IMO

Instruction manual

IMO Jaguar VXM General Purpose Inverter

Three-phase 400V 0.4 - 400kW

Contents

Preface

Thank you for purchasing The Jaguar VXM series inverter. This product is used to drive a 3-phase electric motor at variable speed.
As incorrect use of this product may result in personal injury and/or property damage, read all operating instructions before using.
As this manual does not cover the use of option cards, etc., refer to relevant manuals for option operations.

Safety Instructions

Read this manual carefully before installing, connecting (wiring), operating, servicing, or inspecting the inverter.
Familiarize yourself with all safety features before using the inverter.
In this manual, safety messages are classified as follows:

WARNING
Improper operation may result in serious personal injury or death.

CAUTION
Improper operation may result in slight to medium personal injury or property damage.

Situations more serious than those covered by CAUTION will depend on prevailing circumstances.
Always follow instructions.

Instructions on use

WARNING

1. This inverter is designed to drive a 3-phase induction motor and is not suitable for a single-phase motor or others,
   as fire may result.
2. This inverter may not be used (as is) as a component of a life-support system or other medical device directly affecting the personal welfare of the user.
3. This inverter is manufactured under strict quality control standards. However, safety equipment must be installed if the failure of this device may result in personal injury and/or property damage.
   There is a risk of accident.

Instructions on installation

WARNING

1. Mount this inverter on an incombustible material such as metal.
   There is a risk of fire.
2. Do not place combustible or flammable material near this inverter,
   as fire may result.

CAUTION

1. Do not hold or carry this inverter by the surface cover. Inverter may be dropped **causing injury.**
2. Ensure that the inverter and heat sink surfaces are kept free of foreign matter (lint, paper dust, small chips of wood or metal, and dust),
   as fire or accident may result.
3. Do not install or operate a damaged or hollowed inverter or an inverter with missing parts,
   as electric shock or injury may occur.

CAUTION

1. Confirm that the phases and rated voltage of this product match those of the AC power supply, **as injury may result.**
2. Do not connect the AC power supply to the output terminals (U, V, and W), because this will damage the inverter,
   as injury may result.
3. Do not connect a braking resistor directly to the DC terminals (P(+) and N(-)),
   as fire may result.
4. Ensure that the noise generated by the inverter, motor, or wiring does not adversely affect peripheral sensors and equipment,
   as accident may result.

Instructions on wiring

WARNING

1. Connect the inverter to power via a line-protection molded-case circuit breaker or Fuse, **as fire may result.**
2. Always connect a ground wire,
   as electric shock or fire may result.
3. A licensed specialist must perform the wiring works, **as electric shock may result.**
4. Turn off the power before starting the wiring work, **as electric shock may result.**
5. Wire the inverter after installation is complete,
   as electric shock or injury may occur.

Instructions on operation

WARNING

1. Be sure to install the surface cover before turning on the power (closed). Do not remove the cover while power to the inverter is turned on. **Electric shock may occur.**
2. Do not operate switches with wet hands, **as electric shock may result.**
3. When the retry function is selected, the inverter may restart automatically after tripping. (Design the machine to ensure personal safety in the event of restart). **Accident may result.**
4. When the torque limiting function is selected, operating conditions may differ from preset conditions (acceleration/deceleration time or speed). In this case, personal safety must be assured. **Accident may result.**
5. As the STOP key is effective only when a function setting has been established, install an emergency switch independently, and when an operation via the external signal terminal is selected, the STOP key on the keypad panel will be disabled. **Accident may result.**
6. As operations start suddenly if alarm is reset with a running signal input, confirm that no running signal is input before resetting alarm. **Accident may result.**
7. Do not touch inverter terminals when energized even if inverter has stopped. **Electric shock may result.**

CAUTION

1. Do not start or stop the inverter using the main circuit power. **Failure may result.**
2. Do not touch the heat sink or braking resistor because they become very hot. **Burns may result.**
3. As the inverter can set high speed operation easily, carefully check the performance of motor or machine before changing speed settings. **Injury may result.**
4. Do not use the inverter braking function for mechanical holding. **Injury may result.**

Instructions on maintenance, inspection, and replacement

WARNING

1. Wait a minimum of five minutes (22 kW or less) or ten minutes (30 kW or more) after power has been turned off (open) before starting inspection. (Also confirm that the charge lamp is off and that DC voltage between terminals P(+) and N(-) do not exceed 25 V.) **Electrical shock may result.**
2. Only authorized personnel should perform maintenance, inspection, and replacement operations. (Take off metal jewelry such as watches and rings. Use insulated tools.) **Electric shock or injury may result.**

Instructions on disposal

CAUTION

Treat as industrial waste when disposing it. **Injury may result.**

Other instructions

WARNING

Never modify the product.
Electric shock or injury may result.

Conformity to Low Voltage Directive in Europe

CAUTION

1. The contact capacity of alarm output for any fault (30 A, B, C) and relay signal output (Y5A, Y5C) is 0.5 A at 48 V DC.
2. The ground terminal ⏚G should be connected to the ground. Use a crimp terminal to connect a cable to the main circuit terminal or inverter ground terminal.
3. Where RCD (Residual-current protective device) is used for protection in case of direct or indirect contact, only RCD of type B is allowed on the supply side of this Inverter. Otherwise another protective measure shall be applied such as separation of the Inverter from the environment by double or reinforced insulation or isolation of Inverter and supply system by the transformer.
4. Use a single cable to connect the ⏚G inverter ground terminal. (Do not use two or more inverter ground terminals.)
5. Use a molded-case circuit breaker (MCCB) and magnetic contactor (MC) that conform to EN or IEC standards.
6. Use the inverter connecting the power system which has earthed neutral-point. In case of non- earthed system (ex. IT-NET), the control interface of the inverter is basic insulation, thus do not connect SELV circuit from external controller directly. See Basic connection diagram (Fig. 2-3-1).
7. Use the inverter under over-voltage category III conditions and maintain Pollution degree 2 or better as specified in IEC664. To maintain Pollution degree 2 or better, install the inverter in the control panel (IP54 or higher level) having structure free from water, oil, carbon, dust, etc.
8. For the input-output wiring of the inverter, use cable (diameter and type) as specified in Appendix C in EN60204.
9. In case of external cooling system, cover the inverter rear side so that operator can not touch the main capacitor and braking resistor.
10. To ensure safety, install an optional AC reactor, DC reactor, or external braking resistor as follows:
    1) Install inside an IP4X cabinet or barrier if electrical parts are exposed.
    2) Install inside an IP2X cabinet or barrier if electrical parts are not exposed.

CAUTION FOR UL/cUL REQUIREMENTS

CAUTION

1. Hazard of electrical shock. Disconnect incoming power before working on this control.
2. Dangerous voltage exist until charge lights is off.

WARNING

1. Type1 "INDOOR USE ONLY"
2. More than one live circuit. See Basic connection diagram (Fig. 2-3-1).
3. Use class1 wire only.
4. Connect the wire cable to the terminal blocks, which are the input terminals L1, L2 and L3, the output terminals U, V and W, auxiliary control-power input terminals R0,T0,and the control terminals, with appropriate ring lug. Use a recommend tool according to the terminal maker when attaching ring lug.
5. Tightening torque and wire range for field wiring terminal are marked adjacent to the terminal or on the wiring diagram.
6. Connect the power supply to main power supply terminals (L1, L2 and L3) via the Molded-case circuit breaker (MCCB) or the earth leakage circuit breaker (ELCB) to apply the UL Listing Mark. See Basic connection diagram (Fig. 2-3-1).
7. In case of using auxiliary control-power input, connect it referring to Basic connection diagram (Fig. 2-3-1).

Voltage	Inverter type	Required torque [lb-Inch] (N·m)			Wire diameter [AWG/kcmil] (mm^2)		
	VXM	Main terminal	Auxiliary control-power	Control	L1/R, L2/S, L3/T U, V, W	Auxiliary control-power	Control
3-phase 400V system	VXM40	10.6 (1.2)	—	6.2 (0.7)	16 (1.3)	—	24 (0.2)
	VXM75						
	VXM150	15.9 (1.8)	10.6 (1.2)			16 (1.3)	
	VXM220						
	VXM400				14 (2.1)		
	VXM550	31.0 (3.5)			12 (3.3)		
	VXM750 (CT use)				10 (5.3)		
	VXM1100 (CT use)	51.3 (5.8)					
	VXM1500 (CT use)				8 (8.4)		
	VXM1850 (CT use)				6 (13.3)		
	VXM2200G (CT use)				4 (21.2)		
	VXM30KP (CT use)	119 (13.5)			4 (21.2)		
	VXM30K (CT use)				4 (21.2)		
	VXM37K (CT use)				3 (26.7)		
	VXM45K (CT use)				2 (33.6)		
	VXM55K (CT use)				2 (33.6)		
	VXM75K (CT use)	239 (27) G:119 (13.5)			1/0 (53.5)		
	VXM90K (CT use)				3/0 (85)		
	VXM110K (CT use)				4/0 (107.2)		
	VXM132K (CT use)	425 (48) G:239 (27)			250 (127)		
	VXM160K (CT use)				350 (177)		
	VXM200K (CT use)				500 (253)		
	VXM220K (CT use)				600 (304)		
	VXM220K (VT use)				300 (152)×2		

- Use 60/75 °C copper wire only.
- Use the following power supply in the inverter.

Inverter type	Maximum input voltage	Input source current
VXM40 to VXM2200G	AC 480 V	Not more than 5,000 A
VXM30KP to VXM220K		Not more than 20,000 A

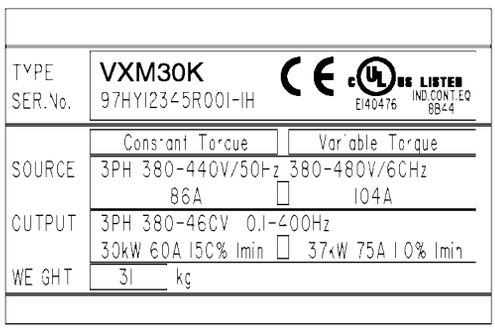
General instructions

Although figures in this manual may show the inverter with covers and safety screens removed for explanation purposes, do not operate the device until all such covers and screens have been replaced.

1 Before Using This Product

1-1 Receiving Inspections

Unpack and check the product as explained below.
If you have any questions about the product, contact IMO or your local distributor where you purchased the unit.



Ratings nameplate

1. Check the ratings nameplate to confirm that the delivered product is the ordered one.

TYPE: Inverter type

VXM 30 KP
- KP: Multiplier: K=1000Watts; G=CT use only, P=VT use only (at rated power)
- 30: Nominal applied motor: 30 → 30 kW
- VXM: Product type:

SER. No.: Serial number

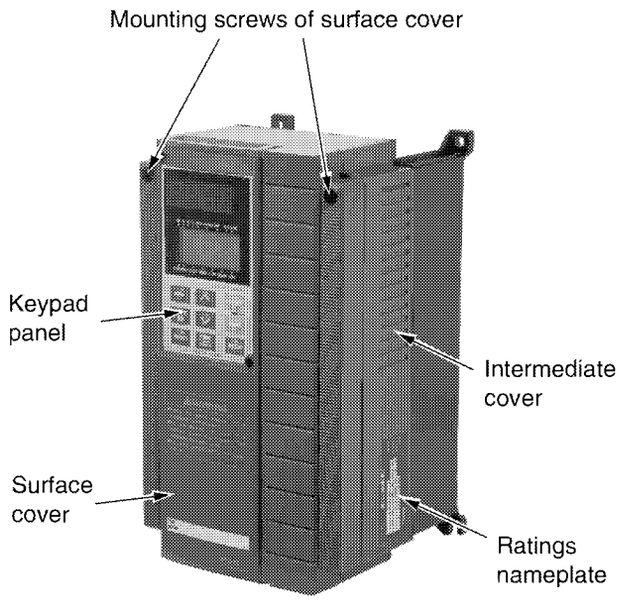
97 HY12345R001 - 1H
- 1H: Product number (not indicated for products 22 kW or less
- HY12345R001: Production lot serial number
- 7: Production month: 1 to 9: January to September, X: October, Y: November, Z: December
- 9: Production year: Last digit of year (9 --> 1999)

SOURCE: Power rating
OUTPUT: Output rating
WEIGHT: Weight (not indicated for products with 22 kW or less)

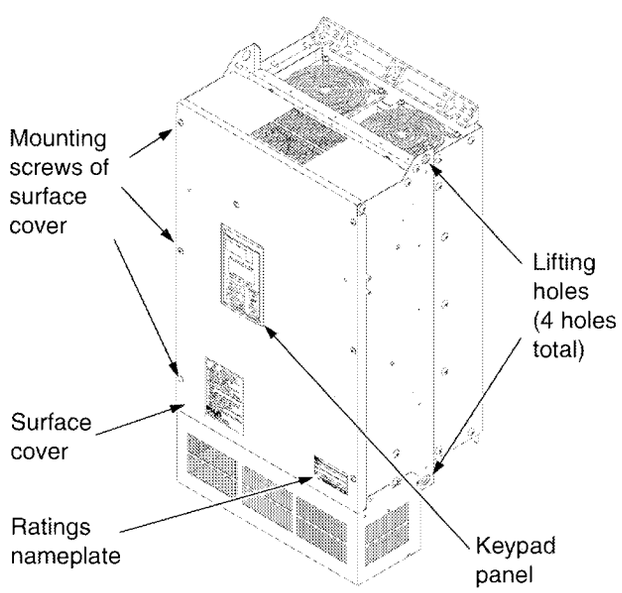
2. Check for damaged and/or missing parts upon delivery.

3. In addition to the inverter unit and this manual, the package contains rubber bushing (for products with 22 kW or less) and a terminating resistor (1/2 W, 120Ω) for RS485 communication.
   The terminating resistor for products rated at 22 kW or less is packed in a plastic bag inside carton.

1-2 Appearance



22 kW or less



30 kW or more

1-3 Handling the Product

1) Removing the surface cover
For the inverter of 22 kW or less, loosen the mounting screws of the surface cover, then remove the cover by pulling the top (see Figure 1-3-1).

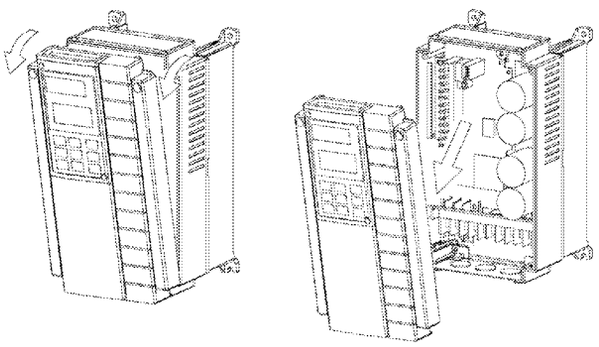


Figure 1-3-1 Removing the surface cover (for inverter of 22 kW or less)

For the inverter of 30 kW or more, remove the six mounting screws of the surface cover, then remove the surface cover.

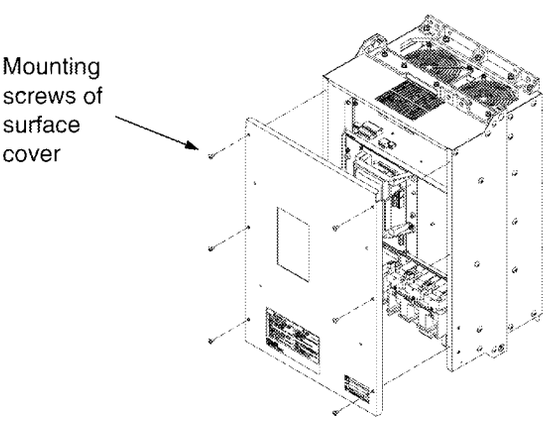


Figure 1-3-2 Removing the surface cover (for inverter of 30 kW or more)

2) Removing the keypad panel
After removing the surface cover as explained in 1), loosen the mounting screws of the keypad panel and remove as shown in Figure 1-3-3.

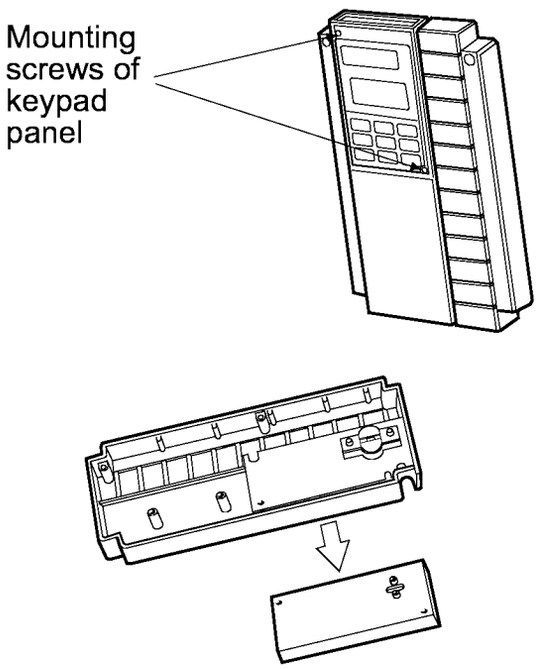


Figure 1-3-3 Removing the keypad panel

Loosen the mounting screws of the keypad panel and remove using the finger holds on the keypad panel case.

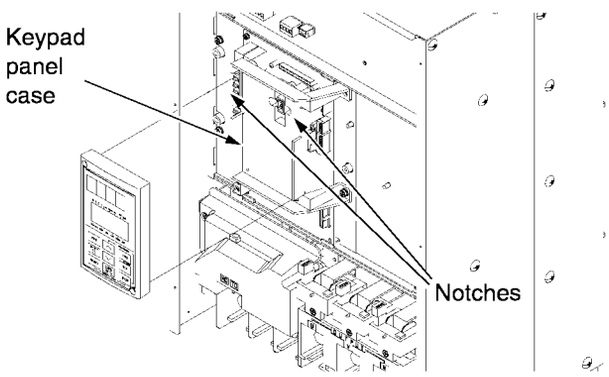


Figure1-3-4 Removing the keypad panel (for inverter of 30 kW or more)

1-4 Carrying

Carry the product by the main unit.
Do not carry the product while holding the cover or parts other than the main unit.
Use a crane or hoist to carry a product equipped with hanging holes.

1-5 Storage

Temporary storage
Temporary storage of this product must meet those conditions listed in Table 1-5-1.

Item	Specifications	
Ambient temperature	-10 to +50 °C	Condensation or freezing must not occur as a result of sudden temperature changes.
Storage/ Transport temperature	-25 to +65 °C	
Storage/ Transport Relative humidity	5 to 95 % Note 2)	
Atmosphere	Pollution degree 2	
Air pressure	Operation/storage: 86 to 106 kPa Transport: 70 to 106 kPa	

Table 1-5-1 Storage environment

Note 1: The storage temperature applies only to short periods such as transport.
Note 2: As a large change in temperature within this humidity range may result in condensation or freezing, do not store where such temperature changes may occur.

1. Do not place this product directly on a floor.
2. To store the product in an extreme environment, pack in vinyl sheet, etc.
3. If the product is stored in a high-humidity environment, insert a drying agent (e.g., silica gel) and pack the product in vinyl sheet.

Long-term storage

If the product is to be stored for an extended period after purchase, the method of storage depends primarily on storage location.

The general long-term storage method is as follows:

1. The above conditions for temporary storage must be satisfied.
   When the storage period exceeds three months, the upper limit of ambient temperature must be reduced to 30 °C to prevent the deterioration of the electrolytic capacitors.
2. Pack the product thoroughly to eliminate exposure to moisture and include a drying agent to ensure a relative humidity of about 70 % or less.
3. If the product is mounted on a unit or control panel and is left unused and exposed to the elements like moisture or dust (particularly on a construction site), remove the product and store in a suitable environment.
4. Electrolytic capacitors not provided with power for an extended period will deteriorate. Do not store electrolytic capacitors for one year or longer without providing power.

2 Installation and Connection

2-1 Operating Environment

Install this product in a location that meets those conditions listed in Table 2-1-1.

Item	Specifications
Location	Indoor
Ambient temperature	-10 to +50 °C (For products of 22kW or less, the ventilating covers must be removed if ambient temperature exceeds +40 °C)
Relative humidity	5 to 95% (No condensation)
Atmosphere	Pollution degree 2
Air pressure	86 to 106 kPa
Vibration	3mm: from 2 to less than 9 Hz 9.8m/s²: from 9 to less than 20 Hz, 2m/s²: from 20 to less than 55 Hz 1m/s²: from 55 to less than 200 Hz

Table 2-1-1 Operating environment

Altitude	Output current reduction rate
1000 m or lower	1.00
1000 - 1500 m	0.97
1500 - 2000 m	0.95
2000 - 2500 m	0.91
2500 - 3000 m	0.88

Table 2-1-2 Output current reduction rate based on altitude

2-2 Installation Method

1. Securely fasten the product in an upright position on a solid structure such that VXM logo is facing the front. Do not turn the product upside down or install in a horizontal position.

2. As heat is generated during inverter operation, the spaces shown in Fig. 2-2-1 are required to ensure sufficient cooling. As heat radiates upward, do not install the product beneath a device sensitive to heat.

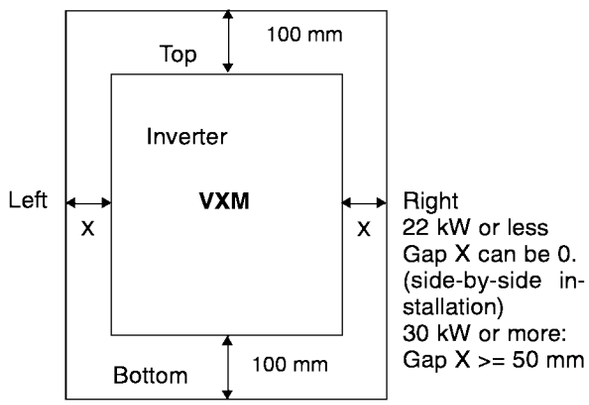


Figure 2-2-1

3. As the heat sink may reach a temperature of 90 °C during inverter operation, ensure that the material surrounding the product can withstand this temperature.

WARNING
Install this product on nonflammable material such as metal.

4. When installing this product in a control panel, consider ventilation to prevent ambient temperature of the inverter from exceeding the specified value. Do not install the product in an area from which heat cannot be sufficiently released.

5. If two or more inverters must be installed in the same device or control panel, arrange the units horizontally to minimize the effect of heat. If two or more inverters must be installed vertically, place an insulated plate be-tween the inverters to minimize the effect of heat.

6. When shipped from the factory, inverters are internal cooling type inside panel. An inverter of 22kW or less can be converted to an external cooling type simply by adding an optional mounting adapter. An inverter of 30kW or more can be converted simply by moving mounting adapter.
   In an external cooling system, a heat sink rediating about 70% of total inverter heat (total loss) can be placed outside the device or control, panel.
   Ensure that heat sink surface are kept free of foreign matter (lint, moist dust particles etc.).

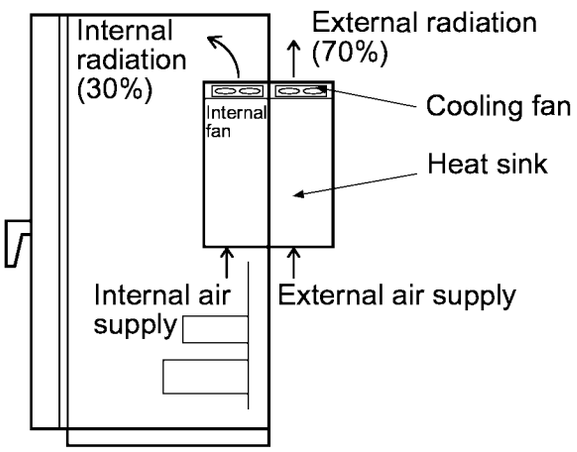


Figure 2-2-2 External cooling system

WARNING

1. In case of external cooling system, cover the inverter rear side in order not to touch main capacitor and breaking resistor. **Electric shock may result.**

2. Ensure that the inverter and heat sink surfaces are kept free of foreign matter such as lint, paper dust, small chips of wood or metal, and dust. **Fire or accident may result.**

An inverter of 30kW or more can be converted to an external cooling type simply by moving upper and lower mounting brackets as shown in Fig. 2-2-3 Remove the M6 bracket screws, move the brackets, then the secure the brackets using the M5 case mounting screws. (The bracket screws are no longer required after changing the bracket mounting position.)

Voltage series	Inverter type	Bracket screws	Case mounting screws
400 V	VXM30 to VXM110K VXM30KP	5	5
	VXM132K to VXM160K	8	8
	VXM200K to VXM220K	8	6

Quantity of mounting screw

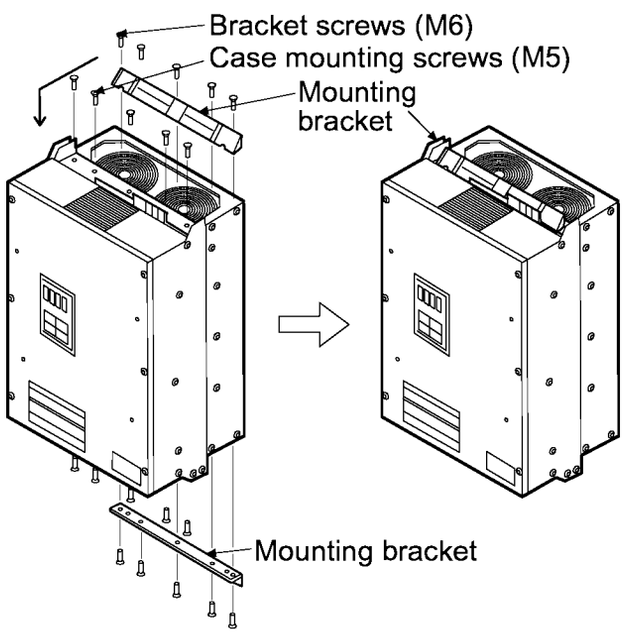


Figure 2-2-3

7. For inverters of 22 kW or less, remove the ventilating covers if ambient temperature exceeds +40 °C.

   Removing the ventilating covers
   One ventilating cover is mounted on top of the inverter and two or three are mounted at the bottom. Remove the surface cover, then remove ventilating covers by popping out the cover inserts as shown in Fig. 2-2-4.

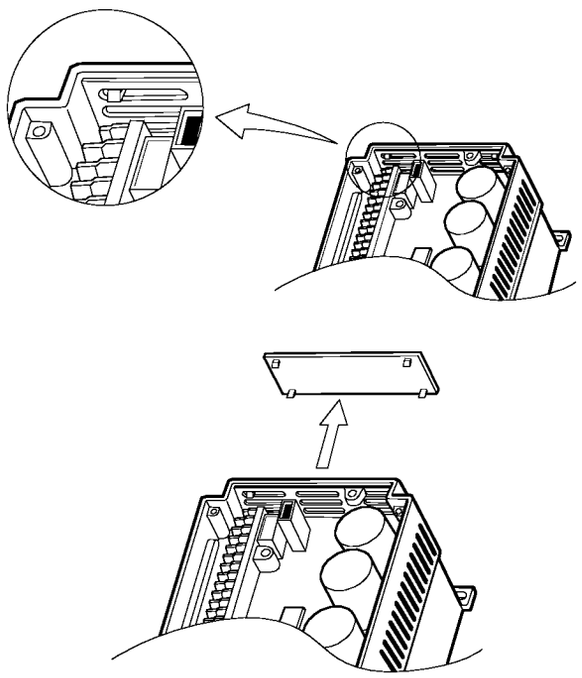


Figure 2-2-4 Removing the ventilating cover

2-3 Connection

Remove the surface cover before connecting the terminal blocks as follows.

2-3-1 Basic connection

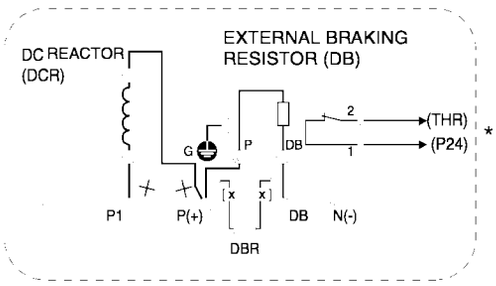
1. Always connect power to the L1/R, L2/S, and L3/T main circuit power terminals of the inverter. Connecting power to another terminal will damage the inverter. Check that the power voltage is within the maximum allowable voltage marked on the nameplate, etc.
2. Always ground the ground terminal to prevent fire or electric shock and to minimize noise.
3. Use a reliable crimp terminal for connection between a terminal and a cable.
4. After terminating the connection (wiring), confirm the following:
   a) Confirm that the connection is correct.
   b) Confirm that all necessary connections have been made.
   c) Confirm that there is no short-circuit or ground fault between terminals and cables.
5. Connection modification after power-on
   The smoothing capacitor in the direct current portion of the main circuit cannot be discharged immediately after the power is turned off.
   To ensure safety, use a multimeter to check that the voltage of the direct current (DC) is lowered to the safety range (25 V DC or less) after the charge lamp goes off. Also, confirm that the voltage is zero before short-circuiting. The residual voltage (electric charge) may cause sparks.

WARNING

1. Always connect a ground wire.
   Electric shock or fire may result.
2. Ensure that a licensed specialist performs all wiring works.
3. Confirm that the power is turned off (open) before commencing wiring operations.
   Electrical shock may result.

Basic connection diagram

- VXM750 or less



* See note 10, page 2-5

- VXM1100 or higher

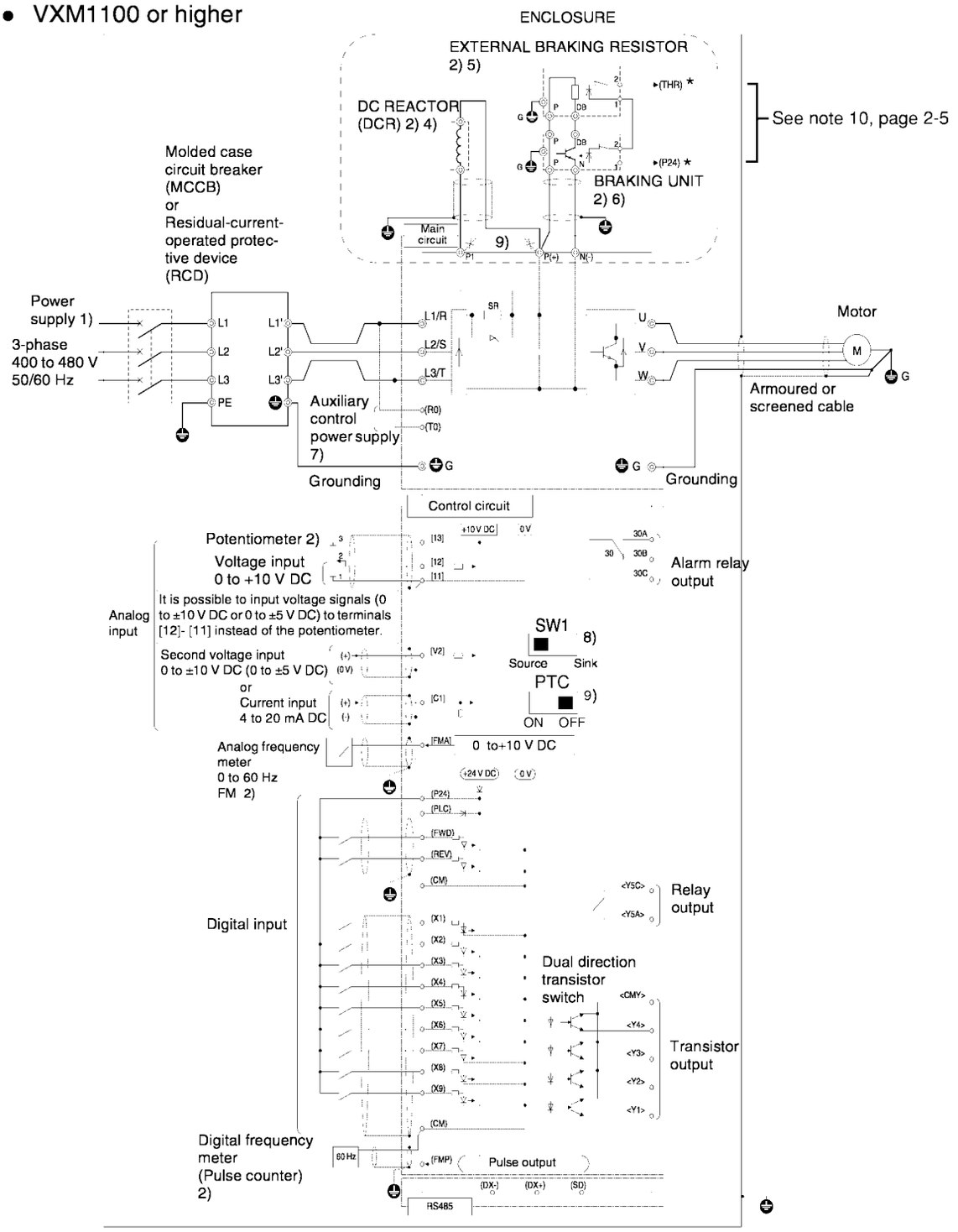


Figure 2-3-1

Notes:

1. Common terminals [11], (CM), and <CMY> of the control circuit are isolated independently.
2. The following options support the inverters:

Items \ Inverter models	VXM30K to VXM315K
Power factor correcting DC reactor (DCR)	[55 kW or less] - Option (separate installation) - Remove the jumper between P1 and P(+) before connecting the DCR [75 kW or more] - Provided standard (separate installation) - Always connect this DCR

1) Use an inverter with the rated voltage matching power supply voltage.

2) Option. Use as required.

3) Use this peripheral device when necessary.

4) To use the power-factor correcting DCR, remove the jumper [9] between P1 and P(+). For inverters of 75 kW or more, the jumper is not connected between P1 and P(+).

5) To connect the external braking resistor (option),

- Alwavs use with the braking unit (option) [6] (VXM: 11kW or more,)
- Disconnect the jumper between P(+) and DB of the internal resistor [8] P(+) must be insulated from DB. (VXM: 7.5 kW or less)

6) Connect the braking unit (option) to the P(+) - N(-). Connect auxiliary terminals [1] and [2] by confirming polarities according to the figure.

7) This terminal is provided as standard for inverters of 1.5 kW or more. The inverter can be operated without auxiliary control-power input.

8) If SW1 is set to SOURCE, digital input terminals are ON when 24 V (P24) is a supplied to the terminal (PNP-Logic).
If SW1 is set to SINK, digital input terminals are ON when 0 V (CM) is connected (NPN-Logic).

All explanations in this manual assume that SW1 is set to SOURCE (factory setting).

9) If using motor thermistors, they can be connected directly to terminals C1 and 11, move switch PTC to the ON position. If terminal C1 is not used, ensure switch PTC remains in the OFF position or reference frequency may be effected. See page 5-59 for more details.
Note: If a 4.20 MA input is required, it is not possible to use motor thermistors I/P at the same time.

10) When an overload of the braking circuit occurs, a THR input can be given to the inverter to stop the motor. It is good engineering practice to configure this control circuit externally to open the main input contactor to the inverter in the event of overload.

2-3-2 Connecting the main circuit and ground terminals

Symbol	Terminal name	Description
L1/R, L2/S, L3/T	Main circuit power terminal	Connects a 3-phase power supply.
U, V, W	Inverter output terminal	Connects a 3-phase motor.
R0, T0	Auxiliary control-power input terminal	Connects a backup AC power supply to the control circuit. (Not supported for inverter of 0.75 kW or less)
P1, P(+)	DC reactor connecting terminal	Connects the optional power-factor correcting DC reactor.
P(+), DB	External braking resistor connecting terminal	Connects the optional external braking resistor. (For inverter of 7.5 kW or less)
P(+), N(-)	DC link circuit terminal	Supplies DC link circuit voltage to the external braking unit (option) or power regeneration unit (option).
⏚G	Inverter ground terminal	Grounds the inverter chassis (case) to the earth.

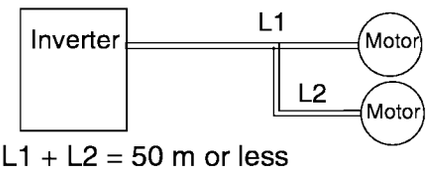
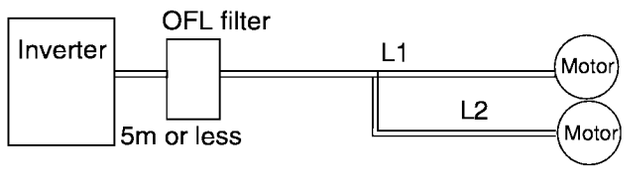
Table 2-3-1 Functions of main circuit terminals and ground terminals

1) Main circuit power terminals (L1/R, L2/S, L3/T)

1. Connect these terminals to the power supply via a molded-case circuit breaker or earth-leakage circuit breaker for circuit (wiring) protection. Phase-sequence matching is unnecessary.
2. To ensure safety, a magnetic contactor should be connected to disconnect the inverter from the power supply when the inverter protective function activates.
3. Use control circuit terminal FWD/REV or the RUN/STOP key on the keypad panel to start or stop the inverter. The main circuit power should be used to start or stop the inverter only if absolutely necessary and then should not be used more than once every hour.
4. Do not connect these terminals to a single-phase power supply.

2) Inverter output terminal (U, V, W)

1. Connect these terminals to a 3-phase motor in the correct phase-sequence. If the direction of motor rotation is incorrect, exchange any two of the U, V, and W phases.
2. Do not connect a phase-advance capacitor or surge absorber to inverter output.
3. If the cable from the inverter to the motor is very long, a high-frequency current may be generated by stray capacitance between the cables and result in an overcurrent trip of the inverter, an increase in leakage current, or a reduction in current indication precision.
   To prevent this, the cable must not exceed 50 meters (for 3.7 kW or less) or 100 meters (for 5.5 kW or more).
   If the cable must be long, connect an optional output circuit filter (OFL filter)

Without output circuit filter connected	With output circuit filter connected
 L1 + L2 = 50 m or less (3.7 kW or less) 100m or less (5.5 kW or more) To drive two or more motors, the total length of cable to these motors must not exceed 50 meters (for 3.7 kW or less) or 100 meters (for 5.5 kW or more).	 L1 + L2 = 400 m or less To drive two or more motors via an OFL filter, the total length of cable to these motors must not exceed 400 meters.

Note: When a motor protective thermal O/L relay is inserted between the inverter and the motor, the thermal O/L relay may malfunction (particularly in the 400 V series) even when the cable length is 50 meters or less. To resolve, insert an OFL filter or reduce the carrier frequency of the inverter operation noise. (Use function code "F26 Motor sound".)

Driving 400 V series motor by inverter

When a motor is driven by a PWM-type inverter, the motor terminals may be subject to surge voltage generated by inverter element switching. When the cable of the motor (the 400 V series in particular) is extremely long, surge voltage will deteriorate motor insulation.
To prevent this when driving the 400 V series motor using the inverter, ensure one of the following:

1. Use a well-insulated motor.
2. Connect an optional OFL filter to the output terminal of the inverter.
3. Minimize the length of the cable between the inverter and the motor (10 to 20 meters or less).

3) Auxiliary control-power input terminals (R0 and T0)

The inverter operates even if power is not provided to these terminals.
If a protective circuit operates and the magnetic contactor on the inverter power side is opened (off), the inverter control circuit power, the alarm output (30A, B, and C), and the keypad panel display goes off.
To prevent this, the same AC power as the main circuit AC power must be supplied (as auxiliary control power) to the auxiliary control-power input terminals (R0 and T0).

1. To ensure effective noise reduction when using a radio noise filter, the output power from the filter must go to the auxiliary control-power input terminals. If these terminals are connected to the input side of the filter, the noise reduction effect deteriorates.

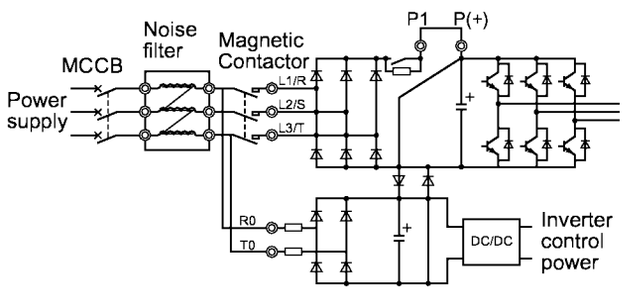


Figure 2-3-2 Connecting the auxiliary control-power input terminals

4) DC reactor connecting terminals (P1 and P(+))

1. Before connecting a power-factor correcting DC reactor (optional) to these terminals, remove the factory-installed jumper.
2. If a DC reactor is not used, do not remove the jumper.

Note: For inverter of 75 kW or more, the DC reactor is provided as a separate standard component and should always be connected to the terminals.

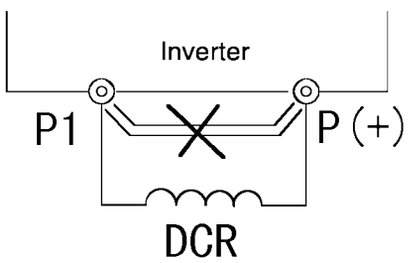


Figure 2-3-3

5) External braking-resistor connecting terminals (P(+) and DB) (7.5 kW or less)

For the G11S of 7.5 kW or less, a built-in braking resistor is connected to terminals P(+) and DB. If this braking resistor does not provide sufficient thermal capacity (e.g., in highly repetitive operation or heavy inertia load operation), an external braking resistor (option) must be mounted to improve braking performance.

1. Remove the built-in braking resistor from terminals P(+) and DB. Insulate the resistor-removed terminals with adhesive insulation tape, etc.
2. Connect terminals P(+) and DB of the external braking resistor to terminals P(+) and DB of the inverter.
3. The wiring (cables twisted or otherwise) should not exceed 5 meters.

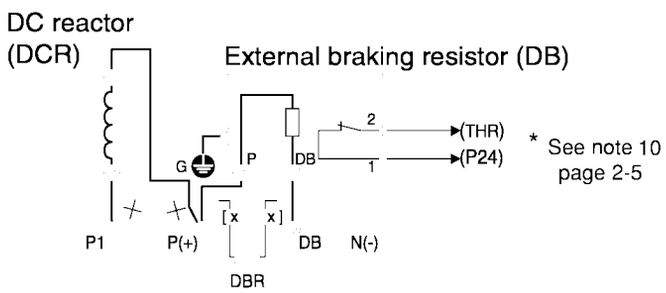


Figure 2-3-4 Connection (7.5 kW or less)

6) DC link circuit terminals (P(+) and N(-))

The VXM inverter of 11 kW or more does not contain a drive circuit for the braking resistor. To improve braking performance, an external braking unit (option) and an external braking resistor (option) must be installed.

1. Connect terminals P(+) and N(-) of the braking unit to terminals P(+) and N(-) of the inverter. The wiring (cables twisted or otherwise) should not exceed 5 meters.
2. Connect terminals P(+) and DB of the braking resistor to terminals P(+) and DB of the braking unit.
   The wiring (cables twisted or otherwise) should not exceed 10 meters. When terminals P(+) and N(-) of the inverter are not used, leave terminals open. If P(+) is connected to N(-) or the braking resistor is connected directly, the resistor will break.
3. Auxiliary contacts 1 and 2 of the braking unit have polarity.
   To connect the power regeneration unit, refer to the "Power Regeneration Unit Instruction Manual".

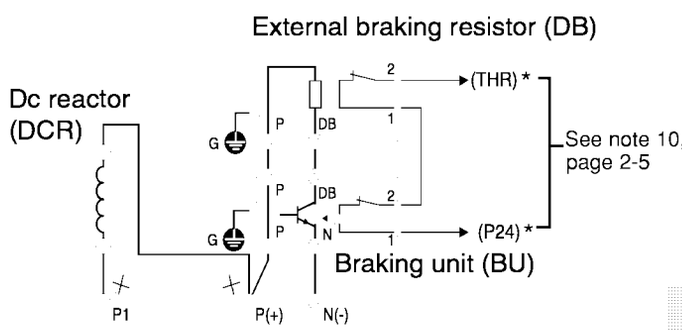


Figure 2-3-5 Connection (11 kW or more)

See note 10,

7) Inverter ground terminal

To ensure safety and noise reduction, always ground the inverter ground terminal. Also, metal frames of electrical equipment must be grounded as specified in the Electric Facility Technical Standard.

The connection procedure is as follows:

1. Ground metal frames to a ground terminal (Ground resistance: 10 Ω or less).
2. Use a suitable cable (short and thick) to connect the inverter system to the ground terminal.

8) Auxiliary power switching connector (CN UX) (for inverter of 30 kW or more)

When an inverter of 30 kW or more requires a main circuit power voltage as listed in Table 2-3-2, disconnect auxiliary power switching connector CN UX from U1 and connect to U2. For the switching method, see Fig. 2-3-8

Frequency [Hz]	Power voltage range [VAC]
50	380 - 398
60	380 - 430

Table 2-3-2 Main circuit power voltage requiring auxiliary power switching connector switching

CAUTION

1. Check that the number of phases and rated voltage of this product match those of the AC power supply.
2. Do not connect the AC power supply to the output terminals (U, V, W), because this will damage the inverter.
   Injury may result.
3. Do not connect a braking resistor directly to the DC terminals (P[+] and N[-]).
   Fire may result.

9) Fan power switching connector (CN RXTX) (for inverter of 30 kW or more)

VXM without options supports DC power input via DC common connection by connecting the power regeneration converter (RHC series) as shown in Fig. 2-3-7.
For details, refer to technical documentation.
The inverter of 30 kW or more contains an AC-powered component (e.g. AC cooling fan).
To use the inverter using DC power input, switch the fan power switching connector (CN RXTX) inside the inverter to the R0-T0 side and provide AC power to the R0 and T0 terminals. (See Fig. 2-3-6.)
For the switching method, see Fig. 2-3-8.

Note: In the standard state, the fan power switching connector (CN RXTX) is connected to the L1/R-L3/T side. When DC power input is not used, do not switch this connector.
The same AC voltage as the main circuit power voltage must be supplied to the auxiliary control-power input terminals (R0 and T0). If not supplied, the fan does not rotate and the inverter will overheat (0H1).

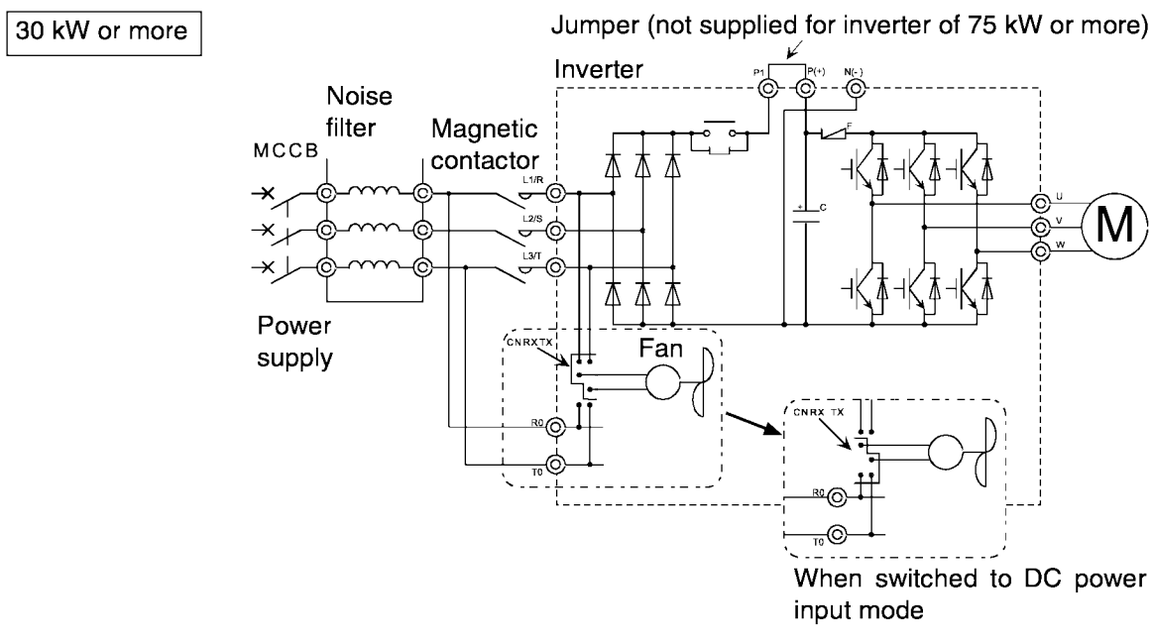


Figure 2-3-6 Fan power switching

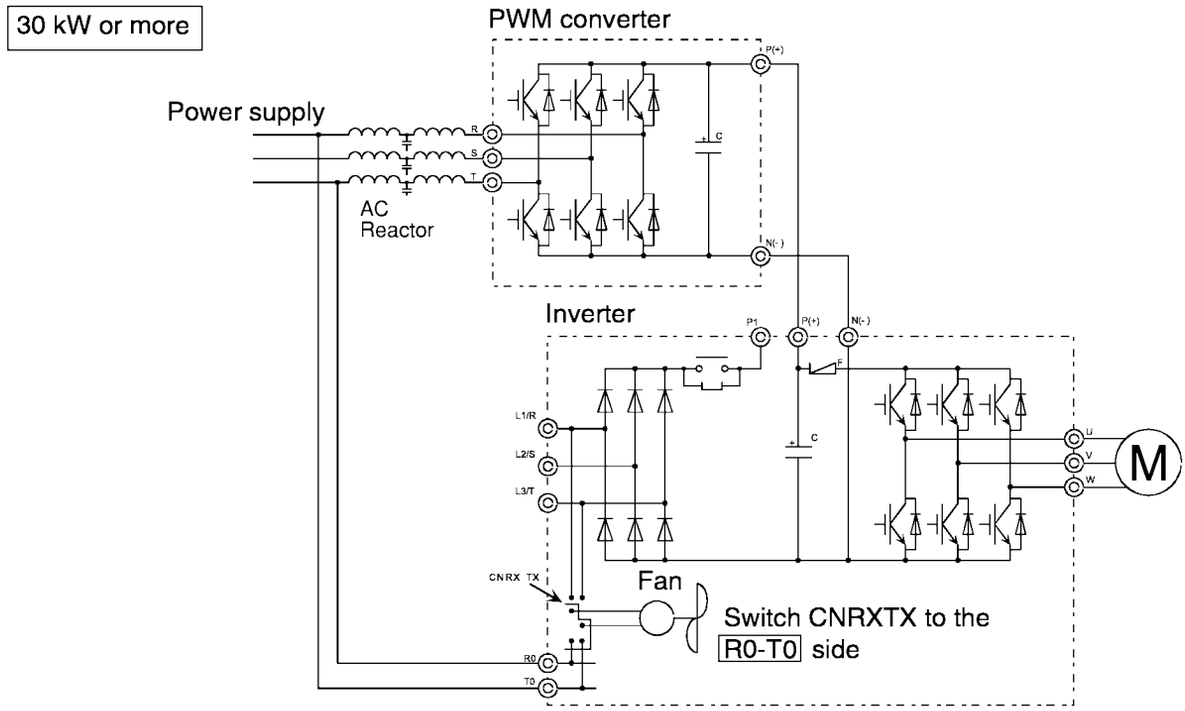
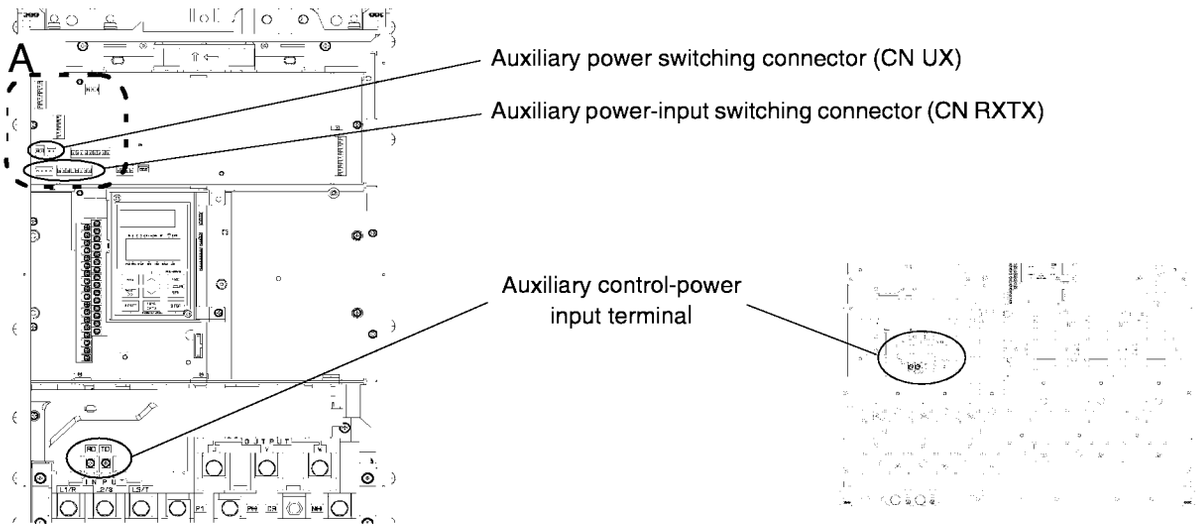


Figure 2-3-7 Example of connection by combination with power regeneration converter

Note: To connect the power regeneration converter to an inverter of 22 kW or less, do not connect the power supply directly to the auxiliary control-power input terminals (R0 and T0) of the inverter.
However, if such a connection is required, isolate these input terminals from the main power of the power regeneration converter with an isolation transformer.
The connection example of a power regeneration unit is provided in the "Power Regeneration Unit Instruction Manual".

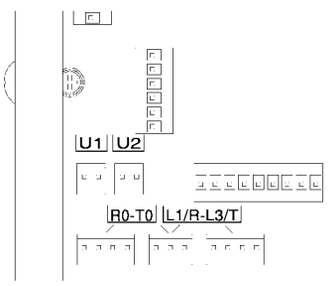
The switching connectors are mounted on the power PCB above the control PCB as shown below.



VXM30K/KP to VXM110K

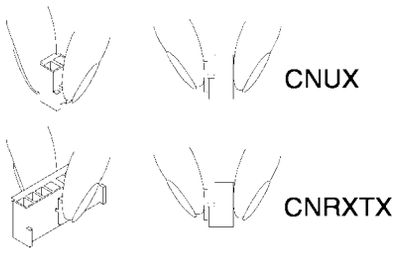
VXM132K to VXM220K

<Enlarged view of part A>

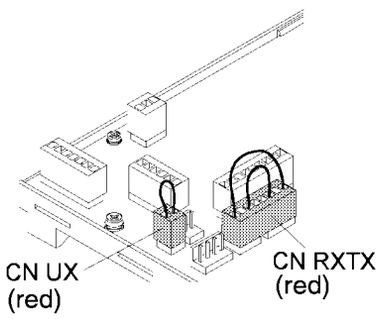


When shipped from the factory, CN UX is connected to the **U1** side and CN RXTX is connected to the **L1/R-L3/T** side.

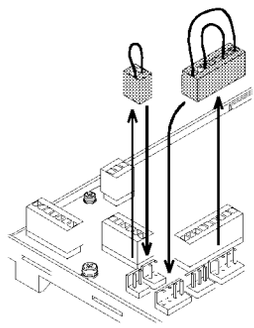
Note: To remove a connector, unlock the connector (using the locking mechanism) and pull. To mount a connector, push the connector until it click locks.



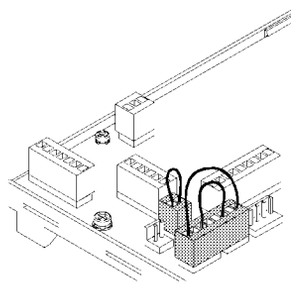
<Oblique view of part A>



Factory shipment status



Connector removal



After connector switching

CNUX: **U1**

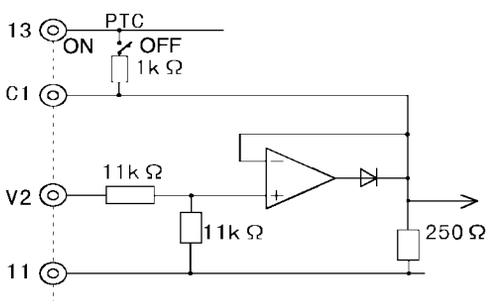
CNRXTX: **L1/R-L3/T**

In this figure the power voltage is 380 to 398 V AC, 50 Hz (or 380 to 430 V AC, 60 Hz) and the inverter is used in DC power input mode.

Figure 2-3-8 Power switching connectors (only for 30 kW or more)

2-3-3 Connecting the control terminals

Table 2-3-3 lists the functions of the control circuit terminals (switch SW1 set to source).
A control circuit terminal should be connected according to the setting of its functions.

Classification	Terminal symbol	Terminal name	Function
Analog input	13	Potentiometer power supply	Used for +10 V DC power supply for frequency setting POT (variable resistor of 1 to 5 kΩ)
	12	Voltage input	1. Frequency is set according to the analog input voltage supplied from an external circuit. - 0 to +10 V DC/0 to 100 % - Reversible operation using positive and negative signals: 0 to +/- 10 V DC/0 to 100 % - Reverse operation: +10 to 0 V DC/0 to 100 % 2. The feedback signal for PID control is input. 3. The analog input value from the external circuit is used for torque control. Input resistance: 22 kΩ
	V2	Voltage input	1. Frequency is set according to the analog input voltage supplied from an external circuit. - 0 to +10 V DC/0 to 100 % - Reverse operation: +10 to 0 V DC/0 to 100 % It can be used only one terminal "V2" or "C1" alternatively. Input resistance: 22 kΩ
	C1	Current input	1. Frequency is set according to the analog input current supplied from an external circuit. - 4 to 20 mA DC/0 to 100 % - Reverse operation: 20 to 4 mA DC/0 to 100 % 2. The feedback signal for PID control is input. 3. PTC thermistor input (Enabling in function H26) It can be used only one terminal "V2" or "C1" alternatively. Input resistance: 250 Ω 
	11	Analog input common	Common terminal for analog input signals

<table>
<tr><th>Classification</th><th>Terminal symbol</th><th>Terminal name</th><th>Function</th></tr>
<tr><td rowspan="14">Digital input</td><td>FWD</td><td>Forward operation/ Stop command</td><td>Used for forward operation (when FWD-P24 is on) or deceleration and stop (when FWD-P24 is off)</td></tr>
<tr><td>REV</td><td>Reverse operation/ Stop command</td><td>Used for reverse operation (when REV-P24 is on) or deceleration and stop (when REV-P24 is off)</td></tr>
<tr><td>X1</td><td>Digital input 1</td><td rowspan="9">The coast-to-stop command, external alarm, alarm reset, multistep frequency selection, and other functions (from an external circuit) can be assigned to terminals X1 to X9.
For details, see "Setting the Terminal Functions E01 to E09" in Section 5.2, "Details of Each Function."
<Specifications of digital input circuit>
<table><tr><th colspan="2">Item</th><th>min.</th><th>typ.</th><th>max.</th></tr><tr><td rowspan="2">Operating voltage</td><td>ON level</td><td>22 V</td><td>24 V</td><td>27 V</td></tr><tr><td>OFF level</td><td>0 V</td><td>-</td><td>2 V</td></tr><tr><td colspan="2">Operating current at ON level</td><td>-</td><td>3.2 mA</td><td>4.5 mA</td></tr><tr><td colspan="2">Allowable leakage current at OFF level</td><td>-</td><td>-</td><td>0.5 mA</td></tr></table></td></tr>
<tr><td>X2</td><td>Digital input 2</td></tr>
<tr><td>X3</td><td>Digital input 3</td></tr>
<tr><td>X4</td><td>Digital input 4</td></tr>
<tr><td>X5</td><td>Digital input 5</td></tr>
<tr><td>X6</td><td>Digital input 6</td></tr>
<tr><td>X7</td><td>Digital input 7</td></tr>
<tr><td>X8</td><td>Digital input 8</td></tr>
<tr><td>X9</td><td>Digital input 9</td></tr>
<tr><td>P24</td><td>Control unit power supply</td><td>+24 V DC power supply for control input
Maximum output current : 100 mA</td></tr>
<tr><td>CM</td><td>Common for P24</td><td>Common terminal for P24 and FMP terminals</td></tr>
<tr><td>PLC</td><td>PLC signal power</td><td>Used to connect power supply for PLC output signals (rated voltage 24 (22 to 27) V DC) at sink logic operation.</td></tr>
<tr><td>Analog output</td><td>FMA (11: Common terminal)</td><td>Analog monitor</td><td>Outputs monitor signal using analog DC voltage 0 to +10 V DC. The meaning of this signal is one of the following:
- Output frequency (before slip compensation)
- Output frequency (after slip compensation)
- Output current
- Output voltage
- Output torque
- Load factor
- Power consumption
- PID feedback value
- PG feedback value
- DC link circuit voltage
- Universal AO
Connectable impedance: 5 kΩ minimum</td></tr>
<tr><td>Pulse output</td><td>FMP (CM: Common terminal)</td><td>Frequency monitor (pulse waveform output)</td><td>Outputs a monitor signal using the pulse waveform.
This signal has the same function as the FMA signal.</td></tr>
</table>

<table>
<tr><th>Classification</th><th>Terminal symbol</th><th>Terminal name</th><th>Function</th></tr>
<tr><td rowspan="5">Transistor output</td><td>Y1</td><td>Transistor output 1</td><td rowspan="4">A running signal, frequency equivalence signal, overload early warning signal, and other signals from the inverter are output (as transistor output) to arbitrary ports.
For details, see "Setting the Terminal Functions E20 to E23" in Section 5.2, "Details of Each Function."
<Specifications of transistor output circuit>
<table><tr><th colspan="2">Item</th><th>min.</th><th>typ.</th><th>max.</th></tr><tr><td rowspan="2">Operating voltage</td><td>ON level</td><td>-</td><td>2 V</td><td>3 V</td></tr><tr><td>OFF level</td><td>-</td><td>24 V</td><td>27 V</td></tr><tr><td colspan="2">Maximum load current at ON level</td><td>-</td><td>-</td><td>50 mA</td></tr><tr><td colspan="2">Leakage current at OFF level</td><td>-</td><td>-</td><td>0.1 mA</td></tr></table></td></tr>
<tr><td>Y2</td><td>Transistor output 2</td></tr>
<tr><td>Y3</td><td>Transistor output 3</td></tr>
<tr><td>Y4</td><td>Transistor output 4</td></tr>
<tr><td>CMY</td><td>Transistor output common</td><td>Common terminal for transistor output signals
This terminal is insulated from terminals [CM] and [11].</td></tr>
<tr><td rowspan="2">Relay output</td><td>30A, 30B, 30C</td><td>Alarm output for any fault</td><td>If the inverter is stopped by an alarm (protective function), the alarm signal is output from the relay contact output terminal (1SPDT).
Contact rating: 48 V DC, 0.5 A
An excitation mode (excitation at alarm occurrence or at normal operation) can be selected.</td></tr>
<tr><td>Y5A, Y5C</td><td>Multipurpose-signal relay output</td><td>These signals can be output similar to the Y1 to Y4 signals above.
The contact rating for any fault is the same as that of the alarm output above.</td></tr>
<tr><td rowspan="2">Communica-tion</td><td>DX+, DX-</td><td>RS485 communication input-output</td><td>Input-output signal terminals for RS485 communication.
UP to 31 inverters can be connected using the daisy chain method.</td></tr>
<tr><td>SD</td><td>Communication-cable shield connection terminal</td><td>Terminal for connecting the shield of a cable.
The terminal is electrically floating.</td></tr>
</table>

Table 2-3-3 Functions of the control circuit terminals

1) Analog input terminals
(13, 12, V2,C1, and 11)

1. These terminals receive weak analog signals that may be affected by external noise. The cables should be as short as possible (20 meters or less), should be shielded, and should be grounded in principle. If the cables are affected by external induction noise, the shielding effect may be improved by connecting the shield to terminal [11].

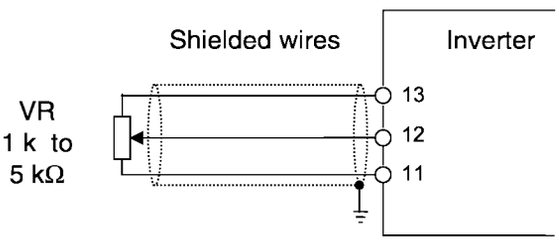


Figure 2-3-9

2. If contacts must be connected to these circuits, twin (bifurcated type) contacts for handling weak signals must be used. A contact must not be connected to terminal [11].

3. If an external analog signal output device is connected to these terminals, it may malfunction as a result of inverter noise.
To prevent malfunction, connect a ferrite core or capacitor to the external analog signal output device.

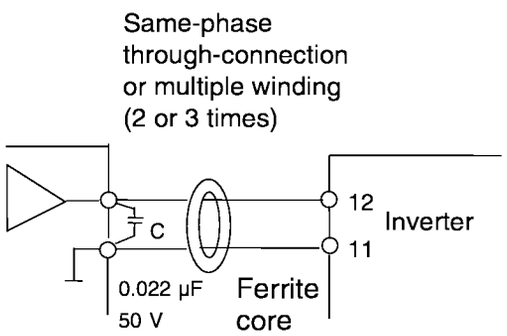


Figure 2-3-10 Example of noise prevention

2) Digital input terminals
(FWD, REV, X1 to X9 and CM)

1. Digital input terminals (e.g., FWD, REV, X1 to X9) are generally turned on or off by connecting or disconnecting the line to the P24 terminal. If +24 V power supply is provided from external, connect each terminals as shown in Fig. 2-3-11.

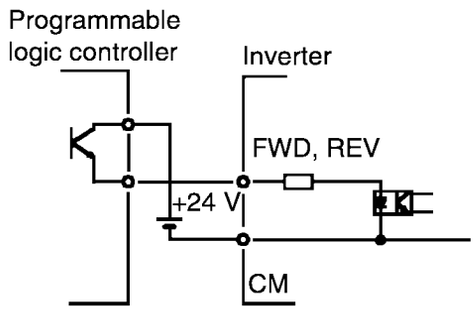


Figure 2-3-11 Connection for External power supply

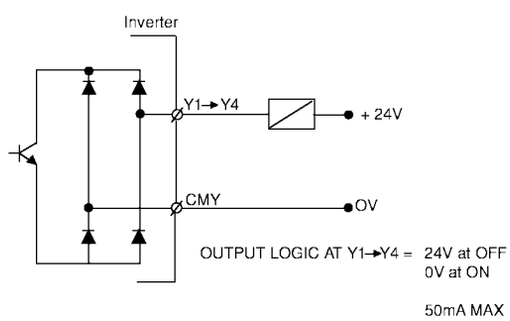
2. When using a contact input, a relay having highly reliable contact must be used.

3) Transistor output terminals (Y1 to Y4, CMY)

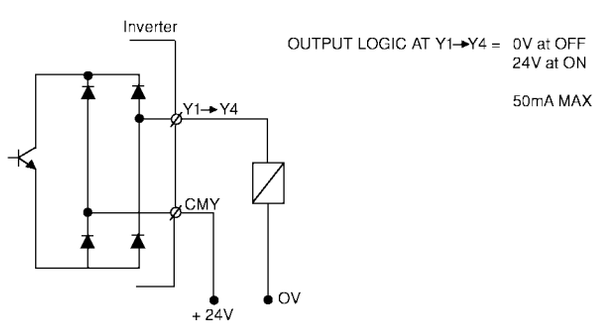
1. To connect a control relay, connect a surge absorbing diode to both ends of its exciting coil.

Y-Outputs (electrical connections)

Example (1) Open Collector Configuration



Example (2) Open Emitter Configuration



4) Others

1. To prevent a malfunction as a result of noise, control terminal cables must be placed as far as possible from the main circuit cables.
2. The control cables inside the inverter must be secured to prevent direct contact with live section (e.g., main-circuit terminal block) of the main circuit.

WARNING

Control lines generally do not have enhanced insulation.
If the insulation of a control line is damaged, the control signals may be exposed to high voltage in the main circuit. The Low Voltage Directive in Europe also restricts the exposure to high voltage.
Electric shock may result.

CAUTION

The inverter, motor, and cables generate noise.
Check that the ambient sensors and devices do not malfunction.
Accident may result.

5) Wiring of control circuit

- VXM30K to VXM110K

1. Pull out the control circuit wiring along the left panel as shown in Fig. 2-3-12.
2. Secure the cable to cable binding hole A (on the left wall of the main circuit terminal block) using a cable-tie (e.g., Insulock).
   The cable-tie must not exceed 3.5 mm in width and 1.5 mm in thickness.
3. When the optional PC board is mounted, the signal lines must be secured to cable binding hole B.

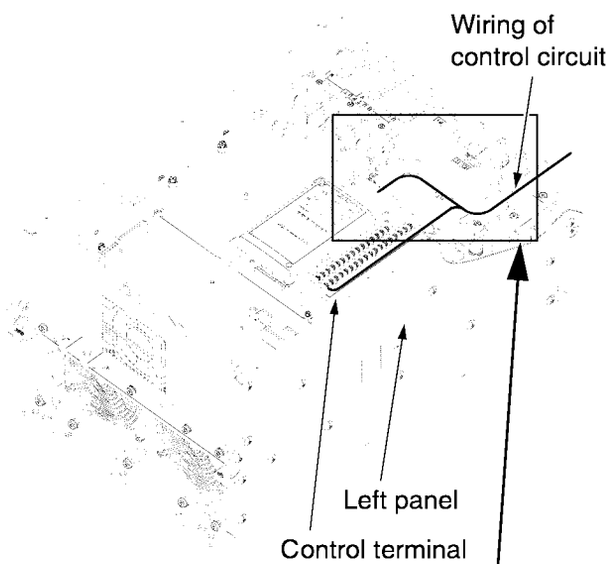


Figure 2-3-12 The wiring route of the control circuit

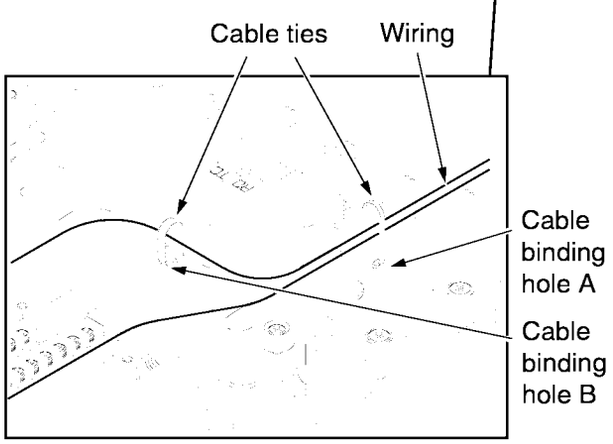


Figure 2-3-13 The securing positions of the control-circuit line of inverter

- VXM132K to VXM160K

1. As shown in Fig. 2-3-14, pull out the cables along the left panel
2. Secure cables to holes of cable-tie holder (on the way of wiring) using cable-ties (e.g., Insulok). The cable-ties must not exceed 3.8 mm in width and 1.5 mm in thickness.

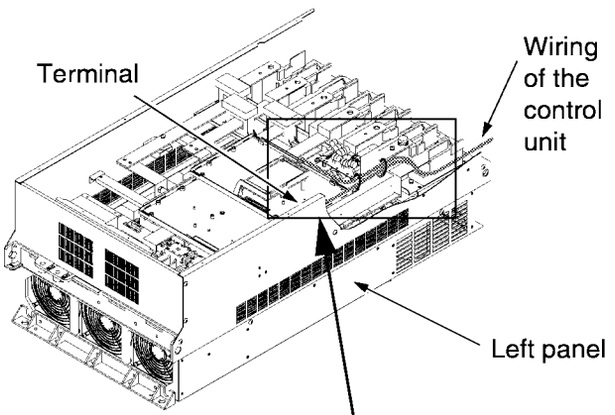


Figure 2-3-14 The wiring route of the control unit

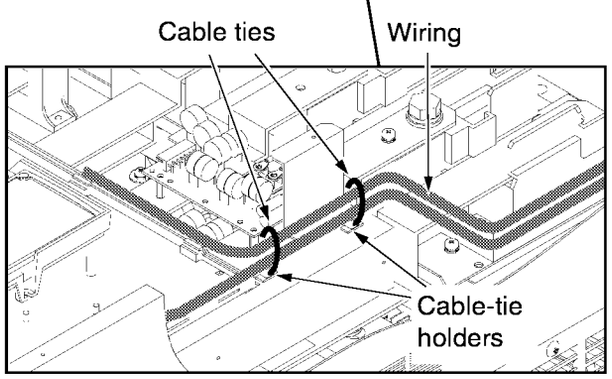


Figure 2-3-15 The securing points of the cables

- VXM200K to VXM220K

1. As shown in Fig. 2-3-16, pull out the cables along the left panel
2. Secure cables to holes of cable-tie holder (on the way of wiring) using cable-ties (e.g., Insulok). The cable-ties must not exceed 3.8 mm in width and 1.5 mm in thickness.

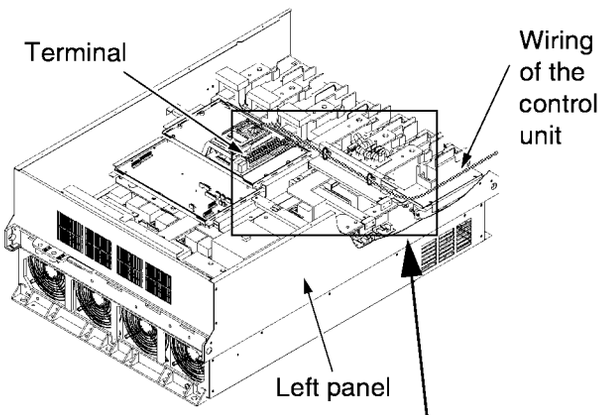


Figure 2-3-16 The wiring route of the control unit

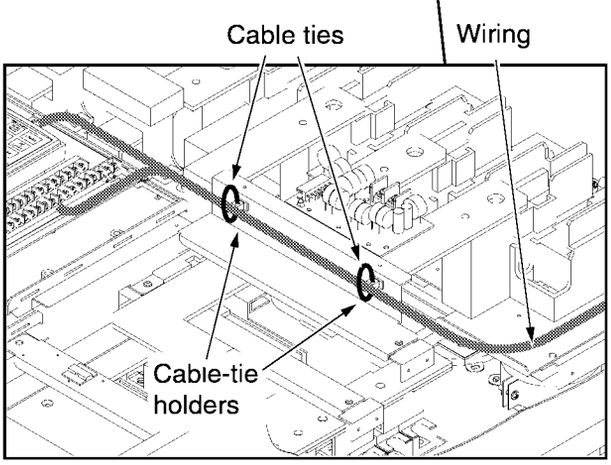


Figure 2-3-17 The securing points of the cables

2-3-4 Terminal arrangement

1) Main circuit terminals

VXM40 to VXM75

L1/R	L2/S	L3/T	DB	P1	P(+)	N(-)	U	V	W

G
G

Screw size M3.5

VXM150 to VXM400

R0 T0 Screw size M3.5

L1/R	L2/S	L3/T	DB	P1	P(+)	N(-)	U	V	W

G Screw size M4 G

VXM550 to VXM750

R0 T0 Screw size M3.5

L1/R	L2/S	L3/T	DB	P1	P(+)	N(-)	U	V	W

G Screw size M5 G

VXM1100 to VXM2200

R0 T0 Screw size M3.5

L1/R	L2/S	L3/T	DB	P1	P(+)	N(-)	U	V	W

G
G

Screw size M6

VXM30K to VXM55K/VXM30KP

Screw size M4

R0	T0		U	V	W
L1/R	L2/S	L3/T	P1	P(+)		N(-)

G G Screw size M8

VXM75K to VXM110K

Screw size M4

R0	T0		U	V	W
L1/R	L2/S	L3/T	P1	P(+)		N(-)

G G Screw size G: M8
other terminals: M10

VXM132K to VXM220K

R0 T0 Screw size M4

L1/R	L2/S	L3/T	U	V	W
			P1	P(+)	N(-)

G G Screw size G: M10
other terminals: M12

2) Control circuit terminals

30C	30A
30B	Y5A
Y5C	CMY
Y4	Y3
Y2	Y1
11	C1
12	FMA
13	FMP
V2	PLC
CM	X1
CM	X2
FWD	X3
REV	X4
P24	X5
P24	X6
DX-	X7
DX+	X8
SD	X9

2-3-5 Applicable equipment and wire size for main circuit

Voltage	Application motor [kW]	Inverter type	CT/VT	Fuse/MCCB current rating [A]		Tightening torque [N•m]				Recommended wire size [mm²]					
										L1/R, L2/S, L3/T (⏚G)					
				With DCR	With-out DCR	L1/R, L2/S, L3/T U, V, W P1, P(+), DB, N(-)	⏚G	R0, T0	Control	With DCR	With-out DCR	U, V, W	R0, T0	P1, P(+)	P(+), DB, N(-)	Control
3phase 400V	0.4	VXM40	CT	6	6	1.2		-	0.7	2.5 (2.5)	2.5 (2.5)	2.5	2.5	2.5	2.5	0.2 to 0.75
	0.75	VXM75	CT	6	6											
	1.5	VXM150	CT	6	10	1.8		1.2								
	2.2	VXM220	CT	10	16											
	3.7	VXM400	CT	10	16											
	5.5	VXM550	CT	16	20	3.5										
	7.5		VT	20	32						6 (6)					
	7.5	VXM750	CT													
	11		VT	32	40					6 (6)	10 (10)	4		4		
	11	VXM1100	CT			5.8										
	15		VT	40	50					10 (10)		6		6		
	15	VXM1500	CT								16 (16)	10		10		
	18.5		VT	40	63											
	18.5	VXM1850	CT								25 (16)					
	22		VT	50	80											
	22	VXM2200G	CT													
	30	VXM30KP	VT	80	100	13.5		1.2		16 (10)	50 (25)	25	2.5 to 6	25	2.5	
	30	VXM30K	CT													
	37		VT	100	125					25 (16)	70 (35)	35		35		
	37	VXM37K	CT													
	45		VT	100	160					35 (25)	70 (35)	50		50		
	45	VXM45K	CT													
	55		VT	125	200					50 (25)	35X2 (35)	70		70	4	
	55	VXM55K	CT													
	75		VT	200	-					35X2	-	35X2		50X2	6	
	75	VXM75K	CT			27	13.5			95 (50)		95				
	90		VT	200	-					50X2 (50)	-	50X2		70X2	10	
	90	VXM90K	CT													
	110		VT	250	-					70X2 (70)	-	70X2		95X2		
	110	VXM110K	CT													
	132		VT	315	-					70X2 (70)	-	95X2		120X2		
	132	VXM132K	CT			48	27									
	160		VT	400	-					120X2 (120)	-	120X2		150X2	16	
	160	VXM160K	CT													
	200		VT	400	-					150X2 (150)	-	185X2		185X2	25	
	200	VXM200K	CT													
	220		VT	500	-					185X2 (185)	-	185X2		185X2	50	
	220	VXM220K	CT													
	280		VT	630	-					240X2	-	300X2		300X2		

Note: The type of wire is 70 °C 600 V Grade heat-resistant polyvinyl chloride insulated wires (PVC).
The above-mentioned wire size are the recommended size under the condition of the ambient temperature 50 °C or lower.

3 Operation

3-1 Inspection and Preparation before Operation

Check the following before operation:

1. Check that the connection is correct.
   In particular, check that the power supply is not connected to any of the U, V, and W output terminals and that the ground terminal is securely grounded.

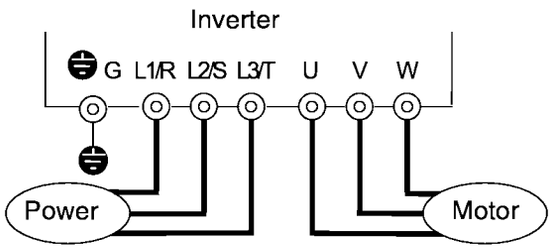


Figure 3-1-1 Inverter connection

2. Check for short-circuits and ground faults between the terminals and live sections.
3. Check for loose terminals, connectors, or screws.
4. Check that the motor is separated from mechanical equipment.
5. Turn off switches before turning power to ensure that the inverter will not start or operate abnormally at power-on.

   Check the following after power-on:
   a) Check that no alarm message is displayed on the keypad panel (see Figure 3-1-2).
   b) Check that the fan inside the inverter is rotating. (For inverters with 1.5 kW or more)

Figure 3-1-2 Display on keypad panel at power-on

WARNING

Be sure to put on the surface cover before turning on the power (close). Never remove the cover while the power is applied to the inverter.
To ensure safety, do not operate switches with wet hands.
Electric shock may result.

3-2 Operation Method

There are various methods of operation. Select a method of operation according to operating purpose and specifications by referring to Section 4-2, "Operating the Keypad Panel," and Chapter 5, "Explanation of Functions."

Table 3-2-1 lists general operation methods.

Operation command	Frequency setting	Operation command
Operation using keypad panel	Keys on keypad panel ∧ ∨	FWD REV STOP
Operation using external signal	∧ ∨ Freq. Setting POT(VR), analog voltage, analog current	Contact input (switch) Terminals-FWD-P24 and REV-P24

Table 3-2-1 General operation methods

3-3 Trial Run

Upon confirming that inspection results are normal (see Section 3-1), proceed with a trial run. The initial operation mode (set at factory) is using the keypad panel.

1. Turn power on and confirm that frequency display 0.00 Hz is blinking on the LED monitor.
2. Set the frequency to about 5Hz using ∧ key.
3. To start the run, press FWD key (for forward rotation) or REV key (for reverse rotation). To stop, press STOP key.
4. Check the following items :

   a) Is the rotating direction correct?
   b) Is the rotation smooth? (no buzzing or abnormal vibration)
   c) Is acceleration and deceleration smooth?

   If no abnormality is detected, increase the frequency and check the above items again.

If the results of the trial run are normal, start a formal run.

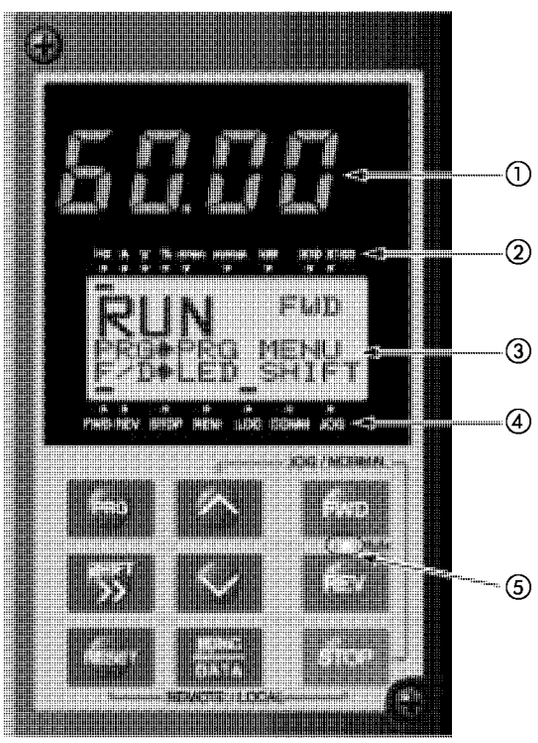
Notes: - If an error is detected in the inverter or motor, immediately stop the operation and attempt to determine the cause of error referring to Chapter 7, "Troubleshooting."

- As voltage is still applied to the main circuit terminals (L1/R, L2/S, L3/T) and auxiliary control-power terminals (R0, T0) even when the output from the inverter is terminated, do not touch the terminals. The smoothing capacitor in the inverter is being charged after the power is turned off and it is not discharged immediately. Before touching an electric circuit, confirm that the charge lamp is off or a multimeter is indicating a low voltage at the terminals.

4 Keypad Panel

The keypad panel has various functions for specifying operations such as keypad operation (frequency setting, run/stop command), confirming and changing function data, confirming status, and copying.
Review the use of each function before commencing running.
The keypad panel can also be removed or inserted during running. However, if the keypad panel is removed during a keypad panel operation (e.g., run/stop, frequency setting), the inverter stops and outputs an alarm.

4-1 Appearance of Keypad Panel



① LED monitor:
Four-digit 7-segment display.
Used to display various items of monitored data such as setting frequency, output frequency and alarm code.

② Auxiliary information indication for LED monitor:
Selected units or multiple of the monitored data (on the LED monitor) are displayed on the top line of the LCD monitor.
The ▬ symbol indicates selected units or multiple number.
The symbol ▲ indicates there is an upper screen not currently displayed.

③ LCD monitor:
Used to display such various items of information as operation status and function data. An operation guide message, which can be scrolled, is displayed at the bottom of the LCD monitor.

④ Indication on LCD monitor:
Displays one of the following operation status:
FWD: Forward operation
REV: Reverse operation
STOP: Stop
Displays the selected operation mode:
REM: Terminal block LOC: Keypad panel
COMM: Communication terminal
JOG: Jogging mode
The symbol ▼ indicates there is a lower screen not currently displayed.

⑤ RUN LED:
Indicates that an operation command was input by pressing the FWD or REV key.

Control keys
(valid during keypad panel operation):
Used for inverter run and stop

FWD	Forward operation command
REV	Reverse operation command
STOP	Stop command

Operation keys:
Used for screen switching, data change, frequency setting, etc.

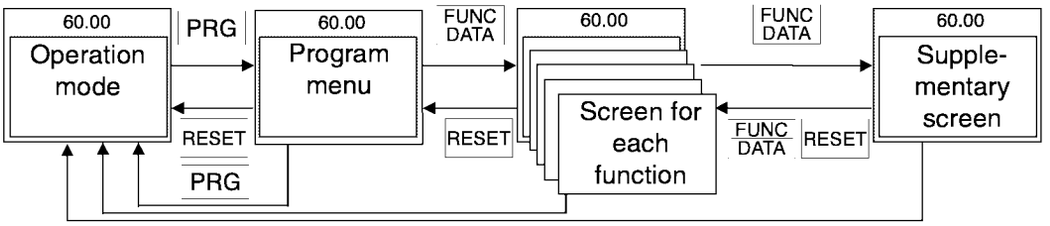
Operation key	Main function
PRG	Used to switch the current screen to the menu screen or switch to the initial screen in the operation/trip mode.
FUNC DATA	Used to switch the LED monitor or to determine the entered frequency, function code, or data.
∧ , ∨	Used to change data, move the cursor up or down, or scroll the screen
SHIFT >>	Used to move the cursor horizontally at data change. When this key is pressed with the up or down key, the cursor moves to the next function block.
RESET	Used to cancel current input data and switch the displayed screen. If an alarm occurs, this key is used to reset the trip status (valid only when the alarm mode initial screen is displayed).
STOP + ∧	Used to switch normal operation mode to jogging operation mode or vice versa. The selected mode is displayed on the LCD monitor.
STOP + RESET	Switches operation mode (from keypad panel operation mode to terminal block operation mode or reverse). When these keys are operated, function F01 data is also switched from 0 to 1 or from 1 to 0. The selected mode is displayed on the LCD indicator.

Table 4-1-1 Functions of operation keys

4-2 Keypad Panel Operation System (LCD screen, Level Structure)

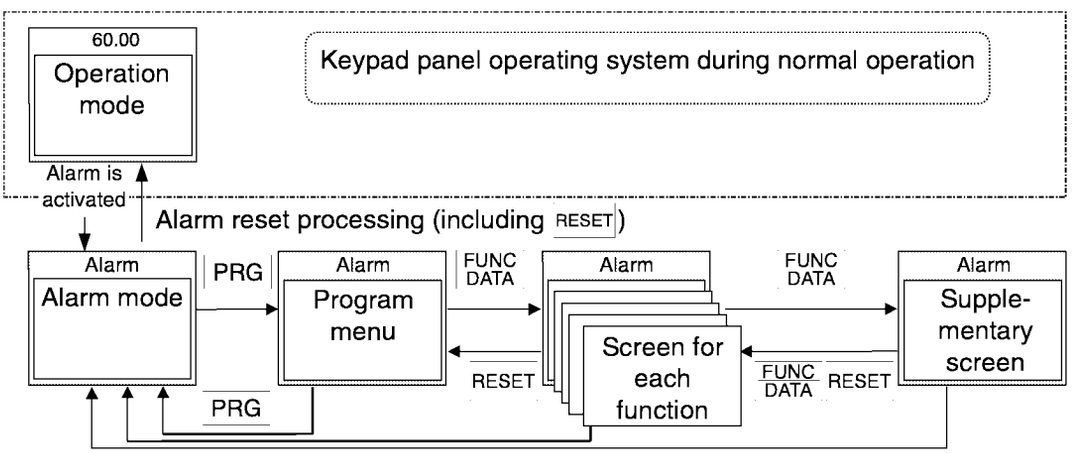
4-2-1 Normal operation

The keypad panel operation system (screen transition, level structure) is structured as follows:



4-2-2 Alarm mode

If an alarm is activated, operation is changed from normal keypad panel operation to an alarm mode operation. The alarm mode screen appears and alarm information is displayed.
The program menu, function screens, and supplementary screens remain unchanged as during normal operation, though the switching method from program menu to alarm mode is limited to PRG.



<table>
<tr><th>No.</th><th>Level name</th><th>Content</th></tr>
<tr><td>1</td><td>Operating mode</td><td>This screen is for normal operation. Frequency setting by keypad panel and the LED monitor switching are possible only when this screen is displayed.</td></tr>
<tr><td>2</td><td>Program menu</td><td>Each function of the keypad panel is displayed in menu form and can be selected. Selecting the desired function from the list and pressing FUNC DATA displays the screen of the selected function. The following functions are available as keypad panel functions (menus).
<table>
<tr><th>No.</th><th>Menu name</th><th>Outline</th></tr>
<tr><td>1</td><td>DATA SET</td><td>The code and name of the function are displayed. Selecting a function displays a data setting screen for checking, or modifying data.</td></tr>
<tr><td>2</td><td>DATA CHECK</td><td>The code and name of the function are displayed. Select a function to display a screen for checking data. Modifying data is possible as described above by going to the data setting screen.</td></tr>
<tr><td>3</td><td>OPR MNTR</td><td>Can check various data on the operating status.</td></tr>
<tr><td>4</td><td>I/O CHECK</td><td>Can check the status of analog and digital input/output for the inverter and options as an I/O checker.</td></tr>
<tr><td>5</td><td>MAINTE-NANC</td><td>Can check inverter status, life expectancy , communication error status, and ROM version information as maintenance information.</td></tr>
<tr><td>6</td><td>LOAD FCTR</td><td>Can measure maximum and average current and average braking force in load rate measurement.</td></tr>
<tr><td>7</td><td>ALM INF</td><td>Can check the operating status and input/output status at the latest alarm occurrence.</td></tr>
<tr><td>8</td><td>ALM CAUSE</td><td>Can check the latest alarm or simultaneously occurred alarms and alarm history. Selecting the alarm and pressing FUNC DATA , displays the contents of alarm as troubleshooting.</td></tr>
<tr><td>9</td><td>DATA COPY</td><td>Places the function of one inverter in memory for copying to another inverter.</td></tr>
</table></td></tr>
<tr><td>3</td><td>Screen for each function</td><td>The function screen selected on the program menu appears, hence completing the function.</td></tr>
<tr><td>4</td><td>Supplementary screen</td><td>Functions not completed (e.g., modifying function data, displaying alarm factors) on individual function screens are displayed on the supplementary screen.</td></tr>
</table>

Table 4-2-1 Overview of contents displayed for each level

4-3-3 Switching the LED monitor

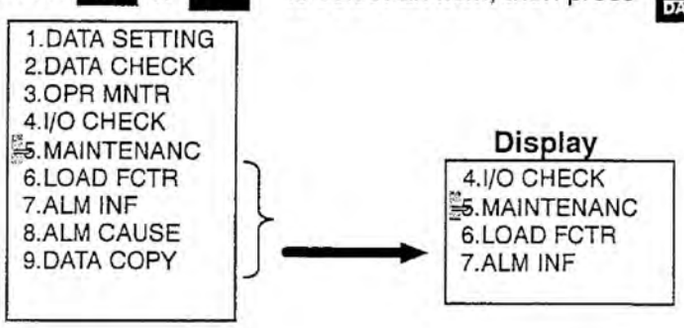
On the normal operation, press FUNC DATA to switch to LED monitor display.

When power is turned on, the monitor contents set by the function (E43) are displayed on the LED.

E43	When stopping (E44 = 0)	When stopping (E44 = 1)	When running (E44 =0,1)	Unit	Remarks
0	Setting frequency	Output frequency 1 (before slip compensation)		Hz	
1	Setting frequency	Output frequency 2 (after slip compensation)			
2	Setting frequency	Setting frequency			
3	Output current	Output current		A	
4	Output voltage (specified value)	Output voltage (specified value)		V	
5	Synchronous speed setting value	Synchronous speed		r/min.	For 4 digits or more, the last digits are cut, with x10, x100 marked on the indicator.
6	Line speed setting value	Line speed		m/min.	
7	Load rotation speed setting value	Load rotation speed		r/min.	
8	Torque calculation value	Torque calculation value		%	± indication
9	Power consumption	Power consumption		kW	
10	PID setting value	PID setting value		–	Displayed only when PID is effective in PID operation selection.
11	PID remote setting value	PID remote setting value		–	
12	PID feedback value	PID feedback value		–	

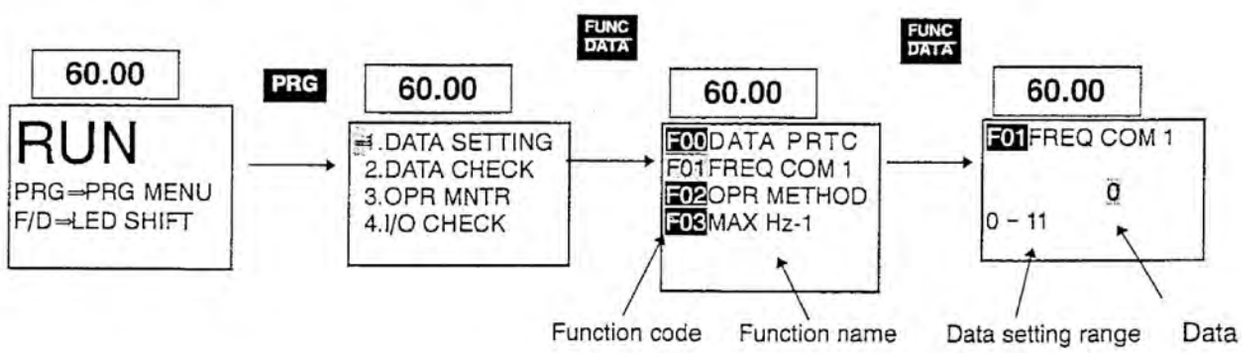
4-3-4 Menu screen

The "Program menu" screen is shown below. Only four items can be displayed simultaneously. Move the cursor with ∧ or ∨ to select an item, then press FUNC DATA to display the next screen.

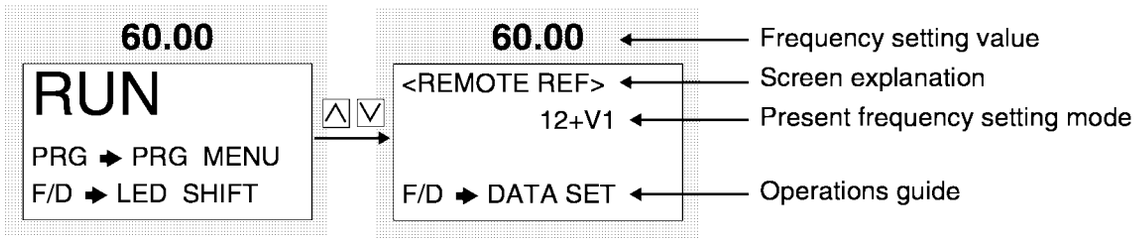


4-3-5 Setting function data

On the "program menu" screen, select **"1. Data Setting"** then the "Function Select" screen appears with function codes and names on it. Select the desired function.



2) Other than digital setting



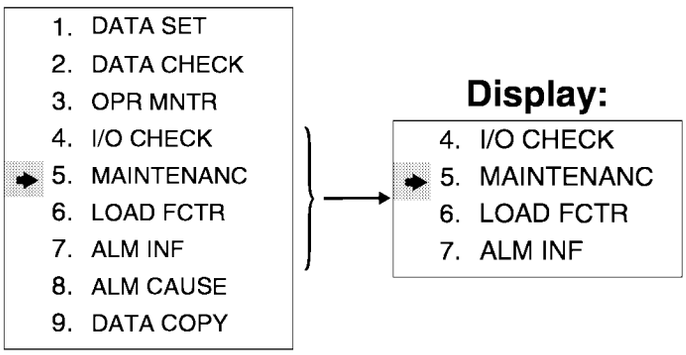
4-3-3 Switching the LED monitor

On the normal operation, press FUNC DATA to switch to LED monitor display. When power is turned on, the monitor contents set by the function (E43) are displayed on the LED.

E43	When stopping (E44 = 0)	When stopping (E44 = 1)	When running (E44 =0,1)	Unit	Remarks
0	Setting frequency	Output frequency 1 (before slip compensation)		Hz	
1	Setting frequency	Output frequency 2 (after slip compensation)		Hz	
2	Setting frequency	Setting frequency		Hz	
3	Output current	Output current		A	
4	Output voltage (specified value)	Output voltage (specified value)		V	
5	Synchronous speed setting value	Synchronous speed		r/min.	For 4 digits or more, the last digits are cut, with x10, x100 marked on the indicator.
6	Line speed setting value	Line speed		m/min.	
7	Load rotation speed setting value	Load rotation speed		r/min.	
8	Torque calculation value	Torque calculation value		%	± indication
9	Power consumption	Power consumption		kW	
10	PID setting value	PID setting value		-	Displayed only when PID is effective in PID operation selection.
11	PID remote setting value	PID remote setting value		-	
12	PID feedback value	PID feedback value		-	

4-3-4 Menu screen

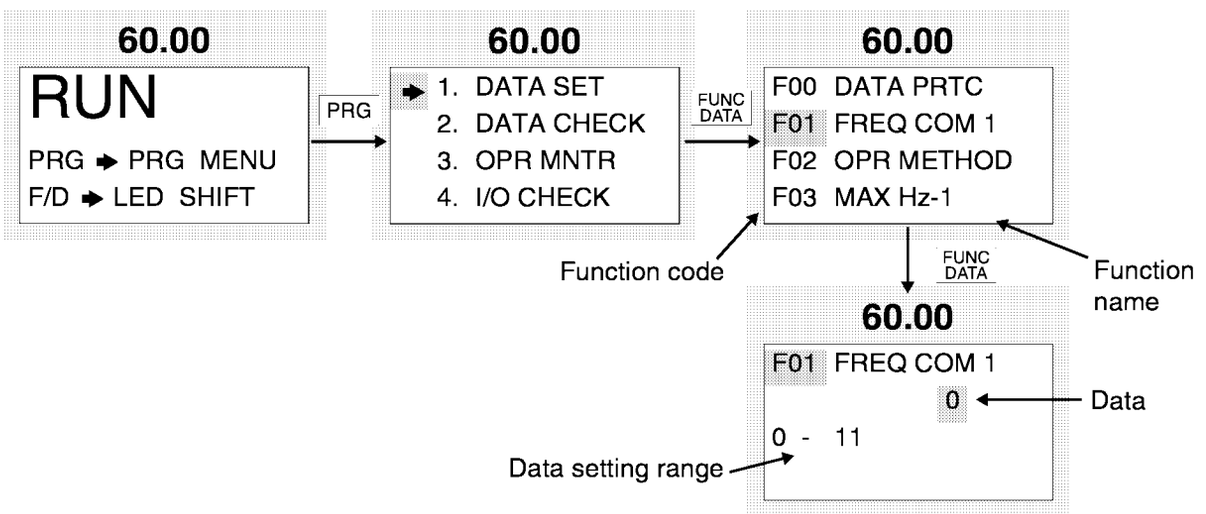
The "Program menu" screen is shown below. Only four items can be displayed simultaneously. Move the cursor with ∧ or ∨ to select an item, then press FUNC DATA to display the next screen.



4

4-3-5 Setting function data

On the "program menu" screen, select "**1. DATA SET**" then the "Function Select" screen appears with function codes and names on it. Select the desired function.

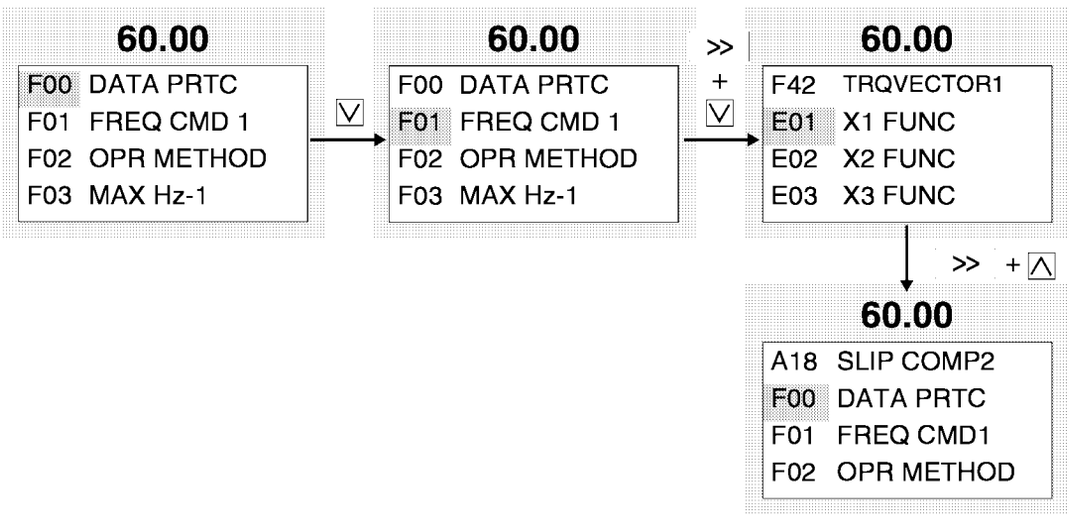


The function code consists of alphanumeric characters.
Unique alphabetical letters are assigned for each function group.

Function code	Function	Remarks
F00 - F42	Fundamental Functions	
E01 - E47	Extension Terminal Functions	
C01 - C33	Control Functions of Frequency	
P01 - P09	Motor Parameters	
H03 - H39	High Performance Functions	
A01 - A18	Alternative Motor Parameters	
o01 - o29	Optional Functions	Can be selected only with an option connected

Table 4-3-2

To scroll "Function Select" screen rapidly, use [>>] + [∧] or [>>] + [∨] to move the screen in a unit grouped by alphabet.



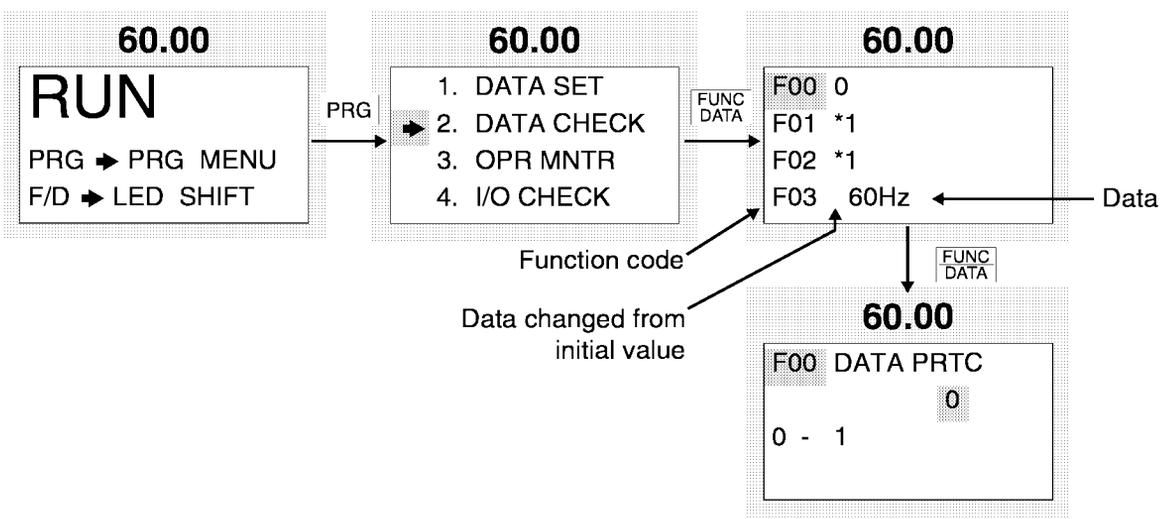
Select the desired function and press [FUNC DATA] to switch to the "data setting" screen.
On the "data setting" screen, the data values on the LCD can be increased or decreased in the smallest possible unit by pressing [∧] or [∨]. Holding down [∧] or [∨] expands the rate of change, thereby enabling values to be modified more rapidly. Otherwise, select the digit to be modified using [>>], then set data directly. When data is modified, the value before modification will be displayed at the same time for reference purpose. To save the data, press [FUNC DATA] Pressing [RESET] cancels the changes made and returns to the "Function Select" screen. The modified data will be effective in inverter operation after the data is saved by [FUNC DATA]. The inverter operation does not change only if data is modified. When data setting is disabled in the case of "Data protected" or "Data setting invalid during inverter running," make necessary changes. Data cannot be modified for the following reasons:

Display	Reason for no modification	Release method
LINK ACTIVE	Currently writing from RS-485/link option to function is being made.	Send a cancel command of function writing from RS-485. Stops a "Write" operation from the link.
NO SIGNAL [WE-KP]	The write enable for KEYPAD function is selected using a general-purpose input terminal.	Among functions E01 to E09, turn the terminal of data 19 (write enable for KEYPAD) ON.
DATA PRTCTD	Data protection is selected for function F00.	Change function F00 to 0.
INV RUNNING	An attempt is made to change a function that cannot be changed during inverter operation.	Stop inverter operation.
FWD/REV ON	An attempt is made to change a function that cannot be changed with the FWD/REV command on.	Turn FWD/REV command off.

Table 4-3-2

4-3-6 Checking function data

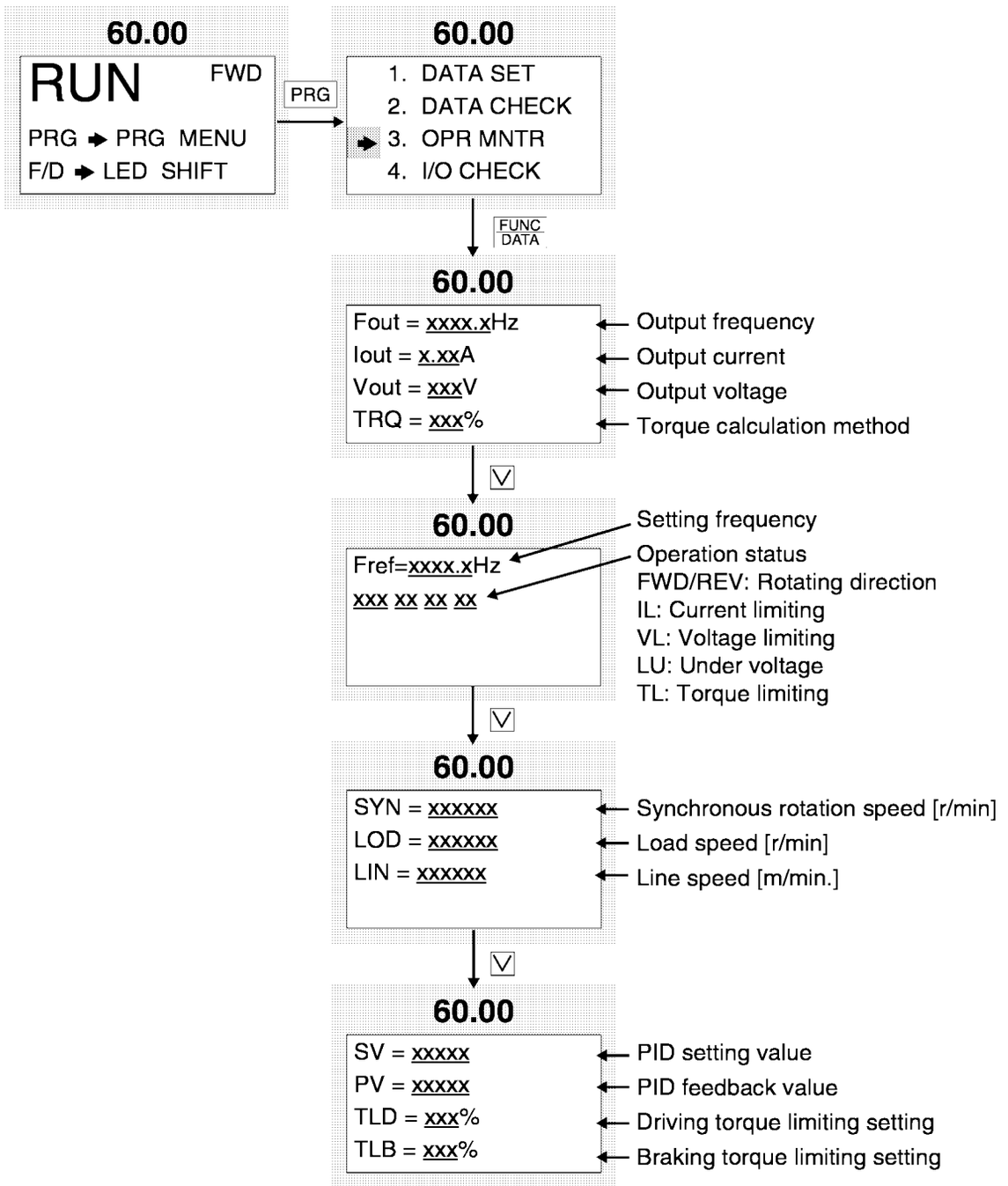
On the "Program menu" screen, select "**2. DATA CHECK**".
The "Function Select" screen then appears with function codes and names.



Select the desired function and press FUNC DATA to check the function data. By pressing FUNC DATA, the screen switches to the "DATA SET" screen, to modify data.

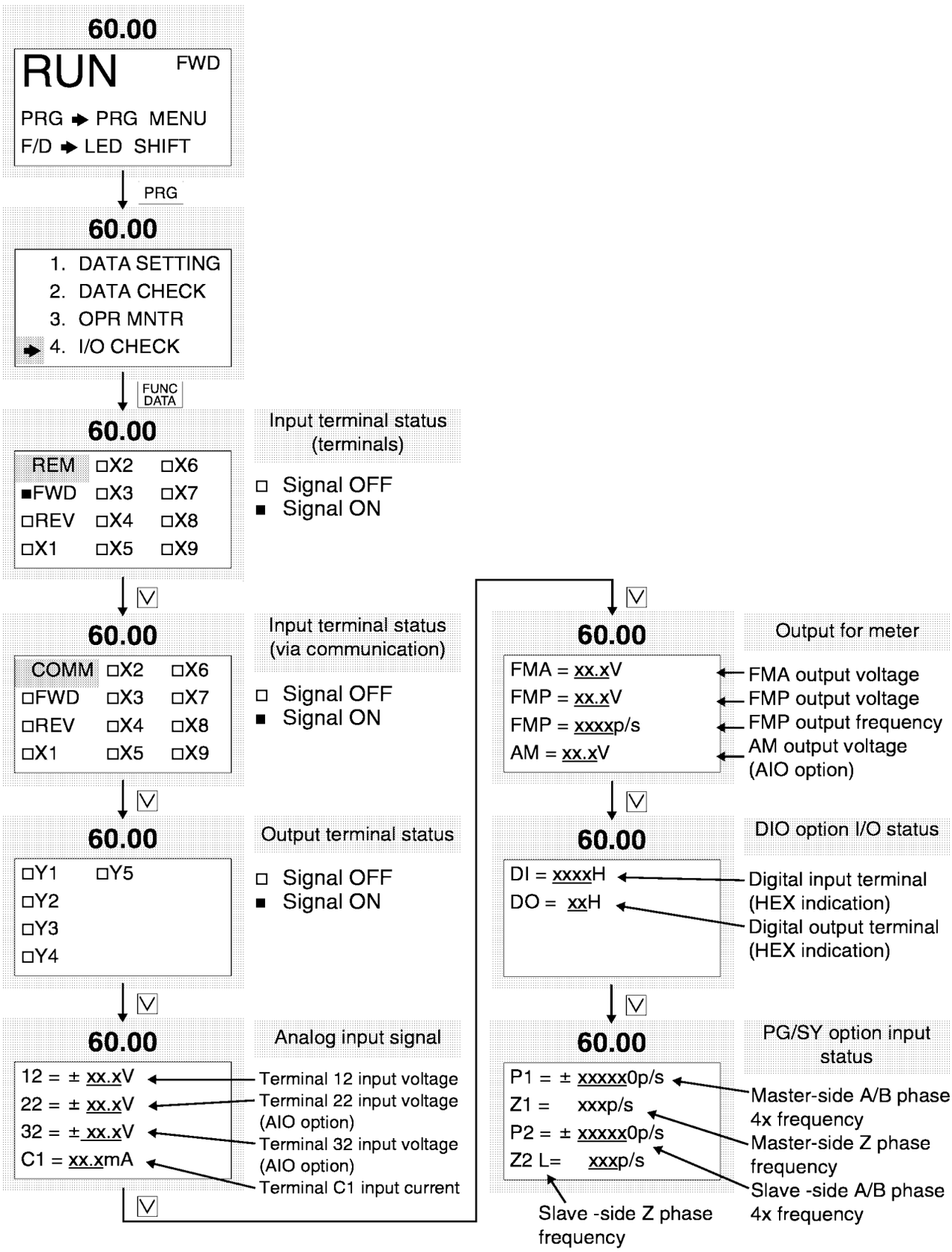
4-3-7 Monitoring operating status

On the "Program menu" screen, select "**3. OPR MNTR**" to display the present operating status of inverter. Use ⋀ and ⋁ to switch between the four operation monitor screens.



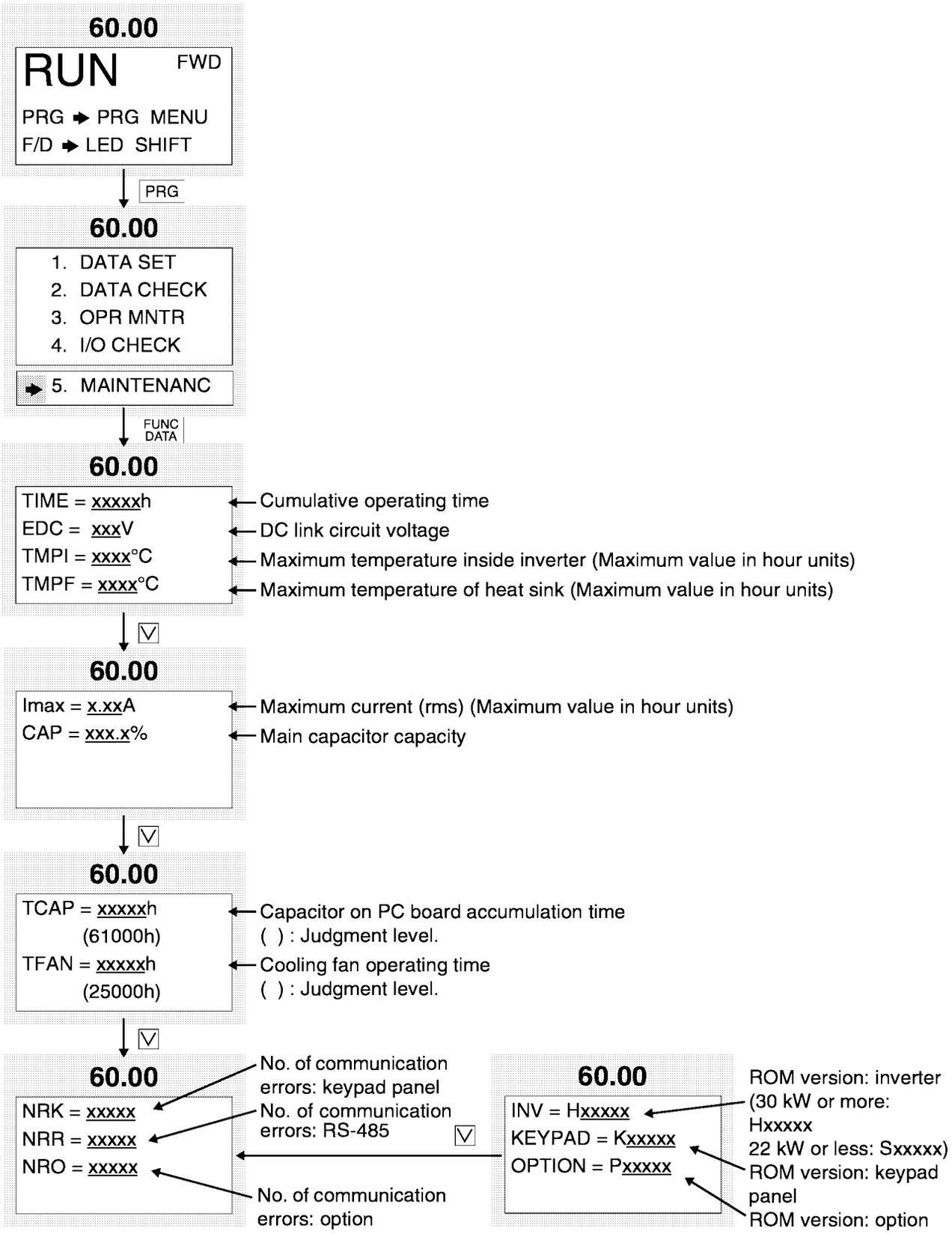
4-3-8 I/O check

On the "Program menu" screen, select "**4. I/O CHECK**" to display analog and digital input/output signal status for the inverter and options. Use ⋀ and ⋁ to switch between the seven screens of data.



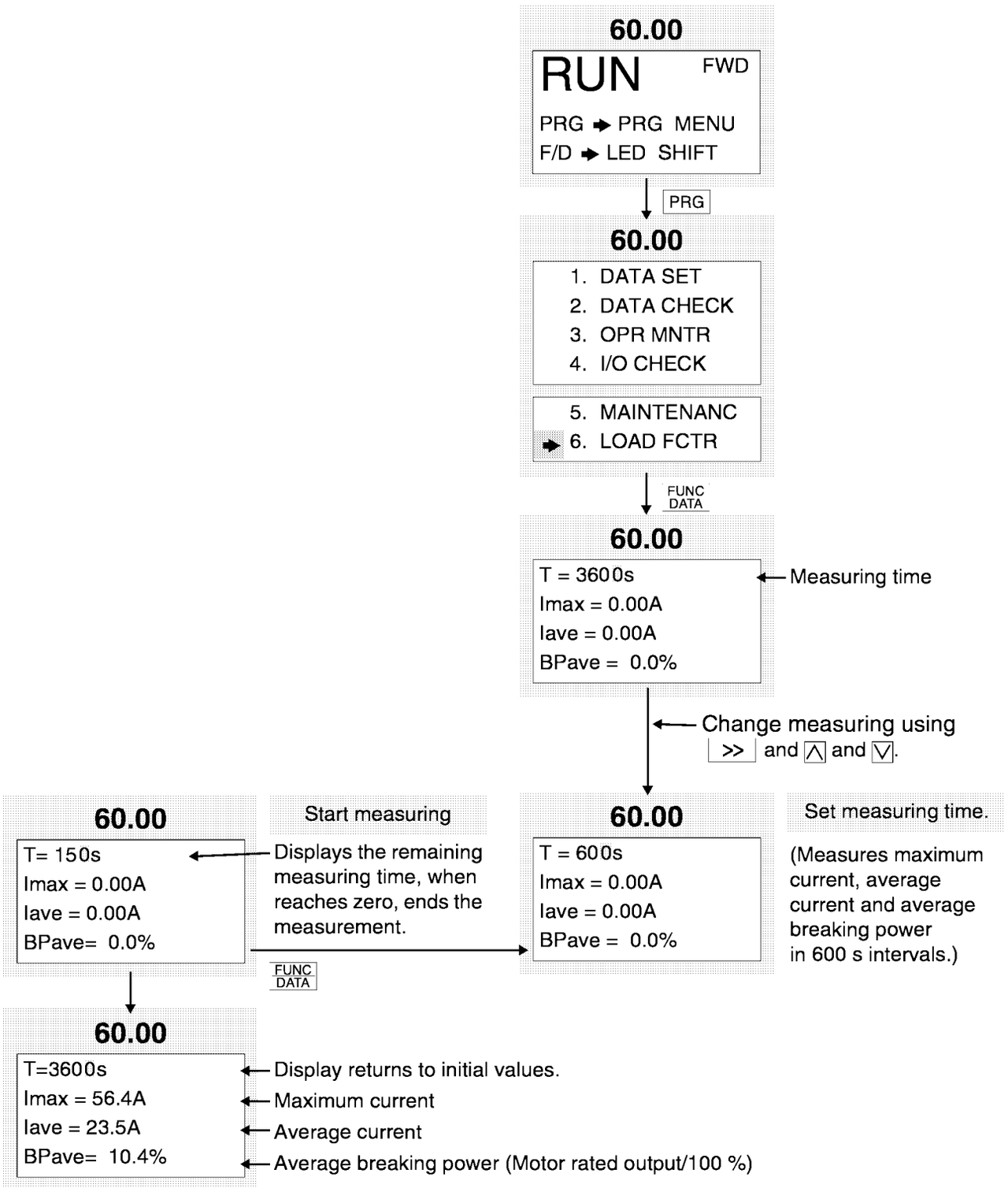
4-3-9 Maintenance information

On the "Program menu" screen, select "**5. MAINTENANC**" to display information necessary for maintenance and inspection.
Use △ and ▽ to switch between the five screens of data.



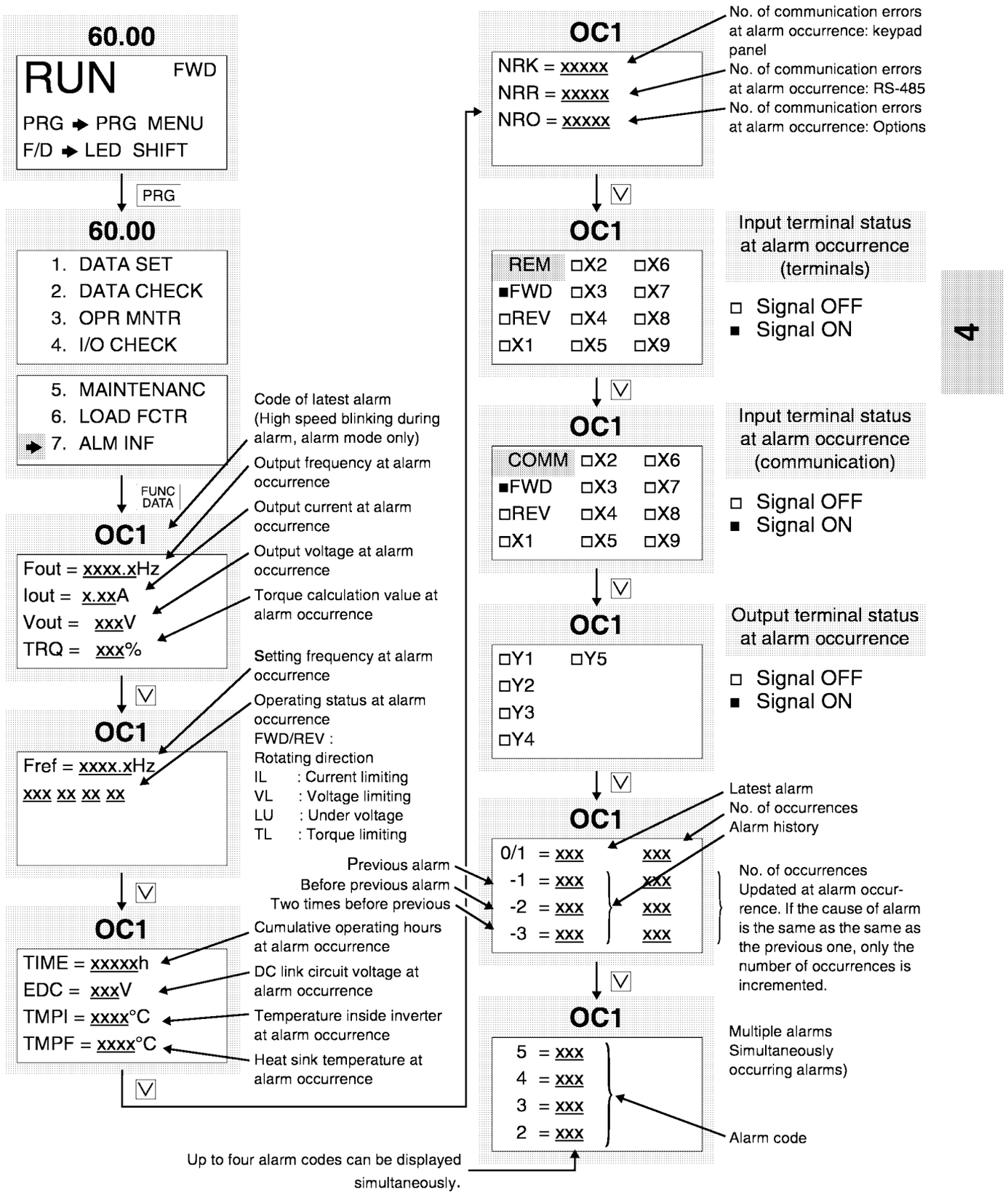
4-3-10 Load rate measurement

On the "Program menu" screen, select "**6. LOAD FCTR**". On the "Load rate measurement" screen, the maximum current, average current, and average breaking power during the set measuring time are measured and displayed.



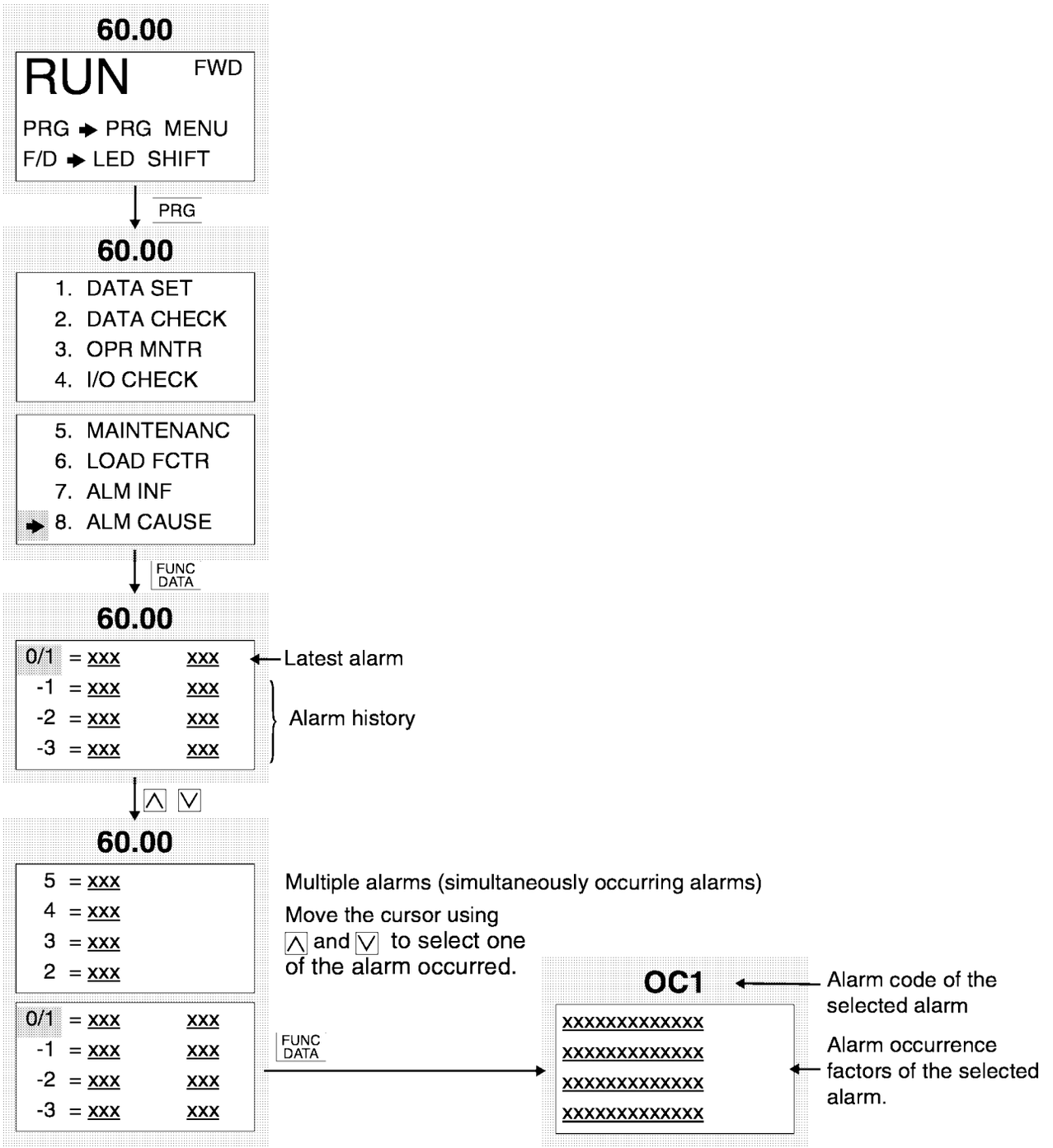
4-3-11 Alarm information

On the "Program menu" screen, select "7. ALM INF". Various operating data when the latest alarm occurred is displayed. Use ∧ and ∨ to switch between the nine screens of alarm information data.



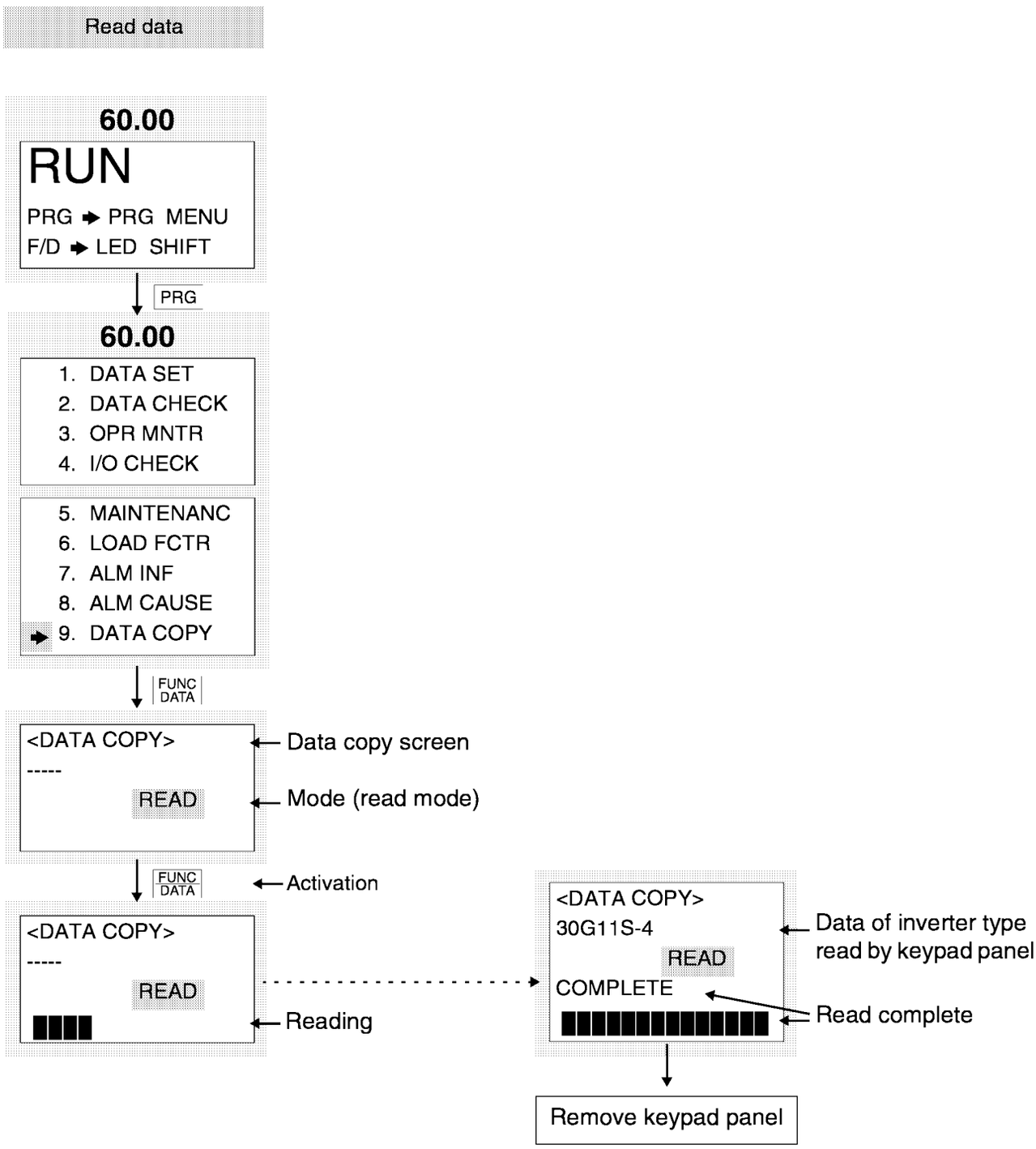
4-3-12 Alarm history and factors

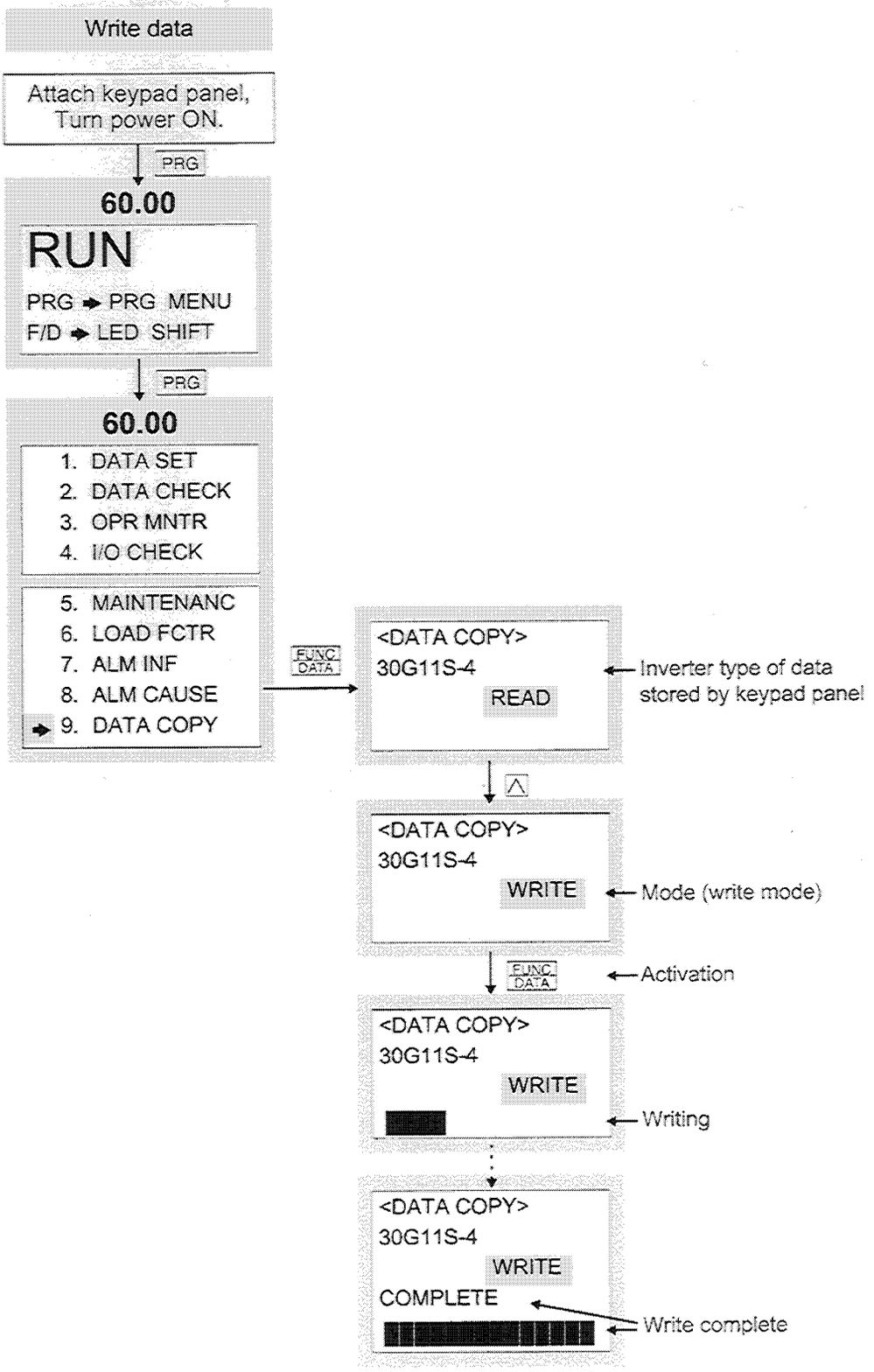
On the "Program menu" screen, select "**8. ALM CAUSE**" to display the alarm history.
Press FUNC DATA to display troubleshooting information for the alarm selected.



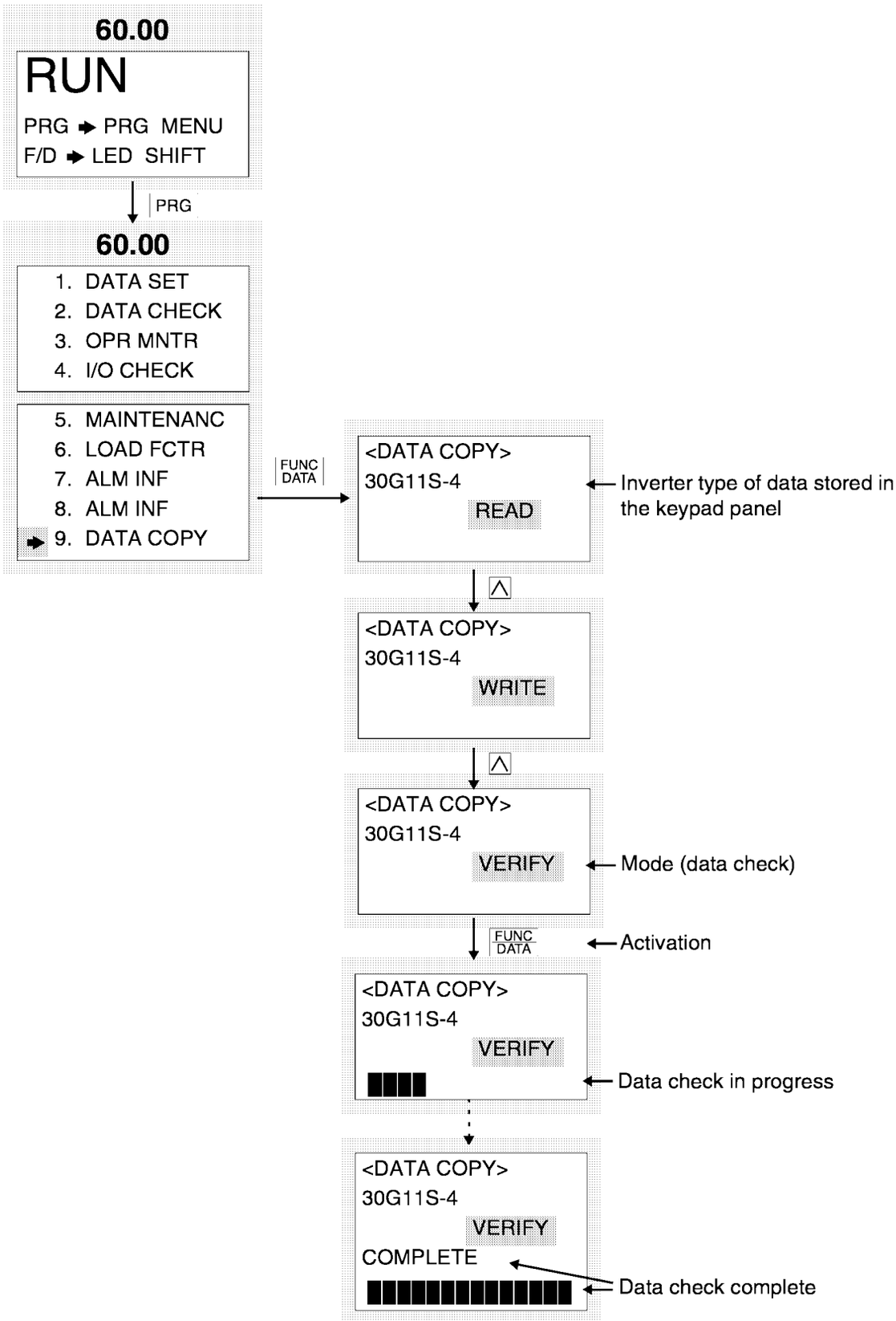
4-3-13 Data copy

On the "Program menu" screen, select "**9. DATA COPY**" to display the data copy read screen. A copy operation is then performed in the following order; reading inverter function data, removing the keypad panel, attaching the keypad panel to another inverter, and writing the data to the inverter.
The "verify" feature also makes it possible to compare and check differences in the data stored in the keypad panel and the data stored in the inverter.




Write data
Attach keypad panel,
Turn power ON.
PRG
60.00
RUN
PRG ➡ PRG MENU
F/D ➡ LED SHIFT
PRG
60.00
1. DATA SET
2. DATA CHECK
3. OPR MNTR
4. I/O CHECK
5. MAINTENANC
6. LOAD FCTR
7. ALM INF
8. ALM CAUSE
➡ 9. DATA COPY
FUNC DATA
<DATA COPY>
30G11S-4
READ
Inverter type of data stored by keypad panel
<DATA COPY>
30G11S-4
WRITE
Mode (write mode)
FUNC DATA
Activation
<DATA COPY>
30G11S-4
WRITE
Writing
<DATA COPY>
30G11S-4
WRITE
COMPLETE
Write complete

Data check (verify)



Error processing

1) Change disabled during operation
If a write operation is attempted during an inverter operation, or vice versa, the error message below will appear.
After stopping the inverter and pressing RESET , retry the write operation.

<DATA COPY>
30G11S-4
WRITE
INV RUNNING

2) Memory error
If a write operation is attempted while data has not been saved (i.e., no data) in the keypad panel data memory during the read mode or when the inverter type of data read by keypad panel is different from the inverter type to which data is to be written, the following error message will appear:

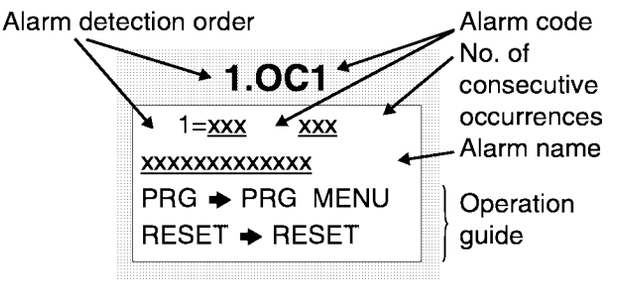
<DATA COPY>
WRITE
MEMORY ERROR

3) Verify error
During a data check (verify) operation, if data stored in the keypad panel differs from data stored in the inverter, the following error message is displayed to indicate the function No. The data check is suspended.
To continue the data check and check for other mismatching data, press FUNC DATA . To stop the data check and switch to another operation, press RESET .

<DATA COPY>
30G11S-4
VERIFY
ERR:F25
■■■■

4-3-14 Alarm mode

If an alarm occurs, the "Alarm screen" indicating the alarm contents is displayed. Use ∧ and ∨ to display alarm history and multiple alarms (if more than two alarms occur simultaneously).



Alarm detection order

Operation method		LED display	LCD display	Description
∧ ↑	∨ ↓	5.	5	No. 5 alarm
		4.	4	No. 4 alarm
		3.	3	No. 3 alarm
		2.	2	No. 2 alarm
		1.	1	No. 1 alarm (more than two alarms occurred)
		Blank	0	Latest alarm (only one alarm occurred/alarm released)
		Blank	-1	Previous alarm history
		Blank	-2	Alarm history before previous alarm
		Blank	-3	Alarm history two times before previous alarm

Alarm code: See Table 6-1-1

5 Function Selection

5-1 List of Function

F: Fundamental Functions

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting -- 22 kW	Factory setting 30 kW --	Change during operation	User Set value
F00	Data protection	F00 DATA PRTC	0, 1	-	-	0		no	
F01	Frequency command 1	F01 FREQ CMD 1	0 to 11	-	-	0		no	
F02	Operation method	F02 OPR METHOD	0, 1	-	-	0		no	
F03	Maximum frequency 1	F03 MAX Hz-1	50 to 400 Hz	Hz	1	50		no	
F04	Base frequency 1	F04 BASE Hz-1	25 to 400 Hz	Hz	1	50		no	
F05	Rated voltage 1 (at Base frequency 1)	F05 RATED V-1	0 V: (Output voltage proportional to source voltage) 320 to 480 V	V	1	400		no	
F06	Maximum voltage 1 (at Maximum frequency 1)	F06 MAX V-1	320 to 480 V	V	1	400		no	
F07	Acceleration time 1	F07 ACC TIME1	0.01 to 3600 s	s	0.01	6.0	20.0	yes	
F08	Deceleration time 1	F08 DEC TIME1							
F09	Torque boost 1	F09 TRQ BOOST1	0.0, 0.1 to 20.0	-	0.1	0.0		yes	
F10	Electronic thermal O/L relay for motor 1 (Select)	F10 ELCTRN OL1	0, 1, 2	-	-	1		yes	
F11	(Level)	F11 OL LEVEL1	INV rated current 20 to 135 %	A	0.01	Motor rated value		yes	
F12	(Thermal time constant)	F12 TIME CNST1	0.5 to 75.0 min	min	0.1	5.0	10.0	yes	
F13	Electronic thermal O/L relay (for braking resistor)	F13 DBR OL	[Up to 7.5 kW] 0, 1, 2	-	-	1		yes	
			[11 kW and above] 0			0		yes	

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting		Change during opera-tion	User Set value
						-- 22 kW	30 kW --		
F14	Restart mode after momentary power failure	F14 RESTART	0 to 5	-	-	0		no	
F15	Frequency limiter (High)	F15 H LIMITER	0 to 400 Hz	Hz	1	70		yes	
F16	(Low)	F16 L LIMITER				0			
F17	Gain (for freq set signal)	F17 FREQ GAIN	0.0 to 200.0 %	%	0.1	100.0		yes	
F18	Bias frequency	F18 FREQ BIAS	-400.0 to +400.0 Hz	Hz	0.1	0.0		yes	
F20	DC brake (Starting freq.)	F20 DC BRK Hz	0.0 to 60.0 Hz	Hz	0.1	0.0		yes	
F21	(Braking level)	F21 DC BRK LVL	0 to 100 %	%	1	0		yes	
F22	(Braking time)	F22 DC BRK t	0.0s (Inactive) 0.1 to 30.0 s	s	0.1	0.0		yes	
F23	Starting frequency (Freq.)	F23 START Hz	0.1 to 60.0 Hz	Hz	0.1	0.5		no	
F24	(Holding time)	F24 HOLDING t	0.0 to 10.0 s	s	0.1	0.0		no	
F25	Stop frequency	F25 STOP Hz	0.1 to 6.0 Hz	Hz	0.1	0.2		no	
F26	Motor sound (Carrier freq.)	F26 MTR SOUND	0.75 to 15 kHz (-- 55 kW) 0.75 to 10 kHz (75 kW --)	kHz	1	15 (-- 55 kW) 10 (75 kW --)		yes	
F27	(Sound tone)	F27 SOUND TONE	0 to 3	-	-	0		yes	
F30	FMA (Voltage adjust)	F30 FMA V-ADJ	0 to 200 %	%	1	100		yes	
F31	(Function)	F31 FMA FUNC	0 to 10	-	-	0		yes	
F33	FMP (Pulse rate)	F33 FMP PULSES	300 to 6000 p/s (full scale)	p/s	1	1440		yes	
F34	(Voltage adjust)	F34 FMP V-ADJ	0 %, 1 to 200 %	%	1	0		yes	
F35	(Function)	F35 FMP FUNC	0 to 10	-	-	0		yes	
F36	30RY operation mode	F36 30RY MODE	0, 1	-	-	0		no	
F40	Torque limiter1 (Driving)	F40 DRV TRQ 1	20 to 200 %, 999	%	1	180	150	yes	
F41	(Braking)	F41 BRK TRQ 1	0 %, 20 to 200 %, 999	%	1	150	100	yes	
F42	Torque vector control 1	F42 TRQVECTOR1	0, 1	-	-	0		no	

E: Extension Terminal Functions

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting -- 22 kW	Factory setting 30 kW --	Change during operation	User Set value
E01	X1 terminal function	E01 X1 FUNC	0 to 32	-	-	0		no	
E02	X2 terminal function	E02 X2 FUNC				1		no	
E03	X3 terminal function	E03 X3 FUNC				2		no	
E04	X4 terminal function	E04 X4 FUNC				3		no	
E05	X5 terminal function	E05 X5 FUNC				4		no	
E06	X6 terminal function	E06 X6 FUNC				5		no	
E07	X7 terminal function	E07 X7 FUNC				6		no	
E08	X8 terminal function	E08 X8 FUNC				7		no	
E09	X9 terminal function	E09 X9 FUNC				8		no	
E10	Acceleration time 2	E10 ACC TIME2	0.01 to 3600 s	s	0.01	10.00	100.00	yes	
E11	Deceleration time 2	E11 DEC TIME2				10.00	100.00	yes	
E12	Acceleration time 3	E12 ACC TIME3				15.00	100.00	yes	
E13	Deceleration time 3	E13 DEC TIME3				15.00	100.00	yes	
E14	Acceleration time 4	E14 ACC TIME4				3.00	100.00	yes	
E15	Deceleration time 4	E15 DEC TIME4				3.00	100.00	yes	
E16	Torque limiter 2 (Driving)	E16 DRV TRQ 2	20 to 200 %, 999	%	1	180	150	yes	
E17	(Braking)	E17 BRK TRQ 2	0 %, 20 to 200 %, 999	%	1	150	100	yes	
E20	Y1 terminal function	E20 Y1 FUNC	0 to 34	-	-	0		no	
E21	Y2 terminal function	E21 Y2 FUNC				1		no	
E22	Y3 terminal function	E22 Y3 FUNC				2		no	
E23	Y4 terminal function	E23 Y4 FUNC				7		no	
E24	Y5A, Y5C terminal func.	E24 Y5 FUNC				10		no	

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting -- 22 kW	Factory setting 30 kW --	Change during opera-tion	User Set value
E25	Y5 RY operation mode	E25 Y5RY MODE	0,1	-	1	0		no	
E30	FAR function signal (Hysteresis)	E30 FAR HYSTR	0.0 to 10.0 Hz	Hz	0.1	2.5		yes	
E31	FDT1 function signal (Level)	E31 FDT1 LEVEL	0 to 400 Hz	Hz	1	50		yes	
E32	(Hysteresis)	E32 FDT1 HYSTR	0.0 to 30.0 Hz	Hz	0.1	1.0		yes	
E33	OL1 function signal (Mode select)	E33 OL1 WARNING	0: Thermal calculation 1: Output current	-	-	0		yes	
E34	(Level)	E34 OL1 LEVEL	5 to 200 %	A	0.01	Motor rated value		yes	
E35	(Timer)	E35 OL1 TIMER	0.1 to 60.0 s	s	0.1	10.0		yes	
E36	FDT2 function (Level)	E36 FDT2 LEVEL	0 to 400 Hz	Hz	1	50		yes	
E37	OL2 function (Level)	E37 OL2 LEVEL	5 to 200 %	A	0.01	Motor rated value		yes	
E40	Display coefficient A	E40 COEF A	-999.00 to 999.00	-	0.01	0.01		yes	
E41	Display coefficient B	E41 COEF B	-999.00 to 999.00	-	0.01	0.00		yes	
E42	LED Display filter	E42 DISPLAY FL	0.0 to 5.0 s	s	0.1	0.5		yes	
E43	LED Monitor (Function)	E43 LED MNTR	0 to 12	-	-	0		yes	
E44	(Display at STOP mode)	E44 LED MNTR2	0, 1	-	-	0		yes	
E45	LCD Monitor (Function)	E45 LCD MNTR	0, 1	-	-	0		yes	
E46	(Language)	E46 LANGUAGE	0 to 5	-	-	1		yes	
E47	(Contrast)	E47 CONTRAST	0 (soft) to 10 (hard)	-	-	5		yes	

C: Control Functions of Frequency

C01	Jump frequency 1	C01 JUMP Hz 1	0 to 400 Hz	Hz	1	0		yes	
C02	Jump frequency 2	C02 JUMP Hz 2				0		yes	
C03	Jump frequency 3	C03 JUMP Hz 3				0		yes	
C04	Jump frequency Hysteresis	C04 JUMP HYSTR	0 to 30 Hz	Hz	1	3		yes	

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting -- 22 kW	Factory setting 30 kW --	Change during opera-tion	User Set value
	Multistep frequency setting								
C05	(Freq. 1)	C05 MULTI Hz-1	0.00 to 400.00 Hz	Hz	0.01	0.00		yes	
C06	(Freq. 2)	C06 MULTI Hz-2				0.00		yes	
C07	(Freq. 3)	C07 MULTI Hz-3				0.00		yes	
C08	(Freq. 4)	C08 MULTI Hz-4				0.00		yes	
C09	(Freq. 5)	C09 MULTI Hz-5				0.00		yes	
C10	(Freq. 6)	C10 MULTI Hz-6				0.00		yes	
C11	(Freq. 7)	C11 MULTI Hz-7				0.00		yes	
C12	(Freq. 8)	C12 MULTI Hz-8				0.00		yes	
C13	(Freq. 9)	C13 MULTI Hz-9				0.00		yes	
C14	(Freq. 10)	C14 MULTI Hz10				0.00		yes	
C15	(Freq. 11)	C15 MULTI Hz11				0.00		yes	
C16	(Freq. 12)	C16 MULTI Hz12				0.00		yes	
C17	(Freq. 13)	C17 MULTI Hz13				0.00		yes	
C18	(Freq. 14)	C18 MULTI Hz14				0.00		yes	
C19	(Freq. 15)	C19 MULTI Hz15				0.00		yes	
C20	JOG frequency	C20 JOG Hz	0.00 to 400.00 Hz	Hz	0.01	5.00		yes	
C21	PATTERN operation (Mode select)	C21 PATTERN	0, 1, 2	-	-	0		no	
C22	(Stage 1)	C22 STAGE 1	Operation time: 0.00 to 6000 s F1 to F4 and R1 to R4	s	0.01	0.00 F1		yes	
C23	(Stage 2)	C23 STAGE 2				0.00 F1		yes	
C24	(Stage 3)	C24 STAGE 3				0.00 F1		yes	
C25	(Stage 4)	C25 STAGE 4				0.00 F1		yes	
C26	(Stage 5)	C26 STAGE 5				0.00 F1		yes	
C27	(Stage 6)	C27 STAGE 6				0.00 F1		yes	
C28	(Stage 7)	C28 STAGE 7				0.00 F1		yes	
C30	Frequency command 2	C30 FREQ CMD 2	0 to 11	-	-	2		no	
C31	Bias (terminal [12])	C31 BIAS 12	-100.0 to +100.0 %	%	0.1	0.0		yes	
C32	Gain (terminal [12])	C32 GAIN 12	0.0 to +200.0 %	%	0.1	100.0		yes	
C33	Analog setting signal filter	C33 REF FILTER	0.00 to 5.00 s	s	0.01	0.05		yes	

P: Motor Parameters

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting		Change during opera-tion	User Set value
						-- 22 kW	30 kW --		
P01	Number of motor 1 poles	P01 M1 POLES	2 to 14	pole	2	4		no	
P02	Motor 1 (Capacity)	P02 M1-CAP	Up to 22 kW: 0.01 to 45 kW 30 kW and above: 0.01 to 500 kW	kW	0.01	Motor Capacity		no	
P03	(Rated current)	P03 M1-Ir	0.00 to 2000 A	A	0.01	Motor rated value		no	
P04	(Tuning)	P04 M1 TUN1	0, 1, 2	-	-	0		no	
P05	(On-line Tuning)	P05 M1 TUN2	0, 1	-	-	0		no	
P06	(No-load current)	P06 M1-Io	0.00 to 2000 A	A	0.01	Motor rated value		no	
P07	(%R1 setting)	P07 M1-%R1	0.00 to 50.00 %	%	0.01	Fuji standard rated value		yes	
P08	(%X setting)	P08 M1-%X	0.00 to 50.00 %	%	0.01	Fuji standard rated value		yes	
P09	Slip compensation control	P09 SLIP COMP1	0.00 to 15.00 Hz	Hz	0.01	0.00		yes	

H: High Performance Functions

H03	Data initializing	H03 DATA INIT	0, 1	-	-	0	no	
H04	Auto-reset (Times)	H04 AUTO-RESET	0, 1 to 10 times	-	1	0	yes	
H05	(Reset interval)	H05 RESET INT	2 to 20 s	s	1	5	yes	
H06	Fan stop operation	H06 FAN STOP	0, 1	-	-	0	yes	
H07	ACC/DEC pattern (Mode select)	H07 ACC PTN	0, 1, 2, 3	-	-	0	no	
H08	Rev. phase sequence lock	H08 REV LOCK	0, 1	-	-	0	no	
H09	Start mode	H09 START MODE	0, 1, 2	-	--	0	no	
H10	Energy-saving operation	H10 ENERGY SAV	0, 1	-	-	0	yes	
H11	DEC mode	H11 DEC MODE	0, 1	-	-	0	yes	
H12	Instantaneous OC limiting	H12 INST CL	0, 1	-	-	1	no	

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting		Change during opera-tion	User Set value
						-- 22 kW	30 kW --		
H13	Auto-restart (Restart time)	H13 RESTART t	0.1 to 10.0 s	s	0.1	0.1	0.5	no	
H14	(Freq. fall rate)	H14 FALL RATE	0.00 to 100.00 Hz/s	Hz/s	0.01	10.00		yes	
H15	(Holding DC voltage)	H15 HOLD V	400 to 600 V	V	1	470 V		yes	
H16	(OPR command selfhold time)	H16 SELFHOLD t	0.0 to 30.0s, 999	s	0.1	999		no	
H18	Torque control	H18 TRQ CTRL	0, 1, 2	-	-	0		no	
H19	Active drive	H19 AUT RED	0, 1	-	-	0		yes	
H20	PID control (Mode select)	H20 PID MODE	0, 1, 2	-	-	0		no	
H21	(Feedback signal)	H21 FB SIGNAL	0, 1, 2, 3	-	-	1		no	
H22	(P-gain)	H22 P-GAIN	0.01 to 10.00 times	-	0.01	0.10		yes	
H23	(I-gain)	H23 I-GAIN	0.0, 0.1 to 3600 s	s	0.1	0.0		yes	
H24	(D-gain)	H24 D-GAIN	0.00s , 0.01 to 10.0 s	s	0.01	0.00		yes	
H25	(Feedback filter)	H25 FB FILTER	0.0 to 60.0 s	s	0.1	0.5		yes	
H26	PTC thermistor (Mode select)	H26 PTC MODE	0, 1			0		yes	
H27	(level)	H27 PTC LEVEL	0.00 to 5.00 V	V	0.01	1.60		yes	
H28	Droop operation	H28 DROOP	-9.9 to 0.0 Hz	Hz	0.1	0.0		yes	
H30	Serial link (Function select)	H30 LINK FUNC	0, 1, 2, 3	-	-	0		yes	
H31	RS485 (Address)	H31 ADDRESS	1 to 31	-	1	1		no	
H32	(Mode select on no response error)	H32 MODE ON ER	0, 1, 2, 3	-	-	0		yes	
H33	(Timer)	H33 TIMER	0.0 to 60.0 s	s	0.1	2.0		yes	
H34	(Baud rate)	H34 BAUD RATE	0, 1, 2, 3, 4	-	-	1		yes	
H35	(Data length)	H35 LENGTH	0, 1	-	-	0		yes	
H36	(Parity check)	H36 PARITY	0, 1, 2	-	-	0		yes	
H37	(Stop bits)	H37 STOP BITS	0 (2 bit), 1 (1 bit)	-	-	0		yes	
H38	(No response error detection time)	H38 NO RES t	0 (No detection), 1 to 60 s	s	1	0		yes	
H39	(Response interval)	H39 INTERVAL	0.00 to 1.00 s	s	0.01	0.01		yes	

A: Alternative Motor Parameters

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting		Change during operation	User Set value
						-- 22 kW	30 kW --		
A01	Maximum frequency 2	A01 MAX Hz-2	50 to 400 Hz	Hz	1	50		no	
A02	Base frequency 2	A02 BASE Hz-2	25 to 400 Hz	Hz	1	50		no	
A03	Rated voltage 2 (at Base frequency 2)	A03 RATED V-2	0, 320 to 480 V	V	1	400		no	
A04	Maximum voltage 2	A04 MAX V-2	320 to 480 V	V	1	400		no	
A05	Torque boost2	A05 TRQ BOOST2	0.0, 0.1 to 20.0	-	-	0.0		yes	
A06	Electronic thermal O/L relay for motor 2 (Select)	A06 ELCTRN OL2	0, 1, 2	-	-	1		yes	
A07	(Level)	A07 OL LEVEL2	INV rated current 20 % to 135 %	A	0.01	Motor rated value		yes	
A08	(Thermal time constant)	A08 TIME CNST2	0.5 to 75.0 min	min	0.1	5.0	10.0	yes	
A09	Torque vector control 2	A09 TRQVECTOR2	0, 1	-	-	0		no	
A10	Number of motor-2 poles	A10 M2 POLES	2 to 14 poles	pole	2	4		no	
A11	Motor 2 (Capacity)	A11 M2-CAP	Up to 22 kW:0.01 to 45 kW 30 kW and above: 0.01 to 500 kW	kW	0.01	Motor capacity		no	
A12	(Rated current)	A12 M2-Ir	0.00 to 2000 A	A	0.01	Motor rated value		no	
A13	(Tuning)	A13 M2 TUN1	0, 1, 2	-	-	0		no	
A14	(On-line Tuning)	A14 M2 TUN2	0, 1	-	-	0		no	
A15	(No-load current)	A15 M2-Io	0.00 to 2000 A	A	0.01	Motor rated value		no	
A16	(%R1 setting)	A16 M2-%R1	0.00 to 50.00 %	%	0.01	Standard rated value		yes	
A17	(%X setting)	A17 M2-%X	0.00 to 50.00 %	%	0.01	Standard rated value		yes	
A18	(Slip compensation control 2)	A18 SLIP COMP2	0.00 to 15.00 Hz	Hz	0.01	0.00		yes	

5-2 Function Explanation

F: Fundamental functions

F00 Data protection

- Setting can be made so that a set value cannot be changed by keypad panel operation.

F	0	0	D	A	T	A		P	R	T	C	

Set value 0 : The data can be changed.
1 : The data cannot be changed.

[Setting procedure]

0 to 1: Press the STOP and ⋀ keys simultaneously to change the value from 0 to 1, then press the FUNC DATA to validate the change.

1 to 0: Press the STOP and ⋁ keys simultaneously to change the value from 1 to 0, then press the FUNC DATA key to validate the change.

F01 Frequency Reference 1

- This function selects the frequency setting method.

Related functions:
E01 to **E09**, **C30**

F	0	1	F	R	E	Q		C	M	D	1	

0: Setting by keypad panel operation (⋀ ⋁ key)
1: Setting by voltage input (terminal [12] (0 to +10 V) + terminal [V2](0 to +10 V))
2: Setting by current input (terminal [C1] (4 to 20 mA)).
3: Setting by voltage input + current input (terminal [12] +terminal [C1]) (-10 to +10 V + 4 to 20 mA).
4: Reversible operation with polarity (terminal [12] (-10 to +10 V))
5: Reversible operation with polarity (terminal [12]+[V2]+[V1](Option[1)]) (-10 to +10 V))
6: Inverse mode operation (terminal [12] +[V2] (+10 V to 0))

Related functions:
E01 to **E09** (Set value **21**)

7: Inverse mode operation (terminal [C1] (20 to 4 mA))

Related functions:
E01 to **E09** (Set value **21**)

8: Setting by UP/DOWN control mode 1 (initial value = 0) Motorized Pot. (terminals [UP] and [DOWN])

Related functions:
E01 to **E09** (Set value **17, 18**)

9: Setting by UP/DOWN control mode 2 (initial value = last final value) Motorized Pot. (terminals [UP] and [DOWN])
See the function explanation of E01 to E09 for details.

Related functions:
E01 to **E09** (Set value **17, 18**)

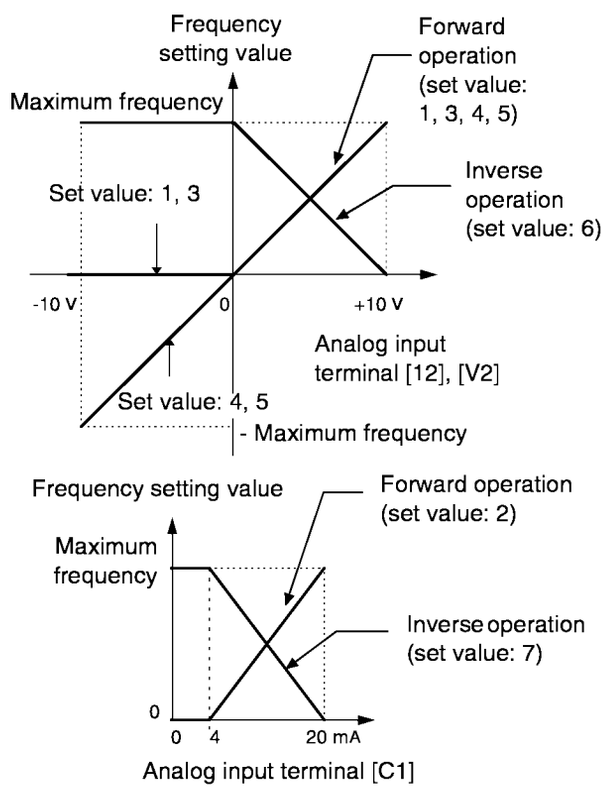
10:Setting by pattern operation.
See the function explanation C21 to C28 for details.

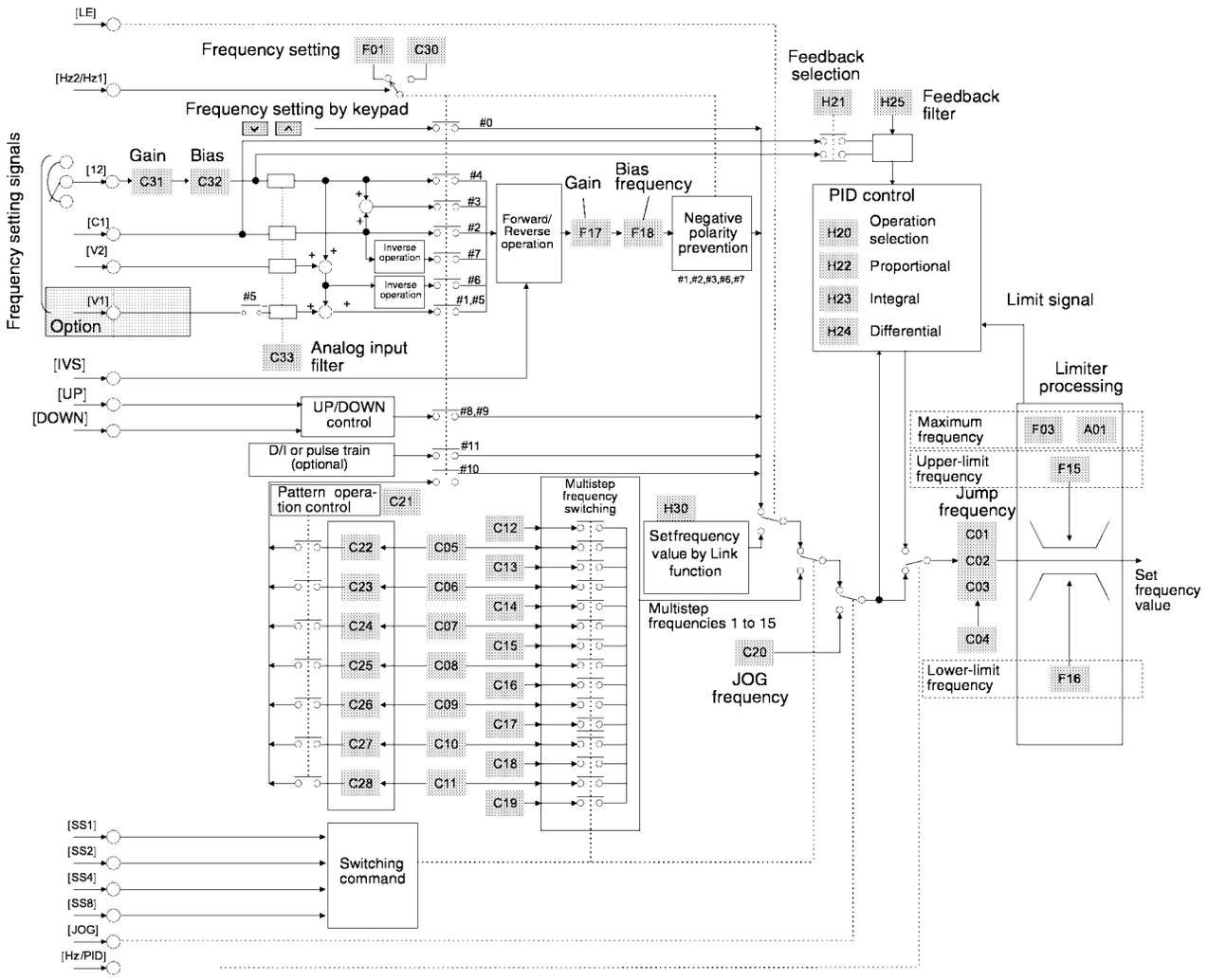
Related functions:
C21 to **C28**

11:Setting by digital input or pulse train input. Optional[1)].

1) For details, see the instruction manual on options.

Forward / Inverse operation





Frequency setting block diagram

F02 Operation method

- This function sets the operation command input method.

F	0	2	O	P	R		M	E	T	H	O	D

Set value

0: Keypad operation
(FWD REV STOP keys).
Press the FWD for forward operation.
Press the REV for reverse operation.
Press the STOP for deceleration to a stop.
Input from terminals [FWD] and [REV] is ignored.

1: Operation by external input
(terminals [FWD] and [REV]).

This function can only be changed when terminals FWD and REV are open.
REMOTE/LOCAL switching from the keypad panel automatically changes the set value of this function.

F03 Maximum output frequency 1

- This function sets the maximum output frequency for motor 1.

F	0	3	M	A	X		H	z	-	1		

Setting range: 50 to 400 Hz

Setting a value higher than the rated value of the device to be driven may damage the motor or machine. Match the rating of the device.

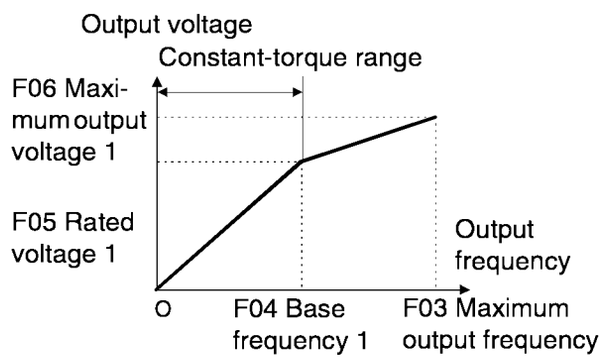
F04 Base frequency 1

- This function sets the maximum output frequency in the constant-torque range of motor 1 or the output frequency at the rated output voltage. Match the rating of the motor.

F	0	4	B	A	S	E		H	z	-	1	

Setting range: 25 to 400 Hz

Note: When the set value of base frequency 1 is higher than that of maximum output frequency 1, the output voltage does not increase to the rated voltage because the maximum frequency limits the output frequency.



F05 Rated voltage 1

- This function sets the rated value of the voltage output to motor 1. Note that a voltage greater than the supply (input) voltage cannot be output.

F	0	5	R	A	T	E	D		V	-	1	

Setting range: 0, 320 to 480 V

Value 0 terminates operation of the voltage regulation function, thereby resulting in the output of a voltage proportional to the supply voltage.

Note: When the set value of rated voltage 1 exceeds maximum output voltage 1, the output voltage does not increase to the rated voltage because the maximum output voltage limits the output voltage.

F06 Maximum output voltage 1

- This function sets the maximum value of the voltage output for motor 1. Note that a voltage higher than the supply (input) voltage cannot be output.

F	0	6	M	A	X		V	-	1			

Setting range: 320 to 480 V

F07 Acceleration time 1
F08 Deceleration time 1

- This function sets the acceleration time for the output frequency from startup to maximum frequency and the deceleration time from maximum frequency to operation stop.

F	0	7	A	C	C		T	I	M	E	1	
F	0	8	D	E	C		T	I	M	E	1	

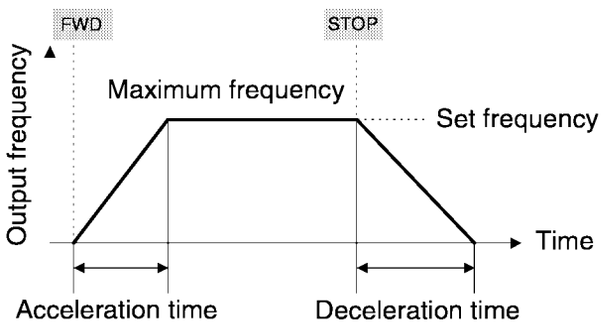
Setting range

Acceleration time 1:
0.01 to 3,600 seconds

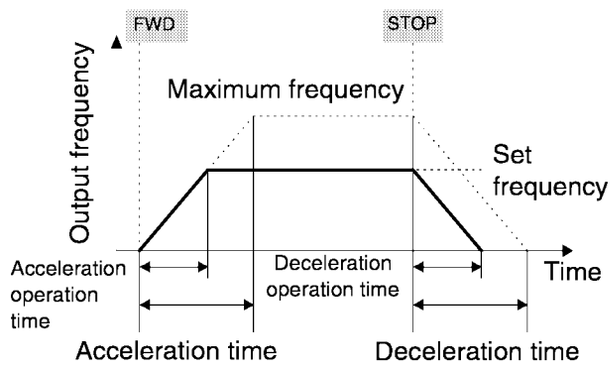
Deceleration time 1:
0.01 to 3,600 seconds

Acceleration and deceleration times are represented by the three most significant digits, thereby the setting of three high-order digits can be set.
Set acceleration and deceleration times with respect to maximum frequency. The relationship between the set frequency value and acceleration/deceleration times is as follows:

Set frequency = maximum frequency
The actual operation time matches the set value.



Set frequency < maximum frequency
The actual operation time differs from the set value.
Acceleration (deceleration) operation time = set value x (set frequency/maximum frequency)



Note: If the set acceleration and deceleration times are too short even though the resistance torque and moment of inertia of the load are great, the torque limiting function or stall prevention function becomes activated, thereby prolonging the operation time beyond that stated above.

F09 Torque boost 1

- This is a motor 1 function. The following can be selected:

F	0	9	T	R	Q		B	O	O	S	T	1

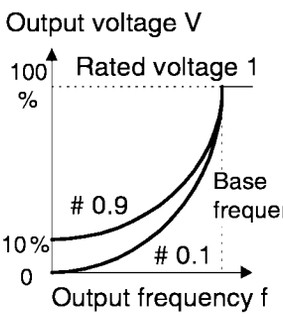
-- Selection of load characteristics such as automatic torque boost, square law reduction torque load, proportional torque load, constant torque load.

-- Enhancement of torque (V/f characteristics), which is lowered during low-speed operation. Insufficient magnetic flux of the motor due to a voltage drop in the low-frequency range can be compensated.

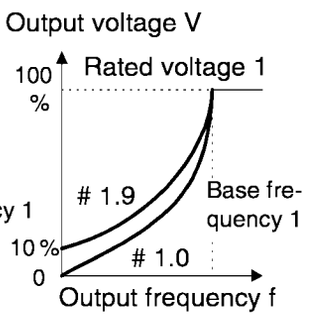
Setting range	Characteristics selected
0.0	Automatic torque boost characteristic where the torque boost value of a constant torque load (a linear change) is automatically adjusted.
0.1 to 0.9	Square law reduction torque for fan and pump loads.
1.0 to 1.9	Proportional torque for middle class loads between square law reduction torque and constant torque (linear change)
2.0 to 20.0	Constant torque (linear change)

- Torque characteristics

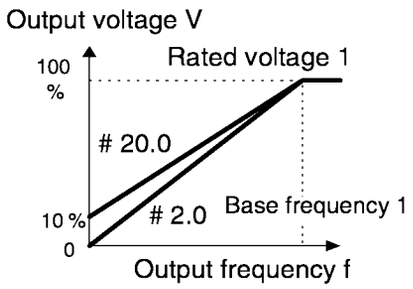
Square law reduction torque



Proportional torque



Constant torque



Note: As a large torque boost value creates overexcitation in the low-speed range, continued operation may cause the motor to overheating. Check the characteristics of the driven motor.

F10 Electronic thermal O/L relay for motor 1 (Select)

F11 Electronic thermal O/L relay for motor 1 (Level)

F12 Electronic thermal O/L relay for motor 1 (Thermal time constant)

The electronic thermal O/L relay manages the output frequency, output current, and operation time of the inverter to prevent the motor from overheating when 150 % of the set current value flows for the time set by F12 (thermal time constant).

- This function specifies whether to operate the electronic thermal O/L relay and selects the target motor. When a general-purpose motor is selected, the operation level is lowered in the low speed range according to the cooling characteristics of the motor.

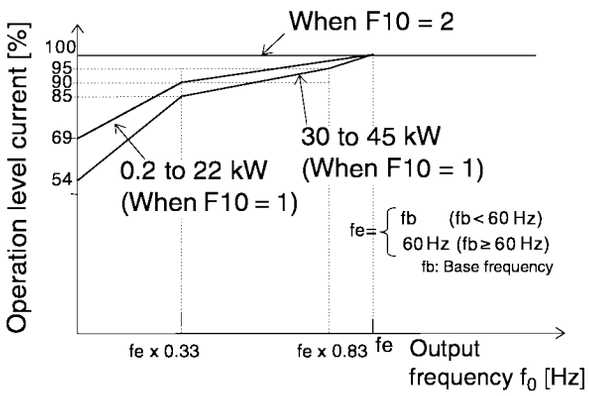
F	1	0	E	L	C	T	R	N		O	L	1

Set value 0: Inactive
1: Active
(for general-purpose motor)
2: Active (for inverter motor)

- This function sets the operation level (current value) of the electronic thermal O/L relay. Enter a value from 1 to 1.1 times the current rating value of the motor.

F	1	1	O	L		L	E	V	E	L	1	

The setting range is 5 to 135 % of the rated current of the inverter.

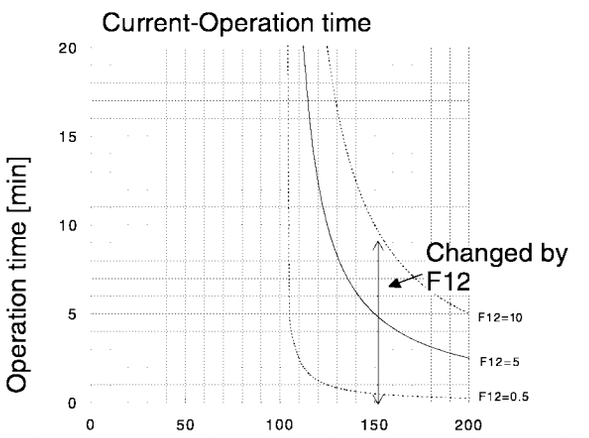


Operation level current and output

- The time from when 150 % of the operation level current flows continuously to when the electronic thermal O/L relay activates can be set.

F	1	2	T	I	M	E		C	N	S	T	1

The setting range is 0.5 to 75.0 minutes (in 0.1 minute steps).



F13 Electronic thermal O/L relay (for braking resistor)

- This function controls the frequent use and continuous operating time of the braking resistor to prevent the resistor from overheating.

F	1	3	D	B	R		O	L				

Inverter capacity	Operation
7.5 kW or less	0: Inactive,(own resistors + own protection) 1: Active (built-in braking resistor) 2: Active ,(factory supplied external unit) (external braking resistor)
11 kW or more	0: Inactive

F14 Restart after momentary power failure (operation selection)

- This function selects operation if a momentary power failure occurs.
  The function for detecting power failure and activating protective operation (i.e., alarm output, alarm display, inverter output cutoff) for undervoltage can be selected.
  The automatic restart function (for automatically restarting a coasting motor without stopping) when the supply voltage is recovered can also be selected.

F	1	4	R	E	S	T	A	R	T			

Setting range: 0 to 5

The following table lists the function details.

Set value	Function name	Operation at power failure	Operation at power recovery
0	Inactive (immediate inverter trip)	If undervoltage is detected, the drive will immediately trip and an undervoltage fault (LU) is displayed. The drive output stops and the motor will coast to a stop.	The drive operation is not automatically restarted. Input a reset command and operation command to restart operation.
1	Inactive (inverter trip at recovery)	If undervoltage is detected, the drive output stops and the motor will immediately coast to a stop. A drive fault is not activated	An undervoltage fault (LU) is activated at power recovery. Drive operation is not automatically restarted. Input a reset command to restart operation.
2	Inactive (inverter trip after deceleration to a stop at power failure)	When the DC bus voltage reaches the continue operation voltage level (H15), a controlled deceleration to a stop occurs. The inverter collects the inertia energy of the load to maintain the DC bus voltage and controls the motor until it stops, then an undervoltage fault (LU) is activated. The drive will automatically decrease the deceleration time if necessary. If the amount of inertia energy from the load is small, and the undervoltage level is achieved before the motor stops, the undervoltage fault is immediately activated and the motor will coast to a stop.	The drive operation is not automatically restarted. Input a reset command and operation command to restart operation.

Set value	Function name	Operation at power failure	Operation at power recovery
3	Active (operation ride through, for high-inertia loads)	When the DC bus voltage reaches the continue operation voltage level (H15), energy is collected from the inertia of the load to maintain the DC bus voltage and extend the ride through time. The drive will automatically adjust the deceleration rate to maintain DC bus voltage level. If undervoltage is detected, the protective function is not activated, but drive output stops and the motor coast to a stop.	Operation is automatically restarted. For power recovery during ride-through the drive will accelerate directly to the original frequency. If undervoltage is detected, operation automatically restarts with the frequency at the time that the undervoltage is detected.
4	Active (restart with the frequency at power failure)	If undervoltage is detected, the protective function is not activated. The drive output stops and the motor will coast to a stop.	Operation is automatically restarted with the frequency at power failure.
5	Active (restart with the start frequency, for low-inertia loads)	If undervoltage is detected, the protective function is not activated, but output stops.	Operation is automatically restarted with the frequency set by F23, “Starting frequency.”

Function codes H13 to H16 are provided to control a restarting operation after momentary power failure. These functions should be understood and used.

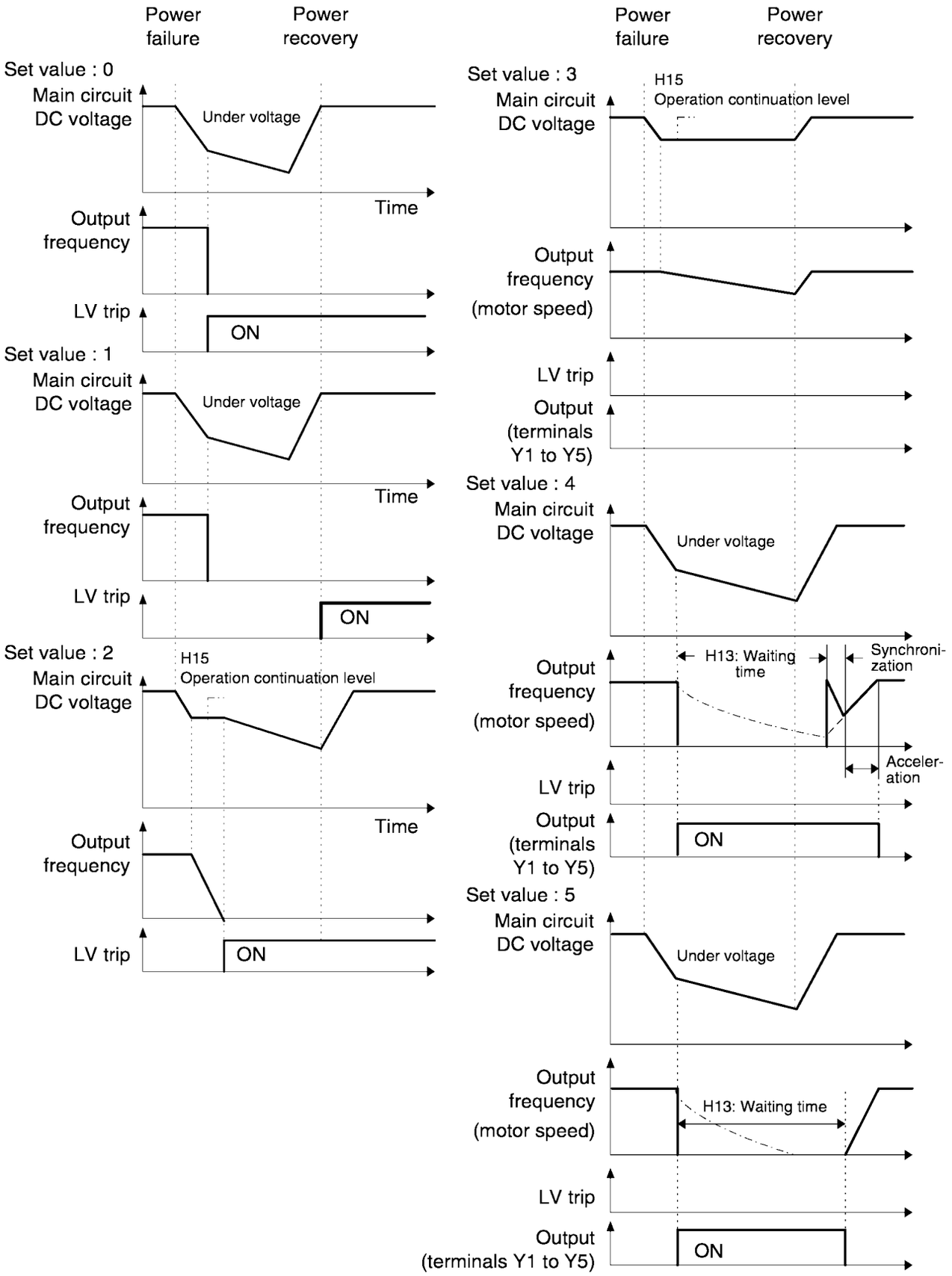
The pick-up (speed search) function can also be selected as a method of restarting when power is recovered following a momentary failure. (For setting details, see function code H09.)

The pick-up function searches for the speed of the coasting motor to restart the motor without subjecting it to excessive shock.

In a high-inertia system, the reduction in motor speed is minimal even when the motor is coasting.

A speed searching time is required when the pick-up function is active. In such a case, the original frequency may be recovered sooner when the function is inactive and the operation restarted with the frequency prior to the momentary power failure.

The pick-up function works in the range of 5 to 120Hz. If the detected speed is outside this range, restart the motor using the regular restart function.



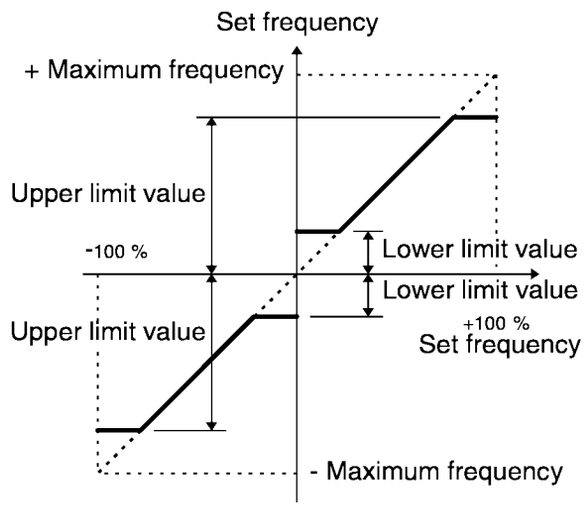
Note: Dotted-dashed lines indicate motor speed.

F15 Frequency limiter (High)
F16 Frequency limiter (Low)

- This function sets the upper and lower limits for the setting frequency.

F	**1**	**5**	H		L	I	M	I	T	E	R
F	**1**	**6**	L		L	I	M	I	T	E	R

Set values: 0 to 400 Hz



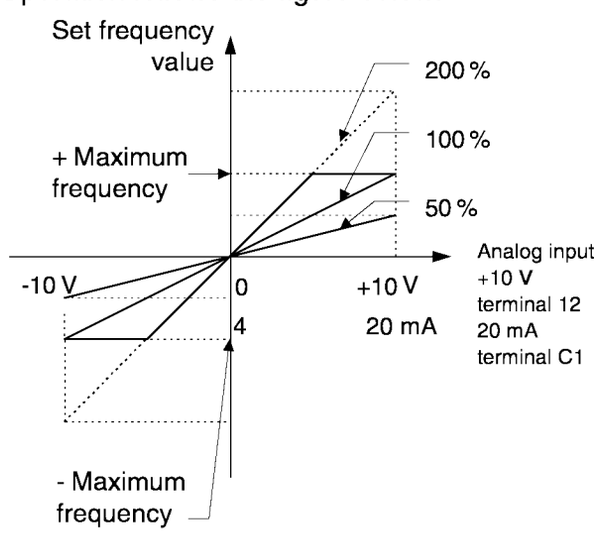
- The inverter output starts with the start frequency when operation begins, and stops with the stop frequency when operation ends.
- If the upper limit value is less than the lower limit value, the upper limit value overrides the lower limit value.

F17 Gain

- This function sets the rate of the set frequency value to analog input.

F	**1**	**7**	F	R	E	Q		G	A	I	N

Operation follows the figure below.

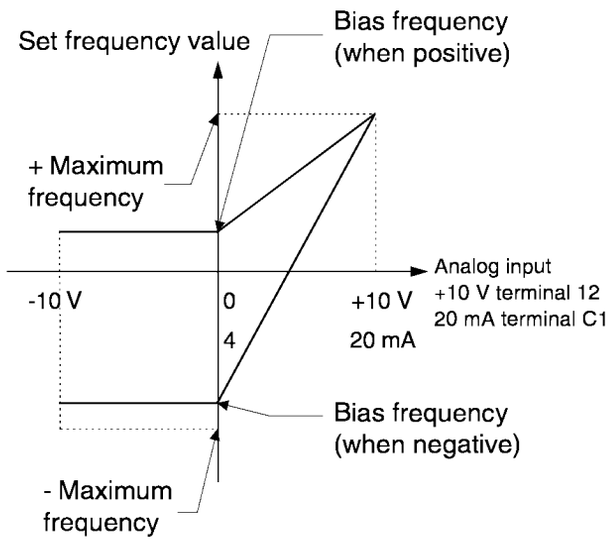


F18 Bias frequency

- This function adds a bias frequency to the set frequency value to analog input.

F	**1**	**8**	F	R	E	Q		B	I	A	S

The operation follows the figure below.
When the bias frequency is higher than the maximum frequency or lower than the - maximum frequency, it is limited to the maximum or - maximum frequency.



When this function is used with function F17 (bias frequency), the gain set with this function is valid and the gained frequency is biased.

F20 DC brake (Starting frequency)
F21 DC brake (Braking level)
F22 DC brake (Braking time)

- Starting frequency: This function sets the frequency with which to start a DC injection brake to decelerate the motor to a stop.

F	**2**	**0**	D	C		B	R	K		H	z

Set values: 0 to 60 Hz

- Operation level: This function sets the output current level when a DC injection brake is applied. Set a percentage of inverter rated output current in 1 % steps.

F	2	1	D	C		B	R	K		L	V	L

Set values: 0 to 100 %

- Time: This function sets the time of a DC injection brake operation.

F	2	2	D	C		B	R	K		t		

Set value 0.0: Inactive
0.1 to 30.0 seconds

CAUTION
Do not use the inverter brake function for mechanical holding.
Injury may result.

5

F23 Starting frequency (frequency)
F24 Starting frequency (Holding time)
F25 Stop frequency

The starting frequency can be set to reserve the torque at startup and can be sustained until the magnetic flux of the motor is being established.

- Frequency: This function sets the frequency at startup.

F	2	3	S	T	A	R	T		H	z		

Set values: 0.1 to 60 Hz

- Holding time: This function sets the holding time during which the start frequency is sustained at startup.

F	2	4	H	O	L	D	I	N	G		t	

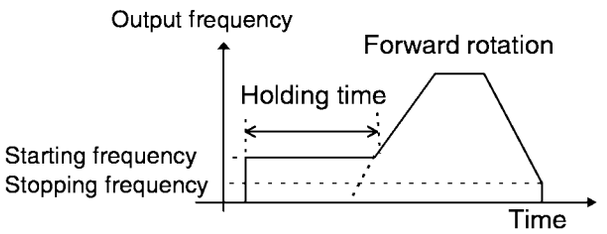
Set values: 0.1 to 10.0 seconds

- The holding time does not apply at the time of switching between forward and reverse.
- The holding time is not included in the acceleration time.
- The holding time also applies when pattern operation (C21) is selected. The holding time is included in the timer value.

- This function sets the frequency at stop.

F	2	5	S	T	O	P		H	z			

Set values: 0.0 to 6.0 Hz



The operation does not start when the setting frequency is less than the stopping frequency.

F26 Motor sound (carrier frequency)

- This function adjusts the carrier frequency, correct adjustment of which prevents resonance with the machine system, reduces motor and inverter noise, and also reduces leakage current from output circuit wiring.

F	2	6	M	T	R		S	O	U	N	D	

Series	Nominal applied motor	Setting range
G11S	55 kW or less	0.75 to 15 kHz
	75 kW or more	0.75 to 10 kHz

Carrier frequency	Low	High
Motor noise	High	Low
Output current waveform	Bad	Good
Leakage current	Small amount	Large amount
Noise occurrence	Extremely low	High

Notes:

1. Reducing the set value adversely affects the output current waveform (i.e., higher harmonics), increases motor loss, and raises motor temperature. For example, at 0.75 kHz, reduce the motor torque by about 15 %.
2. Increasing the set value increases inverter loss and raises inverter temperature.

F27 Motor sound (sound tone)

- The tone of motor noise can be altered when the carrier frequency is 7 kHz or lower. Use this function as required.

F	2	7	M	T	R		T	O	N	E		

Set values: 0, 1, 2, 3

F30 FMA (Voltage adjust)

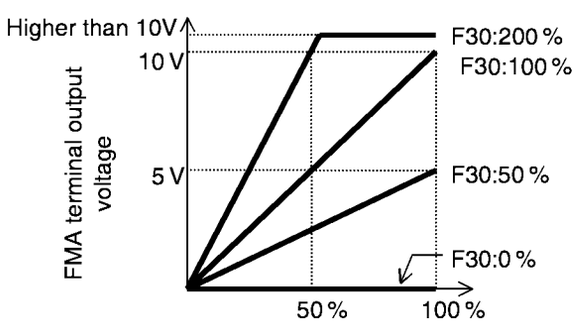
F31 FMA (Function)

Monitor data (e.g.,output frequency, output current) can be output to terminal FMA as a DC voltage. The amplitude of the output can also be adjusted.

- This function adjusts the voltage value of the monitor item selected in F31 when the monitor amount is 100 %. A value from 0 to 200 % can be set in 1 % steps.

F	3	0	F	M	A		V	-	A	D	J	

Set values: 0 to 200 %



- This function selects the monitor item to be output to terminal FMA.

F	3	1	F	M	A		F	U	N	C		

Set value	Monitor item	Definition of 100 % monitor amount
0	Output frequency 1 (before slip compensation)	Maximum output frequency
1	Output frequency 2 (after slip compensation)	Maximum output frequency
2	Output current	Rated output current of inverter x 2
3	Output voltage	400 V series: 500 V
4	Output torque	Rated torque of motor x 2
5	Load rate	Rated load of motor x 2
6	Power consumption	Rated output of inverter x 2
7	PID feedback amount	Feedback amount of 100 %
8	PG feedback amount (only when option is installed)	Synchronous speed at maximum frequency
9	DC link circuit voltage	400 V series: 1,000 V
10	Universal AO	0 to 10 V output through communication and not related to inverter operation.

F33 FMP (Pulse rate)

F34 FMP (Voltage adjust)

F35 FMP (Function)

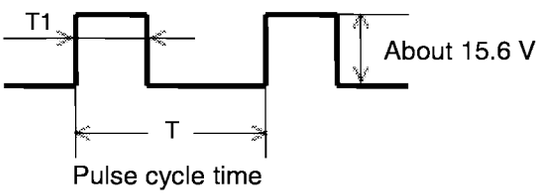
Monitor data (e.g., output frequency, output current) can be output to terminal FMP as pulse voltage. Monitor data can also be sent to an analog meter as average voltage.

When sending data to a digital counter or other instrument as pulse output, set the pulse rate in F33 to any value and the voltage in F34 to 0 %. When data is sent to an analog meter or other instrument as average voltage, the voltage value set in F34 determines the average voltage and the pulse rate in F33 is fixed to 2670 (p/s).

- This function sets the pulse frequency of the monitor item selected in F35 within a range of 300 to 6000 (p/s) in 1 p/s steps.

F	3	3	F	M	P		P	U	L	S	E	S

Set values: 300 to 6,000 p/s



Pulse frequency (p/s) = 1/T
Duty (%) = T1/T x 100
Average voltage (V) = 15.6 x T1/T

- This function sets the average voltage of pulse output to terminal FMP.

F	3	4	F	M	P		V	-	A	D	J	

Set value

0 %: The pulse frequency varies depending on the monitor amount of the monitor item selected in F35.
(The maximum value is the value set in F33.)

1 to 200 %:
Pulse frequency is fixed at 2,670 p/s. The average voltage of the monitor item selected in F35 when the monitor amount is 100 % is adjusted in the 1 to 200 % range (1 % steps).
(The pulse duty varies.)

- This function selects the monitor item to be output to terminal FMP.

F	3	5	F	M	P		F	U	N	C		

The set value and monitor items are the same as those of F31.

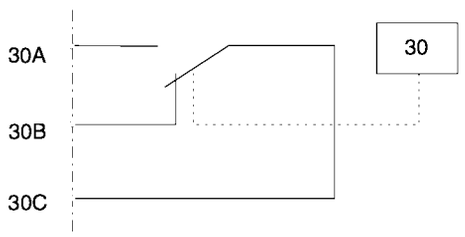
F36 30Ry operation mode

- This function specifies whether to activate (excite) the alarm output relay (30Ry) for any fault at normal or alarm status.

F	3	6	3	0	R	Y		M	O	D	E	

Set value	Operation
0	At normal 30A - 30C: OPEN, 30B - 30C: CLOSED At tripped 30A - 30C: CLOSED, 30B - 30C: OPEN
1	At normal 30A - 30C: CLOSED, 30B - 30C: OPEN At tripped 30A - 30C: OPEN, 30B - 30C: CLOSED

- When the set value is 1, contacts 30A and 30C are connected when the inverter control voltage is established (about one second after power on).



F40 Torque limiter 1 (Driving)

F41 Torque limiter 1 (Braking)

- The torque limit operation calculates motor torque from the output voltage, current and the primary resistance value of the motor, and controls the frequency so the calculated value does not exceed the limit. This operation enables the inverter to continue operation under the limit even if a sudden change in load torque occurs.

- Select limit values for the driving torque and braking torque.
- When this function is activated, acceleration and deceleration operation times are longer than the set values.

F	**4**	**0**	D	R	V		T	R	Q	1		
F	**4**	**1**	B	R	K		T	R	Q	1		

Function	Set value	Operation
Torque limit (driving)	20 % to 200 %	The torque is limited to the set value.
	999	Torque limiting inactive
Torque limit (braking)	20 % to 200 %	The torque is limited to the set value.
	0	Prevents OU trip due to power regeneration.
	999	Torque limiting inactive

WARNING

When the torque limit function is selected, an operation may not match the set acceleration and deceleration time or set speed. The machine should be so designed that safety is ensured even when operation does not match set values.

F42 Torque vector control 1

- To obtain the motor torque most efficiently, the torque vector control calculates torque according to load, to adjust the voltage and current vectors to optimum values based on the calculated value.

F	**4**	**2**	T	R	Q	V	E	C	T	O	R	1

Set value	Operation
0	Inactive
1	Active

Related functions:
P01 to **P09**

- When 1 (Active) is set, the set values of the following functions differ from the written values:

1. F09 Torque boost 1
   Automatically set to 0.0 (automatic torque boosting).
2. P09 Slip compensation amount
   Slip compensation is automatically activated. When 0.0 is set, the amount of slip compensation for a standard 3-phase motor is applied. Otherwise, the written value is applied.

- Use the torque vector control function under the following conditions:

1. There must be only one motor.
   Connection of two or more motors makes accurate control difficult.
2. The function data (rated current P03, no-load current P06, %R1 P07, and %X P08) of motor 1 must be correct.
3. When a standard 3-phase motor is used, setting the capacity (function P02) ensures entry of the above data. An auto tuning operation should be performed for other motors.
4. The rated current of the motor must not be significantly less than the rated current of the inverter. A motor two ranks lower in capacity than the nominal applied motor for the inverter should be used at the smallest (depending on the model).
5. To prevent leakage current and ensure accurate control, the length of the cable between the inverter and motor should not exceed 50 m.
6. When a reactor is connected between the inverter and the motor and the impedance of the wiring cannot be disregarded, use P04, "Auto tuning," to rewrite data.

If these conditions are not satisfied, set 0 (Inactive).

E: Extension Terminal Functions

E01 Terminal X1
~
E09 Terminal X9

- Each function of digital input terminals X1 to X9 can be set as codes.

E	**0**	**1**	X	1		F	U	N	C			
E	**0**	**2**	X	2		F	U	N	C			
E	**0**	**3**	X	3		F	U	N	C			
E	**0**	**4**	X	4		F	U	N	C			
E	**0**	**5**	X	5		F	U	N	C			
E	**0**	**6**	X	6		F	U	N	C			
E	**0**	**7**	X	7		F	U	N	C			
E	**0**	**8**	X	8		F	U	N	C			
E	**0**	**9**	X	9		F	U	N	C			

Set value	Function
0, 1, 2, 3	Multistep frequency selection (1 to 15 steps) [SS1], [SS2], [SS4], [SS8]
4, 5	Acceleration and deceleration time selection (3 steps) [RT1], [RT2]
6	3-wire operation stop command [HLD]
7	Coast-to-stop command [BX]
8	Alarm reset [RST]
9	External fault [THR]
10	Jogging operation [JOG]
11	Frequency reference 2 / Frequency Reference 1 change over command (Hz2/Hz1)
12	Motor 2/Motor 1 [M2/M1]
13	DC brake command [DCBRK]
14	Torque limit 2/Torque limit 1 [TL2/TL1]
15	Switching operation between line and inverter (50 Hz) [SW50]
16	Switching operation between line and inverter (60 Hz) [SW60]
17	UP command [UP] (Motorized Pot)
18	DOWN command [DOWN] (Motorized Pot)
19	Write enable for KEYPAD (data change permission) [WE-KP]
20	PID control cancel [Hz/PID]
21	Inverse mode changeover (terminals 12 and C1) [IVS]
22	Interlock signal (52-2) [IL]
23	Torque control cancel [Hz/TRQ]
24	Comms Link enable (RS485, field bus, etc) [LE]
25	Universal DI [U-DI]
26	Flying start mode [STM]
27	SY-PG enable (Option) [PG/Hz]
28	Synchronization command (Option) [SYC]
29	Zero speed command with PG option [ZERO]
30	Forced stop command with deceleration [STOP1]
31	Forced stop command with deceleration time 4 [STOP2]
32	Pre-exiting command with PG option [EXITE]

Note: Data numbers which are not set in the functions from E01 to E09, are assumed to be inactive.

Multistep frequency selection

The frequency can be switched to a preset frequency in function codes C05 to C19 by switching the external digital input signal. Assign values 0 to 3 to the target digital input terminal. The combination of input signals determines the frequency.

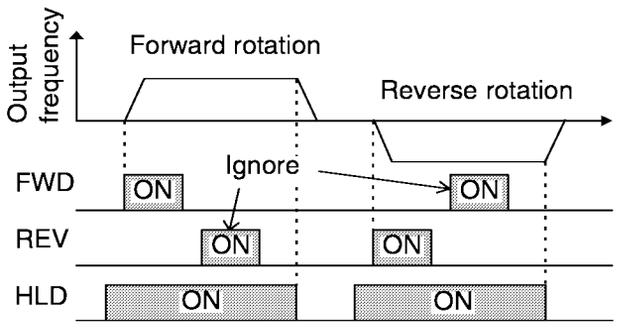
Combination of set value input signals				Frequency selected	
3 [SS8]	2 [SS4]	1 [SS2]	0 [SS1]		
off	off	off	off	Assigned by F01 or C30	
off	off	off	on	C05 MULTI Hz-1	Related functions: **C05** to **C19** Setting range 0.00 to 400.00 Hz
off	off	on	off	C06 MULTI Hz-2	
off	off	on	on	C07 MULTI Hz-3	
off	on	off	off	C08 MULTI Hz-4	
off	on	off	on	C09 MULTI Hz-5	
off	on	on	off	C10 MULTI Hz-6	
off	on	on	on	C11 MULTI Hz-7	
on	off	off	off	C12 MULTI Hz-8	
on	off	off	on	C13 MULTI Hz-9	
on	off	on	off	C14 MULTI Hz-10	
on	off	on	on	C15 MULTI Hz-11	
on	on	off	off	C16 MULTI Hz-12	
on	on	off	on	C17 MULTI Hz-13	
on	on	on	off	C18 MULTI Hz-14	
on	on	on	on	C19 MULTI Hz-15	

Acceleration and deceleration time selection

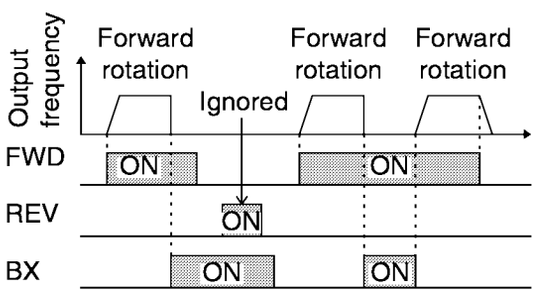
The acceleration and deceleration time can be switched to a preset time in function codes E10 to E15 by switching the external digital input signal. Assign values 4 and 5 to the target digital input terminal. The combination of input signals determines the acceleration and deceleration times.

Combination of set value input signals		Acceleration and deceleration times selected	
5 [RT2]	4 [RT1]		
off	off	F07 ACC TIME1 F08 DEC TIME1	Related functions: **F07~F08** **E10~E15**
off	on	E10 ACC TIME2 E11 DEC TIME2	
on	off	E12 ACC TIME3 E13 DEC TIME3	
on	on	E14 ACC TIME4 E15 DEC TIME4	

3-wire operation stop command [HLD]
This selection is used for 3-wire operation. The FWD or REV signal is self-held when [HLD] is on, and the self-hold is cleared when [HLD] is turned off. To use this [HLD] terminal function, assign 6 to the target digital input terminal.



Coast-to-stop command [BX]
When BX and P24 are connected, inverter output is cut off immediately and the motor starts to coast-to-stop. An alarm signal is neither output nor self-held. If BX and P24 are disconnected when the operation command (FWD or REV) is on, operation starts at the start frequency. To use this BX terminal function, assign value "7" to the target digital input terminal.



Alarm reset [RST]
When an inverter trip occurs, connecting RST and P24 clears the alarm output (for any fault); disconnecting them clears trip indication and re-starts operation. To use this RST terminal function, assign value "8" to the target digital input terminal.

External fault [THR]
Disconnecting THR and P24 during operation cuts off inverter output i.e., motor coasts-to-stop) and outputs alarm OH2, which is self-held internally and cleared by RST input. This function is used to protect an external brake resistor and other components from overheating. To use this THR terminal function, assign value "9" to the target digital input terminal. ON input is assumed when the terminal function is not set.

Jogging operation [JOG]
This function is used for jogging (inching) operation to position a work piece. When JOG and P24 are connected, the operation is performed with the jogging frequency set in function code C20 while the operation command (FWD-P24 or REV-P24) is on. To use this JOG terminal function, assign value "10" to the target digital input terminal.

Frequency Reference 2/Frequency Reference 1 [Hz2/Hz1] Change over command
This function switches the frequency setting method set in function codes F01 and C30 by an external digital input signal, to a designated **X** input. Can be used for LOCAL/REMOTE (OR HAND/AUTO) operation.

Set value input signal	Frequency setting method selected
11	
off	F01 FREQ CMD1
on	C30 FREQ CMD2

Motor 2/Motor 1 [M2/M1]
This function switches motor constants using an external digital input signal.
This input is effective only when the operation command to the inverter is off and operation has stopped and does not apply to the operation at 0Hz.

Set value input signal	Motor selected
12	
off	Motor 1
on	Motor 2 Related functions: **A01~A18**

DC brake command [DCBRK]
When the external digital input signal is on, DC injection braking starts when the inverter's output frequency drops below the frequency preset in function code F20 after the operation command goes off (The operation command goes off when the STOP key is pressed at keypad panel operation and when both terminals FWD and REV go on or off at terminal block operation.) The DC injection braking continues while the digital input signal is on. In this case, the longer time of the following is selected:
- The time set in function code F22.
- The time which the input signal is set on.

Set value input signal	Operation selected
13	
off	No DC injection brake command is given.
on	A DC injection brake command is given.

Torque limit 2/Torque limit 1 [TL2/TL1]
This function switches the torque limit value set in function codes F40 and F41, and E16 and E17 by an external digital input signal.

Set value input signal	Torque limit value selected	
14		
off	F40 DRV TRQ1 F41 BRK TRQ1	Related functions: **F40~F41** **E16~E17**
on	E16 DRV TRQ2 E17 BRK TRQ2	Setting range DRV 20 to 200 %, 999 BRK 0, 20 to 200 %, 999

5

Switching operation between line and inverter (50 Hz) [SW50]

Motor operation can be switched from 50 Hz commercial power operation to inverter operation without stopping the motor by switching the external digital input signal.

Set value input signal	Function
15	
off → on	Inverter operation to line operation (50 Hz)
on → off	Line operation to inverter operation (50 Hz)

Switching operation between line and inverter (60 Hz) [SW60]

Motor operation can be switched from 60 Hz commercial power operation to inverter operation without stopping the motor by switching the external digital input signal.

Set value input signal	Function
16	
off → on	Inverter operation to line operation (60 Hz)
on → off	Line operation to inverter operation (60 Hz)

- When the digital input signal goes off, 50 or 60 Hz is output according to the set value input signal after the restart waiting time following a momentary power failure (function code H13). The motor is then directed to inverter operation.

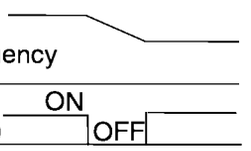
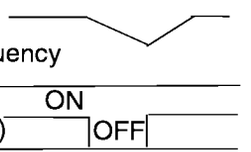
UP command [UP]/ DOWN command [DOWN]

When an operation command is input (on), the output frequency can be increased or decreased by an external digital input signal.

The change ranges from 0 to maximum frequency. Operation in the opposite direction of the operation command is not allowed.

Combination of set value input signals		Function selected (when operation command is on)
18	17	
off	off	Holds the output frequency.
off	on	Increases the output frequency according to the acceleration time.
on	off	Decreases the output frequency according to the deceleration time.
on	on	Holds the output frequency.

There are the two types of UP/DOWN operations as shown below. Set the desired type by setting the frequency (F01 or C30).

Frequency setting (F01 or C30)	Initial value at power input on	Operation command reentry during deceleration
8 (UP/ DOWN1)	0 Hz	Operates at the frequency at reentry. 
9 (UP/ DOWN2)	Previous frequency	Returns to the frequency before deceleration 

Write enable for KEYPAD (data change permission) [WE-KP]
This function allows the data to be changed only when an external signal is being input, thereby making it difficult to change the data.

Set value input signal	Function
19	
off	Inhibit data changes.
on	Allow data changes.

Note: If a terminal is set to value 19, the data becomes unable to be changed. To change the data, turn on the terminal and change the terminal setting to another number.

PID control cancel [Hz/PID]
The PID control can be disabled by an external digital input signal.

Set value input signal	Function selected Related functions: **H20~H25**
20	
off	Enable PID control.
on	Disable PID control (frequency setting from keypad panel).

Inverse mode changeover (terminals 12 and C1) [IVS]
The analog input (terminals 12 and C1) can be switched between forward and inverse operations by an external digital input signal.

Set value input signal	Function selected Related functions: **F01**
21	
off	Forward operation when forward operation is set and vice versa.
on	Inverse operation when forward operation is set and vice versa.

Interlock signal (52-2) [IL]
When a contactor is installed on the output side of the inverter, the contactor opens at the time of a momentary power failure, which hinders the reduction of the DC circuit voltage and may prevent the detection of a power failure and the correct restart operation when power is recovered. The restart operation at momentary power failure can be performed effectively with power failure information provided by an external digital input signal.

Set value input signal	Function
22	
off	No momentary power failure detection operation by digital input
on	Momentary power failure detection operation by digital input

Torque control cancel [Hz/TRQ]
When function code H18 (torque control function selection) is set to be active (value 1 or 2), this operation can be canceled externally
Assign value "23" to the target digital input terminal and switch between operation and no operation in this input signal state.

Set value input signal	Function selected Related functions: **H18**
23	
off	Torque control function active. The input voltage to terminal 12 is the torque command value.
on	Torque control function inactive. The input voltage to terminal 12 is the frequency command value. PID feedback amount when PID control operation is selected (H20 = 1 or 2).

Comms Link enable (RS485, field bus, etc) [LE]

Frequency and operation commands from serial link can be enabled or disabled by switching the external digital input signal. Select the command source in H30, "Link function." Assign value "24" to the target digital input terminal and enable or disable commands in this input signal state.

Set value input signal	Function selected Related functions: **H30**
24	
off	Link command disabled.
on	Link command enabled.

Universal DI [U-DI]

Assigning value "25" to a digital input terminal renders the terminal a universal DI terminal. The ON/OFF state of signal input to this terminal can be checked through the RS485 and BUS option. This input terminal is only used to check for an incoming input signal through communication and does not affect inverter operation.

Flying start mode [STM]

The start characteristics function (pick-up mode) in function code H09 can be enabled or disabled by switching the external digital input signal. Assign value "26" to the target digital input terminal and enable or disable the function in this input signal state.

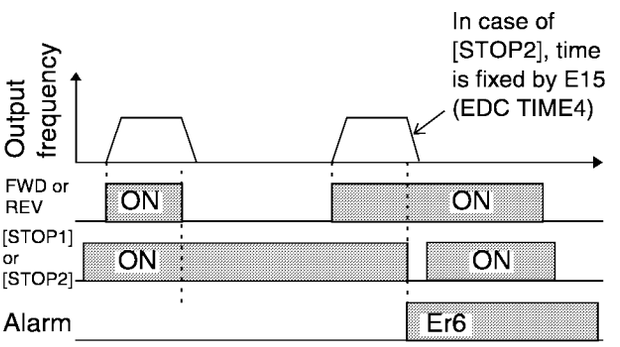
Set value input signal	Function selected Related functions: **H09**
26	
off	Start characteristic function disabled
on	Start characteristic function enabled

SY-PG enable (Option) [PG/Hz]
Synchronization command (Option) [SYC]
Zero speed command with PG option [ZERO]
Pre-exiting command with PG option [EXITE]

These functions are used for PG-Option or SY-Option card.
Refer to each instruction manual.

Forced stop command with deceleration [STOP1]
Forced stop command with deceleration time 4 [STOP2]

Normally this terminal should be "ON", when this terminal goes off during motor running, the motor decelerates to stop, and outputs alarm "Er6 ".
In case of terminal [STOP2], the deceleration time is determined by E15 (DEC TIME4).
This function is prioritized under any operation (Terminal. Keypad, Communication...operation).



Settings when shipped from the factory

Digital input	Setting at factory shipment	
	Set value	Description
Terminal X1	0	Multistep frequency selection [SS1]
Terminal X2	1	Multistep frequency selection [SS2]
Terminal X3	2	Multistep frequency selection [SS4]
Terminal X4	3	Multistep frequency selection [SS8]
Terminal X5	4	Acceleration and deceleration time selection [RT1]
Terminal X6	5	Acceleration and deceleration time selection [RT2]
Terminal X7	6	3-wire operation stop command [HLD]
Terminal X8	7	Coast-to-stop command [BX]
Terminal X9	8	Alarm reset [RST]

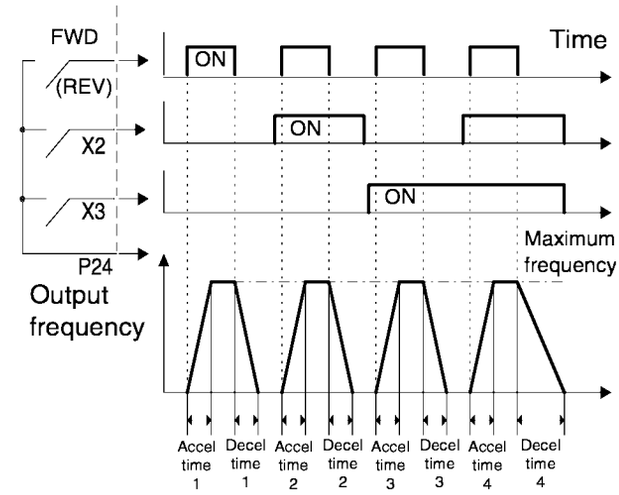
E10 Acceleration time 2
E11 Deceleration time 2
E12 Acceleration time 3
E13 Deceleration time 3
E14 Acceleration time 4
E15 Deceleration time 4

- Acceleration time 1 (F07) and deceleration time 1 (F08) as well as three other types of acceleration and deceleration time can be selected.
- The operation and setting ranges are the same as those of acceleration time 1 and deceleration time 1. See explanations for F07 and F08.
- For switching acceleration and deceleration times, select any two terminals from terminal X1 (function selection) in E01 to terminal X9 (function selection) in E09 as switching signal input terminals. Set "4" (acceleration and deceleration time 1) and "5" (acceleration and deceleration time 2) to the selected terminals and input a signal to each terminal to switch acceleration and deceleration times. Switching is possible during acceleration, deceleration, or constant-speed operation.

E	**1**	**0**	A	C	C		T	I	M	E	2	
E	**1**	**1**	D	E	C		T	I	M	E	2	
E	**1**	**2**	A	C	C		T	I	M	E	3	
E	**1**	**3**	D	E	C		T	I	M	E	3	
E	**1**	**4**	A	C	C		T	I	M	E	4	
E	**1**	**5**	D	E	C		T	I	M	E	4	

- Example: When 4 and 5 are set to terminals X2 and X3:

Operation



E16 Torque limiter 2 (Driving)
E17 Torque limiter 2 (Braking)

- This function is used to switch the torque limit level set in F40 and F41 by an external control signal. Input an external signal by selecting any of the control input terminals (X1 to X9) as torque limit 2/torque limit 1 (value 14) in E01 to E09.

E	**1**	**6**	D	R	V		T	R	Q	2	
E	**1**	**7**	B	R	K		T	R	Q	2	

Related functions:
E01 to **E09** (Set value: 14)

E20 Terminal Y1 (function selection)
~
E24 Terminals Y5A and Y5C (function selection)

- Some control and monitor signals can be selected and output from terminals [Y1] to [Y5]. Terminals [Y1] to [Y4] use transistor output; terminals [Y5A] and [Y5C] use relay contacts.

E	**2**	**0**	Y	1		F	U	N	C			
E	**2**	**1**	Y	2		F	U	N	C			
E	**2**	**2**	Y	3		F	U	N	C			
E	**2**	**3**	Y	4		F	U	N	C			
E	**2**	**4**	Y	5		F	U	N	C			

Set value	Output signal
0	Inverter running [RUN]
1	Frequency equivalence signal [FAR]
2	Frequency level detection [FDT1]
3	Undervoltage detection signal [LV]
4	Torque polarity [B/D]
5	Torque limiting [TL]
6	Auto-restarting [IPF]
7	Overload or overcurrent early warning [OL1]
8	Keypad operation mode [KP]
9	Inverter stopped [STP]
10	Ready output [RDY]
11	Line / Inv changeover [SW88]
12	Line / Inv changeover [SW52-2]
13	Line / Inv changeover [SW52-1]
14	Motor 2 / Motor 1 [SWM2]
15	Auxiliary terminal [AX]
16	Time-up signal for pattern operation [TU]
17	Cycle completion signal for pattern operation [TO]
18	Stage No. indication for pattern operation [STG1]
19	Stage No. indication for pattern operation [STG2]
20	Stage No. indication for pattern operation [STG4]
21	Alarm indication [AL1]
22	Alarm indication [AL2]
23	Alarm indication [AL4]
24	Alarm indication [AL8]
25	Fan operation signal [FAN]
26	Auto-resetting [TRY]
27	Universal DO [U-DO]
28	Overheat early warning [OH]
29	Synchronization completed by synchronous operation card [SY] *
30	-
31	2nd Freq. level detection [FDT2]
32	2nd OL or OC early warning [OL2]
33	Terminal C1 off signal [C1OFF]
34	Speed existence signal [N-EX] *

Note: For output signals marked *, refer to instruction manuals for the PG or the synchronous operation card.

Inverter running [RUN]
"Running" means that the inverter is outputting a frequency. "RUN" signal is output as when there is output speed (frequency). When the DC injection brake function is active, "RUN" signal is off.

Frequency equivalence signal [FAR]
See the explanation of function code E30 (frequency arrival [detection width]).

Frequency level detection [FDT1]
See the explanation of function codes E31 and E32 (frequency detection).

Undervoltage detection signal [LV]
If the undervoltage protective function activates, i.e. when the main circuit DC voltage falls below the undervoltage detection level, an ON signal is output. The signal goes off when the voltage recovers and increases above the detection level. The ON signal is retained while the undervoltage protective function is activating.
Undervoltage detection level 400 V

Torque polarity [B/D]
This function determines the torque polarity calculated in the inverter and outputs a signal indicating driving or braking torque. An OFF signal is output for driving torque; an ON signal is output for braking torque.

Torque limiting [TL]
When the torque limiting activates, the stall prevention function is automatically activated to change the output frequency. The torque limiting signal is output to lighten the load, and also used to display overload conditions on the monitor device. This ON signal is output during the current or torque is limited or power regeneration is prevented.

Auto-restarting [IPF]
Following a momentary power failure, this function reports the start of the restart mode, the occurrence of an automatic pull-in, and the completion of the recovery operation.
Following a momentary power failure, an ON signal is output when power is recovered and a synchronization (pull-in) operation is performed. The signal goes off when the frequency (before power failure) is recovered.
For 0 Hz restart at power recovery, no signal is output because synchronization ends when power is recovered. The frequency is not recovered to the frequency before the power failure occurence.

Overload early warning [OL1]
Before the motor stops by the trip operation of an electronic thermal O/L relay, this function outputs an ON signal when the load reaches the overload early warning level.
Either the electronic thermal O/L relay early warning or output current overload early warning can be selected.
For setting procedure, see "E33 Overload early warning (operation selection)", and "E34 Overload early warning (operation level)."
Note: This function is effective for motor 1 only.

Keypad operation mode [KP]
An ON signal is output when operation command keys (FWD , REV and STOP) on the keypad panel can be used (i.e., 0 set in "F02 Operation") to issue operation and stop commands.

Inverter stopped [STP]
This function outputs an inverted signal to Running (RUN) to indicate zero speed. An ON signal is output when the DC injection brake function is operating.

Ready output [RDY]
This function outputs an ON signal when the inverter is ready to operate. The inverter is ready to operate when the main circuit and control circuit power is established and the inverter protective function is not activating.
About one second is required from power-on to ready for operation in normal condition.

Line / Inv changeover
[SW88] [SW52-2] [SW52-1]
To perform switching operation between the line and the inverter, the sequence prepared in the inverter can be used to select and output signals for opening and closing the magnetic contactors connected to the inverter. As the operation is complex, refer to technical documentation for the Jaguar VXM series when using this function.
As the sequence will operate automatically when SW88 or SW52-2 is selected, do not select when not using the sequence.

Motor 2 / Motor 1 [SWM2]
When a signal for switching to motor 2 is input from the terminal selected by terminals [X1] to [X9], this function selects and outputs the signal for switching the magnetic contactor for the motor. As this switching signal is not output during running including when the DC injection braking function is operating, a signal must be re-input after output stops.

Auxiliary terminal [AX]
When an operation (forward or reverse) command is entered, this function outputs an ON signal. When a stop command is entered, the signal goes off after inverter output stops. When a coast-to-stop command is entered and the inverter protective function operates, the signal goes off immediately.

Time-up signal for pattern operation [TU]
When the pattern operation stage changes, this function outputs a one-shot (100 ms) ON signal to report a stage change.

Cycle completion signal for pattern operation [TO]
When the seven stages of a pattern operation are completed, this function outputs a one-shot (100 ms) ON signal to report the completion of all stages.

Stage No. indication for pattern operation [STG1], [STG2], [STG4]
During pattern operation, this function reports the stage (operation process) being operated.

Pattern operation stage No.	Output terminal		
	STG 1	STG 2	STG 4
Stage 1	on	off	off
Stage 2	off	on	off
Stage 3	on	on	off
Stage 4	off	off	on
Stage 5	on	off	on
Stage 6	off	on	on
Stage 7	on	on	on

When pattern operation is not activated (i.e., no stage is selected), the terminals do not output a signal.

Alarm indication [AL1] [AL2] [AL4] [AL8]
This function reports the operating status of the inverter protective function.

Alarm detail (inverter protective function)	Output terminal			
	AL1	AL2	AL4	AL8
Overcurrent, ground fault, fuse blown	on	off	off	off
Overvoltage	off	on	off	off
Undervoltage shortage, input phase failure	on	on	off	off
Motors 1 and 2 overload	off	off	on	off
Inverter overload	on	off	on	off
Heat sink overheating, inverter inside overheating	off	on	on	off
External alarm input, braking resistor overheating	on	on	on	off
Memory error, CPU error	off	off	off	on
Keypad panel communication error, option communication error	on	off	off	on
Option error	off	on	off	on
Output wiring error	off	off	on	on
RTU communication error	on	off	on	on
Overspeed, PG disconnection	off	on	on	on

In normal operation terminals do not output a signal.

Fan operation signal [FAN]
When used with "H06 Cooling fan ON/OFF control," this function outputs a signal while the cooling fan is operating.

Auto-resetting [TRY]
When a value of 1 or larger is set to "H04 Retry operating," the signal is output while retry operation is activating when the inverter protective function is activated.

Universal DO [U-DO]
Assigning value "27" to a transistor output terminal renders the terminal a universal DO terminal. This function enables ON/OFF through the RS485 and BUS option.
This function serves only to turn on and off the transistor output through communication and is not related to inverter operation.

Overheat early warning [OH]
This function outputs a early warning signal when heat sink temperature is (overheat detection level - 10 °C) or higher.

2nd Freq. level detection [FDT2]
This function is same as Frequency detection [FDT1], the detection level of the output frequency and hysteresis width are determined by E36 and E32.

2nd OL level early warning [OL2]
This function outputs an ON signal when the output current exceeds "E37 OL2 LEVEL" for longer than "E35 OL TIMER".

Terminal C1 off signal [C1OFF]
This function outputs an ON signal when the input current of terminal C1 is less than 2 mA.

Settings when shipped from the factory

Digital input	Setting at factory shipment	
	Set value	Description
Terminal Y1	0	Inverter running [RUN]
Terminal Y2	1	Frequency equivalence signal [FAR]
Terminal Y3	2	Frequency level detection [FDT1]
Terminal Y4	7	Overload early warning [OL1]
Terminal Y5	10	Ready output [RDY]

E25 Y5 Ry operation mode

- This function specifies whether to excite the Y5 relay at "ON signal mode" or "OFF signal mode".

E	2	5	Y	5	R	Y		M	O	D	E	

Set value	Operation
0	At "OFF signal mode" Y5A - Y5C: OPEN At "ON signal mode" Y5A - Y5C: CLOSED
1	At "ON signal mode" Y5A - Y5C: CLOSED At "OFF signal mode" Y5A - Y5C: OPEN

- When the set value is 1, contacts Y5A and Y5C are closed when the inverter control voltage is established (about one second after power on), and open under fault condition (failsafe operation).

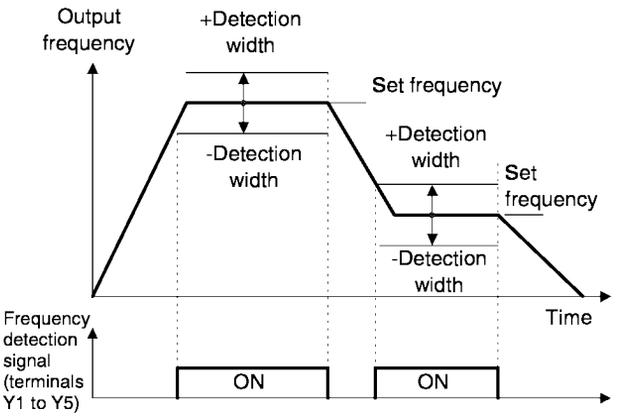
E30 FAR function signal (Hysteresis)

- This function adjusts the detection width when the output frequency is the same as the set frequency (operating frequency).
  The detection width can be adjusted from 0 to ±10 Hz of the setting frequency.

E	3	0	F	A	R		H	Y	S	T	R	

Setting range: 0.0 to 10.0 Hz

When the frequency is within the detection width, an ON signal can be selected and output from terminals [Y1] to [Y5]



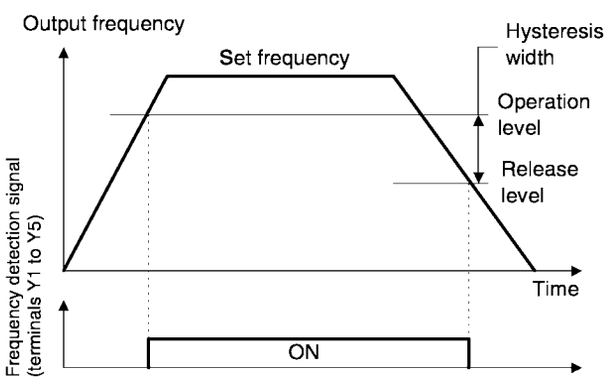
E31 FDT1 function signal (Level)

E32 FDT1 function signal (Hysteresis)

- This function determines the operation (detection) level of the output frequency and hysteresis width for operation release. When the output frequency exceeds the set operation level, an ON signal can be selected and output from terminals [Y1] to [Y5].

E	3	1	F	D	T	1	L	E	V	E	L	
E	3	2	F	D	T		H	Y	S	T	R	

Setting range
(Operation level): 0 to 400 Hz
(Hysteresis width): 0.0 to 30.0 Hz



When the set value is 1, contacts Y5A and Y5C are closed when the inverter control voltage is established (about one second after power on), and open under fault condition (failsafe operation).

E33 OL1 function signal (Mode select)

- Select one of the following two types of overload early warning: early warning by electronic thermal O/L relay function or early warning by output current.

E	3	3	O	L	1	W	A	R	N	I	N	G

Set value 0: Electronic thermal O/L relay
1: Output current

Set value	Function	Description
0	Electronic thermal O/L relay	Overload early warning by electronic thermal O/L relay (having inverse-time characteristics) to output current. The operation selection and thermal time constant for the inverse-time characteristics are the same as those of the electronic thermal O/L relay for motor protection (F10 and F12).
1	Output current	An overload early warning is issued when output current exceeds the set current value for the set time.

E34 OL1 function signal (Level)

- This function determines the operation level of the electronic thermal O/L relay or output current.

E	3	4	O	L	1	L	E	V	E	L		

Setting range: Inverter rated output current x (5 to 200 %)

The operation release level is 90 % of the set value.

E35 OL1 function signal (Timer)

E	3	5	O	L		T	I	M	E	R		

- This function is used when 1 (output current) is set to "E33 Overload early warning (operation selection)."
  Setting range: 0.1 to 60.0 seconds
- Set the time from when the operation level is attained until the overload early warning function is activated.

E36 FDT2 function (Level)

- This function determines the operation (detection) level of output frequency for "2nd Freq. level detection [FDT2]".

E	3	6	F	D	T	2	L	E	V	E	L	

Setting range (Operation level): 0 to 400 Hz

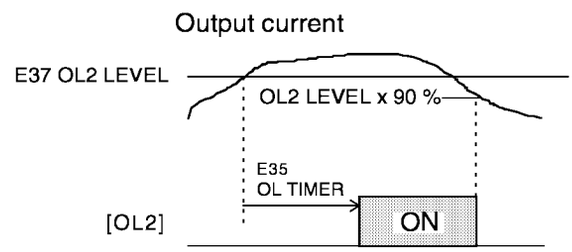
E37 OL2 function (Level)

- This function determines the operation level of the output current for "2nd OL level detection [OL2]".

E	3	7	O	L	2	L	E	V	E	L		

Setting range: Inverter rated output current x (5 to 200 %)

The operation release level is 90 % of the set value.



E40 Display coefficient A

E41 Display coefficient B

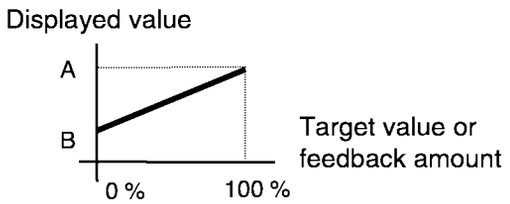
- These coefficients are conversion coefficients which are used to determine the load and line speed and the target value and feedback amount (process amount) of the PID controller displayed on the LED monitor.

E	**4**	**0**	C	O	E	F		A				
E	**4**	**1**	C	O	E	F		B				

Setting range
Display coefficient A:
-999.00 to 0.00 to +999.00
Display coefficient B:
-999.00 to 0.00 to +999.00

- Load and line speed.
  Use the display coefficient A.
  Displayed value = output frequency x
  (0.01 to 200.00)
  Although the setting range is 999.00, the effective value range of display data is 0.01 to 200.00. Therefore, values smaller or larger than this range are limited to a minimum value of 0.01 or a maximum value of 200.00.

- Target value and feedback amount of PID controller.
  Set the maximum value of display data in E40, "Display coefficient A," and the minimum value in E41, "Display coefficient B."
  Displayed value =
  (target value or feedback amount)
  X (display coefficient A - B) + B



E42 LED display filter

- Among data in "E43 LED monitor (display selection)," some data need not be displayed instantaneously when the data changes. For such data, a flickering suppression filter can be used.

E	**4**	**2**	D	I	S	P	L	A	Y		F	L

Setting range: 0.0 to 5.0 seconds

- Monitored items in "E43 LED monitor (display selection)"

Set value	Display item	Set value	Display item
3	Output current	8	Calculated torque value
4	Output voltage	9	Power consumption

E43 LED monitor (Function)

E44 LED monitor (Display at stop mode)

- The data during inverter operation, during stopping, at frequency setting, and at PID setting is displayed on the LED.
- Display during running and stopping.
  During running, the items selected in "E43 LED monitor (Function)," are displayed.
  In "E44 LED monitor (Display at stop mode)," specify whether to display some items out of the set values or whether to display the same items as during running.

E	**4**	**3**	L	E	D		M	N	T	R		
E	**4**	**4**	L	E	D		M	N	T	R	2	

Value set to E43	E44=0		E44=1	
	At stopping	During running	At stopping	During running
0	Set frequency value (Hz)	Output frequency (before slip compensation) [Hz]		
1	Set frequency value (Hz)	Output frequency (after slip compensation) [Hz]		
2	Set frequency value [Hz]			
3	Output current [A]			
4	Output voltage (command value) [V]			
5	Synchronous speed set value (r/min.)	Synchronous speed [r/min]		
6	Line speed set value (m/min.)	Line speed [m/min]		
7	Load speed set value (r/min.)	Load speed [r/min]		
8	Calculated torque value [%]			
9	Output power [kW]			
10	PID target value 1 (direct input from keypad panel)			
11	PID target value 2 (input from "F02 Frequency 1")			
12	PID feedback amount			

Note: For the values 10 to 12 set to E43, the data is displayed only when selected in "H20 PID control (operation selection)."

- Display at frequency setting.
  When a set frequency is checked or changed by the keypad panel, the set value shown below is displayed.
  Select the display item by using "E43 LED monitor (Function)." This display is not affected by "E44 LED monitor (Display at stop mode)."

Value set to E43	Frequency setting
0, 1, 2, 3, 4	Set value of frequency [Hz]
5	Set value of synchronous speed [r/min]
6	Set value of line speed [m/min]
7	Set value of load speed [r/min]
8,9	Set value of frequency [Hz]
10, 11, 12	Set value of frequency [Hz]

Note: For the values 10 to 12 set to E43, the data is displayed only when selected in "H20 PID control (operation selection)."

E45 LCD monitor (Function)

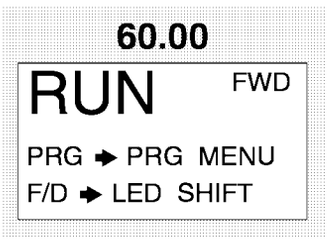
- This function selects the item to be displayed on the LCD monitor in the operation mode.

E	4	5	L	C	D		M	N	T	R		

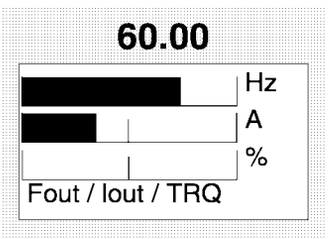
Set value	Display item
0	Operation status, rotating direction, operation guide
1	Output frequency (before slip compensation), output current, calculated torque value in bar graph

During running

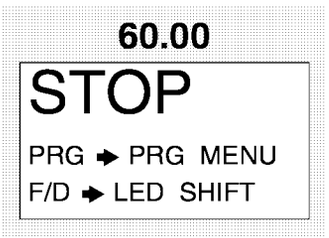
Set value: 0



Set value: 1



When stopping



Full-scale value of bar graph

Display item	Full-scale
Output frequency	Maximum frequency
Output current	200 % of inverter rated value
Calculated torque value	200 % of motor rated value

Note: The scale cannot be adjusted.

E46 LCD monitor (Language)

- This function selects the language for data display on the LCD monitor.

E	4	6	L	A	N	G	U	A	G	E		

Set value	Language displayed	Set value	Language displayed
0	Japanese	3	French
1	English	4	Spanish
2	German	5	Italian

Note: English language is used for all LCD screens in this manual. For other languages, refer to the relevant instruction manual.

E47 LCD monitor (Contrast)

- This function adjusts the LCD contrast. Increase the set value to raise contrast and decrease to lower contrast.

E	4	7	C	O	N	T	R	A	S	T		

Set value	0, 1, 2 • • • • • • 8, 9, 10
Screen	Low ⟷ High

C: Control Functions of Frequency

C01 Jump frequency 1
C02 Jump frequency 2
C03 Jump frequency 3
C04 Jump frequency hysteresis

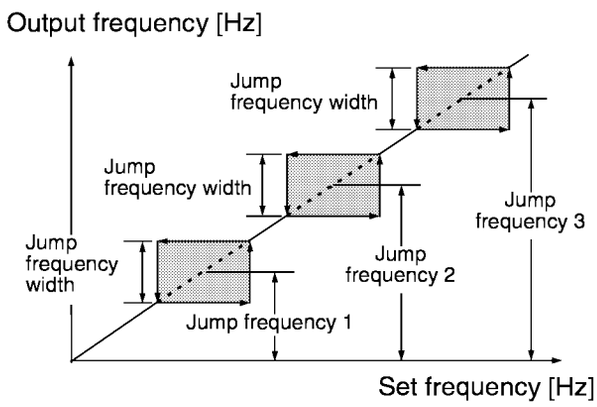
- This function makes the set frequency jump so that the inverter's output frequency does not match the mechanical resonance point of the load.
- Up to three jump points can be set.
- This function is ineffective when jump frequencies 1 to 3 are set to 0 Hz.
- A jump does not occur during acceleration or deceleration.
  When a jump frequency setting range overlaps another range, both ranges are added to determine the actual jump area.

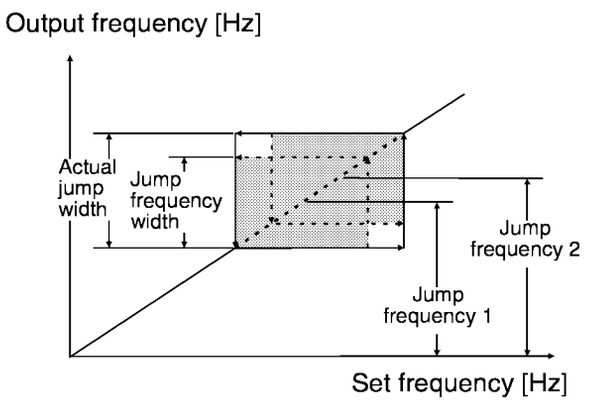
C	**0**	**1**	J	U	M	P		H	z		1	
C	**0**	**2**	J	U	M	P		H	z		2	
C	**0**	**3**	J	U	M	P		H	z		3	

Set value 0 to 400 Hz
In 1 Hz steps (min.)

C	**0**	**4**	J	U	M	P		H	Y	S	T	R

Set value 0 to 30 Hz
In 1 Hz steps (min.)





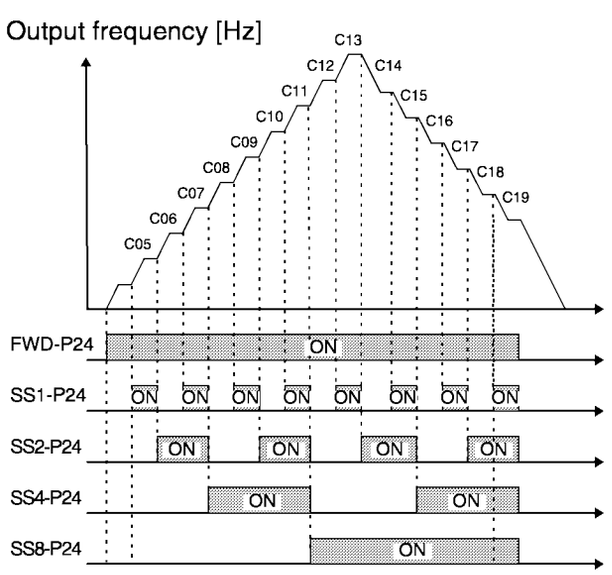
C05 Multistep frequency 1
~
C19 Multistep frequency 15

- Multistep frequencies 1 to 15 can be switched by turning on and off terminal functions SS1, SS2, SS4, and SS8. (See E01 to E09 for terminal function definitions.)
- OFF input is assumed for any undefined terminal of SS1, SS2, SS4, and SS8.

C	**0**	**5**	M	U	L	T	I		H	z	-	1
C	**0**	**6**	M	U	L	T	I		H	z	-	2
C	**0**	**7**	M	U	L	T	I		H	z	-	3
C	**0**	**8**	M	U	L	T	I		H	z	-	4
C	**0**	**9**	M	U	L	T	I		H	z	-	5
C	**1**	**0**	M	U	L	T	I		H	z	-	6
C	**1**	**1**	M	U	L	T	I		H	z	-	7
C	**1**	**2**	M	U	L	T	I		H	z	-	8
C	**1**	**3**	M	U	L	T	I		H	z	-	9
C	**1**	**4**	M	U	L	T	I		H	z	1	0
C	**1**	**5**	M	U	L	T	I		H	z	1	1
C	**1**	**6**	M	U	L	T	I		H	z	1	2
C	**1**	**7**	M	U	L	T	I		H	z	1	3
C	**1**	**8**	M	U	L	T	I		H	z	1	4
C	**1**	**9**	M	U	L	T	I		H	z	1	5

Set value 0 to 400 Hz
In 0.01 Hz steps (min.)

Related functions:
E01 to **E09** (Set value: 0 to 3)



C20 JOG frequency

- This function sets the frequency for jogging operation of motor, which is different from the normal operation.

C	**2**	**0**	J	O	G		H	z				

Setting range: 0.00 to 400.00 Hz

- Starting with the jogging frequency is combined with jogging select signal input from the keypad panel or control terminal. For details, see the explanations of "E01 Terminal X1," to "E09 Terminal X9."

C21 Pattern operation (Mode Select)

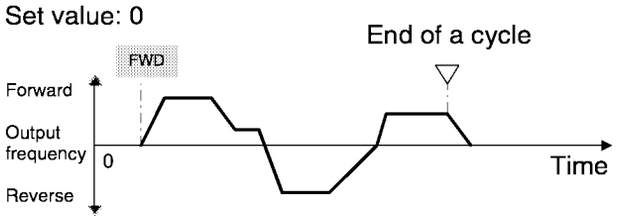
- Pattern operation is an automatic operation according to preset operation time, direction of rotation, acceleration and deceleration time, and frequency.
  When using this function, set 10 (pattern operation) to "F01 Frequency setting."
  The following operation patterns can be selected.

C	2	1	P	A	T	T	E	R	N			

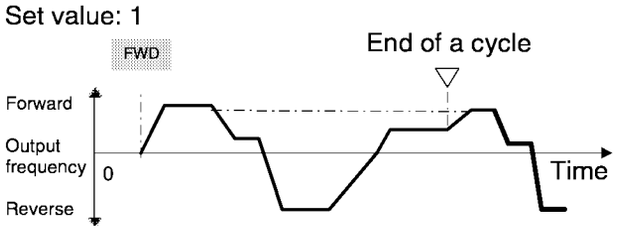
Related functions:
F01, **C30** (Set value:10)

Set value	Operation pattern
0	Perform a pattern operation cycle, then stop operation.
1	Perform pattern operation repeatedly. Stop operation using a stop command.
2	Perform a pattern operation cycle, then continue operation with the last frequency set.

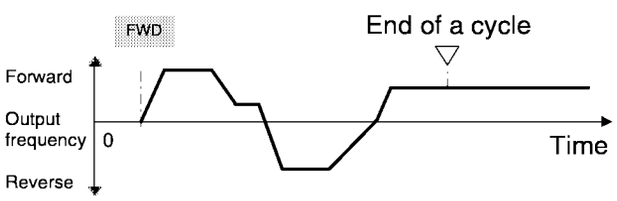
Set value: 0



Set value: 1



Set value: 2



C22 Pattern operation (stage 1)
~
C28 Pattern operation (stage 7)

- Seven stages are operated in order (of function codes) according to the values set in "C22 Pattern operation (stage 1)," to "C28 Pattern operation (stage 7)." Each function sets the operation time and the rotating direction for each stage and assigns set values of the acceleration and deceleration time.

C	2	2	S	T	A	G	E		1			
C	2	3	S	T	A	G	E		2			
C	2	4	S	T	A	G	E		3			
C	2	5	S	T	A	G	E		4			
C	2	6	S	T	A	G	E		5			
C	2	7	S	T	A	G	E		6			
C	2	8	S	T	A	G	E		7			

Set or assign item	Value range
Operation time	0. 00 to 6000 s
Rotation direction	F: Forward R: Reverse
Acceleration and deceleration time	1: Acceleration time 1 (F07), deceleration time 1 (F08)
	2: Acceleration time 2 (E10), deceleration time 2 (E11)
	3: Acceleration time 3 (E12), deceleration time 3 (E13)
	4: Acceleration time 4 (E14), deceleration time 4 (E15)

Note: The operation time is represented by the three most significant digits, hence, can be set with only three high-order digits.

- Setting example

100 F 3
- 3: Acceleration and deceleration time (code): 3
- F: Motor rotating direction: Forward
- 100: Operation time: 100s

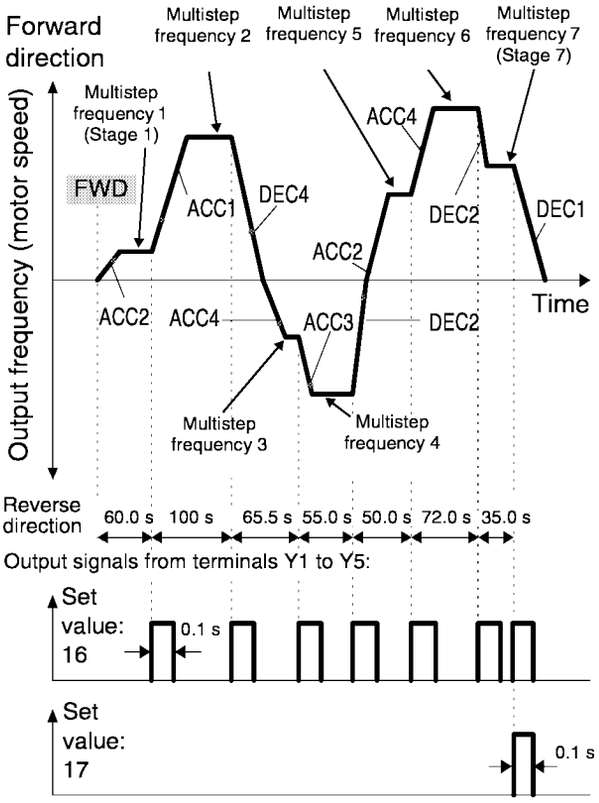
Set the operation time to 0.00 for stages not used, which are skipped in operation.
With regard to the set frequency value, the multistep frequency function is assigned as listed in the table below. Set frequencies to "C05 Multistep frequency 1," to "C11 Multistep frequency 7."

Stage No.	Operation frequency to be set
Stage 1	Multistep frequency 1 (C05)
Stage 2	Multistep frequency 2 (C06)
Stage 3	Multistep frequency 3 (C07)
Stage 4	Multistep frequency 4 (C08)
Stage 5	Multistep frequency 5 (C09)
Stage 6	Multistep frequency 6 (C10)
Stage 7	Multistep frequency 7 (C11)

- Pattern operation setting example

Function	Set value	Operation frequency to be set
C21 (operation selection)	1	-
C22 (stage 1)	60.0F2	Multistep frequency 1 (C05)
C23 (stage 2)	100F1	Multistep frequency 2 (C06)
C24 (stage 3)	65.5R4	Multistep frequency 3 (C07)
C25 (stage 4)	55.0R3	Multistep frequency 4 (C08)
C26 (stage 5)	50.0F2	Multistep frequency 5 (C09)
C27 (stage 6)	72.0F4	Multistep frequency 6 (C10)
C28 (stage 7)	35.0F2	Multistep frequency 7 (C11)

The following diagram shows this operation.



- Running and stopping are controlled by pressing the FWD and STOP keys and by opening and closing the control terminals.
  When using the keypad panel, pressing the FWD key starts operation.
  Pressing the STOP key pauses stage advance.
  Pressing the FWD key again restarts operation from the stop point according to the stages.
  If an alarm stop occurs, press the RESET key to release operation of the inverter protective function, then press the FWD key to restart stage advance.
  If required to start operation from the first stage "C22 Pattern operation (stage 1)," enter a stop command and press the RESET key. If an alarm stop occurs, press the RESET key to release the protective function, then press the key again.

Notes:

1. The direction of rotation cannot be reversed by a command issued from the REV key on the keypad panel or terminal [REV]. Any reverse rotation commands entered are canceled. Select forward or reverse rotation by the data in each stage. When the control terminals are used for operation, the self-hold function of operation command also does not work. Select an alternate type switch when using.
2. At the end of a cycle, the motor decelerates-to-stop according to the value set to "F08 Deceleration time 1."

C30 Frequency Reference 2

- This function selects the frequency setting method.

C	3	0	F	R	E	Q		C	M	D		2

Related functions:
E01 to **E09** (Set value: 11) **F01**

0: Setting by keypad panel operation (△ ▽ key)
1: Setting by voltage input (terminal [12] (0 to +10 V))
2: Inactive
3: Inactive
4: Reversible operation with polarity (terminal [12] (-10 to +10 V))
5: Reversible operation with polarity (terminal [12]+[V1](Option[1)]) (-10 to +10 V))
6: Inverse mode operation (terminal [12] (+10 V to 0))

Related functions:
E01 to **E09** (Set value: 21)

7: Inactive
8: Setting by UP/DOWN control mode 1 (initial value = 0) (terminals [UP] and [DOWN])

Related functions:
E01 to **E09** (Set value: 17, 18)

9: Setting by UP/DOWN control mode 2 (initial value =last final value) (terminals [UP] and [DOWN]) See the function explanation of E01 to E09 for details.

Related functions:
E01 to **E09** (Set value: 17, 18)

10: Setting by pattern operation
See the function explanation C21 to C28 for details.

Related functions:
C21 to **C28**

11: Setting by digital input or pulse train input. Optional.[1)]

1) For details, see the instruction manual on options.

For the setting method, see the explanation for F01.

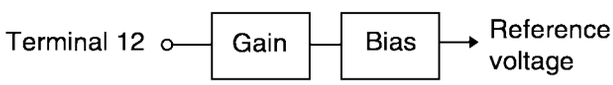
C31 Bias (terminal[12])

C32 Gain (terminal[12])

- This function sets the Gain and Bias of the analog input (terminals [12]).

C	3	1	B	I	A	S		1	2			
C	3	2	G	A	I	N		1	2			

The setting range:
BIAS: -100 to +100 %
GAIN: 0.0 to 200 %



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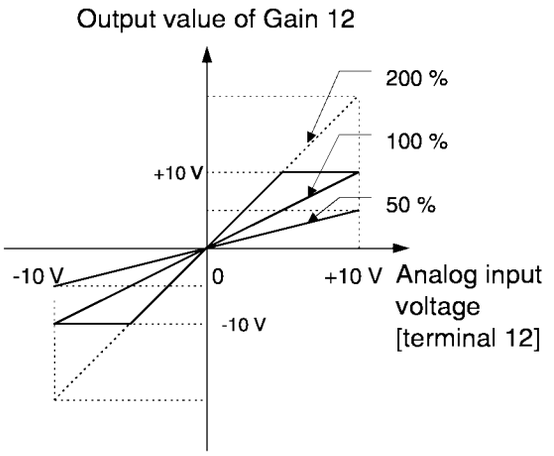
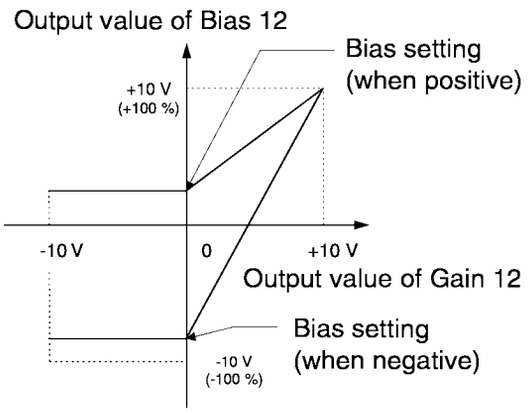




C33 Analog setting signal filter

- Analog signals input from control terminal 12 or C1 may contain noise, which renders control unstable. This function adjusts the time constant of the input filter to remove the effects of noise.

C	3	3	R	E	F		F	I	L	T	E	R

Setting range: 0.00 to 5.00 seconds

- An set value too large delays control response though stabilizing control. A set value too small speeds up control response but renders control unstable.

If the optimum value is not known, change the setting when control is unstable or response is delayed.

Note: The set value is commonly applied to terminals 12 and C1.
For input of PID feedback amount, the PID control feedback filter (set in H25) is used.

Motor 1 (P: Motor Parameters)

P01 Number of motor 1 poles

- This function sets the number of poles of motor 1 to be driven.
If this setting is not made, an incorrect motor speed (synchronous speed) is displayed on the LED.

P	0	1	M	1		P	O	L	E	S		

Set values: 2, 4, 6, 8, 10, 12, 14

P02 Motor 1 (capacity)

- The nominal applied motor capacity is set at the factory. The setting should be changed when driving a motor with a different capacity.

P	0	2	M	1	-	C	A	P				

Set value for models with nominal applied motor of 22 kW or less: 0.01 to 45 kW
Models with nominal applied motor of 30 kW or more: 0.01 to 500 kW

- Set the nominal applied motor capacity listed in 9-1, "Standard Specifications." Also set a value in the range from two ranks lower to one rank higher than the nominal applied motor capacity. When a value outside this range is set, accurate control cannot be guaranteed. If a value between two nominal applied motor capacities is set, data for the lower capacity is automatically written for related function data.

- When the setting of this function is changed, the values of the following related functions are automatically set to data of a typical 3-phase standard motor.
  -- P03 Motor 1 (rated current)
  -- P06 Motor 1 (no-load current)
  -- P07 Motor 1 (% R1)
  -- P08 Motor 1 (% X1)

Note: The set values for the 3-phase standard motor are 200 V, 50 Hz, 4 poles for the 200 V series; 400 V, 50 Hz, 4 poles for the 400 V series.

P03 Motor 1 (rated current)

- This function sets the rated current value of motor 1.

P	0	3	M	1	-	I	r					

Set value: 0.00 to 2,000 A

P04 Motor 1 (Tuning)

- This function measures and automatically writes motor data.

P	0	4	M	1		T	U	N	1			

Set value	Operation
0	Inactive
1	Measure the primary resistance (%R1) of the motor and leakage reactance (%x) at the base frequency when the motor is stopped and automatically write both values in P07 and P08 (static tuning no rotation)
2	Measure the primary resistance (%R1) of the motor and leakage reactance (%x) at the base frequency when the motor is stopped measure the no-load current (Io) when the motor is running, and automatically write these values in P06, P07, and P08 (dynamic tuning). Warning:-Motor rotates.

Note: Measure the no-load current only with uncoupled motor (no load, no gear).

- Perform auto tuning when data written beforehand in "P06 No-load current," "P07 %R1," and "P08 %X," differs from actual motor data. Typical cases are listed below. Auto tuning improves control and calculation accuracy.
  - When a motor other than the FUJI standard 3-phase motor is used and accurate control is required (Torque vector, PG vector).
  - When output-side impedance cannot be ignored as when cable between the inverter and the motor is too long or when a reactor is connected.
  - When a non-standard or special motor is used and %R1 or %X is unknown.

Tuning procedure

1. Adjust the voltage and frequency according to motor characteristics. Adjust functions "F03 Maximum output frequency," "F04 Base frequency," "F05 Rated voltage," and "F06 Maximum output voltage."
2. Enter untunable motor constants first. Set functions "P02 Capacity," "P03 Rated current," and "P06 No-load current," (input of no-load current not required when P04=2, for running the motor at tuning, is selected).
3. When tuning the no-load current (P04=2), beware of motor rotation.
4. Set 1 (static tuning) or 2 (dynamic tuning) to function "P04 Auto tuning." Press the FUNC DATA key to write the set value and press the FWD key or REV key to start tuning. (When F02 = 0)
5. Tuning takes several seconds to several tens of seconds (when 2 is set. As the motor accelerates up to half the base frequency according to acceleration time, is tuned for the no-load current, and decelerates according to the deceleration time, the total tuning time varies depending on set acceleration and deceleration times.)
6. Press the STOP key after the tuning is completed .
7. End of procedure.

Note: Use function "A13 Motor 2 (auto tuning)," to tune motor 2. In this case, set values described in 1 and 2 above are for the function (A01 -) of motor 2.

WARNING

When the auto tuning value is set to 2, the motor rotates at a maximum of half the base frequency. Beware of motor rotation, **as injury may result.**

P05 Motor 1 (On-line Tuning)

- Long-time operation affects motor temperature and motor speed. Online tuning minimizes speed changes when motor temperature changes.

P	0	5	M	1		T	U	N	2			

Set value	Operation
0	Inactive
1	Active

P06 Motor 1 (no-load current)

- This function sets the no-load current (exciting current) of motor 1.

P	0	6	M	1	-	I	O					

Set value: 0.00 to 2,000 A

P07 Motor 1 (%R1 setting)

P08 Motor 1 (%X setting)

- Write this data when using a motor other than a standard 3-phase motor and when the motor constant and the impedance between the inverter and motor are known.

P	0	7	M	1	-	%	R	1				
P	0	8	M	1	-	%	X					

- Calculate %R1 using the following formula:

$$\%\,R\,1 = \frac{R\,1 + \text{Cable R}}{V / (\sqrt{3} \bullet I)} \times 100\ [\%]$$

R1:Primary coil resistance value of the motor [Ω]
Cable R: Output-side cable resistance value [Ω]
V: Rated voltage [V]
I: Motor rated current [A]

- Calculate %X using following formula:

$$\%X = \frac{X1+X2 \bullet XM/(X2 + XM)+\text{Cable X}}{V / (\sqrt{3} \bullet I)} \times 100[\%]$$

X1: Primary leakage reactance of the motor [Ω]
X2: Secondary leakage reactance (converted to a primary value) of the motor [Ω]
XM: Exciting reactance of the motor [Ω]
Cable X: Output-side cable reactance [Ω]
V: Rated voltage [V]
I: Motor rated current [A]

Note: For reactance, use a value in the data written in "F04 Base frequency 1."

- When connecting a reactor or filter to the output circuit, add its value. Use value 0 for cable X values that can be ignored.

P09 Slip compensation control

- Changes in load torque affect motor slippage, thus causing variations in motor speed.
  The slip compensation control adds a frequency (proportional to motor torque) to the inverter output frequency to minimize variations in motor speed due to torque changes.

P	0	9	S	L	I	P		C	O	M	P	1

Set value: 0.00 to 15.00 Hz

- Calculate the amount of slip compensation using the following formula:

Slip compensation amount

$$= \text{Base frequency} \times \frac{\text{Slippage [r/min]}}{\text{Synchronous speed [r/min]}}\ [\text{Hz}]$$

Slippage = Synchronous speed - Rated speed

High Performance functions (H:High Performance function)

H03 Data initializing

- This function returns all function data changed by the customer to the factory setting data. (initialization).

H	0	3	D	A	T	A		I	N	I	T	

Set value 0: Disabled.
1: Initializing data.

- To perform initialization, press the STOP and ∧ keys together to set 1, then press the FUNC DATA key. The set values of all functions are initialized. The set value in H03 automatically returns to 0 following the end of initialization.

H04 Auto-reset (Times)

H05 Auto-reset (Reset interval)

- When the inverter protective function which invokes the retry operation is activated, this function releases operation of the protective function and restarts operation without issuing an alarm or terminating output.
  Set the protective function release count and waiting time from its operation startup to release.

H	0	4	A	U	T	O	-	R	E	S	E	T
H	0	5	R	E	S	E	T		I	N	T	

Setting range
(Times): 0, 1 to 10
(Reset interval): 2 to 20 seconds

To disable the retry function, set 0 to "H04 Auto-reset (Times)."

- Inverter protective functions that can invoke retry function.

OC1, OC2, OC3: Overcurrent	dBH: Braking resistor overheating
OV1, OV2, OV3: Overvoltage	OL1: Motor 1 overload
OH1: Heat sink overheating	OL2: Motor 2 overload
OH3: Inverter inside overheating	OLU: Inverter overload

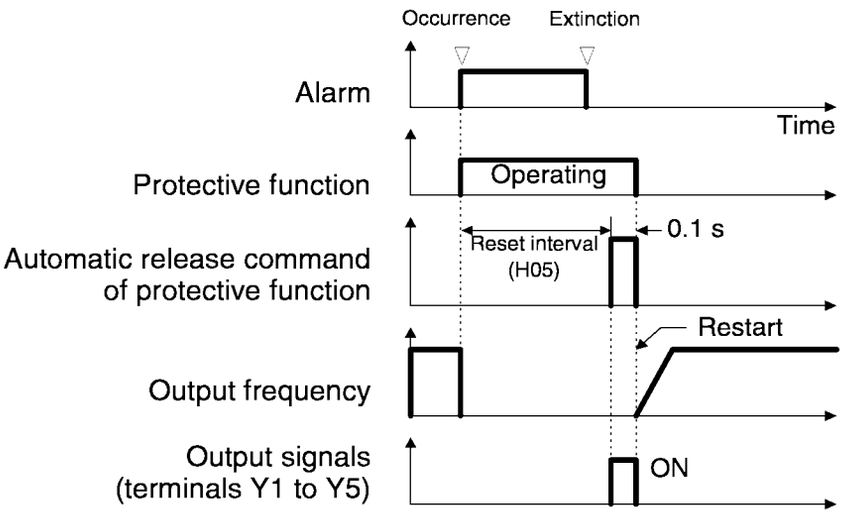
- When the value of "H04 Auto-reset (Times)," is set from 1 to 10, an inverter run command is immediately entered following the wait time set in "H05 Auto-reset (Reset interval)," and the startup of the retry operation. If the cause of the alarm has been removed at this time, the inverter starts without switching to alarm mode. If the cause of the alarm still remains, the protective function is reactivated according to the wait time set in "H05 Auto-reset (Reset interval)." This operation is repeated until the cause of the alarm is removed. The restart operation switches to alarm mode when the retry count exceeds the value set in "H04 Auto-reset (Times)."
  The operation of the retry function can be monitored from terminals Y1 to Y5.

WARNING

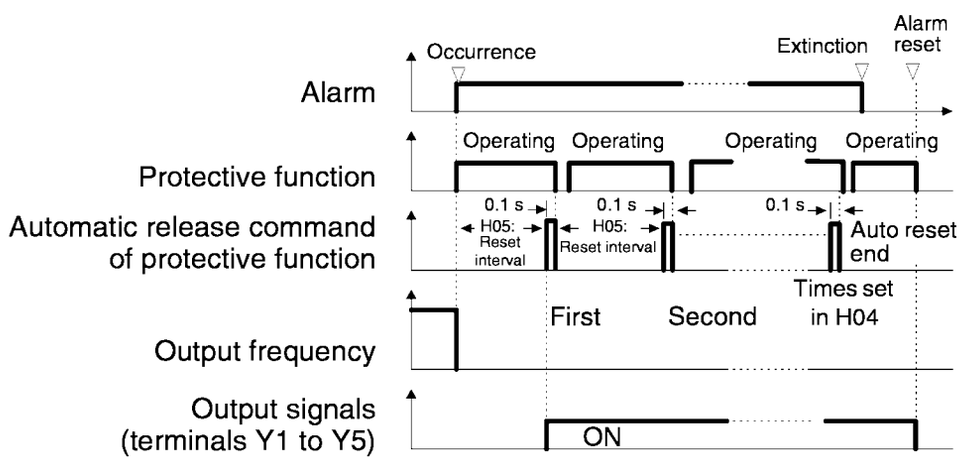
When the retry function is selected, operation automatically restarts depending on the cause of the trip stop. (The machine should be designed to ensure safety during a restart)

5

When retry succeeded



Retry failed



H06 Fan stop operation

- This function specifies whether cooling fan ON/OFF control is automatic. While power is applied to the inverter, the automatic fan control detects the temperature of the cooling air in the inverter and turns the fan on or off.
  When the inverter is in Run mode, the fan is always turned on. If the inverter returns to Stop mode it may take several minutes until fan switches off.
  When this control is not selected, the cooling fan rotates continually.

H	0	6	F	A	N		S	T	O	P		

Set value 0: ON/OFF control disabled.
1: ON/OFF control enabled.

The cooling fan operating status can be monitored from terminals Y1 to Y5.

H07 ACC/DEC (Mode select) pattern

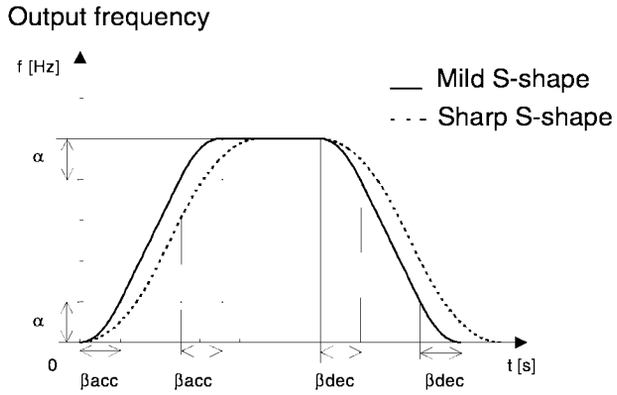
- This function selects the acceleration and deceleration pattern.

H	0	7	A	C	C		P	T	N			

Set value 0: Inactive (linear acceleration and deceleration)
1: S-shape acceleration and deceleration (mild)
2: S-shape acceleration and deceleration (sharp)
3: Curvilinear acceleration and deceleration

S-shape acceleration and deceleration

This pattern reduces shock by mitigating output frequency changes at the beginning/end of acceleration and deceleration.



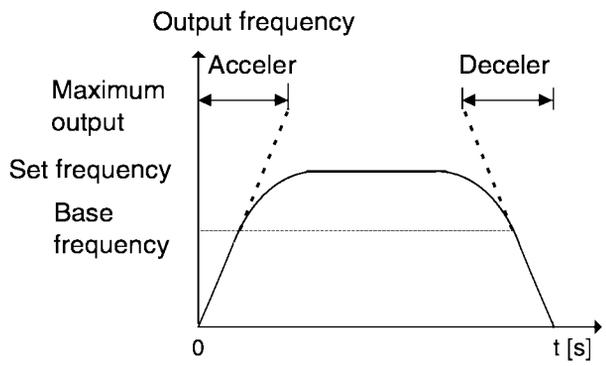
Pattern constants

	When 1 is selected in H07 (mild S-shape pattern)	When 2 is selected in H07 (sharp S-shape pattern)
Range of S-shape(α)	0.05 x maximum output frequency [Hz]	0.10 x maximum output frequency [Hz]
Time for S-shape at acceleration (β acc)	0.10 x acceleration time [s]	0.20 x acceleration time [s]
Time for S-shape at deceleration (β dec)	0.10 x deceleration time [s]	0.20 x deceleration time [s]

When acceleration and deceleration times are very long or short, acceleration and deceleration are rendered linear.

Curvilinear acceleration and deceleration

This function is used to minimize motor acceleration and deceleration times in the range that includes a constant-output range.



5

H08 Motor reversal lock-out

- When accidental reversing is expected to cause a malfunction, this function can be set to prevent reversal.
  This function prevents a reversing operation resulting from a connection between the REV and P24 terminals, inadvertent activation of the REV key, or negative analog input from terminal 12 or V1

H	0	8	R	E	V		L	O	C	K		

Set value 0: Inactive
1: Active

H09 Start mode

- This function smoothly starts the motor which is coasting after a momentary power failure or after the motor has been subject to external force, without stopping motor.
  At startup, this function detects the motor speed and outputs the corresponding frequency, thereby enabling a shock-free motor startup. Although the normal startup method is used, when the coasting speed of the motor is 120 Hz or more as an inverter frequency and when the value set to "F03 Maximum frequency," exceeds the value set to "F15 Frequency limiter (upper limit)."

H	0	9	S	T	A	R	T		M	O	D	E

Setting range 0, 1, 2

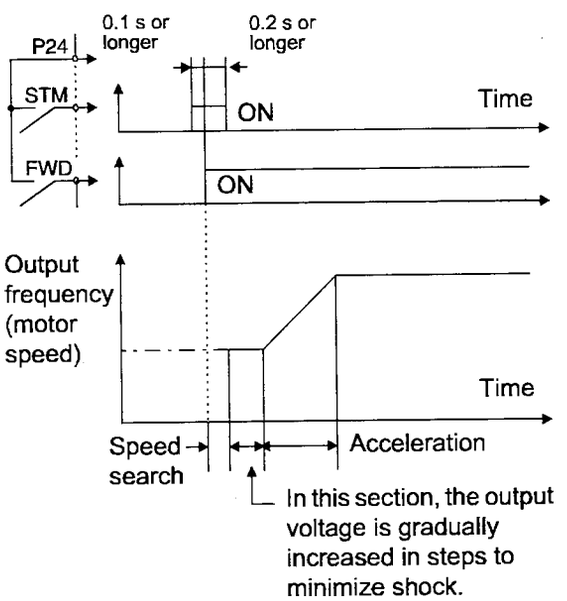
Set value	Normal startup	Restart after a momentary power failure	Line-to-inverter switching
0	Inactive	Inactive	Inactive
1	Inactive	Active	Active
2	Active	Active	Active

- Explanation of set values

-1: This function is effective when 3, 4, or 5 is set to "F14 Restart mode after momentary power failure (operation selection)." This function is also effective when operation is switched from the line to the inverter. The motor is started with the same frequency as the current coasting speed.

-2: In addition to restarting following a momentary power failure and switching between the line and the inverter, this function detects the coasting speed of the motor and starts the motor at the same frequency as all startups (including when an ON operation command is entered).

- By assigning value "26" (pick up start mode) to terminals X1 to X9, this function can be externally selected as the normal startup method when an ON operation command is entered.



Note: The dotted-dashed line indicates motor speed.

H10 Energy-saving operation

- When the output frequency is fixed (constant-speed operation) at light loads and except for "0.0" is set to F09, "Torque boost 1," this function automatically reduces the output voltage, while minimizing the product (power) of voltage and current.

H	1	0	E	N	E	R	G	Y		S	A	V

Set value 0: Inactive
1: Active

Notes:

- Use this function for square law reduction torque loads (e.g., fans, pumps). When used for a constant-torque load or rapidly changing load, this function causes a delay in control response.
- The energy-saving operation automatically stops during acceleration and deceleration and when the torque limiting function is activated.

H11 DEC mode

- This function selects the inverter stopping method when a stop command is entered.

H	1	1	D	E	C		M	O	D	E		

Set value 0: Deceleration-to-stop based on data set to "H07 Non-linear acceleration and deceleration"
1: Coasting-to-stop

Note: This function is effective only when a stop command is entered and, therefore, is ineffective when the motor is stopped by lowering the set frequency.

H12 Instantaneous overcurrent limiting

- An overcurrent trip generally occurs when current flows above the inverter protective level following a rapid change in motor load. The instantaneous overcurrent limiting function controls inverter output and prohibits the flow of a current exceeding the protective level even when the load changes.
- As the operation level of the instantaneous overcurrent limiting function cannot be adjusted, the torque limiting function must be used.
- As motor generation torque may be reduced when instantaneous overcurrent limiting is applied, set this function to be inactive for equipment such as elevators, which are adversely affected by reduced motor generation torque, in which case an overcurrent trip occurs when the current flow exceeds the inverter protective level. A mechanical brake should be used to ensure safety.

H	1	2	I	N	S	T		C	L			

Set value 0: Inactive
1: Active

H13 Auto-restart (Restart time)

- Instantaneous switching to another power line (when the power of an operating motor is cut off or power failure occurs) creates a large phase difference between the line voltage and the voltage remaining in the motor, which may cause electrical or mechanical failure. To rapidly switch power lines, write the remaining voltage attenuation time to wait for the voltage remaining in the motor to attenuate. This function operates at restart after a momentary power failure.

H	1	3	R	E	S	T	A	R	T		T	

Setting range: 0.1 to 5.0 seconds

- When the momentary power failure time is shorter than the wait time value, a restart occurs following the wait time. When the power failure time is longer than the wait time value, a restart occurs when the inverter is ready to operate (after about 0.2 to 0.5 second).

H14 Auto-restart (Freq. fall rate)

- This function determines the reduction rate of the output frequency for synchronizing the inverter output frequency and the motor speed. This function is also used to reduce the frequency and thereby prevent stalling under a heavy load during normal operation.

H	1	4	F	A	L	L		R	A	T	E	

Setting range: 0.00, 0.01 to 100.00 Hz/s

- When 0.00 is set, the frequency is reduced according to the set deceleration time.

Note: A too large frequency reduction rate may temporarily increase the regeneration energy from the load and invoke the overvoltage protective function. Conversely, a rate that is too small extends the operation time of the current limiting function and may invoke the inverter overload protective function.

H15 Auto-restart (Holding DC voltage)

- This function is for when 2 (deceleration-to-stop at power failure) or 3 (operation continuation) is set to "F14 Restart mode after momentary power failure (Mode select)."
  Either function starts a control operation if the main circuit DC voltage drops below the set operation continuation level.

H	1	5	H	O	L	D		V				

Setting range: 400 to 600 V

- When power supply voltage to the inverter is high, control can be stabilized even under an excessive load by raising the operation continuation level. However, when the level is too high, this function activates during normal operation and causes unexpected motion. Please contact IMO when changing the initial value.

H16 Auto-restart (OPR command selfhold time)

- As the power to an external operation circuit (relay sequence) and the main power to the inverter is generally cut off at a power failure, the operation command issued to the inverter is also cut off. This function sets the time an operation command is to be held in the inverter. If a power failure lasts beyond the self-hold time, power-off is assumed, automatic restart mode is released, and the inverter starts operation at normal mode when power is applied again. (This time can be considered the allowable power failure time.)

H	1	6	S	E	L	F	H	O	L	D		T

Setting range: 0.0 to 30.0 seconds, 999

When 999 is set, an operation command is held (i.e., considered a momentary power failure) while control power in the inverter is being established or until the main circuit DC voltage is about 0.

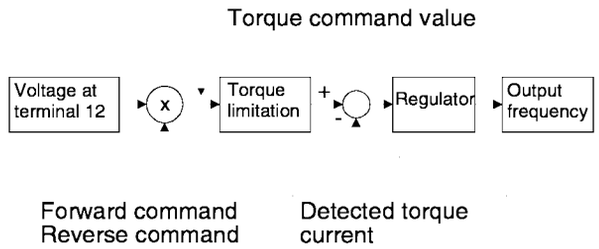
H18 Torque control

- This function controls motor torque according to a command value.

H	1	8	T	R	Q		C	T	R	L		

Related functions:
E01 to **E09** (Set value: 23)

Set value	Operation
0	Inactive (operation by frequency command)
1	Torque control active A 0 to +10 V analog voltage input to terminal 12 and the direction of rotation (FWD or REV) is used for the torque command value. 0 is used for 0 to -10 V.
2	Torque control active A -10 to +10 V analog voltage input to terminal 12 and the direction of rotation (FWD or REV) is used for the torque command value.



Torque control block diagram

The torque command value is +200 % when the voltage at terminal 12 is +10 V and is -200 % when the voltage is -10 V.

- In torque control, the torque command value and motor load determine the speed and direction of rotation.
- When the torque is controlled, the upper limit of frequency refers to the minimum value among the maximum frequency , the frequency limiter (upper limiter) value, and 120 Hz. Maintain the frequency at least one-tenth of the base frequency because torque control performance deteriorates at lower frequencies.
- If the operation command goes off during a torque control operation, the operation is switched to speed control and the motor decelerates-to-stop. At this time, the torque control function does not operate.

H19 Active drive

- This function automatically extends accelerating time against acceleration operation of 60 seconds or longer to prevent an inverter trip resulting from a temperature rise in inverter due to overcurrent.

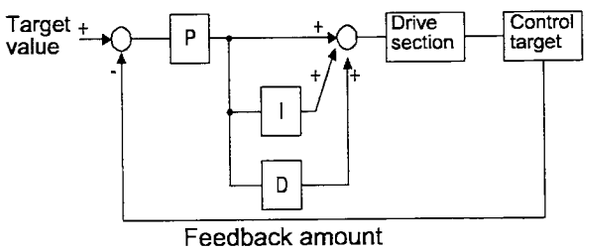
H	1	9	A	U	T		R	E	D			

Set value 0: Inactive
1: Active

(When the active drive function is activated, the acceleration time is three times the selected time.)

H20 ~ H25 PID control (Mode select) ~ PID control (Feedback filter)

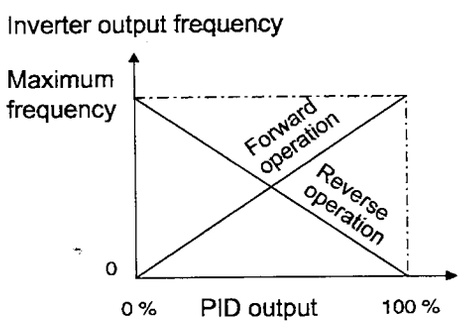
- PID control detects the amount of control (feedback amount) from a sensor of the control target, then compares it with the target value (e.g., reference temperature). If the values differ, this function performs a control to eliminate the deviation. In other words, this control matches the feedback amount with the target value.
  This function can be used for flow control, pressure control, temperature control, and other process controls.



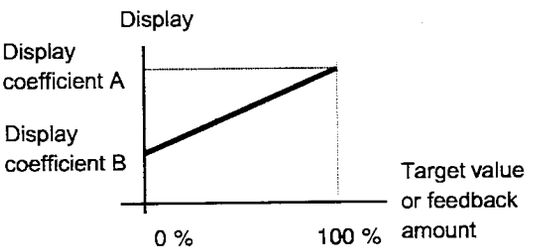
- Forward or reverse operations can be selected for PID controller output. This enables motor revolutions to be faster or lower according to PID controller output.

H	2	0	P	I	D		M	O	D	E		

Set value 0: No operation
1: Forward operation
2: Reverse operation



- The target value can be entered using F01, "Frequency command 1," or directly from the keypad panel. Select any terminal of Terminals X1 (E01) to X9 (E09) and set value 11 (frequency setting switching).
  For entry from F01, "Frequency setting 1," input an OFF signal to the selected terminal. For direct entry from the keypad panel, turn on the selected terminal.
- For the target value and feedback amount, the process amount can be displayed according to the values set in E40, "Display coefficient A," and E41, "Display coefficient B."

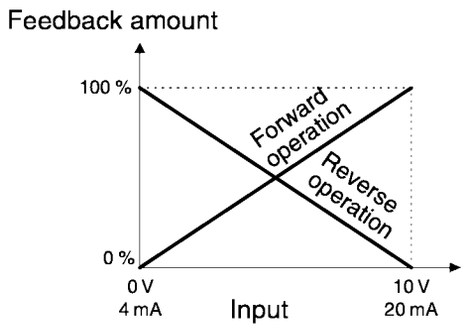


H21 PID control (Feedback signal)

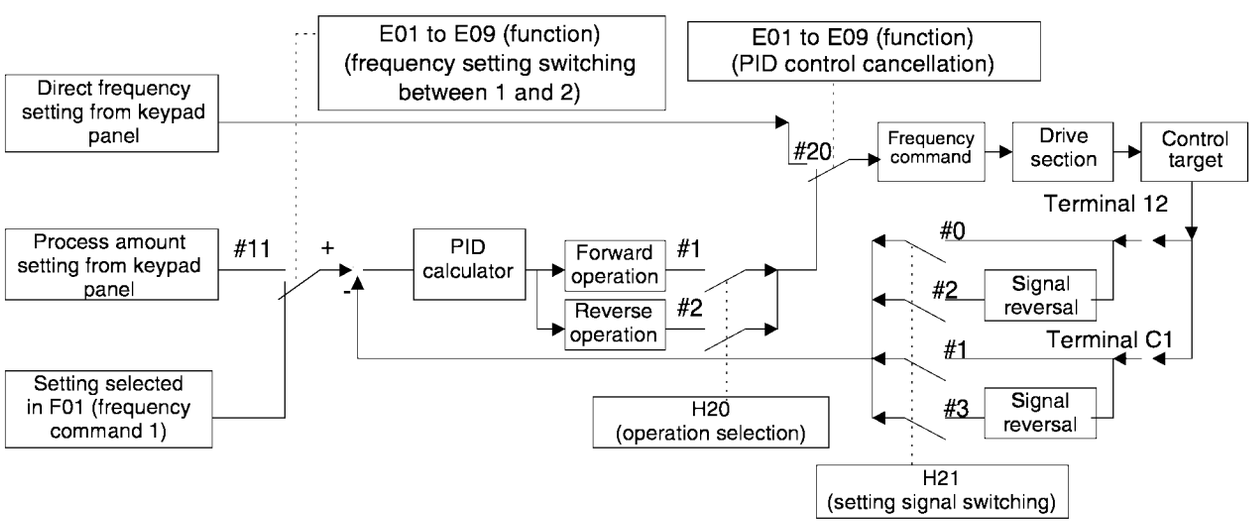
This function selects the feedback amount input terminal and electrical specifications of the terminal. Select a value from the table below according to sensor specifications.

H	2	1	F	B		S	I	G	N	A	L	

Set value	Descriptions
0	Control terminal 12, forward operation (0 to 10 V voltage input)
1	Control terminal C1, forward operation (4 to 20 mA current input)
2	Control terminal 12, reverse operation (10 to 0 V voltage input)
3	Control terminal C1, reverse operation (20 to 4 mA current input)



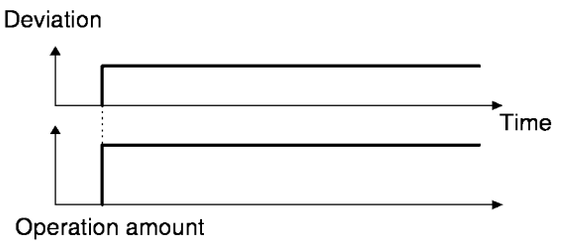
Only positive values can be input for this feedback amount of PID control.
Negative values (e.g., 0 to -10 V, -10 to 0 V) cannot be input, thereby the function cannot be used for a reverse operation by an analog signal.



H22 PID control (P-gain)
H23 PID control (I-gain)
H24 PID control (D-gain)

- These functions are not generally used alone but are combined like P control, PI control, PD control, and PID control.

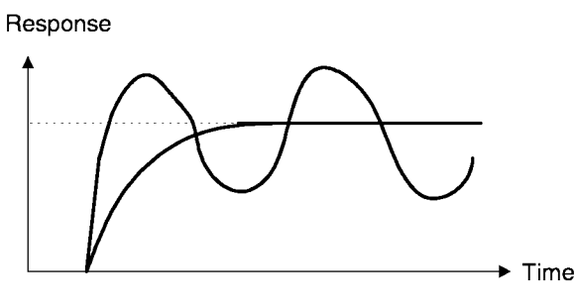
- P operation
  Operation using an operation amount (output frequency) proportional to deviation is called P operation, which outputs an operation amount proportional to deviation, though it cannot eliminate deviation alone.



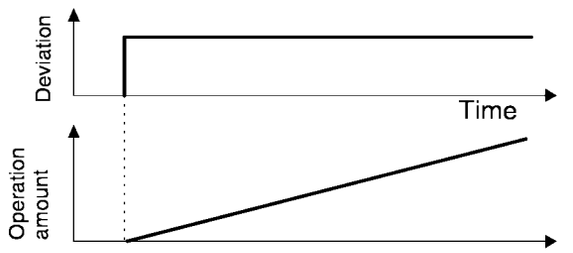
H	2	2	P	-	G	A	I	N				

Setting range: 0.01 to 10.0 times

P (gain) is the parameter that determines the response level for the deviation of P operation. Although an increase in gain speeds up response, an excessive gain causes vibration, and a decrease in gain delays response.



- I operation
  An operation where the change speed of the operation amount (output frequency) is proportional to the deviation is called an I operation. An I operation outputs an operation amount as the integral of deviation and, therefore, has the effect of matching the control amount (feedback amount) to the target value (e.g., set frequency), though it deteriorates response for significant changes in deviation.

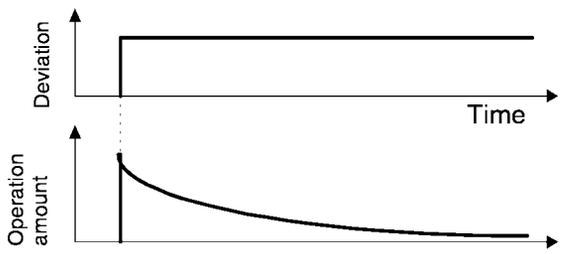


H	2	3	I	-	G	A	I	N				

Setting range: 0.0 (Inactive),
0.1 to 3600 seconds

"H23 I-gain" is used as a parameter to determine the effect of I operation. A longer integration time delays response and weakens resistance to external elements. A shorter integration time speeds up response, but an integration time that is too short causes vibration.

- D operation
  An operation where the operation amount (output frequency) is proportional to the deviation differential is called a D operation, which outputs an operation amount as the deviation differential and, therefore, is capable of responding to sudden changes.



H	2	4	D	-	G	A	I	N				

Setting range: 0.00 (Inactive),
0.01 to 10.0 seconds

"H24 D-gain" is used as a parameter to determine the effect of a D operation. A longer differentiation time causes vibration by P operation quickly attenuating at the occurrence of deviation. Excessive differentiation time could cause vibration. Shortening the differentiation time reduces attenuation at the occurrence of deviation.

- PI control
  P operation alone does not remove deviation completely. P + I control (where I operation is added to P operation) is normally used to remove the remaining deviation. PI control always operates to eliminate deviation even when the target value is changed or there is a constant disturbance. When I operation is strengthened, however, the response for rapidly changing deviation deteriorates. P operation can also be used individually for loads containing an integral element.

- PD control
  If deviation occurs under PD control, an operation amount larger than that of D operation alone occurs rapidly and prevents deviation from expanding. For a small deviation, P operation is restricted. When the load contains an integral element, P operation alone may allow responses to vibrate due to the effect of the integral element, in which case PD control is used to attenuate the vibration of P operation and stabilize responses. In other words, this control is applied to loads in processes without a braking function.

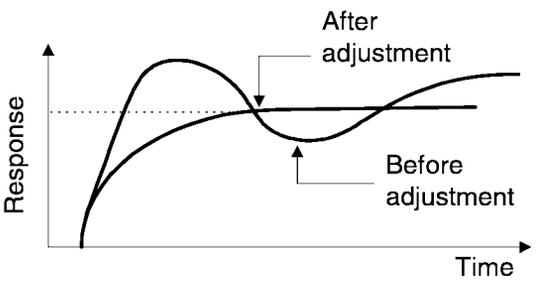
- PID control
  PID control combines the P operation, the I operation which removes deviation, and the D operation which suppresses vibration. This control achieves deviation-free, accurate, and stable responses.

- Adjusting PID set value
  Adjust the PID value while monitoring the response waveform on an oscilloscope or other instrument if possible. Proceed as follows:

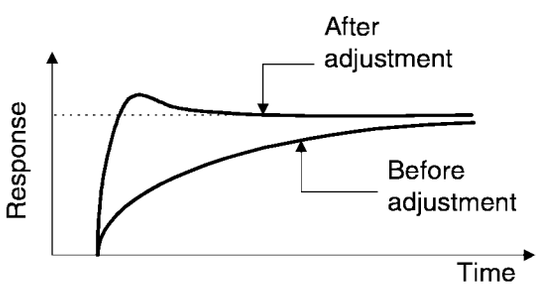
- Increase the value of "H22 P-gain" without generating vibration.
- Decrease the value of "H23 I-gain" without generating vibration.
- Increase the value of "H24 D-gain" without generating vibration.

Adjust the response waveform as follows:

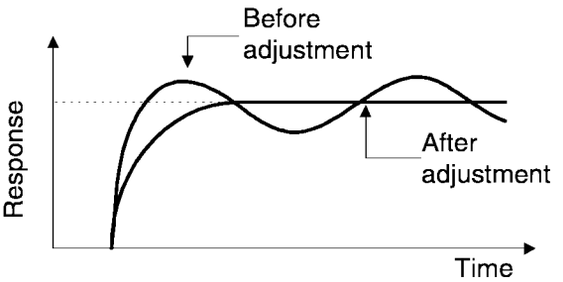
- To remove the overshoot, increase the value of "H23 I-gain," then decrease the value of "H24 D-gain."



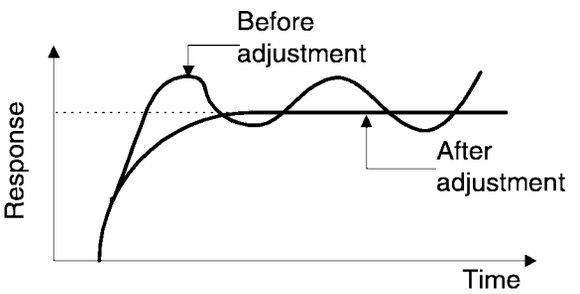
- To stabilize response quickly (i.e., allowing for a little overshoot):
  decrease the value of "H23 I-gain," or
  increase the value of "H24 D-gain."



- To suppress vibration with a period longer than the value of "H23 I-gain," increase the value of H23.



- To suppress vibration with a frequency roughly equivalent to the value "H24 D-gain," decrease the value of H24. If there is residual vibration with 0.0, decrease the value of "H22 P-gain."



H25 PID control (Feedback filter)

- This filter is for feedback signal input from terminal [12] or [C1]. This filter stabilizes operation of the PID control system. A set value that is too large, however, deteriorates response.

H	2	5	F	B		F	I	L	T	E	R	

Setting range: 0.0 to 60.0 seconds

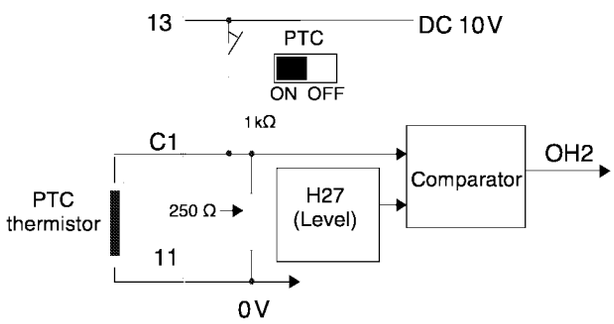
H26 PTC thermistor (Mode select)

- Set this function active when the motor has a PTC thermistor for overheat protection.

H	2	6	P	T	C		M	O	D	E		

Set value 0: Inactive
1: Active

- Connect the PTC thermistor as shown in the figure below.
  Turn on switch "PTC" on the control PCB.
  The trip mode is activated by "OH2:External thermal relay tripped."



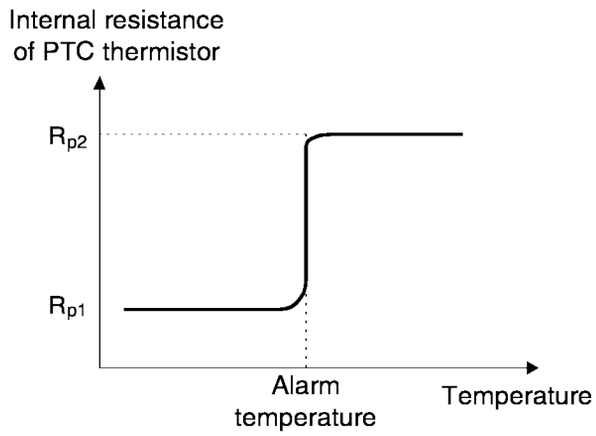
H27 PTC thermistor (Level)

- The voltage input to terminal [C1] is compared to the set voltage (Level). When the input voltage is equal to or greater than the set voltage (Level), "H26 PTC thermistor (Mode select)," starts.

H	2	7	P	T	C		L	E	V	E	L	

Setting range: 0.00 to 5.00 V

- The PTC thermistor has its own alarm temperature. The internal resistance value of the thermistor largely change at the alarm temperature. The operation (voltage) level is set using this change in the resistance value.



The figure in "H26 PTC thermistor (Mode select)," shows that resistor 250 Ω and the thermistor (resistance value R_p) are connected in parallel. Hence, voltage V_{C1} (Level) at terminal [C1] can be calculated by using the following formula.

$$V_{C1} = \frac{\frac{250 \cdot R_p}{250 + R_p}}{1000 + \frac{250 \cdot R_p}{250 + R_p}} \times 10\ [V]$$

The operation level can be set by bringing R_p in the V_{C1} calculation formula into the following range.

$R_{p1} < R_p < R_{p2}$

To obtain R_p easily, use the following formula.

$$R_p = \frac{R_{p1} + R_{p2}}{2}\ [\Omega]$$

H28 Droop operation

When two or more motors drive a single machine, a higher load is placed on the motor rotating the fastest. Droop operation achieves a good load balance by applying drooping characteristics to speed against load variations.

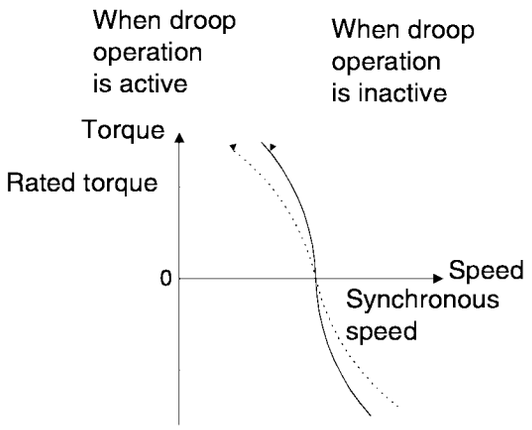
- Calculate the droop amount using the following formula:

$$\text{Droop amount} = \text{Base frequency} \times \frac{\text{Speed droop at rated torque [r/min]}}{\text{Synchronous speed [r/min]}} \text{[Hz]}$$

H	2	8	D	R	O	O	P					

Set value : -9.9 Hz to 0.0 Hz

Characteristics of the motor



H30 Serial link (Function select)

- The link function (communication function) provides RS485 (provided as standard) and bus connections (optional).

The serial link function includes:

1) Monitoring (data monitoring, function data check)
2) Frequency setting
3) Operation command (FWD, REV, and other commands for digital input)
4) Write function data

H	3	0	L	I	N	K		F	U	N	C	

Setting range: 0 to 3

Communication can be enabled and disabled by a digital input. This function sets the serial link function when communication is enabled.

Set value	Frequency command	Operation command
0	Disabled	Disabled
1	Enabled	Disabled
2	Disabled	Enabled
3	Enabled	Enabled

The data monitoring and function data write functions are always enabled. Disabling communication using digital input brings about the same result as when 0 is set to this function. When the bus option is installed, this setting selects the function of the option and the RS485 interface is restricted to monitoring and writing function data. When the option is not installed, this setting selects the RS485 function.

H31 RS485 (Address)
~
H39 RS485 (Response interval)

These functions set the conditions of RS485 communication. Set the conditions according to the upstream device. Refer to technical manual for the protocol.

- This function sets the station address of RS485.

H	3	1	A	D	D	R	E	S	S			

Setting range: 1 to 31

- This function sets processing at communication error and sets the error processing timer value.

H	3	2	M	O	D	E		O	N		E	R
H	3	3	T	I	M	E	R					

Setting range: 0 to 3

Set value	Processing at communication error
0	Immediate Er 8 trip (forced stop)
1	Continue operation within timer time, Er 8 trip after timer time.
2	Continue operation and effect retry within timer time, then invoke an Er 8 trip if a communication error occurs. If an error does not occur, continue operation.
3	Continue operation.

- This function sets the baud rate.

H	3	4	B	A	U	D		R	A	T	E	

Setting range: 0 to 4

Set value	Baud rate
0	19200 bit/s
1	9600 bit/s
2	4800 bit/s
3	2400 bit/s
4	1200 bit/s

- This function sets data length.

H	3	5	L	E	N	G	T	H				

Set value	Data length
0	8 bit
1	7 bit

- This function sets the parity bit.

H	3	6	P	A	R	I	T	Y				

Set value	Parity bit
0	None
1	Even
2	Odd

- This function sets the stop bit.

H	3	7	S	T	O	P		B	I	T	S	

Set value	Stop bit
0	2 bit
1	1 bit

- In a system where the local station is always accessed within a specific time, this function detects that access was stopped due to an open-circuit or other fault and invokes an Er 8 trip.
  This function sets the No response error detection time.

H	3	8	N	O		R	E	S		t		

Setting range: 0 (No detection)
1 to 60 seconds

- This function sets the time from when a request is issued from the upstream device to when a response is returned (response interval).

H	3	9	I	N	T	E	R	V	A	L		

Setting range: 0.00 to 1.00 second

(A: Alternative Motor Parameters)

A01 Maximum frequency 2

- This function sets the maximum frequency for motor 2 output by the inverter. This function operates the same as "F03 Maximum frequency 1,"

  For details, see the explanation for F03.

A	0	1	M	A	X		H	z	-	2		

A02 Base frequency 2

- This function sets the maximum output frequency in the constant-torque area of motor 2 (i.e., output frequency at rated output voltage). This function operates the same as "F04 Base frequency 1."

  For details, see the explanation for F04.

A	0	2	B	A	S	E		H	z	-	2	

A03 Rated voltage 2

- This function sets the rated value of voltage out put to motor 2. This function operates the same as "F05 Rated voltage 1."

  For details, see the explanation for F05.

A	0	3	R	A	T	E	D		V	2		

A04 Maximum voltage 2

- This function sets the maximum value of the inverter output voltage of motor 2. This function operates the same as "F06 Maximum voltage 1."

  For details, see the explanation for F06.

A	0	4	M	A	X			V	-	2		

A05 Torque boost 2

- This function sets the torque boost function of motor 2. This function operates the same as "F09 Torque boost 1."

  For details, see the explanation for F09.

A	0	5	T	R	Q		B	O	O	S	T	2

A06 Electronic thermal overload relay for motor 2 (XXXXX)

A07 Electronic thermal overload relay for motor 2 (Level)

A08 Electronic thermal overload relay for motor 2 (Thermal time constant)

- This function sets the function of the electronic thermal overload realy for motor 2. This function operates the same as F10 to F12, "Electronic thermal overload relay for motor 1." For details, see the explanations for F10 to F12.

A	0	6	E	L	C	T	R	N		O	L	2
A	0	7	O	L		L	E	V	E	L	2	
A	0	8	T	I	M	E		C	N	S	T	2

A09 Torque vector control 2

- This function sets the torque vector function of motor 2. This function operates the same as "F42 Torque vector control 1."

  For details, see the explanation for F42.

A	0	9	T	R	Q	V	E	C	T	O	R	2

A10 Number of motor-2 poles

- This function sets the number of poles of motor 2 to be driven. This function operates the same as "P01 Number of motor-1 poles."

  For details, see explanation for P01.

A	1	0	M	2		P	O	L	E	S		

A11 Motor 2 (Capacity)

- This function sets the capacity of motor 2. This function operates the same as "P02 Motor 1 (Capacity)." For details, see the explanation for P02. However, the related motor data functions change to "A12 Motor 2 (Rated current)," "A15 Motor 2 (No-load current)," "A16 Motor 2 (%R1 setting)," and "A17 Motor 2 (%X setting)."

A	**1**	**1**	M	2	-	C	A	P				

A12 Motor 2 (Rated current)

- This function sets the rated current of motor 2. This function operates the same as "P03 Motor 1 (Rated current)."
  For details, see the explanation for P03.

A	**1**	**2**	M	2	-	I	r					

A13 Motor 2 (Tuning)

- This function sets the auto tuning of motor 2. This function operates the same as "P04 Motor 1 (Tuning)."
  For details, see the explanation for P04.

A	**1**	**3**	M	2		T	U	N	1			

A14 Motor 2 (On-line tuning)

- This function sets the online tuning of motor 2. This function operates the same as "P05 Motor 1 (On-line tuning)."
  For details, see the explanation for P05.

A	**1**	**4**	M	2		T	U	N	2			

A15 Motor 2 (No-load current)

- This function sets the no-load current of motor 2. This function operates the same as "P06 Motor 1 (No-load current)."
  For details, see the explanation for P06.

A	**1**	**5**	M	2	-	I	o					

A16 Motor 2 (%R1 setting)

A17 Motor 2 (%X setting)

- This function sets %R1 and %X of motor 2. This function operates the same as "P07 Motor 1 (%R1 setting)," and "P08 Motor 1 (%X setting)." For details, see the explanations for P07 and P08.

A	**1**	**6**	M	2	-	%	R	1				
A	**1**	**7**	M	2	-	%	X					

A18 Slip compensation control 2

- This function sets the amount of slip compensation for motor 2. This function operates the same as "P09 Slip compensation control."
  For details, see the explanation for P09.

A	**1**	**8**	S	L	I	P		C	O	M	P	2

The following functions are changed or added, refer to section 5-1

Function No.	NAME	Change of added contents
F13	Electric thermal O/L relay (for braking-resistor)	"External braking resistor" of set value 2 means the resistor of type "DB***-2C/4C".
F14	Restart mode after momentary power failure(operation selection)	In case of set value 2 or 3, setting of U23, U24 becomes effective.
F25	Stop frequency	Setting range: changed from "0.1 to 6.0Hz" to "0.1 to 60.0Hz".
F41	Torque limit1 (braking)	U01 (Maximum compensation frequency during braking torque) becomes effective.
E17	Torque limit2 (braking)	In case of 0% selected (regeneration avoidance), U60 becomes effective.
E01 to E09	X1 to X9 terminal function	Setting range: changed from "0 to 32" to "0 to 35".
E20 t0 E24	Y1 to Y4, Y5A and Y5C terminal function	Setting range: changed from "0 to 34" to "0 to 37".
H07	ACC/DEC pattern (mode select)	"Sharp of S-shape" of set value 2 is changed to "variable of S-shape".
UXX	User functions	New addition

5. Function Select

5-1 Function Select List

F : Fundamental Functions

Func No.	NAME	LCD Display		Setting range	Unit	Min. Unit	Factory Setting		Change during op	User Set Value	Remark
							--22kW	30kW--			
F25	Stop frequency	**F25**	STOP Hz	0.1 to 60.0HZ	Hz	0.1	0.2		NA		

E : Extension Terminal Functions

Func No.	NAME	LCD Display		Setting range	Unit	Min. Unit	Factory Setting		Change during op	User Set Value	Remark
							--22kW	30kW--			
E01	X1 terminal function	**E01**	X1 FUNC	0 to 35	–	–	0		NA		
E02	X2 terminal function	**E02**	X2 FUNC				1		NA		
E03	X3 terminal function	**E03**	X3 FUNC				2		NA		
E04	X4 terminal function	**E04**	X4 FUNC				3		NA		
E05	X5 terminal function	**E05**	X5 FUNC				4		NA		
E06	X6 terminal function	**E06**	X6 FUNC				5		NA		
E07	X7 terminal function	**E07**	X7 FUNC				6		NA		
E08	X8 terminal function	**E08**	X8 FUNC				7		NA		
E09	X9 terminal function	**E09**	X9 FUNC				8		NA		
E20	Y1 terminal function	**E20**	Y1 FUNC	0 to 37	–	–	0		NA		
E21	Y2 terminal function	**E21**	Y2 FUNC				1		NA		
E22	Y3 terminal function	**E22**	Y3 FUNC				2		NA		
E23	Y4 terminal function	**E23**	Y4 FUNC				7		NA		
E24	Y5A and Y5C terminal function	**E24**	Y5 FUNC				10		NA		

U : User Functions

Func No.	NAME	LCD Display		Setting range	Unit	Min. Unit	Factory Setting		Change during op	User Set Value	Remark
							--22kW	30kW--			
U01	Maximum compensation frequency during braking torque limit	**U01**	USER 01	0 to 65535	–	1	75		A		
U02	1st S-shape level at acceleration	**U02**	USER 02	1 to 50%	%	1	10		NA		
U03	2nd S-shape level at acceleration	**U03**	USER 03	1 to 50%	%	1	10		NA		
U04	1st S-shape level at deceleration	**U04**	USER 04	1 to 50%	%	1	10		NA		
U05	2nd S-shape level at deceleration	**U05**	USER 05	1 to 50%	%	1	10		NA		
U08	Main DC link (initial value)	**U08**	USER 08	0 to 65535	–	1	xxxx		A		
U09	capacitor (measured value	**U09**	USER 09	0 to 65535	–	1	0		A		
U10	PC board capacitor powered on time	**U10**	USER 10	0 to 65535h	h	1	0		A		
U11	Cooling fan operating time	**U11**	USER 11	0 to 65535h	h	1	0		A		
U13	Magnetize current vibration damping gain	**U13**	USER 13	0 to 32767	–	1	819	410	A		
U15	Slip compensation filter time constant	**U15**	USER 15	0 to 32767	–	1	556	546	A		
U23	Integrall gain of continuous operation at power failure	**U23**	USER 23	0 to 65535	–	1	1738	1000	A		
U24	Proportionall gain of continuous operation at power failure	**U24**	USER 24	0 to 65535	–	1	1024	1000	A		
U48	Input phase loss protection	**U48**	USER 48	0, 1, 2	–	1	--55kW	75kW--	NA		
							0	1			
U49	RS485 protocol selection	**U49**	USER 49	0, 1	–	–	0		NA		
U56	Speed agreement (Detection width)	**U56**	USER 56	0 to 50%	%	1	10		A		
U57	/ PG error (Detection timer)	**U57**	USER 57	0.0 to 10.0s	s	0.1	0.5		A		
U58	PG error selection	**U58**	USER 58	0, 1	–	–	1		NA		
U59	Braking-resistor function select	**U59**	USER 59	00 to A8(HEX)	–	1	00		NA		
U60	Regeneration avoidance at deceleration	**U60**	USER 60	0, 1	–	–	0		NA		
U61	Voltage detect offset and gain adjustment	**U61**	USER 61	--22kW : 0(Fixed.) 30kW-- : 0, 1, 2	–	–	0		A		

Note: U-functions are displayed on the keypad panel ROM version “K08000” or later.

5-2 Function Explanation

F13 Electronic thermal O/L relay (for braking-resistor)

Inverter capacity	Operation
VXM750 or lower	0 : Inactive 1 : Active (built-in braking-resistor) 2 : Active (external braking-resistor)
VXM1100 or greater	0 : Inactive

- If value "2" is selected, set up the type of braking resistor, and a connection circuit by function code:U59.

  Please refer to U59 for details.

Related Functions
U59

F14 Restart mode after momentary power failure (operation selection)

- If selecting value "2" or "3", both integration constant and the proportional constant during operation ride-though can be adjusted by the function code:U23 and U24.

  Please refer to function codes:U23 and U24 for details.

Related Functions
U23
U24

F25 Stop Frequency

Set values: 0.1 to 60.0Hz

F41 Torque limit 1 (braking)

E17 Torque limit 2 (braking)

- The upper limit of frequency increase at the torque limit operation is set by the function code: U01.
- When the set value "0%(Regeneration avoidance)" is set, the operation mode is set by the function code:U60.

  Please refer to the function code:U01 and U60 for details.

Related Functions
U01
U60

E01 X1 Terminal function

E09 X9 Terminal function

Set value	Function
33	Line speed control cancellation [Hz/LSC]
34	Line speed frequency memory [LSC-HLD]
35	Frequency setting 1/ Frequency setting 2 [Hz1/Hz2]

Line speed control cancellation [Hz/LSC]

Line speed frequency memory [LSC-HLD]

- These functions are effective for the option card (VXMEFC/OPC-G11S-PG, PG2, -PGA). Refer to each option manual.

Frequency setting 1/Frequency setting 2 [Hz1/Hz2]

- This function switches the frequency setting method set in function codes F01 and C30 by an external digital input signal. It is reverse-logic of the set value "11" (frequency set 2/frequency set 1[Hz2/Hz1]).

Set value input signal	Frequency setting method selected
35	
Off	C30 FREQ CMD2
On	F01 FREQ CMD1

note: This set value cannot be used with the set value "11" simultaneously. When the set value "11" and "35" are selected, the display becomes "Er6".

E20 Y1 Terminal function

E24 Y5A and Y5C Terminal function

Set value	Function
30	Life expectancy detection signal [LIFE]
35	Speed agreement signal [DSAG]
36	PG error signal [PG-ABN]
37	Torque limiting (Signal with delay [TL2]

Life expectancy detection signal [LIFE]

- When a component's 'Life expectancy' time is reached, an ON signal can be output. However, the inverter does not go into alarm and the fault relay does not change state.

Function code	Parts of Life expectancy judgment	Life expectancy judgment level
U09	Capacitor in main circuit	85% or less of the initial value
U10	Electrolytic capacitor on PC board	61,000 hours
U11	Cooling fan	25,000 hours

- In the following cases, normal life judgment of the capacitor in main circuit may not be able to be performed.
  1 When a power is turned off during inverter operation.
  2 When cooling fan ON/OFF control is operated. (function code : H 06= 1)
  3 When the power is supplied by the auxiliary input terminals (R0,T0).
  4 When an option card is installed.
  5 When RS485 communication is used.
  6 When the power supply is turned off with digital input (FWD, REV, X1-X9) of a control terminal being ON.

  In the case of 3,4,5 and 6, life judgment is enabled by adjusting the function codes U08 and U09.

Related Functions U08~U11

Speed agreement signal [DSAG]

PG error signal [PG-ABN]

- These functions are effective for the option card (VXMEFC/OPC-G11S-PG, -PG2, -PGA).
  Refer to each option card's instruction manual.

Torque limiting (Signal with delay [TL2]

- An ON signal is output by continuing the limiting action (Torque limit operation, regeneration avoidance operation and overcurrent limiting operation) of 20ms or more.

H07 ACC/DEC pattern (mode select)

- This function selects the acceleration and deceleration pattern.
  Set value
  0 : Inactive (linear acceleration and deceleration)
  1 : S-shape acceleration and deceleration (mild)
  2 : S-shape acceleration and deceleration (variable)
  3 : 'Curvi-linear' acceleration and deceleration

  Please refer to: U02 to U05 (setting range of S-shape), when you select the set value "2".

Related Functions U02~U05

U functions are displayed from keypad ROM version K08000 or later

U01 Maximum compensation frequency during braking torque limit

- This function becomes effective, when the torque limit (braking) is used. The inverter automatically increases the output frequency so that torque calculations do not exceed the braking torque limit setting (F41 or E17). (When F41 or E17 is set to 999, it becomes invalid.)
  This function sets the increment of upper limit for output frequency.
  When regeneration avoidance is selected, the resurrection ability can be improved by raising the increment of upper limit. However, the output frequency of the inverter is limited at the frequency limit (high):F15

U	0	1	U	S	E	R		0	1			

Setting range : 0 to 65535

The set value "15" becomes 1Hz.
(The set value "1" becomes 1/15Hz)

U02 1st S-shape level at acceleration (start)

U03 2nd S-shape level at acceleration (stop)

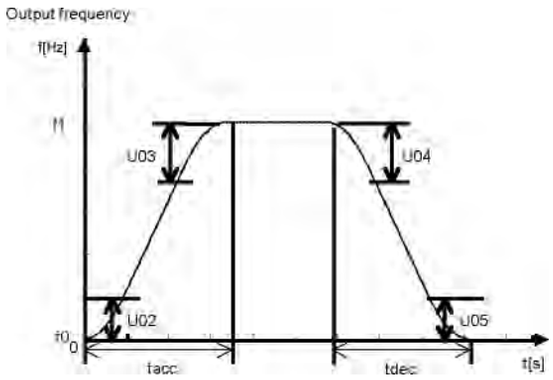
U04 1st S-shape level at acceleration (start)

U05 2nd S-shape level at acceleration (stop)

- When "2" is set in the function code: H07, both curvilinear acceleration and deceleration ranges of S-shape can be set up arbitrarily.
  The range is the ratio for maximum output frequency 1 (F03) or 2 (A01).

U	0	2	U	S	E	R		0	2			
U	0	3	U	S	E	R		0	3			
U	0	4	U	S	E	R		0	4			
U	0	5	U	S	E	R		0	5			

Setting range : 1 to 50%



- 100% value of this function means maximum frequency ***(fmax)*** .

Acceleration time "***tacc***" and deceleration time "tdec" of upper figure become longer than the linear acceleration time and deceleration time. When the set acceleration time (F07, E10, E12, E14) is assumed to be "***Ta***" and deceleration time (F08, E11, E13, E15) is assumed to be "***Td***", "***tacc***" and "***tdec***" can be calculated by the following expressions.

At acceleration,

$$|f1 \quad f0| \quad f\,max \quad \frac{U02 \quad U03}{100} \quad \text{or,}$$

At deceleration,

$$|f1 \quad f0| \quad f\,max \quad \frac{U04 \quad U05}{100}$$

$$tacc \quad \left(\frac{f1 \quad f0}{f\,max} \quad \frac{U02 \quad U03}{100}\right) \quad Ta$$

$$tdec \quad \left(\frac{f1 \quad f0}{f\,max} \quad \frac{U04 \quad U05}{100}\right) \quad Td$$

linear Acceleration and deceleration clause — S-shape clause

- At acceleration,

$$|f1 \quad f0| \quad f\,max \quad \frac{U02 \quad U03}{100} \quad \text{or,}$$

At deceleration,

$$|f1 \quad f0| \quad f\,max \quad \frac{U04 \quad U05}{100}$$

$$tacc \quad 2 \quad \sqrt{\frac{f1 \quad f0}{f\,max} \quad \frac{100}{U02 \quad U03}} \quad \frac{U02 \quad U03}{100} \quad Ta$$

$$tdec \quad 2 \quad \sqrt{\frac{f1 \quad f0}{f\,max} \quad \frac{100}{U04 \quad U05}} \quad \frac{U04 \quad U05}{100} \quad Td$$

U08 **Initial value of main DC link capacitor**

U09 **Measured value of main DC link capacitor**

- Data for the life expectancy judgment of the capacitor in main circuit is stored in this function. The electrical discharge time of the capacitor can be measured automatically, and the time of part replacement can be confirmed according to the decrement rate from the factory shipment.

U	0	8	U	S	E	R		0	8		
U	0	9	U	S	E	R		0	9		

Setting range : 0 to 65535

- The electrical discharge time which is measured in the factory shipment is set to function code U08 as a initial value. This value is different in each inverter.
- The electrical discharge time of the capacitor is measured automatically, when the power supply is turned off. And, the result is stored in function code U09.

  When the power supply is turned off under the conditions as follows, decrement rate (%) to the factory shipment can be measured.

  Conditions: which has been described to "*Estimation of life expectancy based on maintenance information" of the instruction manual "8-2 periodical inspection".

  The result of $\frac{U09}{U08}\ 100$ is displayed in

  CAP=xxx.x% of maintenance information. At 85% it may be necessary to replace the capacitors.
- When you make measurement of capacity and life expectancy judgment of capacitor with an actual operating condition, set the value "30" to the function code "E20 to E24". And write the measurement result U09 with an actual operating condition to the function code U08 as an initial value as early as possible before inverter operation starts.

  However, life judgment by the measurement result cannot be performed in case of ① and ②.

  ① During inverter operation, the power supply is turned off .

  ② Cooling fan ON/OFF control is used. (function code : H 06= 1)

  Turn off the power supply of inverter, until the inverter and the cooling fan have stopped. It is not necessary to remove an option card or control terminal connections.

  As for "measurement with actual operating conditions", carry out this measurement about 10 times to minimize the error of measured results, and make an average value into an initial value .

  If there is 10% or more of difference from the last measured value, measurement should be disregarded in order to prevent incorrect measurement. Renewal of a display is not carried out.
- Set measured value U09 to the initial value U08 after exchanging capacitors.

Related Functions
E20~E24
(Set value :30)

U10 **PCB board capacitor powered on time**

- The accumulation time of the capacitor on PC board is displayed. The accumulated time of the control power supply multiplied by the life expectancy coefficient defined by the temperature inside the inverter are displayed. Hence, the hours displayed may not agree with the actual operating hours. Since the accumulation time are counted by unit hours, power input for less than one hour will be disregarded.

  The accumulated time is displayed in TCAP=xxxxxh of maintenance information. The standard at the replacement time is 61,000h. Refer to the manual "8-2 Periodic Inspection" for the further information.

U	1	0	U	S	E	R		1	0		

Setting range: 0 to 65535 hours

- Clear the accumulated time to 0 hours, after replacing the PC board on which the capacitors are mounted.

Related Functions
E20~E24
(Set value :30)

U11 Cooling Fan operating time

- The integrated operating hours of the cooling fan are displayed. Since the integrated hours are counted by unit hours, power input for less than one hour will be disregarded. The integrated hours are displayed in TFAN=xxxxxh of maintenance information.

  The standard replacement time is 40,000h for inverter of 4.0kW or less. The standard replacement time is 25,000h for inverter of 5.5kW or more. Estimated life expectancy of a cooling-fan at inverter ambient temperature of 40°C.

  The displayed value should be considered as a rough estimate because the actual life of a cooling fan is influenced significantly by the temperature. Refer to the manual "8-2 Periodic Inspection " for information.

U	1	1	U	S	E	R		1	1			

  Setting range : 0 to 65535 hours

- Clear integrated operating time to 0 hour after replacing the cooling fan.

Related Functions
E20~E24
(Set value :30)

U13 Magnetising current damping gain

- Adjust if magnetizing current instability occurs in the inverter output current .

U	1	3	U	S	E	R		1	3			

  Setting range: 0 to 65535

- Adjust the value from 0 to 2048 as a standard value. Damping is at maximum at set value of 4096.

U15 Slip compensation filter time constant

- The filter time constant of Slip compensation is set.

U	1	5	U	S	E	R		1	5			

Setting range : 0 to 32767

- Calculate the filter time constant using the following formula.

$$\textit{Filter time constant} \ \frac{2^{16}}{\text{“U15” set value}} \ [\textbf{ms}]$$

Note: Response time is faster when the set value is bigger. Therefore, there is a possibility that the output frequency may become unstable. It may be necesary to adjust set value to smaller than factory set value.

U23 Integral gain of continuous operation at power failure

U24 Proportional gain of continuous operation at power failure

- This function becomes effective, when function code F14 (Restart mode after momentary power failure) set value is 2 or 3.

U	2	3	U	S	E	R		2	3			

U	2	4	U	S	E	R		2	4			

  Setting range : 0~65535

- In case of F14 set value : 2.

  When the operation continuation level (H15) is reached, deceleration to a stop occurs. The DC voltage of the main circuit sharpens the deceleration slope, and the inverter collects the inertia energy of the load to maintain the DC bus voltage and controls the motor until it stops, so that the undervoltage protection function is not activated.

  The deceleration slope is adjusted with U23 and U24.

  However, the deceleration operation time never becomes longer than the set deceleration time.

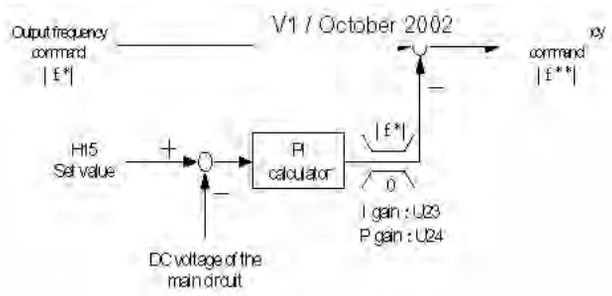
- In case of F14 set value : 3.

  The output frequency is lowered by the control by and the DC voltage of the main circuit is kept constant from the regeneration energy, so that the inverter may continue operation when momentary power failure occurs.

  The response is adjusted with U23 and U24 at this time.

- Calculate the integral gain using the following formula

$$\textit{Integral gain} = \frac{2^{16}}{\text{“U15” set value}} \ [\textbf{ms}]$$



U48 Input phase loss protection

- This function selects operation of input phase loss or power supply imbalance protection.

U48	USER	48

Setting range : 0 to 2

Set value	Operation
0	Active (without reactor (ACR/DCR))
1	Active (with reactor (ACR/DCR))
2	Inactive

⚠ CAUTION	When "2" is set to U48, protection against input phase loss or power supply voltage imbalance is disabled. In the event of a phase loss, the DC capacitors will be stressed. **Failure may result.**

U48 RS485 protocol selection

- The protocol of RS485 communication is changed.

U49	USER	49

Setting range : 0, 1

Set value	Operation
0	FGI-bus (default)
1	Modbus-RTU

Separate instruction manual is available detailing communication protocol, etc. Contact IMO for details.

U56 Speed agreement/PG error (Detection width)

U57 Speed agreement/PG error (Detection timer)

U58 PG error selection

- These functions are effective for the option card (VXMEFC / OPC-G11S-PG, -PG2, -PGA).

  Refer to each option card's instruction manual.

U56	USER	56
U57	USER	57
U58	USER	58

U59 Braking - resistor function select

- When function code F13 (electronic thermal) is set to 2, both the type of the braking resistor and connection circuit are set. Factory setting is set to nominal applied resistor and the number of resistor is one. When the power load capacities of resistor are increased, set the factory setting properly.

U59	USER	59

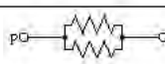
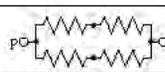
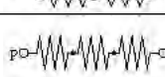
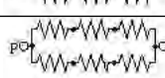
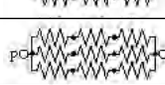
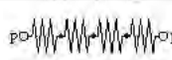
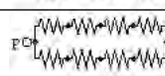
Setting range : 0 to A8 (HEX)

Setting of ten's digit (type selection)

Set value	Applicable inverter capacity (kW)	Resistance [Ω]	Capacity [W]	Duty cycle [%ED]
0	Standard applied resistor	-	-	10%
6	0.4 and 0.75	200	200	
7	1.5 and 2.2	160	400	
8	4.0	130	400	
9	5.5	80	800	
A	7.5	60	900	

⚠ CAUTION	The resistor data above is for 400V VXM series only. Do not connect a resistor of too low [Ω] value. **Failure may result.**

Setting of unit's digit (connection circuit selection)

Set value	Breaking-resistor		**1) Duty cycle [%ED]	Total resistance [Ω]	Power consumption per resistance (comparatively)
	Number of Rs	Connection circuit			
0	1		10%	R	100%
1	2		20%	2R	50%
2	2		20%	(1/2)R	50%
3	4		40%	R	25%
4	3		30%	3R	33%
5	6		50%	(3/2)R	17%
6	9		50%	R	11%
7	4		40%	4R	25%
8	8		50%	2R	12.5%

1) Limited by the %ED value of the braking transistor inside the inverter.

⚠ CAUTION

- Set the function code both " F13" and "U59 " before operating the inverter, and don't change the functions during operation. The integrated thermal data is cleared immediately, when function code " F13" or "U59 " are changed. The overheat protection of resistor becomes invalid. When function codes " F13" or "U59 " are changed in the state where temperature has risen, the overheat protection of resistor becomes invalid also.
- As there is a possibility of damaging the inverter, a resistor value less than standard value should not be connected.
- When designing a network of braking resistors for higher %ED, construct so that power is consumed equally in each resistor.
- When resistors are used of other values to those in the table, function code F13 should be set to "0".
- When resistor values less than Standard applied resistor value is set to the function code, regeneration operation is invalid. OU alarm will be occurred.
- If connection of resistor and setting value of resistor is not corresponded, there is a possibility of damaging the resistor and the inverter.

Failure may result.

U60 Regeneration avoidance at declaration

- This function is available, when torque limit (brake) of F41(or E17) is set to "0%".

U60 USER 60

Setting range: 0, 1

Set value	Operation
0	Torque limit operation (for high response use)
1	OU alarm avoidance operation (for only deceleration or Large inertia use)

- If function code U60 is set to "0", braking torque is kept to about 0% under acceleration, deceleration, and constant speed states. Output frequency is controlled to correspond to a rapid change in motor load to prevent OU trip. Deceleration time becomes longer than the set deceleration time (F08).
- In case of setting value U60 to "1", compared with setting value "0", torque limiting is applied only during deceleration time and to prevent the rise of the DC voltage of the main circuit, and avoid OU trip.

  Although deceleration time becomes longer than the set value of F08, it becomes shorter than setting value "0" of U60. OU trip may occur if load changes rapidly during deceleration.

U61 Voltage detect offset and gain adjustment

- 30kW or more only.

  For adjustment only when a printed circuit board is replaced during maintenance, etc. If not necessary, do not use this function.

U61 USER 61

Setting range: 0, 1, 2

Inverter capacity	Operation
22kW or more	0 : Inactive(fixed)
30kW or less	0 : Inactive 1 : Voltage detect offset adjustment 2 : Voltage detect gain adjustment

5

- Set the function code in the following procedure.

  If the inverter is operated without this adjustment after replacing the PCB, normal operation may not be possible.

  (Offset adjustment)

  1) Confirm that the main power supply is turned ON, the motor is connected and is not running (inverter FWD / REV operation command is OFF).

  2) When the data of U61 is changed to "1", and the FUNC/DATA key is pressed, the offset self adjustment is started. The keypad display shows "storing" then disappears several seconds later. When the set value returns to "0", adjustment is completed.

     If the main power supply is turned OFF, while outputting alarm or run commmand or coast-to-stop command (BX) is ON when this adjustment is started, the inverter displays the message "Er7:TUNING ERROR".

     In this case, start the self adjustment procedure again after correcting the above scenarios.

  (Gain adjustment)

  1) Run the motor at a constant arbitrary frequency of about 10 to 60Hz after executing the above-mentioned offset adjustment (U61 = 1).

     At this time, gain adjustment is available unrelated to the load state.

  2) Change the value of U61 to "2", and press the FUNC/DATA key. The gain self adjustment is started. The keypad display shows "storing" then disappears several seconds later. When the set value returns to "0", adjustment is completed.

     If inverter is not operated, this adjustment is not available.

IMO Jaguar VXM series - Software Version UP

Identification of products as “Previous software version” and “New software version”.

Products up to 22kW
Letter “A” is added in the end of serial number of New software version.

Products 30kW and larger
Please identify with production month seen in the serial numbers.
Production month appears in the second digit of the serial number

25******

First letter shows Production Year (e.g. “2” means 2002 and “3” means 2003)
Second digits shows Production month (“1”= January. “2” = February…….
“X” = October, “Y” = November and “Z” = December.)

Number of ROM version and the combination

ROM number of new software version

	22kW and smaller (Plastic covers)	30kW and larger (Steel covers)
Main inverter software version	S09000 and later	H09000 and late
Keypad panel software version	K08000 and later	

Number of ROM version can be checked by maintenance information in LCD of kepad panel

Interchangablity between present version and new version on ROM version

		VXM inverter	
		Present version	**New software version**
		22kW and Smaller:S08999 and older **30kW and larger**: H08999 and older	**22kW and smaller**:S09000 and later **30kW and larger**: H09000 and later
Keypad	**Present version** K06900 and later	Existing Combination	Interchangeability of operation Present function codes “F, E, C, P, H, A” are displayed and can be either verified or copied. New U (User Function) codes are not displayed.
	New software version K0800 and later	Interchangeability of operation Present function codes “F, E, C, P, H, A” are displayed and can be verified or copied. New U (User Function) codes are not displayed.	All function codes “F, E, C, P, H, A, U” are displayed. Existing function codes “F, E, C, P, H, A” can be verified or copied. New U (User Function) codes cannot be verified or copied.

6 Protective Operation

6-1 List of Protective Functions

In the event of an abnormality in the inverter, the protective function will activate immediately to trip the inverter, display the alarm name on the LED monitor, and the motor coasts-to-a stop. For alarm contents, see Table 6.1.1.

Alarm Name	Keypad panel display		Contents of operation	
	LED	LCD		
Over current	OC1	OC DURING ACC	During acceleration	If the inverter output current momentarily exceeds the overcurrent detection level due to an overcurrent in the motor, or a short-circuit or a ground fault in the output circuit, the protective function is activated.
	OC2	OC DURING DEC	During deceleration	
	OC3	OC AT SET SPD	Running at constant speed	
Ground fault	EF	GROUND FAULT	If a ground fault in the inverter output circuit is detected, the protective function is activated (for 30 kW or more only). If a ground fault occurs in an inverter rated at 22 kW or less, the inverter is protected by the overcurrent protection. If protection against personal injury or property damage is required, install a ground-fault protective relay or earth-leakage circuit breaker separately.	
Overvoltage	OU1	OV DURING ACC	During acceleration	If the DC link circuit voltage of the main circuit exceeds the overvoltage detection level (400 V series: 800 V DC) due to an increase in the regenerating current from the motor, the output is shut down. However, protection against inadvertent overvoltage apply (e.g., high-voltage line) may not be provided.
	OU2	OV DURING DEC	During deceleration	
	OU3	OV AT SET SPD	Running at constant speed	
Undervoltage	LU	UNDER-VOLTAGE	If the DC link circuit voltage of the main circuit falls below the undervoltage detection level (400 V series: 400 V DC) due to a lowered power supply, the output is shut down. If function code F14 (Restart after momentary power failure) is selected, an alarm is not displayed. In addition, if the supply voltage falls to a level unable to maintain control power, an alarm may not be displayed.	
Input open-phase	Lin	PHASE LOSS	If the inverter is driven with any one of the three phases connected to L1/R, L2/S and L3/T of the main circuit power supply "open," or if there is a significant disparity between the phases, the rectifying diodes or smoothing capacitors may be damaged, at such time an alarm is issued and the inverter is tripped.	
Overheating of heat sink	OH1	FIN OVERHEAT	If the temperature of the heat sink rises due to a cooling fan failure, etc., the protective function is activated.	

Alarm Name	Keypad panel display		Contents of operation
	LED	LCD	
External alarm	OH2	EXT ALARM	If the external alarm contacts of the braking unit, braking resistor or external thermal O/L relay are connected to the control circuit terminals (THR), this alarm will be actuated according to contact off signal. When the PTC thermal protection is activated, the drive also stops indicating this alarm.
Inverter internal overheating	OH3	HIGH AMB TEMP	If the temperature inside the inverter rises due to poor ventilation, etc., the protective function is activated.
Overheating of braking resistor	dbH	DBR OVERHEAT	If electronic thermal O/L relay (for braking resistor) function code F13 is selected, the protective function is activated to prevent the resistor from burning due to overheating following frequent use of the braking resistor.
Motor 1 overload	OL1	MOTOR1 OL	The protective function is activated if the motor current exceeds the preset level, provided that electronic thermal O/L relay 1 function code F10 has been selected.
Motor 2 overload	OL2	MOTOR2 OL	If the second motor current exceeds the preset level when the operation is switched to drive the second motor, the protective function is activated, provided that electronic thermal O/L relay 2 of function code A04 is selected.
Inverter overload	OLU	INVERTER OL	If the output current exceeds the rated overload current, the protective function is activated to provide thermal protection against semiconductor element overheating in the inverter main circuit.
Blown fuse	FUS	DC FUSE OPEN	If the fuse in the inverter is blown out following a short-circuit or damage to the internal circuit, the protective function is activated (for 30 kW or more only).
Memory error	Er1	MEMORY ERROR	If a memory error occurs, such as missing or invalid data, the protective function is activated.
Keypad panel communication error	Er2	KEYPD COM ERR	If a communication error or interrupt between the keypad panel and control circuit is detected, the protective function is activated.
CPU error	Er3	CPU ERROR	If an CPU error occurs due to noise, etc., the protective function is activated.
Option error	Er4	OPTN COM ERR	Error when using an optional unit
	Er5	OPTION ERROR	
Forced stop	Er6	OPR PROCD ERR	Error when using the forced stop command
Output wiring error	Er7	TUNING ERROR	If there is an open circuit or a connection error in the inverter output wiring during performing auto-tuning, the protective function is activated.
RS485 communication error	Er8	RS485 COM ERR	If an error occurs when using RS485, the protective function is activated.

Table 6-1-1 List of alarm displays and protective functions

6-2 Alarm Reset

To release the trip status, enter the reset command by pressing the RESET key on the keypad panel or inputting signal from the terminal (RST) of the control terminals after removing the cause of the trip.
Since the reset command is an edge operation, input a command such as "OFF-ON-OFF" as shown in Fig. 6-2-1.

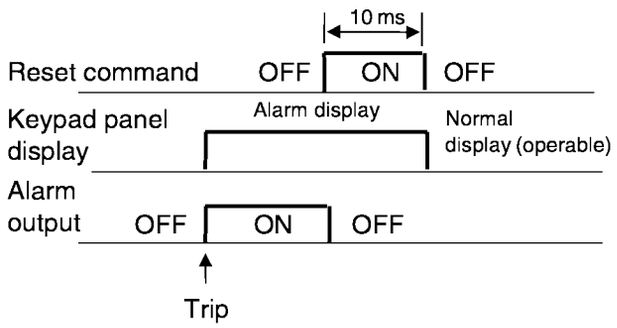


Figure 6-2-1

When releasing the trip status, set the operation command to OFF. If the operation command is set to ON, inverter will start operation after resetting.

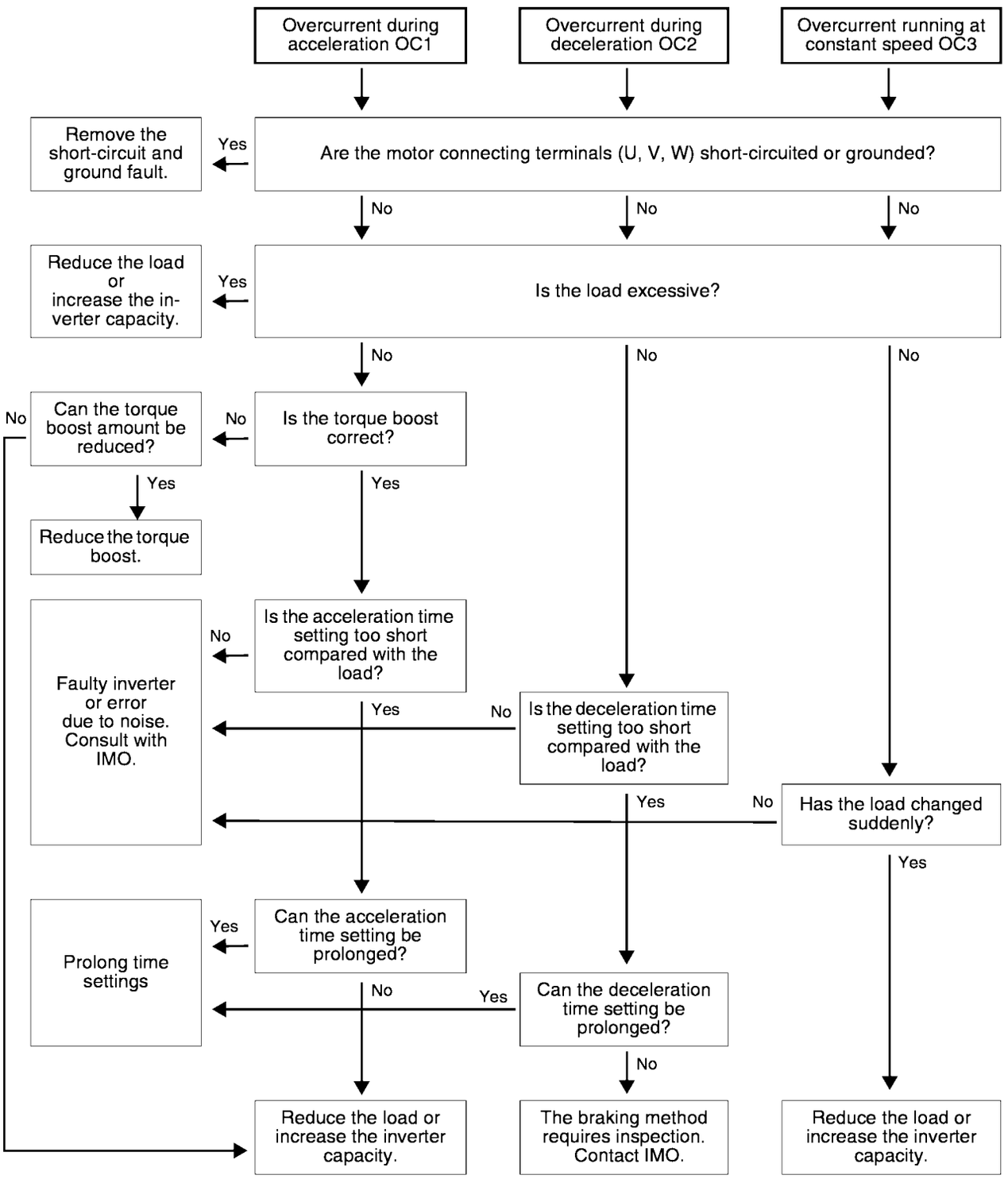
WARNING

If the alarm reset is activated with the operation signal ON, the inverter will restart suddenly, which may be dangerous. To ensure safety, disable the operating signal when releasing the trip status, **as accident may result.**

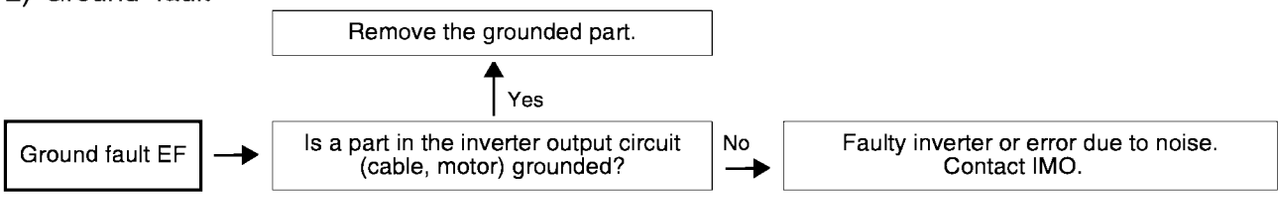
7 Troubleshooting

7-1 Protective function activation

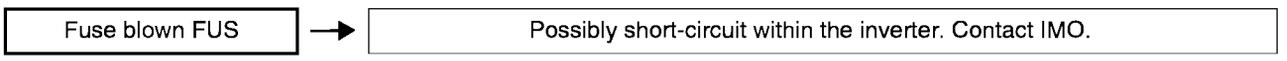
1) Overcurrent



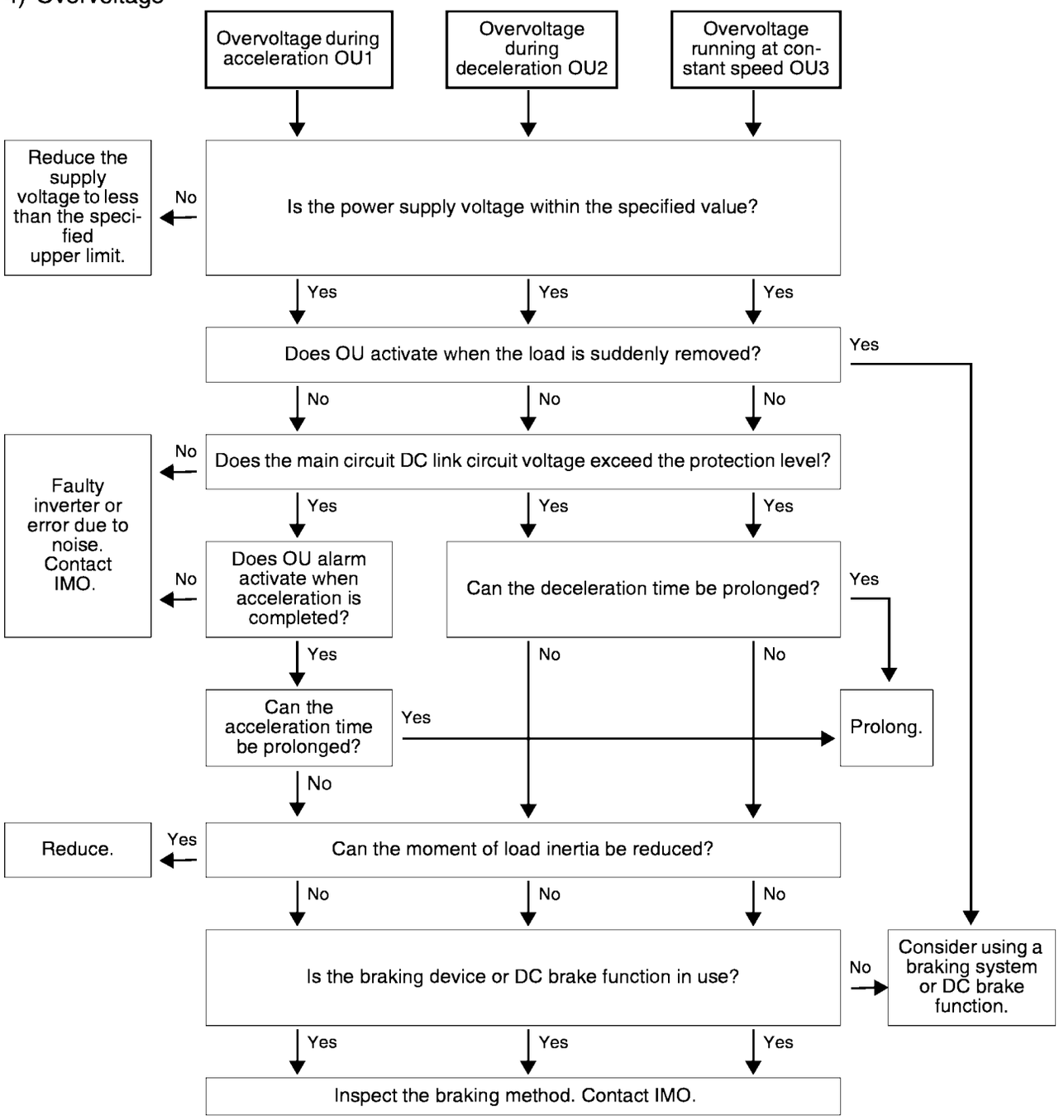
2) Ground fault



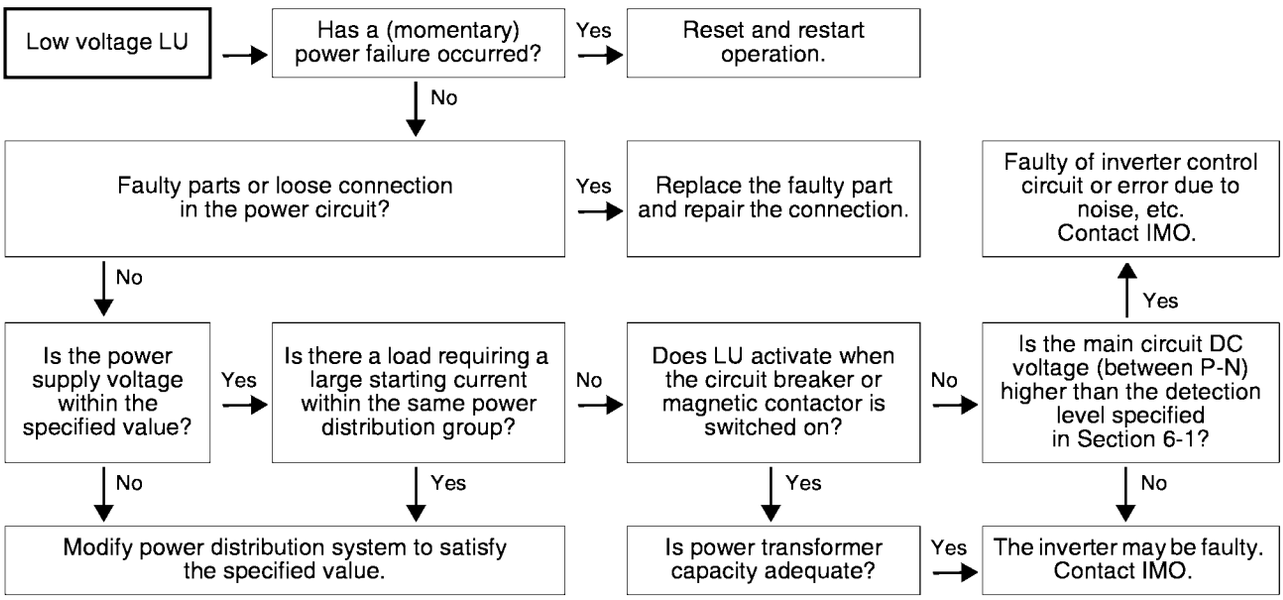
3) Fuse blown



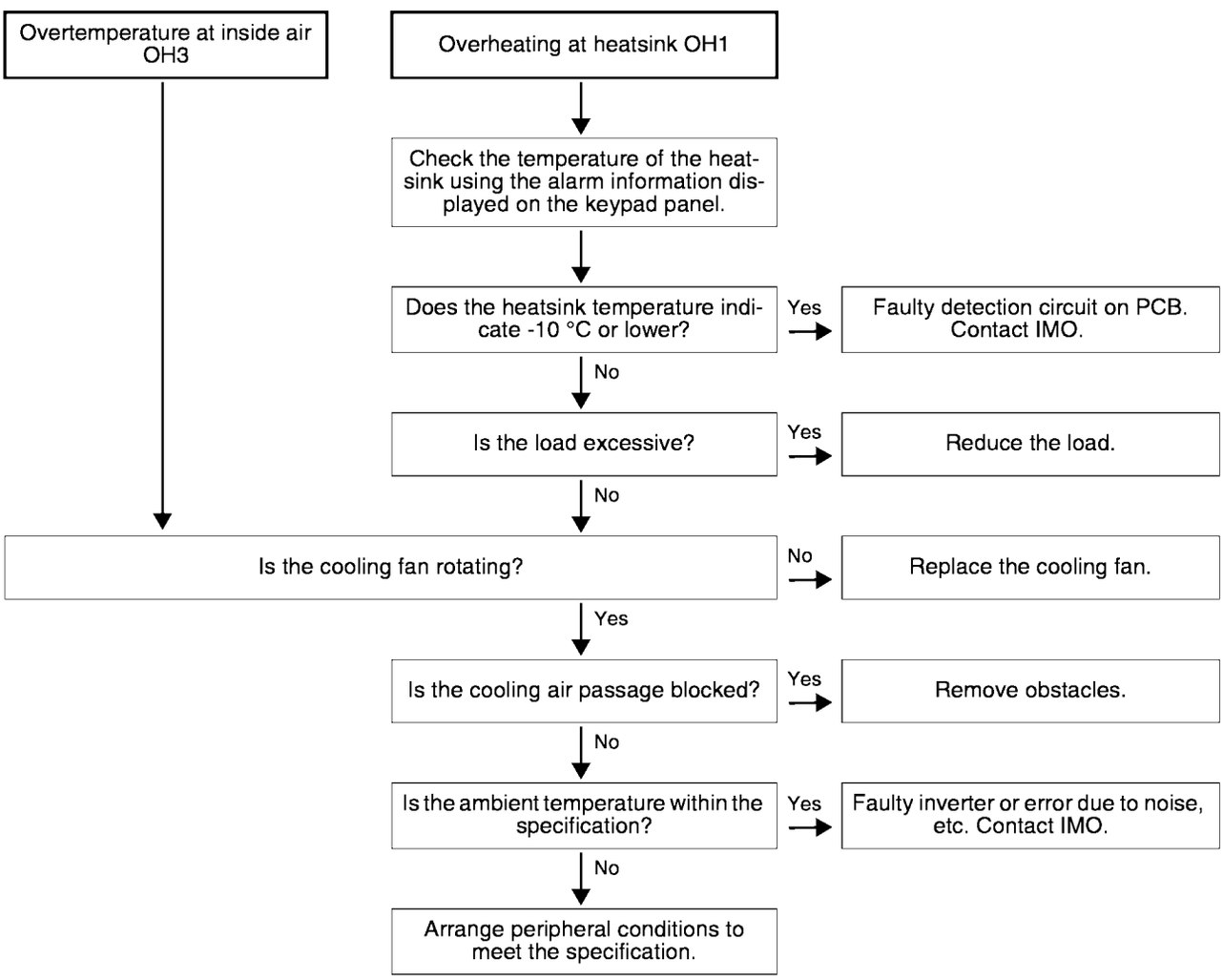
4) Overvoltage



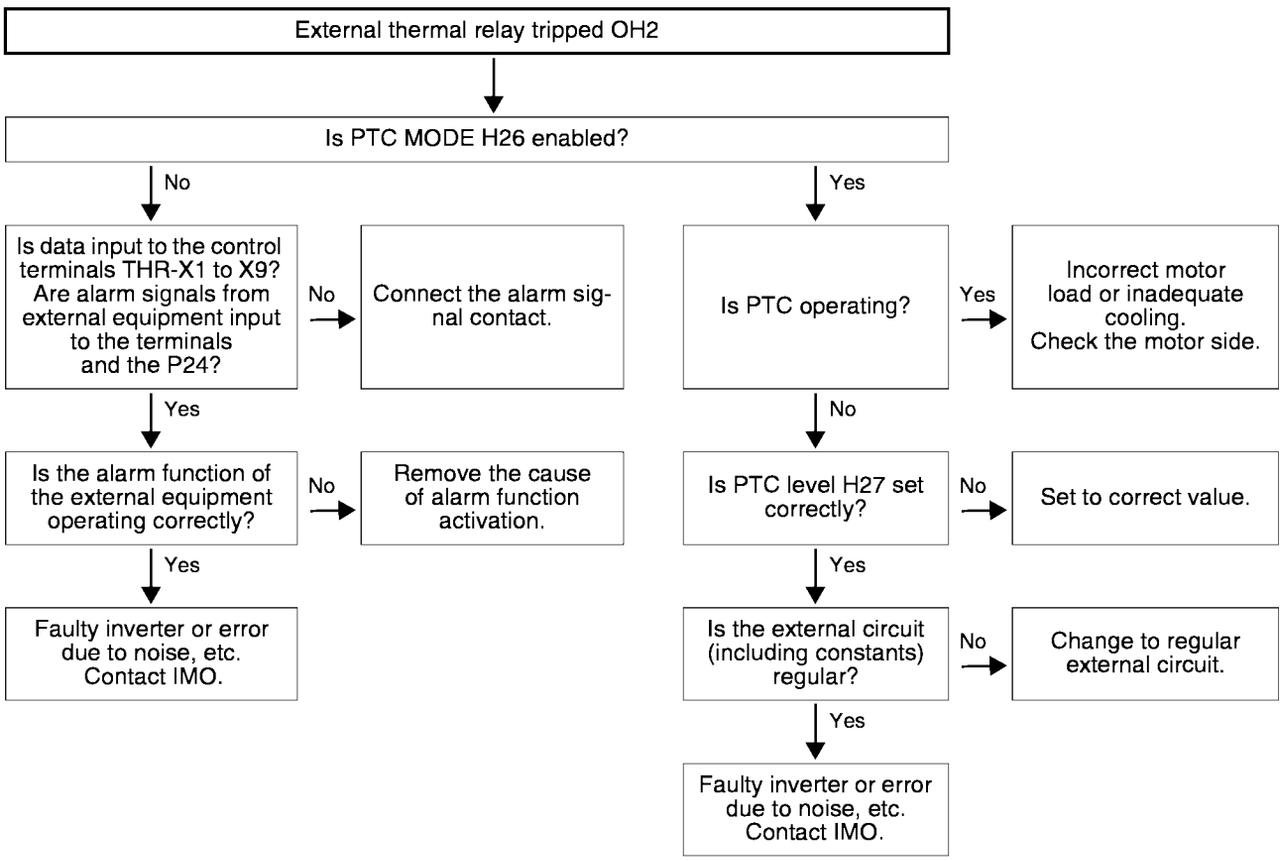
5) Low voltage



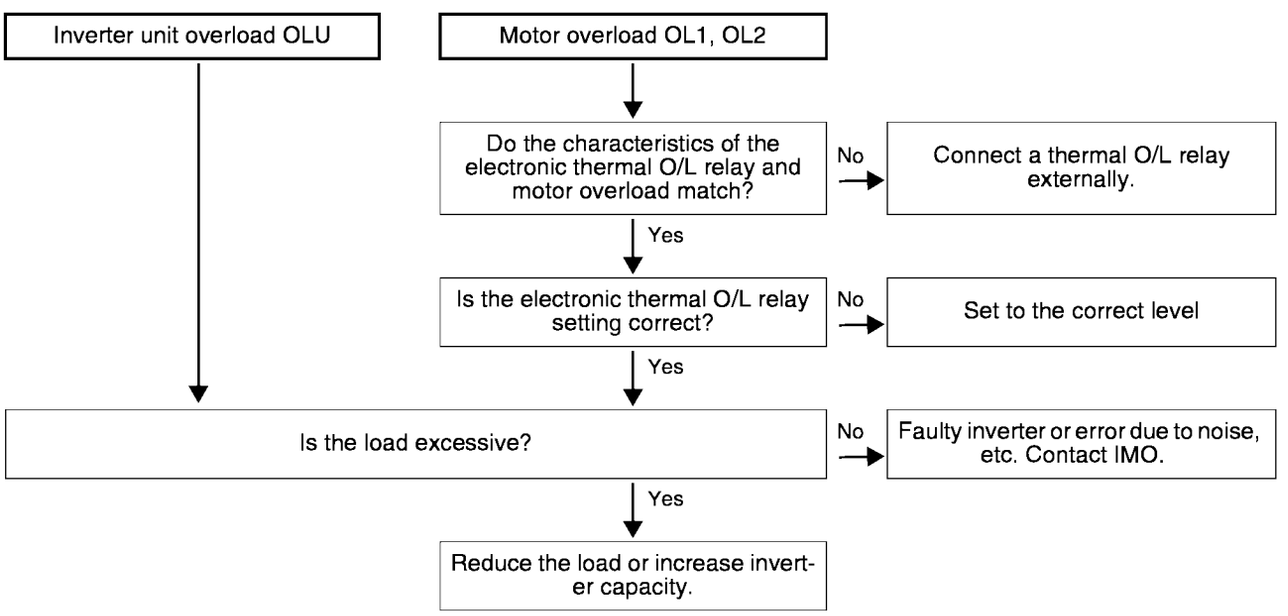
6) Overtemperature at inside air and overheating at heatsink.



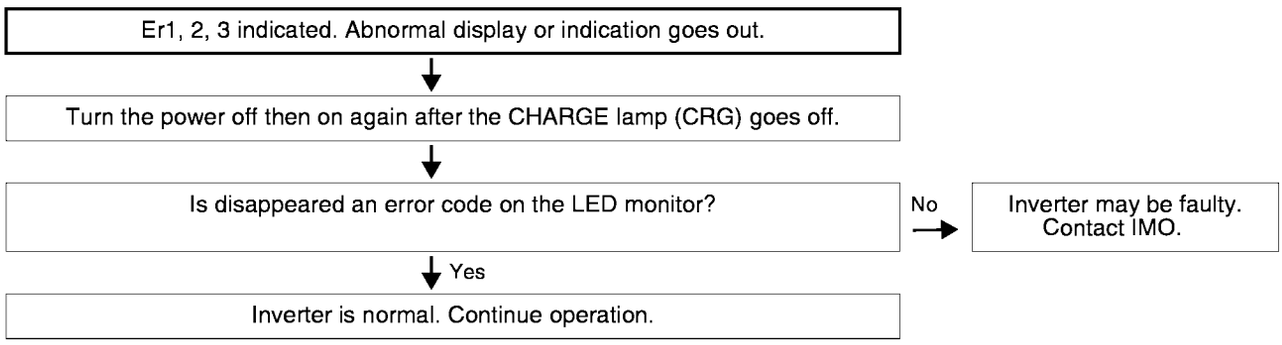
7) External thermal relay tripped



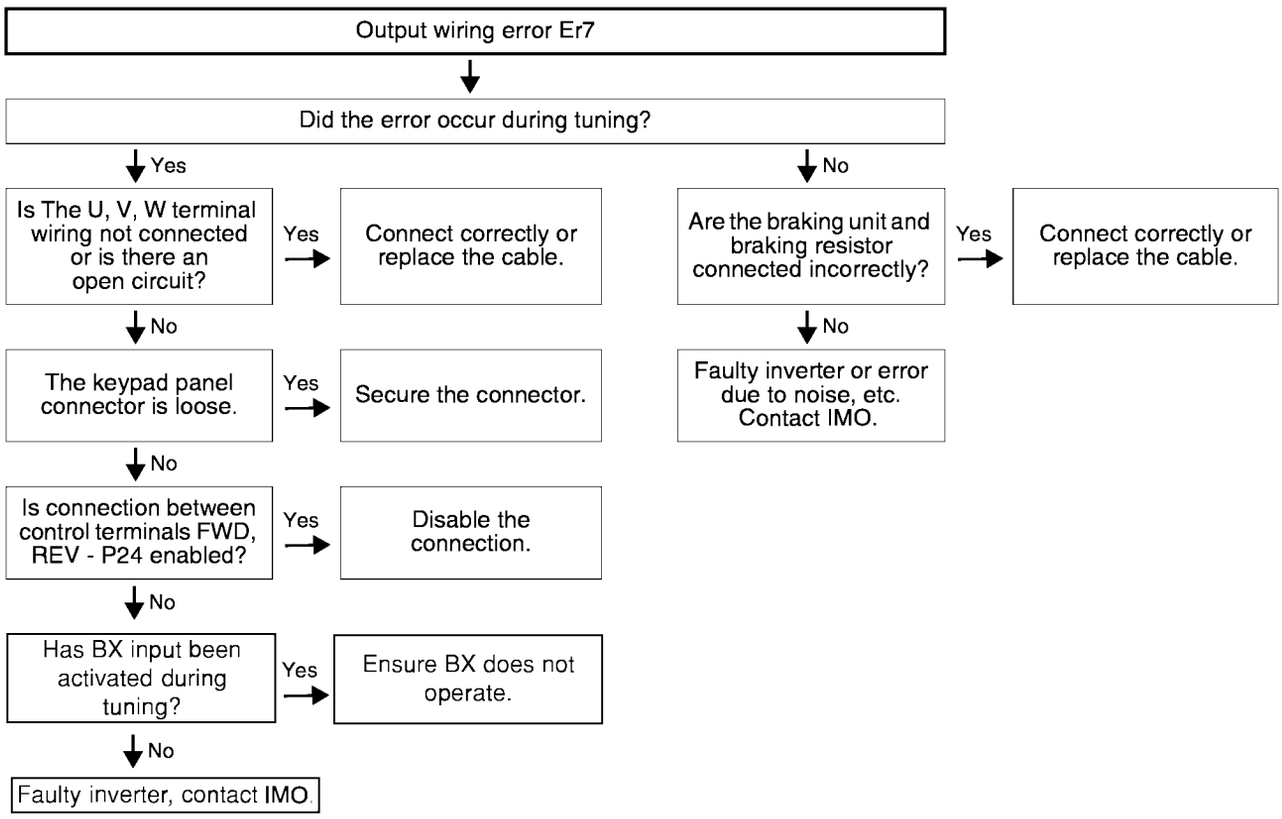
8) Inverter unit overload and motor overload



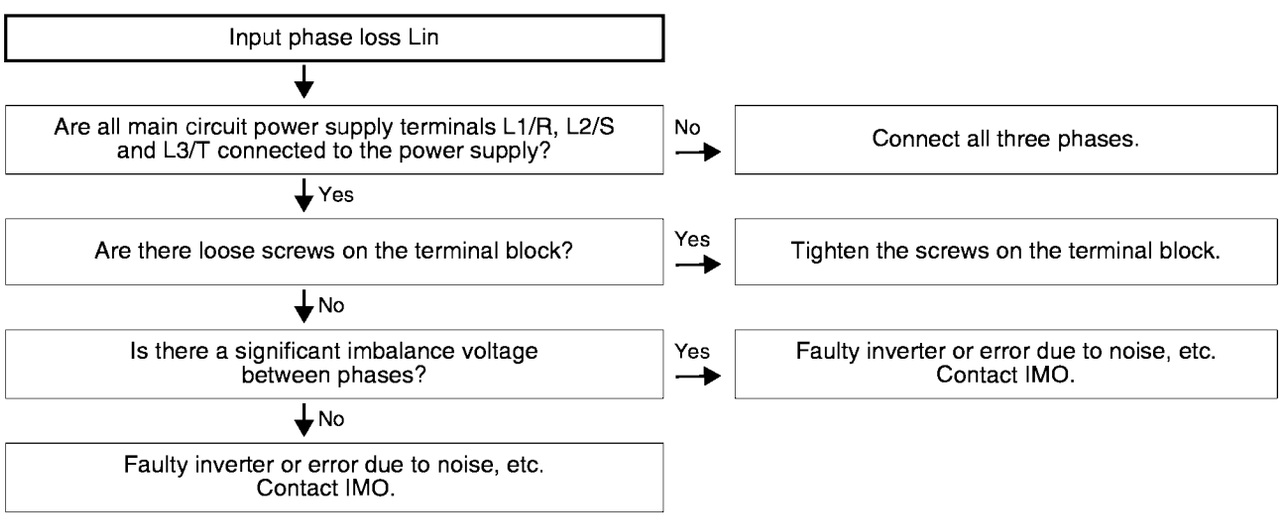
9) Memory error Er1, Keypad panel communication error Er2, CPU error Er3



10) Output wiring error

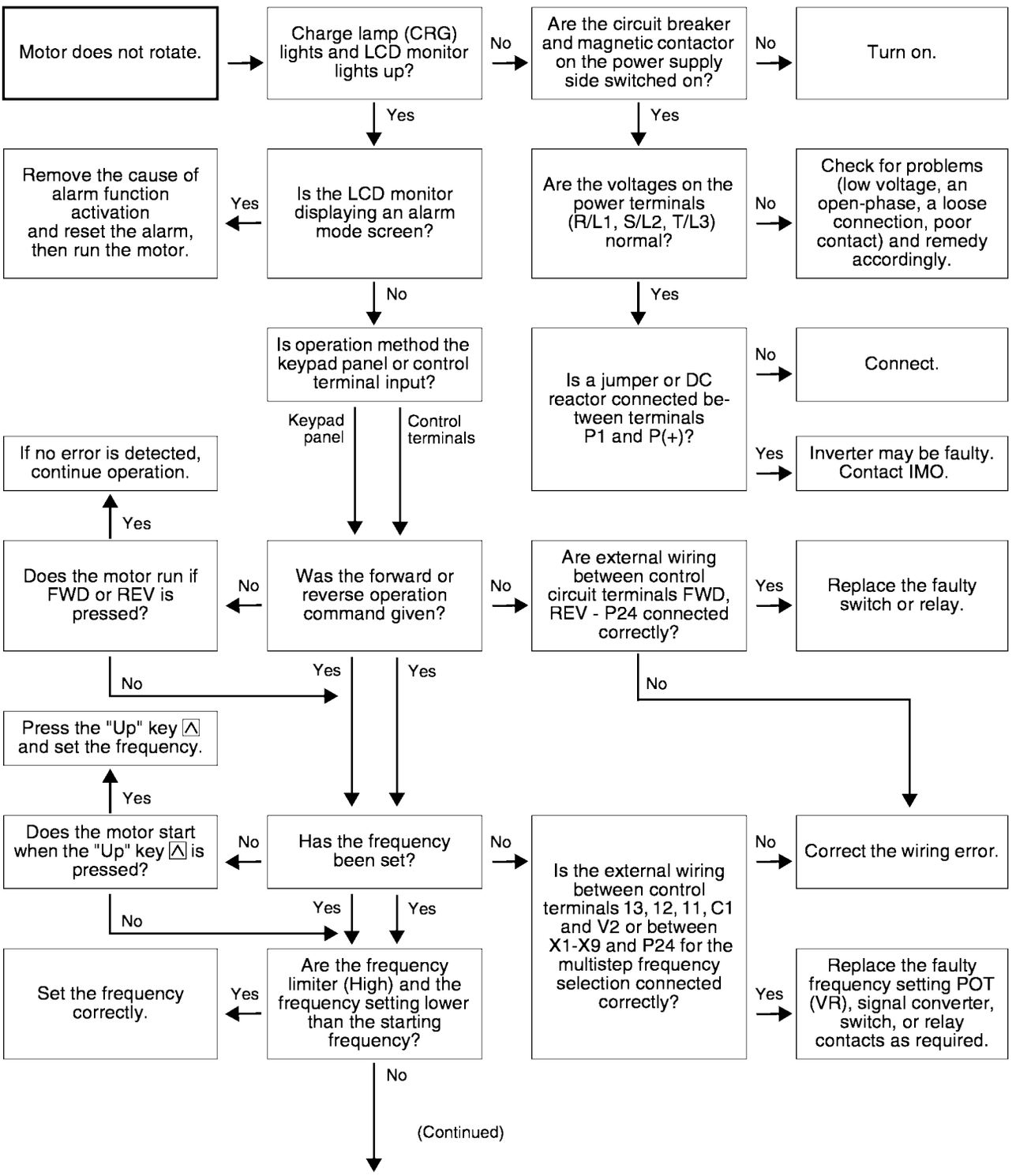


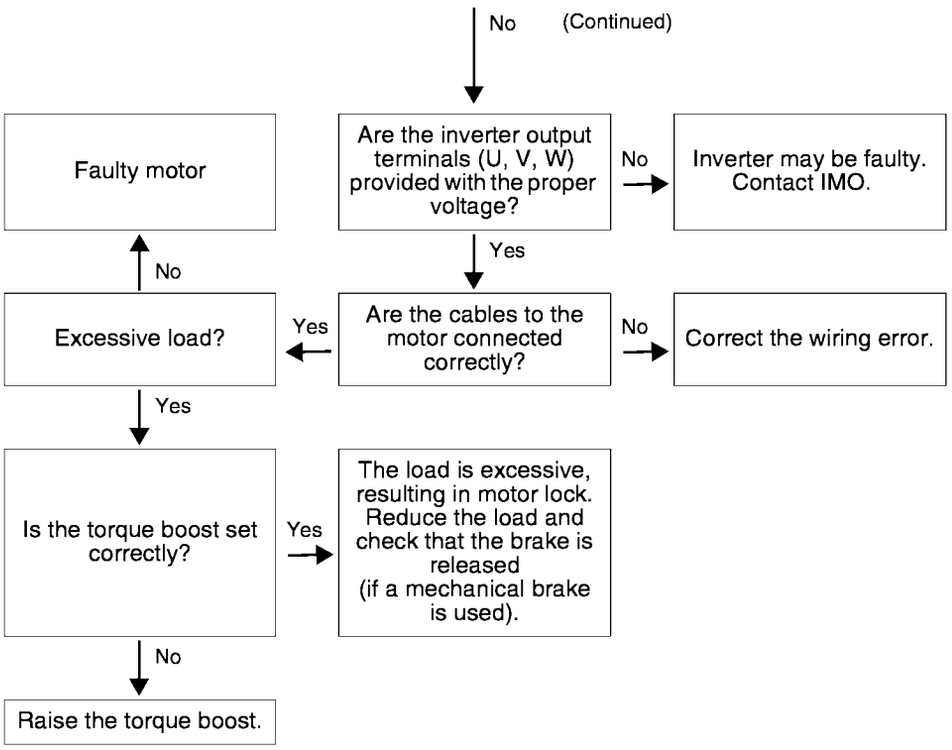
11) Input phase loss



7-2 Abnormal motor rotation

1) If motor does not rotate



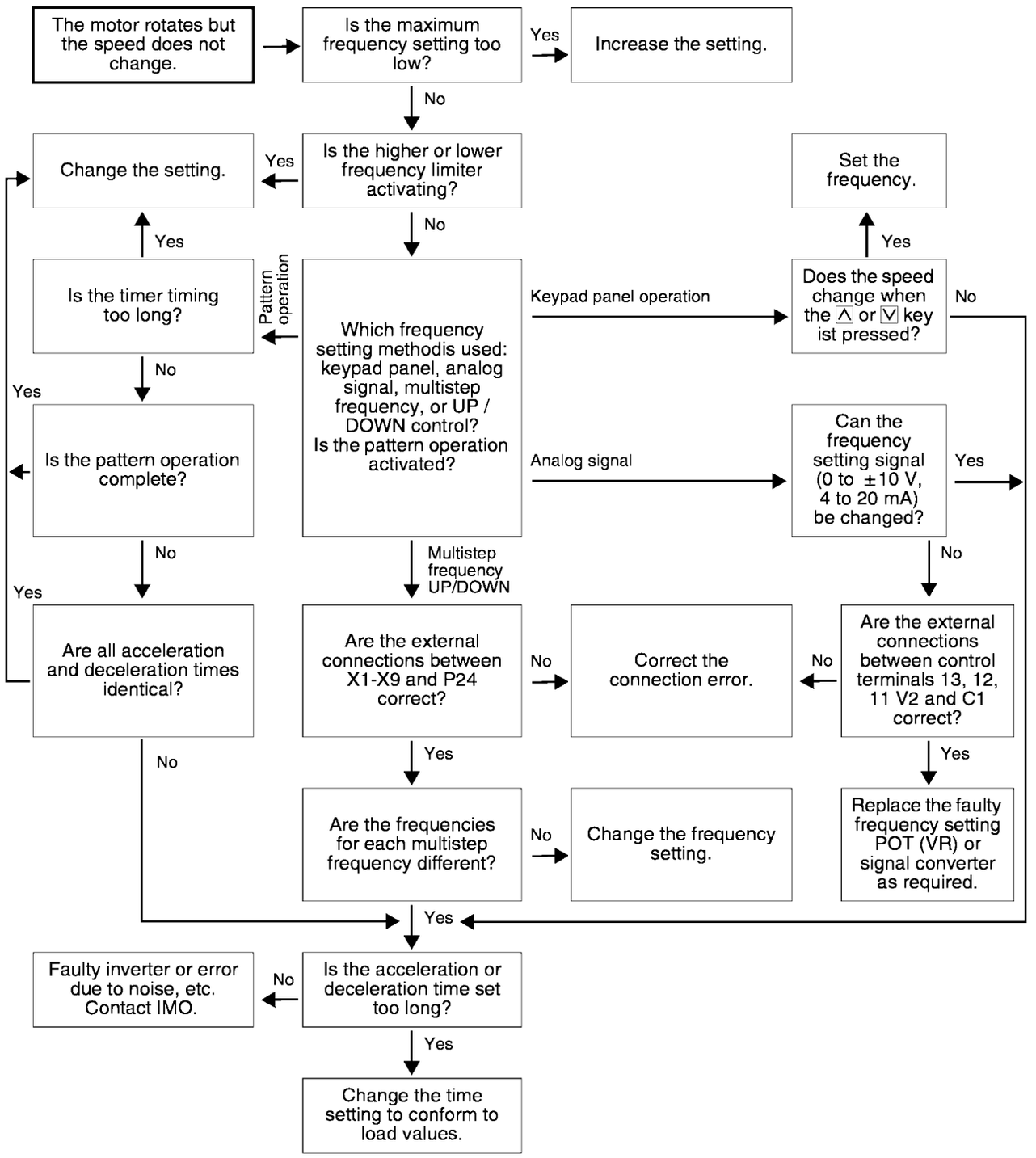


Note: Monitor the operation command or frequency setting values, etc., on the LED or LCD monitor after selecting the respective functions.

The motor does not rotate if the following commands are issued:

- An operation command is issued while the coast-to-stop or DC braking command is output.
- A reverse operation command is issued with the "H08 Motor reversal lock-out" value set to 1.

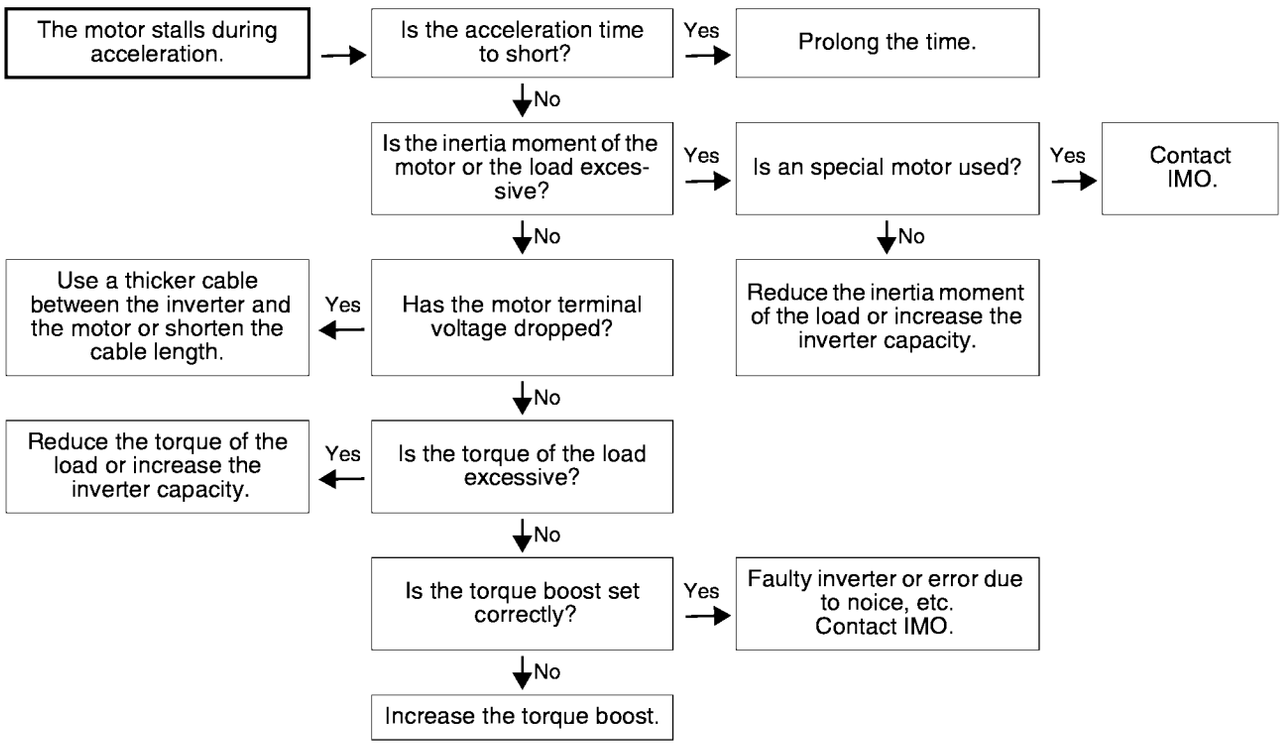
2) If the motor rotates but the speed does not change



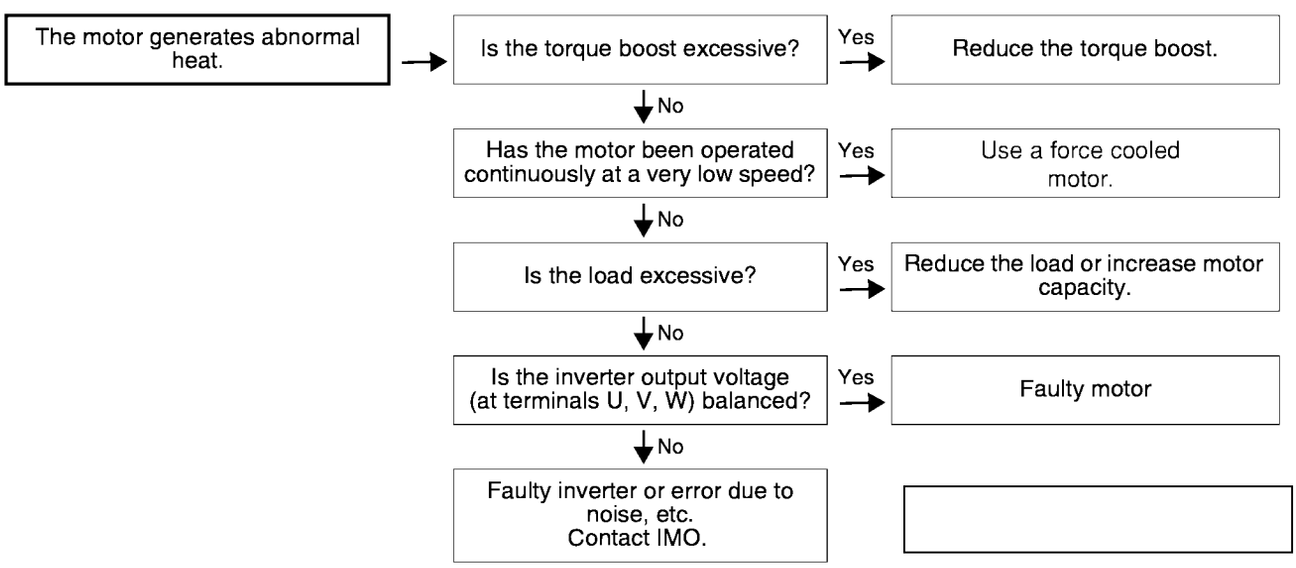
In the following cases, changing the motor speed is also restricted:

- Signals are input from control terminals both 12 and C1 when "F01 Frequency command 1" and "C30 Frequency command 2" are set to 3, and there is no significant change in the added value.
- The load is excessive, and the torque limiting and current limiting functions are activated.
- If switch PTC has been accidently moved during connection of control wires, motor runs at fixed frequency regardless of reference (when no thermistor is fitted to motor)

3) If the motor stalls during acceleration



4) If the motor generates abnormal heat



8 Maintenance and Inspection

Proceed with daily inspection and periodic inspection to prevent malfunction and ensure long-term reliability.
Note the following:

8-1 Daily Inspection

During operation, a visual inspection for abnormal operation is completed externally without removing the covers

The inspections usually cover the following:

1) The performance (satisfying the standard specification) is as expected.
2) The environment satisfies standard specifications.
3) The keypad panel display is normal.
4) There are no abnormal sounds, vibrations, or odors.
5) There are no indications of overheating or no discoloration.

8-2 Periodical Inspection

Periodic inspections must be completed after stopping operations, cutting off the power source, and removing the surface cover.
Note that after turning off the power, the smoothing capacitors in the DC section in the main circuit take time to discharge. To prevent electric shock, confirm using a multimeter that the voltage has dropped below the safety value (25 V DC or below) after the charge lamp (CRG) goes off.

WARNING

1. Start the inspection at least five minutes after turning off the power supply for inverter rated at 22 kW or less, and ten minutes for inverter rated at 30 kW or more. (Check that the charge lamp (CRG) goes off, and that the voltage is 25 V DC or less between terminals P(+) and N(-). **Electric shock may result.**
2. Only authorized personnel should perform maintenance and component replacement operations. (Remove metal jewelry such as watches and rings.) (Use insulated tools.)
3. Never modify the inverter.
   Electric shock or injury may result.

Check parts		Check items	How to inspect	Evaluation Criteria
Environment		1) Check the ambient temperature, humidity, vibration, atmosphere (dust, gas, oil mist, water drops). 2) Is the area surrounding the equipment clear of foreign objects.	1) Conduct visual inspection and use the meter. 2) Visual inspection	1) The specified standard value must be satisfied. 2) The area is clear.
Keypad panel		1) Is the display hard to read? 2) Are the characters complete?	1), 2) Visual inspection	1), 2) The display can be read and is not abnormal.
Structure such as a frame or cover		1) Is there abnormal sound or vibration? 2) Are nuts or bolts loose? 3) Is there deformation or damage? 4 Is there discoloration as a result of overheating? 5) Are there stains or dust?	1) Visual and aural inspection 2) Tighten. 3), 4), 5) Visual inspection	1), 2), 3), 4), 5) Not abnormal
Main circuit	Common	1) Are there loose or missing nuts or bolts? 2) Are there deformation, cracks, damage, and discoloration due to overheating or deterioration in the equipment and insulation? 3) Are there stains and dust?	1) Tighten. 2), 3) Visual inspection	1), 2), 3) Not abnormal **Note:** Discoloration of the bus bar does not indicate a problem.
	Conductor and wire	1) Is there discoloration or distortion of a conductor due to overheating? 2) Are there cracks, or discoloration of the cable sheath?	1), 2) Visual inspection	1), 2) Not abnormal
	Terminal block	Is there damage?	Visual inspection	Not abnormal
	Smoothing capacitor	1) Is there electrolyte leakage, discoloration, or swelling of the case? 2) Is the safety plug not protruding or protruding too far? 3) Measure the capacitance if necessary.	1), 2) Visual inspection 3) * Estimate life expectancy from maintenance information and from measurements using capacitance measuring equipment.	1), 2) Not abnormal 3) Capacitance ≥ initial value x 0.85
	Resistor	1) Is there unusual odor or damage to the insulation by overheating? 2) Is there an open circuit?	1) Visual and olfactory inspection 2) Conduct a visual Inspection or use a multimeter by removing the connection on one side.	1) Not abnormal 2) Less than about ±10 % of the indicated resistance value
	Transformer and reactor	Is there abnormal buzzing or an unpleasant smell?	Aural, olfactory, and visual inspection	Not abnormal

Check parts		Check items	How to inspect	Evaluation Criteria
Main circuit	Magnetic conductor and relay	1) Is there rattling during operation? 2) Are the contacts rough?	1) Aural inspection 2) Visual inspection	1), 2) Not abnormal
Control circuit	Control PC board and connector	1) Are there any loose screws or connectors? 2) Is there an unusual odor or discoloration? 3) Are there cracks, damage, deformation, or excessive rust? 4) Is there electrolyte leakage or damage to the capacitor?	1) Tighten. 2) Visual and olfactory inspection 3) Visual inspection 4) * Estimate life expectancy by visual inspection and maintenance information	1), 2), 3), 4) Not abnormal
Cooling system	Cooling fan	1) Is there abnormal sound or vibration? 2) Are nuts or bolts loose? 3) Is there discoloration due to overheating?	1) Aural and visual inspection. Turn manually (confirm the power is off). 2) Tighten. 3) Visual inspection 4) * Estimate life expectancy by maintenance information	1) The fan must rotate smoothly. 2), 3) Not abnormal
	Ventilation	Is there foreign matter on the heat sink or intake and exhaust ports?	Visual inspection	Not abnormal

Table 8-2-1 Periodical inspection list

* Estimation of life expectancy based on maintenance information
The maintenance information is stored in the inverter keypad panel and indicates the electrostatic capacitance of the main circuit capacitors and the life expectancy of the electrolytic capacitors on the control PC board and of the cooling fans. Use this data as the basis to estimate the life expectancy of parts.

Note: If equipment is stained, wipe with a clean cloth.
Vacuum the dust.

1) Determination of the capacitance of the main circuit capacitors
This inverter is equipped with a function to automatically indicate the capacitance of the capacitors installed in the main circuit when powering up the inverter again after disconnecting the power according to the prescribed conditions.
The initial capacitance values are set in the inverter when shipped from the factory, and the decrease ratio [%] to those values can be displayed.
Use this function as follows:

1. Remove any optional cards from the inverter. Also disconnect the DC bus connections to the main circuit P(+) and N(-) terminals from the braking unit or other inverters if connected. The existing power-factor correcting reactor (DC reactor) need not be disconnected.
A power supply introduced to the auxiliary input terminals (R0, T0) that provides control power should be isolated.
2. Disable all the digital inputs (FWD, REV, X1-X9) on the control terminals. Also disconnect RS485 communication if used.
Turn on the main power supply. Confirm that the cooling fan is rotating and that the inverter is not operating. (There is no problem if the "OH2 External thermal relay tripped" trip function is activated due to the digital input terminal setting off.)
3. Turn the main power off.
4. Turn on the main power again after verifying that the charge lamp is completely off.
5. Open the maintenance information on the keypad panel and confirm the capacitance values of the built-in capacitors.

2) Life expectancy of the control PC board
The actual capacitance of a capacitor is not measured in this case. However, the integrated operating hours of the control power supply multiplied by the life expectancy coefficient defined by the temperature inside the inverter will be displayed. Hence, the hours displayed may not agree with the actual operating hours depending on the operational environment.
Since the integrated hours are counted by unit hours, power input for less than one hour will be disregarded.

3) Life expectancy of cooling fan
The integrated operating hours of the cooling fan are displayed. Since the integrated hours are counted by unit hours, power input for less than one hour will be disregarded.
The displayed value should be considered as a rough estimate because the actual life of a cooling fan is influenced significantly by the temperature.

Parts	Level of judgment
Capacitor in main circuit	85 % or less of the initial value
Electrolytic capacitor on control PC board	61,000 hours
Cooling fan	40,000 hours (4.0 kW or less), 25,000 hours (Over 5.5 kW) [1)]

Table 8-2-2 Rough estimate of life expectancy using maintenance information

1) Estimated life expectancy of a ventilation-fan at inverter ambient temperature of 40 °C.

8-3 Measurement of Main Circuit Electrical Quantity

The indicated values depend on the type of meter because the harmonic component is included in the voltage and current of the main circuit power (input) and the output (motor) side of the inverter. When measuring with a meter for commercial power frequency use, use the meters shown in Table 8-3-1.

The power-factor cannot be measured using power-factor meters currently available on the market, which measure the phase difference between voltage and current. When power-factors must be measured, measure the power, voltage, and current on the input side and output side, then calculate the power-factor using the following formula:

$$\text{Power - factor} = \frac{\text{Power [W]}}{\sqrt{3} \times \text{Voltage [V]} \times \text{Current [A]}} \times 100\ [\%]$$

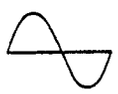
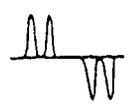
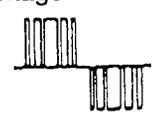
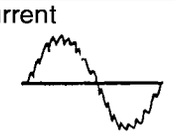
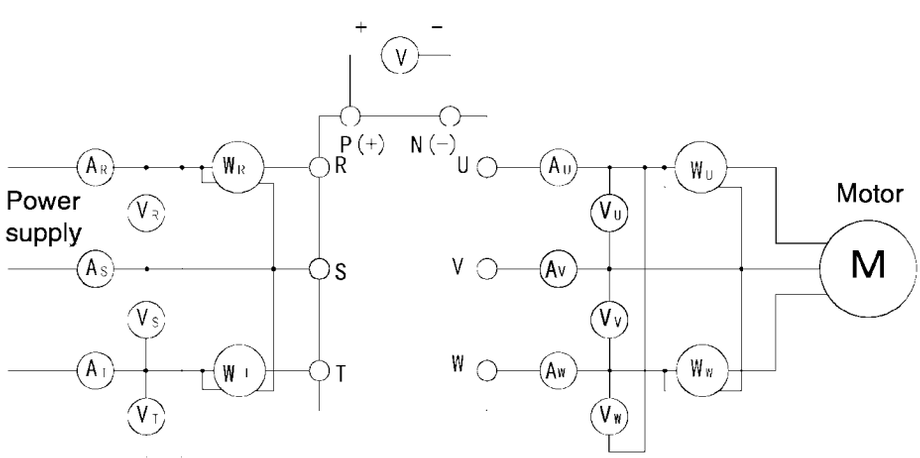
Item	Input (power supply) side			Output (motor) side			DC link circuit voltage (P(+) - N(-))
	Voltage  Current 			Voltage  Current 			
Meter name	Ammeter **A**R, S, T	Voltmeter **V**R, S, T	Powermeter **W**R, S, T	Ammeter **A**U, V, W	Voltmeter **V**U, V, W	Powermeter **W**U, V, W	DC voltmeter **V**
Meter type	Moving-iron type	Rectifier or moving-iron type	Digital power meter	Moving-iron type	Rectifier type	Digital power meter	Moving-coil type
Symbol							

Table 8-3-1 Meters for measuring main circuit

Note: When measuring the output voltage using a rectifier type meter, an error may occur.
Use a digital AC power meter to ensure accuracy.



8-4 Insulation Test

Avoid testing an inverter with a megger because an insulation test is completed at the factory. If a megger test must be completed, proceed as described below. Use of an incorrect testing method may result in product damage.
If the specifications for the dielectric strength test are not followed, the inverter may be damaged. If a dielectric strength test must be completed, contact IMO.

1) Megger test for the main circuit

1. Use a 500 V DC type megger and isolate the main power before commencing measurement.
2. If the test voltage is connected to the user's control circuit, remove all cables to the control circuit terminals.
3. Connect the main circuit terminals using common cables as shown in Fig. 8-4-1.
4. Execute the megger test only between the common cables connected to the main circuit and the ground (terminal ⏚G).
5. A reading indicating 5 MΩ or more is normal. (This is the value measured with an inverter only.)

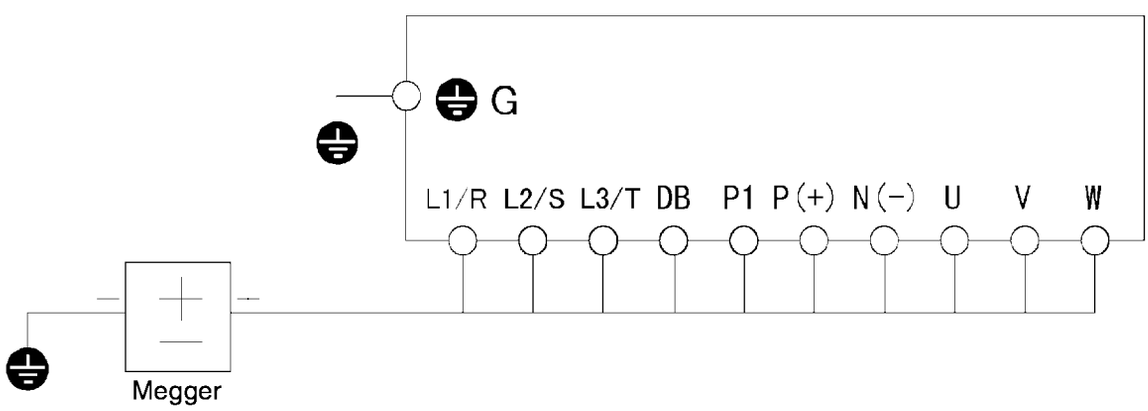


Figure 8-4-1 Megger test

2) Insulation test in the control circuit
A megger test and a dielectric strength test must not be performed on the control circuit. Use a high resistance range multimeter for the control circuit.

1. Remove all external cables from the control circuit terminals.
2. Conduct a continuity test between grounds. A result of 1M or more is normal.

3) Exterior main circuit and sequence control circuit
Remove all cables from inverter terminals to ensure the test voltage is not applied to the inverter.

8-5 Parts Replacement

The life expectancy of a part depends on the type of part, the environment, and usage conditions. Parts should be replaced as shown in Table 8-5-1. Check the actual state of fans and capacitors as described on page 8-4.

Part name	Standard period for replacement	Comments
Cooling fan	3 years	Exchange for a new part.
Smoothing capacitor	5 years	Exchange for a new part (determine after checking).
Electrolytic capacitor on the PC board	7 years	Exchange for a new PC board (determine after checking).
Fuse	10 years	Exchange for a new part.
Other parts	-	Determine after checking.

Table 8-5-1 Part replacement

8-6 Inquiries about Products and Product Guarantee

1) Inquiries
If there is damage, a fault in the product, or questions concerning the product, contact IMO.

a) Inverter type
b) Serial No. (equipment serial number)
c) Purchase date
d) Inquiry details (e.g., damaged part, extent of damage, questions, status of fault)

2) Product guarantee
The product guarantee term is five years after purchase from the year and month of manufacture on the nameplate, whichever expires first.
However, the guarantee will not apply in the following cases, even if the guarantee term has not expired:

1. Damage was caused by incorrect use or inappropriate repair and modification.
2. The product was used outside the standard specified range.
3. Damage was caused by dropping the product after purchasing or damage during transportation.
4. Damage was caused by an earthquake, fire, flooding, lightning, abnormal voltage or other natural causes.

9. Specifications

9-1 Standard Specifications

(1) Three-phase 400V series

Type																															
	VXM/VXMK		0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	-	30	37	45	55	75	90	110	132	150	200	220	280	315	355	400		
	VXM-KP		-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-	-	-	-	-	-							
Applied motor	Nominal (HT) use	[kW]	0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	-	30	37	45	55	75	90	110	132	150	200	220	280	315	355	400		
	Maximum (NT) use	[kW]	-	-	-	-	-	7.5	11	15	18.5	22	-	30	37	45	55	75	90	110	132	160	200	220	280	315	400	450	500		
Output ratings	Rated capacity *1)	[kVA]	1.0	1.7	2.6	3.9	6.4	9.3	12	17	21	28	32	32	43	53	65	80	107	126	150	181	218	270	298	373	420	467	531		
	Rated voltage *2)	[V]	3-phase 360, 400, 415V/50Hz 360, 400, 450V/60Hz																												
	Rated current *3)	(HT)	1.5	2.5	3.7	5.5	9	13	18	24	30	39	45	-	60	75	91	112	150	176	210	253	304	377	415	520	585	650	740		
		(NT)	-	-	-	-	-	16.5	23	30	37	44	-	60	75	91	112	150	176	210	253	304	377	415	520	585	650	740	840		
	Overload capability	(HT) (NT)	150% of rated output current for 1 min. 200% of rated output current for 0.5 s. } HT: (110% 1 min NT)											150% of rated output current for 1 min. 180% of rated output current for 0.5 s. } HT: (110% 1 min NT)																
	Rated frequency	[Hz]	50, 60Hz																												
Input ratings	Phase, Voltage, Frequency		3-phase 380 to 480V 50/60Hz											3-phase 380 to 440V 50/60Hz *4)																	
	Voltage/frequency variation		Voltage: +10 to -15% Voltage unbalance *5): 2% or less Frequency: +5 to -5%																												
	Momentary voltage dip capability *6)		When the input voltage is 310V or more, the inverter can be operated continuously. When the input voltage drops below 310V from rated voltage, the inverter can be operated for 15ms. The smooth recovery method is selectable																												
	Rated current A *7)	(With DCR)	0.82	1.5	2.9	4.2	7.1	10.0	13.5	19.8	26.8	33.2	39.3	54	54	67	81	100	134	160	196	232	282	352	385	491	552	624	704		
		(Without DCR)	1.8	3.5	6.2	9.2	14.2	21.5	27.9	39.1	50.3	59.9	69.3	36	36	104	124	150	-	-	-	-	-	-	-	-	-	-		
	Required power supply capacity (with DCR)	[kVA]	0.6	1.1	2.1	3.0	5.0	7.0	9.4	14	19	24	26	36	36	47	57	70	93	111	136	181	196	244	267	341	383	432	488		
Control	Starting torque		200% (With dynamic torque-vector control selected)											180% (With dynamic torque-vector control selected)																	
Braking	Standard	Braking torque	150%		100%					20% *8)				15 to 10% *8)																	
		Time [s]	5		5					No limit																					
		Duty cycle [%]	5	3	5	3	2	3	2	No limit																					
	Braking torque (using option)		150%											100%																	
	DC injection braking		Starting frequency: 0.1 to 60.0Hz Braking time: 0.0 to 30.0s Braking level: 0 to 100% of rated current																												
Enclosure (IEC60529)			IP40											IP00 (IP20 optional)																	
Cooling method			Natural cooling	Fan cooling																											
Standards			- UL/cUL -CE Marking (EMC, Low voltage) - TUV (up to 22kW) - EN81800-2 - EN61800-3																												
Mass		kg	2.2	2.5	3.8	3.8	3.8	6.5	6.5	10	10	10.5	10.5	31	31	36	41	42	50	73	73	104	104	145	145	250	250	360	360		

Notes:

*1) Specifications for HT and NT use are shown below:

HT: High torque (150% overload)

NT: Normal Torque or Variable Torque (110% overload)

Notes:

1) Inverter output capacity [kVA] at 415V.
2) Output voltage is proportional to the power supply voltage and cannot exceed the power supply voltage.
3) Current derating may be required in case of low impedance loads such as high frequency motor.
4) When the input voltage is 380V/50Hz to 415V/60Hz, the tap of the auxiliary transformer must be changed.
5) Refer to the EN61800-3 (5.2.3).
6) Tested at standard load condition (85% load).
7) Calculated RMS input current at HT Power rating.
8) With a nominal applied motor, this value is average torque when the motor decelerates and stops from 60Hz. (It may change according to motor loss).

(2) Three-Phase 200V series

Nominal applied motor [kw]		1.5	2.2	2.2	15	22
VXM	Type: VXM…A-2	8	11	29	55	78
	kVARated output capacity (*1) [Kva]	3	4.2	11	20	29
	Rated output current (*2) [A]	8	11	29	55	78
	Overload capability	150% of rated current for 1 min 200% of rated current for 0.5s		110% of output rated current for 1min		
	Starting torque	200% or more (under torque vector control)		50% or more		
	Braking torque (*3) [%]	100% or more		Approx 20%		
	Braking time [s]	5		No limit		
	Braking duty cycle [%ED]	5	3	No limit		
	Mass [kg]	3.8	3.8	5.7	10	10.5
Output ratings	Rated output voltage (*4) [V]	3-phase, 200V/50Hz, 200V,220V,230V/60Hz				
	Rated output frequency [Hz]	50, 60Hz				
Input ratings	Phase, Voltage, Frequency	3-phase 200 - 230V50/60HZ				
	Voltage/frequency variations	Voltage: +10% to -15% (unbalance < 2%) Frequency: +5% to-5%				
	Momentary voltage dip capability (*7)	Voltage will continue with 165V or more. If voltage drops below 165V, operation will continue for up to 15ms. If "continuous operation" is selected, the output frequency will be lowered to withstand the load until normal voltage is resumed.				
	Required power supply capability (*8)	2.2	3.1	9.4	19	28

(*1) Indicated capacities are at the rated output voltage 220V for the 200V series and 440V for the 400V series. The rated capacity will be lowered if the supply voltage is lowered.
(*2) In the case of low impedance load, such as a high-frequency motor, the current may drop below the rated current.
(*3) Indicates when a nominal applied motor is used (the average torque when decelerated to stoppage from 60 Hz, which varies depending on motor loss).
(*4) An output voltage exceeding the supply voltage cannot be generated.
(*5) The taps within the inverter must be changed for a power supply rated at 380 to 398V/50 Hz or 380 to 430V/60 Hz.
(*6) If the imbalance between phases exceeds 2%, use a power-factor correcting DC reactor (DCR).

$$\text{Imbalance rate between phases [\%]} = \frac{\text{(Max. Voltage [V] - Min. Voltage [V])}}{\text{3-phase average voltage [V]}} \times 67[\%]$$

(*7) Test was conducted under the standard load conditions stipulated by the JEMA committee (at the load equivalent to 85% of the nominal applied motor).
(*8) Indicates the values required when using a power-factor correcting DC reactor (DCR) (optional for inverters of 55kW or less) with a loaded nominal motor.

9-2 Common Specifications

Item			Explanation
Control	Control method		Sinusoidal wave PWM control (with V/F control, torque vector control, PG feedback vector control (option))
	Output frequency	Maximum frequency	50 to 400 Hz variable setting
		Base frequency	25 to 400 Hz variable setting
		Starting frequency	0.1 to 60 Hz variable setting Holding time: 0.0 to 10.0 s
		Carrier frequency	CT use : 0.75 to 15 kHz (55 kW or less) 0.75 to 10 kHz (75 kW or more) VT use : 0.75 to 15 kHz (22 kW or less) 0.75 to 10 kHz (30 to 75 kW) 0.75 to 6 kHz (90 kW or more)
		Accuracy (stability)	Analog setting: +/- 0.2 % or less of the max. Frequency (at 25 +/- 10 °C) Digital setting: +/- 0.01 % or less of the max. Frequency (-10 to +50 °C)
		Setting resolution	Analog setting: 1/3000 of max. frequency (e.g., 0.02 Hz /60 Hz, 0.05 Hz /150 Hz) Digital setting: 0.01 Hz (99.99 Hz or less), 0.1 Hz (100.0 Hz or more)
	Voltage/ frequency characteristics		Output voltage at base frequency can be adjusted separately, such as 320 to 480 V. Output voltage at max. frequency can be adjusted separately, such as 320 to 480 V.
	Torque boost		Auto: Optimum control corresponding to the load torque. Manual: 0.1 to 20.0 code setting (energy saving reduced torque, constant torque (strong), etc.)
	Acceleration/ deceleration time		0.01 to 3600 s Four acceleration and deceleration time settings are possible independent of each other by selecting digital input signals. In addition to linear acceleration and deceleration, either S-shaped acceleration/ deceleration (weak/strong) or curvilinear acceleration/deceleration can be selected.
	DC injection braking		Starting frequency: 0.0 to 60.0 Hz, braking time: 0.0 to 30.0 s, Braking level: 0 to 100 % (CT use), 0-80 % (VT use)
	Function equipped		Frequency upper and lower limiter, bias frequency, frequency gain, jump frequency, pick-up operation, restart after momentary power failure, switching operation from line to inverter, slip compensation control, automatic energy saving operation, regeneration avoiding control, droop control, torque limiting (2-step), torque control, PID control, second motor switching, cooling fan ON/OFF control.

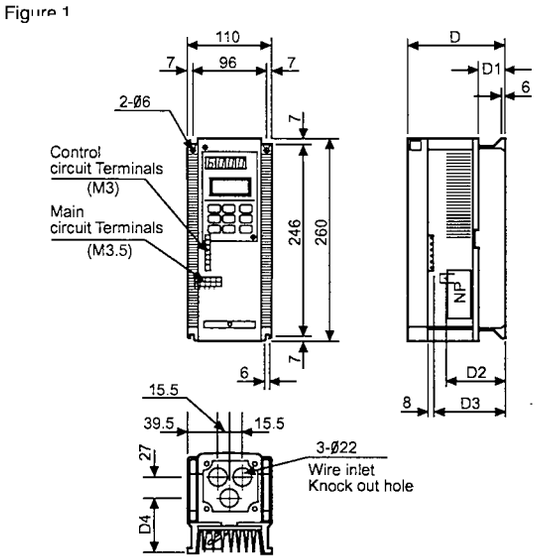
	Item	Explanation
Operation	Operation method	Keypad panel: Run by FWD , REV keys, stop by STOP key Terminal input: Forward/stop command, reverse/stop command, coast-to-stop command, alarm reset, acceleration/deceleration selection, multistep frequency selection, etc.
Operation	Frequency setting	Keypad panel: Setting by ∧, ∨ keys External potentiometer: External freq.setting POT (VR) (1 to 5 kΩ) Analog input: 0 to +10 V (0 to +5 V), 4 to 20 mA, 0 to +/- 10 V (FWD/REV operation) +10 V to 0 (Inverse operation), 20 to 4 mA (Inverse operation) UP/DOWN control: Frequency increases or decreases as long as the digital input signal is turned on. Multistep frequency selection: Up to 15 steps are selectable by a combination of digital input signals (four kinds). Link operation: Operation by RS485 (standard). Program operation: Pattern operation by program Jogging operation: Jogging operation by FWD , REV key or digital input signals
	Operation status signal	Transistor output (4 signals): Running, frequency arrival, frequency detection, overload early warning, etc. Relay output (2 signals): Alarm output (for any fault), multi-purpose relay output signals Analog output (1 signal): Output frequency, output current, output voltage, output torque, power consumption, etc. Pulse output (1 signal): Output frequency, output current, output power, output torque, power consumption, etc.
Indication	Digital display (LED)	Output frequency, setting frequency, output current, output voltage, motor synchronous speed, line speed, load rotation speed, calculated torque value, power consumption, calculated PID value, PID command value, PID feedback value, alarm code
	Liquid crystal display (LCD)	Operation information, operational guide, functional code/name/setting data, alarm information, tester function, motor load rate measuring function Maximum/average current (rms) during measuring period, maintenance information (Integrated operation hours, capacitance measurement for main circuit capacitors, heat sink temperature, etc.)
	Language	Six languages (Japanese, English, German, French, Spanish, and Italian)
	Lamp display	Charging (voltage residual), operation indication

Item			Explanation
Protective functions			Overcurrent, short-circuit, ground fault, overvoltage, undervoltage, overload, overheating, blown fuse, motor overload, external alarm, input open-phase, output open-phase (when tuning), braking resistor protection, CPU and memory error, keypad panel communication error, PTC thermistor protection, surge protection, stall prevention, etc.
Environment	Installation location		Indoor, altitude less than 1000 m, free from corrosive gas, dust, and direct sunlight (Pollution degree 2)
	Ambient temperature		-10 to +50 °C (ventilating cover must be removed under conditions exceeding +40 °C for models rated at 22 kW or less)
	Ambient humidity		5 to 95 % RH (no condensation)
	Air pressure		Operation/storage: 86 to 106 kPa Transport: 70 to 106 kPa
	Vibration		3mm at from 2 to less than 9 Hz, 9.8 m/s^2 at from 9 to less than 20 Hz, 2 m/s^2 at from 20 to less than 55 Hz, 1 m/s^2 at from 55 to less than 200 Hz
	Storage	Ambient temperature	-25 to +65 °C
		Ambient humidity	5 to 95 % RH (no condensation)

9-3 Outline Dimensions

- Dimensions (22 kW or less)

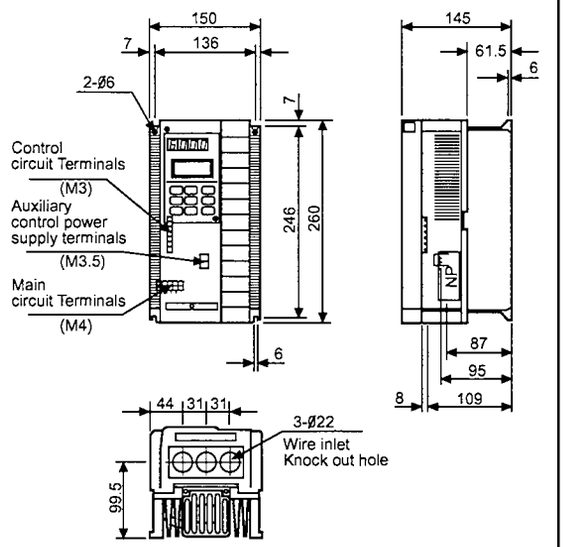
Figure 1



Type	D	D1	D2	D3	D4
VXM40	130	36.5	80	94	71.5
VXM75	145	51.5	95	109	86.5

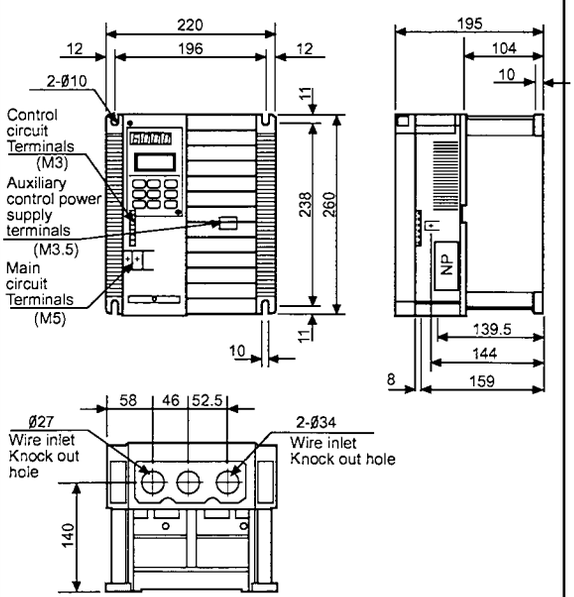
VXM40-VXM75

Figure 2



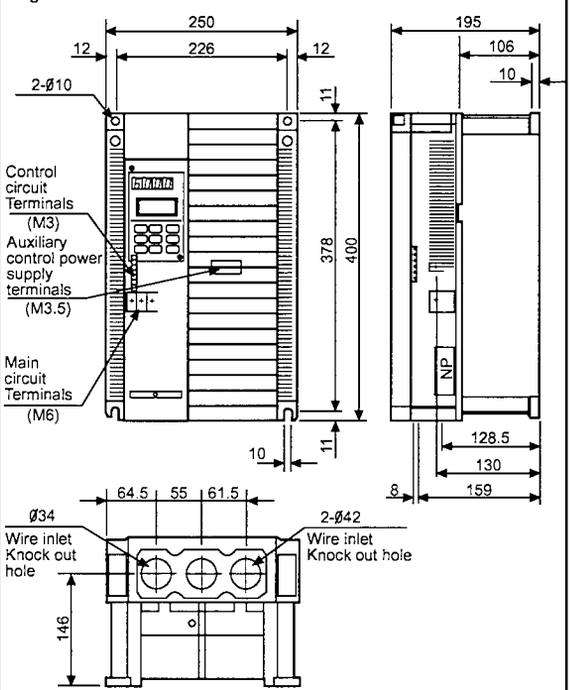
VXM150-VXM400/VXM8A-2-VXM11A-2

Figure 3



VXM550-VXM750/VXM29A-2

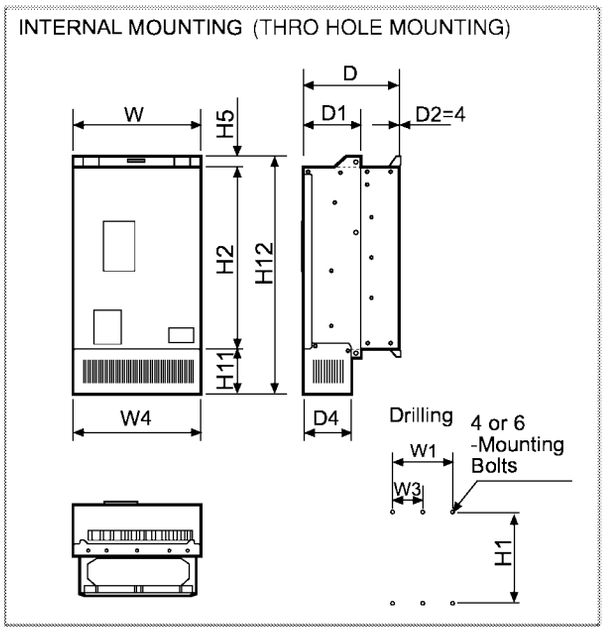
Figure 4

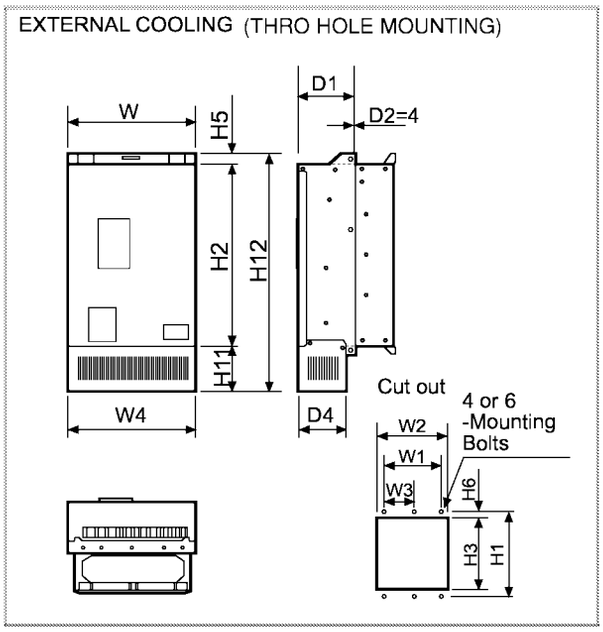


VXM1100-VXM2200/VXM55A-2, VXM78A-2

9

● Dimensions (30kW-220kW)



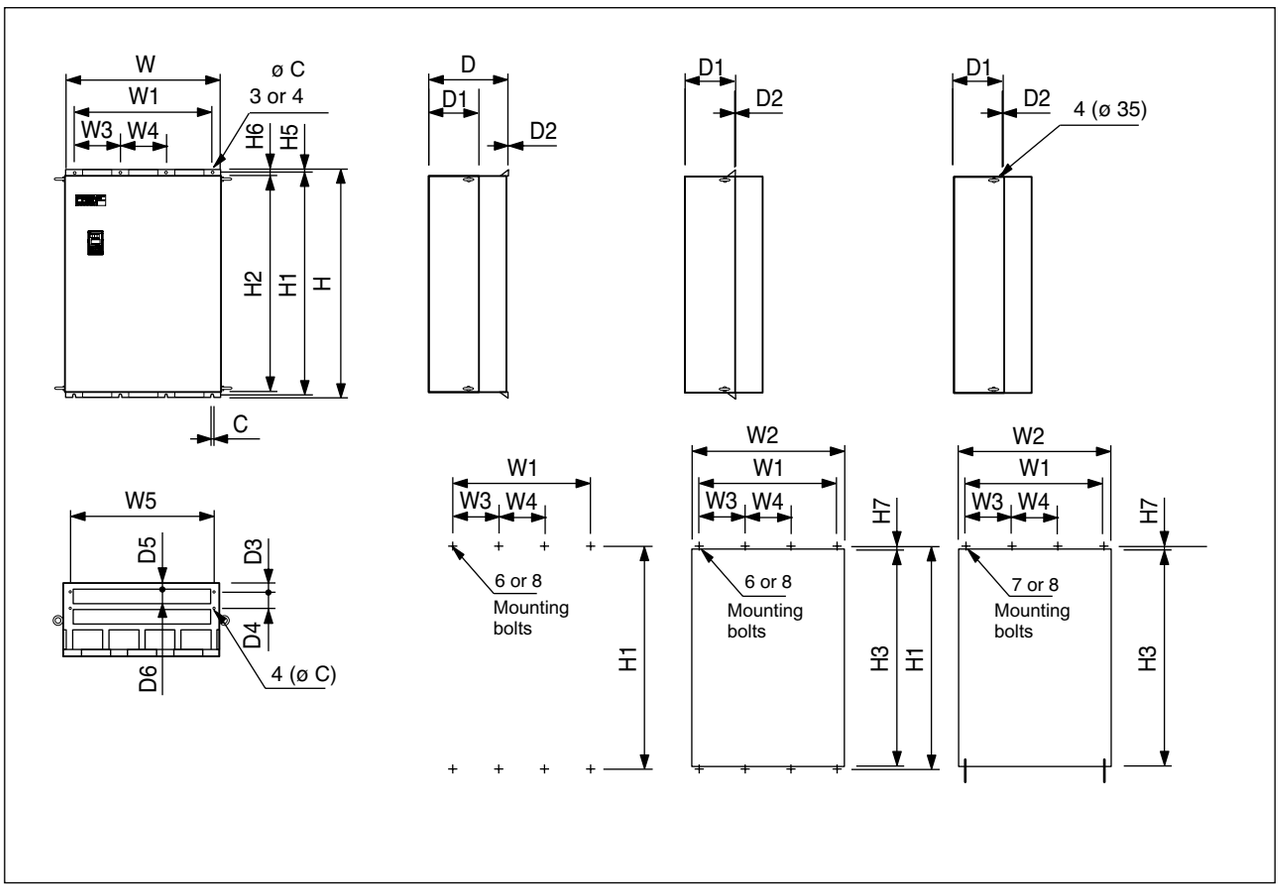


Inverter type	Dimensions (mm)														Mtg. Bolts	Weight (kg)
	W	W1	W2	W3	W4	H1	H2	H3	H5	H6	H11	H12	D	D4		
VXM30KP VXM30K	340	326	240		342.4	530	500	512	25	9	120	645	255	118	M8	31
VXM37K	375	361	275		377.4	655	625	637				770	270			36
VXM45K																41
VXM55K																
VXM75K																
VXM90K	530	510	430		533.2	710	675	685	32.5	12.5		827.5	315	133.5	M12	73
VXM110K																
VXM132K						970	935	945				1087.5	360	178.5		104
VXM160K																
VXM200K	680	660	580	290	683.2											145
VXM220K																

Note (1) All power terminals for 30kW and above are horizontally arranged in two banks, at the bottom of the inverter. Access to power terminals is via bottom cable entry.

(2) Control terminals are vertically aligned on the left hand side, to the left of the keypad. Cable access to control terminals is via bottom cable entry.

● Dimensions (280kW-400kW)



Inverter Type	Dimension [mm]													
	W	W1	W2	W3	W4	W5	H	H1	H2	H3	H4	H5	H6	H7
VXM280K	680	580	660	290	-	610	1400	1370	1330	1340	1335	15,5	35	14,5
VXM315K														
VXM400K	880	780	860	260	260	810								

Inverter Type	Dimensions [mm]								Mtg Bolts	Weight [kg]
	D	D1	D2	D3	D4	D5	D6	C		
VXM280K	450	285	6,4	50	100	35	115	15	M12	250
VXM315K										
VXM400K										360

9-4 RS485 Communi-cation

When connected to host equipment such as a personal computer or PLC, the inverter can be monitored or made to operate, stop or change the program by receiving commands from the host. For details concerning communication, refer to separate documentation.

Item	Specifications
Applicable model	Jaguar VXM series
Physical level	EIA RS485
Maximum length of cable	500 m
Number of units connected	One host and 31 inverters (Station No. 1 to 31)
Transmission speed	19200, 9600, 4800, 2400, 1200 [BPS]
Synchronization method	Start-stop transmission (Asynchronous)
Transmission form (data exchange method)	Half-duplex method
Transmission protocol	Polling/selecting, broadcast
Character system	ASCII 7 bit
Character length	8bit, 7 bit
Stop bit length	1 bit, 2 bit
Frame length	16-byte fixed for general transmission; 8- or 12-byte for high-speed transmission
Parity	even, odd, none
Error check method	Check sum

Table 9-4-1 Transmission specifications

10 Options

10-1 Built-in Options

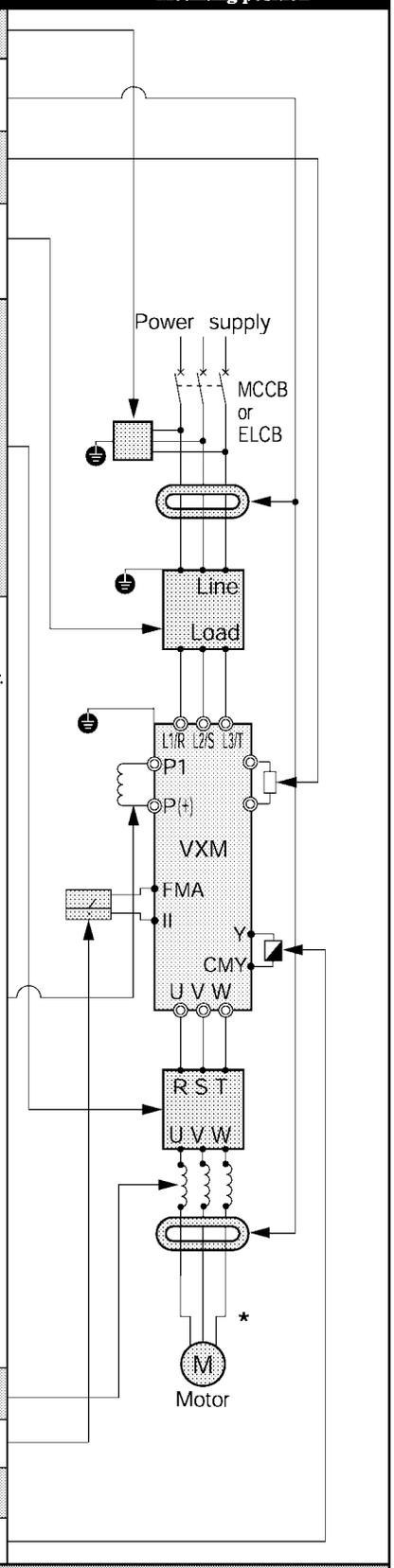
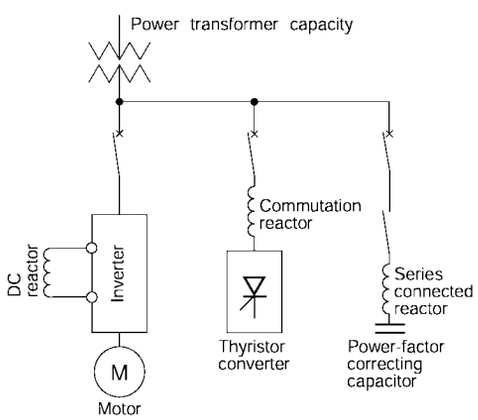
The following are optional cards that can be mounted in the inverter.

Name	Function
Relay output card (VXMROC)	• Relay output card The transistor output from the inverter control output terminals Y1 to Y4 is converted to relay output (1SPDT)
Relay interface card (VXMDI0)	• Frequency setting by binary code (max. 16 bits) • Monitoring (8 bits) of frequency, output current, and output voltage
Analog interface card (VXMAI0)	• Auxiliary input for analog frequency setting (0 to +/-10 V) • Monitoring of inverter output frequency, current, and torque in analog voltage
PG feedback card (VXMEFC)	• This will enable vector control by pulse generator (encoder) feedback signals. • Proportional operation, tuning operation
Synchronised operation card (VXMSYNC)	• Two motors (Master/Slave) can be synchronized)

The following options are mounted beneath the keypad.

Name	Function
Profibus DP (VXM PROFIBUS)	Token passing topology. Communicates to Profibus Standard DIN 19245 (Part 1 & 3). Conforms with Profidrive Profiles V2. Allows the Jaguar VXM to act as a slave to be written to/read from, by a Profibus Master (PLC, etc). <12MBaud / <126 nodes. RS485 or Fibre optic.
DeviceNet (VXM DEVICENET)	Enables communication to DeviceNet via twisted pair. Master/Slave, Peer to Peer. <500KBaud / < 64 nodes. Protection from wiring/module faults. Allows Node removed without breaking the network.
CANopen (VXM CANOPEN)	For connection to CAN network according to DS301/DS402 specifications. Twisted pair - 5000M Maximum. Up to 127 nodes, allows node removed without breaking network. Selectable transmission rates 10Kbit/s→1Mbit/s
Interbus (VXM INTERBUS)	Conforms to Interbus Protocol Standard DIN 19245 (part 2) DRIVECOM is supported. RS485 twisted pair cable. 500Kbits/second. Time deterministic, shift register. Local bus maximum 8 nodes. Remote bus. Maximum 256 nodes.
Modbus Plus (VXM MODBUSPLUS)	Propriety network fieldbus with private protocol. 1MBaud transmission. RS485 twisted pair cable. Maximum number of nodes: Network 32 (64 with repeaters). Maximum cable length 450m without repeaters. Virtual token ring topology.

10-2 Separately Installed Options

Name	Function	Mounting position
Surge arrester (Contact IMO)	Suppresses induced transient surges from power source, thus protecting all equipment connected to the power supply.	
Ferrite ring for reducing radio noise (OC1-OC5)	Reduces radio frequency noise. If the wiring between motor and inverter is shorter than 20m, use the ferrite ring in the power supply side. If longer than 20m, use it in the output side, if required.	
Dynamic brake resistor (DBR□□□R□□□W)	Converts excess regenerated energy into heat. A light duty resistor is supplied as standard for drives less than 11kW. For higher powers/duty, extra resistors or additional equipment is necessary.	
RFI Filter (RFM□□FP)	This is a special filter which complies with the European EMC (Emission) Directive. This filter should be used with a screened motor cable. *Note: Other prerequisites must be fulfiled to ensure compliance with EMC Directives. Refer to IMO for details.*	
Optional Sin O/P filter (Contact IMO)	Connected to the output circuit of inverters under low-noise operation with carrier frequency from 8 to 15kHz, (6kHz higher for 30kW or larger inverters), this filter has the following functions: 1. Suppresses fluctuation of motor terminal voltage. Protects the motor insulation from being damaged by PWM voltage overshoot. (400V series) 2. Suppresses leakage current from output side wiring. Reduces leakage current caused when several motors are operated in parallel or connected with long wiring. *Total wiring length should be less than 400m. 3. Suppresses radial noise or inductive coupling from output side wiring. Effective noise suppression device for long wiring applications such as plant. *Note: When connecting this filter, set the carrier frequency F26 at 8kHz or more.*	
DC Reactor (DCR) (VXLC) (optional for smaller power ratings)	(Use the DCR to normalise the power supply in the following cases.] 1. The power transformer capacity is 500kVA or over and exceeds the inverter rated capacity by 10 times. 2. The inverter and a thyristor converter are connected with the same transformer. * Check if the thyristor converter uses a commutation reactor. If not, AC reactor must be connected to the power supply side. 3. Overvoltage trip occurs due to open/close of the phase-advancing capacitor for the power supply lines. 4. The voltage unbalance exceeds 2%. $\text{Voltage unbalance (\%)} = \frac{\text{Max. voltage [V] - Min. Voltage [V]}}{\text{Three-phase average voltage [V]}} \times 67\ (\%)$  (For improving input power-factor, reducing harmonics) • Used to reduce input harmonic current (correcting power-factor) • For the resultant effects, contact IMO.	
AC Reactor (ACR) (LO□□□-3)	Optional. May be fitted to compensate for long motor cables, or shock loads	
Frequency meter (X72M10V)	Analog frequency meter 72mm square, 0-10VDC, M/C, 1000Ω/V	
Frequency setting device (JAGPOT1K)	Frequency setting potentiometer (mounted externally)	
Output relay and DIN rail base (VXEJ1)	Low power DC coil, 8A capacity, for extending VXM digital outputs Y1-Y4.	
Keypad extension cable (VXPODCABLE)	2 metre extension cable for comissioning, mounting keypad on panel front (REMOTE MOUNTING) etc.	
Brake Module	External brake chopper (resistors not included) For inverters rated at 11kW or greater. Please contact IMO for details.	

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DC REACTOR (DCR)

Power supply voltage	Nominal applied motor [kW]	Inverter type		Weight (Kg)*	Inductance (mH)	Current (A)	Heat Loss (W)
		CT use	VT use				
Three-phase 400 V	0.4	VXM40		CONTACT IMO FOR DATA			
	0.75	VXM75					
	1.5	VXM150					
	2.2	VXM220					
	3.7, 4.0	VXM400					
	5.5	VXM550					
	7.5	VXM750	VXM550				
	11	VXM1100	VXM750		2.2	25	21
	15	VXM1500	VXM1100		1.8	34	28.3
	18.5	VXM1850	VXM1500		1.4	34	28.3
	22	VXM2200G	VXM1850		1.2	49	34.6
	30	VXM30KP	VXM30KP	14	0.86	80	63
	37	VXM37K	VXM30K	17	0.7	100	56
	45	VXM45K	VXM37K	21	0.58	120	58
	55	VXM55K	VXM45K	25	0.47	146	66
	75	VXM75K	VXM55K	25	0.35	200	95
	90	VXM90K	VXM75K	32	0.29	238	94
	110	VXM110K	VXM90K	36	0.24	291	115
	132	VXM132K	VXM110K	40	0.215	326	100
	160	VXM160K	VXM132K	45	0.177	395	115
	200	VXM200K	VXM160K	50	0.142	494	140
	220	VXM220K	VXM200K	50	0.126	557	160
	280	VXM280K	VXM220K	58	0.1	700	170
	315	VXM315K	VXM280K	CONTACT IMO FOR DATA			
	355		VXM315K				

Note: A DC Reactor MUST be used for 75kw or higher inverter.
* Weight is proportional to coppercontent. Specification for copper content may change from time to time effecting overall weight and dimensions.
Please contact IMO for accurate data relating to dimensions and mass, if required.

11 Electromagnetic compatibility (EMC)

11-1 General

In accordance with the provisions described in the European Commission Guidelines Document on Council Directive 89/336/EEC, IMO has chosen to classify the Jaguar VXM range of Inverters as “Complex Components.

Classification as a “Complex Components” allows a product to be treated as an “apparatus”, and thus permits compliance with the essential requirements of the EMC Directive to be demonstrated to both an integrator of Jaguar Inverters and to his customer or the installer and the user.

Jaguar Inverters are supplied ‘CE-marked’, signifying compliance with EC Directive 89/336/EEC when fitted with specified filter units installed and earthed in accordance with this sheet.

This Specification requires the following performance criteria to be met.

EMC product standard EN61800-3:1997 +A11:2000

Immunity: Second environment (Industrial environment)
Emission: See tables 1 and 2

Table 1 First environment	
UNRESTRICTED	*RESTRICTED*
VXM 40 to VXM 1500 when . . . Fitted with ‘RFM’ type EMC filter and installed as shown in Fig. 11-5 + 10m screened motor cable maximum + Carrier freq. ≤ 8kHz + No option cards or bus modules fitted	With no option cards or fieldbus modules fitted VXM1850 and higher ratings With option cards or fieldbus modules fitted All VXM models WARNING This is a product of the restricted sales distribution class according to IEC 61800-3. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Table 2 Second environment	
I ≤ 100A	*I ≤ 100A*
VXM 40 to VXM 2200 when . . . Fitted with ‘2E’ type EMC filter and installed as shown in Fig. 11-5 (page 11-4 VXM main instruction manual + 10m screened motor cable maximum + Carrier freq. ≤ 4kHz	VXM 30K or larger when . . . 10m screened motor cable maximum + Carrier freq. ≤ 4kHz

11-2 Recommended Installation Instructions

It is necessary that to conform to EMC Directive, these instructions must be followed.

Follow the usual safely procedures when working with electrical equipment. All electrical connections to the filter, Inverter and motor must be made by a qualified electrical technician.

1) Use the correct filter according to Table 11-1.

2) Install the Inverter and filter in the electrically shielded metal wiring cabinet.

3) The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc. from the mounting holes and face area of the panel. This will ensure the best possible earthing of the filter.

4) Use the screened cable for the control, motor and other main wiring which are connected to the Inverter, and these screens should be securely earthed.

5) It is important that all wire lengths are kept as short as possible and that incoming mains and outgoing motor cables are kept well separated.

To minimize the conducted radio disturbance in the power distribution system, the length of the motor cable should be as short as possible.

Finally, it is the customer’s responsibility to check whether the equipment conforms to EMC directive.

IMPORTANT

Notice to users of IMO VXM series variable speed drives

This product is intended for professional use

Harmonic restrictions within the European Union (EU)

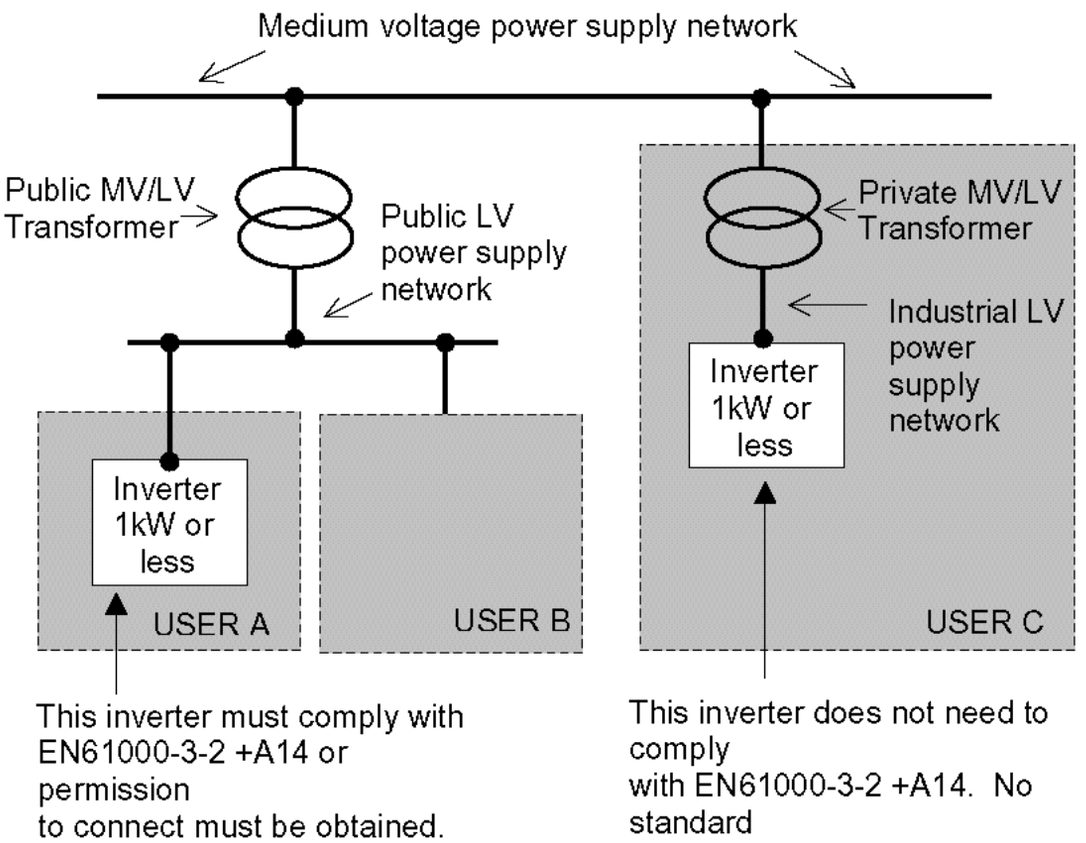
The European Standard **EN61000-3-2:1995 (+A14:2000), Electromagnetic Compatibility (EMC)** part 3-2 sets out the limits for harmonic current emissions for equipment having input currents up to and including 16A per phase.

The following products do not meet these limits unless fitted with the correct DC reactor.

VXM40, VXM75

If the DC reactor is not fitted, the supply authority must be consulted and permission to connect to the public low voltage power supply must be obtained prior to installation.

For details of harmonic current and reactors, contact IMO Precision Controls Ltd.



11

Applied Inverter	Max Rated Voltage	Filter Type	Rated Current	Nominal leakage (max. leakage)	RFI filter			Weight Kg.
					Dimensions LxWxH [mm]	Mount Dimms Y x X [mm]	Note	
VXM40 VXM75	3ph 480VAC	RFM75FP	5 A	0.5mA (38mA)	320x116x42	293x90		0.75
VXM150 VXM220 VXM400		RFM400FP	12 A		320x155x42	293x105	Fig. 11-1	1.45
VXM550 VXM750		RFM750FP	35 A		341x225x47.5	311x167		2.5
VXM1100 VXM1500 (CT use)		RFM1500FP	50 A		500x250x70	449x185		5.0
VXM1500 (VT use) VXM1850 VXM2200G		RFM2200FP	72 A		500x250x70	449x185		5.0
VXM30KP VXM30K (CT use)	3ph 480VAC	RFM30K	100 A	0.5mA (130mA)	435x200x130	408x166	Fig. 11-2	5.5
VXM30K (VT use) VXM37K VXM45K VXM55K VXM75K VXM90K (CT use)		RFM90K	180 A		495x200x160	468x166		8.5
VXM90K (VT use) VXM110K VXM132K (CT use)		RFM132K	280 A	0.5mA (270mA)	587x250x205	560x(85+85)	Fig. 11-3	14.0
VXM132K (VT use) VXM160K VXM200K VXM220K (CT use)		RFM220K	400 A	1.5mA (270mA)	587x250x205	560x(85+85)		16.0
VXM220K (VT use) VXM280K VXM315K		RFM315K	880 A		688x364x180	648x (150+150)	Fig. 11-4	42.0

Table 11-1 RFI filters

Note: (1) Dimemsions subject to change without notice. If in doubt contact IMO.
(2) Nominal leakage: under normal operating conditions and correctly earthed.
Maximum leakage: under fault condition/supply imbalance/at power-up.
(3) Refer to IMO for details of losses.

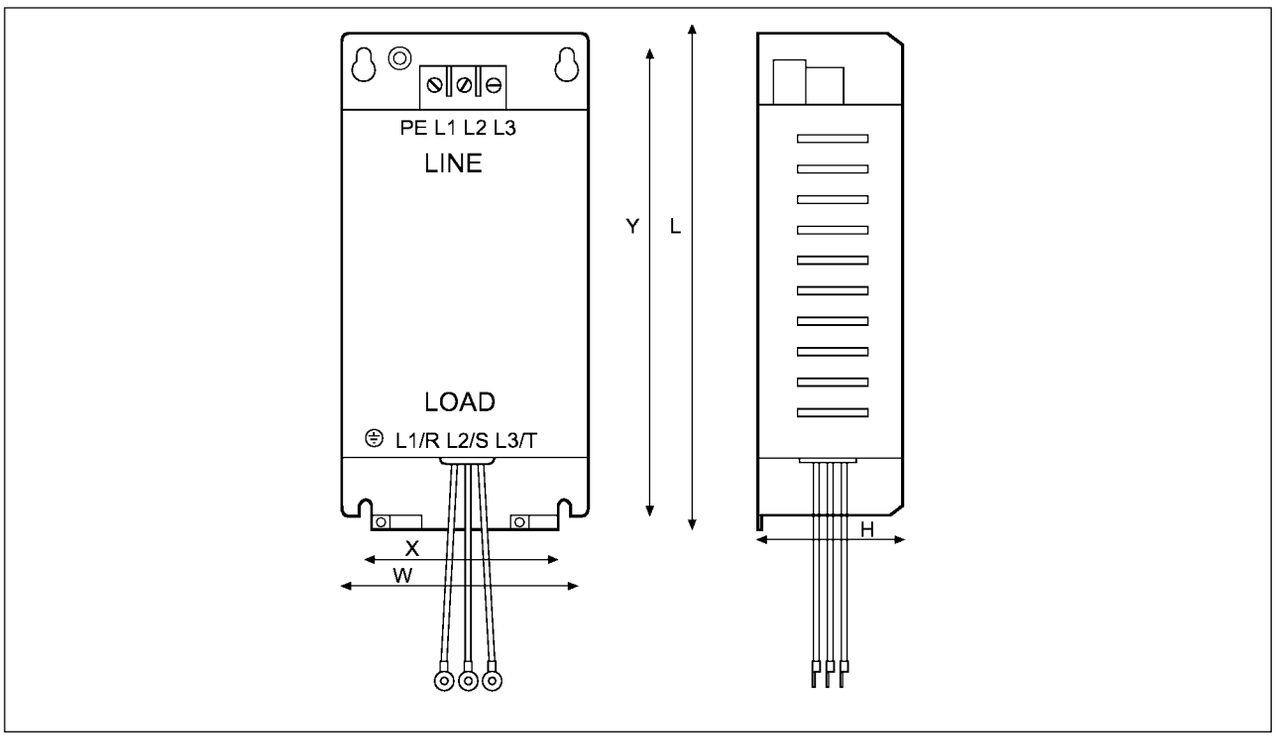
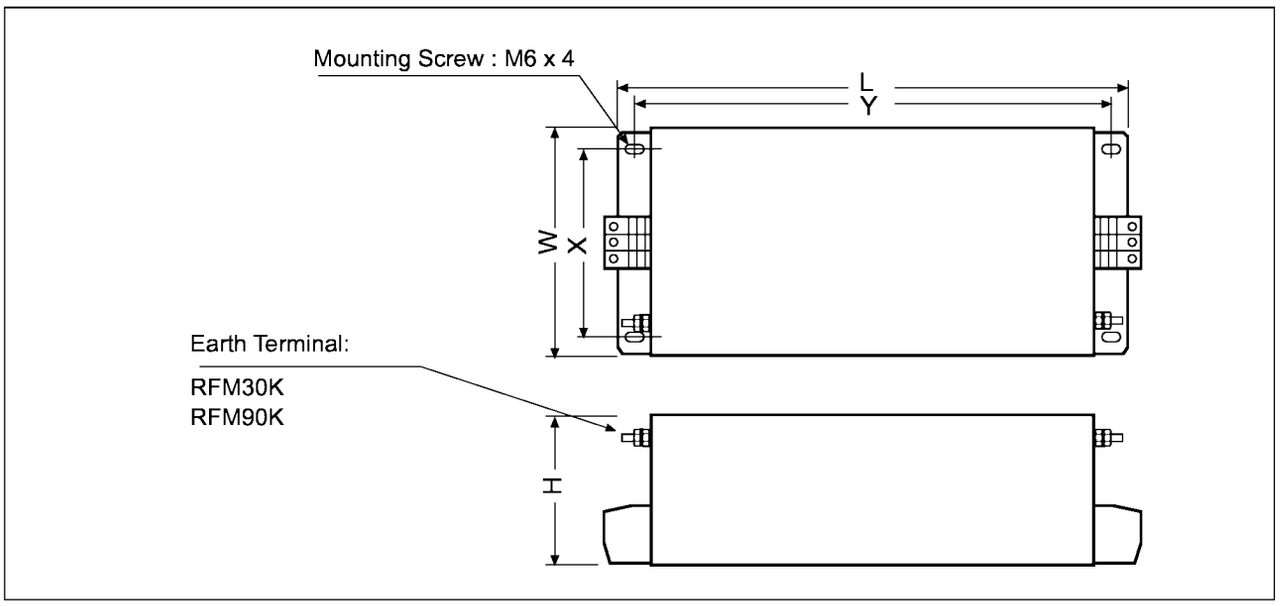


Figure 11-1



	Dimensions [mm]				
	L	W	H	Y	X
RFM30K	435	200	130	408	166
RFM90K	495	200	160	468	166

Figure 11-2 Outline Dimensions (RFM30K, RFM90K)

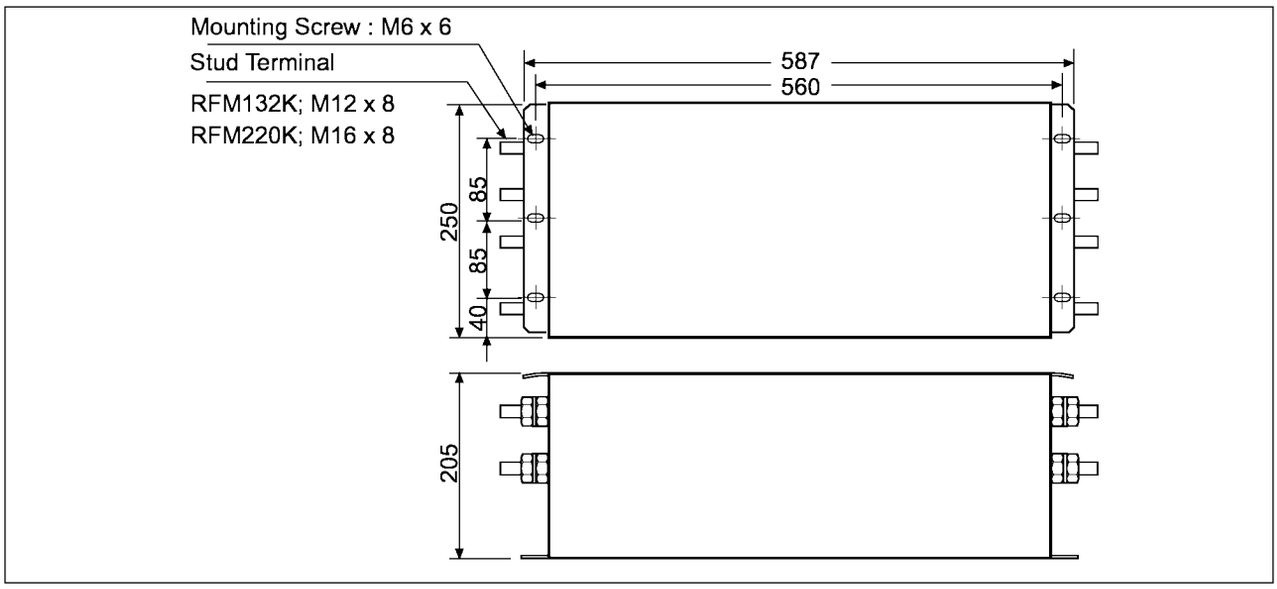


Figure 11-3 Outline Dimensions (RFM132K, RFM220K)

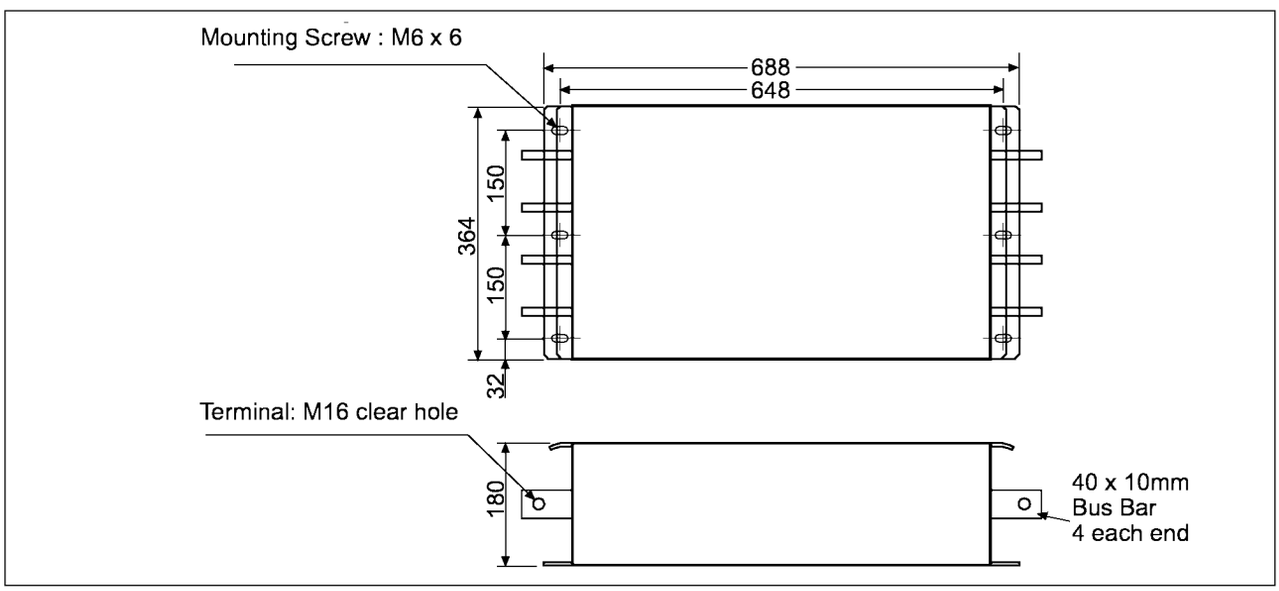
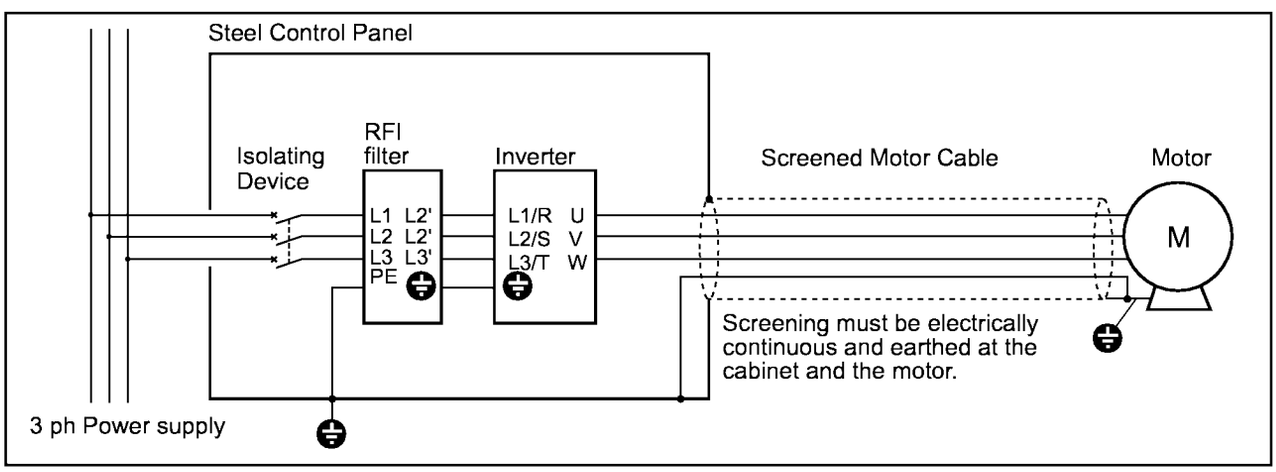


Figure 11-4 Outline Dimensions (RFM315K)



IMO JAGUAR DRIVES
5 YEAR WARRANTY

IMO JAGUAR drives are covered by a unique 5 year warranty against failure arising as a result of inferior material or workmanship.

In the event of a unit failing within 5 years of despatch from IMO, we will repair or replace the drive free of charge.

When possible, in the interest of providing the fastest service to our customers, we will replace the failed drive with a new or service exchange unit at IMO's discretion. This may not be possible, however, if the failed unit is in poor condition owing to abuse or neglect. In such circumstances, the custoer may elect to have the unit repaired within the warranty if viable, but physical refurbishment will be chargeable.

IMO will, upon request, provide a service exchange unit in advance of receipt of the failed unit if the order number is provided along with details of the failed unit. Replacements will be despatched at IMO's cost and credit will be issued upon recipt of the failed unit in good physical condition. Full credit will not be given if in IMO's judgement the unit has been physically or electrically abused. A no-fault found charge will be levied upon units returned and found no to be faulty.

The terms of warranty do not provide for on site service although a service engineer will be provided upon receipt of an order. IMO may elect to waive any charge should the findings on site indicate that any problem found lies within the scope of the warranty.

Documentation

Every effort has been made by IMO Precision Controls Ltd to ensure that this document accurately and completely represents the Jaguar VXM range of inverters at the time of going to press. Information with respects to installation is necessarily generalised, and the supplier accepts no liability for contingencies over which he has no control in respect of the selection, installation and/or operation of equipment.

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