OMRON

SYSDRIVE Inverters
JX Series and RX Series

Environmentally Friendly and Easy to Program
Ideal for a Wide Range of Applications.

realizing

Introducing New, General-purpose SYSDRIVE Three Concepts and Three Series Provide the

Environmentally Friendly

The use of long-life consumables, such as capacitors and fans, extends the life of the Inverter (in comparison to previous models). We also gave ample consideration to the lifetime and energy-saving capability of connected motors, and provided full compliance with the RoHS Directive and other international standards, all as standard features.

Ecological

Easy to Use

Ease of use was given top priority to help reduce the number of overall steps required to use OMRON's Generalpurpose Inverters, starting with wiring and setting parameters and extending to onsite maintenance and adjustments. A wide range of functions is also included to reduce the total cost of ownership (TCO) for the entire system. This further reflects our pursuit of customer satisfaction.

Kind

Inverters from OMRON. Optimal Selection.

Versatile

Versatile in Application

All models meet today's demands for increased performance and advanced functions in General-purpose Inverters, and offer greater versatility in application. From simple models that focus on ease of use to multi-functional and advanced models that are designed to handle diverse applications, a full complement of functions have been provided to ensure optimal performance in meeting various needs.

RX

New Advanced Inverters that handle diverse applications while remaining environmentally friendly and easy to use.

JX

Environmentally friendly and easy-to-use Inverters for simple applications.

Simple, Compact Inverters
SYSDRIVE JX Series

Advanced General-purpose Inverters
SYSDRIVE RX Series

Contents

Select the Exact Model You Need from a Wide Lin
Multi-functional and Advanced Models.

Choose the Inverter that meets your needs -- From a wide range of simple to advanced models.

◆Selection Based on Functions

	Environmental Consideration	Ease of Use	Versatile in Application
Environmentally friendly and easy-to-use Inverters for simple applications.  SYSDRIVE JXSeries	RoHS compliant (standard feature) Built-in radio noise filter (Excluding single-phase/three-phase 200-V models) Microsurge voltage suppression	Side-by-side mounting Standard-feature emergency shutoff function	V/f control PID function
Advanced Inverters that handle diverse applications while remaining environmentally friendly and easy to use.  SYSDRIVE RXSeries	RoHS compliant (standard feature) Built-in radio noise filter Microsurge voltage suppression	Standard-feature emergency shutoff function Removable control terminal block	Vector control with a PG 0-Hz domain sensorless vector control Key Point High starting torque (0.3 Hz 200%) PID function

NEW : A function or performance that was not available in previous OMRON Series of the same level.

Key Point : A new function or performance that was improved compared to previous OMRON Series of the same level.

◆Capacity

RX Series: Models added for 3-phase 400 VAC 75 to 132 kW.

Series	Power supply	Capacity (kW) 0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	400
SYSDRIVE JXSeries	Three-phase 200 V	●	●	●	●	●	●	●	●													
	Single-phase/ three-phase 200 V	●	●	●	●	●																
	Three-phase 400 V		●	●	●	●	●	●	●													
SYSDRIVE RXSeries	Three-phase 200 V		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	▲	▲			
	Three-phase 400 V		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	▲

● December 2008 release ▲ Under Planning

eup that Extends from Simple to

New Models Added to the RX Series:
Models for 3-phase, 400 VAC, 75 to 132 kW

Select the most suitable Inverter by choosing the functions you need for your application.

◆Specifications

Performance and functions		SYSDRIVE JX Series	SYSDRIVE RX Series
			
Power supply and capacity	Three-phase 200 V	0.2 to 7.5 kW	0.4 to 55 kW
	Single-phase/three-phase 200 V	0.2 to 2.2 kW	None
	Three-phase 400 V	0.4 to 7.5 kW	0.4 to 132 kW
Control method	V/f control	●	●
	Sensorless vector control		●
	Vector control with a PG		●
Input/output	No. of multi-function I/O points	• 5 inputs • 1 transistor output • 1 relay output	• 9 inputs (1 RUN (FWD) input + 8 multi-function inputs) • 5 transistor outputs • 1 relay output
	Analog I/O	• 1 input (0 to 10 V, 4 to 20 mA) • 1 output (0 to 10 V)	• 2 inputs (1) 0 to 10 V, 4 to 20 mA (2) 0 to ±10 V • 2 outputs (1) 0 to 10 V (2) 4 to 20 mA • 1 PWM voltage output
Braking	Braking resistor connection		● (22 kW max.)
	Regenerative Braking Unit connection	●	●
	Regenerative Braking Unit + braking resistor connection	●	●
Frequency	Frequency setting range	0.5 to 400 Hz	0.1 to 400 Hz
	Frequency output method	Line-to-line sine wave PWM	Line-to-line sine wave PWM
Installation and wiring	Side-by-side mounting	●	
	Removable terminal block		●
	Power supply and motor wiring	Top/bottom wiring	Bottom wiring
Noise countermeasures	Radio noise filter	Standard feature (built-in)	Standard feature (built-in)
	I/O noise filter	Optional (external)	Optional (external)
	EMC filter	Optional (external)	Standard feature (built-in)
Operation	Digital Operator	Fixed Digital Operator (with adjustment dial)	Removable Digital Operator (without adjustment dial)
	Autotuning		●
Main functions	Multistep speed control	16 steps + jog	16 steps + jog
	Carrier frequency setting	2 to 12 kHz (default setting: 3 kHz)	2 to 15 kHz (default setting: 5 kHz)
	Torque assist function	Manual + auto torque assist	Auto/manual torque assist
	PID function	●	●
	Absolute value positioning		●
	Emergency shutoff	●	●
	0-Hz domain sensorless vector control		●
	Tripless function	●	●
	Momentary power interruption restart	●	●
	Automatic energy saving	●	●
Communications	MODBUS-RTU	●	●
RoHS		●	●
Safety standards	CE	●	●
	UL/cUL	●	●

Environmental Consideration

Careful consideration has been given to the lifetime and energy-saving capability of both the Inverter and the connected motor.
As evidenced by full compliance with the RoHS Directive and other international standards as a standard feature, priority has been placed on achieving Inverters that are truly environmentally friendly.

Standard Compliance with the RoHS Directive and Other International Standards

JX RX

• RoHS

All models comply with the usage restrictions prescribed by the RoHS Directive on the six specified hazardous substances as a standard feature.

Ro
Indicates products that comply with the RoHS Directive.

Pb (Lead)	Cd (Cadmium)	PBB (Polybrominated biphenyl)
Hg (Mercury)	Cr6+ (Hexavalent chromium)	PBDE (Polybrominated diphenyl ether)

•International Standards

All models also comply with CE and UL/cUL standards as a standard feature.

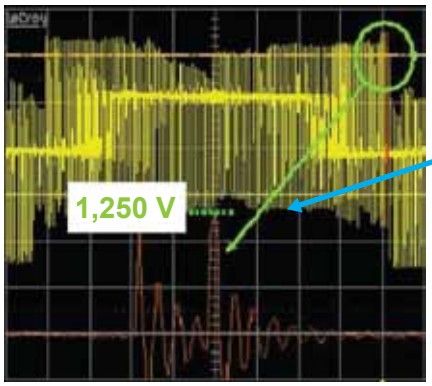
CE c UL us

Microsurge Voltage Suppression

JX RX

PWM control is used to suppress microsurge voltages, which sometimes cause malfunctions in 400-V motors.
This control method suppresses the voltage between motor terminals to 1,250 V for a DC voltage of 625 V max. (equivalent to 440-VAC input) inside the Inverter. It ensures safe, reliable use even for general-purpose induction motors that are normally designed with a dielectric strength of 1,800 V (JIS C4210).
(DC voltage increases, such as those during regenerative braking, may exceed this level of dielectric strength. To prevent this, use an AC reactor on the output side as well.)

* PWM control: Pulse width modulation control



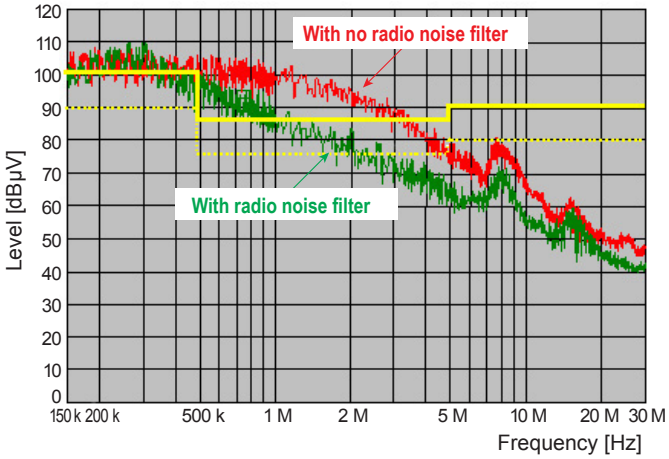
Spikes in the terminal voltage are suppressed even when the wiring distance from the Inverter to the motor is long.

Motor terminal voltage waveform
E = 650 V, cable length: 100 m

Noise Measures for Peripheral Equipment

JX RX

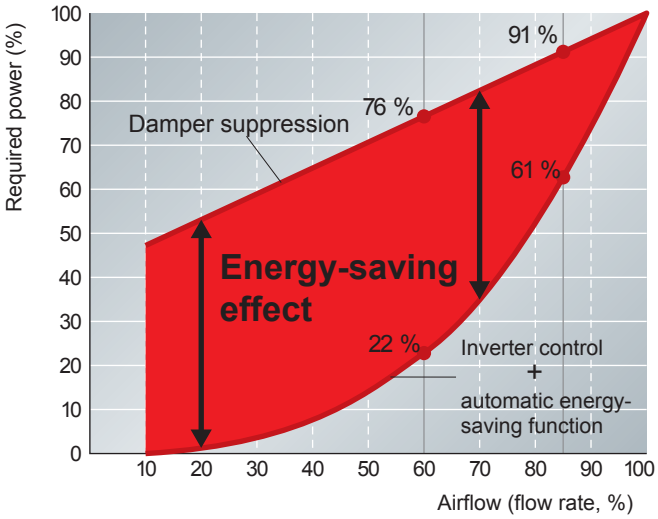
As a noise measure, a built-in radio noise filter is a standard feature on every model that has a three-phase power supply. An optional radio noise filter is available for models with a single-phase/three-phase power supply. By installing an external DC reactor, the Inverter satisfies the requirements of Japan's Ministry of Land, Infrastructure and Transport.



Automatic Energy-saving Function

JX RX

This function automatically minimizes the Inverter output power during constant speed operation. It has a large energy-saving effect when used with fans and pumps.



Simplified Operation

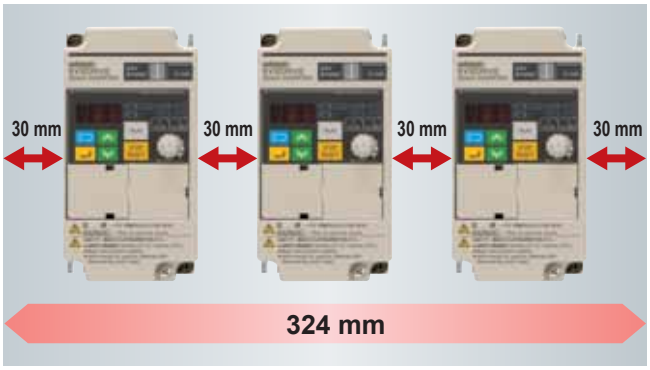
Ease of use has been pursued from the viewpoint of the operator.
As a result, the number of overall steps required to use the Inverter have been reduced, starting with wiring and parameter setting and extending to operation and maintenance.

Side-by-side Mounting Saves Space

JX

When several Inverters are to be mounted in a control panel, side-by-side mounting makes it possible to mount them closely together, thus saving space. (See note.)

● **Mounting the 3G3JV-A2001 to 3G3JV-A2007**



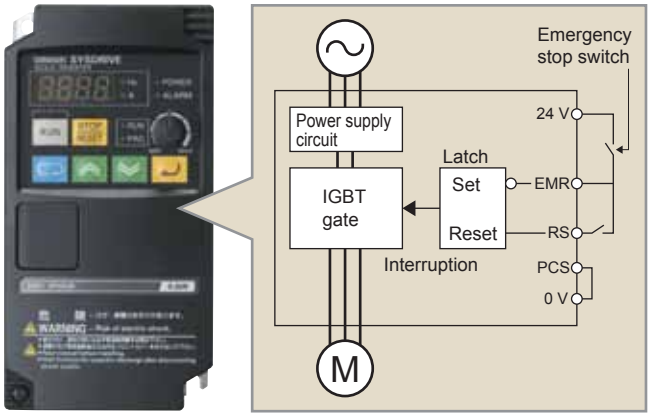
● **Mounting the 3G3JX-A2001 to 3G3JX-A2007**

Note: Some models have restrictions in the ambient temperature, carrier frequency, and output current.

Emergency Shutoff Function

JX RX

Hardware-based output shutoff enables more reliable emergency shutdowns.



Long-life Design

RX

The use of long-life capacitors, fans, and other consumables further extends the time that the general-purpose Inverter can be used, and helps to lengthen the lifetime of equipment in general.

Easy Parameter Setting

RX

Parameters are easy to set and use. Those that have been changed from the initial settings can be automatically stored in U001 to U012. The parameters that are used frequently can also be displayed.

Supports More Applications

The RX Series provides the high performance and advanced functions demanded in a General-purpose Inverter. Optimal performance allows for more applications and satisfies more needs.

Vector Control

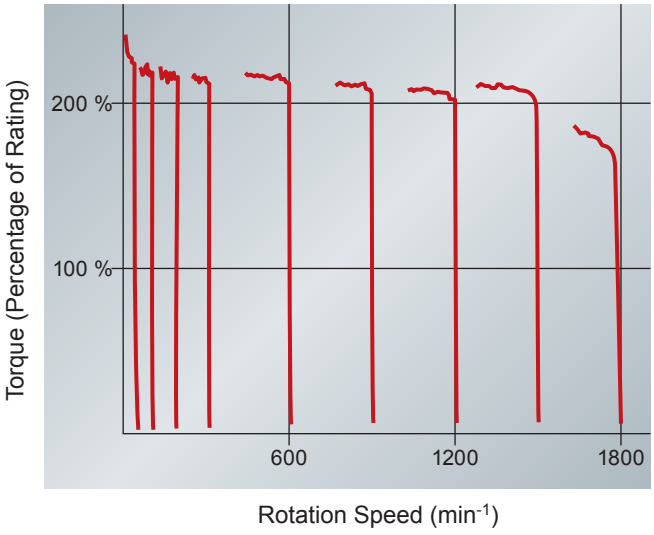
RX

In the SYSDRIVE RX Series...

In addition to V/f control, the following control methods are included. This enables a 200% starting torque at 0.3 Hz.

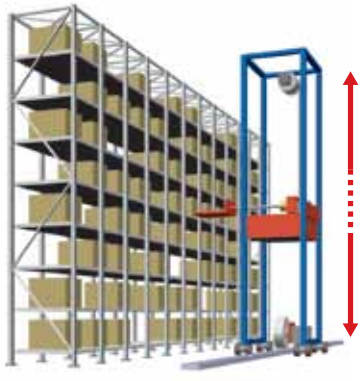
- Sensorless vector control
- Sensorless vector control in 0-Hz domain
- Vector control with a PG

[Example of Speed vs. Torque Characteristics]



MEMO Sensorless Vector Control in 0-Hz Domain

This control method is ideal for lifting equipment, such as cranes and hoists. Sufficient torque is provided in the low-frequency range at the start of the lifting operation, which simplifies controlling braking release.



Simple Positioning Control with the Inverter

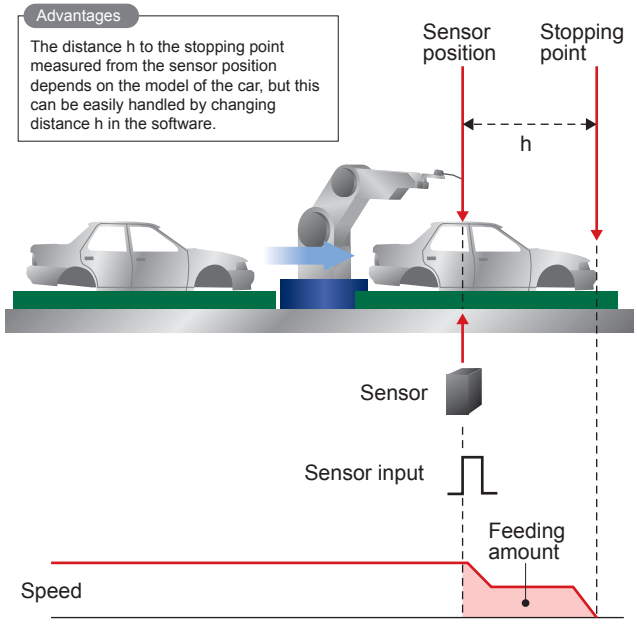
RX

Simple positioning control can be handled by the Inverter, which costs less than a servo system. This also means that you can replace servo systems with Inverters in applications where high-speed, high-precision positioning is not required.

Functions

Position commands, speed commands, and acceleration/deceleration times are set in parameters to perform up to 8-step positioning. The Teaching Function can also be used to store positioning points in memory by actually moving the machine. There are two types of positioning motions to select from: positioning commands with absolute values and interrupt feeding.

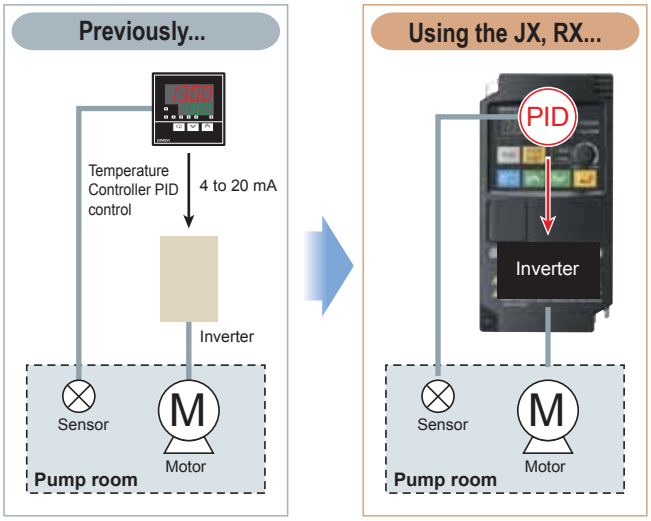
● Example of Interrupt Feeding



PID Control

JX RX

PID control allows the Inverter to control equipment such as fans and pumps using temperature, pressure, flowrate and other process amounts, without the need for external devices like Temperature Controllers.



Momentary Power Interruption Restart

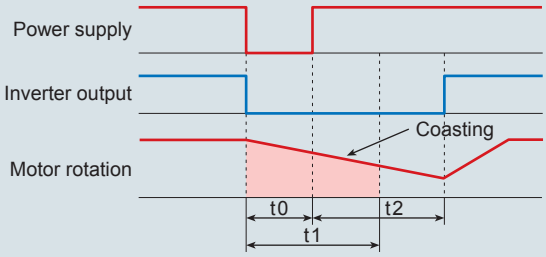
JX RX

When there is a momentary power interruption during operation, the motor will smoothly restart instead of coasting to a stop.

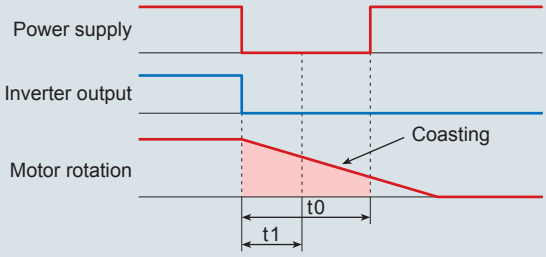
●Example Timing Charts

t0: Momentary power interruption time
t1: Allowable power interruption time (b002)
t2: Retry standby time (b003)

Example 1: Momentary Power Interruption Time < Allowable Power Interruption Time (b002)



Example 2: Momentary Power Interruption Time > Allowable Power Interruption Time (b002)



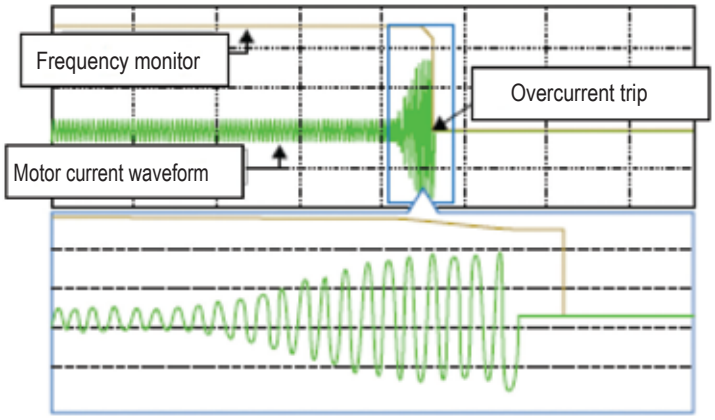
Stall Prevention

JX RX

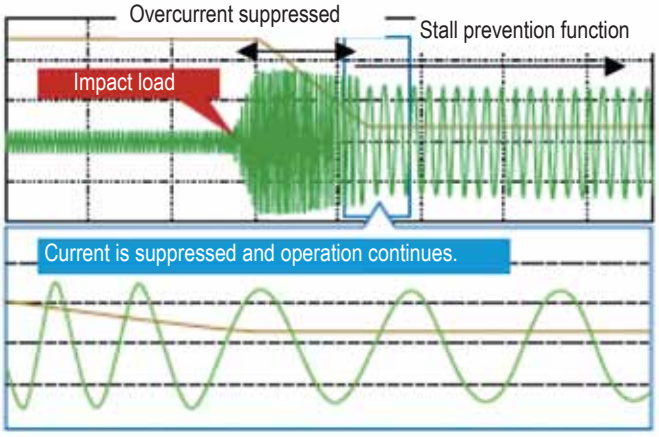
When rapid acceleration or a change in the load results in a sudden overcurrent, the Overcurrent Suppression Function automatically limits the output current to ensure that steady operation continues.

*This function suppresses the detection of most overcurrent occurrences, other than malfunctions such as motor wiring short-circuits. An overload may occur under some operating conditions.

●With Overcurrent Suppression Disabled



●With Overcurrent Suppression Enabled



*The setting methods and parameters of the JX Series differ from those of the RX Series.

Braking Process

RX

All models of 22 kW or less are provided with the Braking Process Function as standard equipment. This function controls applications that are subject to sudden acceleration or stopping.

Simple, Compact Inverters

SYSDRIVE JX Series

Easy-to-Use Compact Simplified Inverter for the Customer's Environment and Application Demands

- Provides a wide ranging capacity from 0.2 to 3.7 kW in spite of the compact size
- The main circuit adopts upper/lower wiring as with a conductor
- Side-by-side mounting Contributes to space saving
- The PID function is featured for the easier control of the fan and pump
- The three-phase models incorporate a zero-phase reactor (radio noise filter) as a standard specification
- ModBus-RTU communication allows you to perform network operation at low cost.

Model Number Explanation

3G3JX-A□□□□

JX-series Inverter

Maximum Motor Capacity

002	0.2 kW	022	2.2 kW
004	0.4 kW	037	3.7 kW
007	0.75 kW	055	5.5 kW
015	1.5 kW	075	7.5 kW

Voltage Class

2	3-phase 200 V AC
4	3-phase 400 V AC
E	1-/3-phase 200 V AC

Standard Models

Rated voltage	Enclosure rating	Max. applicable motor capacity	Model
3-phase 200 V AC	IP20	0.2 kW	3G3JX-A2002
		0.4 kW	3G3JX-A2004
		0.75 kW	3G3JX-A2007
		1.5 kW	3G3JX-A2015
		2.2 kW	3G3JX-A2022
		3.7 kW	3G3JX-A2037
		5.5 kW	3G3JX-A2055
		7.5 kW	3G3JX-A2075
1/3-phase 200 V AC		0.2 kW	3G3JX-AE002
		0.4 kW	3G3JX-AE004
		0.75 kW	3G3JX-AE007
		1.5 kW	3G3JX-AE015
		2.2 kW	3G3JX-AE022
3-phase 400 V AC		0.4 kW	3G3JX-A4004
		0.75 kW	3G3JX-A4007
		1.5 kW	3G3JX-A4015
		2.2 kW	3G3JX-A4022
		3.7 kW	3G3JX-A4037
		5.5 kW	3G3JX-A4055
		7.5 kW	3G3JX-A4075

International Standards (EC Directives and UL/cUL Standards)

The 3G3JX Inverter meets the EC Directives and UL/cUL standard requirements for worldwide use.

Classification		Applicable standard
EC Directives	EMC Directive	EN61800-3: 2004
	Low-voltage Directive	EN61800-5-1: 2003
UL/cUL Standards		UL508C

Standard Specification List

200-V Class

Item		3-phase 200-V class							
Model name (3G3JX-)		A2002	A2004	A2007	A2015	A2022	A2037	A2055	A2075
Applicable motor capacity ✻1	kW	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5
	HP	1/4	1/2	1	2	3	5	7.5	10
Rated output capacity (kVA)	200 V	0.4	0.9	1.3	2.4	3.4	5.5	8.3	11.0
	240 V	0.5	1.0	1.6	2.9	4.1	6.6	9.9	13.3
Rated input voltage		3-phase (3-wire) 200 V −15% to 240 V +10%, 50/60 Hz ±5%							
Built-in filter		Radio noise filter							
Rated input current (A)		1.8	3.4	5.2	9.3	13.0	20.0	30.0	40.0
Rated output voltage ✻2		3-phase: 200 to 240 V (according to the input voltage)							
Rated output current (A)		1.4	2.6	4.0	7.1	10.0	15.9	24.0	32.0
Weight (kg)		0.8	0.9	1.1	2.2	2.4	2.4	4.2	4.2
Cooling method		Self-cooling			Forced-air-cooling				
Braking torque	At short-time deceleration ✻3 At capacitor feedback	Approx. 50%				Approx. 20% to 40%		Approx. 20%	
	DC injection braking	Injection braking frequency/time, braking force variable, frequency control available							

400-V Class

Item		3-phase 400-V class						
Model name (3G3JX-)		A4004	A4007	A4015	A4022	A4037	A4055	A4075
Applicable motor capacity ✻1	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5
	HP	1/2	1	2	3	5	7.5	10
Rated output capacity (kVA)	380 V	0.9	1.6	2.5	3.6	5.6	8.5	10.5
	480 V	1.2	2.0	3.1	4.5	7.1	10.8	13.3
Rated input voltage		3-phase (3-wire) 380 V −15% to 480 V +10%, 50/60 Hz ±5%						
Built-in filter		Radio noise filter						
Rated input current (A)		2.0	3.3	5.0	7.0	11.0	16.5	20.0
Rated output voltage ✻2		3-phase: 380 to 480 V (according to the input voltage)						
Rated output current (A)		1.5	2.5	3.8	5.5	8.6	13.0	16.0
Weight (kg)		1.5	2.3	2.4	2.4	2.4	4.2	4.2
Cooling method		Self-cooling		Forced-air-cooling				
Braking torque	At short-time deceleration ✻3 At capacitor feedback	Approx. 50%		Approx. 20% to 40%			Approx. 20%	
	DC injection braking	Injection braking frequency/time, braking force variable, frequency control available						

1/3-phase 200-V Class

Item		1/3-phase 200-V Class				
Model name (3G3JX-)		AE002	AE004	AE007	AE015	AE022
Applicable motor capacity ✻1	kW	0.2	0.4	0.75	1.5	2.2
	HP	1/4	1/2	1	2	3
Rated output capacity (kVA)	200 V	0.4	0.9	1.3	2.4	3.4
	240 V	0.5	1.0	1.6	2.9	4.1
Rated input voltage		1/3-phase 200 V −15% to 240 V +10%, 50/60 Hz ±5%				
Built-in filter		None				
Rated input current (A)		1.8	3.4	5.2	9.3	13.0
Rated output voltage ✻2		3-phase: 200 to 240 V (according to the input voltage)				
Rated output current (A)		1.4	2.6	4.0	7.1	10.0
Weight (kg)		0.8	0.9	1.5	2.3	2.4
Cooling method		Self-cooling			Forced-air-cooling	
Braking torque	At short-time deceleration ✻3 At capacitor feedback	Approx. 50%			Approx. 20% to 40%	
	DC injection braking	Injection braking frequency/time, braking force variable, frequency control available				

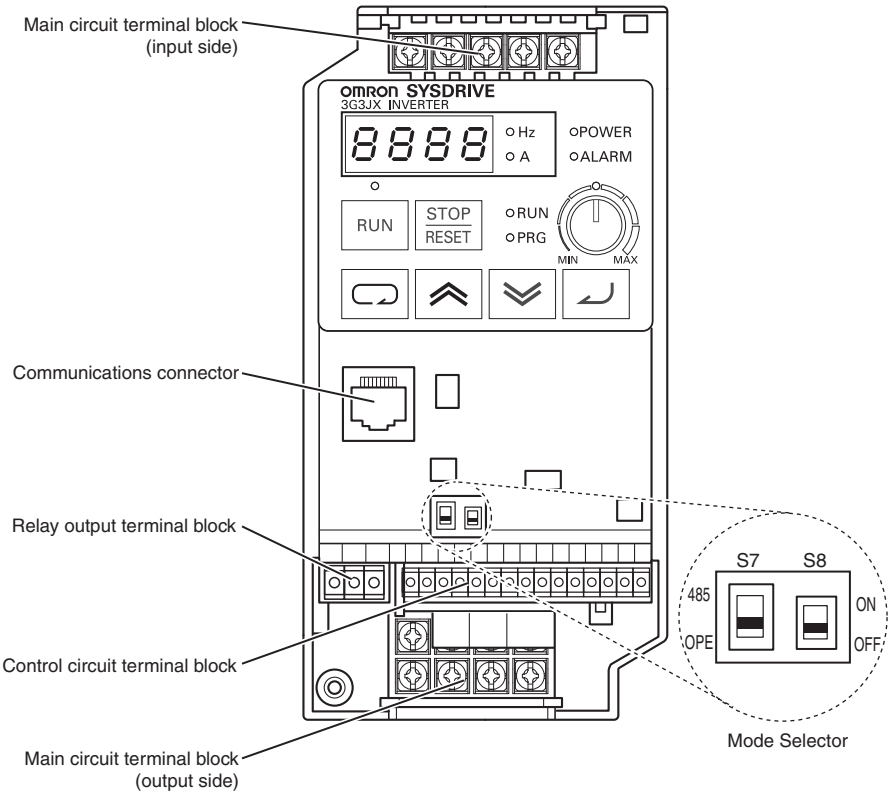
Common Specifications

Item		Specifications
Enclosure rating ✻4		Semi-closed (IP20)
Control	**Control method**	Phase-to-phase sinusoidal modulation PWM
	Output frequency range ✻5	0.5 to 400 Hz
	Frequency precision ✻6	Digital command: ±0.01% of the max. frequency Analog command: ±0.4% of the max. frequency (25°C ±10°C)
	Frequency setting resolution	Digital setting: 0.1 Hz Analog setting: Max. frequency/1000
	Voltage/Frequency characteristics	V/f characteristics (constant/reduced torque)
	Overload current rating	150% for 1 min
	Acceleration/ Deceleration time	0.01 to 3000 s (line/curve selection), 2nd acceleration/deceleration setting available
	Carrier frequency modification range	2 to 12 kHz
	DC injection braking	Starts at a frequency lower than that in deceleration via the STOP command, at a value set lower than that during operation, or via an external input. (Level and time settable.)
Protective functions		Overcurrent, overvoltage, undervoltage, electronic thermal, temperature error, ground-fault overcurrent at power-on state, overload limit, incoming overvoltage, external trip, memory error, CPU error, USP trip, communication error, overvoltage protection during deceleration, momentary power interruption protection, emergency shutoff
Input signal	**Multi-function input**	FW (forward), RV (reverse), CF1 to CF4 (multi-step speed), JG (jogging), DB (external DC injection braking), SET (2nd function), 2CH (2-step acceleration/deceleration), FRS (free run), EXT (external trip), USP (USP function), SFT (soft lock), AT (analog current input function selection), RS (reset), PTC (thermistor input), STA (3-wire startup), STP (3-wire stop), F/R (3-wire forward/reverse), PID (PID selection), PIDC (PID integral reset), UP (UP of UP/DWN function), DWN (DWN of UP/DWN function), UDC (data clear of UP/DWN function), OPE (forced OPE mode), ADD (frequency addition), F-TM (forced terminal block), RDY (operation ready), SP-SET (special setting), EMR (emergency shutoff)
Output signal	**Multi-function output**	RUN (signal during operation), FA1 (frequency arrival signal 1), FA2 (frequency arrival signal 2), OL (overload warning signal), OD (PID excess deviation signal), AL (alarm signal), DC (analog input disconnection detection signal), FBV (PID FB status output), NDc (network error), LOG (logical operation result), ODc (communication option disconnected), LOC (light load signal)
	Frequency monitor	Analog output (0 to 10 V DC, 1 mA max.) Frequency/Current signals are selectable via the AM output terminal.
	Relay output	The relay (SPDT contact) outputs signals corresponding to the multi-function output.
Other functions		AVR function, V/f characteristic selection, upper/lower limit, 16-step speeds, starting frequency adjustment, jogging operation, carrier frequency adjustment, PID control, frequency jump, analog gain/ bias adjustment, S-shape acceleration/deceleration, electronic thermal characteristics/level adjustment, retry function, simplified torque boost, trip monitor, soft lock function, frequency conversion display, USP function, 2nd control function, motor rotation speed UP/DOWN, overcurrent suppression function
General specifications	**Ambient temperature**	−10°C to 50°C (Both the carrier frequency and output current need to be reduced at over 40°C.)
	Ambient storage temperature	−20°C to 65°C (short-time temperature during transport)
	Humidity	20% to 90% RH
	Vibration	5.9 m/s^2 (0.6G), 10 to 55 Hz (Complies with the test method specified in JIS C0040 (1999).)
	Location	At a maximum altitude of 1,000 m; indoors (without corrosive gases or dust)
	Applicable standard	Complies with UL, cUL, CE standards. (Insulation distance)
Options		Noise filter, AC/DC reactors, regenerative braking unit and resistor, etc.

✻1. The applicable motor is a 3-phase standard motor. For using any other type, be sure that the rated current does not exceed that of the Inverter.
✻2. Output voltage decreases according to the level of the power supply voltage.
✻3. The braking torque at the time of capacitor feedback is an average deceleration torque at the shortest deceleration (when it stops from 50 Hz), not a continuous regeneration torque. Also, the average deceleration torque varies depending on the motor loss. The value is reduced in operation over 50 Hz. Note that no regenerative braking circuit is built into the Inverter. If you need a larger regenerative torque, use the optionally available regenerative braking unit and resistor.
The regenerative braking unit should be used only for short-time regeneration.
✻4. Protection method complies with JEM 1030.
✻5. To operate the motor at over 50/60 Hz, contact the motor manufacturer to find out the maximum allowable speed of revolution.
✻6. For the stable control of the motor, the output frequency may exceed the maximum frequency set in A004 (A204) by 2 Hz max.

Terminal Block Specifications

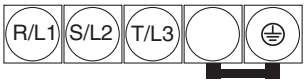
Terminal Block Position



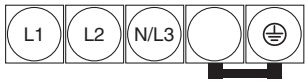
Note: This illustration shows the terminal block with the front cover removed.

Specifications of Main Circuit Terminals

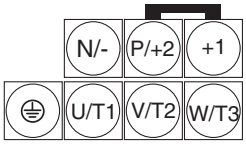
Upper side of the body

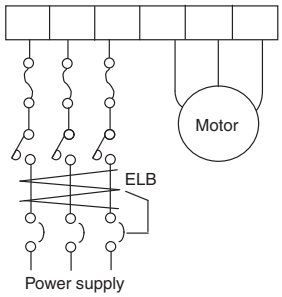


✻ 3G3JX-AE□□□ terminal symbols



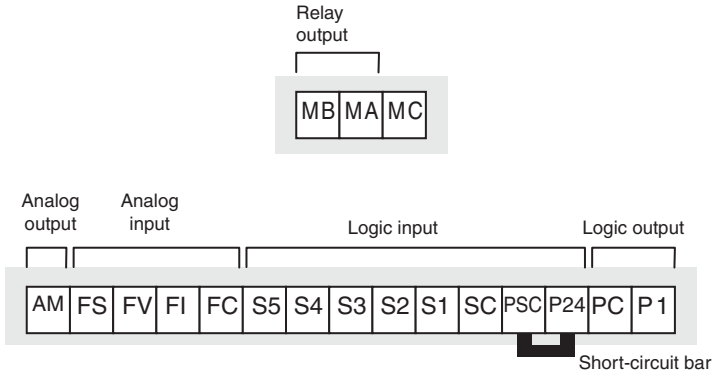
Lower side of the body

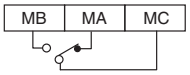


Terminal symbol	Terminal name	Function	Connection example
R/L1 (L1) ✻, S/L2 (L2) ✻, T/L3 (N/L3) ✻	Main power supply input terminal	Connect the input power supply.	 Do not remove the short-circuit bar between +1 and P/+2 when a DC reactor is not connected.
U/T1, V/T2, W/T3	Inverter output terminal	Connect to the motor.	
+1, P/+2	External DC reactor terminal	Normally connected by the short-circuit bar. Remove the short-circuit bar between +1 and P/+2 when a DC reactor is connected.	
P/+2, N/-	Regenerative braking unit connection terminal	Connect optional regenerative braking units. (If a braking torque is required)	
⏚	Ground terminal	Ground (Connect to ground to prevent electric shock and reduce noise.)	

✻ 3G3JX-AE□□□ terminal symbols are shown in brackets.

Control Circuit Terminals Specifications



	Terminal symbol	Terminal name and function	Default setting	Note
Input signal	PSC	External power supply terminal for input signal (input) ...At sink logic Internal power supply output terminal for input signal (output) ...At source logic	–	24 V DC ±10% 30 mA max. 24 V DC ±10% 100 mA max.
	S1	Multi-function input terminals S1 to S5 Select 5 functions among the 31 functions and allocate them to from terminals S1 to S5. The terminal allocation is changed automatically when the emergency shutoff function is used.	Forward/Stop	Contact input Close: ON (Start) Open: OFF (Stop) Minimum ON time: 12 ms min.
	S2		Reverse/Stop	
	S3		Fault reset	
	S4		Emergency stop fault	
	S5		Multi-step speed reference 1	
	SC	Input signal common	–	
Monitor signal	AM	Analog frequency monitor/Analog output current monitor	Analog frequency monitor	
Frequency reference input	FS	Frequency reference power supply	–	10 V DC 10 mA max.
	FV	Voltage frequency reference signal	–	0 to 10 V DC Input impedance 10 kΩ When installing variable resistors at FS, FV, and FC (1 to 2 kΩ)
	FI	Current frequency reference signal	–	4 to 20 mA DC Input impedance 250 Ω
	FC	Frequency reference common	–	
Output signal	P1	Multi-function output terminal Select the status of the Inverter and allocate it to terminal P1.	Frequency arrival signal at a constant speed	27 V DC 50 mA max.
	PC	Output signal common	–	
Relay output signal	MA MB MC	 Factory default relay settings Under normal operation: MA-MC Closed Under abnormal operation or power shutdown: MA-MC Open		

Output terminal	Contact capacity	Resistance load	Inductive load
MA-MC	Max.	AC250V 2.5A DC30V 3A	AC250V 0.2A DC30V 0.7A
	Min.	AC100V 10mA DC5V 100mA	
MB-MC	Max.	AC250V 1A DC30V 1A	AC250V 0.2A DC30V 0.2A
	Min.	AC100V 10mA DC5V 100mA	

Mode Selector

RS-485 Communication/Operator Selector (S7)

Select the mode according to the option connected to the communications connector.
When using the 3G3AX-OP01 supplied with the Inverter, it is available regardless of the switch condition

Symbol	Name	Status	Description
S7	RS-485 communication/operator selector	485	RS485 Modbus communication
		OPE [Default]	Digital Operator (Option: 3G3AX-OP1)

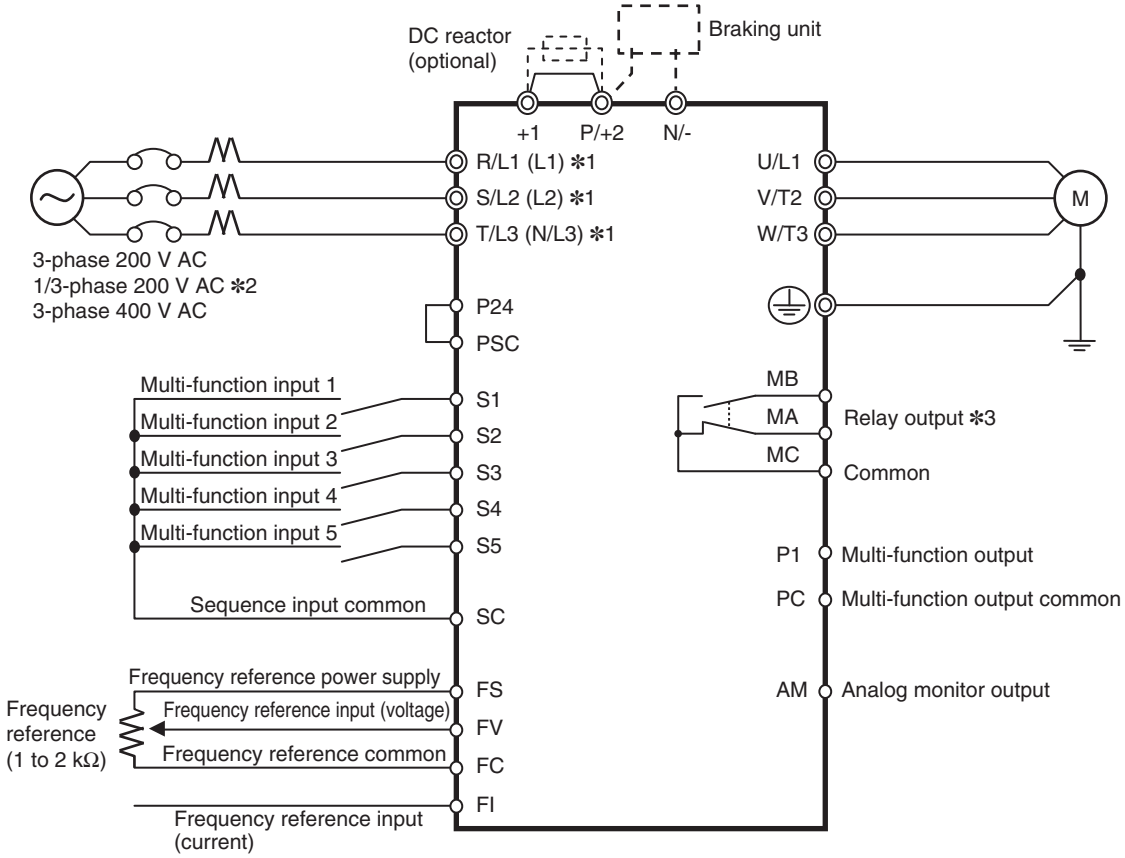
Emergency shutoff selector (S8)

Use this selector to enable the emergency shutoff input function.

Symbol	Name	Status	Description
S8	Emergency shutoff selector	ON	Emergency shutoff input enabled ✻
		OFF [Default]	Normal

✻ The multi-function input terminal 3 is switched to a terminal for emergency shutoff input, and the allocation of other multi-function input terminals is also changed automatically. Do not set to ON immoderately. For details, refer to "Emergency Shutoff Input Function".

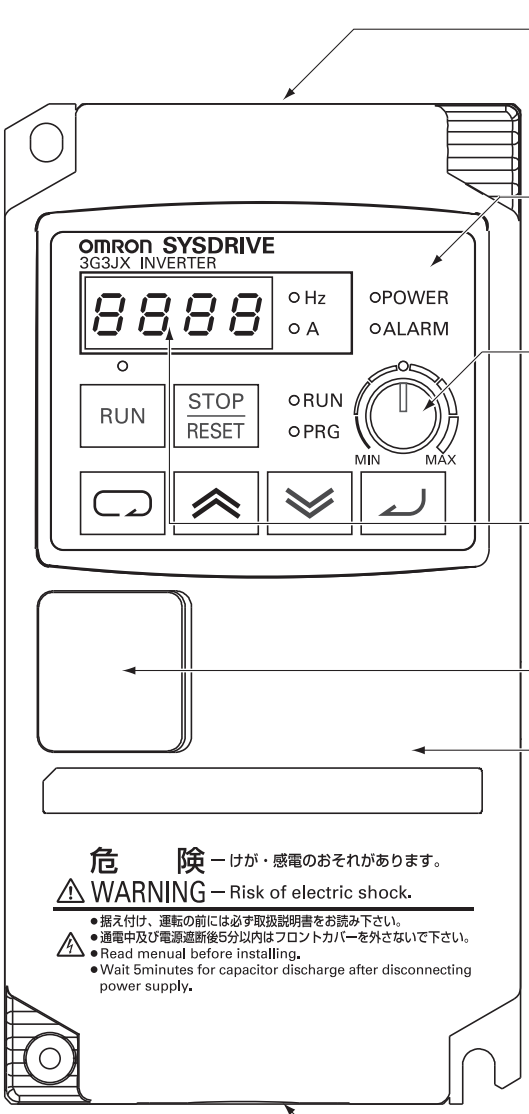
Standard Connection Diagram



✻1. The 3G3JX-AE□□□ terminal symbols are shown in brackets.
✻2. Connect a single-phase 200-V AC input to terminals L1 and N/L3.
✻3. By factory default, MA is set to MC contact, and MB to NO contact in the relay output (MA, MB) selection (C036).

Nomenclature and Functions

Inverter Nomenclature and Functions



Top Cover

Remove this cover when wiring the upper terminal block.

Digital Operator

Used to set parameters, perform various monitoring, and start and stop the Inverter.

Frequency adjuster

Sets the frequency reference within a range between 0 Hz and the maximum frequency.

Data Display

Displays relevant data, such as frequency reference, output current, and set values.

Communications connector (with cover)

Front cover

Remove this cover when wiring the upper or lower terminal block.

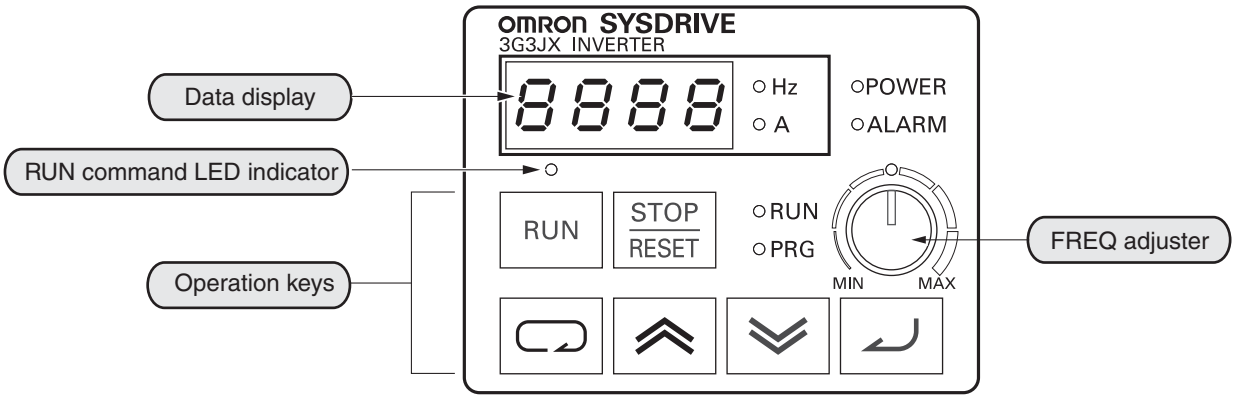
Bottom cover

Remove this cover when wiring the lower terminal blocks.

Note: 1. Connect the communications cable after opening the cover of the communications connector. Remove the front cover to switch communications.

2. The cover of the communications connector is removable. Remove the front cover to attach it.

Part Names and Descriptions of the Digital Operator

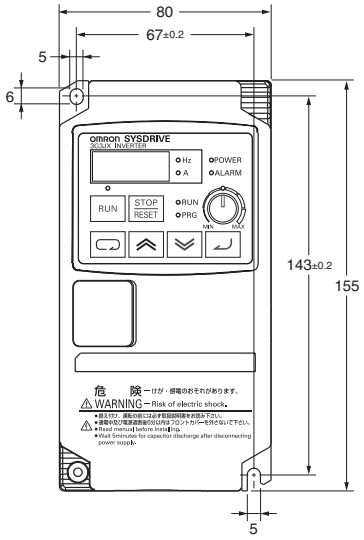


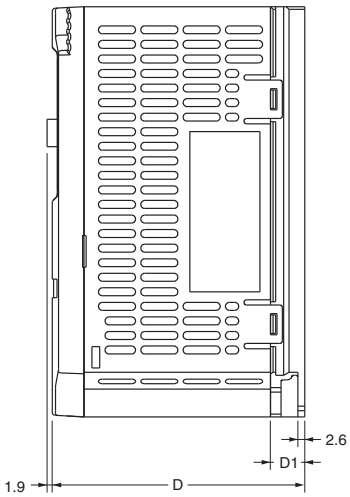
	Name	Description
○POWER	POWER LED indicator	Lit when the power is supplied to the control circuit.
○ALARM	ALARM LED indicator	Lit when an Inverter error occurs.
○RUN	RUN (during RUN) LED indicator	Lit when the Inverter is running.
○PRG	PROGRAM LED indicator	Lit when the set value of each function is indicated on the data display. Blinks during warning (when the set value is incorrect).
8888	Data display	Displays relevant data, such as frequency reference, output current, and set values.
○ Hz ○ A	Data display LED indicator	Lit according to the indication on the data display. Hz: Frequency A: Current
MIN MAX	Volume LED indicator	Lit when the frequency reference source is set to the FREQ adjuster.
	FREQ adjuster	Sets a frequency. Available only when the frequency reference source is set to the FREQ adjuster. (Check that the Volume LED indicator is lit.)
○	RUN command LED indicator	Lit when the RUN command is set to the Digital Operator. (The RUN key on the Digital Operator is available for operation.)
RUN	RUN key	Activates the Inverter. Available only when operation via the Digital Operator is selected. (Check that the RUN command LED indicator is lit.)
STOP/RESET	STOP/RESET key	Decelerates and stops the Inverter. Functions as a reset key if an Inverter error occurs.
	Mode key	Switches between the monitor mode (d□□□), the basic function mode (F□□□), and the extended function mode (A□□□, b□□□, c□□□, H□□□).
	Enter key	Enters the set value. (To change the set value, be sure to press the Enter key.)
	Increment key	Changes the mode. Also, increases the set value of each function.
	Decrement key	Changes the mode. Also, decreases the set value of each function.

Dimensions

(Unit: mm)

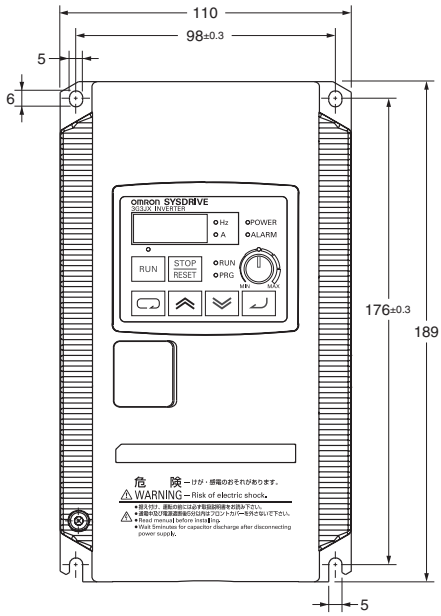
3G3JX-A2002
3G3JX-A2004
3G3JX-A2007
3G3JX-AE002
3G3JX-AE004

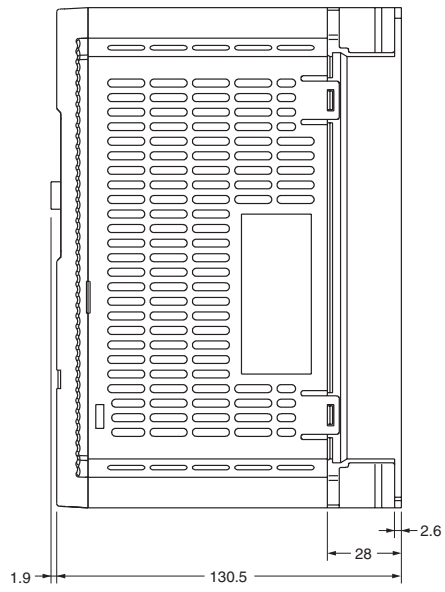




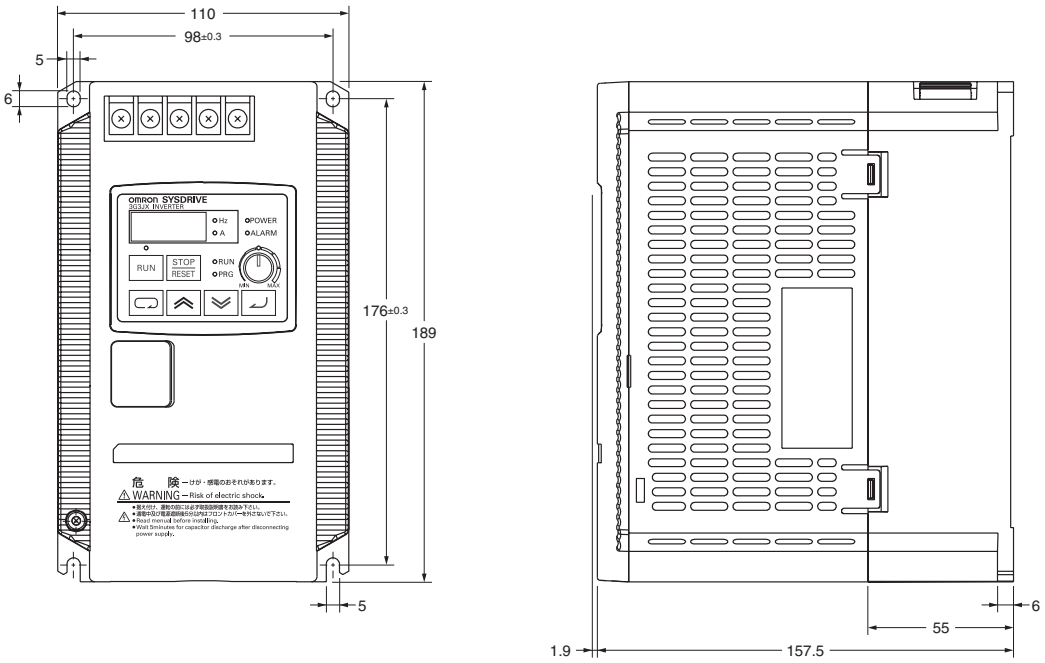
Rated voltage	Model 3G3JX-	Dimensions (mm)	
		D	D1
3phase 200 V AC	A2002	95.5	13
	A2004	109.5	27
	A2007	132.5	50
1/3phase 200 V AC	AE002	95.5	13
	AE004	109.5	27

3G3JX-A4004
3G3JX-AE007

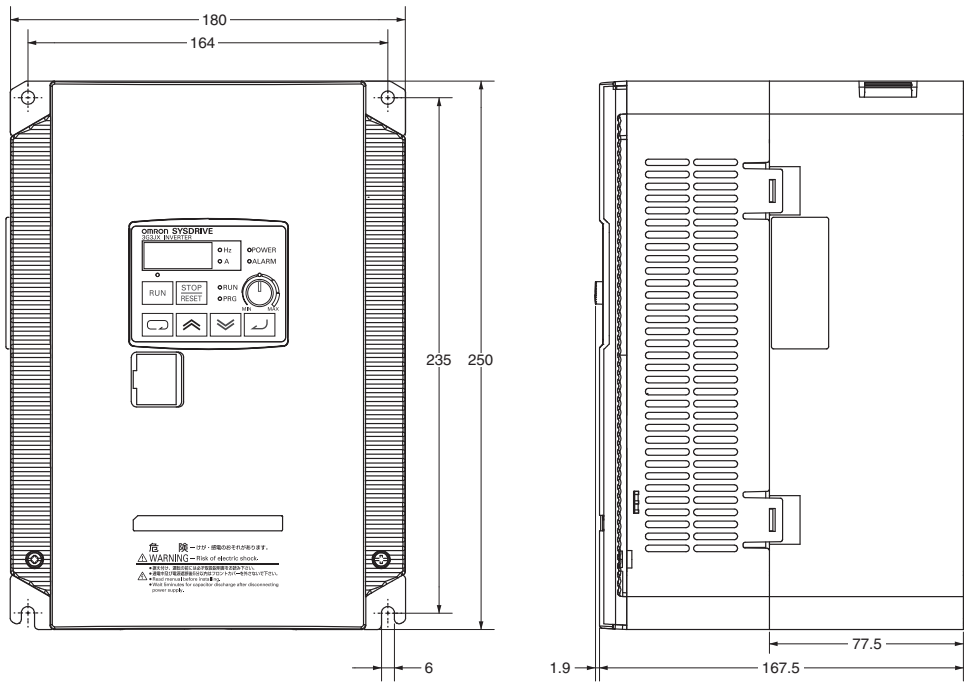




3G3JX-A2015
3G3JX-A2022
3G3JX-A2037
3G3JX-A4007
3G3JX-A4015
3G3JX-A4022
3G3JX-A4037
3G3JX-AE015
3G3JX-AE022



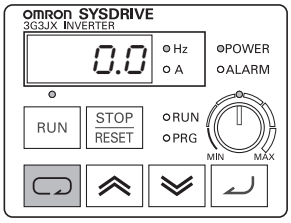
3G3JX-A2055
3G3JX-A2075
3G3JX-A4055
3G3JX-A4075



Using Digital Operator

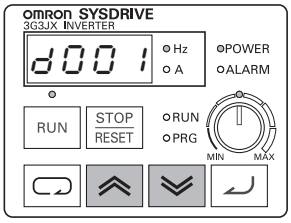
1. Setting the maximum output frequency

Power ON



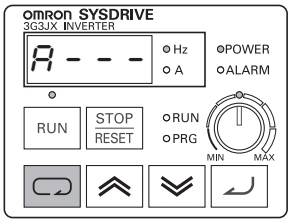
(1) 0.0 or the value previously monitored is displayed.

Press [↺] key.



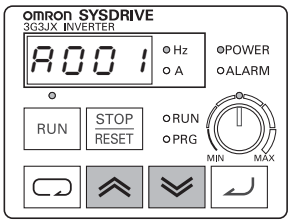
(2) Function code appears.

Press [∧∧] [∨∨] until A --- appears.



(3) A --- appears.

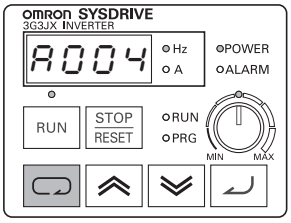
Press [↺] key.



(4) A001 or the code number set in the end of last setting is displayed.

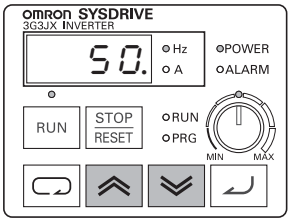
Press [∧∧] [∨∨] until A --- appears.

(It continues in upper right.)



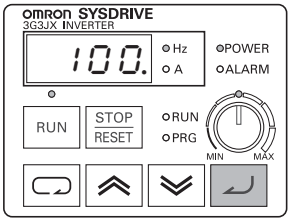
(5) A004 appears.

Press [↺] key.



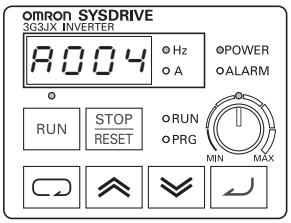
(6) Preset value is displayed.

Press [∧∧] [∨∨] to set desired value.



(7) Newly set value is displayed.

Press [↵] key to store the value.

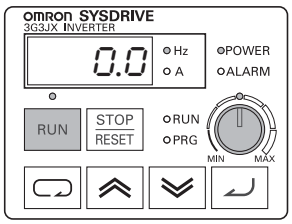


(8) Returns to A004 and the setting is complete.

- To run the motor, go back to monitor mode or basic setting mode.
- Pressing [↺] key for a while and back to d001.

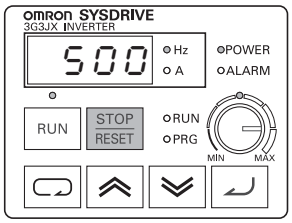
2. Running the motor (by potentiometer)

Power ON



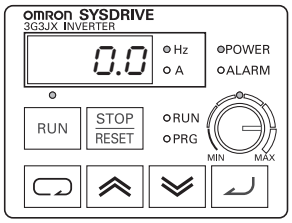
(1) 0.0 or the value previously monitored is displayed.

Press RUN key and turn the potentiometer clockwise.



(2) The motor runs at the frequency set by the potentiometer.

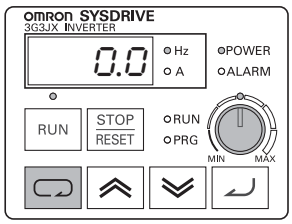
Press STOP RESET key to stop the motor.



(3) The motor stops.

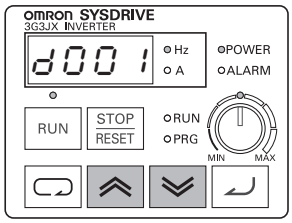
3. Monitoring output current value

Power ON



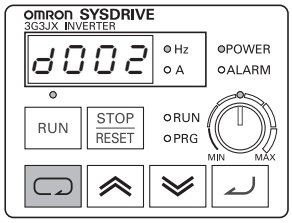
(1) 0.0 or the value previously monitored is displayed.

Press key.



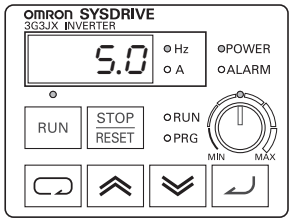
(2) Function code appears.

Press until d002 appears.



(3) d002 appears.

Press key.



(4) Output current value is displayed.

Protective and Diagnostic Functions

Error Code List

Display on Digital Operator	Name	Description	
E_01	Overcurrent trip	Constant speed	If the motor is restrained, or rapidly accelerated or decelerated, a large current will flow through the Inverter, which will result in breakage. To avoid this, an overcurrent protection circuit works to shut off the Inverter output.
E_02		Deceleration	
E_03		Acceleration	
E_04		Others	
E_05	Overload trip	If an Inverter output current is detected and the motor is overloaded, an electronic thermal inside the Inverter operates to shut off the Inverter output. After a trip occurs, normal operation is restored in 10 seconds by resetting the Inverter.	
E_07	Overvoltage trip	If the incoming voltage and regenerative energy from the motor are too high, a protection circuit works to shut off the Inverter output when the voltage on the converter exceeds the specified level.	
E_08	EEPROM error	Shuts off the output if an error occurs in the EEPROM built into the Inverter due to external noise and abnormal temperature rise. Check the set data again if the E_08 error occurs. If the power is shut off during data initialization, an EEPROM error E_08 may occur when the power is next turned on. Shut off the power after completing data initialization.	
E_09	Undervoltage trip	Shuts off the output if the incoming voltage drops below the specified level, causing the control circuit not to work properly during a momentary power interruption.	
E_11	CPU error	Shuts off the output if the internal CPU has malfunctioned. If the multi-function output terminal (relay terminal) is set to 05 (alarm), the signal may not be output during the CPU error E_11. In this case, no data is stored in the trip monitor. The same thing could happen if AL (05) is allocated to the relay output terminal. Again, no data is stored.	
E_12	External trip	If an error occurs in the external equipment or devices, the Inverter receives the signal, and the output is shut off. (Available with the external trip function selected)	
E_13	USP trip	Appears if the Inverter is turned on with the RUN command being input. (Available with the USP function selected) If an undervoltage trip E_09 occurs with the USP terminal set to ON, the trip, after released by resetting, becomes a USP trip E_13. Reset again to release the trip.	
E_14	Ground fault trip	Shuts off the output if a ground fault between the Inverter output unit and the motor is detected when turning on the power. The ground fault trip E_14 cannot be released with the reset input. Shut off the power and check the wiring.	
E_15	Incoming overvoltage trip	Appears if the incoming voltage has remained high for 100 seconds while the Inverter output is stopped.	
E_21	Temperature error	Shuts off the output if the temperature has risen in the main circuit due to malfunction of the cooling fan or other reason.	
E_30	Driver error	Shuts off the output if overcurrent is detected in the main circuit.	
E_35	Thermistor error	While the thermistor input function is used, this detects the resistance of the external thermistor and shuts off the Inverter output.	
E_37	Emergency shutoff	With the emergency shutoff selected (DIP switch on the control board SW8 = ON), this error appears when an emergency shutoff signal is input from input terminal 3.	
E_60	Communications error	Occurs when the communication watchdog timer times out.	

3G3JX Related Option

The following optional items and peripheral devices can be used with the Inverter. Select them according to the application.

Type	Specifications						Description
	Type	Voltage	Inverter 3G3JX-□	Rated Current (A)	Leakage Norm/Max	kg	
EMC Line Filters	Foot Mounting [Rasmi]	200V (Single-phase)	AE002 / AE004	6	0.7mA	0.5	AX-FIJ1006-RE
			AE007	10	0.7mA	0.6	AX-FIJ1010-RE
			AE015 / AE022	23	0.7mA	0.8	AX-FIJ1023-RE
		200V (Three-phase)	A2002 / A2004 / A2007	6	0.3 / 16mA	1.0	AX-FIJ2006-RE
			A2015 / A2022 / A2037	20	1.0 / 50mA	1.3	AX-FIJ2020-RE
			A2055 / A2075	40	1.3 / 65mA	2.3	AX-FIJ2040-RE
		400V (Three-phase)	A4004 / A4007 / A4015	5	0.6 / 70mA	0.9	AX-FIJ3005-RE
			A4022 / A4037	11	0.6 / 70mA	1.1	AX-FIJ3011-RE
			A4055 / A4075	20	0.3 / 40mA	1.7	AX-FIJ3020-RE

Type	Specifications		Description
	Voltage	Inverter 3G3JX-□	
Input AC Reactors	200V (Single-phase)	AE002 / AE004 / AE007 / AE015 / AE022	UNDER DEVELOPMENT
	200V (Three-phase)	A2002 / A2004 / A2007	AX-RAI02800080-DE
		A2015 / A2022 / A2037	AX-RAI00880175-DE
		A2055 / A2075	AX-RAI00350335-DE
	400V (Three-phase)	A4004 / A4007 / A4015	AX-RAI07700042-DE
		A4022 / A4037	AX-RAI03500090-DE
		A4055 / A4075	AX-RAI01300170-DE
DC Reactors	200V (Single-phase)	AE002	AX-RC10700032-DE
		AE004	AX-RC06750061-DE
		AE007	AX-RC03510093-DE
		AE015	AX-RC02510138-DE
		AE022	AX-RC01600223-DE
	200V (Three-phase)	A2002	AX-RC21400016-DE
		A2004	AX-RC10700032-DE
		A2007	AX-RC06750061-DE
		A2015	AX-RC03510093-DE
		A2022	AX-RC02510138-DE
		A2037	AX-RC01600223-DE
		A2055	AX-RC01110309-DE
		A2075	AX-RC00840437-DE
	400V (Three-phase)	A4004	AX-RC43000020-DE
		A4007	AX-RC27000030-DE
		A4015	AX-RC14000047-DE
		A4022	AX-RC10100069-DE
		A4037	AX-RC06400116-DE
		A4055	AX-RC04410167-DE
		A4075	AX-RC03350219-DE

Types	Specifications		Model
	Voltage	Inverter 3G3JX-□	
Output AC Reactors	200V (Single-phase)	AE002 / AE004	AX-RAO11500026-DE
		AE007	AX-RAO07600042-DE
		AE015	AX-RAO04100075-DE
		AE022	AX-RAO03000105-DE
	200V (Three-phase)	A2002 / A2004	AX-RAO11500026-DE
		A2007	AX-RAO07600042-DE
		A2015	AX-RAO04100075-DE
		A2022	AX-RAO03000105-DE
		A2037	AX-RAO01830160-DE
		A2055	AX-RAO01150220-DE
		A2075	AX-RAO00950320-DE
	400V (Three-phase)	A4004 / A4007 / A4015	AX-RAO16300038-DE
		A4022	AX-RAO11800053-DE
		A4037	AX-RAO07300080-DE
		A4055	AX-RAO04600110-DE
		A4075	AX-RAO03600160-DE

Types	Specifications		Model
	Description	Diameter	
Radio Noise Filters	For 2.2 kW motors or below	21	AX-FER2102-RE
	For 15 kW motors or below	25	AX-FER2515-RE

Types	Description	Model
PC Cable	RJ45 to USB Converter, 2m Cable	3G3AX-PCACN2
Remote Operator	LCD Remote operator *1 (5 Line LCD remote operator with copy function, cable length max. 3m.)	AX-OP05-E
	LED Remote Operator with frequency reference volume	3G3AX-OP01
	3 meters cable for connecting remote operator	3G3AX-CAJOP300-EE
	Mounting Kit for LED Operator	4X-KITMINI
Others	RJ45 T-Branch Cable	3G3AX-CTB020-EE
	RJ45 T-Branch Terminator Resistor	3G3AX-CTR150-EE

*1 Please note, for 3G3JX models, the operator will only display 2 lines of text.

Overview of Inverter Selection

Selecting the Motor Capacity

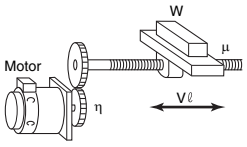
Select a motor before selecting the Inverter. Calculate the load inertia in the application, calculate the motor capacity and torque required to handle the load, and select an appropriate motor.

Simple Selection Method (Calculation of the Required Output)

With this method, you select the motor based on the output (W) required when the motor is rotating at a steady rate. This method does not include the involved calculations for acceleration and deceleration, so add some extra capacity to the calculated value when selecting the motor. This is a simple way to calculate the size of motor needed in equipment that operates at a steady rate for long periods, such as fans, conveyors, and mixing machines. This method is not suitable for the following kinds of applications:

- Applications requiring sudden start-ups
- Applications where the equipment starts and stops frequently
- Applications where there is a lot of inertia in the transmission system
- Applications with a very inefficient transmission system

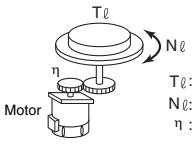
Linear Motion: Steady Power Po (kW)



$$P_0 = \frac{m \cdot W \cdot V\ell}{6120 \cdot \eta}$$

μ: Friction coefficient
W: Weight of moveable load (kg)
Vℓ: Speed of moveable load (m/min)
h: Efficiency of reduction mechanism (transmission)

Rotational Motion: Steady Power Po (kW)



$$P_0 = \frac{T\ell \cdot N\ell}{9535 \cdot \eta}$$

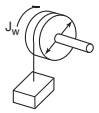
Tℓ: Load torque at load axis (N•m)
Nℓ: Speed of load axis (r/min)
η : Efficiency of reduction mechanism (transmission)

Detailed Selection Method (R.M.S. Calculation Method)

With this method, you calculate the effective torque and maximum torque required in the application's operating pattern. This method provides a detailed motor selection that matches the operating pattern.

Calculating the Motor Shaft Conversion Inertia

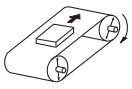
Use the following equations to calculate the inertia of all of the parts and convert that to the motor shaft conversion inertia.



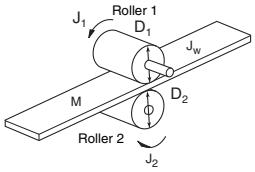
$$J_w = J_1 + J_2 = \left(\frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4} \right) \times 10^{-6} \ (kg \cdot m^2)$$

J_w: Inertia (kg•m²)
J_1: Inertia of cylinder (kg•m²)
J_2: Inertia due to object (kg•m²)
D: Diameter (mm)
M_1: Mass of cylinder (kg)
M_2: Mass of object (kg)

$$J_w = J_1 + J_2 + J_3 + J_4 = \left(\frac{M_1 \cdot D_1^2}{8} + \frac{M_2 \cdot D_2^2}{8} + \frac{D_1^2}{D^2} + \frac{M_3 \cdot D_1^2}{4} + \frac{M_4 \cdot D_1^2}{4} \right) \times 10^{-6} \ (kg \cdot m^2)$$

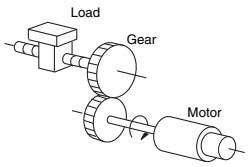


J_w: Inertia (kg•m²)
J_1: Inertia of cylinder 1 (kg•m²)
J_2: Inertia of cylinder 2 (kg•m²)
J_3: Inertia due to object (kg•m²)
J_4: Inertia due to belt (kg•m²)
D_1: Diameter of cylinder 1 (mm)
D_2: Diameter of cylinder 2 (mm)
M_1: Mass of cylinder 1 (kg)
M_2: Mass of cylinder 2 (kg)
M_3: Mass of object (kg)
M_4: Mass of belt (kg)



$$J_w = J_1 + \left(\frac{D_1}{D_2} \right)^2 J_2 + \frac{M \cdot D_1^2}{4} \times 10^{-6} \ (kg \cdot m^2)$$

J_w: Inertia of entire system (kg•m²)
J_1: Inertia of roller 1 (kg•m²)
J_2: Inertia of roller 2 (kg•m²)
D_1: Diameter of roller 1 (mm)
D_2: Diameter of roller 2 (mm)
M: Effective mass of workpiece (kg)



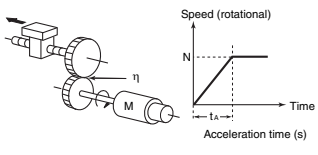
$$J_L = J_1 + G^2 (J_2 + J_w) \ (kg \cdot m^2)$$

J_L: Motor shaft conversion load inertia (kg•m²)
J_w: Load inertia (kg•m²)
J_1: Motor gear inertia (kg•m²)
J_2: Load gear inertia (kg•m²)
Z_1: Number of gear teeth on motor side
Z_2: Number of gear teeth on load side
Gear ratio $G = Z_1/Z_2$

Calculating the Motor Shaft Conversion Torque and Effective Torque

Calculate the total combined torque required for the motor to operate based on the acceleration torque due to the motor shaft conversion load inertia (calculated above) and the load torque due to friction force and the external force applied to the load.

Acceleration Torque

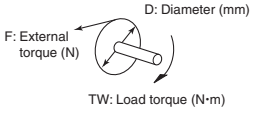


Acceleration Torque (T_A)

$$T_A = \frac{2\pi N}{60 t_A} \left(J_M + \frac{J_L}{\eta} \right) (N \cdot m)$$

T_A: Acceleration Torque (N•m)
J_L: Motor shaft conversion load inertia (kg•m²)
J_M: Inertia of motor itself (kg•m²)
η: Gear transmission efficiency
N: Motor speed (r/min)

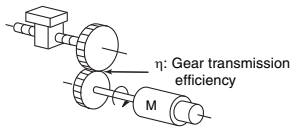
Motor Conversion Load Torque (External and Friction)



$$T_W = F \cdot \frac{D}{2} \times 10^{-3} \ (N \cdot m)$$

Friction force in general:

$F = \mu W$ μ: Friction coefficient
W: Weight of moving parts



$$T_L = T_W \cdot \frac{G}{\eta} \ (N \cdot m)$$

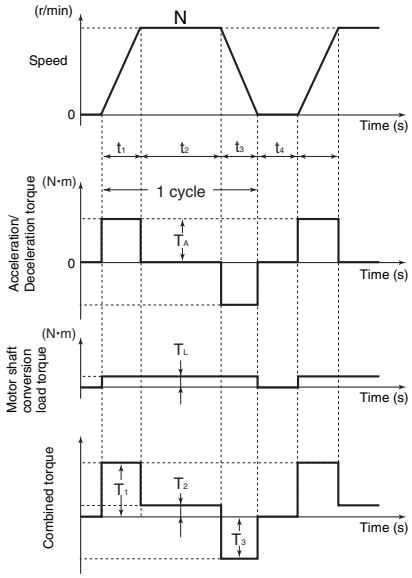
T_L: Motor shaft conversion load torque (N•m)
T_W: Load torque (N•m)
Z_1: Number of gear teeth on motor side
Z_2: Number of gear teeth on load side
Gear (reduction) ratio $G = Z_1/Z_2$

Calculating the Combined Torque and Effective Torque

Effective torque: T_{RMS} (N·m)

$$= \sqrt{\frac{\Sigma(Ti)^2 \cdot ti}{\Sigma ti}} = \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + T_3^2 \cdot t_3 + T_4^2 \cdot t_4}{t_1 + t_2 + t_3 + t_4}}$$

Maximum torque: $T_{MAX} = T_1 = T_A + T_L$



✻ Use the Servomotor's Motor Selection Software to calculate the motor conversion inertia, effective torque, and maximum torque shown above.

Selecting the Motor

Use the results of the calculations above and the equations below to determine the required motor capacity from the effective torque and maximum torque. Use the larger of the following motor capacities when selecting the motor.
When selecting the motor, set a motor capacity higher than the calculated capacity to provide some extra capacity.

Motor Capacity Supplied for Effective Torque:
Motor capacity (kW): $1.048 \bullet N \bullet T_{RMS} \bullet 10^{-4}$
(N: Max. speed in r/min)

Motor Capacity Supplied for Maximum Torque:
Motor capacity (kW): $1.048 \bullet N \bullet T_{RMS} \bullet 10^{-4}/1.5$
(N: Max. speed in r/min)

Selecting the Inverter Capacity

Select an Inverter that is large enough to handle the motor selected in Selecting the Motor above. Basically, select an Inverter with a maximum motor capacity that matches the motor capacity calculated above.
After selecting the Inverter, verify that the following conditions are satisfied. If the conditions are not satisfied, select the Inverter that is one size larger and check the conditions again.

- Motor's rated current ≤ Inverter's rated output current
- The application's continuous maximum torque output time ≤ 1 minute

Note: 1. If the Inverter's overload endurance is 120% of the rated output current for one minute, check for 0.8 minute.
2. When using the 0-Hz sensorless vector control, or a torque with a min. rating of 150% is frequently used under the condition that the holding torque is required with the rotation speed 0 (r/min), use an inverter with one size larger capacity than the inverter selection result.

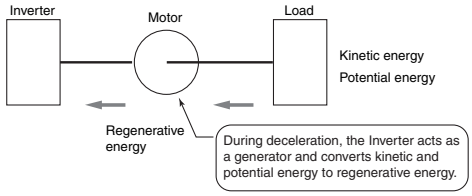
Overview of Braking Resistor Selection

Applications Requiring Braking Resistors

In applications where excessive regenerative motor energy is produced during deceleration or descent, the main-circuit voltage in the Inverter may rise high enough to damage the Inverter. Standard Inverters, which are equipped with the overvoltage protection function, detect the overvoltage protection and stop operation, which will prevents any damage. Although the Inverter will be protected, the overvoltage protection function will generate an error and the motor will stop; this system configuration will not provide stable continuous operation.
This regenerative energy needs to be emitted to the outside of the Inverter using the braking resistor or regenerative braking unit.

About Regenerative Energy

The load connected to the motor has kinetic energy if it is rotating or potential energy if it is at a high level. The kinetic or potential energy is returned to the Inverter when the motor decelerates or lowers the load. This phenomenon is known as regeneration and the returned energy is called regenerative energy.



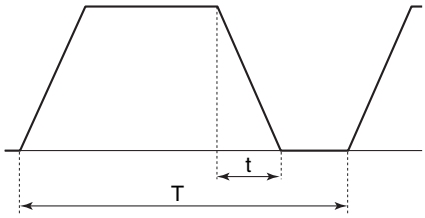
Avoiding the Use of a Braking Resistor

The following methods can be used to avoid having to connect a Braking Resistor. These methods require the deceleration time to be extended, so you must evaluate whether extending the deceleration time will cause any problems in the application.

- Enable the "stall prevention during deceleration" function; the default setting for this function is enabled. (Increase the deceleration time automatically so as not to generate the overvoltage protection.)
- Set a longer deceleration time. (This reduces the rate at which the regenerative energy is produced.)
- Select "coast to stop" as the stopping method. (Regenerative energy will not be returned to the Inverter.)

Simple Method for Braking Resistor Selection

This is a simple method for determining the braking resistance from the percentage of time that regenerative energy is produced during a normal operating pattern.



Use rate (duty) = t/T x 100 (%ED)

t: Deceleration time (regenerative time)
T: Time for 1 cycle of operation

For Models with a Built-in Braking Circuit (3G3MX/3G3RX Max. 18.5 kW)

Select the braking resistor based on the usage rate calculated from the operation patterns.
Refer to the braking resistor list described in the User's manual and catalog, and connect it according to your Inverter.

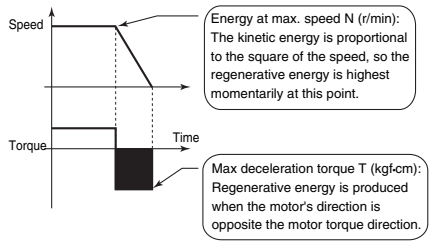
For Models without a Built-in Braking Circuit (3G3JX/3G3RX Min. 22 kW)

Select the regenerative braking unit and the braking resistor.
Refer to the regenerative braking unit and braking resistor lists described in the User's manual and catalog, and connect them according to your Inverter.

Detailed Method for Braking Resistor Selection

If the Braking Resistor's use rate (duty factor) exceeds 10% ED or the application requires an extremely large braking torque, use the following method to calculate the regenerative energy and select a Braking Resistor.

Calculating the Required Braking Resistance



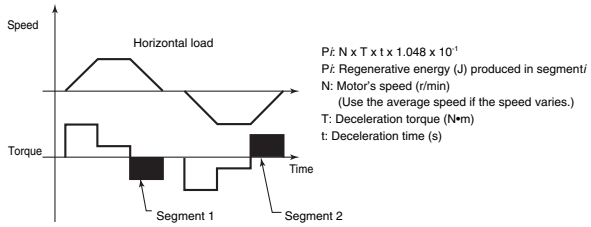
$$\text{Braking Resistor's resistance: } R \leq \frac{V^2}{1.048 \times (T\text{-}0.2 \times Tm) \times N \times 10^{-1}}$$

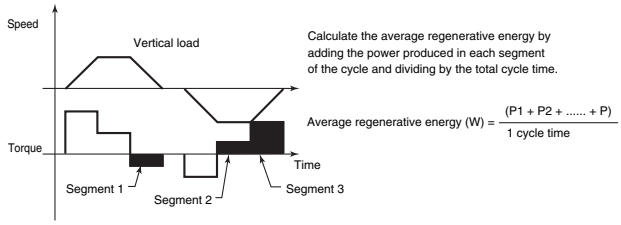
V: 385 V for a 200-V Class Inverter
400 V for a 400-V Class Inverter
T: Maximum braking torque (kgf•cm)
Tm: Motor's rated torque (N•cm)
N: Maximum speed (r/min)

✻ Use the value for the braking torque calculated in *Calculating the Motor Shaft Conversion Torque and Effective Torque* on page 27.

Calculating the Average Regenerative Energy

Regenerative energy is produced when the motor is rotating in the opposite direction of the motor torque. Use the following equations to calculate the regenerative energy produced in each segment of the cycle.





Note: 1. The speed is positive when the motor is rotating forward and the torque is positive when it is in the forward direction.
2. Use the value for the braking torque calculated in *Calculating the Motor Shaft Conversion Torque and Effective Torque* on page 27.

Selecting the Braking Resistor

Select the appropriate Braking Resistor based on the required braking resistance and average regenerative energy that were calculated above.

- Required braking resistance ≥ Braking Resistor's resistance ≥ Inverter or Braking Unit's minimum resistance
- Average regenerative energy ≤ Braking Resistor's allowable power

Note: 1. The internal braking transistor will be damaged if a resistor is connected with a resistance below the Inverter or Regenerative Braking Unit's minimum resistance. If the required resistance is less than the minimum resistance, increase the Inverter's capacity and replace the Inverter or Regenerative Braking Unit with one that has a minimum resistance less than the required resistance.
2. Two or more Regenerative Braking Units can be connected in parallel. Use the following equation to determine the braking resistance when driving two or more Units.
Braking resistance (Ω) = (required braking resistance calculated above) × (number of Units)
3. Do not select the braking resistance with the results calculated above. A rating of 150 W is not the allowed power, it is the maximum rated power in resistance units. The actual allowed power rating depends upon the resistor.

Advanced General-purpose Inverters

SYSDRIVE RX Series

Human-/Environmental-friendly, High-performance, General-purpose Inverters, Enabling Output Control Suitable for Various Applications

- With the vector control and auto-tuning functions, the RX Series has achieved high starting torque in excess of 200% at 0.3 Hz
- The RX Series provides sensorless vector control, which is useful for up/down applications
- Automatic energy-saving operation function. Automatically adjusts so that the Inverter output voltage during operation becomes minimum at a constant speed
- Checks the direction of rotation and frequency, enabling smooth restart of the motor for a free-running motor (e.g. fan motor)
- During a power failure or momentary power interruption, the RX Series can decelerate and stop a motor by using the motor braking energy
- More simplified parameter settings and views
  Only parameters that have been changed from the default settings can be viewed
  With the user setting function, only 12 parameters for frequent use can be viewed
- The RX Series incorporates a zero-phase reactor (radio noise filter) as a standard specification
- ModBus-RTU communication allows you to perform network operation at low cost

Model Number Explanation

3G3RX - □ □ □ □ □

RX-series Inverter

Voltage Class

2	3-phase 200 V AC
4	3-phase 400 V AC

Maximum Motor Capacity

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

Degree of protection

A	Panel-mounting type (IP10 or higter)/closed wall-mounting type
B	Panel-mounting type (IP00)

Standard Models

Rated voltage	Enclosure rating	Max. applicable motor capacity	Model
3-phase 200 V AC	IP20	0.4 kW	**3G3RX-A2004**
		0.75 kW	**3G3RX-A2007**
		1.5 kW	**3G3RX-A2015**
		2.2 kW	**3G3RX-A2022**
		3.7 kW	**3G3RX-A2037**
		5.5 kW	**3G3RX-A2055**
		7.5 kW	**3G3RX-A2075**
		11 kW	**3G3RX-A2110**
		15 kW	**3G3RX-A2150**
		18.5 kW	**3G3RX-A2185**
		22 kW	**3G3RX-A2220**
		30 kW	**3G3RX-A2300**
		37 kW	**3G3RX-A2370**
		45 kW	**3G3RX-A2450**
		55 kW	**3G3RX-A2550**
3-phase 400 V AC		0.4 kW	**3G3RX-A4004**
		0.75 kW	**3G3RX-A4007**
		1.5 kW	**3G3RX-A4015**
		2.2 kW	**3G3RX-A4022**
		3.7 kW	**3G3RX-A4037**
		5.5 kW	**3G3RX-A4055**
		7.5 kW	**3G3RX-A4075**
		11 kW	**3G3RX-A4110**
		15 kW	**3G3RX-A4150**
		18.5 kW	**3G3RX-A4185**
		22 kW	**3G3RX-A4220**
		30 kW	**3G3RX-A4300**
		37 kW	**3G3RX-A4370**
		45 kW	**3G3RX-A4450**
		55 kW	**3G3RX-A4550**
		75 kW	**3G3RX-B4750**
		90 kW	**3G3RX-B4900**
		110 kW	**3G3RX-B411K**
		132 kW	**3G3RX-B413K**

International Standards (EC Directives and UL/cUL Standards)

The 3G3RX Inverter meets the EC Directives and UL/cUL standard requirements for worldwide use.

Classification		Applicable standard
ED Directives	EMC Directive	EN61800-3: 2004
	Low-voltage Directive	EN61800-5-1: 2003
UL/cUL Standards		UL508C

Standard Specification List

lThree-phase 200-V Class

Class		3-phase 200 V														
Model name (3G3RX-)		A2004	A2007	A2015	A2022	A2037	A2055	A2075	A2110	A2150	A2185	A2220	A2300	A2370	A2450	A2550
Max. applicable motor 4P	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Rated output capacity (kVA)	200 V	1.0	1.7	2.5	3.6	5.7	8.3	11.0	15.9	22.1	26.3	32.9	41.9	50.2	63.0	76.2
	240 V	1.2	2.0	3.1	4.3	6.8	9.9	13.3	19.1	26.6	31.5	39.4	50.2	60.2	75.6	91.4
Rated input voltage		3-phase (3-wire) 200 V –15% to 240 V +10%, 50/60 Hz ±5%														
Rated output voltage		3-phase: 200 to 240 V (according to the input voltage)														
Rated output current (A)		3.0	5.0	7.5	10.5	16.5	24	32	46	64	76	95	121	145	182	220
Radio noise filter		Built-in														
Weight (kg)		3.5	3.5	3.5	3.5	3.5	6	6	6	14	14	14	22	30	30	43
Braking	Regenerative braking	Built-in braking resistor circuit (discharge resistor separately mounted)											Regenerative braking unit separately mounted			
	Minimum connection resistance (Ω)	50	50	35	35	35	17	17	17	7.5	7.5	5	---			

lThree-phase 400-V Class

Class		3-phase 400 V										
Model name (3G3RX-)		A4004	A4007	A4015	A4022	A4037	A4055	A4075	A4110	A4150	A4185	A4220
Max. applicable motor 4P	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
Rated output capacity (kVA)	400 V	1.0	1.7	2.5	3.6	6.2	8.3	13.1	17.3	22.1	26.3	33.2
	480 V	1.2	2.0	3.1	4.3	7.4	9.9	15.8	20.7	26.6	31.5	39.9
Rated input voltage		3-phase (3-wire) 380 V –15% to 480 V +10%, 50/60 Hz ±5%										
Rated output voltage		3-phase: 380 to 480 V (according to the input voltage)										
Rated output current (A)		1.5	2.5	3.8	5.3	9.0	14	19	25	32	38	48
Radio noise filter		Built-in										
Weight (kg)		3.5	3.5	3.5	3.5	3.5	6	6	6	14	14	14
Braking	Regenerative braking	Built-in braking resistor circuit (discharge resistor separately mounted)										
	Minimum connection resistance (Ω)	100	100	100	100	70	70	35	35	24	24	20

Class		3-phase 400 V							
Model name (3G3RX-)		A4300	A4370	A4450	A4550	B4750	B4900	B411k	B413k
Max. applicable motor 4P	kW	30	37	45	55	75	90	110	132
Rated output capacity (kVA)	400 V	40.1	51.9	63.0	77.6	103.2	121.9	150.3	180.1
	480 V	48.2	62.3	75.6	93.1	123.8	146.3	180.4	216.1
Rated input voltage		3-phase (3-wire) 380 V –15% to 480 V +10%, 50/60 Hz ±5%							
Rated output voltage		3-phase: 380 to 480 V (according to the input voltage)							
Rated output current (A)		58	75	91	112	149	176	217	260
Radio noise filter		Built-in							
Weight (kg)		22	30	30	30	55	55	70	70
Braking	Regenerative braking	Regenerative braking unit separately mounted							
	Minimum connection resistance (Ω)	---							

Common Specification

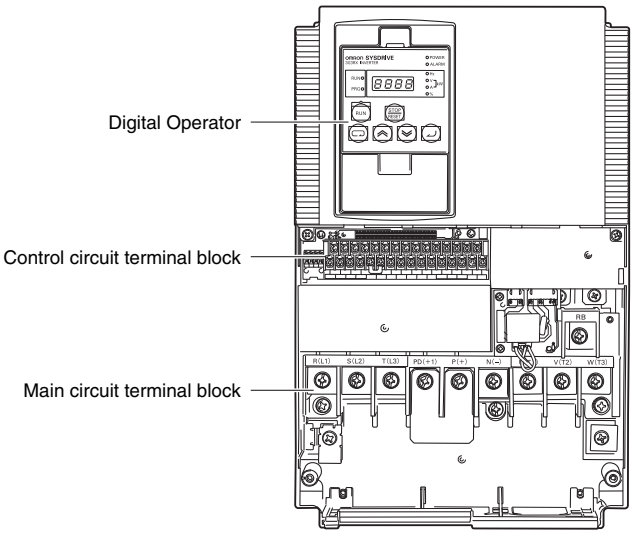
Item		Specifications
Enclosure rating		IP20 (0.4 to 55 kW) IP00 (75 to 132 kW)
Cooling method		Forced air cooling
Control method		Phase-to-phase sinusoidal modulation PWM
Output frequency range		0.1 to 400 Hz
Frequency precision		Digital command: ±0.01% of the max. frequency Analog command: ±0.2% of the max. frequency (25°C ± 10°C)
Frequency resolution		Digital setting: 0.01 Hz Analog setting: Max. frequency/4000 (Terminal FV: 12 bits/0 to +10 V), (Terminal FE: 12 bits/-10 to +10 V), (Terminal FI: 12 bits/0 to +20 mA)
Voltage/Frequency characteristics		V/f optionally changeable at base frequencies of 30 to 400 Hz, V/f braking constant torque, reduction torque, sensor-less vector control, sensor-less vector control at 0 Hz
Speed fluctuation		±0.5% (under sensor-less vector control or sensor-less vector control at 0 Hz)
Overload current rating		150%/60 s, 200%/3 s
Acceleration/Deceleration time		0.01 to 3600.0 s (line/curve selection)
Starting torque		200%/0.3 Hz (under sensor-less vector control or sensor-less vector control at 0 Hz)
		150%/Torque at 0 Hz (under sensor-less vector control at 0 Hz, when a motor size one rank lower than specified is connected)
DC injection braking		Operates when the starting frequency is lower than that in deceleration via the STOP command, when the frequency reference is lower than the operation frequency, or via an external input (braking power, time, and frequency are variable)
Input	Multi-function input	8 terminals, NO/NC switchable, sink/source logic switchable [Terminal function] 8 functions can be selected from among 61. Reverse (RV), Multi-step speed setting binary 1 (CF1), Multi-step speed setting binary 2 (CF2), Multi-step speed setting binary 3 (CF3), Multi-step speed setting binary 4 (CF4), Jogging (JG), DC injection braking (DB), 2nd control (SET), 2-step acceleration/deceleration (2CH), Free-run stop (FRS), External trip (EXT), USP function (USP), Commercial switching (CS), Soft lock (SFT), Analog input switching (AT), 3rd control (SET3), Reset (RS), 3-wire start (STA), 3-wire stop (STP), 3-wire forward/reverse (F/R), PID enabled/disabled (PID), PID integral reset (PIDC), Control gain switching (CAS), UP/DWN function accelerated (UP), UP/DWN function decelerated (DWN), UP/DWN function data clear (UDC), Forced operator (OPE), Multi-step speed setting bit 1 (SF1), Multi-step speed setting bit 2 (SF2), Multi-step speed setting bit 3 (SF3), Multi-step speed setting bit 4 (SF4), Multi-step speed setting bit 5 (SF5), Multi-step speed setting bit 6 (SF6), Multi-step speed setting bit 7 (SF7), Overload limit switching (OLR), Torque limit enabled (TL), Torque limit switching 1 (TRQ1), Torque limit switching 2 (TRQ2), P/PI switching (PPI), Brake confirmation (BOK), Orientation (ORT), LAD cancel (LAC), Position deviation clear (PCLR), Pulse train position command input permission (STAT), Frequency addition function (ADD), Forced terminal block (F-TM), Torque reference input permission (ATR), Integrated power clear (KHC), Servo ON (SON), Preliminary excitation (FOC), Analog command on hold (AHD), Position command selection 1 (CP1), Position command selection 2 (CP2), Position command selection 3 (CP3), Zero return limit signal (ORL), Zero return startup signal (ORG), Forward driving stop (FOT), Reverse driving stop (ROT), Speed/Position switching (SPD), Pulse counter (PCNT), Pulse counter clear (PCC), No allocation (no)
	Thermistor input terminal	1 terminal (Positive/Negative temperature coefficient of resistance element switchable)
Output	Multi-function output	5 open collector output terminals: NO/NC switchable, sink/source logic switchable 1 relay (SPDT contact) output terminal: NO/NC switchable [Terminal function] 6 functions can be selected from among 45. Signal during RUN (RUN), Constant speed arrival signal (FA1), Over set frequency arrival signal (FA2), Overload warning (OL), Excessive PID deviation (OD), Alarm signal (AL), Set-frequency-only arrival signal (FA3), Overtorque (OTQ), Signal during momentary power interruption (IP), Signal during undervoltage (UV), Torque limit (TRQ), RUN time exceeded (RNT), Power ON time exceeded (ONT), Thermal warning (THM), Brake release (BRK), Brake error (BER), 0-Hz signal (ZS), Excessive speed deviation (DSE), Position ready (POK), Set frequency exceeded 2 (FA4), Set frequency only 2 (FA5), Overload warning 2 (OL2), Analog FV disconnection detection (FVDc), Analog FI disconnection detection (FIDc), Analog FE disconnection detection (FEDc), PID FB status output (FBV), Network error (NDc), Logic operation output 1 (LOG1), Logic operation output 2 (LOG2), Logic operation output 3 (LOG3), Logic operation output 4 (LOG4), Logic operation output 5 (LOG5), Logic operation output 6 (LOG6), Capacitor life warning (WAC), Cooling fan life warning (WAF), Starting contact signal (FR), Fin overheat warning (OHF), Light load detection signal (LOC), Operation ready (IRDY), Forward run (FWR), Reverse run (RVR), Fatal fault (MJA), Window comparator FV (WCFV), Window comparator FI (WCFI), Window comparator FE (WCFE), Alarm codes 0 to 3 (AC0 to AC3)
	Multi-function monitor output terminal	Analog voltage output, Analog current output, Pulse train output (A-F, D-F {multiplied by "n", pulse output only}, A, T, V, P, etc.)
Display monitor		Output frequency, Output current, Output torque, Frequency conversion value, Trip record, I/O terminal status, Electric power, etc.
Other functions		V/f free setting (7), Upper/lower frequency limit, Frequency jump, Curve acceleration/deceleration, Manual torque boost level/break, Energy-saving operation, Analog meter adjustment, Starting frequency, Carrier frequency adjustment, Electronic thermal function, (free setting available), External start/end (frequency/rate), Analog input selection, Trip retry, Restart during momentary power interruption, Various signal outputs, Reduced voltage startup, Overload limit, Initialization value setting, Automatic deceleration at power-off, AVR function, Automatic acceleration/deceleration, Auto tuning (Online/Offline), High-torque multi-motor operation control (sensor-less vector control of two monitors with one Inverter)
Carrier frequency modification range		5.9 m/s^2 (0.6G), 10 to 55 Hz (0.4 to 22 kW) 2.94 m/s^2 (0.3G), 10 to 55 Hz (30 to 132 kW)
Protective functions		Overcurrent protection, Overvoltage protection, Undervoltage protection, Electronic thermal protection, Temperature error protection, Momentary power interruption/Power interruption protection, Input phase loss protection, Braking resistor overload protection, Ground-fault current detection at power-on, USP error, External trip, Emergency shutoff trip, CT error, Communication error, Option error, etc.

Item		Specifications
Operating environment	Ambient/Storage temperature/Humidity	-10°C to 50°C/-20°C to 65°C/20% to 90% RH (with no condensation)
	Vibration *	3G3RX-A□004 to A□220 5.9 m/s^2 (0.6G), 10 to 55 Hz 3G3RX-A□300 to A□550 2.94 m/s^2 (0.3G), 10 to 55 Hz
	Location	At a maximum altitude of 1,000 m; indoors (without corrosive gases or dust)
Options	Encoder feedback option	Sensor vector control
	DI Board	4-digit BCD, 16-bit binary
Other options		Braking resistor, AC reactor, DC reactor, Digital Operator cables, Noise filter, Braking unit, etc.

*Complies with the test method specified in JIS C0040 (1999).
Note: Insulation distance complies with UL/CE standards.

Terminal Block Specifications

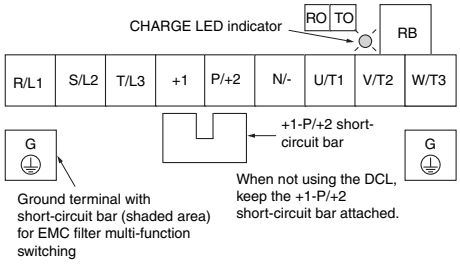
Terminal Block Position



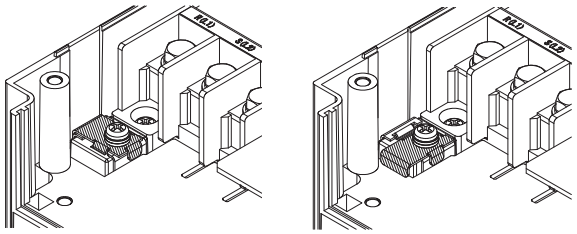
Note: This illustration shows the terminal block with the Terminal block front cover removed.

Arrangement of Main Circuit Terminals

Terminal arrangement



EMC filter functions switching method



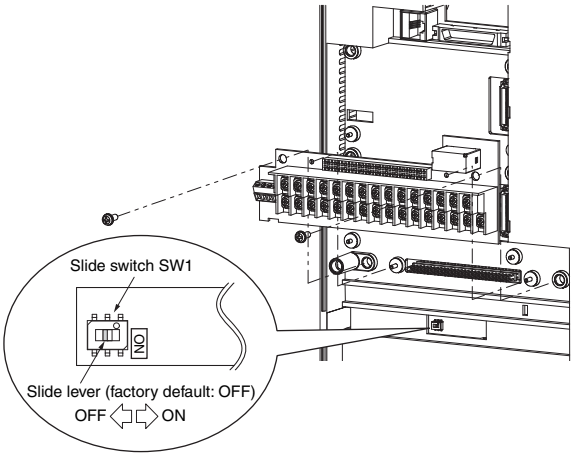
EMC filter enabled

EMC filter disabled (factory default)

Terminal symbol	Terminal name	Description
R/L1, S/L2, T/L3	Main power supply input terminal	Connect the input power supply.
U/T1, V/T2, W/T3	Inverter output terminal	Connect to the 3-phase motor.
+1, P/+2	External DC reactor connection terminal	Remove the short-circuit bar between terminals "+1" and "P/+2", and connect the optional power factor improvement reactor.
P/+2, RB	Braking resistor connection terminals	Connect optional external braking resistors. (The RB terminal is provided for the Inverters with 22 kW or lower capacity.)
P/+2, N/-	Regenerative braking unit connection terminal	Connect optional regenerative braking units.
G ⏚	Ground terminal	Inverter case ground terminal. Connect this terminal to the ground. Class D (200 V), Class C (400 V)

Emergency Shutoff Function

- The built-in slide switch is used to enable or disable the emergency shutoff function (Factory Default: Disabled).
- This function is intended to turn off the Inverter output (Stop switching the main element) via only the multi-function input terminal of the hardware circuit, independent of the CPU Software.

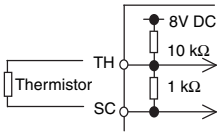


Arrangement of Control Circuit Terminals

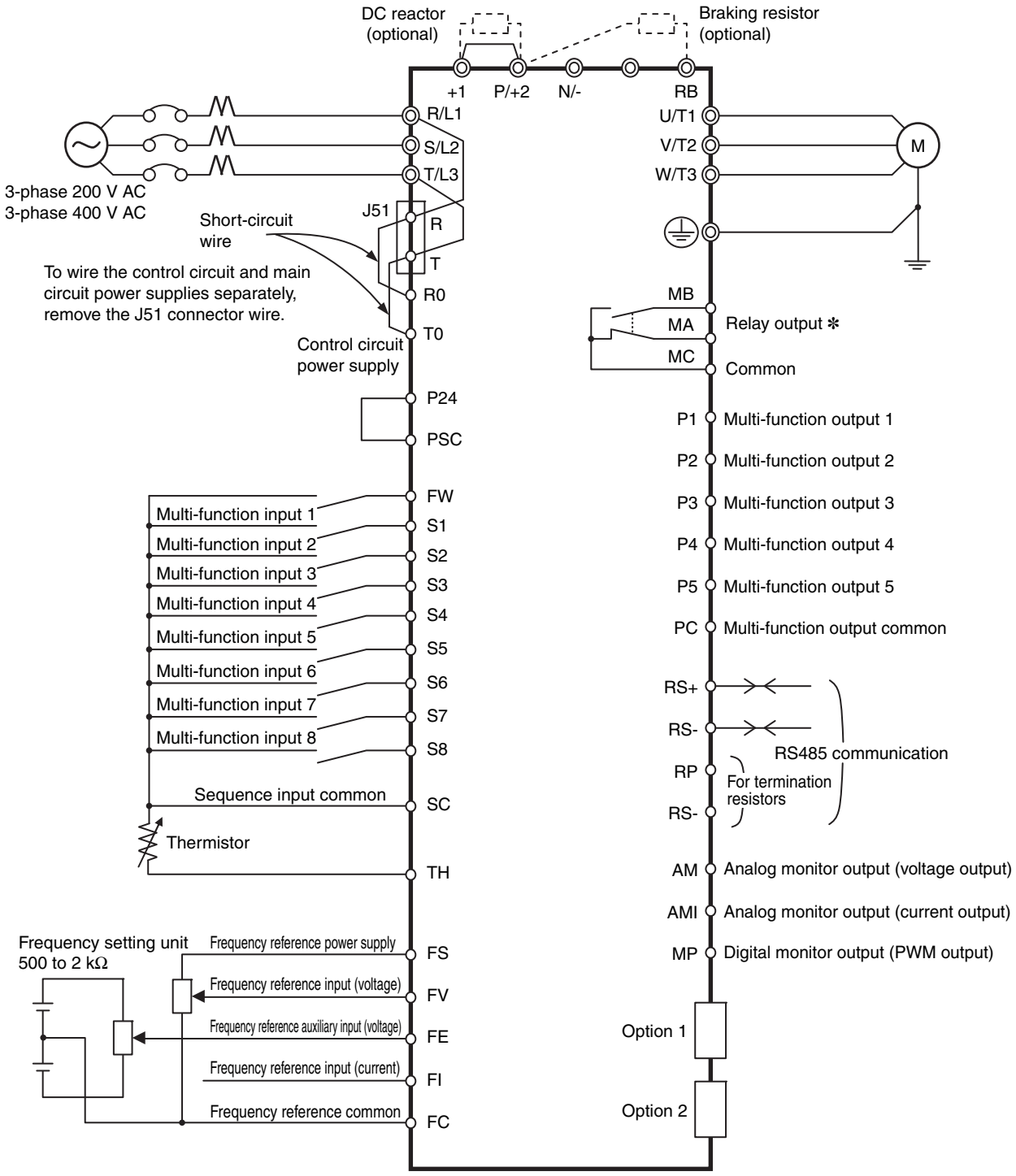
	FS	FE	AM	MP	TH	FW	S8	SC	S5	S3	S1	P4	P3	P1	MA
FC	FV	FI	AMI	P24	PSC	SC	S7	S6	S4	S2	P5	PC	P2	MC	MB

Terminal screw size M3

			Terminal symbol	Terminal name	Description	Specifications
Analog	Power supply		FC	Frequency reference common	Common terminal for the frequency setting signals (FV, FE and FI) and the analog output terminals (AM and AMI). Do not connect this terminal to the ground.	–
			FS	Frequency reference power supply output	+10 V DC power supply for the FV terminal.	Allowable load current: 20 mA max.
	Frequency setting input		FV	Frequency reference input (Voltage directive)	With a 0 V to 10 V DC voltage input, the maximum frequency is set at 10 V. To set the maximum frequency at 10 V or lower, set A014.	Input impedance 10 kΩ Allowable input voltage range: –0.3 to +12 V DC
			FE	Auxiliary frequency reference input (Voltage directive)	With a 0 to 10 V DC voltage input, the FE signal is added to the frequency reference signal of the FV or FI terminal. If the setting is changed, the frequency reference can be input even with the FE terminal independently.	Input impedance 10 kΩ Allowable input voltage 0 to ±12 V DC
			FI	Frequency reference input (Current directive)	With a 4 to 20 mA DC current input, the maximum frequency is set at 20 mA. The FI signal is only active when the AT terminal is ON. Allocate the AT function to the multi-function input terminal.	Input impedance 100 Ω Allowable max. current: 24 mA
	Monitor output		AM	Analog monitor (Voltage)	This terminal outputs a signal selected from the "0 V to 10 V DC Voltage Output" monitor items: Output frequency, Output current, Output torque (with/without sign), Output voltage, Input voltage, Electronic thermal relay load rate, LAD frequency, Motor temperature, Cooling fin temperature, and General-purpose output.	Allowable max. current: 2 mA
			AMI	Analog monitor (Current)	This terminal outputs a signal selected from the "4 to 20 mA DC Current Output" monitor items: Output frequency, Output current, Output torque (with/without sign), Output voltage, Input voltage, Electronic thermal relay load rate, LAD frequency, Motor temperature, Cooling fin temperature, and General-purpose output.	Allowable load impedance: 250 Ω max.
Digital (contact)	Monitor output		MP	Multi-function digital output	This terminal outputs a signal selected from the "0 to 10 V DC Voltage Output (PWM)" monitor items: Output frequency, Output current, Output torque (with/without sign), Output voltage, Input voltage, Electronic thermal relay load rate, LAD frequency, Motor temperature, Cooling fin temperature, General-purpose output, Digital output frequency, and Digital current monitor. "Digital output frequency", and "Digital current monitor" output a digital pulse at 0/10 V DC pulse voltage and 50% duty ratio.	Allowable max. current: 1.2 mA Max. frequency: 3.6 kHz
	Power supply		P24	Interface power supply terminal	24 V DC power supply for contact input signal. When the source logic is selected, this terminal functions as the contact input common terminal.	Allowable max. output current: 100 mA
			SC	Input common	Common terminal for the interface power supply (P24) terminal, thermistor input (TH) terminal and digital monitor (MP) terminal. When the sink logic is selected, this terminal functions as the contact input common terminal. Do not connect this terminal to the ground.	–
	Contact input	RUN command	FW	Forward rotation command terminal	When the FW signal is ON, the motor runs forward. When it is OFF, the motor decelerates and stops.	[Contact input ON condition] Voltage between each input terminal and the PSC terminal: 18 V DC or more. Input impedance between each input terminal and the PSC terminal: 4.7 kΩ Allowable max. voltage: Voltage between each input terminal and the PSC terminal: 27 V DC Load current at 27 V DC power supply voltage: Approx. 5.6 mA
		Function/ Selection	S1	Multi-function input	Select 8 functions from among the 69 functions and allocate them to from terminals S1 to S8. **Note:** Only terminals S1 and S3 can be used for the emergency shutoff function. For details, refer to *Emergency Shutoff Function* on page 36.	
			S2			
			S3			
			S4			
			S5			
			S6			
			S7			
			S8			
			PSC	Multi-function input common	The sink and source logic for contact input can be switched by connecting a short-circuit bar on the control terminal block. Short-circuiting P24 and SC → Sink logic, Short-circuiting SC and PSC → Source logic To drive contact input via an external power supply, remove the short-circuit bar and connect terminal PSC to the external interface circuit.	–

			Terminal symbol	Terminal name	Description	Specifications
Digital (contact)	Open collector output	Status/ Factor	P1	Multi-function output	Select 5 functions from among 51, and allocate them to terminals P1 through P5. If an alarm code is selected in C062, terminals P1 to P3, or terminals P1 to P4 always output an alarm factor code (e.g. Inverter trip). The signal between each terminal and PC always corresponds to the sink or source logic.	Between each terminal and PC Voltage drop 4 V max. at power-on Max. allowable voltage: 27 V DC Max. allowable current: 50 mA
			P2			
			P3			
			P4			
			P5			
			PC	Multi-function output common	Common terminal for multi-function output terminals P1 to P5.	
	Relay output	Status, alarm, etc.	MA MB	Relay output	Select the desired functions from among 43 functions, and allocate them to these terminals. SPDT output. By factory default, the relay output (MA, MB) contact selection (C036) is set at NC contact between MA-MC, and NO contact between MB-MC.	Contact max. capacity MA-MC 250 V AC, 2 A (Resistance) 0.2 A (Induction) MB-MC 250 V AC, 1 A (Resistance) 0.2 A (Induction) Contact min. capacity 100 V AC, 10 mA 5 V DC, 100 mA
			MC	Relay output common		
Analog	Analog input	Sensor	TH	External thermistor input Terminal	Connect an external thermistor to this terminal, to trip the Inverter when a temperature error occurs. The SC terminal functions as the common terminal. [Recommended thermistor characteristics] Allowable rated power: 100 mW min. Impedance at temperature error: 3 kΩ Temperature error detection level is adjustable between 0 and 9999 Ω.	Allowable input voltage range 0 to 8V DC [Input circuit] 

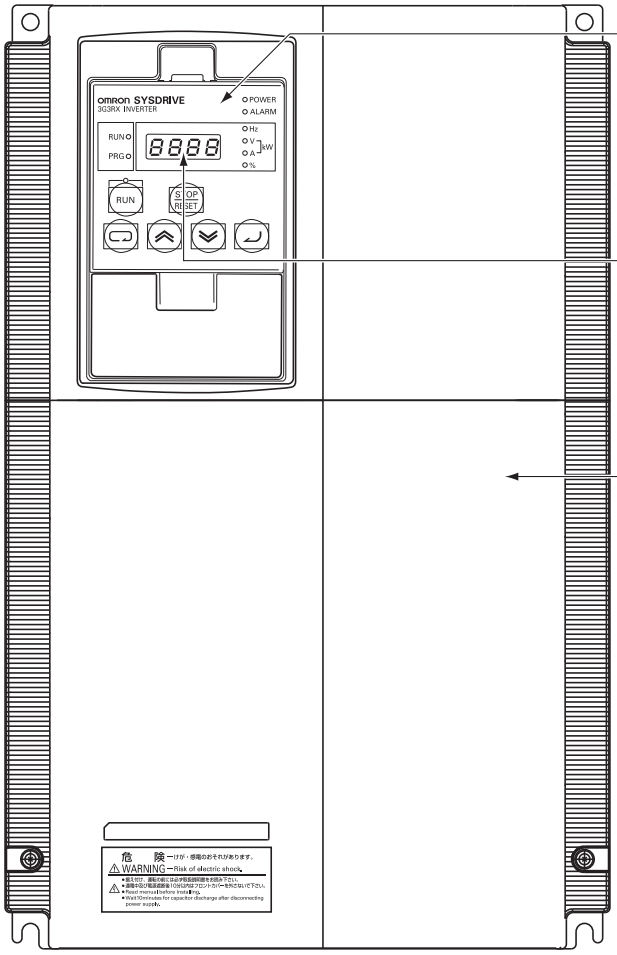
Standard Connection Diagram



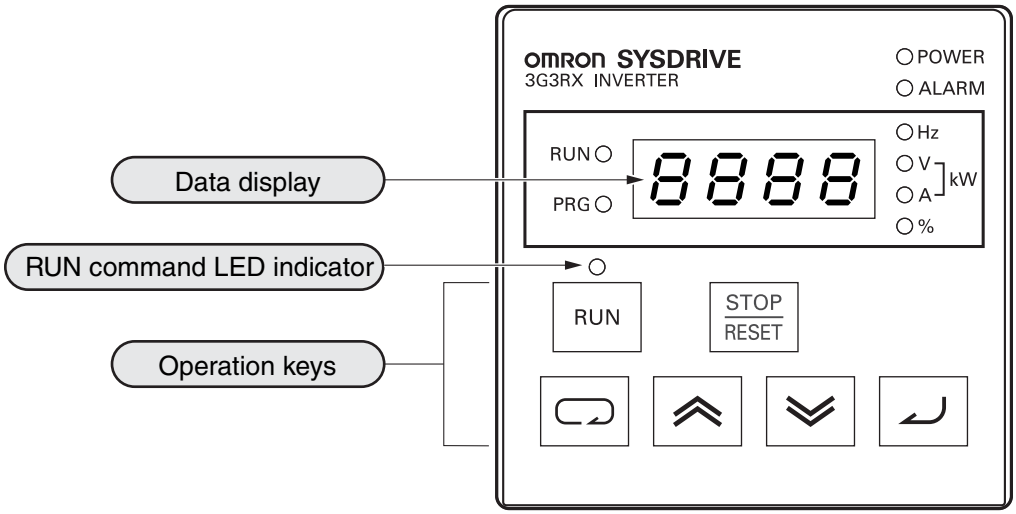
✻ By default, MA is set to MC contact, and MB to NO contact in the contact selection (C036).

Nomenclature and Functions

Inverter Nomenclature and Functions



Part Names and Descriptions of the Digital Operator

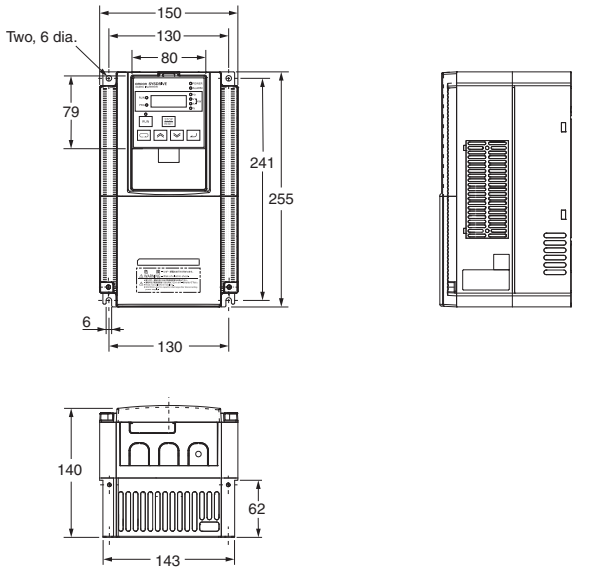


	Name	Function
POWER	POWER LED indicator	Lit when the power is supplied to the control circuit.
ALARM	ALARM LED indicator	Lit when an Inverter error occurs.
RUN	RUN (during RUN) LED indicator	Lit when the Inverter is running.
PRG	PROGRAM LED indicator	Lit when the set value of each function is indicated on the data display. Blinks during warning (when the set value is incorrect).
8.8.8.8.	Data display	Displays relevant data, such as frequency reference, output current, and set values.
Hz V A kW %	Data display LED indicator	Lit according to the indication on the data display. Hz: Frequency V: Voltage A: Current kW: Power %: Ratio
○	RUN command LED indicator	Lit when the RUN command is set to the Digital Operator. (The RUN key on the Digital Operator is available for operation)
RUN	RUN key	Activates the Inverter. Available only when operation via the Digital Operator is selected. (Check that the RUN command LED indicator is lit.)
STOP/RESET	STOP/RESET key	Decelerates and stops the Inverter. Functions as a reset key if an Inverter error occurs.
	Mode key	Switches between: the monitor mode (d□□□), the basic function mode (F□□□), and the extended function mode (A□□□, b□□□, c□□□, H□□□).
	Enter key	Enters the set value. (To change the set value, be sure to press the Enter key.)
	Increment key	Changes the mode. Also, increases the set value of each function.
	Decrement key	Changes the mode. Also, decreases the set value of each function.

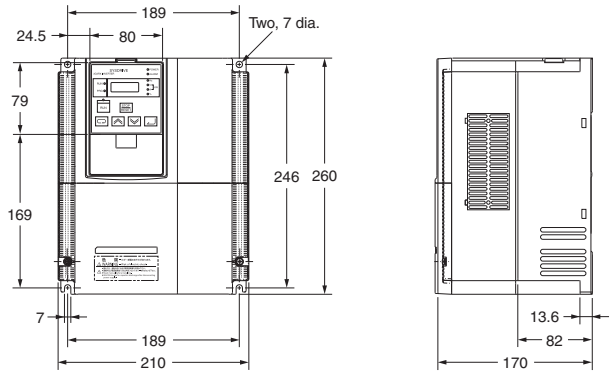
Dimensions

(Unit: mm)

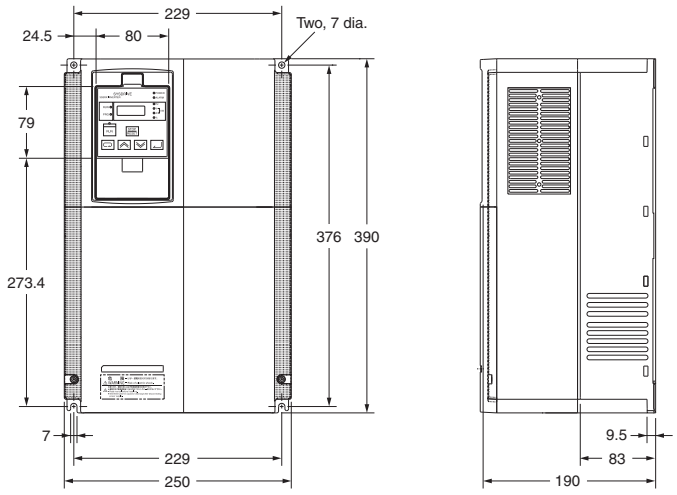
3G3RX-A2004
3G3RX-A2007
3G3RX-A2015
3G3RX-A2022
3G3RX-A2037
3G3RX-A4004
3G3RX-A4007
3G3RX-A4015
3G3RX-A4022
3G3RX-A4037



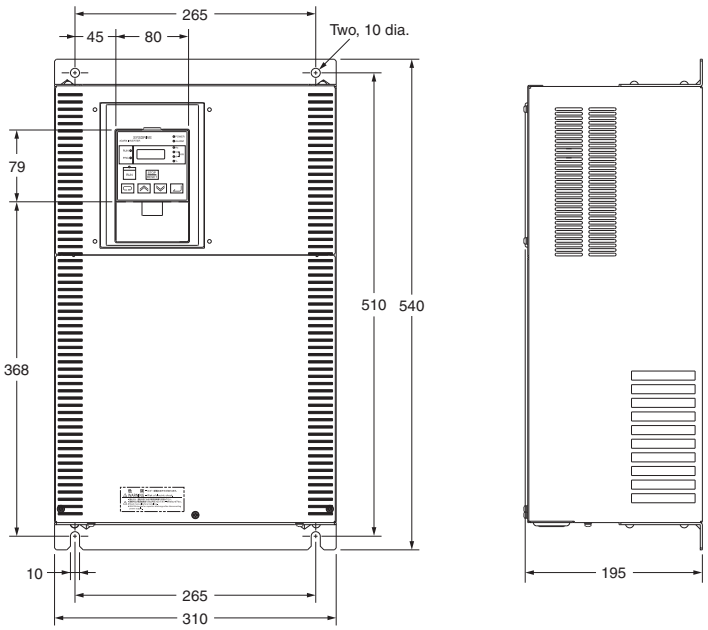
3G3RX-A2055
3G3RX-A2075
3G3RX-A2110
3G3RX-A4055
3G3RX-A4075
3G3RX-A4110



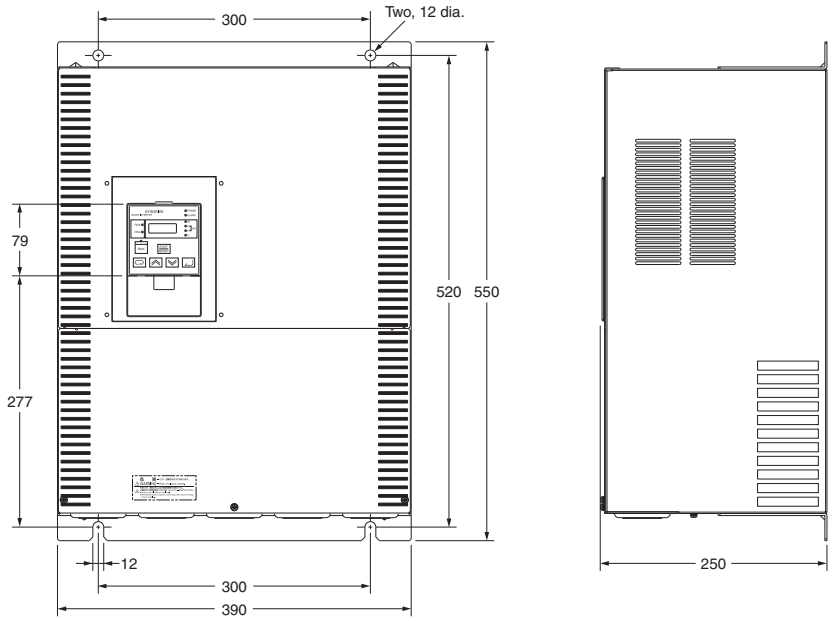
3G3RX-A2150
3G3RX-A2185
3G3RX-A2220
3G3RX-A4150
3G3RX-A4185
3G3RX-A4220



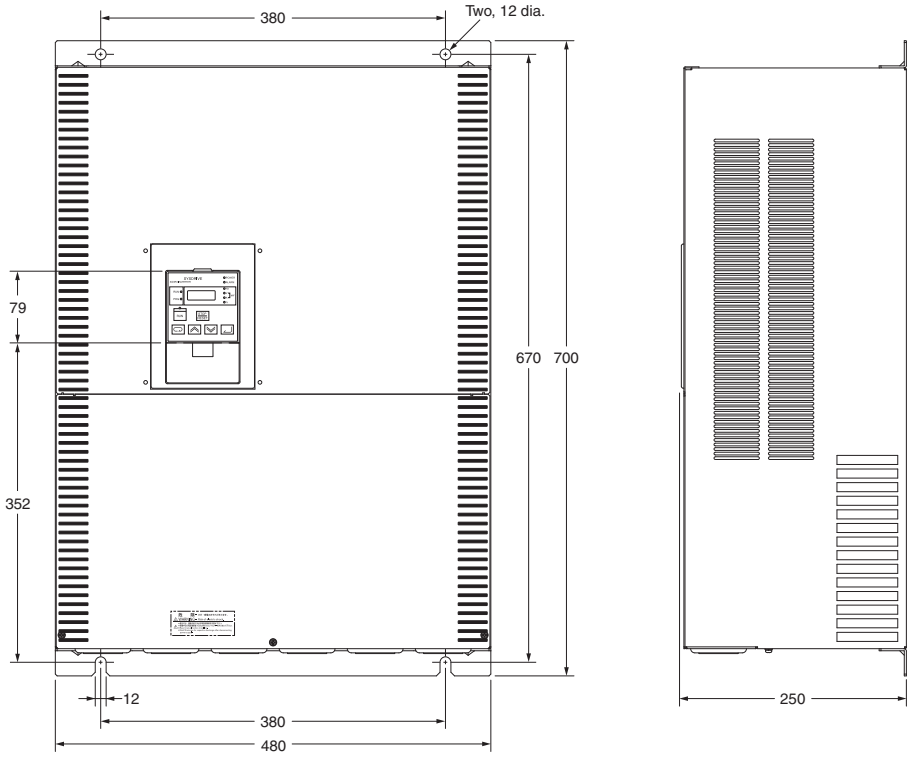
3G3RX-A2300
3G3RX-A4300



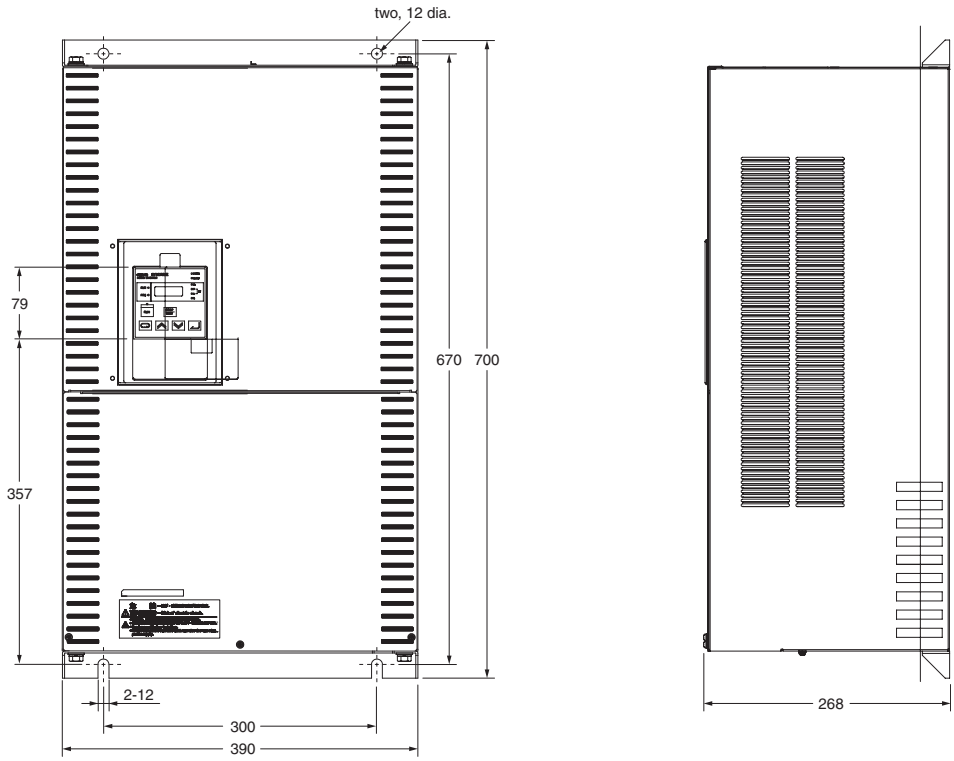
3G3RX-A2370
3G3RX-A2450
3G3RX-A4370
3G3RX-A4450
3G3RX-A4550



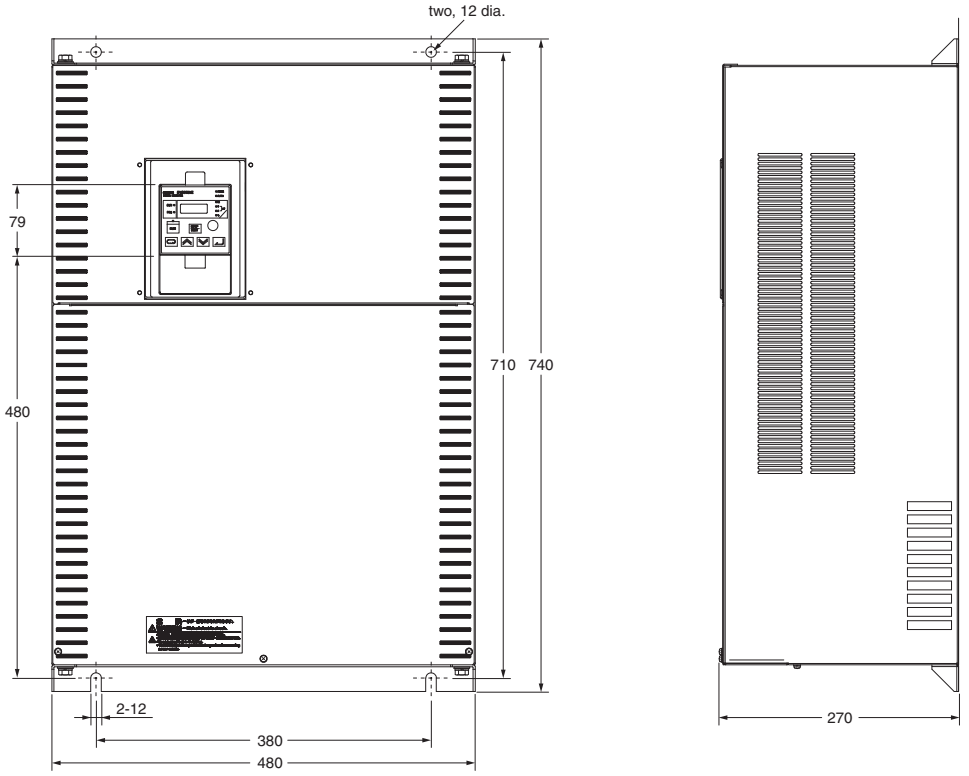
3G3RX-A2550



3G3RX-B4750
3G3RX-B4900

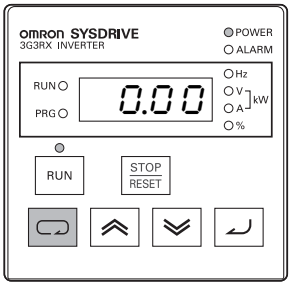


3G3RX-B411K
3G3RX-B413K



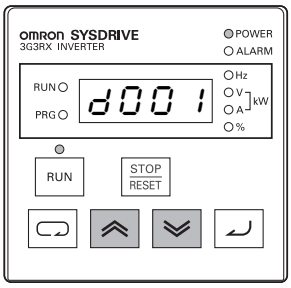
Setting output frequency

Power ON



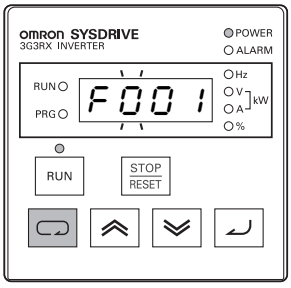
(1) 0.0 or the value previously monitored is displayed.

Press [ ] key.



(2) Function code appears.

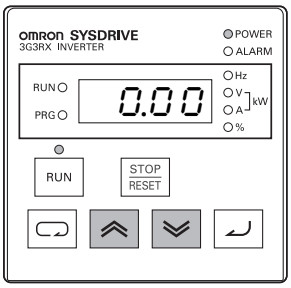
Press [ ] [ ] until F001 appears.



(3) F001 appears.

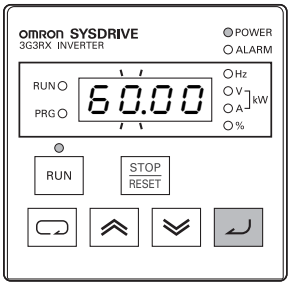
Press [ ] key.

(It continues in upper right.)



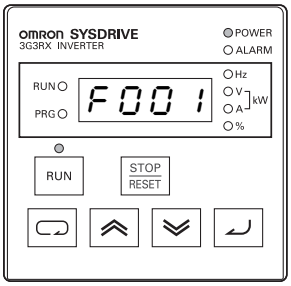
(4) Preset value is displayed.

Press [ ] [ ] to set desired value.



(5) Newly set value is displayed.

Press [ ] key to store the value.



(6) Set end. (Back to F001)

Operation Example for Basic Display (factory default: "b037 = 04")

- Displays the limited basic parameters.

Monitor mode:	All
Function mode:	4 parameters
Extended function mode:	20 parameters

- Other parameters than those mentioned above are not displayed. To display all parameters, select "Complete display 'b037 = 00'".

Parameters to be Displayed and Arrangement

No.	Display code	Item
1	d001 to d104	Monitor display
2	F001	Output frequency setting
3	F002	Acceleration time 1
4	F003	Deceleration time 1
5	F004	Digital Operator rotation direction Selection
6	A001	Frequency reference selection
7	A002	RUN command selection
8	A003	Base frequency
9	A004	Maximum frequency
10	A005	FV/FI terminal selection
11	A020	Multi-step speed reference 0
12	A021	Multi-step speed reference 1
13	A023	Multi-step speed reference 2
14	A044	V/f characteristics selection
15	A045	Output voltage gain
16	A085	RUN mode selection
17	b001	Retry selection
18	b002	Allowable momentary power interruption time
19	b008	Trip retry selection
20	b011	Trip retry wait time
21	b037	Display selection ✻
22	b083	Carrier frequency
23	b084	Initialization selection
24	b130	Overvoltage protection function during deceleration
25	b131	Overvoltage protection level during deceleration
26	C021	Multi-function output terminal P1 selection
27	C022	Multi-function output terminal P2 selection
28	C036	Relay output (MA, MB) contact selection

✻ If the target parameter is not displayed, check the setting of display selection "b037".
To display all parameters, set "00" to "b037".

Protective and Diagnostic Functions

Error Code List

Display on Digital Operator	Name	Description	
E01.□	Overcurrent protection	Constant speed	If the motor is restrained or rapidly accelerated or decelerated, a large current will flow through the Inverter, which will result in breakage. The larger than specified current then shuts off the output and an error appears. The protection detects this overcurrent through AC CT (current detector). The protection circuit operates at approximately 220% of the Inverter rated output current and a trip occurs.
E02.□		Deceleration	
E03.□		Acceleration	
E04.□		Others	
E05.□	Overload protection ✻1	Monitors the Inverter output current and shuts off the output, displaying an error if the built-in electronic thermal function detects overload against the motor. Trips depending on the electronic thermal function settings.	
E06.□	Braking resistor overload protection	Shuts off the output and displays an error if the usage rate of regenerative braking circuit exceeds the b090 set value.	
E07.□	Overvoltage protection	Extremely high DC voltage between P/+2 and N/- may result in failure. This function therefore shuts off the output and displays an error if the DC voltage between P/+2 and N/- exceeds the specified level because of regenerative energy from the motor or increase of the incoming voltage during operation. Trips when the DC voltage between P/+2 and N/- reaches approximately 400 V DC for 200-V class, and 800 V DC for 400-V class.	
E08.□	EEPROM error ✻2 ✻3	Shuts off the output and displays an error if an error occurs because of external noise and abnormal temperature rise in the EEPROM built into the Inverter. Note: It may become a CPU error depending on the case.	
E09.□	Undervoltage	Shuts off the output if the incoming voltage drops below that specified. This is because the control circuit fails to work properly, if the incoming voltage to the Inverter drops. Trips when the DC voltage between P and N reaches approximately 175 V DC for 200-V class, and 345 V DC for 400-V class.	
E10.□	CT error	Shuts off the output if an error occurs in the CT (current detector) built into the Inverter. Trips if the CT output is approximately 0.6 V or more when the power is turned on.	
E11.□	CPU error ✻3	Shuts off the output and displays an error if the internal CPU has worked erroneously or abnormally. **Note:** If an abnormal value is read from EEPROM, it may become a CPU error depending on the case.	
E12.□	External trip	If an error occurs in the external equipment or devices, the Inverter receives the signal, and the output is shut off. (Available with the external trip function selected)	
E13.□	USP error	Appears when the power is turned on with the RUN signal input into the Inverter. (Available with the USP function selected)	
E14.□	Grounding protection ✻3	Protects the Inverter if a ground fault between the Inverter output unit and the motor is detected when turning on the power. (This function does not work when there is residual voltage in the motor.)	
E15.□	Incoming overvoltage protection	Appears if the incoming voltage continues to be higher than the specification value for 100 seconds while the Inverter is stopped. Trips when the main circuit DC voltage reaches approximately 390 V DC for 200-V class, and 780 V DC for 400-V class.	
E16.□	Momentary power interruption protection	Shuts off the output when a momentary power interruption occurs for 15 ms or more. If the shutoff time is long, it is normally recognized as a power shutoff. Note that, when restart is selected, the Inverter restarts from recovery as long as the RUN command remains.	
E20.□	Temperature error when the rotation speed of the cooling fan decreases	Appears if a decrease of the cooling fan rotation speed has been detected when the following temperature error occurs.	
E21.□	Temperature error	Shuts off the output if the temperature has risen in the main circuit because of the high ambient temperature.	
E23.□	Gate array communications error	Trips when a fault is detected in communication behavior between the built-in CPU and the gate array.	
E24.□	Input open-phase protection	Prevents Inverter damage due to input open-phase protection function when the input open-phase selection is enabled (b006=01), and trips. Trips when the open-phase time is approximately 1 s or more.	
E25.□	Main circuit error ✻3	Trips when the gate array cannot confirm IGBT ON/OFF because of erroneous operation or main element breakage caused by noise interfusion.	
E30.□	IGBT error	Shuts off the Inverter output to protect the main element when a momentary overcurrent, temperature error in the main element, or drop of the main element driving power supply occurs. (Retry operation cannot be performed after this trip.)	
E35.□	Thermistor error	Shuts off the Inverter output when detecting the thermistor resistance value inside the motor connected to the TH terminal and resulting motor temperature rise.	
E36.□	Brake error	When 01 is selected in b120 (brake control selection), this error appears if the brake ON/OFF cannot be recognized within the b124 set time (brake confirmation wait time) after the Inverter outputs the brake release signal.	
E37.□	Emergency shutoff ✻4	Shuts off the hardware output and displays an error when the EMR terminal (S3) is turned on with SW1 on the logic board ON.	
E38.□	Overload protection in a low speed range	If an overload is detected in the lowest speed range of 0.2 Hz max., an electronic thermal inside the Inverter works to shut off the Inverter output. (2nd electronic thermal level) (However, higher frequency could remain in the error history.)	
E41.□	Modbus communications error	Appears when the timeout occurs because of disconnection during Modbus-RTU communication. (Trip by the C076 setting)	

Display on Digital Operator	Name	Description
E60.□ E69.□	Option 1 error	Detects an error on the board mounted on option slot 1. For details, refer to the operation manual for the mounted option board.
E70.□ E79.□	Option 2 error	Detects an error on the board mounted on option slot 2. For details, refer to the operation manual for the mounted option board.

✻1. The reset command will not be accepted until approximately 10 seconds pass since the trip occurs (protection function works)
✻2. The reset command will not be accepted if the EEPROM error E08.□ occurs. Turn off the power once. If you find E08 when turning on the power again, it is possible that the memory element has been broken or the parameters have not been memorized correctly. Perform the user initialization to set the parameters again.
✻3. The reset command through the RS terminal or STOP/RESET key will not be accepted. Turn off the power.
✻4. The reset operation via the Digital Operator will not be accepted. Be sure to reset via the RS terminal.

3G3RX Related Option

The following optional items and peripheral devices can be used with the Inverter. Select them according to the application.

Types	Specifications							Model
	Voltage	Inverter 3G3RX-□	Continu-ous Power [kW]	Peak Power [kW]	Continuous Current [A]	Peak Current [A]	Connectable min. resistance Ω	
Braking Units	200V (Three-phase)	A2300 / A2370	13	32	35	90	4.0	AX-BCR2035090-TE
		A2450 / A2550	25	47	70	130	2.8	AX-BCR2070130-TE
	400V (Three-phase)	A4300	11	33	15	45	16	AX-BCR4015045-TE
		A4370 / A4450	13	51	17	68	11	AX-BCR4017068-TE
		A4550 / A4750	26	67	35	90	8.5	AX-BCR4035090-TE
		A4900	52	97	70	130	5.5	AX-BCR4070130-TE
		A411K / A413K	11	33	15	45	16	AX-BCR4090240-TE

Types	Specifications								Model
	% ED	Voltage	Max. Motor [kW]	Inverter 3G3RX-□	Connectable min. resistance Ω	Braking Unit	Resist Ω	Braking torque %	
Braking Resistors	3% 10 sec max	200V (Three-phase)	0.55	A2004	50	Built-In	200	200	AX-REM00K1200-IE
			1.1	A2007				180	
			1.5	A2015	35		70	140	AX-REM00K2070-IE
			2.2	A2022				90	
			4.0	A2037			75	50	AX-REM00K4075-IE
			5.5	A2055	16		35	75	AX-REM00K4035-IE
			7.5	A2075	10			55	
			11.0	A2110			35	40	AX-REM00K6035-IE
			15.0	A2150	7.5		17	55	AX-REM00K9017-IE
			18.5	A2185			10	75	AX-REM03K5010-IE
			22.0	A2220	5			65	
		400V (Three-phase)	0.55	A4004	100	Built-In	400	200	AX-REM00K1400-IE
			1.1	A4007				200	
			1.5	A4015			200	190	AX-REM00K1200-IE
			2.2	A4022			200	130	AX-REM00K2200-IE
			4.0	A4037	70		120	120	AX-REM00K2120-IE
			5.5	A4055			75	140	AX-REM00K4075-IE
			7.5	A4075	35			100	
			11.0	A4110			100	50	AX-REM00K6100-IE
			15.0	A4150	24		70	55	AX-REM00K9070-IE
			18.5	A4185			35	90	AX-REM03K5035-IE
			22.0	A4220	20			75	

Types	Specifications								Model
	% ED	Voltage	Max. Motor [kW]	Inverter 3G3RX-□	Connectable min. resistance Ω	Braking Unit	Resist Ω	Braking torque %	
Braking Resistors	10% 10 sec max for Built-In 5 sec max for External Braking Unit	200V (Three-phase)	0.55	A2004	50	Built-in	200	180	AX-REM00K1200-IE
			1.1	A2007			70	200	AX-REM00K2070-IE
			1.5	A2015	35		75	130	AX-REM00K4075-IE
			2.2	A2022			35	180	AX-REM00K4035-IE
			4.0	A2037			35	100	AX-REM00K6035-IE
			5.5	A2055	16		20	150	AX-REM00K9020-IE
			7.5	A2075	10		17	110	AX-REM01K9017-IE
			11.0	A2110			17	75	AX-REM02K1017-IE
			15.0	A2150	7.5		10	95	AX-REM03K5010-IE
			18.5	A2185			8	95	AX-REM19K0008-IE
			22.0	A2220	5			80	
			30.0	A2300	4	External	6	80	AX-REM19K0006-IE
			37.0	A2370				60	
			45.0	A2450	2.8		3	105	2 x AX-REM19K0006-IE
			55.0	A2550				85	
		400V (Three-phase)	0.55	A4004	100	Built-in	400	200	AX-REM00K1400-IE
			1.1	A4007				200	
			1.5	A4015			200	190	AX-REM00K2200-IE
			2.2	A4022			120	200	AX-REM00K5120-IE
			4.0	A4037	70		100	140	AX-REM00K6100-IE
			5.5	A4055			70	150	AX-REM00K9070-IE
			7.5	A4075	35		70	110	AX-REM01K9070-IE
			11.0	A4110			70	75	AX-REM02K1070-IE
			15.0	A4150	24		35	110	AX-REM03K5035-IE
			18.5	A4185			30	100	AX-REM19K0030-IE
			22.0	A4220	20			85	
			30.0	A4300	16	External	20	95	AX-REM19K0020-IE
			37.0	A4370	11		12	125	AX-REM38K0012-IE
			45.0	A4450				100	
			55.0	A4550	8.5		10	100	2 x AX-REM19K0020-IE
			75.0	A4750			10	75	3 x AX-REM19K0030-IE
			90.0	A4900	5.5		6	105	2 x AX-REM38K0012-IE
			110.0	A411K	3.2		4	125	3 x AX-REM38K0012-IE
			132.0	A413K				105	

Types	Specifications					Model
	Voltage	Inverter 3G3RX-□	Rated Current [A]	Leakage Nom/Max	kg	
Rasmi Line Filters	200V (Three-phase)	A2004 / A2007 / A2015 / A2022 / A2037	18	0.7 / 40 mA	2.0	AX-FIR2018-RE
		A2055 / A2075 / A2110	53	0.7 / 40 mA	2.5	AX-FIR2053-RE
		A2150 / A2185 / A2220	110	1.2 / 70 mA	8.0	AX-FIR2110-RE
		A2300	145	1.2 / 70 mA	8.6	AX-FIR2145-RE
		A2370 / A2450	250	6 / 300 mA	13.0	AX-FIR3250-RE
		A2550	320	6 / 300 mA	13.2	AX-FIR3320-RE
	400V (Three-phase)	A4004 / A4007 / A4015 / A4022 / A4037	10	0.8 / 70 mA	1.9	AX-FIR3010-RE
		A4055 / A4075 / A4110	30	0.3 / 40 mA	2.2	AX-FIR3030-RE
		A4150 / A4185 / A4220	53	0.8 / 70 mA	4.5	AX-FIR3053-RE
		A4300	64	3 / 160 mA	7.0	AX-FIR3064-RE
		A4370	100	3 / 160 mA	8.0	AX-FIR3100-RE
		A4450 / A4550	130	3 / 160 mA	8.6	AX-FIR3130-RE
		B4750 / B4900	250	10 / 500 mA	13.0	AX-FIR3250-RE
		B411K / B413K	320	10 / 500 mA	13.2	AX-FIR3320-RE

Types	Specifications		Model
	Voltage	Inverter 3G3RX-□	
Input AC Reactors	200V (Three-phase)	A2004 / A2007 / A2015	AX-RAI02800100-DE
		A2022 / A2037	AX-RAI00880200-DE
		A2055 / A2075	AX-RAI00350335-DE
		A2110 / A2150	AX-RAI00180670-DE
		A2185 / A2220	AX-RAI00091000-DE
		A2300 / A2370	AX-RAI00071550-DE
		A2450 / A2550	AX-RAI00042300-DE
	400V (Three-phase)	A4004 / A4007 / A4015	AX-RAI07700050-DE
		A4022 / A4037	AX-RAI03500100-DE
		A4055 / A4075	AX-RAI01300170-DE
		A4110 / A4150	AX-RAI00740335-DE
		A4185 / A4220	AX-RAI00360500-DE
		A4300 / A4370	AX-RAI00290780-DE
		A4450 / A4550	AX-RAI00191150-DE
DC Reactors	200V (Three-phase)	A2004	AX-RC10700032-DE
		A2007	AX-RC06750061-DE
		A2015	AX-RC03510093-DE
		A2022	AX-RC02510138-DE
		A2037	AX-RC01600223-DE
		A2055	AX-RC01110309-DE
		A2075	AX-RC00840437-DE
		A2110	AX-RC00590614-DE
		A2150	AX-RC00440859-DE
		A2185 / A2220	AX-RC00301275-DE
		A2300	AX-RC00231662-DE
		A2370	AX-RC00192015-DE
		A2450	AX-RC00162500-DE
		A2550	AX-RC00133057-DE
	400V (Three-phase)	A4004	AX-RC43000020-DE
		A4007	AX-RC27000030-DE
		A4015	AX-RC14000047-DE
		A4022	AX-RC10100069-DE
		A4037	AX-RC06400116-DE
		A4055	AX-RC04410167-DE
		A4075	AX-RC03350219-DE
		A4110	AX-RC02330307-DE
		A4150	AX-RC01750430-DE
		A4185 / A4220	AX-RC01200644-DE
		A4300	AX-RC00920797-DE
		A4370	AX-RC00741042-DE
		A4450	AX-RC00611236-DE
		A4550	AX-RC00501529-DE

Types	Specifications		Model
	Voltage	Inverter 3G3RX-□	
Output AC Reactors	200V (Three-phase)	A2004	AX-RAO11500026-DE
		A2007	AX-RAO07600042-DE
		A2015	AX-RAO04100075-DE
		A2022	AX-RAO03000105-DE
		A2037	AX-RAO01830160-DE
		A2055	AX-RAO01150220-DE
		A2075	AX-RAO00950320-DE
		A2110	AX-RAO00630430-DE
		A2150	AX-RAO00490640-DE
	400V (Three-phase)	A4004 / A4007 / A4015	AX-RAO16300038-DE
		A4022	AX-RAO11800053-DE
		A4037	AX-RAO07300080-DE
		A4055	AX-RAO04600110-DE
		A4075	AX-RAO03600160-DE
		A4110	AX-RAO02500220-DE
		A4150	AX-RAO02000320-DE

Types	Specifications		Model
	Description	Diameter	
Radio Noise Filters	For 2.2 kW motors or below	21	AX-FER2102-RE
	For 15 kW motors or below	25	AX-FER2515-RE
	For 45 kW motors or below	55	AX-FER5045-RE
	For 55 kW motors and above	60	AX-FER6055-RE

Types	Description/Functions	Model
Encoder Feedback	PG Speed controller option card	3G3AX-PG01
Digital Input	Digital Input option card PLC I/O Interface for setting Frequency, Acceleration/Deceleration time etc	3G3AX-DI01
Communication Option	DeviceNet option card Used for running or stopping the inverter or Give Frequency Reference thru DeviceNet	SJ-DN2
	Profibus option card Used for running or stopping the inverter or Give Frequency Reference thru Profibus	SJ-PB2
PC Cable	RJ45 to USB Converter, 2m Cable	3G3AX-PCACN2
Remote Operator	LCD Remote operator *1 (5 Line LCD remote operator with copy function, cable length max. 3m.)	AX-OP05-E
	LED Remote Operator with frequency reference volume	3G3AX-OP01
	3 meters cable for connecting remote operator	3G3AX-CAJOP300-EE
	Mounting Kit for LED Operator	4X-KITMINI

*1 Please note, models with firmware 4287 and 4288, the operator will only display 2 lines of text.

Overview of Inverter Selection

Selecting the Motor Capacity

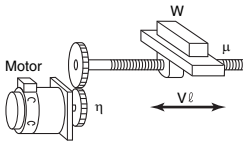
Select a motor before selecting the Inverter. Calculate the load inertia in the application, calculate the motor capacity and torque required to handle the load, and select an appropriate motor.

Simple Selection Method (Calculation of the Required Output)

With this method, you select the motor based on the output (W) required when the motor is rotating at a steady rate. This method does not include the involved calculations for acceleration and deceleration, so add some extra capacity to the calculated value when selecting the motor. This is a simple way to calculate the size of motor needed in equipment that operates at a steady rate for long periods, such as fans, conveyors, and mixing machines. This method is not suitable for the following kinds of applications:

- Applications requiring sudden start-ups
- Applications where the equipment starts and stops frequently
- Applications where there is a lot of inertia in the transmission system
- Applications with a very inefficient transmission system

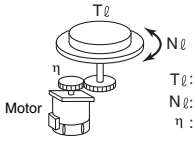
Linear Motion: Steady Power Po (kW)



$$P_0 = \frac{m \cdot W \cdot V\ell}{6120 \cdot \eta}$$

μ: Friction coefficient
W: Weight of moveable load (kg)
Vℓ: Speed of moveable load (m/min)
h: Efficiency of reduction mechanism (transmission)

Rotational Motion: Steady Power Po (kW)



$$P_0 = \frac{T\ell \cdot N\ell}{9535 \cdot \eta}$$

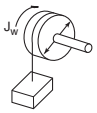
Tℓ: Load torque at load axis (N·m)
Nℓ: Speed of load axis (r/min)
η : Efficiency of reduction mechanism (transmission)

Detailed Selection Method (R.M.S. Calculation Method)

With this method, you calculate the effective torque and maximum torque required in the application's operating pattern. This method provides a detailed motor selection that matches the operating pattern.

Calculating the Motor Shaft Conversion Inertia

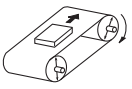
Use the following equations to calculate the inertia of all of the parts and convert that to the motor shaft conversion inertia.



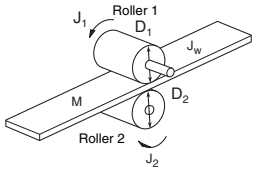
$$J_w = J_1 + J_2 = \left(\frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4} \right) \times 10^{-6} \ (kg \cdot m^2)$$

J_w: Inertia (kg·m²)
J_1: Inertia of cylinder (kg·m²)
J_2: Inertia due to object (kg·m²)
D: Diameter (mm)
M_1: Mass of cylinder (kg)
M_2: Mass of object (kg)

$$J_w = J_1 + J_2 + J_3 + J_4 = \left(\frac{M_1 \cdot D_1^2}{8} + \frac{M_2 \cdot D_2^2}{8} + \frac{D_1^2}{D^2} + \frac{M_3 \cdot D_1^2}{4} + \frac{M_4 \cdot D_1^2}{4} \right) \times 10^{-6} \ (kg \cdot m^2)$$

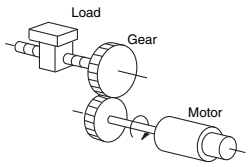


J_w: Inertia (kg·m²)
J_1: Inertia of cylinder 1 (kg·m²)
J_2: Inertia of cylinder 2 (kg·m²)
J_3: Inertia due to object (kg·m²)
J_4: Inertia due to belt (kg·m²)
D_1: Diameter of cylinder 1 (mm)
D_2: Diameter of cylinder 2 (mm)
M_1: Mass of cylinder 1 (kg)
M_2: Mass of cylinder 2 (kg)
M_3: Mass of object (kg)
M_4: Mass of belt (kg)



$$J_w = J_1 + \left(\frac{D_1}{D_2} \right)^2 J_2 + \frac{M \cdot D_1^2}{4} \times 10^{-6} \ (kg \cdot m^2)$$

J_w: Inertia of entire system (kg·m²)
J_1: Inertia of roller 1 (kg·m²)
J_2: Inertia of roller 2 (kg·m²)
D_1: Diameter of roller 1 (mm)
D_2: Diameter of roller 2 (mm)
M: Effective mass of workpiece (kg)



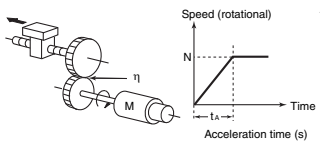
$$J_L = J_1 + G^2 (J_2 + J_w) \ (kg \cdot m^2)$$

J_L: Motor shaft conversion load inertia (kg·m²)
J_w: Load inertia (kg·m²)
J_1: Motor gear inertia (kg·m²)
J_2: Load gear inertia (kg·m²)
Z_1: Number of gear teeth on motor side
Z_2: Number of gear teeth on load side
Gear ratio $G = Z_1/Z_2$

Calculating the Motor Shaft Conversion Torque and Effective Torque

Calculate the total combined torque required for the motor to operate based on the acceleration torque due to the motor shaft conversion load inertia (calculated above) and the load torque due to friction force and the external force applied to the load.

Acceleration Torque

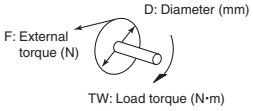


Acceleration Torque (T_A)

$$T_A = \frac{2\pi N}{60 t_A} \left(J_M + \frac{J_L}{\eta} \right) (N \cdot m)$$

T_A: Acceleration Torque (N·m)
J_L: Motor shaft conversion load inertia (kg·m²)
J_M: Inertia of motor itself (kg·m²)
η: Gear transmission efficiency
N: Motor speed (r/min)

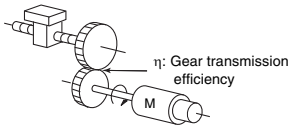
Motor Conversion Load Torque (External and Friction)



$$T_w = F \cdot \frac{D}{2} \times 10^{-3} \ (N \cdot m)$$

Friction force in general:

$F = \mu W$ μ: Friction coefficient
W: Weight of moving parts



$$T_L = T_W \cdot \frac{G}{\eta} \ (N \cdot m)$$

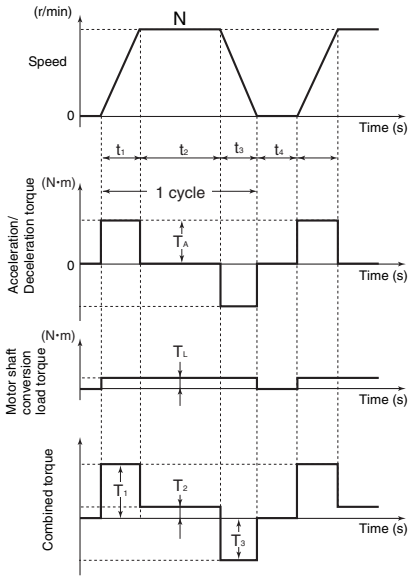
T_L: Motor shaft conversion load torque (N·m)
T_W: Load torque (N·m)
Z_1: Number of gear teeth on motor side
Z_2: Number of gear teeth on load side
Gear (reduction) ratio $G = Z_1/Z_2$

Calculating the Combined Torque and Effective Torque

Effective torque: T_{RMS} (N•m)

$$= \sqrt{\frac{\Sigma(Ti)^2 \cdot ti}{\Sigma ti}} = \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + T_3^2 \cdot t_3 + T_4^2 \cdot t_4}{t_1 + t_2 + t_3 + t_4}}$$

Maximum torque: $T_{MAX} = T_1 = T_A + T_L$



✻ Use the Servomotor's Motor Selection Software to calculate the motor conversion inertia, effective torque, and maximum torque shown above.

Selecting the Motor

Use the results of the calculations above and the equations below to determine the required motor capacity from the effective torque and maximum torque. Use the larger of the following motor capacities when selecting the motor.
When selecting the motor, set a motor capacity higher than the calculated capacity to provide some extra capacity.

Motor Capacity Supplied for Effective Torque:

Motor capacity (kW): $1.048 \bullet N \bullet T_{RMS} \bullet 10^{-4}$
(N: Max. speed in r/min)

Motor Capacity Supplied for Maximum Torque:

Motor capacity (kW): $1.048 \bullet N \bullet T_{RMS} \bullet 10^{-4}/1.5$
(N: Max. speed in r/min)

Selecting the Inverter Capacity

Select an Inverter that is large enough to handle the motor selected in Selecting the Motor above. Basically, select an Inverter with a maximum motor capacity that matches the motor capacity calculated above.
After selecting the Inverter, verify that the following conditions are satisfied. If the conditions are not satisfied, select the Inverter that is one size larger and check the conditions again.

- Motor's rated current ≤ Inverter's rated output current
- The application's continuous maximum torque output time ≤ 1 minute

Note: 1. If the Inverter's overload endurance is 120% of the rated output current for one minute, check for 0.8 minute.
2. When using the 0-Hz sensorless vector control, or a torque with a min. rating of 150% is frequently used under the condition that the holding torque is required with the rotation speed 0 (r/min), use an inverter with one size larger capacity than the inverter selection result.

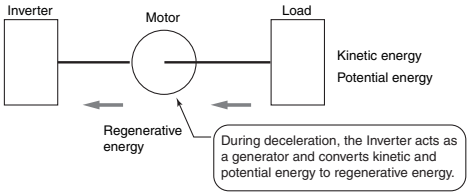
Overview of Braking Resistor Selection

Applications Requiring Braking Resistors

In applications where excessive regenerative motor energy is produced during deceleration or descent, the main-circuit voltage in the Inverter may rise high enough to damage the Inverter. Standard Inverters, which are equipped with the overvoltage protection function, detect the overvoltage protection and stop operation, which will prevents any damage. Although the Inverter will be protected, the overvoltage protection function will generate an error and the motor will stop; this system configuration will not provide stable continuous operation.
This regenerative energy needs to be emitted to the outside of the Inverter using the braking resistor or regenerative braking unit.

About Regenerative Energy

The load connected to the motor has kinetic energy if it is rotating or potential energy if it is at a high level. The kinetic or potential energy is returned to the Inverter when the motor decelerates or lowers the load. This phenomenon is known as regeneration and the returned energy is called regenerative energy.



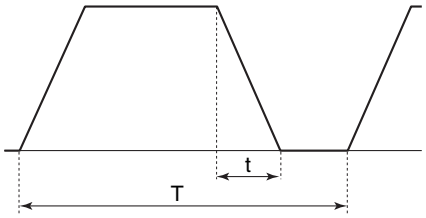
Avoiding the Use of a Braking Resistor

The following methods can be used to avoid having to connect a Braking Resistor. These methods require the deceleration time to be extended, so you must evaluate whether extending the deceleration time will cause any problems in the application.

- Enable the "stall prevention during deceleration" function; the default setting for this function is enabled. (Increase the deceleration time automatically so as not to generate the overvoltage protection.)
- Set a longer deceleration time. (This reduces the rate at which the regenerative energy is produced.)
- Select "coast to stop" as the stopping method. (Regenerative energy will not be returned to the Inverter.)

Simple Method for Braking Resistor Selection

This is a simple method for determining the braking resistance from the percentage of time that regenerative energy is produced during a normal operating pattern.



Use rate (duty) = t/T x 100 (%ED)

t: Deceleration time (regenerative time)
T: Time for 1 cycle of operation

For Models with a Built-in Braking Circuit (3G3MX/3G3RX Max. 18.5 kW)

Select the braking resistor based on the usage rate calculated from the operation patterns.
Refer to the braking resistor list described in the User's manual and catalog, and connect it according to your Inverter.

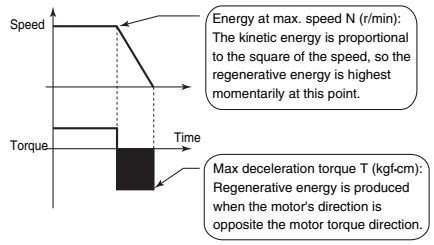
For Models without a Built-in Braking Circuit (3G3JX/3G3RX Min. 22 kW)

Select the regenerative braking unit and the braking resistor.
Refer to the regenerative braking unit and braking resistor lists described in the User's manual and catalog, and connect them according to your Inverter.

Detailed Method for Braking Resistor Selection

If the Braking Resistor's use rate (duty factor) exceeds 10% ED or the application requires an extremely large braking torque, use the following method to calculate the regenerative energy and select a Braking Resistor.

Calculating the Required Braking Resistance



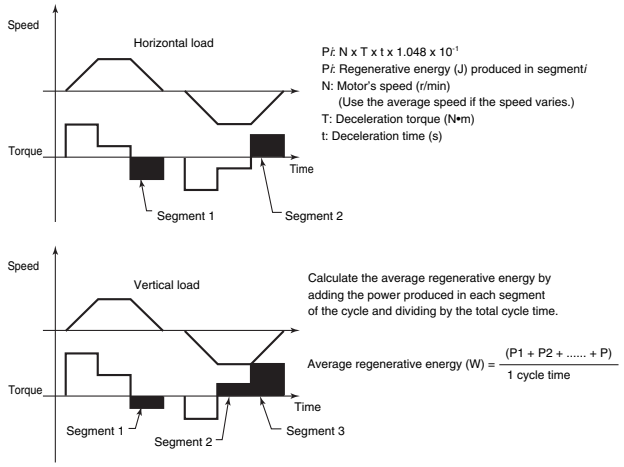
$$\text{Braking Resistor's resistance: } R \leq \frac{V^2}{1.048 \times (T - 0.2 \times Tm) \times N \times 10^{-1}}$$

V: 385 V for a 200-V Class Inverter
400 V for a 400-V Class Inverter
T: Maximum braking torque (kgf•cm)
Tm: Motor's rated torque (N•cm)
N: Maximum speed (r/min)

✻ Use the value for the braking torque calculated in *Calculating the Motor Shaft Conversion Torque and Effective Torque* on page 54.

Calculating the Average Regenerative Energy

Regenerative energy is produced when the motor is rotating in the opposite direction of the motor torque. Use the following equations to calculate the regenerative energy produced in each segment of the cycle.



Note: 1. The speed is positive when the motor is rotating forward and the torque is positive when it is in the forward direction.
2. Use the value for the braking torque calculated in *Calculating the Motor Shaft Conversion Torque and Effective Torque* on page 54.

Selecting the Braking Resistor

Select the appropriate Braking Resistor based on the required braking resistance and average regenerative energy that were calculated above.

- Required braking resistance ≥ Braking Resistor's resistance ≥ Inverter or Braking Unit's minimum resistance
- Average regenerative energy ≤ Braking Resistor's allowable power

Note: 1. The internal braking transistor will be damaged if a resistor is connected with a resistance below the Inverter or Regenerative Braking Unit's minimum resistance. If the required resistance is less than the minimum resistance, increase the Inverter's capacity and replace the Inverter or Regenerative Braking Unit with one that has a minimum resistance less than the required resistance.
2. Two or more Regenerative Braking Units can be connected in parallel. Use the following equation to determine the braking resistance when driving two or more Units.
Braking resistance (Ω) = (required braking resistance calculated above) × (number of Units)
3. Do not select the braking resistance with the results calculated above. A rating of 150 W is not the allowed power, it is the maximum rated power in resistance units. The actual allowed power rating depends upon the resistor.

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