geq 1 \mu\text{s}$ $(\tau/T) \times 100 \leq 50 (\%)$ |

Sensor ON Input (SEN)

Pin 20: Sensor ON input (SEN) Pin 13: Signal ground (SENGND)

Function

This input changes to enable (set value: 1) according to the setting of Absolute Interface Function Selection (Pn616).

When the SEN signal turns ON, this performs serial transmission of multi-rotation data of the absolute encoder and also outputs 1-rotation data as the initial incremental pulses.

If the SEN signal is OFF, motor power supply is not possible even when the RUN signal (Operation command) is input. The RUN signal changes to enable after the SEN signal turns ON and the normal operation of encoder becomes ready.

If the power is turned ON with the encoder disconnected, the SEN signal is ignored.

Backup Battery Input (BAT)

Pin 42: Backup battery +input (BAT)

Pin 43: Backup battery -input (BATGND)

Function

- These are the backup battery connection terminals used when the absolute encoder power is interrupted.
- Normally, the battery is connected to the battery holder for the absolute encoder battery cable. Do not connect anything to these terminals.



Precautions for Correct Use

Be sure not to connect to both of the absolute encoder battery cable and the backup battery inputs at the same time. Such connection may result in malfunction.

Speed Command Input (REF), Torque Command Input (TREF1) and Speed Limit Input (VLIM)

Pin 14: Speed command input (REF), torque command Input (TREF1) and speed limit input (VLIM)

Pin 15: Analog input ground (AGND1)

Function

- During speed control
- Speed command is input. Use the Speed Command Scale (Pn302) to change the rotation speed scale for the command input.
- During torque control

This signal provides either a torque command input (set value: 0 or 2) or speed limit input (set value: 1) according to the setting of Torque Command/Speed Limit Selection (Pn317).

In the case of torque command input 1 (TREF1), you can use Torque Command Scale (Pn319) to change the rotation speed scale relative to the command input.

In the case of speed limit input (VLIM), you can use the Speed Command Scale (Pn302) to change the limit speed scale relative to the analog input.

Torque Command Input 2 (TREF2) and Forward Torque Limit Input (PCL)

Pin 16: Torque command input 2 (TREF2) and forward torque limit input (PCL)

Pin 17: Analog input ground 2 (AGND2)

Function

• During position control, speed control or fully-closed control

This signal provides a forward torque limit input (set value: 0 or 4) or forward/reverse torque limit input (set value: 5) according to the setting of Torque Limit Selection (Pn521).

You can use Analog Torque Limit Scale (Pn527) to change the torque limit scale relative to the analog input.

• During torque control

This signal provides a torque command input (set value: 1) according to the setting of Torque Command/Speed Limit Selection (Pn317).

In the case of torque command input 2 (TREF2), you can use Torque Command Scale (Pn319) to change the rotation speed scale relative to the command input.

Reverse Torque Limit Input (NCL)

Pin 18: Reverse torque limit input (NCL)

Pin 17: Analog input ground 2 (AGND2)

Function

· During position control, speed control or fully-closed control

This signal provides a reverse torque limit input (set value: 0 or 4) according to the setting of Torque Limit Selection (Pn521).

You can use Analog Torque Limit Scale (Pn527) to change the torque limit scale relative to the analog input.

Operation command (RUN)

Pin 29: Operation command (RUN)

This is the allocation at default setting. You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

You must always allocate the operation command (RUN). If it is not allocated, the servo will not turn ON.

Function

This input turns ON the power drive circuit for the main circuit of the Servo Drive. If this signal is not input (servo OFF), the motor cannot drive.

Forward Drive Prohibition Input (POT) and Reverse Drive Prohibition Input (NOT)

Pin 9: Forward drive prohibition input (POT)

Pin 8: Reverse drive prohibition input (NOT)

These two signals are the inputs to prohibit forward and reverse rotation (overtravel inputs). If Drive Prohibition Input Selection (Pn504) is 1, you can use the setting of Stop Selection (Pn505) to select the operation to be taken upon input of each prohibit signal.

If Drive Prohibition Input Selection (Pn504) is 2, drive prohibition input protection (E380) actuates upon input of a drive prohibition.



Precautions for Correct Use

Both signals are disabled (in a state in which drive prohibition will not operate) in the default settings. If prohibiting the drive input is required, set the Drive Prohibit Input Selection (Pn504) to either 0 or 2. The setting on the Input Signal Selection 1 to 10 (Pn400 to Pn409) can change the logic and allocation for the respective Input terminals (CN1 to 8, 9 and 26 to 33).

Alarm Reset Input (RESET)

Pin 31: Alarm reset input (RESET)

This is the allocation at default setting. You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

The input logic for the alarm reset input (RESET) is always NO. (You cannot set NC logic.)

Function

It is the external reset input for servo alarm. (A reset occurs at the rising edge of this input.) Inputting for 120 ms or more releases an alarm condition.

An alarm reset also resets the content of the error counter, upon which the position loop becomes no longer effective.

Eliminate the cause of the alarm before resuming operation. To prevent danger, turn OFF the Operation command (RUN) first, then input the alarm reset signal.

Some alarms cannot be reset with this input.

Error Counter Reset Input (ECRST)

Pin 30: Error counter reset input (ECRST)

This is the allocation at default setting. You can change the functions for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409). You can only allocate the error counter reset input (ECRST) to pin 30 (SI7). Allocating to any other terminal generates an error counter reset signal allocation error (A332).

The input logic for the error counter reset input (ECRST) is always NO. (You cannot set NC logic.)

Function

Inputting the error counter reset resets the content of the error counter, upon which the position loop becomes no longer effective.

You can use Error Counter Reset Condition Selection (Pn517) to set the status (level) signal (ON) or differential (rising edge) signal (from OFF to ON).

Input the differential signal for at least 100 μ s, or status signal for at least 1 ms. A reset may not occur if the time is shorter.

Control Mode Switching (TVSEL)

Pin 32: Control mode switching (TVSEL)

This is the allocation at default setting. You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

If the Control mode Selection (Pn001) is set to 3 to 5, the Control mode can be switched as given in the following table.

| Pn001 set value | OFF (first control mode) | ON (second control mode) | |
|-----------------|--------------------------|--------------------------|--|
| 3 | Position control | Speed control | |
| 4 | Position control | Torque control | |
| 5 | Speed control | Torque control | |

Gain Switching (GSEL)

Pin 27: Gain switching (GSEL)

This is the allocation at default setting. You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Function

This signal changes to enable (set value: 2) according to the setting of the Gain Switching Mode (Pn115 for position control, Pn120 for speed control, or Pn124 for torque control). When the signal is OFF and ON, gain 1 and gain 2 change to enable, respectively.

Damping Filter Switching 1 (DFSEL1) and Damping Filter Switching 2 (DFSEL2)

Pin 26: Damping filter switching 1 (DFSEL1)

No allocation: Damping filter switching 2 (DFSEL2)

This is the allocation at default setting. You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Function

Use the sequence signal to switch among the 4 filters for use in damping control when the setting of Damping Filter Selection (Pn213) is enable (set value: 1 or 2).

| Pn213 set value | DFSEL1 | DFSEL2 | Damping filter 1 | Damping filter 2 | Damping filter 3 | Dampingfilter 4 |
|-----------------|--------|--------|---------------------|------------------|------------------|--------------------|
| 1 | OFF | _ | Enabled | | Enabled | |
| 1 | ON | _ | | Enabled | | Enabled |
| 2 | OFF | OFF | Enabled | | | |
| | ON | OFF | | Enabled | | |
| | OFF | ON | | | Enabled | |
| | ON | ON | | | | Enabled |

Electronic Gear Switching 1 (GESEL1) and Electronic Gear Switching 2 (GESEL2)

Pin 28: Electronic gear switching 1 (GESEL1)

No allocation: Electronic gear switching 2 (GESEL2)

This is the allocation at default setting. You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Use these 2 signals to switch among up to 4 electronic gear ratio numerators.

| GESEL1 | GESEL2 | Electronic Gear 1 | Electronic Gear 2 | Electronic Gear 3 | Electronic Gear 4 |
|--------|--------|----------------------|----------------------|----------------------|----------------------|
| OFF | OFF | Pn009 valid | | | |
| ON | OFF | | Pn500 valid | | |
| OFF | ON | | | Pn501 valid | |
| ON | ON | | | | Pn502 valid |

[•] Electronic Gear Ratio Denominator (Pn010) is a common setting.

Pulse Prohibition Input (IPG)

Pin 33: Pulse prohibition input (IPG)

This is the allocation at default setting. However, Command Pulse Prohibition Input (Pn518) is set to disable (set value: 1). To use this, change Pn518 to enable (set value: 0). You can change the functions for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

You can only allocate the pulse prohibition input (ECRST) to pin 33 (SI10). Allocating this input to any other terminal generates a pulse prohibition input allocation error (A337).

Function

You can use this input to forcibly stop the command pulse input.

When this input is ON, the drive ignores the command pulse input and does not count pulses.

Internally Set Speed Selection 1, 2 and 3 (VSEL1, 2 and 3)

Pin 33: Internally set speed selection 1 (VSEL1) Pin 30: Internally set speed selection 2 (VSEL2)

Pin 28: Internally set speed selection 3 (VSEL3)

This is the allocation at default setting. However, Command Speed Selection (Pn300) is set to disable (set value: 0). To use this, change Command Speed Selection (Pn300) to enable (set value: 1 to 3). You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Perform speed control according to the internal speed set value in the parameter. You can select from up to 8 internal speed set values.

| Pn300 set value | VSEL1 | VSEL2 | VSEL3 | Speed command selection |
|-----------------|-------|-------|-------|------------------------------------|
| | OFF | OFF | _ | No. 1 Internally Set Speed (Pn304) |
| 1 | ON | OFF | _ | No. 2 Internally Set Speed (Pn305) |
| 1 | OFF | ON | _ | No. 3 Internally Set Speed (Pn306) |
| | ON | ON | _ | No. 4 Internally Set Speed (Pn307) |
| | OFF | OFF | _ | No. 1 Internally Set Speed (Pn304) |
| 2 | ON | OFF | _ | No. 2 Internally Set Speed (Pn305) |
| 2 | OFF | ON | _ | No. 3 Internally Set Speed (Pn306) |
| | ON | ON | _ | Analog speed command input (REF) |
| | OFF | OFF | OFF | No. 1 Internally Set Speed (Pn304) |
| | ON | OFF | OFF | No. 2 Internally Set Speed (Pn305) |
| | OFF | ON | OFF | No. 3 Internally Set Speed (Pn306) |
| 3 | ON | ON | OFF | No. 4 Internally Set Speed (Pn307) |
| 3 | OFF | OFF | ON | No. 5 Internally Set Speed (Pn308) |
| | ON | OFF | ON | No. 6 Internally Set Speed (Pn309) |
| | OFF | ON | ON | No. 7 Internally Set Speed (Pn310) |
| | ON | ON | ON | No. 8 Internally Set Speed (Pn311) |

To use the internally set speeds, use NC contacts for the zero speed designation input (VZERO). (If this is OFF, the speed command becomes 0.) The zero speed designation input (VZERO) is set to disable (set value: 0) by default. To use this, change Zero Speed Designation Selection (Pn315) to enable (set value: 1 to 2).

(If the zero speed designation input is not used, the motor turns at No. 1 Internally Set Speed (Pn304) when the servo turns ON.)

Zero Speed Designation (VZERO)

No allocation: Zero speed designation (VZERO)

There is no allocation at default setting. Also, Zero Speed Designation Selection (Pn315) is set to disable (set value: 1). You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Function

You can use this input to forcibly change the speed command to 0.

This signal changes to enable (set value: 1 to 3) according to the setting of Zero Speed Designation Selection (Pn315).

| Pn315 set value | Operation when ON |
|-----------------|---|
| 0 | Zero speed designation is disabled. |
| 1 | The speed command becomes 0. |
| 2 | The speed command becomes 0, and the servo lock is applied when an actual speed is equal to or less than Position Lock Level Setting (Pn316). |
| 3 | The servo lock is applied when a command speed is equal to or less than the Position Lock Level Setting (Pn316) minus 10 r/min. |

Speed Command Sign Input (VSIGN)

No allocation: Speed command sign designation (VSIGN)

There is no allocation at default setting. Also, Speed Command Direction Selection (Pn301) is set to disable (set value: 0). You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Function

You can use this input to designate the rotation direction relative to the speed command. If Speed Command Direction Selection (Pn301) is enable (set value: 1), the polarity of analog command input and rotation direction at internal command speed become disabled.

| Pn301 set value | Pn303 set value | VSIGN | Analog speed command (REF) | Speed command direction*1 |
|-----------------|--------------------|-----------------|----------------------------|---------------------------|
| | 0 | | + Voltage (0 to 10 V) | Forward direction |
| 0 | | Not affected | - Voltage (-10 to 0 V) | Reverse direction |
| O | 1 | | + Voltage (0 to 10 V) | Reverse direction |
| | | | - Voltage (-10 to 0 V) | Forward direction |
| | Not affected | OFF | + Voltage (0 to 10 V) | Forward direction |
| 1 | | | - Voltage (-10 to 0 V) | i orward direction |
| | | ON | + Voltage (0 to 10 V) | Reverse direction |
| | | ON | - Voltage (-10 to 0 V) | Reverse direction |

| Pn301 set value | VSIGN | Internal command speed | Speed command direction*1 |
|--------------------|--------------|-------------------------|---------------------------|
| | | + (1 to 20,000 r/min) | Forward direction |
| 0 | Not affected | − (−20,000 to −1 r/min) | Reverse direction |
| U | | + (1 to 20,000 r/min) | Forward direction |
| | | − (−20,000 to −1 r/min) | Reverse direction |
| 1 | OFF | Not affected | Forward direction |
| | ON | Not allected | Reverse direction |

^{*1.}The motor rotation direction (CW, CCW) specified by the command direction is determined by the setting of Pn000.

Torque Limit Switching (TLSEL)

No allocation: Torque Limit Switching (TLSEL)

There is no allocation at default setting. You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Function

This input is used for switching the torque limit value.

This signal changes to enable (set value: 3 or 6) according to the setting of Torque Limit Selection (Pn521).

| Pn521 set value | Pn521 set value TLSEL Forward direction | | Reverse direction |
|-----------------|---|---------------------------------------|---------------------------------------|
| 3 | OFF | Pn013 (No. 1 Torque Limit) | Pn013 (No. 1 Torque Limit) |
| 0 | ON | Pn522 (No. 2 Torque Limit) | Pn522 (No. 2 Torque Limit) |
| 6 | OFF | Pn013 (No. 1 Torque Limit) | Pn522 (No. 2 Torque Limit) |
| | ON | Pn525 (Forward External Torque Limit) | Pn526 (Reverse External Torque Limit) |

Torque Command Sign Input (TSIGN)

No allocation: Torque command sign input (TSIGN)

There is no allocation at default setting. Also, Torque Command Direction Selection (Pn318) is set to disable (set value: 0). You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Function

You can use this input to designate the rotation direction relative to the torque command. If Torque Command Direction Selection (Pn301) is enable (set value: 1), the polarity of torque command input is disabled.

| Pn318 set value | Pn320 set value | TSIGN | Torque command input (TREF) | Torque command direction*1 | |
|--------------------|--------------------|--------------|--------------------------------|----------------------------|-------------------|
| | 0 | 0 | | + Voltage (0 to 10 V) | Forward direction |
| 0 | | Not affected | - Voltage (-10 to 0 V) | Reverse direction | |
| | 1 | | + Voltage (0 to 10 V) | Reverse direction | |
| | | | - Voltage (-10 to 0 V) | Forward direction | |
| 1 | Not affected | OFF | Not affected | Forward direction | |
| | | ON | | Reverse direction | |

^{*1.} The motor rotation direction (CW, CCW) specified by the command direction is determined by the setting of Pn000.

Emergency Stop Input (STOP)

No allocation: Emergency stop input (STOP)

There is no allocation at default setting. You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Function

This is an external alarm stop input.

Upon input of an emergency stop, the system stops according to the set value of Stop Selection for Alarm Detection (Pn510).

Inertia Ratio Switching Input (JSEL)

No allocation: Inertia ratio switching input (JSEL)

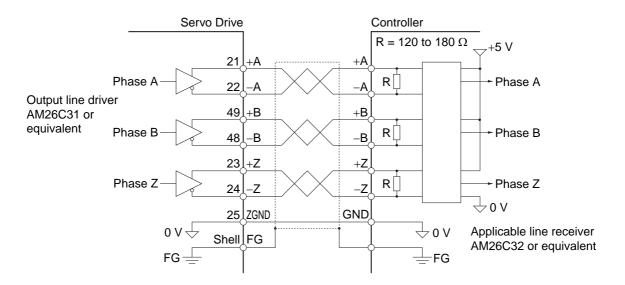
This is the allocation at default setting. You can change the logics and allocations for input terminals (CN1 to 8, 9 and 26 to 33) according to the settings of Input Signal Selection 1 to 10 (Pn400 to 409).

Function

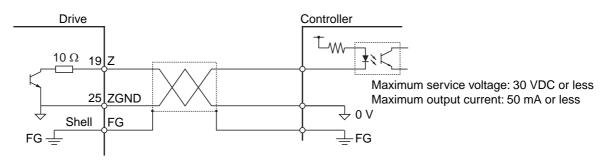
You can switch the inertia ratio between Inertia Ratio 1 (Pn004) and Inertia Ratio 2 (Pn613). When this signal is OFF, Inertia Ratio 1 (Pn004) becomes valid. If ON, Inertia Ratio 2 (Pn613) becomes valid.

Control Output Circuits

Position Feedback Output

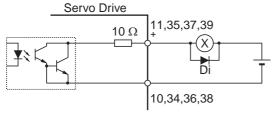


Phase-Z Output (Open Collector Output)



Sequence Output

- General-purpose output
- SO1: 11, SO2: 35, /ALM: 37, SO4: 39
- General-purpose output common SO1COM: 10, SO2COM: 34, ALMCOM: 36, SO4COM: 38

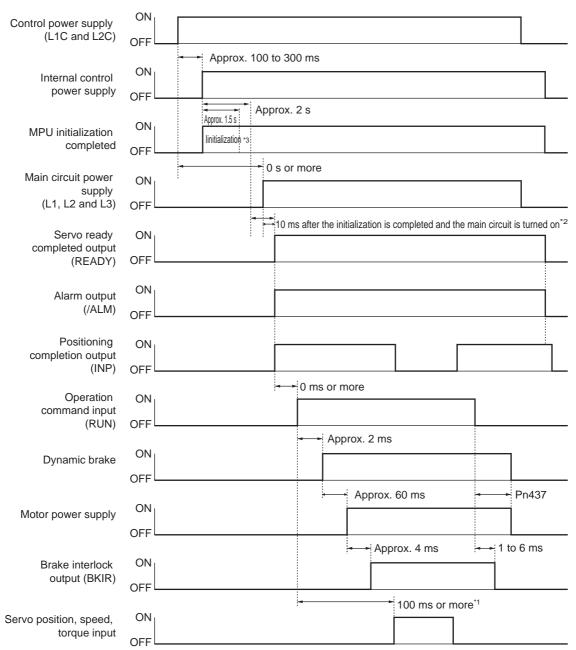


External power supply 12 to 24 VDC Maximum service voltage: 30 VDC or less Maximum output current: 50mA max.

Di: Surge voltage prevention diode (When driving a relay directly with an output signal, always insert a diode as shown in the above figure.)

Control Output Details

Control Output Sequence



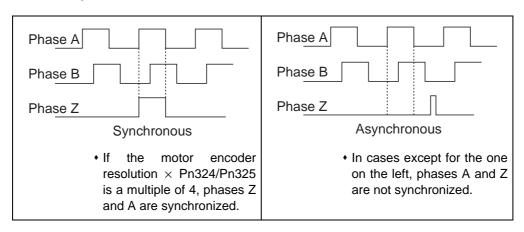
- *1. In this section, the hardware inputs the servo ON signal, but the signal is not accepted.
- *2. The servo ready completed output turns ON the moment the conditions of MPU initialization completed and main circuit power supply establishment are both satisfied.
- *3. Once the internal control power is established, the protective function starts working about 1.5 s after the MPU starts initializing itself. Make sure all I/O signals which connect to the amplifier (especially forward/reverse direction, drive prohibition input and external encoder input) are established before operation of the protective function starts. Also, you can increase this time with Pn618 "Power Supply ON Initialization Time."

Encoder Outputs (Phases A, B and Z)

Pin 21: +A, 22: -A, 48: -B, 49: +B, 23: +Z, 24: -Z

Function

- It outputs the phase A, phase B, and phase Z encoder signals for the Servomotor.
- The encoder outputs conform to the RS-422 communication method.
- You can use External Feedback Pulse Dividing Numerator Setting (Pn324) and External Feedback Pulse Dividing Denominator Setting (Pn325) to set the dividing ratio.
- The logical relation of phase B to the phase A pulse and whether to set the output source to an encoder or external encoder can be selected with Encoder Output Direction Switching Selection (Pn012).
- The ground for the output circuit line driver is connected to the signal ground (ZGND). It is not isolated.
- The maximum output frequency is 4 Mpps (after quadruple multiplier).
- The output frequency = the motor encoder resolution × (Pn324/Pn325) × 4 × motor rotation speed (r/min)/60
- The output phases are as shown below. (They are the same for both incremental and absolute encoders.)



Brake Interlock Output (BKIR)

Pin 11: Brake interlock output (BKIR)

Pin 10: Brake interlock output common (BKIRCOM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

This outputs an external brake timing signal according to the settings of the Brake Timing when Stopped (Pn437) and Brake Timing During Operation (Pn438).

Servo Ready Completed Output (READY)

Pin 35: Servo ready completed output (READY)

Pin 34: Servo ready completed output common (READYCOM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

This output signal indicates the Servo Drive is ready to supply power to the Servomotor. It is turned ON when the control and main power supply is established and not in alarm status.

Alarm Output (/ALM)

Pin 37: Alarm Output (/ALM)

Pin 36: Alarm output common (ALMCOM)

The alarm output terminal is fixed to pin 36 or 37.

Function

The output is turned OFF when the drive detects an error.

This output is OFF when the power supply is turned ON, but turns ON when the drive's initial processing has been completed.

Positioning Completion Output 1 (INP1) and Positioning Completion Output 2 (INP2)

Pin 39: Positioning completion output 1 (INP1)

Pin 38: Positioning completion output common (INP1COM)

No allocation: Positioning completion output 2 (INP2)

No allocation: Positioning completion output 2 common (INP2COM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

The INP1 turns ON when the error counter accumulated pulse is less than or equal to the Positioning Completion Range 1 (Pn431) set value.

The INP2 turns ON when the error counter accumulated pulse is less than or equal to the Positioning Completion Range 2 (Pn442) set value.

The output turns ON according to Positioning Completion Condition Selection (Pn432).

Motor Rotation Speed Detection Output (TGON)

Pin 39: Motor rotation speed detection output (TGON)

Pin 38: Motor rotation speed detection output common (TGONCOM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

It turns ON when the speed of the Servomotor exceeds the set value of the Rotation Speed for Motor Rotation Detection (Pn436).

Torque Limiting Signal (TLIMT)

No allocation: Torque limiting signal (TLIMT)

No allocation: Torque limiting signal common (TLIMTCOM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

This output turns ON while the torque is limited.

Zero Speed Detection Signal (ZSP)

No allocation: Zero speed detection signal (ZSP)

No allocation: Zero speed detection signal common (ZSPCOM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

This output turns ON when the motor rotation speed is equal to Zero Speed Detection (Pn434) or less.

Speed Conformity Output Signal (VCMP)

No allocation: Speed conformity output signal (VCMP)

No allocation: Speed conformity output signal common (VCMPCOM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

This output turns ON when the command speed corresponds to the motor rotation speed. This output turns ON when the difference between the command speed and motor speed is equal to the Speed Conformity Detection Width (Pn435) or less.

Warning Output 1 (WARN1) and Warning Output 2 (WARN2)

No allocation: Warning output 1 (WARN1) and warning output 2 (WARN2)

No allocation: Warning output 1 common (WARN1COM) and warning output 2 common (WARN2COM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

The output turns ON according to the setting conditions of Warning Output Selection 1 (Pn440) and Warning Output Selection 2 (Pn441).

Position Command Status Output (P-CMD)

No allocation: Position command status output (P-CMD)

No allocation: Position command status output common (P-CMDCOM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

This output turns ON when a positioning command is input.

Speed Limiting Output (V-LIMIT)

No allocation: Speed limiting output (V-LIMIT)

No allocation: Speed limiting output common (V-LIMITCOM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

This turns ON during torque control or speed limit status.

Alarm Clear Attribute Output (ALM-ATB)

No allocation: Alarm clear attribute output (ALM-ATB)

No allocation: Alarm clear attribute output common (ALM-ATB COM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

This output turns ON when an alarm occurs or the alarm can be cleared.

Speed Command Status Output (V-CMD)

No allocation: Speed command status output (V-CMD)

No allocation: Speed command status output common (V-CMDCOM)

This is the allocation at default setting. You can change the allocations of output terminals (CN1 to 10, 11, 34, 35, 38 and 39) according to the settings of Output Signal Selections 1 to 4 (Pn410 to 413).

Function

This output turns ON during speed control or when a speed command is input.

Encoder Connector Specifications (CN2)

| Pin number | Symbol | Name | Function and interface |
|---------------|--------|---------------------------|---|
| 1 | E5V | Encoder power supply +5 V | Power supply output for the encoder |
| 2 | E0V | Encoder power supply GND | |
| 3 | BAT+ | Battery + | Backup power supply output for the absolute encoder |
| 4 | BAT- | Battery – | |
| 5 | PS+ | Encoder + phase S input | Encoder signal I/O (serial signal) |
| 6 | PS- | Encoder – phase S input | |
| Shell | FG | Frame ground | Frame ground |

Connectors for CN2 (6 Pins)

| Name | Model | Manufacturer | OMRON model number |
|-----------------|------------|--------------|--------------------|
| Drive connector | 53460-0629 | Molex Japan | _ |
| Cable connector | 55100-0670 | | R88A-CNW01R |

External Encoder Connector Specifications (CN4)

These are the specifications of the connector that connects to the external encoder.

| Pin number | Symbol | Name | Function and interface | |
|---------------|--------|-------------------------------|---|--|
| 1 | E5V | External encoder power supply | Use at 5.2 V \pm 5% and at or below 250 mA. | |
| 2 | E0V | output | This is connected to the control circuit ground connected to connector CN1. | |
| 3 | +EXS | External encoder signal I/O | Performs serial signal input and output. | |
| 4 | -EXS | (Serial signal) | | |
| 5 | +EXA | | Performs input and output of phase A, B, and Z signals. | |
| 6 | –EXA | | | |
| 7 | +EXB | External encoder signal input | | |
| 8 | -EXB | (Phase A, B, and Z signals) | | |
| 9 | +EXZ | | | |
| 10 | -EXZ | | | |
| Shell | FG | Frame ground | Frame ground | |

Connectors for CN4 (10 Pins)

| Name | Model | Manufacturer | OMRON model number |
|-----------|-------------|--------------------|--------------------|
| Connector | MUF-PK10K-X | JST Mfg. Co., Ltd. | R88A-CNK41L |

External Encoder Input Signals Table

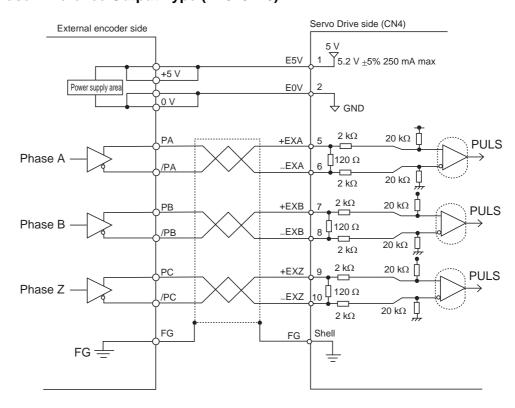
External Encoder I/O (CN4)

| Pin number | Symbol | Name | Function and interface |
|---------------|--------|--|--|
| 1 | E5V | External encoder power | External encoder power supply: 5.2 VDC ± 5%, 250 mA max. |
| 2 | E0V | supply output | If the above capacity is exceeded, provide a separate power supply. |
| 3 | +EXS | External encoder signal serial interface | This is an external encoder serial bi-directional |
| 4 | -EXS | senai interiace | signal.*(Conforming to EIA485) Maximum response frequency: 400 Mpps |
| 5 | +EXA | External encoder signal 90° phase difference input | This is an external encoder 90° phase input signal.* Maximum response frequency: 4 Mpps (quadruple |
| 6 | -EXA | (Phases A, B and Z) | multiplier) |
| 7 | +EXB | | EXAt1 |
| 8 | –EXB | | EXB t1 |
| 9 | +EXZ | | t1 t1 t1>0.25 μs |
| 10 | –EXZ | | t2 t2>1.0 μs |

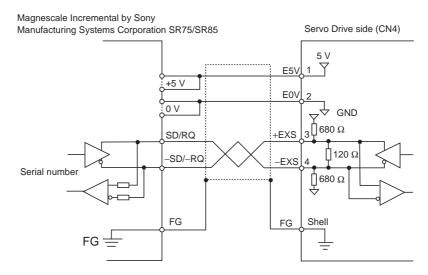
Connect external encoder signals to the serial interface (+EXS/–EXS) or 90° phase difference inputs according to the encoder type.

Example of Connection with External Encoder

■ 90° Phase Difference Output Type (Pn323 = 0)



■ Serial Communications Type, Incremental Encoder Specifications (Pn323 = 1)



Analog Monitor Connector Specifications (CN5)

Monitor Output Signal Table

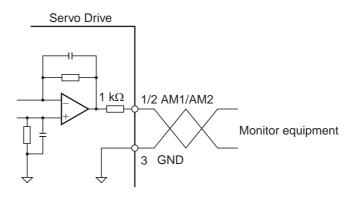
Monitor output (CN5)

| Pin Number | Symbol | Name | Function and interface |
|---------------|--------|-------------------------|---|
| 1 | AM1 | Analog monitor output 1 | Outputs the analog signal for the monitor. Default setting: Motor rotation speed 1 V/(500 r/min) You can use Pn416 and Pn417 to change the item and unit. You can use Pn421 to change the output method. |
| 2 | AM2 | Analog monitor output 2 | Outputs the analog signal for the monitor. Default setting: Torque command, 1 V/(33%) You can use Pn418 and Pn419 to change the item and unit. You can use Pn421 to change the output method. |
| 3 | GND | Analog monitor ground | Ground for analog monitors 1, 2 |
| 4 | _ | Not used | Do not connect. |
| 5 | _ | Not used | Do not connect. |
| 6 | _ | Not used | Do not connect. |

Connectors for CN5 (6 Pins)

| Name | Model | Manufacturer |
|--------------------|------------|--------------|
| Connector housing | 51004-0600 | Molex Japan |
| Connector terminal | 50011-8000 | Molex Japan |

Monitor Output Circuit



USB Connector Specifications (CN7)

Through the USB connection with computer, operations such as parameter setting and changing, monitoring of control status, checking alarm status and alarm history, and parameter saving and loading can be performed.

| Pin number | Symbol | Name | Function and interface |
|---------------|--------|-------------------------------|---|
| 1 | VBUS | | Use this function for computer communication. |
| 2 | D- | USB signal terminal | |
| 3 | D+ | | |
| 4 | _ | Reserved for manufacturer use | Do not connect. |
| 5 | GND | Signal ground | Signal ground |

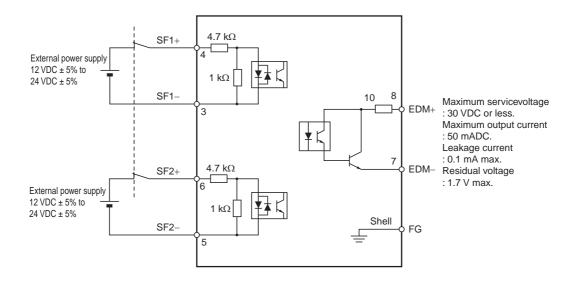


Precautions for Correct Use

• Use a commercially available USB cable that is shielded, equipped with a ferrite core for noise immunity, and supports USB2.0. The Mini B type USB cable can be used.

Safety Connector Specifications (CN8)

Connection of Safety I/O Signals and Processing of External Signals



Safety I/O Signal Table

Safety I/O (CN8)

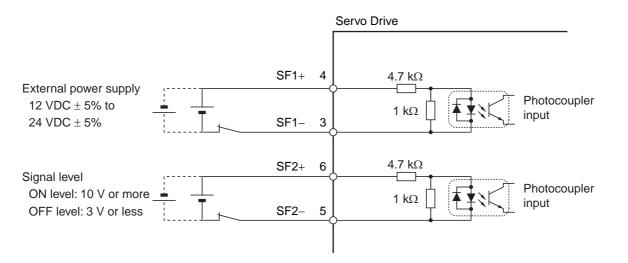
| Pin Number | Symbol | Name | Function and interface |
|---------------|--------|----------------|---|
| 1 | _ | Reserved | Do not connect. |
| 2 | _ | | |
| 3 | SF1- | Safety input 1 | Inputs 1 and 2 for operating the STO function, which are |
| 4 | SF1+ | | 2 independent circuits. This input turns OFF the power transistor drive signals in the Servo Drive to cut off the |
| 5 | SF2- | Safety input 2 | current output to the motor. |
| 6 | SF2+ | | |
| 7 | EDM- | EDM output | A monitor signal is output to detect a safety function |
| 8 | EDM+ | | failure. |
| Shell | FG | Frame ground | Connected to the ground terminal inside the Servo Drive. |

Connector for CN8 (8 Pins)

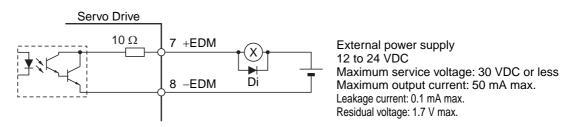
| Name | Model | Manufacturer | OMRON model number |
|--|-----------|-------------------------|-----------------------|
| Industrial Mini I/O Connector (D-SHAPE1) | 2013595-1 | Tyco Electronics AMP KK | R88A-CNK81S |

Note. The recommended cable is a 6-conductor (AWG30 to AWG26) shielded cable with a finished outer diameter of 6.7 mm max.

Safety Input Circuit



EDM Output Circuit



Di: Surge voltage prevention diode (Use a high-speed diode.)

3-2 Overload Characteristics (Electronic Thermal Function)

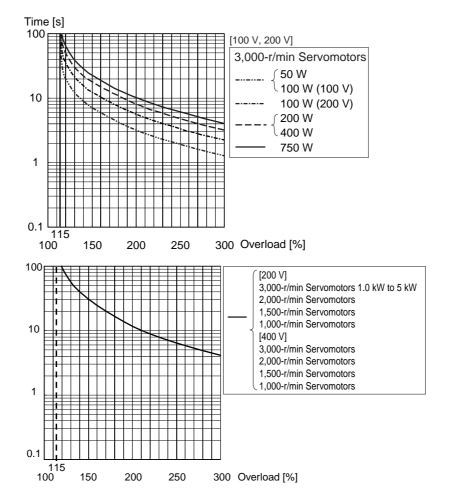
An overload protection function (electronic thermal) is built into the Servo Drive to protect the Servo Drive and motor from overloading.

If an overload does occur, first eliminate the cause of the overload and then wait at least 1 minute for the motor temperature to drop before turning ON the power again.

If the alarm reset is repeated at short intervals, the motor windings may burn out.

Overload Characteristics Graphs

The following graphs show the characteristics of the load ratio and electronic thermal function's operation time.



3-3 Servomotor Specifications

The following OMNUC G5-Series AC Servomotors are available.

- 3,000-r/min Servomotors
- 2.000-r/min Servomotors
- 1,500-r/min Servomotors
- 1,000-r/min Servomotors

There are various options available, such as models with brakes, or different shaft types. Select a Servomotor based on the mechanical system's load conditions and the installation environment.

General Specifications

| ltem | | 1 | 3,000-r/min \$ | 1,000-r/min Servomotors 1,500-r/min Servomotors 2,000-r/min Servomotors | | | | |
|--|---------------------------|-----------------------------|---|---|----------------|--|--|--|
| | | | 50 to 750 W | 1 to 5 kW | 900 W to 15 kW | | | |
| Ambient operating temperature and operating humidity | | | 0 to +40°C, 20% to 85% (with no condensation) | | | | | |
| | rage ambie perature ar | | -20 to +65°C, 20% to 85% (with no condensation) Maximum allowable temperature: 80°C for 72 hours maximum (standard humidity) | | | | | |
| Operating and storage atmosphere | | | No corrosive gases | | | | | |
| Vibration resistance *1 | | | Acceleration of 49 m/s ² * ² 24.5 m/s ² max. in X, Y, and Z directions when the motor is stopped | | | | | |
| Imp | act resistar | nce | Acceleration of 98 m/s ² max. 3 times each in X, Y, and Z directions | | | | | |
| Inst | ulation resis | tance | Between power terminal and FG terminal: 20 MΩ min. (at 500 VDC) | | | | | |
| Dielectric strength | | | 1,500 VAC between power terminal and FG terminal for 1 min (voltage 100 V, 200 V) 1,800 VAC between power terminal and FG terminal for 1 min (voltage 400 V) 1,000 VAC between brake terminal and FG terminal for 1 min | | | | | |
| Inst | ulation class | 3 | Туре В | Type F | | | | |
| Pro | tective stru | cture | IP67 (except for through-shaft parts and motor and encoder connector pins) | | | | | |
| dard | EC Directive | Low Voltage Directive | EN60034-1/-5 | | | | | |
| stan | UL standards | | UL1004-1, UL1004-6 *3 | | | | | |
| International standard | CSA standards | | CSA C22.2 No. 100 | | | | | |

^{*1.} The amplitude may be amplified by machine resonance. Do not exceed 80% of the specified value for extended periods of time.

^{*2. 24.5}m/s² is specified for 1,500-r/min Servomotors of 7.5 to 15 kW and 1,000-r/min Servomotors of 4.5 to 6 kW.

^{*3.} UL 1004-6 applies only to 1,500-r/min Servomotors of 7.5 to 15 kW and 1,000-r/min Servomotors of 4.5 to 6 kW.

Note 1. Do not use the cable when it is laying in oil or water.

Note 2. Do not expose the cable outlet or connections to stress due to bending or the weight of the cable itself.

Note 3. Disconnect all connections to the Servomotor before attempting a megameter test (insulation resistance measurement) on a Servomotor. Failure to follow this guideline may result in damaging the Servomotor. Never perform a dielectric strength test on the Servomotor. Failure to follow this guideline may result in damaging the internal elements.

Characteristics

3,000-r/min Servomotors

| | | | | 100 VAC | | | | | |
|--------------------------|-------------------------------|-------------------|---------------------|------------------------------------|------------------------|-----------------------|-----------------------|--|--|
| Model (R88M-) | | | | K05030H | K10030L | K20030L | K40030L | | |
| Item Unit | | Unit | K05030T | K10030S | K20030S | K40030S | | | |
| Rated output *1 | | W | 50 | 100 | 200 | 400 | | | |
| Ra | ted torqu | e *1 | N • m | 0.16 | 0.32 | 0.64 | 1.3 | | |
| | <u> </u> | on speed | r/min | 3,000 | | L | | | |
| Ma | ximum ro | otation speed | r/min | 6,000 | | | | | |
| | mentary que *1 | maximum | N • m | 0.48 | 0.95 | 1.91 | 3.8 | | |
| Ra | ted curre | nt * ¹ | A (rms) | 1.1 | 1.6 | 2.5 | 4.6 | | |
| | mentary rrent *1 | maximum | A (0-p) | 4.7 | 6.9 | 10.6 | 19.5 | | |
| Ro | tor | Without brake | kg • m² | 0.025×10 ⁻⁴ | 0.051×10 ⁻⁴ | 0.14×10 ⁻⁴ | 0.26×10 ⁻⁴ | | |
| ine | ertia | With brake | kg • m ² | 0.027×10 ⁻⁴ | 0.054×10 ⁻⁴ | 0.16×10 ⁻⁴ | 0.28×10 ⁻⁴ | | |
| Аp | plicable le | oad inertia | _ | 30 times the rotor inertia max. *2 | | | | | |
| То | rque cons | stant *1 | N • m/A | 0.11±10% | 0.14±10% | 0.20±10% | 0.21±10% | | |
| Po | wer rate | Without brake | kW/s | 10.1 | 19.8 | 28.9 | 62.3 | | |
| *1 | | With brake | kW/s | 9.4 | 18.7 | 25.3 | 57.8 | | |
| Ме | chanical | Without brake | ms | 1.43 | 1.03 | 0.61 | 0.48 | | |
| time constant | | With brake | ms | 1.54 | 1.09 | 0.70 | 0.52 | | |
| Electrical time constant | | ms | 0.82 | 0.91 | 3.0 | 3.4 | | | |
| Allowable radial load *3 | | N | 68 | 68 | 245 | 245 | | | |
| All | owable th | rust load *3 | N | 58 | 58 | 98 | 98 | | |
| We | ight Wit | hout brake | kg | Approx. 0.31 | Approx. 0.45 | Approx. 0.78 | Approx. 1.2 | | |
| | With brake | | kg | Approx. 0.51 | Approx. 0.65 | Approx. 1.2 | Approx. 1.6 | | |
| Ra | diator pla | te dimensions | (material) | 100 × 80 × t10 (A | d) | 130 × 120 × t12 (AI) | | | |
| Аp | plicable S | Servo Drives (F | R88D-) | KTA5L | KT01L | KT02L | KT04L | | |
| | Brake in | ertia | kg • m ² | 2×10 ⁻⁷ | 2×10 ⁻⁷ | 1.8×10 ⁻⁶ | 1.8×10 ⁻⁶ | | |
| | Excitation voltage *4 | | V | 24 VDC ± 5% | • | | • | | |
| | Power consumption (at 20°C) | | W | 7 | 7 | 9 | 9 | | |
| | Current consumption (at 20°C) | | А | 0.3 | 0.3 | 0.36 | 0.36 | | |
| | Static friction torque | | N • m | 0.29 min. | 0.29 min. | 1.27 min. | 1.27 min. | | |
| suc | Attraction time *5 | | ms | 35 max. | 35 max. | 50 max. | 50 max. | | |
| cati | Release time *5 | | ms | 20 max. | 20 max. | 15 max. | 15 max. | | |
| eci <u>f</u> ii | Backlash | | | ±1° | 1 | | 1 | | |
| Brake specifications | Allowable work per braking | | J | 39.2 | 39.2 | 137 | 137 | | |
| Bra | Allowab | le total work | J | 4.9×10 ³ | 4.9×10 ³ | 44.1×10 ³ | 44.1×10 ³ | | |

| Model (R88M-) Item Unit | | | 100 VAC | | | | | |
|-------------------------|--------------------------------|--------------------|--|----------------------|---------|---------|--|--|
| | | | K05030H | K10030L | K20030L | K40030L | | |
| | | | K05030T | K10030S | K20030S | K40030S | | |
| specifications | Allowable angular acceleration | rad/s ² | 30,000 max. (Speed of 2,800 r/min or more must not be changed in less than 10 ms.) | | | | | |
| | Brake limit | _ | 10 million times mi |) million times min. | | | | |
| | Rating | _ | Continuous | | | | | |
| Brake sp | Insulation class | - | Type F | | | | | |

| | | | 200 VAC | | | | |
|--------------------------------------|---------------|---------------------|-----------------------------------|--|-----------------------|-----------------------|--|
| Model (R88M-) | | | K05030H | K10030H | K20030H | K40030H | |
| Item | | Unit | K05030T | K10030T | K20030T | K40030T | |
| Rated outp | ut *1 | W | 50 | 100 | 200 | 400 | |
| Rated torqu | ue *1 | N • m | 0.16 | 0.32 | 0.64 | 1.3 | |
| Rated rotat | ion speed | r/min | 3,000 | | | | |
| Maximum r | otation speed | r/min | 6,000 | | | | |
| Momentary torque *1 | maximum | N • m | 0.48 | 0.95 | 1.91 | 3.8 | |
| Rated curre | ent *1 | A (rms) | 1.1 | 1.1 | 1.5 | 2.4 | |
| Momentary current *1 | maximum | A (0-p) | 4.7 | 4.7 | 6.5 | 10.2 | |
| Rotor | Without brake | kg • m² | 0.025×10 ⁻⁴ | 0.051×10 ⁻⁴ | 0.14×10 ⁻⁴ | 0.26×10 ⁻⁴ | |
| inertia | With brake | kg • m ² | 0.027×10 ⁻⁴ | 0.054×10 ⁻⁴ | 0.16×10 ⁻⁴ | 0.28×10 ⁻⁴ | |
| Applicable | load inertia | - | 30 times the rotor inertia max.*2 | | | | |
| Torque constant *1 | | N • m/A | 0.11±10% | 0.21±10% | 0.32±10% | 0.40±10% | |
| Power rate | Without brake | kW/s | 10.1 | 19.8 | 28.9 | 62.3 | |
| * 1 | With brake | kW/s | 9.4 | 18.7 | 25.3 | 57.8 | |
| Mechanical | Without brake | ms | 1.43 | 1.07 | 0.58 | 0.43 | |
| time constant | With brake | ms | 1.54 | 1.13 | 0.66 | 0.46 | |
| Electrical ti | me constant | ms | 0.82 | 0.90 | 3.2 | 3.4 | |
| Allowable radial load *3 | | N | 68 | 68 | 245 | 245 | |
| Allowable thrust load *3 | | N | 58 | 58 | 98 | 98 | |
| Weight Wi | thout brake | kg | Approx. 0.31 | Approx. 0.46 | Approx. 0.79 | Approx. 1.2 | |
| Wi | th brake | kg | Approx. 0.51 | Approx. 0.66 | Approx. 1.2 | Approx. 1.6 | |
| Radiator plate dimensions (material) | | | 100 × 80 × t10 (A | 0 × 80 × t10 (AI) 130 × 120 × t12 (AI) | | (AI) | |
| Applicable Servo Drives (R88D-) | | | KT01H | KT01H | KT02H | KT04H | |

| | | 200 VAC | | | | | |
|---|---------------------|--|---------------------|----------------------|----------------------|--|--|
| Model (R88M-) | | K05030H | K10030H | K20030H | K40030H K40030T | | |
| Item | Unit | K05030T | K10030T | K20030T | | | |
| Brake inertia | kg • m ² | 2×10 ⁻⁷ | 2×10 ⁻⁷ | 1.8×10 ⁻⁶ | 1.8×10 ⁻⁶ | | |
| Excitation voltage *4 | V | 24 VDC ± 5% | | | | | |
| Power consumption (at 20°C) | W | 7 | 7 | 9 | 9 | | |
| Current consumption (at 20°C) | А | 0.3 | 0.3 | 0.36 | 0.36 | | |
| Static friction torque | N•m | 0.29 min. | 0.29 min. | 1.27 min. | 1.27 min. | | |
| Attraction time *5 | ms | 35 max. | 35 max. | 50 max. | 50 max. | | |
| Release time *5 | ms | 20 max. | 20 max. | 15 max. | 15 max. | | |
| Backlash | | ±1° | | | | | |
| Allowable work per braking | J | 39.2 | 39.2 | 137 | 137 | | |
| Allowable total work | J | 4.9×10 ³ | 4.9×10 ³ | 44.1×10 ³ | 44.1×10 ³ | | |
| Allowable angular acceleration Brake limit Rating Insulation class | rad/s ² | 30,000 max. (Speed of 2,800 r/min or more must not be changed in less than 10 ms.) | | | | | |
| Brake limit | _ | 10 million times min. | | | | | |
| Rating | - | Continuous | | | | | |
| Insulation class | _ | Type F | | | | | |

| | | | | 200 VAC | |
|----------------------------|-----------------|------------|------------------------------------|------------------------------------|-----------------------|
| | Model (R88M-) | | K75030H | K1K030H | K1K530H |
| Item Un | | Unit | K75030T | K1K030T | K1K530T |
| Rated outp | out *1 | W | 750 | 1000 | 1500 |
| Rated toro | ue *1 | N • m | 2.4 | 3.18 | 4.77 |
| Rated rota | tion speed | r/min | 3,000 | | |
| Maximum | rotation speed | r/min | 6,000 | 5,000 | |
| Momentar torque *1 | y maximum | N • m | 7.1 | 9.55 | 14.3 |
| Rated curr | ent *1 | A (rms) | 4.1 | 6.6 | 8.2 |
| Momentar current *1 | y maximum | A (0-p) | | 28 | 35 |
| Rotor | Without brake | kg • m² | 0.87×10 ⁻⁴ | 2.03×10 ⁻⁴ | 2.84×10 ⁻⁴ |
| inertia | With brake | kg • m² | 0.97×10 ⁻⁴ | 2.35×10 ⁻⁴ | 3.17×10 ⁻⁴ |
| Applicable | load inertia | _ | 20 times the rotor inertia max. *2 | 15 times the rotor inertia max. *2 | |
| Torque co | nstant *1 | N • m/A | 0.45±10% | 0.37 | 0.45 |
| | Without brake | kW/s | 65.4 | 49.8 | 80.1 |
| *1 | With brake | kW/s | 58.7 | 43.0 | 71.8 |
| Mechanica | Without brake | ms | 0.37 | 0.61 | 0.49 |
| time constant | With brake | ms | 0.42 | 0.71 | 0.55 |
| Electrical t | ime constant | ms | 5.3 | 5.8 | 6.3 |
| Allowable | radial load *3 | N | 392 | 490 | 490 |
| Allowable thrust load *3 N | | N | 147 | 196 | 196 |
| Weight W | ithout brake | kg | Approx. 2.3 | Approx. 3.5 | Approx. 4.4 |
| With brake | | kg | Approx. 3.1 | Approx. 4.5 | Approx. 5.4 |
| Radiator p | late dimensions | (material) | 170 × 160 × t12 (AI) | 320 × 300 × t20 (AI) | • |
| Applicable | Servo Drives (F | R88D-) | KT08H | KT15H | KT15H |

| | | 200 VAC | | | | |
|--|---------------------|-----------------------|------------------------|------------------------|--|--|
| Model (R88M-) | | K75030H | K1K030H | K1K530H | | |
| Item | Unit | K75030T | K1K030T | K1K530T | | |
| Brake inertia | kg • m ² | 0.75×10 ⁻⁵ | 0.33×10 ⁻⁴ | 0.33×10 ⁻⁴ | | |
| Excitation voltage *4 | V | 24 VDC ± 5% | 24 VDC ± 10% | | | |
| Power consumption (at 20°C) | W | 10 | 19 | 19 | | |
| Current consumption (at 20°C) | А | 0.42 | 0.81±10% | 0.81±10% | | |
| Static friction torque | N•m | 2.45 min. | 7.8 min. | 7.8 min. | | |
| Attraction time *5 | ms | 70 max. | 50 max. | 50 max. | | |
| Release time *5 | ms | 20 max. | 15 max. * ⁶ | 15 max. * ⁶ | | |
| Backlash | | ±1° | _ | • | | |
| Allowable work per braking | J | 196 | 392 | 392 | | |
| Allowable total work | J | 1.47×10 ⁵ | 4.9×10 ⁵ | 4.9×10 ⁵ | | |
| Allowable total work Allowable angular acceleration Brake limit Rating Insulation class | rad/s ² | 30,000 | 10,000 | | | |
| Brake limit | - | 10 million times min. | • | | | |
| ® Rating | - | Continuous | | | | |
| กรulation class | _ | Type F | | | | |

| Model (PPPM) | | 200 VAC | | | | | | |
|--------------------------|--------------------|---------------------|------------------------------------|-----------------------|-----------------------|-----------------------|--|--|
| | Model (R88M-) | | K2K030H | K3K030H | K4K030H | K5K030H | | |
| | Item | Unit | K2K030T | K3K030T | K4K030T | K5K030T | | |
| Rated o | utput *1 | W | 2000 | 3000 | 4000 | 5000 | | |
| Rated to | orque *1 | N • m | 6.37 | 9.55 | 12.7 | 15.9 | | |
| Rated ro | otation speed | r/min | 3,000 | | | | | |
| Maximu | m rotation speed | r/min | 5,000 | | 4,500 | 4,500 | | |
| Moment torque * | ary maximum | N•m | 19.1 | 28.6 | 38.2 | 47.7 | | |
| Rated c | urrent *1 | A (rms) | 11.3 | 18.1 | 19.6 | 24.0 | | |
| Moment current | tary maximum *1 | A (0-p) | 48 | 77 | 83 | 102 | | |
| Rotor | Without brake | kg • m² | 3.68×10 ⁻⁴ | 6.50×10 ⁻⁴ | 12.9×10 ⁻⁴ | 17.4×10 ⁻⁴ | | |
| inertia | With brake | kg • m ² | 4.01×10 ⁻⁴ | 6.85×10 ⁻⁴ | 14.2×10 ⁻⁴ | 18.6×10 ⁻⁴ | | |
| Applicat | ole load inertia | - | 15 times the rotor inertia max. *2 | | | | | |
| Torque | constant *1 | N • m/A | 0.44 | 0.41 | 0.49 | 0.49 | | |
| Power ra | Without brake | kW/s | 110 | 140 | 126 | 146 | | |
| | With brake | kW/s | 101 | 116 | 114 | 136 | | |
| Mechan I time | ica Without brake | ms | 0.44 | 0.41 | 0.51 | 0.50 | | |
| constan | t With brake | ms | 0.48 | 0.49 | 0.56 | 0.54 | | |
| Electrica | al time constant | ms | 6.7 | 11 | 12 | 13 | | |
| Allowable radial load *3 | | N | 490 | 490 | 784 | 784 | | |
| Allowab | le thrust load *3 | N | 196 | 196 | 343 | 343 | | |
| Weig | Without brake | kg | Approx. 5.3 | Approx. 8.3 | Approx. 11.0 | Approx. 14.0 | | |
| ht | With brake | kg | Approx. 6.3 | Approx. 9.4 | Approx. 12.6 | Approx. 16.0 | | |
| Radiato | r plate dimensions | (material) | $380 \times 350 \times t30$ | (AI) | | | | |
| Applicat | ole drives (R88D-) | | KT20H | KT30H | KT50H | KT50H | | |

| Model (BOOM) | | 200 VAC | | | | |
|--------------------------------|---------------------|------------------------|------------------------|------------------------|------------------------|--|
| Model (R88M-) | | K2K030H | K3K030H | K4K030H | K5K030H | |
| Item | Unit | K2K030T | K3K030T | K4K030T | K5K030T | |
| Brake inertia | kg • m ² | 0.33×10 ⁻⁴ | 0.33×10 ⁻⁴ | 1.35×10 ⁻⁴ | 1.35×10 ⁻⁴ | |
| Excitation voltage *4 | V | 24 VDC ± 10% | 1 | - 1 | · · | |
| Power consumption (at 20°C) | W | 19 | 19 | 22 | 22 | |
| Current consumption (at 20°C) | А | 0.81±10% | 0.81±10% | 0.90±10% | 0.90±10% | |
| Static friction torque | N•m | 7.8 min. | 11.8 min. | 16.1 min. | 16.1 min. | |
| Attraction time *5 | ms | 50 max. | 80 max. | 110 max. | 110 max. | |
| Release time *5 | ms | 15 max. * ⁶ | 15 max. * ⁶ | 50 max. * ⁷ | 50 max. * ⁷ | |
| Backlash | | ±1° | - | - | | |
| Allowable work per braking | J | 392 | 392 | 1,470 | 1,470 | |
| Allowable total work | J | 4.9×10 ⁵ | 4.9×10 ⁵ | 2.2×10 ⁶ | 2.2×10 ⁶ | |
| Allowable angular acceleration | rad/s ² | 10,000 | | <u>'</u> | - | |
| Brake limit | - | 10 million times | min. | | | |
| Rating | - | Continuous | | | | |
| Insulation class | - | Type F | | | | |

| | | | 400 VAC | | | | |
|-----------------------------------|-----------------|---------------------|------------------------------------|------------------------------------|-----------------------|-----------------------|--|
| Model (R88M-) | | | K75030F | K1K030F | K1K530F | K2K030F | |
| Item | | Unit | K75030C | K1K030C | K1K530C | K2K030C | |
| Rated outp | out *1 | W | 750 | 1000 | 1500 | 2000 | |
| Rated toro | ue *1 | N • m | 2.39 | 3.18 | 4.77 | 6.37 | |
| Rated rota | tion speed | r/min | 3,000 | | | | |
| Maximum | rotation speed | r/min | 5,000 | | | | |
| Momentar torque * ¹ | y maximum | N • m | 7.16 | 9.55 | 14.3 | 19.1 | |
| Rated curi | ent *1 | A (rms) | 2.4 | 3.3 | 4.2 | 5.7 | |
| Momentary maximum current *1 | | A (0-p) | 10 | 14 | 18 | 24 | |
| Rotor | Without brake | kg • m² | 1.61×10 ⁻⁴ | 2.03×10 ⁻⁴ | 2.84×10 ⁻⁴ | 3.68×10 ⁻⁴ | |
| nertia | With brake | kg • m ² | 1.93×10 ⁻⁴ | 2.35×10 ⁻⁴ | 3.17×10 ⁻⁴ | 4.01×10 ⁻⁴ | |
| Applicable | load inertia | _ | 20 times the rotor inertia max. *2 | 15 times the rotor inertia max. *2 | | | |
| Torque co | nstant *1 | N • m/A | 0.78 | 0.75 | 0.89 | 0.87 | |
| Power rate | Without brake | kW/s | 35.5 | 49.8 | 80.1 | 110 | |
| * 1 | With brake | kW/s | 29.6 | 43 | 71.8 | 101 | |
| | Without brake | ms | 0.67 | 0.60 | 0.49 | 0.45 | |
| time constant | With brake | ms | 0.8 | 0.70 | 0.55 | 0.49 | |
| Electrical t | ime constant | ms | 5.9 | 5.8 | 6.5 | 6.6 | |
| Allowable | radial load *3 | N | 490 | 490 | 490 | 490 | |
| Allowable thrust load *3 | | N | 196 | 196 | 196 | 196 | |
| Weight W | ithout brake | kg | Approx. 3.1 | Approx. 3.5 | Approx. 4.4 | Approx. 5.3 | |
| W | ith brake | kg | Approx. 4.1 | Approx. 4.5 | Approx. 5.4 | Approx. 6.3 | |
| Radiator p | late dimensions | (material) | $320 \times 300 \times t20$ (A | l) | | | |
| Applicable | Servo Drives (F | R88D-) | KT10F | KT15F | KT15F | KT20F | |

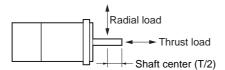
| Madal (DOOM) | | | 400 VAC | | | | | |
|---|---------------------|------------------------|------------------------|------------------------|-----------------------|--|--|--|
| Model (R88M-) | | K75030F | K1K030F | K1K530F | K2K030F | | | |
| tem | Unit | K75030C | K1K030C | K1K530C | K2K030C | | | |
| Brake inertia | kg • m ² | 0.33×10 ⁻⁴ | 0.33×10 ⁻⁴ | 0.33×10 ⁻⁴ | 0.33×10 ⁻⁴ | | | |
| Excitation voltage *4 | V | 24 VDC ± 10% | | | | | | |
| Power consumption (at 20°C) | W | 17 | 19 | 19 | 19 | | | |
| Current consumption (at 20°C) | А | 0.70±10% | 0.81±10% | 0.81±10% | 0.81±10% | | | |
| Static friction torque | N•m | 2.5 min. | 7.8 min. | 7.8 min. | 7.8 min. | | | |
| Attraction time *5 | ms | 50 max. | 50 max. | 50 max. | 50 max. | | | |
| Release time *5 | ms | 15 max. * ⁶ | 15 max. * ⁶ | 15 max. * ⁶ | 15 max. *6 | | | |
| Backlash | | ±1° | • | • | • | | | |
| Allowable work per braking | J | 392 | 392 | 392 | 392 | | | |
| Allowable total work | J | 4.9×10 ⁵ | 4.9×10 ⁵ | 4.9×10 ⁵ | 4.9×10 ⁵ | | | |
| Allowable angular acceleration Brake limit Rating Insulation class | rad/s ² | 10,000 | - ' | - | - | | | |
| Brake limit | _ | 10 million times | min. | | | | | |
| Rating | _ | Continuous | | | | | | |
| Insulation class | _ | Type F | | | | | | |

| | | | | 400 VAC | | | |
|--------------------------------------|-------------------|----------------------|------------------------------------|-----------------------|-----------------------|--|--|
| Model (R88M-) Item Unit | | K3K030F | K4K030F | K5K030F | | | |
| | | Unit | K3K030C | K4K030C | K5K030C | | |
| Rated outp | ut *1 | W | 3000 | 4000 | 5000 | | |
| Rated torq | ue * ¹ | N • m | 9.55 | 12.7 | 15.9 | | |
| Rated rota | tion speed | r/min | 3,000 | | | | |
| Maximum ı | rotation speed | r/min | 5,000 | 4,500 | | | |
| Momentary torque * ¹ | / maximum | N • m | 28.6 | 38.2 | 47.7 | | |
| Rated curre | ent *1 | A (rms) | 9.2 | 9.9 | 12.0 | | |
| Momentary current *1 | / maximum | A (0-p) | 39 | 42 | 51 | | |
| Rotor | Without brake | kg • m² | 6.50×10 ⁻⁴ | 12.9×10 ⁻⁴ | 17.4×10 ⁻⁴ | | |
| inertia | With brake | kg • m ² | 7.85×10 ⁻⁴ | 14.2×10 ⁻⁴ | 18.6×10 ⁻⁴ | | |
| Applicable | load inertia | _ | 15 times the rotor inertia max. *2 | | | | |
| Torque cor | nstant *1 | N • m/A | 0.81 | 0.98 | 0.98 | | |
| Power rate | Without brake | kW/s | 140 | 126 | 146 | | |
| * 1 | With brake | kW/s | 116 | 114 | 136 | | |
| Mechanical | Without brake | ms | 0.40 | 0.51 | 0.50 | | |
| time constant | With brake | ms | 0.49 | 0.56 | 0.54 | | |
| Electrical ti | me constant | ms | 12 | 13 | 13 | | |
| Allowable r | adial load *3 | N | 490 | 784 | 784 | | |
| Allowable thrust load *3 | | N | 196 | 343 | 343 | | |
| Weight Wi | thout brake | kg | Approx. 8.3 | Approx. 11.0 | Approx. 14.0 | | |
| Wi | th brake | kg | Approx. 9.4 | Approx. 12.6 | Approx. 16.0 | | |
| Radiator plate dimensions (material) | | 380 × 350 × t30 (AI) | | | | | |
| Applicable | Servo Drives (F | R88D-) | KT30F | KT50F | KT50F | | |

| | | 400 VAC | | | | |
|---|---------------------|------------------------|------------------------|------------------------|--|--|
| Model (R88M-) | | K3K030F | K4K030F | K5K030F | | |
| em | Unit | K3K030C | K4K030C | K5K030C | | |
| Brake inertia | kg • m ² | 0.33×10 ⁻⁴ | 1.35×10 ⁻⁴ | 1.35×10 ⁻⁴ | | |
| Excitation voltage *4 | V | 24 VDC ± 10% | | • | | |
| Power consumption (at 20°C) | W | 19 | 22 | 22 | | |
| Current consumption (at 20°C) | А | 0.81±10% | 0.90±10% | 0.90±10% | | |
| Static friction torque | N • m | 11.8 min. | 16.1 min. | 16.1 min. | | |
| Attraction time *5 | ms | 80 max. | 110 max. | 110 max. | | |
| Release time *5 | ms | 15 max. * ⁶ | 50 max. * ⁷ | 50 max. * ⁷ | | |
| Backlash | | ±1° | | | | |
| Allowable work per braking | J | 392 | 1470 | 1470 | | |
| Allowable total work | J | 4.9×10 ⁵ | 2.2×10 ⁶ | 2.2×10 ⁶ | | |
| Allowable angular acceleration | rad/s ² | 10,000 | | | | |
| Brake limit | _ | 10 million times min. | | | | |
| Rating | - | Continuous | | | | |
| Allowable angular acceleration Brake limit Rating Insulation class | _ | Type F | | | | |

- *1. These are the values when the Servomotor is combined with a drive at normal temperature (20°C, 65%). The momentary maximum torque indicates the standard value.
- *2. Applicable load inertia.
 - The operable load inertia ratio (load inertia/rotor inertia) depends on the mechanical configuration and its rigidity. For a machine with high rigidity, operation is possible even with high load inertia. Select an appropriate motor and confirm that operation is possible.
 - The dynamic brake is rated for short-term operation. Use it only for emergency stopping. Design the system to stop for at least ten minutes after the dynamic brake operates. Otherwise, the dynamic brake circuits may fail or the dynamic brake resistor may burn.
- *3. The allowable radial and thrust loads are the values determined for a limit of 20,000 hours at normal operating temperatures.

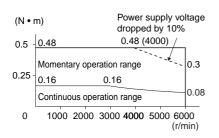
The allowable radial loads are applied as shown in the following diagram.



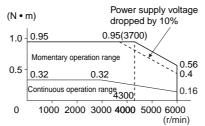
- *4. This is a non-excitation brake. (It is released when excitation voltage is applied.)
- *5. The operation time is the value (reference value) measured with a surge suppressor (CR50500 by Okaya Electric Industries Co., Ltd.).
- *6. Direct current switching with a varistor (Z15D151 by Ishizuka Electronics Co.).
- *7. Direct current switching with a varistor (TNR9G820K by Nippon Chemi-Con Corporation).

Torque-Rotation Speed Characteristics for 3,000-r/min Servomotors

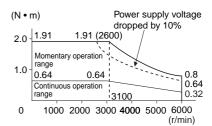
- 3,000-r/min Servomotor (100 VAC)
 - The following graphs show the characteristics with a 3-m standard cable and a 100-VAC input.
- R88M-K05030H/T (50 W)



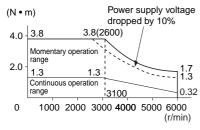
• R88M-K10030L/S (100 W)



• R88M-K20030L/S (200 W)



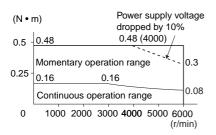
• R88M-K40030L/S (400 W)



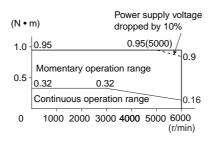
- Note 1: The continuous operation range is the range in which continuous operation is possible. Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.
- Note 2: If the motor power cable exceeds 20 m, the voltage drop will increase and the momentary operation range will become narrower.

• 3,000-r/min Servomotor (200 VAC)
The following graphs show the characteristics with a 3-m standard cable and a 200-VAC input.

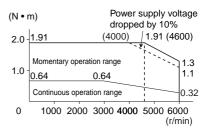
• R88M-K05030H/T (50 W)



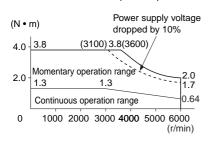
• R88M-K10030H/T (100 W)



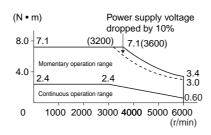
• R88M-K20030H/T (200 W)



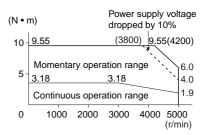
• R88M-K40030H/T (400 W)



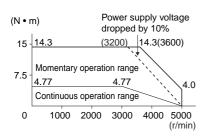
• R88M-K75030H/T (750 W)



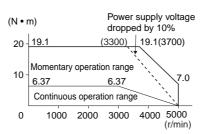
• R88M-K1K030H/T (1 kW)



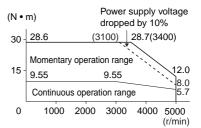
R88M-K1K530H/T (1.5 kW)



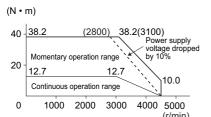
• R88M-K2K030H/T (2 kW)



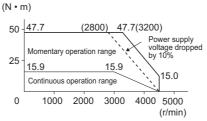
• R88M-K3K030H/T (3 kW)



• R88M-K4K030H/T (4 kW)



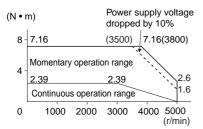
R88M-K5K030H/T (5 kW)



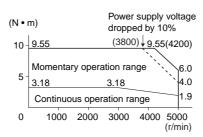
- Note 1: The continuous operation range is the range in which continuous operation is possible. Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.
- Note 2: If the motor power cable exceeds 20 m, the voltage drop will increase and the momentary operation range will become narrower.

3,000-r/min Servomotor (400 VAC) The following graphs show the characteristics with a 3-m standard cable and a 400-VAC input.

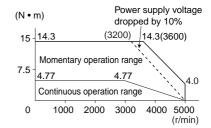
• R88M-K75030F/C (750 W)



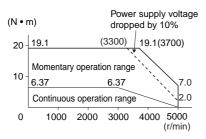
• R88M-K1K030F/C (1 kW)



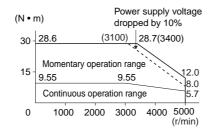
• R88M-K1K530F/C (1.5 kW)



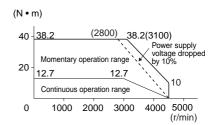
• R88M-K2K030F/C (2 kW)



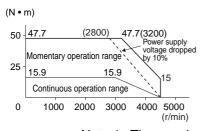
• R88M-K3K030F/C (3 kW)



• R88M-K4K030F/C (4 kW)



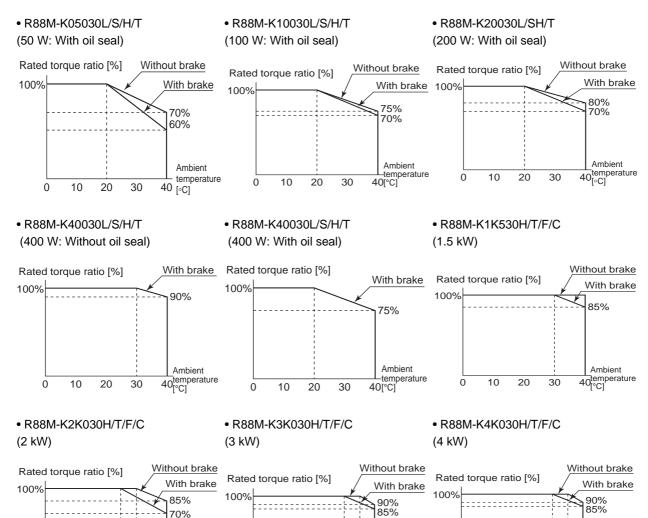
• R88M-K5K030F/C (5 kW)

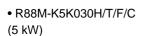


Note 1: The continuous operation range is the range in which continuous operation is possible. Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

Note 2: If the motor power cable exceeds 20 m, the voltage drop will increase and the momentary operation range will become narrower.

Use the following Servomotors in the ranges shown in the graphs below. Using outside of these ranges may cause the motor to generate heat, which could result in encoder malfunction.



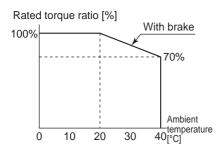


10

20

30

0



Ambient
40 [°C]

10

20

Ambient

40 temperature

10

0

20

30

Ambient

1,500-r/min and 2,000-r/min Servomotors

| | | 200 VAC | | | | |
|-----------------|------------------------|-----------------------|---------------------|----------------------------|------------------------|-----------------------|
| Model (R88M-) | | | | K1K020H | K1K520H | K2K020H |
| Iten | n | | Unit | K1K020T | K1K520T | K2K020T |
| Rated output *1 | | W | 1,000 | 1,500 | 2,000 | |
| Rat | ed torqu | e *1 | N • m | 4.77 | 7.16 | 9.55 |
| Rat | ed rotati | on speed | r/min | 2,000 | l | l |
| Max | ximum ro | otation speed | r/min | 3,000 | | |
| | mentary lue *1 | maximum | N • m | 14.3 | 21.5 | 28.6 |
| Rat | ed curre | nt * ¹ | A (rms) | 5.7 | 9.4 | 11.5 |
| | mentary rent *1 | maximum | A (0-p) | 24 | 40 | 49 |
| Rot | or | Without brake | kg • m ² | 4.60×10 ⁻⁴ | 6.70×10 ⁻⁴ | 8.72×10 ⁻⁴ |
| iner | tia | With brake | kg • m ² | 5.90×10 ⁻⁴ | 7.99×10 ⁻⁴ | 10.0×10 ⁻⁴ |
| App | olicable l | oad inertia | _ | 10 times the rotor inertia | max. * ² | |
| Tor | que con | stant *1 | N • m/A | 0.63 | 0.58 | 0.64 |
| | ver rate | Without brake | kW/s | 49.5 | 76.5 | 105 |
| *1 | | With brake | kW/s | 38.6 | 64.2 | 91.2 |
| | | Without brake | ms | 0.80 | 0.66 | 0.66 |
| time | e stant | With brake | ms | 1.02 | 0.80 | 0.76 |
| Ele | ctrical tir | ne constant | ms | 9.4 | 10 | 10 |
| Allo | wable ra | adial load *3 | N | 490 | 490 | 490 |
| Allo | wable th | rust load *3 | N | 196 | 196 | 196 |
| Wei | ght Wit | hout brake | kg | Approx. 5.2 | Approx. 6.7 | Approx. 8.0 |
| | Wit | h brake | kg | Approx. 6.7 | Approx. 8.2 | Approx. 9.5 |
| | diator pla iterial) | te dimensions | | 275 × 260 × t15 (AI) | | |
| App | olicable S | Servo Drives (F | R88D-) | KT10H | KT15H | KT20H |
| | Brake in | ertia | kg • m ² | 1.35×10 ⁻⁴ | 1.35×10 ⁻⁴ | 1.35×10 ⁻⁴ |
| | Excitation | on voltage *4 | V | 24 VDC ± 10% | | |
| | Power of (at 20°C) | consumption | W | 14 | 19 | 19 |
| | Current (at 20°C | consumption | А | 0.59±10% | 0.79±10% | 0.79±10% |
| ations | Static fri | ction torque | N • m | 4.9 min. | 13.7 min. | 13.7 min. |
| | Attractio | n time * ⁵ | ms | 80 max. | 100 max. | 100 max. |
| cific | Release | time *5 | ms | 70 max. * ⁶ | 50 max. * ⁶ | 50 max. *6 |
| sbe | Backlas | h | | ±1° | • | 1 |
| (0 | Allowab braking | le work per | J | 588 | 1,176 | 1,176 |

| | | | 200 VAC | | | | |
|----------------|--------------------------------|--------------------|-----------------------|---------------------|---------------------|--|--|
| | Model (R88M-) Item Unit | | K1K020H | K1K520H | K2K020H | | |
| Ite | | | K1K020T | K1K520T | K2K020T | | |
| ns_ | Allowable total work | J | 7.8×10 ⁵ | 1.5×10 ⁶ | 1.5×10 ⁶ | | |
| specifications | Allowable angular acceleration | rad/s ² | 10,000 | | · | | |
| spec | Brake limit | _ | 10 million times min. | | | | |
| Brake s | Rating | _ | Continuous | | | | |
| B | Insulation class | _ | Type F | | | | |

| | | | | 200 VAC | | | |
|--------------------------------------|-----------------|----------------------|------------------------------------|-----------------------|-----------------------|--|--|
| | Model (R88M-) | | K3K020H | K4K020H | K5K020H | | |
| Item | | Unit | K3K020T | K4K020T | K5K020T | | |
| Rated out | out *1 | W | 3,000 | 4,000 | 5,000 | | |
| Rated toro | ue *1 | N • m | 14.3 | 19.1 | 23.9 | | |
| Rated rota | | r/min | 2,000 | <u> </u> | | | |
| Maximum | rotation speed | r/min | 3,000 | | | | |
| Momentar torque *1 | / maximum | N • m | 43.0 | 57.3 | 71.6 | | |
| Rated curr | ent *1 | A (rms) | 17.4 | 21.0 | 25.9 | | |
| Momentar current *1 | / maximum | A (0-p) | 74 | 89 | 110 | | |
| Rotor | Without brake | kg • m ² | 12.9×10 ⁻⁴ | 37.6×10 ⁻⁴ | 48.0×10 ⁻⁴ | | |
| inertia | With brake | kg • m ² | 14.2×10 ⁻⁴ | 38.6×10 ⁻⁴ | 48.8×10 ⁻⁴ | | |
| Applicable | load inertia | _ | 10 times the rotor inertia max. *2 | | | | |
| Torque co | nstant *1 | N • m/A | 0.59 | 0.70 | 0.70 | | |
| | Without brake | kW/s | 159 | 97.1 | 119 | | |
| *1 | With brake | kW/s | 144 | 94.5 | 117 | | |
| | Without brake | ms | 0.57 | 0.65 | 0.63 | | |
| time constant | With brake | ms | 0.63 | 0.66 | 0.64 | | |
| Electrical t | ime constant | ms | 12 | 20 | 19 | | |
| Allowable | radial load *3 | N | 784 | 784 | 784 | | |
| Allowable | thrust load *3 | N | 343 | 343 | 343 | | |
| Weight W | ithout brake | kg | Approx. 11.0 | Approx. 15.5 | Approx. 18.6 | | |
| W | ith brake | kg | Approx. 12.6 | Approx. 18.7 | Approx. 21.8 | | |
| Radiator plate dimensions (material) | | 380 × 350 × t30 (AI) | 470 × 440 × t30 (AI) | • | | | |
| Applicable | Servo Drives (F | R88D-) | KT30H | KT50H | KT50H | | |

| | | 200 VAC | | | |
|---|---------------------|------------------------|------------------------|------------------------|--|
| Model (R88M-) |) | K3K020H | K4K020H | K5K020H | |
| ltem | Unit | K3K020T | K4K020T | K5K020T | |
| Brake inertia | kg • m ² | 1.35×10 ⁻⁴ | 4.7×10 ⁻⁴ | 4.7×10 ⁻⁴ | |
| Excitation voltage *4 | V | 24 VDC ± 10% | • | | |
| Power consumption (at 20°C) | W | 22 | 31 | 31 | |
| Current consumption (at 20°C) | А | 0.90±10% | 1.3±10% | 1.3±10% | |
| Static friction torque | N • m | 16.2 min. | 24.5 min. | 24.5 min. | |
| Attraction time *5 | ms | 110 max. | 80 max. | 80 max. | |
| Release time *5 | ms | 50 max. * ⁶ | 25 max. * ⁷ | 25 max. * ⁷ | |
| Backlash | | ±1° | • | | |
| Allowable work per braking | J | 1470 | 1372 | 1372 | |
| Allowable total work | J | 2.2×10 ⁶ | 2.9×10 ⁶ | 2.9×10 ⁶ | |
| Allowable angular acceleration Brake limit Rating Insulation class | rad/s ² | 10,000 | | | |
| Brake limit | _ | 10 million times min. | | | |
| Rating | - | Continuous | | | |
| Insulation class | _ | Type F | | | |

| | | | | 200 VAC | | | | |
|------------------------------|-----------------|---------------------|------------------------------------|----------------------|----------------------|--|--|--|
| | Model (R88M-) | | | | | | | |
| Item | | Unit | K7K515T | K11K015T | K15K015T | | | |
| Rated outp | out *1 | W | 7,500 | 11,000 | 15,000 | | | |
| Rated toro | ue *1 | N • m | 47.8 | 70.0 | 95.0 | | | |
| Rated rotation speed | | r/min | 1,500 | 1,500 | | | | |
| Maximum rotation speed r/m | | r/min | 3,000 | 2,000 | | | | |
| Momentary maximum torque *1 | | N • m | 119.0 | 175.0 | 224.0 | | | |
| Rated current *1 | | A (rms) | 44.0 | 54.2 | 66.1 | | | |
| Momentary maximum current *1 | | A (0-p) | 165 | 203 | 236 | | | |
| Rotor | Without brake | kg • m ² | 101×10 ⁻⁴ | 212×10 ⁻⁴ | 302×10 ⁻⁴ | | | |
| inertia | With brake | kg • m ² | 107×10 ⁻⁴ | 220×10 ⁻⁴ | 311×10 ⁻⁴ | | | |
| Applicable | load inertia | _ | 10 times the rotor inertia max. *2 | | | | | |
| Torque co | nstant *1 | N • m/A | 0.77 | 0.92 | 1.05 | | | |
| Power rate | Without brake | kW/s | 226 | 231 | 302 | | | |
| * 1 | With brake | kW/s | 213 | 223 | 293 | | | |
| | Without brake | ms | 0.58 | 0.80 | 0.71 | | | |
| time constant | With brake | ms | 0.61 | 0.83 | 0.74 | | | |
| Electrical t | ime constant | ms | 21 | 31 | 32 | | | |
| Allowable | radial load *3 | N | 1,176 | 2,254 | 2,254 | | | |
| Allowable | thrust load *3 | N | 490 | 686 | 686 | | | |
| Weight W | ithout brake | kg | Approx. 36.4 | Approx. 52.7 | Approx. 70.2 | | | |
| W | ith brake | kg | Approx. 40.4 | Approx. 58.9 | Approx. 76.3 | | | |
| Radiator p (material) | late dimensions | | 550 × 520 × t30 (AI) | 670 × 630 × t35 (AI) | | | | |
| Applicable | Servo Drives (F | R88D-) | KT75H | KT150H | KT150H | | | |

| | | | 200 VAC | | | | | |
|---|---------------------|-----------------------|----------------------|----------------------|--|--|--|--|
| Model (R88M-) | | | | | | | | |
| tem | Unit | K7K515T | K11K015T | K15K015T | | | | |
| Brake inertia | kg • m ² | 4.7×10 ⁻⁴ | 7.1×10 ⁻⁴ | 7.1×10 ⁻⁴ | | | | |
| Excitation voltage *4 | V | 24 VDC ± 10% | | <u> </u> | | | | |
| Power consumption (at 20°C) | | | 26 | 26 | | | | |
| Current consumption (at 20°C) | А | 1.4±10% | 1.08±10% | 1.08±10% | | | | |
| Static friction torque | N•m | 58.8 min. | 100 min. | 100 min. | | | | |
| Attraction time *5 | ms | 150 max. | 300 max. | 300 max. | | | | |
| Release time *5 | ms | 50 max. | 140 max. | 140 max. | | | | |
| Backlash | | ±1° | 1 | - 1 | | | | |
| Allowable work per braking | J | 1,372 | 2,000 | 2,000 | | | | |
| Allowable total work | J | 2.9×10 ⁶ | 4.0×10 ⁶ | 4.0×10 ⁶ | | | | |
| Allowable angular acceleration | rad/s ² | 5,000 | 3,000 | | | | | |
| Brake limit | _ | 10 million times min. | | | | | | |
| Rating | - | Continuous | | | | | | |
| Allowable total work Allowable angular acceleration Brake limit Rating Insulation class | _ | Type F | | | | | | |

| | | | 400 VAC | | | | | |
|---------------------------|-----------------|---------------------|------------------------------------|-----------------------|-----------------------|-----------------------|--|--|
| 1 | Model (R88M-) | | K40020F | K60020F | K1K020F | K1K520F | | |
| Item | | Unit | K40020C | K60020C | K1K020C | K1K520C | | |
| Rated outp | ut *1 | W | 400 | 600 | 1,000 | 1,500 | | |
| Rated torq | ue *1 | N • m | 1.91 | 2.86 | 4.77 | 7.16 | | |
| Rated rota | | r/min | 2,000 | | | I | | |
| Maximum ı | otation speed | r/min | 3,000 | | | | | |
| Momentary torque *1 | maximum | N • m | 5.73 | 8.59 | 14.3 | 21.5 | | |
| Rated curre | ent *1 | A (rms) | 1.2 | 1.5 | 2.8 | 4.7 | | |
| Momentary current *1 | maximum | A (0-p) | 4.9 | 6.5 | 12 | 20 | | |
| Rotor | Without brake | kg • m ² | 1.61×10 ⁻⁴ | 2.03×10 ⁻⁴ | 4.60×10 ⁻⁴ | 6.70×10 ⁻⁴ | | |
| inertia | With brake | kg • m ² | 1.90×10 ⁻⁴ | 2.35×10 ⁻⁴ | 5.90×10 ⁻⁴ | 7.99×10 ⁻⁴ | | |
| Applicable | load inertia | _ | 10 times the rotor inertia max. *2 | | | | | |
| Torque cor | stant *1 | N • m/A | 1.27 | 1.38 | 1.27 | 1.16 | | |
| Power rate | Without brake | kW/s | 22.7 | 40.3 | 49.5 | 76.5 | | |
| *1 | With brake | kW/s | 19.2 | 34.8 | 38.6 | 64.2 | | |
| | Without brake | ms | 0.70 | 0.62 | 0.79 | 0.66 | | |
| time constant | With brake | ms | 0.83 | 0.72 | 1.01 | 0.79 | | |
| Electrical ti | me constant | ms | 5.7 | 5.9 | 10 | 10 | | |
| Allowable r | adial load *3 | N | 490 | 490 | 490 | 490 | | |
| Allowable t | hrust load *3 | N | 196 | 196 | 196 | 196 | | |
| Weight Wi | thout brake | kg | Approx. 3.1 | Approx. 3.5 | Approx. 5.2 | Approx. 6.7 | | |
| Wi | th brake | kg | Approx. 4.1 | Approx. 4.5 | Approx. 6.7 | Approx. 8.2 | | |
| Radiator pl (material) | ate dimensions | | 320 × 300 × t20 (AI) | | 275 × 260 × t15 (AI) | | | |
| Applicable | Servo Drives (F | R88D-) | KT06F | KT06F | KT10F | KT15F | | |

| | | 400 VAC | | | | | | |
|---|---------------------|------------------------|------------------------|------------------------|-----------------------|--|--|--|
| Model (R88M-) | | K40020F | K60020F | K1K020F | K1K520F | | | |
| tem | Unit | K40020C | K60020C | K1K020C | K1K520C | | | |
| Brake inertia | kg • m ² | 1.35×10 ⁻⁴ | 1.35×10 ⁻⁴ | 1.35×10 ⁻⁴ | 1.35×10 ⁻⁴ | | | |
| Excitation voltage *4 | V | 24 VDC ± 10% | | | - | | | |
| Power consumption (at 20°C) | W | 17 | 17 | 14 | 19 | | | |
| Current consumption (at 20°C) | А | 0.70±10% | 0.70±10% | 0.59±10% | 0.79±10% | | | |
| Static friction torque | N • m | 2.5 min. | 2.5 min. | 4.9 min. | 13.7 min. | | | |
| Attraction time *5 | ms | 50 max. | 50 max. | 80 max. | 100 max. | | | |
| Release time *5 | ms | 15 max. * ⁷ | 15 max. * ⁷ | 70 max. * ⁶ | 50 max. *6 | | | |
| Backlash | | ±1° | | - | | | | |
| Allowable work per braking | J | 392 | 392 | 588 | 1176 | | | |
| Allowable total work | J | 4.9×10 ⁵ | 4.9×10 ⁵ | 7.8×10 ⁵ | 1.5×10 ⁶ | | | |
| Allowable total work Allowable angular acceleration Brake limit Rating Insulation class | rad/s ² | 10,000 | • | • | · | | | |
| Brake limit | - | 10 million times min. | | | | | | |
| Rating | _ | Continuous | | | | | | |
| Insulation class | _ | Type F | | | | | | |

| | | | 400 VAC | | | | | | |
|----------------------------|-------------------|---------------------|------------------------------------|-------------------------|-----------------------|-----------------------|--|--|--|
| ı | Model (R88M-) | | K2K020F | K3K020F | K4K020F | K5K020F | | | |
| Item | | Unit | K2K020C | K3K020C | K4K020C | K5K020C | | | |
| Rated output *1 | | W | 2,000 | 3,000 | 4,000 | 5,000 | | | |
| Rated torqu | ле * ¹ | N • m | 9.55 | 14.3 | 19.1 | 23.9 | | | |
| Rated rotation speed | | r/min | 2,000 | | | | | | |
| Maximum r | otation speed | r/min | 3,000 | | | | | | |
| Momentary torque *1 | maximum | N • m | 28.7 | 43.0 | 57.3 | 71.6 | | | |
| Rated curre | ent *1 | A (rms) | 5.9 | 8.7 | 10.6 | 13.0 | | | |
| Momentary current *1 | maximum | A (0-p) | 25 | 37 | 45 | 55 | | | |
| Rotor | Without brake | kg • m ² | 8.72×10 ⁻⁴ | 12.9×10 ⁻⁴ | 37.6×10 ⁻⁴ | 48.0×10 ⁻⁴ | | | |
| inertia | With brake | kg • m ² | 10.0×10 ⁻⁴ | 14.2×10 ⁻⁴ | 38.6×10 ⁻⁴ | 48.8×10 ⁻⁴ | | | |
| Applicable | load inertia | _ | 10 times the rotor inertia max. *2 | | | | | | |
| Torque con | stant *1 | N • m/A | 1.27 | 1.18 | 1.40 | 1.46 | | | |
| Power rate | Without brake | kW/s | 105 | 159 | 97.1 | 119 | | | |
| * 1 | With brake | kW/s | 91.2 | 144 | 94.5 | 117 | | | |
| Mechanical | Without brake | ms | 0.68 | 0.56 | 0.60 | 0.60 | | | |
| time constant | With brake | ms | 0.78 | 0.61 | 0.61 | 0.61 | | | |
| Electrical ti | me constant | ms | 10 | 12 | 21 | 19 | | | |
| Allowable ra | adial load *3 | N | 490 | 784 | 784 | 784 | | | |
| Allowable tl | nrust load *3 | N | 196 | 343 | 343 | 343 | | | |
| Weight Wit | thout brake | kg | Approx. 8.0 | Approx. 11.0 | Approx. 15.5 | Approx. 18.6 | | | |
| Wit | th brake | kg | Approx. 9.5 | Approx. 12.6 | Approx. 18.7 | Approx. 21.8 | | | |
| Radiator pla (material) | ate dimensions | | 275 × 260 × t15 (AI) | 380 × 350 × t30 (AI) | 470 × 440 × t30 (AI) | | | | |
| Applicable | Servo Drives (F | R88D-) | KT20F | KT30F | KT50F | KT50F | | | |

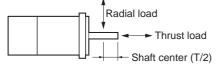
| Martal (Doom) | | | 400 VAC | | | | | | |
|---|---------------------|------------------------|------------------------|------------------------|------------------------|--|--|--|--|
| Model (R88M-) | | K2K020F | K3K020F | K4K020F | K5K020F | | | | |
| tem | Unit | K2K020C | K3K020C | K4K020C | K5K020C | | | | |
| Brake inertia | kg • m ² | 1.35×10 ⁻⁴ | 1.35×10 ⁻⁴ | 4.7×10 ⁻⁴ | 4.7×10 ⁻⁴ | | | | |
| Excitation voltage *4 | V | 24 VDC ± 10% | | | | | | | |
| Power consumption (at 20°C) | W | 19 | 22 | 31 | 31 | | | | |
| Current consumption (at 20°C) | А | 0.79±10% | 0.90±10% | 1.3±10% | 1.3±10% | | | | |
| Static friction torque | N•m | 13.7 min. | 16.2 min. | 24.5 min. | 24.5 min. | | | | |
| Attraction time *5 | ms | 100 max. | 110 max. | 80 max. | 80 max. | | | | |
| Release time *5 | ms | 50 max. * ⁶ | 50 max. * ⁶ | 25 max. * ⁷ | 25 max. * ⁷ | | | | |
| Backlash | | ±1° | | | | | | | |
| Allowable work per braking | J | 1176 | 1470 | 1372 | 1372 | | | | |
| Allowable total work | J | 1.5×10 ⁶ | 2.2×10 ⁶ | 2.9×10 ⁶ | 2.9×10 ⁶ | | | | |
| Allowable angular acceleration | rad/s ² | 10,000 | | | | | | | |
| Allowable total work Allowable angular acceleration Brake limit Rating Insulation class | _ | 10 million times min. | | | | | | | |
| Rating | _ | Continuous | | | | | | | |
| Insulation class | _ | Type F | | | | | | | |

| | Model (R88M-) | | | 400 VAC | | | |
|---------------------|------------------------|---------|------------------------------------|----------------------|----------------------|--|--|
| | Model (Room-) | | | | | | |
| Item | | Unit | K7K515C | K11K015C | K15K015C | | |
| Rated output *1 | | W | 7,500 | 11,000 | 15,000 | | |
| Rated to | rque *1 | N • m | 47.8 | 70.0 | 95.9 | | |
| Rated ro | otation speed | r/min | 1,500 | 1 | | | |
| Maximu | m rotation speed | r/min | 3,000 | 2,000 | | | |
| Moment torque * | ary maximum 1 | N • m | 119.0 | 175.0 | 224.0 | | |
| Rated c | urrent *1 | A (rms) | 22.0 | 27.1 | 33.1 | | |
| Moment | ary maximum ₁ | A (0-p) | 83 | 101 | 118 | | |
| Rotor | Without brake | kg • m² | 101×10 ⁻⁴ | 212×10 ⁻⁴ | 302×10 ⁻⁴ | | |
| inertia | With brake | kg • m² | 107×10 ⁻⁴ | 220×10 ⁻⁴ | 311×10 ⁻⁴ | | |
| Applicat | ole load inertia | _ | 10 times the rotor inertia max. *2 | | | | |
| Torque | constant *1 | N • m/A | 1.54 | 1.84 | 2.10 | | |
| Power ra | ate Without brake | kW/s | 226 | 231 | 302 | | |
| *1 | With brake | kW/s | 213 | 223 | 293 | | |
| Mechani | cal Without brake | ms | 0.58 | 0.80 | 0.71 | | |
| time constant | With brake | ms | 0.61 | 0.83 | 0.74 | | |
| Electrica | Il time constant | ms | 21 | 31 | 32 | | |
| Allowab | le radial load *3 | N | 1,176 | 2,254 | 2,254 | | |
| Allowab | le thrust load *3 | N | 490 | 686 | 686 | | |
| Weight | Without brake | kg | Approx. 36.4 | Approx. 52.7 | Approx. 70.2 | | |
| | With brake | kg | Approx. 40.4 | Approx. 58.9 | Approx. 76.3 | | |
| Radiato (materia | plate dimensions l) | | 550 × 520 × t30 (AI) | 670 × 630 × t35 (AI) | | | |
| Applicat | ole Servo Drives (F | R88D-) | KT75F | KT150F | KT150F | | |

| | | | 400 VAC | | | | |
|----------------|--------------------------------|---------------------|-----------------------|----------------------|----------------------|--|--|
| | Model (R88M-) | | | | | | |
| Ite | m | Unit | K7K515C | K11K015C | K15K015C | | |
| | Brake inertia | kg • m ² | 4.7×10 ⁻⁴ | 7.1×10 ⁻⁴ | 7.1×10 ⁻⁴ | | |
| | Excitation voltage *4 | V | 24 VDC ± 10% | • | | | |
| | Power consumption (at 20°C) | W | 34 | 26 | 26 | | |
| | Current consumption (at 20°C) | А | 1.4±10% | 1.08±10% | 1.08±10% | | |
| | Static friction torque | N • m | 58.8 min. | 100 min. | 100 min. | | |
| | Attraction time *5 | ms | 150 max. | 300 max. | 300 max. | | |
| | Release time *5 | ms | 50 max. | 140 max. | 140 max. | | |
| | Backlash | | ±1° | | | | |
| | Allowable work per braking | J | 1,372 | 2,000 | 2,000 | | |
| us | Allowable total work | J | 2.9×10 ⁶ | 4.0×10 ⁶ | 4.0×10 ⁶ | | |
| specifications | Allowable angular acceleration | rad/s ² | 5,000 3,000 | | • | | |
| sbec | Brake limit | _ | 10 million times min. | | | | |
| Brake s | Rating | _ | Continuous | | | | |
| E E | Insulation class | _ | Type F | | | | |

- *1. These are the values when the Servomotor is combined with a drive at normal temperature (20°C, 65%). The momentary maximum torque indicates the standard value.
- *2. Applicable load inertia.
 - The operable load inertia ratio (load inertia/rotor inertia) depends on the mechanical configuration and its rigidity. For a machine with high rigidity, operation is possible even with high load inertia. Select an appropriate motor and confirm that operation is possible.
 - The dynamic brake is rated for short-term operation. Use it only for emergency stopping. Design the system to stop for at least ten minutes after the dynamic brake operates. Otherwise, the dynamic brake circuits may fail or the dynamic brake resistor may burn.
- *3. The allowable radial and thrust loads are the values determined for a limit of 20,000 hours at normal operating temperatures.

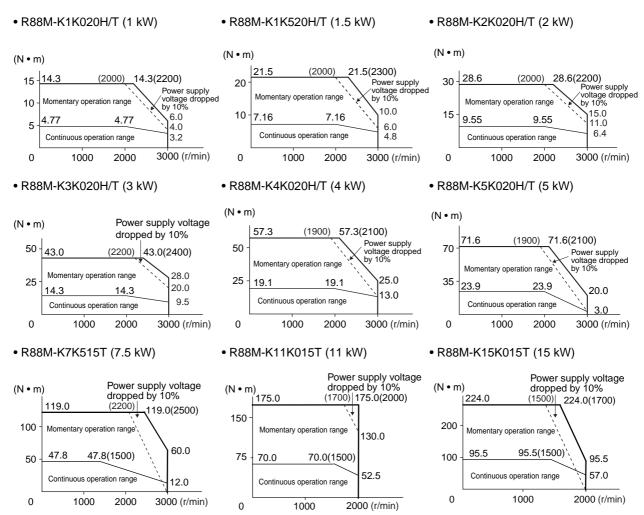
The allowable radial loads are applied as shown in the following diagram.



- *4. This is a non-excitation brake. (It is released when excitation voltage is applied.)
- *5. The operation time is the value (reference value) measured with a surge suppressor (CR50500 by Okaya Electric Industries Co., Ltd.).
- *6. Direct current switching with a varistor (TNR9G820K by Nippon Chemi-Con Corporation).
- *7. Direct current switching with a varistor (Z15D151 by Ishizuka Electronics Co.).

Torque-Rotation Speed Characteristics for 1,500-r/min and 2,000-r/min Servomotors

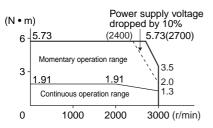
1,500-r/min and 2,000-r/min Servomotor (200 VAC)
 The following graphs show the characteristics with a 3-m standard cable and a 200-VAC input.

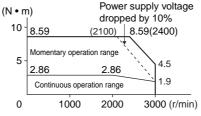


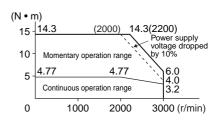
Note 1: The continuous operation range is the range in which continuous operation is possible. Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.

Note 2: If the motor power cable exceeds 20 m, the voltage drop will increase and the momentary operation range will become narrower.

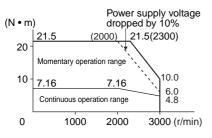
- 1,500-r/min and 2,000-r/min Servomotor (400 VAC)
 The following graphs show the characteristics with a 3-m standard cable and a 400-VAC input.
- R88M-K40020F/C (400 W)
- R88M-K60020F/C (600 W)
- R88M-K1K020F/C (1 kW)

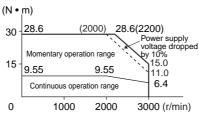


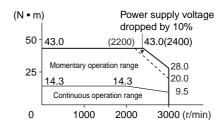




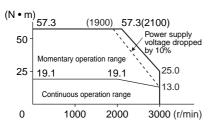
- R88M-K1K520F/C (1.5 kW)
- R88M-K2K020F/C (2 kW)
- R88M-K3K020F/C (3 kW)

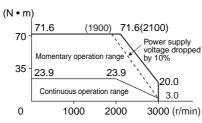


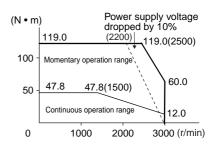




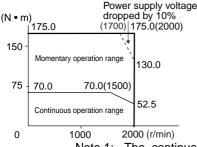
- R88M-K4K020F/C (4 kW)
- R88M-K5K020F/C (5 kW)
- R88M-K7K515C (7.5 kW)

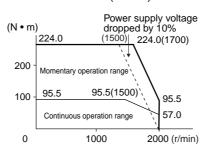






- R88M-K11K015C (11 kW)
- R88M-K15K015C (15 kW)





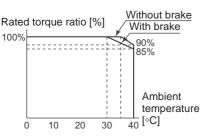
- Note 1: The continuous operation range is the range in which continuous operation is possible. Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.
- Note 2: If the motor power cable exceeds 20 m, the voltage drop will increase and the momentary operation range will become narrower.

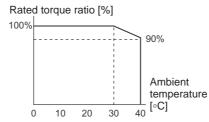
Use the following Servomotors in the ranges shown in the graphs below. Using outside of these ranges may cause the motor to generate heat, which could result in encoder malfunction.

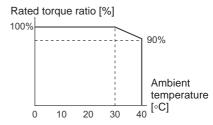
• R88M-K5K020H/T/F/C (5 kW)

• R88M-K7K515T/C (7.5 kW)

• R88M-K15K015T/C (15 kW)







1,000-r/min Servomotors

| | | | | 200 VAC | | | | | |
|----------------------|-----------------------|-------------------|---------------------|-----------------------|------------------------|------------------------|-------------------------|-------------------------|--|
| | N | lodel (R88M-) | | K90010H | K2K010H | K3K010H | | | |
| Iten | n | | Unit | K90010T | K2K010T | K3K010T | K4K510T | K6K010T | |
| Rate | Rated output *1 W | | W | 900 | 2,000 | 3,000 | 4,500 | 6,000 | |
| Rate | ed torqu | e * ¹ | N • m | 8.59 | 19.1 | 28.7 | 43.0 | 57.0 | |
| Rate | ed rotati | on speed | r/min | 1,000 | | 1 | 1 | | |
| Max | kimum ro | otation speed | r/min | 2,000 | | | | | |
| | mentary ue *1 | maximum | N • m | 19.3 | 47.7 | 71.7 | 107.0 | 143.0 | |
| Rate | ed curre | nt * ¹ | A (rms) | 7.6 | 17.0 | 22.6 | 29.7 | 38.8 | |
| | mentary ent *1 | maximum | A (0-p) | 24 | 60 | 80 | 110 | 149 | |
| Rote | | Without brake | kg • m ² | 6.70×10 ⁻⁴ | 30.3×10 ⁻⁴ | 48.4×10 ⁻⁴ | 79.1×10 ⁻⁴ | 101×10 ⁻⁴ | |
| iner | tia | With brake | kg • m ² | 7.99×10 ⁻⁴ | 31.4×10 ⁻⁴ | 49.2×10 ⁻⁴ | 84.4×10 ⁻⁴ | 107×10 ⁻⁴ | |
| App | licable l | oad inertia | - | 10 times the r | otor inertia max. | *2 | | • | |
| Tord | que cons | stant *1 | N • m/A | 0.86 | 0.88 | 0.96 | 1.02 | 1.04 | |
| Pow | ver rate | Without brake | kW/s | 110 | 120 | 170 | 233 | 325 | |
| * 1 | | With brake | kW/s | 92.4 | 116 | 167 | 219 | 307 | |
| Med | hanical | Without brake | ms | 0.66 | 0.75 | 0.63 | 0.55 | 0.54 | |
| time | e stant | With brake | ms | 0.78 | 0.78 | 0.64 | 0.63 | 0.57 | |
| Elec | ctrical tin | ne constant | ms | 11 | 18 | 21 | 20 | 23 | |
| Allo | wable ra | ndial load *3 | N | 686 | 1176 | 1470 | 1470 | 1764 | |
| Allo | wable th | rust load *3 | N | 196 | 490 | 490 | 490 | 588 | |
| Weig | ght Wit | hout brake | kg | Approx. 6.7 | Approx. 14.0 | Approx. 20.0 | Approx. 29.4 | Approx. 36.4 | |
| | Wit | h brake | kg | Approx. 8.2 | Approx. 17.5 | Approx. 23.5 | Approx. 33.3 | Approx. 40.4 | |
| | liator pla terial) | te dimensions | | 270 × 260 × t1 | 15 (AI) | | 470 × 440 × t30 (AI) | 550 × 520 × t30 (AI) | |
| App | licable S | Servo Drives (F | R88D-) | KT15H | KT30H | KT50H | KT75H | KT75H | |
| | Brake in | ertia | kg • m ² | 1.35×10 ⁻⁴ | 4.7×10 ⁻⁴ | 4.7×10 ⁻⁴ | 4.7×10 ⁻⁴ | 4.7×10 ⁻⁴ | |
| | Excitation | on voltage *4 | V | 24 VDC ± 10% | 6 | | | | |
| | Power c | onsumption () | W | 19 | 31 | 34 | 34 | 34 | |
| | Current (at 20°C | consumption | А | 0.79±10% | 1.3±10% | 1.4±10% | 1.4±10% | 1.4±10% | |
| icati | Static fri | ction torque | N • m | 13.7 min. | 24.5 min. | 58.8 min. | 58.8 min. | 58.8 min. | |
| Brake specifications | Attractio | n time *5 | ms | 100 max. | 80 max. | 150 max. | 150 max. | 150 max. | |
| ke sk | Release | time *5 | ms | 50 max. *6 | 25 max. * ⁷ | 50 max. * ⁷ | 50 max. | 50 max. | |
| Bral | Backlas | | | ±1° | ! | ! | ļ | ! | |

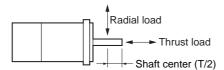
| | | 200 VAC | | | | | | |
|----------------|--------------------------------|--------------------|---------------------|-----------------------|---------------------|---------------------|---------------------|--|
| | Model (R88M-) | | K90010H | K2K010H | K3K010H | | | |
| Ite | m | Unit | K90010T | K2K010T | K3K010T | K4K510T | K6K010T | |
| | Allowable work per braking | J | 1176 | 1372 | 1372 | 1372 | 1372 | |
| SC | Allowable total work | J | 1.5×10 ⁶ | 2.9×10 ⁶ | 2.9×10 ⁶ | 2.9×10 ⁶ | 2.9×10 ⁶ | |
| specifications | Allowable angular acceleration | rad/s ² | 10,000 | 10,000 5,000 | | | | |
| bec | Brake limit | _ | 10 million time | 10 million times min. | | | | |
| | Rating | _ | Continuous | | | | | |
| Brake | Insulation class | _ | Type F | | | | | |

| | | | 400 VAC | | | | | |
|--------------------------|-------------------|---------------------|-------------------------|-----------------------|-----------------------|-------------------------|-------------------------|--|
| | Model (R88M-) | | K90010F | K2K010F | K3K010F | | | |
| Item | | Unit | K90010C | K2K010C | K3K010C | K4K510C | K6K010C | |
| Rated out | out *1 | W | 900 | 2,000 | 3,000 | 4,500 | 6,000 | |
| Rated tor | μe * ¹ | N • m | 8.59 | 19.1 | 28.7 | 43.0 | 57.3 | |
| Rated rota | tion speed | r/min | 1,000 | -[| l | l | -[| |
| Maximum | rotation speed | r/min | 2,000 | | | | | |
| Momental torque *1 | y maximum | N • m | 19.3 | 47.7 | 71.7 | 107.0 | 143.0 | |
| Rated cur | rent *1 | A (rms) | 3.8 | 8.5 | 11.3 | 14.8 | 19.4 | |
| Momental current *1 | y maximum | A (0-p) | 12 | 30 | 40 | 55 | 74 | |
| Rotor | Without brake | kg • m² | 6.70×10 ⁻⁴ | 30.3×10 ⁻⁴ | 48.4×10 ⁻⁴ | 79.1×10 ⁻⁴ | 101×10 ⁻⁴ | |
| inertia | With brake | kg • m ² | 7.99×10 ⁻⁴ | 31.4×10 ⁻⁴ | 49.2×10 ⁻⁴ | 84.4×10 ⁻⁴ | 107×10 ⁻⁴ | |
| Applicable | load inertia | _ | 10 times the ro | otor inertia max. | *2 | • | II. | |
| Torque co | nstant *1 | N • m/A | 1.72 | 1.76 | 1.92 | 2.05 | 2.08 | |
| Power rate | Without brake | kW/s | 110 | 120 | 170 | 233 | 325 | |
| *1 | With brake | kW/s | 92.4 | 116 | 167 | 219 | 307 | |
| Mechanica | Without brake | ms | 0.66 | 0.76 | 0.61 | 0.55 | 0.54 | |
| time constant | With brake | ms | 0.79 | 0.78 | 0.62 | 0.63 | 0.57 | |
| Electrical | time constant | ms | 11 | 18 | 22 | 20 | 23 | |
| Allowable | radial load *3 | N | 686 | 1176 | 1470 | 1470 | 1764 | |
| Allowable | thrust load *3 | N | 196 | 490 | 490 | 490 | 588 | |
| Weight V | ithout brake | kg | Approx. 6.7 | Approx. 14.0 | Approx. 20.0 | Approx. 29.4 | Approx. 36.4 | |
| V | ith brake | kg | Approx. 8.2 | Approx. 17.5 | Approx. 23.5 | Approx. 33.3 | Approx. 40.4 | |
| Radiator p (material) | late dimensions | | 270 × 260 × t15 (AI) | 470 × 440 × t30 (AI) | | 470 × 440 × t30 (AI) | 550 × 520 × t30 (AI) | |
| Applicable | Servo Drives (F | R88D-) | KT15F | KT30F | KT50F | KT50F | KT75F | |

| = | | | | | | | | |
|----------------|--------------------------------|---------------------|-----------------------|----------------------|----------------------|----------------------|----------------------|--|
| | M. L.I. (DOOM.) | | | | 400 VAC | | | |
| | Model (R88M-) |) | K90010F | K2K010F | K3K010F | | | |
| Ite | m | Unit | K90010C | K2K010C | K3K010C | K4K510C | K6K010C | |
| | Brake inertia | kg • m ² | 1.35×10 ⁻⁴ | 4.7×10 ⁻⁴ | 4.7×10 ⁻⁴ | 4.7×10 ⁻⁴ | 4.7×10 ⁻⁴ | |
| | Excitation voltage *4 | V | 24 VDC ± 10% | | | | | |
| | Power consumption (at 20°C) | W | 19 | 31 | 34 | 34 | 34 | |
| | Current consumption (at 20°C) | А | 0.79±10% | 1.3±10% | 1.4±10% | 1.4±10% | 1.4±10% | |
| | Static friction torque | N•m | 13.7 min. | 24.5 min. | 58.8 min. | 58.8 min. | 58.8 min. | |
| | Attraction time *5 | ms | 100 max. | 80 max. | 150 max. | 150 max. | 150 max. | |
| | Release time *5 | ms | 50 max. *6 | 25 max. *7 | 50 max. *7 | 50 max. | 50 max. | |
| | Backlash | | ±1° | 1 | П | • | | |
| | Allowable work per braking | J | 1176 | 1372 | 1372 | 1372 | 1372 | |
| SI | Allowable total work | J | 1.5×10 ⁶ | 2.9×10 ⁶ | 2.9×10 ⁶ | 2.9×10 ⁶ | 2.9×10 ⁶ | |
| specifications | Allowable angular acceleration | rad/s ² | 10,000 | | 1 | 5,000 | 1 | |
| bec | Brake limit | _ | 10 million times min. | | | | | |
| ke s | Rating | _ | Continuous | | | | | |
| Brake | Insulation class | _ | Type F | | | | | |

- *1. These are the values when the Servomotor is combined with a drive at normal temperature (20°C, 65%). The momentary maximum torque indicates the standard value.
- *2. Applicable load inertia.
 - The operable load inertia ratio (load inertia/rotor inertia) depends on the mechanical configuration and its rigidity. For a machine with high rigidity, operation is possible even with high load inertia. Select an appropriate motor and confirm that operation is possible.
 - The dynamic brake is rated for short-term operation. Use it only for emergency stopping. Design the system to stop for at least ten minutes after the dynamic brake operates. Otherwise, the dynamic brake circuits may fail or the dynamic brake resistor may burn.
- *3. The allowable radial and thrust loads are the values determined for a limit of 20,000 hours at normal operating temperatures.

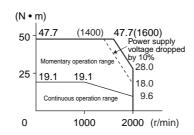
The allowable radial loads are applied as shown in the following diagram.



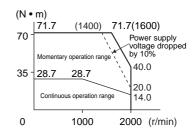
- *4. This is a non-excitation brake. (It is released when excitation voltage is applied.)
- *5. The operation time is the value (reference value) measured with a surge suppressor (CR50500 by Okaya Electric Industries Co., Ltd.).
- *6. Direct current switching with a varistor (TNR9G820K by Nippon Chemi-Con Corporation).
- *7. Direct current switching with a varistor (Z15D151 by Ishizuka Electronics Co.).

Torque-Rotation Speed Characteristics for 1,000-r/min Servomotors

- 1,000-r/min Servomotor (200/400 VAC) The following graphs show the characteristics with a 3-m standard cable and a 200-VAC input.
- R88M-K90010H/T/F/C (900 W)
- Power supply voltage (N • m) dropped by 10% 19.3(1800) (1600)20 **√19.3** 8.59 8.59 10 8.0 43 Continuous operation range 0 1000 2000 (r/min)
- R88M-K2K010H/T/F/C (2 kW)



• R88M-K3K010H/T/F/C (3 kW)

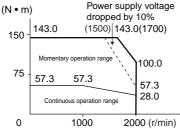


- R88M-K4K510T/C (4.5 kW)
- Power supply voltage dropped by 10% (N • m) 107.0 (1500) 107.0(1700) 100 Momentary operation range 70.0 50 43.0 43.0 50.0 22.0

1000

0

R88M-K6K010T/C (6 kW)



- 2000 (r/min) Note 1: The continuous operation range is the range in which continuous operation is possible. Continuous operation at the maximum speed is also possible. However, doing so will reduce the output torque.
- Note 2: If the motor power cable exceeds 20 m, the voltage drop will increase and the momentary operation range will become narrower.

Temperature Characteristics of the Motor and Mechanical System

- OMNUC G5-Series AC Servomotors use rare earth magnets (neodymium-iron magnets). The temperature coefficient for these magnets is approx. -0.13%/°C.
- As the temperature drops, the motor's momentary maximum torque increases, and as the temperature rises, the motor's momentary maximum torque decreases.
- The momentary maximum torque rises by 4% at a normal temperature of 20°C compared to a temperature of -10°C. Conversely, the momentary maximum torque decreases about 8% when the magnet warms up to 80°C from the normal temperature.
- Generally, when the temperature drops in a mechanical system, the friction torque and the load torque increase. For that reason, overloading may occur at low temperatures.
- In particular, in systems that use a Decelerator, the load torque at low temperatures may be nearly twice as much as the load torque at normal temperatures.
- Check whether overloading may occur during starting at low temperature.
- Also check to see whether abnormal motor overheating or alarms occur at high temperatures.
- An increase in load friction torque seemingly increases load inertia.
 Therefore, even if the drive gains are adjusted at a normal temperature, the motor may not operate properly at low temperatures. Check to see whether optimal operation can be obtained even at low temperatures.

Encoder Specifications

Incremental Encoder Specifications

| Item | Specifications | | |
|-------------------------|---|--|--|
| Encoder system | Optical encoder | | |
| | 20 bits | | |
| Number of output pulses | Phases A and B: 262,144 pulses/rotation Phase Z: 1 pulse/rotation | | |
| Power supply voltage | 5 VDC ± 5% | | |
| Power supply current | 180 mA (max.) | | |
| Output signals | +S, -S | | |
| Output interface | RS-485 compliant | | |

Absolute Encoder Specifications

| Item | Specifications | | |
|--------------------------------|--|--|--|
| Encoder system | Optical encoder | | |
| | 17 bits | | |
| Number of output pulses | Phases A and B: 32,768 pulses/rotation Phase Z: 1 pulse/rotation | | |
| Maximum rotations | -32,768 to +32,767 rotations | | |
| Power supply voltage | 5 VDC ± 5% | | |
| Power supply current | 110 mA (max.) | | |
| Applicable battery voltage | 3.6 VDC | | |
| Current consumption of battery | 265 μA (for a maximum of 5 s right after power interruption) 100 μA (for operation during power interruption) 3.6 μA (when power is supplied to the Servo Drive) | | |
| Output signals | +S, -S | | |
| Output interface | RS-485 compliant | | |

Note: Multi-rotation Data Backup

- The multi-rotation data will be lost if the battery cable connector is disconnected at the motor when connecting the battery cable for the absolute encoder and battery.
- If you do not use an absolute encoder battery cable and connect the battery to CN1, the multi-rotation data will be lost if CN2 is disconnected.

3-4 Cable and Connector Specifications

Encoder Cable Specifications

These cables are used to connect the encoder between the Servo Drive and the Servomotor. Select the cable matching the Servomotor. The cables listed are flexible, shielded and have IP67 protection.

Encoder Cables (European Flexible Cables)

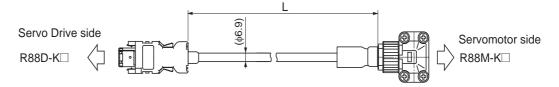
R88A-CRKA□CR-E

Cable types

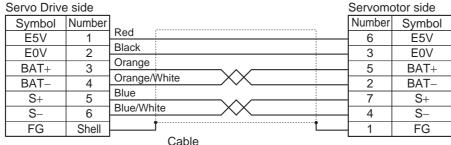
(For both absolute encoders and incremental encoders: [100 V and 200 V] For 3,000-r/min Servomotors of 50 to 750 W)

| Model | Length (L) | Outer diameter of sheath | |
|--------------------|------------|--------------------------|--|
| R88A-CRKA001-5CR-E | 1.5 m | | |
| R88A-CRKA003CR-E | 3 m | 6.9 dia. | |
| R88A-CRKA005CR-E | 5 m | | |
| R88A-CRKA010CR-E | 10 m | 0.5 dia. | |
| R88A-CRKA015CR-E | 15 m | | |
| R88A-CRKA020CR-E | 20 m | | |

Connection configuration and external dimensions



Wiring



[Servo Drive side connector] Connector model

55100-0670 (Molex Japan)

 $0.34 \text{ mm}^2 \times 2\text{C} + 0.22 \text{ mm}^2 \times 2\text{P}$

AWG22 × 2C + AWG24 × 2P

[Servomotor side connector] Angle clamp model

JN6FR07SM1 (Japan Aviation Electronics)

Connector pin model LY10-C1-A1-1000 (Japan Aviation Electronics)

R88A-CRKC□NR

Cable types

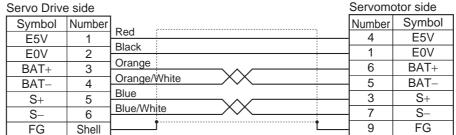
(For both absolute encoders and incremental encoders: [100 V and 200 V] For 3,000-r/min Servomotors of 1 kW or more, [400 V] 3,000-r/min Servomotors, 2,000-r/min Servomotors and 1,000-r/min Servomotors)

| Model | Length (L) | Outer diameter of sheath | |
|--------------------|------------|--------------------------|--|
| R88A-CRKC001-5NR-E | 1.5 m | | |
| R88A-CRKC003NR-E | 3 m | | |
| R88A-CRKC005NR-E | 5 m | 7.6 dia. | |
| R88A-CRKC010NR-E | 10 m | 7.0 dia. | |
| R88A-CRKC015NR-E | 15 m | | |
| R88A-CRKC020NR-E | 20 m | | |

Connection configuration and external dimensions



Wiring



[Servo Drive side connector] Connector model

55100-0670 (Molex Japan)

Cable $1~mm^2 \times 2C + 0.22~mm^2 \times 2P$ $AWG17 \times 2C + AWG24 \times 2P$

[Servomotor side connector] Straight plug model JN2DS10SL2-R (Japan Aviation Electronics)

Contact model

JN1-22-22S-10000 (Japan Aviation Electronics)

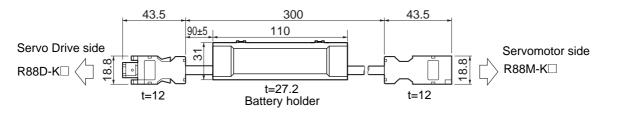
Absolute Encoder Battery Cable Specifications

Use the following Cable when using an absolute encoder.

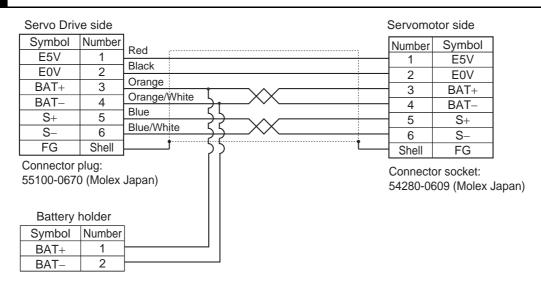
Cable Model

| Model | Length (L) | Battery | Weight |
|------------------|------------|------------------------|----------------|
| R88A-CRGD0R3C | 0.3 m | Not included | Approx. 0.1 kg |
| R88A-CRGD0R3C-BS | 0.3 m | R88A-BAT01G 1 included | Approx. 0.1 kg |

Connection Configuration and External Dimensions



Wiring



Motor Power Cable Specifications

These cables connect the Servo Drive and the Servomotor. Select the cable matching the Servomotor.

The cables listed are flexible, shielded and have IP67 protection.

Power Cables without Brakes (European Flexible Cables)

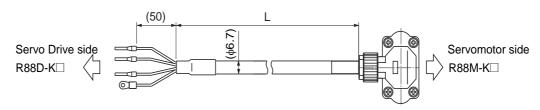
R88A-CAKA□SR-E

Cable types

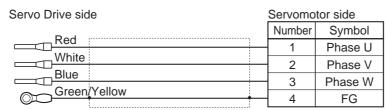
[100 V and 200 V] (For 3,000-r/min Servomotors of 50 to 750 W)

| Model | Length (L) | Outer diameter of sheath |
|--------------------|------------|--------------------------|
| R88A-CAKA001-5SR-E | 1.5 m | |
| R88A-CAKA003SR-E | 3 m | |
| R88A-CAKA005SR-E | 5 m | 6.7 dia. |
| R88A-CAKA010SR-E | 10 m | o.r dia. |
| R88A-CAKA015SR-E | 15 m | |
| R88A-CAKA020SR-E | 20 m | |

Connection configuration and external dimensions



Wiring



 $0.5~\text{mm}^2 \times 4C$ or AWG20 \times 4C

M4 crimp terminal

[Servomotor side connector]

Angle plug model

JN8FT04SJ1 (Japan Aviation Electronics)

Connector pin model

ST-TMH-S-C1B-3500-A534G (Japan Aviation Electronics)

Note: for servomotors with brake a separate cable R88A-CAKA BR-E is needed.

Cable

R88A-CAGB□SR-E

Cable types

200 V:

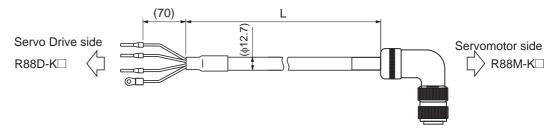
(For 3,000-r/min Servomotors of 1 to 2 kW, 2,000-r/min Servomotors of 1 to 2 kW, 1,000-r/min Servomotors of 900 W)

400 V:

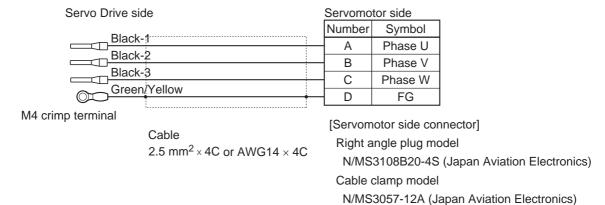
(For 3,000-r/min Servomotors of 750W to 2 kW, 2,000-r/min Servomotors of 400 W to 2 kW, 1,000-r/min Servomotors of 900 W)

| Model | Length (L) | Outer diameter of sheath |
|--------------------|------------|--------------------------|
| R88A-CAGB001-5SR-E | 1.5 m | |
| R88A-CAGB003SR-E | 3 m | |
| R88A-CAGB005SR-E | 5 m | 12.7 dia. |
| R88A-CAGB010SR-E | 10 m | 12.7 dia. |
| R88A-CAGB015SR-E | 15 m | |
| R88A-CAGB020SR-E | 20 m | |

Connection configuration and external dimensions



Wiring



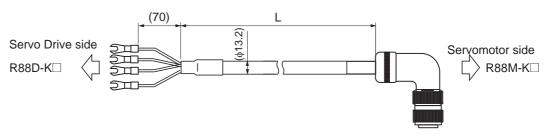
R88A-CAGD□SR-E

Cable types

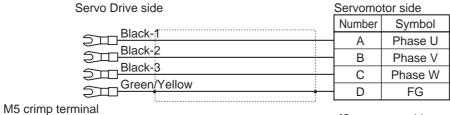
(For 3,000-r/min Servomotors of 3 to 5 kW, 2,000-r/min Servomotors of 3 to 5 kW, 1,000-r/min Servomotors of 2 to 4.5 kW)

| Model | Length (L) | Outer diameter of sheath |
|--------------------|------------|--------------------------|
| R88A-CAGD001-5SR-E | 1.5 m | |
| R88A-CAGD003SR-E | 3 m | |
| R88A-CAGD005SR-E | 5 m | 13.2 dia. |
| R88A-CAGD010SR-E | 10 m | 10.2 dia. |
| R88A-CAGD015SR-E | 15 m | |
| R88A-CAGD020SR-E | 20 m | |

Connection configuration and external dimensions



Wiring



Cable 4 mm² \times 4C or AWG11 \times 4C [Servomotor side connector]

Right angle plug model

N/MS3108B22-22S (Japan Aviation Electronics)

Cable clamp model

N/MS3057-12A (Japan Aviation Electronics)

Power Cables with Brakes (European Flexible Cables)

R88A-CAGB□BR-E

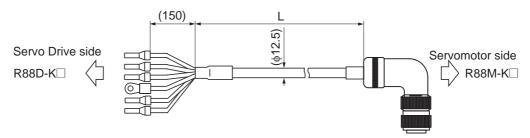
Cable types

200 V:

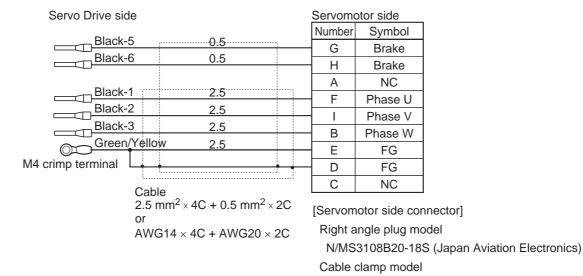
(For 3,000-r/min Servomotors of 1 to 2 kW, 2,000-r/min Servomotors of 1 to 2 kW, 1,000-r/min Servomotors of 900 W)

| Model | Length (L) | Outer diameter of sheath |
|--------------------|------------|--------------------------|
| R88A-CAGB001-5BR-E | 1.5 m | |
| R88A-CAGB003BR-E | 3 m | |
| R88A-CAGB005BR-E | 5 m | 12.5 dia. |
| R88A-CAGB010BR-E | 10 m | 12.0 dia. |
| R88A-CAGB015BR-E | 15 m | |
| R88A-CAGB020BR-E | 20 m | |

Connection configuration and external dimensions



Wiring



N/MS3057-12A (Japan Aviation Electronics)

R88A-CAKF□BR-E

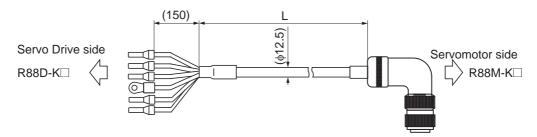
Cable types

400 V:

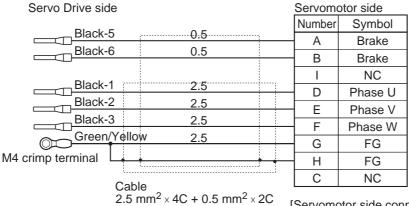
(For 3,000-r/min Servomotors of 750W to 2 kW, 2,000-r/min Servomotors of 400 W to 2 kW, 1,000-r/min Servomotors of 900 W)

| Model | Length (L) | Outer diameter of sheath |
|--------------------|------------|--------------------------|
| R88A-CAKF001-5BR-E | 1.5 m | |
| R88A-CAKF003BR-E | 3 m | |
| R88A-CAKF005BR-E | 5 m | 12.5 dia. |
| R88A-CAKF010BR-E | 10 m | 12.0 dia. |
| R88A-CAKF015BR-E | 15 m | |
| R88A-CAKF020BR-E | 20 m | |

Connection configuration and external dimensions



Wiring



 $AWG14 \times 4C + AWG20 \times 2C$

[Servomotor side connector]

Right angle plug model

N/MS3108B24-11S (Japan Aviation Electronics)

Cable clamp model

N/MS3057-16A (Japan Aviation Electronics)

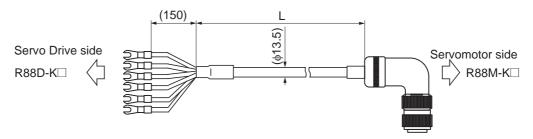
R88A-CAGD□BR-E

Cable types

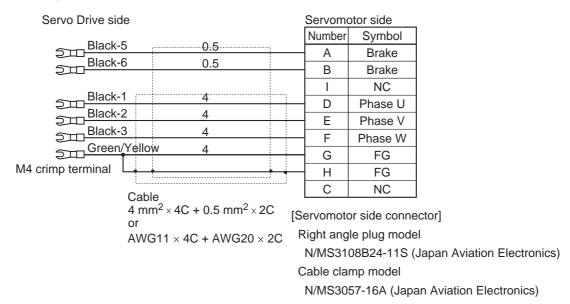
(For 3,000-r/min Servomotors of 3 to 5 kW, 2,000-r/min Servomotors of 3 to 5 kW, 1,000-r/min Servomotors of 2 to 4.5 kW)

| Model | Length (L) | Outer diameter of sheath |
|--------------------|------------|--------------------------|
| R88A-CAGD001-5BR-E | 1.5 m | |
| R88A-CAGD003BR-E | 3 m | |
| R88A-CAGD005BR-E | 5 m | 13.5 dia. |
| R88A-CAGD010BR-E | 10 m | 10.5 dia. |
| R88A-CAGD015BR-E | 15 m | |
| R88A-CAGD020BR-E | 20 m | |

Connection configuration and external dimensions



Wiring



Brake Cables (European Flexible Cables)

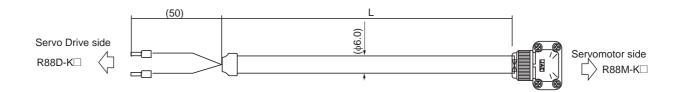
R88A-CAKA BR-E

Cable types 100 and 200 V:

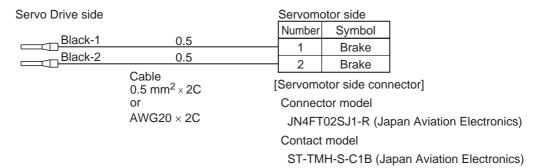
(For 3,000-r/min Servomotors of 50 to 750 W)

| Model | Length (L) | Outer diameter of sheath |
|--------------------|------------|--------------------------|
| R88A-CAKA001-5BR-E | 1.5 m | |
| R88A-CAKA003BR-E | 3 m | |
| R88A-CAKA005BR-E | 5 m | 6.0 dia. |
| R88A-CAKA010BR-E | 10 m | o.o dia. |
| R88A-CAKA015BR-E | 15 m | |
| R88A-CAKA020BR-E | 20 m | |

Connection configuration and external dimensions



Wiring



Connector Specifications

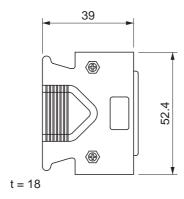
Control I/O Connector (R88A-CNU11C)

This is the connector to be connected to the Servo Drive's control I/O connector (CN1). Use this connector when preparing a control cable by yourself.

For information on wiring method, refer to Control Cable Specifications (P.3-112).

This connector is soldered.

Dimensions



Connector plug model

10150-3000PE (Sumitomo 3M)

Connector case model

10350-52A0-008 (Sumitomo 3M)

Encoder Connectors

These connectors are used for encoder cables.

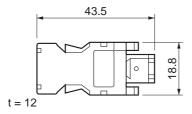
Use them when preparing an encoder cable by yourself.

For information on wiring method, refer to Encoder Cable Specifications (P.3-97).

Dimensions

R88A-CNW01R (Drive's CN2 side)

This connector is soldered.



Connector plug model 55100-0670 (Molex Japan)

R88A-CNK02R (Servomotor side)

This connector is pressure welded.

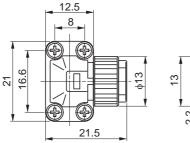
For the tools that are required for production, contact the manufacturer directly.

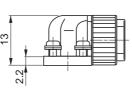
The cable direction from the angle plug can be reversed.

Adaptive motors

100-V, 3,000-r/min Servomotors of 50 to 400 W

200-V, 3,000-r/min Servomotors of 50 to 750 $\ensuremath{\mathsf{W}}$





Angle clamp model JN6FR07SM1 (Japan Aviation Electronics) Connector pin model LY10-C1-A1-10000 (Japan Aviation Electronics)

R88A-CNK04R (Servomotor side)

This connector is pressure welded.

For the tools that are required for production, contact the manufacturer directly.

Adaptive motors

200-V, 3,000-r/min Servomotors of all capacities

200-V, 2,000-r/min Servomotors of all capacities

200-V, 1,500-r/min Servomotors of all capacities

200-V, 1,000-r/min Servomotors of all capacities

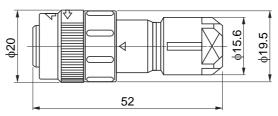
400-V, 3,000-r/min Servomotors of all capacities

400-V, 2,000-r/min Servomotors of all capacities

400-V, 1,000-r/min Servomotors of all capacities

400-V, 1,500-r/min Servomotors of all capacities





Straight plug model JN2DS10SL2-R (Japan Aviation Electronics) Contact model JN1-22-22S-PKG100 (Japan Aviation Electronics)

Power Cable Connector (R88A-CNK11A)

This connector is used for power cables.

Use it when preparing a power cable by yourself. For information on wiring method, refer to *Motor Power Cable Specifications* (P.3-100).

This connector is pressure welded.

For the tools that are required for production, contact the manufacturer directly.

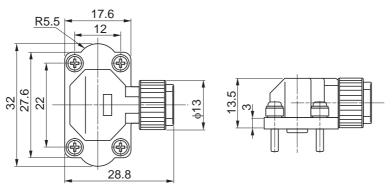
The cable direction from the angle plug can be reversed.

Note If you reverse the direction, you cannot attach the Connector to Servomotors of 50 W and 100 W.

Adaptive motors

100-V, 3,000-r/min Servomotors of 50 to 400 W

200-V, 3,000-r/min Servomotors of 50 to 750 $^{\mathrm{W}}$



Angle plug model JN8FT04SJ1 (Japan Aviation Electronics)

Socket contact model ST-TMH-S-C1B-3500-(A534G) (Japan Aviation Electronics)

Brake Cable Connector (R88A-CNK11B)

This connector is used for brake cables.

Use it when preparing a brake cable by yourself. For information on wiring method, refer to *Brake Cables (European Flexible Cables)* (P.3-106).

This connector is pressure welded.

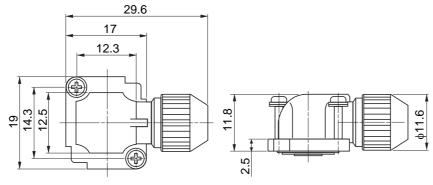
For the tools that are required for production, contact the manufacturer directly.

The cable direction from the angle plug can be reversed.

Adaptive motors

100-V, 3,000-r/min Servomotors of 50 to 400 $\,\mathrm{W}$

200-V, 3,000-r/min Servomotors of 50 to 750 $_{\rm W}$



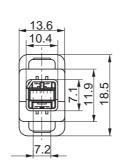
Angle plug model JN4FT02SJ1-R (Japan Aviation Electronics)

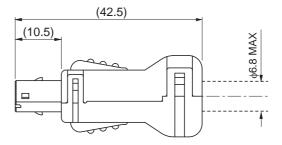
Socket contact model ST-TMH-S-C1B-3500-(A534G)

(Japan Aviation Electronics)

External Encoder Connector (R88A-CNK41L)

Use this connector to connect to an external encoder in fully-closed control. This connector is soldered.

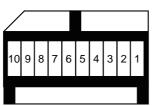




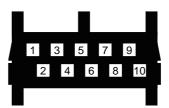
Connector plug model MUF-PK10K-X (J.S.T. Mfg. Co., Ltd.)

Pin Arrangement

View from Inserted Portion



View from Soldered Housing Surface



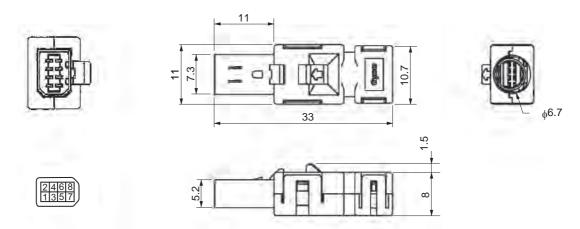
- Note 1: The recommended cable is a AWG28 to AWG24 shielded cable with a finished outer diameter of 6.8 max.
- Note 2: For information on wiring method, refer to External Encoder Connector Specifications (CN4) (P.3-51).

The cable length must be 20 m or less.

Safety I/O Signal Connector (R88A-CNK81S)

Use this connector to connect to a safety device.

This connector is soldered.



- Note 1: The recommended cable is a 6-conductor (AWG30 to AWG26) shielded cable with a finished outer diameter of 6.7 mm max.
- Note 2: For information on wiring, refer to Safety Connector Specifications (CN8) (P. 3-55).

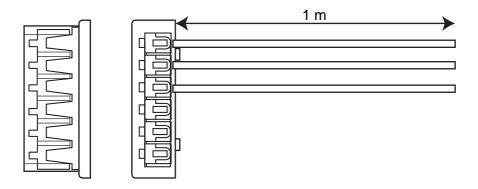
Analog Monitor Cable Specifications

Analog Monitor Cable (R88A-CMK001S)

Connection configuration and external dimensions

| Symbol | No. | Red |
|--------|-----|--------------------------|
| AM1 | 1 | White |
| AM2 | 2 | |
| GND | 3 | Black |
| | 4 | |
| | 5 | |
| | 6 | Cable: AWG24 × 3C UL1007 |

Connector housing: 51004-0600 (Molex Japan) Connector terminal: 50011-8000 (Molex Japan)



Control Cable Specifications

Specified Cables for Motion Control Unit (R88A-CPG□M□)

Use this cable to connect to the Motion Control Units for OMRON Programmable Controllers (SYSMAC). Cables are available for either 1 axis or 2 axes.

The following Motion Control Units can be used.

CS1W-MC221/421(-V1)

CV500-MC221/-MC421

C200H-MC221

Cable types

Cables for 1 axis

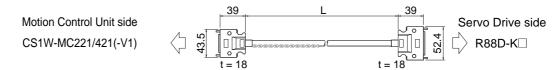
| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| R88A-CPG001M1 | 1 m | | Approx. 0.2 kg |
| R88A-CPG002M1 | 2 m | 8.3 dia. | Approx. 0.3 kg |
| R88A-CPG003M1 | 3 m | o.o dia. | Approx. 0.4 kg |
| R88A-CPG005M1 | 5 m | | Approx. 0.6 kg |

Cables for 2 axes

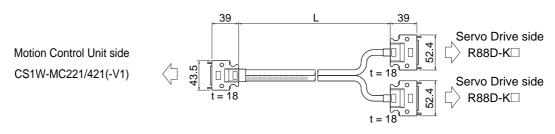
| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| R88A-CPG001M2 | 1 m | | Approx. 0.3 kg |
| R88A-CPG002M2 | 2 m | 8.3 dia. | Approx. 0.5 kg |
| R88A-CPG003M2 | 3 m | o.5 dia. | Approx. 0.7 kg |
| R88A-CPG005M2 | 5 m | | Approx. 1.0 kg |

Connection configuration and external dimensions

• Cables for 1 axis



• Cables for 2 axes



Cables for 1 axis

| Motion Cor | ntrol | | | | |
|------------|--------|--------------------------------|---------|----------------|----------------------|
| Unit side | | AMC20 Rad | Servo D | rive side | |
| Symbol | Number | AWG20 Red | Number | Symbol | |
| +24V | 1 | AWG20 Black | | | |
| DCGND | 2 | Mhita/Dlack (4) | | | |
| XALM | 3 | White/Black (1) | 37 | /ALM | |
| XRUN | 4 | Pink/Black (1) | 29 | RUN | |
| XALMRS | 5 | Yellow/Black (1) | 31 | RESET | |
| XSGND | 8 | Gray/Black (1) | 13 | SENGND | * |
| XSOUT | 9 | Gray/Red (1) | 20 | SEN | * |
| X-GND | 10 | Orange/Black (2) | 25 | ZGND | |
| X-A | 11 | White/Red (1) | 21 | +A | |
| X-Ā | 12 | White/Black (1) | 22 | -A | |
| X–B | 13 | Yellow/Red (1) | 49 | +B | |
| X-B | 14 | Yellow/Black (1) | 48 | −B | |
| X–Z | 15 | Pink/Red (1) | 23 | +Z | |
| X-Z | 16 | Pink/Black (1) | 24 | -Z | |
| XOUT | 17 | Orange/Red (1) | 14 | REF/TREF1/VLIM | Connector plug model |
| XAGND | 18 | Orange/Black (1) | 15 | AGND | 10150-3000PE |
| | | O(DII- (A) | Shell | FG | (Sumitomo 3M) |
| +F24V | 19 | Orange/Black (1) | 7 | +24VIN | Connector case model |
| FDC GND | 20 | Gray/Black (1) | 36 | ALMCOM | 10350-52A0-008 |
| YALM | 21 | Cable: AWG26 × 5P + AWG26 × 6C | | | (Sumitomo 3M) |
| YRUN | 22 | | | | , |
| YALMRS | 23 | | | | |
| YSGND | 26 | | | | |
| YSOUT | 27 | | | | |
| Y-GND | 28 | | | | |
| Y–A | 29 | | | | |
| Y–Ā | 30 | | | | |
| Y–B | 31 | | | | |
| Y-B | 32 | | | | |
| Y–Z | 33 | Connector plug model | | | |
| Y-Z | 34 | 10136-3000PE (Sumitomo 3M) | | | |
| YOUT | 35 | Connector case model | | | |
| YAGND | 36 | 10336-52A0-008 (Sumitomo 3M) | | | |

- The symbols on the controller side are the DRVX and DRVY connector symbols. For the DRVZ and DRVU connectors, X and Y are indicated as Z and U, respectively.
- Terminals marked with asterisks are for absolute encoders.
- Connect 24 VDC to the 2 lines (red and black) extending from the connector on the controller side. (red: +24 V, black: -)

• Cables for 2 axes

| Motion Cor | ntrol | | 0 5 | | |
|------------------|--------|---|--------|----------------|----------------------|
| Unit side | NI | AWG20 Red | | rive side | 1 |
| Symbol | Number | AWG20 Black | Number | Symbol | ļ |
| +24V | 1 | <u> </u> | | | |
| DCGND | 2 | White/Black (1) | | | |
| XALM | 3 | Pink/Black (1) | 37 | /ALM | |
| XRUN | 4 | Yellow/Black (1) | 29 | RUN | |
| XALMRS | 5 | Gray/Black (1) | - 31 | RESET | |
| XSGND | 8 | Gray/Red (1) | 13 | SENGND | * |
| XSOUT | 9 | Orange/Black (2) | 20 | SEN | * |
| X-GND | 10 | White/Red (1) | 25 | ZGND | |
| X–A | 11 | White/Black (1) | 21 | +A | |
| X-Ā | 12 | Yellow/Red (1) | 22 | -A | |
| X–B | 13 | | 49 | +B | |
| X–B | 14 | Yellow/Black (1) | 48 | −B |] |
| X–Z | 15 | Pink/Red (1) | - 23 | +Z | |
| X-Z | 16 | Pink/Black (1) | - 24 | -Z | Connector plug model |
| XOUT | 17 | Orange/Red (1) | 14 | REF/TREF1/VLIM | 10150-3000PE |
| XAGND | 18 | Orange/Black (1) | - 15 | AGND | (Sumitomo 3M) |
| | | | Shell | FG | Connector case model |
| +F24V | 19 | Orange/Black (1) | 7 | +24VIN | 10350-52A0-008 |
| FDC GND | 20 | Gray/Black (1) | 36 | ALMCOM | (Sumitomo 3M) |
| | | Cable | | | , , |
| | | AWG26 × 5P + AWG26 > | < 6C | | |
| | | | Number | Symbol |] |
| | | | 7 | +24VIN | 1 |
| | | | 36 | ALMCOM | 1 |
| YALM | 21 | White/Black (1) | 37 | /ALM | |
| YRUN | 22 | Pink/Black (1) | 29 | RUN | |
| YALMRS | 23 | Yellow/Black (1) | - 31 | RESET | |
| YSGND | 26 | Gray/Black (1) | 13 | SENGND | * |
| YSOUT | 27 | Gray/Red (1) | 20 | SEN | * |
| Y-GND | 28 | Orange/Black (2) | 25 | ZGND | |
| Y-A | 29 | White/Red (1) | 21 | +A | |
| $Y-\overline{A}$ | 30 | White/Black (1) | 22 | -A | |
| Y–B | 31 | Yellow/Red (1) | 49 | +B | |
| Y-B | 32 | Yellow/Black (1) | 48 | -B | Connector plug model |
| Y–Z | 33 | Pink/Red (1) | 23 | +Z | 10150-3000PE |
| Y-Z | 34 | Pink/Black (1) | 24 | -Z | (Sumitomo 3M) |
| YOUT | 35 | Orange/Red (1) | 14 | I . | Connector case model |
| YAGND | 36 | Orange/Black (1) | 15 | AGND | 10350-52A0-008 |
| Connector | | el Cable | Shell | FG | (Sumitomo 3M) |
| | | | | 1 0 | (Sumilonio Sivi) |
| | ハハトヒィク | umitomo 3M) AWG26 \times 5P + AWG26 \times 60 | , | | |

Connector case model

10336-52A0-008 (Sumitomo 3M)

- The symbols on the controller side are the DRVX and DRVY connector symbols. For the DRVZ and DRVU connectors, X and Y are indicated as Z and U, respectively.
- Terminals marked with asterisks are for absolute encoders.
- Connect 24 VDC to the 2 lines (red and black) extending from the connector on the controller side. (red: +24 V, black: -)

Specified Cables for Position Control Unit (for CJ1W-NC□□4 - High-speed Type)

This cable is for connecting Position Control Units (CJ1W-NC□□4) for OMRON Programmable Controller SYSMAC CJ Series. Cables are available for either 1 axis or 2 axes. The following types of Position Control Units are supported. CJ1W-NC214/-NC414/-NC234/-NC434

Cable types

• Cable for line-driver output for 1 axis

| Model | Length |
|--------------|--------|
| XW2Z-100J-G9 | 1 m |
| XW2Z-500J-G9 | 5 m |
| XW2Z-10MJ-G9 | 10 m |

• Cable for open collector output for 1 axis

| Model | Length |
|---------------|--------|
| XW2Z-100J-G13 | 1 m |
| XW2Z-300J-G13 | 3 m |

• Cable for line-driver output for 2 axes

| Model | Length |
|--------------|--------|
| XW2Z-100J-G1 | 1 m |
| XW2Z-500J-G1 | 5 m |
| XW2Z-10MJ-G1 | 10 m |

• Cable for open collector output for 2 axes

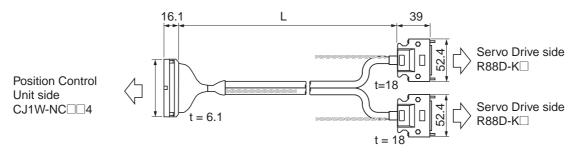
| Model | Length |
|--------------|--------|
| XW2Z-100J-G5 | 1 m |
| XW2Z-300J-G5 | 3 m |

Connection configuration and external dimensions

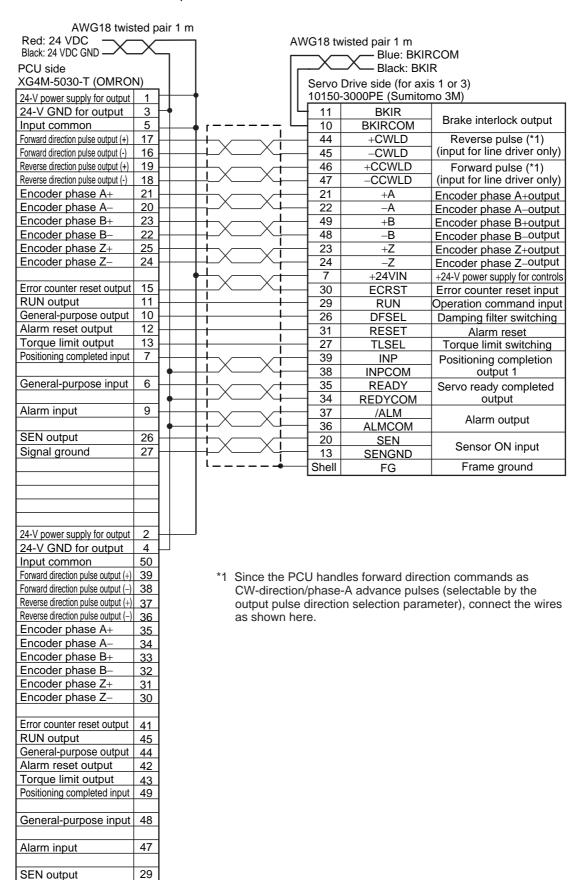
• Cables for 1 axis



· Cables for 2 axes



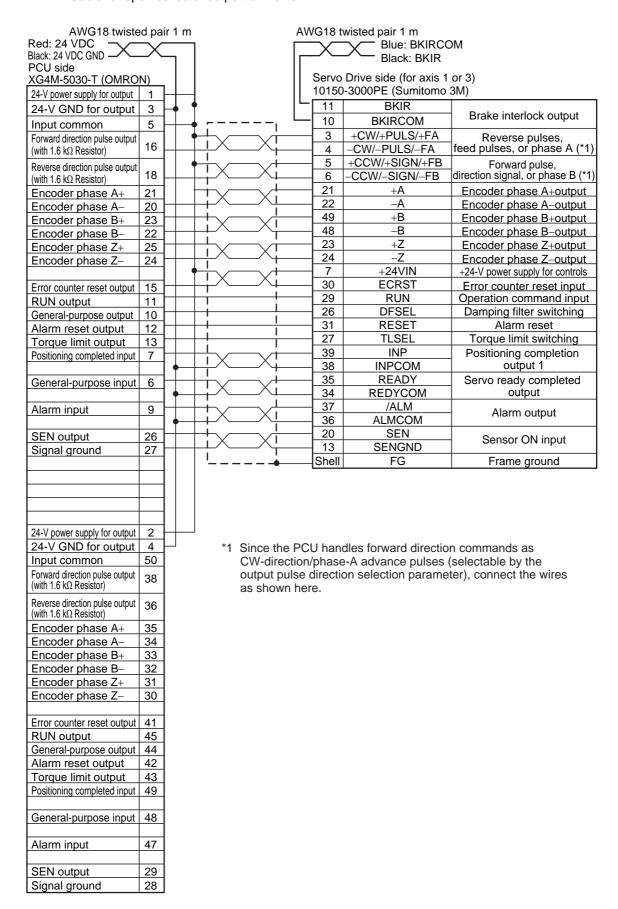
Cable for line-driver output for 1 axis



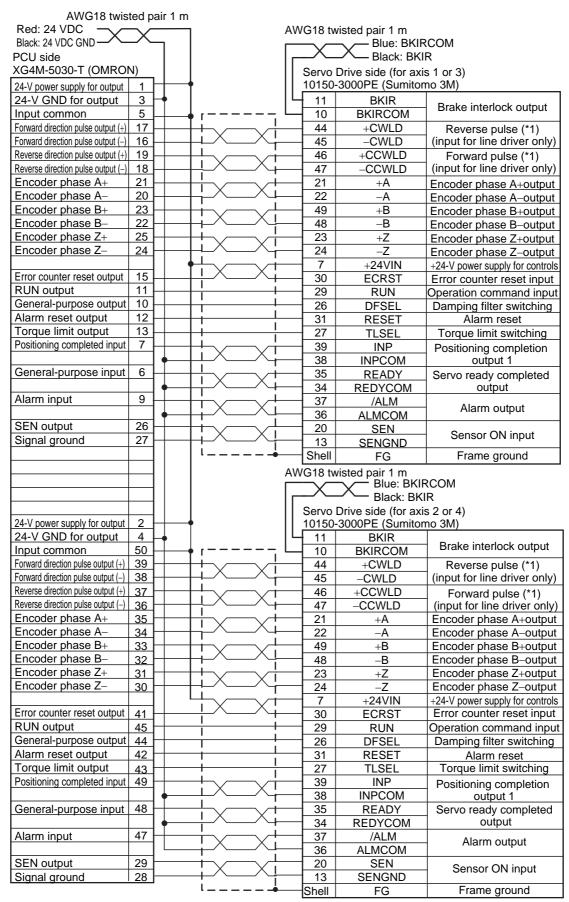
28

Signal ground

· Cable for open collector output for 1 axis

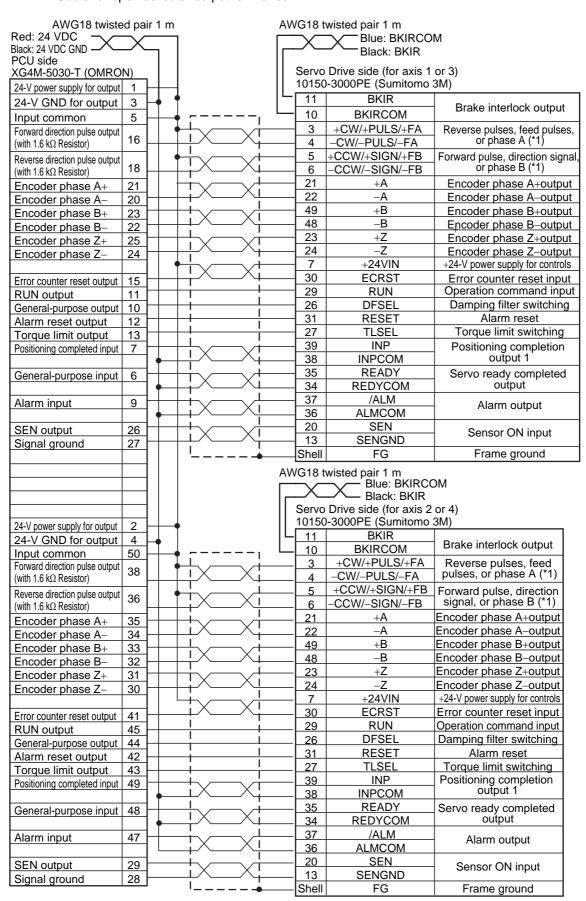


Cable for line-driver output for 2 axes



^{*1} Since the PCU handles forward direction commands as CW-direction/phase-A advance pulses (selectable by the output pulse direction parameter), connect the wires as shown here.

· Cable for open collector output for 2 axes



^{*1} Since the PCU handles forward direction commands as CW-direction/phase-A advance pulses (selectable by the output pulse direction parameter), connect the wires as shown here.

General-purpose Control Cables (R88A-CPG□S)

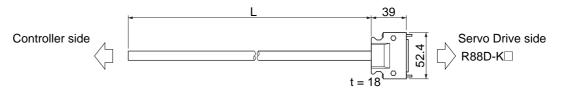
This is a cable attached to the connector to be connected to the drive's control I/O connector (CN1). The connector for the controller is not provided. When connecting to a Position Control Unit which does not have a specified cable or connecting to another company's controller, prepare wiring suited for the controller to be connected.

• When connecting to a controller which does not have a specified cable, either use a generalpurpose control cable or a connector-terminal block cable and a connector-terminal block.

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|--------------|------------|--------------------------|----------------|
| R88A-CPG001S | 1 m | 12.8 dia. | Approx. 0.3 kg |
| R88A-CPG002S | 2 m | 12.0 dia. | Approx. 0.6 kg |

Connection configuration and external dimensions



| Number | Wire/Mark color | Symbol | Number | Wire/Mark color | Symbol |
|--------|-------------------------------------|----------------|--------|------------------|--------|
| 1 | Orange/Red (1) | +24VCW | 27 | Pink/Black (3) | SI4 |
| 2 | Orange/Black (1) | +24VCCW | 28 | White/Black (3) | SI5 |
| 3 | Gray/Red (1) | +CW/+PULS/+FA | 29 | Yellow/Red (3) | SI6 |
| 4 | Gray/Black (1) | -CW/-PULS/-FA | 30 | Pink/Red (3) | SI7 |
| 5 | White/Red (1) | +CCW/+SIGN/+FB | 31 | Yellow/Black (3) | SI8 |
| 6 | White/Black (1) | -CCW/-SIGN/-FB | 32 | Gray/Black (4) | SI9 |
| 7 | Yellow/Red (1) | +24VIN | 33 | Orange/Red (4) | SI10 |
| 8 | Pink/Red (1) | SI1 | 34 | White/Red (4) | SO2- |
| 9 | Pink/Black (1) | SI2 | 35 | White/Black (4) | SO2+ |
| 10 | Orange/Red (2) | SO1- | 36 | Yellow/Red (4) | ALMCOM |
| 11 | Orange/Black (2) | SO1+ | 37 | Yellow/Black (4) | /ALM |
| 12 | Yellow/Black (1) | | 38 | Pink/Red (4) | SO4- |
| 13 | Gray/Black (2) | SENGND | 39 | Pink/Black (4) | SO4+ |
| 14 | White/Red (2) | REF/TREF1/VLIM | 40 | Gray/Red (4) | |
| 15 | White/Black (2) | AGND1 | 41 | Orange/Black (4) | |
| 16 | Yellow/Red (2) | PCL/TREF2 | 42 | Gray/Red (5) | BAT |
| 17 | Yellow/Black (2), Pink/Black (2) | AGND2 | 43 | Gray/Black (5) | BATGND |
| 18 | Pink/Red (2) | NCL | 44 | White/Red (5) | +CWLD |
| 19 | Orange/Red (5) | Z | 45 | White/Black (5) | -CWLD |
| 20 | Gray/Red (2) | SEN | 46 | Yellow/Red (5) | +CCWLD |
| 21 | Orange/Red (3) | +A | 47 | Yellow/Black (5) | -CCWLD |
| 22 | Orange/Black (3) | -A | 48 | Pink/Black (5) | -В |
| 23 | Gray/Red (3) | +Z | 49 | Pink/Red (5) | +B |
| 24 | Gray/Black (3) | -Z | 50 | | |
| 25 | Orange/Black (5) | ZGND | Shell | | FG |
| 26 | White/Red (3) | SI3 | _ | L | • |

Connector plug model: 10150-3000PE (Sumitomo 3M) Connector case model: 10350-52A0-008 (Sumitomo 3M)

Cable: AWG24 \times 25P UL20276

[•] Wires with the same wire color and the same number of marks form a twisted pair.

Example: Wires with respective wire and mark colors of orange/red (1) and orange/black (1) form a twisted pair.

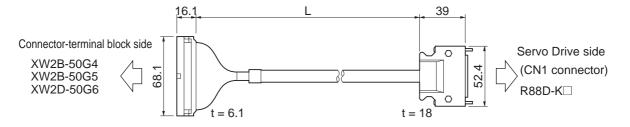
Terminal Block Cables (XW2Z-□J-B24)

This is a cable to connect the Servo drive I/O signals (CN1 connector) to a terminal block for general-purpose. All servo drive I/O signals are wired.

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| XW2Z-100J-B24 | 1 m | 11.2 dia. | Approx. 0.2 kg |
| XW2Z-200J-B24 | 2 m | 11.2 dia. | Approx. 0.4 kg |

Connection configuration and external dimensions



| | DIOCK | Conne | ctor | Servo | Drive side | |
|--------|--------------|--------|--|--------|---------------------|----------------|
| Number | | Number | | Number | Wire and mark color | Symbol |
| 1 | ┝ | 1 | +- | 1 | Blue/Red (1) | +24VCW |
| 3 | | 2 | $+-\sim$ | 2 3 | Blue/Black (1) | +24VCCW |
| 3 | <u> </u> | 3 | $\vdash \!\!\! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \!$ | 3 | Pink/Red (1) | +CW/+PULS/+FA |
| 4 | <u> </u> | 4 | $+-\sim$ | 4 | Pink/Black (1) | -CW/-PULS/-FA |
| 5 | | 5 | $\vdash \vdash \land \frown$ | - 5 | Green/Red (1) | +CCW/+SIGN/+FB |
| 6 | ├─ | 6 | | 6 | Green/Black (1) | -CCW/-SIGN/-FB |
| 7 | ├─ | 7 | | 7 | Orange/Red (1) | +24VIN |
| 8 | <u> </u> | 8 | $\vdash \!\!\! \vdash \!\!\! \searrow \sim$ | 8 | Gray/Red (1) | SI1 |
| 9 | <u> </u> | 9 | | 9 | Gray/Black (1) | SI2 |
| 10 | <u> </u> | 10 | $\vdash \vdash \land \frown$ | 10 | Blue/Red (2) | SO1- |
| 11 | | 11 | - -XX | 11 | Blue/Black (2) | SO1+ |
| 13 | | 13 | $\vdash \!\!\! \vdash \!\!\! \downarrow \!\!\! \searrow \sim$ | 13 | Pink/Red (2) | SENGND |
| 20 | | 20 | XX_ | 20 | Pink/Black (2) | SEN |
| 14 | | 14 | $\vdash \downarrow \downarrow \downarrow \downarrow \frown$ | 14 | Green/Red (2) | REF/TREF1/VLIM |
| 15 | | 15 | XX | 15 | Green/Black (2) | AGND1 |
| 16 | | 16 | L ^ <i></i> | 16 | Orange/Red(2) | PCL/TREF2 |
| 17 | | 17 | L:_XX_ | 17 | Orange/Black (2) | AGND2 |
| 18 | | 18 | | 18 | Gray/Red (1) | NCL |
| 12 | | 12 | | 12 | Gray/Black(2) | NOL |
| 19 | | 19 | LL , _ | 19 | Blue/Red (3) | Z |
| 25 | | 25 | $\sqcup XX$ | 25 | Blue/Black (3) | ZGND |
| 21 | | 21 | | 21 | Pink/Red (3) | +A |
| 22 | | 22 | | 22 | Pink/Black(3) | -A |
| 23 | | 23 | | 23 | Green/Red (3) | -A +Z |
| 24 | | 24 | | 24 | | -Z |
| 26 | | 26 | | 26 | Green/Black (3) | SI3 |
| | | | | | Orange/Red(3) | |
| 27 | | 27 | | 27 | Orange/Black(3) | SI4 |
| 28 | | 28 | | 28 | Gray/Red (3) | SI5 |
| 29 | | 29 | | 29 | Gray/Black(3) | SI6 |
| 30 | | 30 | | 30 | Blue/Red (4) | SI7 |
| 31 | | 31 | | 31 | Blue/Black (4) | SI8 |
| 32 | | 32 | | 32 | Pink/Red (4) | SI9 |
| 33 | | 33 | | 33 | Pink/Black (4) | SI10 |
| 34 | | 34 | | 34 | Green/Red (4) | SO2- |
| 35 | | 35 | \vdash | 35 | Green/Black (4) | SO2+ |
| 36 | | 36 | | 36 | Orange/Red(4) | ALMCOM |
| 37 | | 37 | H | 37 | Orange/Black (4) | /ALM |
| 38 | | 38 | | 38 | Gray/Red(4) | SO4- |
| 39 | \vdash | 39 | H/^_ | 39 | Gray/Black(4) | SO4+ |
| 40 | \vdash | 40 | | 40 | Blue/Red (5) | |
| 41 | | 41 | | 41 | Blue/Black (5) | |
| 42 | \vdash | 42 | $\vdash \sim \sim$ | 42 | Pink/Red (5) | BAT |
| 43 | | 43 | $+-\sim-$ | 43 | Pink/Black (5) | BATGND |
| 44 | <u> </u> | 44 | \vdash | 44 | Green/Red (5) | +CWLD |
| 45 | <u> </u> | 45 | $+-\sim$ | 45 | Green/Black (5) | -CWLD |
| 46 | <u> </u> | 46 | H-\ | 46 | Orange/Red (5) | +CCWLD |
| 47 | <u> </u> | 47 | \vdash \sim | 47 | Orange/Black (5) | -CCWLD |
| 48 | <u> </u> | 48 | $\vdash \vdash \land \frown$ | 48 | Gray/Red (5) | -B |
| 49 | <u> </u> | 49 | XX_ | 49 | Gray/Black(5) | +B |
| | | 50 | | 50 | Orange/Red(1) | |
| 50 | | | | | | |

 1 Wires with the same wire color and the same number of marks form a twisted pair

Example: Wires with respective wire and mark colors of Yellow/Black (1) and Pink/Black (1) form a twisted pair

Servo Drive Connector:
Connector plug model
10150-3000PE (Sumitomo 3M)
Connector case model
10350-52A0-008 (Sumitomo 3M)

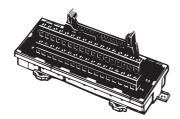
Terminal Block Connector: Connector socket model XG4M-5030 (OMRON) Strain relief model XG4T-5004 (OMRON)

Cable: AWG28 \times 25P UL2464

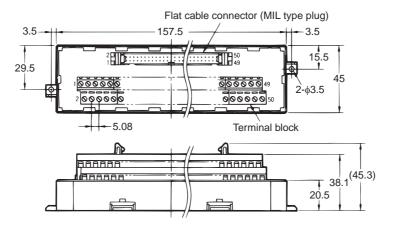
Connector-Terminal Block Conversion Unit

The Connector-Terminal Block Conversion Unit connects the servo drive I/O signals (CN1 connector) for general purpose. Use the cable (XW2Z-\Bullet J-B24) to connect the Connector-Terminal Block Conversion Unit to the CN1 connector.

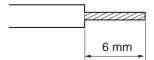
XW2B-50G4 (M3 Screw Terminal Block)



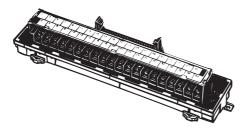
Dimensions



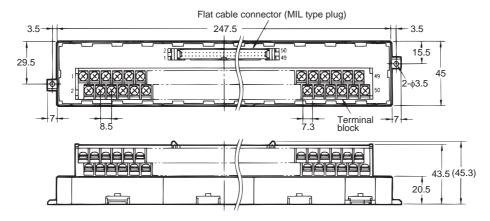
- Use 0.3 to 1.25 mm² wire (AWG22 to 16).
- The wire inlet is 1.8 mm (height) × 2.5 mm (width).
- Strip the insulation from the end of the wire for 6 mm as shown below.



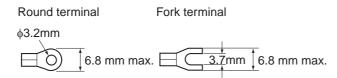
XW2B-50G5 (M3.5 Screw Terminal Block)



Dimensions

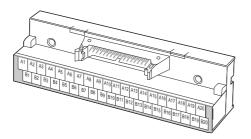


- When using crimp terminals, use crimp terminals with the following dimensions.
- When connecting wires and crimp terminals to a terminal block, tighten them with a tightening torque of 0.59 N•m.

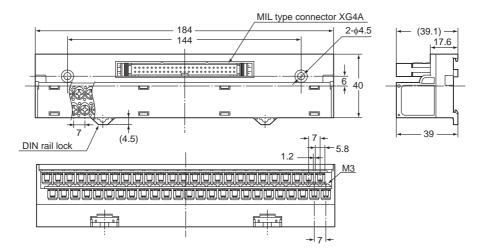


| Applicable crimp terminals | | Applicable wires |
|----------------------------|---------|--|
| Round terminals | 1.25–3 | AWG22-16 (0.3 to 1.25 mm ²) |
| Round terminals | 2–3.5 | AWG16-14 (1.25 to 2.0 mm ²) |
| Fork terminals | 1.25Y-3 | AWG22-16 (0.3 to 1.25 mm ²) |
| T OIK terminals | 2–3.5 | AWG16-14 (1.25 to 2.0 mm ²) |

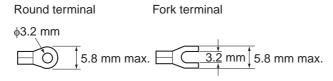
XW2D-50G6 (M3 Screw Terminal Block)



Dimensions



- When using crimp terminals, use crimp terminals with the following dimensions.
- When connecting wires and crimp terminals to a terminal block, tighten them with a tightening torque of 0.7 N•m.



| Applicable crimp terminals | | Applicable wires |
|----------------------------|---------|--|
| Round terminals | 1.25–3 | AWG22-16 (0.3 to 1.25 mm ²) |
| Fork terminals | 1.25Y-3 | AWG22-16 (0.3 to 1.25 mm ²) |

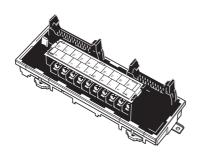
3-5 Servo Relay Units and Cable Specifications

This section provides the specifications for the Servo Relay Unit and cables used for connecting to Position Control Units for OMRON Programmable Controllers (SYSMAC). Select the models that match the Position Control Unit to be used.

Servo Relay Units Specifications

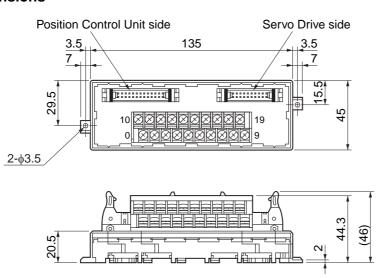
XW2B-20J6-1B

This Servo Relay Unit connects to the following OMRON Position Control Units.

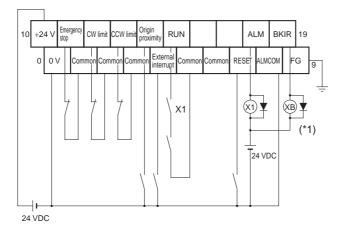


- CJ1W-NC113/-NC133
- CS1W-NC113/-NC133
- C200HW-NC113

Dimensions



Terminal block pitch: 7.62 mm



*1. The XB contacts are used to turn ON/OFF the electromagnetic brake.

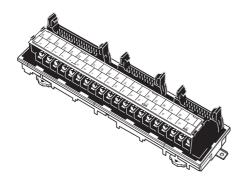
Note 1.Do not connect unused terminals.

Note 2.The 0 V terminal is internally connected to the common terminals.

Note 3. The applicable crimp terminal is R1.25-3 (round with open end).

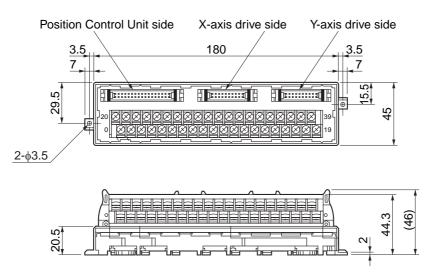
XW2B-40J6-2B

This Servo Relay Unit connects to the following OMRON Position Control Units.

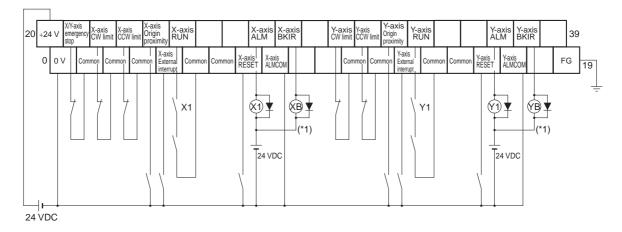


- CJ1W-NC213/-NC233/-NC413/-NC433
- CS1W-NC213/-NC233/-NC413/-NC433
- C200HW-NC213/-NC413

Dimensions



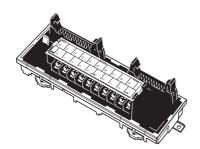
• Terminal block pitch: 7.62 mm



- *1. The XB and YB contacts are used to turn ON/OFF the electromagnetic brake.
- Note 1.Do not connect unused terminals.
- Note 2. The 0 V terminal is internally connected to the common terminals.
- Note 3. The applicable crimp terminal is R1.25-3 (round with open end).

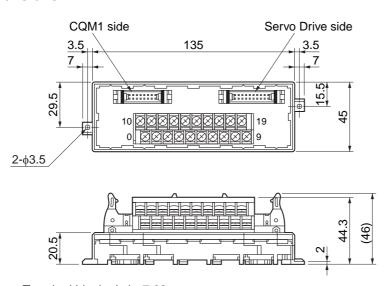
XW2B-20J6-3B

This Servo Relay Unit connects to the following OMRON Programmable Controllers.

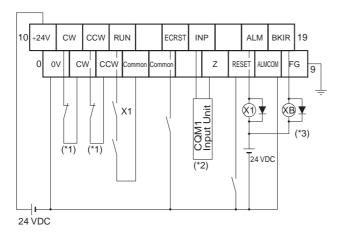


- CQM1-CPU43-V1
- CQM1-PLB21

Dimensions



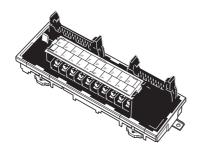
• Terminal block pitch: 7.62 mm



- *1. If this signal is input, the output pulse from the CQM1 will be input to the high-speed counter.
- *2. Input this output signal to a CQM1 Input Unit.
- *3. The XB contacts are used to turn ON/OFF the electromagnetic brake.
- Note 1. The phase Z is an open collector.
- Note 2.Do not connect unused terminals.
- Note 3. The 0 V terminal is internally connected to the common terminals.
- Note 4. The applicable crimp terminal is R1.25-3 (round with open end).

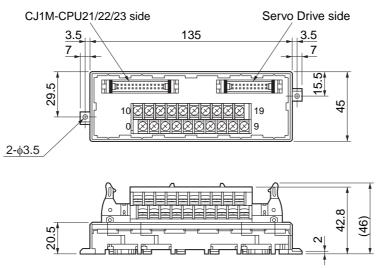
XW2B-20J6-8A

This Servo Relay Unit connects to the following OMRON Programmable Controllers.



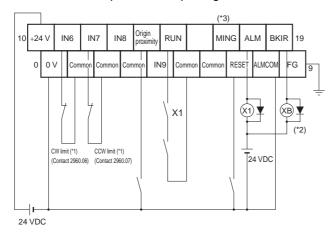
CJ1M-CPU21/-CPU22/-CPU23 (for 1 axis)

Dimensions



Terminal block pitch: 7.62 mm

The Servo Drive phase Z output signal is wired to the origin signal in this terminal block.



*1. CW and CCW limit input signals can also be input through Input Units. The signal for the CW/CCW limit inputs in the CJ1M are as follows: CW: A540.08, CCW: A540.09 for pulse output 0 and CW: A541.08, CCW: A541.09 for pulse output 1. Accordingly, the actual inputs can be used as the CW/CCW limit by outputting the flags below in the ladder program.

Example)

- *2. The XB contacts are used to turn ON/OFF the electromagnetic brake.
- *3. Connection to the MING input terminal is disabled.

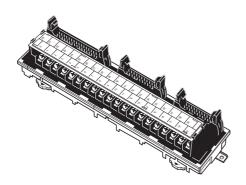
Note 1.Do not connect unused terminals.

Note 2. The 0 V terminal is internally connected to the common terminals.

Note 3. The applicable crimp terminal is R1.25-3 (round with open end).

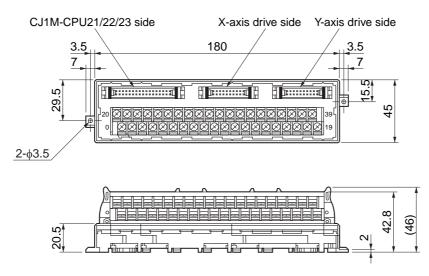
XW2B-40J6-9A

This Servo Relay Unit connects to the following OMRON Programmable Controllers.



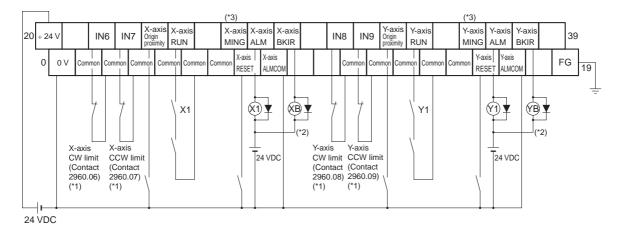
CJ1M-CPU21/-CPU22/-CPU23 (for 2 axes)

Dimensions



• Terminal block pitch: 7.62 mm

The Servo Drive phase Z output signal is wired to the origin signal in this terminal block.



*1. CW and CCW limit input signals can also be input through Input Units. The signal for the CW/CCW limit inputs in the CJ1M are as follows: CW: A540.08, CCW: A540.09 for pulse output 0 and CW: A541.08, CCW: A541.09 for pulse output 1. Accordingly, the actual inputs can be used as the CW/CCW limit by outputting the flags below in the ladder program.

Example)

- *2. The XB and YB contacts are used to turn ON/OFF the electromagnetic brake.
- *3. Connection to the MING input terminal is disabled.
- *4. Do not connect unused terminals.
- *5. The 0 V terminal is internally connected to the common terminals.
- *6. The applicable crimp terminal is R1.25-3 (round with open end).

Servo Drive Cable (XW2Z-□J-B31)

This cable connects the drive to a Servo Relay Unit (XW2B-20J6-8A, XW2B-40J6-9A).

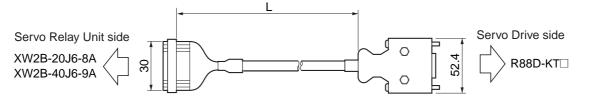
Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| XW2Z-100J-B31 | 1 m | 8.1 dia. | Approx. 0.1 kg |
| XW2Z-200J-B31 | 2 m | 0.1 dia. | Approx. 0.2 kg |

Note: Do not use a Servo Relay Unit Cable for line receiver inputs (+CWLD: CN1 pin 44, -CWLD: CN1 pin 45, +CCWLD: CN1 pin 46, -CCWLD: CN1 pin 47).

Use a General-purpose Control Cable (R88A-CPG□S) and prepare wiring suited for the controller to be connected.

Connection configuration and external dimensions



Wiring

| Servo Relay Ur | nit side | | Servo Drive side |
|---------------------|----------|----------------------------|------------------|
| Wire and mark color | Number | r | Number |
| Blue/Red (1) | 1 | <u> </u> | 7 |
| Blue/Black (1) | 2 | | 38 |
| Pink/Red (1) | 3 | | 5 |
| Pink/Black (1) | 4 | ├ | 6 |
| Green/Red (1) | 5 | | 3 |
| Green/Black (1) | 6 | <u>-</u> | 4 |
| Orange/Red (1) | 7 | | |
| _ | 8 | | 30 |
| _ | 9 | | 10 |
| Gray/Red (1) | 10 | | 23 |
| Gray/Black (1) | 11 | | 24 |
| Blue/Red (2) | 12 | | 39 |
| Blue/Black (2) | 13 | | 29 |
| Orange/Black (1) | 14 | | |
| Pink/Red (2) | 15 | | 27 |
| Pink/Black (2) | 16 | 1 | 31 |
| Orange/Red (2) | 17 | | 11 |
| Green/Black (2) | 18 | | 37 |
| Orange/Red (2) | 19 | | 36 |
| Any | 20 | - | Shell |

[Servo Relay Unit connector]

Connector socket model: XG4M-2030 Strain relief model: XG4T-2004

[Cable]

AWG28 × 10P UL2464

[Drive connector]

Connector plug model: 10150-3000PE (Sumitomo 3M) Connector case model: 10350-52A0-008 (Sumitomo 3M)

Position Control Unit-Servo Relay Unit Cable Specifications

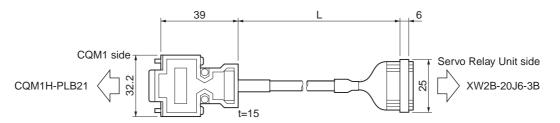
Position Control Unit Cable (XW2Z-□J-A3)

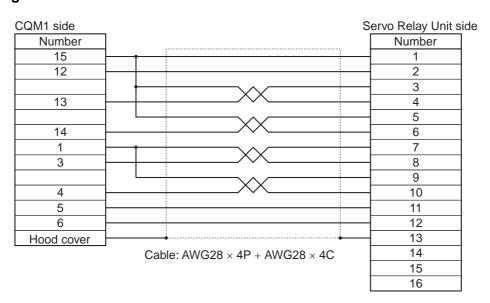
This cable connects a Programmable Controller (CQM1H-PLB21) to a Servo Relay Unit (XW2B-20J6-3B).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|--------------|------------|--------------------------|----------------|
| XW2Z-050J-A3 | 50 cm | 7.5 dia. | Approx. 0.1 kg |
| XW2Z-100J-A3 | 1 m | 7.5 dia. | Approx. 0.1 kg |

Connection configuration and external dimensions





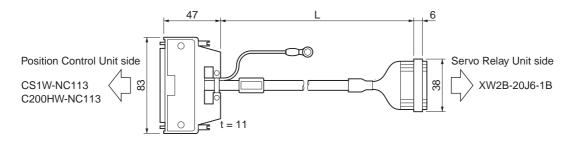
Position Control Unit Cable (XW2Z-□J-A6)

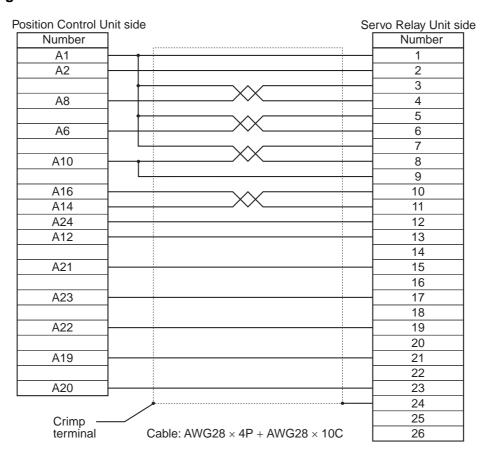
This cable connects a Position Control Unit (CS1W-NC113 and C200HW-NC113) to a Servo Relay Unit (XW2B-20J6-1B).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|--------------|------------|--------------------------|----------------|
| XW2Z-050J-A6 | 50 cm | 8.0 dia. | Approx. 0.1 kg |
| XW2Z-100J-A6 | 1 m | o.o dia. | Approx. 0.1 kg |

Connection configuration and external dimensions





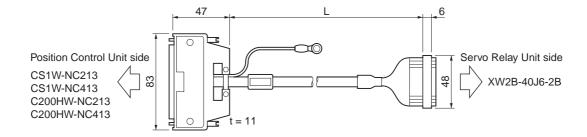
Position Control Unit Cable (XW2Z-□J-A7)

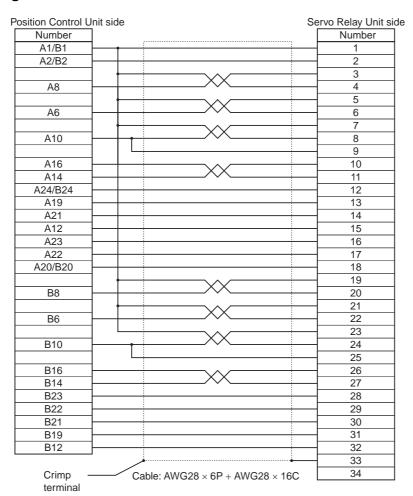
This cable connects a Position Control Unit (CS1W-NC213/NC413 and C200HW-NC213/NC413) to a Servo Relay Unit (XW2B-40J6-2B).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|--------------|-----------------|--------------------------|----------------|
| XW2Z-050J-A7 | 50 cm 10.0 dia. | | Approx. 0.1 kg |
| XW2Z-100J-A7 | 1 m | 10.0 dia. | Approx. 0.2 kg |

Connection configuration and external dimensions





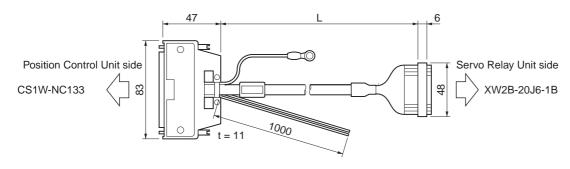
Position Control Unit Cable (XW2Z-□J-A10)

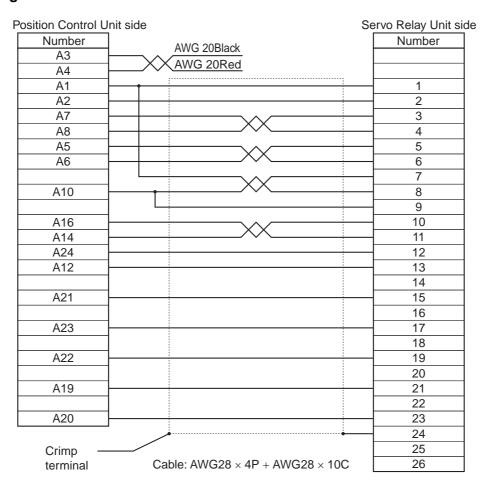
This cable connects a Position Control Unit (CS1W-NC133) to a Servo Relay Unit (XW2B-20J6-1B).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| XW2Z-050J-A10 | 50 cm | n 10.0 dia. | |
| XW2Z-100J-A10 | 1 m | 10.0 dia. | Approx. 0.2 kg |

Connection configuration and external dimensions





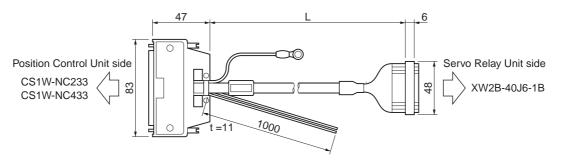
Position Control Unit Cable (XW2Z-□J-A11)

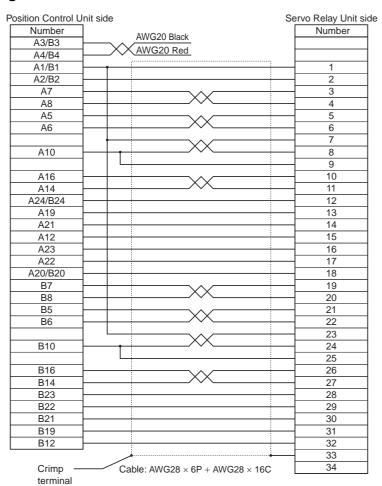
This cable connects a Position Control Unit (CS1W-NC233/433) to a Servo Relay Unit (XW2B-40J6-1B).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|-----------------|--------------------------|----------------|
| XW2Z-050J-A11 | 50 cm 10.0 dia. | | Approx. 0.1 kg |
| XW2Z-100J-A11 | 1 m | 10.0 dia. | Approx. 0.2 kg |

Connection configuration and external dimensions





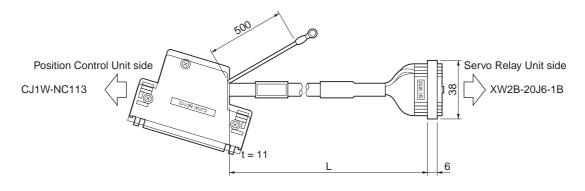
Position Control Unit Cable (XW2Z-□J-A14)

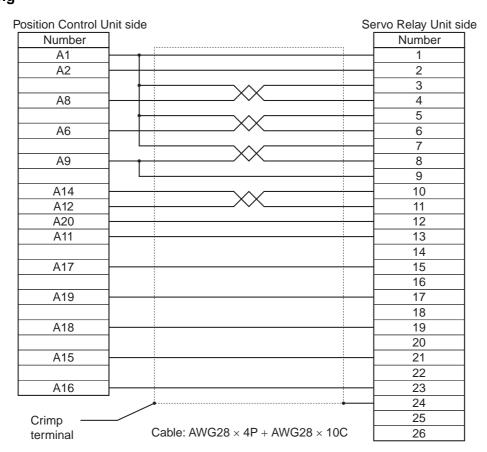
This cable connects a Position Control Unit (CJ1W-NC113) to a Servo Relay Unit (XW2B-20J6-1B).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| XW2Z-050J-A14 | 50 cm | 10.0 dia. | Approx. 0.1 kg |
| XW2Z-100J-A14 | 1 m | 10.0 dia. | Approx. 0.2 kg |

Connection configuration and external dimensions





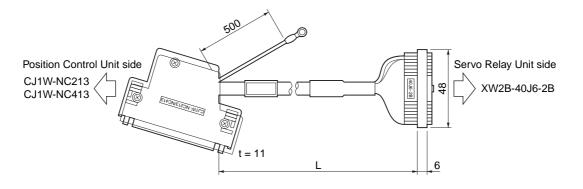
Position Control Unit Cable (XW2Z-□J-A15)

This cable connects a Position Control Unit (CJ1W-NC213/NC413) to a Servo Relay Unit (XW2B-40J6-2B).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| XW2Z-050J-A15 | 50 cm | cm 10.0 dia. | |
| XW2Z-100J-A15 | 1 m | 10.0 dia. | Approx. 0.2 kg |

Connection configuration and external dimensions



| tion Control Unit side Number | Servo Relay Uni Number |
|--------------------------------|---------------------------|
| A1/B1 | 1 |
| | |
| A2/B2 | 2 |
| | 3 |
| A8 | 4 |
| | 5 |
| A6 | 6 |
| | 7 |
| A9 1 | 8 |
| | 9 |
| A14 | 10 |
| A12 | 11 |
| A20/B20 | 12 |
| A15 | 13 |
| A17 | 14 |
| A11 | 15 |
| A19 | 16 |
| A18 | 17 |
| A16/B16 | 18 |
| 7.110/210 | <u> </u> |
| B8 XX | 20 |
| | 21 |
| B6 XX | 22 |
| | 23 |
| B9 XX | 24 |
| | 25 |
| B14 | 26 |
| B12 | 27 |
| B19 | 28 |
| B18 | 29 |
| B17 | 30 |
| B15 | 31 |
| B11 | 32 |
| DII | |
| | 33 |
| p terminal — Cable: AWG28 × 8P | 34 |

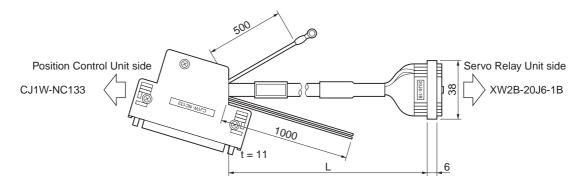
Position Control Unit Cable (XW2Z-□J-A18)

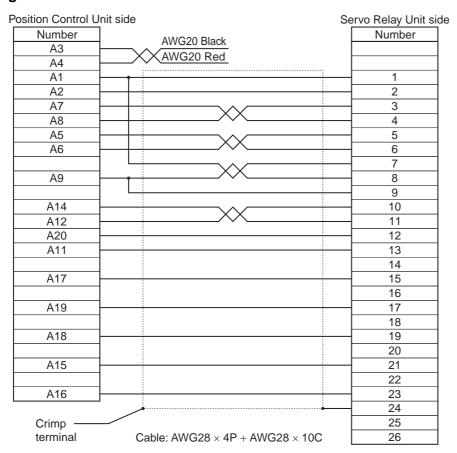
This cable connects a Position Control Unit (CJ1W-NC133) to a Servo Relay Unit (XW2B-20J6-1B).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| XW2Z-050J-A18 | 50 cm | 10.0 dia. | Approx. 0.1 kg |
| XW2Z-100J-A18 | 1 m | 10.0 dia. | Approx. 0.2 kg |

Connection configuration and external dimensions





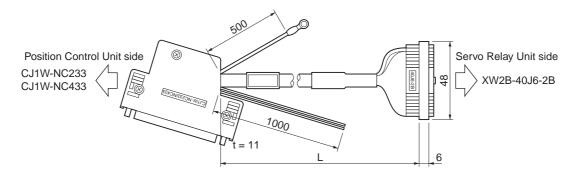
Position Control Unit Cable (XW2Z-□J-A19)

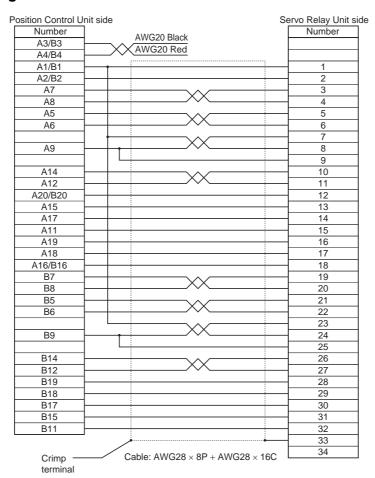
This cable connects a Position Control Unit (CJ1W-NC233/433) to a Servo Relay Unit (XW2B-40J6-2B).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| XW2Z-050J-A19 | 50 cm | 0 cm 10.0 dia. | |
| XW2Z-100J-A19 | 1 m | 10.0 dia. | Approx. 0.2 kg |

Connection configuration and external dimensions





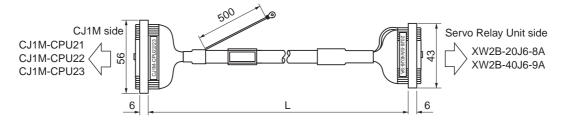
Position Control Unit Cable (XW2Z-□J-A33)

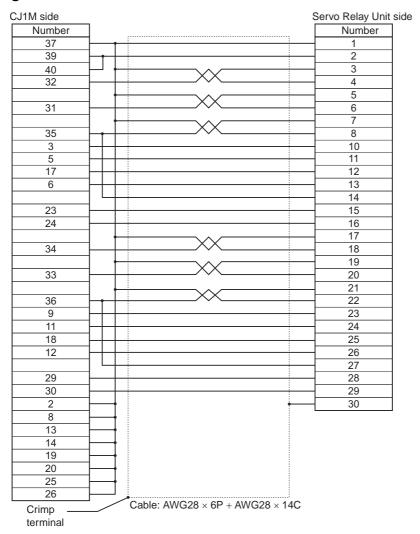
This cable connects a Programmable Controller (CJ1M-CPU21/CPU22/CPU23) to a Servo Relay Unit (XW2B-20J6-8A or XW2B-40J6-9A).

Cable types

| Model | Length (L) | Outer diameter of sheath | Weight |
|---------------|------------|--------------------------|----------------|
| XW2Z-050J-A33 | 50 cm | 10.0 dia. | Approx. 0.1 kg |
| XW2Z-100J-A33 | 1 m | 10.0 dia. | Approx. 0.2 kg |

Connection configuration and external dimensions





3-6 External Regeneration Resistor Specifications

External Regeneration Resistor Specifications

R88A-RR08050S

| Model | Resistance value | Nominal capacity | Regeneration absorption for 120°C temperature rise | Heat radiation condition | Thermal switch output specifications |
|-------------------|------------------|------------------|--|--|--|
| R88A- RR08050S | 50 Ω | 80 W | 20 W | Aluminum 350 × 350, Thickness: 3.0 | Operating temperature: 150°C ± 5% NC contact Rated output (resistive load): 125 VAC, 0.1 A max. 30 VDC, 0.1 A max. (minimum current: 1 mA) |

R88A-RR080100S

| Model | Resistance value | Nominal capacity | Regeneration absorption for 120°C temperature rise | Heat radiation condition | Thermal switch output specifications |
|--------------------|------------------|------------------|--|--|--|
| R88A- RR080100S | 100 Ω | 80 W | 20 W | Aluminum 350 × 350, Thickness: 3.0 | Operating temperature: 150°C ± 5% NC contact Rated output (resistive load): 125 VAC, 0.1 A max. 30 VDC, 0.1 A max. (minimum current: 1 mA) |

R88A-RR22047S1

| Model | Resistance value | Nominal capacity | Regeneration absorption for 120°C temperature rise | Heat radiation condition | Thermal switch output specifications |
|--------------------|------------------|------------------|--|--|--|
| R88A- RR22047S1 | 47 Ω | 220 W | 70 W | Aluminum 350 × 350, Thickness: 3.0 | Operating temperature: 150°C ± 5% NC contact Rated output (resistive load): 250 VAC, 0.2 A max. 42 VDC, 0.2 A max. (minimum current: 1 mA) |

R88A-RR50020S

| Model | Resistance value | Nominal capacity | Regeneration absorption for 120°C temperature rise | Heat radiation condition | Thermal switch output specifications |
|-------------------|------------------|------------------|--|--|--|
| R88A- RR50020S | 20 Ω | 500 W | 180 W | Aluminum 600 × 600, Thickness: 3.0 | Operating temperature 200°C ± 7°C NC contact Rated output (resistive load): 250 VAC, 0.2 A max. 42 VDC, 0.2 A max. (minimum current: 1 mA) |

3-7 EMC Filter Specifications

Specifications

| Applicable servo drive | Filter model | Rated current | Leakage current | Rated voltage |
|------------------------|----------------|---------------|--------------------|------------------------|
| R88D-KT01H | R88A-FIK102-RE | 2.4 A | | |
| R88D-KT02H | | 2.4 // | | |
| R88D-KT04H | R88A-FIK104-RE | 4.1 A | | 250 VAC single-phase |
| R88D-KT08H | R88A-FIK107-RE | 6.6 A | | 200 VAO sirigie-priase |
| R88D-KT10H | R88A-FIK114-RE | 14.2 A | 3.5 mA | |
| R88D-KT15H | | | | |
| R88D-KT06F | R88A-FIK304-RE | | 3.3 IIIA | |
| R88D-KT10F | | 4 A | | |
| R88D-KT15F | | | | 400 VAC single-phase |
| R88D-KT20F | R88A-FIK306-RE | 6 A | | 400 VAO sirigie-priase |
| R88D-KT30F | R88A-FIK312-RE | 12 A | | |
| R88D-KT50F | | 12 /7 | | |



System Design

This chapter explains the installation conditions for the Servo Drive and Servomotor, wiring methods including wiring conforming to EMC Directives and regenerative energy calculation methods as well as the performance of External Regeneration Resistors.

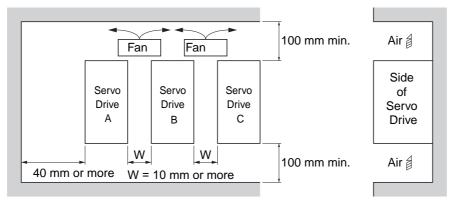
| 4-1 | Installation Conditions | 4-1 |
|-----|---|------|
| | Space Conditions around Servo Drives | 4-1 |
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4-1 Installation Conditions

Space Conditions around Servo Drives

Space Conditions around Equipment

• Install Servo Drives according to the dimensions shown in the following illustration to ensure proper dispersion of heat from inside the drive and convection inside the panel. If the drives are installed side by side, install a fan for air circulation to prevent uneven temperatures inside the panel.



- W must be 50 mm or more if 7.5-kW or 15-kW Servo Drives are installed.
- Servo Drives of 100 V or 200 V with a capacity of 750 W max. can be installed side by side with a 1-mm clearance (W in above illustration). For ambient temperature requirements, refer to Environment Operating Conditions below.
- If the mounting surface of the Servo Drive is coated, remove the coating to allow electrical conduction. If you make your own mounting bracket, we recommend that you apply electrically conductive plating.

Mounting Direction

Mount the Servo Drive perpendicular on the panel so that the model number reads normally.

Environment Operating Conditions

• The environment in which drives are operated must meet the following conditions. Drives may malfunction if operated under any other conditions.

Operating ambient temperature: 0 to $+55^{\circ}$ C (Take into account temperature rises in the following individual drives themselves.)

Operating humidity: 85% max. (with no condensation)

Operating atmosphere: No corrosive gases.

Altitude: 1,000 m max.

• For Servo Drives of 100 V or 200 V with a capacity of 750 W max., the specifications for operating ambient temperature depend on the Servo Drive (A, B, and C) when the clearance between Servo Drives is 1 mm.

Servo Drive A: 0 to 50 °C Servo Drive B: 0 to 40 °C Servo Drive C: 0 to 45 °C

Ambient Temperature Control

- Operation in an environment in which there is minimal temperature rise is recommended to maintain a high level of reliability.
- When the drive is installed in a closed space, such as a box, the ambient temperature may rise
 due to temperature rise in each unit. Use a fan or air conditioner to prevent the Servo Drive's
 ambient temperature from exceeding 55°C.
- Drive surface temperatures may rise to as much as 30°C above the ambient temperature. Use heat-resistant materials for wiring, and provide a distance from any devices or wiring that are sensitive to heat.
- The service life of a Servo Drive is largely determined by the ambient temperature around the internal electrolytic capacitors. When an electrolytic capacitor reaches its limit, electrostatic capacity drops and internal resistance increases. This leads to overvoltage alarms, malfunctioning due to noise, and damage to individual elements.
- If a drive is always operated at the ambient temperature of 55°C and with a 100% output of the rated torque and rated rotation speed, its life is expected to be approx. 28,000 hours (excluding the axial-flow fan). A drop of 10°C in the ambient temperature will double the expected life for drive.

Lifetime 25°C = Lifetime 55°C × 2
$$\frac{55-25}{10}$$
 = 224000 hour

Keeping Foreign Objects Out of Units

- Place a cover over the drive or take other preventative measures to prevent foreign objects, such
 as drill filings, from getting into the drive during installation. Be sure to remove the cover after
 installation is complete. If the cover is left on during operation, drive's heat dissipation is blocked,
 which may result in malfunction.
- Take measures during installation and operation to prevent foreign objects such as metal particles, oil, machining oil, dust, or water from getting inside of the drives.

Servomotor Installation Conditions

Environment Operating Conditions

• The environment in which the motor is operated must meet the following conditions. Operating the motor outside of the following ranges may result in malfunction of the motor.

Operating ambient temperature: 0 to +40°C*1

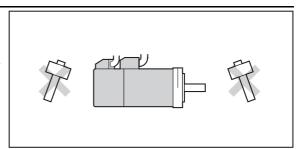
Operating humidity: 85% RH max. (with no condensation)

Operating atmosphere: No corrosive gases.

*1. The ambient operating temperature is the temperature at a point 50 mm from the motor.

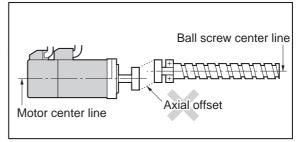
Impact and Load

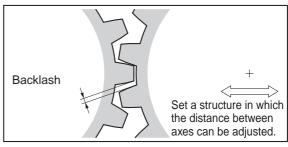
- The motor is resistant to impacts of up to 98 m/s².
 Do not apply heavy impacts or loads during transport, installation, or removal of the motor.
- When transporting the motor, hold the motor body itself. And do not hold the encoder, cable, or connector areas. Failure to follow this guideline may result in damaging the motor.
- Always use a pulley remover to remove pulleys, couplings, or other objects from the shaft.
- After assembly, secure cables so that there is no impact or load placed on the cable outlet.

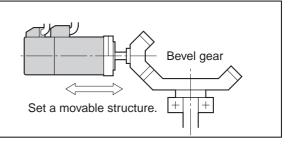


Connecting to Mechanical Systems

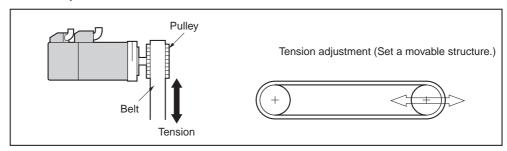
- For the allowable axial loads for motors, refer to "Characteristics"(P.3-2). If an axial load greater than that specified is applied to a motor, it may reduce the limit of the motor bearings and may break the motor shaft.
- When connecting to a load, use couplings that can sufficiently absorb mechanical eccentricity and declination.
- For spur gears, an extremely large radial load may be applied depending on the gear precision.
 Use spur gears with a high degree of precision (for example, JIS class 2: normal line pitch error of 6 µm max. for a pitch circle diameter of 50 mm).
- If the gear precision is not adequate, allow backlash to ensure that no radial load is placed on the motor shaft.
- When using bevel gears, a load is applied in the thrust direction depending on the structural precision, the gear precision, and temperature changes. Provide appropriate backlash or take other measures to ensure that a thrust load larger than the specified level is not applied.
- Do not put rubber packing on the flange surface. If the flange is mounted with rubber packing, the motor flange may crack under the tightening force.







- When connecting to a V-belt or timing belt, consult the manufacturer for belt selection and tension.
- A radial load twice as large as the belt tension will be placed on the motor shaft. Do not allow a load that exceeds the allowable radial load to be placed on the motor shaft. If an excessive radial load is applied, the motor shaft and bearings may be damaged.
- Set up a movable pulley in the middle of the motor shaft and the load shaft so that the belt tension can be adjusted.



Water and Drip Resistance

The protective structure for the motors is as follows:
 Equivalent to IP67 (except for through-shaft parts and motor connector pins and encoder connector pins)

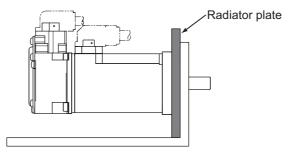
Oil-water Measures

Use the Servomotor with an oil seal if you are using it in an environment where oil drops can adhere to the through-shaft part. The operating conditions of the Servomotor with an oil seal are as follows:

- Keep the oil level below the lip of the oil seal.
- Prepare a good lubricated condition under which only oil droplets splash on the oil seal.
- If you are using the Servomotor with the shaft in upward direction, make sure that no oil accumulates on the lip of the oil seal.

Radiator Plate Installation Conditions

• When you mount a Servomotor onto a small device, be sure to provide enough radiation space on the mounting area. Otherwise the Servomotor temperature rises too high. One of the preventive measures is to install a radiator plate between the motor attachment area and the motor flange. (Refer to the following figure.) If a radiator plate cannot be connected, the Servomotor may be damaged by an excessive rise in temperature. Refer to the "Servomotor Specifications" (P.3-59) for the radiator plate specifications.



• The temperature rise depends on the mounting part materials and the installation environment. Check the actual temperature rise by using a real Servomotor.

• Depending on the environment, such as when the Servomotor is installed near a heating element, the Servomotor temperature may rise significantly. In this case, take any of the following measures.

Lower the load ratio.

Review the heat radiation conditions of the Servomotor.

Install a cooling fan and apply forced air cooling to the Servomotor.

Other Precautions

• Take measures to protect the motor shaft from corrosion. The motor shaft is coated with anticorrosion oil when shipped, but anti-corrosion oil or grease should also be applied when connecting the components that apply load to the shaft.



Caution



Do not apply a commercial power supply directly to the motor. Failure may result.



Never repair the Servo Drive by disassembling it. Electric shock or injury may result.

Decelerator Installation Conditions

Using Another Company's Decelerator (Reference)

If the system configuration requires another company's decelerator to be used in combination with an OMNUC G5-Series motor, select the decelerator so that the load on the motor shaft (i.e., both the radial and thrust loads) is within the allowable range. (Refer to "Characteristics"(P.3-2) for details on the allowable loads for the motors.)

Also, select the decelerator so that the allowable input rotation speed and allowable input torque of the decelerator are not exceeded.

4-2 Wiring

Wiring

Power Cables for 1,500-r/min Servomotors

For a 1,500-r/min Servomotor with 11 kW or 15 kW, make the following cable yourself and use it to connect the Servomotor and Servo Drive.

| vviing | | |
|--|----------|---------------|
| Servo Drive side | Servomo | tor side |
| | Number | Symbol |
| | — A | Phase U |
| White | — В | Phase V |
| Blue | — с | Phase W |
| Green/Yellow | — р | FG |
| Cable: AWG4 × 4C UL62 M6 crimp terminal | [Convomo | tor side sonn |

[Servomotor side connector]

Straight plug model

N/MS3106B32-17S (Japan Aviation Electronics)

Cable clamp model

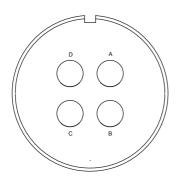
N/MS3057-20A (Japan Aviation Electronics)

Note 1. The cable length between the Servomotor and Servo Drive must be 50 m or less.

Use wire lengths that match the positions of the U, V, W, and FG terminals on the Servo Driver (M6 crimp terminals).

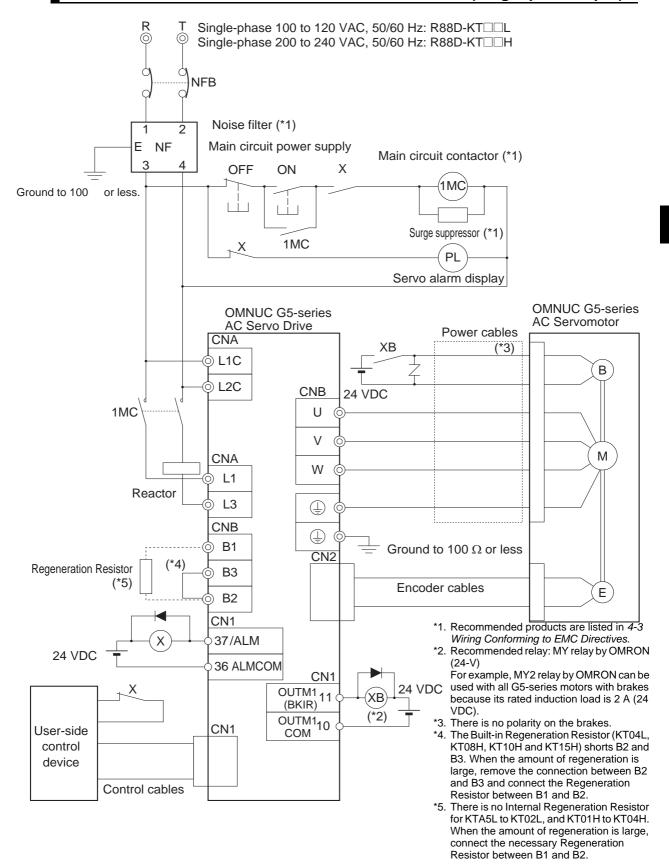
Note 2. The power connector and brake connector are separate for Servomotors with brakes.

Connector Pin Arrangement on Servomotor End (Viewed from Soldered Side of Plug)

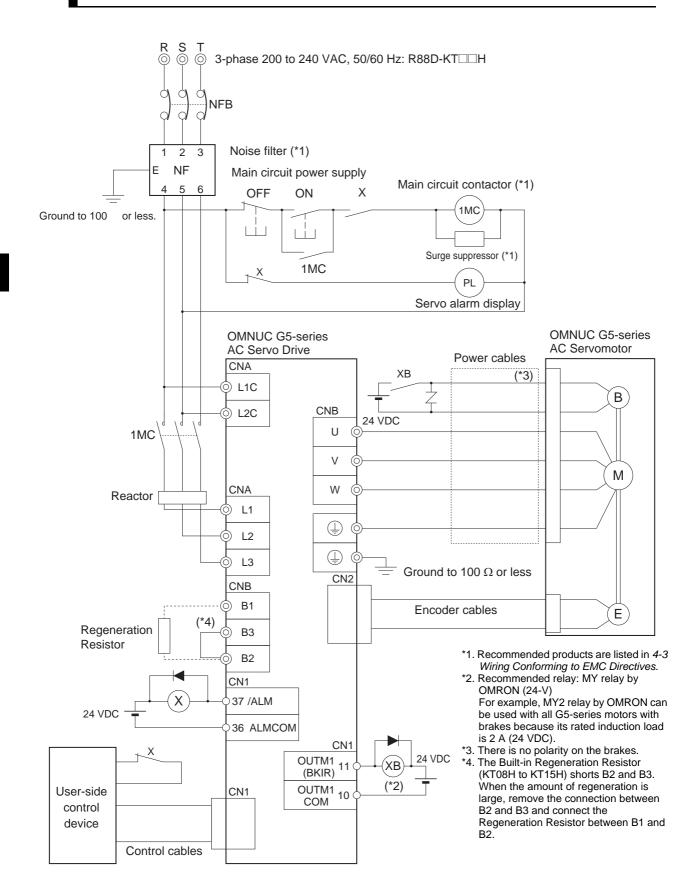


Peripheral Equipment Connection Examples

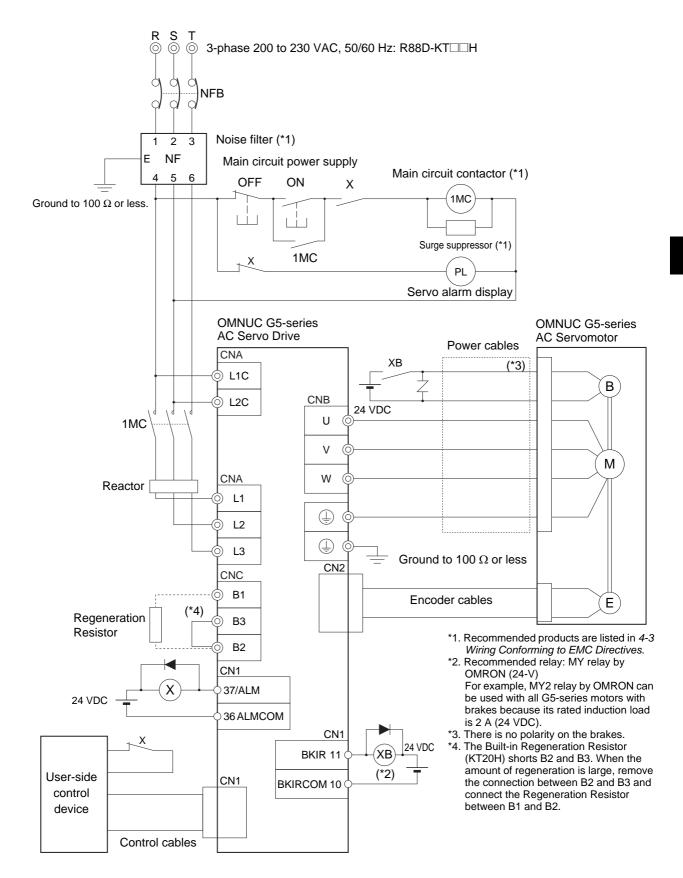
R88D-KTA5L/-KT01L/-KT02L/-KT04L R88D-KT01H/-KT02H/-KT04H/-KT08H/-KT10H/-KT15H (Single-phase Input)



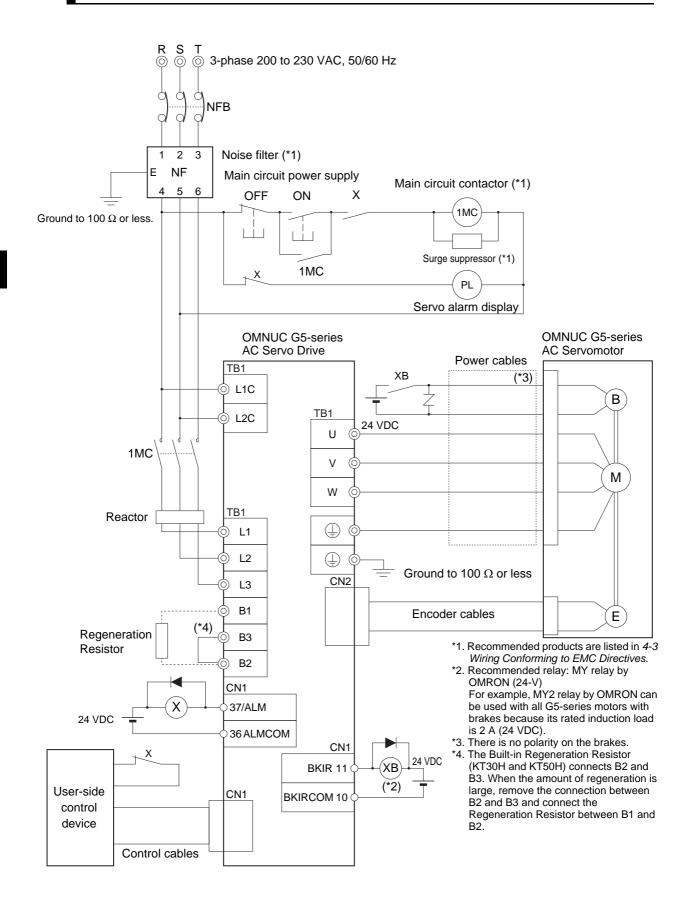
R88D-KT01H/-KT02H/-KT04H/-KT08H/-KT10H/-KT15H (3-phase Input)



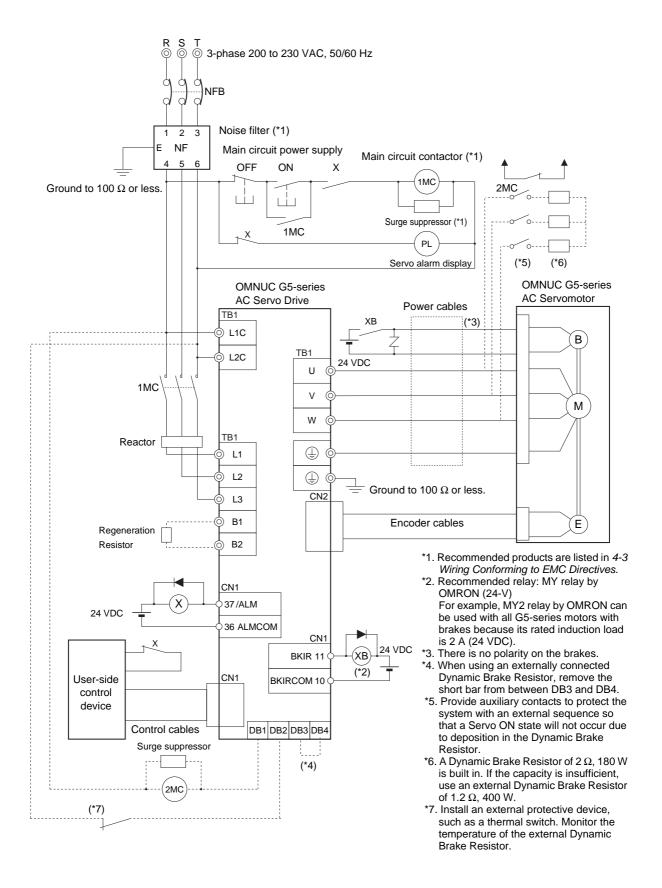
R88D-KT20H



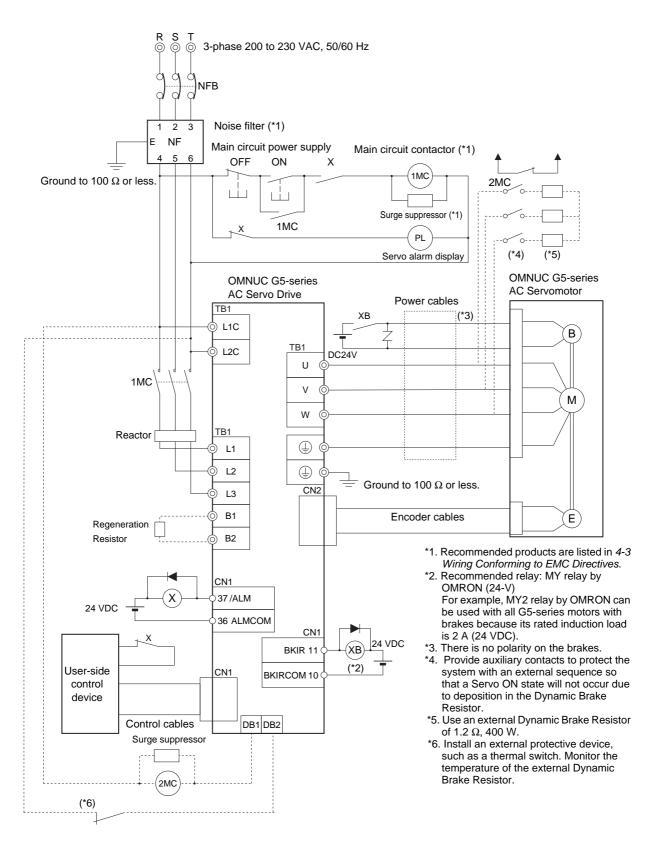
R88D-KT30H/-KT50H



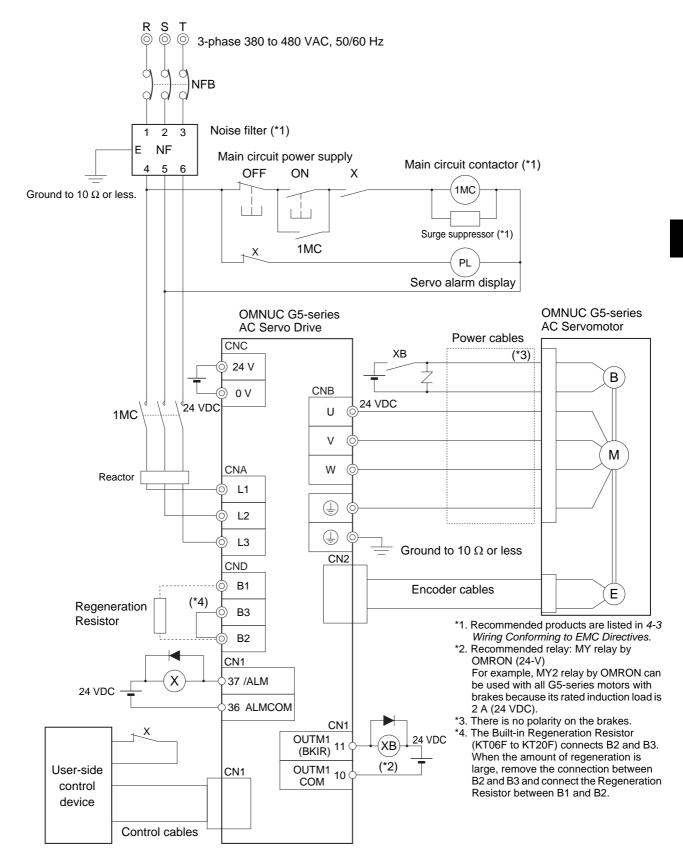
R88D-KT75H with AC Power Supply Input



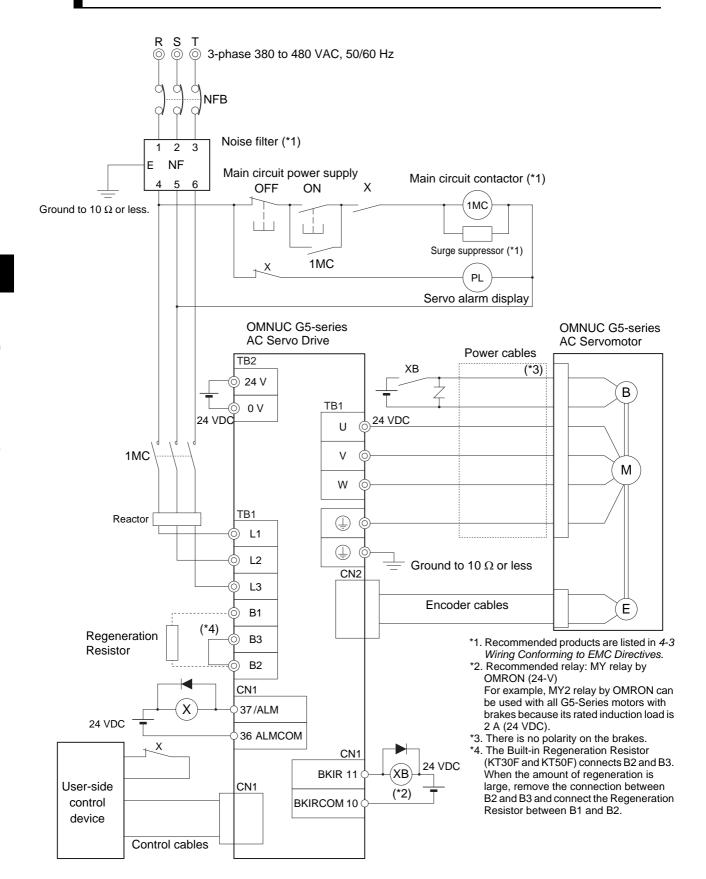
R88D-KT150H with AC Power Supply Input



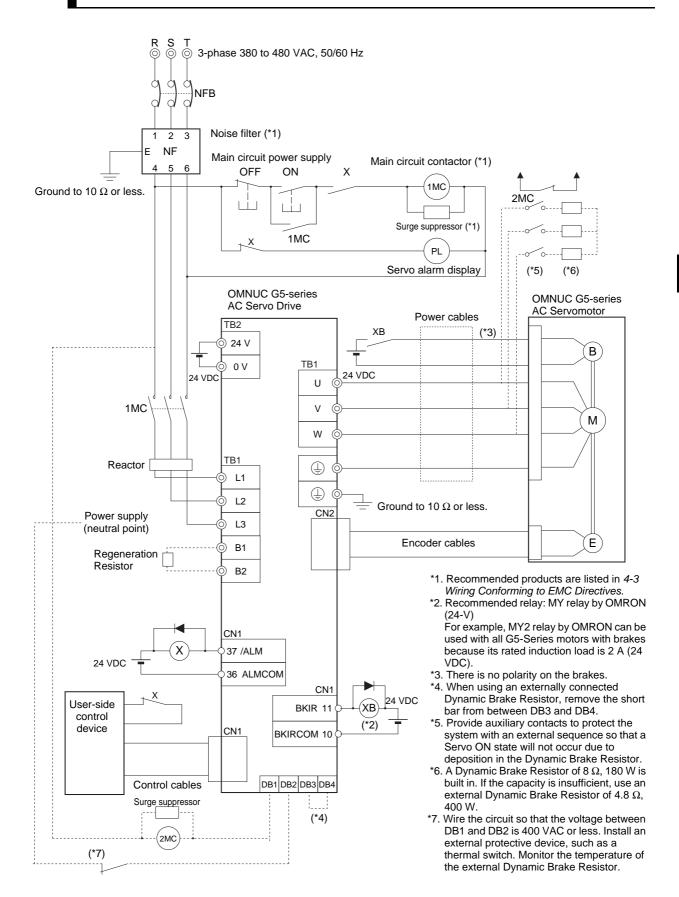
R88D-KT06F/-KT10F/-KT15F/-KT20F



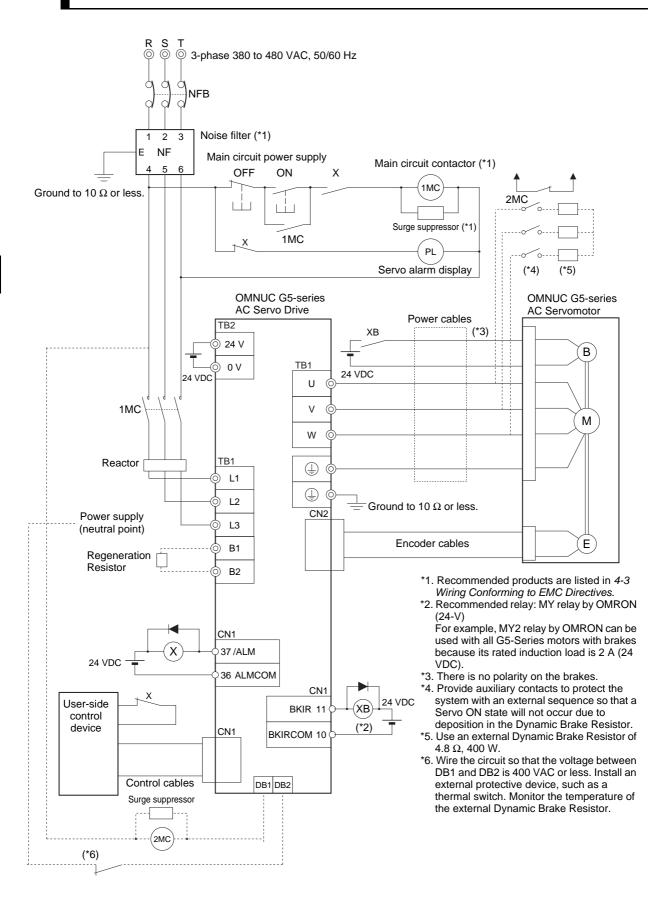
R88D-KT30F/-KT50F



R88D-KT75F



R88D-KT150F



Main Circuit and Motor Connections

When wiring the main circuit, use proper wire sizes, grounding systems, and noise resistance.

R88D-KTA5L/-KT01L/-KT02L/-KT04L R88D-KT01H/-KT02H/-KT04H/-KT08H/-KT10H/-KT15H

Main Circuit Connector Specifications (CNA)

| Symbol | Name | Function |
|--------|------------------------------------|---|
| L1 | | R88D-KT□L |
| L2 | | (50 to 400 W): Single-phase 100 to 120 VAC (85 to 132 V) 50/60 Hz |
| L3 | Main circuit power supply input | (100 W to 1.5 kW) : Single-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz (100 W to 1.5 kW): 3-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz |
| L1C | Control circuit power supply input | R88D-KT L: Single-phase 100 to 120 VAC (85 to 132 V) 50/60Hz |
| L2C | | R88D-KT□H : Single-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz |

Motor Connector Specifications (CNB)

| Symbol | Name | Function |
|-------------|---|---|
| B1 | | R88D-KTA5L/-KT01L/-KT02L/-KT01H/-KT02H/-KT04H: |
| B3 | | Normally, do not short B1 and B2. Doing so may cause malfunctions. |
| B2 | External Regeneration Resistor connection terminals | If there is high regenerative energy, connect an External Regeneration Resistor between B1 and B2. R88D-KT04L/-KT08H/-KT10H/-KT15H: Normally B2 and B3 are shorted. Do not short B1 and B2. Doing so may cause malfunctions. If there is high regenerative energy, remove the short-circuit bar between B2 and B3 and connect an External Regeneration Resistor between B1 and B2. |
| U | | These are the output terminals to the Servomotor. |
| V | Motor connection terminals | Be sure to wire them correctly. |
| W | | |
| (±) | | |
| + | Frame ground | This is the ground terminal. Ground to 100 Ω or less. |

R88D-KT20H

Main Circuit Connector Specifications (CNA)

| Symbol | Name | Function |
|--------|---------------------------|--|
| L1 | Main circuit power supply | R88D-KT□H (2 kW) : |
| L2 | input | 3-phase: 200 to 230 VAC (170 to 253 V) 50/60 Hz |
| L3 | | |
| L1C | Control circuit power | R88D-KT□H : Single-phase 200 to 230 VAC (170 to 253 V) 50/60 |
| L2C | supply input | Hz |

Motor Connector Specifications (CNB)

| Symbol | Name | | Function | |
|-------------|------------------|--|---|--|
| U | Motor connection | Red | These are the output terminals to the Servomotor. | |
| V | terminals | White | Be sure to wire them correctly. | |
| W | | Blue | | |
| (±) | | Green/ Yellow | | |
| (±) | Frame ground | This is the ground terminal. Ground to 100 Ω or less. | | |

External Regeneration Resistor Connector Specifications (CNC)

| Symbol | Name | Function |
|--------|---|---|
| B1 | External Regeneration Resistor connection | Normally B2 and B3 are shorted. Do not short B1 and B2. Doing so may cause malfunctions. |
| В3 | terminals | If there is high regenerative energy, remove the short-circuit bar between B2 and B3 and connect an External Regeneration Resistor between B1 and B2. |
| B2 | | |
| NC | Do not connect. | |



Precautions for Correct Use

Never connect an External Regeneration Resistor between the B1 and NC terminals.

R88D-KT30H/-KT50H

Terminal Block Specifications

| Symbol | Name | Function |
|------------|---|--|
| L1 | Main circuit power supply input | R88D-KT□H (3 to 5 kW): 3-phase 200 to 230 VAC (170 to 253 V) 50/60 Hz |
| L2 | | |
| L3 | | |
| L1C | Control circuit power supply input | R88D-KT□H: Single-phase 200 to 230 VAC (170 to 253 V) 50/60 Hz |
| L2C | | |
| B1 | External Regeneration Resistor connection terminals | Normally B2 and B3 are connected. Do not short B1 and B2. Doing so may cause malfunctions. If there is high regenerative energy, remove the short-circuit bar between B2 and B3 and connect an External Regeneration Resistor between B1 and B2. |
| B3 | | |
| B2 | | |
| NC | Do not connect. | |
| U | Motor connection terminals | These are the output terminals to the Servomotor. |
| V | | Be sure to wire them correctly. |
| W | | |
| (±) | | |
| + | Frame ground | This is the ground terminal. Ground to 100 Ω or less. |



Precautions for Correct Use

Never connect an External Regeneration Resistor between the B1 and NC terminals.

R88D-KT75H

Terminal Block Specifications, Left Terminal Block (TB1)

| Symbol | Name | Function |
|------------|---|--|
| L1 | Main circuit power supply input | R88D-KT□H (7.5 kW): 3-phase 200 to 230 VAC (170 to 253 V) 50/ 60 Hz 280 to 325 VDC (238 to 357 VDC) |
| L2 | | |
| L3 | | |
| B1 | External Regeneration Resistor connection terminals | Connect an External Regeneration Resistor between B1 and B2. Terminal B1 is main circuit DC output (positive). |
| B2 | | |
| N (NC) | | |
| U | Motor connection terminals | These are the output terminals to the Servomotor. |
| V | | Be sure to wire them correctly. |
| W | | |
| (±) | | |

Terminal Block Specifications, Right Terminal Block (TB2)

| Symbol | Name | Function |
|----------|--|--|
| L1C | Control circuit power supply input | R88D-KT□H: Single-phase 200 to 230 VAC (170 to 253 V) 50/60 |
| L2C | | Hz 280 to 325 VDC (238 to 357 VDC) |
| DB1 | Dynamic brake resistance control terminals | These terminals are used to control the MC for externally connected |
| DB2 | | dynamic brake resistance. The output contact specifications are 1 A max. at 300 VAC/100 VDC max. Connect them if required. |
| DB3 | | Normally DB3 and DB4 are connected. When using an externally |
| DB4 | | connected Dynamic Brake Resistor, remove the short bar from between DB3 and DB4. |
| = | Frame ground | This is the ground terminal. Ground to 100 Ω or less. |



Precautions for Correct Use

Never connect an External Regeneration Resistor between the B1 and N (NC) terminals

R88D-KT150H

Terminal Block Specifications, Top Terminal Block (TB1)

| Symbol | Name | Function | |
|--------|------------------------------|--|--|
| L1C | Control circuit power | R88D-KT□H: Single-phase 200 to 230 VAC (170 to 253 V) 50/60 | |
| L2C | supply input | 280 to 325 VDC (238 to 357 VDC) | |
| DB1 | Dynamic brake | These terminals are used to control the MC for externally connected | |
| DB2 | resistance control terminals | dynamic brake resistance. The output contact specifications are 1 A max. at 300 VAC/100 VDC max. Connect them if required. | |

Terminal Block Specifications, Bottom Terminal Block (TB2)

| Symbol | Name | Function |
|----------|---|--|
| L1 | | R88D-KT H (15 kW): 3-phase 200 to 230 VAC (170 to 253 V) 50/ |
| L2 | Main circuit power supply input | 60 Hz |
| L3 | ' | 280 to 325 VDC (238 to 357 VDC) |
| B1 | External Regeneration Resistor connection terminals | Connect an External Regeneration Resistor between B1 and B2. Terminal B1 is main circuit DC output (positive). |
| B2 | | Tomas D. Tomas Ground D. Caspas (positio). |
| N (NC) | terriiriais | |
| U | | These are the output terminals to the Servomotor. |
| V | Motor connection terminals | Be sure to wire them correctly. |
| W | | |
| = | | |
| (1) | Frame ground | This is the ground terminal. Ground to 100 Ω or less. |



Precautions for Correct Use

Never connect an External Regeneration Resistor between the B1 and N (NC) terminals

R88D-KT06F/-KT10F/-KT15F/-KT20F

Main Circuit Connector Specifications (CNA)

| Symbol | Name | Function |
|--------|---------------------------|---|
| L1 | Main circuit power supply | R88D-KT F |
| L2 | input | (600 W to 2 kW) : 3-phase: 380 to 480 VAC (323 to 528 V) 50/60 Hz |
| L3 | | |

Motor Connector Specifications (CNB)

| Symbol | Name | Function | |
|--------|----------------------------|---|---|
| U | Motor connection terminals | Red | These are the output terminals to the Servomotor. Be sure to wire them correctly. |
| V | | White | |
| W | | Blue | |
| (1) | | Green/ Yellow | |
| + | Frame ground | This is the ground terminal. Ground to 10 Ω or less. | |

Control Circuit Connector Specifications (CNC)

| Symbol | Name | Function |
|--------|-----------------------|-------------------------|
| 24 V | Control circuit power | 24 VDC (21.6 to 26.4 V) |
| 0 V | supply input | |

External Regeneration Resistor Connector Specifications (CND)

| Symbol | Name | Function |
|--------|---|--|
| B1 | External Regeneration Resistor connection | Normally B2 and B3 are connected. Do not short B1 and B2. Doing so may cause malfunctions. |
| B3 | terminals | If there is high regenerative energy, remove the short-circuit bar |
| B2 | | between B2 and B3 and connect an External Regeneration Resistor between B1 and B2. |
| NC | Do not connect. | |



Precautions for Correct Use

Never connect an External Regeneration Resistor between the B1 and NC terminals.

R88D-KT30F/-KT50F

Terminal Block Specifications (TB1)

| Symbol | Name | Function | |
|--------|-----------------------|-------------------------|--|
| 24 V | Control circuit power | 24 VDC (21.6 to 26.4 V) | |
| 0 V | supply input | | |

Terminal Block Specifications (TB2)

| Symbol | Name | Function | | | |
|----------|---|--|---|--|--|
| L1 | | | | | |
| L2 | Main circuit power supply input | | R88D-KT□F (3 to 5 kW): 3-phase 380 to 480 VAC (323 to 528 V) 50/60 Hz | | |
| L3 | ' | | | | |
| B1 | F | | Normally B2 and B3 are connected. Do not short B1 and B2. Doing | | |
| B3 | External Regeneration Resistor connection | so may cause malfunctions. If there is high regenerative energy, remove the short-circuit bar | | | |
| B2 | terminals | between B2 and B3 and connect an External Regeneration Resistor between B1 and B2. | | | |
| NC | Do not connect. | connect. | | | |
| U | | Red | These are the output terminals to the Servomotor. | | |
| V | Motor connection | White | Be sure to wire them correctly. | | |
| W | terminals | Blue | | | |
| <u>_</u> | | Green/ Yellow | | | |
| <u>_</u> | Frame ground | This is the ground terminal. Ground to 10 Ω or less. | | | |



Precautions for Correct Use

Never connect an External Regeneration Resistor between the B1 and NC terminals.

R88D-KT75F

Terminal Block Specifications, Left Terminal Block (TB1)

| Symbol | Name | Function | | | |
|--------|---|--|---|--|--|
| L1 | | | | | |
| L2 | Main circuit power supply input | R88D-K 60 Hz | R88D-KT□F (7.5 kW): 3-phase 380 to 480 VAC (323 to 528 V) 50/ 60 Hz | | |
| L3 | | | | | |
| B1 | External Regeneration Resistor connection | Connect an External Regeneration Resistor between B1 and B2. | | | |
| B2 | terminals | | | | |
| NC | Do not connect. | | | | |
| U | | Red | These are the output terminals to the Servomotor. | | |
| V | Motor connection | White | Be sure to wire them correctly. | | |
| W | terminals | Blue | | | |
| | | Green/ Yellow | | | |

Terminal Block Specifications, Right Terminal Block (TB2)

| Symbol | Name | Function |
|-------------|--|--|
| 24 V | Control circuit power | 24 VDC±15% |
| 0 V | supply input | |
| DB1 | Dynamic brake resistance control terminals | These terminals are used to control the MC for externally connected dynamic brake resistance. The output contact |
| DB2 | control terminals | specifications are 1 A max. at 300 VAC/100 VDC max. Connect them if required. |
| DB3 | | Normally DB3 and DB4 are connected. When using an externally |
| DB4 | | connected Dynamic Brake Resistor, remove the short bar from between DB3 and DB4. |
| (±) | Frame ground | This is the ground terminal. Ground to 10 Ω or less. |



Precautions for Correct Use

Never connect an External Regeneration Resistor between the B1 and NC terminals.

R88D-KT150F

Terminal Block Specifications, Top Terminal Block (TB1)

| Symbol | Name | Function | |
|--------|--------------------------|--|--|
| 24 V | Control circuit power | 24 VDC±15% | |
| 0 V | supply input | | |
| DB1 | Dynamic brake resistance | These terminals are used to control the MC for externally connected dynamic brake resistance. The output contact | |
| DB2 | control terminals | specifications are 1 A max. at 300 VAC/100 VDC max. Connect them if required. | |

Terminal Block Specifications, Bottom Terminal Block (TB2)

| Symbol | Name | Function | | | |
|---------|---|--|---|--|--|
| L1 | | | | | |
| L2 | Main circuit power supply input | R88D-K 60 Hz | R88D-KT□F (15 kW): 3-phase 380 to 480 VAC (323 to 528 V) 50/ 60 Hz | | |
| L3 | 1 | | | | |
| B1 | External Regeneration Resistor connection | Connect an External Regeneration Resistor between B1 and B2. | | | |
| B2 | terminals | | | | |
| NC | Do not connect. | | | | |
| U | | Red | These are the output terminals to the Servomotor. | | |
| V | Motor connection | White | Be sure to wire them correctly. | | |
| W | terminals | Blue | | | |
| (1) | | Green/ Yellow | | | |
| | Frame ground | This is the ground terminal. Ground to 10 Ω or less. | | | |



Precautions for Correct Use

Never connect an External Regeneration Resistor between the B1 and NC terminals.

Terminal Block Wire Sizes

100-VAC Input Type Wire Sizes: R88D-KT□□L

| Mo | odel (R88D-) | KTA5L | KT01L | KT02L | KT04L | | |
|--|-------------------|-------|--------------|-------|-------|-------|--|
| Item | | Unit | KIASL | KIUIL | KIUZL | K104L | |
| Power supply capac | ity | kVA | 0.4 | 0.4 | 0.5 | 0.9 | |
| Main circuit power | Rated current | А | 1.7 | 2.6 | 4.3 | 7.6 | |
| supply input (L1 and L3, or L1, L2 and L3) | Wire size | _ | AWG 14 to 18 | | | | |
| Control circuit power supply input (L1C and L2C) | Wire size | _ | AWG 18 | | | | |
| Motor connection | Rated current | А | 1.2 | 1.7 | 2.5 | 4.6 | |
| terminals (U, V, W, and FG) *1 *2 | Wire size | _ | AWG 14 to 18 | | | | |
| Frame ground (FG) | Wire size | _ | AWG 14 | | | | |
| | Screw size | _ | M4 | | | | |
| | Tightening torque | N⋅m | 1.2 | | | | |

^{*1.} Use the same wire size for B1 and B2.

^{*2.} Connect an OMRON power cable to the motor connection terminals.

200 VAC Input Type Wire Sizes: R88D-KT□□H

| M | odel (R88D-) | | KT01H | KT02H | KT04H | KT08H | KT10H |
|---|---------------------------|------|-----------|---------|---------------|---------------|---------------|
| Item | | Unit | KIUIH | K102H | K104H | КІООП | KITOH |
| Power supply capacity | Power supply capacity kVA | | 0.5 | 0.5 | 0.9 | 1.3 | 1.8 |
| Main circuit power supply input (L1 and L3, or L1, L2 and L3) | Rated current | А | 1.6/0.9*1 | 2.4/1.3 | 4.1/2.4 *1 | 6.6/3.6 *1 | 9.1/5.2 *1 |
| | Wire size | - | AWG14 to | 18 | | • | AWG14 |
| | Screw size | - | - | - | - | _ | _ |
| | Tightening torque | N-m | - | - | - | - | _ |
| Control circuit power | Wire size | - | AWG18 | | | | |
| supply input (L1C and L2C) | Screw size | - | - | - | - | _ | _ |
| | Tightening torque | N-m | - | - | - | - | _ |
| Motor connection | Rated current | А | 1.2 | 1.6 | 2.6 | 4.1 | 5.9 |
| terminals (U, V, W, and FG) *2 *3 | Wire size | - | AWG14 to | 18 | | • | AWG14 |
| and r O) | Screw size | - | - | - | - | _ | _ |
| | Tightening torque | N-m | - | - | - | - | _ |
| Frame ground (FG) | Wire size | - | AWG14 | | | • | |
| | Screw size | _ | M4 | | | | |
| | Tightening torque | N⋅m | 1.2 | | | | |

^{*1.} The first value is for single-phase input and the second value is for 3-phase input.

^{*2.} Use the same wire size for B1 and B2.

^{*3.} Connect an OMRON power cable to the motor connection terminals.

| Mo | odel (R88D-) | | KT15H | KT20H | KT30H | KT50H | KT75H | KT150H |
|---|-------------------|------|----------------------------|-------|------------|-------|---------------|---------------|
| Item | | Unit | KIISII | K120H | KISUH | КІЗОП | KI73II | KITSOH |
| Power supply capacity | | kVA | 2.3 | 3.3 | 4.5 | 7.5 | 11.0 | 22.0 |
| Main circuit power supply input (L1 and | Rated current | А | 14.2/ 8.1 ^{*1} | 11.8 | 15.1 | 21.6 | 32.0 | 58.0 |
| L3, or L1, L2 and L3) | Wire size | _ | AWG14 | | AWG12 | | AWG10 | AWG6 |
| | Screw size | - | _ | _ | M5 | | | M6 |
| | Tightening torque | N-m | - | - | 2.0 | | 2.0 to 2.4 | 2.2 to 2.5 |
| Control circuit power | Wire size | - | AWG18 | • | | | • | |
| supply input (L1C and L2C) | Screw size | - | _ | - | M5 | | M4 | |
| | Tightening torque | N-m | - | - | 2.0 | | 1.3 to 1.5 | 0.7 to 0.8 |
| Motor connection | Rated current | А | 9.4 | 13.4 | 18.7 | 33.0 | 44.0 | 66.1 |
| terminals (U, V, W, and FG) *2 *3 | Wire size | - | AWG14 | • | AWG12 AWG6 | | AWG4 | |
| | Screw size | - | _ | _ | M5 | | | M6 |
| | Tightening torque | N-m | - | - | 2.0 | | 2.0 to 2.4 | 2.2 to 2.5 |
| Frame ground (FG) | Wire size | - | AWG14 | • | AWG12 | | AWG6 | AWG4 |
| | Screw size | - | M4 | | M5 | | | M6 |
| | Tightening torque | N·m | 1.2 | | 2.0 | | 1.4 to 1.6 | 2.4 to 2.8 |
| Dynamic brake | Wire size | - | - | | AWG18 | | AWG18 | |
| resistance control terminals | Screw size | - | | | | | M5 | M4 |
| | Tightening torque | N-m | _ | | | | 1.3 to 1.5 | 0.7 to 0.8 |

^{*1.} The first value is for single-phase input and the second value is for 3-phase input.

^{*2.} Use the same wire size for B1 and B2.

^{*3.} Connect an OMRON power cable to the motor connection terminals.

400 VAC Input Type Wire Sizes: R88D-KT□□F

| Mod | el (R88D-) | | KT06F | KT10F | KT15F | KT20F | KT30F | KT50F | KT75F | KT150F |
|--------------------------------|-------------------|------|-------|-------|-------|-------|-------|-------|---------------|---------------|
| Item | | Unit | KIUUF | KIIUF | KIISF | KIZUF | KISUF | KISUF | KITSF | KIISUF |
| Main circuit power supply | Rated current | А | 2.1 | 2.8 | 3.9 | 5.9 | 7.6 | 12.1 | 16.0 | 29.0 |
| input (L1 and L3, or L1, L2 | Wire size | - | AWG14 | • | • | • | AWG12 | | AWG10 | AWG6 |
| and L3) | Screw size | - | _ | _ | _ | _ | M5 | | | M6 |
| | Tightening torque | N∙m | _ | - | - | _ | 2.0 | | 2.0 to 2.4 | 2.2 to 2.5 |
| Control circuit | Wire size | - | AWG20 | to 24 | • | • | AWG18 | | | |
| power supply input (L1C | Screw size | - | - | _ | _ | - | M5 | | | M4 |
| and L2C) | Tightening torque | N∙m | - | - | - | - | 2.0 | | 1.3 to 1.5 | 0.7 to 0.8 |
| Motor connection | Rated current | А | 1.5 | 2.9 | 4.7 | 6.7 | 9.4 | 16.5 | 22.0 | 33.1 |
| terminals (U, V, W, and FG) | Wire size | - | AWG14 | | | • | AWG12 | | AWG6 | AWG4 |
| *1 *2 | Screw size | - | - | - | - | - | M5 | | • | M6 |
| | Tightening torque | N∙m | - | - | - | - | 2.0 | | 2.0 to 2.4 | 2.2 to 2.5 |
| Frame ground | Wire size | - | AWG14 | | | • | AWG12 | | AWG6 | AWG4 |
| (FG) | Screw size | - | M4 | | | | M5 | | | M6 |
| | Tightening torque | N⋅m | 1.2 | | | | 2.0 | | 1.4 to 1.6 | 2.4 to 2.8 |
| Dynamic | Wire size | - | - | | | | | | AWG18 | |
| brake resistance | Screw size | _ | | | | | | | M5 | M4 |
| control terminals | Tightening torque | N∙m | _ | | | | | | 1.3 to 1.5 | 0.7 to 0.8 |

^{*1.} Use the same wire size for B1 and B2.

^{*2.} Connect an OMRON power cable to the motor connection terminals.

Wire Sizes and Allowable Current (Reference)

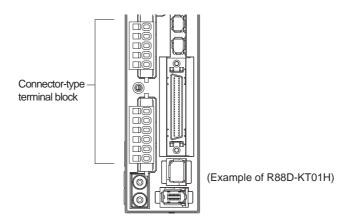
The following table shows the allowable current when there are 3 power supply wires. Use a current below these specified values.

600-V Heat-resistant Vinyl Wire (HIV)

| AWG size | Nominal cross- sectional area | Configuration (wires/mm ²) | Conductive resistance | Allowable current (A) for ambient temperature | | |
|----------|----------------------------------|--|-----------------------|---|------|------|
| | (mm ²) | (Wiles/IIIII) | (Ω/km) | 30°C | 40°C | 50°C |
| 20 | 0.5 | 19/0.18 | 39.5 | 6.6 | 5.6 | 4.5 |
| _ | 0.75 | 30/0.18 | 26.0 | 8.8 | 7.0 | 5.5 |
| 18 | 0.9 | 37/0.18 | 24.4 | 9.0 | 7.7 | 6.0 |
| 16 | 1.25 | 50/0.18 | 15.6 | 12.0 | 11.0 | 8.5 |
| 14 | 2.0 | 7/0.6 | 9.53 | 23 | 20 | 16 |
| 12 | 3.5 | 7/0.8 | 5.41 | 33 | 29 | 24 |
| 10 | 5.5 | 7/1.0 | 3.47 | 43 | 38 | 31 |
| 8 | 8.0 | 7/1.2 | 2.41 | 55 | 49 | 40 |
| 6 | 14.0 | 7/1.6 | 1.35 | 79 | 70 | 57 |
| 4 | 22.0 | 7/2.0 | 0.85 | 99 | 88 | 70 |

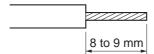
Terminal Block Wiring Procedure

On a Servo Drive with 2.0 kW or less, connector-type terminal blocks are used. The procedure for wiring these terminal blocks is explained below.



- Remove the terminal block from the Servo Drive before wiring.
 The Servo Drive may be damaged if the wiring is done with the terminal block in place.
- 2. Strip off 8 to 9 mm of the covering from the end of each wire.

Refer to "Terminal Block Wire Sizes" (P.4-27) for applicable wire sizes.



3. Open the wire insertion slots in the terminal block using a tool.

There are 2 ways to open the wire insertion slots, as follows.

- Pry the slot open using the lever that comes with the Servo Drive. (Figure A)
- Insert a flat-blade screwdriver (end width: 3.0 to 3.5 mm) into the opening for the screwdriver on the terminal block, and press down firmly to open the slot. (Figure B)

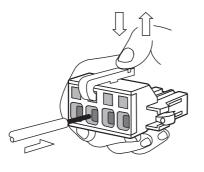


Figure A

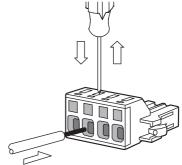


Figure B

4. With the wire insertion slot held open, insert the end of the wire.

After inserting the wire, let the slot close by releasing the pressure from the lever or the screwdriver.

5. Mount the terminal block to the Servo Drive.

After all of the terminals have been wired, return the terminal block to its original position on the Servo Drive.

Note. Some shapes of the ferrules that are connected to the lines may be difficult to insert into the connector. If so, use the following methods to insert the ferrules.

- Rotate the connector insertion orientation by 90°.
- Adjust the shape of the ferrules with pliers or other suitable tool and then insert the ferrules.

4-3 Wiring Conforming to EMC Directives

Conformance to the EMC Directives (EN 55011 Class A Group 1 (EMI) and EN 61000-6-2 (EMS)) can be ensured by wiring under the conditions described in this section.

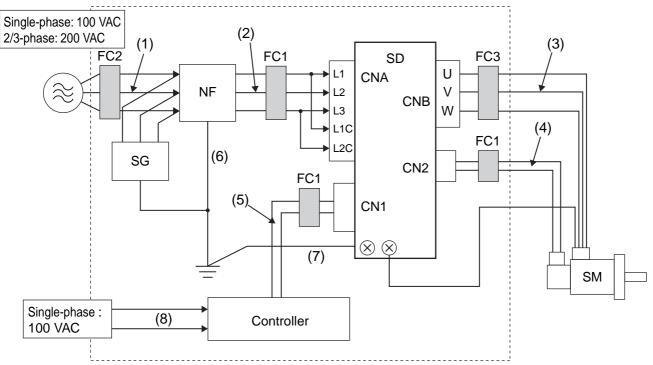
These conditions are for conformance of OMNUC G5-series products to the EMC directives. EMC-related performance of these products, however, may be influenced by the configuration, wiring, and other conditions of the equipment in which the products are installed. The EMC conformance of the system as a whole must be confirmed by the customer.

The following are the requirements for EMC Directive conformance.

- The Servo Drive must be installed in a metal case (control panel). (The motor does not, however, have to be covered with a metal plate.)
- Noise filters and lightening surge absorptive elements (surge absorbers) must be installed on power supply lines.
- Braided shielded cables must be used for all encoder cables. (Use tin-plated, mild steel wires for the shielding.)
- All cables, I/O wiring, and power lines connected to the Servo Drive must have clamp cores installed to improve the noise immunity.
- The shields of all cables must be directly connected to a ground plate.

Wiring Method

R88D-KTA5L/-KT01L/-KT02L/-KT04L/-KT01H/-KT02H/-KT04H/-KT08H/-KT10H/-KT15H/-KT20H/-KT30H/-KT50H/-KT75H/-KT150H



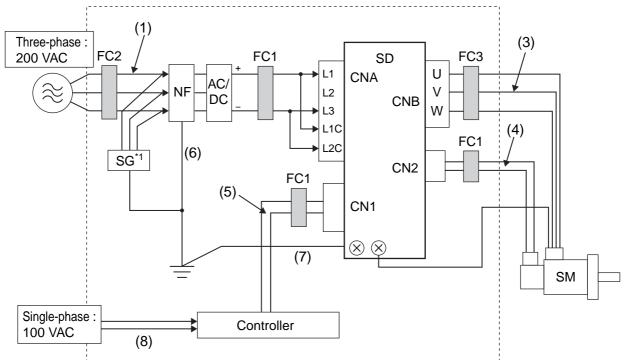
- *1. For models with a single-phase power supply input (R88D-KTA5L/-KT01L/-KT02L/-KT04L/-KT01H/-KT02H/-KT04H/-KT08H/-KT10H/-KT15H), the main circuit power supply input terminals are L1 and L3.
- Ground the motor's frame to the machine ground when the motor is on a movable shaft.
- Use a ground plate for the frame ground for each unit, as shown in the above diagrams, and ground to a single point.
- Use ground lines with a minimum thickness of 3.5 mm², and arrange the wiring so that the ground lines are as short as possible.
- A no-fuse breaker, surge absorber, and noise filter should be positioned near the input terminal block (ground plate), and I/O lines should be separated and wired at the shortest distance.

Unit Details

| Symbol | Name | Manufacturer | Model | Comment |
|--------|----------------|-------------------------------------|-----------------|--------------------------------|
| SG | Surge absorber | Okaya Electric Industries Co., Ltd. | R-A-V-781BXZ-4 | 3-phase 200 VAC |
| | | | SUP-EK5-ER-6 | Single-phase 100/200 VAC (5 A) |
| | | Okaya Electric | 3SUP-HU10-ER-6 | 3-phase 200 VAC (10 A) |
| NF | Noise filter | Industries Co., Ltd. | 3SUP-HU30-ER-6 | 3-phase 200 VAC (30 A) |
| INIT | Noise ilitei | | 3SUP-HL50-ER-6B | 3-phase 200 VAC (50 A) |
| | | Schaffner EMC Inc. | FS5559-60-34 | 3-phase 200 VAC (60 A) |
| | | Schainler Livic Inc. | FS5559-80-34 | 3-phase 200 VAC (80 A) |
| SD | Servo Drive | OMRON | - | *1 |
| SM | Servomotor | OMRON | _ | *1 |
| FC1 | Clamp core | TDK | ZCAT3035-1330 | - |
| FC2 | Clamp core | Kanna Industry | RJ8035 | |
| FG2 | Clamp core | Konno Industry | RJ8095 | _ |
| FC3 | Clamp core | MICROMETALS | T400-61D | For R88D-KT75H/-KT150H |
| 1 03 | Clarip Core | TDK | ZCAT3035-1330 | For other models |
| _ | Controller | _ | _ | - |

^{*1.} A specified combination of Servo Drive and Servomotor must be used.

R88D-KT75H/-KT150H with DC Power Supply Input



Note. The main circuit power supply input terminals are L1 and L3. Connect the positive line to L1 and the negative line to L3.

- Ground the motor's frame to the machine ground when the motor is on a movable shaft.
- Use a ground plate for the frame ground for each Unit, as shown in the above diagrams, and ground to a single point.
- Use ground lines with a minimum thickness of 3.5 mm², and arrange the wiring so that the

ground lines are as short as possible.

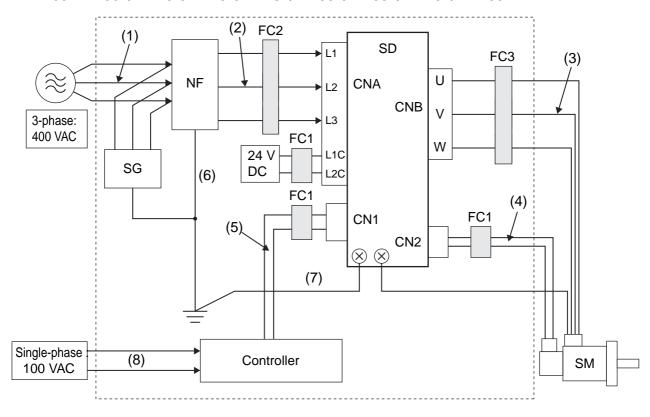
• A no-fuse breaker, surge absorber, and noise filter should be positioned near the input terminal block (ground plate), and I/O lines should be separated and wired at the shortest distance.

Unit Details

| Symbol | Name | Manufacturer | Model | Comment |
|--------|----------------|-------------------------------------|----------------|------------------------|
| SG | Surge absorber | Okaya Electric Industries Co., Ltd. | R·A·V-781BXZ-4 | 3-phase 200 VAC |
| NF | Noise filter | Schaffner EMC Inc. | FN258-42-07 | 3-phase 200 VAC (42 A) |
| SD | Servo Drive | OMRON | _ | *1 |
| SM | Servomotor | OMRON | _ | *1 |
| FC1 | Clamp core | TDK | ZCAT3035-1330 | _ |
| FC2 | Clamp core | Konno Industry | RJ8095 | _ |
| FC3 | Clamp core | MICROMETALS | T400-61D | _ |
| _ | Controller | _ | _ | _ |

^{*1.} A specified combination of Servo Drive and Servomotor must be used.

R88D-KT06F/-KT10F/-KT15F/-KT20F/-KT30F/-KT50F/-KT75F/-KT150F



Unit Details

| Symbol | Name | Manufacturer | Model | Comment |
|--------|----------------|-------------------------------------|----------------|------------------------|
| SG | Surge absorber | Okaya Electric Industries Co., Ltd. | R·A·V-801BXZ-4 | |
| | | | FN258L-16-07 | 3-phase 400 VAC (16 A) |
| NF | Noise filter | Schaffner EMC Inc. | FN258L-30-07 | 3-phase 400 VAC (30 A) |
| | | | FN258-42-07 | 3-phase 400 VAC (42 A) |
| SD | Servo Drive | OMRON | _ | *1 |
| SM | Servomotor | OMRON | _ | *1 |
| FC1 | Clamp core | TDK | ZCAT3035-1330 | - |
| FC2 | Clamp core | Konno Industry | RJ8035 | |
| F02 | Clamp core | Konno maastry | RJ8095 | _ |
| FC3 | Clamp coro | MICROMETALS | T400-61D | For R88D-KT75F/-KT150F |
| FUS | Clamp core | TDK | ZCAT3035-1330 | For other models |
| _ | Controller | _ | _ | - |

^{*1.} A specified combination of Servo Drive and Servomotor must be used.

Cable Details

| Symbol | Supplies from | Connects to | Cable name | Length | Comment | Shielded | Ferrite |
|--------|-----------------|--------------|-------------------|--------|---------|----------|----------|
| (1) | AC power supply | Noise filter | Power supply line | 2 m | _ | No | No |
| (2) | Noise filter | Servo Drive | Power supply line | 2 m | _ | No | Optional |
| (3) | Servo Drive | Servomotor | Power cable | 20 m | _ | No | Optional |
| (4) | Servo Drive | Servomotor | Encoder cable | 20 m | _ | Yes | Optional |
| (5) | Switch box | Servo Drive | I/O cable | 2 m | _ | No | Optional |
| (6) | Frame ground | Noise filter | FG line | 1.5 m | _ | No | No |
| (7) | Frame ground | Servo Drive | FG line | 1.5 m | _ | No | No |
| (8) | AC power supply | Controller | Power supply line | 1.5 m | _ | No | No |

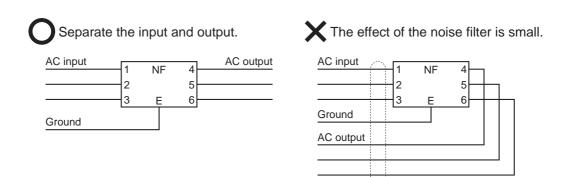
Noise Filter for Power Supply Input

We recommend you to use the noise filter for the Servo Drive.

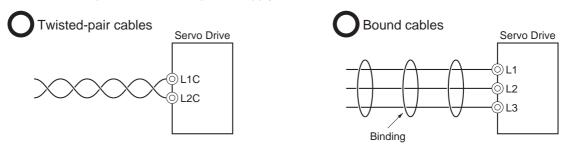
| ı | Drive | Noise filter for power supply input | | | | | |
|--------------|---------------------------|-------------------------------------|---------------|--------------------------------|-------------------|--|--|
| Phase | Model | Model | Rated current | Leakage current (60 Hz) max | Manufacturer | | |
| Single-phase | R88D-K□A5L□□ | | | | | | |
| | R88D-K□01L□□ | SUP-EK5-ER-6 | 5A | 1.0mA (at 250 VAC) | | | |
| | R88D-K□02L□□ | | | | | | |
| Single-phase | R88D-K□04L□□ | 3SUP-HU10-ER-6 | 10A | 3.5mA (at 500 VAC) | | | |
| Single-phase | R88D-K□01H□□ | SUP-EK5-ER-6 | 5A | 1.0mA (at 250 VAC) | | | |
| 3-phase | ROOD-REOTTEE | 3SUP-HU10-ER-6 | 10A | 3.5mA (at 500 VAC) | | | |
| Single-phase | R88D-K□02H□□ | SUP-EK5-ER-6 | 5A | 1.0mA (at 250 VAC) | | | |
| 3-phase | ROOD-REOZITEE | 3SUP-HU10-ER-6 | 10A | 3.5mA (at 500 VAC) | Okaya Electric | | |
| Single-phase | R88D-K□04H□□ | SUP-EK5-ER-6 | 5A | 1.0mA (at 250 VAC) | Industries | | |
| 3-phase | R88D-K□08H□□ | 3SUP-HU10-ER-6 | 10A | 3.5mA (at 500 VAC) | Co., Ltd. | | |
| Single or 3- | R88D-K 10H | | | | | | |
| phase | R88D-K 15H 0 | 3SUP-HU30-ER-6 | 30A | 3.5mA (at 500 VAC) | | | |
| | R88D-K□20H□□ | 3SUP-HU50-ER-6 | 50A | 3.5mA (at 500 VAC) | | | |
| | R88D-K□30H□□ R88D-K□50H□□ | 3SUP-HL50-ER-6B | 50A | 8.0mA (at 500 VAC) | | | |
| | R88D-K□75H□□ | FS5559-60-34 | 60A | 1.35mA (at 480 VAC/50 Hz) | | | |
| | R88D-K□150H□□ | FS5559-80-34 | 80A | 1.35mA (at 480 VAC/50 Hz) | | | |
| 3-phase | R88D-K□06F□□ | | | | | | |
| | R88D-K□10F□□ | FN258L-16-07 | 16A | 0.8mA | Schaffner | | |
| | R88D-K□15F□□ | FN230L-10-07 | 104 | (at 440 VAC/50 Hz) | EMC Inc. | | |
| | R88D-K□20F□□ | | | | | | |
| | R88D-K□30F□□ | FN258L-30-07 | 30A | 0.8mA | | | |
| | R88D-K□50F□□ | 1142301-30-07 | 307 | (at 440 VAC/50 Hz) | | | |
| | R88D-K□75F□□ | FN258-42-07 | 42A | 25.8mA | | | |
| | R88D-K□150F□□ | 111200-42-01 | 74/1 | (at 440 VAC/50 Hz) | | | |

[•] For operations, if no-fuse breakers are installed at the top and the power supply line is wired from the lower duct, use metal tubes for wiring or make sure that there is adequate distance between the input lines and the internal wiring. If input and output lines are wired together, noise resistance will decrease.

[•] The noise filter must be installed as close as possible to the entrance of the control panel. Wire as shown at the left in the following illustration.

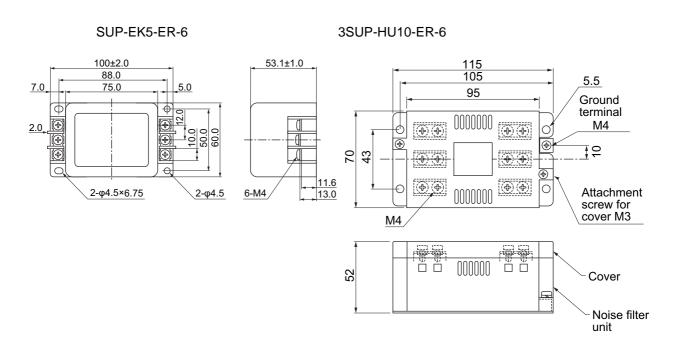


• Use twisted-pair cables for the power supply cables, or bind the cables.



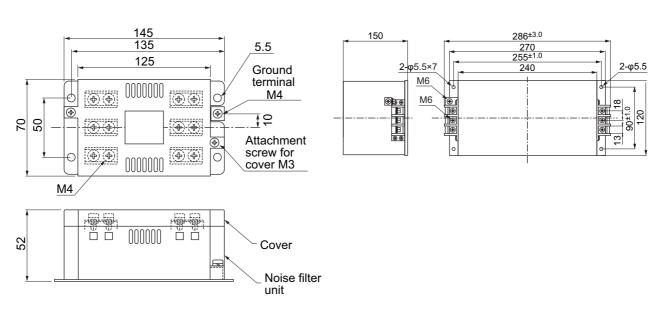
Separate power supply lines and signal lines when wiring.

External Dimensions

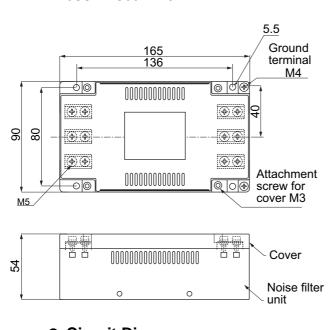


3SUP-HU30-ER-6

3SUP-HL50-ER-6B



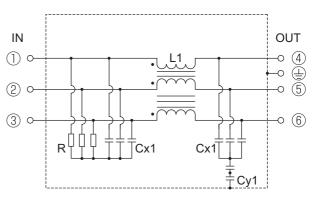
3SUP-HU50-ER-6



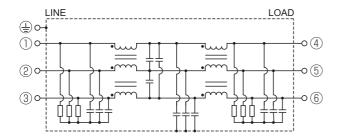
Circuit Diagram



3SUP-HU10-ER-6/3SUP-HU30-ER-6 3SUP-HU50-ER-6



3SUP-HL50-ER-6B



Noise Filter for the Brake Power Supply

• We recommend using a noise filter for the Servo Drive.

| Model | Rated current | Rated voltage | Leakage current | Manufacturer |
|--------------|---------------|---------------|-----------------------------|--|
| SUP-EK5-ER-6 | 5 A | 250 V | 1.0 mA (at 250 Vrms, 60 Hz) | Okaya Electric Industries Co., Ltd. |

Note. Noise can also be reduced by 1.5 turns with the ZCAT3035-1330 (TDK) Clamp Core.

Control Panel Structure

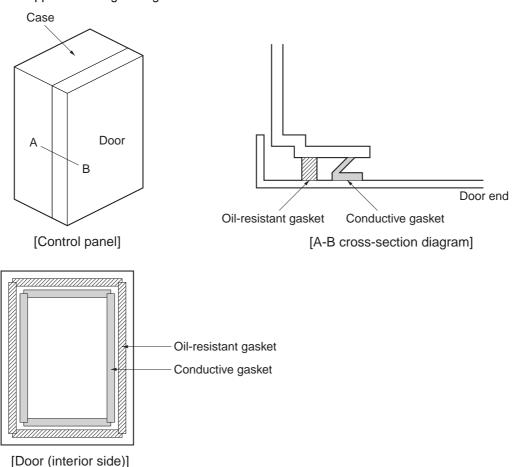
Openings in the control panel, such as holes for cables, panel mounting holes, and gaps around the door, may allow electromagnetic waves into the panel. To prevent this, observe the recommendations described below when designing or selecting a control panel.

Case Structure

- Use a metal control panel with welded joints at the top, bottom, and sides so that the surfaces are electrically conductive.
- If assembly is required, strip the paint off the joint areas (or mask them during painting), to make them electrically conductive.
- The panel may warp and gaps may appear when screws are tightened. Be sure that no gaps appear when tightening screws.
- Do not leave any conductive part unconnected.
- Ground all units within the case to the case itself.

Door Structure

- Use a metal door.
- Use a water-draining structure where the door and case fit together, and leave no gaps. (Refer to the diagrams.)
- Use a conductive gasket between the door and the case. (Refer to the diagrams.)
- Strip the paint off the sections of the door and case that will be in contact with the conductive gasket (or mask them during painting), so that they are electrically conductive.
- The panel may warp and gaps may appear when screws are tightened. Be sure that no gaps appear when tightening screws.



Selecting Connection Component

This section explains the criteria for selecting the connection components required to improve noise resistance. Understand each component's characteristics, such as its capacity, performance, and applicable range when selecting the connection components.

For more details, contact the manufacturers directly.

No-fuse Breaker (NFB)

When selecting a no-fuse breaker, consider the maximum input current and the inrush current.

Maximum Input Current

• The momentary maximum output of the Servo Drive is approx. 3 times the rated output, and can be output for up to 3 seconds.

Therefore, select no-fuse breakers with an operation time of at least 5 seconds at 300% of the rated current ratio. General and low-speed no-fuse breakers are generally suitable.

- Select a no-fuse breaker with a rated current greater than the total effective load current of all the motors (when multiple Servo Drives are used). (The rated current of the power supply input for each motor is provided in "Main Circuit and Motor Connections" (P.4-18).)
- Add the current consumption of other controllers, and any other components when selecting.

Inrush Current

- The following table lists the Servo Drive inrush currents.
- With low-speed no-fuse breakers, an inrush current 10 times the rated current can flow for 0.02 second.
- When the power of multiple Servo Drives are turned ON simultaneously, select a no-fuse breaker with a 20-ms allowable current that is greater than the total inrush current, shown in the following table.

| | Inrush cur | rent (A0-p) |
|-------------------|---------------------------|------------------------------|
| Servo Drive model | Main circuit power supply | Control circuit power supply |
| R88D-KTA5L | 7 | 14 |
| R88D-KT01L | 7 | 14 |
| R88D-KT02L | 7 | 14 |
| R88D-KT04L | 15 | 14 |
| R88D-KT01H | 14 | 28 |
| R88D-KT02H | 14 | 28 |
| R88D-KT04H | 14 | 28 |
| R88D-KT08H | 29 | 28 |
| R88D-KT10H | 29 | 28 |
| R88D-KT15H | 29 | 28 |
| R88D-KT20H | 29 | 14 |
| R88D-KT30H | 22 | 14 |
| R88D-KT50H | 22 | 14 |
| R88D-KT75H | 66 | 15 |
| R88D-KT150H | 66 | 15 |

| | Inrush current (A0-p) | | | |
|-------------------|---------------------------|------------------------------|--|--|
| Servo Drive model | Main circuit power supply | Control circuit power supply | | |
| R88D-KT06F | 28 | 48 | | |
| R88D-KT10F | 28 | 48 | | |
| R88D-KT15F | 28 | 48 | | |
| R88D-KT20F | 32 | 48 | | |
| R88D-KT30F | 32 | 48 | | |
| R88D-KT50F | 32 | 48 | | |
| R88D-KT75F | 32 | 48 | | |
| R88D-KT150F | 32 | 48 | | |

Leakage Breaker

- Select a leakage breaker for high frequencies and surge resistance.
- When selecting leakage breakers, remember to add the leakage current from devices other than

the motor, such as devices using a switching power supply, noise filters, inverters, and so on. To prevent malfunction due to inrush current, we recommend using a leakage breaker of 10 times the total of all leakage current values.

- The leakage breaker is activated at 50% of the rated current. Select a leakage breaker with approx. twice the capacity.
- For details on leakage breakers selection method, refer to the manufacturer's catalog.
- Because switching takes place inside the Servo Drives, high-frequency current leaks from the SW elements of the Servo Drive, the armature of the motor, and the cables.

High-frequency, surge-resistant leakage breakers, because they do not detect high-frequency current, can prevent operation with high-frequency leakage current.

When using a general leakage breaker, use 3 times the total of the leakage current given in the following table as a reference value.

| Servo Drive model | Input power supply | Leakage current (Cable: 3 m) | Increase per 10 m of cable | |
|-------------------|-----------------------|------------------------------|----------------------------|--|
| R88D-KTA5L | Single-phase 100 V | 0.38 mA | | |
| R88D-KT01L | Single-phase 100 V | 0.39 mA | 0.1 mA | |
| R88D-KT02L | Single-phase 100 V | 0.41 mA | | |
| R88D-KT04L | Single-phase 100 V | 0.46 mA | 0.12 mA | |
| R88D-KT01H | Single-phase 200 V | 0.83 mA | | |
| KOOD-KTOTTI | 3-phase 200 V | | | |
| R88D-KT02H | Single-phase 200 V | 0.84 mA | - 0.23 mA | |
| K00D-K10211 | 3-phase 200 V | 1.02 mA | | |
| R88D-KT04H | Single-phase 200 V | 0.96 mA | 0.3 mA | |
| K00D-K104H | 3-phase 200 V | 1.27 mA | 0.5 IIIA | |
| R88D-KT08H | Single-phase 200 V | 1.01 mA | 1.1 mA | |
| KOOD-KTOOIT | 3-phase 200 V | 1.39 mA | 1.11111A | |
| R88D-KT10H | Single-phase 200 V | 0.88 mA | | |
| KOOD-KI IOII | 3-phase 200 V | 3-phase 200 V 1.14 mA | | |
| R88D-KT15H | Single-phase 200 V | 0.96 mA | - 0.93 mA | |
| K00D-K11311 | 3-phase 200 V | 1.18 mA | | |
| R88D-KT20H | 3-phase 200 V | 1.53 mA | | |
| R88D-KT30H | 3-phase 200 V | 1.52 mA | 1.23 mA | |
| R88D-KT50H | 3-phase 200 V | 1.39 mA | | |
| R88D-KT75H | 3-phase 200 V | 3.50 mA | 2.07 mA | |
| R88D-KT150H | 3-phase 200 V | 5.30 mA | 1.13 mA | |
| R88D-KT06F | 3-phase 400 V | 2.28 mA | 1.8 mA | |
| R88D-KT10F | 3-phase 400 V | 2.20 mA | 1.0 IIIA | |
| R88D-KT15F | 3-phase 400 V | 2.55 mA | 2.03 mA | |
| R88D-KT20F | 3-phase 400 V | 2.92 mA | 2.4 mA | |
| R88D-KT30F | 3-phase 400 V | | 3.23 mA | |
| R88D-KT50F | 3-phase 400 V | 3.54 mA | 2.9 mA | |
| R88D-KT75F | 3-phase 400 V | 6.70 mA | 3.73 mA | |
| R88D-KT150F | 3-phase 400 V 10.40 r | | 2.73 mA | |

Note: These values vary greatly depending on the installation conditions of the motor power cable and the measurement conditions. Use them for reference only.

Surge Absorber

- Use surge absorbers to absorb lightning surge voltage and abnormal voltage from power supply input lines.
- When selecting surge absorbers, take into account the varistor voltage, the surge immunity and the energy tolerated dose.
- For 200-VAC systems, use surge absorbers with a varistor voltage of 620 V.
- The surge absorbers shown in the following table are recommended.

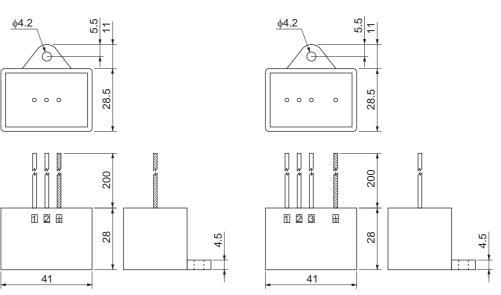
| Manufacturer | Model | Surge immunity | | Туре | Comment |
|--|----------------|----------------|--------|-------|-----------------------------|
| Okaya Electric Industries Co., Ltd. | R•A•V-781BWZ-4 | 700 V ± 20% | 2500 A | | Single-phase 100/200 VAC |
| Okaya Electric Industries Co., Ltd. | R•A•V-781BXZ-4 | 700 V ± 20% | 2500 A | Block | 3-phase 200 VAC |
| Okaya Electric Industries Co., Ltd. | R•A•V-801BXZ-4 | 800 V ± 20% | 2500 A | | 3-phase 400 VAC |

- Note 1. Refer to the manufacturers' catalog for operating details.
- Note 2. The surge immunity is for a standard impulse current of $8/20~\mu s$. If pulses are wide, either decrease the current or change to a larger-capacity surge absorber.

External Dimensions

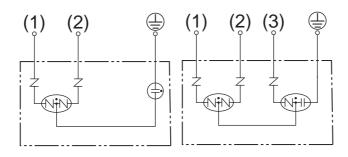
For single-phase (BWZ series)

For 3-phase (BXZ series)



Equalizing Circuits

For single-phase (BWZ series) For 3-phase (BXZ series)



Radio Noise Filter and Emission Noise Prevention Clamp Core

Use one of the following filters to prevent switching noise of PWM of the Servo Drive and to prevent noise emitted from the internal clock circuit.

| Model | Manufacturer | Application |
|------------------|----------------|---|
| 3G3AX-ZCL1 *1 | OMRON | For Drive output and power cable |
| 3G3AX-ZCL2 *2 | OMRON | For Drive output and power cable |
| ESD-R-47B *3 | NEC TOKIN | For Drive output and power cable |
| ZCAT3035-1330 *4 | TDK | For Encoder cable and I/O cable |
| RJ8035 | Konno Industry | For power lines |
| RJ8095 | Konno Industry | For power lines |
| T400-61D | MICROMETALS | For Servo Drive output and power cables |

^{*1.} Generally used for 1.5 kW or higher.

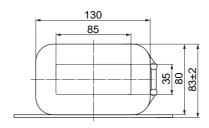
^{*2.} Generally used for 1.5 kW or lower. The maximum number of windings is 3 turns.

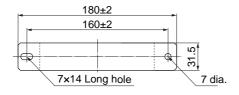
^{*3.} Generally used for 50/100 W. The maximum number of windings is 2 turns.

^{*4.} Also used on the Drive output power lines to comply with the EMC Directives. Only a clamp is used. This clamp can also be used to reduce noise current on a FG line.

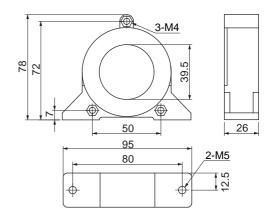
External Dimensions

3G3AX-ZCL1

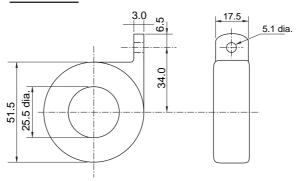




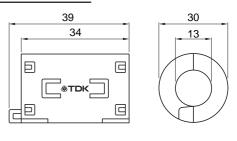
3G3AX-ZCL2



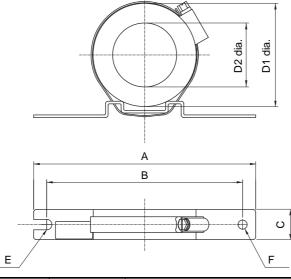
ESD-R-47B



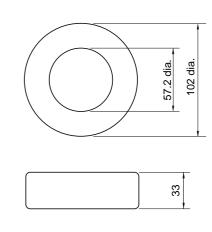
ZCAT3035-1330



RJ8035/RJ8095



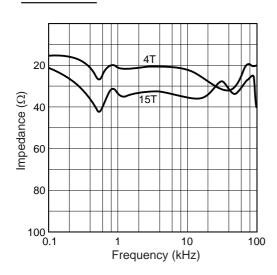
T400-61D



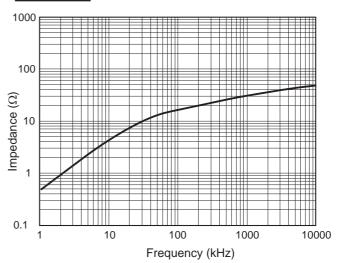
| | | Dimensions (unit: mm) | | | | | | | |
|--------|---------|-----------------------|-----|----|-----|-----|----------------|------|---|
| Model | Current | A | В | С | D1 | D2 | Core thickness | E | F |
| RJ8035 | 35 A | 170 | 150 | 23 | 80 | 53 | 24 | R3.5 | 7 |
| RJ8095 | 95 A | 200 | 180 | 34 | 130 | 107 | 35 | R3.5 | 7 |

Impedance Characteristics

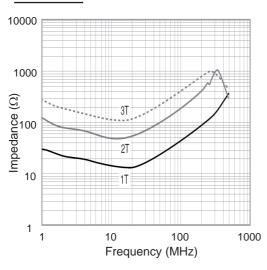




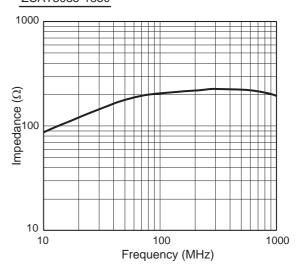
3G3AX-ZCL2

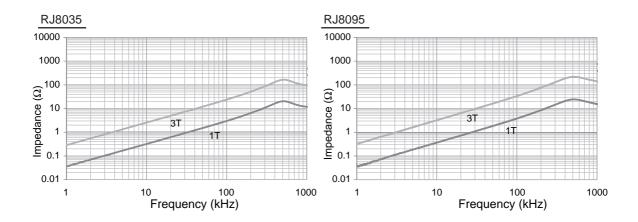


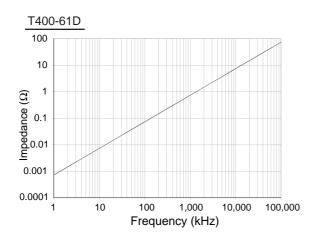
ESD-R-47B



ZCAT3035-1330







Surge Suppressor

- Install surge suppressors for loads that have induction coils, such as relays, solenoids, brakes, clutches, etc.
- The following table shows the types of surge suppressors and recommended products.

| Туре | Feature | Recommended product |
|--------------------------|--|---|
| Diodes | Diodes are used for relatively small loads such as relays when the reset time is not a critical issue. At power shutoff the surge voltage is the lowest, but the reset time takes longer. Used for 24/48-VDC systems. | Use a fast-recovery diode with a short reverse recovery time. (e.g., RU2 of Sanken Electric Co., Ltd.). |
| Thyristors and varistors | Thyristors and varistors are used for loads when induction coils are large, as in electromagnetic brakes, solenoids, etc., and when reset time is critical. The surge voltage at power shutoff is approx. 1.5 times the varistor voltage. | Select the varistor voltage as follows. 24-VDC systems: varistor voltage 39 V 100-VDC systems: varistor voltage 200 V 100-VAC systems: varistor voltage 270 V 200-VAC systems: varistor voltage 470 V |
| Capacitor + resistor | The capacitor plus resistor combination is used to absorb vibration in the surge at power supply shutoff. The reset time can be shortened by selecting the appropriate capacitance and resistance. | Okaya Electric Industries Co., Ltd. XEB12002 0.2 μ F-120 Ω XEB12003 0.3 μ F-120 Ω |

[•] Thyristors and varistors are made by the following manufacturers. Refer to manufacturer's documentation for details on these components.

Thyristors: Ishizuka Electronics Co.

Varistor: Ishizuka Electronics Co., Panasonic Corporation

Contactor

- Select contactors based on the circuit's inrush current and the maximum momentary phase current.
- The drive inrush current is covered in the preceding explanation of no-fuse breaker selection.

 And the maximum momentary phase current is approx. twice the rated current.

Improving Encoder Cable Noise Resistance

Take the following steps during wiring and installation to improve the encoder's noise resistance.

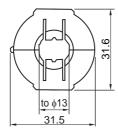
- Always use the specified encoder cables.
- Do not coil cables. If cables are long and are coiled, mutual induction and inductance will increase and cause malfunctions. Always use cables fully extended.
- When installing noise filters for encoder cables, use clamp cores.
- The following table shows the recommended clamp cores.

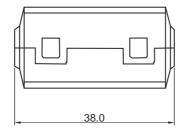
| Manufacturer | Product name | Model | Specifications |
|--------------|--------------|---------------|----------------------------|
| NEC TOKIN | Clamp core | ESD-SR-250 | For cable dia. up to 13 mm |
| TDK | Clamp core | ZCAT3035-1330 | For cable dia. up to 13 mm |

• Do not place the encoder cable with the following cables in the same duct. Control cables for brakes, solenoids, clutches, and valves.

External Dimensions

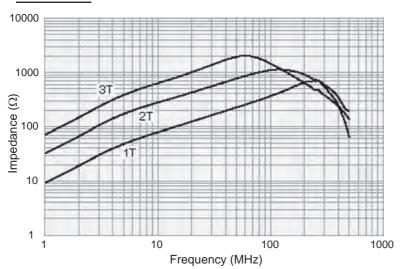
ESD-SR-250





Impedance Characteristics

ESD-SR-250



Refer to the following sections for the dimensions and impedance characteristics of the ZCAT3035-1330: "External Dimensions" (P.4-46) and "Impedance Characteristics" (P.4-47).

Improving Control I/O Signal Noise Resistance

Positioning can be affected and I/O signal errors can occur if control I/O is influenced by noise.

- Use completely separate power supplies for the control I/O power supply (especially 24 VDC) and the external operation power supply. In particular, do not connect the 2 power supply ground wires.
- Install a noise filter on the primary side of the control I/O power supply.
- If motors with brakes are being used, do not use the same 24-VDC power supply for both the brakes and the control I/O. Additionally, do not connect the ground wires. Connecting the ground wires may cause I/O signal errors.
- Keep the power supply for pulse commands and error counter reset input lines separated from the control I/O power supply as far as possible. In particular, do not connect the 2 power supply ground wires.
- We recommend using line drivers for the pulse command outputs.
- Always use twisted-pair shielded cable for the pulse command and error counter reset signal lines, and connect both ends of the shield cable to frame grounds.
- If the control I/O power supply wiring is long, noise resistance can be improved by adding $1-\mu F$ laminated ceramic capacitors between the control I/O power supply and ground at the drive input section or the controller output section.
- For open collector inputs/outputs, keep the length of wires to within 2 m.

Reactor to Reduce Harmonic Current

Harmonic Current Measures

- Use a Reactor to suppress harmonic currents. The Reactor functions to suppress sudden and quick changes in electric currents.
- The Guidelines for Suppressing Harmonic Currents in Home Appliances and General Purpose Components requires that manufacturers take appropriate remedies to suppress harmonic current emissions onto power supply lines.
- Select the proper Reactor model according to the Servo Drive to be used.

| Servo | Drive | Reactor | | | | |
|--------------|------------------------|---------------------|--------|------------|-----------------|--|
| Model | Number of power phases | Model Rated current | | Inductance | Weight | |
| R88D-KTA5L | | 3G3AX-DL2002 | 1.6 A | 21.4 mH | Approx. 0.8 kg | |
| R88D-KT01L | Single-phase | 3G3AX-DL2004 | 3.2 A | 10.7 mH | Approx. 1.0 kg | |
| R88D-KT02L | Sirigie-priase | 3G3AX-DL2007 | 6.1 A | 6.75 mH | Approx. 1.3 kg | |
| R88D-KT04L | | 3G3AX-DL2015 | 9.3 A | 3.51 mH | Approx. 1.6 kg | |
| R88D-KT01H | Single-phase | 3G3AX-DL2002 | 1.6 A | 21.4 mH | Approx. 0.8 kg | |
| KOOD-KTOTTI | Three-phase | 3G3AX-AL2025 | 10.0 A | 2.8 mH | Approx. 2.8 kg | |
| R88D-KT02H | Single-phase | 3G3AX-DL2004 | 3.2 A | 10.7 mH | Approx. 1.0 kg | |
| K00D-K10211 | Three-phase | 3G3AX-AL2025 | 10.0 A | 2.8 mH | Approx. 2.8 kg | |
| R88D-KT04H | Single-phase | 3G3AX-DL2007 | 6.1 A | 6.75 mH | Approx. 1.3 kg | |
| K00D-K104H | Three-phase | 3G3AX-AL2025 | 10.0 A | 2.8 mH | Approx. 2.8 kg | |
| R88D-KT08H | Single-phase | 3G3AX-DL2015 | 9.3 A | 3.51 mH | Approx. 1.6 kg | |
| K00D-K10011 | Three-phase | 3G3AX-AL2025 | 10.0 A | 2.8 mH | Approx. 2.8 kg | |
| R88D-KT10H | Single-phase | 3G3AX-DL2015 | 9.3 A | 3.51 mH | Approx. 1.6 kg | |
| KOOD-KITOIT | Three-phase | 3G3AX-AL2025 | 10.0 A | 2.8 mH | Approx. 2.8 kg | |
| R88D-KT15H | Single-phase | 3G3AX-DL2022 | 13.8 A | 2.51 mH | Approx. 2.1 kg | |
| 100D-1011311 | Three-phase | 3G3AX-AL2025 | 10.0 A | 2.8 mH | Approx. 2.8 kg | |
| R88D-KT20H | | 3G3AX-AL2055 | 20.0 A | 0.88 mH | Approx. 4.0 kg | |
| R88D-KT30H | | 000/01/12000 | 20.07 | | Approx. 4.0 kg | |
| R88D-KT50H | | 3G3AX-AL2110 | 37.0 A | 0.35 mH | Approx. 5.0 kg | |
| R88D-KT75H | | 3G3AX-AL2220 | 70.0 A | 0.18 mH | Approx. 10.0 kg | |
| R88D-KT150H | | 303AA-ALZZZ0 | 70.0 A | 0.1011111 | Approx. 10.0 kg | |
| R88D-KT06F | | | | | | |
| R88D-KT10F | Three-phase | 3G3AX-AL4025 | 6.0 A | 7.7 mH | Approx. 2.7 kg | |
| R88D-KT15F | | | | | | |
| R88D-KT20F | | 3G3AX-AL4055 | 10.0 A | 3.5 mH | Approx. 4.0 kg | |
| R88D-KT30F | | JGJAA-AL4033 | 10.0 A | J.J IIII I | Αρριολ. 4.0 kg | |
| R88D-KT50F | | 3G3AX-AL4110 | 20.0 A | 1.3 mH | Approx. 6.0 kg | |
| R88D-KT75F | | 3G3AX-AL4220 | 36.0 A | 0.74 mH | Approx. 10.0 kg | |
| R88D-KT150F | | 000AA-AL4220 | 30.0 A | 0.74 11111 | Applox. 10.0 kg | |

4-4 Regenerative Energy Absorption

A Servo Drive uses its built-in capacitors to absorb the regenerative energy produced during motor deceleration. If the amount of regenerative energy is too much for the built-in capacitors to absorb, it also uses an Internal Regeneration Resistor. An overvoltage error occurs, however, if the amount of regenerative energy from the Servomotor is too large. If this occurs, reduce the regenerative energy by changing operating patterns or increase the regeneration process capacity by connecting External Regeneration Units.



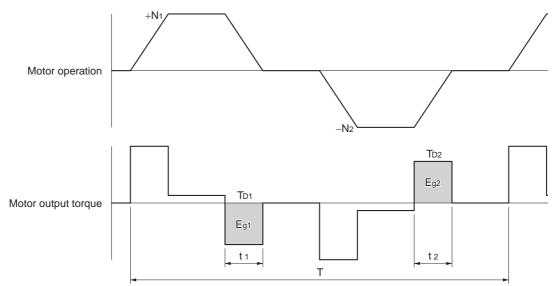
Precautions for Correct Use

- Some Servo Drive models do not have any built-in Internal Regeneration Resistor.
- The regeneration absorption capacity of a Servo Drive varies depending on the Servo Drive model.

For information on whether or not your Servo Drive has an Internal Regeneration Resistor and its regeneration absorption capacity, refer to Servo Drive Regeneration Absorption Capacity (P.4-56).

Regenerative Energy Calculation

The method for calculating regenerative energy on the horizontal axis is indicated below.



- In the output torque graph, acceleration in the forward direction is shown as positive, and acceleration in the reverse direction is shown as negative.
- The regenerative energy values in each region can be derived from the following equations.

$$\begin{split} & \cdot \, E_{\text{g1}} \! = \! \frac{1}{2} \! \cdot \! \frac{2 \pi}{60} \cdot \, N_1 \cdot T_{\text{D1}} \cdot t_1 \quad [J] \\ & \cdot \, E_{\text{g2}} \! = \! \frac{1}{2} \! \cdot \! \frac{2 \pi}{60} \cdot N_2 \cdot T_{\text{D2}} \cdot t_2 \quad [J] \end{split}$$

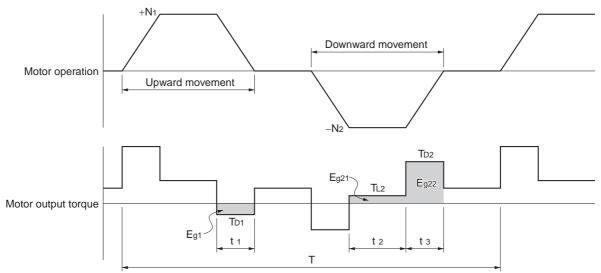
N₁, N₂: Rotation speed at start of deceleration [r/min]

 T_{D1} , T_{D2} : Deceleration torque [N·m]

t₂ : Deceleration time

Note. Due to the loss of motor winding resistance and PWM, the actual regenerative energy will be approx. 90% of the values derived from these equations.

The method for calculating regenerative energy on the vertical axis is indicated below.



- In the output torque graph, acceleration in the forward direction (rising) is shown as positive, and acceleration in the reverse direction (falling) is shown as negative.
- The regenerative energy values in each region can be derived from the following equations.

$$\cdot \; E_{g1} = \frac{1}{2} \cdot \frac{2\pi}{60} \cdot \; N_1 \cdot T_{D1} \cdot t_1 \qquad \quad [J]$$

$$\cdot \mathsf{E}_{\mathsf{g22}} = \frac{1}{2} \cdot \frac{2\pi}{60} \cdot \mathsf{N}_2 \cdot \mathsf{T}_{\mathsf{D2}} \cdot \mathsf{t}_3 \qquad [\mathsf{J}]$$

$$\cdot E_{g2} = E_{g21} + E_{g22}$$
 [J

N₁, N₂ : Rotation speed at start of deceleration [r/min]

T_{D1} , T_{D2} : Deceleration torque $[N \cdot m]$

: Torque during downward movement T₁₂ $[N \cdot m]$

t1. t3 : Deceleration time [s]

: Constant-speed driving time during downward movement [s]

Note. Due to the loss of winding resistance, the actual regenerative energy will be approx. 90% of the values derived from these equations.

Determining the Capacity of Regenerative Energy Absorption by Built-in Capacitors

If both the values E_{g1} and E_{g2} [J] mentioned above are equal to or less than the value of the Servo Drive's regenerative energy that can be absorbed by built-in capacitors E_{g1} , the Servo Drive can process regenerative energy only by its built-in capacitors.

If either the value E_{g1} or E_{g2} [J] exceeds the value of the Servo Drive's regenerative energy that can be absorbed by built-in capacitors Ec [J], however, use the following equations to determine the average regeneration power Pr [W].

$$\cdot E_g = (E_{g1} - E_c) + (E_{g2} - E_c)$$
 [J]
 $\cdot P_r = E_g/T$ [W]

Pr: Average regeneration power that must be absorbed in 1 cycle of operation [W]

E₃: Regenerative energy that must be absorbed in 1 cycle of operation [J]

Ec: Regenerative energy that can be absorbed by built-in capacitors [J]

T: Operation cycle [s]

Note. If the expression $(E_{g1} - E_c)$ result is zero or less, regard it as 0. The expression $(E_{g2} - E_c)$ must also be handled in the same way.

The above expressions calculate the average regeneration power Pr [W], which cannot be absorbed by the built-in capacitors. If this average regeneration power Pr [W] is equal to or less than the average amount of regeneration that can be absorbed by the Servo Drive's Internal Regeneration Resistor, the Servo Drive can independently process the regenerative energy.

If this average regeneration power Pr [W] cannot be processed only by the Servo Drive, take the following processes.

- Connect an External Regeneration Resistor. (Regeneration process capacity improves.)
- Reduce the rotation speed. (The amount of regeneration is proportional to the square of the rotation speed.)
- Lengthen the deceleration time. (Regenerative energy per unit time decreases.)
- Lengthen the operation cycle, i.e., the cycle time. (Average regenerative power decreases.)

Servo Drive Regeneration Absorption Capacity

The following table shows the regenerative energy (and amount of regeneration) that each Servo Drive can absorb. If these values are exceeded, take the processes above.

| Servo Drive model | Regenerative energy to be absorbed by built-in capacitor [J] | Internal regeneration resistor Average amount of regenerative energy to be absorbed [W] | Allowable minimum regeneration resistance [Ω] |
|-------------------|--|--|--|
| R88D-KTA5L | 11 | - | 17 |
| R88D-KT01L | 11 | - | 17 |
| R88D-KT02L | 15 | - | 17 |
| R88D-KT04L | 22 | 17 | 13 |
| R88D-KT01H | 18 | - | 34 |
| R88D-KT02H | 18 | - | 34 |
| R88D-KT04H | 26 | - | 34 |
| R88D-KT08H | 46 | 12 | 25 |
| R88D-KT10H | 74 | 18 | 25 |
| R88D-KT15H | 74 | 18 | 25 |
| R88D-KT20H | 74 | 72 | 10 |
| R88D-KT30H | 113 | 60 | 7 |
| R88D-KT50H | 113 | 60 | 5 |
| R88D-KT75H | 282 | - | 4 |
| R88D-KT150H | 254 | _ | 4 |
| R88D-KT06F | 64 | 21 | 100 |
| R88D-KT10F | 64 | 21 | 100 |
| R88D-KT15F | 64 | 21 | 100 |
| R88D-KT20F | 64 | 29 | 40 |
| R88D-KT30F | 106 | 60 | 40 |
| R88D-KT50F | 106 | 60 | 29 |
| R88D-KT75F | 273 | _ | 14 |
| R88D-KT150F | 492 | - | 14 |

Regenerative energy to be absorbed by built-in capacitor varies depending on the input voltage to the main circuit power supply for the Servo Drive. The above value for each Servo Drive model is calculated when the input voltage is as follows.

| Model | Main circuit power supply input voltage |
|-----------|---|
| R88D-K□□L | 100 VAC |
| R88D-K□□H | 200 VAC |
| R88D-K□□F | 400 VAC |

Regenerative Energy Absorption with an External Regeneration Resistor

If the regenerative energy exceeds the regeneration absorption capacity of the Servo Drive, connect an External Regeneration Resistor.

Connect the External Regeneration Resistor between B1 and B2 terminals on the Servo Drive. Double-check the terminal names when connecting the resistor because the drive may be damaged if connected to the wrong terminals.

The External Regeneration Resistor will heat up to approx. 120°C. Do not place it near equipment and wiring that is easily affected by heat. Attach radiator plates suitable for the heat radiation conditions.

External Regeneration Resistor

Characteristics

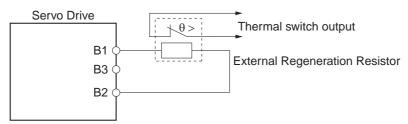
| Model | Resistance value | Nominal capacity | Regeneration absorption for 120°C temperature rise | Heat radiation condition | Thermal switch output specifications |
|--------------------|------------------|------------------|--|--|--|
| R88A- RR08050S | 50 Ω | 80 W | 20 W | Aluminum 350 × 350, Thickness: 3.0 | Operating temperature: 150°C ± 5% NC contact Rated output (resistive load): 125 VAC, 0.1 A max. 30 VDC, 0.1 A max. (minimum current: 1 mA) |
| R88A- RR080100S | 100 Ω | 80 W | 20 W | Aluminum 350 × 350, Thickness: 3.0 | Operating temperature: 150°C ± 5% NC contact Rated output (resistive load): 125 VAC, 0.1 A max. 30 VDC, 0.1 A max. (minimum current: 1 mA) |
| R88A- RR22047S1 | 47 Ω | 220 W | 70 W | Aluminum 350 × 350, Thickness: 3.0 | Operating temperature: 150°C ± 5% NC contact Rated output (resistive load): 250 VAC, 0.2 A max. 42 VDC, 0.2 A max. (minimum current: 1 mA) |
| R88A- RR50020S | 20 Ω | 500 W | 180 W | Aluminum 600 × 600, Thickness: 3.0 | Operating temperature 200°C ± 7°C NC contact Rated output (resistive load): 250 VAC, 0.2 A max. 42 VDC, 0.2 A max. (minimum current: 1 mA) |

Connecting an External Regeneration Resistor

R88D-KTA5L/-KT01L/-KT02L/-KT01H/-KT02H/-KT04H

Normally B2 and B3 are open.

If an External Regeneration Resistor is necessary, remove the short-circuit bar between B2 and B3, and then connect the External Regeneration Resistor between B1 and B2 as shown in the diagram below.





Precautions for Correct Use

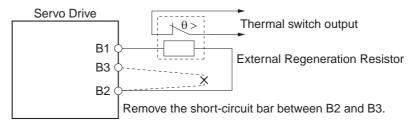
• Connect the thermal switch output so that the main circuit power supply is shut OFF when the contacts open.

When using multiple External Regeneration Resistors, connect each thermal switch in series. The resistor may be damaged by burning, or cause fire if it is used without setting up a power supply shutoff sequence using the output from the thermal switch.

R88D-KT04L/-KT08H/-KT10H/-KT15H/-KT20H/-KT30H/-KT50H/-KT06F/-KT10F/-KT15F/-KT20F/-KT30F/-KT50F

Normally B2 and B3 are connected.

If an External Regeneration Resistor is necessary, remove the short-circuit bar between B2 and B3, and then connect the External Regeneration Resistor between B1 and B2 as shown in the diagram below.





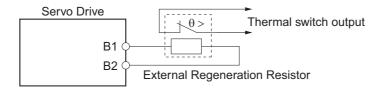
Precautions for Correct Use

• Connect the thermal switch output so that the main circuit power supply is shut OFF when the contacts open.

When using multiple External Regeneration Resistors, connect each thermal switch in series. The resistor may be damaged by burning, or cause fire if it is used without setting up a power supply shutoff sequence using the output from the thermal switch.

R88D-KT75H/-KT150H/-KT75F/-KT150F

If an External Regeneration Resistor is necessary, connect the External Regeneration Resistor between B1 and B2 as shown in the diagram below.





Precautions for Correct Use

• Connect the thermal switch output so that the main circuit power supply is shut OFF when the contacts open.

When using multiple External Regeneration Resistors, connect each thermal switch in series. The resistor may be damaged by burning, or cause fire if it is used without setting up a power supply shutoff sequence using the output from the thermal switch.

Combining External Regeneration Resistors

| Regeneration absorption capacity *1 | 20 W | 40 W | 70 W | 140 W |
|-------------------------------------|------------|---------------------------------|----------------|----------------|
| Model | | R88A-RR08050S R88A-RR080100S | R88A-RR22047S1 | R88A-RR22047S1 |
| Resistance value | 50 Ω/100 Ω | 25 Ω/50 Ω | 47 Ω | 94 Ω |
| Connection method | ○R | R | ○ R - ○ | ○ R R ○ |

| Regeneration absorption capacity *1 | 140 W | 280 W | 560 W |
|-------------------------------------|----------------|----------------|---------------------------------------|
| Model | R88A-RR22047S1 | R88A-RR22047S1 | R88A-RR22047S1 |
| Resistance value *2 | 23.5 Ω | 47 Ω | 23.5 Ω |
| Connection method | R | RRR | R R R R R R R R R R R R R R R R R R R |

| Regeneration absorption capacity *1 | 180 W | 360 W | 1440 W |
|-------------------------------------|---------------|---------------|---------------------------------------|
| Model | R88A-RR50020S | R88A-RR50020S | R88A-RR50020S |
| Resistance value *2 | 20 Ω | 10 Ω | 10 Ω |
| Connection method | ○—_R_—○ | R | R R R R R R R R R R R R R R R R R R R |

- *1. Select a combination that has an absorption capacity greater than the average regeneration power (Pr).
- *2. Do not use a combination with resistance values lower than the allowable minimum regeneration resistance of each drive. For information on the allowable minimum regeneration resistance, refer to Servo Drive Regeneration Absorption Capacity (P.4-56).



Precautions for Safe Use

• Surface temperatures on regeneration resistance can reach 200°C.

Do not place objects that tend to catch fire nearby. To prevent people from touching them, install a cover that enables heat dissipation.

4-5 Large Load Inertia Adjustment and Dynamic Brake

The applicable load inertia of the Servomotor is the value of the load inertia at which the Servo Drive circuit is not destroyed in normal usage conditions. Use at a level below the applicable load inertia, and note the cautions below regarding adjustment and dynamic braking.

Adjustment When the Load Inertia Is Large

In the instances below, realtime autotuning may not function properly. In this event, improve the load conditions, or perform manual tuning to set the gain and the inertia ratio.

- When the load inertia is less than 3 times or over 20 times the rotor inertia, or is over the applicable load inertia ratio.
- · When the load inertia varies.
- · When the load has low mechanical rigidity.
- When backlash or non-linear conditions occur in the load.
- When the acceleration/deceleration torque is less than the unbalanced load or viscous friction torque.
- When a speed of 100 r/min or higher or an acceleration/deceleration of 2000 r/min per second or higher continues for no more than 50 ms.

Dynamic Brake When the Load Inertia Is Large

Because the dynamic brake is used for emergency stopping, the rating is for short time intervals. To prevent wire breakage, smoke, and fire during dynamic braking, pay attention to the following points.

- Do not intentionally start and stop the motor by Servo ON/OFF.
- Do not drive the motor using an externally applied power. Do not turn ON the power while the motor is rotating.
- If motor rotation stops due to dynamic braking, establish a stop time of at least 10 minutes until the Servo is turned ON again.

The dynamic brake converts the rotational energy of the motor into heat by the dynamic brake resistance.

The rotational energy of the motor is calculated using the equation below.

• Rotational energy of motor
$$=\frac{1}{2} \cdot J \cdot \omega^2 = \frac{1}{2} \cdot J \cdot (2\pi)^2 \cdot (\frac{N}{60})^2$$

J : Load inertia + rotor inertia of motor [W]

N : Motor speed [r/min]

When the load inertia is large or the rotation speed is high, the load on the dynamic brake circuit increases. Set the maximum operating rotation speed appropriately for the load inertia.

You can specify in the parameters whether or not the dynamic brake operates in the conditions below.

A 5 kW or less Servo Drive enters the dynamic braking state when the control power turns OFF, regardless of the settings.

Main circuit power supply OFF (Pn507 Stop Selection with Main Power Supply OFF)

When the Servo is OFF (Pn506 Stop Selection with Servo OFF)
 When an error occurs (Pn510 Stop Selection for Alarm Detection)

When drive prohibition is input (Pn505 Stop Selection for Drive Prohibition Input)

4-6 Using DC Power

You can use either an AC or DC power supply for the main power and control power for the following Servo Drives.

- R88D-KT75H
- R88D-KT150H

There are no Servo Drive parameters that you need to change to use an AC or DC power supply.

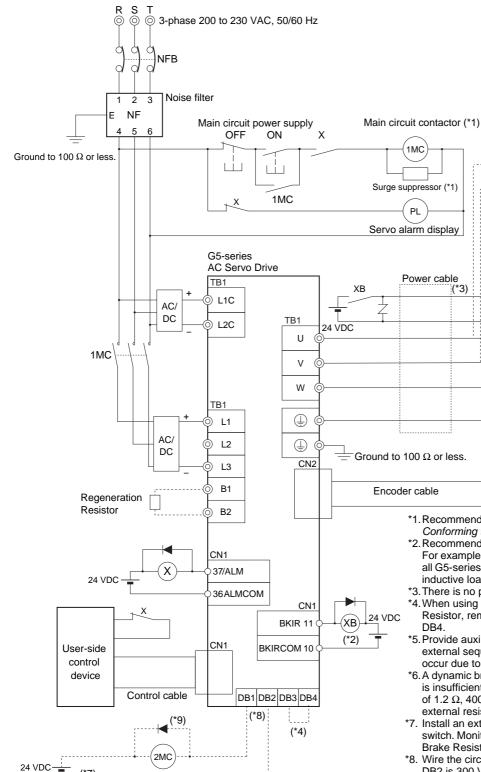


Precautions for Correct Use

- If you use a DC power supply for the main power and control power, connect the positive side to L1 and L1C on the terminal block (TB1) and connect the negative side to L3 and L3C.
- Time is required to discharge power when the main power is turned OFF. High voltages remain inside the Servo Drive even after the power supply is turned OFF. Take sufficient precautions against electric shock. Before carrying out wiring or inspection, turn OFF the main power supply and wait for at least 15 minutes.
- Do not connect the power supply to the B1 or N terminal. Internal elements may be destroyed.
- Do not connect or disconnect the terminal block while the main power supply is ON. Arcs may cause burning.

Connection Examples for DC Power

R88D-KT75H with DC Power Supply Input



- *1. Recommended products are listed in 4-3 Wiring Conforming to EMC Directives.
- *2. Recommended relays: MY Relays by OMRON (24-V) For example, MY2 Relays by OMRON can be used witl all G5-series Servomotors with Brakes because its rate inductive load is 2 A (24 VDC).
- *3. There is no polarity on the brake.

2MC

(*3)

G5-series

AC Servomotor

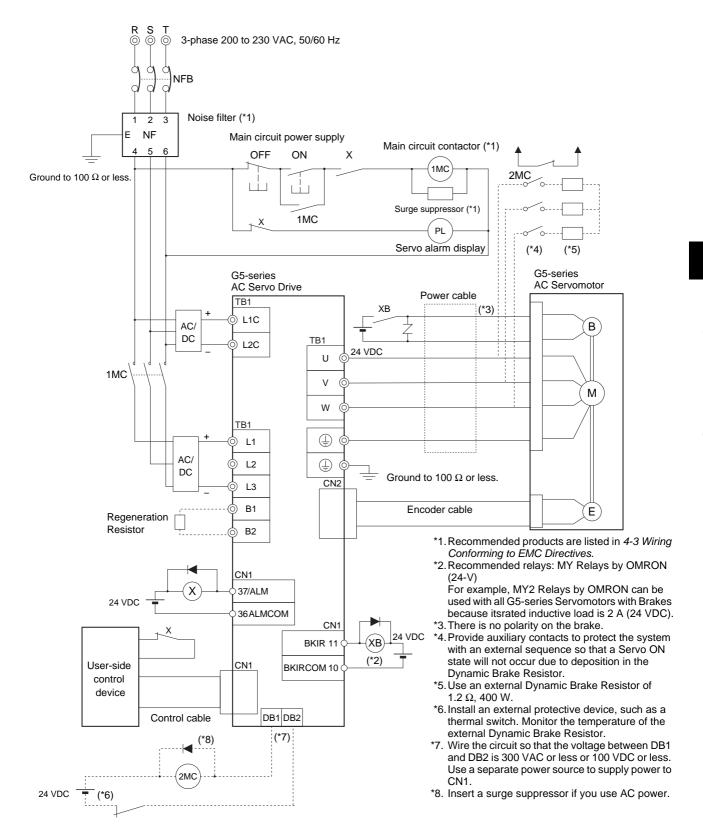
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- *4. When using an externally connected Dynamic Brake Resistor, remove the short bar from between DB3 and
- *5. Provide auxiliary contacts to protect the system with a external sequence so that a Servo ON state will not occur due to deposition in the Dynamic Brake Resistor
- *6. A dynamic brake of 2 Ω , 180 W is built in. If the capacit is insufficient, use an external Dynamic Brake Resistor of 1.2 Ω , 400 W. Do not use the built-in resistor and ar external resistor at the same time.
- *7. Install an external protective device, such as a thermal switch. Monitor the temperature of the external Dynami Brake Resistor.
- *8. Wire the circuit so that the voltage between DB1 and DB2 is 300 VAC or less or 100 VDC or less. Use a separate power source to supply power to CN1.
- *9. Insert a surge suppressor if you use AC power.

R88D-KT150H with DC Power Supply Input





Basic Control Mode

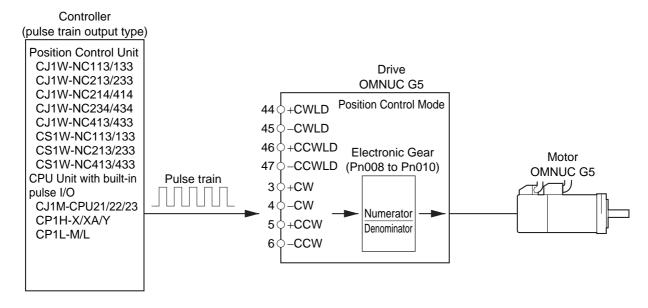
This chapter explains an outline of operations available in various control modes and explains the contents of setting.

| 5-1 | Position Control | 5-1 |
|-----|---|------|
| | Outline of Operation | |
| | Parameters Requiring Settings | |
| | Related Functions | |
| | Parameter Block Diagram for Position Control Mode | |
| 5-2 | Speed Control | |
| | Outline of Operation | |
| | Parameters Requiring Settings | |
| | Related Functions | |
| | Parameter Block Diagram for Speed Control Mode | 5-13 |
| 5-3 | Torque Control | 5-14 |
| | Outline of Operation | 5-14 |
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| | Related Functions | |
| 5-6 | Fully-closed Control | 5-26 |
| | Outline of Operation | |
| | Parameters Requiring Settings | |
| | Parameter Block Diagram for Fully-closed Control Mode | |

5-1 Position Control

Outline of Operation

- Position control is performed based on the pulse train input received from the controller.
- The motor rotates using the value of the pulse train input multiplied by the Electronic Gear (Pn008 to Pn010).



Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|--|---|-----------|
| Pn000 | Reference Direction | Select the relation between the reference command and the rotation direction in the motor. | P.8-1 |
| Pn001 | Control Mode Selection | Select the control mode. | P.8-2 |
| Pn005 | Command Pulse Input Selection | Select the command pulse input terminal. | P.8-3 |
| Pn006 | Command Pulse Rotation Direction Switching Selection | Set the count direction for the command pulse input. | P.8-3 |
| Pn007 | Command Pulse Mode Selection | Set the count method for the command pulse input. | P.8-4 |
| Pn008 | Electronic Gear Integer Setting | Define the number of command pulses per motor revolution. If this is zero, Pn009 and Pn010 become active. | P.8-5 |
| Pn009 | Electronic Gear Ratio Numerator 1 | Set the numerator of the electronic gear ratio for the command pulse input. | P.8-5 |
| Pn010 | Electronic Gear Ratio Denominator | Set the denominator of the electronic gear ratio for the command pulse input. | P.8-6 |

Control Mode Selection (Pn001)

Select the position control (Set values: 0=Position control, 3=Switch between position control and speed control or 4=Switch between position control and torque control).

Command Pulse Input Process (Pn005, Pn006, Pn007)

Position command input terminals are classified into the input 1 system (+CW, -CW, +CCW, -CCW) and input 2 system (+CWLD, -CWLD, +CCWLD, -CCWLD).

If the position command output is an open collector output, set input 1. If it is a line-driver output, set input 2.

Although input 1 can also be used for a line-driver output, the allowable maximum input frequency will become lower than when input 2 is selected.

| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|---|---|---------------|------|
| Pn005 | Command Pulse Input Selection | Select the command pulse input terminal. 0: Photocoupler input (+CW, -CW, +CCW, -CCW) 1: Input for line driver only (+CWLD, -CWLD, +CCWLD, -CCWLD) | 0 or 1 | - |
| Pn006 | Command Pulse Rotation Direction Switching Selection | Set the count direction for the command pulse input. 0: Command pulse, forward direction 1: Command pulse, reverse direction | 0 or 1 | - |
| Pn007 | Command Pulse Mode Selection | Set the count method for the command pulse input. 0: 90° phase difference (A/B) signal input) 1: Forward/reverse pulse 2: 90° phase difference (A/B) signal input) 3: Feed pulse/direction signal | 0 to 3 | - |

The settings for command pulse rotation direction and command pulse mode are as follows.

| Pn006 | Pn007 | Command pulse pattern | Signal name | Forward direction command | Reverse direction command |
|-------|--------------------------|--|-------------|---|----------------------------------|
| | | 90° phase difference, | CW | Phase A t1 t1 t1 | 11 11 |
| | 0 or 2 | 2-phase pulse (phase A + phase B) | ccw | Phase B is 90° ahead of phase A. | Phase B is 90° behind phase A. |
| 0 | 1 | Forward direction pulse train + Reverse | CW | t3 | 12 12 |
| 3 | direction pulse train | ccw | t2 t2 | | |
| | Pulse train + Sign | cw | t4 t5 | t4 t5 | |
| | | ccw | t6 H t6 L | | |
| | 0 or 2 | 90° phase difference, 2- phase pulse (phase A + phase B) | CW | Phase A 11 11 11 11 11 11 11 11 11 11 11 11 1 | |
| | 0 01 2 | | ccw | Phase B is 90° behind phase A. | Phase B is 90° ahead of phase A. |
| 1 | 1 | Forward direction pulse train + Reverse | CW | t2 t2 | |
| | | direction pulse train | ccw | t3 | t2 t2 |
| | 3 | Pulse train | CW | t4 t5 | 1 1/1 1 1 |
| | | + Sign | ccw | t6 L <u>t6</u> | <u>t6</u> H <u>t6</u> |

| Symbol | | Allowable | Minimum required duration [μs] | | | | | |
|---------------------------------|----------------|-------------------------------|--------------------------------|-------|-------|-------|-------|-------|
| | | input maximum frequency | t1 | t2 | t3 | t4 | t5 | t6 |
| +CWLD, -CWLD, +CCWLD, -CCWLD | | 4 Mpps | 0.25 | 0.125 | 0.125 | 0.125 | 0.125 | 0.125 |
| +CW, -CW, | Line driver | 500 kpps | 2 | 1 | 1 | 1 | 1 | 1 |
| +CCW, -CCW | Open collector | 200 kpps | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |

Electronic Gear Function (Pn008, Pn009, Pn010)

This function allows you to multiply the pulse command input from the host controller by the specified gear ratio to determine the position command.

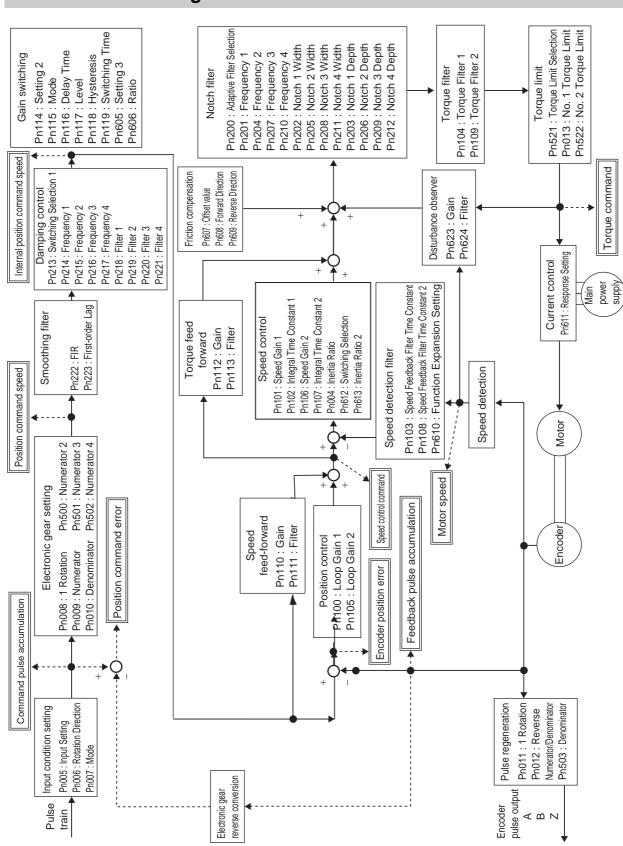
| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|---|---|----------------------|-------|
| Pn008 | Electronic Gear Integer Setting | Set the number of command pulses corresponding to 1 motor rotation. | 0 to 2 ²⁰ | Pulse |
| Pn009 | Electronic Gear Ratio Numerator 1 | Set the numerator of the electronic gear ratio for the command pulse input. | 0 to 2 ³⁰ | _ |
| Pn010 | Electronic Gear Ratio Denominator | Set the denominator of the electronic gear ratio for the command pulse input. | 1 to 2 ³⁰ | _ |

[•] For details on the electronic gear function, refer to "6-4 Electronic Gear Function" (P.6-10).

Related Functions

| Parameter number | Parameter name | Explanation | Reference |
|------------------|---|--|-----------|
| Pn008 | Electronic Gear Integer Setting | Set the number of command pulses corresponding to 1 motor rotation. | P.8-5 |
| Pn011 | Encoder Dividing Numerator | Set the pulse output resolution using the numbers of output pulses per rotation for phase A and phase B, respectively. | P.8-6 |
| Pn012 | Encoder Output Direction Switching Selection | Set the phase-B logic and output source for pulse output. | P.8-6 |
| Pn222 | Position Command Filter Time Constant | Set the time constant of the first-order lag filter for the position command. | P.8-23 |
| Pn223 | Smoothing Filter Time Constant | Set the time constant of the FIR filter for the position command. | P.8-24 |
| Pn431 | Positioning Completion Range 1 | Set the threshold of position error for output of the positioning completion signal. | P.8-42 |
| Pn432 | Positioning Completion Condition Selection | Select the condition under which the positioning completion signal is output. | P.8-43 |
| Pn433 | Positioning Completion Hold Time | Set the INP signal output time. | P.8-42 |
| Pn503 | Encoder Dividing Denominator | You can set a dividing ratio by using Encoder Dividing Numerator (Pn011) as the dividing numerator and Encoder Dividing Denominator (Pn503) as the dividing denominator. | P.8-47 |
| Pn517 | Error Counter Reset Condition Selection | Set the reset condition under which the error counter reset input signal. | P.8-54 |
| Pn518 | Command Pulse Prohibition Input Setting | Set whether to enable or disable the command pulse prohibition input. | P.8-55 |

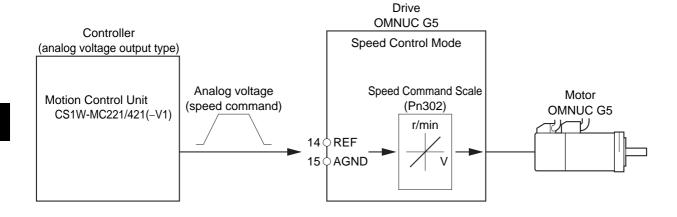
Parameter Block Diagram for Position Control Mode



5-2 Speed Control

Outline of Operation

- Motor speed control is performed based on the analog voltage input from the controller. You can also perform position control by combining with a controller that has a position control function
- You can change the relation between the speed command and the rotation speed by setting the Speed Command Scale (Pn302).



Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|---|---|-----------|
| Pn000 | Reference direction | Select the relation between the reference command and the rotation direction in the motor. | P.8-2 |
| Pn001 | Control Mode Selection | Select the control mode. | P.8-2 |
| Pn300 | Command Speed Selection | Select the speed command input method. | P.8-25 |
| Pn301 | Speed Command Direction Selection | Set the method for designating the forward or reverse direction for the speed command. | P.8-25 |
| Pn302 | Speed Command Scale | Set the input gain for the analog speed command input. | P.8-27 |
| Pn303 | Analog Speed Command Rotation Direction Switching | Inverts the polarity of the analogue speed command. | P.8-27 |
| Pn312 | Soft Start Acceleration Time | Set the acceleration time for internally set speed control. Set the time until 1,000 r/min is reached. | P.8-28 |
| Pn313 | Soft Start Deceleration Time | Set the deceleration time for internally set speed control. Set the time until 1,000 r/min is reached. | P.8-29 |
| Pn314 | S-curve Acceleration/ Deceleration Time Setting | Set the S-curve time in the time width centered on the inflection points for acceleration and deceleration. | P.8-29 |

Control Mode Selection (Pn001)

Select the speed control (Set values: 1=Speed control, 3=Switching between position and speed control or 5=Switching between speed control and torque control).

Analog Speed Command Input Process (Pn300, Pn301, Pn302, Pn303)

Convert the voltage input by an analog input to a speed command to control the motor.

| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|--|---|---------------|-----------|
| Pn300 | Command Speed Selection | Select the speed command input method. 0: Analog torque command 1: No. 1 to 4 internally set speed 2: No. 1 to 3 internally set speed, analog torque command 3: No. 1 to 8 internally set speed | 0 to 3 | _ |
| Pn301 | Speed Command Direction Selection | Select the method for designating the direction for the speed command. 0: Use the sign of the speed command Example: +: Forward -: Reverse 1: Use the speed command sign selection (VSIGN) Example: OFF: Forward ON: Reverse | 0 or 1 | _ |
| Pn302 | Speed Command Scale | Set the input gain for the analog speed command input. | 10 to 2000 | (r/min)/V |
| Pn303 | Analog Speed Command Rotation Direction Switching | Set to reverse the polarity of the speed command input. 0: The rotation direction is controlled by the voltage of the analog speed command (REF). Positive voltage: Forward Negative voltage: Reverse 1: The rotation direction is controlled by the voltage of the analog speed command (REF). Positive voltage: Reverse Negative voltage: Forward | 0 or 1 | _ |

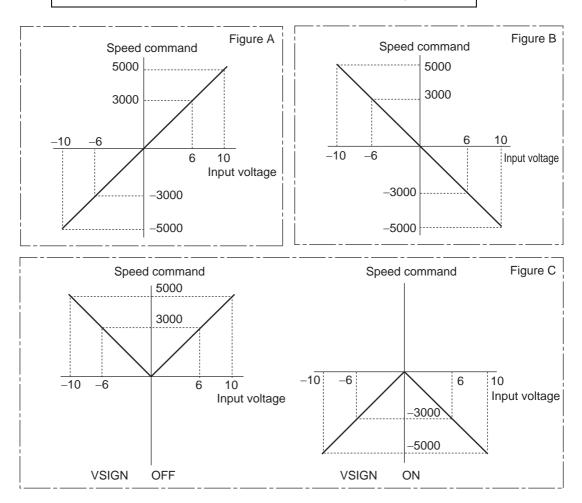
The conversion of analog speed command is explained below.

| Command Speed Selection (Pn300) | Speed Command Direction Selection (Pn301) | Analog Speed Command Rotation Direction Switching (Pn303) | Analog speed command (REF) | Speed command sign selection (VSIGN) | Speed command direction ^{*1} | Conversion graph |
|--|---|---|----------------------------------|--|---|--------------------------|
| | 0 | 0 | + Voltage (0 to 10 V) | Not affected | Forward direction | - Figure A - Figure B |
| | | | - Voltage (-10 to 0 V) | | Reverse direction | |
| | | 1 | + Voltage (0 to 10 V) | | Reverse direction | |
| 1 | | | - Voltage (-10 to 0 V) | | Forward direction | |
| | | | + Voltage (0 to 10 V) | OFF | Forward | |
| | 1 | Not | - Voltage (-10 to 0 V) | OFF | direction | Figure C |
| | 1 | affected | + Voltage (0 to 10 V) | ON | Reverse | - Tigure C |
| | | | - Voltage (-10 to 0 V) | | direction | |

^{*1.} The motor rotation direction (CW, CCW) specified by the command direction is determined by the setting of Pn000.

Example) When Speed Command Scale (Pn302) = 500

Speed limit value = Speed Command Scale (Pn302) × input voltage



Speed Command Acceleration/Deceleration Setting Function (Pn312, Pn313, Pn314)

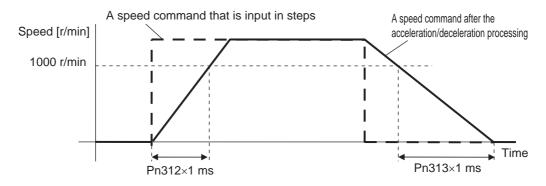
With a step speed command, you can change the speed command based on this setting to reduce the shock caused by change in acceleration.

| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|--|---|---------------|----------------------|
| Pn312 | Soft Start Acceleration Time | Set the acceleration time for acceleration process with respect to the speed command input. | 0 to 10000 | ms/(1,000 r/ min) |
| Pn313 | Soft Start Deceleration Time | Set the deceleration processing deceleration time for speed command inputs. | 0 to 10000 | ms/(1,000 r/ min) |
| Pn314 | S-curve Acceleration/ Deceleration Time Setting | Set the S-curve acceleration/ deceleration time. | 0 to 1000 | ms |

Soft Start Acceleration Time (Pn312), Soft Start Deceleration Time (Pn313)

If a step speed command is input, set in Soft Start Acceleration Time (Pn312) the time needed for the speed command to reach 1,000 r/min. Also set in Soft Start Deceleration Time (Pn313) the time needed for the speed command to reach 0 r/min from 1,000 r/min.

Soft start acceleration time [ms] = $Vc/1,000 \times Pn312 \times 1$ ms Soft start deceleration time [ms] = $Vc/1,000 \times Pn313 \times 1$ ms

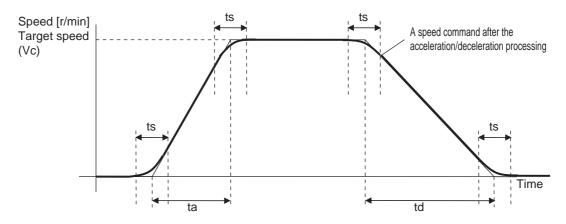


S-curve Acceleration/Deceleration Time Setting (Pn314)

Set the S-curve time in the time width centered on the inflection points in acceleration/deceleration relative to the acceleration or deceleration time set in Soft Start Acceleration Time (Pn312) or Soft Start Deceleration Time (Pn313).

ta = $Vc/1,000 \times Pn312 \times 1$ ms td = $Vc/1,000 \times Pn313 \times 1$ ms ts = $Pn314 \times 1$ ms

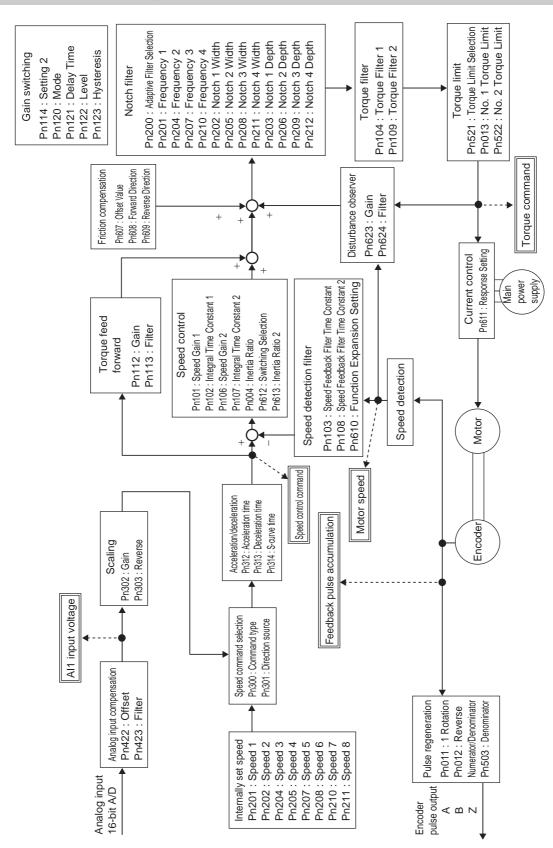
Set an appropriate time so that ta > ts and td > ts are satisfied.



Related Functions

| Parameter number | Parameter name | Explanation | Reference |
|------------------|--|---|-----------|
| Pn315 | Zero Speed Designation Selection | Set the zero speed designation. | P.8-30 |
| Pn316 | Position Lock Level Setting | Set the threshold for transition to the servo lock state under position control. | P.8-31 |
| Pn435 | Speed Conformity Detection Range | Set the detection threshold for the motor rotation speed detection output. If the difference between the speed command and motor speed is within the set threshold, a motor rotation speed detection output is output. This setting has a hysteresis of 10 r/min for detection. | P.8-44 |
| Pn436 | Rotation Speed for Motor Rotation Detection | Set the detection threshold for speed reached output. A speed reached output is output when the motor speed exceeds the set value. This setting has a hysteresis of 10 r/min for detection. | P.8-44 |
| Pn422 | Analog Input 1 Offset | Set the analog input 1 offset. | P.8-40 |
| Pn423 | Analog Input 1 Filter Time Constant | Set the filter for analog input 1. | P.8-41 |

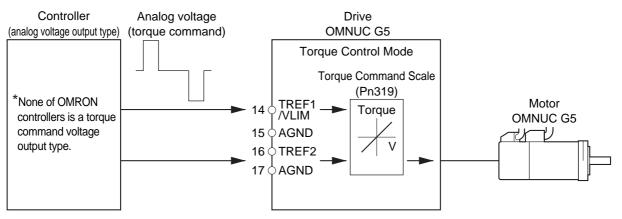
Parameter Block Diagram for Speed Control Mode



5-3 Torque Control

Torque control is performed based on the torque command specified by the analog voltage. In addition to the torque command, torque control also requires a speed limit input to prevent the motor rotation speed from becoming excessively high.

Outline of Operation



h

Precautions for Correct Use

• If the motor speed is limited by the speed limit, the motor speed will be limited and will not reach the speed corresponding to the analog torque command.

Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|--|---|-----------|
| Pn001 | Control Mode Selection | Select the control mode. | P.8-2 |
| Pn317 | Torque Command/Speed Limit Selection | Select the input location for the torque command and speed limit. | P.8-31 |
| Pn318 | Torque Command Direction Selection | Select the rotation direction of the torque command. | P.8-32 |
| Pn319 | Torque Command Scale | Set the input gain for analog torque command input. | P.8-34 |
| Pn320 | Analog Torque Command Rotation Direction Switching | Reverse the polarity of the torque command input. | P.8-34 |

Control Mode Selection (Pn001)

Select the torque control (Set values: 2=Torque control, 4=Switching between Position control and Torque control or 5=Switching between Speed control and torque control).

Analog Torque Command Input Process (Pn317, Pn318, Pn319, Pn320)

Convert the voltage input by an analog input to a torque command to control the motor.

| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|---|---|---------------|------------|
| Pn317 | Torque Command/Speed Limit Selection | Select the input location for the torque command and speed limit value. 0: Torque command: Analog input 1 speed limit: Pn321 1: Torque command: Analog input 2 speed limit: Analog input 1 2: Torque command: Analog input 1 speed limit: Pn321, Pn322 | 0 to 2 | - |
| Pn318 | Torque Command Direction Selection | Select the method for selecting the direction for the torque command. 0: Use the sign 1: Use TVSIGN | 0 or 1 | - |
| Pn319 | Torque Command Scale | Set the input gain for analog torque command input. | 10 to 100 | 0.1 V/100% |
| Pn320 | Analog Torque Command Rotation Direction Switching | Reverse the polarity of the torque command input. 0: Forward operation 1: Reverse operation | 0 or 1 | _ |

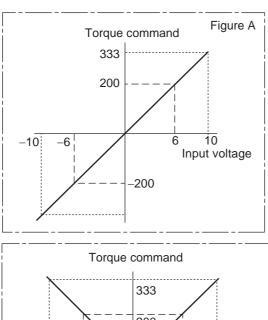
The conversion of analog torque command is explained below.

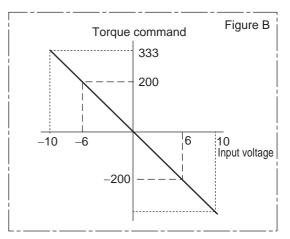
| Torque Command/ Speed Limit Selection (Pn317) | Torque Command Direction Selection (Pn318) | Analog Torque Command Rotation Direction Switching (Pn320) | Analog torque command (TREF) | Torque command sign selection (TSIGN) | Torque command direction* ¹ | Conversion graph |
|--|--|--|------------------------------|---|--|----------------------------|
| | | 0 | +Voltage (0 to 10 V) | | Forward direction | Figure A Figure B Figure C |
| | 0 - | | -Voltage (-10 to 0 V) | Not affected | Reverse direction | |
| 0 | | 1 | +Voltage (0 to 10 V) | | Reverse direction | |
| | | | -Voltage (-10 to 0 V) | | Forward direction | |
| | | Not affected | Not affected | OFF | Forward direction | |
| | | | | ON | Reverse direction | |

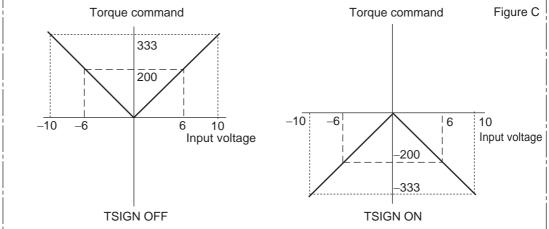
^{*1.} The motor rotation direction (CW, CCW) specified by the command direction is determined by the setting of Pn000.

Example) When the torque command scale is 30

Torque command = $100 \times Input voltage / (Torque Command Scale (Pn319) <math>\times 0.1$)



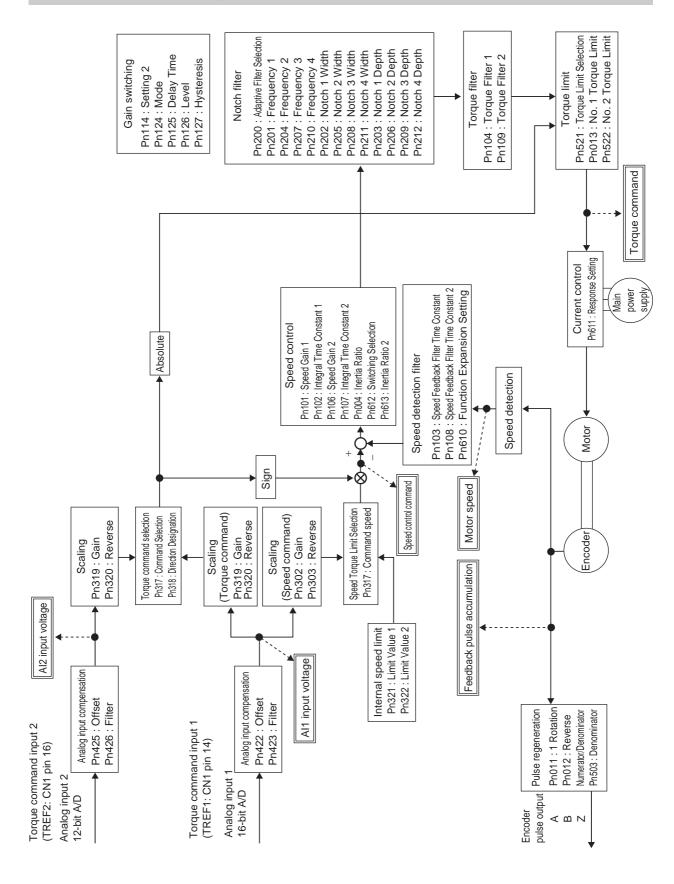




Related Functions

| Parameter number | Parameter name | Explanation | Reference |
|------------------|---|--|-----------|
| Pn315 | Zero Speed Designation Selection | Set the zero speed designation function. | P.8-30 |
| Pn321 | Speed Limit Value Setting | Set the speed limit value applicable during torque control. During torque control, the speed is controlled so as not to exceed the level set by the speed limit value. | P.8-34 |
| Pn322 | Reverse Direction Speed Limit Value Setting | Set this if you want to change the speed limit value depending on whether the direction is forward or reverse. | P.8-34 |
| Pn422 | Analog Input 1 Offset | Set the offset for analog input 1. | P.8-40 |
| Pn423 | Analog Input 1 Filter Time Constant | Set the filter for analog input 1. | P.8-41 |
| Pn425 | Analog Input 2 Offset | Set the offset for analog input 2. | P.8-41 |
| Pn426 | Analog Input 2 Filter Time Constant | Set the filter for analog input 2. | P.8-41 |

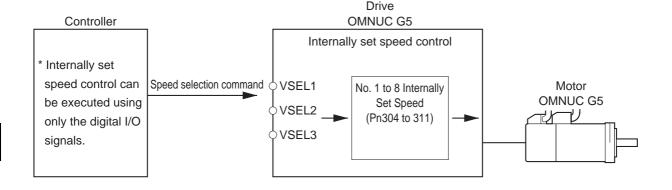
Parameter Block Diagram for Torque Control Mode



5-4 Internally Set Speed Control

Outline of Operation

- Performs motor speed control using the speeds set in the No. 1 to 8 Internally Speed Settings.
- Select the internally set speed using Internally Set Speed Selections 1 to 3 of the control input terminals (VSEL1: CN-1 to 33 pins, VSEL2: CN-1 to 30 pins, VSEL3: CN-1 to 28 pins).



Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|----------------------------|--|-----------|
| Pn001 | Control Mode Selection | Select the control mode for internally set speed control. (Set values: 1, 3 and 5) | P.8-2 |
| Pn300 | Command Speed Selection | Select the speed command input method. | P.8-25 |
| Pn304 | No. 1 Internally Set Speed | Set the internally set speeds (r/min). | |
| Pn305 | No. 2 Internally Set Speed | The settings can be made from -20,000 to 20,000 r/min. Be sure to set the speeds within the allowable range of | |
| Pn306 | No. 3 Internally Set Speed | rotation speed of the motor. | |
| Pn307 | No. 4 Internally Set Speed | | P.8-27 |
| Pn308 | No. 5 Internally Set Speed | | 1 .0-21 |
| Pn309 | No. 6 Internally Set Speed | | |
| Pn310 | No. 7 Internally Set Speed | | |
| Pn311 | No. 8 Internally Set Speed | | |

Selecting the Internally Set Speeds

The following tables show the internally set speeds that are set with VSEL1, VSEL2 and VSEL3 (internally set speed selection 1, 2 and 3).

Pn300 = 1

| Number | VSEL1 | VSEL2 | VSEL3 | Set speed |
|--------|-------|-------|----------|-----------|
| 0 | OFF | OFF | Disabled | Pn304 |
| 1 | ON | OFF | Disabled | Pn305 |
| 2 | OFF | ON | Disabled | Pn306 |
| 3 | ON | ON | Disabled | Pn307 |

Pn300 = 2

| Number | VSEL1 | VSEL2 | VSEL3 | Set speed |
|--------|-------|-------|----------|-----------|
| 0 | OFF | OFF | Disabled | Pn304 |
| 1 | ON | OFF | Disabled | Pn305 |
| 2 | OFF | ON | Disabled | Pn306 |
| 3 | ON | ON | Disabled | *1 |

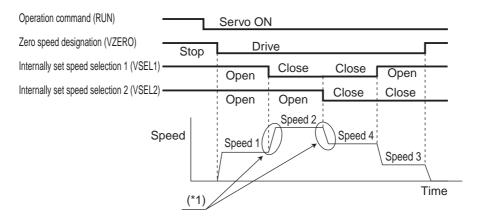
^{*1.} The mode will be analog speed control. Input the proper current to REF.

Pn300 = 3

| Number | VSEL1 | VSEL2 | VSEL3 | Set speed |
|--------|-------|-------|-------|-----------|
| 0 | OFF | OFF | OFF | Pn304 |
| 1 | ON | OFF | OFF | Pn305 |
| 2 | OFF | ON | OFF | Pn306 |
| 3 | ON | ON | OFF | Pn307 |
| 4 | OFF | OFF | ON | Pn308 |
| 5 | ON | OFF | ON | Pn309 |
| 6 | OFF | ON | ON | Pn310 |
| 7 | ON | ON | ON | Pn311 |

Operation Example

Internally set speed control with 4 speed changes when Pn300 = 1



*1. The acceleration time, deceleration time, and S-curve acceleration/deceleration time can be set using parameters (Pn312, Pn313, and Pn314).



Precautions for Correct Use

If more than one internally set speed selection signals are changed at the same time (e.g., as when changing from speed 2 to speed 3), the internally set speed selection signals between them may be temporarily selected. (For example, speed 1 or speed 4 may be temporarily selected.)

Observe the following precautions if an acceleration time or deceleration time of 0 or close to 0 is used, if the sign of the internally set speed command changes, or if the change in the internally set speed command is large. Any of these may cause a sudden change in the internally set speed command.

- 1) Do not change between more than one internally set speed signal at the same time.
- 2) Set soft start acceleration and soft start deceleration and change the speed gradually (i.e., do not change the speed suddenly).

Internal Speed Command (Pn304 to 311)

Control the motor speed according to the internal speed command value set by a parameter. The internally set speed becomes valid when the setting of Speed Setting Internal/External Switching is 1 to 3.

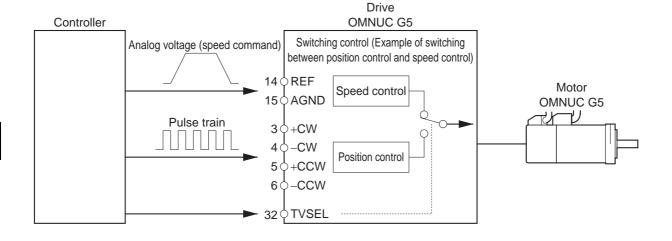
Up to 8 internally set speeds can be set.

| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|-------------------------------|---------------------------------------|----------------------|-------|
| Pn304 | No. 1 Internally Set Speed | Set the speed 1 internally set speed. | -20,000 to 20,000 | r/min |
| Pn305 | No. 2 Internally Set Speed | Set the speed 2 internally set speed. | -20,000 to 20,000 | r/min |
| Pn306 | No. 3 Internally Set Speed | Set the speed 3 internally set speed. | -20,000 to 20,000 | r/min |
| Pn307 | No. 4 Internally Set Speed | Set the speed 4 internally set speed. | -20,000 to 20,000 | r/min |
| Pn308 | No. 5 Internally Set Speed | Set the speed 5 internally set speed. | -20,000 to 20,000 | r/min |
| Pn309 | No. 6 Internally Set Speed | Set the speed 6 internally set speed. | -20,000 to 20,000 | r/min |
| Pn310 | No. 7 Internally Set Speed | Set the speed 7 internally set speed. | -20,000 to 20,000 | r/min |
| Pn311 | No. 8 Internally Set Speed | Set the speed 8 internally set speed. | -20,000 to 20,000 | r/min |

5-5 Switching Control

Outline of Operation

- This function controls the motor by switching between two control modes via external inputs.
- The control mode switching is performed by the control mode switching input (TVSEL: CN-1 pin 32).



Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|------------------------|---|-----------|
| Pn001 | Control Mode Selection | Select control mode for switching control. (Set values: 3, 4 and 5) | P.8-2 |

Control Mode Selected by TVSEL (Control Mode Switching Input)

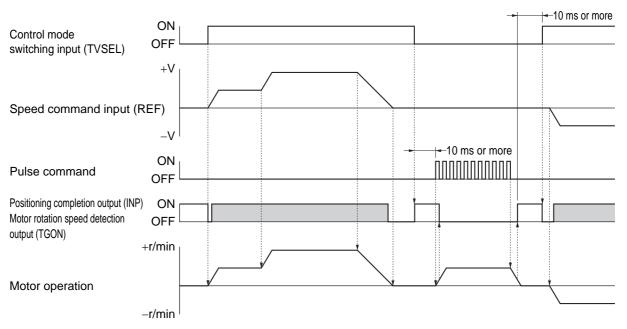
• The following table shows the relation between TVSEL (control mode switching input) and the control mode selected.

| Control Mode | TVSEL | |
|------------------------------|------------------|----------------|
| Selection (Pn001) setting | OFF | ON |
| 3 | Position control | Speed control |
| 4 | Position control | Torque control |
| 5 | Speed control | Torque control |

Note. Use caution when switching control mode. Operation may change suddenly depending on the control mode settings.

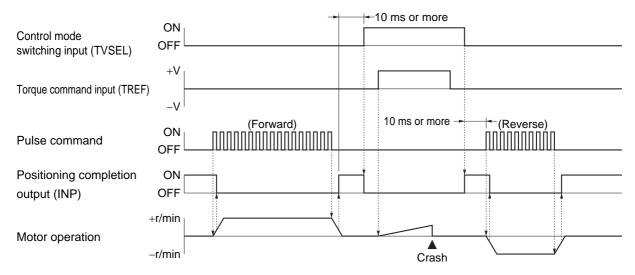
Operation Example

Position and Speed Control Switching Example (Pn001 = 3)



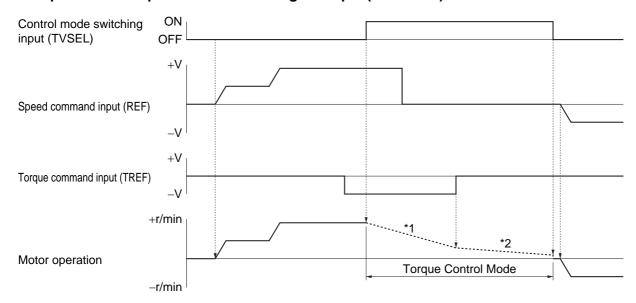
- There is a maximum delay of 10 ms in reading the input signal.
- When switching from speed control to position control, turn OFF the control mode switching input (TVSEL) and wait at least 10 ms after the positioning completion output (INP) turns ON before inputting the pulse command. The pulses input before INP turns ON will be ignored.
- The shaded areas for the positioning completion output (INP) in the time chart show that the signal is turned ON as the motor rotation speed detection output (TGON). (The meaning of the signal depends on the control mode.)

Position and Torque Control Switching Example (Pn001 = 4)



- This time chart shows an example of torque thrust.
- There is a maximum delay of 10 ms in reading the input signal.
- When switching from torque control to position control, turn OFF the control mode switching input (TVSEL) and wait at least 10 ms after the positioning completion output (INP) turns ON before inputting the pulse command. The pulses input before INP turns ON will be ignored.

Speed and Torque Control Switching Example (Pn001 = 5)



- *1. Deceleration for the torque command.
- *2. Deceleration due to load inertia energy and load friction torque.
- There is a maximum delay of 10 ms in reading the input signal.
- Motor operation in torque control changes according to the motor load conditions (e.g., friction, external power, inertia). Take safety measures on the machine side to prevent motor runaway.
- Adjust the torque command using Analog Input 2 Offset (Pn425) and Analog Input 2 Filter Time Constant (Pn426) because the torque command input is analog input 2.

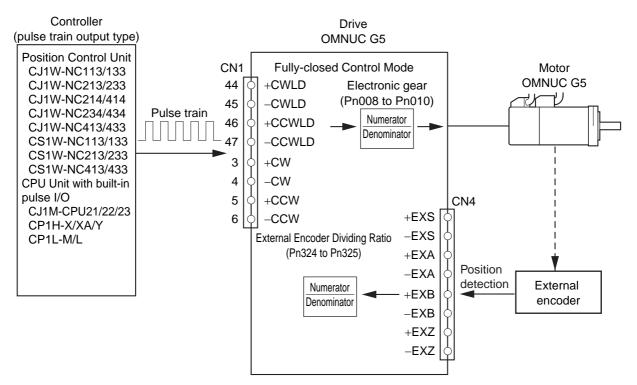
Related Functions

Refer to the related functions for each control mode.

5-6 Fully-closed Control

Outline of Operation

• An externally provided encoder is used to directly detect the position of the control target and feedback the detected machine position to perform position control. This way, controls can be performed without being affected by ball screw error, temperature changes, etc. You can achieve highly accurate positioning by configuring a fully-closed control system.



Precautions for Correct Use

You cannot connect an external encoder with absolute encoder specifications.

Setting Procedure for Fully-closed Control

- 1. Set the Control Mode Selection (Pn001) to 6.
- 2. Set the Encoder Output Direction Switching Selection (Pn012) to 2 or 3. For details on encoder dividing function, refer to "6-5 Encoder Dividing Function" (P.6-14).
- 3. Set the Electronic Gear Integer Setting (Pn008) to 0, and set the Electronic Gear Ratio Numerator 1 (Pn009) and Electronic Gear Ratio Denominator (Pn010).

For fully-closed control, the command pulse or external encoder input is used as the reference. If the gear ratio (Pn009 and Pn010) is set to 1/1, one command pulse or one input pulse from the external encoder will determine the travel distance.

Example: Using an External Encoder with a Resolution of 0.1 µm

• If the gear ratio (Pn009 and Pn010) is set to 1/1 and a command of 100 pulses is applied to the Servo Drive, a positioning operation of 10 μm will be performed for the external encoder.

100 command units \times 1/1 (gear ratio) \times 0.1 μ m = 10 μ m

• If the gear ratio (Pn009 and Pn010) is set to 1/2 and a command of 200 pulses is applied to the Servo Drive, a positioning operation of 10 μm will be performed for the external encoder.

200 command units \times 1/2 (gear ratio) \times 0.1 μ m = 10 μ m

- 4. Set the External Feedback Pulse Dividing Ratio (Pn324 and Pn325) according to information in " External Feedback Pulse Dividing Ratio Setting (Pn324, Pn325)" (P. 5-33).
- 5. Set the Internal/External Feedback Pulse Error Counter Overflow Level (Pn328) and Internal/External Feedback Pulse Error Counter Reset (Pn329) according to information in "External Feedback Pulse Error Setting (Pn328, Pn329)" (P. 5-34).

Parameters Requiring Settings

| Parameter number | Parameter name | e Explanation | |
|------------------|---|--|--------|
| Pn000 | Rotation Direction Switching | Set the relation between the command direction and the motor rotation direction. | P.8-1 |
| Pn001 | Control Mode Selection | Select the control mode. | P.8-2 |
| Pn005 | Command Pulse Input Selection | Select the command pulse input. | P.8-3 |
| Pn006 | Command Pulse Rotation Direction Switching Selection | Set the count direction for the command pulse input. | P.8-3 |
| Pn007 | Command Pulse Mode Selection | Set the count method for the command pulse input. | P.8-4 |
| Pn008 | Electronic Gear Integer Setting | Set the number of command pulses corresponding to 1 motor rotation. | P.8-5 |
| Pn009 | Electronic Gear Ratio Numerator 1 | Set the numerator of the electronic gear ratio for the command pulse input. | P.8-5 |
| Pn010 | Electronic Gear Ratio Denominator | Use this parameter to set the denominator of the electronic gear ratio for the command pulse input. | P.8-6 |
| Pn011 | O11 Encoder Dividing Numerator Set the number of phase A and phase B output pulses, respectively per motor rotation. | | P.8-6 |
| Pn012 | Encoder Output Direction Switching Selection Select the phase B logic for pulse regeneration output and the output source. | | P.8-6 |
| Pn323 | External Feedback Pulse Type Selection | Select the external encoder type. | P.8-34 |
| Pn324 | External Feedback Pulse Dividing Numerator | Set the numerator of the external encoder divider setting. | P.8-35 |
| Pn325 | External Feedback Pulse Dividing Denominator | Set the denominator of the external encoder divider setting. | P.8-35 |
| Pn326 | External Feedback Pulse Direction Switching | Set the polarity of the external encoder feedback pulse. | P.8-35 |
| Pn327 | External Feedback Pulse Phase-Z Setting | Set whether to enable or disable the disconnection detection function of phase Z when a 90° phase difference output type external encoder is used. | P.8-36 |
| Pn328 | Internal/External Feedback Pulse Error Counter Overflow Level | dback Set the threshold of A250 "internal/external feedback pulse error counter overflow" in the command unit. | |
| Pn329 | Internal/External Feedback Pulse Error Counter Reset | The hybrid error becomes 0 every time the motor rotates by the set value. | P.8-36 |
| Pn503 | Encoder Dividing Denominator | Set the denominator when the number of pulses per motor rotation in pulse regeneration is not an integer. | P.8-47 |
| Pn620 | External Encoder Phase-Z Setting | Set the external encoder phase-Z output width. | P.8-63 |

Rotation Direction Switching (Pn000)

Set the relation between the command direction and the motor rotation direction.

0: A forward direction command sets the direction to CW as viewed from the shaft end

1: A forward direction command sets the direction to CCW as viewed from the shaft end

Take note that if Pn000 = 1, the scale count direction becomes opposite to the count direction used for monitoring the total external encoder feedback pulses, etc.

Control Mode Selection (Pn001)

Select the fully-closed control (set value: 6).

Command Pulse Input Process (Pn005, Pn006, Pn007)

Position command input terminals are classified into the input 1 system (+CW, -CW, +CCW, -CCW) and input 2 system (+CWLD, -CWLD, +CCWLD, -CCWLD).

If the position command output is a line-driver output, set input 2. If it is an open collector output, set input 1. Although input 2 can also be used for a line-driver output, the allowable maximum input frequency will become lower than when input 1 is selected.

| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|---|---|---------------|------|
| Pn005 | Command Pulse Input Selection | Select the command pulse input terminal. When using a Servo Relay Unit cable, set to 0 (photocoupler input). 0: Photocoupler input | 0 or 1 | _ |
| Pn006 | Command Pulse Rotation Direction Switching Selection | Set the count direction for the command pulse input. 0: Command pulse, forward direction 1: Command pulse, reverse direction | 0 or 1 | _ |
| Pn007 | Command Pulse Mode Selection | Set the count method for the command pulse input. 0: 90° phase difference (A/B) signal input 1: Forward/reverse pulse 2: 90° phase difference (A/B) signal input 3: Feed pulse/direction signal | 0 to 3 | _ |

[•] For information on the settings for command pulse rotation direction and command pulse mode, refer to "5-1 Position Control" (P.5-1).

Electronic Gear Function (Pn008, Pn009, Pn010)

This function sets the position command for the position control part a value calculated by multiplying the pulse command input from the Host Controller with the set electronic gear ratio.

| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|---|---|----------------------|-------|
| Pn008 | Electronic Gear Integer Setting | Set the number of command pulses corresponding to 1 motor rotation. | 0 to 2 ²⁰ | Pulse |
| Pn009 | Electronic Gear Ratio Numerator 1 | Set the numerator of the electronic gear ratio for the command pulse input. | 0 to 2 ³⁰ | _ |
| Pn010 | Electronic Gear Ratio Denominator | Set the denominator of the electronic gear ratio for the command pulse input. | 1 to 2 ³⁰ | _ |

- For details on the electronic gear function, refer to "6-4 Electronic Gear Function" (P.6-10).
- For fully-closed control, set the Electronic Gear Integer Setting (Pn008) to 0, and set the Electronic Gear Ratio Numerator 1 (Pn009) and Electronic Gear Ratio Denominator (Pn010).

Encoder Dividing Function (Pn011, Pn012, Pn503)

The number of pulses can be set for the encoder signals output from the drive.

| Parameter number | Parameter name | | Explanation | 1 | Setting range | Unit |
|------------------|---|---|--|---|----------------------|---------|
| Pn011 | Encoder Dividing Numerator | phase B | Set the number of phase A and phase B output pulses, respectively per motor rotation. | | 1 to 262144 | Pulse/r |
| | Encoder Output Direction Switching Selection | regenera source. | ne phase B logic ation output and For fully-closed on external encod ource. | the output control, | | |
| Pn012 | | Set value | Output source | Phase B logic | 0 to 3 | _ |
| | | 0 | Encoder | Non-reverse | | |
| | | 1 | Lilcodei | Reverse | | |
| | | 2 | External | Non-reverse | | |
| | | 3 | encoder | Reverse | | |
| | | | | | | |
| Pn503 | Encoder Dividing Denominator | rotation a dividin value he and usir | e number of outp is not an integer, ig ratio by setting ere to a number o ing Pn011 as the for and Pn503 as nator. | you can set g the set other than 0, dividing | 0 and 1 to 262144 | _ |

[•] For details on encoder dividing function, refer to "6-5 Encoder Dividing Function" (P.6-14).

External Feedback Pulse Type Selection (Pn323, Pn326)

Set the external encoder output type and direction.

| Parameter number | Parameter name | | Explanation | Setting range | Unit |
|------------------|--|---|--|---------------|------|
| | External Feedback Pulse Type Selection | Select the ty | ype of the external encoder to be | | |
| | Type delection | Set value | External encoder type | | |
| Pn323 | | 0 | 90° phase difference output type | 0 to 2 | _ |
| | | 1 | Incremental encoder with serial communications | | |
| | | 2 | Reserved (Do not use this setting.) | | |
| Pn326 | External Feedback Pulse Direction Switching | If the count directions of the external encoder feedback pulse and the encoder total feedback pulses do not match, reverse the external encoder feedback pulse direction in this setting. 0: Not reversed, 1: Reversed | | 0 or 1 | - |

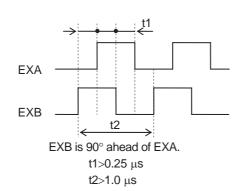
The corresponding external encoders for each output type are given in the following table.

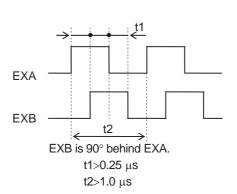
| Pn323 set value | External encoder type | Corresponding external encoder examples | Maximum input frequency *2 |
|-----------------------|--|---|----------------------------|
| 0 | 90° phase difference output type*1 | 90° phase difference output type external encoder | 0 to 4 Mpps (After × 4) |
| 1 | Incremental encoder with serial communications | Sony Manufacturing Systems Corporation SR75, SR85 | 0 to 400 Mpps |
| 2 | Reserved (Do not use this s | setting.) | |

^{*1.} These are the directions in which the Servo Drive counts the pulses from a 90° phase difference output type external encoder.

Count-down direction

Count-up direction





*2. These are the feedback speeds from the external encoder at which Servo Drive can respond. Check the external encoder operation manual for its maximum output frequency. For example, the maximum speed when an external encoder with a resolution of 0.01 μ m is used for the serial communication type is 0.01 μ m \times (400 \times 10⁶) pps = 4.00 m/s. An overspeed error protection is generated, however, if the motor shaft rotation speed exceeds the maximum speed.



Precautions for Correct Use

- For the external encoder connection direction, set the rotation direction so that count-up occurs when the motor shaft is rotating counterclockwise, and count-down occurs when the motor shaft is rotating clockwise. If the connection direction cannot be selected due to installation conditions, etc., the count direction can be reversed using External Feedback Pulse Direction Switching (Pn326).
- Take note that if Pn000 = 1, the encoder count direction becomes opposite to the count direction used for monitoring the total external encoder feedback pulses, etc.

 If Pn000 = 0, the count direction matches the count direction for monitoring.
- Even when the speed command is within the Drive's speed command range, an acceleration error will occur if the speed command exceeds the maximum speed of motor shaft rotation.
- To confirm that the installation direction is correct, use the front-panel monitor or the CX-Drive monitor function to check the counting direction of the total external encoder feedback pulses and the total encoder feedback pulses. If the counting directions are the same, the connections are correct.

External Feedback Pulse Dividing Ratio Setting (Pn324, Pn325)

Set the dividing ratio for the encoder resolution and external encoder resolution.

| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|--|--|----------------------|------|
| Pn324 | External Feedback Pulse Dividing Numerator | Set the numerator of the external encoder divider setting. Normally, set the number of encoder output pulses per motor rotation. If the set value is 0, the encoder resolution is set automatically. | 0 to 2 ²⁰ | - |
| Pn325 | External Feedback Pulse Dividing Denominator | Set the denominator of the external encoder divider setting. Normally, set the number of external encoder output pulses per motor rotation. | 1 to 2 ²⁰ | - |

Check the number of encoder feedback pulses and the number of external encoder output pulses per motor rotation, and set External Feedback Pulse Dividing Numerator (Pn324) and External Feedback Pulse Dividing Denominator (Pn325) so that the following formula works out.

Pn324 = Number of encoder output pulses per motor rotation

Number of external encoder output pulses per motor rotation

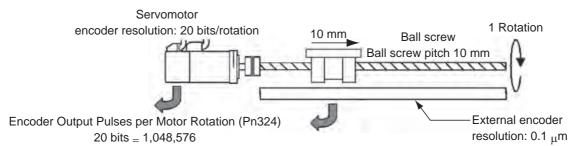
If this divider setting is wrong, there will be deviations between the position calculated from encoder pulses and the position calculated from external encoder. If the movement distance is long, these deviations accumulate and cause an internal/external feedback pulse error counter overflow level error.

■ Setting Examples

• Ball screw pitch: 10 mm

• External encoder resolution: 0.1 μm

• Encoder resolution: 20 bits



External Encoder Output Pulse Per Motor Rotation (Pn325) $10 \text{ [mm]} / 0.1 \text{ [} \mu\text{m/pulse]} = 100,000 \text{ [pulses]}$

 $\frac{\text{Pn324}}{\text{Pn325}} = \frac{\text{Number of encoder output pulses per motor rotation}}{\text{Number of external encoder output pulses per motor rotation}} = \frac{1,048,576}{100,000}$

External Feedback Pulse Error Setting (Pn328, Pn329)

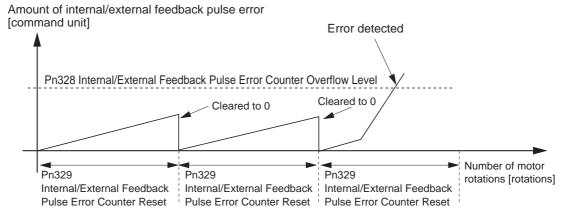
The difference between the encoder position and external encoder position is detected, and if the difference exceeds the value of Internal/External Feedback Pulse Error Counter Overflow Level (Pn328), an alarm will occur.

| Parameter number | Parameter name | Explanation | Setting range | Unit |
|------------------|--|--|----------------------|---------------|
| Pn328 | Internal/External Feedback Pulse Error Counter Overflow Level | Set the allowable difference (hybrid error) between the encoder-detected position and external encoder-detected position in command units. | 1 to 2 ²⁷ | Command units |
| Pn329 | Internal/External Feedback Pulse Error Counter Reset | The hybrid error becomes 0 every time the motor rotates by the set value. If the set value is 0, the hybrid error is not cleared. | 0 to 100 | Rotations |

Pn329: Internal/External Feedback Pulse Error Counter Reset

Every time the motor rotates for the amount set by Pn329, the internal/external feedback pulse error is cleared.

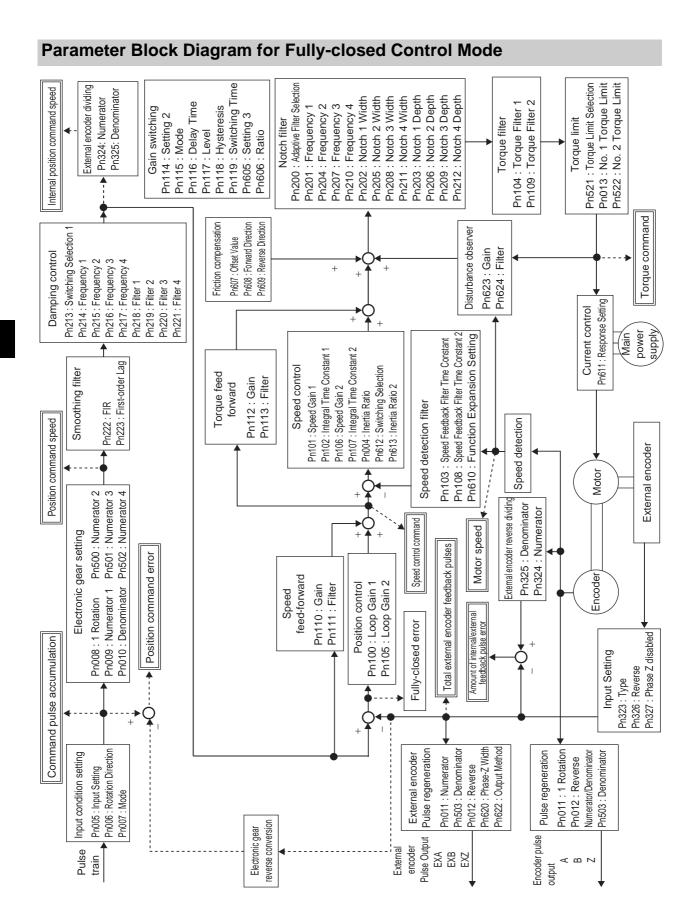
This function can be used when there is deviation between the position calculated from encoder pulses and the position calculated from external encoder due to slipping, etc, and internal/external feedback pulse errors accumulate.





Precautions for Correct Use

- An internal/external feedback pulse error counter overflow level error occurs when the external encoder is abnormal, connection is wrong, or connection point between the motor and load is loose, among others. Accordingly, check these items when an alarm occurs.
- Be sure to set an appropriate value for Internal/External Feedback Pulse Error Counter Reset (Pn329). If an extremely small value is set, this function may not operate.
- Take sufficient safety measures, such as installing limit sensors.





Applied Functions

This chapter gives outline of applied functions such as damping control, electronic gears, gain switching and disturbance observer, and explains the contents of setting.

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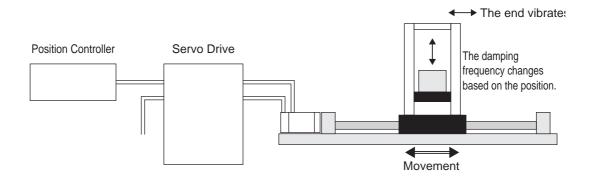
6-1 Damping Control

Outline of Operation

If the tip of the mechanical unit vibrates, you can use the damping control function to reduce vibration.

This is effective on vibration generated by a machine of low rigidity. The applicable frequencies are from 1 to 200 Hz.

Since damping control is performed using position commands, it cannot be used with speed or torque control.



Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|-----------------------------|---|-----------|
| Pn001 | Control Mode Selection | Set to the Position Control Mode or Fully-closed Control Mode. 0: Position control 3: First control mode for position/speed control 4: First control mode for position/torque control 6: Fully-closed control | P.8-2 |
| Pn213 | Damping Filter Selection | Select the damping filter switching mode according to the condition of the unit. 0: Damping filter 1 or 2 enabled 1: Switching by external input (DFSEL1) 2: Switching by external input (DFSEL1, DFSEL2) 3: Switching with command direction | P.8-21 |
| Pn214 | Damping Frequency 1 | Set damping frequency 1 to suppress vibration at the end of the load in damping control. If the damping control function is not used, set 0. | P.8-22 |
| Pn215 | Damping Filter 1 Setting | When the Damping Frequency 1 (Pn214) is set, reduce the setting if torque saturation occurs or increase the setting to increase operation speed. Normally 0 is set. If the damping filter 1 is disabled, this parameter is also disabled. | P.8-22 |
| Pn216 | Damping Frequency 2 | The function is the same with Pn214. | P.8-22 |
| Pn217 | Damping Filter 2 Setting | The function is the same with Pn215. | P.8-22 |
| Pn218 | Damping Frequency 3 | The function is the same with Pn214. | P.8-23 |
| Pn219 | Damping Filter 3 Setting | The function is the same with Pn215. | P.8-23 |
| Pn220 | Damping Frequency 4 | The function is the same with Pn214. | P.8-23 |
| Pn221 | Damping Filter 4 Setting | The function is the same with Pn215. | P.8-23 |



Precautions for Correct Use

- Stop operation before changing the parameters or switching with DFSEL.
- Damping control may not function properly or the effect may not be apparent under the following conditions.

| Item | Conditions under which the effect of damping control is inhibited |
|----------------|---|
| Control mode | - Speed Control Mode or Torque Control Mode |
| Load condition | If forces other than position commands, such as external forces, cause vibration. If the damping frequency is outside the range of 1 to 200 Hz. If the ratio of the resonance frequency to anti-resonance frequency is large. |

Operating Procedure

1. Adjust the position loop gain and speed loop gain.

Adjust Position Loop Gain (Pn100), Speed Loop Gain (Pn101), Speed Loop Integral Time Constant (Pn102) and Torque Command Filter Time Constant (Pn104). If no problem occurs in realtime autotuning, you can continue to use the settings.

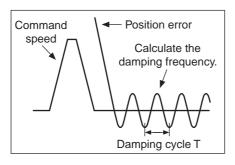
2. Measure the damping frequency at the tip of the mechanical unit.

Measure the damping frequency by using a measurement device such as a laser displacement sensor, servo acceleration meter, or acceleration pick-up.

Set the damping frequency in one of Damping Frequency 1 to Damping Frequency 4 (1: Pn214, 2: Pn216, 3: Pn218, 4: Pn220) according to the operation.

Also set the switching mode using Damping Filter Selection (Pn213).

If the measurement device cannot be used, use CX-Drive tracing function, and read the residual damping frequency (Hz) from the position error waveform as shown in the following figure.



• The damping frequency in the figure is calculated with the following formula:

$$f(Hz) = \frac{1}{T(s)}$$

Since the parameter unit is 0.1 Hz: $(Pn214, Pn216, Pn218, Pn220) = 10 \times f$

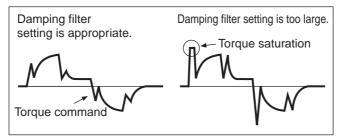
Application example
 If the damping cycle is 100 ms or 20 ms, set 100 or 500 in the parameter so that the damping frequency becomes 10 Hz or 50 Hz.

If vibration persists after setting the frequency, increase or decrease the damping frequency to find the frequency at which vibration decreases.

3. Make the damping filter settings.

Make the damping filter settings (1: Pn215, 2: Pn217, 3: Pn219, 4: Pn221). First, set to 0.

The stabilization time can be reduced by setting a large value; however, torque ripple will increase at the command change point as shown in the following figure. Set a range that will not cause torque saturation under actual operation conditions. The effects of vibration suppression will be lost if torque saturation occurs.



When the Damping Frequency 1 (Pn214) is set, reduce the setting if torque saturation occurs or increase the setting to increase operation speed. Normally 0 is set.

If the damping filter 1 is enabled, use the following setting range.

Setting range: $100 \le Pn214 + Pn215 \le Pn214 \times 2$ or 2,000

Note: If the damping filter 1 is disabled under Damping Filter Selection (Pn213), this parameter is also disabled.

4. Set the Damping Filter Selection (Pn213).

Damping filters 1 to 4 can be switched according to the conditions of the machine vibration.

| Set value | Switching mode | | | |
|-----------|---|--|--|--|
| 0 | Damping filter 1 and 2 enabled | | | |
| 1 | Switching by external input (DFSEL1) Open: Damping filter 1 or 3 enabled Shorted: Damping filter 2 or 4 enabled | | | |
| 2 | Switching by external input (DFSEL1, DFSEL2) When DFSEL1 and DFSEL2 are both open: Damping filter 1 enabled When DFSEL1 is shorted and DFSEL2 is open: Damping filter 2 enabled When DFSEL1 is open and DFSEL2 is shorted: Damping filter 3 enabled When DFSEL1 and DFSEL2 are both shorted: Damping filter 4 enabled | | | |
| 3 | Switching with command direction Forward: Damping filters 1 and 3 enabled Reverse: Damping filters 2 and 4 enabled | | | |

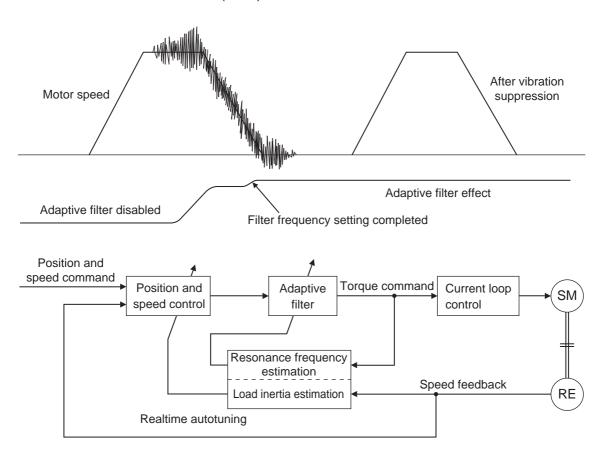
6-2 Adaptive Filter

Outline of Operation

The adaptive filter reduces resonance point vibration by estimating the resonance frequency from the vibration component that appears in the motor speed during actual operation and automatically sets the frequency of the notch filter, which removes the resonance component from the torque command.

The automatically set notch filter frequency is set in Notch 3 (Pn207 to Pn209) or Notch 4 (Pn210 to Pn212).

Refer to "6-3 Notch Filter" (P.6-7) for information on notch filter.



Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|------------------------------|--|-----------|
| Pn200 | Adaptive Filter Selection | Set the number of resonance frequencies to be estimated by the adaptive filter and the operation to be performed after estimation. 0: Adaptive filter disabled 1: 1 adaptive filters enabled 2: 2 adaptive filters enabled 3: Resonance Frequency Measurement Mode The servo drive measures the resonant frequency automatically. 4: Adaptive result clear The notch filter 3 and notch filter 4 parameters are disabled, and adaptive result is cleared. | P.8-20 |



Precautions for Correct Use

• Adaptive filter may not operate correctly under the following conditions.

| Item | Conditions under which the adaptive filter not operates properly | | | |
|------------------|---|--|--|--|
| Control mode | · Torque Control Mode | | | |
| Resonance points | If the resonance frequency is 300 Hz or lower. If the resonance peak or control gain is too low to affect the motor speed. If there are three or more resonance points. | | | |
| Load | If the motor speed with high-frequency components changes due to backlash on other non-linear elements. | | | |
| Command pattern | The acceleration/deceleration is sudden. | | | |

- If the adaptive filter does not operate properly, use Notch 1 (Pn201 to Pn203) or Notch 2 (Pn204 to Pn206) to implement resonance measures according to the manual adjustment procedure. Refer to "6-3 Notch Filter" (P.6-7) for information on notch filter.
- An unusual noise or vibration may occur until the adaptive filter stabilizes after startup, immediately after
 the first servo ON, or when the Realtime Autotuning Machine Rigidity Selection (Pn003) is increased,
 but this is not a problem if it disappears right away. If the vibration or unusual noise, however, continues
 for three or more reciprocating operations, take the following measures in the possible order.
 - · Write the parameters used during normal operation to the EEPROM.
 - · Lower the Realtime Autotuning Machine Rigidity Selection (Pn003).
 - Disable the adaptive filter by setting the Adaptive Filter Selection (Pn200) to 0.
 (Resetting of inertial estimation and adaptive operation)
 - · Manually set the notch filter.
- If unusual noise or vibration occurred, the setting of Notch 3 (Pn207 to Pn209) or Notch 4 (Pn210 to Pn212) may have changed to an extreme value. In this case, set Adaptive Filter Selection (Pn200) to 0 to disable the parameter and then set Notch 3 Frequency Setting (Pn207) and Notch 4 Frequency Setting (Pn210) to 5,000 (disabled). Next, enable Adaptive Filter Selection again.
- Notch 3 Frequency Setting (Pn207) and Notch 4 Frequency Setting (Pn210) are written to the EEPROM every 30 minutes. When the power supply is turned OFF and then turned ON again, this data will be used as the default settings to perform adaptive operation.
- The adaptive filter is disabled when torque control is performed, but the adaptive filter frequency used in the control mode before switching will be held if torque control has been selected by setting the Control Mode Selection (Pn001) to 5 or 6.

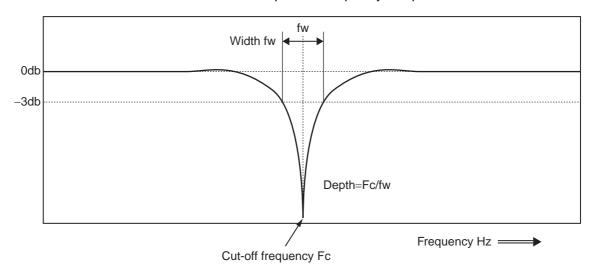
6-3 Notch Filter

Outline of Operation

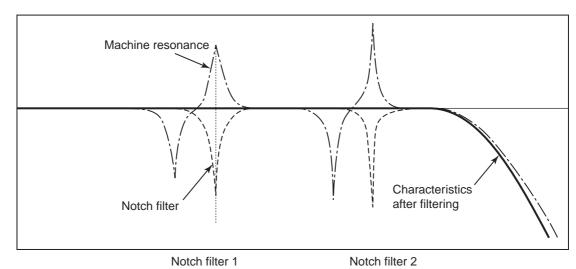
You can set up to 4 notch filters for the torque command.

If a ball screw or other controlled device causes resonance at a specific location, you can set the resonance frequency using a notch filter to eliminate resonance.

A notch filter is used to eliminate a specified frequency component.



If machine resonance occurs, use this notch filter to eliminate resonance.



Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|---------------------------------|---|-----------|
| Pn201 | Notch 1 Frequency Setting | Set the center frequency of notch filter 1. The notch filter is enabled at 50 to 4,999 Hz, and disabled at 5,000 Hz. | P.8-20 |
| Pn202 | Notch 1 Width Setting | Select the width of the notch filter 1 frequency. Increasing the value widens the notch width. (Setting range: 0 to 20) | P.8-20 |
| Pn203 | Notch 1 Depth Setting | Select the depth of the notch filter 1 center frequency. Increasing the value decreases the notch depth and thereby reduces the phase delay. The notch filter is disabled if 100 is set. (Setting range: 0 to 99) | P.8-20 |
| Pn204 | Notch 2 Frequency Setting | Set the center frequency of the notch filter 2. The details are the same with the notch filter 1 frequency. | P.8-20 |
| Pn205 | Notch 2 Width Setting | Select the width of the notch filter 2 frequency. The details are the same with the notch filter 1 width. | P.8-20 |
| Pn206 | Notch 2 Depth Setting | Select the depth of the notch filter 2 center frequency. The details are the same with the notch filter 1 depth. | P.8-21 |
| Pn207 | Notch 3 Frequency Setting *1 | Set the center frequency of the notch filter 3. The details are the same with the notch filter 1 frequency. | P.8-21 |
| Pn208 | Notch 3 Width Setting *1 | Select the width of the notch filter 3 frequency. The details are the same with the notch filter 1 width. | P.8-21 |
| Pn209 | Notch 3 Depth Setting *1 | Select the depth of the notch filter 3 center frequency. The details are the same with the notch filter 1 depth. | P.8-21 |
| Pn210 | Notch 4 Frequency Setting *1 | Set the center frequency of the notch filter 4. The details are the same with the notch filter 1 frequency. | P.8-21 |
| Pn211 | Notch 4 Width Setting *1 | Select the width of the notch filter 4 frequency. The details are the same with the notch filter 1 width. | P.8-21 |
| Pn212 | Notch 4 Depth Setting *1 | Select the depth of the notch filter 4 center frequency. The details are the same with the notch filter 1 depth. | P.8-21 |

^{*1} If an adaptive filter is used, these are set automatically.



Precautions for Correct Use

• Identify the resonance frequency using the frequency characteristics measurement function, resonance frequency monitor or operation waveform of the waveform graphics function of CX-Drive and set the identified frequency as the notch filter frequency.

Notch Filter Width and Depth

Width Setting

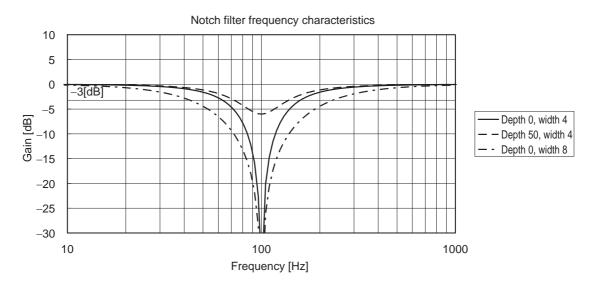
This is the ratio of the frequency bandwidth at a damping factor of -3 [dB] relative to the center frequency when the depth is 0. This value should conform to the left column in the table below.

Depth Setting

This is the I/O ratio at which the center frequency input is completely cut off at a set value of 0 and completely passed at a set value of 100. If the indication unit is [dB], this value should conform to the right column in the table below.

| Width | | | |
|-----------|----------------------------|--|--|
| Set value | Bandwidth/center frequency | | |
| 0 | 0.50 | | |
| 1 | 0.59 | | |
| 2 | 0.71 | | |
| 3 | 0.84 | | |
| 4 | 1.00 | | |
| 5 | 1.19 | | |
| 6 | 1.41 | | |
| 7 | 1.68 | | |
| 8 | 2.00 | | |
| 9 | 2.38 | | |
| 10 | 2.83 | | |
| 11 | 3.36 | | |
| 12 | 4.00 | | |
| 13 | 4.76 | | |
| 14 | 5.66 | | |
| 15 | 6.73 | | |
| 16 | 8.00 | | |
| 17 | 9.51 | | |
| 18 | 11.31 | | |
| 19 | 13.45 | | |
| 20 | 16.00 | | |

| Depth | | | | |
|-----------|---------------|---------------------|--|--|
| Set value | I/O ratio (%) | Damping factor (dB) | | |
| 0 | 0 (Cut off) | -∞ | | |
| 1 | 1 | -40.0 | | |
| 2 | 2 | -34.0 | | |
| 3 | 3 | -30.5 | | |
| 4 | 4 | -28.0 | | |
| 5 | 5 | -26.0 | | |
| 10 | 10 | -20.0 | | |
| 15 | 15 | -16.5 | | |
| 20 | 20 | -14.0 | | |
| 25 | 25 | -12.0 | | |
| 30 | 30 | -10.5 | | |
| 35 | 35 | -9.1 | | |
| 40 | 40 | -8.0 | | |
| 45 | 45 | -6.9 | | |
| 50 | 50 | -6.0 | | |
| 60 | 60 | -4.4 | | |
| 70 | 70 | -3.1 | | |
| 80 | 80 | -1.9 | | |
| 90 | 90 | -0.9 | | |
| 100 | 100 (Passed) | 0.0 | | |



6-4 Electronic Gear Function

Outline of Operation

- The motor can be rotated for the number of pulses obtained by multiplying the position command values by the electronic gear ratio.
- This function supports position and fully-closed control.

Parameters Requiring Settings

| Parameter number | Parameter name Explanation | | Reference |
|------------------|---|--|-----------|
| Pn008 | Electronic Gear Integer Setting | ear Integer Set the number of command pulses corresponding to 1 motor rotation. | |
| Pn009 | Electronic Gear Ratio Numerator 1 | Set the numerator of the electronic gear ratio. If the set value is 0, the encoder resolution is automatically set as the numerator. 131,072 for a 17-bit absolute encoder 1,048,576 for a 20-bit incremental encoder | |
| Pn010 | Electronic Gear Ratio Denominator | Set the denominator of the electronic gear ratio. | P.8-5 |
| Pn500 | Electronic Gear Ratio Numerator 2 *1 | Set the numerator of the electronic gear ratio 2. | |
| Pn501 | Electronic Gear Ratio Numerator 3 *1 | Set the numerator of the electronic gear ratio 3. | |
| Pn502 | Electronic Gear Ratio Numerator 4 *1 | Set the numerator of the electronic gear ratio 4. | |

^{*1.} Switching among Electronic Gear Ratio Numerators 2 to 4 (Pn500 to Pn502) is performed using the electronic gear switching input (GESEL1/GESEL2).

The settings of GESEL1 and GESEL2 are as follows.

| GESEL1 GESEL2 | | Applicable parameters | |
|---------------|-----|---|--|
| OFF | OFF | Electronic Gear Ratio Numerator 1 (Pn009) | |
| ON | OFF | Electronic Gear Ratio Numerator 2 (Pn500) | |
| OFF | ON | Electronic Gear Ratio Numerator 3 (Pn501) | |
| ON | ON | Electronic Gear Ratio Numerator 4 (Pn502) | |

Any values can be set for PN008, Pn009, and Pn010, but operation may not be correct if you set an extreme electronic gear ratio. Set the electronic gear ratio to between 1/1,000 and 1,000.

Electronic Gear Ratio Setting (Pn008, Pn009, Pn010)

| Electronic Gear Integer Setting (Pn008) | Electronic Gear Ratio Numerator 1 (Pn009) | Electronic Gear Ratio Denominator (Pn010) | Explanation | |
|---|--|--|--|--|
| | | - | When the Electronic Gear Integer Setting (Pn008) ≠ 0 The processing will be based on the set value of Electronic Gear Integer Setting (Pn008) regardless of the set values of Electronic Gear Ratio Numerator 1 (Pn009) and Electronic Gear Ratio Denominator (Pn010). | |
| 1 to 1048576 | _ | | Command pulse input Encoder resolution * Electronic Gear Integer Setting (Pn008) Position command | |
| | | | Position command pulse = Encoder resolution / Electronic Gear Integer Setting (Pn008) Switching among electronic gear ratio numerators 1 to 4 is disabled when the Electronic Gear Integer Setting (Pn008) ≠ 0. | |
| | 0 1 to 1073741824 | 1 to 1073741824 | When the Electronic Gear Integer Setting (Pn008) = 0, or Electronic Gear Ratio Numerator 1 (Pn009) = 0 The processing will be based on the set value of Electronic Gear Ratio Denominator (Pn010). | |
| | | | Command pulse input Encoder resolution * Electronic Gear Ratio Denominator (Pn010) Position command | |
| | | | Position command pulse = Encode resolution / Electronic Gear Ratio Denominator (Pn010) | |
| 0 | | | When the Electronic Gear Integer Setting (Pn008) = 0, or Electronic Gear Ratio Numerator 1 (Pn009) \neq 0 The processing will be based on the set values of Electronic Gear Ratio Numerator 1 (Pn009) and Electronic Gear Ratio Denominator (Pn010). | |
| | | | Command pulse input Electronic Gear Ratio Numerator 1 (Pn009) Electronic Gear Ratio Denominator (Pn010) | |
| | | | | Position command pulse = Electronic Gear Ratio Numerator 1 (Pn009) / Electronic Gear Ratio Denominator (Pn010) |

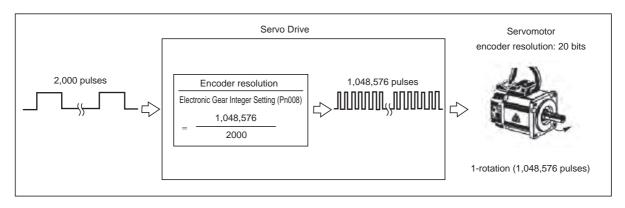
^{*} The encoder resolution is set as the numerator for fully-closed control. The command pulse is the external encoder reference for fully-closed control. Accordingly, please be cautious that the Pn008 set value will not be the number of command pulses per motor rotation.

Operation Example

• Example of a motor with a 20-bit encoder (1,048,576 pulses/rotation)

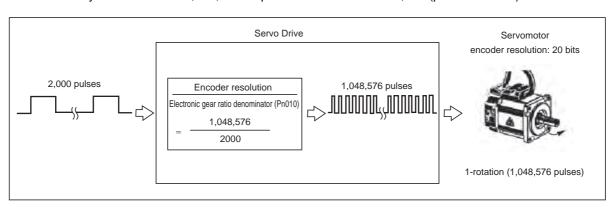
When the Electronic Gear Integer Setting (Pn008) \neq 0

• If you set Pn008 = 2,000, it will operate the same as the 2,000 (pulses/rotation) Servomotor.



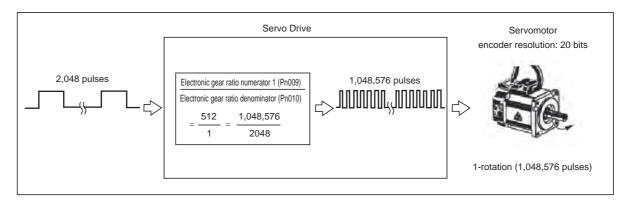
When the Electronic Gear Integer Setting (Pn008) = 0 and the Electronic Gear Ratio Numerator = 0

• If you set Pn010 = 2,000, it will operate the same as the 2,000 (pulses/rotation) Servomotor.



When the Electronic Gear Integer Setting (Pn008) = 0 and the Electronic Gear Ratio Numerator ≠ 0

• If you set Pn009 and Pn010 = 512/1, it will operate the same as the 2,048 (pulses/rotation) Servomotor.





Precautions for Correct Use

• Set the parameters so that the command pulse frequency multiplied by the electronic gear ratio does not exceed 175 Mpps*. If 175 Mpps* is exceeded, alarm 27.2 will occur. Example:

The following calculation is for an incremental encoder with a resolution of 1,048,576, an electronic gear setting of 500 (Pn008 = 500), and a command pulse frequency of 100 kpps.

100 Kpps \times 1,048,576/500 = 209,715,200 = 209.7152 Mpps, which exceeds 175 Mpps*. The calculation changes as follows if the electronic gear is set to 5,000 (Pn008 = 5,000) and the command pulse frequency is 100 kpps.

 $100 \text{ Kpps} \times 1,048,576/5,000 = 20,971,520 = 20.97152 \text{ Mpps}, which does not exceed 175 Mpps*.}$

* Alarm 27.2 will occur if 3 Gpps is exceeded when using software version 1.10 or higher. The software version can be checked on the front panel or with the CX-Drive. For information on checking the software version on the front panel, refer to *9-4 Setting the Mode*.

6-5 Encoder Dividing Function

Outline of Operation

- The number of output pulses from the drive can be adjusted.
- You can set the number of pulses per motor rotation in the range of 1 to (the number of encoder resolution pulses).
- This function is used in the following cases:
 - When you use a controller with a low response frequency
 - When you want to set the pulse rate corresponding to a certain value Example: Set the encoder dividing ratio to 2,000 (pulses/rotation) for when the resolution is set to 5 μ m/pulse on mechanical systems that travel 10 mm per motor rotation.

Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|---|---|-----------|
| Pn011 | Encoder Dividing Numerator | Set the number of phase-A and phase-B output pulses, respectively per motor rotation. | |
| Pn012 | Encoder Output Direction Switching Selection | Select the phase B logic for pulse regeneration output and the output source. | P.8-6 |
| Pn503 | Encoder Dividing Denominator | Set the denominator when the number of pulses per motor rotation in pulse regeneration is not an integer. | P.8-47 |
| Pn533 | Pulse Regeneration Output Limit Setting | Set whether to enable or disable the detection of Alarm 28.0 "pulse regeneration error." 0: Disabled, 1: Enabled | P.8-59 |
| Pn620 | External Encoder Phase-Z Setting | Set the external encoder phase-Z output width. | P.8-63 |
| Pn622 | 90° Phase Difference Output External Encoder Pulse Output Method Selection | Select the regeneration method of pulse outputs A and B when a 90° phase difference output type external encoder is used. 0: Without signal regeneration. 1: With signal regeneration for phase-A and phase-B. Without signal regeneration for phase-Z. | P.8-63 |

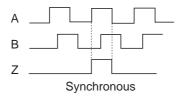
Encoder Dividing Ratio Setting (Pn011, Pn503)

| Encoder Dividing Numerator (Pn011) | Encoder Dividing Denominator (Pn503) | Explanation | | | |
|---|---|---|--|--|--|
| | | When the output source is the encoder When Encoder Dividing Denominator (Pn503) = 0 This is set by Encoder Dividing Numerator (Pn011), and the output pulse is the number of pulses set by Encoder Dividing Numerator (Pn011) as follows. Encoder pulse Pn011 set value × 4 Encoder resolution Output pulse from the drive | | | |
| 1 to 262144 | 0 | Number of pulse output per rotation = Encoder Dividing Numerator (Pn011) \times 4 When the output source is the external encoder When Encoder Dividing Denominator (Pn503) = 0 The dividing ratio is 1:1. | | | |
| | | External encoder pulse 1 Output pulse from the drive | | | |
| | 1 to 262144 | When Encoder Dividing Denominator (Pn503) ≠ 0 The output pulse will be as follows based on Encoder Dividing Numerator (Pn011) and Encoder Dividing Denominator (Pn503). | | | |
| 1 to 262144 | | Encoder pulse or external encoder pulse Pn011 set value Pn503 set value Output pulse from the drive | | | |
| | | Number of pulse output per rotation = Encoder Dividing Numerator (Pn011) × encoder resolution | | | |

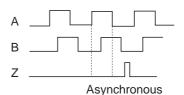
Phase Z Signal Output

1 phase-Z signal is output by 1 pulse per motor rotation. When the Encoder Dividing Denominator (Pn503) \neq 0, and if the pulse output resolution per rotation is not a multiple of 4, phase-Z and phase-A outputs are not synchronized. The output will be made as an encoder resolution, resulting in narrower width.

If Pn011 and Pn503 are integers



If Pn011 and Pn503 are not integers



Encoder Output Direction Switching Selection (Pn012)

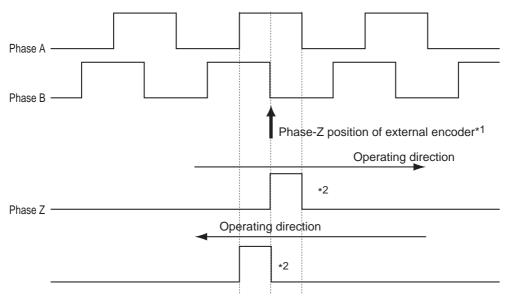
The corresponding external encoders for each output type are given in the following table.

| Pn012 set value | Output source | Phase B logic | CCW direction operation | CW direction operation |
|-----------------|------------------|---------------|-------------------------|------------------------|
| 0 | Encoder | Non- | Phase A | Phase |
| 2 | External encoder | reverse | | Phase B |
| 1 | Encoder | - Reverse | Phase | Phase A |
| 3 | External encoder | | Phase B | Phase B |

External Encoder Pulse Regeneration Function

Serial Incremental External Encoder

Phase Z is output without dividing the phase Z of the serial incremental external encoder. In addition, take note that there are differences as illustrated in the figure below depending on the direction passing phase Z.



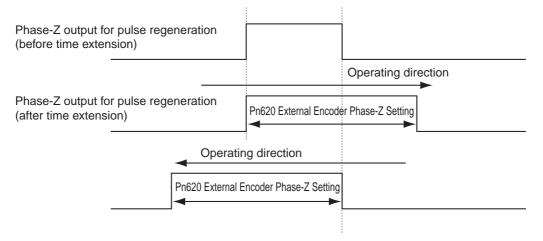
- *1. Phase-Z position and its relationship with phases A and B vary depending on the scale.
- *2. Phase Z is regenerated for 1 pulse. If the width is narrow, the output time can be extended by the External Encoder Phase Z Setting (Pn620).

90° Phase Difference Output Type External Encoder

- Phase Z is output without dividing the Z signal that is input from the 90° phase difference output type external encoder.
- When 90° Phase Difference Output External Encoder Pulse Output Method Selection (Pn622) = 1, the phase AB signal can be input into the amplifier and regenerated. Note, in this case, that the phase-AB regeneration will be delayed compared to when Pn622 is set to 0.

External Encoder Common Items

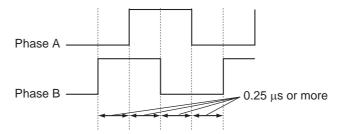
• When detection cannot be made because the phase-Z signal width is narrow due to the external encoder travel distance, if you set the phase-Z signal output time in the External Encoder-Z Setting (Pn620), phase Z can be output at least for that period of time. In addition, take note that the output is made from when the phase-Z signal starts and, therefore, it will be different from the actual phase-Z signal width. Take note, also, that the direction of the time extension varies depending on the direction of the operation.



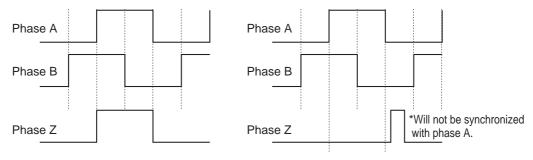


Precautions for Correct Use

• The maximum output frequency of the pulse regeneration output will be 4 Mpps (after quadruple multiplier). If operated at a speed that exceeds this, the regeneration function may not operate properly and position misalignment may result.



- You can generate Alarm 28.0 "pulse regeneration error" when the pulse regeneration limit is reached based on the Pulse Regeneration Output Limit Setting (Pn533). Note that this alarm is generated when the pulse regeneration output limit is detected. Therefore, the alarm does not occur due to the maximum output frequency. Depending on the motor rotation status (uneven rotations), the alarm may occur when the detection is made at the frequency that goes up momentarily.
- Take not that if the encoder is used as the output source and the pulse output resolution per rotation is not a multiple of 4, phase Z and phase A are not synchronized, and the width may be narrow.



When the dividing ratio is multiple of 4

When the dividing ratio is not multiple of 4

Note: When Pn503 = 0 and the output resolution is set to Pn011, the dividing ratio is always a multiple of 4.

• When en encoder with the incremental specifications is used, the first phase Z output after the power supply is turned ON may not always be within the above pulse width. When you are using the phase-Z signal, rotate the motor more than once after turning ON the power supply, and confirm that phase-Z regeneration has been performed once before using the second and subsequent phase Z outputs.

6-6 Brake Interlock

Outline of Operation

• This function lets you set the output timing for the brake interlock (BKIR) signal that activates the holding brake when the servo is turned ON, an alarm generates, or the servo is turned OFF.

Parameters Requiring Settings

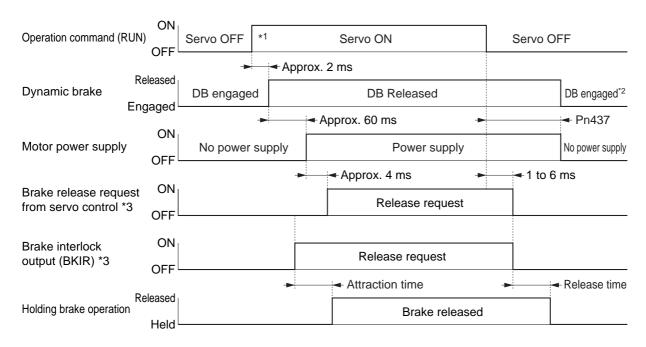
| Parameter number | Parameter name | Explanation | Reference |
|------------------|----------------------------------|--|-----------|
| Pn437 | Brake Timing when Stopped | Set the time after a servo OFF command is issued upon servo lock stop, until the brake interlock output (BKIR) signal turns OFF and power supply stops. | P.8-45 |
| Pn438 | Brake Timing During Operation | Set the time after a servo OFF command is issued while the motor is rotating, until the brake interlock output (BKIR) turns OFF and power supply stops. If the speed drops to the speed set inPn439 or below before the time set here elapses, BKIR will turn OFF. | P.8-45 |
| Pn439 | Brake Clear Speed Setting | To set the speed threshold for run time mechanical brake output determination. | P.8-46 |

Precautions for Correct Use of Holding Brake

- The brake on a Servomotor with a brake is a normally closed brake designed only to hold when the operation is stopped.
 - Accordingly, set an appropriate time so that the brake actuates after the motor stops.
- If the brake is engaged while the Servomotor is rotating, the brake disc will wear abnormally or sustain damage, resulting in a bearing or encoder failure in the Servomotor.

Operation

Servo ON/OFF Operation Timings < when Motor Is Stopped>



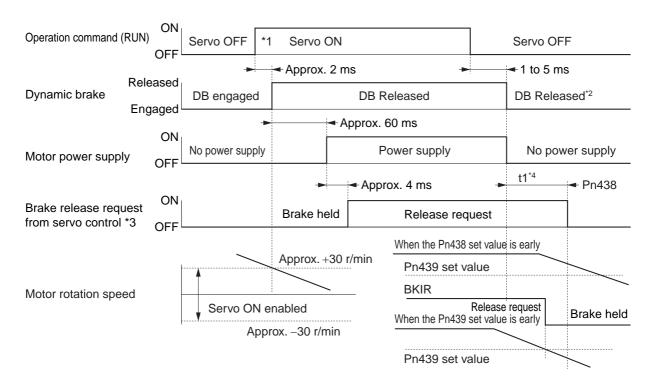
- *1. The servo does not turn ON until the motor rotation speed drops to approx. 30 r/min or below.
- *2. The dynamic brake operation when the servo is OFF depends on Stop Selection with Servo OFF (Pn506).
- *3. The brake interlock (BKIR) signal is output upon a release request from servo control. The BKIR signal is assigned to the general-purpose output (CN1).

Note: The brake application time and release time vary depending on the Servomotor brake. For details, refer to "3-3 Servomotor Specifications" (P.3-59).

Servo ON/OFF Operation Timings < When Motor Is Rotating>

Based on these operation timings, regenerative energy is produced if the motor rotation stops abnormally.

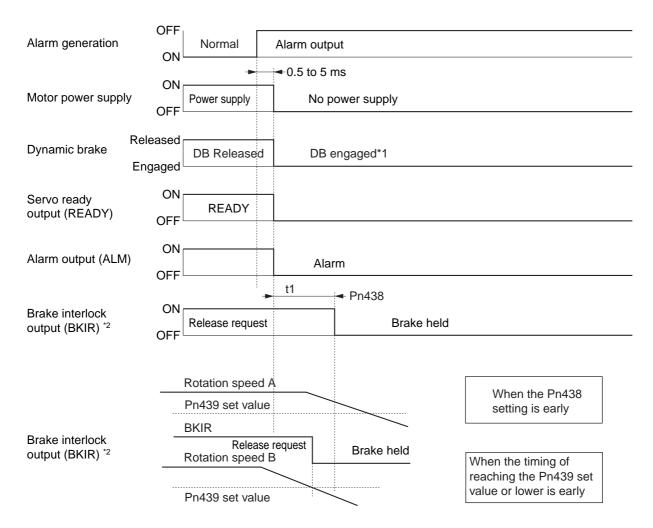
Accordingly, repeated operation cannot be performed. Provide a wait time of at least 10 minutes for the motor to cool down.



- *1. The servo does not turn ON until the motor rotation speed drops to approx. 30 r/min or below.
- *2. The dynamic brake operation when the servo is OFF depends on Stop Selection with Servo OFF (Pn506).
- *3. The brake interlock (BKIR) signal is output upon a release request from servo control. The BKIR signal is assigned to the general-purpose output (CN1).
- *4. "t1" is either the time set for the Brake Timing During Operation (Pn438), or the time needed for the motor speed to drop to speed set in Brake Release Speed Setting (Pn439) or below, whichever comes first.

Note: Even when the servo ON input is turned ON again while the motor is decelerating, the system does not enter the servo ON state until the motor stops.

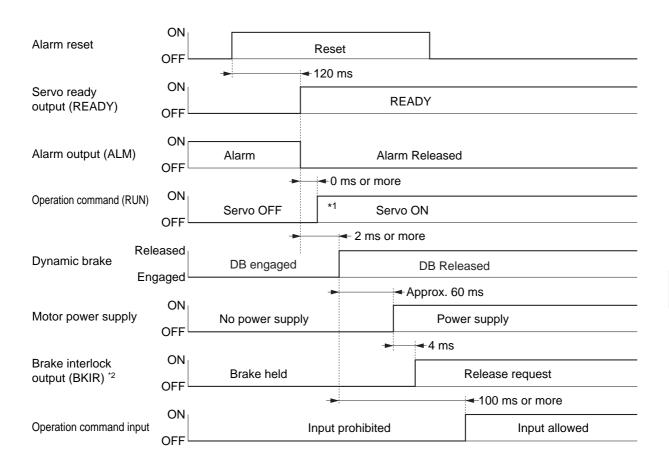
Operation Timings when Alarm Generates (Servo ON)



- *1. The dynamic brake operation when an alarm generates depends on Stop Selection with Servo OFF (Pn506).
- *2. "t1" is either the time set for the Brake Timing During Operation (Pn438), or the time needed for the motor speed to drop to speed set in Brake Release Speed Setting (Pn439) or below, whichever comes first.
- Note 1.Even when the servo ON input is turned ON again while the motor is decelerating, the system does not enter the servo ON state until the motor stops. The BKIR signal is assigned to the general-purpose output (CN1).
- Note 2.If the main circuit power supply turns OFF while the motor is operating, a phase loss alarm or main circuit voltage low alarm will occur, in which case this operation timing will be applied.

Operation Timings at Alarm Reset

Reset alarms by turning OFF the power supply and then turning it ON again. The alarm reset input recognition time can be changed using Alarm Reset Condition Selection (Pn516). The default setting is 120 ms.



- *1. The servo does not turn ON until the motor rotation speed drops to approx. 30 r/min or below.
- *2. The brake interlock (BKIR) signal is output upon a release request from servo control. The BKIR signal is assigned to the general-purpose output (CN1).

Note:After the alarm has been reset, the system enters the servo OFF state (motor not excited). To turn the servo ON, issue a servo ON command again after resetting the alarm, according to the above timings.

6-7 Gain Switching Function

Outline of Operation

- This function switches the position loop and speed loop gain.
- Select enable or disable using Gain Switching Input Operating Mode Selection (Pn114). Set the switching condition using the gain switching setting.
- If the load inertia changes or you want to change the responsiveness depending on whether the motor is stopping and operating, you can perform optimal control by using gain switching.
- Use gain switching when the realtime autotuning does not work effectively, etc. (See below.)
 - When the load inertia fluctuates in 200 ms or less.
 - When the motor rotation speed does not exceed 500 r/min, or load torque does not exceed 50% of the rated torque.
 - When an external force is constantly applied, as with a vertical axis.

Note. When Gain 2 has been selected, realtime autotuning does not operate normally. If using the gain switching, set the Realtime Autotuning to "disabled" (Pn002 = 0).

Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|--|--|-----------|
| Pn114 | Gain Switching Input Operating Mode Selection | Set whether to enable or disable the gain switching function. | P.8-12 |
| Position Con | trol Mode | | |
| Pn115 | Switching Mode in Position Control | Set the condition for switching between Gain 1 and Gain 2. | P.8-13 |
| Pn116 | Gain Switching Delay Time in Position Control | Set the time to return from Gain 2 to Gain 1. (Unit: 0.1 ms) | P.8-14 |
| Pn117 | Gain Switching Level in Position Control | Set the judgment level for switching between Gain 1 and Gain 2. | P.8-15 |
| Pn118 | Gain Switching Hysteresis in Position Control | Set the hysteresis width to be provided in the judgment level set in Gain Switching Level (Pn117). | P.8-15 |
| Pn119 | Position Gain Switching Time | Set the number of phased switches from low to high gain. (Unit: 0.1 ms) | P.8-15 |
| Speed Contr | ol mode | | |
| Pn120 | Switching Mode in Speed Control | Set the condition for switching between Gain 1 and Gain 2. | P.8-16 |
| Pn121 | Gain Switching Delay Time in Speed Control | Set the time to return from Gain 2 to Gain 1. (Unit: 0.1 ms) | P.8-17 |
| Pn122 | Gain Switching Level in Speed Control | Set the judgment level for switching between Gain 1 and Gain 2. | P.8-17 |
| Pn123 | Gain Switching Hysteresis in Speed Control | Set the hysteresis width to be provided in the judgment level set in Gain Switching Level (Pn122). | P.8-18 |
| Torque Cont | rol Mode | | |
| Pn124 | Switching Mode in Torque Control | Set the condition for switching between Gain 1 and Gain 2. | P.8-18 |
| Pn125 | Gain Switching Delay Time in Torque Control | Set the time to return from Gain 2 to Gain 1. (Unit: 0.1 ms) | P.8-19 |
| Pn126 | Gain Switching Level in Torque Control | Set the judgment level for switching between Gain 1 and Gain 2. | P.8-19 |
| Pn127 | Gain Switching Hysteresis in Torque Control | Set the hysteresis width to be provided in the judgment level set in Gain Switching Level (Pn126). | P.8-19 |

6-25

Diagrams of Gain Switching Setting

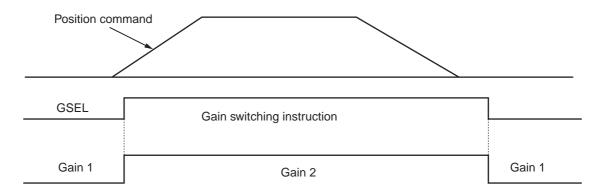
Switching between Gain 1 (Pn100 to Pn104) and Gain 2 (Pn105 to Pn109) occurs at the following times. Take note that, in the case of position loop gains, switching occurs based on the setting of Pn119.

For the details of each gain, refer to "Chapter 8, Parameter Details".

The details of the gain switching setting vary depending on the control mode used. For the details of settings available in each mode, refer to "Gain Switching Setting for Each Control Mode" (P.6-30).

Gain Switching Mode = 2: Gain Switching (GSEL)

The gain is switched instantly when a gain switching command is issued by external input.

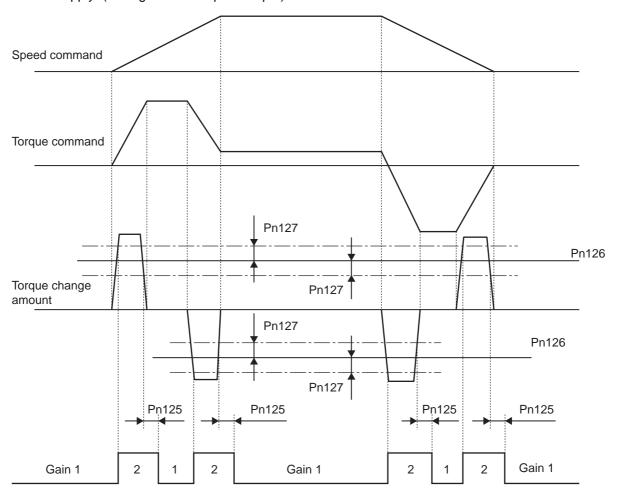


Gain Switching Mode = 3: Switching by Torque Command Change Amount

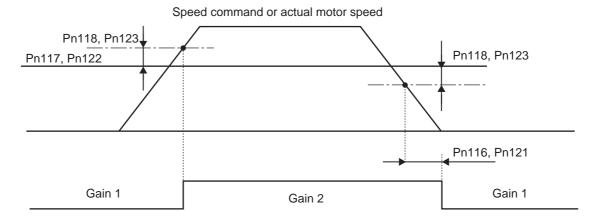
Torque command change amount (angular acceleration and deceleration speed command) is set in units of $0.05\%/166~\mu s$.

If the amount of change fluctuates and the switching time is not met, the switching will be cancelled.

In the case of switching due to a change amount of 4% over 2 ms, a value of approx. 6 will apply. (Change of 0.33% per 166 μ s.)

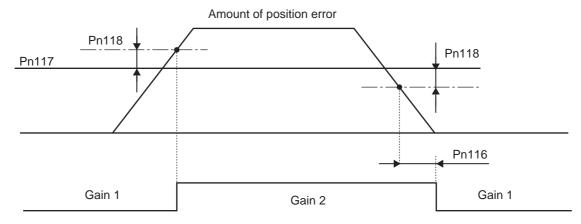


Gain Switching Mode = 5 or 9: Switching by Speed Command or Actual Motor Speed



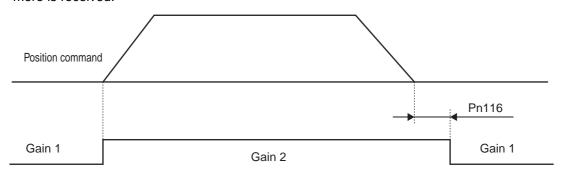
Gain Switching Mode (Pn031) = 6: Switching by Amount of Position Error

Gain switching is performed based on the accumulated count in the error counter.



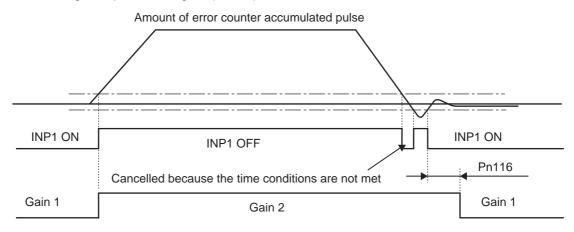
Gain Switching Mode = 7: Switching by Position Command Received

Gain switching is performed when a position command corresponding to 1 command unit or more is received.



Gain Switching Mode = 8: Switching by Positioning Completion Signal OFF

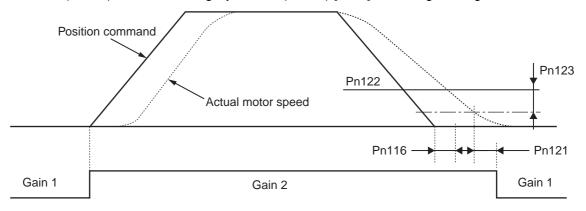
Switching to the gain 2 is performed when the error counter accumulated pulse exceeds the Positioning Completion Range 1 (Pn431).



Gain Switching Mode = 10: Switching by Combination of Position Command Received and Speed

Switching to the gain 2 occurs when a position command is received.

If no position command is issued for the period of Gain Switching Delay Time in Speed Control (Pn121) and the speed also becomes the same as or less than the result of Gain Switching Level (Pn122) - Gain Switching Hysteresis (Pn123) [r/min], switching to the gain 1 will occur.



Timing for Position Gain Switching Time (Pn119)

You can suppress rapid increases in the position loop gain during position control when there is a large difference between Position Loop Gain 1 (Pn100) and Position Loop Gain 2 (Pn105). When the position loop gain increases, it will be changed over the specified time.

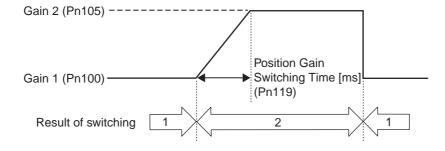
Position Gain Switching Time

The Position Gain Switching Time (Pn119) can be set to reduce torque variations and vibration caused by a rapid increase in the position loop gain that can occur when the gain is switched during position control or fully closed control.



Precautions for Correct Use

 When the position loop gain is switched to a smaller value, the setting of this parameter will be ignored and the gain will be switched immediately.
 Example Gain 1 (Pn100) > Gain 2 (Pn105)



Gain Switching Setting for Each Control Mode

The settable switching conditions vary depending on the control mode used. Set the parameters for each control mode.

Position Control Mode

In the Position Control Mode, it varies as follows according to gain switching mode in Position Control (Pn115).

($\sqrt{:}$ Enabled, -: Disabled)

| Pn115 set value | Switching conditions | Gain Switching Delay Time (Pn116) | Gain Switching Level (Pn117) | Gain Switching Hysteresis (Pn118) | Position Gain Switching Time (Pn119) |
|--------------------|--|--|---------------------------------------|--|---|
| 0 | Always gain 1 | _ | _ | _ | _ |
| 1 | Always gain 2 | _ | _ | _ | _ |
| 2 | Switching from gain switching (GSEL) | _ | _ | _ | √ |
| 3 | Torque command change amount | V | √ [× 0.05%] | √ [× 0.05%] | 1 |
| 4 | Always gain 1 | _ | - | - | - |
| 5 | Command speed | 1 | √ [r/min] | √ [r/min] | 1 |
| 6 | Amount of position error | V | √ [pulse] | √ [pulse] | √ |
| 7 | Position command received | √ | _ | _ | √ |
| 8 | Positioning completion signal (INP1) OFF | V | _ | _ | √ |
| 9 | Actual motor speed | V | √ [r/min] | √ [r/min] | √ |
| 10 | Combination of position command received and speed | √ | V | V | √ |

Speed Control Mode

In the Speed Control Mode, it varies as follows according to switching mode in Speed Control (Pn120).

($\sqrt{:}$ Enabled, -: Disabled)

| Pn120 set value | Switching conditions | Gain Switching Delay Time (Pn121) | Gain Switching Level (Pn122) | Gain Switching Hysteresis (Pn123) |
|-----------------|--------------------------------------|---|---------------------------------|---|
| 0 | Always gain 1 | _ | _ | _ |
| 1 | Always gain 2 | _ | _ | _ |
| 2 | Switching from gain switching (GSEL) | _ | _ | _ |
| 3 | Torque command change amount | V | √ [× 0.05%] | √ [× 0.05%] |
| 4 | Amount of change in speed command | _ | _ | _ |
| 5 | Speed command | V | √ [r/min] | √ [r/min] |

Torque Control Mode

In the Torque Control Mode, it varies as follows according to switching mode in Torque Control (Pn124).

(√: Enabled, – : Disabled)

| Pn124 set value | Switching conditions | Gain Switching Delay Time (Pn125) | Gain Switching Level (Pn126) | Gain Switching Hysteresis (Pn127) |
|-----------------|--------------------------------------|---|---------------------------------|---|
| 0 | Always Gain 1 | _ | _ | _ |
| 1 | Always Gain 2 | _ | _ | _ |
| 2 | Switching from gain switching (GSEL) | _ | _ | _ |
| 3 | Torque command change amount | V | √ [× 0.05%] | √ [× 0.05%] |

6-8 Torque Limit

Outline of Operation

- The output torque by the Servomotor can be limited.
- This function is used in the following conditions.
 - When push-motion operation, such as pressing, is performed.
 - When the torque at startup and during deceleration should be suppressed to protect the mechanical system, etc.
- Various methods are available according to Torque Control Selection (Pn521).

Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|--|--|-----------|
| Pn521 | Torque Limit Selection | Select the torque limit based on the various parameters and input signals. | P.8-56 |
| Pn013 | No. 1 Torque Limit | Set the No. 1 motor output torque limit value. | P.8-7 |
| Pn522 | No. 2 Torque Limit | Set the No. 2 motor output torque limit value. | P.8-56 |
| Pn523 | Torque Limit Switching Setting 1 | Set the rate of change (fluctuate) when switching from the No. 1 torque limit to No. 2 torque limit. | P.8-57 |
| Pn524 | Torque Limit Switching Setting 2 | Set the rate of change (fluctuate) when switching from the No. 2 torque limit to No. 1 torque limit. | P.8-57 |
| Pn525 | Forward External Torque Limit | Set the forward torque limit for a network signal. | P.8-57 |
| Pn526 | Reverse External Torque Limit | Set the reverse torque limit for a network signal. | P.8-57 |
| Pn527 | Analog Torque Limit Scale | Set the gain for conversion for the analog torque limit input. | P.8-57 |
| Pn425 | Analog Input 2 Offset | Set the offset adjustment value for the voltage applied to analog input 2. | P.8-41 |
| Pn426 | Analog Input 2 Filter Time Constant | Set the time constant of the first-order lag filter for the voltage applied to analog input 2. | P.8-41 |
| Pn428 | Analog Input 3 Offset | Set the offset adjustment value for the voltage applied to analog input 3. | P.8-42 |
| Pn429 | Analog Input 3 Filter Time Constant | Set the time constant of the first-order lag filter for the voltage applied to analog input 3. | P.8-42 |

Torque Limit in Position, Speed and Fully-Closed Controls

| Pn521 set value | Explanation |
|-----------------|---|
| 0 | Forward operation: Set by PCL (0 to 10 V) Reverse operation: Set by NCL (-10 to 0 V) |
| 1 | Limit in both forward and reverse operation: Set by Pn013 |
| 2 | Forward operation: Set by Pn013 Reverse operation: Set by Pn522 |
| 3 | Switch the limit value using torque limit switching (TLSEL). When TLSEL is OFF Limit in both forward and reverse operation: Pn013 When TLSEL is ON Limit in both forward and reverse operation: Pn522 |
| 4 | Forward operation: Set by PCL (0 to 10 V) Reverse operation: Set by NCL (0 to 10 V) |
| 5 | Limit in both forward and reverse operation: Set by PCL (0 to 10 V) |
| 6 | Switch the limit value using torque limit switching (TLSEL). When TLSEL is OFF Forward operation: Pn013 Reverse operation: Pn522 When TLSEL is ON Forward operation: Pn525 Reverse operation: Pn526 |

- For the torque limit in torque control, always select No. 1 Torque Limit (Pn013).
- The torque limit under torque feed-forward selection is enable only during speed control when the set value is 1 to 3.
- PCL signal is assigned to the terminal 16 in CN1. For details, refer to "Torque Command Input 2 (TREF2) and Forward Torque Limit Input (PCL)" (P. 3-37).
- NCL signal is assigned to the terminal 18 in CN1. For details, refer to "Reverse Torque Limit Input (NCL)" (P. 3-37).

Rate of Change Setting at Switching (Pn521 = 3)

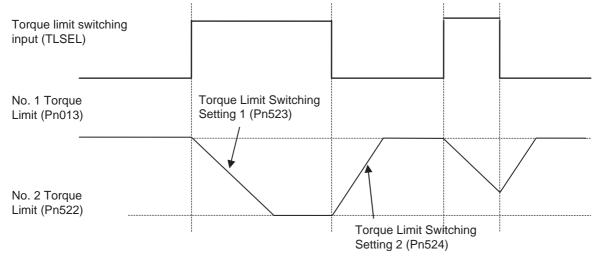
If 3 is set in Torque Limit Selection (Pn521), you can add fluctuate the change at the time of switching. This function is disabled in any other setting.

How to Set Rate of Change (Fluctuate)

Set the parameter according to the switching type.

- From No. 1 torque limit to No. 2 torque limit: Pn523
- From No. 2 torque limit to No. 1 torque limit: Pn524

The sign of the rate of change switches automatically inside the drive based on the magnitude correlation of the No. 1 torque limit and No. 2 torque limit.



If the setting of No. 1 Torque Limit (Pn013) or No. 2 Torque Limit (Pn522) is changed from the front panel or CX-Drive, the rate of change setting will be ignored and the new torque limit value will be applied immediately.

Torque Limit Settings by Servomotors

• The torque limit setting range is between 0% and 300%. The default setting is 300%. This is not the case when a Servo Drive and a Servomotor are used in the following combinations.

| Servo Drive | Applicable Servomotor | Maximum torque limit [%] |
|-------------|--------------------------|--------------------------|
| R88D-KT15□ | R88M-K90010□ | 225 |
| R88D-KT30□ | R88M-K2K010□ | 250 |
| R88D-KT50□ | R88M-K3K010□ | 250 |
| | R88M-K4K510□ | 263 |
| R88D-KT75□ | R88M-K6K010□ | 272 |
| R88D-KT75H | R88M-K7K515T | 265 |
| R88D-KT75F | R88M-K7K515C | 267 |
| R88D-KT150□ | R88M-K11K015□ | 265 |
| | R88M-K15K015□ | 253 |

6-9 Sequence I/O Signal

Outline of Operation

- You can set sequences in various operating conditions.
- For the connection of I/O signals and processing of external signals, refer to "Control I/O Connector Specifications (CN1)" (P.3-18).

Input Signals

You can allocate any function of input signals to the input pins for the control I/O connector (CN1). In addition, you can change logic. However, refer to "Input Signal Allocation Method" (P.6-36) for more information because some signals have allocation limitations.

If a G-series Servo Drive is being replaced with a G5-series Servo Drive, use the G5-series Servo Drive with the default settings.

Input Signal Default Setting

The allocations of the default input signals are as follows. Refer to "Input Signal Allocation Method" when you change the allocation to use.

| | | | Default setting state | | | | | |
|-----------------------|------------------|-------------------------------------|-----------------------|--|-------------|---------|----------------|-------|
| Applicable parameters | Input signals | Factory default setting (hex) | fully-c | control or Speed control Torque ontrol | | control | | |
| | | | Signal name | Logic | Signal name | Logic | Signal name | Logic |
| Pn400 | SI1 input | 00828282h (8553090) | NOT | NC | NOT | NC | NOT | NC |
| Pn401 | SI2 input | 00818181h (8487297) | POT | NC | РОТ | NC | РОТ | NC |
| Pn402 | SI3 input | 0091910Ah (9539850) | DFSEL1 | NO | VZERO | NC | VZERO | NC |
| Pn403 | SI4 input | 00060606h (394758) | GSEL | NO | GSEL | NO | GSEL | NO |
| Pn404 | SI5 input | 0000100Ch (4108) | GESEL1 | NO | VSEL3 | NO | _ | _ |
| Pn405 | SI6 input | 00030303h (197379) | RUN | NO | RUN | NO | RUN | NO |
| Pn406 | SI7 input | 00000f07h (3847) | ECRST | NO | VSEL2 | NO | _ | _ |
| Pn407 | SI8 input | 00040404h (263172) | RESET | NO | RESET | NO | RESET | NO |
| Pn408 | SI9 input | 00050505h (328965) | TVSEL | NO | TVSEL | NO | TVSEL | NO |
| Pn409 | SI10 input | 00000E88h (3720) | IPG | NC | VSEL1 | NO | _ | _ |

Contacts NO and NC in the logic fields indicate the following statuses.

NO: Disabled (OFF) when signal input is open with COM– Enabled (ON) when signal input is shorted with COM–

NC: Disabled (OFF) when signal input is shorted with COM– Enabled (ON) when signal input is open with COM– "-" indicates the status where no function is allocated.

Parameters that Can Be Allocated

Use the following parameters when changing the input signal allocation to use. For the setting method, refer to "Input Signal Allocation Method".

| Parameter number | Parameter name | Explanation | Reference |
|------------------|------------------------------|---|-----------|
| Pn400 | Input Signal Selection 1 | Set the SI1 input function allocation. This parameter is based on the hex display standard. (The display on the front panel is based on decimal.) | P.8-37 |
| Pn401 | Input Signal Selection 2 | Set the SI2 input function allocation. | P.8-37 |
| Pn402 | Input Signal Selection 3 | Set the SI3 input function allocation. | P.8-37 |
| Pn403 | Input Signal Selection 4 | Set the SI4 input function allocation. | P.8-37 |
| Pn404 | Input Signal Selection 5 | Set the SI5 input function allocation. | P.8-37 |
| Pn405 | Input Signal Selection 6 | Set the SI6 input function allocation. | P.8-37 |
| Pn406 | Input Signal Selection 7 | Set the SI7 input function allocation. | P.8-37 |
| Pn407 | Input Signal Selection 8 | Set the SI8 input function allocation. | P.8-37 |
| Pn408 | Input Signal Selection 9 | Set the SI9 input function allocation. | P.8-37 |
| Pn409 | Input Signal Selection 10 | Set the SI10 input function allocation. | P.8-37 |

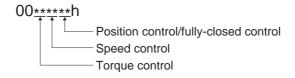
Input Signal Allocation Method

Input the setting for each control mode in any of the parameters of Pn400 to Pn409 to allocate signals.

Set the parameters based on the hex display standard.

Set the set value of the function for each control mode in "**" below.

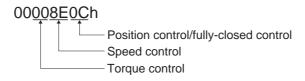
Refer to the function number table provided below for the set value of each function. The logic setting is included in the function numbers.



Example:

Position control or fully-closed control: Electronic gear switching input 1 for contact NO (0Ch) Speed control: Internally set speed selection 1 for contact NC (8Eh)

Torque control: Disabled (00h)



This will be 36364 since the front panel display is in decimal numbers.

Function Number Table

The set values to be used for allocations are as follows:

| Signal name | Symbol | Set | value | |
|-----------------------------------|--------|-----|-----------------------|--|
| Signal name | Symbol | NO | NC | |
| Disabled | _ | 00h | Setting not available | |
| Forward drive prohibition input | POT | 01h | 81h | |
| Reverse drive prohibition input | NOT | 02h | 82h | |
| Operation command *1 | RUN | 03h | 83h | |
| Alarm reset input | RESET | 04h | Setting not available | |
| Control mode switching input | TVSEL | 05h | 85h | |
| Gain switching | GSEL | 06h | 86h | |
| Error counter reset input *2 | ECRST | 07h | Setting not available | |
| Pulse prohibition input *3 | IPG | 08h | 88h | |
| Torque limit switching | TLSEL | 09h | 89h | |
| Damping filter switching 1 | DFSEL1 | 0Ah | 8Ah | |
| Damping filter switching 2 | DFSEL2 | 0Bh | 8Bh | |
| Electronic gear switching input 1 | GESEL1 | 0Ch | 8Ch | |
| Electronic gear switching input 2 | GESEL2 | 0Dh | 8Dh | |
| Internally set speed selection 1 | VSEL1 | 0Eh | 8Eh | |
| Internally set speed selection 2 | VSEL2 | 0Fh | 8Fh | |
| Internally set speed selection 3 | VSEL3 | 10h | 90h | |
| Zero speed designation input | VZERO | 11h | 91h | |
| Speed command sign input | VSIGN | 12h | 92h | |
| Torque command sign input | TSIGN | 13h | 93h | |
| Emergency stop input | STOP | 14h | 94h | |
| Inertia ratio switching input | J-SEL | 15h | 95h | |

^{*1} The operation command (RUN) always needs to be allocated. Servo cannot be turned ON if it is not allocated.

^{*2} Allocate this to Input Signal Selection 7 (Pn406). An alarm will occur if it is allocated to anything other than that.

^{*3} Allocate this to Input Signal Selection 10 (Pn409). An alarm will occur if it is allocated to anything other than that.



Precautions for Correct Use

- Do not use any values other than the settings listed.
- If you allocate the same function to multiple input signals, interface input duplicate allocation error 1 (Alarm 33.0) or interface input duplicate allocation error 2 (Alarm 33.1) will occur.
- You can allocate error counter reset input (ECRST) to Input Signal Selection 7 (Pn406) only. If you allocate it to anything other than that, a counter reset allocation error (Alarm 33.6) will occur.
- You can allocate pulse prohibition input (IPG) to Input Signal Selection 10 (Pn409) only. If you allocate
 it to anything other than that, a command pulse prohibition input allocation error (Alarm 33.7) will
 occur.
- If you are using the control mode switching input (TVSEL), you must set it for all control mode. If you do not set it for all control mode, interface input function number error 1 (Alarm 33.2) or interface input function number error 2 (Alarm 33.3) will occur.
- If you set Zero Speed Designation Selection (Pn315) to 2 or 3, you must always allocate zero speed designation input (VZERO) in speed control for the same pin where zero speed designation input (VZERO) is allocated for speed control. In addition, specify the same settings for the logic.
- Be sure to allocate the functions that are used by multiple control mode (such as operation command and alarm reset input) to the same pin, and do the same for the logic. If this is not set correctly, interface input duplicate allocation error 1 (Alarm 33.0) or interface input duplicate allocation error 2 (Alarm 33.1) will occur.
- You must always allocate the operation command (RUN). Servo cannot be turned ON if it is not allocated.

Output Signals

You can allocate output signal functions to the output pins for the control I/O connector (CN1). If a G-series Servo Drive is being replaced with a G5-series Servo Drive, use the G5-series Servo Drive with the default settings.

Output Signal Default Setting

The allocations of the default output signals are as follows. Refer to "Output Signal Allocation Method" when you change the allocation to use.

| | | | | Default setting state | |
|-----------------------|-------------------|-----------------------|--|-----------------------|----------------|
| Applicable parameters | Output Signals | Default set value | Position control or fully-closed control | Speed control | Torque control |
| | | | Signal name | Signal name | Signal name |
| Pn410 | SO1 output | 00030303h (197379) | BKIR | BKIR | BKIR |
| Pn411 | SO2 output | 00020202h (131586) | READY | READY | READY |
| Pn412 | SO3 output | *1 | ALM | ALM | ALM |
| Pn413 | SO4 output | 00050504h (328964) | INP | TGON | TGON |

^{*1} Alarm output signal allocations cannot be changed.

Parameters that Can Be Allocated

Use the following parameters when changing the output signal allocation to use. For the setting method, refer to "Output Signal Allocation Method".

| Parameter number | Parameter name | Explanation | Reference |
|------------------|---------------------------|--|-----------|
| Pn410 | Output Signal Selection 1 | Set the SO1 output function allocation. This parameter is set in hexadecimal standard. Refer to the output signal function number table for details. | P.8-37 |
| Pn411 | Output Signal Selection 2 | Set the SO2 output function allocation. | P.8-37 |
| Pn412 | Output Signal Selection 3 | Set the SO3 output function allocation. This parameter is always fixed to the alarm output signals. | P.8-37 |
| Pn413 | Output Signal Selection 4 | Set the SO4 output function allocation. | P.8-37 |

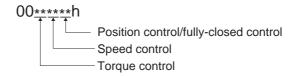
Output Signal Allocation Method

Input the setting for each control mode in any of the parameters of Pn410 to Pn413 to allocate signals.

Set up the parameters based on the hex display standard in the same manner as the input signal allocation method.

Set the set value of the function for each control mode in "**" below.

Refer to the function number table provided below for the set value of each function. The logic setting is included in the function numbers.

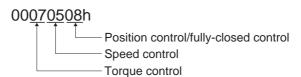


Example:

Position control or fully-closed control: Speed conformity output (08h)

Speed control: Motor rotation speed detection output (05h)

Torque control: Zero speed detection signal (07h)



This will be 460040 since the front panel display is in decimal numbers.

Function Number Table

The set values to be used for allocations are as follows:

| Signal name | Symbol | Set value |
|---------------------------------------|---------|-----------|
| Disabled | - | 00h |
| Servo ready completed output | READY | 02h |
| Brake interlock output | BKIR | 03h |
| Positioning completion output | INP | 04h |
| Motor rotation speed detection output | TGON | 05h |
| Torque limiting signal | TLC | 06h |
| Zero speed detection output | ZSP | 07h |
| Speed conformity output | VCMP | 08h |
| Warning output 1 | WARN1 | 09h |
| Warning output 2 | WARN2 | 0Ah |
| Position command status output | P-CMD | 0Bh |
| Positioning completion output 2 | INP2 | 0Ch |
| Output during speed limit | V-LIMIT | 0Dh |
| Alarm attribute output | ALM-ATB | 0Eh |
| Speed command status output | V-CMD | 0Fh |



Precautions for Correct Use

- Do not use any values other than the settings listed.
- You can allocate the same function to more than one output signal.
- You cannot change the output signal logic. When the function is disabled (OFF), signal input is open with COM—, and when the function is enabled (ON), signal input is shorted with COM—.

6-10 Forward and Reverse Drive Prohibition Functions

Outline of Operation

- When the forward drive prohibition input (POT) and the reverse drive prohibition input (NOT) are turned OFF, the motor will stop rotating.
- You can stop the motor from rotating beyond the device's operating range by connecting limit inputs.

Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|-------------------|---|---|-----------|
| Pn400 to Pn409 | Input Signal Selection 1 to 10 | Set the input signal allocations and logic. In the default settings, the allocations are as follows. Pn400 (CN1 - pin 8): NOT (Logic contact NC) Pn401 (CN1 - pin 9): POT (Logic contact NC) | |
| Pn504 | Drive Prohibition Input Selection | Set the operation to be performed upon forward and reverse drive prohibition input. | |
| Pn505 | Stop Selection for Drive Prohibition Input | Set the deceleration and stop methods upon forward and reverse drive prohibition input. | |

Input Signal Selection Function (Default setting: Pn400, Pn401)

In the default setting, the allocations are as follows.

| | | Default setting | | | |
|---------------------|-----------------------------|------------------------|--|---------------|-------------------|
| Parameter number | Parameter name | Set value | Position Control or fully-closed control | Speed control | Torque control |
| Pn400 | Input Signal Selection 1 | 00828282h (8553090) | NOT (NC) | NOT (NC) | NOT (NC) |
| Pn401 | Input Signal Selection 2 | 00818181h (8487297) | POT (NC) | POT (NC) | POT (NC) |

• Refer to "6-9 Sequence I/O Signal" (P.6-35) for details on input signal selections 1 to 10.

Drive Prohibition Input Selection (Pn504)

Install limit switches at both ends of the axis to prohibit the Servomotor from driving in the direction specified by the switch. This can be used to prevent the workpiece from driving too far and thus prevent damage to the machine. Set the operation to be performed upon forward and reverse drive prohibition input.

| Drive Prohibition Input Selection (Pn504) | Explanation |
|--|---|
| 0 | Forward drive prohibition input and reverse drive prohibition input enabled. The operation when a signal is input is as follows. Forward drive prohibition input closed: Forward limit switch not operating and status normal. Forward drive prohibition input open: Forward direction prohibited and reverse direction permitted. Reverse drive prohibition input closed: Reverse limit switch not operating and status normal. Reverse drive prohibition input open: Reverse direction prohibited and forward direction permitted. The Servomotor will decelerate and stop according to the sequence set in Stop Selection for Drive Prohibition Input (Pn505). For details, refer to explanation for Stop Selection for Drive Prohibition Input (Pn505). If the forward and the reverse prohibition inputs are both open, a drive prohibition input error 1 (Alarm 38.0) occurs because it is taken that Servo Drive is in error condition. |
| 1 | Forward and reverse drive prohibition input disabled. |
| 2 | Forward and reverse drive prohibition input enabled. If either the forward or the reverse prohibition input is open, a drive prohibition input error (Alarm 38.0) occurs. |



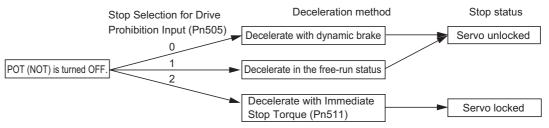
Precautions for Correct Use

Drive Prohibition Input Selection (Pn504) is set to 1 (disabled) in the default settings. If prohibiting the drive input is required, set the Drive Prohibit Input Selection (Pn504) to either 0 or 2. The setting on the Input Signal Selection 1 to 10 (Pn400 to Pn409) can change the logic and allocation for the respective Input terminals (CN1 to 8, 9 and 26 to 33).

Stop Selection for Drive Prohibition Input (Pn505)

Set the deceleration and stop methods upon a forward or reverse drive prohibition input.

| Stop Selection for Drive Prohibition Input (Pn505) | Deceleration method | After stopping | Error counter |
|--|---|--|--------------------------------------|
| 0 | Dynamic brake | Torque command in drive- prohibited direction = 0 | Held |
| 1 | Free-run (Torque command = 0 for drive prohibition direction) | Torque command in drive- prohibited direction = 0 | Held |
| 2 | Immediate stop | Servo lock | Clear before and after deceleration. |



While the Forward Drive Prohibition Input (POT) is OFF, the Servomotor cannot be driven in the forward direction, but it can be driven in the reverse direction. Conversely, while the reverse drive prohibition input (NOT) is OFF, the Servomotor cannot be driven in the reverse direction, but it can be driven in the forward direction.

If immediate stop torque is set for deceleration and servo lock is set for stop (set value: 2), torque limit during deceleration will be limited with the set value of the Immediate Stop Torque (Pn511).



Precautions for Correct Use

- A load on the vertical axis and so forth may fall due to its own weight in the drive prohibition input state. To prevent the load from falling, set emergency stop torque for deceleration and servo lock for stop (set value: 2) in Stop Selection for Drive Prohibition Input (Pn505), or limit the operation using the Host Controller rather than using this function.
- Because an immediate stop will force the motor to decelerate quickly, the position error will momentarily be a large value during position control, and Alarm 24.0 "error counter overflow" or Alarm 34.0 "overrun limit error" may occur. In such a case, set the Position Counter Overflow Level (Pn014) and the Overrun Limit Setting (Pn514) to appropriate values.

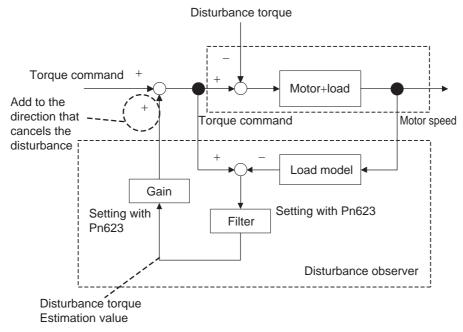
6-11 Disturbance Observer Function

Outline of Operation

You can lower the effect of the disturbance torque and reduce vibration by using the estimated disturbance torque value.

You can use the disturbance observer in the following situations for position control or speed control.

- When servo is ON
- · When there is no trouble with the motor's normal rotation
- When realtime autotuning function is disabled
- When instantaneous speed observer function is disabled





Precautions for Correct Use

• If there is a resonance point below the cut-off frequency estimated by the disturbance observer or if a large amount of high-frequency elements is found in the disturbance torque, the disturbance observer may not be effective.

Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|---|---|-----------|
| Pn610 | Function Expansion Setting | Set the bits related to the disturbance observer. | P.8-60 |
| Pn623 | Disturbance Torque Compensation Gain | Set the compensation gain for the disturbance torque. | P.8-63 |
| Pn624 | Disturbance Observer Filter Setting | Set the filter time constant for disturbance torque compensation. | P.8-63 |

Operating Procedure

1. Set the Function Expansion Setting (Pn610).

Set whether to enable or disable the disturbance observer in bit 1.

- 0: Disabled
- 1: Enabled

Set the operating conditions to be enabled in bit 2.

- 0: Enabled at all time
- 1: Enabled only when gain 1 is selected

2. Set the Disturbance Observer Filter Setting (Pn624).

Set Disturbance Torque Compensation Gain (Pn623) to a small value, and then change the value of Disturbance Observer Filter Setting (Pn624) from a large value to a small value. And set to the set value in which the effectiveness of suppressing the impact of disturbance and the operating noise level are balanced.

3. Set the Disturbance Torque Compensation Gain (Pn623).

Change the value of Disturbance Torque Compensation Gain (Pn623) from a small value to a large value. And set to the set value in which the effectiveness of suppressing the impact of disturbance and the operating noise level are balanced.

6-12 Gain Switching 3 Function

Outline of Operation

You can newly set gain 3 right before stopping to the gain switching function of Gain Switching Input Operating Mode Selection (Pn114).

You can use the gain 3 switching function in the following situations for position control or fullyclosed control.

- When servo is ON
- When there is no trouble with the motor's normal rotation

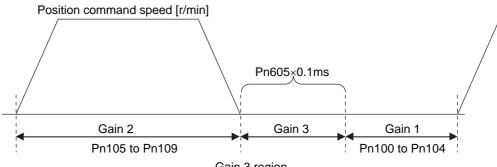
Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|-----------------------|-------------------------------------|-----------|
| Pn605 | Gain 3 Effective Time | Set effective time of gain 3. | P.8-60 |
| Pn606 | Gain 3 Ratio Setting | Set gain 3 as a multiple of gain 1. | P.8-60 |

Operation

Operation Timings of Gain 1, 2 and 3

Example: When the switching mode in position control = 7 and the switching condition is set to position command received



Gain 3 region

Position loop gain=Pn100×Pn606/100

Speed loop gain=Pn101×Pn606/100

The gain 1 value is used for the speed loop integral time constant, speed feedback filter time constant, and torque command filter time constant.



Precautions for Correct Use

- If gain 3 is not used, set the Gain 3 Effective Time (Pn605) to 0 and Gain 3 Ratio Setting (Pn606) to 0.
- In the gain 3 region, only the position loop gain and the speed loop gain are treated as gain 3, and the gain 1 setting is applied for all other gains.
- If the gain 2 switching condition is established in the gain 3 region, operation switches to gain 2.
- If gain 2 is switching to gain 3, Position Gain Switching Time (Pn119) is enabled.
- Take note that there will be a gain 3 region even when gain 2 is switched to gain 1 due to a parameter change and so forth.

6-13 Friction Torque Compensation Function

Outline of Operation

As a function to reduce the effect of friction, you can set the unbalanced load compensation that always compensates the constantly working offset torque, and the dynamic friction compensation that changes its direction depending on the operating direction.

You can use the function under the following conditions:

- When Servo is ON
- . When there is no trouble with the motor's normal rotation

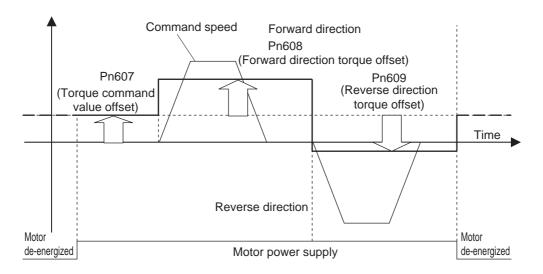
Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|------------------------------------|--|-----------|
| Pn607 | Torque Command Value Offset | Set the unbalanced load compensation value that is always added to the torque command in the control mode other than torque control. | P.8-60 |
| Pn608 | Forward Direction Torque Offset | Set the dynamic friction compensation value that is added to the torque command when a forward direction position command is input for position control or fully-closed control. | P.8-60 |
| Pn609 | Reverse Direction Torque Offset | Set the dynamic friction compensation value that is added to the torque command when a reverse direction position command is input for position control or fully-closed control. | P.8-60 |

Operation Example

Torque Command Value Offset (Pn607) reduces the variations of positioning operations due to the movement directions when a certain amount of unbalanced load torque is always applied to the motor at the vertical axis and so forth if that torque command value is set.

Forward Direction Torque Offset (Pn608) and Reverse Direction Torque Offset (Pn609) are used with loads that require a large amount of dynamic friction torque due to the radial load, such as the belt drive axis. By setting the friction torque for each rotation direction for all parameters, you can reduce the deterioration and inconsistencies of positioning stabilization time due to dynamic friction.



h

Precautions for Correct Use

You can use the unbalanced load compensation and the dynamic friction compensation together or separately. Take note that the following use limit is applied upon control mode switching or servo ON.

- During torque control
 - The unbalanced load compensation and the dynamic friction compensation are 0 regardless of the parameter setting.
- When servo is OFF during speed control
 - The load compensation is enabled based on Pn607 when the servo is turned OFF. The dynamic friction compensation will be 0 regardless of the parameter setting.
- When the servo is turned ON during position control or fully-closed control
 - The unbalanced load compensation and the dynamic friction compensation values are held until the first position command is input. When the position command is input, the unbalanced load compensation will be updated based on Pn607. Also, based on the command direction, the dynamic friction compensation value will be updated according to parameters Pn608 or Pn609.

6-14 Inertia Ratio Switching Function

Outline of Operation

You can switch the inertia ratio from 1 or 2 using inertia ratio switching input (JSEL). This functions effectively if used when the load inertia changes in 2 levels.

You can use inertia ratio switching in the following situations.

- When Servo is ON
- . When there is no trouble with the motor's normal rotation
- · When realtime autotuning is disabled
- When adaptive filter function is disabled
- When instantaneous speed observer function is disabled
- When disturbance observer function is disabled

Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|-------------------------------|--|-----------|
| Pn610 | Function Expansion Setting | Set the bits related to inertia ratio switching. | P.8-60 |
| Pn004 | Inertia Ratio | Set the inertia ratio 1. | P.8-3 |
| Pn613 | Inertia Ratio 2 | Set the inertia ratio 2. | P.8-61 |

Operating Procedure

1. Set the Function Expansion Setting (Pn610).

Set whether to enable or disable inertia ratio switching in bit 3.

- 0: Disabled
- 1: Enabled
- 2. Set the Inertia Ratio 1 (Pn004).
- 3. Set the Inertia Ratio 2 (Pn613).
- 4. Set the inertia ratio switching input (JSEL).

| Function Expansion Setting (Pn610) | Inertia ratio switching input (JSEL) | Applicable inertia ratio |
|---------------------------------------|--------------------------------------|--------------------------|
| | OFF | |
| switching is disabled | ON | Inertia Ratio 1 (Pn004) |
| | OFF | |
| switching is enabled | ON | Inertia Ratio 2 (Pn613) |



Precautions for Correct Use

- Be sure that the motor is stopped when using the inertia ratio switching function.
- If the difference between inertia ratio 1 and inertia ratio 2 is large, a vibration may occur even if the motor is stopped. Use it upon confirming that there is no problem with vibration on the actual machine.

6-15 Hybrid Vibration Suppression Function

Outline of Operation

This function suppresses the vibration that is caused by the amount of the torsion between the motor and the load in the Fully-closed Control Mode. You can use this function to raise the gain setting.

The hybrid vibration suppression function can be used in the following situations.

- Fully-closed Control Mode
- When Servo is ON
- When there is no trouble with the motor's normal rotation

Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|--|---|-----------|
| Pn634 | Hybrid Vibration Suppression Gain | Set the hybrid vibration suppression gain. In general, set it to the same value as the position loop gain, and finely adjust it based on the situation. | P.8-66 |
| Pn635 | Hybrid Vibration Suppression Filter | Set the hybrid vibration suppression filter. | P.8-66 |

Operating Procedure

- 1. Set the Hybrid Vibration Suppression Gain (Pn634) to the same value as the position loop gain.
- 2. Gradually increase the set value of the Hybrid Vibration Suppression Filter (Pn635) while driving with fully-closed control and check the changes in the response. If the response improves, find the combination of Pn634 and Pn635 that result in the optimal response by adjusting them.



Precautions for Correct Use

• This function is effective when the amount of torsion between the motor shaft and the load is large. It may be less effective when the amount of torsion is small.

6-16 Feed-forward Function

Outline of Operation

The feed-forward function come in 2 types: speed feed-forward and torque feed-forward.

The speed feed forward can minimize the position error and increase the responsiveness by calculating the speed control command that is required for the operation based on the internal positioning command during position or fully-closed control, and adding it to the speed command that is calculated based on the comparison with the position feedback.

The torque feed forward can increase the responsiveness during speed control by calculating the torque command that is required for the operation based on the speed control command, and adding it to the torque command that is calculated based on the comparison with the speed feedback.

Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|---|---|-----------|
| Pn110 | Speed Feed-forward Amount | Use this parameter to add the speed control command calculated from the internal positioning command that is multiplied by this parameter's ratio to the speed command from the position control process. | P.8-12 |
| Pn111 | Speed Feed-forward Command Filter | Set the time constant for the first-order lag filter that is applied to speed feed-forward input. | P.8-12 |
| Pn112 | Torque Feed-forward Amount | Use this parameter to add the torque command calculated from the speed control command that is multiplied by this parameter's ratio to the torque command from the speed control process. | P.8-12 |
| Pn113 | Torque Feed-forward Command Filter | Set the time constant for the first-order lag filter that is applied to torque feed-forward input. | P.8-12 |
| Pn600 | Analog Torque Feed- forward Gain Setting | Set the input gain of analog torque feed-forward. 0 to 9 will be disabled. | P.8-60 |
| Pn610 | Function Expansion Setting | Set the bits related to inertia ratio switching. | P.8-60 |

6-51

Operating Procedure

Speed Feed-forward Operating Method

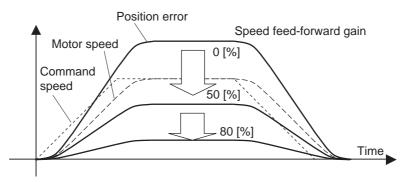
- 1. Set the Speed Feed-forward Command Filter (Pn111). Set it to approx. 50 (0.5 ms).
- 2. Adjust the Speed Feed-forward Amount (Pn110).

Gradually increase the value of Speed Feed-forward Amount (Pn110) and finely adjust it to avoid overshooting during acceleration/deceleration.

If the speed feed-forward amount is set to 100%, the position error will be 0 in calculation. However, a large overshooting will occur during acceleration/deceleration.

The position error during an operation at a constant speed will decrease based on the following formula according to the speed feed-forward gain value.

Position error [command unit] = command speed [command unit/s] / position loop gain [1/s] \times (100 - speed feed-forward amount [%]) / 100



The position error in the range of constant speed becomes smaller as the speed feed-forward gain increases.



Precautions for Correct Use

 The operating noise may increase when the speed feed forward is enabled if the update cycle of the position command input is longer than the Servo Drive's control cycle, or if the pulse frequency is not uniform. Apply the position command filter (first-order lag or FIR smoothing) or increase the speed feed-forward filter setting.

Torque Feed-forward Operating Method

1. Set the Inertia Ratio (Pn004).

Set the inertia ratio as correctly as possible.

- If the inertia ratio is calculated for the selected motor, input the calculated value.
- If the inertia ratio is not known, perform autotuning and set the inertia ratio.

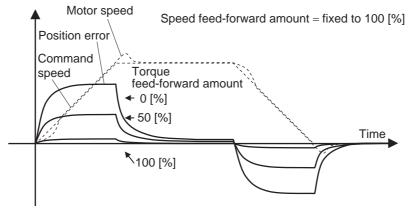
2. Set the Torque Feed-forward Command Filter (Pn113).

Set it to approx. 50 (0.5 ms).

3. Adjust the Torque Feed-forward Amount (Pn112).

Gradually increase the value of Torque Feed-forward Amount (Pn112).

Since the position error during acceleration/deceleration at a certain speed can be brought close to 0, it can be controlled almost to 0 throughout the entire operation range during a trapezoidal speed pattern under ideal conditions where no disturbance torque is working. In reality, disturbance torque is always present and, therefore, the position error cannot be completely 0.



Torque feed-forward can reduce the position error in a range of constant acceleration/deceleration.

• When operating in position control, this function normally is used together with the speed feedforward.



Precautions for Correct Use

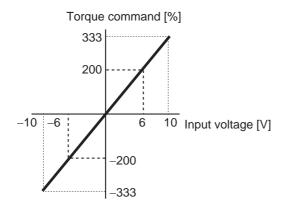
• If you increase the torque feed-forward filter time constant, the operation noise will be reduced. However, the position error where the acceleration changes will become larger.

Application Example of Analog Torque Feed Forward

The analog torque feed forward is enabled when bit 5 of the Function Expansion Setting (Pn610) is set to 1. In addition, if analog input 3 is used by another function (for example, analog torque limit), this function is disabled.

It is converted to torque from the voltage [V] that is applied to analog input 3 based on the Analog Torque Feed-forward Gain Setting (Pn600) and is added to the torque command [%]. The conversion from the input voltage [V] to analog input 3 to a torque command [%] to the motor is performed as illustrated in the graph below. The slope of the graph is when Pn600 = 30. The slope changes based on the Pn600 set value.

Torque command [%] = $100 \times Input \ voltage \ [V] \ / \ (Pn600 \ set \ value \times 0.1)$



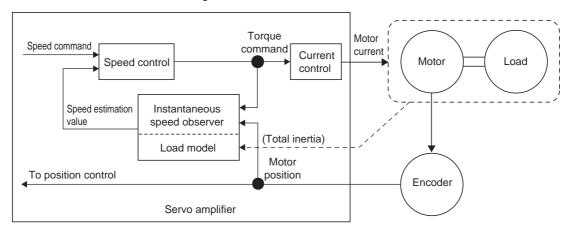
6-17 Instantaneous Speed Observer Function

Outline of Operation

Estimating the motor speed using a load inertia increases responsiveness and reduces vibration at stopping and improves the speed detection accuracy. This function can be used for position control.

The instantaneous speed observer function can be used in the following situations.

- When Servo is ON
- When there is no trouble with the motor's normal rotation
- When realtime autotuning is disabled



Parameters Requiring Settings

| Parameter number | Parameter name | Explanation | Reference |
|------------------|---|---|-----------|
| Pn610 | Function Expansion Setting | Set whether to enable or disable the instantaneous observer function. | P.8-60 |
| Pn004 | Inertia Ratio | Set the inertia ratio 1. | P.8-3 |
| Pn100 | Position Loop Gain | Set the position loop gain. | P.8-9 |
| Pn101 | Speed Loop Gain | Set the speed loop gain. | P.8-10 |
| Pn103 | Speed Feedback Filter Time Constant | Set six filter time constants. | P.8-11 |
| Pn108 | Speed Feedback Filter Time Constant 2 | Set six filter time constants. | P.8-11 |

Operating Procedure

1. Set the Inertia Ratio (Pn004).

Set the inertia ratio as correctly as possible.

- If the Inertia Ratio (Pn004) is requested in a realtime auto gain tuning, use the set value.
- If the inertia ratio is calculated for the selected motor, input the calculated value.
- If the inertia ratio is not known, perform autotuning and set the inertia ratio.

2. Adjust the position loop gain and speed loop gain.

Adjust Position Loop Gain (Pn100), Speed Loop Gain (Pn101), Speed Loop Integral Time Constant (Pn102) and Torque Command Filter Time Constant (Pn104).

If no problem occurs in realtime autotuning, you can continue to use the settings.

3. Set the Function Expansion Setting (Pn610).

Set whether to enable or disable the instantaneous speed observer function in bit 0.

- 0: Disabled
- 1: Enabled

If you set this to 1 (enabled), the speed detection method will switch to instantaneous speed observer.

- If the machine operation noise or vibration, or a change in the torque monitor waveform is significant enough to cause any problem, return the setting to 0 and make sure that the inertia ratio or the adjustment parameters are correct.
- If the machine operation noise or vibration, or a change in the torque monitor waveform is small, make small adjustments to the Inertia Ratio (Pn004) to find the setting that makes the smallest change while monitoring the position error waveform and the actual speed waveform.
- If Position Loop Gain (Pn100), Speed Loop Gain (Pn101) or Speed Loop Integral Time Constant (Pn102) is changed, the optimal value for the Inertia Ratio (Pn004) may have changed, so make small adjustments on the value for the Inertia Ratio (Pn004) again to set a value that makes the smallest change.



Precautions for Correct Use

- This function may not function properly or the effect may not be apparent under the following conditions.
 - · If the margin of error with the actual device is large for the inertia load
 - · If there are multiple resonance points
 - If there is a large resonance point at a frequency of 300 Hz or lower
 - · If there is a non-linear element (play), such as a large backlash
 - · If the load inertia changes
 - · If there is a large disturbance torque with high-frequency elements is applied
 - · If the setting range for positioning is small



Safety Function

This function stops the Servomotor based on a signal from a safety controller or safety sensor.

An outline of the function is given together with operation and connection examples.

| 7-1 | Safe Torque OFF (STO) Function | 7-1 |
|-----|--------------------------------|-----|
| | Outline of Operation | 7-1 |
| | I/O Signal Specifications | 7-2 |
| 7-2 | Operation Example | 7-4 |
| 7-3 | Connection Example | 7-6 |

7-1 Safe Torque OFF (STO) Function

Outline of Operation

The safe torque OFF (hereinafter referred to as STO according to IEC61800-5-2) function is used to cut off the motor current and stop the motor through the input signals from a safety equipment, such as a Safety Controller or safety sensor, that is connected to the safety connector (CN8).

When the STO function is operating, the Servo Drive turns OFF the servo ready completed output (READY) to go into the safety status.

• The PFH value is 2.30×10^{-8} .



Precautions for Safe Use

- When using the STO function, be sure to execute a risk assessment of the equipment to confirm that the system safety requirements are met.
- There are the following risks even when the STO function is operating. Be sure to take safety into account as part of the risk assessment.
 - The motor runs if an external force is present (e.g., force of gravity on a vertical axis). If holding
 is required, implement appropriate measures, such as providing external brakes. The brakes
 for a Servo Drive with brakes are used for the holding purpose only, and cannot be used for
 control.
 - Even if there is no external force, when Stop Selection for Alarm Detection (Pn510) is set to free-run (with the dynamic brake disabled), the motor operates as free-run and the stop distance is long.
 - The motor may operate in the range of up to 180 degrees of electrical angle due to a power transistor trouble and so forth.
 - The power supply to the motor is cut off by the STO function, but the power supply to the Servo Drive will not be cut off nor electrically isolated. For Servo Drive maintenance, cut off the power supply to the Servo Drive through another means.
- The EDM output signal is not a safety output. Do not use the EDM output for any purpose other than the failure monitoring function.
- Be sure to check the wiring when installing. Especially check the following:
 - The wiring is not short-circuited or disconnected.
 - · The polarity of EDM circuit is not reversed.
 - SF1, SF2 and EDM operate properly.
- The system with incorrect wiring may damage the safety function.
- The dynamic brake and external brake release signal outputs are not safety-related parts. Make sure to design the equipment so that it is not dangerous even if the external brake release fails during the STO status.
- When using the STO function, connect equipment that meets the safety standards.
- Following certifications are fulfilled:
 - CAT-3 (EN 954-1, EN/ISO 13849-1)
 - Performance level d (EN/ISO 13849-1)
 - SIL 2 (IEC/EN 62061)

I/O Signal Specifications

Safety Input Signal

There are 2 safety input circuits to operate the STO function.

| | Symbol | Pin number | Description | | Control mode | | | |
|----------------|--------|---------------|--|----------|--------------|----------|------------------|--|
| Signal name | | | | | Speed | Torque | Fully- closed | |
| Safety input 1 | SF+ | CN8-4 | The upper arm drive signal of the power transistor inside the Servo | | V | 1 | 1 | |
| | SF- | CN8-3 | Drive is cut off. | V | V | 1 | 1 | |
| Safety input 2 | SF2+ | CN8-6 | The lower arm drive signal of the power transistor inside the Servo | V | V | 1 | 1 | |
| | SF2- | CN8-5 | Drive is cut off. | V | V | V | 1 | |

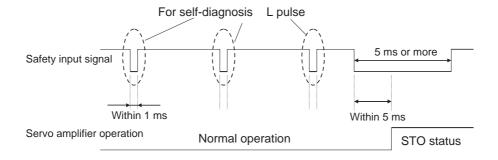
- When safety input 1 or 2 turns OFF, the STO function will start operating within 5 ms of the input, and the motor output torque will be reduced to 0.
- Connect the equipment so that the safety input circuit is turned OFF to operate the STO function.
- Use Stop Selection for Alarm Detection (Pn510) to set the operation when the safety input is turned OFF.



Precautions for Correct Use

· L-pulses for self-diagnosis of safety equipment

When you are connecting a safety device, such as a safety controller or a safety sensor, the safety output signal of the device may include L pulses for self-diagnosis. To avoid malfunction due to the L pulses for self-diagnosis, a filter that removes the L pulses is built into the safety input circuit. If the OFF time of the safety input signal is 1 ms or less, the safety input circuit does not recognize it as OFF. To make sure that OFF is recognized, maintain the OFF status of safety input signal for at least 5 ms.



External Device Monitor (EDM) Output Signal

This is a monitor output signal that is used to monitor the status of safety input signals using an external device.

Connect a safety device, such as a safety controller or a safety sensor. Connect the EDM output signal to the monitoring terminal on a safety device.

| | Symbol | Pin number | 5 | | Control mode | | | |
|-------------|--------|---------------|--|----------|--------------|----------|------------------|--|
| Signal name | | | Description | Position | Speed | Torque | Fully- closed | |
| EDM output | EDM+ | CN8-8 | A monitor signal is output to detect a safety function failure. * This is not a safety output. | √ | √ | V | 1 | |
| | EDM- | CN8-7 | | √ | √ | V | √ | |

Relationship Between Safety Input Signals and EDM Output Signal

Normally when both safety inputs 1 and 2 are OFF, i.e., when the STO function is activated for both safety input circuits, the EDM output is ON.

You can detect a failure of the safety input circuit and the EDM output circuit by monitoring all of the following 4 signal states using an external device.

Errors occur in the following two cases:

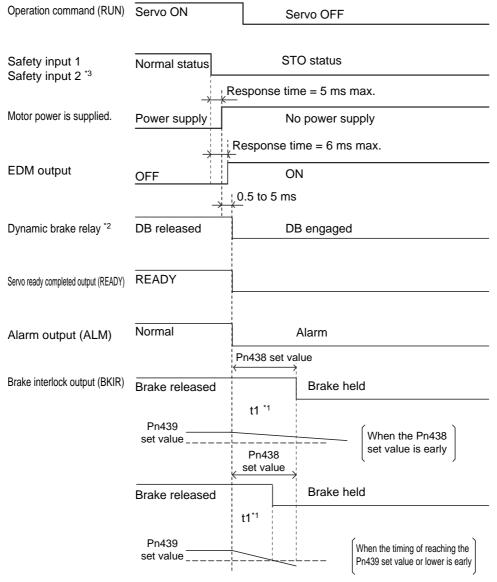
- Both safety inputs 1 and 2 are OFF, but the EDM output circuit signal does not turn ON.
- Either or both safety inputs 1 and 2 are ON, but the EDM output circuit signal is ON.

| Signal name | Symbol | Signal status | | | | |
|----------------|--------|---------------|-----|-----|-----|--|
| Safety input 1 | SF1 | ON | ON | OFF | OFF | |
| Safety input 2 | SF2 | ON | OFF | ON | OFF | |
| EDM output | EDM | OFF | OFF | OFF | ON | |

[•] The maximum delay time is 6 ms after the safety input signal is input until the EDM output signal is output.

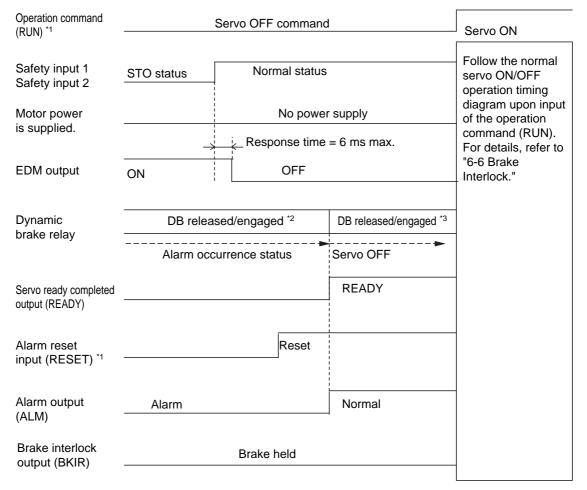
7-2 Operation Example

Operation Timings to a Safety Status



- *1. t1 is the set value of the Brake Timing During Operation (Pn438), or the time needed for the motor rotation speed to drop to or below the Brake Release Speed Setting (Pn439), whichever occurs first.
- *2. The dynamic brake is based on the Stop Selection for Alarm Detection (Pn510) setting.
- *3. STO status is entered when either safety input 1 or 2 turns OFF.

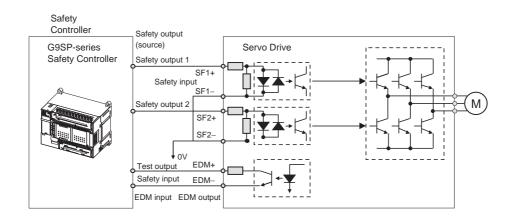
Timing of Return from the Safety Status



- *1. Make sure that servo ON input is turned OFF when you return the input signals of safety inputs 1 and 2 to ON. Alarm clear must be performed because alarms will occur. Be sure to execute the alarm clear when both safety inputs 1 and 2 are returned to the ON status. An alarm will occur immediately if the alarm reset is executed when even one of these is still in the OFF status. Depending on the timing, another error (Alarm No. 99.0) may occur. If another error occurs, you must turn OFF the power supply, then turn it ON again.
- *2. Since this is a status where alarms will occur, the dynamic brake is based on the Stop Selection for Alarm Detection (Pn510).
- *3. Since this is a normal servo OFF status, the dynamic brake is based on the Stop Selection with Servo OFF (Pn506) setting.

7-3 Connection Example

Connection with a Safety Controller (Two Safety Inputs and One EDM Output)





Parameter Details

This chapter explains the set value and contents of setting of each parameter.

| 8-1 | Basic Parameters | 8-1 |
|-----|--------------------------------------|------|
| 8-2 | Gain Parameters | 8-9 |
| 8-3 | Vibration Suppression Parameters | 8-20 |
| 8-4 | Analog Control Parameters | 8-25 |
| 8-5 | Interface Monitor Setting Parameters | 8-37 |
| 8-6 | Extended Parameters | 8-47 |
| 8-7 | Special Parameters | 8-60 |

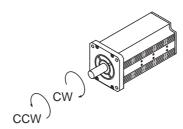
8-1 Basic Parameters

| Pn000 | Rotation Direction Switching | g | | | | А | |
|---------------|------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | _ | Default setting | 1 | Power OFF and ON | Yes |

Explanation of Set Values

•This object switches the motor rotation direction for a position, speed, or torque command.

| Set value | Description |
|--------------|---|
| 0 | A forward direction command sets the motor rotation direction to CW. |
| 1 | A forward direction command sets the motor rotation direction to CCW. |

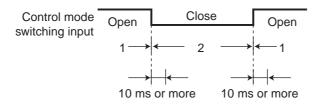


• Regarding the motor rotation direction, when seen from load-side axis, clockwise is referred to as CW and counterclockwise as CCW.

| Pn001 | Control Mode Selection | | | | | А | II |
|---------------|------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 6 | Unit | _ | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|--------------|--|
| 0 | Position control (pulse train command) |
| 1 | Speed control (analog command) |
| 2 | Torque control (analog command) |
| 3 | Mode 1: Position control, Mode 2: Speed control |
| 4 | Mode 1: Position control, Mode 2: Torque control |
| 5 | Mode 1: Speed control, Mode 2: Torque control |
| 6 | Fully-closed control |

- Set the control mode to be used.
- If a composite mode is set (set values: 3 to 5), mode 1 or mode 2 can be selected using the control mode switching input (TVSEL).
 - · When the control mode switching input is open: Select mode 1.
 - · When the control mode switching input is short-circuited: Select mode 2.
- Do not input a command within 10 ms before or after switching.



| Pn002 | Realtime Autotuning Mode Selection | | | | | A | All . |
|---------------|------------------------------------|------|---|-----------------|---|------------------|-------|
| Setting range | 0 to 6 | Unit | - | Default setting | 1 | Power OFF and ON | _ |

| Set value | Description |
|--------------|--|
| 0 | Disabled |
| 1 | This mode focuses on stability. |
| 2 | This mode focuses on positioning. |
| 3 | Used when an unbalanced load is present such as a vertical axis. |
| 4 | Used when friction is large (unbalanced load also calculated). |
| 5 | Used only for estimating load characteristics. |
| 6 | Used when customizing Realtime Autotuning Mode. |

[•] Refer to "10-2 Realtime Autotuning" (P.10-3) for details on the settings

| Pn003 | Realtime Autotuning Machine Rigidity Setting | | | | А | II | |
|---------------|--|------|---|-----------------|------|------------------|---|
| Setting range | 0 to 31 | Unit | _ | Default setting | 13 * | Power OFF and ON | _ |

- Default settings:
 - * Pn003 = 11 For 200V drives of 1 kW or upper and 400V drives
- Set the machine rigidity to one of 32 levels when realtime autotuning is enabled.

Low ←Responsiveness→ High

• If the set value is changed suddenly by a large amount, the gain may change rapidly, subjecting the machine to shock. Always start with a small setting, and gradually increase the setting while monitoring machine operation.

| Pn004 | Inertia Ratio | | | | | А | All . |
|---------------|---------------|------|---|-----------------|-----|------------------|-------|
| Setting range | 0 to 10,000 | Unit | % | Default setting | 250 | Power OFF and ON | - |

- Set the load inertia as a percentage of the motor rotor inertia.
- Pn004 = (Load inertia / Rotor inertia) × 100%
- When realtime autotuning is enabled, the inertia ratio is continuously estimated and saved in EEPROM every 30 minutes.
- If the inertia ratio is set correctly, the setting unit for the Speed Loop Gain (Pn101) and Speed Loop Gain 2 (Pn106) is Hz.
- •If the Inertia Ratio (Pn004) is set larger than the actual value, the setting for speed loop gain will increase. If the Inertia Ratio (Pn004) is set smaller than the actual value, the setting for speed loop gain will decrease.

| Pn005 | Command Pulse Input Selection | | | Pos | sition Fully-clo | sed | |
|---------------|-------------------------------|------|---|-----------------|------------------|------------------|-----|
| Setting range | 0 or 1 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|--------------|---|
| 0 | Photocoupler input (+PULS: CN1 pin 3, -PULS: CN1 pin 4, +SIGN: CN1 pin 5, -SIGN: CN1 pin 6) |
| 1 | Input for line driver only (+CWLD: CN1 pin 44, -CWLD: CN1 pin 45, +CCWLD: CN1 pin 46, -CCWLD: CN1 pin 47) |

- Selects whether to use photocoupler or input for line driver only for the command pulse input.
- When using a Servo Relay Unit cable, set to 0 (photocoupler input).

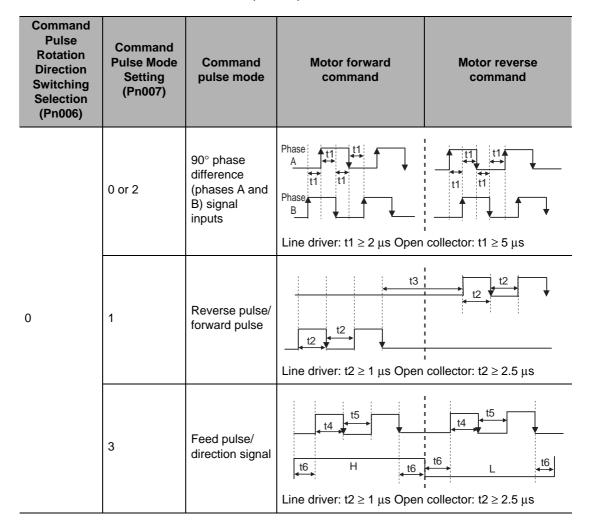
| Pn006 | Command Pulse Rotation Direction Switching Selection | | | | | sition Fully-clos | sed |
|---------------|--|------|---|-----------------|---|-------------------|-----|
| Setting range | 0 or 1 | Unit | _ | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|--------------|--|
| 0 | The motor rotates in the direction specified by the command pulse. |
| 1 | The motor rotates in the opposite direction from the direction specified by the command pulse. |

• Set the motor rotation direction for the command pulse input.

| Pn007 | Command Pulse Mode Sele | Command Pulse Mode Selection | | | | | sed |
|---------------|-------------------------|------------------------------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 3 | Unit | - | Default setting | 1 | Power OFF and ON | Yes |

• Set the count method for the command pulse input.



| Command Pulse Rotation Direction Switching Selection (Pn006) | Command Pulse Mode Setting (Pn007) | Command pulse mode | Motor forward command | Motor reverse command |
|--|---|---|---|--|
| | 0 or 2 | 90° phase difference (phases A and B) signal inputs | Phase $\frac{1}{A}$ | collector: $t1 \ge 5 \mu s$ |
| 1 | 1 | Reverse pulse/ forward pulse | Line driver: $t2 \ge 1 \mu s$ Open | t2 t2 collector: $t2 \ge 2.5 \mu s$ |
| | 3 | Feed pulse/ direction signal | Line driver: $t2 \ge 1 \mu s$ Open | t4 t5 t6 H t6 collector: $t2 \ge 2.5 \mu s$ |

- Set the form of the pulse inputs sent as command to the drive from a Position Controller.
- Modes 0 and 2 are exactly the same.
- For fully-closed control, set the parameter to 0, and set the Electronic Gear Ratio Numerator 1 (Pn009) and Electronic Gear Ratio Denominator (Pn010).

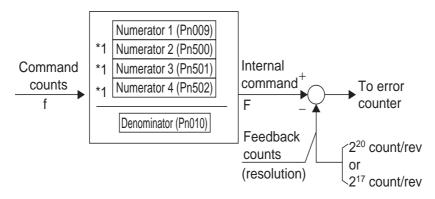
| Pn008 | Electronic Gear Integer Setting | | | | | sition Fully-clo | sed |
|---------------|---------------------------------|------|-------|-----------------|-------|------------------|-----|
| Setting range | 0 to 2 ²⁰ | Unit | pulse | Default setting | 10000 | Power OFF and ON | Yes |

- Set the number of command pulses corresponding to 1 motor rotation.
- If the set value is 0, Electronic Gear Ratio Numerator 1 (Pn009) and Electronic Gear Ratio Denominator (Pn010) become valid.

| Pn009 | Electronic Gear Ratio Numerator 1 | | | | | Pos | ition |
|---------------|-----------------------------------|------|---|-----------------|---|------------------|-------|
| Setting range | 0 to 2 ³⁰ | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

| Pn010 | Electronic Gear Ratio Deno | minator | | | | Pos | ition |
|---------------|----------------------------|---------|---|-----------------|-------|------------------|-------|
| Setting range | 1 to 2 ³⁰ | Unit | _ | Default setting | 10000 | Power OFF and ON | _ |

- Set the electronic gear function.
 - · It is enabled when Pn008 is 0.
- The electronic gear can be used for the following:
 - To set the amount of motor rotation or travel distance per input command pulse.
 - To increase the nominal command pulse frequency by using a multiplier when the desired motor speed cannot be achieved due to the limited pulse generation capability of the host device (possible maximum output frequency).
- Electronic Gear Block Diagram:



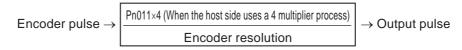
*1. Numerator 2 to 4 is selected using the electronic gear switching (GESEL1 and GESEL2).

| GESEL1 | GESEL2 | Selected numerator |
|--------|--------|-----------------------------------|
| OFF | OFF | Electronic Gear Ratio Numerator 1 |
| ON | OFF | Electronic Gear Ratio Numerator 2 |
| OFF | ON | Electronic Gear Ratio Numerator 3 |
| ON | ON | Electronic Gear Ratio Numerator 4 |

Any values can be set for PN008, Pn009, and Pn010, but operation may not be correct if you set an extreme electronic gear ratio. Set the electronic gear ratio to between 1/1,000 and 1,000. Refer to "6-4 Electronic Gear Function" (P.6-10) for information on the settings.

| Pn011 | Encoder Dividing Numerator | | | | | | II |
|---------------|----------------------------|------|-----|-----------------|------|------------------|-----|
| Setting range | 1 to 262,144 | Unit | P/r | Default setting | 2500 | Power OFF and ON | Yes |

- If Encoder Dividing Denominator (Pn503) = 0, the encoder resolution becomes the pulse output dividing denominator.
- Note that 1 pulse corresponds to 4 counts. Encoder resolution corresponds with counts.



| Pn012 | Encoder Output Direction Switching Selection | | | | | А | .II |
|---------------|--|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 3 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

• Set the phase-B logic and output source for pulse output. For fully-closed control, select an external encoder for the output source. For other control modes, set the encoder.

Parameter Details

Explanation of Set Values

| Pn012 set value | Output source | Phase B logic | CCW direction operation | CW direction operation |
|-----------------|------------------|---------------|-------------------------|------------------------|
| 0 | Encoder | Non- | Phase A | Phase |
| 2 | External encoder | reverse | | Phase B |
| 1 | Encoder | Reverse | Phase | Phase A |
| 3 | External encoder | INGVEISE | Phase B | Phase B |

| Pn013 | No. 1 Torque Limit | | | | | А | .II |
|---------------|--------------------|------|---|-----------------|-----|------------------|-----|
| Setting range | 0 to 500 | Unit | % | Default setting | 500 | Power OFF and ON | _ |

[•] Set the No. 1 limit value for the output torque of the motor.

| Pn014 | Error Counter Overflow Lev | Error Counter Overflow Level | | | | sition Fully-clo | sed |
|---------------|----------------------------|------------------------------|--------------|-----------------|--------|------------------|-----|
| Setting range | 0 to 2 ²⁷ | Unit | Command unit | Default setting | 100000 | Power OFF and ON | _ |

[•] Set the range of the error counter overflow level.

| Pn015 | Operation Switch when Using Absolute Encoder | | | | Pos | sition Fully-clo | sed |
|---------------|--|------|---|-----------------|-----|------------------|-----|
| Setting range | 0 to 2 | Unit | _ | Default setting | 1 | Power OFF and ON | Yes |

Explanation of Set Values

| Set value | Description |
|--------------|---|
| 0 | Use as absolute encoder. |
| 1 | Use as incremental encoder. |
| 2 | Use as absolute encoder but ignore multi-rotation counter overflow. |

• Set the operating method for the 17-bit absolute encoder.

| Pn016 | Regeneration Resistor Selection | | | | | А | .II |
|---------------|---------------------------------|------|---|-----------------|-----|------------------|-----|
| Setting range | 0 to 3 | Unit | - | Default setting | 3 * | Power OFF and ON | Yes |

^{*} The default setting is 0 for 100-V Servo Drives of 400 W, 200-V Servo Drives of 750 W to 5 kW, and 400-V Servo Drives of 5 kW or lower.

| Set value | Description |
|--------------|--|
| 0 | Regeneration Resistor used: Built-in Resistor The regeneration processing circuit operates and the regeneration overload (Alarm No. 18) will be enabled according to the Built-in Resistor (with approx. 1% duty). |
| 1 | Regeneration Resistor used: External Resistor The regeneration processing circuit operates, and regeneration overload (Alarm No. 18) will cause a trip when the operating rate of the Regeneration Resistor exceeds 10%. |
| 2 | Regeneration Resistor used: External Resistor The regeneration processing circuit operates, but regeneration overload (Alarm No. 18) will not occur. |
| 3 | Regeneration Resistor used: None The regeneration processing circuit and regeneration overload (Alarm No. 18) will not operate, and all regenerative energy will be processed by the built-in capacitor. |

- Do not touch the External Regeneration Resistor. A burn injury may result.
- •Always provide a temperature fuse or other protective measure when using an External Regeneration Resistor. Regardless of whether the regeneration overload error is enabled or disabled, the Regeneration Resistor can generate heat and may cause burning.
- •Set this parameter depending on whether the Built-in Regeneration Resistor is used, or the Built-in Regeneration Resistor is disconnected and an External Regeneration Resistor is connected. (The External Regeneration Resistor connection terminal is connected.)
- •To use the Built-in Regeneration Resistor, always set this parameter to 0.

| Pn017 | External Regeneration Resistor Setting | | | | | А | |
|---------------|--|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 4 | Unit | _ | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|--------------|---|
| 0 | Regeneration load ratio is 100% when operating rate of the External Regeneration Resistor is 10%. |
| 1 | Reserved |
| 2 | Reserved |
| 3 | Reserved |
| 4 | Reserved |

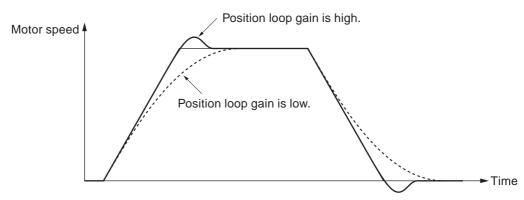
8-2 Gain Parameters

| Pn100 | Position Loop Gain | | | | Pos | sition Fully-clos | sed |
|---------------|--------------------|------|-------|-----------------|-------|-------------------|-----|
| Setting range | 0 to 30,000 | Unit | 0.1/s | Default setting | 480 * | Power OFF and ON | _ |

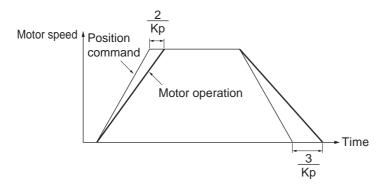
- The default setting is 320 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- Adjust the position loop response to suit the machine rigidity.
- •The responsiveness of the servo system is determined by the position loop gain. Servo systems with a high position loop gain have a high responsiveness and fast positioning. To increase the position loop gain, you must improve machine rigidity and increase the specific damping frequency. This should be 500 to 700 (0.1/s) for ordinary machine tools, 300 to 500 (0.1/s) for general-use and assembly machines, and 100 to 300 (0.1/s) for industrial robots. The default position loop gain is 400 (0.1/s), so be sure to lower the set value for machines with low machine rigidity.
- •Increasing the position loop gain in systems with low machine rigidity or systems with low specific damping frequencies may cause machine resonance, resulting in an overload alarm.
- •If the position loop gain is low, you can shorten the positioning time using feed-forward.
- •This parameter is automatically changed by executing realtime autotuning function. To set it manually, set the Realtime Autotuning Mode Selection (Pn002) to 0. Position loop gain is generally expressed as follows:

Position loop gain (Kp) =
$$\frac{\text{Command pulse frequency (pulses/s)}}{\text{Error counter accumulated pulse (pulse)}}$$
 (0.1/s)

Response when the position loop gain is operated



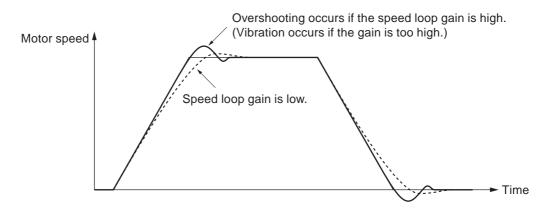
• If the speed loop gain and position loop gain are optimally set, the motor operation for the command will be delayed 2/Kp at acceleration and delayed 3/Kp at deceleration.



| Pn101 | Speed Loop Gain | | | | | А | II |
|---------------|-----------------|------|--------|-----------------|-------|------------------|----|
| Setting range | 1 to 32,767 | Unit | 0.1 Hz | Default setting | 270 * | Power OFF and ON | _ |

- The default setting is 180 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- Determine speed loop responsiveness.
- •The setting for the speed loop gain must be increased to increase the position loop gain and improve the responsiveness of the entire servo system. Setting too high, however, may result in vibration.
- •The setting unit for Pn101 will be Hz if the Inertia Ratio (Pn004) is set correctly.

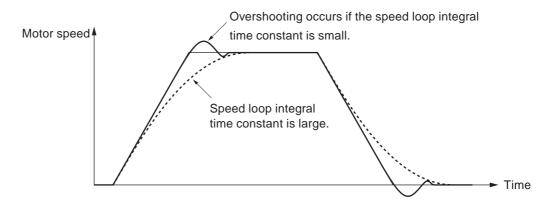
When the speed loop gain is changed, the response is as shown in the following diagram.



| Pn102 | Speed Loop Integral Time Constant | | | | | А | II |
|---------------|-----------------------------------|------|--------|-----------------|-------|------------------|----|
| Setting range | 1 to 10,000 | Unit | 0.1 ms | Default setting | 210 * | Power OFF and ON | _ |

- The default setting is 310 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- Set the speed loop integral time constant.
- The smaller the set value, the faster the error approaches 0 when stopping. Set to 9,999 to maintain integration. Set to 10,000 to invalidate the effect of integration.

When the speed loop integral time constant is changed, the response is as shown in the following diagram.



| Pn103 | Speed Feedback Filter Tim | e Consta | ınt | | | А | II |
|---------------|---------------------------|----------|-----|-----------------|---|------------------|----|
| Setting range | 0 to 5 | Unit | - | Default setting | 0 | Power OFF and ON | _ |

- Set the time constant for the low pass filter (LPF) after speed detection to one of 6 levels (0 to 5).
- Increasing the set value increases the time constant and decreases the noise generated by the motor. Responsiveness, however, also decreases.
- · Normally, use the default set value.

| Pn104 | Torque Command Filter Time Constant | | | | | А | .II |
|---------------|-------------------------------------|------|---------|-----------------|------|------------------|-----|
| Setting range | 0 to 2,500 | Unit | 0.01 ms | Default setting | 84 * | Power OFF and ON | _ |

- The default setting is 126 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- Set the time constant for the first-order lag filter inserted into the torque command.
- This parameter may be effective in suppressing vibration due to torsion resonance.

| Pn105 | Position Loop Gain 2 | | | | Pos | sition Fully-clo | sed |
|---------------|----------------------|------|-------|-----------------|-------|------------------|-----|
| Setting range | 1 to 30,000 | Unit | 0.1/s | Default setting | 570 * | Power OFF and ON | _ |

- The default setting is 380 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- Set the responsiveness of the position control system for the second position loop.

| Pn106 | Speed Loop Gain 2 | | | | | А | II |
|---------------|-------------------|------|--------|-----------------|----|------------------|----|
| Setting range | 1 to 32,767 | Unit | 0.1 Hz | Default setting | 1* | Power OFF and ON | _ |

- The default setting is 180 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- •Set the responsiveness of the second speed loop.

| Pn107 | Speed Loop Integral Time Constant 2 | | | | | .II | |
|---------------|-------------------------------------|------|--------|-----------------|-------|------------------|---|
| Setting range | 1 to 10,000 | Unit | 0.1 ms | Default setting | 10000 | Power OFF and ON | _ |

· Set the second speed loop integral time constant.

| Pn108 | Speed Feedback Filter Time Constant 2 | | | | | | II |
|---------------|---------------------------------------|------|---|-----------------|---|------------------|----|
| Setting range | 0 to 5 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

· Set the second speed feedback filter.

| Pn109 | Torque Command Filter Tin | Torque Command Filter Time Constant 2 | | | | | |
|---------------|---------------------------|---------------------------------------|---------|-----------------|------|------------------|---|
| Setting range | 0 to 2,500 | Unit | 0.01 ms | Default setting | 84 * | Power OFF and ON | _ |

- The default setting is 126 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- Set the second torque filter time constant.
- •The parameters from Pn105 to Pn109 are the gain and time constants to be selected when the Gain Switching Input Operating Mode Selection (Pn114) is enabled.
- •The gains are switched according to the condition set in the Gain Switching Mode (Pn115, Pn120 and Pn124).
- •If the mechanical system inertia changes greatly or if you want to change the responsiveness depending on whether the motor is rotating or being stopped, you can achieve the appropriate control by setting the gains and time constants beforehand for each of these conditions, and switching them according to the condition.
- •This parameter is automatically changed by executing realtime autotuning function. To set it manually, set the Realtime Autotuning Mode Selection (Pn002) to 0.

| Pn110 | Speed Feed-forward Amou | nt | | | Pos | sition Fully-clos | sed |
|---------------|-------------------------|------|------|-----------------|-----|-------------------|-----|
| Setting range | 0 to 1,000 | Unit | 0.1% | Default setting | 300 | Power OFF and ON | _ |

•Set the feed-forward amount. Increasing the set value decreases the position error and increases the responsiveness. Overshooting, however, will occur more easily.

| Pn111 | Speed Feed-forward Comm | Speed Feed-forward Command Filter | | | | | sed |
|---------------|-------------------------|-----------------------------------|---------|-----------------|----|------------------|-----|
| Setting range | 0 to 6,400 | Unit | 0.01 ms | Default setting | 50 | Power OFF and ON | _ |

- Set the time constant for the first-order lag filter inserted into the feed forward.
- •Setting the filter may improve operation if speed overshooting occurs or the noise during operation is large when the feed-forward is set high.

| Pn112 | Torque Feed-forward Amou | Position Speed Fully-closed | | | | | |
|---------------|--------------------------|-----------------------------|------|-----------------|---|------------------|---|
| Setting range | 0 to 1,000 | Unit | 0.1% | Default setting | 0 | Power OFF and ON | _ |

•Set the feed-forward amount in the torque loop. Increasing the set value decreases the position error and increases the responsiveness. Overshooting, however, will occur more easily.

| Pn113 | Torque Feed-forward Command Filter | | | Position Speed Fully-closed | | | |
|---------------|------------------------------------|------|---------|-----------------------------|---|------------------|---|
| Setting range | 0 to 6,400 | Unit | 0.01 ms | Default setting | 0 | Power OFF and ON | _ |

- Set the time constant for the first-order lag filter inserted into the feed forward.
- •Setting the filter may improve operation if speed overshooting occurs or the noise during operation is large when the feed-forward is set high.

| Pn114 | Gain Switching Input Operating Mode Selection All | | | | | .II | |
|---------------|--|------|---|-----------------|---|------------------|---|
| Setting range | 0 or 1 | Unit | _ | Default setting | 1 | Power OFF and ON | _ |

| Set value | Description |
|--------------|-----------------------------------|
| 0 | Gain 1 (PI/P switching enabled) |
| 1 | Gain 1/gain 2 switching available |

- Select either PI/P operation switching or gain 1/gain 2 switching.
- •PI/P operation switching is performed using gain switching (GSEL: CN1 pin 27). PI is not changed, however, if the Torque Limit Selection (Pn521) is set to 3.

| Gain input | Speed loop operation |
|------------|----------------------|
| GSEL OFF | PI operation |
| GSEL ON | P operation |

- For information on switching conditions between gain 1 and gain 2, refer to "6-7 Gain Switching Function" (P.6-24).
- •If autotuning is enabled, feedforward gain and filter are set at a fixed value.

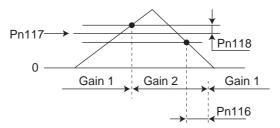
| Pn115 | Switching Mode in Position | Control | | | Pos | sition Fully-clos | sed |
|---------------|----------------------------|---------|---|-----------------|-----|-------------------|-----|
| Setting range | 0 to 10 | Unit | - | Default setting | 0 | Power OFF and ON | |

Explanation of Settings

(√: Enabled, –: Disabled)

| | | Explanation | | |
|--------------|--|--|--|--|
| Set value | Gain switching conditions | Gain Switching Delay Time in Position Control (Pn116) *1 | Gain Switching Level in Position Control (Pn117) | Gain Switching 1 Hysteresis in Position Control (Pn118) *2 |
| 0 | Always Gain 1 (Pn100 to Pn104) | _ | _ | - |
| 1 | Always Gain 2 (Pn105 to Pn109) | _ | _ | _ |
| 2 | Switching using gain switching input (GSEL) for CN1 pin 27 | - | - | - |
| 3 | Torque command variation (Refer to Figure A) | √ | √ *3 (× 0.05%) | √*3 (× 0.05%) |
| 4 | Always Gain 1 (Pn100 to Pn104) | _ | _ | _ |
| 5 | Command speed (Refer to Figure B) | √ | √ (r/min) | √ (r/min) |
| 6 | Amount of position error (Refer to Figure C) | √ | √ *4 (pulse) | √ *4 (pulse) |
| 7 | Command pulses received (Refer to Figure D) | √ | _ | - |
| 8 | Positioning completion signal (INP) OFF (Refer to Figure E) | √ | - | - |
| 9 | Actual motor speed (Refer to Figure B) | √ | √ (r/min) | √ (r/min) |
| 10 | Combination of command pulse input and speed (Refer to Figure F) | √ | √ *5 (r/min) | √ *5 (r/min) |

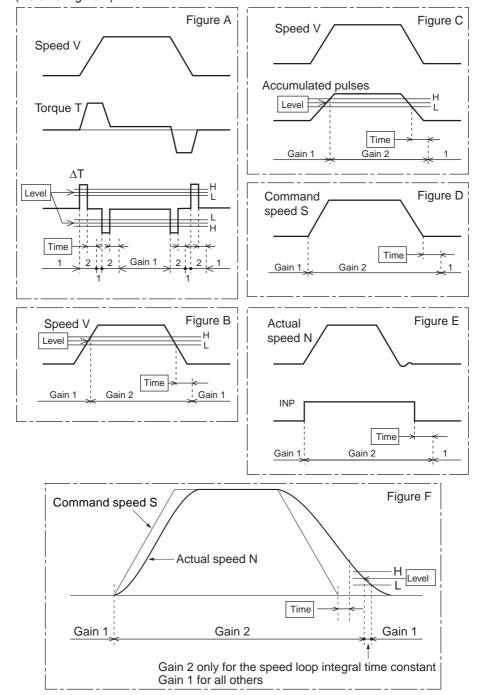
- Select the conditions for switching between gain 1 and gain 2 when the Gain Switching Input Operating Mode Selection (Pn114) is set to 1.
- The gain is always gain 1 regardless of the gain input if the Gain Switch input is not assigned to any input if this setting is 2.
- *1. The Gain Switching Delay Time in Position Control (Pn116) becomes effective when the gain is switched from 2 to 1.
- *2. The Gain Switching Hysteresis in Position Control (Pn118) is defined in the drawing below.



- *3. The variation means the change amount in a millisecond (ms).

 E.g. The set value is 200 when the condition is a 10% change in torque in 1 millisecond.
- *4. This is the encoder resolution.

*5. The meanings of the gain switching delay time in position control, gain switching level in position control, and gain switching hysteresis in position control are different from normal if this is set to 10. (Refer to Figure F)



| Pn116 | Gain Switching Delay Time | Pos | sition Fully-clos | sed | | | |
|---------------|---------------------------|------|-------------------|-----------------|----|------------------|---|
| Setting range | 0 to 10,000 | Unit | 0.1 ms | Default setting | 50 | Power OFF and ON | _ |

[•] Set the delay time when returning from gain 2 to gain 1 if the Switching Mode in Position Control (Pn115) is set to 3 or 5 to 10.

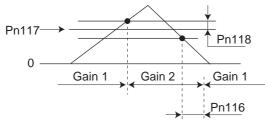
| Pn117 | Gain Switching Level in Position Control Position Fully-c | | | | | | sed |
|---------------|--|------|---|-----------------|----|------------------|-----|
| Setting range | 0 to 20,000 | Unit | _ | Default setting | 50 | Power OFF and ON | _ |

• This is enabled when the Switching Mode in Position Control (Pn115) is set to 3, 5, 6, 9 or 10. It sets the judgment level for switching between gain 1 and gain 2. The unit depends on the Switching Mode in Position Control (Pn115).

| Pn118 | Gain Switching Hysteresis i | Pos | sition Fully-clos | sed | | | |
|---------------|-----------------------------|------|-------------------|-----------------|----|------------------|---|
| Setting range | 0 to 20,000 | Unit | _ | Default setting | 33 | Power OFF and ON | _ |

• Set the hysteresis width above and below the judgment level set in the Gain Switching Level in Position Control (Pn117). The unit depends on the setting of the Switching Mode in Position Control (Pn115).

The following shows the definitions for the Gain Switching Delay Time in Position Control (Pn116), Gain Switching Level in Position Control (Pn117), and Gain Switching Hysteresis in Position Control (Pn118).



• The settings for the Gain Switching Level in Position Control (Pn117) and the Gain Switching Hysteresis in Position Control (Pn118) are enabled as absolute values (positive/negative).

| Pn119 | Position Gain Switching Tin | Position Gain Switching Time | | | | | |
|---------------|-----------------------------|------------------------------|--------|-----------------|----|------------------|---|
| Setting range | 0 to 10,000 | Unit | 0.1 ms | Default setting | 33 | Power OFF and ON | - |

If the difference between the Position Loop Gain (Pn100) and Position Loop Gain 2 (Pn105) is large during position control, this parameter can be used to suppress a rapid increase in the position loop gain. When the gain increases, it will change by the time set for this parameter.

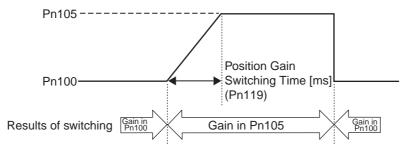
Position Gain Switching Time

The Position Gain Switching Time (Pn119) can be set to more smoothly change the gain and reduce vibration when a large change is being made in the position loop gain during position control or fully-closed control. This smooths vibration and the changes in torque that can occur when the position loop gain is changed too quickly.



Precautions for Correct Use

• If the gain is changed to a smaller value, the setting of this parameter is ignored and the gain is changed immediately. Example: Pn100 > Pn105



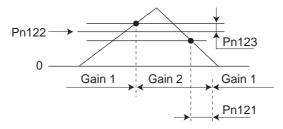
| Pn120 | Switching Mode in Speed Control | | | | | | ed |
|---------------|---------------------------------|------|---|-----------------|---|------------------|----|
| Setting range | 0 to 5 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

Explanation of Settings

(√: Enabled, –: Disabled)

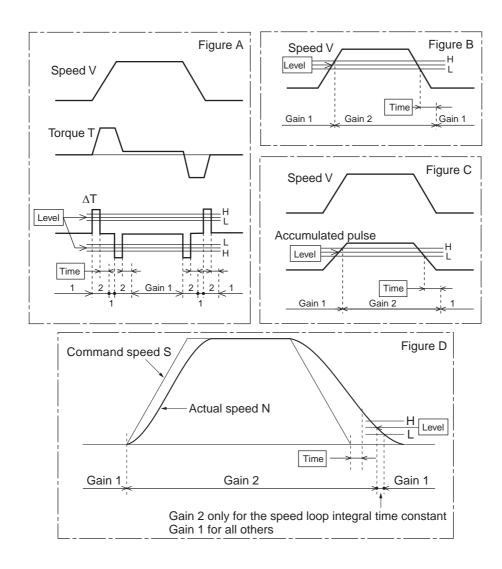
| | | Explanation | | |
|--------------|--|---|---|--|
| Set value | Gain switching conditions | Gain Switching Delay Time in Speed Control (Pn121) *1 | Gain Switching Level in Speed Control (Pn122) | Gain Switching Hysteresis in Speed Control (Pn123) *2 |
| 0 | Always the Gain 1 (Pn100 to Pn104) | _ | _ | _ |
| 1 | Always the Gain 2 (Pn105 to Pn109) | _ | _ | _ |
| 2 | Switching using gain switching input (GSEL) for CN1 pin 27 | - | _ | - |
| 3 | Torque command variation (Refer to Figure A) | V | (0.05%) | √ *3 (0.05%) |
| 4 | Speed command variation (Refer to Figure B) | V | √ *4 (10 r/min/s) | $\sqrt{*4}$ (10 r/min/s) |
| 5 | Speed command (Refer to Figure C) | √ | √ (r/min) | √ (r/min) |

- Select the conditions for switching between gain 1 and gain 2 when the Gain Switching Input Operating Mode Selection (Pn114) is set to 1.
- •The gain is always gain 1 regardless of the gain input if the switching input is not assigned when Pn120 = 2.
- *1. The Gain Switching Delay Time in Speed Control (Pn121) becomes effective when the gain is switched from 2 to 1.
- *2. The Gain Switching Hysteresis in Speed Control (Pn123) is defined as shown in the drawing below.



- *3. The variation means the change amount in a millisecond (ms).

 E.g. The set value is 200 when the condition is a 10% change in torque in 1 millisecond.
- *4. The meanings of the Gain Switching Delay Time in Speed Control (Pn121), Gain Switching Level in Speed Control (Pn122), and Gain Switching Hysteresis in Speed Control (Pn123) are different from normal if this is set to 10. (Refer to Figure D)



| Pn121 | Gain Switching Delay Time | Gain Switching Delay Time in Speed Control | | | | | |
|---------------|---------------------------|--|--------|-----------------|---|------------------|---|
| Setting range | 0 to 10,000 | Unit | 0.1 ms | Default setting | 0 | Power OFF and ON | _ |

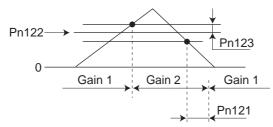
• Set the delay time when returning from gain 2 to gain 1 if the Switching Mode in Speed Control (Pn120) is set to 3 to 5.

| Pn122 | Gain Switching Level in Speed Control | | | | | | ed |
|---------------|---------------------------------------|------|---|-----------------|---|------------------|----|
| Setting range | 0 to 20,000 | Unit | - | Default setting | 0 | Power OFF and ON | _ |

• In Speed Control Mode, this is enabled when the Switching Mode in Speed Control (Pn120) is set to 3 to 5. Set the judgment level for switching between gain 1 and gain 2. The unit depends on the Switching Mode in Speed Control (Pn120).

| Pn123 | Gain Switching Hysteresis i | n Speed | Control | | | Spe | eed |
|---------------|-----------------------------|---------|---------|-----------------|---|------------------|-----|
| Setting range | 0 to 20,000 | Unit | - | Default setting | 0 | Power OFF and ON | _ |

• Set the hysteresis width above and below the judgment level set in the Gain Switching Level in Speed Control (Pn122). The unit depends on the setting of the Switching Mode in Speed Control (Pn120). The following shows the definitions for the Gain Switching Delay Time in Speed Control (Pn121), Gain Switching Level in Speed Control (Pn122), and Gain Switching Hysteresis in Speed Control (Pn123).



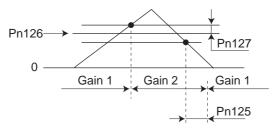
• The settings for the Gain Switching Level in Speed Control (Pn122) and the Gain Switching Hysteresis in Speed Control (Pn123) are enabled absolute values (positive/negative).

| Pn124 | Switching Mode in Torque (| Switching Mode in Torque Control | | | | | |
|---------------|----------------------------|----------------------------------|---|-----------------|---|------------------|---|
| Setting range | 0 to 3 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

Explanation of Settings

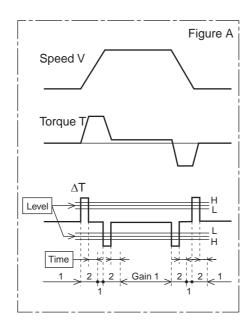
| | | Explanation | | | |
|--------------|--|--|--|---|--|
| Set value | Gain switching conditions | Gain Switching Delay Time in Torque Control (Pn125) *1 | Gain Switching Level in Torque Control (Pn126) | Gain Switching Hysteresis in Torque Control (Pn127) *2 | |
| 0 | Always Gain 1 (Pn100 to Pn104) | _ | _ | _ | |
| 1 | Always Gain 2 (Pn105 to Pn109) | _ | _ | _ | |
| 2 | Switching using gain switching input (GSEL) for CN1 pin 27 | _ | _ | _ | |
| 3 | Torque command variation (Refer to Figure A) | V | √ *3 (0.05%) | √ *3 (0.05%) | |

- Select the switching condition between gain 1 and gain 2 when the Gain Switching Input Operating Mode Selection (Pn114) is set to 1.
- •The gain is always gain 1 regardless of the gain input if the switching input is not assigned when Pn124=2.
- *1. The Gain Switching Delay Time in Torque Control (Pn125) becomes effective the gain is switched from 2 to 1.
- *2. The Gain Switching Hysteresis in Torque Control (Pn127) is defined as shown in the following figure.



*3. The variation means the change amount in a millisecond (ms).

E.g. The set value is 200 when the condition is a 10% change in torque in 1 millisecond.



| Pn125 | Gain Switching Delay Time | in Torqu | e Control | | | Tor | que |
|---------------|---------------------------|----------|-----------|-----------------|---|------------------|-----|
| Setting range | 0 to 10,000 | Unit | 0.1 ms | Default setting | 0 | Power OFF and ON | _ |

• Set the delay time when returning from gain 2 to gain 1 if the Switching Mode in Torque Control (Pn124) is set to 3.

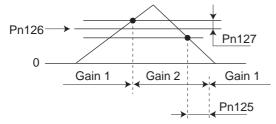
| Pn126 | Gain Switching Level in Tor | que Con | trol | | | Tor | que |
|---------------|-----------------------------|---------|------|-----------------|---|------------------|-----|
| Setting range | 0 to 20,000 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

• This is enabled when the Switching Mode in Torque Control (Pn124) is set to 3. It sets the judgment level for switching between gain 1 and gain 2. The unit depends on the setting of Switching Mode in Torque Control (Pn124).

| Pn127 | Gain Switching Hysteresis i | n Torque | e Control | | | Tor | que |
|---------------|-----------------------------|----------|-----------|-----------------|---|------------------|-----|
| Setting range | 0 to 20,000 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

• Set the hysteresis width above and below the judgment level set in the Gain Switching Level in Torque Control (Pn126). The unit depends on the setting of Switching Mode in Torque Control (Pn124).

The following shows the definitions for the Gain Switching Delay Time in Torque Control (Pn125), Gain Switching Level in Torque Control (Pn126), and Gain Switching Hysteresis in Torque Control (Pn127).



• The settings for the Gain Switching Level in Torque Control (Pn126) and the Gain Switching Hysteresis in Torque Control (Pn127) are enabled as absolute values (positive/negative).

8-3 Vibration Suppression Parameters

| Pn200 | Adaptive Filter Selection | | | Po | sition | eed Fully-clos | sed |
|---------------|---------------------------|------|---|-----------------|--------|------------------|-----|
| Setting range | 0 to 4 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

| Set value | Description |
|-----------|---|
| 0 | Disabled. The current values are held for the parameters related to notch filters 3 and 4. |
| 1 | One adaptive filter is enabled. The parameter related to notch filter 3 is updated based on the applicable result. |
| 2 | Two adaptive filter is enabled. The parameters related to notch filters 3 and 4 are updated based on the applicable result. |
| 3 | The resonance frequency is measured. The measurement result can be checked using CX-Drive. The current values are held for the parameters related to notch filters 3 and 4. |
| 4 | Adaptive result is cleared. Parameters related to notch filters 3 and 4 are disabled and the adaptive result is cleared. |

- Set the operation of the adaptive filter.
- The adaptive filter is normally disabled in the Torque Control Mode.

| Pn201 | Notch 1 Frequency Setting | | | | | А | |
|---------------|---------------------------|------|----|-----------------|------|------------------|---|
| Setting range | 50 to 5,000 | Unit | Hz | Default setting | 5000 | Power OFF and ON | _ |

- Set the frequency of resonance suppression notch filter 1.
- The notch filter function will be disabled if this parameter is set to 5,000.

| Pn202 | Notch 1 Width Setting | | | | | А | II |
|---------------|-----------------------|------|---|-----------------|---|------------------|----|
| Setting range | 0 to 20 | Unit | _ | Default setting | 2 | Power OFF and ON | _ |

- Set the width of resonance suppression notch filter 1 to one of 20 levels.
- Increasing the set value widens the notch width. Normally, use the default set value.

| Pn203 | Notch 1 Depth Setting | | | | | А | |
|---------------|-----------------------|------|---|-----------------|---|------------------|---|
| Setting range | 0 to 99 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

- Set the notch depth of resonance suppression notch filter 1.
- Increasing the set value shortens the notch depth and the phase lag.

| Pn204 | Notch 2 Frequency Setting | | | | | А | II |
|---------------|---------------------------|------|----|-----------------|------|------------------|----|
| Setting range | 50 to 5,000 | Unit | Hz | Default setting | 5000 | Power OFF and ON | _ |

- Set the notch frequency of resonance suppression notch filter 2.
- The notch filter function will be disabled if this parameter is set to 5,000.

| Pn205 | Notch 2 Width Setting | | | | | А | |
|---------------|-----------------------|------|---|-----------------|---|------------------|---|
| Setting range | 0 to 20 | Unit | - | Default setting | 2 | Power OFF and ON | _ |

- Select the notch width of resonance suppression notch filter 2.
- Increasing the set value widens the notch width. Normally, use the default set value.

| Pn206 | Notch 2 Depth Setting | | | | | A | ۱I | | | |
|------------------|---|--|-----|-----------------|-------------|------------------|-----|--|--|--|
| Setting range | 0 to 99 | Unit | _ | Default setting | 0 | Power OFF and ON | T- | | | |
| | Set the notch depth o Increasing the set val | | | | ag. | | | | | |
| Pn207 | Notch 3 Frequency Set | ting | | | | A | \II | | | |
| Setting range | 50 to 5,000 | 50 to 5,000 Unit Hz Default setting 5000 Power OF and ON | | | | | | | | |
| | Set the notch frequen The notch filter function | • | | | 5,000. | | | | | |
| Pn208 | Notch 3 Width Setting | | | | | A | ۱I | | | |
| Setting range | 0 to 20 | Unit | _ | Default setting | 2 | Power OFF and ON |]. | | | |
| | Select the notch width Increasing the set val | | • • | | e default s | et value. | | | | |
| Pn209 | Notch 3 Depth Setting | Notch 3 Depth Setting All | | | | | | | | |
| Setting range | 0 to 99 | Unit | _ | Default setting | 0 | Power OFF and ON |]. | | | |
| | Set the notch depth o Increasing the set val | | | | ag. | • | | | | |
| Pn210 | Notch 4 Frequency Set | ting | | | | | \II | | | |
| Setting range | 50 to 5,000 | Unit | Hz | Default setting | 5000 | Power OFF and ON | | | | |
| | Set the notch frequen The notch filter function | • | | | 5,000. | • | | | | |
| Pn211 | Notch 4 Width Setting | | | | | A | \II | | | |
| Setting range | 0 to 20 | Unit | _ | Default setting | 2 | Power OFF and ON |] - | | | |
| | Select the notch width Increasing the set val | | | | e default s | et value. | | | | |
| Pn212 | Notch 4 Depth Setting | otch 4 Depth Setting All | | | | | | | | |
| Setting range | 0 to 99 | Unit | _ | Default setting | 0 | Power OFF and ON | Ī | | | |
| | Set the notch depth o Increasing the set val | | | | ag. | • | | | | |
| Pn213 | Damping Filter Selectio | n | | | | Pos | sit | | | |
| Setting | 0 to 3 | Unit | _ | Default | 0 | Power OFF | Τ | | | |

range

setting

and ON

| Set value | Description |
|--------------|--|
| 0 | Damping filter 1 and 2 enabled |
| 1 | With external input (DFSEL1), either 1 and 3 or 2 and 4 can be selected. Open: Damping filters 1 and 3 enabled Shorted: Damping filters 2 and 4 enabled |
| 2 | With external input (DFSEL1 and DFSEL2), one of the filters 1 to 4 can be selected. When DFSEL1 and DFSEL2 are both open: Damping filter 1 enabled When DFSEL1 is shorted and DFSEL2 is open: Damping filter 2 enabled When DFSEL1 is open and DFSEL2 is shorted: Damping filter 3 enabled When DFSEL1 and DFSEL2 are both shorted: Damping filter 4 enabled |
| 3 | The damping filters are switched with position command direction. Forward direction: Damping filters 1 and 3 enabled Reverse direction: Damping filters 2 and 4 enabled |

| Pn214 | Damping Frequency 1 | | | | | | |
|---------------|---------------------|------|--------|-----------------|---|------------------|---|
| Setting range | 0 to 2,000 | Unit | 0.1 Hz | Default setting | 0 | Power OFF and ON | - |

- Set damping frequency 1 to suppress vibration at the end of the load in damping control.
- Measure the frequency of vibration at the end of the load and make the setting in units of 0.1 Hz.
- The range of frequency setting is 1.0 to 200.0 Hz. The function is disabled if the setting is 0 to 0.9 Hz.
- Refer to "6-1 Damping Control" (P.6-1) for more information on settings.

| Pn215 | Damping Filter 1 Setting | | | | | Pos | ition |
|---------------|--------------------------|------|--------|-----------------|---|------------------|-------|
| Setting range | 0 to 1,000 | Unit | 0.1 Hz | Default setting | 0 | Power OFF and ON | _ |

- First set the Damping Frequency 1 (Pn214). Then reduce the setting if torque saturation occurs or increase the setting to increase operation speed. Normally, use a setting of 0.
- Set value is restricted in the following manner.
 Upper limit: Corresponding damping frequency

Lower limit: Damping frequency + damping filter setting ≥ 100

•Refer to "6-1 Damping Control" (P.6-1) for more information on settings.

| Pn216 | Damping Frequency 2 | | | | | Pos | ition |
|---------------|---------------------|------|--------|-----------------|---|------------------|-------|
| Setting range | 0 to 2,000 | Unit | 0.1 Hz | Default setting | 0 | Power OFF and ON | _ |

- Set Damping Frequency 2 to suppress vibration at the end of the load in damping control.
- Measure the frequency of vibration at the end of the load and make the setting in units of 0.1 Hz.
- The range of frequency setting is 1.0 to 200.0 Hz. The function is disabled if the setting is 0 to 0.9 Hz.
- Refer to "6-1 Damping Control" (P.6-1) for more information on settings.

| Pn217 | Damping Filter 2 Setting | | | | | Pos | ition |
|---------------|--------------------------|------|--------|-----------------|---|------------------|-------|
| Setting range | 0 to 1,000 | Unit | 0.1 Hz | Default setting | 0 | Power OFF and ON | _ |

- First set the Damping Frequency 2 (Pn216). Then reduce the setting if torque saturation occurs or increase the setting to increase operation speed. Normally, use a setting of 0.
- •Set value is restricted in the following manner.

Upper limit: Corresponding damping frequency

Lower limit: Damping frequency + damping filter setting ≥ 100

•Refer to "6-1 Damping Control" (P.6-1) for more information on settings.

| Pn218 | Damping Frequency 3 | | | | | Pos | ition |
|---------------|---------------------|------|--------|-----------------|---|------------------|-------|
| Setting range | 0 to 2,000 | Unit | 0.1 Hz | Default setting | 0 | Power OFF and ON | _ |

- Set Damping Frequency 3 to suppress vibration at the end of the load in damping control.
- Measure the frequency of vibration at the end of the load and make the setting in units of 0.1 Hz.
- The range of frequency setting is 1.0 to 200.0 Hz. The function is disabled if the setting is 0 to 0.9 Hz.
- Refer to "6-1 Damping Control" (P.6-1) for more information on settings.

| Pn219 | Damping Filter 3 Setting | | | | | Pos | ition |
|---------------|--------------------------|------|--------|-----------------|---|------------------|-------|
| Setting range | 0 to 1,000 | Unit | 0.1 Hz | Default setting | 0 | Power OFF and ON | _ |

- First set the Damping Frequency 3 (Pn218). Then reduce the setting if torque saturation occurs or increase the setting to increase operation speed. Normally, use a setting of 0.
- •Set value is restricted in the following manner.
- Upper limit: Corresponding damping frequency
- Lower limit: Damping frequency + damping filter setting ≥ 100
- •Refer to "6-1 Damping Control" (P.6-1) for more information on settings.

| Pn220 | Damping Frequency 4 | | | | | Pos | ition |
|---------------|---------------------|------|--------|-----------------|---|------------------|-------|
| Setting range | 0 to 2,000 | Unit | 0.1 Hz | Default setting | 0 | Power OFF and ON | _ |

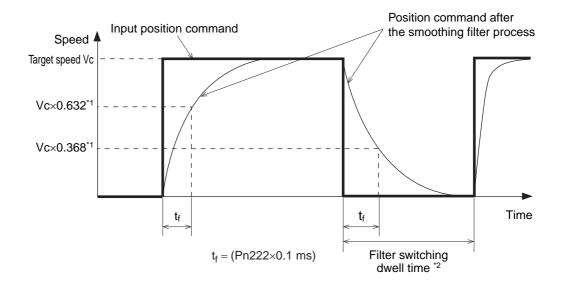
- Set Damping Frequency 4 to suppress vibration at the end of the load in damping control.
- Measure the frequency of vibration at the end of the load and make the setting in units of 0.1 Hz.
- The range of frequency setting is 1.0 to 200.0 Hz. The function is disabled if the setting is 0 to 0.9 Hz.
- Refer to "6-1 Damping Control" (P.6-1) for more information on settings.

| Pn221 | Damping Filter 4 Setting | | | | | | |
|---------------|--------------------------|------|--------|-----------------|---|------------------|---|
| Setting range | 0 to 1,000 | Unit | 0.1 Hz | Default setting | 0 | Power OFF and ON | _ |

- First set the Damping Frequency 4 (Pn220). Then reduce the setting if torque saturation occurs or increase the setting to increase operation speed. Normally, use a setting of 0.
- *Set value is restricted in the following manner.
 - Upper limit: Corresponding damping frequency
 - Lower limit: Damping frequency + damping filter setting ≥ 100
- •Refer to "6-1 Damping Control" (P.6-1) for more information on settings.

| Pn222 | Position Command Filter Ti | Position Command Filter Time Constant | | | | | |
|---------------|----------------------------|---------------------------------------|--------|-----------------|---|------------------|---|
| Setting range | 0 to 10,000 | Unit | 0.1 ms | Default setting | 0 | Power OFF and ON | - |

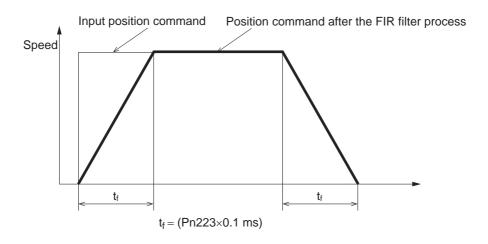
- The position command filter time constant is the first-order lag filter inserted after the electronic gear ratio for the command pulse input.
- •The position command filter time constant can be used for the following:
 - If the command pulses change abruptly, the filter can be used to reduce the stepping movement of the motor.
 - The following are examples of when the command pulses can change abruptly:
 The electronic gear ratio setting is high (10 times or higher).
 The command pulse frequency is low.



- *1 The actual process involves calculation error.
- *2 If accumulated pulses remain within the filter after the filter set value has been changed, etc., the motor may operate at a speed higher than the command speed immediately after switching the filter.

| Pn223 | Smoothing Filter Time Cons | Smoothing Filter Time Constant | | | | | |
|---------------|----------------------------|--------------------------------|--------|-----------------|---|------------------|---|
| Setting range | 0 to 10,000 | Unit | 0.1 ms | Default setting | 0 | Power OFF and ON | - |

- Set the FIR filter time constant used for command pulse input. (FIR: Finite impulse response)
- The higher the set value, the smoother the command pulses.



Parameter Details

8-4 Analog Control Parameters

| Pn300 | Command Speed Selection | | | | | | |
|---------------|-------------------------|------|---|-----------------|---|------------------|---|
| Setting range | 0 to 3 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

Explanation of Set Values

| Set value | Description |
|-----------|---|
| 0 | Analog speed command |
| 1 | No. 1 Internally Set Speed to No. 4 Internally Set Speed (Pn304 to Pn307) |
| 2 | No. 1 Internally Set Speed to No. 3 Internally Set Speed (Pn304 to Pn306), analog speed command |
| 3 | No. 1 Internally Set Speed to No. 8 Internally Set Speed (Pn304 to Pn311) |

- Select the speed command when using speed control. The drive has internally set speed function that can be used to easily achieve speed control by using contact inputs.
- •For details on internally set speed function, refer to "5-4 Internally Set Speed Control" (P.5-19).

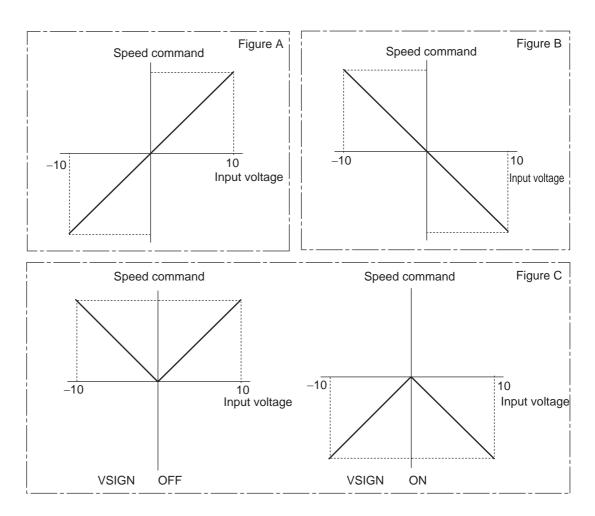
| Pn301 | Speed Command Direction Selection | | | | | | eed |
|---------------|-----------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

| Set value | Description |
|-----------|--|
| 0 | Use the sign of the speed command: Example: +: Forward, -: Reverse |
| 1 | Use the speed command sign selection (VSIGN); Example: OFF: Forward, ON: Reverse |

- Set to reverse the polarity of the speed command input (REF: CN1 pin 14). This is used to change the motor rotation direction without changing the polarity of host device command signals.
- •The default setting for this parameter is 0. By rotating to the reverse direction with the +command keeps the compatibility with all OMNUC W-Series Servo Drives.
- •The operation of the Servomotor may be abnormal if the polarity of the speed command signal from the Position Control Unit does not agree with the setting of this parameter when the Servo Drive system is comprised of the combination of the Servo Drive set to the Speed Control Mode and an external Position Control Unit.

| Command Speed Selection (Pn300) | Speed Command Direction Selection (Pn301) | Analog Speed Command Rotation Direction Switching (Pn303) | Analog speed command (REF) | Speed command sign selection (VSIGN) | Speed command direction*1 | Conversion graph | |
|--|---|---|----------------------------------|--|---------------------------------|---------------------|--|
| | 0 | 0 | + Voltage (0 to 10 V) | | Forward direction | Figure A | |
| | | | - Voltage (-10 to 0 V) | Not affected | Reverse direction | | |
| | | 1 | + Voltage (0 to 10 V) | | Reverse direction | Figure B | |
| 0 | | | - Voltage (-10 to 0 V) | | Forward direction | i igule b | |
| | | | + Voltage (0 to 10 V) | OFF | Forward | | |
| | 1 | Not affected | - Voltage (-10 to 0 V) | 011 | direction | Figure C | |
| | ' | | + Voltage (0 to 10 V) | ON | Reverse | Tigule 0 | |
| | | | - Voltage (-10 to 0 V) | OIV | direction | 1 | |

^{*1.} The motor rotation direction (CW, CCW) specified by the command direction is determined by the setting of Pn000.



| Pn302 | Speed Command Scale | Speed Tor | que | | | | |
|---------------|---------------------|-----------|-----------|-----------------|-----|------------------|---|
| Setting range | 10 to 2,000 | Unit | (r/min)/V | Default setting | 500 | Power OFF and ON | - |

- Set the relation between the voltage applied to the speed command input (REF: CN1 pin 14) and the motor speed.
- •For details on speed control, refer to "5-2 Speed Control" (P.5-7).
- •This parameter sets the relation between voltage and speed limit when applying an analog speed limit in Torque Control Mode

| Pn303 | Analog Speed Command Rotation Direction Switching | | | | | | eed |
|---------------|---|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | _ | Default setting | 1 | Power OFF and ON | _ |

| Set value | Description |
|-----------|--|
| 0 | Rotation direction is changed by analog speed command (REF) voltage. +Voltage: Forward direction -Voltage: Reverse direction |
| 1 | Rotation direction is changed by analog speed command voltage. +Voltage: Reverse direction -Voltage: Forward direction |

| Pn304 | No. 1 Internally Set Speed | | | | | | | |
|---------------|----------------------------|------|-------|-----------------|---|------------------|--|--|
| Setting range | -20,000 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | | |
| | | | | | | | | |
| Pn305 | No. 2 Internally Set Spe | ed | | | | Speed | | |
| Setting range | -20,000 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | | |
| | | | | | | | | |
| Pn306 | No. 3 Internally Set Spe | ed | | | | Speed | | |
| Setting range | -20,000 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | | |
| | · | | • | | | | | |
| Pn307 | No. 4 Internally Set Spe | ed | | | | Speed | | |
| Setting range | -20,000 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | | |
| | | | | | | | | |
| Pn308 | No. 5 Internally Set Spe | ed | | | | Speed | | |
| Setting range | -20,000 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | | |
| | <u>.</u> | • | • | <u>.</u> | • | <u>.</u> | | |
| Pn309 | No. 6 Internally Set Spe | ed | | | | Speed | | |
| Setting range | -20,000 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | | |

| Pn310 | No. 7 Internally Set Speed Speed | | | | | | |
|---------------|----------------------------------|------|-------|-----------------|---|------------------|-----|
| Setting range | -20,000 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | _ |
| | | | | | | | |
| Pn311 | No. 8 Internally Set Speed | | | | | Spe | eed |
| Setting range | -20,000 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | _ |

[•] If internal speed settings are enabled in the Command Speed Selection (Pn300), set the No. 1 to 4 internally set speed in Pn304 to Pn307 and the No. 5 to 8 internally set speed in Pn308 to Pn311. Set the speed in r/min.

•The polarity of the set values indicates the polarity of the internally set speed.

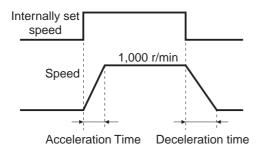
| + | The forward direction as viewed from the shaft end |
|---|--|
| - | The reverse direction as viewed from the shaft end |

• The absolute value of the parameter setting is limited by the Overspeed Level Setting (Pn513).

| Pn312 | Soft Start Acceleration Time | | | | | | eed |
|---------------|------------------------------|------|------------------|-----------------|---|------------------|-----|
| Setting range | 0 to 10,000 | Unit | ms/(1,000 r/min) | Default setting | 0 | Power OFF and ON | _ |

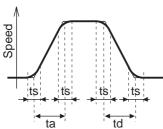
| Pn313 | Soft Start Deceleration Time | | | | | | |
|---------------|------------------------------|------|------------------|-----------------|---|------------------|---|
| Setting range | 0 to 10,000 | Unit | ms/(1,000 r/min) | Default setting | 0 | Power OFF and ON | _ |

- Control the speed by setting acceleration/deceleration to the speed command inside the drive.
- •A soft start can be set when inputting speed commands of stepping movement or when using internal speed setting.
- •Do not set acceleration/deceleration time settings when using the drive in combination with an external position loop. (Set both Pn312 and Pn313 to 0.)



| Pn314 | S-curve Acceleration/Deceleration Time Setting | | | | | | eed |
|---------------|--|------|----|-----------------|---|------------------|-----|
| Setting range | 0 to 1,000 | Unit | ms | Default setting | 0 | Power OFF and ON | _ |

• Set the pseudo-S-curve acceleration/deceleration value to add to the speed command to enable smooth operation. This is useful for applications where impact may occur due to a large change in acceleration or deceleration when starting or stopping with linear acceleration or deceleration.



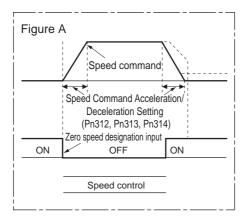
- Basic linear acceleration time and deceleration time are set by Pn312 and Pn313, respectively.
- The S-curve time is set by Pn314 (unit: 2 ms) based on the time width around the point of inflection during linear acceleration and deceleration.

ta: Pn312 Use $\frac{ta}{2}$ > ts, and $\frac{td}{2}$ > ts

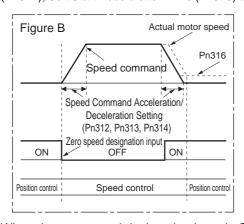
ts: Pn314 as settings

| Pn315 | Zero Speed Designation Selection | | | | | Speed Toro | que |
|---------------|----------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 3 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

| Set value | Description | | | | | | | |
|--------------|---|--|--|--|--|--|--|--|
| 0 | Zero speed designation function is disabled. | | | | | | | |
| 1 | Speed command becomes 0 upon zero speed designation input. (Refer to Figure A) | | | | | | | |
| 2 | Speed command becomes 0 upon zero speed designation input, and servo locks with position control when actual speed reaches below Position Lock Level Setting (Pn316). (Refer to Figure B) | | | | | | | |
| 3 | Servo locks with position control upon zero speed designation input and when speed command reaches below Zero Destination Level (Pn316). (Refer to Figure C) | | | | | | | |

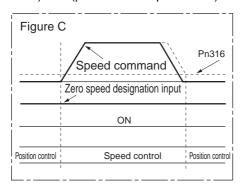


- When the zero speed designation input is turned ON, the speed command is forcibly set to 0.
- Set the acceleration/deceleration setting of the speed command using Soft Start Acceleration Time (Pn312), Soft Start Deceleration Time (Pn313) or S-curve Acceleration/Deceleration Time Setting (Pn314).



- When the zero speed designation input is ON, the speed command is forcibly set to 0, and if the actual speed is equal to or less than the Position Lock Level Setting (Pn316), operation switches to position control and the servo lock is applied. When the zero speed designation input is OFF, operation switches to speed control. Once the servo lock is applied in position control, this state continues as long as the zero speed designation input is ON, even if the actual speed becomes greater than the Position Lock Level Setting (Pn316) by external forces.
- Since the position command for position control is forced to be 0, properly set the position loop gain, various error detection functions and other settings.
- Use this parameter when the Control Mode Selection (Pn001) is set to 1 (speed control).

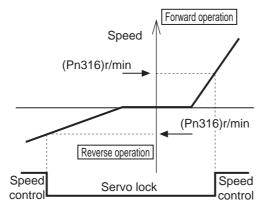
This may not operate correctly if the Control Mode Setting (Pn001) is set to 3 (position or speed control) or 4 (position or torque control).



- The zero speed designation input is turned ON, and when the speed command is equal to or less than the Position Lock Level Setting (Pn316) minus 10 r/min, operation switches to position control and the servo lock is applied. When the speed command is equal to or more than the Position Lock Level Setting (Pn316) plus 10 r/min, operation switches to speed control and the motor speed follows the command speed.
- When the zero speed designation input is turned ON, the speed command will never be 0. You need to change the speed command.
- Since the operation is executed as a normal position control during position control, properly set the position loop gain, various alarm detection functions and other settings.
- Use this parameter when the Control Mode Selection (Pn001) is set to 1 (speed control). This may not operate correctly if the Control Mode Setting (Pn001) is set to 3 (position or speed control) or 4 (position or torque control).

| Pn316 | Position Lock Level Setting | Speed Torque | | | | | |
|---------------|-----------------------------|--------------|-------|-----------------|----|------------------|---|
| Setting range | 10 to 20,000 | Unit | r/min | Default setting | 30 | Power OFF and ON | _ |

- Servo locks with position control when the speed of the motor is lower than the setting of this parameter.
- •The setting of this parameter is valid for both forward and reverse direction regardless of the motor rotation direction.



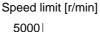
| Pn317 | Torque Command/Speed Limit Selection | | | | | Tore | que |
|---------------|--------------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 2 | Unit | - | Default setting | 0 | Power OFF and ON | _ |

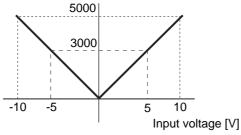
| Set value | Torque command | Speed limit |
|--------------|------------------------|-----------------------|
| 0 | Analog input 1 (TREF1) | Pn321 |
| 1 | Analog input 2 (TREF2) | Analog input 1 (VLIM) |
| 2 | Analog input 1 (TREF1) | Pn321, Pn322 |

- It depends on the control mode.
- When the control mode is set to speed control/torque control, the torque command input is set to analog input 2.
- •If analog input 1 is used for the speed limit, the speed control scale is set in Pn302. The applied voltage is converted to a speed limit as shown below when the analog speed limit is in effect.

Speed limit [r/min] = |Pn302 × Input voltage [V]|

An example is shown below for Pn302 = 500 [r/min/V]



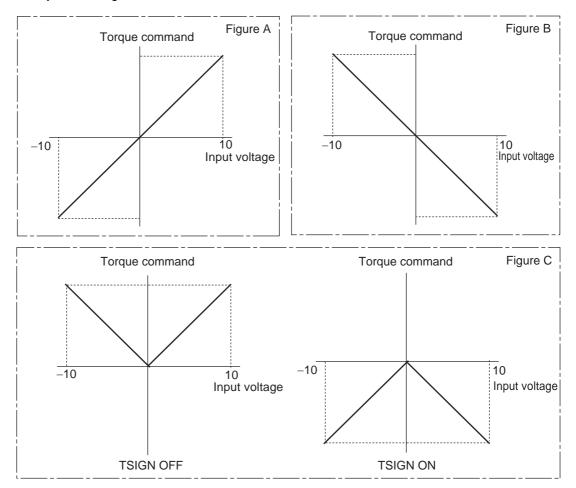


| Pn318 | Torque Command Direction Selection | | | | | | que |
|---------------|------------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

| Set value | Description | | | | | | |
|--------------|---|--|--|--|--|--|--|
| 0 | The direction is specified by the sign of the torque command | | | | | | |
| 1 | The direction is specified by the torque command sign input (TSIGN) | | | | | | |

| Torque Command / Speed Limit Selection (Pn317) | Torque Command Direction Selection (Pn318) | Analog Torque Command Rotation Direction Switching (Pn320) | Analog torque command (TREF) | Torque command sign selection (TSIGN) | Torque command direction* ¹ | Conversion graph |
|---|--|--|------------------------------|---|--|---------------------|
| | 0 0 1 1 Not aff | 0 | +Voltage (0 to 10 V) | | Forward direction | Figure A |
| | | | -Voltage (-10 to 0 V) | Not affected | Reverse direction | |
| 0 | | 1 | +Voltage (0 to 10 V) | | Reverse direction | Figure B |
| U | | | -Voltage (-10 to 0 V) | | Forward direction | Figure B |
| | | Not affected | Not affected | OFF | Forward direction | Figure C |
| | | THO GITCOLOG | Not affected Thot affected | | Reverse direction | i iguio O |

^{*1.} The motor rotation direction (CW, CCW) specified by the command direction is determined by the setting of Pn000.



| Pn319 | Torque Command Scale | | | | | Tord | que |
|---------------|----------------------|------|------------|-----------------|----|------------------|-----|
| Setting range | 10 to 100 | Unit | 0.1 V/100% | Default setting | 30 | Power OFF and ON | - |

[•] Set the relation between the voltage applied to the torque reference input (TREF1: CN1 pin 14, TREF2: CN2 pin 16) and the motor speed.

[•]Refer to "5-3 Torque Control" (P.5-14) for more information on torque command scale.

| Pn320 | Analog Torque Command Rotation Direction Switching | | | | | Tord | que |
|---------------|--|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 1 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

| Set value | Description |
|--------------|---|
| 0 | Direction of motor torque: The +command indicates the forward direction as viewed from the shaft end. |
| 1 | Direction of motor torque: The +command indicates the reverse direction as viewed from the shaft end. |

• Reverse the polarity of the torque command input (REF/TREF1: CN1 pin 14 or PCL/TREF2: CN1 pin 16).

| Pn321 | Speed Limit Value Setting | | | | | Tord | que |
|---------------|---------------------------|-----------|-----------|-----------------|---|------------------|-----|
| Setting range | 0 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | _ |
| | | | | | | | |
| Pn322 | Reverse Direction Speed L | imit Valu | e Setting | | | Tore | que |
| Setting range | 0 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | _ |

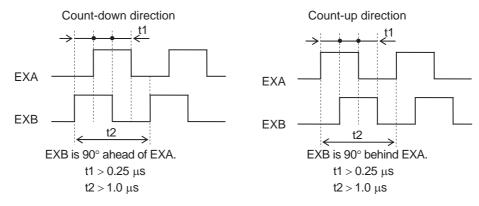
• Corresponding speed limit values during torque control is shown in the table below.

| Torque Command/ Speed Limit Selection (Pn317) | Speed Limit Value Setting (Pn321) | Reverse Direction Speed Limit Value Setting (Pn322) | Zero Speed Designation Selection (Pn315) | Zero speed clamp | Analog torque command direction | Speed limit value | |
|---|---|---|---|------------------|---------------------------------|----------------------|--|
| | | | 0 | Not affected | | Pn321 set value | |
| 0 | 0 to 20,000 | Not affected | 1 to 3 | OFF | Not affected | Pn321 set value | |
| | | | | ON | | 0 | |
| | 0 to 20.000 | 0 to 20.000 | 0 | Not affected | Forward direction | Pn321 set value | |
| | 0 10 20,000 | 0 10 20,000 | O | Not affected | Reverse direction | Pn322 set value | |
| 2 | 0 to 20,000 | 1 to 20.000 | 1 to 3 | OFF | Forward direction | Pn321 set value | |
| | 0 10 20,000 | 1 10 20,000 | 1 10 3 | Oll | Reverse direction | Pn322 set value | |
| | 0 to 20,000 | 1 to 20,000 | 1 to 3 | ON | Not affected | 0 | |

| Pn323 | External Feedback Pulse Type Selection | | | | | Fully-clos | sed |
|---------------|--|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 2 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|-----------|--|
| 0 | 90° phase difference output type *1 |
| 1 | Incremental encoder with serial communications |
| 2 | Reserved (Do not use this setting.) |

*1. These are the directions in which the Servo Drive counts the pulses from a 90° phase difference output type external encoder.



- For the external encoder connection direction, set the direction so that count-up occurs when the motor shaft is rotating counterclockwise, and count-down occurs when the motor shaft is rotating clockwise. If the connection direction cannot be selected due to installation conditions, etc., the count direction can be reversed using External Feedback Pulse Direction Switching (Pn326).
- •Take note that if Pn000 = 1, the encoder count direction becomes opposite to the count direction used for monitoring the total external encoder feedback pulses, etc.
 - If Pn000 = 0, the count direction matches the count direction for monitoring.
- •Even when the speed command is within the Drive's speed command range, an acceleration error will occur if the speed command exceeds the maximum speed of motor shaft rotation.

| Pn324 | External Feedback Pulse Dividing Numerator | | | | | Fully-clos | sed |
|---------------|--|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 2 ²⁰ | Unit | _ | Default setting | 0 | Power OFF and ON | Yes |

| Pn325 | External Feedback Pulse Dividing Denominator | | | | | Fully-clos | sed |
|---------------|--|------|---|-----------------|-------|------------------|-----|
| Setting range | 1 to 2 ²⁰ | Unit | _ | Default setting | 10000 | Power OFF and ON | Yes |

• Check the number of encoder pulses per motor rotation and number of external encoder pulses per motor rotation, and set External Feedback Pulse Dividing Numerator (Pn324) and External Feedback Pulse Dividing Denominator (Pn325).

Pn324 Encoder resolution per motor rotation [pulses]

Pn325 External encoder resolution per motor rotation [pulses]

- •If this ratio is incorrect, the deviation between the position calculated from encoder pulses and position calculated from external encoder pulses will increase. Particularly when the moving distance is long, an excessive deviation error will occur.
- •Set Pn324 to 0 to have encoder resolution automatically set as numerator.

| Pn326 | External Feedback Pulse Direction Switching | | | | | Fully-clo | sed |
|---------------|---|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | _ | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|--------------|--|
| 0 | External encoder feedback pulse count direction not reversed |
| 1 | External encoder feedback pulse count direction reversed |

| Pn327 | External Feedback Pulse Phase-Z Setting | | | | | Fully-clos | sed |
|---------------|---|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

[•]Set to enable or disable phase-Z disconnection detection when a 90° phase difference output type external encoder is used.

Explanation of Set Values

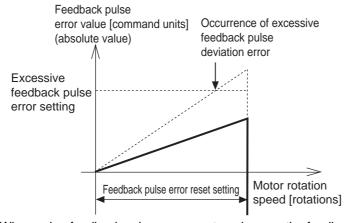
| Set value | Description |
|--------------|--|
| 0 | Phase-Z disconnection detection enabled |
| 1 | Phase-Z disconnection detection disabled |

| Pn328 | Internal/External Feedback | nternal/External Feedback Pulse Error Counter Overflow Level | | | | | sed |
|---------------|----------------------------|--|--------------|-----------------|-------|------------------|-----|
| Setting range | 1 to 2 ²⁷ | Unit | Command unit | Default setting | 16000 | Power OFF and ON | Yes |

• Set the allowable difference (feedback pulse error) between the motor (encoder) position and load (external encoder) position in command units.

| Pn329 | Internal/External Feedback Pulse Error Counter Reset | | | | | Fully-clos | sed |
|---------------|--|------|----------|-----------------|---|------------------|-----|
| Setting range | 0 to 100 | Unit | Rotation | Default setting | 0 | Power OFF and ON | Yes |

•The feedback pulse error is reset every time the motor rotates for the amount set by the Internal/ External Feedback Pulse Error Counter Reset (Pn329). This can be used for applications where feedback pulse error accumulates due to slippage.



• When using feedback pulse error reset, make sure the feedback pulse error reset setting is set to a proper value. When the set value is extremely small, the protective function may not work to prevent any erroneous operation due to improper connection of the external encoder. Take sufficient care to ensure safety.

8-5 Interface Monitor Setting Parameters

| Pn400 | Input Signal Selection 1 | | | | | A | JI I |
|---------------|---------------------------|--------|---|-----------------|---------|----------------------|----------|
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 8553090 | Power OFF and ON | Yes |
| | | | | | | | 1 |
| Pn401 | Input Signal Selection 2 | | | | | Α | All . |
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 8487297 | Power OFF and ON | Ye |
| | | | 1 | | | | |
| Pn402 | Input Signal Selection 3 | | | | | А | II . |
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 9539850 | Power OFF and ON | Yes |
| Pn403 | loo | | | | | | |
| | Input Signal Selection 4 | 1 1 14 | | Default action | 204750 | Power OFF and ON | |
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 394758 | Power OFF and ON | Yes |
| Pn404 | Input Signal Selection 5 | | | | | ГА | JI |
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 4108 | Power OFF and ON | Ye |
| | | | | | | | |
| Pn405 | Input Signal Selection 6 | | | | | А | Ш |
| Setting range | 0 to 00FFFFFFh | Unit | - | Default setting | 197379 | Power OFF and ON | Ye |
| | | | | | | | |
| Pn406 | Input Signal Selection 7 | | | | | A | Ш |
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 3847 | Power OFF and ON | Ye |
| Pn407 | Input Signal Selection 8 | | | | | А | JI |
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 263172 | Power OFF and ON | Ye |
| | | | | | | | |
| Pn408 | Input Signal Selection 9 | | | | | Α | .II |
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 328965 | Power OFF and ON | Ye |
| | | | | | | | |
| Pn409 | Input Signal Selection 10 | | | | | A | _ |
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 3720 | Power OFF and ON | Ye |
| Pn410 | Output Signal Selection 1 | | | | | A | |
| Setting range | 0 to 00FFFFFh | Unit | _ | Default setting | 197379 | Power OFF and ON | Ye |
| Octarig range | 0 10 0011111111 | Offic | | Delault setting | 107075 | 1 OWCI OI 1 dild OIV | 10 |
| Pn411 | Output Signal Selection 2 | | | | | А | |
| Setting range | 0 to 00FFFFFh | Unit | _ | Default setting | 131586 | Power OFF and ON | Ye |
| | | | | | I | | |
| Pn412 | Not used | | | | | А | .II |
| Setting range | _ | Unit | _ | Default setting | - | Power OFF and ON | _ |
| | <u>I</u> | I | 1 | _I | I | I | <u> </u> |
| Pn413 | Output Signal Selection 4 | | | | | А | .II |
| Setting range | 0 to 00FFFFFFh | Unit | _ | Default setting | 328964 | Power OFF and ON | Yes |

[•]Refer to "6-9 Sequence I/O Signal" (P.6-35) for more information on settings.

| Pn416 | Analog Monitor 1 Selection | | | | | All | |
|---------------|----------------------------|------|---|-----------------|---|------------------|---|
| Setting range | 0 to 21 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

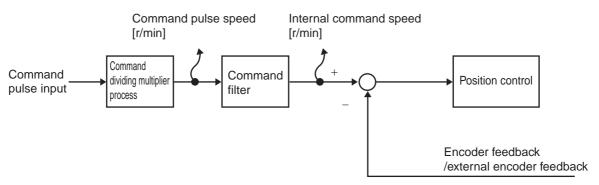
| Set | | Explanation | |
|-------|-------------------------------------|--------------------------------|----------------------------|
| value | Monitor type | Unit | Output gain when Pn417 = 0 |
| 0 | Motor speed | r/min | 500 |
| 1 | Position command speed * 3 | r/min | 500 |
| 2 | Internal position command speed * 3 | r/min | 500 |
| 3 | Speed control command | r/min | 500 |
| 4 | Torque command | % (rated torque ratio) | 33 |
| 5 | Position command error * 4 | pulse (command units) | 3,000 |
| 6 | Encoder position error * 4 | pulse (encoder units) | 3,000 |
| 7 | Fully-closed error * 4 | pulse (external encoder units) | 3,000 |
| 8 | Hybrid Error | pulse (command units) | 3,000 |
| 9 | P-N voltage | V | 80 |
| 10 | Regeneration load ratio | % | 33 |
| 11 | Overload load ratio | % | 33 |
| 12 | Forward direction torque limit | % (rated torque ratio) | 33 |
| 13 | Reverse direction torque limit | % (rated torque ratio) | 33 |
| 14 | Speed limit value | r/min | 500 |
| 15 | Inertia ratio | % | 500 |
| 16 | Analog input 1 * ² | V | 1 |
| 17 | Analog input 2 * ² | V | 1 |
| 18 | Analog input 3 * 2 | V | 1 |
| 19 | Encoder temperature | °C | 10 |
| 20 | Drive temperature | °C | 10 |
| 21 | Encoder 1-rotation data * 1 | pulse (encoder units) | 110,000 |

^{*1.} Forward and reverse directions of monitor data are the direction set in Pn000. However, CCW will be the forward direction for the absolute encoder 1-rotation data. A normal value is output from the incremental encoder after the first phase Z is input.

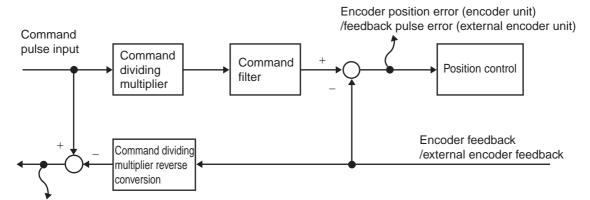
^{*2.} Analog inputs 1 to 3 will output terminal voltage even when terminal is not used.

^{*3.} Corresponding to command pulse input, command pulse speed is before command filter (position command filter time constant and smoothing filter time constant), and internal command speed is after command filter.

^{*4.} The position command error is an error from the command pulse input, while the encoder position error or fully-closed position error is the error at the input of the position loop.



*4. Position error and feedback pulse error come in 2 types, encoder unit/external encoder unit and command unit. Encoder unit/external encoder unit will be an error of position control input section and command unit will be an error of command pulse input.



Position command error (command unit) /command feedback pulse error (command unit)

| Pn417 | Analog Monitor 1 Scale Setting | | | | | | |
|---------------|--------------------------------|------|---|-----------------|---|------------------|---|
| Setting range | 0 to 214,748,364 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

• Set output gain for analog monitor 1.

| Pn418 | Analog Monitor 2 Selection | | | | | А | II |
|---------------|----------------------------|------|---|-----------------|---|------------------|----|
| Setting range | 0 to 21 | Unit | - | Default setting | 4 | Power OFF and ON | _ |

- Select the type of analog monitor 2.
- •The set value for this parameter is same as Analog Monitor 1 Type (Pn416).

| Pn419 | Analog Monitor 2 Scale Setting | | | | | А | II |
|---------------|--------------------------------|------|---|-----------------|---|------------------|----|
| Setting range | 0 to 214,748,364 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

• Set the output gain for analog monitor 2.

| Pn421 | Analog Monitor Output Sele | ection | | | | А | I |
|---------------|----------------------------|--------|---|-----------------|---|------------------|---|
| Setting range | 0 to 2 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

Select the analog monitor output voltage direction.

| Set value | Output range | Data output |
|--------------|--------------|---|
| 0 | –10 to 10 V | Output voltage [V] 10 V Motor speed -5,000 |
| 1 | 0 to 10 V | Output voltage [V] 10 V Motor speed -5,000 0 V 5,000 [r/min] |
| 2 | 0 to 10 V | Output voltage [V] 10 V 5 V Motor speed 0 V 0 2,500 [r/min] -2,500 |

• When monitor type is motor speed and gain of conversion is 500 (1 V = 500 r/min)

| Pn422 | Analog Input 1 Offset | | | | | А | ll l |
|---------------|-----------------------|------|----------|-----------------|---|------------------|------|
| Setting range | -5,578 to 5,578 | Unit | 0.359 mV | Default setting | 0 | Power OFF and ON | _ |

- Adjust the offset of the speed command input (REF: CN1 pin 14).
- •The offset amount is approx. the set value times 0.359 mV.
- •There are 2 ways to adjust the offset.
 - · Manual adjustment
 - · Automatic adjustment
- The manual adjustment is as follows:
 - To adjust the offset for individual drives, accurately input 0 V to the speed command input/torque command input (REF/TREF1) (or connect to the signal ground), and then set this parameter so that the motor does not rotate.
 - If you use a position loop in the host device, set this parameter so that there are no accumulated pulses at servo lock stop status.
- The automatic adjustment is as follows:

This parameter will be automatically set when automatic offset adjustment is executed. Refer to "Analog Input Automatic Offset Adjustment" (P.9-26) for the automatic offset adjustment method.

8-5 Interface Monitor Setting Parameters

| Pn423 | Analog Input 1 Filter Time (| А | dl | | | | |
|---------------|------------------------------|------|---------|-----------------|---|------------------|---|
| Setting range | 0 to 6,400 | Unit | 0.01 ms | Default setting | 0 | Power OFF and ON | _ |

• Set the first-order lag filter time constant in the speed command input (REF: CN1 pin 14).

| Pn424 | Excessive Analog Input 1 | | | | | | |
|---------------|--------------------------|------|-------|-----------------|---|------------------|---|
| Setting range | 0 to 100 | Unit | 0.1 V | Default setting | 0 | Power OFF and ON | _ |

- Set the overflow level for speed command input (REF: CN1 pin 14) or torque command input (TREF1: CN1 pin 14) using voltage after offset compensation.
- •Excessive analog input (Alarm No. 39) will be disabled if this parameter is set to 0.

| Pn425 | Analog Input 2 Offset | | | | | А | |
|---------------|-----------------------|------|---------|-----------------|---|------------------|---|
| Setting range | -342 to 342 | Unit | 5.86 mV | Default setting | 0 | Power OFF and ON | - |

- Adjust the offset of the speed command input (REF: CN1 pin 16).
- •The offset amount is approx. the set value times 5.86 mV.
- •There are 2 ways to adjust the offset.
 - · Manual adjustment
 - · Automatic adjustment
- The manual adjustment is as follows:
 - To adjust the offset for individual drives, accurately input 0 V to the speed command input/ torque command input (REF/TREF1) (or connect to the signal ground), and then set this parameter so that the motor does not rotate.
 - If you use a position loop in the host device, set this parameter so that there are no accumulated pulses at servo lock stop status.
- The automatic adjustment is as follows:

This parameter will be automatically set when automatic offset adjustment is executed. Refer to "Analog Input Automatic Offset Adjustment" (P.9-26) for the automatic offset adjustment method.

| Pn426 | Analog Input 2 Filter Time (| Analog Input 2 Filter Time Constant | | | | | | |
|---------------|------------------------------|-------------------------------------|---------|-----------------|---|------------------|---|--|
| Setting range | 0 to 6,400 | Unit | 0.01 ms | Default setting | 0 | Power OFF and ON | _ | |

• Set the first-order lag filter time constant in the speed command input (REF: CN1 pin 16).

| Pn427 | Excessive Analog Input 2 | | | | | | | |
|---------------|--------------------------|------|-------|-----------------|---|------------------|---|--|
| Setting range | 0 to 100 | Unit | 0.1 V | Default setting | 0 | Power OFF and ON | _ | |

- Set the overflow level for speed command input (REF: CN1 pin 16) or torque command input (TREF1: CN1 pin 14) using voltage after offset compensation.
- •Excessive analog input (Alarm No. 39) will be disabled if this parameter is set to 0.

| Pn428 | Analog Input 3 Offset | | | | | А | II |
|---------------|-----------------------|------|---------|-----------------|---|------------------|----|
| Setting range | -342 to 342 | Unit | 5.86 mV | Default setting | 0 | Power OFF and ON | _ |

- Adjust the offset of the speed command input (REF: CN1 pin 18).
- •The offset amount is approx. the set value times 5 mV.
- •There are 2 ways to adjust the offset.
 - · Manual adjustment
 - · Automatic adjustment
- The manual adjustment is as follows:
 - To adjust the offset for individual drives, accurately input 0 V to the speed command input/ torque command input (REF/TREF1) (or connect to the signal ground), and then set this parameter so that the motor does not rotate.
 - If you use a position loop in the host device, set this parameter so that there are no accumulated pulses at servo lock stop status.
- The automatic adjustment is as follows:

This parameter will be automatically set when automatic offset adjustment is executed. Refer to "Analog Input Automatic Offset Adjustment" (P.9-26) for the automatic offset adjustment method.

| Pn429 | Analog Input 3 Filter Time Constant | | | | | | | |
|---------------|-------------------------------------|------|---------|-----------------|---|------------------|---|--|
| Setting range | 0 to 6,400 | Unit | 0.01 ms | Default setting | 0 | Power OFF and ON | _ | |

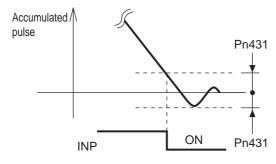
• Set the first-order lag filter time constant in the speed command input (REF: CN1 pin 18).

| Pn430 | Excessive Analog Input 3 | | | | | А | II |
|---------------|--------------------------|------|-------|-----------------|---|------------------|----|
| Setting range | 0 to 100 | Unit | 0.1 V | Default setting | 0 | Power OFF and ON | _ |

- Set the overflow level for speed command input (REF: CN1 pin 18) or torque command input (TREF1: CN1 pin 14) using voltage after offset compensation.
- •Excessive analog input (Alarm No. 39) will be disabled if this parameter is set to 0.

| Pn431 | Positioning Completion Ran | | Position Fully-closed | | | | |
|---------------|----------------------------|------|-----------------------|-----------------|----|------------------|---|
| Setting range | 0 to 262,144 | Unit | Command unit | Default setting | 10 | Power OFF and ON | _ |

- Use this parameter in combination with the Positioning Completion Condition Selection (Pn432) to set the timing to output the positioning completion output (INP1). The positioning completion output (INP) will output when the Servomotor (workpiece) movement stops and the number of the accumulated pulses in the error counter is within the set value of this parameter, after command pulse input is completed.
- •Unit for setting is command unit, but it can be changed to encoder unit with Position Setting Unit Selection (Pn520). However, note that the unit for error counter overflow level will be changed as well
- •If this parameter is set to a very small value, the time required for the INP signal to be output will increase and the chattering may occur during output. The setting of the positioning completion range does not affect the precision of the final positioning.



| Pn432 | Positioning Completion Cor | Positioning Completion Condition Selection | | | | | | |
|---------------|----------------------------|--|---|-----------------|---|------------------|---|--|
| Setting range | 0 to 3 | Unit | _ | Default setting | 0 | Power OFF and ON | _ | |

| Set value | Description |
|--------------|--|
| 0 | Positioning completion output (INP1) turns ON when the position error is within the Positioning Completion Range 1 (Pn431). |
| 1 | Positioning completion output turns ON when the position error is within the Positioning Completion Range 1 (Pn431) and there is no position command. |
| 2 | Positioning completion output (INP1) turns ON when the zero speed detection output (ZSP) is ON, the position error is within the Positioning Completion Range 1 (Pn431), and there is no position command. |
| 3 | Positioning completion output turns ON when the position error is within the Positioning Completion Range 1 (Pn431) and there is no position command. The ON status is then held until the Positioning Completion Hold Time (Pn433) elapses. After that, if turns ON or OFF based on the position error at the time. |

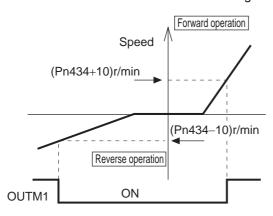
• Use this in combination with the Positioning Completion Range 1 (Pn431) to set the operation for positioning completion output (INP: CN1 pin 39).

| Pn433 | Positioning Completion Hol | Positioning Completion Hold Time | | | | | | |
|---------------|----------------------------|----------------------------------|------|-----------------|---|------------------|---|--|
| Setting range | 0 to 30,000 | Unit | 1 ms | Default setting | 0 | Power OFF and ON | _ | |

• When Positioning Completion Hold Time (Pn433) is set to 0, hold time becomes infinite and ON status is held until the next position command comes in.

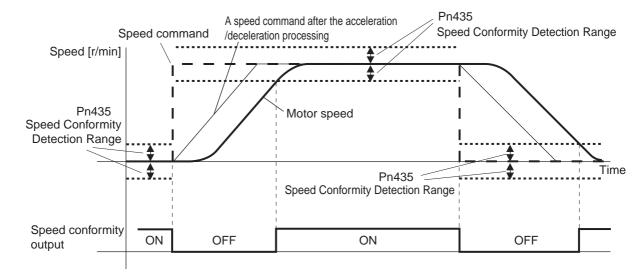
| Pn434 | Zero Speed Detection | | | | | А | .II |
|---------------|----------------------|------|-------|-----------------|----|------------------|-----|
| Setting range | 10 to 20,000 | Unit | r/min | Default setting | 50 | Power OFF and ON | |

- General-purpose output timing is set by rotation speed r/min.
- •General-purpose output 1 (ZSP) will be turned ON when the speed of the motor is lower than the setting of this parameter.
- •The set value in this parameter is valid in both forward and reverse directions, regardless of the actual motor rotation direction. The setting has a hysteresis of 10 r/min.



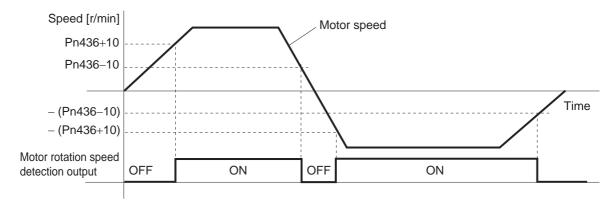
| Pn435 | Speed Conformity Detection | Speed Conformity Detection Range | | | | | | |
|---------------|----------------------------|----------------------------------|-------|-----------------|----|------------------|---|--|
| Setting range | 10 to 20,000 | Unit | r/min | Default setting | 50 | Power OFF and ON | _ | |

- When speed command and motor speed are identical, speed conformity output signal is output.
- •This setting has a hysteresis of 10 r/min for detection.



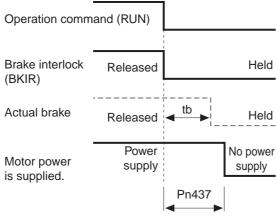
| Pn436 | Rotation Speed for Motor Rotation Detection | | | | | | |
|---------------|---|------|-------|-----------------|------|------------------|---|
| Setting range | 10 to 20,000 | Unit | r/min | Default setting | 1000 | Power OFF and ON | - |

- Motor rotation speed detection output signal is output when the motor speed reaches the speed set as the achieved speed.
- •This setting has a hysteresis of 10 r/min for detection.



| Pn437 | Brake Timing when Stoppe | А | II | | | | |
|---------------|--------------------------|------|------|-----------------|---|------------------|---|
| Setting range | 0 to 10,000 | Unit | 1 ms | Default setting | 0 | Power OFF and ON | - |

- Set the time required for the Servomotor to be de-energized (servo free) after the brake interlock output (BKIR: CN1 pin 10) turns OFF (i.e., brake held), when servo OFF status is entered while the Servomotor is stopped.
- •When the Servomotor is stopped and the operation command (RUN) is turned OFF, the brake interlock signal (BKIR) will turn OFF, and the Servomotor will be de-energized after waiting for the setting time (set value × ms).



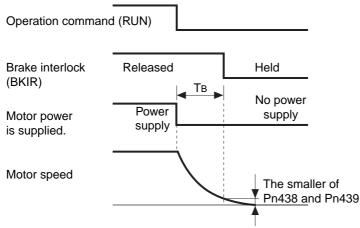
•Make the setting as follows to prevent the machine (workpiece) from moving or falling due to the delay time in the brake operation (tb).

Brake timing when stopped (set value \times 1 ms) \geq tb

•For details, refer to "6-6 Brake Interlock" (P.6-19).

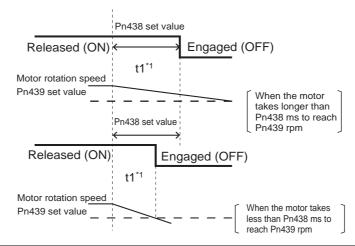
| Pn438 | Brake Timing During Operation | | | | | | |
|---------------|-------------------------------|------|------|-----------------|---|------------------|---|
| Setting range | 0 to 10,000 | Unit | 1 ms | Default setting | 0 | Power OFF and ON | - |

• Set the required time for the brake interlock output (BKIR: CN1 pin 10) to turn OFF after the operation command (RUN: CN1 pin 29) is detected to be OFF when servo OFF status is entered while the Servomotor is operating. When the operation command (RUN) is turned OFF while the motor is operating, the motor will decelerate to reduce speed, and the brake interlock signal (BKIR) will turn ON after the setting time (set value × 1 ms) has elapsed.



- •"TB" in the above figure is the Brake Timing During Operation (Pn438) (set value × 1 ms) or the time until the motor rotation speed falls to the speed set for the Brake Release Speed Setting (Pn439) or lower, whichever is shorter.
- •For details, refer to "6-6 Brake Interlock" (P.6-19).

| Pn439 | Brake Release Speed Setti | А | II | | | | |
|---------------|---------------------------|------|-------|-----------------|----|------------------|---|
| Setting range | 30 to 3,000 | Unit | r/min | Default setting | 30 | Power OFF and ON | - |



| Pn440 | Warning Output Selection 1 | А | | | | | |
|---------------|----------------------------|------|---|-----------------|---|------------------|---|
| Setting range | 0 to 10 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

| Set value | Description |
|--------------|---|
| 0 | An OR output of all alarm status |
| 1 | Overload warning |
| 2 | Excessive regeneration warning |
| 3 | Battery warning |
| 4 | Fan warning |
| 5 | Encoder communications warning |
| 6 | Encoder overheating warning |
| 7 | Vibration detection warning |
| 8 | Service life detection warning |
| 9 | External encoder error warning |
| 10 | External encoder communications error warning |

• Refer to "11-2 Warning List" (P.11-4) for more information on settings.

| Pn441 | Warning Output Selection 2 | | | | | | |
|---------------|----------------------------|------|---|-----------------|---|------------------|---|
| Setting range | 0 to 7 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

• The set values for this parameter are same as Warning Output Selection 1 (Pn440).

| Pn442 | Positioning Completion Rar | | Position Fully-closed | | | | |
|---------------|----------------------------|------|-----------------------|-----------------|----|------------------|---|
| Setting range | 0 to 262,144 | Unit | Command unit | Default setting | 10 | Power OFF and ON | _ |

- Set the positioning completion range.
- •The set values for this parameter are same as Positioning Completion Range 1 (Pn431).

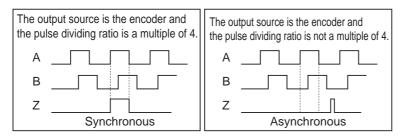
8-6 Extended Parameters

| Pn500 | Electronic Gear Ratio Num | erator 2 | | | | Pos | ition |
|---------------|---------------------------|----------|---|--------------------|---|------------------|-------|
| Setting range | 0 to 2 ³⁰ | Unit | - | Default setting | 0 | Power OFF and ON | _ |
| | | • | • | • | • | • | • |
| Pn501 | Electronic Gear Ratio Num | erator 3 | | | | Pos | ition |
| Setting range | 0 to 2 ³⁰ | Unit | - | Default setting | 0 | Power OFF and ON | _ |
| | | | | | | | |
| Pn502 | Electronic Gear Ratio Num | erator 4 | | | | Pos | ition |
| Setting range | 0 to 2 ³⁰ | Unit | _ | Default setting | 0 | Power OFF and ON | _ |
| | | | | | | | |
| Pn503 | Encoder Dividing Denomina | ator | | | | А | II |
| Setting range | 0 to 262,144 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

• If encoder dividing denominator $\neq 0$, division is performed at the rate according to the formula below.

Encoder FB pulse
$$\rightarrow \frac{Pn011}{Pn503} \rightarrow Output pulse$$

- •Therefore, the formula will be as follows when the host side counts pulses through processing with quadruple multiplier.
- Number of pulse output resolution per rotation = $\frac{Pn011}{Pn053}$ × Encoder resolution
- •The pulse output resolution per rotation will never exceed the encoder resolution. (If the above settings are used, the pulse output resolution per rotation will be equal to the encoder resolution.)
- •1 phase-Z signal is output for each rotation of the motor.
- •If the pulse output resolution per rotation from the above equation is a multiple of 4, phases Z and A are output in synchronization. In all other cases, the output width of phase Z will be output as the encoder resolution, resulting to be narrower than phase A. Accordingly, phases A and Z will not be synchronized.



| Pn504 | Drive Prohibition Input Sele | Drive Prohibition Input Selection | | | | | | |
|---------------|------------------------------|-----------------------------------|---|-----------------|---|------------------|-----|--|
| Setting range | 0 to 2 | Unit | - | Default setting | 1 | Power OFF and ON | Yes | |

| Set value | Description |
|-----------|---|
| 0 | Forward drive prohibition input and reverse drive prohibition input enabled. |
| 1 | Forward drive prohibition input and reverse drive prohibition input disabled. |
| 2 | Forward drive prohibition input and reverse drive prohibition input enabled. |

- •Install limit switches at both ends of the axis to prohibit the motor from traveling in the direction where one of the switches operates. This can be used to prevent the workpiece from traveling too far and thus prevent damage to the machine.
- *Operation will be as follows if 0 is set.
 - Forward drive prohibition input (POT: CN1 pin 9) and COM connected: Normal status when the forward limit switch does not operate
 - Forward drive prohibition input (POT: CN1 pin 9) and COM open: Forward direction prohibited and reverse direction permitted
 - Reverse drive prohibition input (NOT: CN1 pin 8) and COM connected: Normal status when the reverse limit switch does not operate
 - Reverse drive prohibition input (NOT: CN1 pin 8) and COM open: Reverse direction prohibited and forward direction permitted.
- If this parameter is set to 0, the Servomotor will decelerate and stop according to the sequence set in the Stop Selection for Drive Prohibition Input (Pn505) For details, refer to explanation for Stop Selection for Drive Prohibition Input (Pn505).
- If this parameter is set to 0 and the forward and reverse prohibition inputs are both open, a drive prohibition input error (Alarm No.38) occurs because it is taken that Servo Drive is in error condition.
- If this parameter is set to 2, a drive prohibition input error (Alarm No. 38) will occur when the connection between either the forward or reverse prohibition input and COM is open.
- If a limit switch above the workpiece is turned OFF when using a vertical axis, the upward torque will be eliminated, and there may be repeated vertical movement of the workpiece. If this occurs, set the Stop Selection for Drive Prohibition Input (Pn505) to 2 or perform limit processing using the Host Controller rather than using this function.

| Pn505 | Stop Selection for Drive Prohibition Input | | | | | А | |
|---------------|--|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 2 | Unit | _ | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|-----------|--|
| 0 | During deceleration: Dynamic brake operation After stop: Torque command is 0 for drive prohibition direction Error counter: Held |
| 1 | During deceleration: Torque command is 0 for drive prohibition direction After stop: Torque command is 0 for drive prohibition direction Error counter: Held |
| 2 | During deceleration: Immediate stop After stop: Torque command is 0 for drive prohibition direction Error counter: Clear before and after deceleration |

- Set the drive conditions during deceleration or after stopping after the drive prohibition input (POT: CN1 pin 9 or NOT: CN1 pin 8) is enabled.
- If this is set to 2, the Immediate Stop Torque (Pn511) will be used to torque limit during deceleration.

•The dynamic brake is designed only for emergency stopping. Design the system to stop within about ten minutes after the dynamic brake operates.

| Pn506 | Stop Selection with Servo OFF | | | | | А | . |
|---------------|-------------------------------|------|---|-----------------|---|------------------|---|
| Setting range | 0 to 9 | Unit | _ | Default setting | 0 | Power OFF and ON | - |

| Set | Explanation | | | | | |
|-------|-------------------------|-------------------------|---------------------|--|--|--|
| value | During deceleration * 3 | After stopping | Error counter | | | |
| 0 | Dynamic brake operation | Dynamic brake operation | Clear * 4 | | | |
| 1 | Free-run | Dynamic brake operation | Clear * 4 | | | |
| 2 | Dynamic brake operation | Servo free | Clear * 4 | | | |
| 3 | Free-run | Servo free | Clear * 4 | | | |
| 4 | Dynamic brake operation | Dynamic brake operation | Hold * ² | | | |
| 5 | Free-run | Dynamic brake operation | Hold * ² | | | |
| 6 | Dynamic brake operation | Servo free | Hold * ² | | | |
| 7 | Free-run | Servo free | Hold * ² | | | |
| 8 | Immediate stop * 1 | Dynamic brake operation | Clear * 4 | | | |
| 9 | Immediate stop * 1 | Servo free | Clear * 4 | | | |

- If an alarm occurs when servo is turned OFF, the operation will be based on the Stop Selection for Alarm Detection (Pn510). Additionally, if the main power supply is turned OFF when servo is OFF, it will be based on the Stop Selection with Main Power Supply OFF (Pn507).
- •The dynamic brake is designed only for emergency stopping. Design the system to stop within about ten minutes after the dynamic brake operates.
- *1. Emergency stop refers to an immediate stop operation applying control while servo is still ON and stopping the operation immediately.

 At that time, the torque command value is restricted by the Immediate Stop Torque (Pn511).
- *2. If the position command is given or the motor runs continuously when servo is turned OFF, the position error accumulates and Alarm 24.0, "error counter overflow," may occur. In addition, if servo is turned ON when the position error or external encoder error is a large value, the motor may operate abruptly to perform a control operation to bring the error to 0. Take sufficient care when using while holding the position error or external encoder error.
- *3. Decelerating is the time between when the motor is running and when the motor speed reaches 30 r/min or less. Once the motor reaches 30 r/min or less and moves to the after-stop status, subsequent operation is based on the after-stop status regardless of the motor speed.
- *4. The position error or external encoder error will always be cleared to 0.

| Pn507 | Stop Selection with Main Power Supply OFF | | | | | Al | |
|---------------|---|------|---|-----------------|---|------------------|---|
| Setting range | 0 to 9 | Unit | - | Default setting | 0 | Power OFF and ON | _ |

| Set | Explanation | | | | | |
|-------|------------------------------------|-------------------------|---------------------|--|--|--|
| value | During deceleration * ³ | After stopping | Error counter | | | |
| 0 | Dynamic brake operation | Dynamic brake operation | Clear * 4 | | | |
| 1 | Free-run | Dynamic brake operation | Clear * 4 | | | |
| 2 | Dynamic brake operation | Servo free | Clear * 4 | | | |
| 3 | Free-run | Servo free | Clear * 4 | | | |
| 4 | Dynamic brake operation | Dynamic brake operation | Hold * ² | | | |
| 5 | Free-run | Dynamic brake operation | Hold * ² | | | |
| 6 | Dynamic brake operation | Servo free | Hold * ² | | | |
| 7 | Free-run | Servo free | Hold * ² | | | |
| 8 | Immediate stop * 1 | Dynamic brake operation | Clear * 4 | | | |
| 9 | Immediate stop * 1 | Servo free | Clear * 4 | | | |

- If an alarm occurs when the main power supply is turned OFF, the operation will be based on the Stop Selection for Alarm Detection (Pn510). If the main power supply is turned OFF when Servo is ON, and if the Undervoltage Alarm Selection (Pn508) is set to 1, Alarm 13.1, "main power supply undervoltage (AC cut-off detection)," will occur. Follow the Stop Selection for Alarm Detection (Pn510).
- •The dynamic brake is designed only for emergency stopping. Design the system to stop within about ten minutes after the dynamic brake operates.
- *1. Emergency stop refers to an immediate stop operation applying control while servo is still ON and stopping the operation immediately.
 - At that time, the torque command value is restricted by the Immediate Stop Torque (Pn511).
- *2. If the position command is given or the motor runs continuously when the main power supply is turned OFF, the position error accumulates and Alarm 24.0, "error counter overflow," may occur. In addition, if servo is turned ON when the position error or external encoder error is a large value, the motor may operate abruptly to perform a control operation to bring the error to 0. Take sufficient care when using while holding the position error or external encoder error.
- *3. Decelerating is the time between when the motor is running and when the motor speed reaches 30 r/min or less. Once the motor reaches 30 r/min or less and moves to the after-stop status, subsequent operation is based on the after-stop status regardless of the motor speed.
- *4. The position error or external encoder error will always be cleared to 0.

| Pn508 | Undervoltage Alarm Selection | | | | | А | II |
|---------------|------------------------------|------|---|-----------------|---|------------------|----|
| Setting range | 0 or 1 | Unit | _ | Default setting | 1 | Power OFF and ON | - |

| Set value | Description |
|-----------|---|
| 0 | The servo is turned OFF based on the setting of the Stop Selection with Main Power Supply OFF (Pn507) and turn it back to servo ON state by turning ON the main power supply. |
| 1 | Alarm 13.1 "main power supply undervoltage" will occur and a trip will be caused. |

| Pn509 | Momentary Hold Time | | | | | А | II |
|---------------|---------------------|------|------|-----------------|----|------------------|-----|
| Setting range | 70 to 2,000 | Unit | 1 ms | Default setting | 70 | Power OFF and ON | Yes |

- Set main power supply alarm detection time.
- The main power supply OFF detection will be disabled if this is set to 2,000.

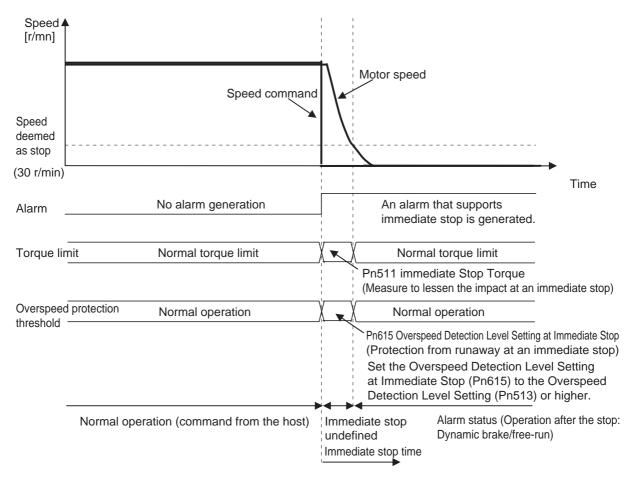
| Pn510 | Stop Selection for Alarm Detection | | | | | А | .II |
|---------------|------------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 7 | Unit | _ | Default setting | 0 | Power OFF and ON | - |

| Set | Explanation | | | | | | |
|-------|---|-------------------------|----------------------|--|--|--|--|
| value | During deceleration * 3 | After stopping | Error counter | | | | |
| 0 | Dynamic brake operation | Dynamic brake operation | Clear * 1 | | | | |
| 1 | Free-run | Dynamic brake operation | Clear * 1 | | | | |
| 2 | Dynamic brake operation | Servo free | Clear * 1 | | | | |
| 3 | Free-run | Servo free | Clear * 1 | | | | |
| 4 | Operation A: Immediate stop * ² Operation B: Dynamic brake operation | Dynamic brake operation | Clear * ¹ | | | | |
| 5 | Operation A: Immediate stop * ² Operation B: Free-run | Dynamic brake operation | Clear * ¹ | | | | |
| 6 | Operation A: Immediate stop * ² Operation B: Dynamic brake operation | Servo free | Clear * ¹ | | | | |
| 7 | Operation A: Immediate stop * ² Operation B: Free-run | Servo free | Clear * ¹ | | | | |

- Set the operation to be performed after stopping or during deceleration when any protective function of the drive operates and an alarm occurs.
- •The dynamic brake is designed only for emergency stopping. Design the system to stop within about ten minutes after the dynamic brake operates.
- *1. The error counter is cleared when an alarm is reset.
- *2. Operations A and B indicate whether immediate stop takes place upon alarm generation. If an immediate stop alarm is generated, immediate stop in operation A is executed.

 If an alarm that does not support immediate stop is generated, immediate stop in operation B will take place.
- *3. Decelerating is the time between when the motor is running and when the motor speed reaches 30 r/min or less. Once the motor reaches 30 r/min or less and moves to the after-stop status, subsequent operation is based on the after-stop status regardless of the motor speed.

Immediate Stop Operation when an Alarm that Supports Immediate Stop is Generated



- If the actual speed is not 30 r/min or less after the time set by the Alarm Detection Allowable Time Setting (Pn614) elapses, an immediate alarm status will occur. In addition, if an alarm that does not support immediate stop occurs inside the drive at immediate stop, an immediate alarm status will occur.
- Set the allowable overspeed level to Pn615, "Overspeed Detection Level Setting at Immediate Stop," as a protective measure against runaway at an immediate stop. Alarm 26.1, "overspeed 2," if it occurs, will cause an immediate alarm trip because it is an alarm that does not support immediate stop. However, if the setting is below Pn513, "Overspeed Detection Level Setting," an immediate stop will not take place because Alarm 26.1, "overspeed 2," will occur before Alarm 26.0, "overspeed."

In addition, if Alarm 26.0 and Alarm 26.1 are detected at the same time, Alarm 26.0 will be displayed. However, an immediate stop will not take place because Alarm 26.1 has also occurred internally.

| Pn511 | Immediate Stop Torque | | | | | А | II |
|---------------|-----------------------|------|---|-----------------|---|------------------|----|
| Setting range | 0 to 500 | Unit | % | Default setting | 0 | Power OFF and ON | - |

- Set the torque limit for the following cases.
 - · Drive prohibition deceleration with the Stop Selection for Drive Prohibition Input (Pn505) set to 2.
 - · Deceleration with the Stop Selection with Main Power Supply OFF (Pn507) set to 8 or 9.
 - · Deceleration with the Stop Selection with Servo OFF (Pn506) set to 8 or 9.
- The normal torque limit will be used if this parameter is set to 0.
- This object is set in units of 0.1% of the rated torque.

| Pn512 | Overload Detection Level Setting | | | | | А | II |
|---------------|----------------------------------|------|---|-----------------|---|------------------|----|
| Setting range | 0 to 500 | Unit | % | Default setting | 0 | Power OFF and ON | - |

- Set the overload detection level.
- •If this setting is 0, the level is set to 115% of nominal torque
- •Internally there is a limit of 115%, so higher values are limited to 115%
- •This object is set as a percentage of the rated torque.

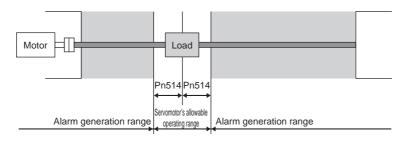
| Pn513 | Overspeed Detection Level Setting | | | | | А | II |
|---------------|-----------------------------------|------|-------|-----------------|---|------------------|----|
| Setting range | 0 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | _ |

- Set the overspeed detection level.
- •The overspeed detection level setting is 1.2 times the maximum motor rotation speed if this parameter is set to 0.
- •This parameter should normally be set to 0. The setting should be changed only when it is necessary to lower the overspeed detection level.
- •The set value of this parameter is limited to 1.2 times the maximum motor rotation speed.
- •The detection margin of error for the set value is ±3 r/min for 17 bit absolute encoder and ±36 r/min for a 20 bit incremental encoder

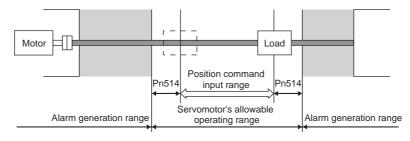
| Pn514 | Overrun Limit Setting | | | | Pos | sition Fully-clo | sed |
|---------------|-----------------------|------|--------------|-----------------|-----|------------------|-----|
| Setting range | 0 to 1,000 | Unit | 0.1 rotation | Default setting | 10 | Power OFF and ON | - |

- Set the allowable operating range for the position command input range.
- •If the set value is exceeded, motor operation range setting protection is activated.

When position command is not input



When position command is input



| Pn515 | Control Input Signal Read Setting | | | | | А | II |
|---------------|-----------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 3 | Unit | _ | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|--------------|-------------|
| 0 | 0.166 ms |
| 1 | 0.333 ms |
| 2 | 1 ms |
| 3 | 1.666 ms |

- Select the signal read cycle for control input (digital input).
- The Servo Drive reads an input signal multiple times at the specified cycle. If the Servo Drive reads the same signal for multiple consecutive cycles, then the input signal is valid.

| Pn516 | Alarm Reset Condition Selection | | | | | А | II |
|---------------|---------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | _ | Default setting | 0 | Power OFF and ON | Yes |

Explanation of Set Values

| Set value | Description |
|-----------|---|
| 0 | 120 ms |
| 1 | Follow the Control Input Signal Read Setting (Pn515). |

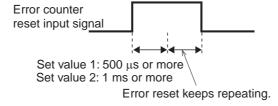
• Select the signal confirmation time for alarm reset input signal (RESET).

| Pn517 | Error Counter Reset Condition Selection | | | | Pos | sition Fully-clos | sed |
|---------------|---|------|---|-----------------|-----|-------------------|-----|
| Setting range | 0 to 4 | Unit | _ | Default setting | 3 | Power OFF and ON | _ |

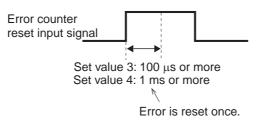
Explanation of Set Values

| Set value | Description |
|-----------|---|
| 0 | Disabled |
| 1 | Clears the error counter at level when the signal is shorted for 500 µs or longer. |
| 2 | Clears the error counter at level when the signal is shorted for 1 ms or longer. |
| 3 | Clears the error counter at edge when the signal changes from open to shorted for 100 µs or longer. |
| 4 | Clears the error counter at edge when the signal changes from open to shorted for 1 ms or longer. |

• When set to 1 or 2, the minimum time width will be as follows.



• When set to 3 or 4, the minimum time width will be as follows.



| Pn518 | Command Pulse Prohibition Input Setting | | | | | sition Fully-clos | sed |
|---------------|---|------|---|-----------------|---|-------------------|-----|
| Setting range | 0 or 1 | Unit | - | Default setting | 1 | Power OFF and ON | _ |

| Set value | Description |
|-----------|-------------|
| 0 | Enabled |
| 1 | Disabled |

• Enable or disable the pulse prohibition input signal (IPG).

When command pulse prohibition input is enabled, command pulse input count process is force stopped.

| Pn519 | Command Pulse Prohibition | Position Fully-closed | | | | | |
|---------------|---------------------------|-----------------------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 3 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

Explanation of Set Values

| Set value | Description |
|--------------|--|
| 0 | 0.166 ms |
| 1 | 0.333 ms |
| 2 | 1 ms |
| 3 | 1.666 ms |
| 4 | 0.166 ms (No judgment of multiple matches) |

- Select the signal read cycle for the pulse prohibition input signal (IPG).
- •The signal status is updated when the signal status in each signal read cycle that has been set matches multiple times.
- •You can lower the possibility of incorrect operation caused by noise by extending the signal read cycle. However, the responsiveness to signal inputs will be reduced.

| Pn520 | Position Setting Unit Select | Position Setting Unit Selection | | | | | |
|---------------|------------------------------|---------------------------------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|--------------|---------------|
| 0 | Command units |
| 1 | Encoder units |

[•] Select the setting unit of Positioning Completion Range 1 and 2 (Pn431 and Pn442), and Error Counter Overflow Level (Pn014).

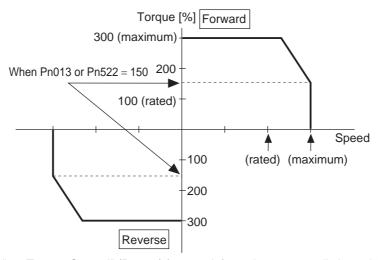
| Pn521 | Torque Limit Selection | | Position Speed Fully-closed | | | | |
|---------------|------------------------|------|-----------------------------|-----------------|---|------------------|---|
| Setting range | 0 to 6 | Unit | - | Default setting | 1 | Power OFF and ON | _ |

| Torque Limit Selection (Pn521) | Torque limit switching input (TLSEL) | Torque Limit Switching Setting (Pn523 and 524) | Forward torque limit input (PCL) | Reverse torque limit input (NCL) | Forward direction torque limit | Reverse direction torque limit |
|---|--|---|--|--|--------------------------------|---|
| 0 | | | 0 to 10 V | -10 to 0 V | PCL | NCL |
| 1 | _ | _ | | | Pn013 | |
| 2 | - | - | | | Pn013 | Pn522 |
| 3 | OFF | Enabled | | | Pn013 | |
| 3 | ON | Enabled | | | Pn522 | |
| 4 | | | 0 to 10 V | 0 to 10 V | PCL | NCL |
| 5 | | | 0 to 10 V | Not affected | PCL | PCL |
| 6 | OFF | _ | | | Pn013 | Pn522 |
| U | ON | _ | | | Pn525 | Pn526 |

- Select the method to set the forward and reverse torque limits.
- •If this parameter is set to 1, the forward and reverse torque limit input will be limited by the No. 1 Torque Limit (Pn013).
- •When using torque control, the No. 1 Torque Limit (Pn013) will be the limit value for forward and reverse operation regardless of the setting of this parameter.

| Pn522 | No. 2 Torque Limit | | | Position Speed Fully-closed | | | | |
|---------------|--------------------|------|---|-----------------------------|-----|------------------|---|--|
| Setting range | 0 to 500 | Unit | % | Default setting | 500 | Power OFF and ON | _ | |

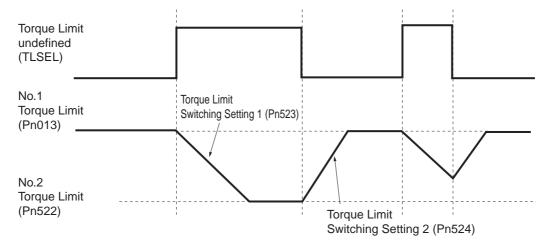
- Set the limit value for the output torque (Pn013: No. 1 Torque Limit, Pn522: No. 2 Torque Limit) of the motor.
- •Refer to information on the Torque Limit Selection (Pn521) to select the torque limits.
- •During torque control, maximum torques for both forward and reverse directions are limited. Settings in Torque Limit Selection (Pn521) and No. 2 Torque Limit (Pn522) will be ignored.
- •Make the settings as a percentage of the rated torque. [Example] Maximum torque is limited to 150%



•Refer to "5-3 Torque Control" (P.5-14) for more information on torque limits and the torque limit selection.

| Pn523 | Torque Limit Switching Sett | ing 1 | | Position Speed Fully-closed | | | | |
|---------------|-----------------------------|-------|---------|-----------------------------|---|------------------|---|--|
| Setting range | 0 to 4,000 | Unit | ms/100% | Default setting | 0 | Power OFF and ON | - | |

- Set the rate of change from torque limit 1 to torque limit 2
- •When set to 0, switching takes place immediately.



| Pn524 | Torque Limit Switching Setting 2 | | | Position Speed Fully-closed | | | | |
|---------------|----------------------------------|------|---------|-----------------------------|---|------------------|---|--|
| Setting range | 0 to 4,000 | Unit | ms/100% | Default setting | 0 | Power OFF and ON | _ | |

- Set values for this parameter are same as those for Torque Limit Switching Setting 1 (Pn523).
- •Set the rate of change from torque limit 2 to torque limit 1

| Pn525 | Forward External Torque Li | Position Speed Fully-closed | | | | | |
|---------------|----------------------------|-----------------------------|---|-----------------|-----|------------------|---|
| Setting range | 0 to 500 | Unit | % | Default setting | 500 | Power OFF and ON | _ |

- Set the forward external torque limit for the torque limit switching input.
- •This object is set in units of 0.1% of the rated torque.

| Pn526 | Reverse External Torque Limit | | | Position Speed Fully-closed | | | | |
|---------------|-------------------------------|------|---|-----------------------------|-----|------------------|---|--|
| Setting range | 0 to 500 | Unit | % | Default setting | 500 | Power OFF and ON | _ | |

- Set the reverse external torque limit for the torque limit switching input.
- •This object is set in units of 0.1% of the rated torque.

| Pn527 | Analog Torque Limit Scale | Po | Position Speed Fully-closed | | | | |
|---------------|---------------------------|------|-----------------------------|-----------------|----|------------------|---|
| Setting range | 10 to 100 | Unit | 0.1 V/100% | Default setting | 30 | Power OFF and ON | _ |

• Set the gain for conversion for the analog torque limit input.

| Pn528 | Default Display | | | | | А | II |
|---------------|-----------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 35 | Unit | _ | Default setting | 1 | Power OFF and ON | Yes |

| Set value | Description |
|-----------|---|
| 0 | Position command error |
| 1 | Motor speed |
| 2 | Position command speed |
| 3 | Speed control command |
| 4 | Torque command |
| 5 | Total encoder pulses |
| 6 | Total command pulses |
| 8 | Total external encoder feedback pulses |
| 9 | Control mode |
| 10 | I/O signal status |
| 11 | Analog input value |
| 12 | Alarm factor, history |
| 13 | Warning number |
| 14 | Regeneration resistance load ratio |
| 15 | Overload load ratio |
| 16 | Inertia ratio |
| 17 | Reason for no rotation |
| 18 | Display of the number of I/O signal changes |
| 20 | Absolute encoder data |
| 21 | Absolute external encoder position |
| 22 | Monitor for the number of encoder communications errors |
| 23 | Display of axis numbers for communication |
| 24 | Position error (encoder unit) |
| 25 | External encoder error (external encoder unit) |
| 26 | Hybrid error |
| 27 | P-N voltage |
| 28 | Soft version |
| 29 | Drive serial number |
| 30 | Motor serial number |
| 31 | Accumulative operation time |
| 32 | Automatic motor recognition function |
| 33 | Temperature information |
| 35 | Safety status monitor |

- Select the data to be displayed on the 7-segment LED on the front panel after the power supply is turned ON.
- For information on the display, refer to "9-4 Setting the Mode" (P.9-7).

| Pn531 | Axis Number | | | | | | II |
|---------------|-------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 127 | Unit | _ | Default setting | 1 | Power OFF and ON | Yes |

[•] Set the axis number for USB communications. Normally, do not change the set value.

| Pn532 | Command Pulse Input Maximum Setting | | | | | sition Fully-clo | sed |
|---------------|-------------------------------------|------|------|-----------------|------|------------------|-----|
| Setting range | 250 to 4,000 | Unit | kpps | Default setting | 4000 | Power OFF and ON | Yes |

- Set the maximum number of pulses for a command pulse input. If the command pulse input frequency exceeds 1.2 multiplied by this set value, alarm 27.0 (command pulse frequency error) will occur.
- •Command pulse input frequency errors are detected for the number of pulses that are received by the Servo Drive. If the number of pulses that is input greatly exceeds this set value, normal detection of the error may not be possible. Also, if the set value is less than 1,000, one of the following digital filters is applied to the command pulse input.

| Pn532 set value | Digital filter |
|-----------------|---------------------|
| 250 to 499 | 200 ns × 2 readings |
| 500 to 999 | 100 ns × 2 readings |
| 1,000 to 4,000 | None (through) |

| Pn533 | Pulse Regeneration Output Limit Setting | | | | | А | II |
|---------------|---|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|--------------|--------------------------|
| 0 | Error detection disabled |
| 1 | Error detection enabled |

[•]Set the detection of Alarm 28.0 "pulse regeneration error".

| Pn535 | Front Key Protection Setting | | | | | А | II |
|---------------|------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

| Set value | Description |
|--------------|-----------------------------------|
| 0 | Front panel operation not blocked |
| 1 | Front panel operation blocked |

- Set the operation limitation from the front panel.
- The operation limits depend on the mode. The operation limits are as follows.

| Mode | Operation limits |
|-------------------------|---|
| Monitor Mode | All monitor data can be checked. |
| Parameter Setting Mode | Parameters cannot be changed. However, parameter set values can be checked. |
| EEPROM Write Mode | Cannot be executed. (Will not be displayed) |
| Auxiliary Function Mode | Operations other than the release of the front key protection setting cannot be executed. (Will not be displayed) |

8-7 Special Parameters

| | Unit | Setting 0.1 V/100% | Po Default setting | | eed Fully-closed | | | |
|---|--|--|--|--|--|--|--|--|
| Set the input gain for anal | | 0.1 V/100% | Default setting | _ | | | | |
| | oa torai | | Delault Setting | 0 | Power OFF and ON — | | | |
| | Set the input gain for analog torque feed-forward. 0 to 9 will disable the function. | | | | | | | |
| Excessive Speed Error Setting All | | | | | | | | |
| 0 to 20000 | Unit | r/min | Default setting | 0 | Power OFF and ON — | | | |
| Set the detection level for excessive speed error (alarm 24.1). | | | | | | | | |
| • If 0 is set, excessive speed error will not be detected. | | | | | | | | |
| Jog Speed | | | | | All | | | |
| 0 to 500 | Unit | r/min | Default setting | 300 | Power OFF and ON — | | | |
| Set the command speed of | during J | OG trial operation (sp | eed control). | | · | | | |
| Gain 3 Effective Time | | | | Pos | sition Fully-closed | | | |
| 0 to 10,000 | Unit | 0.1 ms | Default setting | 0 | Power OFF and ON — | | | |
| Set effective time of gain 3 | 3 of 3-st | ep gain switching. | | | | | | |
| Gain 3 Ratio Setting | | | | Pos | sition Fully-closed | | | |
| 100 to 1,000 | Unit | % | Default setting | 100 | Power OFF and ON — | | | |
| Set gain 3 as a multiple of | gain 1. | | | | | | | |
| Torque Command Value Of | fset | | | | All | | | |
| -100 to 100 | Unit | % | Default setting | 0 | Power OFF and ON - | | | |
| Set offset torque to add to | torque | command. | | | | | | |
| This object is set as a perc | centage | of the rated torque. | | | | | | |
| Forward Direction Torque O | ffset | | | | All | | | |
| –100 to 100 | Unit | % | Default setting | 0 | Power OFF and ON — | | | |
| Set the value to add to the | e torque | command in the forw | ard direction | operation | | | | |
| This object is set as a perd | centage | of the rated torque. | | | | | | |
| Reverse Direction Torque Offset | | | | | | | | |
| -100 to 100 | Unit | % | Default setting | 0 | Power OFF and ON - | | | |
| Set offset torque to add to | torque | command for reverse | direction ope | eration. | , | | | |
| This object is set as a perc | centage | of the rated torque. | · | | | | | |
| Function Expansion Setting | | | | | Position | | | |
| 0 to 63 | Unit | _ | Default setting | 0 | Power OFF and ON - | | | |
| | If 0 is set, excessive spee Jog Speed 0 to 500 Set the command speed of Gain 3 Effective Time 0 to 10,000 Set effective time of gain 3 Gain 3 Ratio Setting 100 to 1,000 Set gain 3 as a multiple of Torque Command Value Of 100 Set offset torque to add to This object is set as a perofession of the Value to add to the This object is set as a perofession of the Value to add to the This object is set as a perofession of the Value to add to the This object is set as a perofession of the Value to add to the This object is set as a perofession of the Value to add to the This object is set as a perofession of the Value to add to the This object is set as a perofession of the Value to add to This object is set as a perofession of the Value to add to This object is set as a perofession of the Value to Setting of the Value of Setting of Setting of the Value of Setting of | If 0 is set, excessive speed error value of the command speed during July Gain 3 Effective Time of the command speed during July Gain 3 Effective Time of the command speed during July Gain 3 Effective time of gain 3 of 3-st Gain 3 Ratio Setting 100 to 1,000 Unit Set gain 3 as a multiple of gain 1. Torque Command Value Offset —100 to 100 Unit Set offset torque to add to torque This object is set as a percentage Forward Direction Torque Offset —100 to 100 Unit Set the value to add to the torque This object is set as a percentage Reverse Direction Torque Offset —100 to 100 Unit Set offset torque to add to torque This object is set as a percentage Reverse Direction Torque Offset —100 to 100 Unit Set offset torque to add to torque This object is set as a percentage Function Expansion Setting | If 0 is set, excessive speed error will not be detected. Jog Speed 0 to 500 Unit r/min Set the command speed during JOG trial operation (speed in the command speed during JOG trial operation (speed in the command speed during JOG trial operation (speed in the command speed during JOG trial operation (speed in the command speed during JOG trial operation (speed in the command speed during JOG trial operation (speed in the command speed in the command in the forward bright speed in the command i | If 0 is set, excessive speed error will not be detected. Jog Speed D to 500 | If 0 is set, excessive speed error will not be detected. Jog Speed Do to 500 Unit r/min Default setting 300 Set the command speed during JOG trial operation (speed control). Gain 3 Effective Time Poto to 10,000 Unit 0.1 ms Default setting 0 Set effective time of gain 3 of 3-step gain switching. Gain 3 Ratio Setting Poto Default setting 100 Set gain 3 Ratio Setting Poto Default setting 100 Set gain 3 as a multiple of gain 1. Torque Command Value Offset -100 to 100 Unit % Default setting 0 Set offset torque to add to torque command. This object is set as a percentage of the rated torque. Forward Direction Torque Offset -100 to 100 Unit % Default setting 0 Set the value to add to the torque command in the forward direction operation. This object is set as a percentage of the rated torque. Reverse Direction Torque Offset -100 to 100 Unit % Default setting 0 Set offset torque to add to torque command for reverse direction operation. This object is set as a percentage of the rated torque. Forward Direction Torque Offset -100 to 100 Unit % Default setting 0 Set offset torque to add to torque command for reverse direction operation. This object is set as a percentage of the rated torque. | | | |

• Set the functions by bit.

| Bit | Function | Set value | | | |
|-------|--|----------------|------------------------------|--|--|
| Dit | runction | 0 | 1 | | |
| bit 0 | Instantaneous speed observer function | Disabled | Enabled | | |
| bit 1 | Disturbance observer function | Disabled | Enabled | | |
| bit 2 | Disturbance observer operation setting | Always enabled | Only when gain 1 is selected | | |
| bit 3 | Inertia ratio switching function | Disabled | Enabled | | |
| bit 4 | Electric current response improvement function | Disabled | Enabled | | |
| bit 5 | Analog Torque Feed-forward | Disabled | Enabled | | |

- Set the decimal value that has been converted from the bits. [Example]
- Instantaneous speed observer function: enabled
- Disturbance observer function: enabled
- Disturbance observer operation setting: always enabled
- Inertia ratio switching function: disabled
- Electric current response improvement function: enabled
- Analog torque feed-forward: disabled If the settings are as described above, the bits will be 010011, and the decimal value will be 19. Therefore, the set value will be 19.

| Pn611 | Electric Current Response | Electric Current Response Setting | | | | | |
|---------------|---------------------------|-----------------------------------|---|-----------------|-----|------------------|---|
| Setting range | 50 to 100 | Unit | % | Default setting | 100 | Power OFF and ON | _ |

• Make fine adjustment to electric current response. The default setting is 100%.

| Pn613 | Inertia Ratio 2 | | | | | А | |
|---------------|-----------------|------|---|-----------------|-----|------------------|---|
| Setting range | 0 to 10,000 | Unit | % | Default setting | 250 | Power OFF and ON | - |

• Set the second load inertia as a percentage of the motor rotor inertia.

| Pn614 | Alarm Detection Allowable | Alarm Detection Allowable Time Setting | | | | | |
|---------------|---------------------------|--|----|-----------------|-----|------------------|---|
| Setting range | 0 to 1,000 | Unit | ms | Default setting | 200 | Power OFF and ON | - |

- Set the allowable time required until the motor stops by an emergency stop due to an alarm.
- When the time exceeds the set value, the operation forcibly turns to an alarming state.
- When the parameter is set to 0, the protection by allowable time does not function.
- Refer to the "Stop Selection for Alarm Detection" (Pn510) (P.8-51).

| Pn615 | Overspeed Detection Level | Setting | at Immediate Stop | | | А | II |
|---------------|---------------------------|---------|-------------------|-----------------|---|------------------|----|
| Setting range | 0 to 20,000 | Unit | r/min | Default setting | 0 | Power OFF and ON | - |

- Set overspeed detection level upon generation of immediate stop alarm.
- •The overspeed detection level setting will be 1.2 times the maximum motor rotation speed if this parameter is set to 0.
- •This parameter should normally be set to 0. The setting should be changed only when it is necessary to lower the overspeed detection level.
- •The set value of this parameter is limited to 1.2 times the maximum motor rotation speed.

| Pn616 | Absolute Interface Function | Absolute Interface Function Selection | | | | | |
|---------------|-----------------------------|---------------------------------------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | - | Default setting | 1 | Power OFF and ON | Yes |

| Set value | Explanation |
|-----------|-------------|
| 0 | Disabled |
| 1 | Enabled |

• Set this parameter to 1.

| Pn617 | Front Panel Parameter Writ | | А | | | | |
|---------------|----------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 or 1 | Unit | _ | Default setting | 0 | Power OFF and ON | Yes |

Explanation of Set Values

| Set value | Explanation |
|-----------|---|
| 0 | EEPROM write not performed when a parameter is changed from the front panel |
| 1 | EEPROM write performed at the same time |

• Set the EEPROM write conditions when the front panel parameter is changed.

| Pn618 | Power Supply ON Initializat | Power Supply ON Initialization Time | | | | | All | |
|---------------|-----------------------------|-------------------------------------|-------|-----------------|---|------------------|-----|--|
| Setting range | 0 to 100 | Unit | 0.1 s | Default setting | 0 | Power OFF and ON | Yes | |

• Set initialization time after power supply ON to the standard 1.5 seconds plus some.

| Pn619 | Encoder Phase-Z Setting | | | | | | II |
|---------------|-------------------------|------|-------|-----------------|---|------------------|-----|
| Setting range | 0 to 32,767 | Unit | Pulse | Default setting | 0 | Power OFF and ON | Yes |

- Finely adjust the ON width of encoder phase-Z signal output.
- This is enabled when the phase-Z output and phase-A output are not synchronized (Pn011/Pn503 × Encoder resolution is not a multiple of 4) due to the encoder dividing ratio setting.
- •The set value of Pn619 and the ON width of phase-Z output are related as follows: Phase-Z output width $[s] = 30/(Pn619 \times Motor speed [r/min])$

| Pn620 | External Encoder Phase-2 | External Encoder Phase-Z Setting | | | | | |
|---------------|--------------------------|----------------------------------|----|-----------------|---|------------------|-----|
| Setting range | 0 to 400 | Unit | μs | Default setting | 0 | Power OFF and ON | Yes |

- Set the external encoder phase-Z regeneration width with time.
- •You can output the phase-Z signal at least for the period of time that has been set if the phase-Z signal width is too short for detection due to the travel distance from the external encoder.

| Pn622 | 90° Phase Difference Output 1 | ype Exte | rnal Encoder Phase-AB F | Regeneration Me | ethod Selec | tion Fully-clo | sed |
|---------------|-------------------------------|----------|-------------------------|-----------------|-------------|------------------|-----|
| Setting range | 0 or 1 | Unit | - | Default setting | 0 | Power OFF and ON | Yes |

Select the regeneration method of pulse outputs A and B when a 90° phase difference output type external encoder is used.

| Set value | Explanation |
|-----------|--------------------------------|
| 0 | Without signal regeneration |
| 1 | With signal regeneration *1,*2 |

- *1. Through outputs are always made for phase Z without signal regeneration.
- *2. If the signal regeneration setting is selected, the duties of A and B are regenerated on the amplifier side and disturbance of waveforms can be suppressed. Take note, however, that this causes delays in phase Z.

| Pn623 | Disturbance Torque Compensation Gain | | | | | sition Fully-clos | sed |
|---------------|--------------------------------------|------|---|-----------------|---|-------------------|-----|
| Setting range | -100 to 100 | Unit | % | Default setting | 0 | Power OFF and ON | _ |

• Set the compensation gain for the disturbance torque.

| Pn624 | Disturbance Observer Filter Setting | | | | Pos | sition Fully-clos | sed |
|---------------|-------------------------------------|------|---------|-----------------|-----|-------------------|-----|
| Setting range | 10 to 2,500 | Unit | 0.01 ms | Default setting | 53 | Power OFF and ON | _ |

• Set the filter time constant for disturbance torque compensation.

| Pn627 | Warning Latch Hold Time Selection | | | | | А | II |
|---------------|-----------------------------------|------|---|-----------------|---|------------------|-----|
| Setting range | 0 to 10 | Unit | S | Default setting | 5 | Power OFF and ON | Yes |

- After the cause of a warning is cleared, the warning state is held for the number of seconds set with Warning Latch Hold Time Selection (Pn627).
- When 0 is set, the warning state is held even after the cause of the warning is cleared.

| Set value | Explanation |
|-----------|--|
| 0 | The warning state is held even after the cause of the warning is cleared. To clear the warning state, execute the alarm clear. |
| 1 to 10 | The warning state is held for the set number of seconds after the cause of the warning is cleared. For example, when 3 is set, the warning state is held for 3 seconds after the cause of the warning is cleared. |

| Pn628 | Not used | Not used A | | | | | .II |
|---------------|--|------------|---|-----------------|---|------------------|-----|
| Setting range | - | Unit | - | Default setting | _ | Power OFF and ON | _ |
| | | | | | | | |
| Pn631 | Realtime Autotuning Estimated Speed Selection All | | | | | .II | |
| Setting range | 0 to 3 | Unit | _ | Default setting | 1 | Power OFF and ON | Yes |

| Set value | Explanation | | | | |
|-----------|--|--|--|--|--|
| 0 | inalize estimated results when load estimation becomes stable. | | | | |
| 1 | stimates every minute from the load characteristic changes. | | | | |
| 2 | Estimates every second from the load characteristic changes. | | | | |
| 3 | stimates the optimum speed from the load characteristic changes. | | | | |

| Pn632 | Realtime Autotuning Customization Mode Setting | | | | | А | II |
|---------------|--|------|---|-----------------|---|------------------|----|
| Setting range | -32,768 to 32,767 | Unit | _ | Default setting | 0 | Power OFF and ON | _ |

- Set details of autotuning when the Realtime Autotuning Mode Selection (Pn002) is set to 6.
- Refer to "10-2 Realtime Autotuning" (P.10-3) for information on realtime Autotuning.

| Bits | Name | Explanation |
|--------|------------------------------------|---|
| 0 or 1 | Load characteristics estimation *1 | Enable or disable load characteristics change, the estimation. 0: Disabled 1: Enabled |
| 2 or 3 | Change inertia ratio | Set how to update the results of load characteristics estimation for the Inertia Ratio (Pn004). 0: Use the present set value 1: Update with the estimation result |
| 4 to 6 | Torque compensation | Set how to update the results of load characteristics estimation for the Torque Command Offset (Pn607), Forward Torque Offset (Pn608), and Reverse Torque Offset (Pn609). 0: Use the present set value 1: Disable torque compensation and clear the above parameters to 0. 2: Vertical mode. Update Pn607 and clear Pn608 and Pn609 to 0. 3: Weak friction compensation. Update Pn607 and set Pn608 and Pn609 for weak friction compensation. 4: Medium friction compensation. Update Pn607 and set Pn608 and Pn609 for medium friction compensation. 5: Strong friction compensation. Update Pn607 and set Pn608 and Pn609 for strong friction compensation. |
| 7 | Rigidity setting | Enable or disable the basic gain settings for the Realtime Autotuning Machine Rigidity Selection (Pn003). 0: Disabled 1: Enabled |

| Bits | Name | Explanation |
|---------|-------------------------|---|
| 8 | Fixed parameter setting | Enable or disable the normally fixed parameters. 0: Use the current settings 1: Set to fixed values |
| 9 to 10 | Gain switching setting | Select the setting method for parameters related to gain switching when realtime autotuning is enabled. 0: Use the current settings 1: Disable gain switching 2: Enable gain switching |

^{*1} When load characteristic estimation is disabled, inertia ratio updating is also disabled, even if the latter is set to be updated with the estimation result. When torque compensation is updated with the estimation result, load characteristic estimation is disabled.



Safety Points

• This parameter is set at the bit level. Unexpected operation may occur if the bits are not set correctly. Set this parameter with care.



Reference

Setting Bit-level Parameters

Use the following procedure to calculate the set value if all settings are not 0.

- Check the lowest bit for each setting.
 Example: Lowest bit for torque compensation: 4
- (2) Multiply the set value by 2 to the power of the lowest bit. Example: The value for weak friction compensation for the torque compensation would be $2^4 \times 3 = 48$.
- (3) Repeat steps 1 and 2 for all settings and add the results to obtain the set value for Pn632. Example: The calculation is as follows for the following settings: Load characteristic estimation: Enabled, Inertia ratio updating: Enabled, Torque compensation: Weak friction compensation, Rigidity setting: Enabled, Fixed parameters: Set to fixed values, and Gain switching: Enabled.

$$2^{0} \times 1 + 2^{2} \times 1 + 2^{4} \times 3 + 2^{7} \times 1 + 2^{8} \times 1 + 2^{9} \times 2 = 1461$$

| Pn633 | Absolute Encoder Initial Pulse Regeneration Speed | | | | | А | II |
|---------------|---|------|-------|-----------------|------|------------------|----|
| Setting range | 1,000 to 3,000 | Unit | r/min | Default setting | 1000 | Power OFF and ON | _ |

- Set the pulse regeneration speed when the initial pulse is output.
- Connection with OMRON controller
 - For the Host Controller to correctly receive the position from the absolute encoder, the pulse output from the drive must be set to be completed before the controller's timeout.
- •Pulse are outputted to a speed equivalent to a motor rotating at a speed specified by this parameter.

The following values or more are recommended for use.

| OMRON controller | Pn633 |
|------------------|-------|
| CJ1W-NC□□4 | 1000 |
| CS1W-MC□□□ | 1000 |
| CV500-MC | 3000 |
| 3F88M-DRT141 | 1500 |

^{*1.} You can set the timeout setting time on the controller side.

| Pn634 | Hybrid Vibration Suppression Gain Fully-closed | | | | | | sed |
|---------------|--|------|-------|-----------------|---|------------------|-----|
| Setting range | 0 to 30,000 | Unit | 0.1/s | Default setting | 0 | Power OFF and ON | - |

- •Set the hybrid vibration suppression gain.
- •In general, set it to the same value as the position loop gain, and finely adjust it based on the situation.

| Pn635 | Hybrid Vibration Suppression Filter Fully-closed | | | | | | sed |
|---------------|--|------|---------|-----------------|----|------------------|-----|
| Setting range | 0 to 6,400 | Unit | 0.01 ms | Default setting | 10 | Power OFF and ON | - |

•Set the hybrid vibration suppression filter.

| Pn637 | Vibration Detection Threshold | | | | | | |
|---------------|-------------------------------|------|------|-----------------|---|------------------|---|
| Setting range | 0 to 1,000 | Unit | 0.1% | Default setting | 0 | Power OFF and ON | - |

- •Set the vibration detection threshold.
- •If torque vibration that exceeds this setting is detected, the vibration detection warning will occur.
- •This object is set in units of 0.1% of the rated torque.

| Pn638 | Warning Mask Setting | | | | | | |
|---------------|----------------------|------|---|-----------------|---|------------------|-----|
| Setting range | -32,768 to 32,767 | Unit | - | Default setting | 4 | Power OFF and ON | Yes |

- Set a mask for warning detection.
- If you set the corresponding bit to 1, the corresponding warning detection will be disabled.
- Refer to "11-2 Warning List" (P.11-4) for details on the setting method.



Precautions for Correct Use

Parameters between Pn700 and Pn800 are not used. Do not change the settings.



Operation

This chapter gives the operating procedures and explains how to operate in each mode.

| 9-1 | Operational Procedure | 9-1 |
|-----|---|------|
| 9-2 | Preparing for Operation | 9-2 |
| | Items to Check Before Turning ON the Power Supply | |
| | Turning ON the Power Supply | 9-3 |
| | Checking the Displays | |
| | Absolute Encoder Setup | 9-4 |
| 9-3 | Using the Front Display | 9-6 |
| 9-4 | Setting the Mode | 9-7 |
| | Changing the Mode | 9-7 |
| | Monitor Mode | |
| | Parameter Setting Mode | 9-22 |
| | Parameter Write Mode | |
| | Auxiliary Function Mode | 9-25 |
| 9-5 | Trial Operation | 9-33 |
| | Preparation for Trial Operation | 9-33 |
| | Trial Operation in Position Control Mode | |
| | Trial Operation in Speed Control Mode | 9-35 |
| | Trial Operation in Torque Control Mode | 9-36 |
| | Trial Operation in Fully-closed Control Mode | 9-37 |

9-1 Operational Procedure

Turn ON the power supply after the correct installation and wiring to check the operation of the individual motor and drive.

Then make the function settings as required according to the use of the motor and drive. If the user parameters are set incorrectly, there is a risk of an unpredictable motor operation,

If the user parameters are set incorrectly, there is a risk of an unpredictable motor operation, which is dangerous. Set the parameters securely according to the setting methods in this manual.

| Item | Contents | Reference | | | | | | |
|---------------------------|--|----------------|--|--|--|--|--|--|
| Mounting and installation | Install the motor and drive according to the installation conditions.(Do not connect the motor to the mechanical system before checking no-load operation.) | Chapter 4, 4-1 | | | | | | |
| — | | | | | | | | |
| Wiring and connections | Connect the motor and drive to the power supply and peripheral equipment. Specified installation and wiring conditions must be satisfied, particularly for models conforming to the EC Directives. | Chapter 4, 4-2 | | | | | | |
| | | | | | | | | |
| Preparing for operation | Check the necessary items and then turn ON the power supply. Check on the display to see whether there are any internal errors in the drive. When using a Servomotor with an absolute encoder, set up the absolute encoder. | Chapter 9, 9-2 | | | | | | |
| <u></u> | | | | | | | | |
| Function settings | By means of the user parameters, set the functions according to the operating conditions. | Chapter 8 | | | | | | |
| | | | | | | | | |
| Trial operation | First, check the motor operation with no-load. Then turn the power supply OFF and connect the motor to the mechanical system. If using a motor with an absolute encoder, set up the absolute encoder and set the Motion Control Unit's initial parameters. Turn ON the power supply again, and check to see whether protective functions, such as the emergency stop and operational limits, work properly. Check operation at both low speed and high speed using the system without a workpiece, or with dummy workpieces. | Chapter 9, 9-5 | | | | | | |
| | | | | | | | | |
| Adjustment | Manually adjust the gain if necessary. Further adjust the various functions to improve the control performance. | Chapter 10 | | | | | | |
| <u> </u> | | | | | | | | |
| Operation | Operation can now be started. If any problems should occur, refer to "Chapter 11, Troubleshooting and Maintenance". | Chapter 11 | | | | | | |

9-2 Preparing for Operation

This section explains the procedure to prepare the mechanical system for operation following installation and wiring of the motor and drive. It explains items to check both before and after turning ON the power supply.

It also explains the setup procedure required if using a motor with an absolute encoder.

Items to Check Before Turning ON the Power Supply

Checking Power Supply Voltage

Check to be sure that the power supply voltage is within the ranges shown below.

R88D-KTA5L/KT01L/KT02L/KT04L (Single-phase 100-VAC input)
Main circuit power supply: Single-phase 100 to 120 VAC (85 to 132) 50/60 Hz
Control circuit power supply: Single-phase 100 to 120 VAC (85 to 132) 50/60 Hz

R88D-KT01H/02H/04H/08H/10H/15H (Single-phase or single-phase/3-phase 200-VAC input) Main circuit power supply: Single-phase or single-phase/3-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz Control circuit power supply: Single-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz

R88D-KT20H/30H/50H/75H/150H (3-phase 200-VAC input)
Main circuit power supply: 3-phase 200 to 230 VAC (170 to 253 V)
50/60 Hz Control circuit power supply: Single-phase 200 to 230 VAC (170 to 253 V) 50/60 Hz

R88D-KT06F/KT10F/KT15F/KT20F/KT30F/KT50F/KT75F/KT150F (3-phase 400-VAC input) Main circuit power supply: 3-phase 380 to 480 VAC (323 to 528 V) 50/60 Hz Control circuit power supply: 24 VDC \pm 15%

Checking Terminal Block Wiring

- The main circuit power supply inputs (L1/L3 or L1/L2/L3) must be properly connected to the terminal block.
- The control circuit power supply inputs (L1C/L2C) must be properly connected to the terminal block.
- The motor's U, V, and W power lines and the green/yellow (ⓐ) must be properly connected to the terminal block.

Checking the Motor

- There should be no load on the motor. (Do not connect the mechanical system.)
- The motor side power lines and the power cables must be securely connected.

Checking the Encoder Wiring

- The encoder cable must be securely connected to the encoder connector (CN2) at the drive.
- The encoder cable must be securely connected to the encoder connector at the motor.

Checking the Control I/O Connector

- The control cable must be securely connected to the control I/O connector (CN1).
- The operation command (RUN) must be OFF.

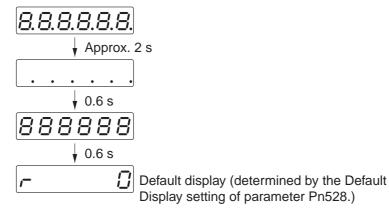
Turning ON the Power Supply

- First carry out the preliminary checks, and then turn ON the control circuit power supply. It makes no difference whether or not the main circuit power supply is turned ON.
- The alarm output (/ALM) will take approx. 2 seconds to turn ON after the power supply has been turned ON. Do not attempt to detect an alarm using the Host Controller during this time. (If power supply is turned ON while the Host Controller is connected.)

Checking the Displays

Displays on the Drive

• The following will appear on the display area on the drive when the power supply is turned ON.



Absolute Encoder Setup ABS

You must set up the absolute encoder if using a motor with an absolute encoder. The setup is required when you turn ON the power supply for the first time, when an absolute encoder system down error (Alarm No. 40) occurs, or when the encoder cable is disconnected and then connected again.

When using an absolute encoder, set Pn015 to 0 or 2 and set Pn616 to 1.

Set up an absolute encoder while the servo is OFF. Always cycle the power supply after completing the setup.

Absolute Encoder Setup Procedure

1. Turn ON the power supply and align the origin position.

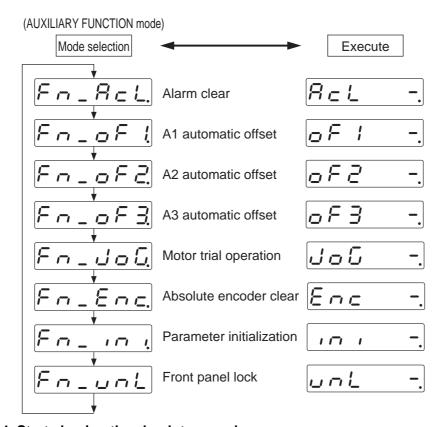
Turn ON the power supply, perform the origin adjustment operation, and move the machine to the origin position.

2. Go to Auxiliary Function Mode.

Press (3) and (3) on the drive. Auxiliary Function Mode will be displayed.

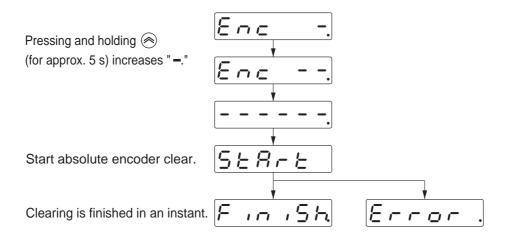
3. Use the Increment and Decrement keys to go to the Absolute Encoder Clear Mode.

Press (AMA) again. Absolute Encoder Clear Mode will be displayed.



4. Start clearing the absolute encoder.

Hold down . Clearing the absolute encoder will be started.

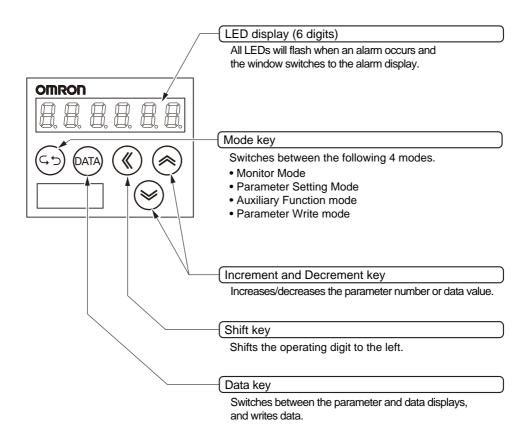


Note. *Error* will be displayed if absolute encoder clear is performed on an incremental encoder.

5. Restart the drive.

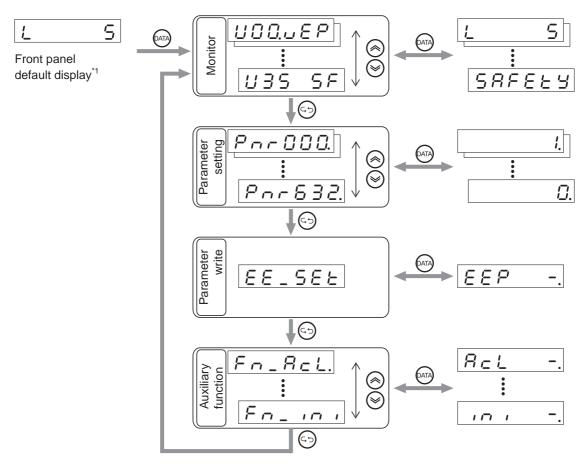
Turn OFF the control power supply to the drive and then turn it back ON.

9-3 Using the Front Display



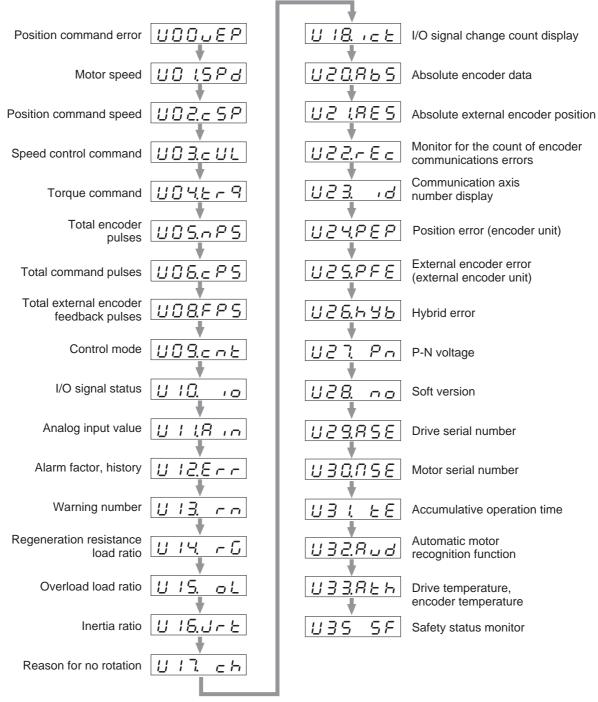
9-4 Setting the Mode

Changing the Mode



*1. The display will be based on the Default Display (Pn528) setting after the power supply is turned ON.

Monitor Mode



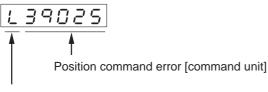
When sis pressed, the display position will move in the direction of the arrow.

When is pressed, it will move in the opposite direction.

• The motor rotation speed will be displayed the first time the power supply is turned ON after purchase. To change the initial display when the power supply is turned ON, change the setting for the Default Display (Pn528). For details, refer to Pn528 "Default Display" (P.8-57).

Position Command Error

UBBUEP



Lower (L)

Higher (H)

Press (4) to switch between Lower (L) and Higher (H).

Motor Rotation Speed

|UO 15Pa|

- Displays the motor rotation speed (unit: r/min).
- Rotation speeds in reverse operation are displayed with "-".

Position Command Speed UB2.c 5P

• Displays the position command speed (unit: r/min).

Speed Control Command

U 0 3. UL

• Displays the speed control command (unit: r/min).

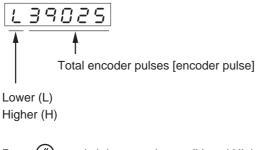
Torque Command

U04.E - 9

- Displays the percentage of drive torque command.
- When the rated torque output for the drive is used, "100%" is displayed.
- Torque outputs in reverse operation are displayed with "-".

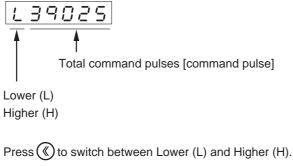
Total Encoder Pulses

U05.~P5



Press (to switch between Lower (L) and Higher (H).

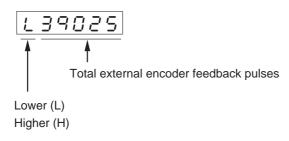
Total Command Pulses



L39025 ←→ H 103

Total External Encoder Feedback Pulses

U08.FPS



Press to switch between Lower (L) and Higher (H).

Control Mode

U09.cnE

Position Control Mode

Speed Control Mode

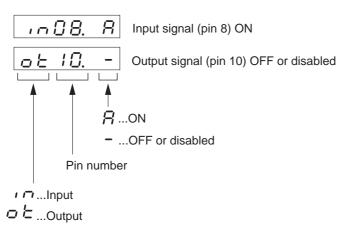
Foliant

Fully-closed Control Mode

• Displays which control mode is being used: position control, speed control, torque control, or fullyclosed control.

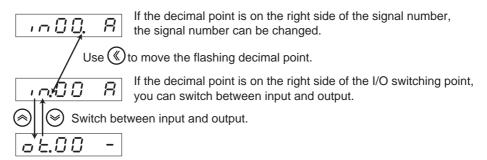
I/O Signal Status



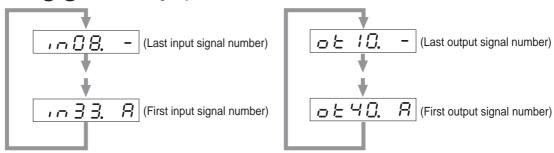


• Displays the status of the control input and output signals connected to CN1.

Switching between Input Signals and Output Signals

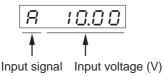


Press 🛇 🤡 to select the signal you want to monitor.

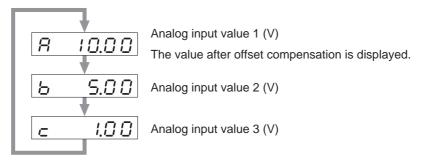


Analog Input Value

U 1 18 ...



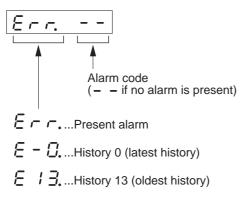
Press to select the signal you want to monitor.



Note. Voltages exceeding +/-10 V are not displayed accurately.

Alarm Factor, History

U 12.Err



- Up to the most recent 14 alarms, including the current one, can be viewed in the reason of error.
- The display area will flash when an alarm occurs.
- If an alarm that is recorded in the history occurs, the alarm code for the current alarm and for history 0 will be the same.
- "st" will flash on the display if a safety input error (alarm 30.0) occurs.

Alarm Codes and Meanings

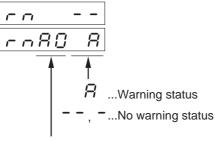
| Alarm codes | Contents | Alarm codes | Contents |
|-------------|-----------------------------------|-------------|---|
| 11 | Control power supply undervoltage | 36 | Parameter error |
| 12 | Overvoltage | 37 | Parameters destruction |
| 13 | Main power supply undervoltage | 38 | Drive prohibition input error |
| 14 | Overcurrent | 39 | Excessive analog input |
| 15 | Servo Drive overheat | 40 | Absolute encoder system down error ABS |
| 16 | Overload | 41 | Absolute encoder counter overflow error ABS |
| 18 | Regeneration overload | 42 | Absolute encoder overspeed error ABS |
| 21 | Encoder communications error | 44 | Absolute encoder 1-rotation counter error ABS |
| 23 | Encoder communications data error | 45 | Absolute encoder multi-rotation counter error ABS |
| 24 | Error counter overflow | 46 | Encoder error 1 |
| 26 | Overspeed | 47 | Absolute encoder status error ABS |
| 27 | Electronic gear setting error | 48 | Encoder phase-Z error |
| 34 | Overrun limit error | 49 | Encoder CS signal error |

Note. The following alarms are not recorded in the history.

- 11: Control power supply undervoltage
- 13: Main power supply undervoltage
- 36: Parameter error
- 37: Parameters destruction
- 38: Drive prohibition input error
- 95: Motor non-conformity

Warning Number

U 13. rn

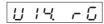


Warning number

Press 🔊 🕞 to display the occurrence status of each warning.



Regeneration Load Ratio



• Displays the regeneration resistance load ratio as a percentage when the detection level for the regeneration overload is 100%.

Overload Load Ratio

U IS. oL

• Displays the overload ratio as a percentage when the rated load corresponds to 100%.

Inertia Ratio

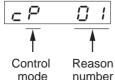
U 18.JrE

The inertia ratio (%) is displayed.

Reasons for No Rotation

LI 17. ch

A number is displayed to indicate the reason the motor does not rotate.



| | Control Reason number | | ion control |
|----------|-------------------------------------|-----------------------------|---|
| Number | Item | Relevant control mode | Description |
| Flashing | Alarm or warning has occurred | All | An alarm has occurred. Warning has occurred. |
| 0 | No reason | All | No reason has been detected. The motor opera possible. |
| 1 | Main power supply interrupted | All | The main power supply to the drive is not turned |
| 2 | No RUN input | All | The operation command (RUN) is not connected |
| | Drive prohibition input is enabled. | | When Pn504 = 0 (drive prohibition input enabled • The forward drive prohibition input (POT) is o |

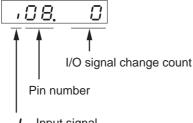
r operation should be t turned ON. nnected to COM. enabled): OT) is open and the speed 3 ΑII command is in the forward direction. The reverse drive prohibition input (NOT) is open and the speed command is in the reverse direction. Low torque limit setting The currently effective torque limit set value, Pn013 (No. 1 Torque ΑII Limit) or Pn522 (No. 2 Torque Limit), is less than 5% of the rated torque. Analog torque limit input is When Pn527 = 0 (analog torque limit scale): · The forward analog torque limit input is negative and the speed enabled. 5 P.S command is in the forward direction. · The reverse analog torque limit input is positive and the speed command is in the reverse direction. IPG input is enabled. Pn518 = 0 (command pulse prohibition input enabled) and the IPG Р 6 input is open. Frequency of command · The command pulse is not input correctly. pulse input is low. · The input selected in Pn005 is not connected correctly. 7 Ρ • The type of input selected in Pn006 or Pn007 is not correct. The position command per control cycle is 1 pulse or less and the above are some of the possible causes. ECRST input is enabled. Pn517 = 0 (Error counter reset at the level) and the error counter Р 8 reset input (ECRST) is connected to COM. VZERO input is enabled. Pn315 = 1 (zero speed designation enabled) and the zero speed 9 S. T designation input (VZERO) is open. External speed command The analog speed command is 0.06 V or lower when the analog S 10 speed command is selected. is low. Internal speed command The internal speed command is 30 r/min or less when the internal S 11 speed command is selected. The analog torque command input (REF or PCL) is 5% or less of the Torque command is low 12 Т rated torque. Speed limit is low Pn317 = 0 (speed limit with No. 4 internally set speed) and the No. 4 Internally Set Speed (Pn307) is 30 r/min or lower. 13 Т Pn317 = 1 (speed limit with REF input) and the analog speed command input (REF) is 0.06 V or lower.

| Number | Item | Relevant control mode | Description |
|--------|---------------|-----------------------------|--|
| 14 | Other reasons | All | Reasons 1 to 13 do not apply, but the motor is rotating at 20 r/min or lower. (Low command, heavy, locked, or crashed load, faulty drive or motor, etc.) |

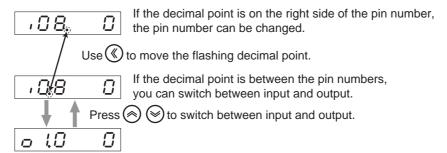
Note. The motor may rotate even if a reason number other than 0 is displayed.

Display of the Number of I/O Signal Changes

U 18. .c E



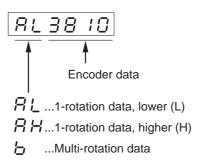
- / ...Input signal
- ...Output signal



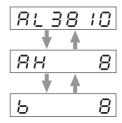
• Display the number of transitions in one input since last power-on.

Absolute Encoder Data

U20.865



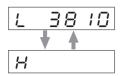
Press (to select the data you want to display.



Encoder data

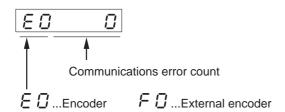
L...Absolute external encoder position, lower (L)

Press (to switch between Lower (L) and Higher (H).



Monitor for the Number of Encoder and External Encoder Communications Error

U22.-Ec

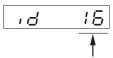


Press (to switch between encoder and external encoder.



Display of Axis Numbers for Communication

U 2 3. *,* \forall



The value set by the Axis Number (Pn531) is displayed.

Encoder Position Error

U24PEP



Lower (L) Higher (H)

Press to switch between Lower (L) and Higher (H).

External Encoder Position Error

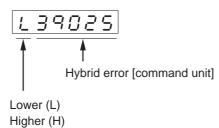
U25.PFE



Press (to switch between Lower (L) and Higher (H).

Hybrid Error

U26.546



Press (to switch between Lower (L) and Higher (H).

<u>Pn 280</u> †

P-N voltage [V] is displayed.

Soft Version

U28. no

8-1.23

• Displays the soft version of the drive. (Display example: Ver. 1.23)

Drive Serial Number

*u29.*85*E*

Amplifier serial number

₽ '_ ...Amplifier serial number, lower (L) ₽ H ...Amplifier serial number, higher (H)

Press (S) (S) to switch between Lower (L) and Higher (H).

Display example) When serial number is 09040001

RL000 I ▼ ↑ RH0904

Motor Serial Number

U30.05E

Motor serial number

 $\Pi \mathrel{\ \square}$...Motor serial number, lower (L) $\Pi \mathrel{\ \square}$...Motor serial number, higher (H)

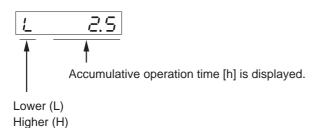
Press (S) to switch between Lower (L) and Higher (H).

Display example) When serial number is 09040001

NL000 I ▼ ↑ NH0904

Accumulative Operation Time

U3 1, EE



Press to switch between Lower (L) and Higher (H).



Automatic Motor Recognition Function

U32.Rud



Drive Temperature and Encoder Temperature

U33.86h



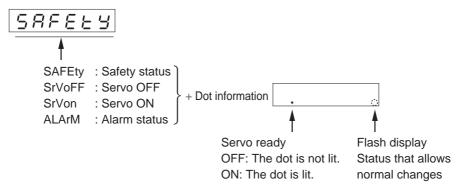
Press or to switch to the item to be monitored.



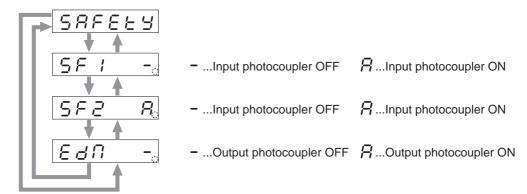
Note: Encoder temperature information is displayed only for an incremental encoder. "0" will be displayed for an absolute encoder.

Safety Status

UBS SF



Press (to switch between monitors you want to display.



Parameter Setting Mode

1. Displaying Parameter Mode

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| | _ B | The item set for the Default Display (Pn528) is displayed. |
| DATA | Un _ 5Pd. | Press the (DATA) key to display Monitor Mode. |
| (45) | Pn_ 18. | Press (key to display Parameter Setting Mode. |

2. Setting the parameter number

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| () () | Pr. 10. | Use (keys to set the parameter number. Press to move "." to the left and change the digit to be set. Press to increase the value of the digit with ".". Press to decrease the value of the digit with ".". |

3. Displaying parameter set values

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | ч <i>в</i> . | Press the ATA key to display the set value. |

4. Changing the parameter set value

| Key operation | Display example | Explanation |
|------------------|-----------------|---|
| | 100. | Use the \(\bigcirc \otimes \) keys to change the value. Press \(\otimes \) to move "." to the left and change the digit to be set. Press \(\otimes \) to increase the value of the digit with ".". Press \(\otimes \) to decrease the value of the digit with ".". |
| DATA | 100. | Press the (DATA) key to save the new set value. To cancel the change, instead of pressing (DATA), press (CD) to return to the display in procedure 2. |

5. Returning to Parameter Setting Mode

| Key operation | Display example | Explanation |
|------------------|-----------------|---|
| DATA | Pn_ 18. | Press the (DATA) key to return to Parameter Setting Mode. |



Precautions for Correct Use

- Some parameters will be displayed with an "r" before the number when the display returns to the Parameter Setting Mode. To enable the set values that have been changed for these parameters, you must turn the power supply OFF and ON after saving the parameters to the EEPROM.
- If the Front Panel Parameter Write Selection (Pn617) is set to 1, the parameter set value is automatically written to EEPROM when changed.
- When the set value for a parameter is saved, the new setting will be used for control. Make gradual changes instead of changing the large numbers at once, when changing values for parameters that greatly affect motor operation (speed loop gain, position loop gain, etc. in particular).
- For details on parameters, refer to "Chapter 8, Parameter Details".

Parameter Write Mode

Set values changed in Parameter Setting Mode must be saved to EEPROM. To do so, the following operation must be performed.

1. Saving changed set values

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| (C, 5) | EE_SEE | Press the (5) key to display Parameter Write Mode. |
| DATA | EEP | Press the (ATA) key to enter Parameter Write Mode. |
| | EEP | Press and hold the key for 5 seconds or longer until 5 t 8 r t is displayed. |
| | | The bar indicator will increase. |
| | SERFE | Writing will start. (This display will appear only momentarily.) |
| | F .n .5h. | This indicates a normal completion. In addition to this display, either FESEL or Error may be displayed. If FESEL is displayed, writing has been completed normally, but some of the changed parameters will be valid only after the power supply has been turned OFF and ON again. Turn OFF the drive power supply and then turn it ON again. Error will be displayed if there is a write alarm. Write the data again. |

2. Returning to Parameter Write Mode

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | EE_5EE | Press the DATA key to return to Parameter Write Mode. |



Precautions for Correct Use

- If a write alarm occurs, write the data again. If write alarms continue to occur, there may be a fault in the drive.
- Do not turn OFF the power supply while writing to EEPROM. Incorrect data may be written if the power supply is turned OFF. If the power supply is turned OFF, perform the settings again for all parameters, and write the data again.

Auxiliary Function Mode

Auxiliary Function Mode includes the alarm clear, analog input automatic offset adjustment, absolute encoder reset, jog operation, parameter initialization, and front panel lock/release.

Displaying Auxiliary Function Mode

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| | | The item set for the Default Display (Pn528) is displayed. |
| DATA | Un_SPd. | Press the (ATA) key to display Monitor Mode. |
| | Fn_8cL | Press the key 3 times to display Auxiliary Function Mode. |

Alarm Clear

This releases the alarm generation status.

Some alarms cannot be released. Refer to "11-3 Alarm List" (P.11-5) for details.

1. Execute alarm clear

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | 8ct | Press the (DATA) key to enter Alarm Clear Mode. |
| | 8cL | Press and hold the key for 5 seconds or longer until 5 t B r t is displayed. |
| | | The bar indicator will increase. |
| | SERFE | Alarm clear will start. |
| | F 10 15h. | This indicates a normal completion. \(\begin{align*} \in \cdot |

2. Returning to Auxiliary Function Mode display

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| DATA | Fn_8cL | Press the DATA key to return to Auxiliary Function Mode. |

Analog Input Automatic Offset Adjustment

This performs automatic adjustment on the Offset Values (Pn422, Pn425 and Pn428) of Analog Inputs 1 to 3 (Al1 to Al3).

Do not perform this operation if a position loop has been configured with the host system.

1. Execute automatic offset adjustment

| Key operation | Display example | Explanation |
|------------------|----------------------------------|--|
| | Fn_oF !, or Fn_oF 2. or Fn_oF 3. | Press the key to display the Analog Input Automatic Offset Adjustment Mode from the alarm clear display in the Auxiliary Function Mode. |
| DATA | of! or oF 2 or oF 3 | Press the DATA key to enter the Automatic Offset Adjustment Mode of the analog input number to be set. |
| | oF! or oF 2 or oF 3 | Press and hold the key for 5 seconds or longer until 5 & R - & is displayed. |
| | | The bar indicator will increase. |
| | SERFE | Automatic offset adjustment will start. |
| | F in 15h. | This indicates a normal completion. Error will be displayed if the automatic offset adjustment could not be performed. Set a valid control mode or make the setting so that the offset value does not exceed the range for the Speed Command Offset Value (Pn422, Pn425, or Pn428), and then execute the procedure again. |

2. Returning to Auxiliary Function Mode display

| Key operation | Display example | Explanation |
|---------------|--|--|
| DATA | Fn_oF! or Fn_oF2. or Fn_oF3. | Press the (DATA) key to return to Auxiliary Function Mode. |



Precautions for Correct Use

- Automatic offset adjustment function cannot be performed in Position Control Mode.
- Data is not written to the EEPROM simply by performing automatic offset adjustment. The data must be written to the EEPROM for the results to be saved.

Jog Operation

You can perform a trial operation of the motor with no load without wiring the control I/O connector (CN1).

1. Prepare for a jog operation

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| | Fn_J05. | Press the key to display the Jog Operation Mode from the alarm clear display in Auxiliary Function Mode. |
| DATA | Jo5 | Press the (ATA) key to enter Jog Operation Mode. |
| | Job | Press and hold the key for 5 seconds or longer until |
| | | The bar indicator will increase. |
| | r & 8 d y . | This completes preparations for jog operation. $\boxed{\mathcal{E}_{\Gamma \Gamma \emptyset \Gamma}}$ will be displayed if the servo is not ready. |
| (| r E 8 d 3. | Press and hold the (() key for 5 seconds or longer until |
| | r.E 8 d Y | The decimal point will move to the left. |
| | Srulon | The Servo will turn ON. |

2. Execute jog operation

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| | SrU_0n | Forward direction operation will be performed while the key is pressed, and reverse direction operation will be performed while the key is pressed. The motor will stop when the key is released. The rotation speed at this time will be the speed set for the Jog Speed (Pn604). [Error] will be displayed if the servo is not ready. |

3. Returning to Auxiliary Function Mode display

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| DATA | Fn_JoG. | Press the (DATA) key to return to Auxiliary Function Mode. The servo lock will be released and the servo will be unlocked. |



Precautions for Correct Use

- When performing a jog operation, be sure to first disconnect the motor from any load and remove the control I/O connector (CN1).
- When performing a jog operation, set the parameter related to gains to an appropriate value to avoid any troubles, such as vibration. Set the Inertia Ratio (Pn004) to 0.
- The motor operates in the Speed Control Mode during a jog operation. Set each of the various settings so that the motor operates correctly for speed control.
- If the operation command (RUN) is turned ON during a jog operation, [£rrgr] will be displayed, and the jog operation will be cancelled and a normal operation through an external command will be performed.

Absolute Encoder Reset ABS

This resets the multi-rotation data and alarms of the absolute encoder.

1. Execute absolute encoder reset

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| | Fn_Enc | Press the key to display the Absolute Encoder Reset Mode from the alarm clear display in Auxiliary Function Mode. |
| DATA | Enc | Press the (DATA) key to enter Absolute Encoder Reset Mode. |
| | Enc | Press and hold the key for 5 seconds or longer until |
| | | The bar indicator will increase. |
| | SERFE | Absolute encoder reset will start. |
| | F .n .Sh. | This indicates a normal completion. [Error] will be displayed if the absolute encoder reset could not be performed. Check whether an unsupported encoder is connected, and then execute the procedure again. |

2. Returning to Auxiliary Function Mode display

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | Fn_Enc | Press the (DATA) key to return to Auxiliary Function Mod. |



Precautions for Correct Use

• The absolute encoder reset function can be used only with systems that use an absolute encoder.

Parameter Initialization

This initializes the parameters.

1. Execute the initialization of the parameter.

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | Fn_ ,n , | Press the (ATA) key to enter Parameter Initialization Mode. |
| | · · · · | Press and hold the key for 5 seconds or longer until 5 t 8 r t is displayed. |
| | | The bar indicator will increase. |
| | SERFE | The initialization of the parameter will start. |
| | F 10 15h. | This indicates a normal completion. Error will be displayed if the parameter could not be initialized. Turn OFF the drive power supply and then execute again. |

2. Returning to Auxiliary Function Mode display

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| DATA | Fn_Enc | Press the DATA key to return to Auxiliary Function Mode. |



Precautions for Correct Use

• If Alarm No. 11 (power supply undervoltage), 36 (parameter error) or 37 (parameter destruction) is displayed, the parameter cannot be initialized.

Front Panel Lock

This locks the front panel.

1. Displaying Parameter Mode

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | Un_SPd. | Press the (ATA) key to display Monitor Mode. |
| (45) | Pr. 10. | Press (45) key to display Parameter Setting Mode. |

2. Setting the parameter number

| Key operation | Display example | Explanation |
|------------------|-----------------|---|
| () | Pnr 5 3 5. | Use the keys to set to Pn535. Press to move "." to the left and change the digit to be set. Press to increase the value of the digit with ".". Press to decrease the value of the digit with ".". |

3. Displaying parameter set values

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | S. | Press the (ATA) key to display the set value. |

4. Changing the parameter set value

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| () () | <i>I.</i> | Use the keys to change the value. Press to move "." to the left and change the digit to be set. Press to increase the value of the digit with ".". Press to decrease the value of the digit with ".". |
| DATA | 1. | Press the (ATA) key to save the new set value. To cancel the change, instead of pressing (ATA), press (CD) to return to the display in procedure 2. |

5. Returning to Parameter Setting Mode

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | Pnr 535. | Press the (DATA) key to return to Parameter Setting Mode. |

6. Saving changed set values

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| (C, 5) | [EE_SEE] | Press the 🖘 key to display Parameter Write Mode. |
| DATA | EEP | Press the (ATA) key to enter Parameter Write Mode. |

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| | EEP | Press and hold the key for 5 seconds or longer until 5 t 8 r t is displayed. |
| | | The bar indicator will increase. |
| | SERFE | Writing will start. (This display will appear only momentarily.) |
| | F in 15h. | This indicates a normal completion. In addition to this display, either $\[\[\] \] \]$ or $\[\] \[\] \]$ may be displayed. If $\[\] \] \]$ is displayed, writing has been completed normally, but some of the changed parameters will be valid only after the power supply has been turned OFF and ON again. Turn OFF the drive power supply and then turn it ON again. $\[\] \]$ will be displayed if there is a write alarm. Write the data again. |

7. Returning to Parameter Write Mode

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | 881588 | Press the (DATA) key to return to Parameter Write Mode. |

8. Restart the power supply to the drive



Precautions for Correct Use

- The items that are limited depend on the mode.
- If the Front Panel Parameter Write Selection (Pn617) is set to 1, the parameter set value is automatically written to EEPROM when changed.
- Refer to the Front Key Protection Setting (Pn535) in "8-6 Extended Parameters" (P.8-47) for details on the front panel lock function.

Front Panel Lock Release

This releases the front panel lock.

1. Release the front panel lock

| Key operation | Display example | Explanation |
|---------------|-----------------|--|
| | Fn_unL | Press the key to display the Front Panel Lock Mode from the alarm reset display in Auxiliary Function Mode. |
| DATA | unt | Press the DATA key to enter Front Panel Lock Mode. |
| | unt | Press and hold the key for 5 seconds or longer until 5 t 8 r t is displayed. |
| | | The bar indicator will increase. |
| | SERFE | The front panel lock will be released. |
| | F 10 15h. | This indicates a normal completion. [Error] will be displayed if the front panel lock is not released. Turn OFF the drive power supply and then execute again. |

2. Returning to Auxiliary Function Mode display

| Key operation | Display example | Explanation |
|---------------|-----------------|---|
| DATA | Fn_Enc | Press the (ATA) key to return to Auxiliary Function Mode. |

9-5 Trial Operation

When you have finished installation, wiring, and switch settings, and have confirmed that status is normal after turning ON the power supply, perform trial operation. The main purpose of trial operation is to confirm that the servo system is electrically correct.

If an error occurs during the trial operation, refer to "Chapter 11, Troubleshooting and Maintenance" to eliminate the cause. Then check for safety, and then retry the trial operation.

Preparation for Trial Operation

Inspections before Trial Operation

Check the following items.

Wiring

- Make sure that there is no error (especially the power supply input and motor output).
- Make sure that there are no short-circuits. (Check the ground for short circuits as well.)
- Make sure that there are no loose connections.

Power Supply Voltage

• Make sure that the voltage corresponds to the rated voltage.

Motor Installation

Make sure that the Servomotor is securely installed.

Disconnection from Mechanical System

• If necessary, make sure that the motor has been disconnected from the mechanical system.

Brake Released

• Make sure that the brake has been released.

Trial Operation in Position Control Mode

- 1. Use the Connector CN1.
- 2. Turn ON the Servo Drive power.
- 3. Confirm that the parameters are set to the standard set values.
- 4. Set to the output from the host device that agrees using the Command Pulse Input Mode (Pn007).
- 5. Write the parameters to EEPROM and then turn OFF the power supply and turn it ON again.
- 6. Apply 12 to 24 VDC between the operation command input (RUN: CN1 pin 29) and +24VIN (CN1 pin 7). Servo ON status will be entered and the Servomotor will be activated.
- 7. Input a low-frequency pulse signal from the host device to start low-speed operation.

Check to see if the motor is rotating at the set speed and to see if the motor stops when the command (pulses) are stopped.

Trial Operation in Speed Control Mode

- 1. Use the Connector CN1.
- 2. Turn ON the Servo Drive power.
- 3. Confirm that the parameters are set to the standard set values.
- 4. Apply 12 to 24 VDC between the operation command input (RUN: CN1 pin 29) and +24VIN (CN1 pin 7). Servo ON status will be entered and the Servomotor will be activated.
- 5. Gradually vary the DC voltage between the speed command input (REF, CN1 pin 14) and AGND1 (CN1 pin 15) from 0 V in the positive and negative directions. Check to see if the Servomotor rotates.

Check to see if the motor is rotating at the set speed and to see if the motor stops when the command are stopped.

Use the following parameters to change the motor rotation speed or direction.

- Pn302: Speed Command Scale
- Pn303: Command Speed Rotation Direction Switching

Trial Operation in Torque Control Mode

- 1. Use the Connector CN1.
- 2. Turn ON the Servo Drive power.
- 3. Confirm that the parameters are set to the standard set values.
- 4. Set the Speed Limit Value Setting (Pn321) to a low value.
- 5. Apply 12 to 24 VDC between the operation command input (RUN: CN1 pin 29) and +24VIN (CN1 pin 7). Servo ON status will be entered and the Servomotor will be activated.
- 6. Apply a positive or negative DC voltage between the torque command input TREF1 (CN1 pin 14) and AGND1 (CN1 pin 15). Check to see if the motor rotates according to the direction (forward/reverse) set in Pn307.

Use the following parameters to change the amount of the torque, direction of the torque, or speed limit value for the command voltage.

- Pn321: Speed Limit Value Setting (default set value: 0 r/min)
- Pn319: Torque Command Scale
- Pn320: Torque Output Direction Switching

Trial Operation in Fully-closed Control Mode

- 1. Use the Connector CN1.
- 2. Turn ON the Servo Drive power.
- 3. Turn ON the power supply to the Servo Drive.
- 4. Confirm that the parameters are set to the standard set values.
- 5. Set the outputs from the host device to agree with the Command Pulse Mode (Pn005).
- 6. Write the parameters to EEPROM and then turn OFF the power supply and turn it ON again.
- 7. Apply 12 to 24 VDC between the operation command input (RUN: CN1 pin 29) and +24VIN (CN1 pin 7). Servo ON status will be entered and the Servomotor will be activated.
- 8. Input a low-frequency pulse signal from the host device to start low-speed operation.

Check to see if the motor is rotating at the set speed and to see if the motor stops when the command (pulses) are stopped.



Adjustment Functions

This chapter explains the functions, setting methods, and items to note regarding various gain adjustments.

| 10-1 Gain Adjustment | 10-1 |
|--------------------------------|-------|
| Purpose of the Gain Adjustment | 10-1 |
| Gain Adjustment Methods | |
| Gain Adjustment Procedure | |
| 10-2 Realtime Autotuning | 10-3 |
| Setting Realtime Autotuning | 10-4 |
| Setting Machine Rigidity | |
| 10-3 Manual Tuning | 10-10 |
| Basic Settings | 10-10 |

10

10-1 Gain Adjustment

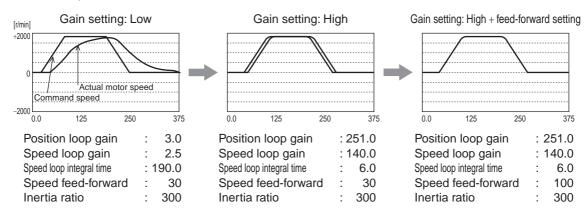
OMNUC G5-series Servo Drives provide a realtime autotuning function.

With this function, gain adjustments can be made easily even by those using a servo system for the first time. If you cannot obtain the desired responsiveness with autotuning, use manual tuning.

Purpose of the Gain Adjustment

The Servo Drive must operate the motor in response to commands from the host system with minimal time delay and maximum reliability. The gain is adjusted to bring the actual operation of the motor as close as possible to the operation specified by the commands, and to maximize the performance of the machine.

Example: Ball screw



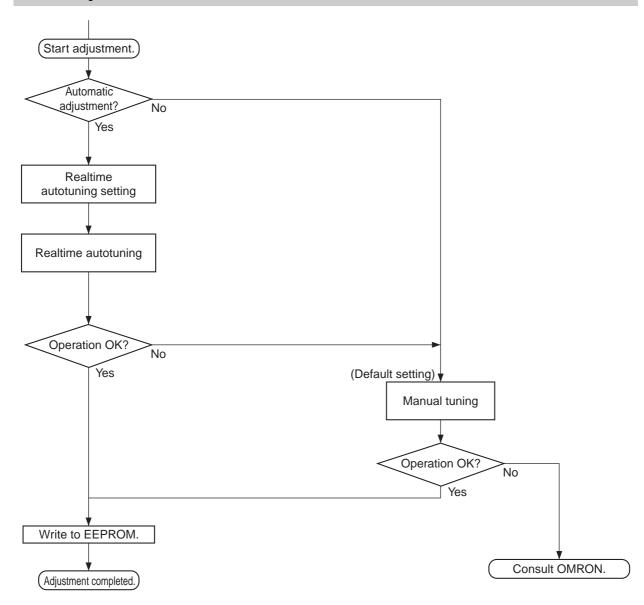
Gain Adjustment Methods

| | 1 | Function | Description | Reference page | | |
|----------------------|--|-----------------|--|----------------|--|--|
| Automatic adjustment | machine in realtime and automatically sets the optimal gain according to the estimated load inertia. | | | | | |
| Manual | Man | ual tuning | Manual adjustment is performed if autotuning cannot be executed due to restrictions on the control mode or load conditions or if ensuring that the maximum responsiveness matches each load is required. | P.10-10 | | |
| adjustment | | Basic procedure | Position Control/Fully-closed Control Mode adjustment | P.10-11 | | |
| | | | Speed Control Mode adjustment | P.10-12 | | |
| | | | Torque Control Mode adjustment | P.10-17 | | |

Note 1. Take sufficient measures to ensure safety.

Note 2.If vibration occurs (unusual noise or vibration), immediately turn OFF the power supply or turn OFF the servo.

Gain Adjustment Procedure



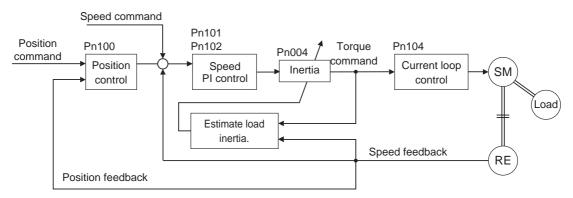
Gain Adjustment and Machine Rigidity

To improve machine rigidity:

- Install the machine on a secure base so that it does not have any play.
- Use couplings that have a high rigidity, and that are designed for servo systems.
- Use a wide timing belt. And use a tension within the range of allowable axial load for the motor or Decelerator output.
- Use gears with small backlash.
 - The specific vibration (resonance frequencies) of the mechanical system has a large impact on the gain adjustment of the servo. The servo system responsiveness cannot be set high for machines with a low resonance frequency (low machine rigidity).

10-2 Realtime Autotuning

Realtime autotuning estimates the load inertia of the machine in realtime, and operates the machine by automatically setting the gain according to the estimated load inertia. At the same time, it can lower the resonance and vibration if the adaptive filter is enabled. Realtime autotuning is enabled for any control to adjust the speed loop PI control.



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Precautions for Correct Use

 Realtime autotuning may not function properly under the conditions described in the following table. In such cases, use manual tuning.

| | Conditions under which realtime autotuning does not operate properly |
|-------------------|--|
| Load inertia | If the load inertia is too small or too large compared with the rotor inertia (less than 3 times, more than 20 times, or more than the applicable load inertia ratio). If the load inertia changes quickly. (in less than 10 s) |
| Load | If the machine rigidity is extremely low. If there is backlash or play in the system. |
| Operation pattern | If the speed continues at below 100 r/min. If the acceleration/deceleration is below 2,000 r/min in 1 s. If the acceleration/deceleration torque is too small compared with the unbalanced load and the viscous friction torque. If either a speed of 100 r/min or higher, or an acceleration/deceleration of 2,000 r/min/s does not last for at least 50 ms. |

 With realtime autotuning, each parameter is fixed to the value in the machine rigidity table at the time the machine rigidity is set. By estimating the load inertia from the operation pattern, the operation coefficient for the speed loop gain and the integral time constant are altered. Doing this for each pattern can cause vibration, so the estimation value is set conservatively.

Setting Realtime Autotuning

- 1. When setting realtime autotuning, turn the servo OFF.
- 2. Set Realtime Autotuning Mode Selection (Pn002) depending on the load.

Normally, set the parameter to 1 or 2. When using a vertical axis, set the parameter to 3 or 4. A setting of 5 is used in combination with a software tool. Do not set the parameter to 5 for normal operation.

The gain switching function is enabled for set values 2 to 4. If Pn002 is set to 2 to 4, the Switching Mode in Position Control (Pn115) must be set to 10 (Combination of command pulse input and speed). The gain is switched according to this switching condition setting. Refer to page "Gain Switching Setting for Each Control Mode" (P.6-30) for details on setting the Switching Mode in Position Control (Pn115).

| Set value | Realtime autotuning | Description |
|--------------|---|---|
| 0 | Disabled | Realtime autotuning is disabled. |
| 1 | Focus on stability (default setting) | No unbalanced load, friction compensation, or gain switching. |
| 2 | Focus on position control | Used when unbalanced load and friction are small. Gain switching is set. |
| 3 | Vertical axis | Used when an unbalanced load is present, such as a vertical axis. |
| 4 | Friction compensation and vertical axis | Used when a vertical axis or other unbalanced load is present and when friction is large. |
| 5 | Load characteristic estimation | Used only for estimating load characteristics. |
| 6 | Customization | Used to customize the Realtime Autotuning Mode. |

Setting Machine Rigidity

1. Set the Realtime Autotuning Machine Rigidity Selection (Pn003) according to the table below.

Start from the lower machine rigidity number and check the operation.

| Machine configuration and drive method | Realtime Autotuning Machine Rigidity Selection (Pn003) |
|--|---|
| Ball screw direct coupling | 12 to 24 |
| Ball screw and timing belt | 8 to 20 |
| Timing belt | 4 to 16 |
| Gears, rack and pinion drives | 4 to 16 |
| Other machines with low rigidity | 1 to 8 |
| Stacker cranes | Perform manual tuning. |

2. Turn the servo ON and operate the machine with a normal pattern.

To increase responsiveness, increase the machine rigidity number, and check the response. If vibration occurs, enable the adaptive filter and operate. If already enabled, lower the machine rigidity number.

• The adaptive filter can be left enabled even when disabling realtime autotuning after completing adjustments. Even if the adaptive filter is disabled, the set values of notch filters 3 and 4 will be maintained.



Precautions for Correct Use

- Unusual noise or vibration may occur until the load inertia is estimated or the adaptive filter stabilizes after startup, immediately after the first servo ON, or when the Realtime Autotuning Machine Rigidity Selection (Pn003) is increased. This is not an error if it disappears right away. If the unusual noise or vibration, however, continues for 3 or more reciprocating operations, take the following measures in any order you can.
 - Write the parameters used during normal operation to the EEPROM.
 - Lower the Realtime Autotuning Machine Rigidity Selection (Pn003).
 - · Manually set the notch filter.
- Once unusual noise or vibration occurs, Inertia Ratio (Pn004), Torque Command Value Offset (Pn607), Forward Direction Torque Offset (Pn608), and Reverse Direction Torque Offset (Pn609) may have changed to an extreme value. In this case, also take the measures described above.
- Out of the results of realtime autotuning, the Inertia Ratio (Pn004), Torque Command Value Offset (Pn607), Forward Direction Torque Offset (Pn608) and Reverse Direction Torque Offset (Pn609) are automatically saved to the EEPROM every 30 minutes. Realtime autotuning will use this saved data as the default setting when the power supply is turned OFF and turned ON again.
- The parameter will automatically be set based on the Realtime Autotuning Machine Rigidity Setting (Pn003) if realtime autotuning is enabled.

Realtime Autotuning (RTAT) Parameter Table

| Parameter number | Parameter name | AT Machine Rigidity Setting (Pn003) | | | | | | | | |
|------------------|--|-------------------------------------|----------|-------------------|-------|-------|-------|-------|-------|--|
| Hamber | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Pn004 | Inertia Ratio | Estima | ted load | l inertia | ratio | | | | | |
| Pn100 | Position Loop Gain | 20 | 25 | 30 | 40 | 45 | 55 | 75 | 95 | |
| Pn101 | Speed Loop Gain | 15 | 20 | 25 | 30 | 35 | 45 | 60 | 75 | |
| Pn102 | Speed Loop Integral Time Constant | 3700 | 2800 | 2200 | 1900 | 1600 | 1200 | 900 | 700 | |
| Pn103 | Speed Feedback Filter Time Constant | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn104 | Torque Command Filter Time Constant 1*1 | 1500 | 1100 | 900 | 800 | 600 | 500 | 400 | 300 | |
| Pn105 | Position Loop Gain 2 | 25 | 30 | 40 | 45 | 55 | 70 | 95 | 120 | |
| Pn106 | Speed Loop Gain 2 | 15 | 20 | 25 | 30 | 35 | 45 | 60 | 75 | |
| Pn107 | Speed Loop Integral Time Constant 2*2 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | |
| Pn108 | Speed Feedback Filter Time Constant 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn109 | Torque Command Filter Time Constant 2*1 | 1500 | 1100 | 900 | 800 | 600 | 500 | 400 | 300 | |
| Pn110 | Speed Feed-forward Amount | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | |
| Pn111 | Speed Feed-forward Command Filter | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | |
| Pn112 | Torque Feed-forward Amount | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn113 | Torque Feed-forward Command Filter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn114 | Gain Switching Input Operating Mode Selection | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Pn115 | Switching Mode in Position Control | | | Enable Disable | | | l | l | l | |
| Pn116 | Gain Switching Delay Time in Position Control | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | |
| Pn117 | Gain Switching Level in Position Control | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | |
| Pn118 | Gain Switching Hysteresis in Position Control | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | |
| Pn119 | Position Gain Switching Time | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | |
| Pn120 | Switching Mode in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn121 | Gain Switching Delay Time in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

| Parameter number | Parameter name | AT Machine Rigidity Setting (Pn003) | | | | | | | | | |
|---------------------|--|-------------------------------------|-----|------------|----------|----------|----------|-----------|--------|--|--|
| Humber | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | |
| Pn122 | Gain Switching Level in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn123 | Gain Switching Hysteresis in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn124 | Switching Mode in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn125 | Gain Switching Delay Time in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn126 | Gain Switching Level in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn127 | Gain Switching Hysteresis in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn605 | Gain 3 Effective Time | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn606 | Gain 3 Ratio Setting | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | | |
| Pn607 | Torque Command Value Offset | If Pn0 comm | | or 4, this | s is the | estimate | ed offse | t for the | torque | | |
| Pn608 | Forward Direction Torque Offset | If Pn0 comm | | or 4, this | s is the | estimate | ed offse | t for the | torque | | |
| Pn609 | Reverse Direction Torque Offset | If Pn0 comm | | or 4, this | s is the | estimate | ed offse | t for the | torque | | |
| Pn610.0, Pn610.3 | Function Expansion Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn611 | Electric Current Response Setting | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | | |
| Pn613 | Inertia Ratio 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn623 | Disturbance Torque Compensation Gain | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn624 | Disturbance Observer Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

^{*1.} This is limited to a minimum value of 10 if a 17-bit absolute encoder is used.

^{*2} If realtime autotuning is performed in vertical axis mode or friction compensation and vertical axis mode, the value will be 9999 until load characteristic estimation (estimation of the inertia ratio, torque command value offset, and forward/reverse direction torque offset) is completed. The value will change to 10000 after the load characteristic estimation is completed.

| Parameter number | Parameter name | AT Machine Rigidity Setting (Pn003) | | | | | | | | |
|------------------|--|-------------------------------------|----------|----------|-------|-------|-------|-------|-------|--|
| Humber | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | |
| Pn004 | Inertia Ratio | Estima | ted load | linertia | ratio | | | | | |
| Pn100 | Position Loop Gain | 115 | 140 | 175 | 320 | 390 | 480 | 630 | 720 | |
| Pn101 | Speed Loop Gain | 90 | 110 | 140 | 180 | 220 | 270 | 350 | 400 | |
| Pn102 | Speed Loop Integral Time Constant | 600 | 500 | 400 | 310 | 250 | 210 | 160 | 140 | |
| Pn103 | Speed Feedback Filter Time Constant | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn104 | Torque Command Filter Time Constant 1*1 | 300 | 200 | 200 | 126 | 103 | 84 | 65 | 57 | |
| Pn105 | Position Loop Gain 2 | 140 | 175 | 220 | 380 | 460 | 570 | 730 | 840 | |
| Pn106 | Speed Loop Gain 2 | 90 | 110 | 140 | 180 | 220 | 270 | 350 | 400 | |
| Pn107 | Speed Loop Integral Time Constant 2*2 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | |
| Pn108 | Speed Feedback Filter Time Constant 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn109 | Torque Command Filter Time Constant 2*1 | 300 | 200 | 200 | 126 | 103 | 84 | 65 | 57 | |
| Pn110 | Speed Feed-forward Amount | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | |
| Pn111 | Speed Feed-forward Command Filter | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | |
| Pn112 | Torque Feed-forward Amount | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn113 | Torque Feed-forward Command Filter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn114 | Gain Switching Input Operating Mode Selection | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |

| Parameter number | Parameter name | | AT | Machin | e Rigid | ity Sett | ing (Pn | 003) | | | |
|---------------------|--|--|-------------------|---------|----------|----------|----------|-----------|-------|--|--|
| Hullibei | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | |
| Pn115 | Switching Mode in Position Control | Gain Switching Enable Mode: 10 Gain Switching Disable Mode: 0 | | | | | | | | | |
| Pn116 | Gain Switching Delay Time in Position Control | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | | |
| Pn117 | Gain Switching Level in Position Control | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | | |
| Pn118 | Gain Switching Hysteresis in Position Control | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | | |
| Pn119 | Position Gain Switching Time | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | | |
| Pn120 | Switching Mode in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn121 | Gain Switching Delay Time in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn122 | Gain Switching Level in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn123 | Gain Switching Hysteresis in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn124 | Switching Mode in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn125 | Gain Switching Delay Time in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn126 | Gain Switching Level in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn127 | Gain Switching Hysteresis in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn605 | Gain 3 Effective Time | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn606 | Gain 3 Ratio Setting | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | | |
| Pn607 | Torque Command Value Offset | If Pn00 comma | 12 = 3 oi and. | 4, this | is the e | stimated | d offset | for the t | orque | | |
| Pn608 | Forward Direction Torque Offset | If Pn00 comma | 12 = 3 oi and. | 4, this | is the e | stimated | d offset | for the t | orque | | |
| Pn609 | Reverse Direction Torque Offset | If Pn00 comma | 12 = 3 oi and. | 4, this | is the e | stimated | d offset | for the t | orque | | |
| Pn610.0, Pn610.3 | Function Expansion Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn611 | Electric Current Response Setting | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | | |
| Pn613 | Inertia Ratio 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn623 | Disturbance Torque Compensation Gain | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Pn624 | Disturbance Observer Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |

^{*1.} This is limited to a minimum value of 10 if a 17-bit absolute encoder is used.

^{*2} If realtime autotuning is performed in vertical axis mode or friction compensation and vertical axis mode, the value will be 9999 until load characteristic estimation (estimation of the inertia ratio, torque command value offset, and forward/reverse direction torque offset) is completed. The value will change to 10000 after the load characteristic estimation is completed.

| Parameter number | Parameter name | AT Machine Rigidity Setting (Pn003) | | | | | | | |
|------------------|---|-------------------------------------|----------|----------|-------|-------|-------|-------|-------|
| | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| Pn004 | Inertia Ratio | Estima | ted load | Iinertia | ratio | | | | |
| Pn100 | Position Loop Gain | 900 | 1080 | 1350 | 1620 | 2060 | 2510 | 3050 | 3770 |
| Pn101 | Speed Loop Gain | 500 | 600 | 750 | 900 | 1150 | 1400 | 1700 | 2100 |
| Pn102 | Speed Loop Integral Time Constant | 120 | 110 | 90 | 80 | 70 | 60 | 50 | 40 |
| Pn103 | Speed Feedback Filter Time Constant | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn104 | Torque Command Filter Time Constant 1*1 | 45 | 38 | 30 | 25 | 20 | 16 | 13 | 11 |
| Pn105 | Position Loop Gain 2 | 1050 | 1260 | 1570 | 1880 | 2410 | 2930 | 3560 | 4400 |
| Pn106 | Speed Loop Gain 2 | 500 | 600 | 750 | 900 | 1150 | 1400 | 1700 | 2100 |
| Pn107 | Speed Loop Integral Time Constant 2*2 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| Pn108 | Speed Feedback Filter Time Constant 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Parameter | Parameter name | AT Machine Rigidity Setting (Pn003) | | | | | | | | |
|---------------------|--|-------------------------------------|-----|------------|--------------------|----------|----------|---------|--------|--|
| number | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | |
| Pn109 | Torque Command Filter Time Constant 2*1 | 45 | 38 | 30 | 25 | 20 | 16 | 13 | 11 | |
| Pn110 | Speed Feed-forward Amount | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 | |
| Pn111 | Speed Feed-forward Command Filter | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | |
| Pn112 | Torque Feed-forward Amount | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn113 | Torque Feed-forward Command Filter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn114 | Gain Switching Input Operating Mode Selection | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| Pn115 | Switching Mode in Position Control | | | _ | le Mode le Mode | | | | | |
| Pn116 | Gain Switching Delay Time in Position Control | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 | |
| Pn117 | Gain Switching Level in Position Control | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 | |
| Pn118 | Gain Switching Hysteresis in Position Control | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | |
| Pn119 | Position Gain Switching Time | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 | |
| Pn120 | Switching Mode in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn121 | Gain Switching Delay Time in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn122 | Gain Switching Level in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn123 | Gain Switching Hysteresis in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn124 | Switching Mode in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn125 | Gain Switching Delay Time in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn126 | Gain Switching Level in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn127 | Gain Switching Hysteresis in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn605 | Gain 3 Effective Time | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn606 | Gain 3 Ratio Setting | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| Pn607 | Torque Command Value Offset | If Pn0 comm | | or 4, this | is the e | estimate | d offset | for the | torque | |
| Pn608 | Forward Direction Torque Offset | If Pn0 comm | | or 4, this | is the e | estimate | d offset | for the | torque | |
| Pn609 | Reverse Direction Torque Offset | If Pn0 comm | | or 4, this | is the e | estimate | d offset | for the | torque | |
| Pn610.0, Pn610.3 | Function Expansion Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn611 | Electric Current Response Setting | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | |
| Pn613 | Inertia Ratio 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn623 | Disturbance Torque Compensation Gain | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| Pn624 | Disturbance Observer Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |

^{*1.} This is limited to a minimum value of 10 if a 17-bit absolute encoder is used.

^{*2} If realtime autotuning is performed in vertical axis mode or friction compensation and vertical axis mode, the value will be 9999 until load characteristic estimation (estimation of the inertia ratio, torque command value offset, and forward/reverse direction torque offset) is completed. The value will change to 10000 after the load characteristic estimation is completed.

| Parameter number | Parameter name | AT Machine Rigidity Setting (Pn003) | | | | | | | | |
|------------------|-----------------------------------|-------------------------------------|------|------|------|------|------|------|------|--|
| | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | |
| Pn004 | Inertia Ratio | Estimated load inertia ratio | | | | | | | | |
| Pn100 | Position Loop Gain | 4490 | 5000 | 5600 | 6100 | 6600 | 7200 | 8100 | 9000 | |
| Pn101 | Speed Loop Gain | 2500 | 2800 | 3100 | 3400 | 3700 | 4000 | 4500 | 5000 | |
| Pn102 | Speed Loop Integral Time Constant | 40 | 35 | 30 | 30 | 25 | 25 | 20 | 20 | |

| Pn103 Speed Feedback Filter Time Constant 0 0 0 0 0 0 0 0 0 | Parameter Parameter name | | AT Machine Rigidity Setting (Pn003) | | | | | | | |
|--|--------------------------|---|-------------------------------------|-------|---------|----------|----------|----------|-----------|-------|
| Pn104 Torque Command Filter Time Constant 1 ⁵¹ 9 | number | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| Pn105 Position Loop Gain 2 S240 S900 8500 7100 7700 8400 9400 10500 Pn106 Speed Loop Integral Time Constant 2" 2500 2800 3100 3400 3700 4500 5000 5000 Pn107 Speed Loop Integral Time Constant 2" 100000 100000 10000 10000 10000 10000 1000 | Pn103 | Speed Feedback Filter Time Constant | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn106 Speed Loop Gain 2 2500 2800 3100 3400 3700 4000 4500 5000 50107 Speed Loop Integral Time Constant 2 2 0 0 0 0 0 0 0 0 | Pn104 | Torque Command Filter Time Constant 1*1 | 9 | 8 | 7 | 7 | 6 | 6 | 5 | 5 |
| Pn107 Speed Loop Integral Time Constant 2" 10000 | Pn105 | Position Loop Gain 2 | 5240 | 5900 | 6500 | 7100 | 7700 | 8400 | 9400 | 10500 |
| Pn108 Speed Feedback Filter Time Constant 2 0 0 0 0 0 0 0 0 0 | Pn106 | Speed Loop Gain 2 | 2500 | 2800 | 3100 | 3400 | 3700 | 4000 | 4500 | 5000 |
| Pn109 | Pn107 | Speed Loop Integral Time Constant 2*2 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 | 10000 |
| Pn110 | Pn108 | Speed Feedback Filter Time Constant 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn111 | Pn109 | Torque Command Filter Time Constant 2*1 | 9 | 8 | 7 | 7 | 6 | 6 | 5 | 5 |
| Pn112 | Pn110 | Speed Feed-forward Amount | 300 | 300 | 300 | 300 | 300 | 300 | 300 | 300 |
| Pn113 | Pn111 | Speed Feed-forward Command Filter | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| Pn114 | Pn112 | Torque Feed-forward Amount | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn114 Selection | Pn113 | Torque Feed-forward Command Filter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ph | Pn114 | , , , | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Pn117 Gain Switching Level in Position Control 50 | Pn115 | Switching Mode in Position Control | | | • | | | | | |
| Pn118 | Pn116 | Gain Switching Delay Time in Position Control | 30 | 30 | 30 | 30 | 30 | 30 | 30 | 30 |
| Pn119 | Pn117 | Gain Switching Level in Position Control | 50 | 50 | 50 | 50 | 50 | 50 | 50 | 50 |
| Pn120 | Pn118 | , | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| Pn121 Gain Switching Delay Time in Speed Control 0< | Pn119 | Position Gain Switching Time | 33 | 33 | 33 | 33 | 33 | 33 | 33 | 33 |
| Pn122 Gain Switching Level in Speed Control 0 | Pn120 | Switching Mode in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn123 Gain Switching Hysteresis in Speed Control 0 | Pn121 | Gain Switching Delay Time in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn124 Switching Mode in Torque Control 0 | Pn122 | Gain Switching Level in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn125 Gain Switching Delay Time in Torque Control 0 | Pn123 | Gain Switching Hysteresis in Speed Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn125 | Pn124 | Switching Mode in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn127 Gain Switching Hysteresis in Torque Control 0 | Pn125 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn605 Gain 3 Effective Time 0 <td>Pn126</td> <td>Gain Switching Level in Torque Control</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> | Pn126 | Gain Switching Level in Torque Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn606 Gain 3 Ratio Setting 100 | Pn127 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn607 Torque Command Value Offset If Pn002 = 3 or 4, this is the estimated offset for the torque command. Pn608 Forward Direction Torque Offset If Pn002 = 3 or 4, this is the estimated offset for the torque command. Pn609 Reverse Direction Torque Offset If Pn002 = 3 or 4, this is the estimated offset for the torque command. Pn610.0, Pn610.3 Function Expansion Setting O O O O O O O O O O O O O O O O O O | Pn605 | Gain 3 Effective Time | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn607 Torque Command Value Offset command. Pn608 Forward Direction Torque Offset If Pn002 = 3 or 4, this is the estimated offset for the torque command. Pn609 Reverse Direction Torque Offset If Pn002 = 3 or 4, this is the estimated offset for the torque command. Pn610.0, Pn610.3 Function Expansion Setting 0 0 0 0 0 0 0 Pn611 Electric Current Response Setting 100 100 100 100 100 100 100 Pn613 Inertia Ratio 2 0 0 0 0 0 0 0 0 Pn623 Disturbance Torque Compensation Gain 0 0 0 0 0 0 0 | Pn606 | Gain 3 Ratio Setting | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Pn608 Forward Direction Torque Offset command. Pn609 Reverse Direction Torque Offset If Pn002 = 3 or 4, this is the estimated offset for the torque command. Pn610.0, Pn610.3 Function Expansion Setting 0 0 0 0 0 0 0 0 Pn611 Electric Current Response Setting 100 | Pn607 | Torque Command Value Offset | | | 4, this | is the e | stimated | d offset | for the t | orque |
| Pn609 Reverse Direction Torque Offset | Pn608 | Forward Direction Torque Offset | | | 4, this | is the e | stimated | d offset | for the t | orque |
| Pn610.3 Function Expansion Setting 0 100 1 | Pn609 | Reverse Direction Torque Offset | | | 4, this | is the e | stimated | d offset | for the t | orque |
| Pn613 Inertia Ratio 2 0 | | Function Expansion Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn623 Disturbance Torque Compensation Gain 0 0 0 0 0 0 0 | Pn611 | Electric Current Response Setting | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| | Pn613 | Inertia Ratio 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pn624 Disturbance Observer Filter Setting 0 0 0 0 0 0 0 | Pn623 | Disturbance Torque Compensation Gain | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Pn624 | Disturbance Observer Filter Setting | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

^{*1.} This is limited to a minimum value of 10 if a 17-bit absolute encoder is used.

^{*2} If realtime autotuning is performed in vertical axis mode or friction compensation and vertical axis mode, the value will be 9999 until load characteristic estimation (estimation of the inertia ratio, torque command value offset, and forward/reverse direction torque offset) is completed. The value will change to 10000 after the load characteristic estimation is completed.

[•] The parameters Pn103, Pn108, Pn110 to Pn127, Pn605, Pn606, Pn610, Pn611, Pn613, Pn623 and Pn624 are set to fixed values.

10-3 Manual Tuning

Basic Settings

As described before, the OMNUC G5-series Servo Drives have a realtime autotuning function. Readjustment, however, is required if realtime autotuning cannot adjust the gain properly for same reasons: there is a restriction by load conditions, or a necessity to ensue optimum responsiveness and stability for each load.

This section describes how to perform manual tuning for each control mode and function.

Before Manual Setting

More reliable adjustment can be performed quickly by using waveform monitoring with the data tracing function of the CX-Drive or by measuring the analog voltage waveform with the monitor function.

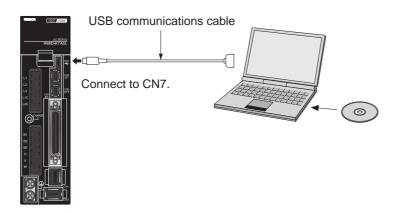
Analog Monitor Output

The actual motor speed, command speed, torque, and number of accumulated pulses can be measured in the analog voltage level using an oscilloscope or other device. The type of signal to output and the output voltage level are set with Analog Monitor 1 Selection (Pn416) and Analog Monitor 2 Selection (Pn418) settings. For details, refer to "12-2 Parameter List" (P.12-11).

The refresh period of the analog monitor is 1 ms.

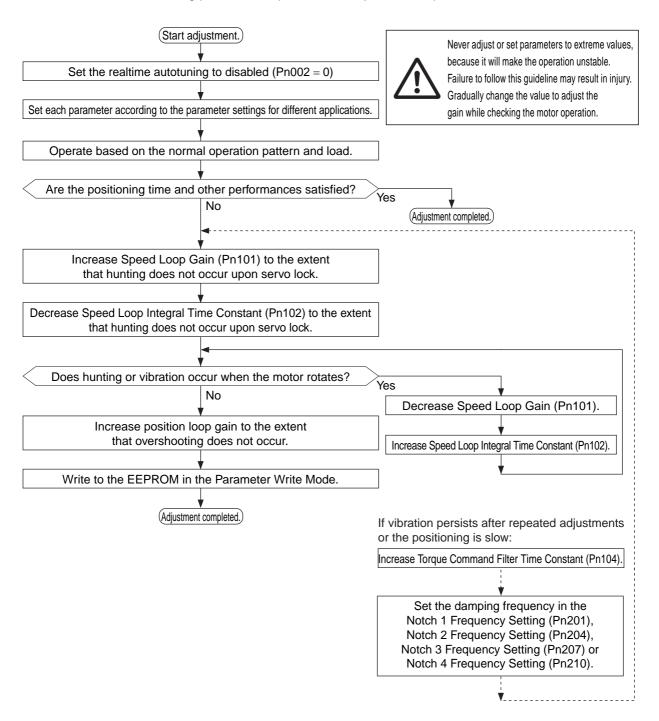
CX-Drive Data Tracing Function

Commands to the motor and motor operation (speed, torque command, and position error) can be displayed on a computer as waveforms. Refer to the *CX-Drive Operation Manual* (Cat. No. W453).



Position Control/Fully-closed Control Mode Adjustment

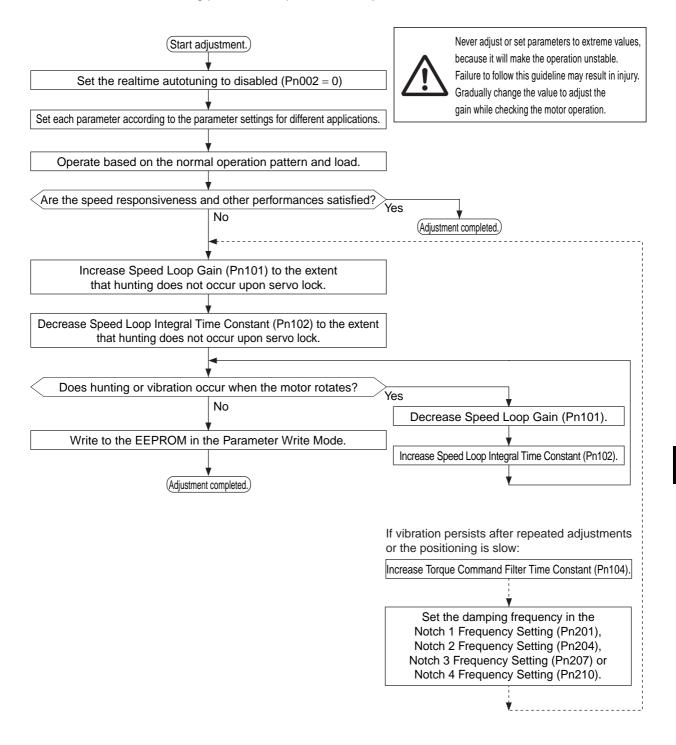
Use the following procedure to perform the adjustment in position control for the Servo Drive.



Speed Control Mode Adjustment

Adjustments in speed control for the OMNUC G5 Series are very similar to Position Control Mode adjustment.

Use the following procedure to perform the adjustment.



Servo Manual Tuning Method

The following 4 parameters are the basic servo adjustment parameters.

If desired operation characteristics are obtained by adjusting the following 4 parameters, the adjustments of other parameters are not necessary.

| Parameter number | Parameter name | Default setting | Parameter number 2 |
|------------------|--|-----------------|--------------------|
| Pn100 | Position Loop Gain | 48.0 [1/s] | Pn105 |
| Pn101 | Speed Loop Gain | 27.0 Hz | Pn106 |
| Pn102 | Speed Loop Integral Time Constant | 21.0 ms | Pn107 |
| Pn104 | Torque Command Filter Time Constant | 0.84 ms | Pn109 |

Adjustment of Each Parameter

The control loop for the servo consists of, from the outside, a position loop, speed loop and current loop.

The inner loop is affected by the outer loop, and the outer loop is affected by the inner loop. What determines the default setting includes the structure and the rigidity of the machine, and the inertia ratio

Guide of each parameter for different applications is as follows.

Parameter Settings for Different Applications

| Application name | Inertia | Rigidity | Position loop gain [1/s] | Speed loop gain [Hz] | Speed loop integral time constant | Torque command filter time constant [x 0.01 ms] |
|------------------------------------|---------|-----------|--------------------------------|----------------------------|-----------------------------------|---|
| Ball screw horizontal | Large | Low | 20 | 140 | 35 | 160 |
| Ball screw horizontal | Medium | Medium | 40 | 80 | 20 | 100 |
| Ball screw horizontal | Small | High | 80 | 60 | 15 | 80 |
| Ball screw vertical | Large | Low | 20 | 160 | 45 | 160 |
| Ball screw vertical | Medium | Medium | 40 | 80 | 30 | 120 |
| Ball screw vertical | Small | High | 60 | 60 | 20 | 100 |
| Ball screw nut rotation horizontal | Large | Low | 20 | 140 | 40 | 160 |
| Ball screw nut rotation horizontal | Medium | Medium | 40 | 100 | 30 | 120 |
| Ball screw nut rotation vertical | Large | Low | 20 | 160 | 45 | 160 |
| Ball screw nut rotation vertical | Medium | Medium | 40 | 120 | 25 | 120 |
| Timing belt | Large | Low | 20 | 160 | 60 | 160 |
| Timing belt | Medium | Medium | 30 | 120 | 40 | 120 |
| Rack and pinion drives | Large | Low | 20 | 160 | 60 | 160 |
| Rack and pinion drives | Large | Medium | 30 | 120 | 40 | 120 |
| Rack and pinion drives | Medium | Medium | 40 | 100 | 20 | 100 |
| Index table | Large | Medium | 40 | 120 | 25 | 120 |
| Index table | Small | High | 80 | 120 | 20 | 100 |
| Robot arm cylinder | Large | Low | 15 | 160 | 60 | 160 |
| Robot arm cylinder | Medium | Medium | 25 | 120 | 40 | 120 |
| Other general-purpose | Medium | Medium | 30 | 100 | 30 | 150 |
| + Inartia Datia (Dn004) ia s | | -1 -1 000 | 20/ | 1 | 1 | l. |

[•] Inertia Ratio (Pn004) is when fixed at 300%.

Inertia guide

| The inertia is small. | 5 times the rotor inertia max. |
|------------------------|---------------------------------------|
| The inertia is medium. | 5 to 10 times the rotor inertia max. |
| The inertia is large. | 10 to 20 times the rotor inertia max. |

Pn100 and Pn105 Position Loop Gain

This loop controls the number of pulses from encoder to be the designated number of pulses. This is called an error counter, and when the pulse is equal to or lower than the specified value, positioning is completed and the signal is output.

The ratio of maximum speed used and error counter is called a position loop gain.

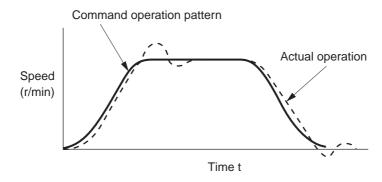
For the position loop gain, use the inverse of Speed Loop Integral Time Constant (Pn102) as a guide for setting. Setting Pn102 to 100 ms results in 10 [1/s].

There will be no overshooting under this condition. To quicken positioning, increase the value of position loop gain. If the value is too large, overshooting or vibration will occur. In such cases, set the value smaller.

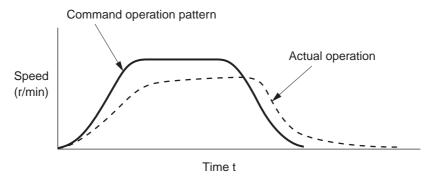
If the speed loop or the current loop is vibrating, adjusting the position loop does not eliminate the vibration.

Response to the position loop gain adjustment is illustrated below.

• If the position loop gain is high, an overshooting occurs.



• If the position loop gain is low, positioning completion speed becomes slow.



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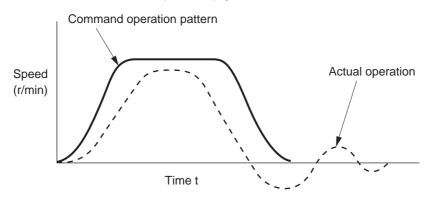
Pn101 and Pn106 Speed Loop Gain

The speed loop gain determines the responsiveness of the servo.

This value becomes the response frequency if the Inertia Ratio (Pn004) is set correctly. Increasing the value of the speed loop gain improves the responsiveness and quickens positioning, but vibration is more likely to occur. Adjustment must be made so vibration will not occur

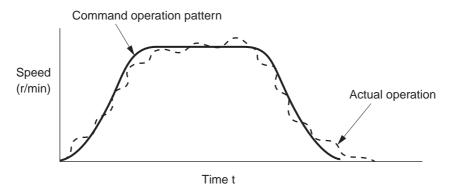
This is related to Speed Loop Integral Time Constant (Pn102), and by increasing the integral time constant, the speed loop gain value can be increased.

• If the speed loop gain is low, the speed response becomes slow and a large overshooting occurs. In such case, increase the speed loop gain.



• If the speed loop gain is high, vibrations are more likely to occur. Vibration or resonance may not disappear.

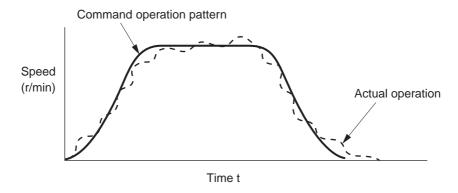
In such case, decrease the speed loop gain.



Pn102 and Pn107 Speed Loop Integral Time Constant

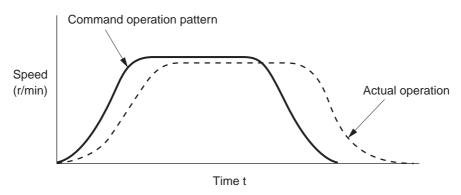
The speed loop integral time constant also determines the responsiveness of the servo.

• If the speed loop integral time constant is low, vibration or resonance occurs. In such case, increase the speed loop integral time constant.



• If the speed loop integral time constant is high, the response is delayed. The servo rigidity becomes weak.

In such case, decrease the speed loop integral time constant.



Pn104 and Pn109 Torque Command Filter Time Constant (Current Loop Input Adjustment)

The torque command filter applies a filter so the current command from the speed loop becomes smooth. The result is a smooth current flow which suppresses vibration.

The default setting of the filter time constant is 84 (0.84 ms).

Increase the value to reduce vibration. Increasing the value slows the response.

As a guide, aim for about 1/25 of the Speed Loop Integral Time Constant (Pn102).

Also, the torque command filter reduces vibration due to the machine rigidity.

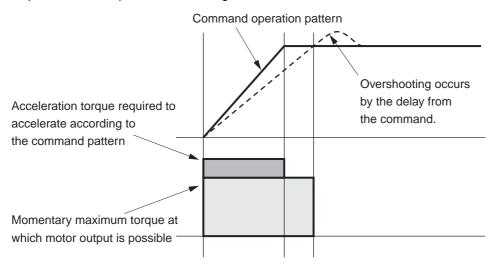
This is related to Speed Loop Gain (Pn101), and if Pn101 is too large, increasing the torque command filter time constant does not reduce vibration.

If there is machine resonance such as with the ball screw, vibration is reduced by using notch filters such as Pn201, Pn204, Pn207 and Pn210. Or, enable the adaptive filter.

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Other Adjustments

If the torque loop is saturated because the acceleration time is short or the load torque is large, an overshooting occurs for the speed response. In such case, increase the acceleration time to prevent the torque from saturating.



Torque Control Mode Adjustment

This is a torque control based on the speed control loop where the speed limit is the speed limit value from Speed Limit (Pn304, Pn305, Pn306 or Pn307). This section describes the settings for these speed limit values.

Setting Speed Limit Values

- If Torque Command/Speed Limit Selection (Pn317) is 0, speed limit is the value set by Speed Limit Value Setting (Pn321) and Reverse Direction Speed Limit Value Setting (Pn322). If Torque Command/Speed Limit Selection (Pn317) is 1, the speed limit is the value obtained by converting the voltage applied to analog input 1 with Torque Command Scale (Pn319).
- When the motor speed approaches the speed limit value, the speed control switches to that using Speed Limit Value Setting (Pn321) and Reverse Direction Speed Limit Value Setting (Pn322) as commands.
- To have a stable operation while the speed is limited, the parameter should be set according to "Speed Control Mode Adjustment".
- The torque may not be produced as specified by the torque command because the input to the torque limit section is small, when the speed limit values in Speed Limit Value Setting (Pn321) and Reverse Direction Speed Limit Value Setting (Pn322) are too low, when the speed loop gain is too low, or when the speed loop integral time constant is 10,000 (disabled).



Troubleshooting and Maintenance

This chapter explains the items to check when problems occur, error diagnosis using the alarm LED display and measures, error diagnosis based on the operating condition and measures, and periodic maintenance.

| 11-1 | Troubleshooting | 11-1 |
|------|--|---|
| | Preliminary Checks When a Problem Occurs | 11-1 |
| | Precautions When a Problem Occurs | 11-2 |
| | Replacing the Servomotor or Servo Drive | 11-3 |
| 11-2 | Warning List | 11-4 |
| 11-3 | Alarm List | 11-5 |
| | | |
| 11-4 | Troubleshooting | 11-10 |
| 11-4 | Troubleshooting Error Diagnosis Using the Alarm Displays | |
| 11-4 | _ | 11-10 |
| | Error Diagnosis Using the Alarm Displays | 11-10 11-23 |
| | Error Diagnosis Using the Alarm Displays Troubleshooting Using the Operation Status | 11-10 11-23 11-27 |
| | Error Diagnosis Using the Alarm Displays Troubleshooting Using the Operation Status Periodic Maintenance | 11-10 11-23 11-27 11-27 |

11-1 Troubleshooting

Preliminary Checks When a Problem Occurs

This section explains the preliminary checks required to determine the cause of a problem if one occurs.

Checking the Power Supply Voltage

R88D-KT□F

• Check the voltage at the power supply input terminals.

Main Circuit Power Supply Input Terminals (L1, L2, L3)

R88D-KT□L (50 to 400 W) : Single-phase 100 to 120 VAC (85 to 132 V) 50/60 Hz
R88D-KT□H (100 W to 1.5 kW) : Single-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz
(750 W to 1.5 kW) : 3-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz

(2 to 15 kW) : 3-phase 200 to 230 VAC (170 to 253 V) 50/60 Hz (750 W to 15 kW) : 3-phase 380 to 480 VAC (323 to 528 V) 50/60 Hz

Control Circuit Power Supply Input Terminals (L1C, L2C)

R88D-KT□L (50 to 400 W) : Single-phase 100 to 120 VAC (85 to 132 V) 50/60 Hz
R88D-KT□H (100 W to 1.5 kW) : Single-phase 200 to 240 VAC (170 to 264 V) 50/60 Hz
(2 to 15 kW) : Single-phase 200 to 230 VAC (170 to 253 V) 50/60 Hz

R88D-KT F (750 W to 15 kW) : 24 VDC (21.6 to 26.4 V)

If the voltage is out of range, there is a risk of operation failure. Be sure that the power supply is within the specified range.

• Check the voltage of the sequence input power supply (+24 VIN terminal (CN1 pin 7)). It must be between 11 and 25 VDC.

If the voltage is out of range, there is a risk of operation failure. Be sure that the power supply is within the specified range.

Checking Whether an Alarm Has Occurred

- Make an analysis using the 7-segment LED display area in the front of the Servo Drive and using the Operation keys.
- · When an alarm has occurred
 - \dots Check the alarm display that is displayed ($\square\square$) and make an analysis based on the alarm that is indicated.
- · When an alarm has not occurred
 - ... Make an analysis according to the error conditions.
- In either case, refer to "11-4 Troubleshooting" (P.11-10) for details.

Precautions When a Problem Occurs

When checking and verifying I/O after a problem has occurred, the Servo Drive may suddenly start to operate or suddenly stop, so always take the following precautions.

You should assume that anything not described in this manual is not possible with this product.

Precautions

- Disconnect the wiring before checking for cable breakage. If you test conduction with the cable connected, test results may not be accurate due to conduction via bypassing circuit.
- If the encoder signal is lost, the motor may run away, or an alarm may occur. Be sure to disconnect the motor from the mechanical system before checking the encoder signal.
- When measuring the encoder output, perform the measurement based on the SENGND (CN1 pin 13).
- When an oscilloscope is used for measurement, it will not be affected by noise if measurements are performed using the differential between CH1 and CH2.
- When performing tests, first check that there are no persons in the vicinity of the equipment, and that the equipment will not be damaged even if the motor runs away.
 - Before performing the tests, verify that you can immediately stop the machine using an emergency stop even if it runs away.

Replacing the Servomotor or Servo Drive

Use the following procedure to replace the Servomotor or Servo Drive.

Replacing the Servomotor

- 1. Replace the motor.
- 2. Perform origin adjustment (for position control).
 - When the motor is replaced, the motor's origin position (phase Z) may deviate, so origin adjustment must be performed.
 - Refer to the position controller's manual for details on performing origin adjustment.
- 3. Set up the absolute encoder.
 - If a motor with an absolute encoder is used, the absolute value data in the absolute encoder is cleared when the motor is replaced, so setup is again required.
 - The multi-rotation data will be different from before it was replaced, so initialize the Motion Control Unit settings.
 - For details, refer to "Absolute Encoder Setup" (P.9-4).

Replacing the Servo Drive

1. Copy the parameters.

Use a software tool such as the CX-Drive to read and save all parameter settings from the Servo Drive.

- 2. Replace the Servo Drive.
- 3. Reset the parameters.

Use a software tool such as the CX-Drive to set and transfer all parameter settings to the Servo Drive.

- 4. Set up the absolute encoder.
 - If a motor with an absolute encoder is used, the absolute value data in the absolute encoder is cleared when the Servo Drive is replaced, so setup is again required.
 - The multi-rotation data will be different from before it was replaced, so initialize the Motion Control Unit settings.
 - For details, refer to "Absolute Encoder Setup" (P.9-4).

11-2 Warning List

This is a function to output a warning signal before the protective function operates to notify the overload and other statuses in advance. Set the warning output type to Warning Output Selection 1 (Pn440) and Waning Output Selection 2 (Pn441).



Precautions for Correct Use

• Each warning automatically returns to the status before it occurred once the system recovers from the error. However, for the time set in the Warning Latch Hold Time Selection (Pn627), the warning status will be held. To clear the warning during the latch hold time, do so by performing the same procedures as alarm clear.

Warning List

| Warning number | Warning name | Latch*1 | Warning condition | Warning Output Selection (Pn440, Pn441) *2 | Warning Mask Setting (Pn638) |
|-------------------|---|---------------------------------------|---|--|---------------------------------|
| A0 | Overload warning | √ | The load ratio is 85% or more of the protection level. | 1 | bit 7 |
| A1 | Excessive regeneration warning | V | The regeneration load ratio is 85% or more of the protection level. | 2 | bit 5 |
| A2 | Battery warning | Always fixed with no time limit | Battery voltage is 3.2 V or less. | 3 | bit 0 |
| А3 | Fan warning | √ | The fan stops for 1 second. | 4 | bit 6 |
| A4 | Encoder communications warning | V | Encoder communications errors occurred in series more than the specified value. | 5 | bit 4 |
| A5 | Encoder overheating warning | √ | The encoder temperature exceeded the specified value. | 6 | bit 3 |
| A6 | Vibration detection warning | V | Vibration is detected. | 7 | bit 9 |
| A7 | Life expectancy warning | Always fixed with no time limit | The life expectancy of the capacitor or the fan is shorter than the specified value. | 8 | bit 2 |
| A8 | External encoder error warning | √ | The external encoder detected a warning. | 9 | bit 8 |
| A9 | External encoder communications warning | V | The external encoder has more communications errors in series than the specified value. | 10 | bit 10 |
| | | • | | • | • |

^{*1.} The "√" fields can be set to 1 to 10 s in the Warning Latch Hold Time Selection (Pn627) or to the notime limit setting. However, the battery warning is fixed with no time limit.

The warning detection is masked when the bit = 1.

^{*2.} Select the type of warning to be output in warning output 1 (WARN1) and warning output 2 (WARN2) in the Warning Output Selection 1 (Pn440) and Warning Output Selection 2 (Pn441). If you set this to 0, all warning types will be output. Do not set it to a value other than above.

^{*3.} Each warning detection can be masked using the Warning Mask Setting (Pn638). The corresponding bits are shown in the table.

11-3 Alarm List

If the drive detects an error, the alarm output (ALM) will turn ON, the power drive circuit in the drive will turn OFF, and the alarm code will be displayed.



Precautions for Correct Use

- Refer to "Error Diagnosis Using the Alarm Displays" (P.11-10) for appropriate alarm measures.
- Reset the alarm using one of the following methods. Remove the cause of the alarm first.
 - · Input the alarm reset input (RESET) signal.
 - · Turn OFF the power supply, then turn it ON again.
 - · Reset the alarm from the CX-Drive.

However, some alarms can only be reset by turning the power supply OFF then ON again. Refer to the next item "Alarm List".

- If you reset an alarm while the operation command (RUN) is turned ON, the Servo Drive will start operation as soon as the alarm is released, which is dangerous. Be sure to turn OFF the RUN before clearing the alarm.
 - If the RUN is always ON, first check safety sufficiently before clearing the alarm.
- When an alarm occurs, the servo drive latches the status of the servo drive just before the alarm occurrence. Those latched values can be read with the software tool for diagnostics. Refer to the CX-Drive Operation Manual (Cat. No. W453) for details.
- The stop mode in case of an alarm may vary depending on the "Immediate stop" attribute in each alarm.

Alarm List

| Alarm number | | Error detection function | Detection details and probable | Attribute | | |
|-----------------|---|---|---|--------------|----------------|-------------------|
| Main | Sub | End detection function | cause | | Can be cleared | Immediate stop *1 |
| 11 | 0 | Control power supply undervoltage | The DC voltage of the control circuit is below the specified value. | - | V | - |
| 12 | 0 | Overvoltage | The DC voltage in the main circuit is abnormally high. | V | V | - |
| 13 | 0 | Main power supply undervoltage (Insufficient voltage between P and N) | The DC voltage of the main circuit is low. | _ | V | _ |
| 13 | 1 | Main power supply undervoltage (AC cut-off detection) | A location was detected where the main circuit AC power supply is cut off. | _ | V | _ |
| 14 | 0 | Overcurrent | Overcurrent flowed to the IGBT. | \checkmark | - | _ |
| 17 | 1 | IPM error | Motor power line ground fault or short circuit. | V | _ | _ |
| 15 | 0 | Servo Drive overheat | The temperature of the Servo Drive radiator exceeded the specified value. | √ | _ | √ |
| 16 | 0 | Overload | Operation was performed with torque significantly exceeding the rating for several seconds to several tens of seconds. | | V | _ |
| 18 | Regeneration overload The regenerative energy exceeds the processing capacity of the Regeneration Resistor. | | V | - | V | |
| | 1 | Regeneration Tr error | An error was detected in a Servo Drive regeneration drive Tr. | 1 | _ | _ |
| 21 | 0 | Encoder communications disconnection error | The encoder wiring is disconnected. | 1 | _ | ı |
| | 1 | Encoder communications error | An encoder communications error was detected. | 1 | _ | ı |
| 23 | 0 | Encoder communications data error | Communications cannot be performed between the encoder and the Servo Drive. | √ | _ | _ |
| | 0 | Error counter overflow | The error counter accumulated pulse exceeds the set value for the Error Counter Overflow Level (Pn014). | V | V | √ |
| 24 | 1 | Excessive speed error | The difference between the internal position command speed and the actual speed (i.e., the speed error) exceeded the Excessive Speed Error Setting (Pn602). | √ | √ | √ |
| 25 | 0 | Excessive hybrid error | During fully-closed control, difference between position of load from external encoder and position of motor due to encoder was larger than the pulse number set by Excessive Hybrid Error Setting (Pn332). | 1 | _ | √ |

| Alarm number | | Error detection function | Detection details and probable | | Attribute | | | |
|-----------------|-----------|--|---|-----------|----------------|-------------------|--|--|
| Main | Sub | Error detection function | cause | | Can be cleared | Immediate stop *1 | | |
| 26 | 0 | Overspeed | The motor rotation speed exceeded the value set on the Overspeed Level set (Pn513). | V | √ | √ | | |
| 20 | 1 | Overspeed 2 | The motor rotation speed exceeded the value set on the Overspeed Level set 2 (Pn615). | V | V | _ | | |
| 27 | 0 | Command pulse frequency error | A command pulse frequency error was detected. | 1 | V | √ | | |
| 21 | 2 | Command pulse multiplier error | The command pulse divider or multiplier is not suitable. | V | √ | √ | | |
| 28 | 0 | Pulse regeneration error | The pulse regeneration output frequency exceeded the limit. | √ | √ | √ | | |
| 29 | 0 | Error counter overflow | Error counter value based on the encoder pulse reference exceeded 2 ²⁹ (536,870,912). | V | √ | _ | | |
| 30 (st) | 0 | Safety input error | Safety input signal turned OFF. | _ | V | _ | | |
| | 0 | Interface input duplicate allocation error 1 | A duplicate setting for the interface input signals was detected. | V | _ | _ | | |
| | 1 | Interface input duplicate allocation error 2 | | V | _ | _ | | |
| | 2 | Interface input function number error 1 | An undefined number was detected in the interface input signal allocations. | 1 | _ | - | | |
| | 3 | Interface input function number error 2 | | 1 | _ | - | | |
| 33 | 4 | Interface output function number error 1 | An undefined number was detected in the interface output signal allocations. | √ | _ | | | |
| | 5 | Interface output function number error 2 | | V | _ | - | | |
| | 6 | Counter reset allocation error | The counter reset function was allocated to something other than input signal SI7. | V | _ | - | | |
| | 7 | Command pulse prohibition input allocation error | The command pulse prohibition input function was allocated to something other than input signal SI10. | √ | _ | - | | |
| 34 | 0 | Overrun limit error | The motor exceeded the allowable operating range set in the Overrun Limit Setting (Pn514) with respect to the position command input. | $\sqrt{}$ | V | - | | |
| 36 | 0 to 2 | Parameter error | Data in the Parameter Save area was corrupted when the power supply was turned ON and data was read from the EEPROM. | | _ | _ | | |
| 37 | 0 to 2 | Parameters destruction | The checksum for the data read from the EEPROM when the power supply was turned ON does not match. | | _ | _ | | |
| 38 | 0 | Drive prohibition input error | The forward drive prohibition and reverse drive prohibition inputs are both turned OFF. | _ | √ | _ | | |

| Alarm number | | Error detection function | Detection details and probable | Attribute | | | |
|-----------------|-----|---|--|-----------|----------------|----------|--|
| Main | Sub | End detection function | cause | | Can be cleared | | |
| | 0 | Excessive analog input 1 | A current exceeding the Speed Command/Torque Command Input | 1 | V | V | |
| 39 | 1 | Excessive analog input 2 | Overflow Level Setting (Pn424, Pn427 or Pn430) was applied to the analog command input (pin 14). | 1 | V | V | |
| | 2 | Excessive analog input 3 | (p. 1 - 1). | 1 | V | √ | |
| 40 | 0 | Absolute encoder system down error ABS | The voltage supplied to the absolute encoder is lower than the specified value. | 1 | V | _ | |
| 41 | 0 | Absolute encoder counter overflow error ABS | The multi-rotation counter of the absolute encoder exceeds the specified value. | V | - | _ | |
| 42 | 0 | Absolute encoder overspeed error ABS | The motor rotation speed exceeds the specified value when only the battery power supply of the absolute encoder is used. | V | 1 | - | |
| 43 | 0 | Encoder initialization error | An encoder initialization error was detected. | V | _ | _ | |
| 44 | 0 | Absolute encoder 1- rotation counter error ABS | A 1-turn counter error was detected. | | _ | _ | |
| 45 | 0 | Absolute encoder multi- rotation counter error | A multi-rotation counter error or phase-AB signal error was detected. | | _ | - | |
| 47 | 0 | Absolute encoder status error ABS | The rotation of the absolute encoder is higher than the specified value. | V | - | - | |
| 48 | 0 | Encoder phase-Z error | A serial incremental encoder phase Z pulse irregularity was detected. | V | - | _ | |
| 49 | 0 | Encoder CS signal error | A logic error was detected in the CS signal for serial incremental encoder. | V | - | - | |
| 50 | 0 | External encoder connection error | An error was detected in external encoder connection. | V | - | _ | |
| 50 | 1 | External encoder communications data error | An error was detected in external encoder communications data. | V | - | - | |
| | 0 | External encoder status error 0 | An external encoder alarm code was detected. | V | - | - | |
| | 1 | External encoder status error 1 | | V | - | - | |
| 51 | 2 | External encoder status error 2 | | V | - | _ | |
| JΙ | 3 | External encoder status error 3 | | V | _ | - | |
| | 4 | External encoder status error 4 | | V | - | - | |
| | 5 | External encoder status error 5 | | V | - | - | |

| | arm nber | Error detection function | Detection details and probable | Attribute | | |
|---------------|--|----------------------------|---|-----------|----------------|-------------------|
| Main | Sub | | cause | History | Can be cleared | Immediate stop *1 |
| | 0 | Phase-A connection error | An error was detected in the external encoder phase A connection. | √ | _ | _ |
| 55 | Phase-B connection error An error was detected in the external encoder phase B connection. | | An error was detected in the external encoder phase B connection. | √ | _ | _ |
| | 2 | Phase-Z connection error | An error was detected in the external encoder phase Z connection. | √ | _ | _ |
| 87 | 0 | Emergency stop input error | An emergency stop input signal (STOP) was input. | _ | V | _ |
| 95 | 0 to 4 | Motor non-conformity | The combination of the Servomotor and Servo Drive is not appropriate. | _ | _ | _ |
| 99 | 0 | Other errors | The control circuit malfunctioned due to excess noise or some other problem. | | | |
| Other numb | | | An alarm clear operation was performed when safety input 1 or safety input 2 was not in the normal status (i.e., when the input photocoupler was not ON). | √ | _ | _ |

^{*1.} An immediate stop means an alarm causing an immediate stop when the Pn510 "Stop Selection for Alarm Detection" is set to 4 to 7. For details, refer to "Stop Selection for Alarm Detection" (P.8-51).

11-4 Troubleshooting

If an error occurs in the machine, determine the error conditions from the alarm displays and operation status, identify the cause of the error, and take appropriate measures.

Error Diagnosis Using the Alarm Displays

| Alarm number | | Name | Cause | Measures | | |
|-----------------|-----|-----------------------------------|---|--|--|--|
| Main | Sub | | | | | |
| 11 | 0 | Control power supply undervoltage | The voltage between the positive and negative terminals in the control power supply converter dropped below the specified value. 100-V models: Approx. 70 VDC (approx. 50 VAC) 200-V models: Approx. 145 VDC (approx. 100 VAC) 400-V models: Approx. 15 VDC The power supply voltage is low. A momentary power interruption occurred. Insufficient power supply capacity: The power supply voltage dropped because there was inrush current when the main power supply was turned ON. The Servo Drive has failed (circuit failure). | Measure the voltage between the L1C and L2C lines on the connector and the terminal block. Increase the power supply voltage. Change the power supply. Increase the power supply capacity. Replace the Servo Drive. | | |

| Alarm number | | Name | Cause | Measures | | |
|-----------------|-----|-------------|---|---|--|--|
| Main | Sub | | | | | |
| 12 | 0 | Overvoltage | The power supply voltage exceeded the allowable input voltage range, causing the voltage between the positive and negative terminals in the converter to exceed the specified value. The power supply voltage is high. The voltage was suddenly increased by the phase advance capacitor or the uninterruptible power supply (UPS). 100-V models: Approx. 200 VDC (approx. 140 VAC) 200-V models: Approx. 400 VDC (approx. 280 VAC) 400-V models: Approx. 800 VDC (approx. 560 VAC) The regeneration resistor wiring is broken. The External Regeneration Resistor is inappropriate and cannot absorb all of the regenerative energy. The load inertia is too large, gravitational torque on the vertical axis is too large, or there is some other problem in absorbing the regenerative energy. The Servo Drive has failed (circuit failure). | Measure the voltage between the L1, L2, and L3 lines on the connector and the terminal block. Input the correct voltage. Remove the phase advance capacitor. Use a tester to measure the resistance of the external resistor between the B1 and B2 terminals on the Servo Drive. If the resistance is infinite, the wiring is broken. Replace the External Regeneration Resistor. Change the regeneration resistance and wattage to the specified values. (Calculate the regenerative energy and connect an External Regeneration Resistor with the required regeneration absorption capacity. Reduce the descent speed.) Replace the Servo Drive. | | |

| Alarm number | | Name | Cause | Measures |
|-----------------|-----|--|--|--|
| Main | Sub | | | |
| 13 | 0 | Main power supply undervoltage (insufficient voltage between P and N) | (Pn508) is set to 1, a momentary power interruption occurred between L1 and L3 for longer than the value specified for the Momentary Hold Time (Pn509). Or, the voltage between the positive and negative terminals in the control power supply L2, and L3 lines of the terminal block. Increase the posacity. Char supply. Eliminate the control power supply | Measure the voltage between the L1, L2, and L3 lines on the connector and the terminal block. Increase the power supply voltage capacity. Change the power supply. Eliminate the cause of the failure of the electromagnetic contactor on the main circuit power supply, |
| | 1 | Main power supply undervoltage (AC cutoff detection) | specified value while the Servo was ON. 100-V models: Approx. 80 VDC (approx. 55 VAC) 200-V models: Approx. 110 VDC (approx. 75 VAC) 400-V models: Approx. 180 VDC (approx. 125 VAC) The power supply voltage is low. A momentary power interruption occurred. Insufficient power supply capacity: The power supply voltage dropped because there was inrush current when the main power supply was turned ON. Phase loss: A Servo Drive with 3-phase input specification was operated with a single-phase power supply. The Servo Drive has failed (circuit failure). | and then turn ON the power again. Check the setting of the Momentary Hold Time (Pn509). Correctly set the phases of the power supply. Increase the power supply capacity. Refer to Servo Drive and Servomotor Combination Tables on page 2-11 for information on the power supply capacity. Connect the phases (L1, L2, L3) of the power supply correctly. Use L1 and L3 for single-phase 100 V and single-phase 200 V. Replace the Servo Drive. |

| Alarm number | | Name | Cause | Measures |
|-----------------|-----|----------------------|--|---|
| Main | Sub | Name | Cause | ivicasui es |
| 14 | 0 | Overcurrent | The current flowing between P and N of the converter exceeded the specified value. The Servo Drive is faulty (faulty circuit, faulty IGBT part, etc.). The Servomotor cable is short-circuited between phases U, V, and W. The Servomotor cable is ground-faulted. Motor windings are burned out. The Servomotor wiring contact is faulty. The relay for the dynamic brake | Disconnect the Servomotor cable, and turn ON the servo. If the problem immediately recurs, replace the Servo Drive with a new one. Check to see if the Servomotor cable is short-circuited between phases U, V and W by checking for loose wire strands on the connector leads. Connect the Servomotor cable correctly. Check the insulation resistance between phases U, V, and W of the Servomotor cable and the |
| | 1 | IPM error | | the Servomotor cable and the grounding wire of the Servomotor. If the insulation is faulty, replace the Servomotor. Check the balance between the resistance of each wire of the Servomotor. If resistance is unbalanced, replace the Servomotor. Check for missing connector pins in Servomotor connections U, V, and W. If any loose or missing connector pins are found, secure them firmly. Replace the Servo Drive. Do not turn ON the Servo for at least ten minutes after using the dynamic brake. Wait at least 100 ms after the Servo is turned ON, then input commands. |
| 15 | 0 | Servo Drive overheat | The temperature of the Servo Drive radiator or power elements exceeded the specified value. The ambient temperature of the Servo Drive exceeded the specified value. Overload | Improve the ambient temperature and the cooling conditions of the Servo Drive. Increase the capacities of the Servo Drive and the Servomotor. Set longer acceleration and deceleration times. Reduce the load. |

| Alarm number | | Name | Cause | Measures |
|-----------------|-----|----------|---|----------------------------------|
| Main | Sub | | | |
| 16 | 0 | Overload | When the feedback value for torque command exceeds the overload level specified in the Overload Detection Level Setting (Pn512), overload protection is performed according to the overload characteristics. The load was heavy, the effective torque exceeded the rated torque, and operation continued too long. Vibration or hunting occurred due to faulty gain adjustment. The Servomotor vibrates or makes unusual noise. The Inertia Ratio (Pn004) setting is incorrect. The Servomotor wiring is incorrect or broken. The machine load suddenly became heavy, e.g., the machine hit an object. The machine was distorted. The electromagnetic brake remained ON. When multiple machines were wired, the wiring was incorrect and the Servomotor cable was connected to a Servomotor for another axis. Refer to 3-2 Overload Characteristics information on overload characteristics. | S |
| | | | The connected external regeneration is allowable value (for the minimum allow Connect a regeneration resistance with external regeneration resistance comb P.4-59) | vable value, refer to page 4-56) |

Name

Alarm number

Main Sub

| IVIAIII | Sub | | | |
|---------|-----|--|---|--|
| 18 | 0 | Regeneration overload | Regeneration Resistor the Regeneration R | Check the load rate of the Regeneration Resistor through CX-Drive. This Regeneration Resistor cannot be used for continuous regenerative braking. Check the operation pattern (speed monitor). Check the load rate of the Regeneration Resistor and check for the excessive regeneration warning display. Increase the capacities of the Servo Drive and the Servomotor, and lengthen the deceleration time. Use an External Regeneration Resistor. Check the operation pattern (speed monitor). Check the load rate of the Regeneration Resistor and check for the excessive regeneration warning display. Increase the capacities of the Servo Drive and the Servomotor, and lengthen the deceleration time. Reduce the Servomotor rotation speed. Use an External Regeneration Resistor. Set the Regeneration Resistor. Set the Regeneration Resistor Selection (Pn016) to 2. |
| | 1 | Regeneration Tr error | The Servo Drive regeneration drive Tr is faulty. | Replace the Servo Drive. |
| 21 | 0 | Encoder communications disconnection error | A disconnection was detected because communications between the encoder and the Servo Drive were stopped more frequently than the specified value. | Wire the encoder correctly as shown in the wiring diagram. Correct the connector pin connections. |
| | 1 | Encoder communications error | There was a communications error in data from the encoder. There was a data error mainly due to noise. The encode cable is connected, but a communications data error occurred. | Provide the required encoder power supply voltage of 5 VDC ±5% (4.75 to 5.25 V). Be careful especially when the encode cable is long. If the Servomotor cable and the encoder cable are bundled together, separate them. Connect the encoder cable correctly. |

Cause

Measures

| Alarm number | | Name | Cause | Measures |
|-----------------|-----|---|--|---|
| Main | Sub | Name | Cause | measures |
| 23 | 0 | Encoder communications data error | No communications error occurred with the data from the encoder, but there is an error in the contents of the data. There was a data error mainly due to noise. The encode cable is connected, but a communications data error occurred. | Provide the required encoder power supply voltage of 5 VDC ±5% (4.75 to 5.25 V). Be careful especially when the encode cable is long. If the Servomotor cable and the encoder cable are bundled together, separate them. Connect the encoder cable correctly. |
| 24 | 0 | Error counter overflow | Position error pulses exceeded the setting of the Error Counter Overflow Level (Pn014). Motor operation does not follow the command. The value of the Error Counter Overflow Level (Pn014) is small. | Check to see if the Servomotor rotates according to the position command pulse. Check on the torque monitor to see if the output torque is saturated. Adjust the gain. Set the No. 1 Torque Limit (Pn013) or No. 2 Torque Limit (Pn522) is set to the maximum value. Connect the encoder cable correctly. Lengthen the acceleration and deceleration times. Reduce the load and the speed. Increase the set value for the Error Counter Overflow Level (Pn014). |
| | 1 | Excessive speed error | The difference between the internal position command speed and the motor speed (i.e., the speed error) exceeded the Excessive Speed Error Setting (Pn602). Note: When the internal position command speed is forced to 0 for an immediate stop due to a command pulse prohibition input (IPG) or forward/reverse drive prohibition input, the speed deviation immediately increases. The speed deviation also increases at the start of the internal position command speed. Therefore, provide enough margin when making the settings. | Increase the set value of the Excessive Speed Error Setting (Pn602). Lengthen the acceleration time of the internal position command speed. Alternatively, improve the tracking (following) performance by adjusting the gain. Disable the Excessive Speed Deviation Setting. (Pn602 = 0) |

Alarm

| num | ber | Name | Cause | Measures |
|------|-----|--------------------------------|---|---|
| Main | Sub | | | |
| 25 | 0 | Excessive hybrid error | During fully-closed control, the difference between the position of load from the external encoder and the position of the motor due to the encoder was larger than the number of pulses set for the Internal/External Feedback Pulse Error Counter Overflow Level (Pn328). | Check the motor and load connections. Check the external encoder and drive connection. When moving the load, check to see if the change in the Servomotor position (total encoder pulses) has the same sign as the change in the load position (total external encoder feedback pulses). Check to see if the External Feedback Pulse Dividing Numerator and Denominator (Pn324 and Pn325), and External Feedback Pulse Direction Switching (Pn326) are set correctly. |
| 26 | 0 | Overspeed | The Servomotor rotation speed exceeded the value set for the Overspeed Detection Level Setting (Pn513). | Do not give excessive speed commands. Check the input frequency, dividing ratio, and multiplication ratio of the command pulse. |
| | 1 | Overspeed 2 | The Servomotor rotation speed exceeded the value set for the Overspeed Detection Level Setting at Immediate Stop (Pn615). | If overshooting occurred due to faulty gain adjustment, adjust the gain. Connect the encoder cable correctly. |
| 27 | 0 | Command pulse frequency error | The command pulse input frequency exceeded 1.2 multiplied by the Command Pulse Input Maximum Setting (Pn532). | Check the command pulse input. |
| | 2 | Command pulse multiplier error | The command pulse frequency or electronic gear ratio parameters are not set correctly. The number of command pulses per 0.167 ms multiplied by the electronic gear ratio exceeded approximately 3 Gpps (or approx. 175 Kpps for software versions lower than V1.10). The command pulse input frequency varies greatly. Counting errors are resulting from noise on the command pulse input. | Set the electronic gear ratio to the lower possible value between 1/1,000 and 1,000. Check the command pulse input. If possible, use a line driver interface. Set the Command Pulse Input Maximum Setting (Pn532) to less than 1,000 to enable a digital filter. |
| 28 | 0 | Pulse regeneration error | The pulse regeneration output frequency exceeded the limit. | Check the set values of the Encoder Dividing Numerator (Pn011) and Encoder Dividing Denominator (Pn503). To disable detection, set the Pulse Regeneration Output Limit Setting (Pn533) to 0. |

| | ırm nber | Name | Cause | Measures | | |
|------------|-------------|--|---|--|--|--|
| Main | Sub | | | | | |
| 29 | 0 | Error counter overflow | The position error for the encoder feedback pulse reference exceeded $\pm 2^{29}$ (536,870,912). | Check that the motor rotates according to the position command. Check on the torque monitor that the output torque is not saturated. Adjust the gain. Set the No. 1 Torque Limit (Pn013) or No. 2 Torque Limit (Pn522) is set to the maximum value. Connect the encoder cable correctly. | | |
| 30 (st) | 0 | Safety input error | At least one of the input photocouplers for safety inputs 1 and 2 turned OFF. | Check the input wiring of safety inputs 1 and 2. | | |
| | 0 | Interface input duplicate allocation error 1 | There is a duplicate setting in the input signal (IN1, IN2, IN3, IN4, and IN5) function allocations. | | | |
| | 1 | Interface input duplicate allocation error 2 | There is a duplicate setting in the input signal (IN6, IN7, IN8, IN9, and IN10) function allocations. | | | |
| | 2 | Interface input function number error 1 | There is an undefined number specification in the input signal (IN1, IN2, IN3, IN4, and IN5) function allocations. | | | |
| 33 | 3 | Interface input function number error 2 | There is an undefined number specification in the input signal (IN6, IN7, IN8, IN9, and IN10) function allocations. | Allocate the functions to the connector pins correctly. | | |
| | 4 | Interface output function number error 1 | There is an undefined number specification in the output signal (SO1 and SO2) function allocations. | | | |
| | 5 | Interface output function number error 2 | There is an undefined number specification in the output signal (SO4) function allocation. | | | |
| | 6 | Counter reset allocation error | The error counter reset input (ECRST) was allocated to something other than input signal SI7. | | | |
| | 7 | Command pulse prohibition input allocation error | The pulse prohibition input (IPG) was allocated to something other than input signal SI10. | | | |
| 34 | 0 | Overrun limit error | The Servomotor exceeded the allowable operating range set in the Overrun Limit Setting (Pn514) with respect to the position command input range. The gain is not suitable. The set value of Pn514 is too small. | Check the gain (the balance between position loop gain and speed loop gain) and the inertia ratio. Increase the set value of Pn514. Alternatively, set Pn514 to 0 to disable the protection function. | | |

| _ | ırm nber | Name | Cause | Measures |
|------|-------------|---|---|---|
| Main | Sub | | | |
| 36 | 0 1 2 | Parameter error | Data in the Parameter Save area was corrupted when the power supply was turned ON and data was read from the EEPROM. | Reset all parameters. If this error occurs repeatedly, the Servo Drive may be faulty. In this case, replace the Servo Drive. Return the Servo Drive to the |
| 37 | 0 | Parameters destruction | EEPROM write verification data was corrupted when the power supply was turned ON and data was read from | dealer that it was purchased from. The Servo Drive is faulty. Replace the Servo Drive. Return the Servo Drive to the dealer that it was purchased |
| 38 | 0 | Drive prohibition input error | the EEPROM. When the Drive Prohibition Input Selection (Pn504) was set to 0, both the Forward Drive Prohibition Input (POT) and the Reverse Drive Prohibition Input (NOT) turned ON. When Pn504 was set to 2, either the Forward Drive Prohibition input or the Reverse Drive Prohibition input turned ON. | from. Check for any problems with the switches, wires, and power supplies that are connected to the forward drive prohibition input or the reverse drive prohibition input. In particular, check to see if the external DC power supply (12 to 24 VDC) for sequence inputs turned ON too slowly. |
| | 0 | Excessive analog input 1 | A voltage that exceeded the value set for the Excessive Analog Input 1 (Pn424) was applied to analog input 1. | Set the Pn424 correctly. Check the connections to CN1. Set Pn424 to 0 to disable alarm detection. |
| 39 | 1 | Excessive analog input 2 | A voltage that exceeded the value set for the Excessive Analog Input 2 (Pn427) was applied to analog input 2. | Set the Pn427 correctly. Check the connections to CN1. Set Pn427 to 0 to disable alarm detection. |
| | 2 | Excessive analog input 3 | A voltage that exceeded the value set for the Excessive Analog Input 3 (Pn430) was applied to analog input 3. | Set the Pn430 correctly. Check the connections to CN1. Set Pn430 to 0 to disable alarm detection. |
| 40 | 0 | Absolute encoder system down error | The voltage of the built-in capacitor dropped below the specified value because the power supply to the encoder or the battery power supply was down. | Connect the battery power supply, and then clear the absolute encoder. Unless the absolute encoder is cleared, the error cannot be reset. |
| 41 | 0 | Absolute encoder counter overflow error | The multi-rotation counter of the encoder exceeded the specified value. | Set the Operation Switch when Using Absolute Encoder (Pn015) to an appropriate value. Make sure that the traveling distance from the origin of the machine is no more than 32,767 revolutions. |
| 42 | 0 | Absolute encoder overspeed error | The Servomotor rotation speed exceeded the specified value when only the battery power supply was used during a power interruption. | Check the power supply voltage (5 VDC ± 5%) at the encoder. Check the connections to connector CN2. Unless the absolute encoder is cleared, the error cannot be reset. |
| 43 | 0 | Encoder initialization error | An encoder initialization error was detected. | Replace the Servomotor. |

| | arm nber | Name | Cause | Measures | | |
|------|-------------|--|---|---|--|--|
| Main | Sub | | | | | |
| 44 | 0 | Absolute encoder 1- rotation counter error | The encoder detected a 1-rotation counter error. | Replace the Servomotor. | | |
| 45 | 0 | Absolute encoder multi-rotation counter error ABS The encoder detected a multi-rotation counter counter error. Replace the Servomotor. | | Replace the Servomotor. | | |
| 47 | 0 | Absolute encoder status error | The rotation of the encoder was higher than the specified value when the power supply was turned ON. | Do not let the Servomotor move when the power supply is turned ON. | | |
| 48 | 0 | Encoder phase-Z error | A missing serial incremental encoder phase-Z pulse was detected. The encoder is faulty. | Replace the Servomotor. | | |
| 49 | 0 | Encoder CS signal error | A logic error was detected in the CS signal for serial incremental encoder. The encoder is faulty. | Replace the Servomotor. | | |
| 50 | 0 | External encoder connection error | A disconnection was detected because communications between the external encoder and the Servo Drive were interrupted more than the specified number of times. | Wire the external encoder correctly as shown in the connection diagram. Correct the connector pin connections. | | |
| | 1 | External encoder communications data error | There was a communications error in data from external encoder. There was a data error mainly due to noise. The external encoder connection cable is connected, but a communications data error occurred. | Provide the required external encoder power supply voltage or 5 VDC ±5% (4.75 to 5.25 V). Be careful especially when the external encoder connection cable is long. If the Servomotor cable and the external encoder connection cable are bundled together, separate them. Wire the external encoder cable correctly. Refer to the external encoder connection diagram. | | |
| | 0 | External encoder status error 0 | Bit 0 of the external encoder error code (ALMC) was set to 1. Check the external encoder specifications. | | | |
| | 1 | External encoder status error 1 | Bit 1 of the external encoder error code (ALMC) was set to 1. Check the external encoder specifications. | | | |
| 51 | 2 | External encoder status error 2 | Bit 2 of the external encoder error code (ALMC) was set to 1. Check the external encoder specifications. | Eliminate the cause of the error and then clear the external encoder error | | |
| | 3 | External encoder status error 3 | Bit 3 of the external encoder error code (ALMC) was set to 1. Check the external encoder specifications. | from the front panel. Then, cycle the control power supply. | | |
| | 4 | External encoder status error 4 | Bit 4 of the external encoder error code (ALMC) was set to 1. Check the external encoder specifications. | | | |
| | 5 | External encoder status error 5 | Bit 5 of the external encoder error code (ALMC) was set to 1. Check the external encoder specifications. | | | |

| Alarm number | | Name Cause | | Measures | | |
|------------------|-----------|----------------------------|--|---|--|--|
| Main | Sub | | | | | |
| | 0 | Phase-A connection error | An error such as broken wiring was detected in the external encoder phase-A connection. | Check the external encoder phase-A connection. | | |
| 55 | 1 | Phase-B connection error | An error such as broken wiring was detected in the external encoder phase-B connection. | Check the external encoder phase-B connection. | | |
| | 2 | Phase-Z connection error | An error such as broken wiring was detected in the external encoder phase-Z connection. | Check the external encoder phase-Z connection. | | |
| 87 | 0 | Emergency stop input error | An emergency stop input (STOP) was input. | Check the emergency stop input (STOP) wiring. | | |
| 95 | 0 to 4 | Motor non-conformity | The Servomotor does not match the Servo Drive. | Replace the Servomotor with a Servomotor that matches the Servo Drive. | | |
| 99 | 0 | | An alarm was reset when safety input 1 or 2 was not normal (one of the input photocouplers is not ON). *1 The control circuit malfunctioned due to excess noise or some other problem. The self-diagnosis function of the Servo Drive was activated, and an error occurred in the Servo Drive. | Reset the alarm when safety inputs 1 and 2 are normal (both input photocouplers are ON). *2 Turn OFF the power once, and turn it ON again. If the alarm is displayed even after the power is turned ON again, the system may be faulty. Stop using the system, and replace the Servomotor and/or the Servo Drive. Return the Servo Drive to the dealer that it was purchased from and ask for investigation and repair. | | |
| Other numbers | | Other errors | The control circuit malfunctioned due to excess noise or some other problem. The self-diagnosis function of the Servo Drive was activated, and an error occurred in the Servo Drive. A voltage of ±11 V or higher was applied to analog input 2 or analog input 3. | Turn OFF the power once, and turn it ON again. If the alarm is displayed even after the power is turned ON again, the system may be faulty. Stop using the system, and replace the Servomotor and/or the Servo Drive. Return the Servo Drive to the dealer that it was purchased from and ask for investigation and repair. Adjust the voltage applied to a suitable value. | | |

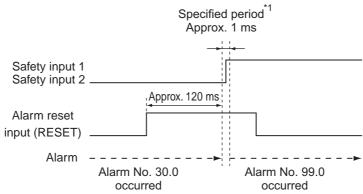
^{*1.} This alarm may occur due to the timing between safety input 1/2 and alarm clear input. For details, refer to Alarm No. 99.0 on page 11-22.

^{*2.} For the alarm reset input timing, refer to Operation Timings to a Safety Status on page 7-4.

Alarm No. 99.0

Alarm No. 99.0 may occur due to the timing between safety input 1/2 and alarm clear input. This alarm will occur if both of the following conditions are met:

- An alarm was cleared when at least one of the input photocouplers for safety inputs 1 and 2 was OFF (which means that a Safety Input Error (Alarm No. 30.0) had occurred).
- At least one of the input photocouplers for safety inputs 1 and 2 was turned from OFF to ON in a specific period during the alarm clear process (See below).



*1. Alarm No. 99.0 will occur if at least one of the input photocouplers for safety inputs 1 and 2 is turned from OFF to ON.



Precautions for Correct Use

Be sure to clear the alarm after turning ON the photocouplers for safety inputs 1 and 2 again.

Troubleshooting and Maintenance

Troubleshooting Using the Operation Status

| Symptom | Probable cause | Items to check | Measures | |
|---|---|--|--|--|
| The PWR LED indicator does not light when the power | The power supply cable is wired incorrectly. | Check to see if the power supply input is within the allowed power supply voltage range. | Supply the correct power supply voltage. | |
| supply is turned ON. | | Check to see if the power supply input is wired correctly. | Wire correctly. | |
| The motor does not rotate even if commands are input from the controller. | The operation command (RUN) is OFF. | In Monitor Mode, check whether the RUN signal is ON or OFF. | Turn ON the operation command (RUN). Wire correctly. | |
| (Continued on next page) | The Forward or Reverse Drive Prohibition Input (POT or NOT) is OFF. | In Monitor Mode, check whether the POT signal and NOT signal are ON or OFF. | Turn ON the POT and NOT signals. Disable them in the settings when the POT and NOT signals are not used. | |
| | The control mode does not conform to the command. | Check the control mode Selection (Pn001). | Set the control mode according to the command. | |
| | The error counter reset (ECRST) is ON. | In Monitor Mode, check whether the ECRST signal is ON or OFF. | Turn OFF the ECRST signal. Wire correctly. | |
| | Command Pulse Mode Selection (Pn007) is selection is incorrect. | Check the controller's command pulse type and the Servo Drive's command pulse type. | Set the Servo Drive's pulse type to match the controller's command pulse type. | |
| | The zero speed designation (VZERO) is OFF. | In Monitor Mode, check whether the VZERO signal is ON or OFF. | Turn ON the VZERO signal. Wire correctly. | |
| | The internally set speeds are not set. | Check the set value of Pn304 to Pn311. | Set the desired speeds. | |
| | The No. 1 Torque Limit (Pn013) or No. 2 Torque Limit (Pn522) is set to 0. | Check the set value of Pn013 and Pn522. | Return the set value to the default setting. | |
| | The Servomotor power cable is wired incorrectly. | Check the wiring. | Wire correctly. | |
| | The encoder cable is wired incorrectly. | | | |
| | The control I/O connector (CN1) | Check the command pulse's wiring. | Wire correctly. | |
| | is wired incorrectly. | Check the command pulse type. | Set the Servo Drive's pulse type to match the controller's command pulse type. | |
| | | Check the command pulse's voltage. | Connect a resistor that matches the voltage. | |
| | Power is not supplied. | Check whether the power supply is ON and check the PWR LED indicator. | Turn ON the power supply. | |
| | | Check the voltage across the power supply terminals. | Wire the power-ON circuit correctly. | |
| | The speed command is disabled. | Check if the speed command method is correct. | Set the external analog command correctly. Set the internal speed correctly. | |

| Symptom | Probable cause | Items to check | Measures | |
|---|--|--|--|--|
| The motor does not rotate even if | The torque command is disabled. | Check if the torque command input method is correct. | Set the torque command correctly. | |
| commands are input from the controller. (Continued from previous page) | The CW input and CCW input are ON at the same time. | Check the command pulse's wiring. | Input the pulse signal either to the CW input or CCW input. Always turn OFF the terminal that is not input to. | |
| | The Servo Drive has broken down. | - | Replace the Servo Drive. | |
| The Servomotor operates | The Servomotor power cable is wired incorrectly. | Check the wiring of the Servomotor power cable's phases U, V, and W. | Wire correctly. | |
| momentarily, but then it does not operate after that. | The encoder cable is wired incorrectly. | Check the encoder cable's wiring. | Wire correctly. | |
| The Servomotor | The command pulse input is | Check the command pulse type. | Set the correct command pulse input. | |
| rotates without a command. | incorrect. | Check the command pulse's voltage. | Connect a resistor that matches the voltage. | |
| | The Servo Drive has broken down. | - | Replace the Servo Drive. | |
| The Servomotor rotates in the reverse direction from the command. | The CW input and CCW input connections are reversed. | Check the controller's command pulse type and the Servo Drive's command pulse type. | Connect the CW pulse signal to the CW input and the CCW pulse signal to the CCW input. | |
| Motor rotation is unstable. | The Servomotor power cable or encoder cable is wired incorrectly. | Check the wiring of the Servomotor power cable's phases U, V, and W and check the encoder cable's wiring. | Wire correctly. | |
| | The coupling system between the motor shaft and the mechanical | Check the mechanical system's coupling section. | Review and adjust the machine. | |
| | system has eccentricity or loose screws, or the load torque is fluctuating due to engagement between pulleys or gears. | Try rotating the motor without a load. (Disconnect it from the mechanical system.) | | |
| | The load's moment of inertia exceeds the Servo Drive's allowable value. | Try rotating the motor without a load. (Disconnect it from the mechanical system.) | Reduce the load. Replace the Servomotor and Servo Drive with higher capacity models. | |
| | The pulse signal line's connections are loose. | Check the pulse signal line's wiring at the controller and Servo Drive. | Wire correctly. | |
| | | Check the controller's command pulse type and the Servo Drive's command pulse type. | Set the Servo Drive's pulse type to match the controller's command pulse type. | |
| | The gain is wrong. | _ | Perform manual tuning. | |
| | The CN1 input signal is chattering. | Check the operation command (RUN), error counter reset (ECRST), zero speed designation (VZERO), internally set speed selection 1 (VSEL1) and internally set speed selection 2 (VSEL2). | Wire correctly so that there is no chattering. | |
| The Servomotor is overheating. | The ambient temperature is too high. | Check that the ambient temperature around the motor is 40°C or less. | Lower the ambient temperature around the Servomotor to 40°C or less. (Use a fan or air conditioner.) | |
| | Ventilation is obstructed. | Check to see whether anything is blocking ventilation. | Improve ventilation. | |
| | The Servomotor is overloaded. | Try rotating the motor without a load. | Reduce the load. Replace the Servomotor and Servo Drive with higher capacity models. | |
| | The Servomotor vibrates during rotation. | (Disconnect it from the mechanical system.) | | |

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| Symptom | Probable cause | Items to check | Measures |
|---|--|---|--|
| The Servomotor holding brake is ineffective. | Power is supplied to the holding brake. | Check whether power is supplied to the holding brake. | Configure a circuit that cuts power supply to the holding brake when the motor stops and the load is held by the holding brake. |
| The motor does not stop or is hard to stop even if the operation | The load inertia is too large. | Check the following: -Is the load too large? -Is the motor rotation speed too high? | Review the load conditions, and replace the Servomotor and Servo Drive with appropriate models. |
| command (RUN) is turned OFF while the motor is rotating. | The stop circuit failed. | - | Replace the Servo Drive. |
| The motor is producing unusual noises or the | There are problems with the machine's installation. | Check to see if the Servomotor's mounting screws are loose. | Retighten the mounting screws. |
| machine is vibrating. (Continued on next | | Check whether the axes are misaligned in the coupling. | Align the coupling. |
| page) | | Check whether the coupling is unbalanced. | Adjust the coupling's balance. |
| | There is a problem with the bearings. | Check for noise or vibration around the bearings. | Contact your OMRON dealer or sales office. |
| | The gain is wrong. | _ | Perform manual tuning. |
| | The Speed Feedback Filter Time Constant (Pn103) is wrong. | Check the value set in Pn103. | Return the set to 0 (default set) or increase the set value. |
| | Noise is entering into the control I/O signal cable because the cable does not meet specifications. | Check to see if the cable is a twisted-pair cable or shielded twisted-pair cable with core wires that are at least 0.08 mm dia. | Use a control I/O signal cable that meets specifications. |
| | Noise is entering into the control I/O signal cable because the cable is longer than the specified length. | Check the length of the control I/O signal cable. | Shorten the control I/O signal cable to 3 m or less. |
| | Noise is entering into the cable because the encoder cable does not meet specifications. | Check to see if it is a shielded twisted-pair cable with core wires that are at least 0.12 mm dia. | Use an encoder cable that meets specifications. |
| | Noise is entering into the encoder cable because the cable is longer than the specified length. | Check the length of the encoder cable. | Shorten the encoder cable to less than 50 m. |
| | Noise is entering into the signal lines because the encoder cable is stuck or the sheath is damaged. | Check the encoder cable for damage. | Correct the encoder cable's pathway. |
| | Excessive noise on encoder cable. | Check to see if the encoder cable is bound together with or too close to high-current lines. | Install the encoder cable where it won't be subjected to surges. |
| | The FG's potential is fluctuating due to devices near the Servomotor, such as welding machines. | Check for ground problems (loss of ground or incomplete ground) at equipment such as welding machines near the Servomotor. | Ground the equipment properly and prevent current from flowing to the encoder FG. |
| | Errors are being caused by excessive vibration or shock on the encoder. | There are problems with mechanical vibration or Servomotor installation (such as the precision of the mounting surface, attachment, or axial offset). | Reduce the mechanical vibration or correct the Servomotor's installation. |
| The motor is producing unusual noises or the machine is vibrating. (Continued from previous page) | The machine and the motor are resonating. | Check to see if the machine is resonating. | Readjust the torque command filter time constant. If there is resonance, set the Notch Filter 1 Frequency (Pn201), Notch Filter 1 Width (Pn202), and Notch Filter 1 Depth (Pn203). |

| Symptom | Probable cause | Items to check | Measures |
|---|--|--|--|
| Vibration is occurring at the same | Inductive noise is occurring. | Check to see if the drive control signal lines are too long. | Shorten the control signal lines. |
| frequency as the power supply. | | Check to see if the control signal lines and power supply lines are not bound together. | Separate control signal lines from power supply lines. Use a low-impedance power supply for control signals. |
| The position is misaligned. (Position | There is an error in the coupling of the mechanical system and the Servomotor. | Check to see if the coupling of the mechanical system and the Servomotor is misaligned. | Correct the coupling between the mechanical system and the Servomotor. |
| misalignment occurs without an alarm being output.) | | Check to see if the control signal lines and power supply lines are bound together. | Separate the control signal lines from the power lines or take other measures against noise. |
| | Noise is entering on the error counter reset (ECRST) input. Noise is entering on the | Check to see if it is a shielded twisted-pair cable with core wires that are at least 0.08 mm dia. | Use a control I/O signal cable that meets specifications. |
| | position command pulse (CW and CCW) inputs. | Check the length of the control I/O signal cables. | Do not allow the length of the control I/O signal cables to exceed 10 m for a line driver input and 3 m for an open-connector input. |
| | The gain is wrong. | - | Perform manual tuning. |
| | The load inertia is large. | Inspect the following. Is the load too large? Is the motor rotation speed too high? | Adjust the gain. Review the load conditions, and replace the Servomotor and Servo Drive with appropriate models. |

11-5 Periodic Maintenance

∕ Caution



After replacing the Servo Drive, transfer to the new Servo Drive all data needed to resume operation, before restarting the operation. Equipment damage may result.



Never repair the Servo Drive by disassembling it. Electric shock or injury may result.

Servomotors and Servo Drives contain many components and will operate properly only when each of the individual components is operating properly.

Some of the electrical and mechanical components require maintenance depending on application conditions. Periodic inspection and replacement are necessary to ensure proper long-term operation of Servomotors and Servo Drives. (Quoted from *The Recommendation for Periodic Maintenance of a General-purpose Inverter* published by JEMA.)

The periodic maintenance cycle depends on the installation environment and application conditions of the Servomotors and Servo Drives.

Recommended maintenance times are listed below for Servomotors and Servo Drives. Use these for reference in periodic maintenance.

Servomotor Life Expectancy

• The lifetimes for the different motor parts are listed below.

Bearings: 20,000 hours
Oil seal: 5,000 hours
Encoder: 30,000 hours

These values presume an ambient motor operating temperature of 40°C, within the allowable axial load, rated operation (rated torque and rated rotation speed), and proper installation as described in this manual.

The bearings, reducer, oil seal, and encoder can be replaced for repair work.

• The radial load during Servomotor operation on timing pulleys and other components contacting belts is two or more times the static load or more. Consult with the belt and pulley manufacturers and adjust designs and system settings so that the motor allowable axial load is not exceeded even during operation. If a motor is used under a shaft load exceeding the allowable limit, the motor shaft can break and the bearings can be damaged.

Servo Drive Life Expectancy

- The lifetimes for the different drive parts are listed below.
 - Aluminum electrolytic capacitors: 28,000 hours
 - (at an ambient drive operating temperature of 55°C, constant output of rated torque, constant output of rated rotation speed, and installation as described in this manual)
 - Axial-flow fan: 10,000 to 30,000 hours (The limit depends on the operating conditions.)
 - Inrush current prevention relay: Approx. 20,000 operations (The limit depends on the operation conditions.)
- When using the Servo Drive in continuous operation, use fans or air conditioners to maintain the ambient temperature below 40°C.
- We recommend that ambient temperature and the power supply ON time be reduced as much the possible to lengthen the service life of the Servo Drive.
- The limit of aluminum electrolytic capacitors is greatly affected by the ambient operating temperature. Generally, an increase of 10°C in the operating ambient temperature will reduce capacitor service life by 50%. Following equation shows an example for 25°C:

Lifetime 25°C = Lifetime 55°C × 2
$$\frac{55-25}{10}$$
 = 224000 hour

- The aluminum electrolytic capacitors deteriorate even when the Servo Drive is stored with no power supplied. If the Servo Drive is not used for a long time, we recommend periodic inspection and a part replacement period of 5 years.
- If the Servomotor or Servo Drive is not to be used for a long time, or if they are to be used under conditions worse than those described above, a periodic inspection period of 5 years is recommended.
- Upon request, OMRON will examine the Servo Drive and Servomotor and determine if part replacement is required.

Replacing the Absolute Encoder Battery ABS

If an Absolute Encoder System Down Error (Alarm No. 40) occurs, replace the battery.

Battery Life

Examples of calculating the life of the absolute encoder battery are given below for robot operation.

A battery capacity of 2,000 mAh is used in the calculations.

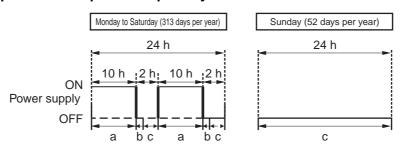
The calculations only estimate the life of the battery. The actual life may vary.



Precautions for Correct Use

Only the current consumption is included in the following calculations. They do not consider deterioration of the battery due to fluid leakage or other factors. The battery life will be reduced depending on ambient conditions.

1. Example for Two Operations per Day



a: Current consumption in normal mode: 3.6 µA

- b: Current consumption in power-OFF timer mode: 180 µA
- In power-OFF timer mode, response up to the maximum speed is possible even when the power is turned OFF (5 s).
- c: Current consumption in power-OFF mode:80 µA

Consumed capacity in 1 year

 $(10 \text{ hr} \times \text{a} + 0.0014 \text{ hr} \times \text{b} + 2 \text{ hr} \times \text{c}) \times 2 \times 313 \text{ days} + 24 \text{ hr} \times \text{c} \times 52 \text{ days} = 222.7 \text{ mAh}$ Battery life = 2,000 mAh/222.7 mAh/year = 9.0 (8.9809) years

2. Example for One Operation per Day

An example of calculating the battery life is given below for when the second operation in the first example given above is not performed.

Consumed capacity in 1 year

 $(10 \text{ hr} \times \text{a} + 0.0014 \text{ hr} \times \text{b} + 14 \text{ hr} \times \text{c}) \times 313 \text{ days} + 24 \text{ hr} \times \text{c} \times 52 \text{ days} = 461.7 \text{ mAh}$ Battery life = 2,000 mAh/461.7 mAh/year = 4.3 (4.3314) years

Replacement Battery Model and Specifications

| Item | Specifications |
|------------------|--------------------------------------|
| Name | Absolute Encoder Backup Battery Unit |
| Model | R88A-BAT01G |
| Battery model | ER6V (Toshiba) |
| Battery voltage | 3.6 V |
| Current capacity | 2,000 mA·h |

Mounting the Backup Battery Unit

Mounting the Battery Unit for the First Time

Connect the Absolute Encoder Backup Battery Unit to the motor, then set up the absolute encoder. Refer to "Absolute Encoder Setup" (P.9-4).

After the Absolute Encoder Battery Unit is attached, it is recommended that the control power supply be turned ON and OFF once a day to refresh the battery.

If you neglect to refresh the battery, battery warning will occur due to voltage delays in the battery.

Replacing the Battery Unit

If a battery warning occurs, the Absolute Encoder Backup Battery Unit must be replaced. Replace the Battery Unit with the control power supply of the Servo Drive turned ON. If the Battery Unit is replaced with the control power supply of the Servo Drive turned OFF, data held in the encoder will be lost.

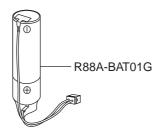
The Battery Warning will occur after you replace the Absolute Encoder Backup Battery Unit. Use one of the following methods to clear it.

- Use the alarm reset input signal of CN1 control inputs.
- Use the front panel to perform the alarm clear (refer to page 9-25).
- Use the absolute encoder setting in the CX-Drive.

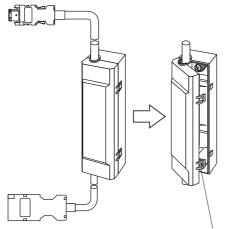
Note: If the absolute encoder is cleared using the front panel or communications, all alarms and multi-rotation data will be lost and the absolute encoder must be set up again. Refer to "Absolute Encoder Setup" (P.9-4).

Battery Unit Mounting Method

1. Prepare the replacement Battery Unit (R88A-BAT01G).

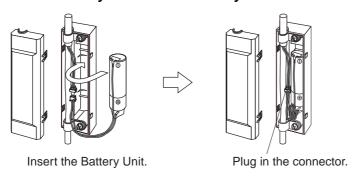


2. Remove the Battery Unit box cover.

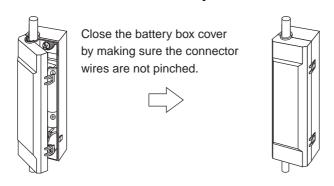


Raise the tabs and remove the cover.

3. Put the Battery Unit into the battery box.



4. Close the cover to the battery box.





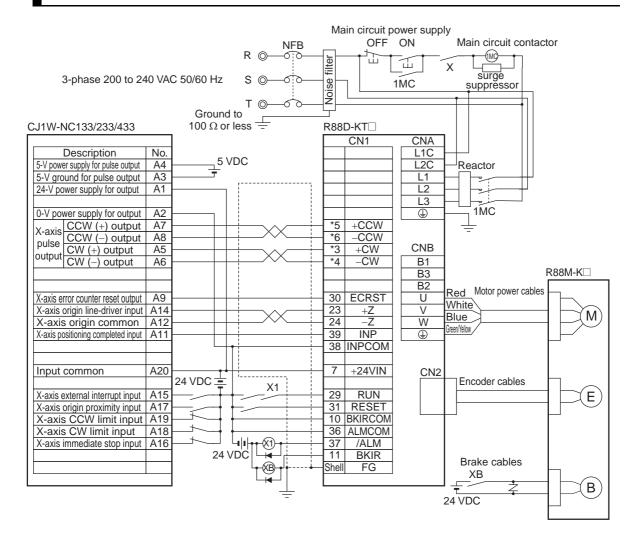
Appendix

This chapter provides connection examples using OMRON's PLC and Position Controller, as well as a list of parameters.

| 12-1 C | Connection Examples | 12-1 |
|--------|---------------------|-------|
| 12-2 P | arameter List | 12-11 |

12-1 Connection Examples

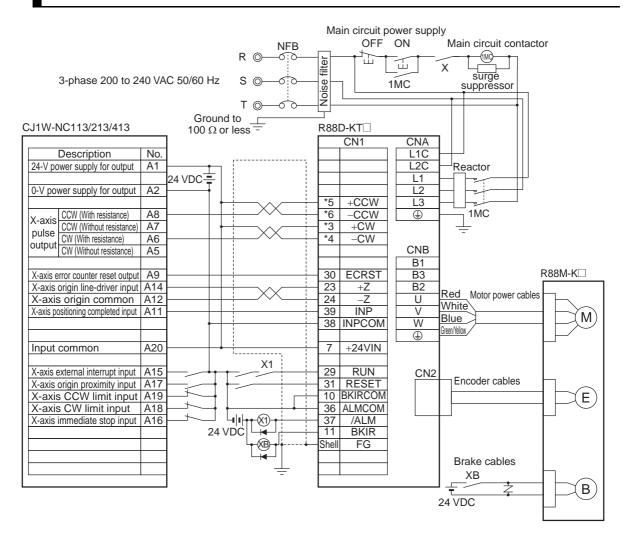
Connection Example 1: Connecting to SYSMAC CJ1W-NC133/233/433





- The wiring for the pins with * is the same as it is when a Servo Relay Unit Cable is used. Set Pn005 (Command Pulse Input Selection) to 0 (photocoupler input).
- The example shows a 3-phase, 200-VAC input to the drive for the main circuit power supply. Be sure to provide a power supply and wiring conforming to the power supply specifications for the drive in use.
- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Use mode 2 for origin search.
- The diode recommended for surge absorption is the RU 2 (Sanken Electric Co., Ltd.) or the equivalent.
- Make the setting so that the servo can be turned ON/OFF with the RUN signal.

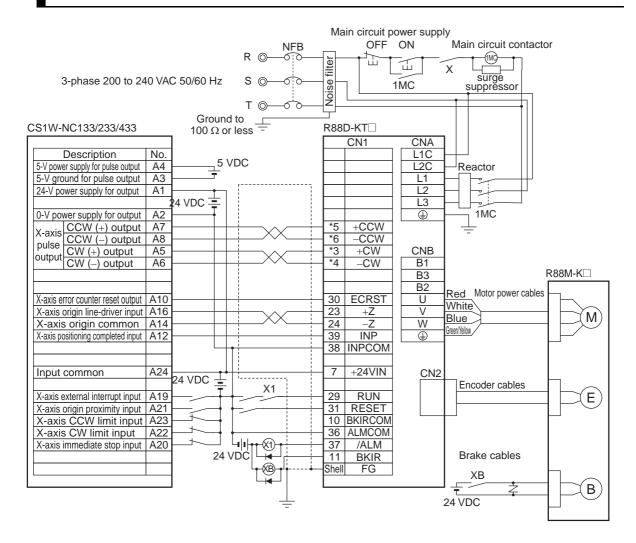
Connection Example 2: Connecting to SYSMAC CJ1W-NC113/213/413





- The wiring for the pins with * is the same as it is when a Servo Relay Unit Cable is used. Set Pn005 (Command Pulse Input Selection) to 0 (photocoupler input).
- The example shows a 3-phase, 200-VAC input to the drive for the main circuit power supply. Be sure to provide a power supply and wiring conforming to the power supply specifications for the drive in use.
- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Use mode 2 for origin search.
- The diode recommended for surge absorption is the RU 2 (Sanken Electric Co., Ltd.) or the equivalent.
- Make the setting so that the servo can be turned ON/OFF with the RUN signal.

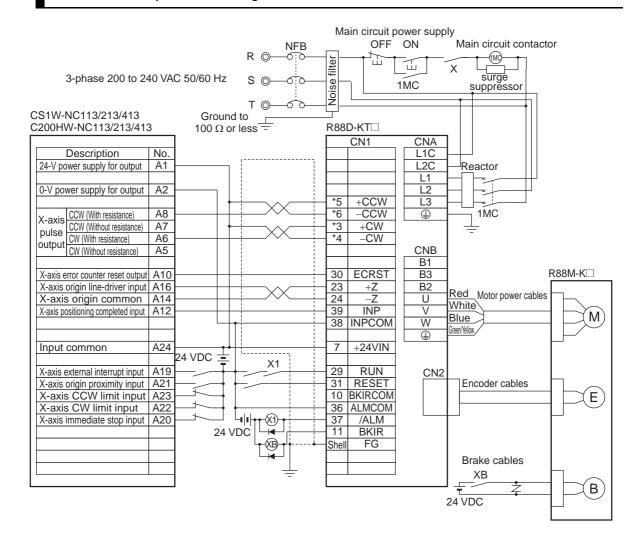
Connection Example 3: Connecting to SYSMAC CS1W-NC133/233/433





- The wiring for the pins with * is the same as it is when a Servo Relay Unit Cable is used. Set Pn005 (Command Pulse Input Selection) to 0 (photocoupler input).
- The example shows a 3-phase, 200-VAC input to the drive for the main circuit power supply. Be sure to provide a power supply and wiring conforming to the power supply specifications for the drive in use
- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Use mode 2 for origin search.
- The diode recommended for surge absorption is the RU 2 (Sanken Electric Co., Ltd.) or the equivalent.
- Make the setting so that the servo can be turned ON/OFF with the RUN signal.

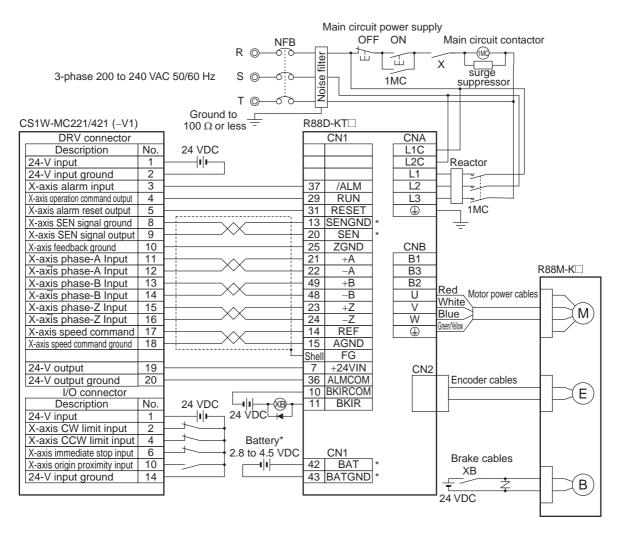
Connection Example 4: Connecting to SYSMAC CS1W-NC113/213/413 or C200HW-NC113/213/413





- The wiring for the pins with * is the same as it is when a Servo Relay Unit Cable is used. Set Pn005 (Command Pulse Input Selection) to 0 (photocoupler input).
- The example shows a 3-phase, 200-VAC input to the drive for the main circuit power supply. Be sure to provide a power supply and wiring conforming to the power supply specifications for the drive in use.
- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Use mode 2 for origin search.
- The diode recommended for surge absorption is the RU 2 (Sanken Electric Co., Ltd.) or the equivalent.
- Make the setting so that the servo can be turned ON/OFF with the RUN signal.

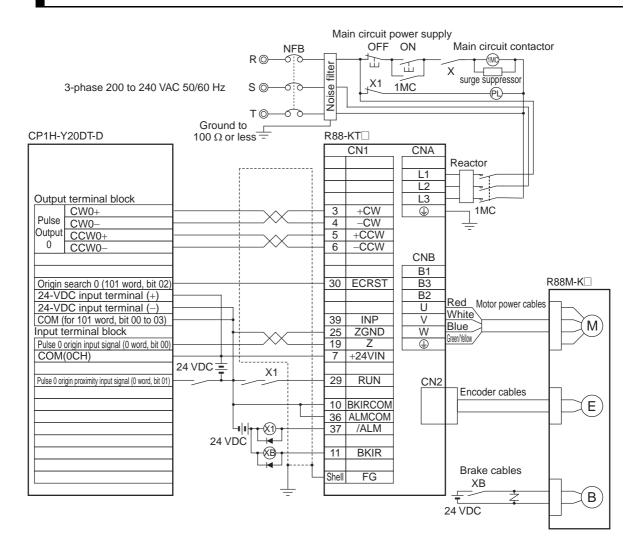
Connection Example 5: Connecting to a SYSMAC Motion Control Unit





- The example shows a 3-phase, 200-VAC input to the drive for the main circuit power supply. Be sure to provide a power supply and wiring conforming to the power supply specifications for the drive in use.
- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Connect terminals and wiring marked with an asterisk (*) when using an absolute encoder.
- This wiring diagram is an example of X-axis wiring only. For other axes, connections must be made in the same way with the drive.
- Always short unused NC input terminals at the Motion Control Unit I/O connectors.
- Make the setting so that the servo can be turned ON/OFF with the RUN signal.

Connection Example 6: Connecting to SYSMAC CP1H-Y□□DT-D

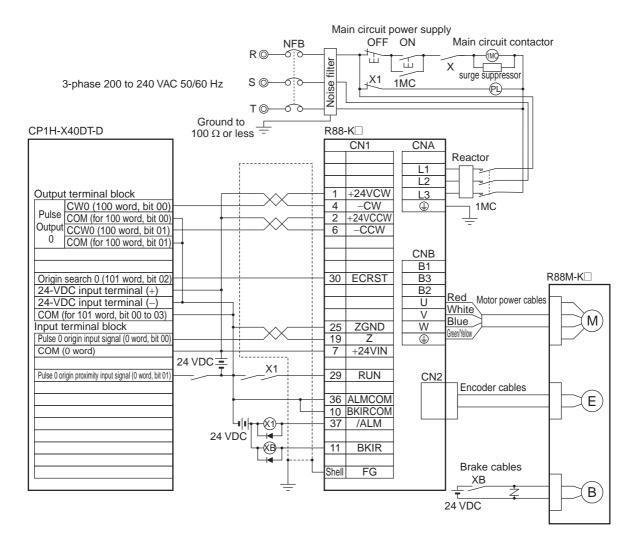




- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Do not share the power supply for brakes (24 VDC) with the 24-VDC power supply for controls.
- The diode recommended for surge absorption is the RU 2 (Sanken Electric Co., Ltd.) or the equivalent.

Appendix

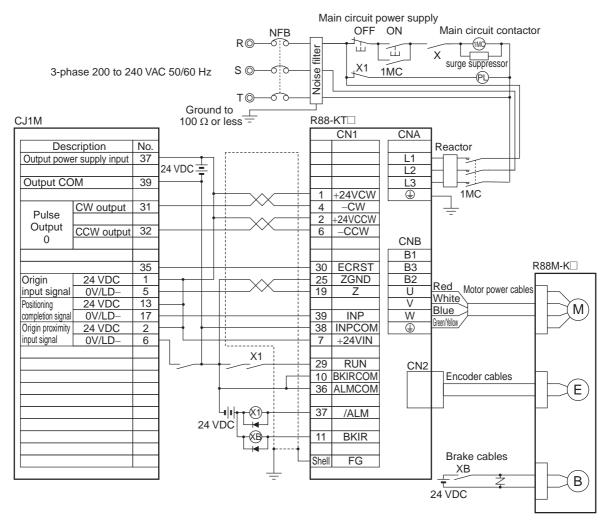
Connection Example 7: Connecting to SYSMAC CP1H-XDDT-D/CP1L-DDT-D





- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Do not share the power supply for brakes (24 VDC) with the 24-VDC power supply for controls.
- The diode recommended for surge absorption is the RU 2 (Sanken Electric Co., Ltd.) or the equivalent.

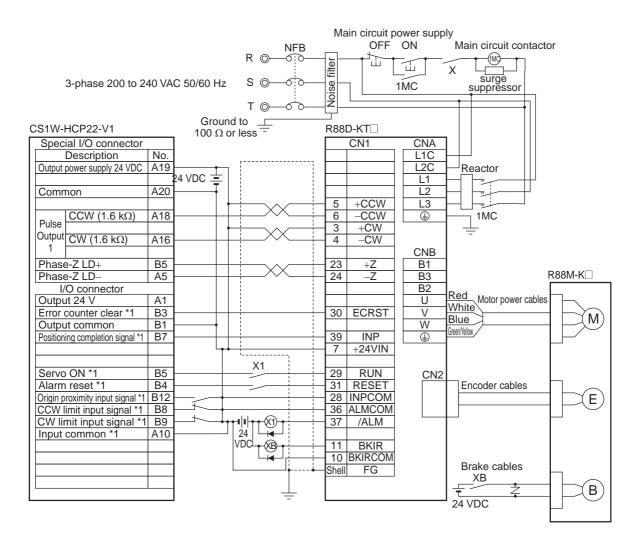
Connection Example 8: Connecting to SYSMAC CJ1M





- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Use mode 2 for origin search.
- Use the power supply for command pulse (24 VDC) as a dedicated power supply.
- Do not share the power supply for brakes (24 VDC) with the 24-VDC power supply for controls.
- The diode recommended for surge absorption is the RU 2 (Sanken Electric Co., Ltd.) or the equivalent.

Connection Example 9: Connecting to a SYSMAC CS1W-HCP22-V1 Customizable Counter Unit

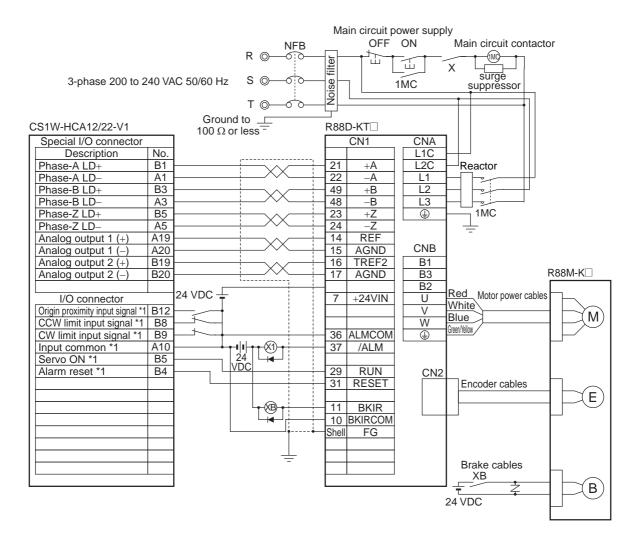


*1. The I/O signals for the HCP22 depend on the memory allocations in the Internal Memory area. Change the wiring according to the allocations.



- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Use the power supply for command pulse (24 VDC) as a dedicated power supply.
- The diode recommended for surge absorption is the RU 2 (Sanken Electric Co., Ltd.) or the equivalent.
- Do not share the power supply for brakes (24 VDC) with the 24-VDC power supply for controls.

Connection Example 10: Connecting to a SYSMAC CS1W-HCA12/22-V1 Customizable Counter Unit



*1. The I/O signals for the HCA12/22 depend on the allocations in the Internal Memory area. Change the wiring according to the allocations.



- Incorrect signal wiring can cause damage to units and the drive.
- Leave unused signal lines open and do not wire them.
- Use the power supply for command pulse (24 VDC) as a dedicated power supply.
- The diode recommended for surge absorption is the RU 2 (Sanken Electric Co., Ltd.) or the equivalent.
- Do not share the power supply for brakes (24 VDC) with the 24-VDC power supply for controls.

12-2 Parameter List

- Some parameters are enabled by turning the power supply OFF and then ON again. (Those parameters are indicated in the table.) After changing these parameters, turn OFF the power supply, confirm that the power supply indicator has gone OFF, and then turn ON the power supply
- Do not change the parameters marked "Reserved". Do not change the settings marked "Reserved".

Basic Setting Parameters

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|--|---------|--|--------------------|------|----------------|---------------------------------|
| | | | Set the relation between the command direction and the motor rotation direction. | | | | |
| 000 | Rotation Direction | 0 | A forward direction command sets the direction to CW as viewed from the shaft end | 1 | _ | 0 or 1 | Yes |
| | Switching | 1 | A forward direction command sets the direction to CCW as viewed from the shaft end | | | | |
| | | Sele | ect the Servo Drive control mode. | | _ | | Yes |
| | | 0 | Position control (pulse train command) | | | 0 to 6 | |
| | | 1 | Speed control (analog command) | | | | |
| | | 2 | Torque control (analog command) | | | | |
| 001 | Control Mode Selection | 3 | No. 1: Position control No. 2: Speed control | 0 | | | |
| | | 4 | No. 1: Position control No. 2: Torque control | | | | |
| | | 5 | No. 1: Speed control No. 2: Torque control | | | | |
| | | 6 | Fully-closed control | | | | |
| | | Set t | the operation mode for realtime autotuning. | | _ | | _ |
| | | 0 | Disabled | | | | |
| | | 1 | Emphasizes stability | | | | |
| | | 2 | Emphasizes positioning | | | | |
| 002 | Realtime Autotuning Mode Selection | 3 | If there is an unbalanced load like in a vertical axis. | 1 | | 0 to 6 | |
| | Wode Gelection | 4 | Used when friction is large. | | | | |
| | | 5 | Used when there is an unbalanced load, such as a vertical axis, and friction is large. | | | | |
| | | 6 | Used to customize the Realtime Autotuning Mode. | | | | |
| 003 | Realtime Autotuning Machine Rigidity Setting | | Set the machine rigidity for executing realtime autotuning. | | _ | 0 to 31 | _ |
| 004 | Inertia Ratio | | Set the load inertia as a percentage of the motor rotor inertia. | | % | 0 to 10,000 | _ |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---|---------|---|-----------------|---------------|----------------------|------------------------|
| | Command | Sele | ect the command pulse input. | | | | |
| 005 | Pulse Input | 0 | Photocoupler input | 0 | _ | 0 or 1 | Yes |
| | Selection | 1 | Input for line driver only | | | | |
| | Command Pulse | | | | | | |
| 006 | Rotation Direction Switching | 0 | Forward direction | 0 | _ | 0 or 1 | Yes |
| | Selection | 1 | Reverse direction | | | | |
| | | Set | the command pulse mode. | | | | |
| | Command | 0 | 90° differential-phase (A/B) inputs | | | | |
| 007 | Pulse Mode | 1 | Forward pulse/reverse pulse | 1 | _ | 0 to 3 | Yes |
| | Selection | 2 | 90° differential-phase (A/B) inputs | | | | |
| | | 3 | Feed pulse and direction signal | | | | |
| 008 | Electronic Gear Integer Setting | | the number of command pulses per or rotation. | 10000 | Pulses | 0 to 2 ²⁰ | Yes |
| 009 | Electronic Gear Ratio Numerator 1 | If Pi | the electronic gear ratio. n009 = 0, the encoder resolution is set as numerator. | 0 | _ | 0 to 2 ³⁰ | _ |
| 010 | Electronic Gear Ratio Denominator | | Electronic gear ratio numerator 1 (Pn009) Electronic gear ratio denominator (Pn010) | 10000 | _ | 1 to 2 ³⁰ | - |
| 011 | Encoder Dividing Numerator | | the number of phase A and phase B out pulses, respectively per motor rotation. | 2500 | P/r | 1 to 262,144 | Yes |
| | | | Select the phase B logic for pulse regeneration output and the output source. | | | | |
| | Encoder Output | 0 | Phase B logic: Not reversed Output source: Encoder | | _ | | Yes |
| 012 | Direction Switching | 1 | Phase B logic: Reversed Output source: Encoder | 0 | | 0 to 3 | |
| | Selection | 2 | Phase B logic: Not reversed Output source: External encoder | | | | |
| | | 3 | Phase B logic: Reversed Output source: External encoder | | | | |
| 013 | No. 1 Torque Limit | | | 500 | % | 0 to 500 | _ |
| 014 | Error Counter Overflow Level | leve | the range of the error counter overflow el. Detection of error counter overflow el error is disabled if the set value is 0. | 100000 | Command units | 0 to 2 ²⁷ | _ |
| | | Sele | ect the absolute encoder usage method. | | | | |
| | Operation | 0 | Used as an absolute encoder. | | | | |
| 015 | Switch when | 1 | Used as an incremental encoder. | 1 | _ | 0 to 2 | Yes |
| | Using Absolute Encoder | 2 | Used as an absolute encoder. (Multi-rotation counter overflows are ignored.) | 1 | | 0.02 | |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---------------------------------------|---------|---|--------------------|------|---------------|------------------------|
| | Regeneration Resistor Selection | Sel | ect the Regeneration Resistor used. | | | 0 to 3 | Yes |
| 016 | | 0 | Use the Built-in Resistor. Triggering of regeneration overload protection (Alarm No. 18) depends on the Built-in Resistor (with approx. 1% duty). | | | | |
| | | 1 | Use an External Resistor. The regeneration processing circuit operates and regeneration overload protection (Alarm No. 18) is triggered when the operating rate of the Regeneration Resistor exceeds 10%. | See Note 2 | _ | | |
| | | 2 | Use an External Resistor. Regeneration overload protection (Alarm No. 18) does not operate. | | | | |
| | | 3 | No Regeneration Resistor All regeneration power is processed with built-in capacitors. | | | | |
| | | | ect the type of load ratio calculation for External Regeneration Resistor. | | | | |
| | External | 0 | Regeneration load ratio is 100% when operating rate of the External Regeneration Resistor is 10%. | 0 | | | |
| 017 | Regeneration Resistor Setting | 1 | Reserved | 0 | _ | 0 to 4 | Yes |
| | | 2 | Reserved | | | | |
| | | 3 | Reserved | | | | |
| | | 4 | Reserved | | | | |

[•]Note 1: The default setting is 11 for 200-V Servo Drives of 1 kW or higher and 400-V Servo Drives.

[•]Note 2: The default setting is 0 for 100-V Servo Drives of 400 W, 200-V Servo Drives of 750 W to 5 kW, and 400-V Servo Drives of 5 kW or lower.

Gain Parameters

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---|---------|---|--------------------|------------|----------------|------------------------|
| 100 | Position Loop Gain | Set | the position loop gain 1. | See Note 1 | 0.1/s | 0 to 30,000 | _ |
| 101 | Speed Loop Gain | Set | the speed loop gain 1. | See Note 2 | 0.1 Hz | 1 to 32,767 | - |
| 102 | Speed Loop Integral Time Constant | Set | the speed loop integral time constant 1. | See Note 3 | 0.1 ms | 1 to 10,000 | _ |
| 103 | Speed Feedback Filter Time Constant | | speed feedback filter 1 can be set to one values. | 0 | _ | 0 to 5 | _ |
| 104 | Torque Command Filter Time Constant | Set | the time constant for the torque filter 1. | See Note 4 | 0.01 ms | 0 to 2,500 | _ |
| 105 | Position Loop Gain 2 | Set | the position loop gain 2. | See Note 5 | 0.1/s | 0 to 30,000 | _ |
| 106 | Speed Loop Gain 2 | Set | the speed loop gain 2. | See Note 6 | 0.1 Hz | 1 to 32,767 | _ |
| 107 | Speed Loop Integral Time Constant 2 | Set | the speed loop integral time constant 2. | 10000 | 0.1 ms | 1 to 10,000 | _ |
| 108 | Speed Feedback Filter Time Constant 2 | | speed feedback filter 2 can be set to one values. | 0 | _ | 0 to 5 | - |
| 109 | Torque Command Filter Time Constant 2 | Set | the time constant for the torque filter 2. | See Note 7 | 0.01 ms | 0 to 2,500 | - |
| 110 | Speed Feed- forward Amount | Set | the speed feed-forward amount. | 300 | 0.1% | 0 to 1,000 | _ |
| 111 | Speed Feed- forward Command Filter | | the speed feed-forward filter time stant. | 50 | 0.01 ms | 0 to 6,400 | _ |
| 112 | Torque Feed- forward Amount | Set | the torque feed-forward amount. | 0 | 0.1% | 0 to 1,000 | _ |
| 113 | Torque Feed- forward Command Filter | Set | et the torque feed-forward filter. 0 | | 0.01 ms | 0 to 6,400 | _ |
| 114 | Gain Switching Input Operating Mode Selection | | cute optimum tuning using the gain sching function. Gain 1 (PI/P switching enabled) Gain 1 and gain 2 switching available | 1 | _ | 0 or 1 | _ |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---|---------|--|--------------------|--------|----------------|---------------------------------|
| | | pos | ect the gain switching condition for ition control. necessary that Pn114 be set to 1. | | | | |
| | | 0 | Always gain 1 | | | | |
| | | 1 | Always gain 2 | | | | |
| | | 2 | Switching using gain switching input (GSEL) | | | | |
| | Switching Mode | 3 | Torque command change amount | | | | |
| 115 | in Position Control | 4 | Always gain 1 | 0 | _ | 0 to 10 | _ |
| | Control | 5 | Command speed | | | | |
| | | 6 | Amount of position error | | | | |
| | | 7 | Command pulses received | | | | |
| | | 8 | Positioning completion signal (INP) OFF | | | | |
| | | 9 | Actual motor speed | | | | |
| | | 10 | Combination of command pulse input and speed | | | | |
| 116 | Gain Switching Delay Time in Position Control | | the delay time for switching from gain 2 ain 1. | 50 | 0.1 ms | 0 to 10,000 | _ |
| 117 | Gain Switching Level in Position Control | Set | the gain switching level. | 50 | _ | 0 to 20,000 | _ |
| 118 | Gain Switching Hysteresis in Position Control | Set | the hysteresis for gain switching. | 33 | - | 0 to 20,000 | _ |
| 119 | Position Gain Switching Time | | the position gain switching time for gain ching. | 33 | 0.1 ms | 0 to 10,000 | _ |
| | | con | Select the gain switching condition for speed ontrol. is necessary that Pn114 be set to 1. | | | | |
| | | 0 | Always gain 1 | | | | |
| | Switching Mode | 1 | Always gain 2 | | | | |
| 120 | in Speed Control | 2 | Switching using gain switching input (GSEL) | 0 | _ | 0 to 5 | _ |
| | | 3 | Torque command change amount | | | | |
| | | 4 | Speed command change amount | | | | |
| | | 5 | Command speed | | | | |
| 121 | Gain Switching Delay Time in Speed Control | | the delay time for switching from gain 2 ain 1. | 0 | 0.1 ms | 0 to 10,000 | _ |
| 122 | Gain Switching Level in Speed Control | Set | the gain switching level. | 0 | _ | 0 to 20,000 | _ |
| 123 | Gain Switching Hysteresis in Speed Control | Set | the hysteresis for gain switching. | 0 | _ | 0 to 20,000 | _ |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---|---------|--|--------------------|--------|----------------|------------------------|
| 124 | | torq | ect the gain switching condition for ue control. necessary that Pn114 be set to 1. | | | | |
| | Switching Mode | 0 | Always gain 1 | | | 00 | |
| | in Torque Control | 1 | Always gain 2 | -0 - | _ | 0 to 3 | _ |
| | | 2 | Switching using gain switching input (GSEL) | | | | |
| | | 3 | Torque command change amount | | | | |
| 125 | Gain Switching Delay Time in Torque Control | | the delay time for switching from gain 2 ain 1. | 0 | 0.1 ms | 0 to 10,000 | _ |
| 126 | Gain Switching Level in Torque Control | Set | the gain switching level. | 0 | _ | 0 to 20,000 | _ |
| 127 | Gain Switching Hysteresis in Torque Control | Set | the hysteresis for gain switching. | 0 | _ | 0 to 20,000 | _ |

- •Note 1: The default setting is 320 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- •Note 2: The default setting is 180 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- •Note 3: The default setting is 310 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives
- •Note 4: The default setting is 126 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- •Note 5: The default setting is 380 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- •Note 6: The default setting is 180 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.
- •Note 7: The default setting is 126 for 200-V Servo Drives of 1 kW or higher, and 400-V Servo Drives.

Vibration Suppression Function Parameters

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---------------------------------|-------------|--|--------------------|------|----------------|---------------------------------|
| | | Set | the operation of the adaptive filter. | | | | |
| | | 0 | Disabled | | | | |
| | | 1 | One enabled. Frequency limited after adaptation. | | | | |
| 200 | Adaptive Filter Selection | 2 | Two enabled. Frequency limited after adaptation. | 0 | _ | 0 to 4 | _ |
| | | 3 | One enabled. Adaptation performed at all times. | | | | |
| | | 4 | Two enabled. Adaptation performed with 1 filter at all times. | | | | |
| 201 | Notch 1 Frequency Setting | | the notch frequency of resonance pression notch filter 1. | 5000 | Hz | 50 to 5,000 | _ |
| 202 | Notch 1 Width Setting | | the notch width of the resonance pression notch filter 1. | 2 | _ | 0 to 20 | _ |
| 203 | Notch 1 Depth Setting | | the notch depth of resonance pression notch filter 1. | 0 | _ | 0 to 99 | _ |
| 204 | Notch 2 Frequency Setting | | the notch frequency of resonance pression notch filter 2. | 5000 | Hz | 50 to 5,000 | _ |
| 205 | Notch 2 Width Setting | | the notch width of the resonance pression notch filter 2. | 2 | _ | 0 to 20 | _ |
| 206 | Notch 2 Depth Setting | | the notch depth of resonance pression notch filter 2. | 0 | _ | 0 to 99 | _ |
| 207 | Notch 3 Frequency Setting | sup This | the notch frequency of resonance pression notch filter 3. s is set automatically when an adaptive ch is enabled. | 5000 | Hz | 50 to 5,000 | - |
| 208 | Notch 3 Width Setting | sup This | the notch width of the resonance pression notch filter 3. s is set automatically when an adaptive ch is enabled. | 2 | _ | 0 to 20 | _ |
| 209 | Notch 3 Depth Setting | sup This | the notch depth of resonance pression notch filter 3. s is set automatically when an adaptive ch is enabled. | 0 | _ | 0 to 99 | _ |
| 210 | Notch 4 Frequency Setting | sup This | the notch frequency of resonance pression notch filter 4. s is set automatically when an adaptive ch is enabled. | 5000 | Hz | 50 to 5,000 | _ |
| 211 | Notch 4 Width Setting | sup This | the notch width of the resonance pression notch filter 4. s is set automatically when an adaptive ch is enabled. | 2 | _ | 0 to 20 | _ |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|-----------------------------|-------------|---|--------------------|--------|---------------|------------------------|
| 212 | Notch 4 Depth Setting | sup This | the notch depth of resonance pression notch filter 4. s is set automatically when an adaptive ch is enabled. | 0 | _ | 0 to 99 | _ |
| | | Sele | ect the damping filter switching method. | | | | |
| 213 | Damping Filter Selection | 1 | Enabled When DF-SEL1 input open: Damping filter 1 and 3 enabled When DF-SEL1 input shorted: Damping filter 2 and 4 enabled | | | | |
| | | 2 | When DF-SEL1 open and DF-SEL2 open: Damping filter 1 enabled When DF-SEL1 shorted and DF-SEL2 open: Damping filter 2 enabled When DF-SEL1 open and DF-SEL2 shorted: Damping filter 3 enabled When DF-SEL1 shorted and DF-SEL2 shorted: Damping filter 4 enabled | 0 | _ | 0 to 3 | _ |
| | | 3 | Forward direction: Damping filter 1 and 3 enabled Reverse direction: Damping filter 2 and 4 enabled | | | | |
| 214 | Damping Frequency 1 | | the damping frequency 1. The function is oled if the set value is 10 (= 1 Hz) or greater. | 0 | 0.1 Hz | 0 to 2,000 | _ |
| 215 | Damping Filter 1 Setting | torq | ely adjust damping control function 1. If ue saturation occurs, lower this setting; ncrease responsiveness, raise this ing. | 0 | 0.1 Hz | 0 to 1,000 | _ |
| 216 | Damping Frequency 2 | | the damping frequency 2. The function is oled if the set value is 10 (= 1 Hz) or greater. | 0 | 0.1 Hz | 0 to 2,000 | _ |
| 217 | Damping Filter 2 Setting | torq | ely adjust damping control function 2. If ue saturation occurs, lower this setting; ncrease responsiveness, raise this ing. | 0 | 0.1 Hz | 0 to 1,000 | - |
| 218 | Damping Frequency 3 | ena | the damping frequency 3. The function is bled if the set value is 10 (= 1 Hz) or ater. | 0 | 0.1 Hz | 0 to 2,000 | _ |
| 219 | Damping Filter 3 Setting | torq | ely adjust damping control function 3. If ue saturation occurs, lower this setting; acrease responsiveness, raise this ing. | 0 | 0.1 Hz | 0 to 1,000 | _ |
| 220 | Damping Frequency 4 | ena | the damping frequency 4. The function is bled if the set value is 10 (= 1 Hz) or ater. | 0 | 0.1 Hz | 0 to 2,000 | _ |
| 221 | Damping Filter 4 Setting | torq | ely adjust damping control function 4. If ue saturation occurs, lower this setting; acrease responsiveness, raise this ing. | 0 | 0.1 Hz | 0 to 1,000 | _ |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---|---------|--|--------------------|--------|----------------|------------------------|
| 222 | Position Command Filter Time Constant | | the time constant of the first-order lag r for the position command. | 0 | 0.1 ms | 0 to 10,000 | _ |
| 223 | Smoothing Filter Time Constant | | the time constant of the FIR filter for the ition command. | 0 | 0.1 ms | 0 to 10,000 | _ |

Speed, Torque Control, and Fully-Closed Control Parameters

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|------------------------|---------|---|--------------------|---------------|----------------|------------------------|
| | | Sele | ct the speed command when using speed control. | | | | |
| | | 0 | Analog speed command | | | | |
| 300 | Command | 1 | No. 1 Internally Set Speed to No. 4 Internally Set Speed (Pn304 to Pn307) | | | | |
| | Speed Selection | 2 | No. 1 Internally Set Speed to No. 4 Internally Set Speed (Pn304 to Pn306), analog speed command | -0 | | 0 to 3 | _ |
| | | 3 | No. 1 Internally Set Speed to No. 8 Internally Set Speed (Pn304 to Pn311) | | | | |
| | Speed Command | | elect the method for designating the direction for the peed command | | | | |
| 301 | Direction | 0 | Specified with the sign | 0 | _ | 0 or 1 | _ |
| | Selection | 1 | Specified with VSIGN | | | | |
| 302 | Speed Command Scale | | the input gain for the analog speed nmand input. | 500 | (r/min)/ V | 10 to 2,000 | _ |
| | Analog Speed | Set | the polarity for analog speed commands. | | | | |
| 303 | Command Rotation | 0 | +Voltage: Forward direction -Voltage: Reverse direction | 1 | _ | 0 or 1 | _ |
| | Direction Switching | 1 | +Voltage: Reverse direction -Voltage: Forward direction | | | | |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|--|-------------|--|--------------------|--------------------------|-----------------|------------------------|
| 304 | No. 1 Internally Set Speed | Set valu | the No. 1 internal speed command ie. | 0 | r/min | | _ |
| 305 | No. 2 Internally Set Speed | Set valu | the No. 2 internal speed command ie. | 0 | r/min | | _ |
| 306 | No. 3 Internally Set Speed | Set valu | the No. 3 internal speed command ue. | 0 | r/min | | _ |
| 307 | No. 4 Internally Set Speed | Set valu | the No. 4 internal speed command ue. | 0 | r/min | -20,000 | _ |
| 308 | No. 5 Internally Set Speed | Set valu | the No. 5 internal speed command ie. | 0 | r/min | to 20,000 | _ |
| 309 | No. 6 Internally Set Speed | Set valu | the No. 6 internal speed command ie. | 0 | r/min | | _ |
| 310 | No. 7 Internally Set Speed | Set valu | the No. 7 internal speed command ue. | 0 | r/min | | _ |
| 311 | No. 8 Internally Set Speed | Set valu | the No. 8 internal speed command ue. | 0 | r/min | | _ |
| 312 | Soft Start Acceleration Time | | ne for speed commands. 0 (1,000 r/min) 10 | | 0 to 10,000 | _ | |
| 313 | Soft Start Deceleration Time | | the deceleration processing eleration time for speed commands. | 0 | ms/ (1,000 r/ min) | 0 to 10,000 | _ |
| 314 | S-curve Acceleration/ Deceleration Time Setting | pro | et the acceleration/deceleration | | ms | 0 to 1,000 | _ |
| | | | ect the function of the zero speed ignation input (ZEROSPD). | | | | |
| | | 0 | Disabled | | | | |
| | | 1 | The speed command is 0. | | | | |
| 315 | Zero Speed Designation Selection | 2 | If the speed command is 0 and the actual speed is less than the zero speed designation, the servo lock is applied. | 0 | _ | 0 to 3 | _ |
| | | 3 | When the speed command is equal to or less than the Position Lock Level Setting (Pn316) minus 10 r/min, the servo lock is applied. | | | | |
| 316 | Position Lock Level Setting | Set | the threshold for position lock moving. | 30 | r/min | 10 to 20,000 | _ |
| | | Sele | ct the torque command and speed limit value. | | | | |
| | Torque | 0 | Torque command: Analog input 1 Speed limit: Pn321 set value | | | | |
| 317 | Command/ Speed Limit Selection | 1 | Torque command: Analog input 2 Speed limit: Analog input 1 | 0 | _ | 0 to 2 | _ |
| | | 2 | Torque command: Analog input 1 Speed limit: Pn321 and Pn322 set values | | | | |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|--|---------------------|---|--------------------|----------------|----------------------|---------------------------------|
| | Torque Command | | ect the method for selecting the direction he torque command. | | | | |
| 318 | Direction | 0 | Specified with the sign | 0 | _ | 0 or 1 | _ |
| | Selection | 1 | Specified with VSIGN | | | | |
| 319 | Torque Command Scale | | the input gain for analog torque nmand input. | 30 | 0.1 V/ 100% | 10 to 100 | - |
| | Analog Torque | Set | the analog torque command input polarity. | | | | |
| 320 | Command Rotation Direction | 0 | Forward operation | 0 | _ | 0 or 1 | _ |
| | Switching | 1 | Reverse operation | | | | |
| 321 | Speed Limit Value Setting | Set | the speed limit value. | 0 | r/min | 0 to 20,000 | - |
| 322 | Reverse Direction Speed Limit Value Setting | | tch the speed limit value according to the ction. | 0 | r/min | 0 to 20,000 | _ |
| | External Feedback Pulse Type Selection | Sel | ect the external feedback pulse type. | | | 0 to 2 | |
| | | 0 | 90° phase difference output type | | | | |
| 323 | | 1 | Incremental encoder with serial communications | 0 | _ | | Yes |
| | | 2 | Reserved (Do not use this setting.) | | | | |
| 324 | External Feedback Pulse Dividing Numerator | | the external feedback pulse dividing nerator. | 0 | _ | 0 to 2 ²⁰ | Yes |
| 325 | External Feedback Pulse Dividing Denominator | | the external feedback pulse dividing ominator. | 10000 | - | 1 to 2 ²⁰ | Yes |
| | External Feedback Pulse | | rerse the external feedback pulse count ction by changing the setting. | | | | |
| 326 | Direction | 0 | Count direction not reversed | 0 | _ | 0 or 1 | Yes |
| | Switching | 1 | Count direction reversed | | | | |
| 327 | External Feedback Pulse | unc feed outr | disconnection detection in the phase-Z onnected state when the external dback pulse of a 90° phase difference but type is used. | 0 | _ | 0 or 1 | Yes |
| | Phase-Z Setting | 0 | Enabled | | | | |
| | | 1 | Disabled | | | | |
| 328 | Internal/External Feedback Pulse Error Counter Overflow Level | | the threshold for feedback pulse iation errors. | 16000 | Command units | 1 to 2 ²⁷ | Yes |
| 329 | Internal/External Feedback Pulse Error Counter Reset | | ar to 0 the feedback pulse error value for h set rotation speed. | 0 | Rotations | 0 to 100 | Yes |

Interface Monitor Setting Parameters

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|------------------------------|---------|--|--------------------|------|-------------------|------------------------|
| 400 | Input Signal Selection 1 | Set | the input signal 1 function and logic. | 855309 0 | _ | 0 to 00FFFFFFh | Yes |
| 401 | Input Signal Selection 2 | Set | the input signal 2 function and logic. | 848729 7 | _ | 0 to 00FFFFFh | Yes |
| 402 | Input Signal Selection 3 | Set | the input signal 3 function and logic. | 953985 0 | _ | 0 to 00FFFFFh | Yes |
| 403 | Input Signal Selection 4 | Set | the input signal 4 function and logic. | 394758 | _ | 0 to 00FFFFFh | Yes |
| 404 | Input Signal Selection 5 | Set | the input signal 5 function and logic. | 4108 | _ | 0 to 00FFFFFFh | Yes |
| 405 | Input Signal Selection 6 | Set | the input signal 6 function and logic. | 197379 | _ | 0 to 00FFFFFh | Yes |
| 406 | Input Signal Selection 7 | Set | the input signal 7 function and logic. | 3847 | _ | 0 to 00FFFFFh | Yes |
| 407 | Input Signal Selection 8 | Set | the input signal 8 function and logic. | 263172 | _ | 0 to 00FFFFFh | Yes |
| 408 | Input Signal Selection 9 | Set | the input signal 9 function and logic. | 328965 | _ | 0 to 00FFFFFh | Yes |
| 409 | Input Signal Selection 10 | Set | the input signal 10 function and logic. | 3720 | _ | 0 to 00FFFFFh | Yes |
| 410 | Output Signal Selection 1 | Set | the output signal 1 function allocation. | 197379 | _ | 0 to 00FFFFFh | Yes |
| 411 | Output Signal Selection 2 | Set | the output signal 2 function allocation. | 131586 | _ | 0 to 00FFFFFh | Yes |
| 412 | Not used | Do | not change the set value. | - | _ | _ | _ |
| 413 | Output Signal Selection 4 | Set | the output signal 4 function allocation. | 328964 | _ | 0 to 00FFFFFh | Yes |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|--|---------|---|--------------------|------------|---------------------|------------------------|
| | | Sele | ect the type for analog monitor 1. | | | | |
| | | 0 | Motor speed | | | | |
| | | 1 | Position command speed | | | | |
| | | 2 | Internal position command speed | | | | |
| | | 3 | Speed Control Command | | | | |
| | | 4 | Torque command | | | | |
| | | 5 | Position command error | | | | |
| | | 6 | Encoder Position Error | | | | |
| | | 7 | Fully-closed Error | | | | |
| | | 8 | Hybrid Error | | | | |
| | | 9 | P-N voltage | | | | |
| 416 | Analog Monitor 1 Selection | 10 | Regeneration load ratio | 0 | _ | 0 to 21 | _ |
| | T Coloculori | 11 | Overload load ratio | | | | |
| | | 12 | Forward direction torque limit | | | | |
| | | 13 | Reverse direction torque limit | | | | |
| | | 14 | Speed limit value | | | | |
| | | 15 | Inertia Ratio | | | | |
| | | 16 | Analog input 1 | | | | |
| | | 17 | Analog input 2 | | | | |
| | | 18 | Analog input 3 | | | | |
| | | 19 | Encoder temperature | | | | |
| | | 20 | Drive temperature | | | | |
| | | 21 | Encoder 1-rotation data | | | | |
| 417 | Analog Monitor 1 Scale Setting | Set | the output gain for analog monitor 1. | 0 | _ | 0 to 214,748,364 | _ |
| 418 | Analog Monitor 2 Selection | The | ect the type for analog monitor 2. e set values for this parameter are the ne as Analog Monitor 1 Type (Pn416). | 4 | _ | 0 to 21 | _ |
| 419 | Analog Monitor 2 Scale Setting | Sele | ect the output gain for analog monitor 2. | 0 | _ | 0 to 214,748,364 | _ |
| | | Sele | ect the analog monitor output voltage method. | | | | |
| | Analog Monitor | 0 | Output range: -10 to 10 V Data output: Positive, negative | | | | |
| 421 | Analog Monitor Output Setting | 1 | Output range: 0 to 10 V Data output: Positive, negative | 0 | _ | 0 to 2 | _ |
| | | 2 | Output range: 0 to 10 V Data output: Positive, negative | | | | |
| 422 | Analog Input 1 Offset | Set | the analog input 1 offset. | 0 | 0.359 mV | -5,578 to 5,578 | _ |
| 423 | Analog Input 1 Filter Time Constant | Set | the analog input 1 filter. | 0 | 0.01 ms | 0 to 6,400 | _ |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---|------------|--|--------------------|---------------|-----------------|------------------------|
| 424 | Excessive Analog Input 1 | | the voltage after offset for the excess | 0 | 0.1 V | 0 to 100 | _ |
| 425 | Analog Input 2 Offset | Set | the analog input 2 offset. | 0 | 5.86 mV | -342 to 342 | _ |
| 426 | Analog Input 2 Filter Time Constant | Set | the analog input 2 filter. | 0 | 0.01 ms | 0 to 6,400 | _ |
| 427 | Excessive Analog Input 2 | | the voltage after offset for the excess of analog input 2 input voltage. | 0 | 0.1 V | 0 to 100 | _ |
| 428 | Analog Input 3 Offset | Set | the analog input 3 offset. | 0 | 5.86 mV | -342 to 342 | - |
| 429 | Analog Input 3 Filter Time Constant | Set | the analog input 3 filter. | 0 | 0.01 ms | 0 to 6,400 | _ |
| 430 | Excessive Analog Input 3 | | e voltage after offset for the excess f analog input 3 input voltage. | | 0.1 V | 0 to 100 | _ |
| 431 | Positioning Completion Range 1 | | the allowed number of pulses for the tioning completion range. | 10 | Command units | 0 to 262,144 | _ |
| | | Set th | Positioning completion output turns ON when the positioning Completion Range 1 (Pn431). Positioning completion output turns ON when the Positioning Completion Range 1 (Pn431). | 0 | | | |
| | Positioning Completion Condition Selection | 1 | position error is within the Positioning Completion Range 1 (Pn431) and there is no position command. | | | | |
| 432 | | 2 | Positioning completion output turns ON when the zero speed detection signal is ON, the position error is within the Positioning Completion Range 1 (Pn431), and there is no position command. | | | 0 to 3 | _ |
| | | 3 | Positioning completion output turns ON when the position error is within the Positioning Completion Range 1 (Pn431) and there is no position command. The ON status will then be held until the next position command is received. | | | | |
| 433 | Positioning Completion Hold Time | Set | the positioning completion hold time. | 0 | 1 ms | 0 to 30,000 | _ |
| 434 | Zero Speed Detection | Set (ZS | the detection threshold for zero speed P). | 50 | r/min | 10 to 20,000 | - |
| 435 | Speed Conformity Detection Range | outp | the detection threshold for speed conformity out (VCMP) with the difference between the ed command and the actual speed. | 50 | r/min | 10 to 20,000 | _ |
| 436 | Rotation Speed for Motor Rotation Detection | | the detection threshold for the motor tion speed detection output (TGON). | 1000 | r/min | 10 to 20,000 | _ |
| 437 | Brake Timing when Stopped | | the operation time for the mechanical se at stop. | 0 | 1 ms | 0 to 10,000 | _ |
| 438 | Brake Timing During Operation | | the operation time for the mechanical se during operation. | 0 | 1 ms | 0 to 10,000 | _ |
| 439 | Brake Release Speed Setting | | the speed threshold for mechanical se output judgment during operation. | 30 | r/min | 30 to 3,000 | _ |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|-----------------------------------|-----------|--|--------------------|---------------|-----------------|------------------------|
| | | | ect the warning type to be output by rning Output 1. | | | | |
| | | 0 | An OR output of all alarm status | | | | |
| | | 1 | Overload warning | | | | |
| | | 2 | Excessive regeneration warning | | | | |
| | | 3 | Battery warning | | | 0 to 10 | |
| 440 | Warning Output Selection 1 | 4 | Fan warning | 0 | _ | | |
| 440 | | 5 | Encoder communications warning | U | | | _ |
| | | 6 | Encoder overheating warning | | | | |
| | | 7 | Vibration detection warning | | | | |
| | | 8 | Service life detection warning | | | | |
| | | 9 | External encoder error warning | | | | |
| | | 10 | External encoder communications error warning | | | | |
| 441 | Warning Output Selection 2 | Wa The | rning Output 2. relationships among the set values for this parameter he same as for Warning Output Selection 1 (Pn440). | 0 | _ | 0 to 10 | _ |
| 442 | Positioning Completion Range 2 | | the allowable number of pulses for the ond positioning completion range. | 10 | Command units | 0 to 262,144 | _ |

Expansion Parameters

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|--------------------------------------|--|---|--------------------|------|----------------------|------------------------|
| 500 | Electronic Gear Ratio Numerator 2 | If P | the electronic gear ratio. n500, Pn501, Pn502 = 0, the encoder | 0 | _ | 0 to 2 ³⁰ | _ |
| 501 | Electronic Gear Ratio Numerator 3 | reso | Dlution is set as the numerator. Electronic Gear Ratio Numerator 2 (Pn500) or | 0 | _ | 0 to 2 ³⁰ | - |
| 502 | Electronic Gear Ratio Numerator 4 | | Electronic Gear Ratio Numerator 3 (Pn501) or Electronic Gear Ratio Numerator 4 (Pn502) Electronic Gear Ratio Denominator (Pn010) | 0 | _ | 0 to 2 ³⁰ | _ |
| 503 | Encoder Dividing Denominator | | he denominator when the number of pulses per or rotation in pulse regeneration is not an integer. | 0 | _ | 0 to 262,144 | Yes |
| | | Set the operation to be performed upon forward/ reverse direction drive prohibition input. | | | | | |
| 504 | Drive Prohibition | 0 | Forward or reverse direction drive prohibition input enabled | 1 | _ | 0 to 2 | Yes |
| | Input Selection | 1 | Forward or reverse direction drive prohibition input disabled | • | | 0 10 2 | 100 |
| | | 2 | Forward or reverse direction drive prohibition input enabled | | | | |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|--|------------|---|--------------------|------|---------------|------------------------|
| | | Mak | te the setting upon drive prohibition input. | | | | |
| | Stop Selection for Drive | 0 | The torque in the drive prohibit direction is disabled, and the dynamic brake is activated. | | | | |
| 505 | Prohibition Input | 1 | The torque in the drive prohibit direction is disabled, and free-run deceleration is performed. | 0 | _ | 0 to 2 | Yes |
| | | 2 | The torque in the drive prohibit direction is disabled, and an emergency stop is performed. | | | | |
| | | Set t | he stop operation when the servo is turned OFF. | | | | |
| | | 0 | During deceleration: Dynamic brake After stopping: Dynamic brake Error counter: Clear | | | | |
| | | 1 | During deceleration: Free-run After stopping: Dynamic brake Error counter: Clear | | | | |
| | Stop Selection with Servo OFF | 2 | During deceleration: Dynamic brake After stopping: Servo free Error counter: Clear | | | | |
| | | 3 | During deceleration: Free-run After stopping: Servo free Error counter: Clear | | | | |
| 506 | | 4 | During deceleration: Dynamic brake After stopping: Dynamic brake Error counter: Hold | 0 | _ | 0 to 9 | _ |
| | | 5 | During deceleration: Free-run After stopping: Dynamic brake Error counter: Hold | | | | |
| | | 6 | During deceleration: Dynamic brake After stopping: Servo free Error counter: Hold | | | | |
| | | 7 | During deceleration: Free-run After stopping: Servo free Error counter: Hold | | | | |
| | | 8 | During deceleration: Emergency stop After stopping: Dynamic brake Error counter: Clear | | | | |
| | | 9 | During deceleration: Emergency stop After stopping: Servo free Error counter: Clear | | | | |
| 507 | Stop Selection with Main Power Supply OFF | sup The | the stop operation when the main power ply is turned OFF. set values for this parameter are the same stop Selection with Servo OFF (Pn506). | 0 | _ | 0 to 9 | _ |
| 508 | Undervoltage Alarm Selection | Sele | ect whether to trip the LV or turn OFF the to if there is a main power supply alarm. | 1 | _ | 0 or 1 | _ |
| 509 | Momentary Hold Time | Set | the main power supply alarm detection time. | 70 | 1 ms | 70 to 2,000 | Yes |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|--|---------|--|--------------------|------------------|----------------|------------------------|
| | | Set | the alarm sequence. | | | | |
| | | 0 | During deceleration: Dynamic brake After stopping: Dynamic brake | | | | |
| | | 1 | During deceleration: Free-run After stopping: Dynamic brake | | | | |
| | | 2 | During deceleration: Dynamic brake After stopping: Servo free | | | | |
| | | 3 | During deceleration: Free-run After stopping: Servo free | | | | |
| 510 | Stop Selection for Alarm Detection | 4 | During Emergency stop alarm deceleration: Emergency stop During deceleration: Dynamic brake After stopping: Dynamic brake | 0 | _ | 0 to 7 | _ |
| | Detection | 5 | During Emergency stop alarm deceleration: Emergency stop During deceleration: Free-run After stopping: Dynamic brake | | | | |
| | | 6 | During Emergency stop alarm deceleration: Emergency stop During deceleration: Dynamic brake After stopping: Servo free | | | | |
| | | 7 | During Emergency stop alarm deceleration: Emergency stop During deceleration: Free-run After stopping: Servo free | | | | |
| 511 | Immediate Stop Torque | Set | the torque limit for immediate stops. | 0 | % | 0 to 500 | _ |
| 512 | Overload Detection Level Setting | Set | the overload detection level. | 0 | % | 0 to 500* | - |
| 513 | Overspeed Detection Level Setting | Set | the overspeed error detection level. | 0 | r/min | 0 to 20,000 | _ |
| 514 | Overrun Limit Setting | | the motor over-travel distance for ition commands. | 10 | 0.1 Rotations | 0 to 1,000 | _ |
| | | Sele | ect from one of 4 values for the IF read cycle. | | | | |
| | Control Input | 0 | 0.166 ms | | | | |
| 515 | Signal Read | 1 | 0.333 ms | 0 | _ | 0 to 3 | Yes |
| | Setting | 2 | 1 ms | | | | |
| | | 3 | 1.666 ms | | | | |
| | Alarm Reset | Set | the alarm clear input detection method. | | | | |
| 516 | Condition | 0 | 120 ms | 0 | _ | 0 or 1 | Yes |
| | Setting | 1 | Follow the Control Input Signal Read Setting (Pn515). | | | | |

^{*} For example, if you set 115 or higher, the resolution will be 115%.

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---|---------|--|--------------------|-------------|---------------|------------------------|
| | | | the clear condition for the error counter reset t signal. | | | | |
| | | 0 | Disabled | | | | |
| | Error Counter | 1 | Clears the error counter with the level. (Shorted for 500 µs or longer) | | | | |
| 517 | Reset Condition Selection | 2 | Clears the error counter with the level. (Shorted for 1 ms or longer) | 0 | _ | 0 to 4 | _ |
| | | 3 | Clears the error counter with the edge. (Change from open to shorted for 100 µs or longer) | | | | |
| | | 4 | Clears the error counter with the edge. (Change from open to shorted 1 ms or longer) | | | | |
| | Command Pulse | | ble or disable the command pulse nibition input signals (INH). | | | | |
| 518 | Prohibition | 0 | Enabled | 1 | _ | 0 or 1 | _ |
| | Input Setting | 1 | Disabled | | | | |
| | | Selec | t the signal read cycle for the command pulse prohibition input. | | | | |
| | Command | 0 | 0.166 ms | | | | |
| 519 | Pulse Prohibition Input Read Setting | 1 | 0.333 ms | 0 | _ | 0 to 4 | Yes |
| 313 | | 2 | 1 ms | | | | |
| | | 3 | 1.666 ms | | | | |
| | | 4 | 0.166 ms | | | | |
| | Position Setting | | ect the positioning completion range and or counter overflow level setting unit. | | | | ,, |
| 520 | Unit Selection | 0 | Command unit | 0 | _ | 0 or 1 | Yes |
| | | 1 | Encoder unit | | | | |
| | | | the forward or reverse direction torque selection method. | | | | |
| | | 0 | Use P-ATL and N-ATL as analog torque limit inputs. | | | | |
| | | 1 | Pn013 is the limit value for both forward and reverse directions. | | | | |
| | Torque Limit | 2 | Forward operation: Set by Pn013, Reverse operation: Set by Pn522. | | | | |
| 521 | Selection | 3 | When TL-SEL input is open: Use Pn013. When TL-SEL input is shorted: Use Pn522. | 1 | _ | 0 to 6 | _ |
| | | 4 | Use P-ATL and N-ATL as analog torque limit inputs. | | | | |
| | | 5 | Use P-ATL and N-ATL as analog torque limit inputs. | | | | |
| | | 6 | When TL-SEL input is open: Forward direction, use Pn013; Reverse direction, use Pn522. When TL-SEL input is shorted: Forward direction, use Pn525; Reverse direction, use Pn526. | | | | |
| 522 | No. 2 Torque Limit | Set t | the No. 2 limit value for the motor output torque. | 500 | % | 0 to 500 | _ |
| 523 | Torque Limit Switching Setting 1 | | the change rate (fluctuate) for when the ue limit is switched from No. 1 to No. 2. | 0 | ms/ 100% | 0 to 4,000 | _ |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|-------------------------------------|---------|--|--------------------|----------------|---------------|------------------------|
| 524 | Torque Limit Switching Setting 2 | | the change rate (fluctuate) for when the ue limit is switched from No. 2 to No. 1. | 0 | ms/ 100% | 0 to 4,000 | _ |
| 525 | Forward External Torque Limit | | the forward direction torque limit for TL-SEL twhen Pn521 Torque Limit Selection is set to 6. | 500 | % | 0 to 500 | _ |
| 526 | Reverse External Torque Limit | | the reverse direction torque limit for TL-SEL twhen Pn521 Torque Limit Selection is set to 6. | 500 | % | 0 to 500 | _ |
| 527 | Analog Torque Limit Scale | | the gain of conversion for analog torque tinput. | 30 | 0.1 V/ 100% | 10 to 100 | _ |
| | | | ct the data to be displayed on the 7-segment LED lly when the control power supply is turned ON. | | | | |
| | | 0 | Position command error | | Command units | | |
| | | 1 | Motor speed | | r/min | | |
| | | 2 | Position command speed | | r/min | | |
| | | 3 | Speed Control Command | | r/min | | |
| | | 4 | Torque command | | % | | |
| | | 5 | Total encoder pulses | | Pulses | | |
| | | 6 | Total command pulses | | Pulses | | |
| | | 8 | Total External Encoder Feedback Pulses | Pulses V | | | |
| | | 9 | Control mode | | | | |
| | | 10 | I/O signal status | | | | |
| | | 11 | Analog input value | | | | |
| | | 12 | Alarm factor, history | | _ | | Yes |
| 528 | Default Display | 13 | Warning number | 1 | _ | 0 to 35 | |
| | | 14 | Regeneration resistance load ratio | | % | | |
| | | 15 | Overload load ratio | | % | | |
| | | 16 | Inertia Ratio | | % | | |
| | | 17 | Reason for no rotation | | _ | | |
| | | 18 | Display of the number of I/O signal changes | | times | | |
| | | 20 | Absolute encoder data | | _ | | |
| | | 21 | Absolute external encoder position | | _ | | |
| | | 22 | Monitor for the number of encoder communications errors | | times | | |
| | | 23 | Display of axis numbers for communication | | _ | | |
| | | 24 | Position error (encoder unit) | | _ | | |
| | | 25 | External encoder error (external encoder unit) | Command units | | | |
| | | 26 | Hybrid error | | | | |
| | | 27 | P-N voltage | | V |] | |
| | | 28 | Soft version | | _ |] | |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---|---------|--|--------------------|------|-----------------|------------------------|
| | | 29 | Drive serial number | | - | | |
| 528 | | 30 | Motor serial number | | - | | |
| | Default Display | 31 | Accumulative operation time | 1 | h | 0 to 35 | Yes |
| 320 | Delault Display | 32 | Automatic Motor Recognition Function | • | _ | 0 10 33 | 163 |
| | | 33 | Temperature Information | | °C | | |
| | | 35 | Safety status monitor | | _ | | |
| 531 | Axis Number | con | the axis number for USB nmunications. Normally, do not change set value. | 1 | _ | 0 to 127 | Yes |
| 532 | Command Pulse Input Maximum Setting | Set | the maximum command pulse input. | 4000 | kpps | 250 to 4,000 | Yes |
| | Pulse | Set | the detection of pulse regeneration limit error. | | | | |
| 533 | Regeneration Limit Output | 0 | Disabled | 0 | _ | 0 or 1 | Yes |
| | Setting | 1 | Enabled | | | | |
| 535 | Front Key | Set | the operation limit for the front panel. | | | | |
| | Protection | 0 | Operation not blocked | 0 | _ | 0 or 1 | Yes |
| | Setting | 1 | Operation blocked | | | | |

Special Setting Parameters

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|---|---------|---|--------------------|----------------|----------------|------------------------|
| 600 | Analog Torque Feed-forward Gain Setting | forv | the input gain for analog torque feed- vard. 9 will be disabled. | 0 | 0.1 V/ 100% | 0 to 100 | _ |
| 602 | Excessive Speed Error Setting | pos | the detection level between the internal ition command speed and the actual ed (i.e., the speed error). | 0 | r/min | 0 to 20000 | _ |
| 604 | Jog Speed | | the command speed during JOG trial ration (speed control). | 300 | r/min | 0 to 500 | _ |
| 605 | Gain 3 Effective Time | | effective time of gain 3 of 3-step gain ching. | | 0.1 ms | 0 to 10,000 | _ |
| 606 | Gain 3 Ratio Setting | Set | gain 3 as a multiple of gain 1. | 100 | % | 50 to 1,000 | _ |
| 607 | Torque Command Value Offset | Set | offset torque to add to torque command. | 0 | % | -100 to 100 | _ |
| 608 | Forward Direction Torque Offset | | the value to add to a torque command orward direction operation. | 0 | % | -100 to 100 | _ |
| 609 | Reverse Direction Torque Offset | | the value to add to a torque command everse direction operation. | | % | -100 to 100 | _ |
| 610 | Function Expansion Setting | | the function expansion. The setting tents vary depending on the function. | | _ | 0 to 63 | _ |
| 611 | Electric Current Response Setting | | se fine adjustment to electric current ponse. The default setting is 100%. | 100 | % | 50 to 100 | _ |
| 613 | Inertia Ratio 2 | Set | the inertia ratio switching. | 250 | % | 0 to 10,000 | _ |
| 614 | Alarm Detection Allowable Time Setting | an e | the allowable time until stopping when emergency stop is actuated upon alarm ection. | 200 | ms | 0 to 1,000 | _ |
| 615 | Overspeed Detection Level Setting at Immediate Stop | dete | ing an emergency stop upon alarm ection, if the motor speed exceeds this value, this is an overspeed 2 error. | 0 | r/min | 0 to 20,000 | _ |
| | Absolute Interface | Sel | ect the absolute encoder data transfer. | | | | |
| 616 | Function | 0 | Disabled | 1 | _ | 0 or 1 | Yes |
| | Selection | 1 | Enabled | | | | |
| | | | ect the EEPROM write specifications en a parameter is changed. | | | | |
| 617 | Front Panel Parameter Write Selection | 0 | Writing not to be performed when a parameter is changed. | 0 | _ | 0 or 1 | Yes |
| | vville Selection | 1 | Writing to be performed when a parameter is changed. | | | | |
| 618 | Power Supply ON Initialization Time | | initialization time after power supply ON ne standard 1.5 s plus some. | 0 | 0.1 s | 0 to 100 | Yes |

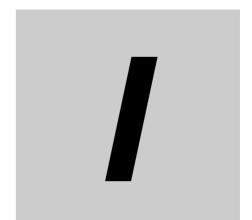
| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|--|--|--|--------------------|------------|----------------------|------------------------|
| 619 | Encoder Phase- Z Setting | pha This and (Pno mul- ratio The pha Pha | ely adjust the ON width of encoder se-Z signal output. It is enabled when the phase-Z output phase-A output are not synchronized 011/Pn503 × Encoder resolution is not a tiple of 4) due to the encoder dividing o setting. It is set value of Pn619 and the ON width of se-Z output are related as follows: se-Z output width [s] = 30/(Pn619 × or speed [r/min]) | 0 | Pulses | 0 to 32,767 | Yes |
| 620 | External Encoder Phase-Z Expansion Setting | Set widt | the external encoder phase-Z output h. | 0 | μs | 0 to 400 | Yes |
| 621 | Serial Absolute External Encoder Phase- Z Setting | | the phase-Z regeneration position when serial absolute external encoder is used. | 0 | Pulses | 0 to 2 ²⁸ | Yes |
| 622 | 90° Phase Difference Output Type External Encoder Phase- AB Regeneration Method Selection | outp outp 0 | ect the regeneration method of pulse outs A and B when a 90° phase difference out type external encoder is used. Without signal regeneration With signal regeneration | 0 | _ | 0 or 1 | Yes |
| 623 | Disturbance Torque Compensation Gain | | the compensation gain for the urbance torque. | 0 | % | -100 to | _ |
| 624 | Disturbance Observer Filter Setting | | the filter time constant for disturbance ue compensation. | 53 | 0.01 ms | 10 to 2,500 | _ |
| | | Sele | ect the warning latch time. | | | | |
| 627 | Warning Latch Hold Time Selection | 0 1 to 10 | Latch time infinite Latch time of 1 to 10 s | 5 | s | 0 to 10 | Yes |
| 628 | Not used | Do | not change the setting. | _ | _ | _ | _ |
| | | | the load characteristics estimated speed on realtime autotuning is enabled. | | | | |
| | Realtime | 0 | Finalize estimated results when load estimation becomes stable. | | | | |
| 631 | Autotuning Estimated Speed | 1 | Estimates every minute from the load characteristic changes. | 0 | _ | 0 to 3 | _ |
| | Selection | 2 | Estimates every second from the load characteristic changes. | | | | |
| | | 3 | Estimates the optimum speed from the load characteristic changes. | | | | |
| 632 | Realtime Autotuning Customization Mode Setting | | the Customization Mode detail for time autotuning. | 0 | _ | -32,768 to 32,767 | _ |

| Pn number | Parameter name | Setting | Description | Default setting | Unit | Setting range | Power supply OFF to ON |
|-----------|--|-------------|--|--------------------|------------|----------------------|------------------------|
| 633 | Absolute Encoder Initial Pulse Regeneration Speed | | the pulse regeneration speed when the all pulse is output. | 1000 | r/min | 1,000 to 3,000 | _ |
| 634 | Hybrid Vibration Suppression Gain | | et the hybrid vibration suppression gain uring fully-closed control. | | 0.1/s | 0 to 30,000 | _ |
| 635 | Hybrid Vibration Suppression Filter | | the hybrid vibration suppression filter constant during fully-closed control. | 10 | 0.01 ms | 0 to 6,400 | _ |
| 637 | Vibration Detection Threshold | If to | the vibration detection threshold. rque vibration that exceeds this setting is ected, the vibration detection warning will ur. | 0 | 0.1% | 0 to 1,000 | _ |
| 638 | Warning Mask Setting | the corr | a mask for warning detection. If you set corresponding bit to 1, the responding warning detection will be abled. | 4 | _ | -32,768 to 32,767 | Yes |



Precautions for Correct Use

Parameters between Pn700 and Pn800 are not used. Do not change the settings.



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