Simple, Compact Inverters

SYSDRIVE JX Series

CSM_3G3JX_DS_E_1_1

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				

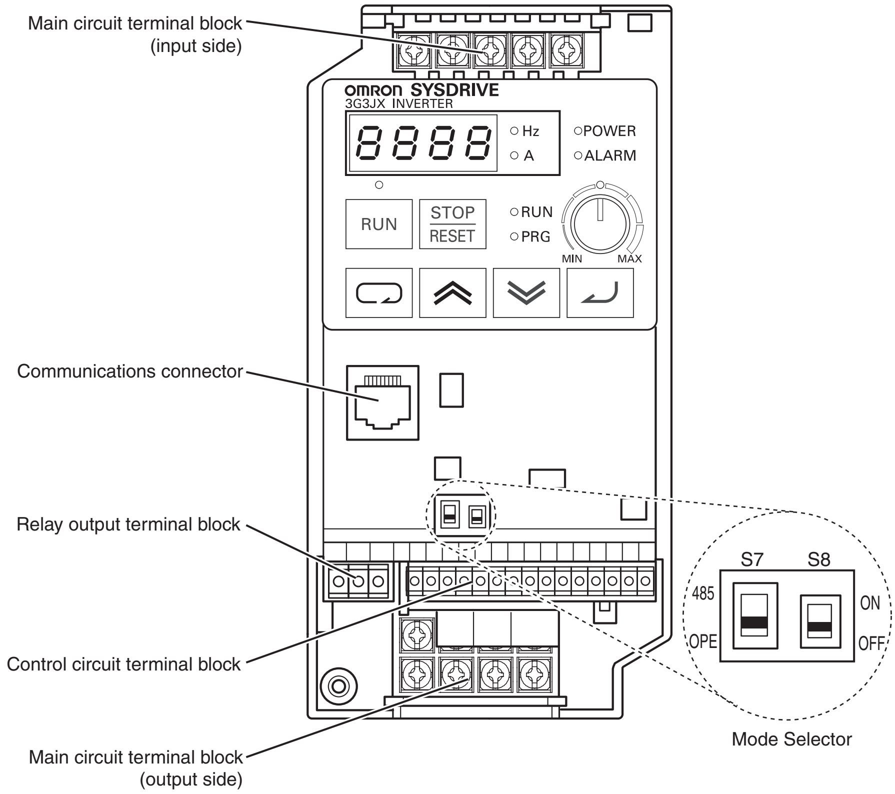
Common Specifications

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 specifica-tions	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.

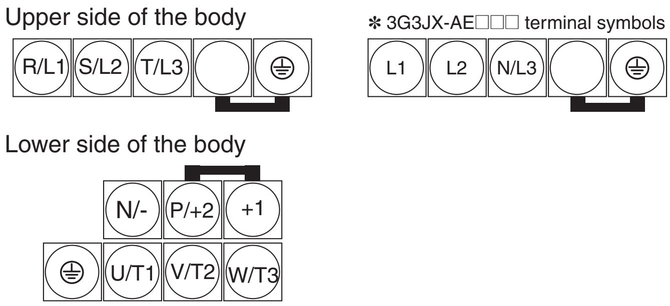
Terminal Block Specifications

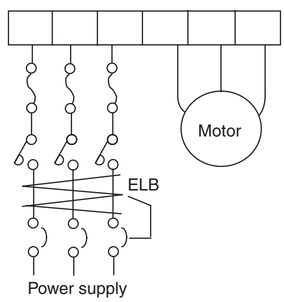
Terminal Block Position



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

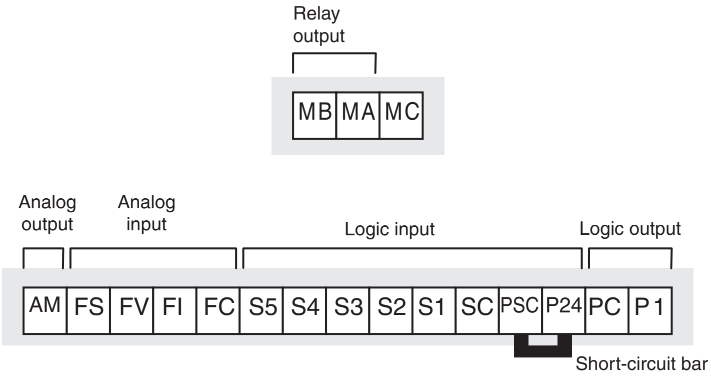
Specifications of Main Circuit Terminals

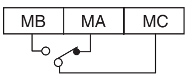


Terminal symbol	Terminal name	Function	Connection example
R/L1 (L1) ✻, S/L2 (L2) ✻, T/L3 (N/L3) ✻	Main power supply input terminal	Connect the input power supply.	 Do not remove the short-circuit bar between +1 and P/+2 when a DC reactor is not connected.
U/T1, V/T2, W/T3	Inverter output terminal	Connect 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	 Factory default relay settings Under normal operation: MA-MC Closed Under abnormal operation or power shutdown: MA-MC Open		
	MB			
	MC			

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)

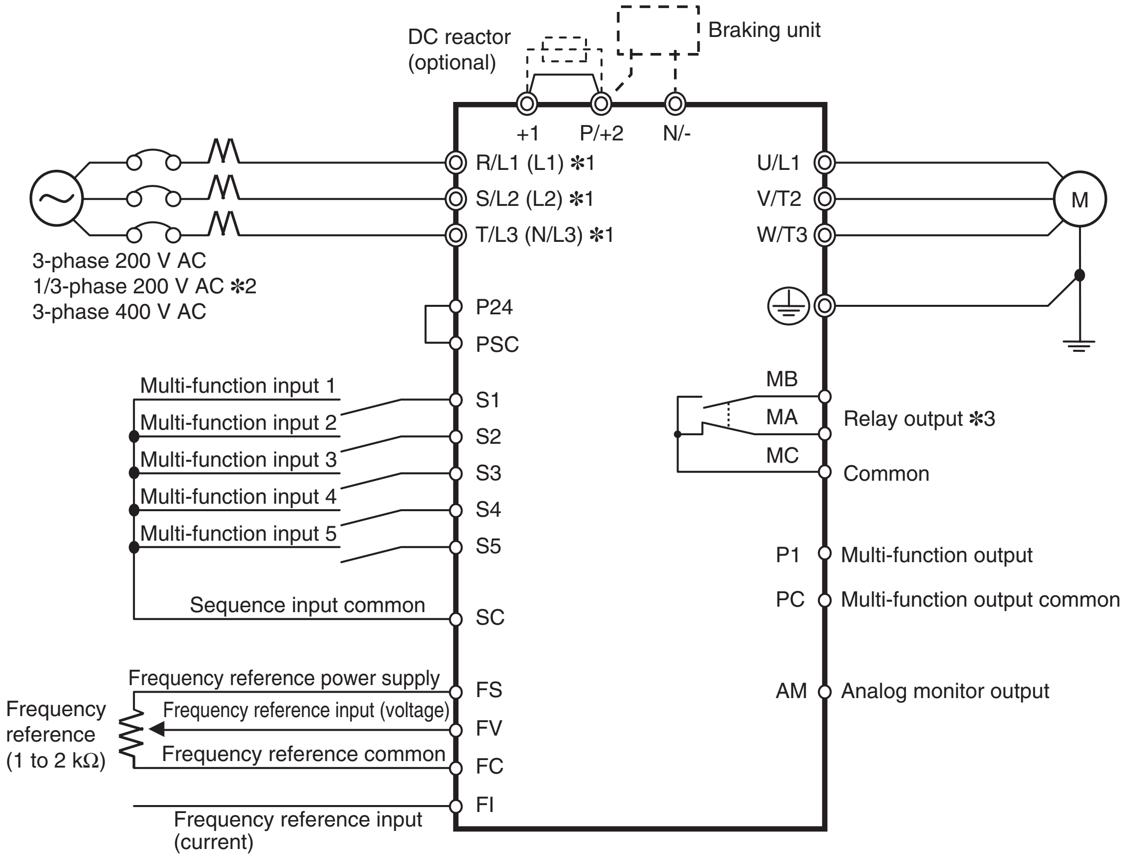
Emergency shutoff selector (S8)

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".

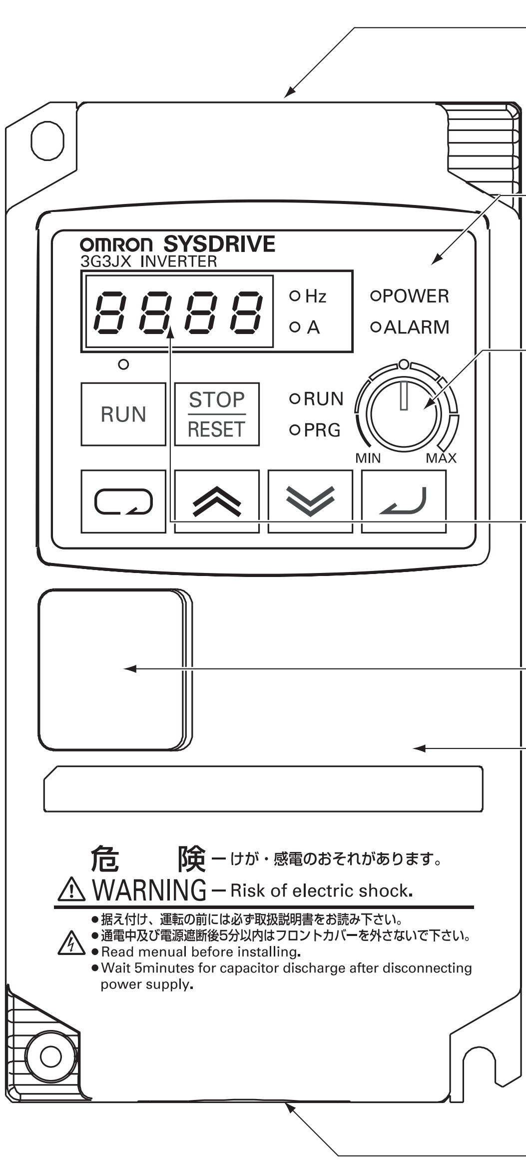
Standard Connection Diagram



✻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.

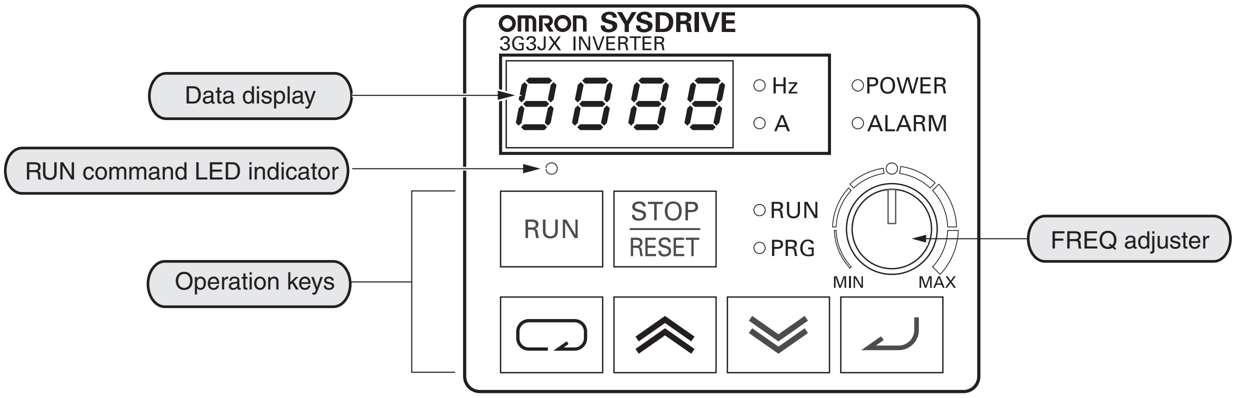
Bottom cover

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

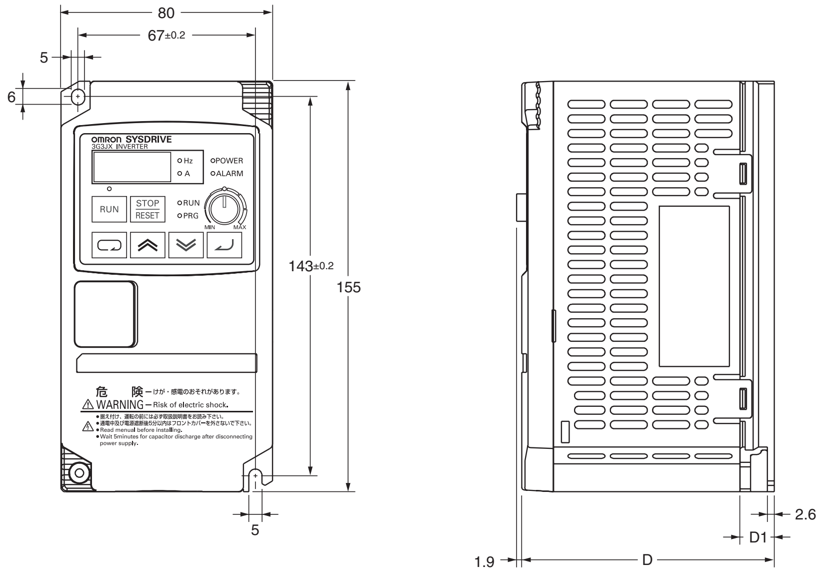


	Name	Description
○POWER	POWER LED indicator	Lit when the power is supplied to the control circuit.
○ALARM	ALARM LED indicator	Lit when an Inverter error occurs.
○RUN	RUN (during RUN) LED indicator	Lit when the Inverter is running.
○PRG	PROGRAM LED indicator	Lit when the set value of each function is 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

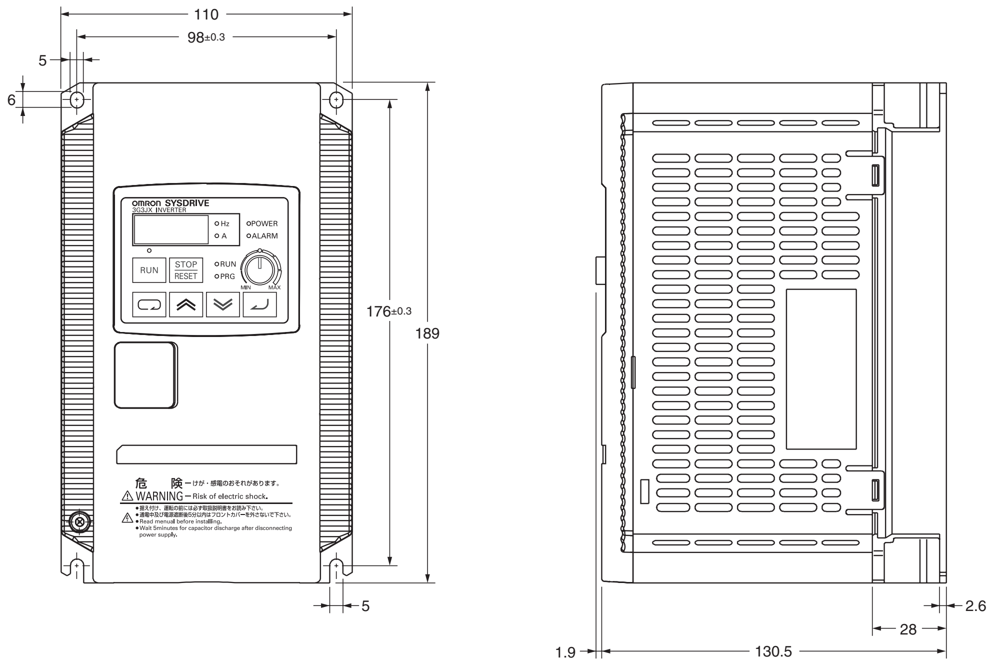
(Unit: mm)

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

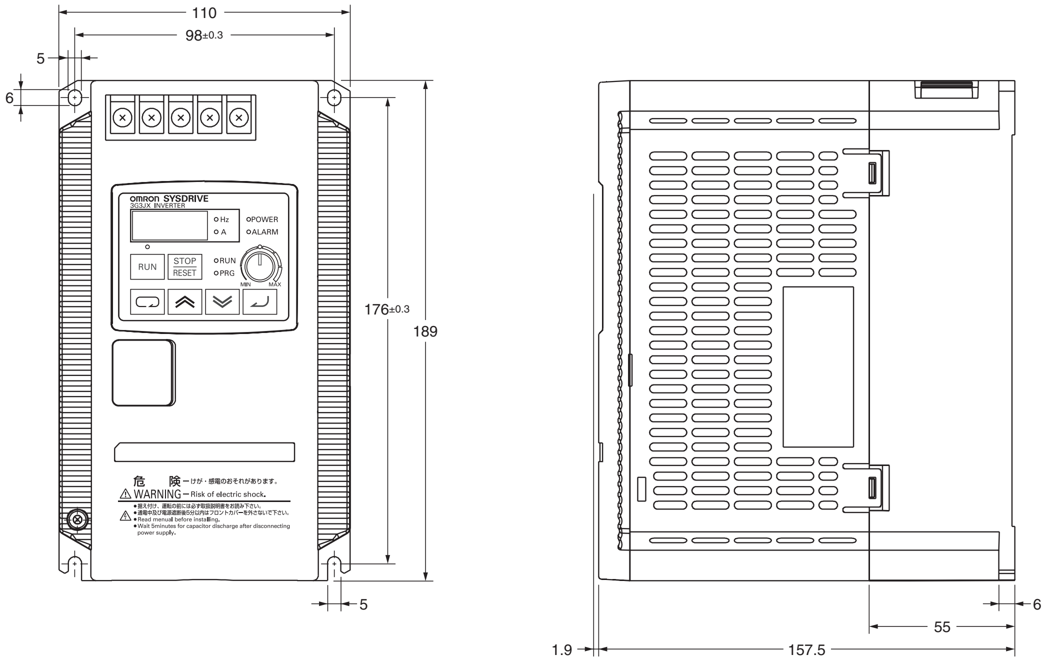


Rated voltage	Model 3G3JX-	Dimensions (mm)	
		D	D1
3phase 200 V AC	A2002	95.5	13
	A2004	109.5	27
	A2007	132.5	50
1/3phase 200 V AC	AE002	95.5	13
	AE004	109.5	27

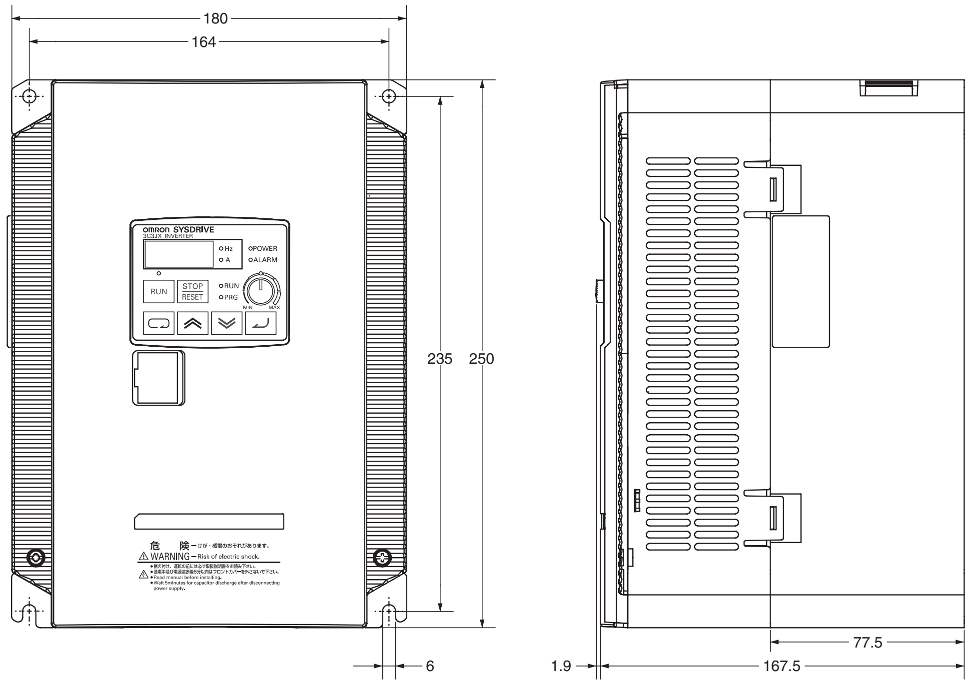
3G3JX-A4004
3G3JX-AE007



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



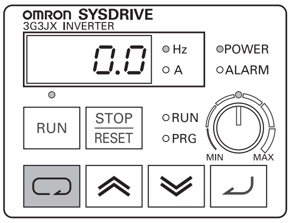
3G3JX-A2055
3G3JX-A2075
3G3JX-A4055
3G3JX-A4075



Using Digital Operator

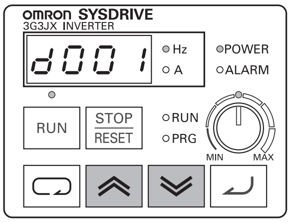
1. Setting the maximum output frequency

Power ON



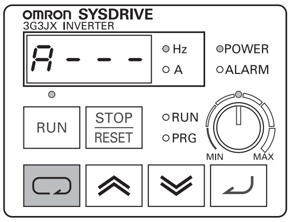
(1) 0.0 or the value previously monitored is displayed.

Press key.



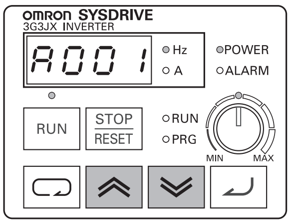
(2) Function code appears.

Press until A --- appears.



(3) A --- appears.

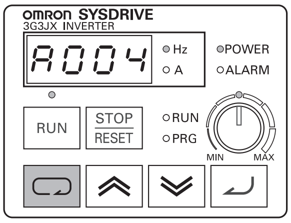
Press key.



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

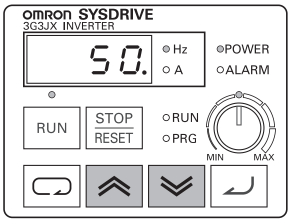
Press until A --- appears.

(It continues in upper right.)



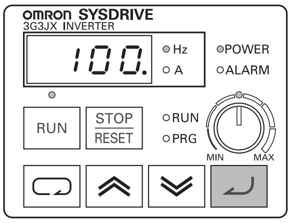
(5) A004 appears.

Press key.



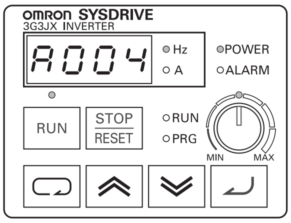
(6) Preset value is displayed.

Press to set desired value.



(7) Newly set value is displayed.

Press key to store the value.

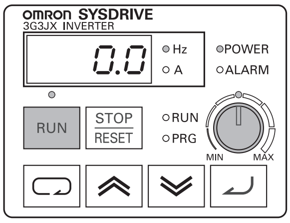


(8) Returns to A004 and the setting is complete.

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

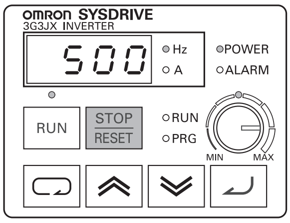
2. Running the motor (by potentiometer)

Power ON



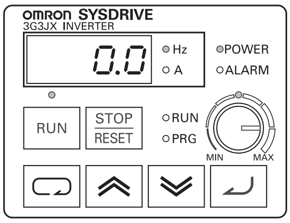
(1) 0.0 or the value previously monitored is displayed.

Press RUN key and turn the potentiometer clockwise.



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

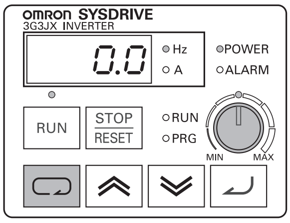
Press STOP/RESET key to stop the motor.



(3) The motor stops.

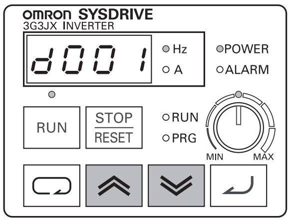
3. Monitoring output current value

Power ON



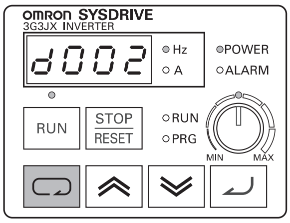
(1) 0.0 or the value previously monitored is displayed.

Press key.



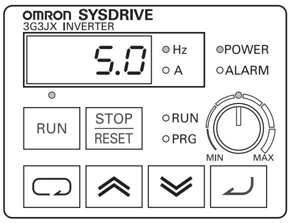
(2) Function code appears.

Press until d002 appears.



(3) d002 appears.

Press key.



(4) Output current value is displayed.

Protective and Diagnostic Functions

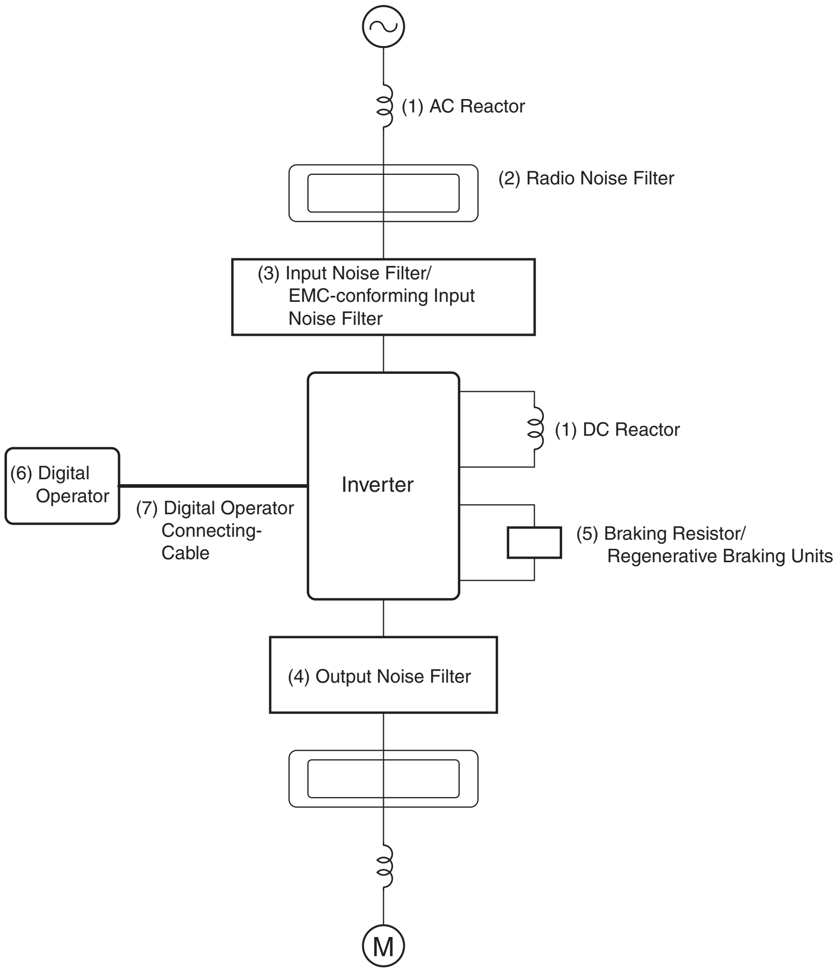
Error Code List

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.	

SYSDRIVE Option

Specifications of Optional Items and Peripheral Devices

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



Purpose	No.	Name	Model	Description
Improve the input power factor of the Inverter	(1)	DC Reactor AC Reactor	3G3AX-DL□□□□ 3G3AX-AL□□□□	Used to improve the input power factor of the Inverter. All Inverters of 22 kW or higher contain built-in DC reactors. These are optional for Inverters of 18 kW or less. Install DC and AC reactors for applications with a large power supply capacity (600 kVA or higher).
Reduce the affects of radio and control device noise	(2)	Radio Noise Filter	3G3AX-ZCL□	Reduces noise coming into the inverter from the power supply line and to reduce noise flowing from the inverter into the power supply line. Connect as close to the Inverter as possible.
	(3)	Input Noise Filter	3G3AX-NFI□□	Reduces noise coming into the inverter from the power supply line and to reduce noise flowing from the inverter into the power supply line. Connect as close to the Inverter as possible.
		EMC-conforming Input Noise Filter	3G3AX-EFI□□	This input noise filter is for use in systems that must comply with the EC's EMC Directives. Select a filter appropriate for the Inverter model.
	(4)	Output Noise Filter	3G3AX-NFO□□	Reduces noise generated by the Inverter. Connect as close to the Inverter as possible.
Enable stopping the machine in a set time	(5)	Braking Resistor	3G3AX-RB□□□□□	Consumes the regenerative motor energy with a resistor to reduce deceleration time (use rate: 3% ED).
		Regenerative Braking Unit	3G3AX-RBU□□	
Operates the Inverter externally	(6)	Digital Operator	3G3AX-OP□□	Remote Operator **Note:** MX and RX series has this operator. It's used separated the Inverter.
	(7)	Digital Operator Connecting-Cable	3G3AX-OPCN□□	Extension cable to use a Digital Operator remotely. Cable length: 1 m or 3 m

Note: Use a ground fault interrupter with a current sensitivity of 200 mA minimum and an operating time of 0.1 s minimum to prevent operating errors. The interrupter must be suitable for high-frequency operation.
Example: NV series by Mitsubishi Electric Corporation (manufactured in or after 1998)
EG, SG series by Fuji Electric Co., Ltd. (manufactured in or after 1984)

JX/MX/RX Series Related Options

❍ : Release

Name	Model	Specifications		Applicable Series		
				JX	MX	RX
Regenerative Braking Units	3G3AX-RBU21	3-phase 200 V	General purpose with Braking resistor	❍	❍	❍
	3G3AX-RBU22		High Regeneration purpose with Braking resistor	❍	❍	❍
	3G3AX-RBU23		General purpose for 30 kW ✻			❍
	3G3AX-RBU24		General purpose for 55 kW ✻			❍
	3G3AX-RBU41	3-phase 400 V	General purpose with Braking resistor	❍	❍	❍
	3G3AX-RBU42		General purpose for 30 kW ✻			❍
	3G3AX-RBU43		General purpose for 55 kW ✻			❍
Braking Resistor	3G3AX-RBA1201	Compact type	Resistor 120 W, 180 Ω		❍	❍
	3G3AX-RBA1202		Resistor 120 W, 100 Ω		❍	❍
	3G3AX-RBA1203		Resistor 120 W, 5 Ω		❍	❍
	3G3AX-RBA1204		Resistor 120 W, 35 Ω		❍	❍
	3G3AX-RBB2001	Standard type	Resistor 200 W, 180 Ω		❍	❍
	3G3AX-RBB2002		Resistor 200 W, 100 Ω		❍	❍
	3G3AX-RBB3001		Resistor 300 W, 50 Ω		❍	❍
	3G3AX-RBB4001		Resistor 400 W, 35 Ω		❍	❍
	3G3AX-RBC4001	Medium capacity type	Resistor 400 W, 50 Ω			❍
	3G3AX-RBC6001		Resistor 600 W, 35 Ω			❍
	3G3AX-RBC12001		Resistor 1200 W, 17 Ω			❍
DC Reactor	3G3AX-DL2002	3-phase 200 V	0.2 kW	❍	❍	❍
	3G3AX-DL2004		0.4 kW	❍	❍	❍
	3G3AX-DL2007		0.7 kW	❍	❍	❍
	3G3AX-DL2015		1.5 kW	❍	❍	❍
	3G3AX-DL2022		2.2 kW	❍	❍	❍
	3G3AX-DL2037		3.7 kW	❍	❍	❍
	3G3AX-DL2055		5.5 kW	❍	❍	❍
	3G3AX-DL2075		7.5 kW	❍	❍	❍
	3G3AX-DL2110		11 kW			❍
	3G3AX-DL2150		15 kW			❍
	3G3AX-DL2220		22 kW			❍
	3G3AX-DL2300		30 kW			❍
	3G3AX-DL2370		37 kW			❍
	3G3AX-DL2450		45 kW			❍
	3G3AX-DL2550		55 kW			❍
	3G3AX-DL4004	3-phase 400 V	0.4 kW	❍	❍	❍
	3G3AX-DL4007		0.7 kW	❍	❍	❍
	3G3AX-DL4015		1.5 kW	❍	❍	❍
	3G3AX-DL4022		2.2 kW	❍	❍	❍
	3G3AX-DL4037		3.7 kW	❍	❍	❍
	3G3AX-DL4055		5.5 kW	❍	❍	❍
	3G3AX-DL4075		7.5 kW	❍	❍	❍
	3G3AX-DL4110		11 kW			❍
	3G3AX-DL4150		15 kW			❍
	3G3AX-DL4220		22 kW			❍
	3G3AX-DL4300		30 kW			❍
	3G3AX-DL4370		37 kW			❍
	3G3AX-DL4450		45 kW			❍
	3G3AX-DL4550		55 kW			❍
Radio Noise Filter	3G3AX-ZCL1			❍	❍	❍
	3G3AX-ZCL2			❍	❍	❍

✻ The braking resistor is optionally required.

Name	Model	Specifications		Applicable Series		
				JX	MX	RX
Input Noise Filter	3G3AX-NFI21	3-phase 200 V	0.2 to 0.75 kW	❍	❍	❍
	3G3AX-NFI22		1.5 kW	❍	❍	❍
	3G3AX-NFI23		2.2, 3.7 kW	❍	❍	❍
	3G3AX-NFI24		5.5 kW	❍	❍	❍
	3G3AX-NFI25		7.5 kW	❍	❍	❍
	3G3AX-NFI26		11 kW			❍
	3G3AX-NFI27		15 kW			❍
	3G3AX-NFI28		18.5 kW			❍
	3G3AX-NFI29		22, 30 kW			❍
	3G3AX-NFI2A		37 kW			❍
	3G3AX-NFI2B		45 kW			❍
	3G3AX-NFI2C		55 kW			❍
	3G3AX-NFI41	3-phase 400 V	0.2 to 2.2 kW	❍	❍	❍
	3G3AX-NFI42		3.7 kW	❍	❍	❍
	3G3AX-NFI43		5.5, 7.5 kW	❍	❍	❍
	3G3AX-NFI44		11 kW			❍
	3G3AX-NFI45		15 kW			❍
	3G3AX-NFI46		18.5 kW			❍
	3G3AX-NFI47		22 kW			❍
	3G3AX-NFI48		30 kW			❍
	3G3AX-NFI49		37 kW			❍
	3G3AX-NFI4A		45, 55 kW			❍
Output Noise Filter	3G3AX-NFO01	1/3-phase 200 V 0.2 to 0.75 kW, 3-phase 400 V to 2.2 kW		❍	❍	❍
	3G3AX-NFO02	1/3-phase 200 V 1.5, 2.2 kW, 3-phase 400 V 3.7 kW		❍	❍	❍
	3G3AX-NFO03	3-phase 200 V 3.7, 5.5 kW, 3-phase 400 V 5.5 to 11 kW		❍	❍	❍
	3G3AX-NFO04	3-phase 200 V 7.5, 11 kW, 3-phase 400 V 15 to 22 kW		❍	❍	❍
	3G3AX-NFO05	3-phase 200 V 15 kW, 3-phase 400 V 30, 37 kW				❍
	3G3AX-NFO06	3-phase 200 V 18.5, 22 kW, 3-phase 400 V 45 kW				❍
	3G3AX-NFO07	3-phase 200 V 30, 37 kW, 3-phase 400 V 55, 75 kW				❍
AC Reactor	3G3AX-AL2025	200 V	0.2 to 1.5 kW	❍	❍	❍
	3G3AX-AL2055		2.2 to 3.7 kW	❍	❍	❍
	3G3AX-AL2110		5.5 to 7.5 kW	❍	❍	❍
	3G3AX-AL2220		11 to 15 kW			❍
	3G3AX-AL2330		18.5 to 22 kW			❍
	3G3AX-AL2500		30 to 37 kW			❍
	3G3AX-AL2750		45 to 55 kW			❍
	3G3AX-AL4025	400 V	0.4 to 1.5 kW	❍	❍	❍
	3G3AX-AL4055		2.2 to 3.7 kW	❍	❍	❍
	3G3AX-AL4110		5.5 to 7.5 kW	❍	❍	❍
	3G3AX-AL4220		11 to 15 kW			❍
	3G3AX-AL4330		18.5 to 22 kW			❍
	3G3AX-AL4500		30 to 37 kW			❍
	3G3AX-AL4750		45 to 55 kW			❍
Encoder Feedback Board	3G3AX-PG01	For Position or Frequency Control				❍
DI Board	3G3AX-DI01	PLC I/O Interface for setting Frequency, Acceleration/Deceleration time etc				❍
Digital Operator	3G3AX-OP01			❍	❍	❍
Digital Operator Connecting Cable	3G3AX-OPCN1	Cable Length 1 m		❍	❍	❍
	3G3AX-OPCN3	Cable Length 3 m		❍	❍	❍

Overview of Inverter Selection

Selecting the Motor Capacity

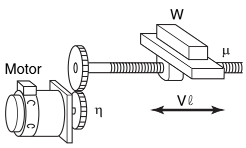
Select a motor before selecting the Inverter. Calculate the load inertia in the application, calculate the motor capacity and torque required to handle the load, and select an appropriate motor.

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

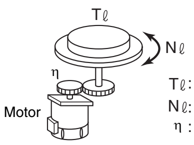
Linear Motion: Steady Power Po (kW)



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

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)



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

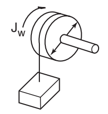
Tℓ: Load torque at load axis (N·m)
Nℓ: Speed of load axis (r/min)
η : Efficiency of reduction mechanism (transmission)

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

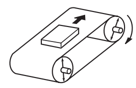
Use the following equations to calculate the inertia of all of the parts and convert that to the motor shaft conversion inertia.



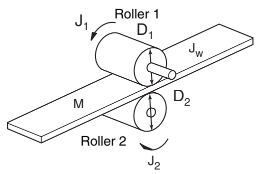
$$J_w = J_1 + J_2 = \left(\frac{M_1 \cdot D^2}{8} + \frac{M_2 \cdot D^2}{4}\right) \times 10^{-6}\ (\text{kg}\cdot\text{m}^2)$$

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)

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

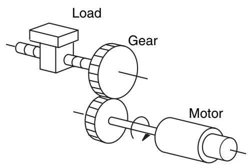


J_w: Inertia (kg·m²)
J_1: Inertia of cylinder 1 (kg·m²)
J_2: Inertia of cylinder 2 (kg·m²)
J_3: Inertia due to object (kg·m²)
J_4: Inertia due to belt (kg·m²)
D_1: Diameter of cylinder 1 (mm)
D_2: Diameter of cylinder 2 (mm)
M_1: Mass of cylinder 1 (kg)
M_2: Mass of cylinder 2 (kg)
M_3: Mass of object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



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

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)



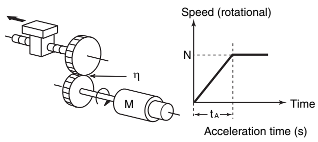
$$J_L = J_1 + G^2 (J_2 + J_w)\ (\text{kg}\cdot\text{m}^2)$$

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

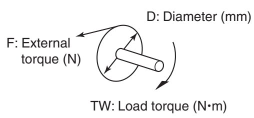


Acceleration Torque (T_A)

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

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)

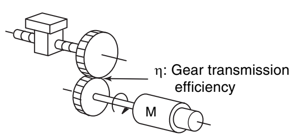
Motor Conversion Load Torque (External and Friction)



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

Friction force in general:

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



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

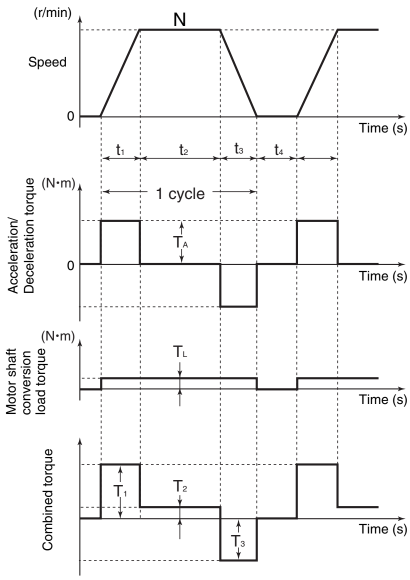
T_L: Motor shaft conversion load torque (N·m)
T_W: Load torque (N·m)
Z_1: Number of gear teeth on motor side
Z_2: Number of gear teeth on load side
Gear (reduction) ratio $G = Z_1/Z_2$

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.

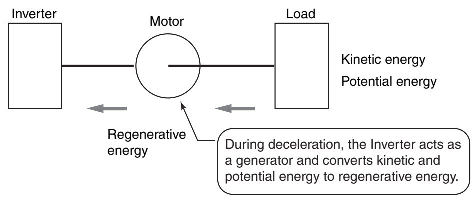
Overview of Braking Resistor Selection

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.



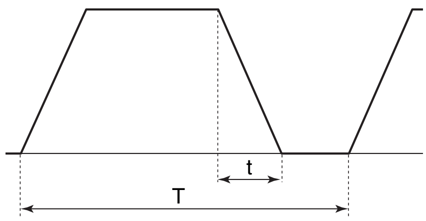
Avoiding the Use of a Braking Resistor

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.

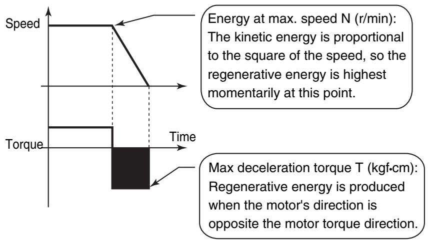
For Models without a Built-in Braking Circuit (3G3JX/3G3RX Min. 22 kW)

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



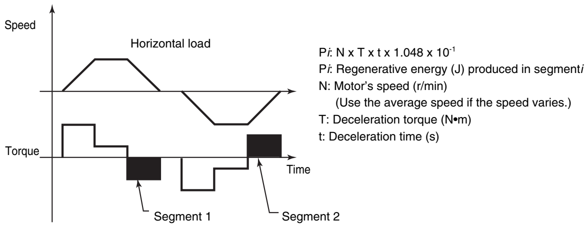
Braking Resistor's resistance: $R \leq \dfrac{V^2}{1.048 \times (T - 0.2 \times Tm) \times N \times 10^{-1}}$

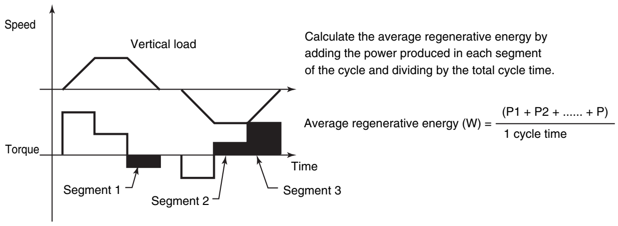
V: 385 V for a 200-V Class Inverter
400 V for a 400-V Class Inverter
T: Maximum braking torque (kgf•cm)
Tm: Motor's rated torque (N•cm)
N: Maximum speed (r/min)

✻ Use the value for the braking torque calculated in *Calculating the Motor Shaft Conversion Torque and Effective Torque* on page 19.

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 19.

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.