Instruction Manual

FRENIC 5000G11S/P11S

High-Performance, Low-Noise Inverter

General-Purpose Industrial Machines

200V Series
0.2kW /FRN0.2G11S-2JE
to 90kW /FRN90G11S-2JE

400V Series
0.4kW /FRN0.4G11S-4JE
to 220kW /FRN220G11S-4JE

Fans and Pumps

200V Series
5.5kW /FRN5.5P11S-2JE
to 110kW /FRN55P11S-2JE

400V Series
5.5kW /FRN5.5P11S-4JE
to 280kW /FRN280P11S-4JE

⚠ CAUTION

- Read all operating instructions before installing, connecting (wiring), operating, servicing, or inspecting the inverter.
- Ensure that this instruction manual is made available to the final user of the inverter.
- Store this manual in a safe, convenient location.
- The product is subject to change without prior notice.

Fuji Electric FA Components & Systems Co., Ltd. INR-SI47-0592d-E

Preface

Thank you four purchasing our FRENIC5000G11S or FRENIC5000P11S 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

- 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.**
- 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.
- 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

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

⚠CAUTION

- Do not hold or carry this inverter by the surface cover. Inverter may be dropped **causing injury.**
- 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.**
- Do not install or operate a damaged inverter or an inverter with missing parts, **as injury may result.**

Instructions on wiring

⚠WARNING

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

⚠CAUTION

- Confirm that the phases and rated voltage of this product match those of the AC power supply, **as injury may result.**
- Do not connect the AC power supply to the output terminals (U, V, and W), **as injury may result.**
- Do not connect a braking resistor directly to the DC terminals (P(+) and N(-)), **as fire may result.**
- 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 operation

⚠WARNING

- 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.
- Do not operate switches with wet hands, **as electric shock may result.**
- 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.
- 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.
  - 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.
- 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.
- Do not touch inverter terminals when energized even if inverter has stopped.
  Electric shock may result

⚠CAUTION

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

Instructions on maintenance, inspection, and replacement

⚠WARNING

- Wait a minimum of five minutes (22kW or less) or ten minutes (30kW 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 25V.)
  Electrical shock may result.
- 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

- The contact capacity of alarm output for any fault (30A, B, C) and relay signal output (Y5A, Y5C) is 0.5A at 48V DC.
- 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.
- 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 EE(Electric equipment).
  Otherwise another protective measure shall be applied such as separation of the EE from the environment by double or reinforced insulation or isolation of EE and supply system by the transformer.
- Use a single cable to connect the ⏚ G inverter ground terminal. (Do not use two or more inverter ground terminals.)
- Use a molded-case circuit breaker (MCCB) and magnetic contactor (MC) that conform to EN or IEC standards.
- 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 more, install the inverter in the control panel (IP54 or higher level) having structure free from water, oil, carbon, dust, etc.
- For the input-output wiring of the inverter, use cable (diameter and type) as specified in Appendix C in EN60204.
- 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.

- It is necessary to install the inverter in appropriate method using an appropriate RFI filter to conform to the EMC directive. It is customer's responsibility to check whether the equipment ,the inverter is installed in, conforms to EMC directive.

Conformity to Low Voltage Directive in Europe

⚠CAUTION

Table 1-1 Applicable equipment and wire size for main circuit in Europe

Voltage	Application motor [kW]	Inverter type	Fuse/MCCB current rating [A]		Tightening torque [N*m]				Recommended wire size [mm2]					
			With DCR	Without DCR	L1/R,L2/S,L3/T U,V,W P1,P(+),DB,N(-)	⏚ G	R0,T0	Control	L1/R,L2/SL3/T (⏚ G) With DCR	L1/R,L2/SL3/T (⏚ G) Without DCR	U,V,W	R0,T0	P1,P(+)	P(+),DB,N(-)	Control
3phase 200V system	0.2	FRN0.2G11S-2	5	5	1.2		-	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
	0.4	FRN0.4G11S-2	5	5											
	0.75	FRN0.75G11S-2	5	10											
	1.5	FRN1.5G11S-2	10	15	1.8										
	2.2	FRN2.2G11S-2	10	15											
	3.7	FRN3.7G11S-2	20	30						4(4)					
	5.5	FRN5.5P11S-2	30	40	3.5				6(6)	10(10)	4		4		
	5.5	FRN5.5G11S-2													
	7.5	FRN7.5P11S-2	40	60					10 (10)	16 (16)	6		6		
	7.5	FRN7.5G11S-2													
	11	FRN11P11S-2	50	100						35 (16)	10		10		
	11	FRN11G11S-2			5.8										
	15	FRN15P11S-2	75	125					25 (16)	50 (25)	16		16		
	15	FRN15G11S-2													
	18.5	FRN18.5P11-2	100	150					35 (16)		25		25	3.5	
	18.5	FRN18.5G11S-2													
	22	FRN22P11S-2	100	175							35		35	5.5	
	22	FRN22G11S-2													
	30	FRN30P11S-2	125	225	13.5				16 (10)	50 (25)	25	2.5 to 6	25	2.5	
	30	FRN30G11S-2													
	37	FRN37P11S-2	150	300					25 (16)	70 (35)	35		35		
	37	FRN37G11S-2													
	45	FRN45P11S-2	175	350					35 (25)	70 (35)	50		50		
	45	FRN45G11S-2													
	55	FRN55P11S-2	225	400					50 (25)	35X2 (35)	70		70	4	
	55	FRN55G11S-2													
	75	FRN75P11S-2		-					35X2	-	35X2		50X2	6	
	75	FRN75G11S-2							95(50)		95				
	90	FRN90P11S-2		-					50X2 (50)	-	50X2		70X2	10	
	90	FRN90G11S-2													
	110	FRN110P11S-2		-	27	13.5			70X2 (70)	-	70X2		95X2		

Note: The type of wire is 75°C 600V 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.

Conformity to Low Voltage Directive in Europe

⚠CAUTION

Table 1-2 Applicable equipment and wire size for main circuit in Europe

Voltage	Application motor [kW]	Inverter type	Fuse/MCCB current rating [A]		Tightening torque [N*m]				Recommended wire size [mm2]						
			With DCR	Without DCR	L1/R,L2/S,L3/T U,V,W P1,P(+),DB,N(-)	⏚ G	R0,T0	Control	L1/R,L2/SL3/T (⏚ G) With DCR	L1/R,L2/SL3/T (⏚ G) Without DCR	U,V,W	R0,T0	P1,P(+)	P(+),DB,N(-)	Control
3phase 400V	0.4	FRN0.4G11S-4	5	5	1.2		-								
	0.75	FRN0.75G11S-4	5	5											
	1.5	FRN1.5G11S-4	5	10											
	2.2	FRN2.2G11S-4	10	15	1.8				2.5 (2.5)	2.5 (2.5)	2.5	2.5	2.5	2.5	
	3.7	FRN3.7G11S-4	10	15											
	5.5	FRN5.5P11S-4	15	20											
	5.5	FRN5.5G11S-4													
	7.5	FRN7.5P11S-4	20	30	3.5					6 (6)					
	7.5	FRN7.5G11S-4													
	11	FRN11P11S-4	30	40					6 (6)	10 (10)	4		4		0. 2 to 0.75
	11	FRN11G11S-4													
	15	FRN15P11S-4	40	50	5.8						6		6		
	15	FRN15G11S-4													
	18.5	FRN18.5P11-4	40	60					10 (10)	16 (16)	10		10		
	18.5	FRN18.5G11S-4													
	22	FRN22P11S-4	50	75						25 (16)					
	22	FRN22G11S-4					1.2	0.7							
	30	FRN30P11S-4	75	100	13.5				16 (10)	50 (25)	25		25		
	30	FRN30G11S-4													
	37	FRN37P11S-4	100	125					25 (16)	70 (35)	35		35	2.5	
	37	FRN37G11S-4										2.5 to 6			
	45	FRN45P11S-4	100	150					35 (25)	70 (35)	50		50		
	45	FRN45G11S-4													
	55	FRN55P11S-4	125	175					50 (25)	35X2 (35)	70		70	4	
	55	FRN55G11S-4													
	75	FRN75P11S-4	175	-					35X2	-	35X2		50X2	6	
	75	FRN75G11S-4							95(50)		95				
	90	FRN90P11S-4	200	-					50X2 (50)	-	50X2		70X2	10	
	90	FRN90G11S-4													
	110	FRN110P11S-4	225	-	27	13.5			70X2 (70)	-	70X2		95X2		
	110	FRN110G11S-4													
	132	FRN132P11S-4	300	-					70X2 (70)	-	95X2		120X2		
	132	FRN132G11S-4													
	160	FRN160P11S-4	350	-	48	27			120X2 (120)	-	120X2		150X2	16	
	160	FRN160G11S-4													
	200	FRN200P11S-4	400	-					150X2 (150)	-	185X2		185X2	25	
	200	FRN200G11S-4													
	220	FRN220P11S-4	500	-					185X2 (185)	-	185X2		185X2	50	
	220	FRN220G11S-4													
	280	FRN280P11S-4	600	-					240X2	-	300X2		300X2		

Note: The type of wire is 75°C 600V 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.

Compliance with UL/cUL standards [Applicable to products with UL/cUL mark]

⚠CAUTION

- [CAUTION] Hazard of electrical shock. Disconnect incoming power before working on this control.
- [CAUTION] Dangerous voltage exists until charge lights is off.
- [WARNING]
- More than one live parts inside the inverter.
- Type 1 "INDOOR USE ONLY"
  The inverter is approved as a part used inside a panel. Install it inside a panel.
- Use 60/75 C copper wire only.
- A Class 2 circuit wired with class1 wire.
- Field wiring connection must be made by a UL Listed and CSA Certified closed-loop terminal connector sized for the wire gauge involved. connector must be fixed using the crimp tool specified by the connector manufacturer.
- Connect the power supply to main power supply terminals via the Molded-case circuit breaker(MCCB) or the earth leakage circuit breaker(ELCB) to apply the UL Listing Mark.
  (See Instruction Manual basic connection diagram Fig.2-3-1).
- In case of using auxiliary control-power input (R0,T0), connect it referring to Basic connection diagram Fig.2-3-1
- Solid state motor overload protection is provided in each model.

Tightening torque and wire range

Voltage	Inverter type	Required torque (N·m)			Wire range [AWG] (mm^2)		
	G11S/P11S	Main terminal	Auxiliary control-power	Control	L1/R,L2/S,L3/T U,V,W	Auxiliary control-power	Control
3-phase 200V	FRN0.2G11S-2	1.2	-	0.7	16 (1.3)	-	24 (0.2)
	FRN0.4G11S-2						
	FRN0.75G11S-2						
	FRN1.5G11S-2	1.8	1.2		14 (2.1)	16(1.3)	
	FRN2.2G11S-2						
	FRN3.7G11S-2				10 (5.3)		
	FRN5.5G11S-2 FRN5.5,7.5P11S-2	3.5			8 (8.4)		
	FRN7.5G11S-2 FRN11P11S-2				6 (13.3)		
	FRN11G11S-2 FRN15P11S-2	5.8			4 (21.2)		
	FRN15G11S-2 FRN18.5P11S-2				3 (26.7)		
	FRN18.5G11S-2 FRN22P11S-2				2 (33.6)		
	FRN22G11S-2				1 (42.4)		
3-phase 400V	FRN0.4G11S-4	1.2	-	0.7	16 (1.3)	-	24 (0.2)
	FRN0.75G11S-4						
	FRN1.5G11S-4	1.8	1.2			16(1.3)	
	FRN2.2G11S-4						
	FRN3.7G11S-4				14 (2.1)		
	FRN5.5G11S-4 FRN5.5,7.5P11S-4	3.5			12 (3.3)		
	FRN7.5G11S-4 FRN11P11S-4				10 (5.3)		
	FRN11G11S-4 FRN15P11S-4	5.8			8 (8.4)		
	FRN15G11S-4 FRN18.5P11S-4				6 (13.3)		
	FRN18.5G11S-4 FRN22P11S-4				4 (21.2)		
	FRN22G11S-4						

Compliance with UL/cUL standards [Applicable to products with UL/cUL mark]

⚠CAUTION

・Use the following power supply in the Inverter.

Inverter type	Maximum input voltage	Input source current
FRN0.2G11S-2 to FRN22G11S-2 FRN5.5P11S-2 to FRN22P11S-2	AC240V	Not more than 5,000A
		Not more than 20,000A
FRN0.4G11S-4 to FRN22G11S-4 FRN5.5P11S-4 to FRN22P11S-4	AC480V	Not more than 5,000A
		Not more than 20,000A

General instructions

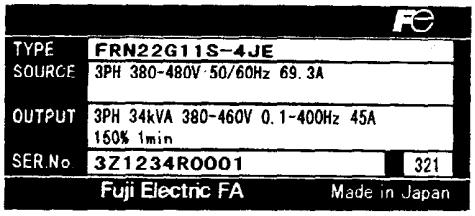
Although figures in this manual may show the inverter with covers and safety screens removed for explanation purposes, do not operate the device until all such covers and screens have been replaced.

Contents

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 the nearest Fuji sales office or your local distributor where you purchased the unit.



Ratings nameplate

①Check the ratings nameplate to confirm that the delivered
product is the ordered one.
TYPE : Inverter type

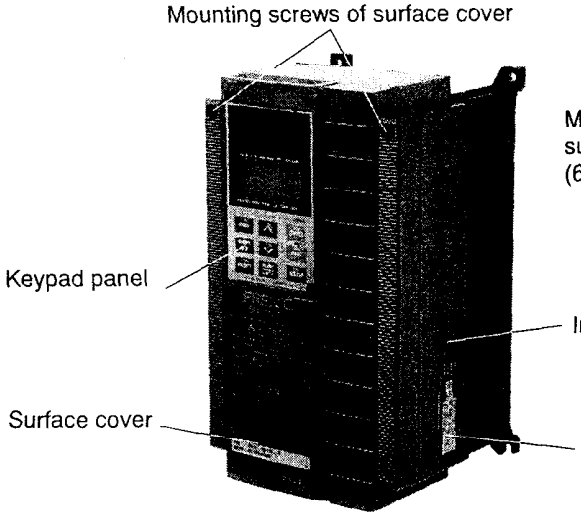
FRN 22 G11S-4
- Power supply voltage system :2→ 200V grade、4→400V grade
- Series name:G11S or P11S
- Nominal applied motor:22→22kW
- Product type: FRENIC5000

SOURCE : Power rating
OUTPUT : Output rating
MASS : Mass (not indicated for products with 22kW or less)
SER.No. : Serial number

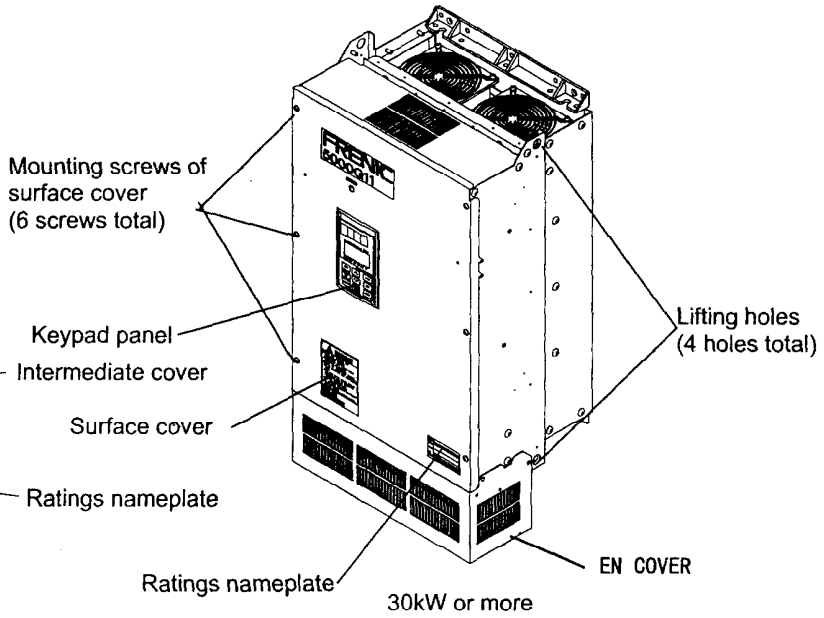
3 Z 1234R0001
- Production lot serial number
- Production month: 1 to 9: January to September, X: October, Y: November, Z: December
- Production year: Last digit of year (3 --> 2003)

②Check for damaged and/or missing parts upon delivery.
③In addition to the inverter unit and this manual, the package contains rubber bushing (for products with 22kW or less) and a terminating resistor (1/2 W, 120Ω). The terminating resistors for products with 22kW or less is packed in a sack. The terminating resistors for products with 30kW or more is connected to the control terminal of the inverter unit. This terminating resistor is required for RS485 communication. The terminating resistor need not be removed regardless of RS485 communication status.

1-2 Appearance



22kW or less



30kW or more

Note : Attach EN COVER after wiring. And refer to the PROCEDURE in EN COVER package with inverter package.

1-3 Handling the Product

(1)Removing the surface cover

For the inverter of 22kW or less, loosen the mounting screws of the surface cover, then remove the cover by pulling the top (see Figure 1.3.1).

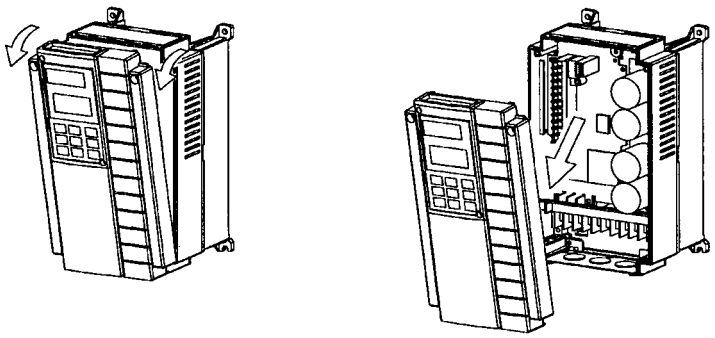


Fig.1-3-1Removing the surface cover (for inverter of 22kW or less)

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

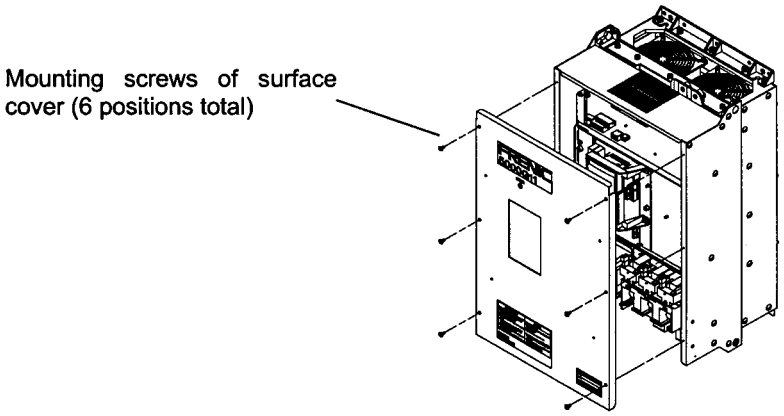


Fig.1-3-2 Removing the surface cover (for inverter of 30kW or more)

(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.

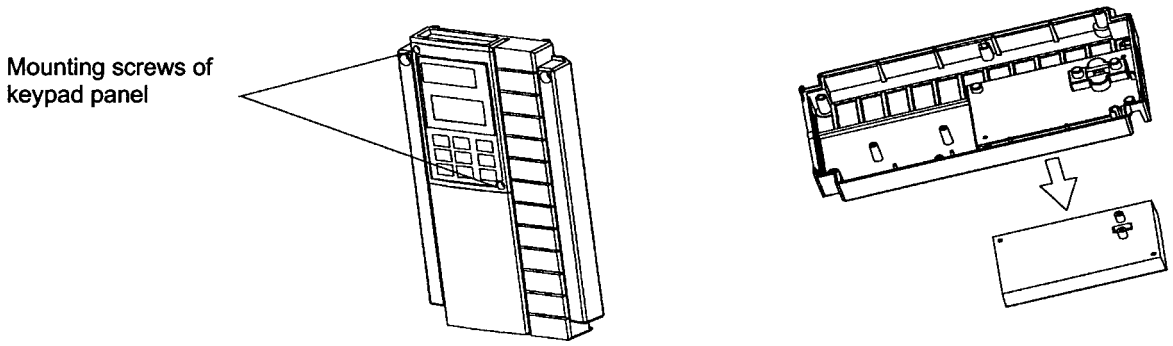


Fig.1-3-3Removing the keypad panel

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

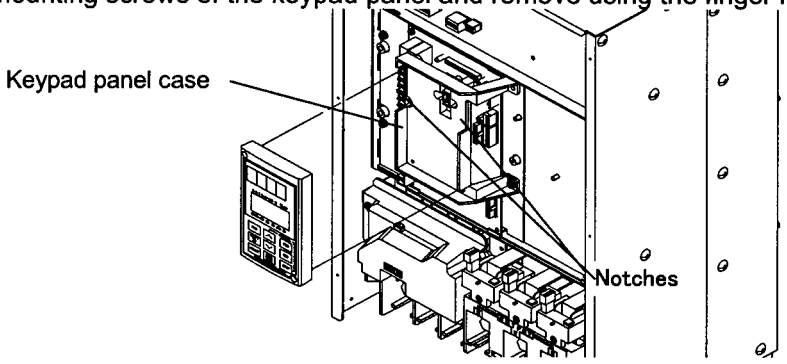


Fig.1-3-4Removing the keypad panel (for inverter of 30kW or more)

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.

Table 1-5-1 Storage environment

Item	Specifications	
Ambient temperature	-10 to +50 °C	Condensation or freezing must not occur as a result of sudden temperature changes.
Storage temperature	-25 to +65	
Relative humidity	5 to 95% Note2	
Atmosphere	Pollution degree 2	
Air pressure	Operation/storage : 86 to 106 kPa Transport : 70 to 106 kPa	

Note1: The storage temperature applies only to short periods such as transport.
Note2: 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.

①Do not place this product directly on a floor.
②To store the product in an extreme environment, pack in vinyl sheet, etc.
③If 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:

①The 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.
②Pack the product thoroughly to eliminate exposure to moisture and include a drying agent to ensure a relative humidity of about 70% or less.
③If 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.
④Electrolytic 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

Table 2-1-1 Operating environment

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	3 mm : from 2 to less than 9 Hz , 1 m/s² : from 9 to less than 20 Hz , 1 m/s² : from 20 to less than 55 Hz , 1 m/s² : from 55 to less than 200 Hz

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

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

2-2 Installation Method

① Securely fasten the product in an upright position on a solid structure such that FRENIC5000G11S is facing the front.
Do not turn the product upside down or install in a horizontal position.

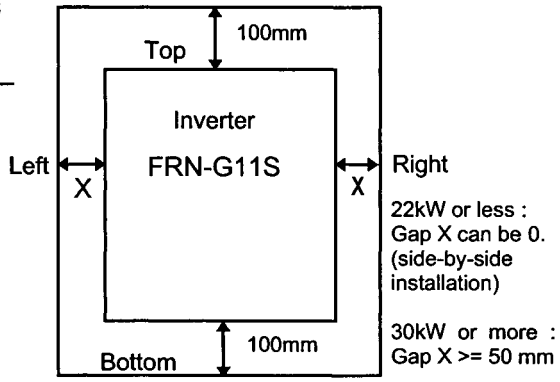


Fig. 2-2-1

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.

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 between 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 radiating about 70% of total inverter heat (total loss) can be placed outside the device or control panel.
Ensure that heat sink surfaces are kept free of foreign matter (lint, moist dust particles etc.).

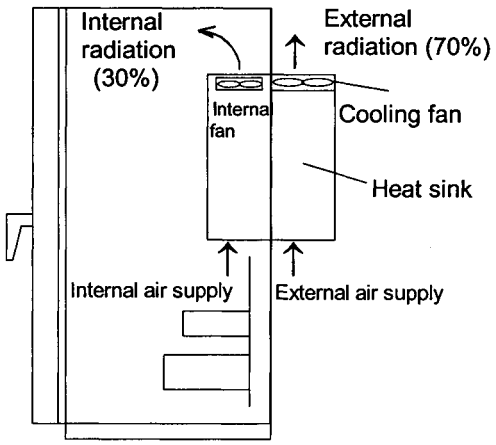


Fig.2-2-2 External cooling system

⚠ **WARNING**	• In case of external cooling system, cover the inverter rear side in order not to touch the main capacitor and braking resistor. **Electric shock may result.** •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 secure the brackets using the M5 case mounting screws. (The bracket screws are no longer required after changing the bracket mounting position.)

Quantity of mounting screw

Voltage series	Inverter type	Bracket screws	Case mounting screws
200V	FRN30G11S-2 to FRN75G11S-2 FRN30P11S-2 to FRN90P11S-2	5	5
	FRN90G11S-2 FRN110P11S-2	6	6
400V	FRN30G11S-4 to FRN160G11S-4 FRN30P11S-4 to FRN200P11S-4	5	5
	FRN200G11S-4 to FRN220G11S-4 FRN220P11S-4 to FRN280P11S-4	6	6

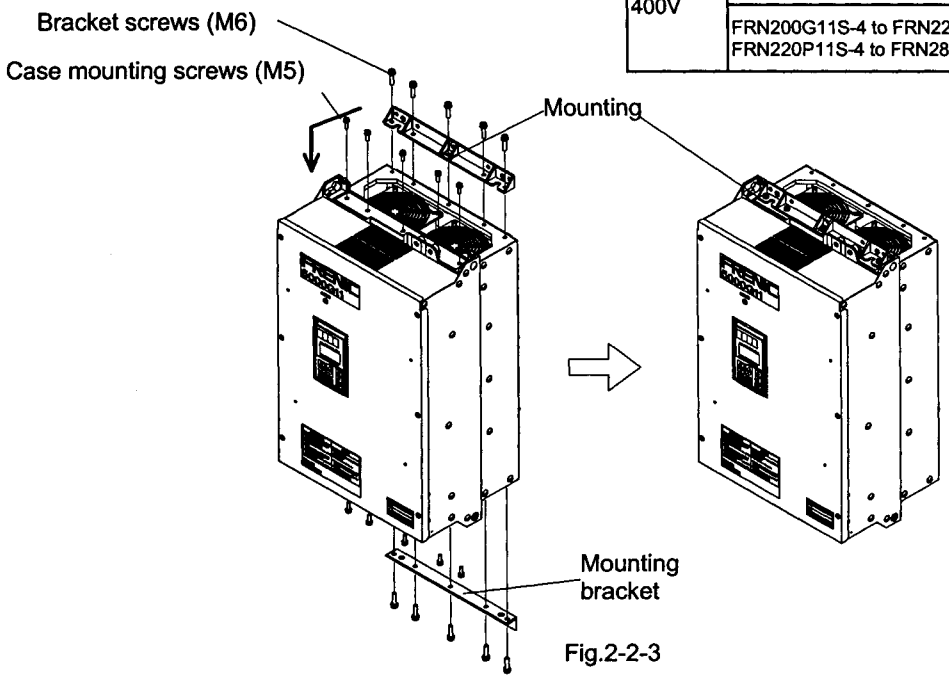


Fig.2-2-3

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

(1) 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.

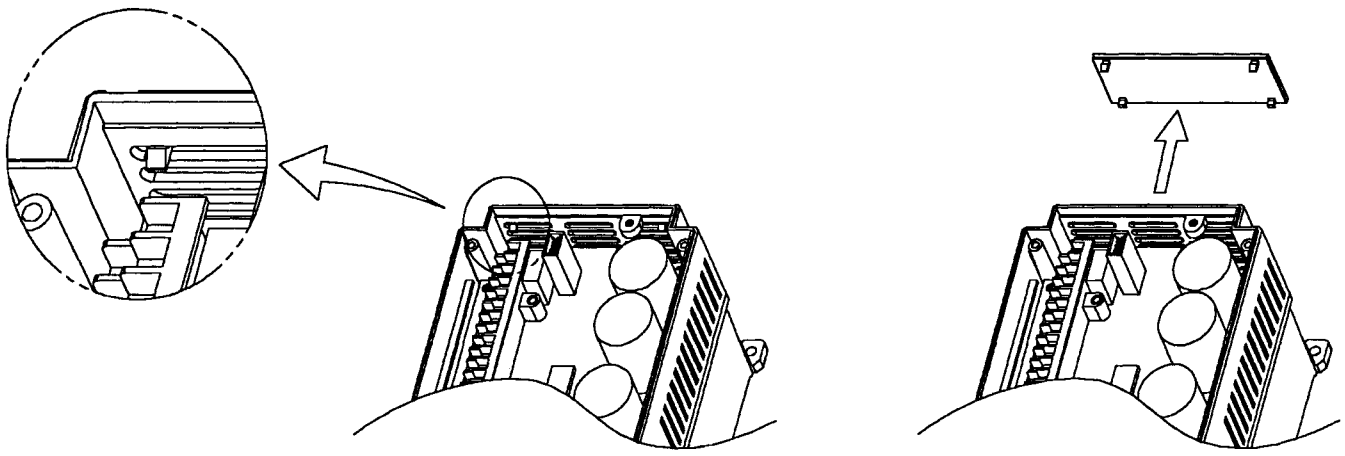


Fig. 2-2-4 Removing the ventilating cover

2-3 Connection

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

2-3-1 Basic connection

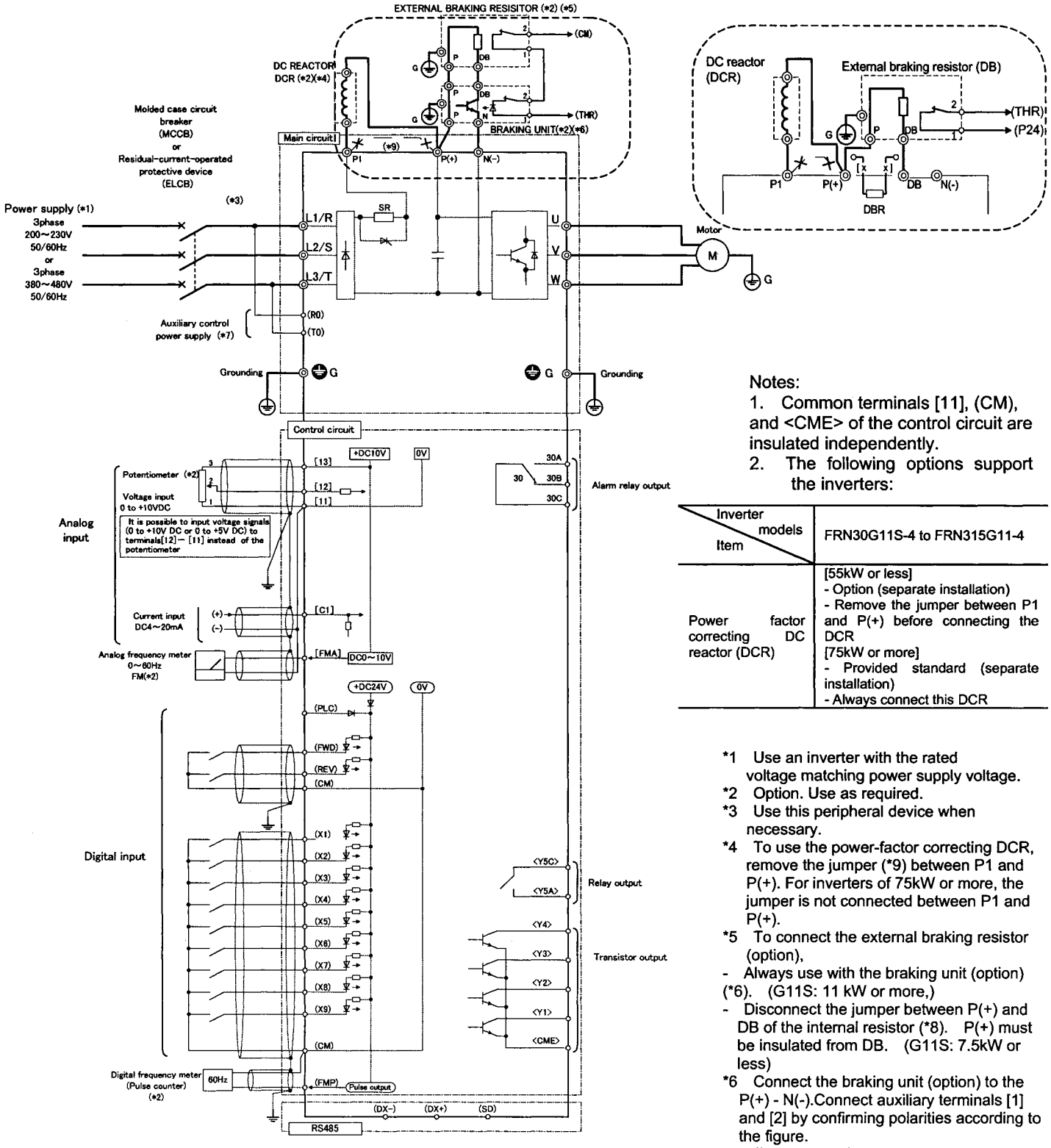
① Always connect power to the L1/R, L2/S, and L3/T main circuit power terminals of the inverter. Connecting power to another terminal will damage the inverter. Check that the power voltage is within the maximum allowable voltage marked on the nameplate, etc.
② Always ground the ground terminal to prevent disasters such as fire or electric shock and to minimize noise.
③Use 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 (25V 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 causesparks.

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

■Basic connection diagram

■ FRENIC5000G11S 11kW or more
■ FRENIC5000P11S 15kW or more

■ FRENIC5000G11S 7.5kW or less
■ FRENIC5000P11S 11kW or less



Notes:

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

Item \ Inverter models	FRN30G11S-4 to FRN315G11-4
Power factor correcting DC reactor (DCR)	[55kW or less] - Option (separate installation) - Remove the jumper between P1 and P(+) before connecting the DCR [75kW 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 75kW or more, the jumper is not connected between P1 and P(+).
*5 To connect the external braking resistor (option),
- Always use with the braking unit (option) (*6). (G11S: 11 kW or more,)
- Disconnect the jumper between P(+) and DB of the internal resistor (*8). P(+) must be insulated from DB. (G11S: 7.5kW 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 the inverters of 1.5kW or more.
The inverter can be operated without auxiliary control-power input.

Fig. 2-3-1

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

Table 2-3-1 Functions of main circuit terminals 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 0.75kW 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 7.5kW 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.

(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.

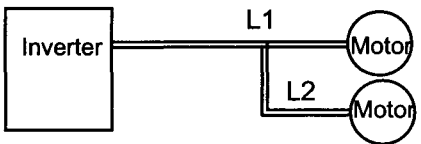
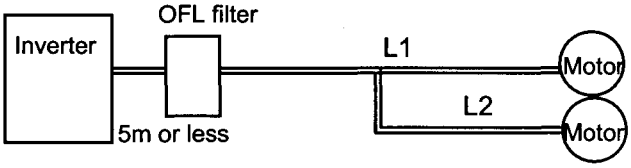
④ Do not connect these terminals to a single-phase power supply.

(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 3.7kW or less) or 100 meters (for 5.5kW 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 (3.7kW or less) 100m or less (5.5kW or more) To drive two or more motors, the total length of cable to these motors must not exceed 50 meters (for 3.7kW or less) or 100 meters (for 5.5kW or more).	 L1 + L2 = 400m 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 400V 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 400V 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 400V series motor, in particular) is particularly long, surge voltage will deteriorate motor insulation. To prevent this when driving the 400V series motor using the inverter, ensure one of the following:

① Use a well-insulated motor. (Fuji Electric's standard motors are well insulated.)

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).

①To 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.

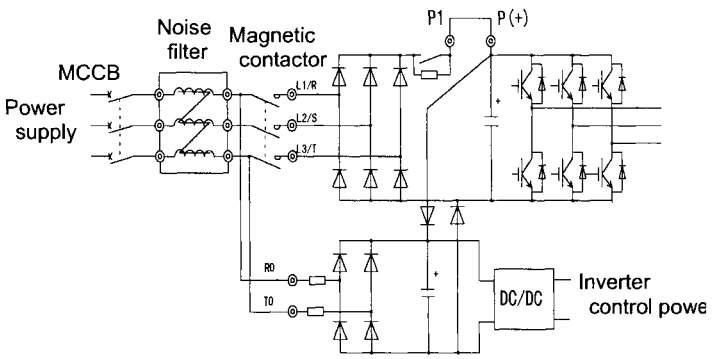


Fig.2-3-2 Connecting the auxiliary control-power input terminals

(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 75kW or more, the DC reactor is provided as a separate standard component and should always be connected to the terminals.

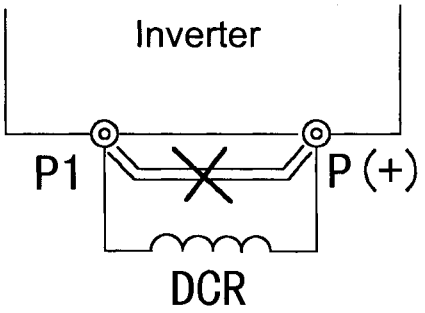


Fig. 2-3-3

(5) External braking-resistor connecting terminals (P(+) and DB) (G11S: 7.5kW or less)
For the G11S of 7.5kW 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.

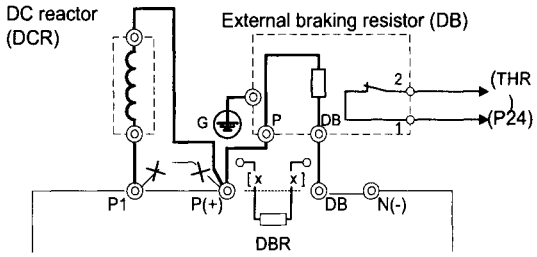


Fig. 2-3-4 Connection (G11S : 7.5kW or less)

(6) DC link circuit terminals (P(+) and N(-))
The G11S inverter of 11kW 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".

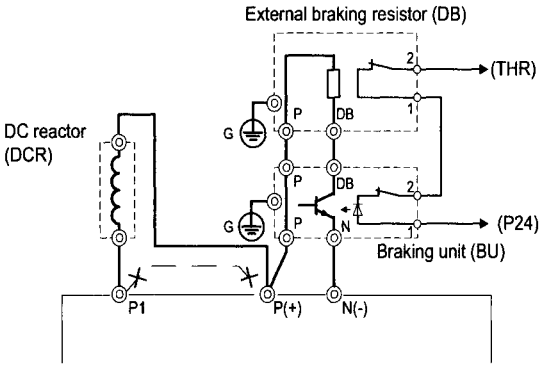


Fig. 2-3-5 Connection (G11S : 11kW or more)

(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: 10Ω 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 30kW or more)

When an inverter of 30kW 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

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

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

⚠ **CAUTION**	· Check that the number of phases and rated voltage of this product match those of the AC power supply. · Do not connect the AC power supply to the output terminals (U, V, W). **Injury may result.** · 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 30kW or more)

G11S 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 30kW 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 RTXT) 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).

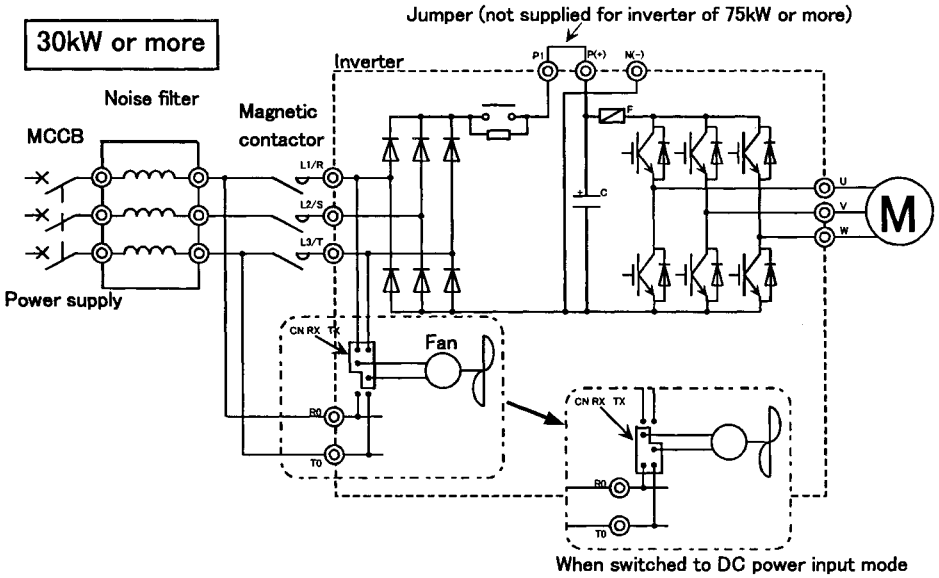


Fig. 2-3-6 Fan power switching

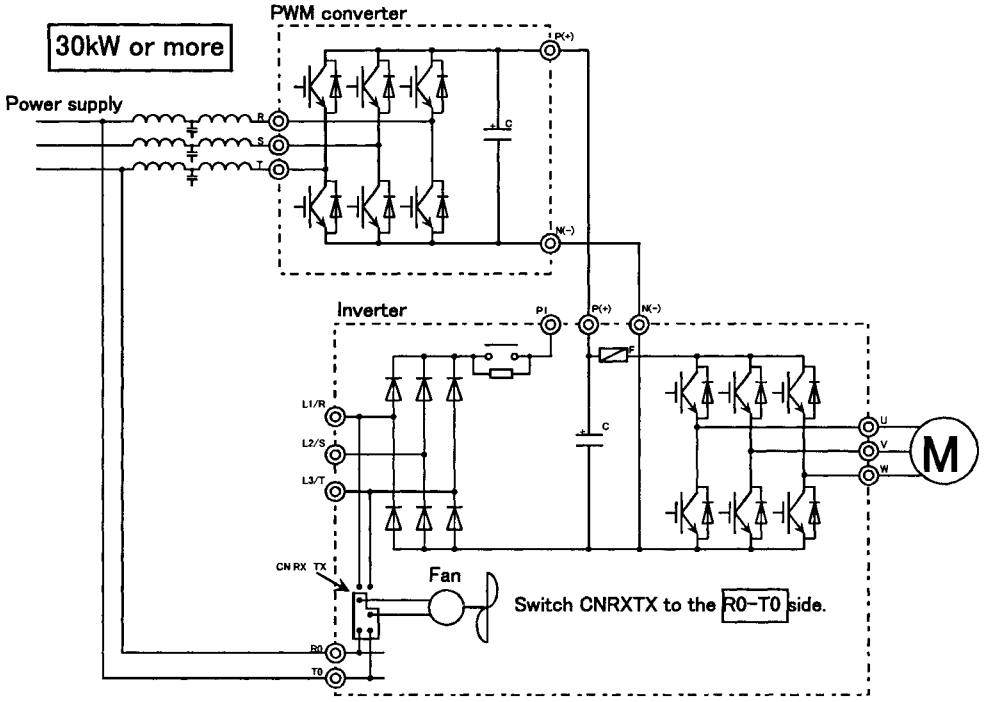
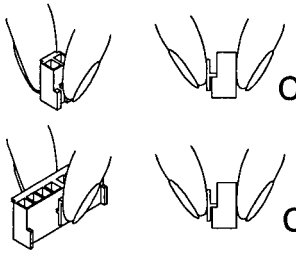


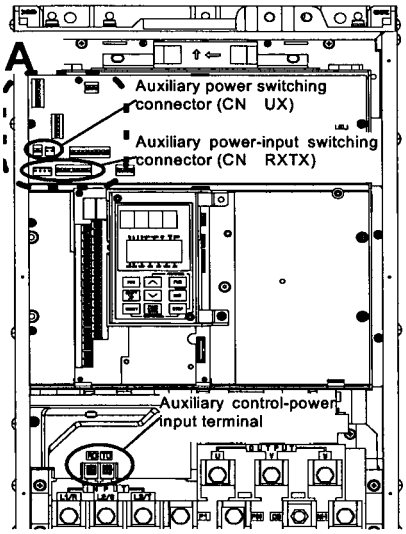
Fig. 2-3-7 Example of connection by combination with power regeneration converter

Note:
To connect the power regeneration converter to an inverter of 22kW 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, insulate these input terminals from the main power of the power regeneration converter with an insulation transformer.The connection example of a power regeneration unit is provided in the "Power Regeneration Unit Instruction Manual".

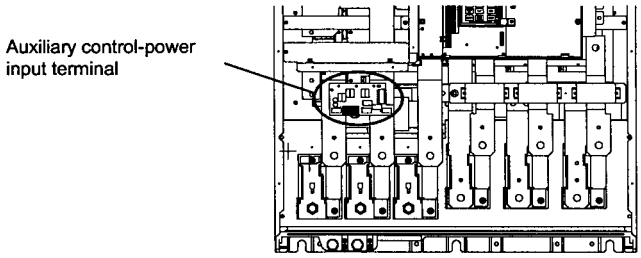
The switching connectors are mounted on the power PCB above the control PCB as shown on the right.



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.

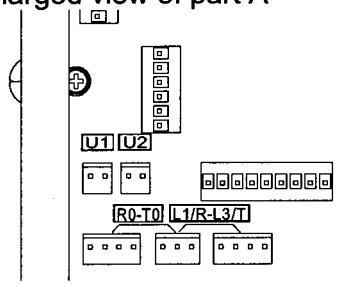


FRN30G11S-4 to FRN110G11S-4



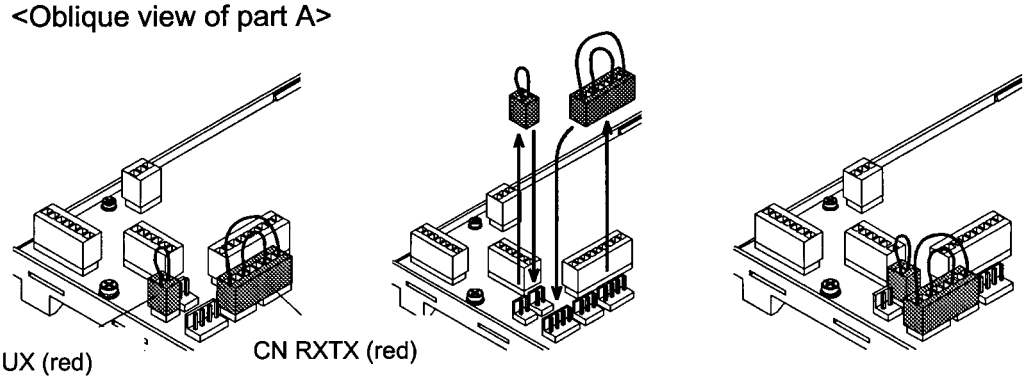
FRN132G11S-4 to FRN220G11S-4

<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.

<Oblique view of part A>



CN UX (red)

CN RXTX (red)

Factory shipment status Connector removal After connector switching.

CNUX : U1

CNRXTX: L1/R-L3/T

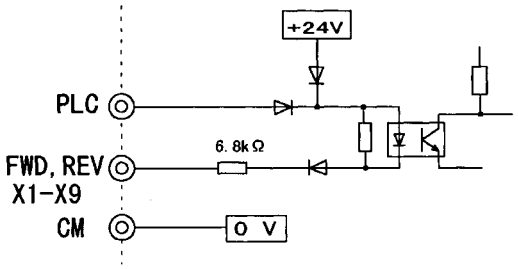
In this figure the power voltage is 380 to 398V AC, 50 Hz (or 380 to 430V AC, 60Hz) and the inverter is used in DC power input mode.

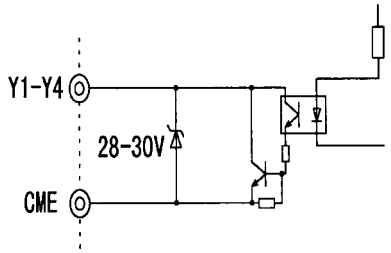
Fig. 2-3-8 Power switching connectors (only for 30kW or more)

2-3-3 Connecting the control terminals

Table 2-3-3 lists the functions of the control circuit terminals. A control circuit terminal should be connected according to the setting of its functions.

Table 2-3-3

<table>
<tr><th>Classification</th><th>Terminal symbol</th><th>Terminal name</th><th>Function</th></tr>
<tr><td rowspan="3">Analog input</td><td>13</td><td>Potentiometer power supply</td><td>Used for +10V DC power supply for frequency setting POT (variable resistor of 1 to 5kΩ)</td></tr>
<tr><td>12</td><td>Voltage input</td><td>① Frequency is set according to the analog input voltage supplied from an external circuit.
- 0 to +10V DC/0 to 100%
- Reversible operation using positive and negative signals: 0 to +/- 10V DC/0 to 100%
- Reverse operation: +10 to 0V 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. (P11S does not support this function.)
* Input resistance: 22 kΩ</td></tr>
<tr><td>C1</td><td>Current input</td><td>① Frequency is set according to the analog input current supplied from an external circuit.
- 4 to 20mA DC/0 to 100%
- Reverse operation: 20 to 4mA DC/0 to 100%
② The feedback signal for PID control is input.
③ PTC thermistor input
* It can be used only one terminal "V2" or "C1" alternatively.
* Input resistance: 250Ω</td></tr>
<tr><td></td><td>11</td><td>Analog input common</td><td>Common terminal for analog input signals</td></tr>
<tr><td rowspan="13">Digital input</td><td>FWD</td><td>Forward operation/stop command</td><td>Used for forward operation (when FWD-CM is on) or deceleration and stop (when FWD-CM is off)</td></tr>
<tr><td>REV</td><td>Reverse operation/stop command</td><td>Used for reverse operation (when REV-CM is on) or deceleration and stop (when REV-CM 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>2V</td><td>-</td><td>2V</td></tr>
<tr><td>OFF level</td><td>22V</td><td>24V</td><td>27V</td></tr>
<tr><td colspan="2">Operating current at ON level</td><td>-</td><td>3.2mA</td><td>4.5mA</td></tr>
<tr><td colspan="2">Allowable leakage current at OFF level</td><td>-</td><td>-</td><td>0.5mA</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>CM</td><td>Common terminal</td><td>Common terminal for Digital input 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 source 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 +10V DC.
The meaning of this signal is one of the following:
- Output frequency (before slip compensation) - Power consumption
- Output frequency (after slip compensation) - PID feedback value
- Output current - PG feedback value
- Output voltage - DC link circuit voltage
- Output torque - Universal AO
- Load factor
* Connectable impedance: 5kΩ minimum</td></tr>
</table>

<table>
<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>
<tr><td rowspan="6">Transistor output</td><td>Y1</td><td>Transistor output 1</td><td rowspan="5">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>2V</td><td>3V</td></tr><tr><td>OFF level</td><td>-</td><td>24V</td><td>27V</td></tr><tr><td colspan="2">Maximum load current at ON level</td><td>-</td><td>-</td><td>50mA</td></tr><tr><td colspan="2">Leakage current at OFF level</td><td>-</td><td>-</td><td>0.1mA</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></td><td></td></tr>
<tr><td>CME</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: 48V DC, 0.5A
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.
An excitation mode (excitation at alarm occurrence or at normal operation) can be selected.</td></tr>
<tr><td rowspan="2">Communication</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>

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

①These terminals receive weak analog signals that may be affected by external noise. The cables must be as short as possible (20 meters or less), must be shielded, and must 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].

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.

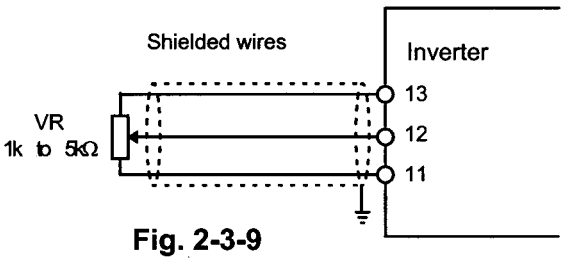


Fig. 2-3-9

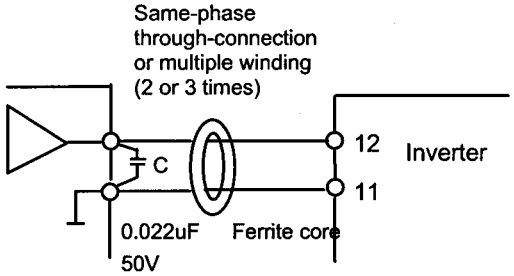


Fig. 2-3-10 Example of noise prevention

(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 or from the CM terminal. If Digital input terminals are turned on or off by switching the open collector output of PLC using an external power supply, a resulting bypass circuit may cause the inverter to malfunction.
To prevent a malfunction, connect the PLC terminal as shown in Fig. 2-3-11.

② When using a contact input, a relay having highly reliable contact must be used.
Example: Fuji Electric Control Relay : HH54PW

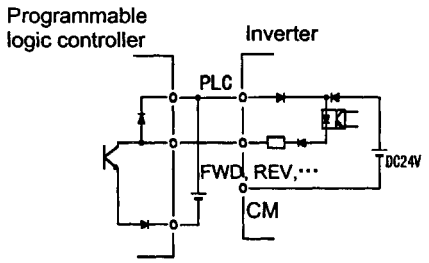


Fig. 2-3-11
Connection for External power supply

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

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

(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 (inverter of 30kW or more)

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 holeB.

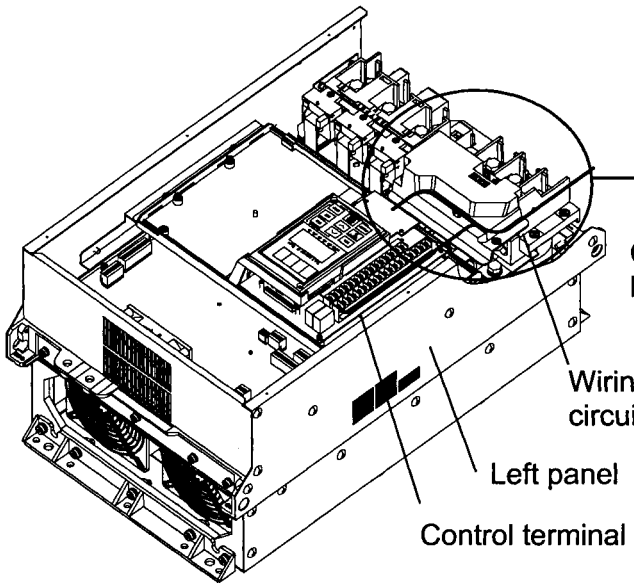


Fig. 2-3-12 The wiring route of the control circuit

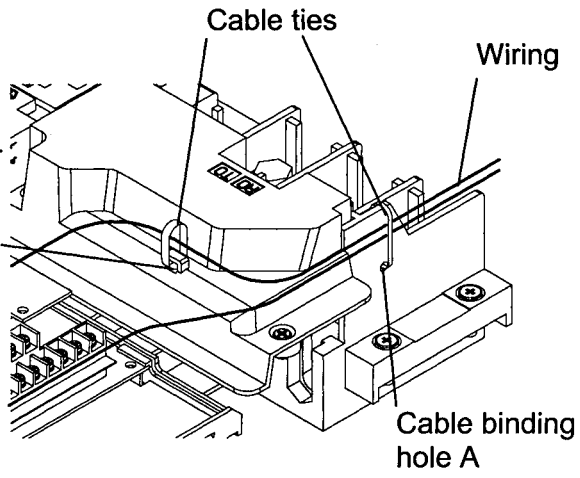
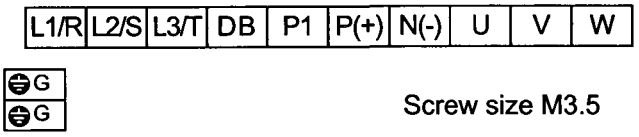


Fig. 2-3-13 The securing positions of the control-circuit line of inverter (30 kW or more)

2-3-4 Terminal arrangement

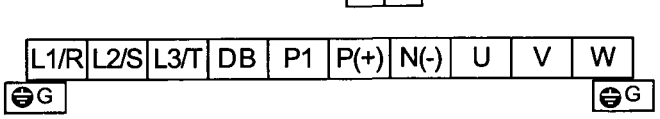
(1)Main circuit terminals

FRN0.2 to 0.75G11S-2
FRN0.4 to 0.75G11S-4 Screw size M3.5



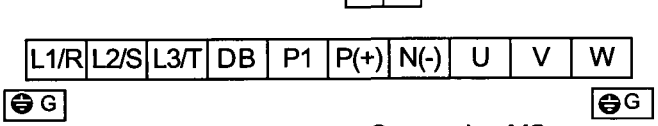
Screw size M3.5

FRN1.5 to 3.7G11S-2 Screw size M3.5
FRN1.5 to 3.7G11S-2



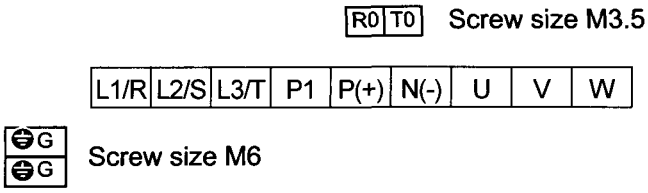
Screw size M4

FRN5.5 to 7.5G11S-2/ FRN5.5 to 11P11S-2
FRN5.5 to 7.5G11S-4/ FRN5.5 to 11P11S-4



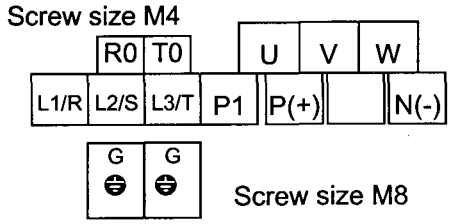
Screw size M3.5
Screw size M5

FRN11 to 22G11S-2 / FRN15 to 22P11S-2
FRN11 to 22G11S-4 / FRN15 to 22P11S-4



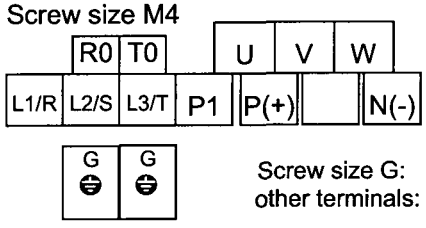
Screw size M3.5
Screw size M6

FRN30G11S-2/ FRN30 to 37P11S-2
FRN30 to 55G11S-4/ FRN30 to 75P11S-4



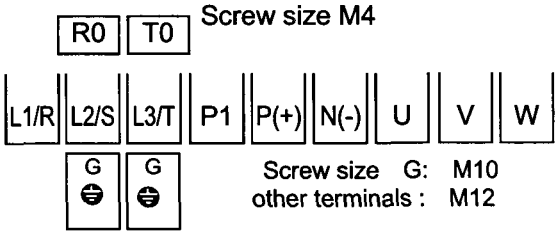
Screw size M8

FRN37 to 55G11S-2/ FRN45 to 75P11S-2
FRN75 to 110G11S-4/FRN90 to 132P11S-4



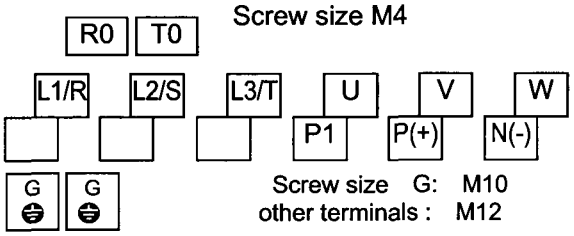
Screw size G: M8
other terminals: M10

FRN75G11S-2/FRN90P11S-2



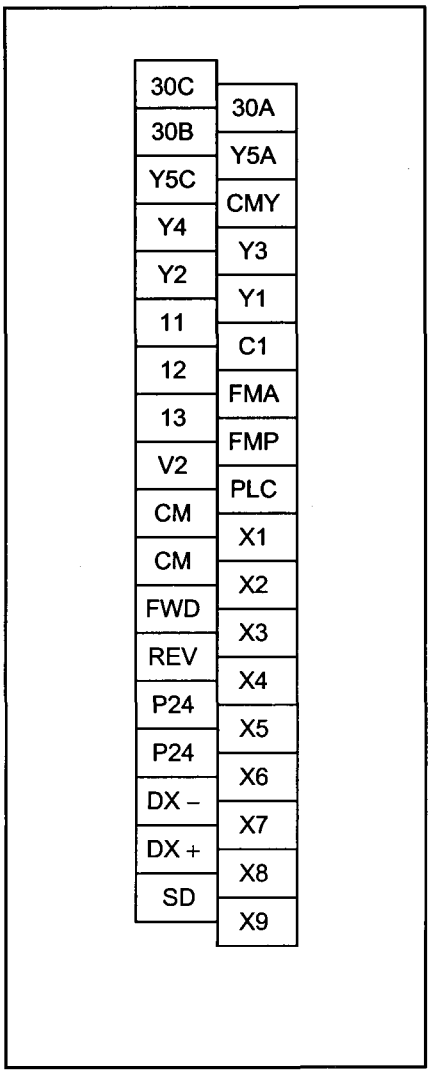
Screw size G: M10
other terminals : M12

FRN90G11S-2/ FRN110P11S-2
FRN132 to 220G11S-4/FRN160 to 280P11S-4



Screw size G: M10
other terminals : M12

(2) Control circuit terminals



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

Voltage	Application motor [kW]	Inverter type	Fuse/MCCB current rating [A]		Tightening torque [N*m]				Recommended wire size [mm2]							
									L1/R,L2/SL3/T							
			With DCR	Without DCR	L1/R,L2/S,L3/T U,V,W P1,P(+),DB,N(-)	⏚ G	R0,T0	Control	With DCR	Without DCR	⏚ G	U,V,W	R0,T0	P1,P(+)	P(+),DB,N(-)	Control
3phase 200V system	0.2	FRN0.2G11S-2	5	5	1.2		-	1.2	2	2	2	2	-	2	2	0. 2 to 0.75
	0.4	FRN0.4G11S-2	5	5												
	0.75	FRN0.75G11S-2	5	10												
	1.5	FRN1.5G11S-2	10	15	1.8								2			
	2.2	FRN2.2G11S-2	10	20												
	3.7	FRN3.7G11S-2	20	30						3.5						
	5.5	FRN5.5P11S-2	30	40	3.5					5.5				3.5		
	5.5	FRN5.5G11S-2										3.5				
	7.5	FRN7.5P11S-2	40	60					3.5	8	3.5			5.5		
	7.5	FRN7.5G11S-2														
	11	FRN11P11S-2	50	100								5.5				
	11	FRN11G11S-2			5.8				5.5	14	5.5	8		8		
	15	FRN15P11S-2	75	125												
	15	FRN15G11S-2							8	22	8			14		
	18.5	FRN18.5P11S-2	100	150											3.5	
	18.5	FRN18.5G11S-2							14	38		14		22		
	22	FRN22P11S-2	100	175								22			5.5	
	22	FRN22G11S-2														
3phase 400V system	0.4	FRN0.4G11S-4	5	5	1.2		-	1.2	2	2	2	2	-	2	2	0. 2 to 0.75
	0.75	FRN0.75G11S-4	5	5												
	1.5	FRN1.5G11S-4	5	10	1.8								2			
	2.2	FRN2.2G11S-4	10	15												
	3.7	FRN3.7G11S-4	10	15						3.5						
	5.5	FRN5.5P11S-4	15	20	3.5					5.5				3.5		
	5.5	FRN5.5G11S-4										3.5				
	7.5	FRN7.5P11S-4	20	30					3.5	8	3.5			5.5		
	7.5	FRN7.5G11S-4														
	11	FRN11P11S-4	30	40								5.5				
	11	FRN11G11S-4			5.8				5.5	14	5.5	8		8		
	15	FRN15P11S-4	40	50												
	15	FRN15G11S-4														
	18.5	FRN18.5P11S-4	40	60												
	18.5	FRN18.5G11S-4														
	22	FRN22P11S-4	50	75												
	22	FRN22G11S-4														

Note: The type of wire is 70°C 600V 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.

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.

⑥ 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 1.5kW or more)

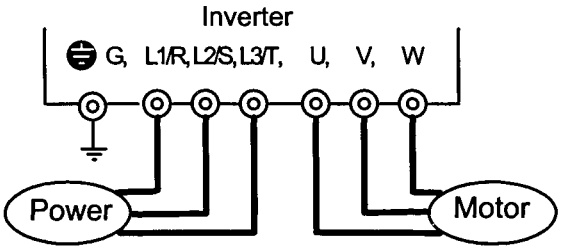


Fig. 3-1-1 Inverter connection

Fig. 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

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.

Table 3-2-1 General operation methods

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

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

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

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.

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.

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.

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.

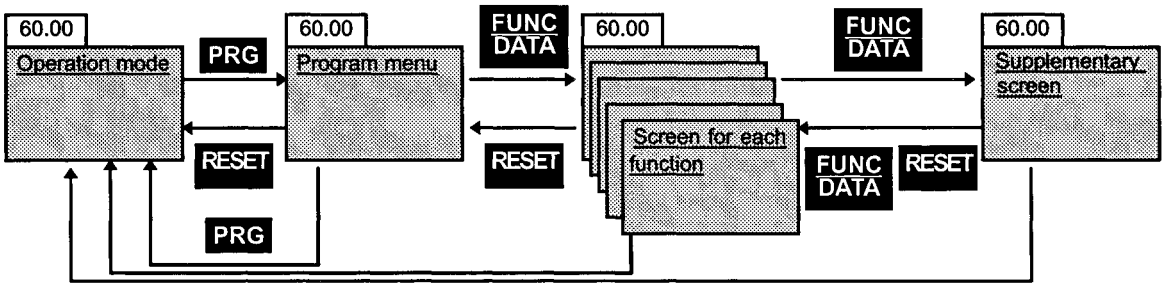
Table 4-1-1 Functions of operation keys

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.

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 occurrence

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 .

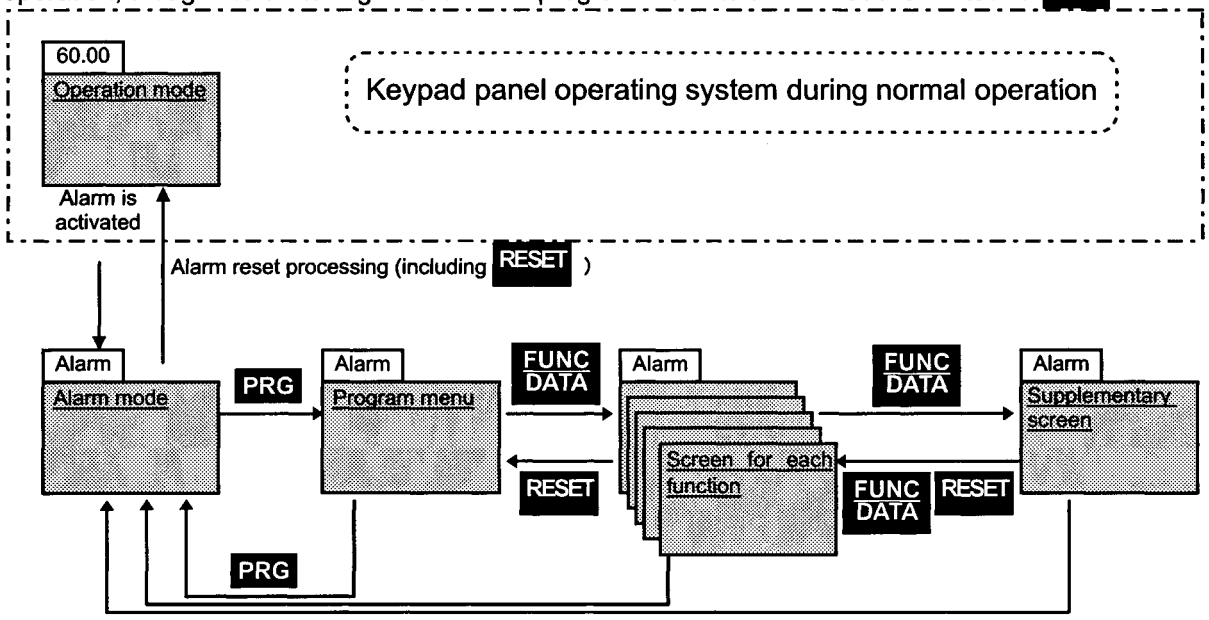


Table 4-2-1 Overview of contents displayed for each level

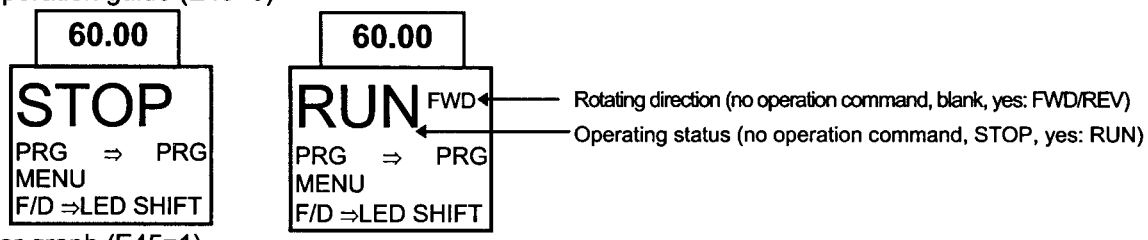
<table>
<tr><th>No.</th><th>Level name</th><th>Content</th></tr>
<tr><td>1</td><td>Operating mode</td><td>This screen is for normal operation. Frequency setting by keypad panel and the LED monitor switching are possible only when this screen is displayed.</td></tr>
<tr><td>2</td><td>Program menu</td><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>MAINTENANC</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 breaking 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>

4-3 Operating Keypad Panel

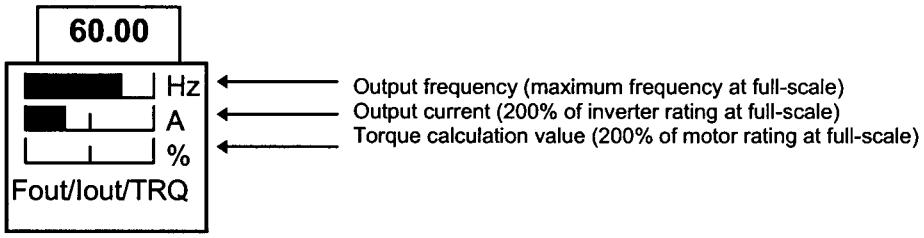
4-3-1 Operation Mode

The screen for normal inverter operation includes a screen for displaying inverter operating status and an operation guide and a screen for graphically displaying the operating status in the form of a bar graph. Switching between both screens is possible using the E45 function.

1) Operation guide (E45=0)



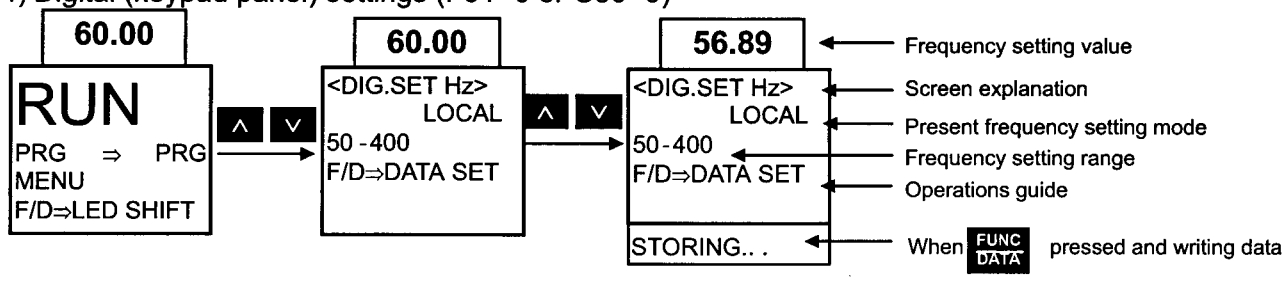
2) Bar graph (E45=1)



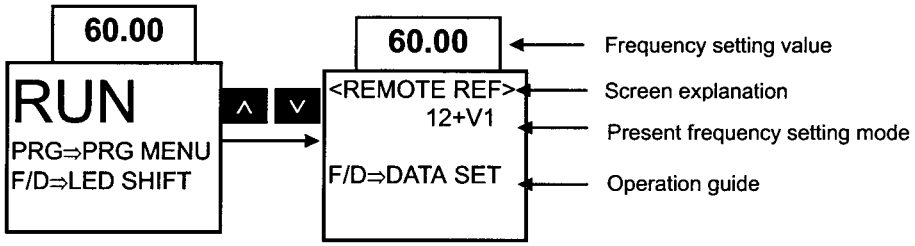
4-3-2 Setting digital frequency

On the operation mode screen, press ∧ or ∨ to display the set frequency on the LED. Data is initially incremented and decremented in the smallest possible unit. Holding down ∧ or ∨ increases or decreases the speed of increment or decrement. The digit to change data can be selected using SHIFT >> and then data can be set directly. To save the frequency settings, press FUNC DATA .
Press RESET and PRG to return to the operation mode.
If keypad panel settings are not selected, the present frequency setting mode appears on the LCD.
When selecting the PID function, PID command can be set with a process value. (Refer to technical documentation for details).

1) Digital (keypad panel) settings (F01=0 or C30=0)



2) Other than digital setting



4-3-3 Switching the LED monitor

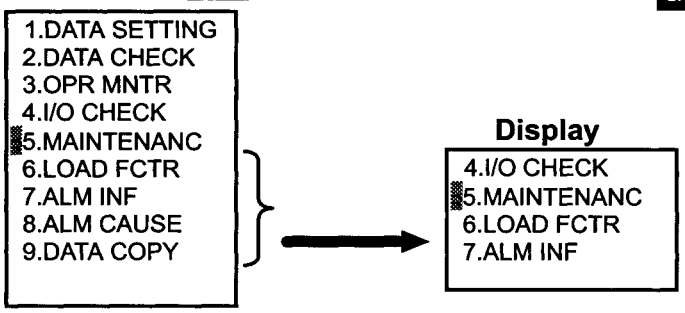
On the normal operation, press FUNC DATA to switch to LED monitor display.

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)			
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		–	

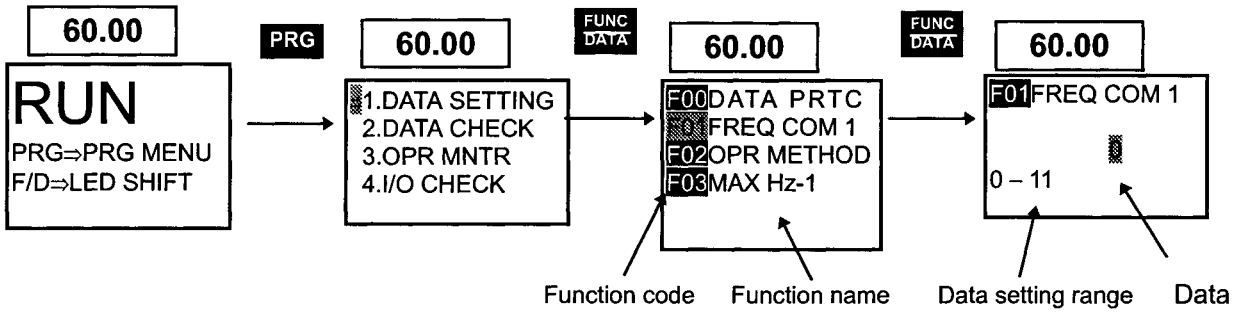
4-3-4 Menu screen

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.

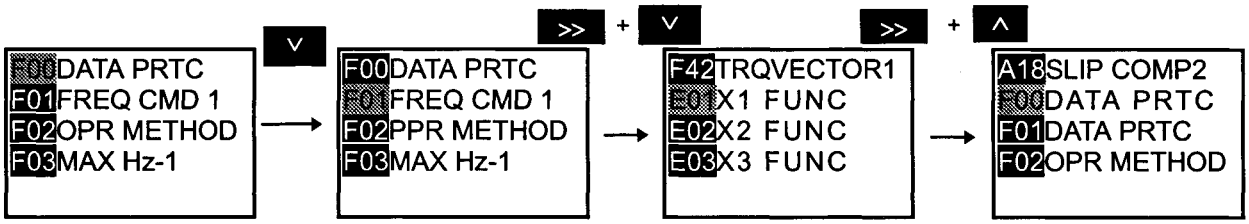


The function code consists of alphanumeric characters. Unique alphabetical letters are assigned for each function group.

Table 4-3-1

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

To scroll "Function Select" screen rapidly , use >> + ^ or >> + v to move the screen in a unit grouped by alphabet.



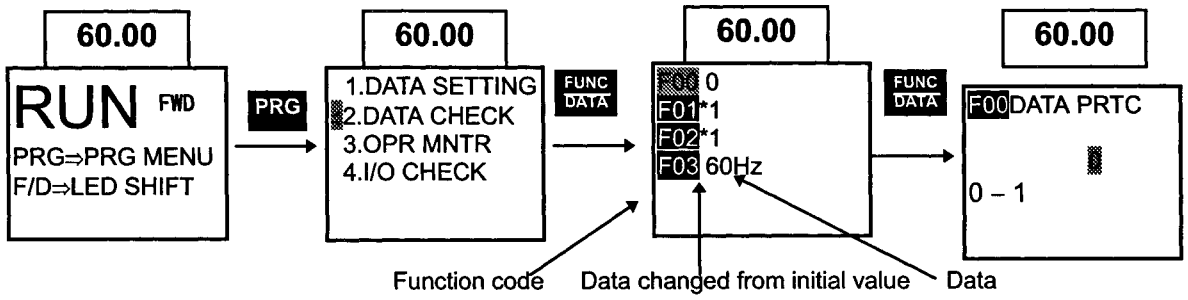
Select the desired function and press FUNC DATA to switch to the "data setting" screen.
On the "data setting" screen, the data values on the LCD can be increased or decreased in the smallest possible unit by pressing ^ or v . Holding down ^ or v expands the rate of change, thereby enabling values to 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 change s. Data cannot be modified for the following reasons :

Table 4-3-2

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)	The edit enabling command function is selected using a general-purpose input terminal.	Among functions E01 to E09, turn the terminal of data 19 (edit enabling command selection) 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.

4-3-6 Checking function data

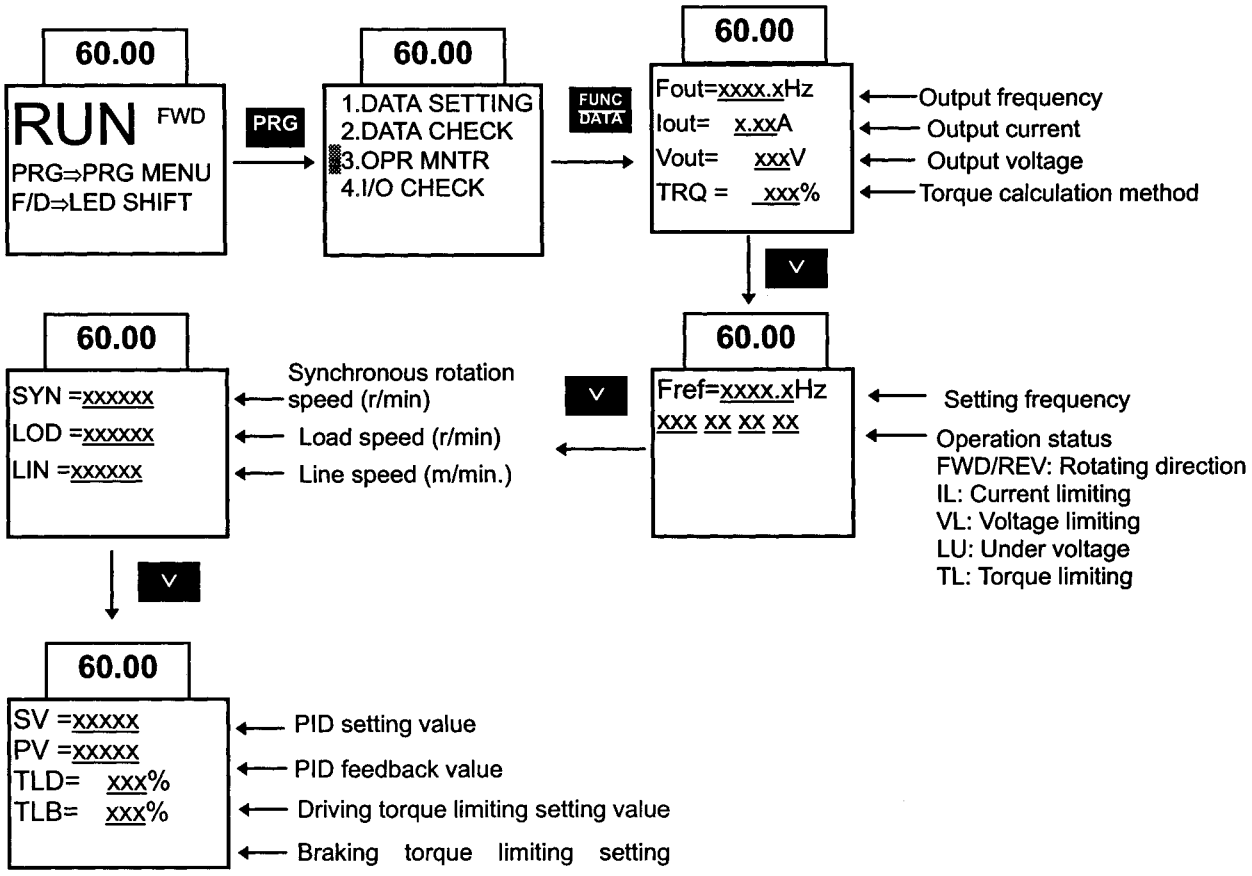
On the "Program menu" screen, select **"2. DATA CHECK"**. The "Function Select" screen then appears with function codes and names.



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

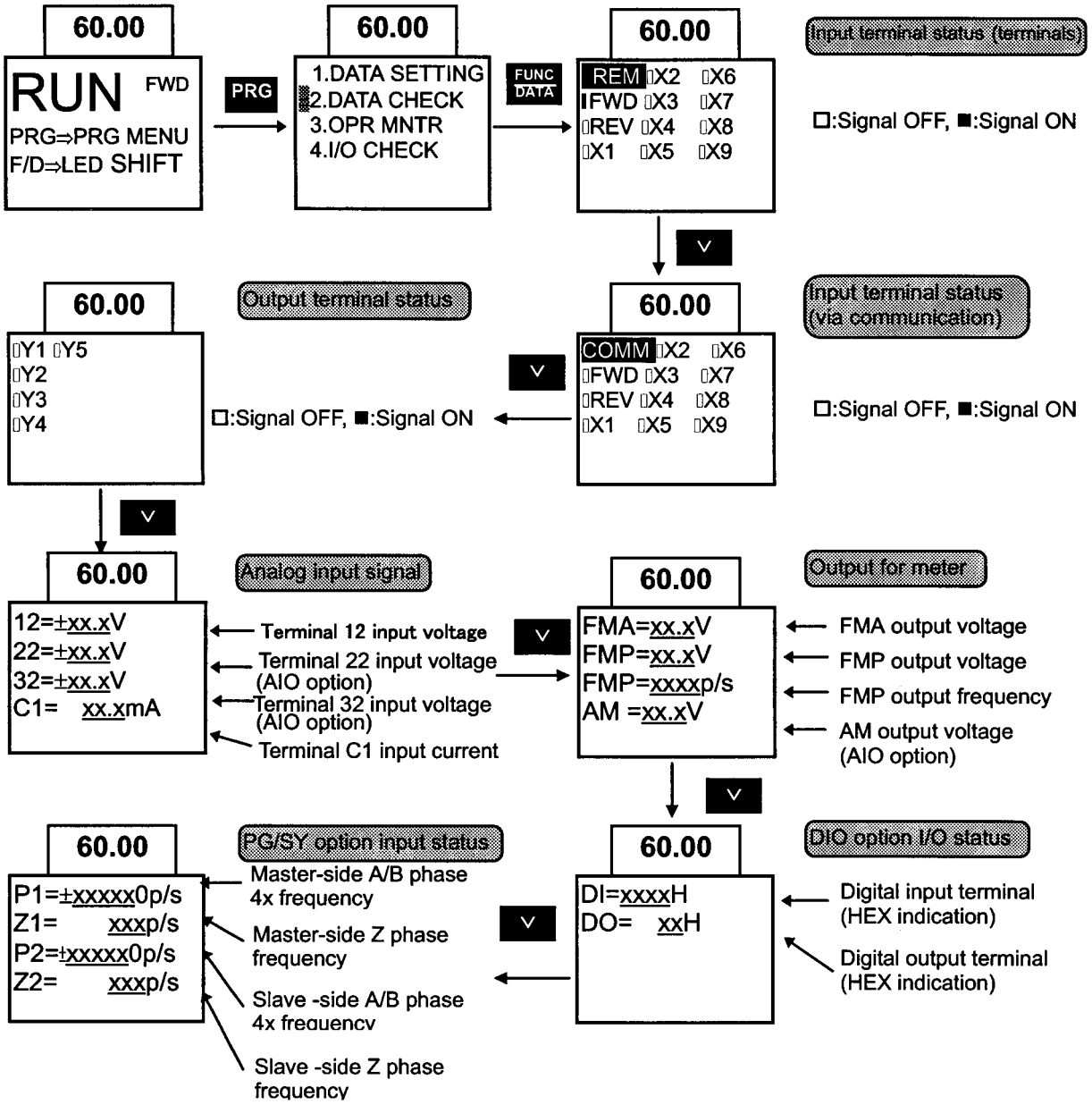
4-3-7 Monitoring operating status

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



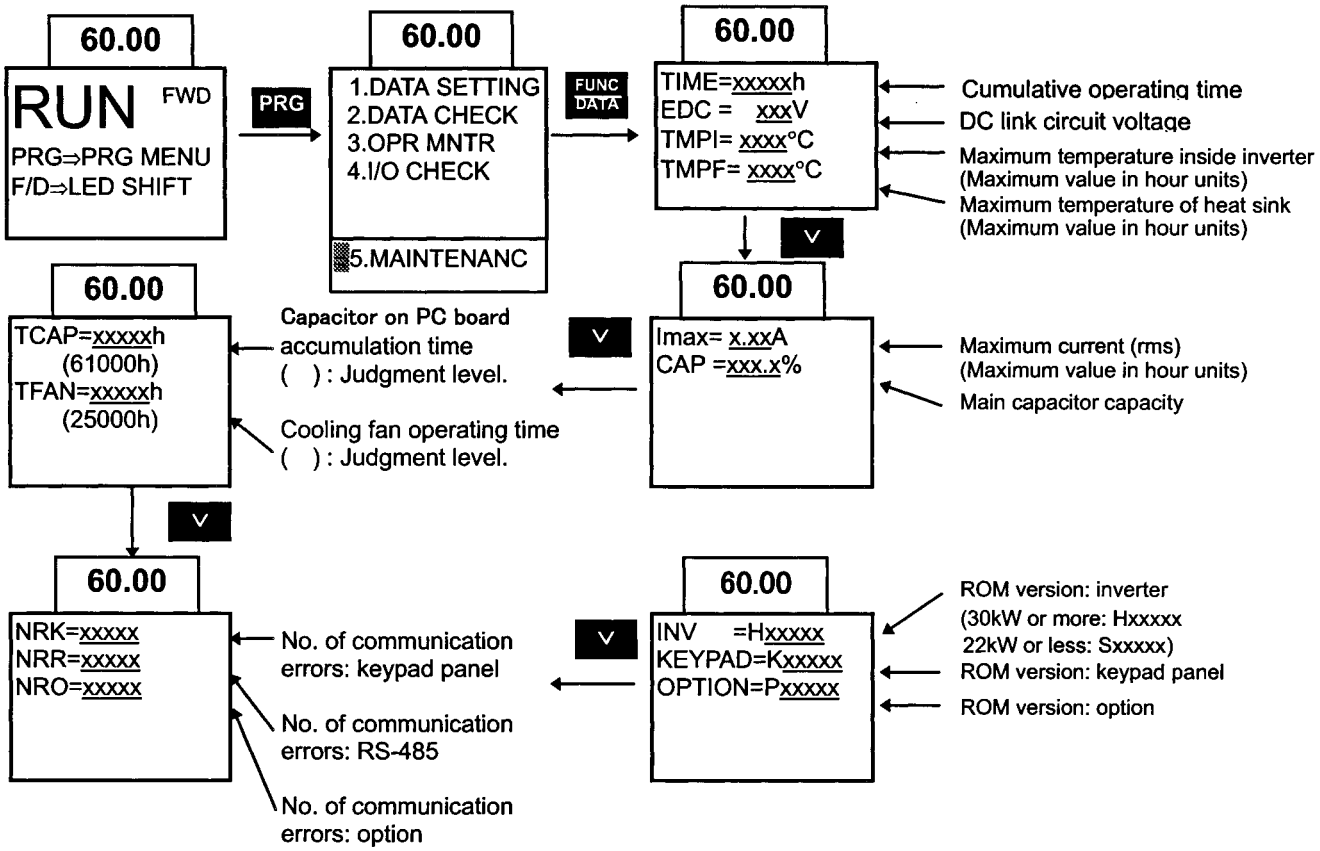
4-3-8 I/O check

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.



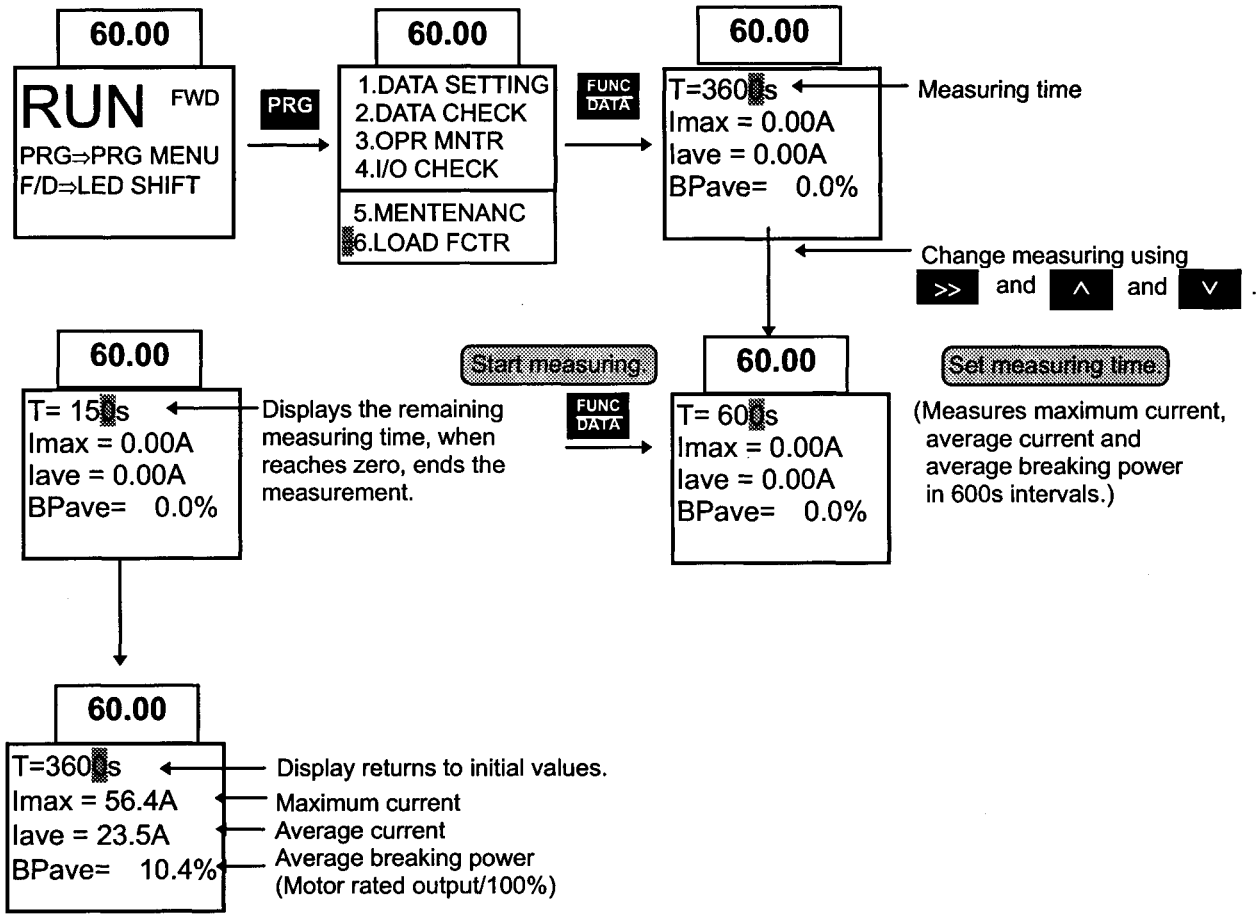
4-3-9 Maintenance information

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



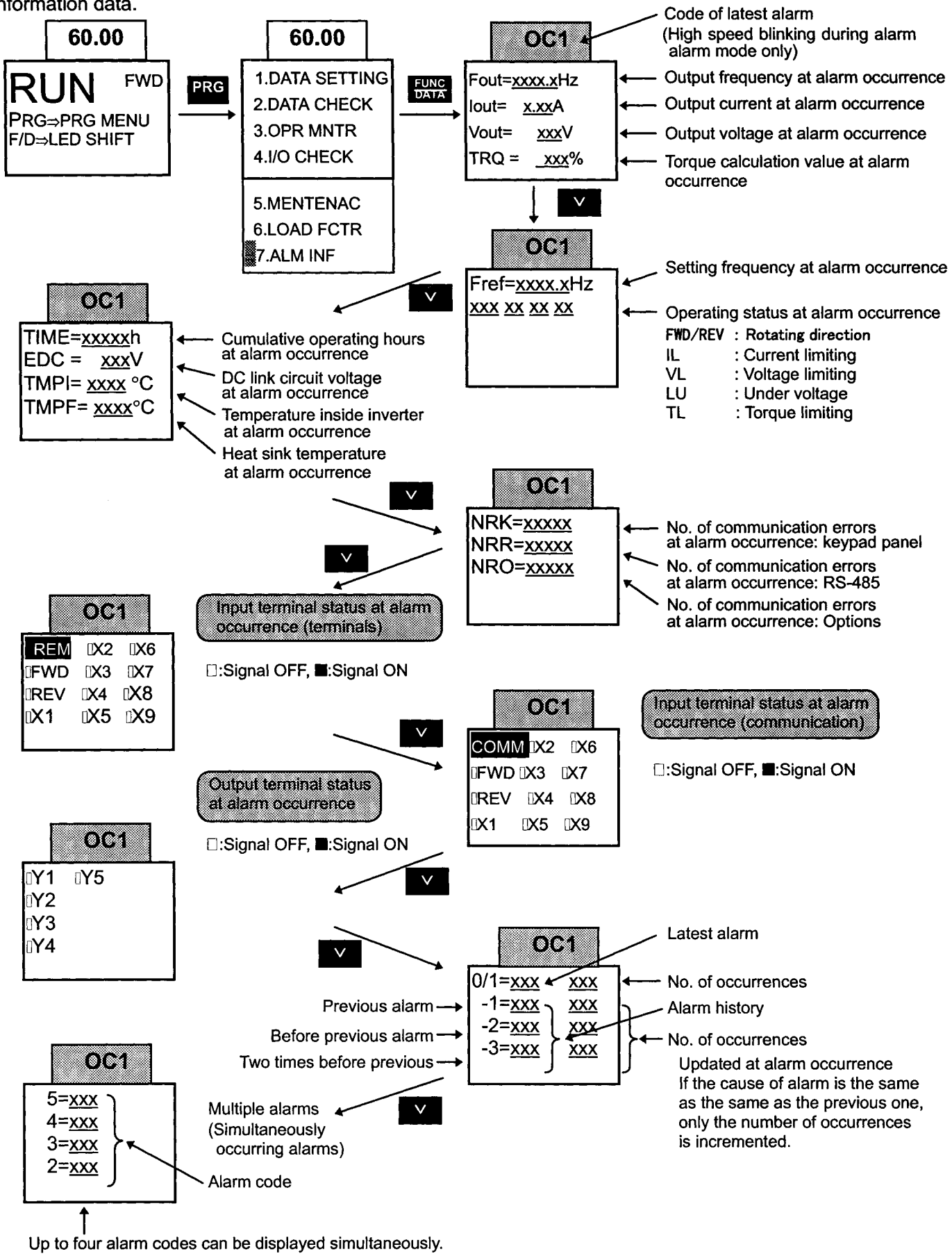
4-3-10 Load rate measurement

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



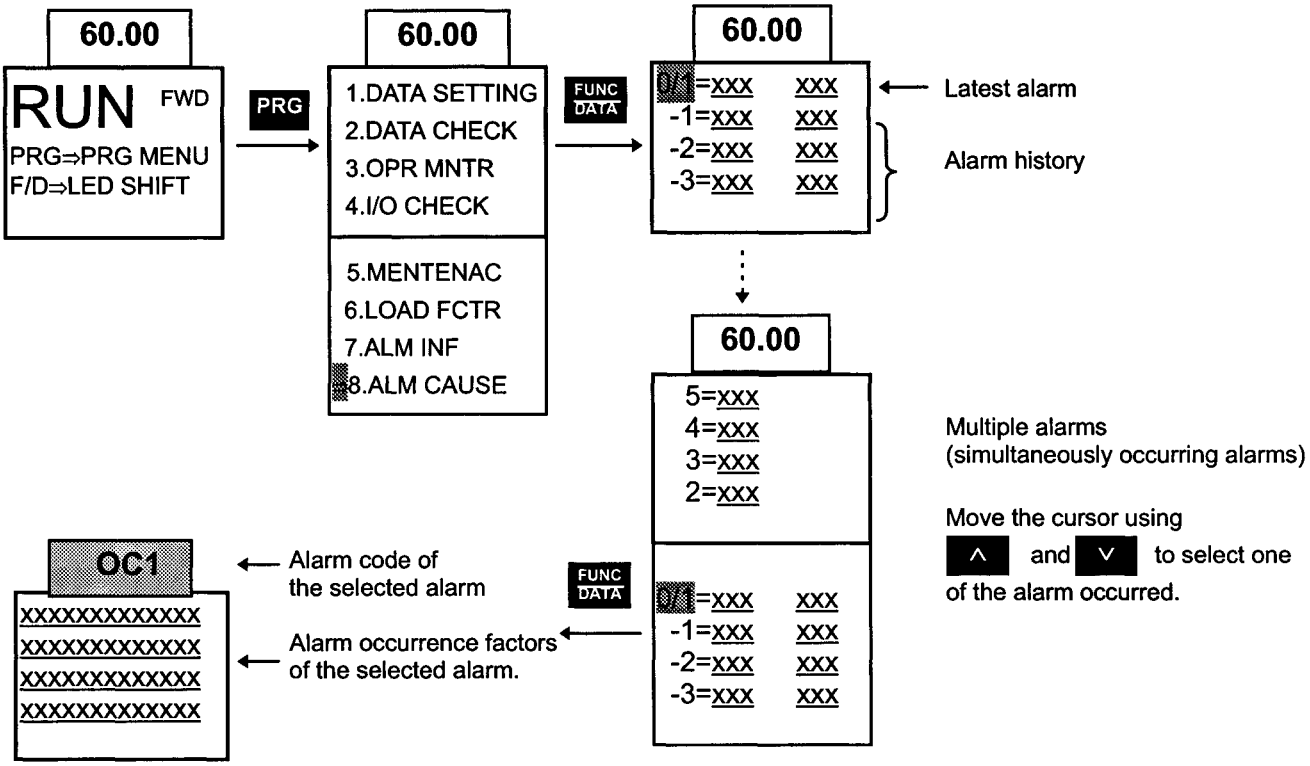
4-3-11 Alarm information

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



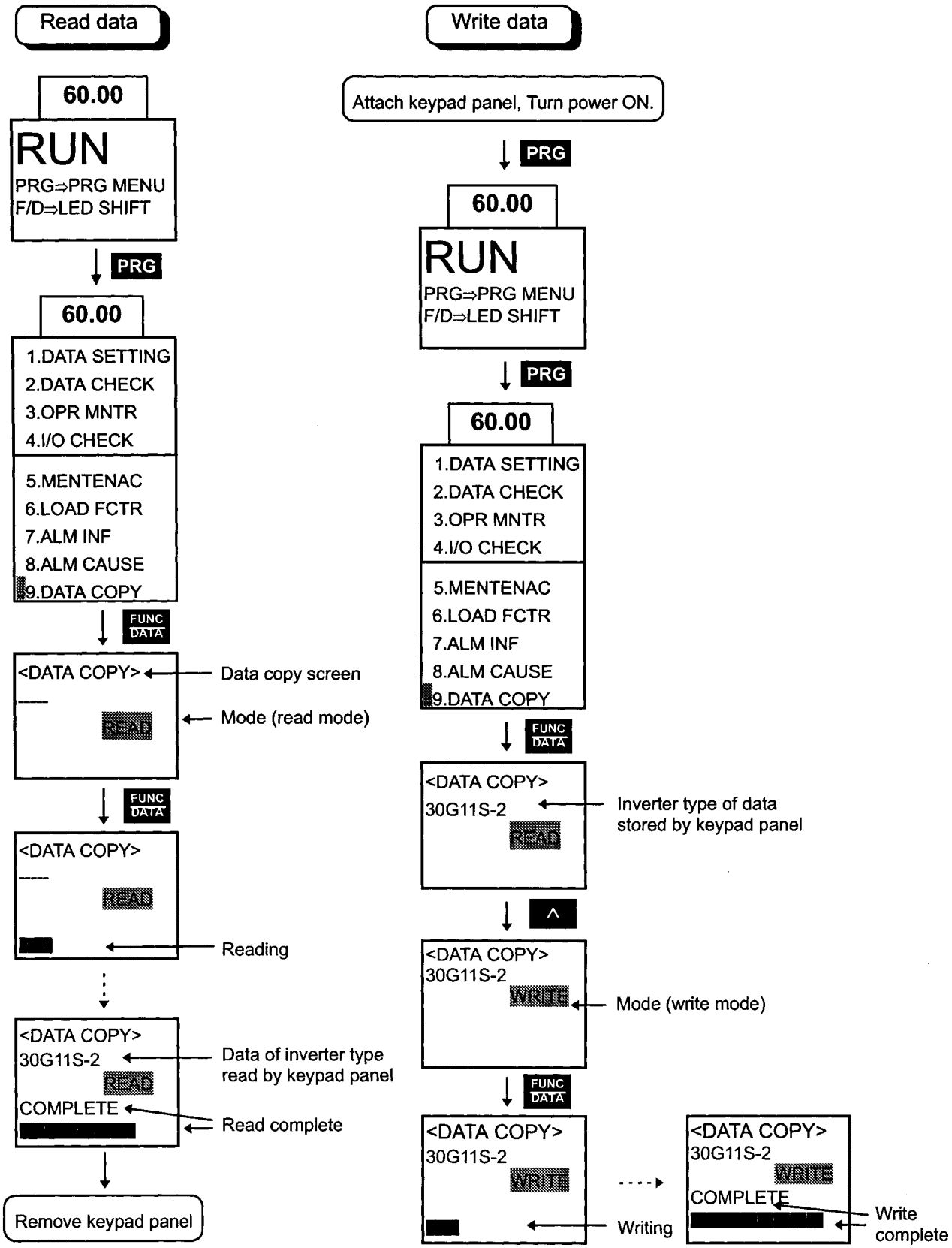
4-3-12 Alarm history and factors

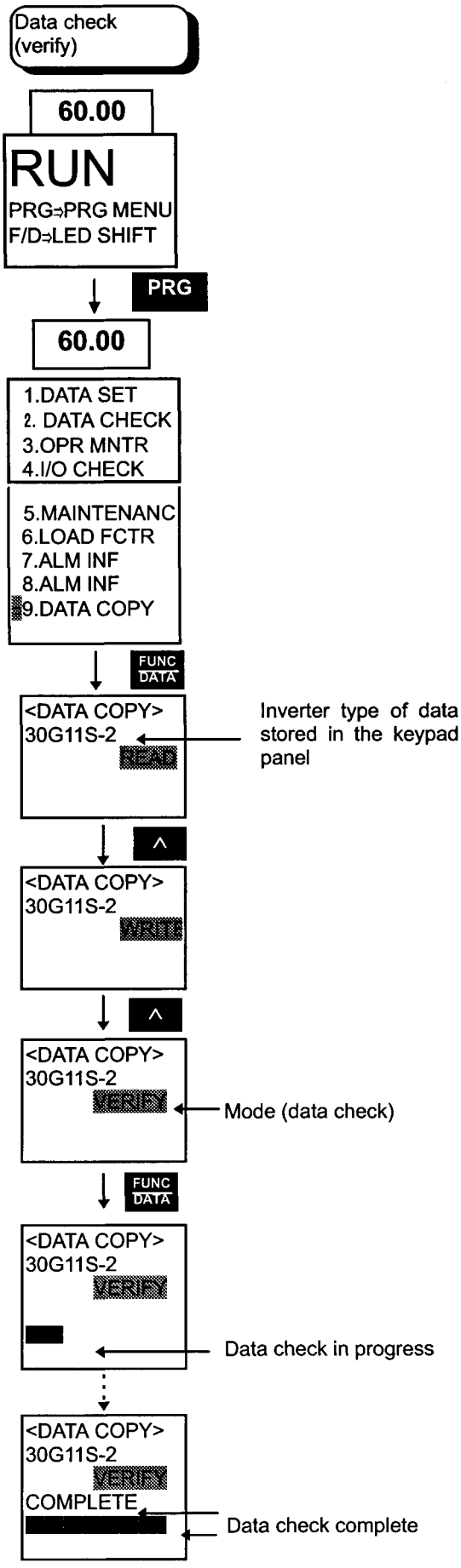
On the "Program menu" screen, select **"8. Alarm Factors"** to display the alarm history.
Press FUNC DATA to display troubleshooting information for the alarm selected.



4-3-12 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.



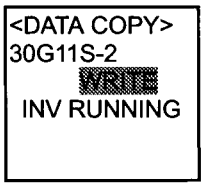


Error processing

1) Change disabled during operation

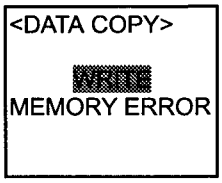
If a write operation is attempted during an inverter operation, or vice versa, the error message below will appear.

After stopping the inverter and pressing RESET , retry the write operation.



2) Memory error

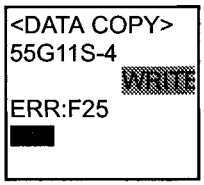
If a write operation is attempted while data has not been saved (i.e., no data) in the keypad panel data memory during the read mode or when the inverter type of data read by keypad panel is different from the inverter type to which data is to be written, the following error message will appear:



3) Verify error

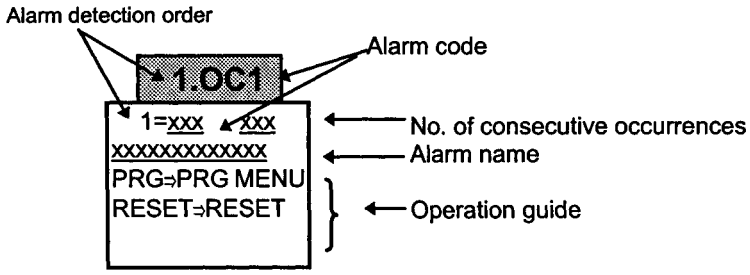
During a data check (verify) operation, if data stored in the keypad panel differs from data stored in the inverter, the following error message is displayed to indicate the function No. The data check is suspended.

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 .



4-3-14 Alarm mode

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



Alarm detection order

Operation method	LED display	LCD display	Description
^ (↑) / v (↓)	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 select
5-1 Function select list
F:Fundamental Functions

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting --22kW	Factory setting 30kW--	Change during op	User Set value	remark
F00	Data protection	F00 DATA PRTC	0, 1	-	-	0		NA		
F01	Frequency command 1	F01 FREQ CMD 1	0 to 11	-	-	0		NA		
F02	Operation method	F02 OPR METHOD	0 ,1	-	-	0		NA		
F03	Maximum frequency 1	F03 MAX Hz-1	G11S: 50 to 400Hz P11S: 50 to 120Hz	Hz	1	60		NA		
F04	Base frequency 1	F04 BASE Hz-1	G11S: 25 to 400Hz P11S: 25 to 120Hz	Hz	1	60		NA		
F05	Rated voltage 1 (at Base frequency 1)	F05 RATED V-1	0V: (Output voltage proportinal to sorce voltage) 80 to 240V: (200V class) 320 to 480V: (400V class)	V	1	220:(200V class) 380:(400V class)		NA		
F06	Maximum voltage 1 (at Maximum frequency 1)	F06 MAX V-1	80 to 240V: (200V class) 320 to 480V: (400V class)	V	1	220:(200V class) 380:(400V class)		NA		
F07	Acceleration time 1	F07 ACC TIME1	0.01 to 3600s	s	0.01	6.0	20.0	A		
F08	Deceleration time 1	F08 DEC TIME1								
F09	Torque boost 1	F09 TRQ BOOST1	0.0, 0.1 to 20.0	-	0.1	G11S:0.0 P11S:0.1		A		
F10	Electronic (Select)	F10 ELCTRN OL1	0, 1, 2	-	-	1		A		
F11	thermal 1 (Level)	F11 OL LEVEL1	INV rated current 20 to 135%	A	0.01	Motor rated current		A		
F12	(Thermal time constant)	F12 TIME CNST1	0.5 to 75.0 min	min	0.1	5.0	10.0	A		
F13	Electronic thermal overload relay (for braking resistor)	F13 DBR OL	G11 [Up to 7.5[kW]] 0, 1, 2 [11[kW]and above] 0 P11 [Up to 11[kW]] 0, 2 [15[kW]and above] 0	-	-	 1 0 0 0		A		
F14	Restart mode after momentary power failure	F14 RESTART	0 to 5	-	-	0		NA		
F15	Frequency (High)	F15 H LIMITER	G11S: 0 to 400Hz P11S: 0 to 120Hz	Hz	1	70		A		
F16	limiter (Low)	F16 L LIMITER				0		A		
F17	Gain (for freq set signal)	F17 FREQ GAIN	0.0 to 200.0%	%	0.1	100.0		A		
F18	Bias frequency	F18 FREQ BIAS	G11S: -400.0 to +400.0Hz P11S: -120.0 to +120.0Hz	Hz	0.1	0.0		A		
F20	DC brake (Starting freq.)	F20 DC BRK Hz	0.0 to 60.0Hz	Hz	0.1	0.0		A		
F21	(Braking level)	F21 DC BRK LVL	G11S: 0 to 100% P11S: 0 to 80%	%	1	0		A		
F22	(Braking time)	F22 DC BRK t	0.0s(Inactive) 0.1 to 30.0s	s	0.1	0.0		A		
F23	Starting frequency(Freq.)	F23 START Hz	0.1 to 60.0Hz	Hz	0.1	0.5		NA		
F24	(Holding time)	F24 HOLDING t	0.0 to 10.0s	s	0.1	0.0		NA		
F25	Stop frequency	F25 STOP Hz	0.1 to 6.0Hz	Hz	0.1	0.2		NA		
F26	Motor sound(Carrier freq.)	F26 MTR SOUND	0.75 to 15kHz	kHz	1	2		A		
F27	(Sound tone)	F27 SOUND TONE	0 to 3	-	-	0		A		
F30	FMA (Voltage adjust)	F30 FMA V-ADJ	0 to 200%	%	1	100		A		
F31	(Function)	F31 FMA FUNC	0 to 11	-	-	0		A		
F33	FMP (Pulse rate)	F33 FMP PULSES	300 to 6000p/s (full scale)	p/s	1	1440		A		
F34	(Voltage adjust)	F34 FMP V-ADJ	0%, 1 to 200%	%	1	0		A		
F35	(Function)	F35 FMP FUNC	0 to 10	-	-	0		A		
F36	30RY operation mode	F36 30RY MODE	0, 1	-	-	0		NA		
F40	Torque limiter1(Driving)	F40 DRV TRQ 1	G11S: 20 to 200% C 999 P11S: 20 to 150% C 999	%	1	999		A		
F41	(braking)	F41 BRK TRQ 1	G11S: 0%, 20 to 200%, 999 P11S: 0%, 20 to 150%, 999			999		A		
F42	Torque vector control 1	F42 TRQVECTOR1	0, 1	-	-	0		NA		

E:Extension Terminal Functions

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting --22kW	Factory setting 30kW--	Change during op	User Set value	remark
E01	X1 terminal function	E01 X1 FUNC	0 to 32			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		
E10	Acceleration time 2	E10 ACC TIME2	0.01 to 3600s	s	0.01	6.00	20.00	A		
E11	Deceleration time 2	E11 DEC TIME2				6.00	20.00	A		
E12	Acceleration time 3	E12 ACC TIME3				6.00	20.00	A		
E13	Deceleration time 3	E13 DEC TIME3				6.00	20.00	A		
E14	Acceleration time 4	E14 ACC TIME4				6.00	20.00	A		
E15	Deceleration time 4	E15 DEC TIME4				6.00	20.00	A		
E16	Torque limiter 2 (Driving	E16 DRV TRQ 2	G11S: 20 to 200%, 999 P11S: 20 to 150%, 999	%	1	999		A		
E17	(braking)	E17 BRK TRQ 2	G11S: 0%, 20 to 200%, 999 P11S: 0%, 20 to 150%, 999	%	1	999		A		
E20	Y1 terminal function	E20 Y1 FUNC	0 to 34			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, Y5C terminal func.	E24 Y5 FUNC				10		NA		
E25	Y5 RY operation mode	E25 Y5RY MODE	0,1	-	1	0		NA		
E30	FAR function(Hysteresis)	E30 FAR HYSTR	0.0 to 10.0Hz	Hz	0.1	2.5		A		
E31	FDT function (Level)	E31 FDT1 LEVEL	G11S: 0 to 400Hz P11S: 0 to 120Hz	Hz	1	60		A		
E32	signal (Hysteresis)	E32 FDT1 HYSTR	0.0 to 30.0Hz	Hz	0.1	1.0		A		
E33	OL1function(Mode select)	E33 OL1 WARNING	0: Thermal calculation 1: Output current	-	-	0		A		
E34	signal (Leve	E34 OL1 LEVEL	G11S: 5 to 200% P11S: 5 to 150%	A	0.01	Motor rated current		A		
E35	(Timer)	E35 OL1 TIMER	0.0 to 60.0s	s	0.1	10.0		A		
E36	FDT2 function (Level)	E36 FDT2 LEVEL	G11S: 0 to 400Hz P11S: 0 to 120Hz	Hz	1	60		A		
E37	OL2 function (Level)	E37 OL2 LEVEL	G11S: 5 to 200% P11S: 5 to 150%	A	0.01	Motor rated current		A		
E40	Display coefficient A	E40 COEF A	-999.00 to 999.00	-	0.01	0.01		A		
E41	Display coefficient B	E41 COEF B	-999.00 to 999.00	-	0.01	0.00		A		
E42	LED Display filter	E42 DISPLAY FL	0.0 to 5.0s	s	0.1	0.5		A		
E43	LED Monitor (Function)	E43 LED MNTR	0 to 12	-	-	0		A		
E44	(Display at STOP mode)	E44 LED MNTR2	0, 1	-	-	0		A		
E45	LCD Monitor(Function)	E45 LCD MNTR	0, 1	-	-	0		A		
E46	(Language)	E46 LANGUAGE	0 to 5	-	-	1		A		
E47	(Contrast)	E47 CONTRAST	0(soft) to 10(hard)	-	-	5		A		

C:Control Functions of Frequency

C01	Jump (Jump freq. 1)	C01 JUMP Hz 1	G11S: 0 to 400Hz	Hz	1	0	A		
C02	frequency (Jump freq. 2)	C02 JUMP Hz 2	P11S: 0 to 120Hz			0	A		
C03	(Jump freq. 3)	C03 JUMP Hz 3				0	A		
C04	(Hysteresis)	C04 JUMP HYSTR	0 to 30Hz	Hz	1	3	A		
C05	Multistep (Freq. 1)	C05 MULTI Hz-1	G11S: 0.00 to 400.00Hz	Hz	0.01	0.00	A		
C06	frequency (Freq. 2)	C06 MULTI Hz-2	P11S: 0.00 to 120.00Hz			0.00	A		
C07	setting (Freq. 3)	C07 MULTI Hz-3				0.00	A		
C08	(Freq. 4)	C08 MULTI Hz-4				0.00	A		
C09	(Freq. 5)	C09 MULTI Hz-5				0.00	A		
C10	(Freq. 6)	C10 MULTI Hz-6				0.00	A		
C11	(Freq. 7)	C11 MULTI Hz-7				0.00	A		
C12	(Freq. 8)	C12 MULTI Hz-8				0.00	A		
C13	(Freq. 9)	C13 MULTI Hz-9				0.00	A		
C14	(Freq. 10)	C14 MULTI Hz-10				0.00	A		
C15	(Freq. 11)	C15 MULTI Hz-11				0.00	A		
C16	(Freq. 12)	C16 MULTI Hz-12				0.00	A		
C17	(Freq. 13)	C17 MULTI Hz-13				0.00	A		
C18	(Freq. 14)	C18 MULTI Hz-14				0.00	A		
C19	(Freq. 15)	C19 MULTI Hz-15				0.00	A		

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting --22kW	Factory setting 30kW--	Change during op	User Set value	remark
C20	JOG frequency	C20 JOG Hz	G11S:0.00 to 400.00Hz P11S:0.00 to 120.00Hz	Hz	0.01	5.00		A		
C21	PATTERN(Mode select) operation	C21 PATTERN	0,1,2	-	-	0		NA		
C22	(Stage 1)	C22 STAGE 1	Operation time:0.00 to 6000s	s	0.01	0.00 F1		A		
C23	(Stage 2)	C23 STAGE 2	F1 to F4 and R1 to R4			0.00 F1		A		
C24	(Stage 3)	C24 STAGE 3				0.00 F1		A		
C25	(Stage 4)	C25 STAGE 4				0.00 F1		A		
C26	(Stage 5)	C26 STAGE 5				0.00 F1		A		
C27	(Stage 6)	C27 STAGE 6				0.00 F1		A		
C28	(Stage 7)	C28 STAGE 7				0.00 F1		A		
C30	Frequency command 2	C30 FREQ CMD 2	0 to 11	-	-	2		NA		
C31	Bias (terminal[12])	C31 OFFSET 12	-5.0 to +5.0%	%	0.1	0.0		A		
C32	Gain (terminal [C1])	C32 OFFSET C1	-5.0 to +5.0%	%	0.1	0.0		A		
C33	Analog setting signal filter	C33 REF FILTER	0.00 to 5.00s	s	0.01	0.05		A		

P:Motor Parameters

P01	Number of motor 1 poles	P01 M1 POLES	2 to 14	-	2	4		NA		
P02	Motor 1 (Capacity)	P02 M1-CAP	Up to 22[kW]: 0.01 to 45kW 30[kW]and above: 0.01 to 500kW	kW	0.01	Motor Capacity		NA		
P03	(Rated current)	P03 M1-Ir	0.00 to 2000A	A	0.01	Motor rated current		NA		
P04	(Tuning)	P04 M1 TUN1	0, 1, 2	-	-	0		NA		
P05	(On-line Tuning)	P05 M1 TUN2	0, 1	-	-	0		NA		
P06	(No-load current)	P06 M1-Io	0.00 to 2000A	A	0.01	Fuji STANDARD RATED VALUE		NA		
P07	(%R1 setting)	P07 M1-%R1	0.00 to 50.00%	%	0.01	Fuji STANDARD RATED VALUE		A		
P08	(%X setting)	P08 M1-%X	0.00 to 50.00%	%	0.01	Fuji STANDARD RATED VALUE		A		
P09	Slip compensation control1	P09 SLIP COMP1	0.00 to 15.00Hz	Hz	0.01	0.00		A		

H:High Performance Functions

H03	Data initializing	H03 DATA INIT	0, 1	-	-	0		NA		
H04	Auto-reset (Times)	H04 AUTO-RESET	0, 1 to 10 times	-	1	0		A		
H05	(Reset interval)	H05 RESET INT	2 to 20s	s	1	5		A		
H06	Fan stop operation	H06 FAN STOP	0, 1	-	-	0		A		
H07	ACC/DEC pattern(Mode select)	H07 ACC PTN	0,1,2,3	-	-	0		NA		
H08	Rev. phase sequence lock	H08 REV LOCK	0, 1	-	-	0		NA		
H09	Start mode	H09 START MODE	0, 1, 2	-	--	0		NA		
H10	Energy-saving operation	H10 ENERGY SAV	0, 1	-	-	G11S:0 P11S:1		A		
H11	DEC mode	H11 DEC MODE	0, 1	-	-	0		A		
H12	Instantaneous OC limiting	H12 INST CL	0, 1	-	-	1		NA		
H13	Auto-restart (Restart time)	H13 RESTART t	0.1 to 10.0s	s	0.1	0.5		NA		
H14	(Freq. fall rate)	H14 FALL RATE	0.00 to 100.00Hz/s	Hz/s	0.01	10.00		A		
H15	(Holding DC voltage)	H15 HOLD V	3ph 200V class: 200 to 300V 3ph 400V class: 400 to 600V	V	1	200V class:235V 400V class:470V		A		
H16	(OPR command selfhold time)	H16 SELFHOLD t	0.0 to 30.0s, 999	s	0.1	999		NA		
H18	Torque control	H18 TRQ CTRL	G11:0, 1, 2 , P11:0	-	-	0		NA		
H19	Active drive	H19 AUT RED	0, 1	-	-	0		A		
H20	PID control (Mode select)	H20 PID MODE	0, 1, 2	--	-	0		NA		
H21	(Feedback signal)	H21 FB SIGNAL	0, 1, 2, 3	-	-	1		NA		
H22	(P-gain)	H22 P-GAIN	0.01 to 10.00 times	-	0.01	0.1		A		
H23	(I-gain)	H23 I-GAIN	0.0 , 0.1 to 3600s	s	0.1	0.0		A		
H24	(D-gain)	H24 D-GAIN	0.00s , 0.01 to 10.0s	s	0.01	0.00		A		
H25	(Feedback filter)	H25 FB FILTER	0.0 to 60.0s	s	0.1	0.5		A		
H26	PTC thermistor(Mode select)	H26 PTC MODE	0, 1			0		A		
H27	(level)	H27 PTC LEVEL	0.00 to 5.00V	V	0.01	1.60		A		
H28	Droop operation	H28 DROOP	G11:-9.9 to 0.0Hz, P11:0.0(Fixed.)	Hz	0.1	0.0		A		
H30	Serial link(Function select)	H30 LINK FUNC	0, 1, 2, 3	-	-	0		A		
H31	RS485 (Address)	H31 ADDRESS	1 to 31	-	1	1		NA		
H32	(Mode select on no response error)	H32 MODE ON ER	0, 1, 2, 3	-	-	0		A		
H33	(Timer)	H33 TIMER	0.0 to 60.0s	s	0.1	2.0		A		
H34	(Baud rate)	H34 BAUD RATE	0, 1, 2, 3,4	-	-	1		A		
H35	(Data length)	H35 LENGTH	0,1	-	-	0		A		
H36	(Parity check)	H36 PARITY	0, 1, 2	-	-	0		A		
H37	(Stop bits)	H37 STOP BITS	0(2bit), 1(1bit)	-	-	0		A		
H38	iNo response error detection time j	H38 NO RES t	0(No detection), 1 to 60s	s	1	0		A		
H39	(Response interval)	H39 INTERVAL	0.00 to 1.00s	s	0.01	0.01		A		

A: Alternative Motor Parameters

Func No.	NAME	LCD Display	Setting range	Unit	Min. Unit	Factory setting --22kW	Factory setting 30kW--	Change during op	User Set value	remark
A01	Maximum frequency 2	A01 MAX Hz-2	G11S: 50 to 400Hz P11S: 50 to 120Hz	Hz	1	60		NA		
A02	Base frequency 2	A02 BASE Hz-2	G11S: 25 to 400Hz P11S: 25 to 120Hz	Hz	1	60		NA		
A03	Rated voltage 2 (at Base frequency 2)	A03 RATED V-2	0: 80 to 240V:(200V class) 320 to 480V:(400V class)	V	1	220:(200V class) 380:(400V class)		NA		
A04	Maximum voltage 2 (at Base frequency 2)	A04 MAX V-2	80 to 240V:(200V class) 320 to 480V:400V (class)	V	1	220:(200V class) 380:(400V class)		NA		
A05	Torque boost2	A05 TRQ BOOST2	0.0, 0.1 to 20.0	-	-	G11S:0.0 P11S:0.1		A		
A06	Electronic thermal overload relay for motor 2 (Select)	A06 ELCTRN OL2	0, 1, 2	-	-	1		A		
A07	(Level)	A07 OL LEVEL2	INV rated current 20%to135%	A	0.01	Motor rated current		A		
A08	(Thermal time constant)	A08 TIME CNST2	0.5 to 75.0 min	min	0.1	5.0	10.0	A		
A09	Torque vector control 2	A09 TRQVECTOR2	0, 1	-	-	0		NA		
A10	Number of motor-2 poles	A10 M2 POLES	2 to 14 poles	ploe	2	4		NA		
A11	Motor 2 (Capacity)	A11 M2-CAP	Up to 22kW:0.01 to 45kW 30kW and above:0.01to500kW	kW	0.01	Motor capacity		NA		
A12	(Rated current)	A12 M2-Ir	0.00 to 2000A	A	0.01	Motor rated current		NA		
A13	(Tuning)	A13 M2 TUN1	0, 1, 2	-	-	0		NA		
A14	(On-line Tuning)	A14 M2 TUN2	0, 1	-	-	0		NA		
A15	(No-load current)	A15 M2-Io	0.00 to 2000A	A	0.01	Fuji standard rated value		NA		
A16	(%R1 setting)	A16 M2-%R1	0.00 to 50.00%	%	0.01	Fuji standard rated value		A		
A17	(%X setting)	A17 M2-%X	0.00 to 50.00%	%	0.01	Fuji standard rated value		A		
A18	(Slip compensation control 2)	A18 SLIP COMP2	0.00 to 15.00Hz	Hz	0.01	0.00		A		

5-2 Function Explanation

F:Fundamental function

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 command 1

◆This function selects the frequency setting method.

Related functions
E01 to E09
(Set values 17,18)
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 +10V) + terminal [V2](0 to +10V))
2. Setting by current input (terminal [C1] (4 to 20mA)).
3. Setting by voltage input + current input (terminal [12] + terminal [C1]) (-10 to +10V + 4 to 20mA).
4. Reversible operation with polarity (terminal [12] (-10 to +10V)
5. Reversible operation with polarity (terminal [12] +[V2]+[V1](Option) (-10 to +10V))
6. Inverse mode operation (terminal [12] +[V2] (+10V to 0))
7. Inverse mode operation (terminal [C1] (20 to 4mA)

Related functions:
E01 to E09
(Set value 21)

8. Setting by UP/DOWN control mode 1 (initial value = 0) (terminals [UP] and [DOWN])
9. Setting by UP/DOWN control mode 2 (initial value =last final value) (terminals [UP] and [DOWN])

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

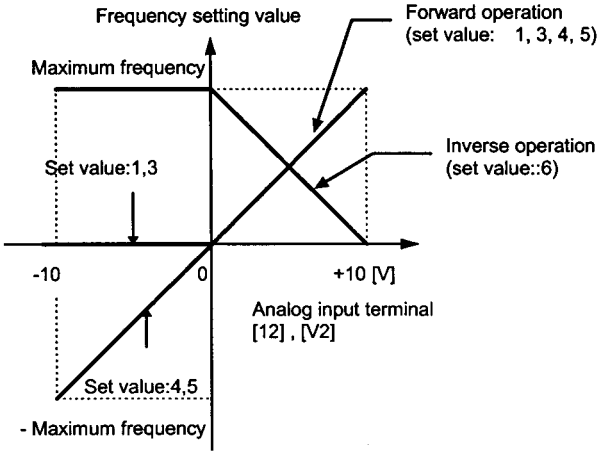
See the function explanation of E01 to E09 for details.

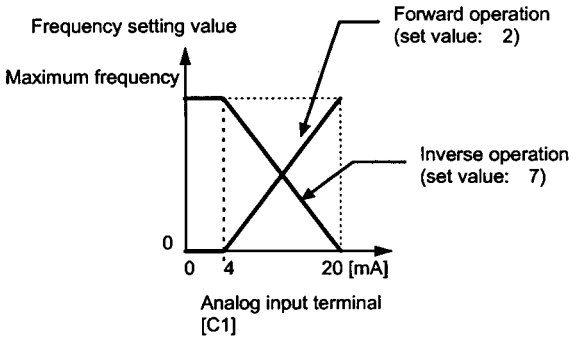
10. Setting by pattern operation
See the function explanation C21 to C28 for details.

Related functions:
C21to C28

11. Setting by digital input or pulse train
* input. Optional. For details, see the instruction manual on options.

Forward / Inverse operation





F02 Operation method

◆This function sets the operation command input method.

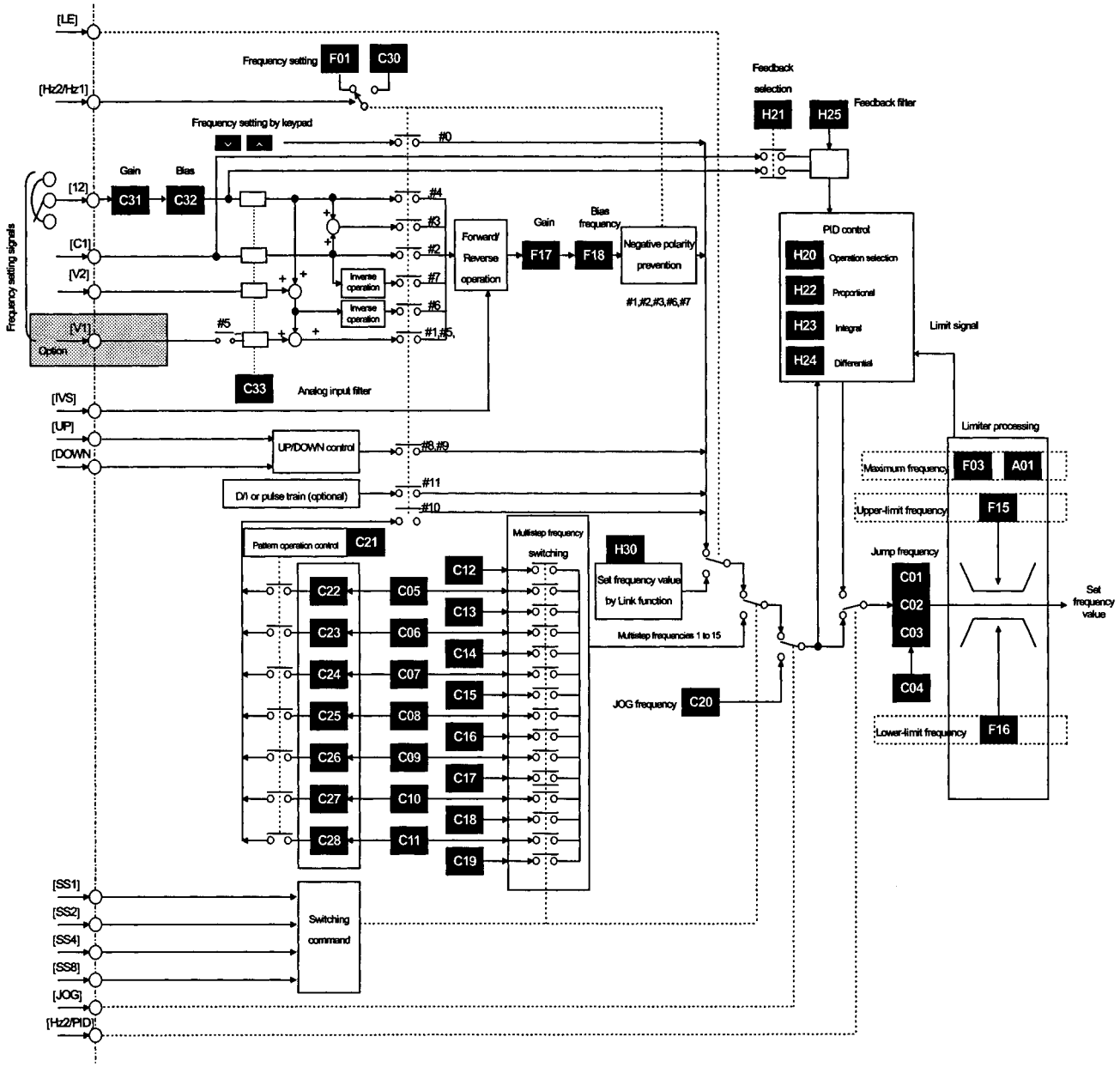
F	0	2	O	P	R		M	E	T	H	O	D

Set value 0: Key pad 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.



Frequency setting block diagram

F03 Maximum frequency 1

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

F	0	3	M	A	X		H	z	-	1		

Setting range G11S: 50 to400 Hz
P11S: 50 to 120Hz

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

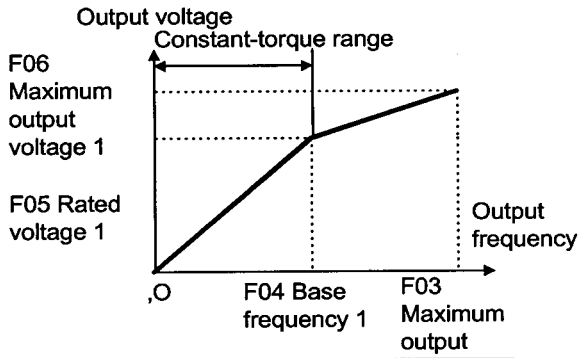
◆This function sets the maximum output frequency in the

F	0	4	B	A	S	E		H	z	-	1	

constant-torque range of motor 1 or the output frequency at the rated output voltage. Match the rating of the motor.

Setting range G11S: 25 to 400Hz
P11S: 25 to 120Hz

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

F	0	5	R	A	T	E	D		V	-	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.

Setting range 200V AC series: 0, 80 to 240V
400 V series: 0, 320 to 480V

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 voltage 1

◆This function sets the maximum value of the voltage

F	0	6	M	A	X		V	-	1			

output for motor 1. Note that a voltage higher than the supply (input) voltage cannot be output.

Setting range 200V AC series: 80 to 240V
400 V series: 320 to 480V

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	

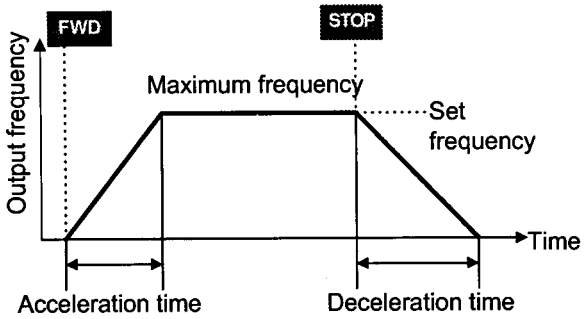
Setting range Acceleration time 1: 0.01 to 3,600 seconds
Deceleration time 1: 0.01 to 3,600 seconds

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

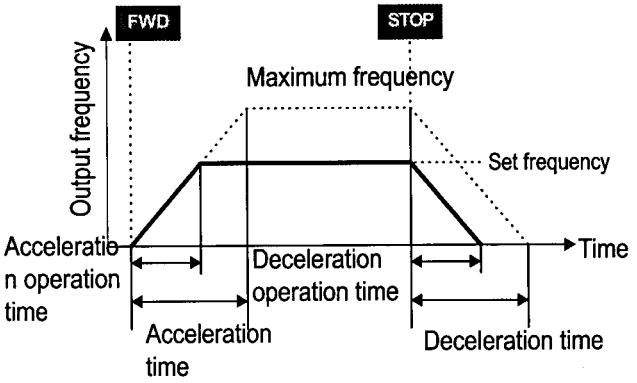
The actual operation time matches the set value.



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:

F09 TRQ BOOST1

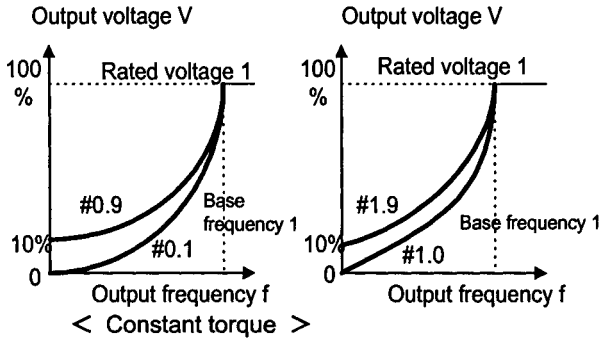
– Selection of load characteristics such as automatic torque boost, square law reduction torque load, proportional torque load, constant torque load.

– 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)

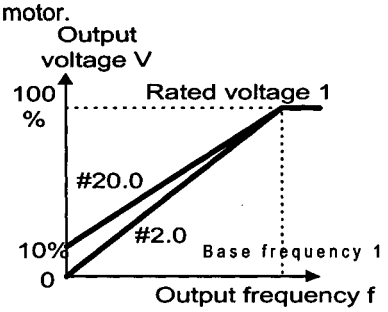
◆Torque characteristics

<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 Electric thermal O/L relay for motor1(selection)

F11 Electric thermal O/L relay for motor1 (level)

F12 Electric thermal O/L relay for motor1 (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.

Set value 0: Inactive

F10 ELCTRN OL1

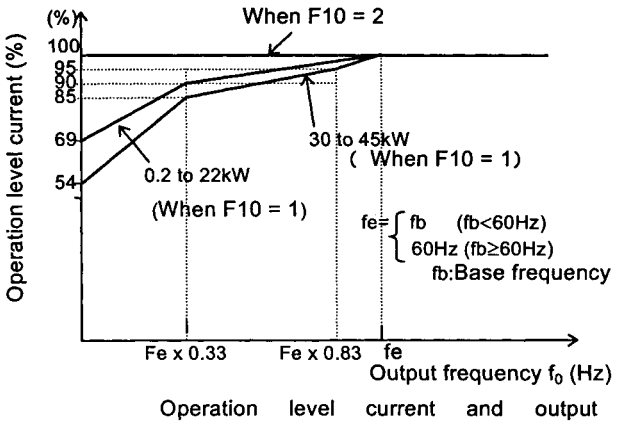
1: Active (for general-purpose motor)

2: Active (for inverter motor)

◆This function sets the operation level (current value) of the electronic thermal. Enter a value from 1 to 1.1 times the current rating value of the motor.

F11 OL LEVEL1

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

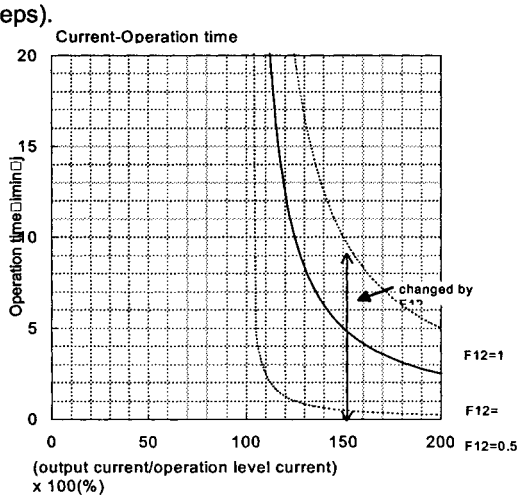


Operation level current and output

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

F12 TIME CNST1

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



F13 Electric thermal O/L relay (for breaking resistor)

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

F13 DBR OL

Inverter capacity	Operation
G11S: 7.5kW or less	0: Inactive 1: Active (built-in braking resistor) 2: Active (external braking resistor)
P11S: 11kW or less	0: Inactive 1: Inactive 2: Active (external braking resistor)
G11S: 11kW or more P11S: 15kW or more	0: Inactive

F14 Restart modeafter momentary power failure (operation selection)

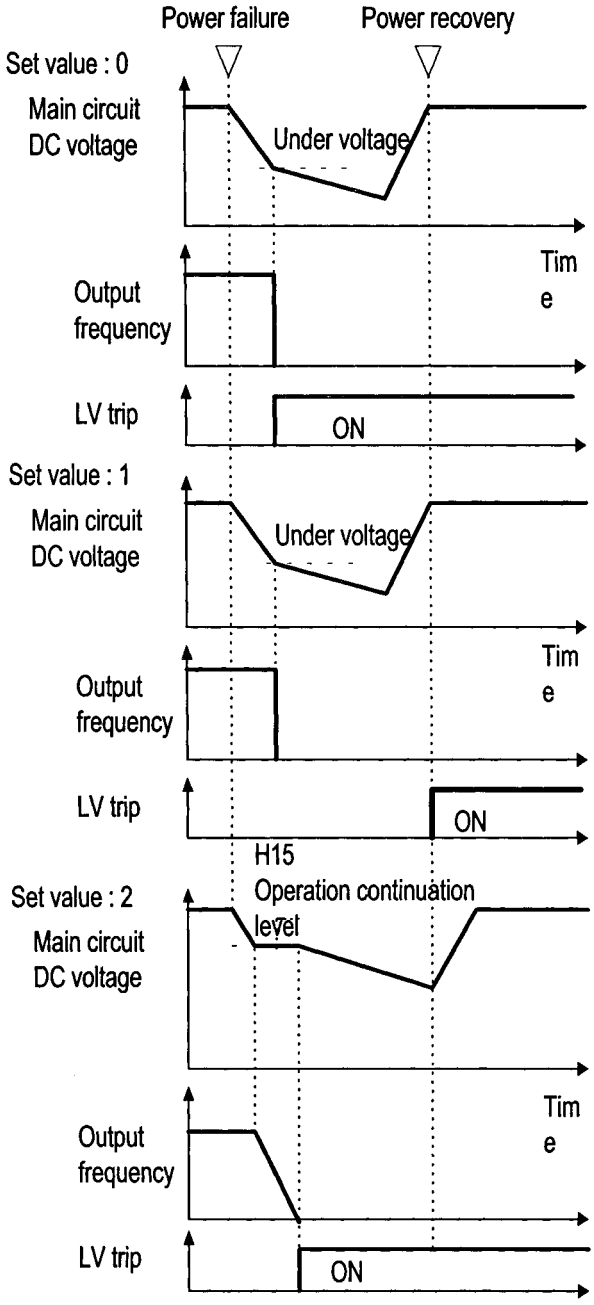
◆This function selects operation if momentary power failure occurs.
The function for detecting power failure and activating protective operation (i.e., alarm output, alarm display, inverter output cutoff) for undervoltage can be selected. The automatic restart function (for automatically restarting a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

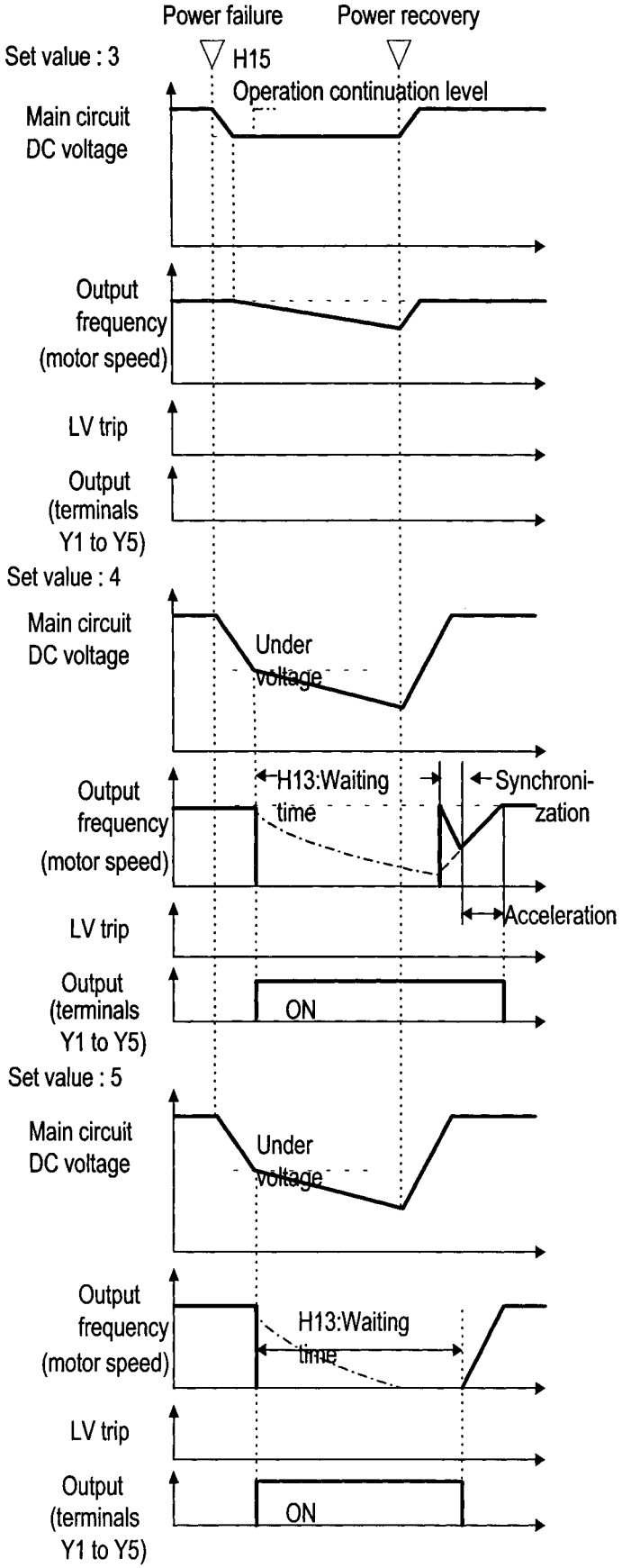
F 1 4 R E S T A R T

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 (intermediate inverter trip)	If undervoltage is detected, the protective function is activated and output stops.	Inverter is not restarted.	Inputting the protective function reset command and operation command restarts operation.
1	Inactive (inverter trip at recovery)	If undervoltage is detected, the protective function is not activated, but output stops.	The protective function is activated, but operation is not restarted.	
2	Inactive (inverter trip after deceleration to a stop at power failure)	When the operation continuation level (H15) is reached, deceleration to a stop occurs. The DC voltage of the main circuit sharpens the deceleration slope so that the undervoltage protective function is not activated. The inverter collects the inertia energy of the load and control the motor until it stops, then the undervoltage protective function is activated. If the amount of inertia energy from the load is small, and the undervoltage level is achieved during deceleration, the undervoltage protective function is then activated.	The protective function is activated, and operation is not restarted	
3	Active (operation continued, for high-inertia loads)	When the operation continuation level is achieved, energy is collected from the inertia amount of the load to extend the operation continuation time. If undervoltage is detected, the protective function is not activated, but output stops.	Operation is automatically restarted. For power recovery during operation continuation, rotation accelerates directly to the original frequency. If undervoltage is detected, operation automatically restarts with the frequency at that time.	
4	Active (restart with the frequency at power failure)	If undervoltage is detected, the protective function is not activated, but output stops.	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 120 Hz. If the detected speed is outside this range, restart the motor using the regular restart function.





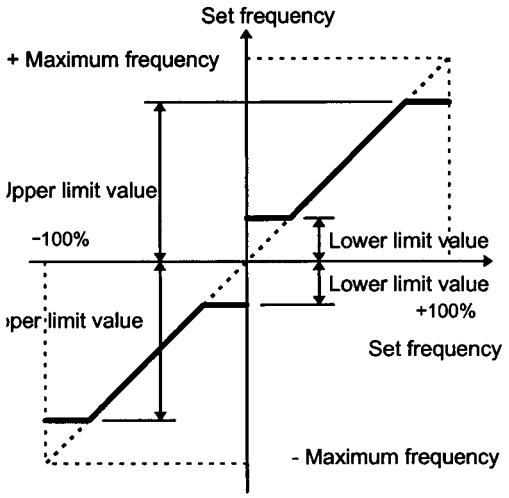
Note : Dotted-dashed lines indicate motor speed.

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 400Hz (P11S: 0 to 120Hz)



※ The inverter output starts with the start frequency when operation begins, and stops with the stop frequency when operation ends.

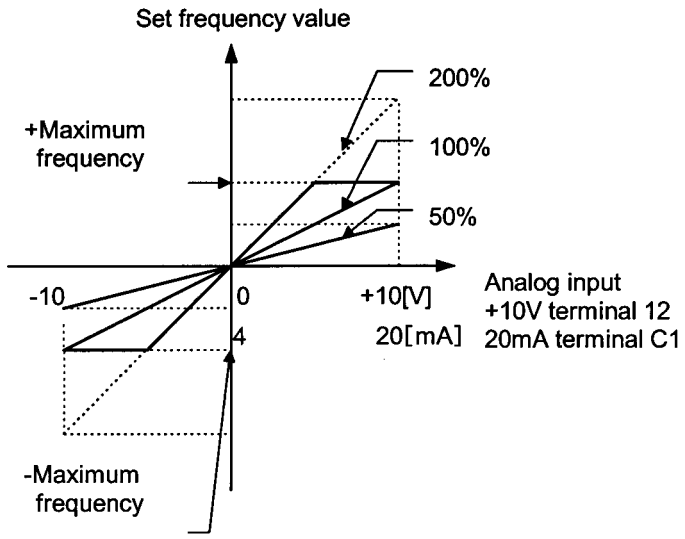
※ If the upper limit value is less than the lower limit value, the upper limit value overrides the lower limit value.

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.



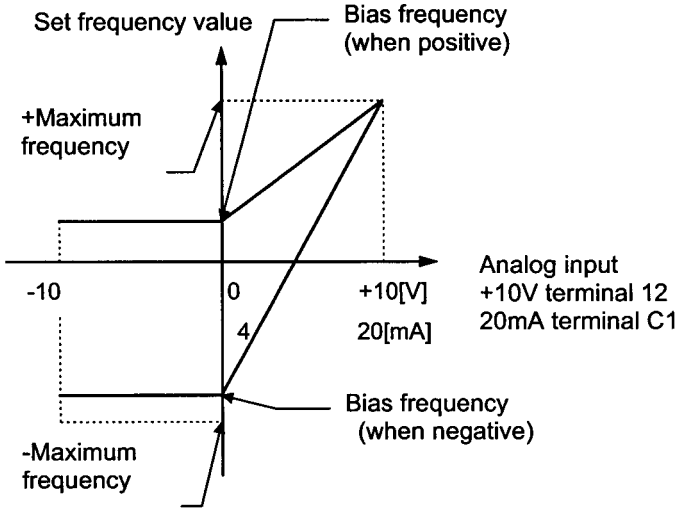
F18 Bias frequency

◆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.



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 60Hz

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% (P11S: 0 to 80%)

◆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.

F23 Starting frequency (frequency)
F24 Start 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.

F23 START Hz

Set values: 0.1 to 60Hz

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

F24 HOLDING t

Set values: 0.1 to 10.0 seconds

*The holding time does not apply at the time of switching between forward and reverse.

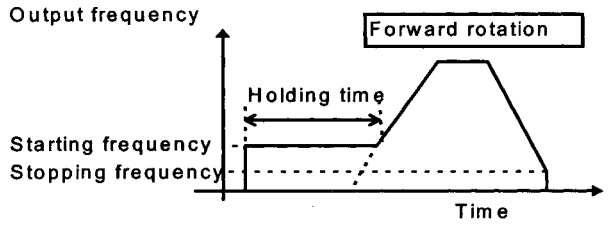
*The holding time is not included in the acceleration time.

*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.

F25 STOP Hz

Set values: 0.0 to 6.0Hz



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

F26 MTR SOUND

Series	Nominal applied motor	Setting range
G11S	55kW or less	0.75 to 15kHz
	75kW or more	0.75 to 10kHz
P11S	22kW or less	0.75 to 15kHz
	30~75kW	0.75 to 10kHz
	90kW or more	0.75 to 6kHz

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 0.75kHz, reduce the motor torque by about15%.
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 7kHz or lower. Use this function as required.

F27 MTR TONE

Set values: 0 , 1, 2 , 3

F30 FMA (voltage adjustment)
F31 FMA (function)

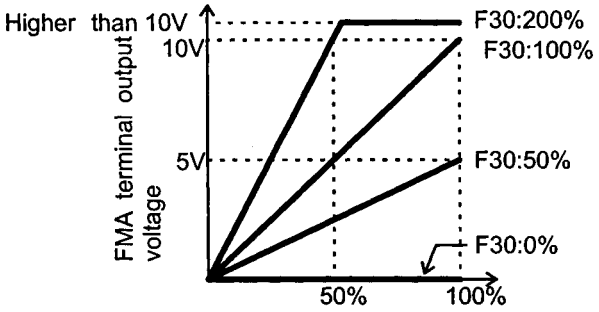
Monitor data (e.g.,output frequency, output current) can be output to terminal FMA as a DC voltage. The amplitude of the output can also be adjusted.

◆This function adjusts the voltage value of the monitor item

F30 FMA -ADJ

selected in F31 when the monitor amount is 100%. A value from 0 to 200 (%) can be set in 1% steps.

Set values: 0 to 200%



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

F31 FMA FUNC

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	200V series: 250V 400V series: 500V
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	200V series: 500V 400V series: 1,000V
10	Universal AO	0 to 10V output through communication and not related to inverter operation.

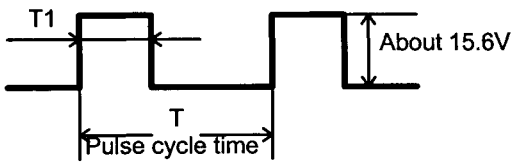
F33 FMP (pulse rate)
F34 FMP (voltage adjustment)
F35 FMP (function)

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.

F33	FMP PULSES

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.

Set value

F34	FMP -ADJ

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 ① 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.

F35	FMP FUNC

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

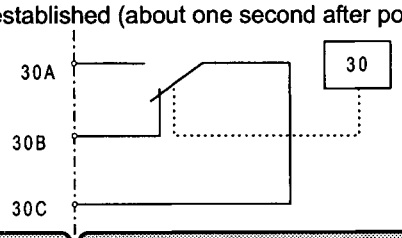
F36 30Ry operation mode

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

F36	30RY MODE

Set value	Operation
0	At normal 30A - 30C: OFF, 30B - 30C: ON At abnormal 30A - 30C: ON, 30B - 30C:OFF
1	At normal 30A - 30C:ON, 30B - 30C: OFF At abnormal 30A - 30C: OFF, 30B - 30C: ON

◆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 limit 1 (driving)
F41 Torque limit 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.

F40	DRV TRQ1
F41	BRK TRQ1

Function	Set value	Operation
Torque limit (driving)	G11S:20% to 200% P11S:20% to 150%	The torque is limited to the set value.
	999	Torque limiting inactive
Torque limit (braking)	G11S:20% to 200% P11S:20% to 150%	The torque is limited to the set value.
	0	Prevents OU trip due to power regeneration effect automatically.
	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 the FUJI 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.
②The function data (rated current P03, no-load current P06, %R1 P07, and %X P08) of motor 1 must be correct.
When the standard FUJI 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.
③The 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).
④To prevent leakage current and ensure accurate control, the length of the cable between the inverter and motor should not exceed 50 m.
⑤When 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).

E01 X1 Terminal function
E09 X9 Terminal function

◆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	Self-hold selection [HLD]
7	Coast-to-stop command [BX]
8	Alarm reset [RST]
9	External alarm [THR]
10	Jogging [JOG]
11	Frequency setting 2/frequency setting 1 [Hz2/Hz1]
12	Motor 2/motor 1 [M2/M1]
13	DC injection brake command [DCBRK]
14	Torque limit 2/torque limit 1 [TL2/TL1]
15	Switching operation from line to inverter (50Hz) [SW50]
16	Switching operation from line to inverter (60Hz) [SW60]
17	UP command [UP]
18	DOWN command [DOWN]
19	Edit permission command (data change permission) [WE-KP]
20	PID control cancellation [Hz/PID]
21	Forward/inverse switching (terminals 12 and C1) [IVS]
22	Interlock (52-2) [IL]
23	Torque control cancellation [Hz/TRQ]
24	Link operation selection (Standard:RS485, Option: BUS) [LE]
25	Universal DI [U-DI]
26	Start characteristics selection [STM]
27	PG-SY enable (Option) [PG/Hz]
28	Synchronization command (Option) [SYC]
29	Zero speed command with PG option [ZERO]
30	Forced stop command [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 function C05 to C19 Setting range G11S:0.00 to 400.00Hz P11S:0.00 to 120.00Hz
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	

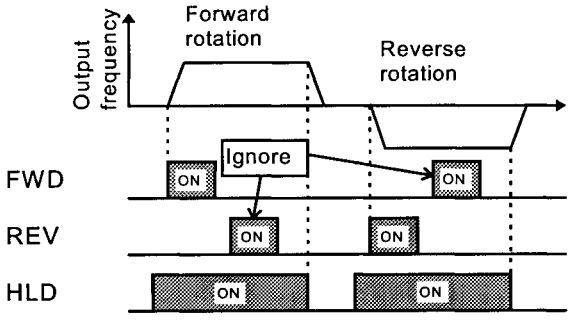
Acceleration and deceleration time selection

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 function F07~F08 E10~E15 Setting range 0.01 to 3600s
off	on	E10 ACC TIME2 E11 DEC TIME2	
on	off	E12 ACC TIME3 E13 DEC TIME3	
on	on	E14 ACC TIME4 E15 DEC TIME4	

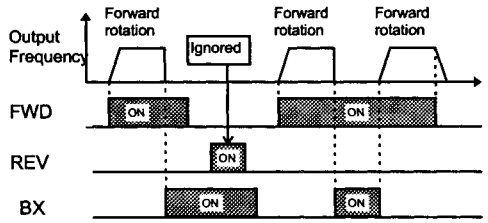
Self-hold selection [HLD]

This selection is used for 3-wire operation. The FWD or REV signal is self-held when HLD-CM is on, and the self-hold is cleared when HLD-CM 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 CM 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 CM 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 CM clears the alarm output (for any fault) ; disconnecting them clears trip indication and restarts operation. To use this RST terminal function, assign value "8" to the target digital input terminal.

External fault [THR]

Disconnecting THR and CM during operation cuts off inverter output (i.e., motor starts to coast-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 this terminal function is not set.

Jogging operation [JOG]

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

Frequency setting 2/frequency setting 1

This function switches the frequency setting method set in function codes F01 and C30 by an external digital input signal.

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

Motor 2/motor 1

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 function A01~A18

DC brake command

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

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 function F40~F41 E16~E17
on	E16 DRV TRQ2 E17 BRK TRQ2	Setting range DRV 20 to 200% ,999 BRK 0, 20 to 200% ,999

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

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

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

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

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

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

◆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)	0Hz	Operates at the frequency at reentry. Frequency FWD ON (REV) OFF
9 (UP/DOWN2)	Previous frequency	Returns to the frequency before deceleration Frequency FWD ON (REV) OFF

Write enable for KEYPAD [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.

19	Function selected
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 20	Function selected	Related function H20~H25
off	Enable PID control.	
on	Disable PID control (frequency setting from keypad panel).	

Inverse mode changeover[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 21	Function selected	Related function F01
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 22	Function
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 23	Function selected (Related function H18)
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).

Link enable (RS485 standard, BUS)[LE]

Frequency and operation commands from the 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 24	Function selected (Related function H30)
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.,

Pick up 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 26	Function selected (Related function H09)
off	Start characteristic function disabled
on	Start characteristic function enabled

PG-SY enable (Option) [PG/Hz]

Synchronization command (Option) [SYC]

Zero speed command with PG option [ZERO]

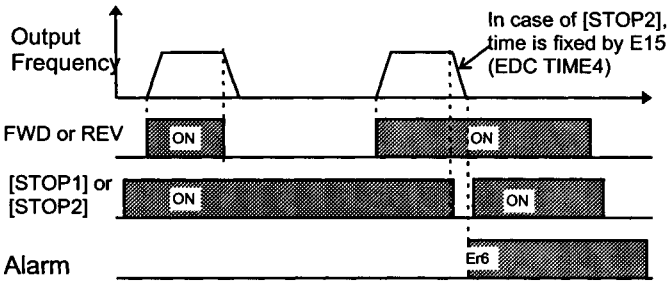
Pre-exiting command with PG option [EXITE]

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 selection (RT1)
Terminal X6	5	Acceleration and deceleration selection (RT2)
Terminal X7	6	Self-hold selection (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

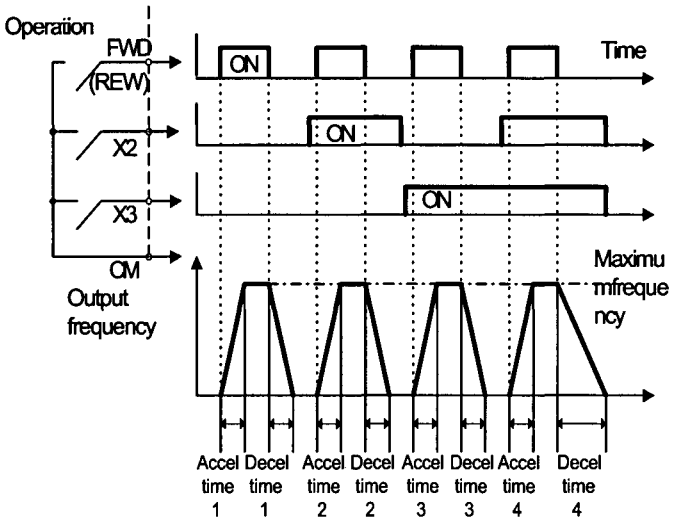
◆Acceleration time 1 (F07) and deceleration time 1 (F08) as well as three other types of acceleration and deceleration time can be selected.

◆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.

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

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



E16	Torque limit 2 (drive)
E17	Torque limit 2 (brake)

◆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 values:14)

E20	Y1 Terminal function
E24	Y5A and Y5C Terminals function

◆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 early warning [OL1]
8	KEYPAD operation mode [KP]
9	Inverter stopping [STP]
10	Ready output [RDY]
11	Line/Inverter changeover (for 88) [SW88]
12	Line/Inverter changeover (for 52-2) [SW52-2]
13	Line/Inverter changeover (for 52-1) [SW52-1]
14	Motor1/Motor 2 [SWM2]
15	Terminal AX function [AX]
16	Time-up signal for Pattern operation [TU]
17	Cycle completion signal for Pattern operation [TO]
18	Pattern operation stage No. indication1 [STG1]
19	Pattern operation stage No. indication 2 [STG2]
20	Pattern operation stage No. indication 4 [STG4]
21	Alarm indication1 [AL1]
22	Alarm indication2 [[AL2]
23	Alarm indication4 [AL4]
24	Alarm indication8 [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 level 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 RTU communication and 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
200V series: 200V , 400V series: 400V

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-restaring [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 0Hz 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 stopping [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 /Inverter 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 FRENIC5000G11S/P11S 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.

Motor1/Motor 2 [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 (100ms) 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. 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]

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 operating signal [FAN]

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

Auto-restting [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℃) 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 detection [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 2mA.

Settings when shipped from the factory

Digital input	Setting at factory shipment	
	Set value	Description
Terminal Y1	**0**	Operating (RUN)
Terminal Y2	**1**	Frequency arrival (FAR)
Terminal Y3	**2**	Frequency 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: OFF At "ON signal mode" Y5A - Y5C: ON
1	At "OFF signal mode" Y5A - Y5C: ON At "ON signal mode" Y5A - Y5C: OFF

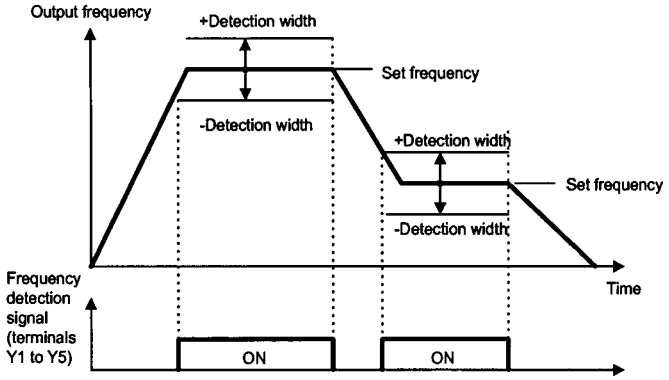
◆When the set value is 1, contacts Y5A and Y5C are connected when the inverter control voltage is established (about one second after power on).

E30 Frequency arrival (detection width)

◆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]

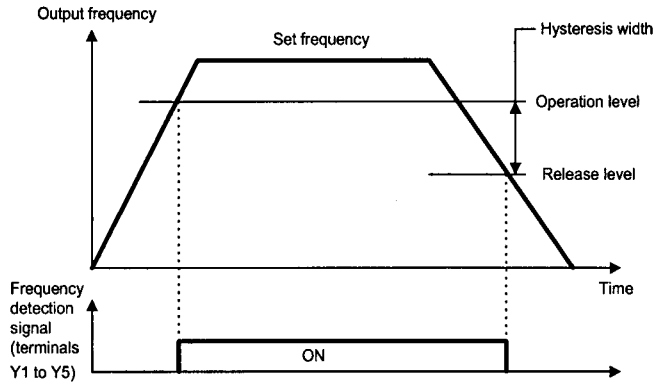


E31 Frequency detection1 (operation level)
E32 Frequency detection (hysteresis width)

◆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) : G11S: 0 to 400 Hz
P11S: 0 to 120 Hz
(Hysteresis width) : 0.0 to 30.0 Hz



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.

E33 OL1 WARNING

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.

E34 OL1 LEVEL

Setting range G11S:Inverter rated output current x (5 to 200%)
P11S:Inverter rated output current x (5 to 150%)
The operation release level is 90% of the set value.

E35 OL1 function signal (Timer)

E35 OL1 TIMER

◆This function is used when 1 (output current) is set to "E33 Overload early warning (operation selection)."
Setting range: 0.0 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]".

E36 FDT2 LEVEL

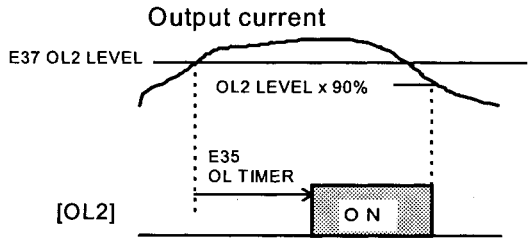
Setting range(Operation level) : G11S: 0 to 400 Hz
P11S: 0 to 120 Hz

E37 OL2 function signal (Level)

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

E37 OL2 LEVEL

Setting range G11S:Inverter rated output current x (5 to 200%)
P11S:Inverter rated output current x (5 to 150%)
The operation release level is 90% of the set value.



E40 Display coefficient A

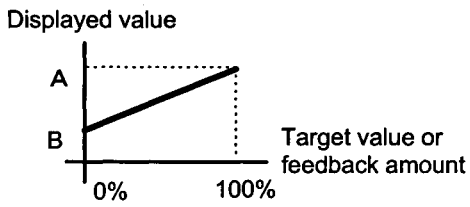
E41 Display coefficient B

◆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.

E40 COEF A
E41 COEF 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.

E42 DISPLAY FL

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 (display selection)," are displayed. In "E44 LED monitor (display at stopping)," specify whether to display some items out of the set values or whether to display the same items as during running..

E43	LED		MNTR	
E44	LED		MNTR	2

Value set to E43	E44=0		E44=1	
	At stopping	During running	At stopping	During running
0	Set frequency value (Hz)	Output frequency 1(before slip compensation) (Hz)		
1	Set frequency value (Hz)	Output frequency 2(after slip compensation) (Hz)		
2	Set frequency (Hz)			
3	Output current (A)			
4	Output voltage (command value) (V)			
5	Motor synchronous speed set value (r/min)	Motor synchronous speed (r/min)		
6	Line speed set value (m/min.)	Line speed (m/min.)		
7	Load shaft speed set value (r/min)	Load shaft speed (r/min)		
8	Torque calculation value (%)			
9	Consumption			
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 (display selection)." This display is not affected by "E44 LED monitor (display at stopping)."

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.

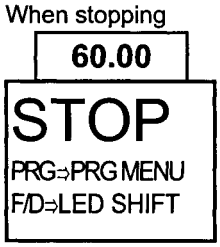
E45	LCD		MNTR	

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

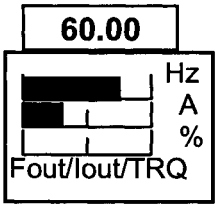
Set value: 0

During running

When stopping



Set value: 1



Full-scale value of bar graph

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

Note: The scale cannot be adjusted.

E46 Language

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

E46	LANGUAGE		

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

Note: Japanese 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.

E47	CONTRAST		

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

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 0Hz.
◆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.

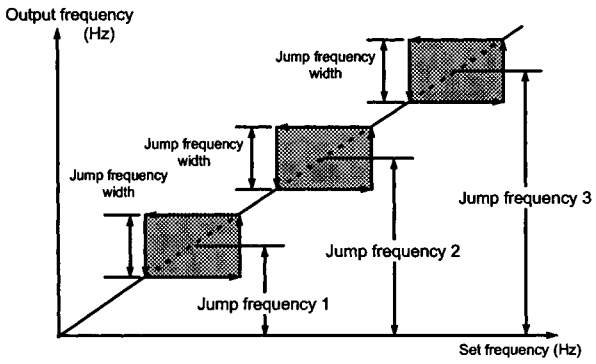
C	0	1	J	U	M	P		H	z		1	
C	0	2	J	U	M	P		H	z		2	
C	0	3	J	U	M	P		H	z		3	

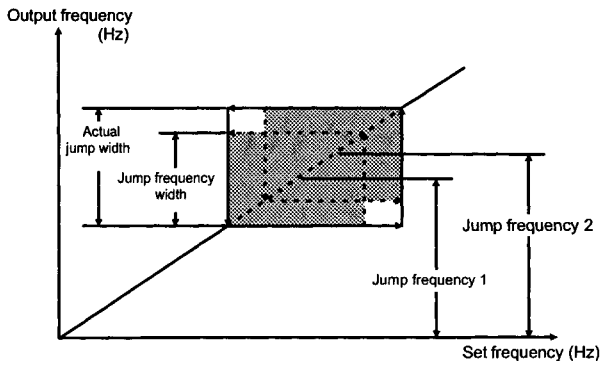
Set value
0 to 400Hz (P11S: 0 to 120Hz)
In 1Hz steps (min.)

Set value

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

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



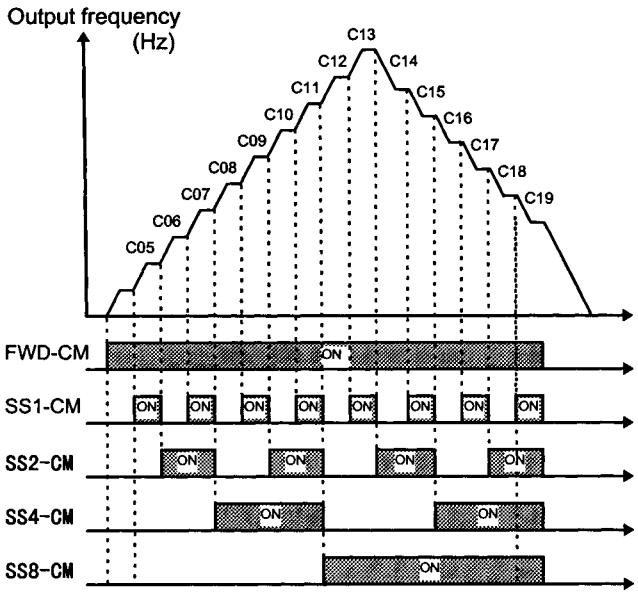


C05 Multistep frequency 1
C19 Multistep frequency 15

◆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

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



Set value
0 to 400Hz (P11S: 0 to 120Hz)
In 0.01Hz steps (min.)

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 G11S : 0.00 to 400.00 Hz
P11S : 0.00 to 120.00 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 selection)

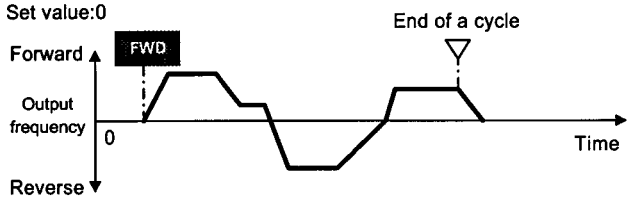
◆Pattern operation is anautomatic operation according to preset operation time, direction of rotation, acceleration and deceleration time, and frequency.
When using this function, set 10 (pattern operation) to "F01 Frequency setting."
The following operation patterns can be selected

C 2 1 P A T T E R N

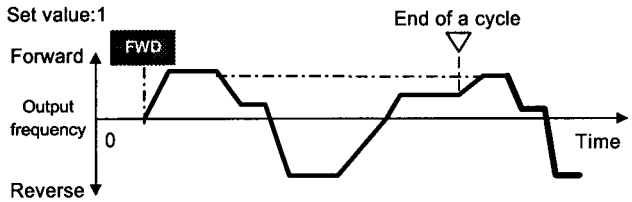
Related functions
F01, C30
(Set value:10)

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.

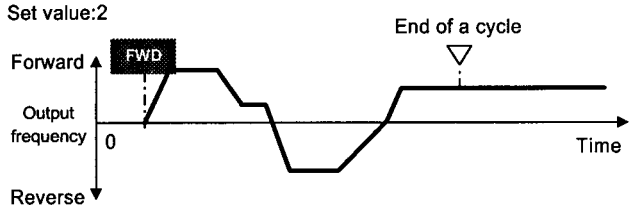
Set value:0



Set value:1



Set value:2



C22 Pattern operation (stage 1)

ʃ ʃ

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 6000s
Rotation direction	F: Forward (counterclockwise) R: Reverse (clockwise)
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 (counterclockwise)
- 100 — Operation time: 100s

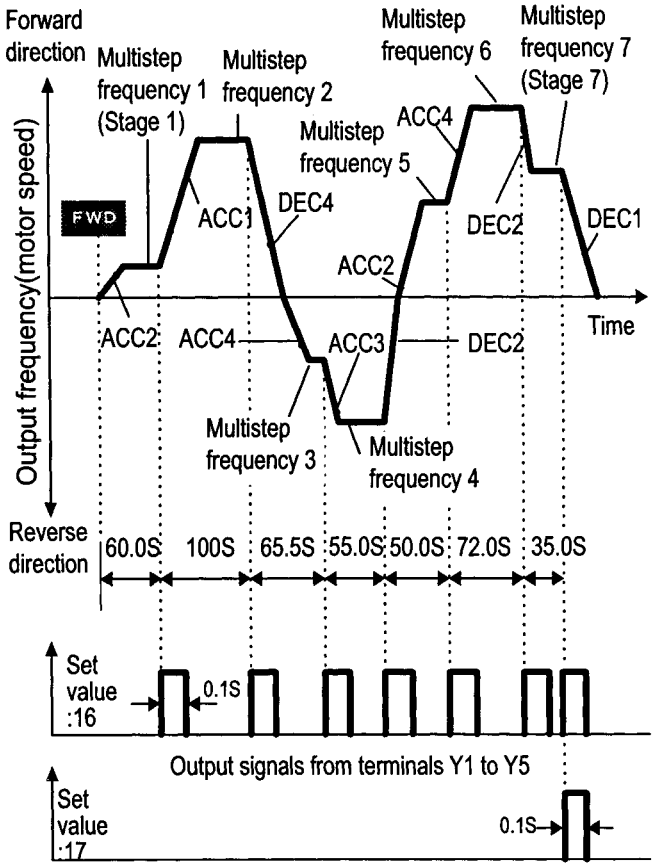
Set the operation time to 0.00 for stages not used, which are skipped in operation.
With regard to the set frequency value, the multistep frequency function is assigned as listed in the table below. Set frequencies to "C05 Multistep frequency 1," to "C11 Multistep frequency 7."

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 (mode 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 command 2

◆This function selects the frequency setting method.

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

C	3	0	F	R	E	Q		C	M	D		2

For the setting method, see the explanation for F01.

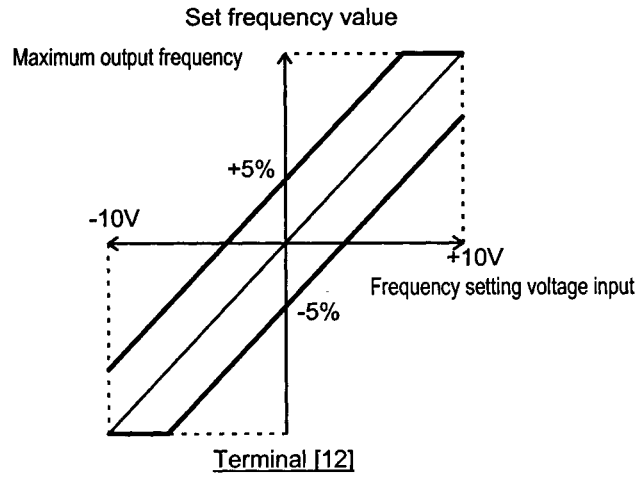
C31 Bias (terminal[12])

C32 Gain (terminal[C1])

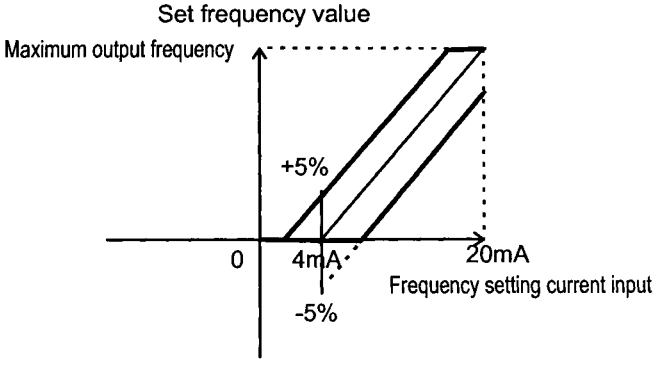
◆This function sets the offset of the analog input (terminals [12] and [C1]).

C	3	1	O	F	F	S	E	T		1	2	
C	3	2	O	F	F	S	E	T		C	1	

The setting range is -5.0 to +5.0% (in 0.1% steps) of the maximum output frequency.



Terminal [12]



Terminal [C1]

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.

C33 REF FILTER

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.

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

◆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 the FUJI 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 FUJI 3-phase standard motor are 200V, 50Hz, 4 poles for the 200V series; 400V, 50Hz, 4 poles for the 400V 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 2,000A

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) of the base frequency when the motor is stopping and automatically write both values in P07 and P08.
2	Measure the primary resistance (%R1) of the motor and leakage reactance (%X) of the base frequency when the motor is stopping, measure the no-load current (Io) when the motor is running, and automatically write these values in P06, P07, and P08.

◆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 data is required for close control.
- 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 %R1 or %X is unknown as when a non-standard or special motor is used.

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, beware of motor rotation.
4. Set 1 (motor stop) or 2 (motor rotation) to function "P04 Auto tuning." Press the FUNC DATA key to write the set value and press the FWD key or REV key then start tuning simultaneously.
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.

Set value: 0.00 to 2,000A

P	0	6	M	1	–	I	O					

P07 Motor 1 (%R1 setting)

P08 Motor 1 (%X setting)

◆Write this data when using a motor other than the FUJI 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:

$$\%R1 = \frac{R1 + \text{Cable R}}{V / (\sqrt{3} \cdot I)} \times 100 \ [\%]$$

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 the following formula:

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

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 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 15.00Hz

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

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

Slippage = Synchronous speed - Rated speed

H03 Data initializing (Data reset)

◆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.

H	0	4	A	U	T	O	-	R	E	S	E	T

H	0	5	R	E	S	E	T		I	N	T	

Set the protective function release count and waiting time from its operation startup to release.
Setting range (Count) : 0, 1 to 10
(Waiting time) : 2 to 20 seconds

To not use the retry function, set 0 to "H04 Retry (count)."

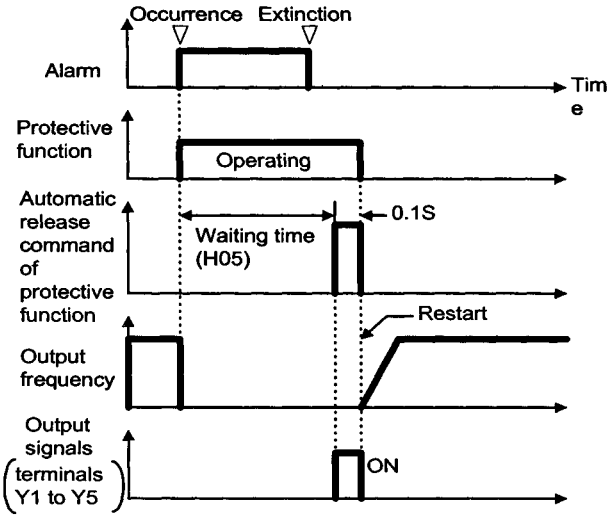
◆Inverter protective functions that can invoke retry function.

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

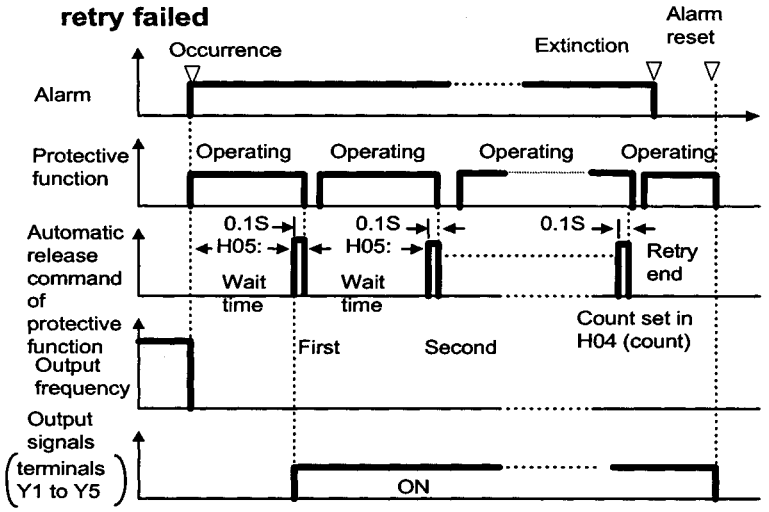
◆When the value of "H04 Retry (count)," is set from 1 to 10, an inverter run command is immediately entered following the wait time set in H05, "Retry (wait time)," and the startup of the retry operation. If the cause of the alarm has been removed at this time, the inverter starts without switching to alarm mode. If the cause of the alarm still remains, the protective function is reactivated according to the wait time set in "H05 Retry (waiting time)." 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 Retry (count)."
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)

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 fin in the inverter and turns the fan on or 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.

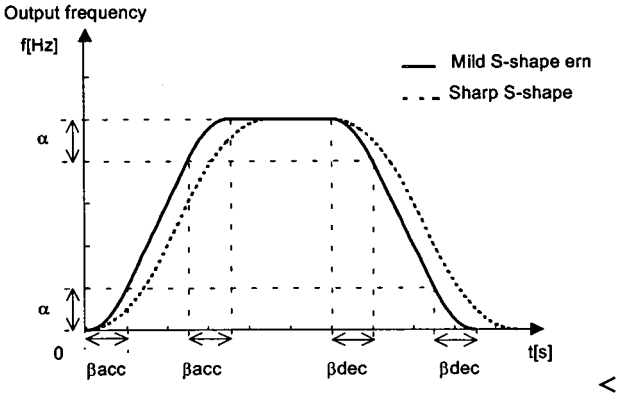
H07 ACC/DEC pattern (Mode select)

◆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.

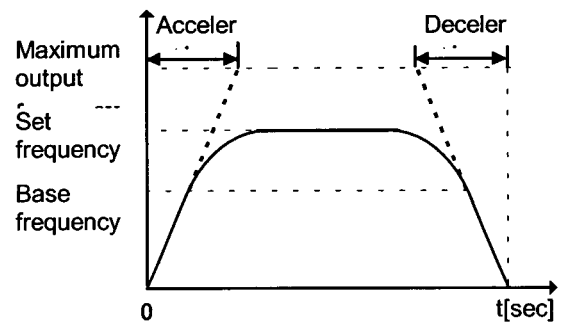


<Pattern constants>

	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.



H08 Rev. phase sequence lock

◆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 CM terminals, inadvertent activation of the REV key, or negative analog input from terminal 12 or V1

H08 REV LOCK

Set value 0: Inactive
1: Active

This function is inactive when H18 Torque Control is active . So Reversing operation is active.

H09 Start mode (Rotating motor pick up)

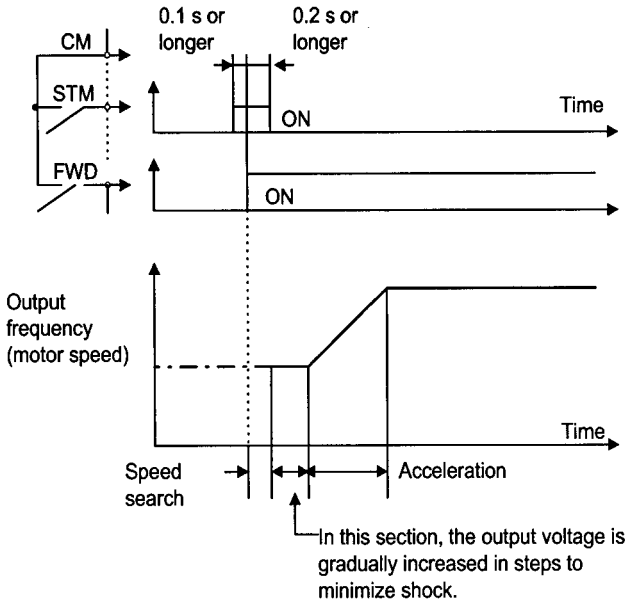
This function smoothly starts the motor which is coasting after a momentary power failure or after the motor has been subject to external force, without stopping motor.
At startup, this function detects the motor speed and outputs the corresponding frequency, thereby enabling a shock-free motor startup. 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)."

H09 START MODE

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 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" (start characteristics selection) 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.

The following setting is recommended, for the exact motor speed is detected.

① Set the value "0.0" of F09 Torque Boost 1.
② Perform the P04 Motor 1 Tuning when other manufacture's motors or long motor cable are set.

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.

H10 ENERGY SAV

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.

H11 DEC MODE

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.

H12 INST CL

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.

H13 RESTART 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.

H14 FALL RATE

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 is 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 after momentary power failure (operation selection)." Either function starts a control operation if the main circuit DC voltage drops below the set operation continuation level.

H15 HOLD V

Setting range 200V series: 200 to 300V
400 V series: 400 to 600V

◆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 Fuji electric 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.)

H16 SELFHOLD 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 circu0t DC voltage is about 0.

H18 Torque control

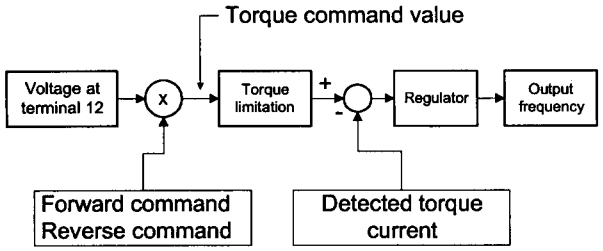
◆This function controls motor torque according to a command value.

H18 TRQ CTRL

Related functions E01toE09 (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 -10V.
2	Torque control active A -10 to +10V 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 +10V and is -200% when the voltage is -10V.

◆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

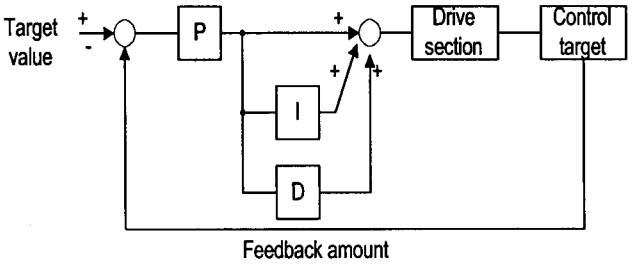
◆This function automatically extends accelerating time against acceleration operation of 60 seconds or longer to prevent an inverter trip resulting from a temperature rise in inverter due to overcurrent.

H19 AUT RED

Set value 0: Inactive
1: Active
(When the active drive function is activated, the acceleration time is three times the selected time.)

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

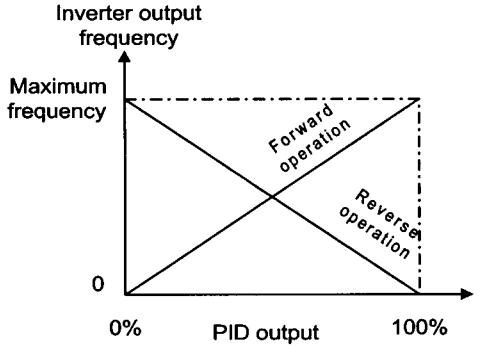
◆PID control detects the amount of control (feedback amount) from a sensor of the control target, then compares it with the target value (e.g., reference temperature). If the values differ, this function performs a control to eliminate the deviation. In other words, this control matches the feedback 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

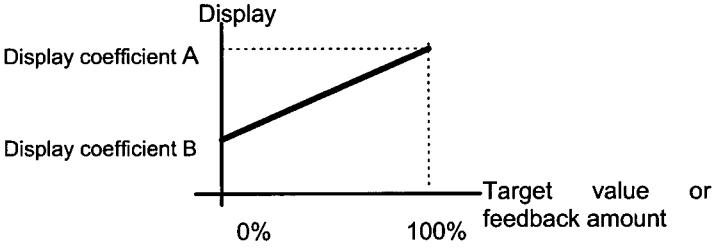
H20 PID MODE

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



◆The target value can be entered using F01, "Frequency setting 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."

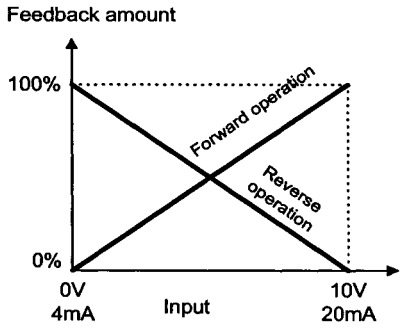


H21 PID control (Feedback signal)

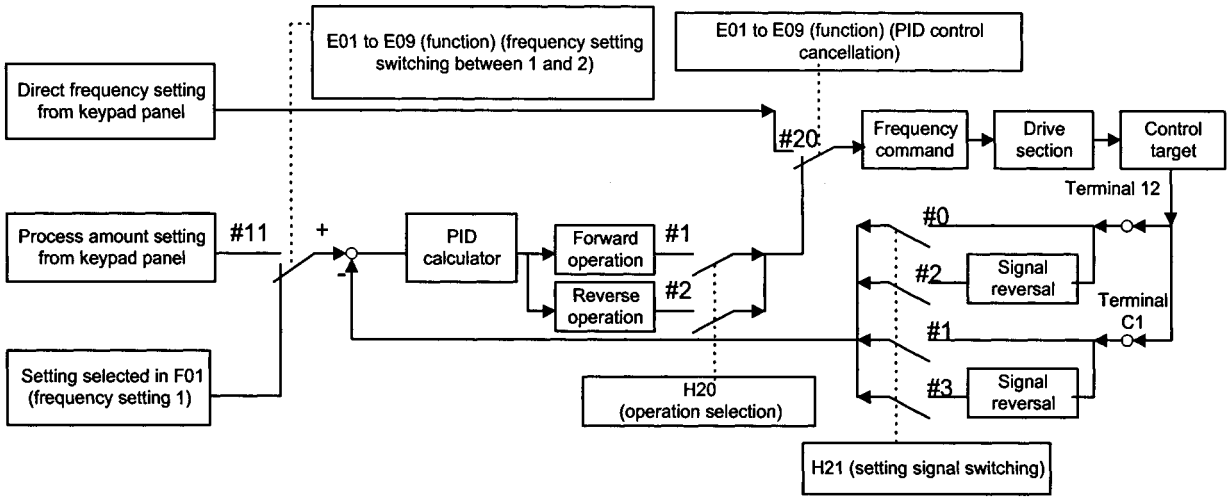
This function selects the feedback amount input terminal and electrical specifications of the terminal. Select a value from the table below according to sensor specifications.

H 2 1 F B S I G N A L

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



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

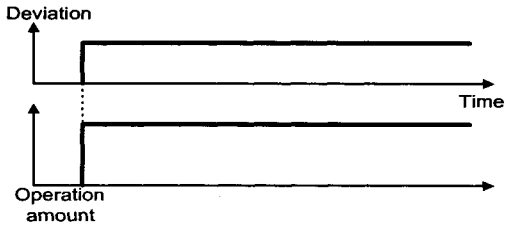


H22 PID control (P-gain)
H23 PID control (I-gain)
H24 PID control (D-gain)

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

◆P operation

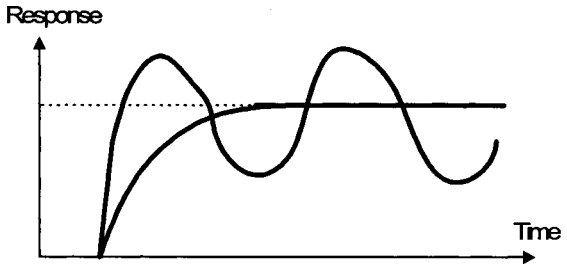
Operation using an operation amount (output frequency) proportional to deviation is called P operation, which outputs an operation amount proportional to deviation, though it cannot eliminate deviation alone.



H 2 2 P - G A I N

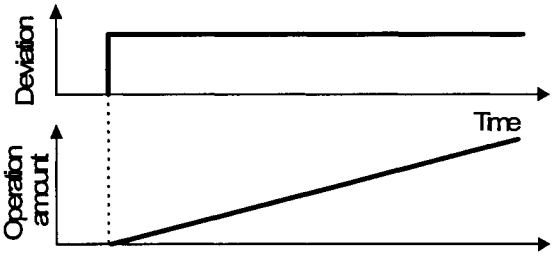
Setting range: 0.01 to 10.0 times

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.



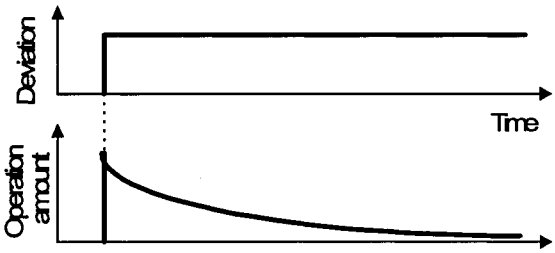
H	2	3	I	-	G	A	I	N				

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

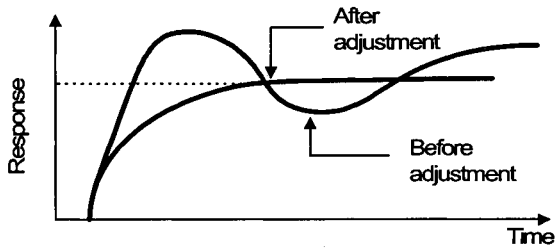
Adjust the PID value while monitoring the response waveform on an oscilloscope or other instrument if possible. Proceed as follows:

-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.

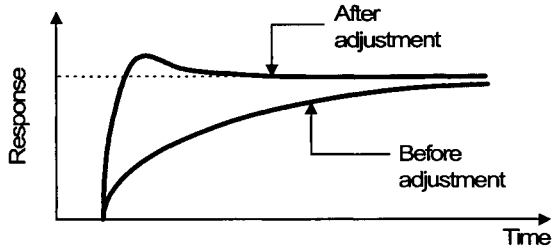
Adjust the response waveform as follows:

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

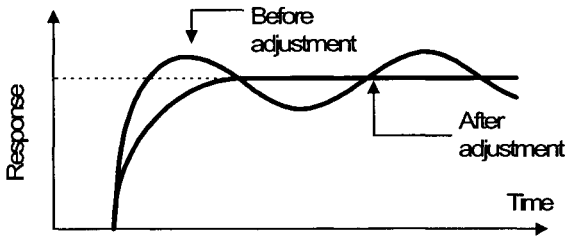


- To stabilize response quickly (i.e., allowing for a little overshoot),

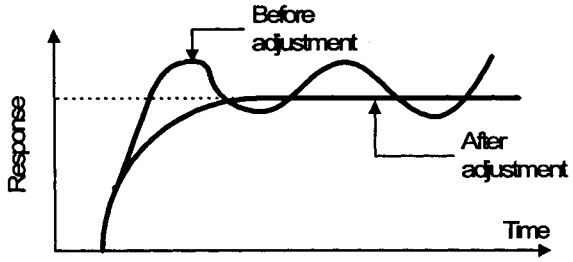
: decrease the value of "H23 I-gain," or
increase the value of "H24 D-gain."



-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.

H25	FB		FILTER

Setting range: 0.0 to 60.0 seconds

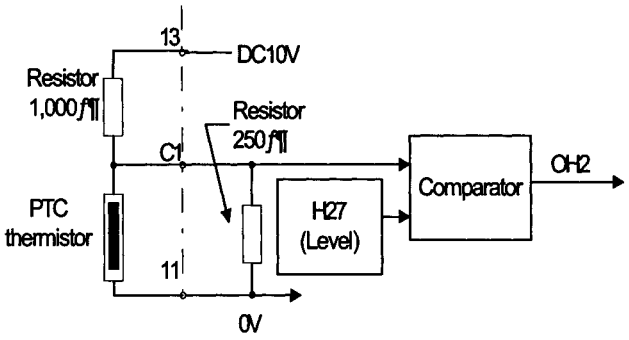
H26 PTC thermistor (Mode select)

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

H26	PTC		MODE

Set value 0: Inactive
1: Active

◆Connect the PTC thermistor as shown in the figure below. The protective operation uses the trip command(external fault) input to terminals [X1] to [X9] when selected. Hence, the trip mode is activated by "OH2:External thermal relay tripped."



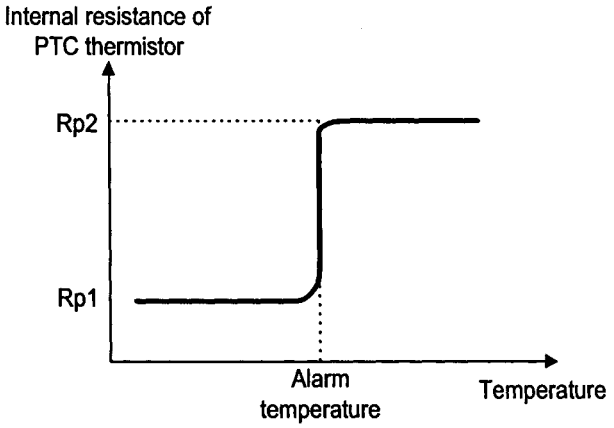
H27 PTC thermistor (Level)

◆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.

H27	PTC		LEVEL

Setting range: 0.00 to 5.00V

◆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 250Ω and the thermistor (resistance value Rp) are connected in parallel. Hence, voltage Vc1 (Level) at terminal [C1] can be calculated by using the following formula.

$$Vc_1 = \frac{\frac{250 \cdot Rp}{250 + Rp}}{1000 + \frac{250 \cdot Rp}{250 + Rp}} \times 10[V]$$

The operation level can be set by bringing Rp in theVc1 calculation formula into the following range.

Rp1 < Rp < Rp2

To obtain Rp easily, use the following formula.

$$Rp = \frac{Rp_1 + Rp_2}{2} [\Omega]$$

H28 Droop operation

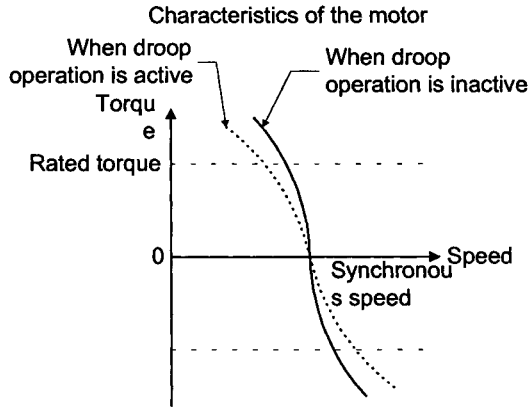
When two or more motors drive a single machine, a higher load is placed on the motor rotating the fastest. Droop operation achieves a good load balance by applying drooping characteristics to speed against load variations.

◆Calculate the droop amount using the following formula:

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

H28	DROOP				

Set value : -9.9Hz to 0.0Hz



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

H30 LINK FUNC

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 RTU.

H31 ADDRESS

Setting range: 1 to 31

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

H32 MODE ON
H33 TIMER

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.

H34 BAUD RATE

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.

H35 LENGTH

Set value	Data length
0	8 bit
1	7 bit

◆This function sets the parity bit.

H36 PARITY

Set value	Parity bit
0	None
1	Even
2	Odd

◆This function sets the stop bit.

H37 STOP BITS

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.

H38 NO RESt

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.

H39 INTERVAL

Setting range: 0.00 to 1.00 second

A01 Maximum frequency2

◆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 output 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 2 (Select)

A07 Electronic thermal overload relay 2 (Level)

A08 Electronic thermal overload relay 2 (Thermal time constant)

◆This function sets the function of the electronic thermal overload relay for motor 2. This function operates the same as F10 to F12, "Electronic thermal overload relay 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 the 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

Set value: 0.00 to 15.00Hz

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

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

Slippage = Synchronous speed - Rated speed

6. Protective Operation

6-1 List of Protective Operations

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 Section 6.1.1.

Table 6.6.1 List of alarm displays and protective functions

Alarm Name	Keypad panel display		Contents of operation	
	LED	LCD		
Over current protection	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 30kW or more only). If a ground fault occurs in an inverter rated at 22kW 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 protection	OU1	OV DURING ACC	During acceleration	If the DC link circuit voltage of the main circuit exceeds the overvoltage detection level (200V series: 400V DC or more, 400V series: 800V DC or more) 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 protection	LU	UNDERVOLTAGE	If the DC link circuit voltage of the main circuit falls below the undervoltage detection level (200V series: 200V DC or less , 400V series: 400V DC or less) 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 phase loss protection	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.	
Overheat protection	OH1	FIN OVERHEAT	If the temperature of the heat sink rises due to a cooling fan failure, etc., the protective function is activated.	
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), the contacts will be actuated according to contact signals.	
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 30kW 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 Modbus-RTU, the protective function is activated.	

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.

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.

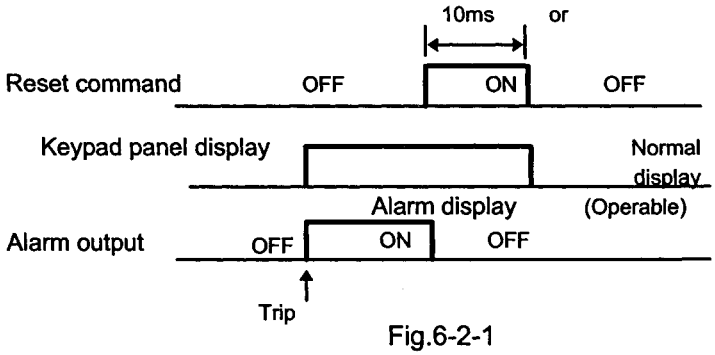


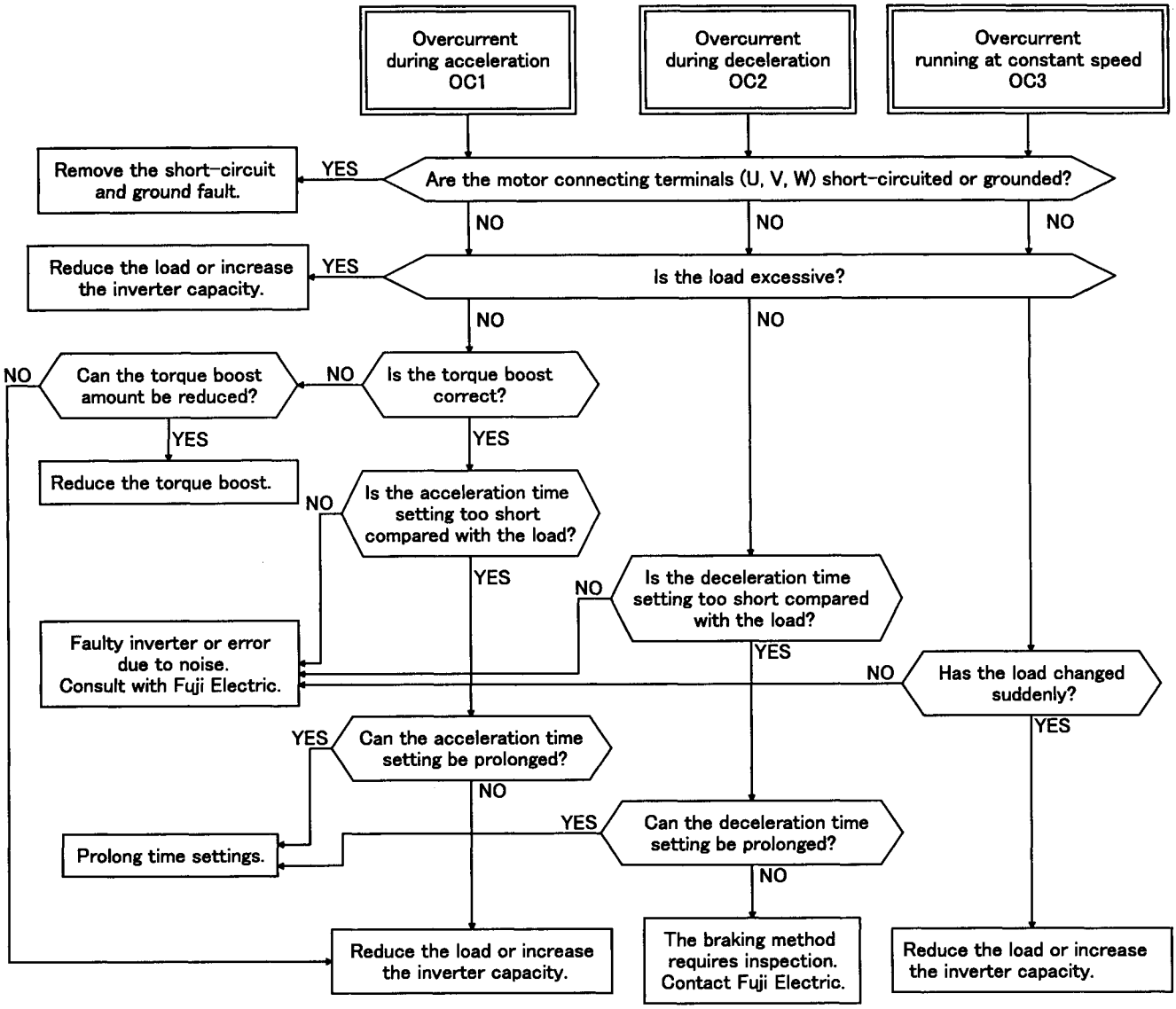
Fig.6-2-1

⚠ 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.**

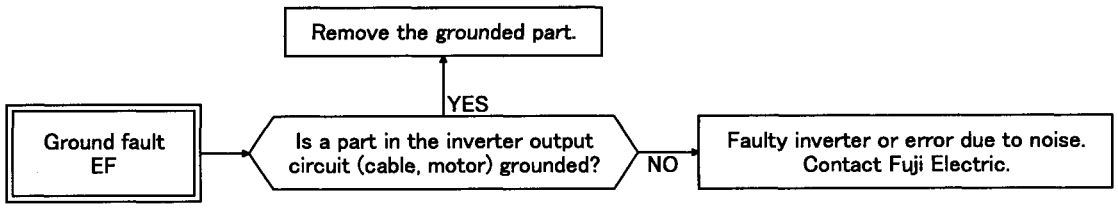
7.Trouble shooting

7.1 Protective function activation

(1)Overcurrent

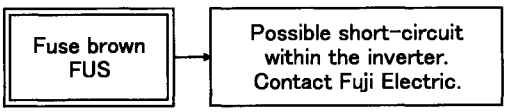


(2) Ground fault

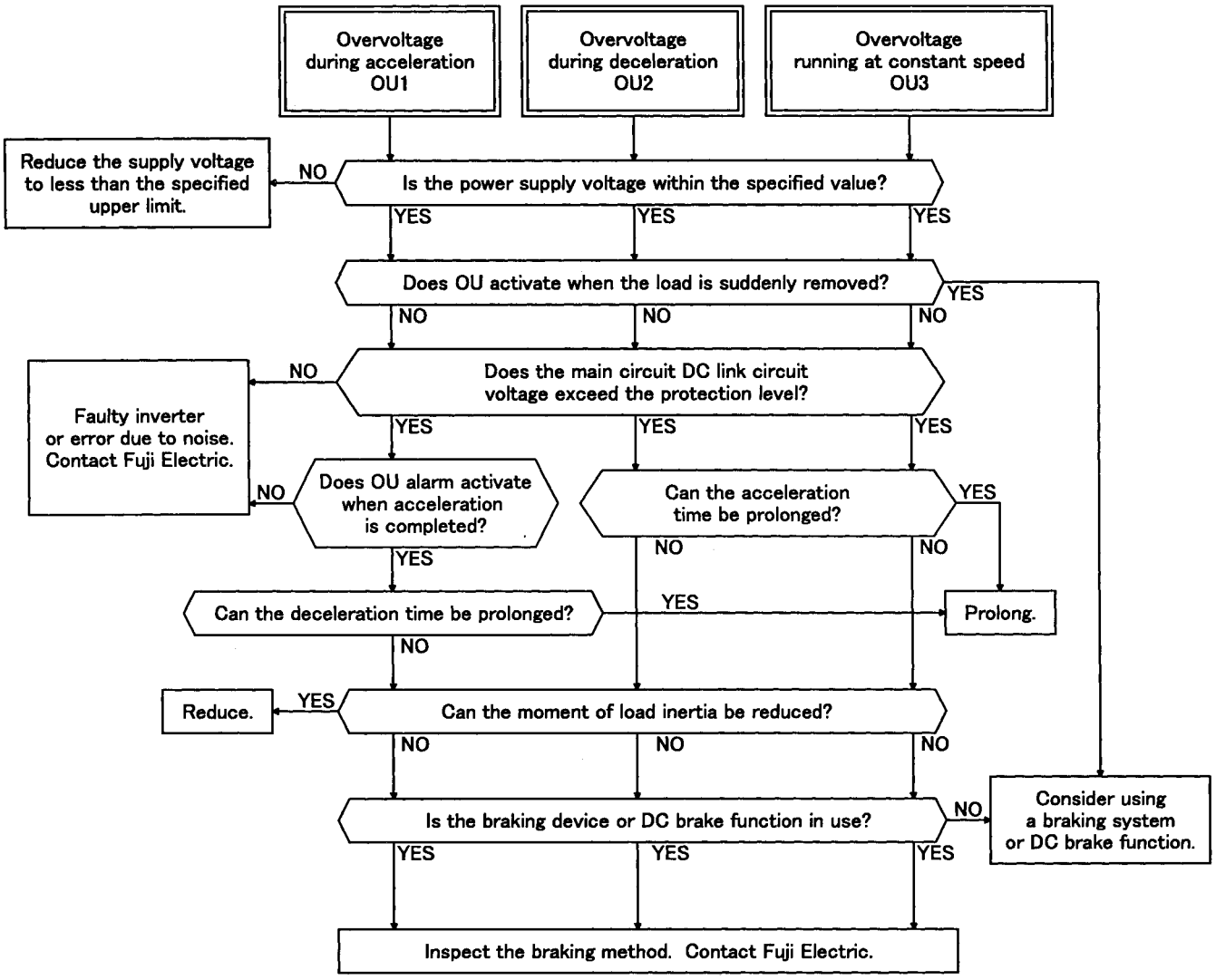


Note:The ground fault protective function is provided only for inverter for nominal applied motors rated at 30kW or more.

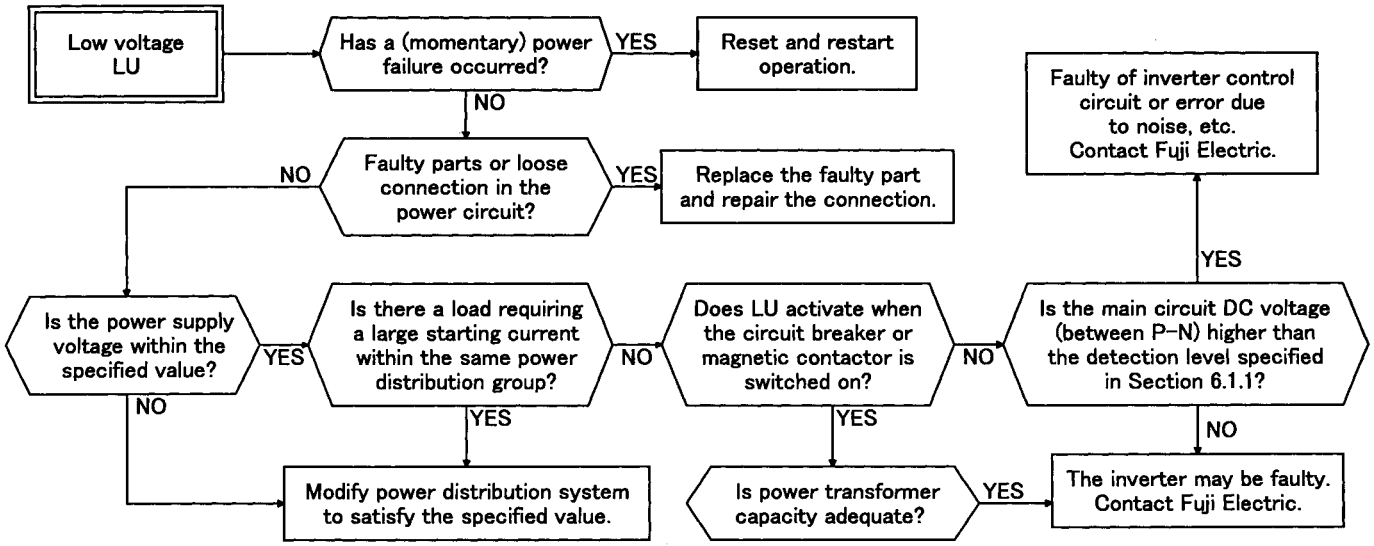
(3)Fuse brown



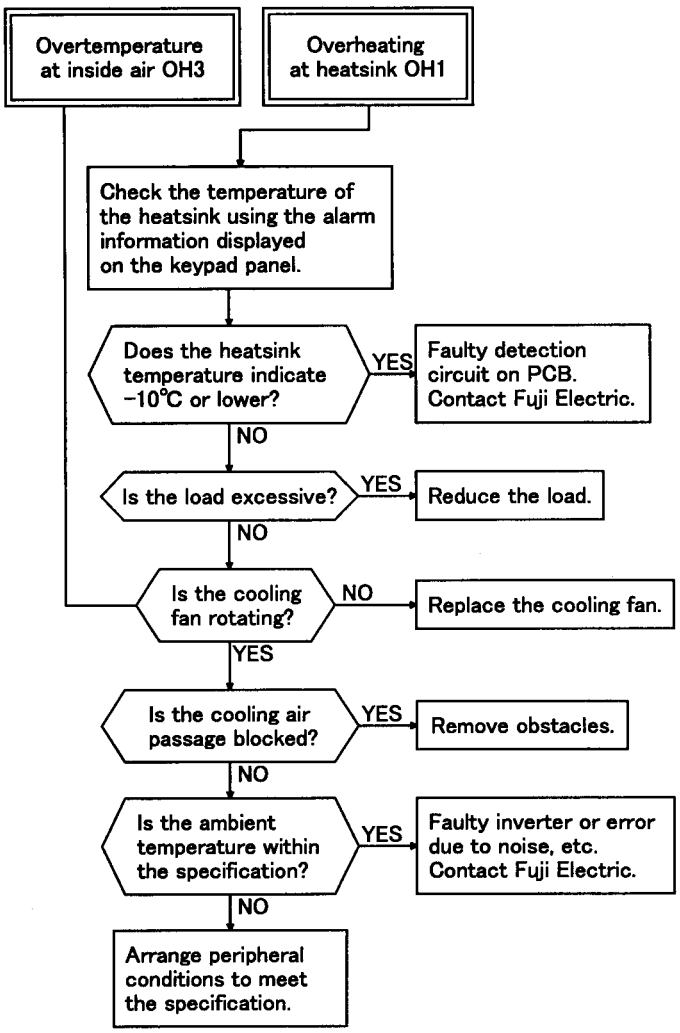
(4)Overvoltage



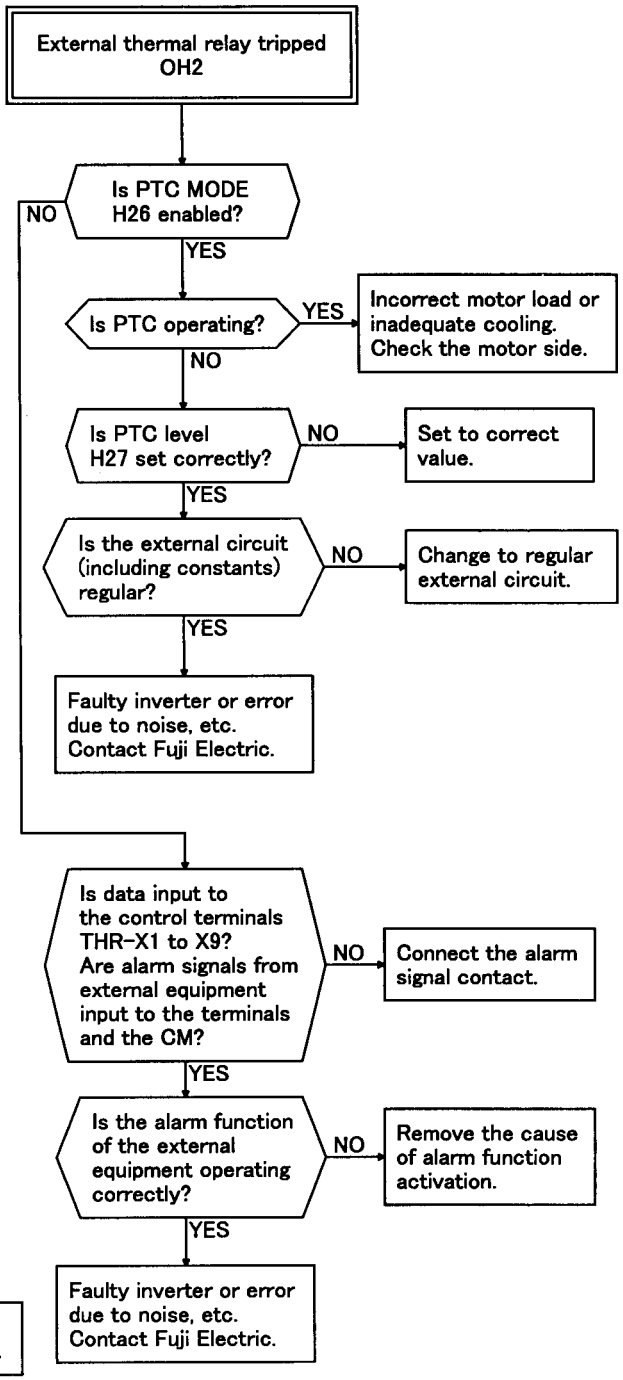
(5)Low voltage



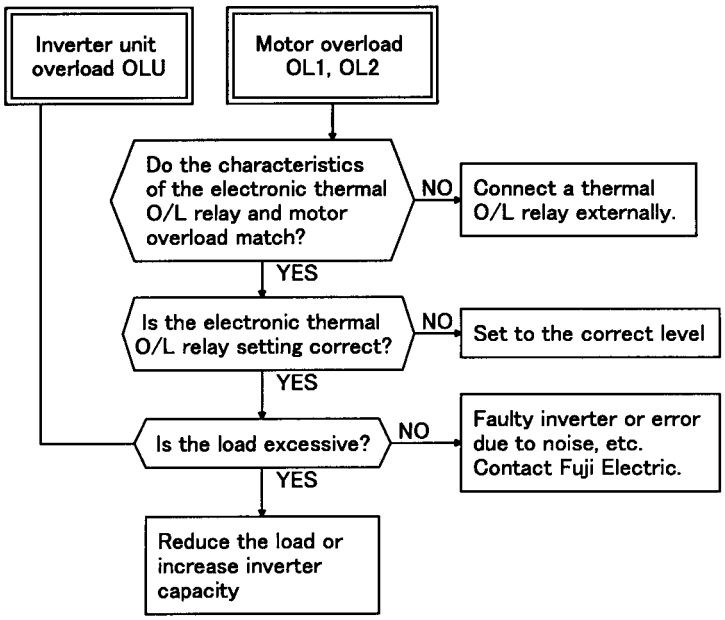
(6) Overtemperature at inside air and overheating at heatsink.



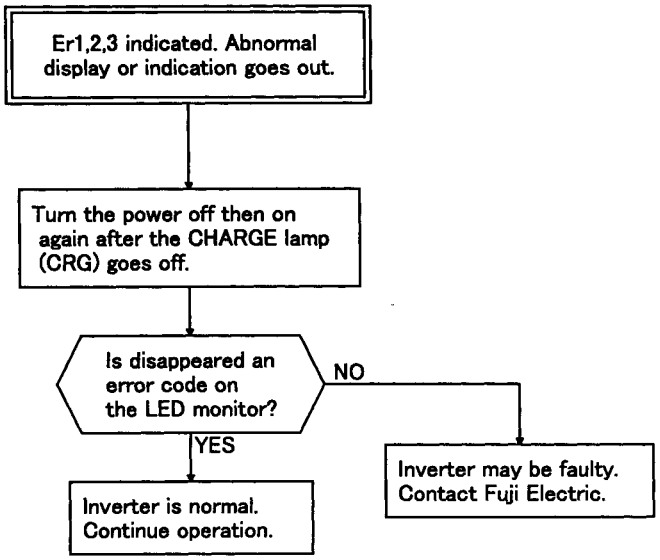
(7) External thermal relay tripped



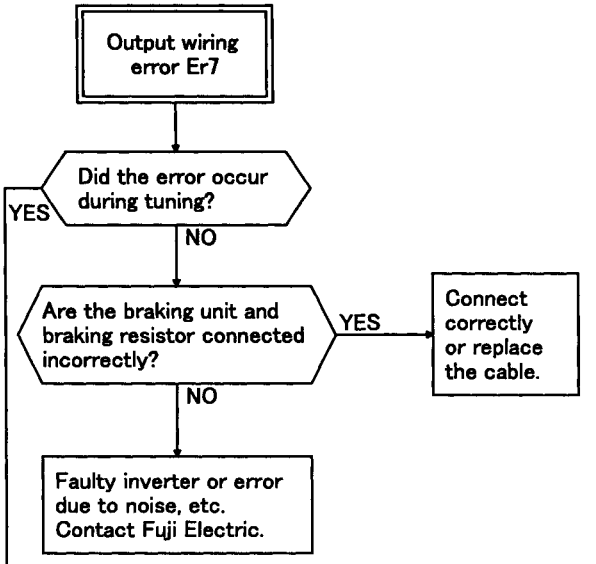
(8) Inverter unit overload and motor overload



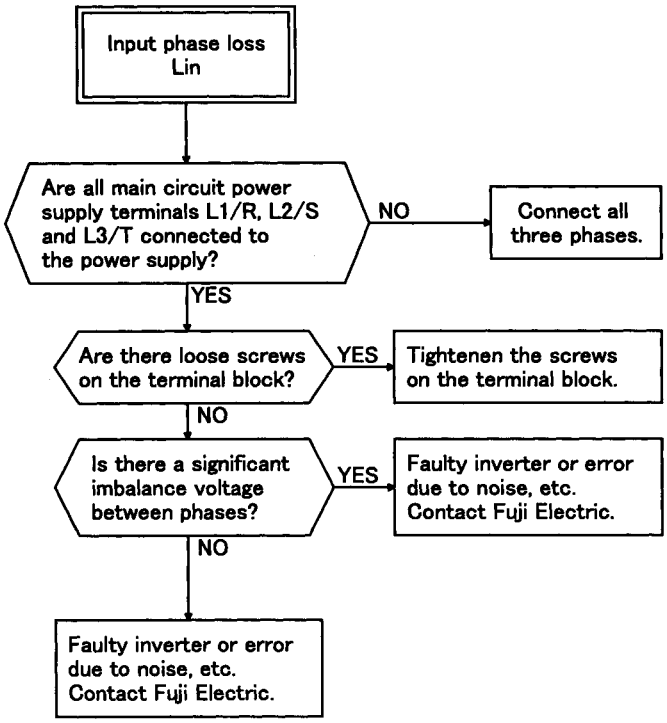
(9) Memory error Er1,
Keypad panel communication error Er2,
CPU error Er3

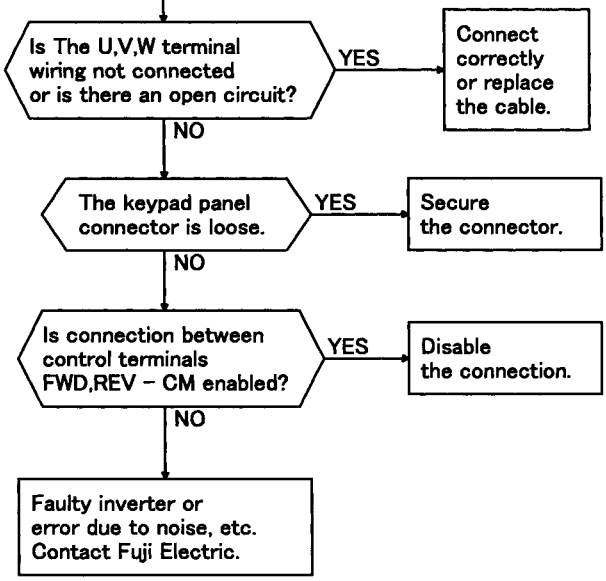


(10) Output wiring error



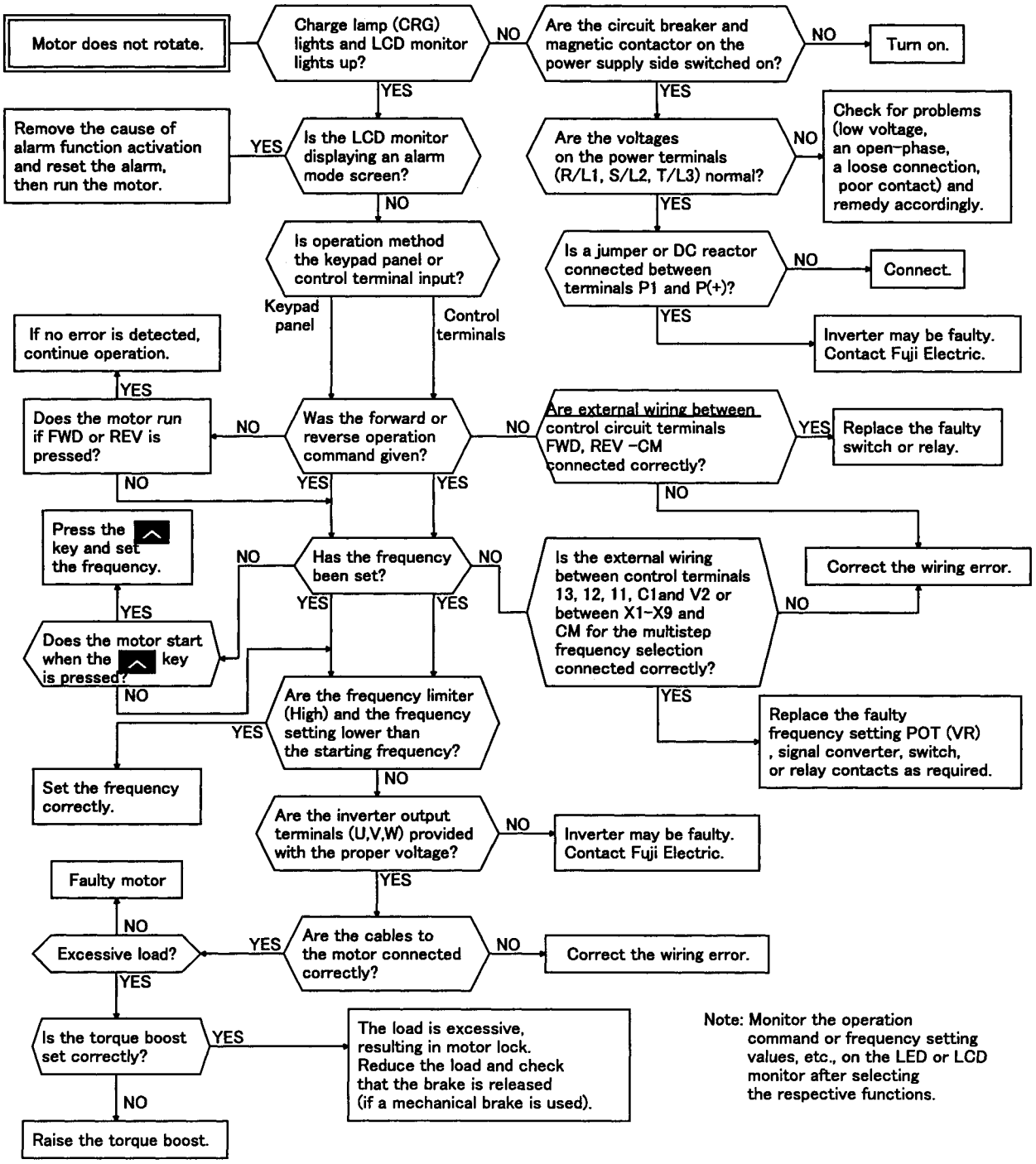
(11) Input phase loss





7-2 Abnormal motor rotation

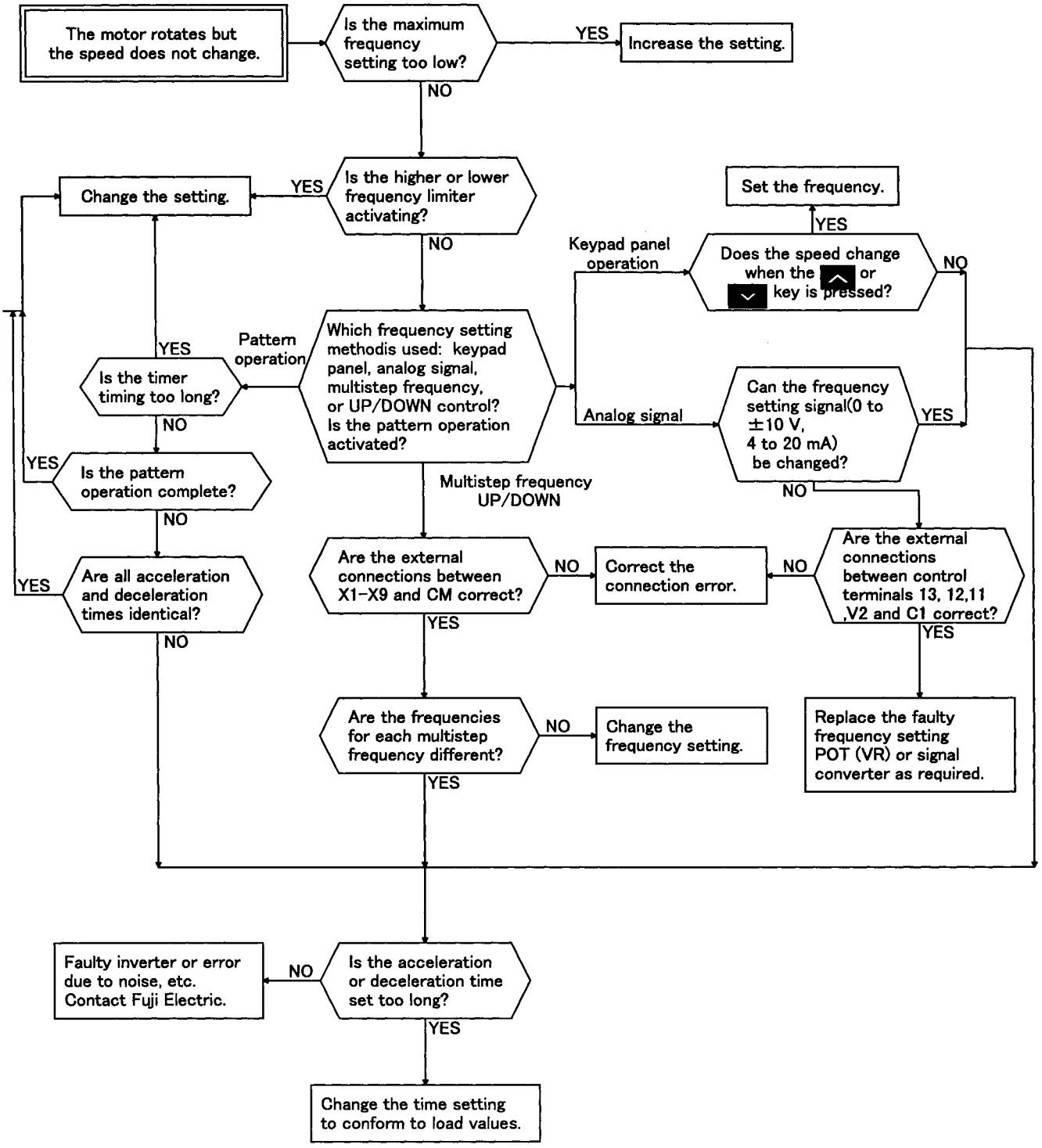
(1) If motor does not rotate



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 Rev. phase sequence lock" value set to 1.

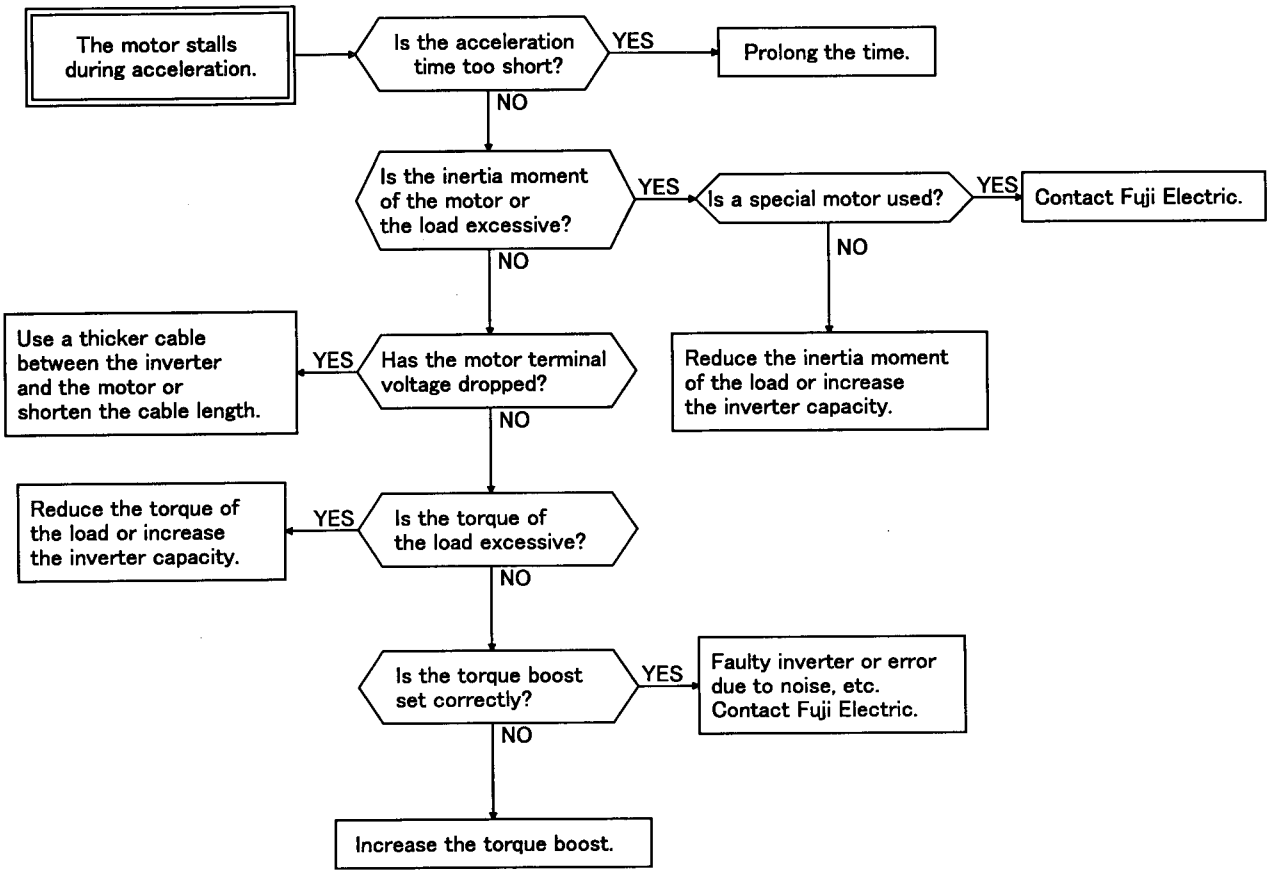
(2) If the motor rotates but the speed does not change



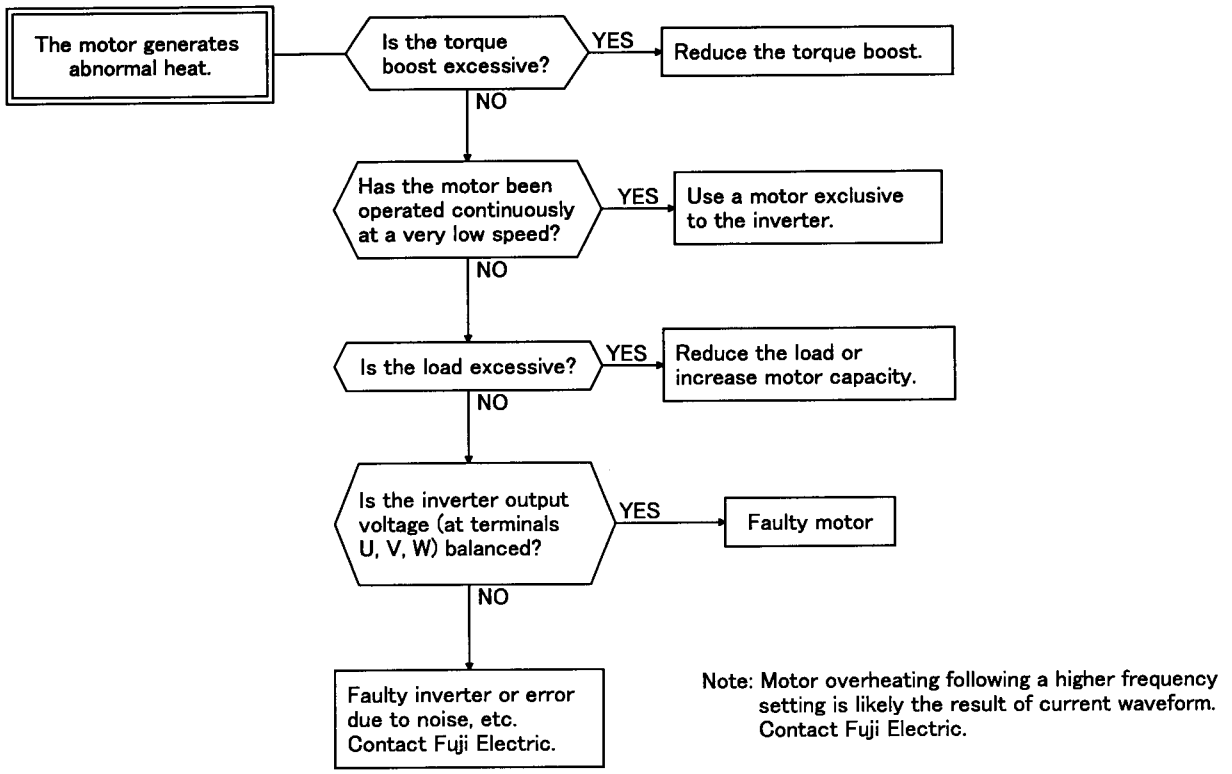
In the following cases, changing the motor speed is also restricted:

- Signals are input from control terminals both 12 and C1 when "F01 Frequency command 1"and "C30 Frequency command 2" are set to3, and there is no significant change in the added value
- The load is excessive, and the torque limiting and current limiting functions are activated

(3) If the motor stalls during acceleration



(4) If the motor generates abnormal heat



Note: Motor overheating following a higher frequency setting is likely the result of current waveform. Contact Fuji Electric.

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**	• Start the inspection at least five minutes after turning off the power supply for inverter rated at 22kW or less, and ten minutes for inverter rated at 30kW or more. (Check that the charge lamp (CRG) goes off, and that the voltage is 25V DC or less between terminals P(+) and N(-). **Electric shock may result.** • Only authorized personnel should perform maintenance and component replacement operations. (Remove metal jewelry such as watches and rings.) (Use insulated tools.)) • Never modify the inverter. **Electric shock or injury may result.**

Table 8-2-1 Periodical inspection list

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, crazing or discoloration of the cable sheath?	1),2) Visual inspection	1), 2) Not abnormal

Main circuit	Terminal block	Is there damage?	Visual inspection	Not abnormal
	Smoothing capacitor	1) Is there electrolyte leakage, discoloration, crazing, or swelling of the case? 2) Is the safety valve not protruding or are valves 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
Main circuit	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
	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

Note: If equipment is stained, wipe with a clean cloth. Vacuum the dust.

*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.

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.

Table 8-2-2 Rough estimate of life expectancy using maintenance information

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 (3.7 kW or less), 25,000 hours (Over 5.5 kW) (*1)

*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:

$$\text{Power} - \text{factor} = \frac{\text{Power[W]}}{\sqrt{3} \times \text{Voltage[V]} \times \text{Current[A]}} \times 100[\%]$$

Table 8-3-1 Meters for measuring main circuit

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							

Note: When measuring the output voltage using a rectifier type meter, an error may occur.
Use a digital AC power meter to ensure accuracy.

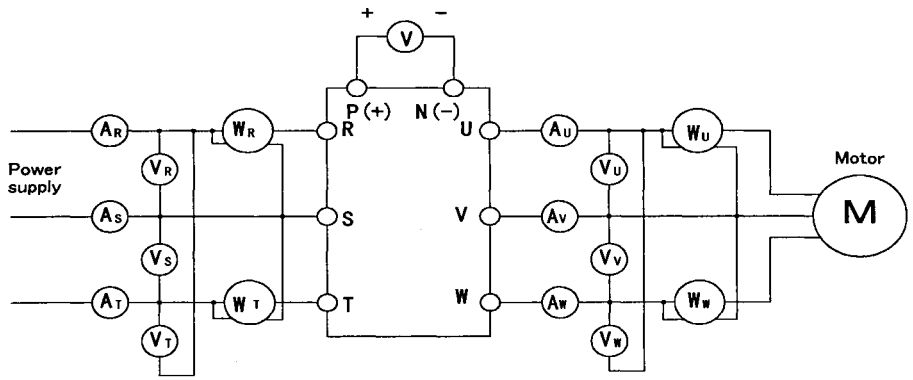


Fig 8-3-1 Connection of the meters

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 your local distributor or nearest Fuji Electric sales office.

(1) Megger test for the main circuit

① Use a 500V DC type megger and isolate the main power before commencing measurement.

② If the test voltage is connected to the control circuit, remove all connection cables to the control circuit.

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 megger indicating 5MΩ or more is normal. (This is the value measured with an inverter only.)

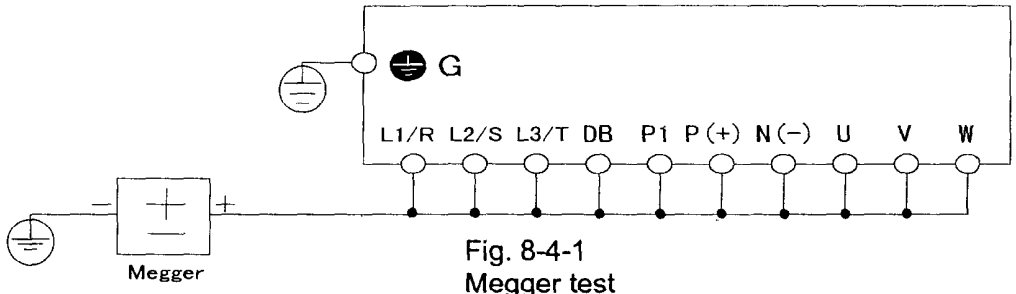


Fig. 8-4-1
Megger test

(2) Insulation test in the control circuit

A megger test and a dielectric strength test must not be performed in the control circuit. Prepare a high resistance range multimeter for the control circuit.

①Remove all external cables from the control circuit terminals.

②Conduct a continuity test between grounds. A result of 1MΩ 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.

Table 8-5-1 Part replacement

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.

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 your local distributor or nearest Fuji Electric sales office:

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 one year after purchase or 18 months 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 calamities and secondary disasters.

9. Specifications

9-1 Standard Specifications

(1) Three-phase 200V series

Nominal applied motor [kW]		0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110
G11	Type FRN□□□G11S-2JE	0.2	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	
	Rated output capacity (*1) [kVA]	0.57	1.1	1.9	3.0	4.2	6.4	9.5	12	17	22	28	33	43	55	68	81	107	131	
	Rated output current (*2) [A]	1.5	3.0	5.0	8.0	11	17	25	33	46	59	74	87	115	145	180	215	283	346	
	Overload capability	150% of rated output current for 1 min. 200% of rated output current for 0.5 s												150% of rated output current for 1 min. 180% of rated output current for 0.5 s						
	Starting torque	200% or more (under torque vector control)												180% or more (under torque vector control)						
	Braking torque (*3) [%]	150% or more			100% or more					Approx. 20%				Approx. 10 to 15%						
	Braking time [s]	10	5		5					No limit										
	Braking duty cycle [%ED]	10	5	3	5	3	2	3	2	No limit										
	Mass [kg]	2.2	2.2	2.5	3.8	3.8	3.8	6.1	6.1	10	10	10.5	10.5	29	36	44	46	70	115	-
P11	Type FRN□□□P11S-2JE	-	-	-	-	-	-	5.5	7.5	11	15	18.5	22	30	37	45	55	70	90	110
	Rated capacity (*1) [kVA]	-	-	-	-	-	-	8.3	11	16	20	25	29	43	55	68	81	107	131	158
	Rated output current (*2) [A]	-	-	-	-	-	-	22	29	42	55	67	78	115	145	180	215	283	346	415
	Overload capability	110% of rated output current for 1 min.																		
	Starting torque	50% or more																		
	Braking torque (*3) [%]	Approx. 20%												Approx. 10 to 15%						
	Braking time [s]	No limit																		
	Braking duty cycle [%ED]	No limit																		
	Mass [kg]	-	-	-	-	-	-	5.7	5.7	5.7	10	10	10.5	29	29	36	44	46	70	115
Output ratings	Rated output voltage (*4) [V]	3-phase, 200V/50Hz, 200V,220V,230V/60Hz																		
	Rated output frequency [Hz]	50,60Hz																		
Input ratings	Phases, voltage, frequency	3-phase, 200 to 230V, 50/60Hz												3-phase, 200 to 220V, 220 to 230V/50Hz 3-phase, 200 to 230V/60Hz						
	Voltage/frequency variations	Voltage: +10% to -15% (Imbalance rate between phases: 3% or less (*6), Frequency: +5% to -5%																		
	Momentary voltage dip capability (*7)	Operation will continue with 165V or more. If voltage drops below 165V, operation will continue for up to 15 ms. If "Continuous operation" is selected, the output frequency will be lowered to withstand the load until normal voltage is resumed.																		
	Required power supply capacity(*8)	0.4	0.7	1.3	2.2	3.1	5.0	7.2	9.7	15	20	24	29	38	47	56	69	93	111	134

(2) Three-phase 400V series

Nominal applied motor [kW]		0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	200	220	280
G11	Type FRN□□□G11S-4JE	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	200	220	280
	Rated output capacity (*1) [kVA]	1.1	1.9	2.8	4.1	6.8	9.9	13	18	22	29	34	45	57	69	85	114	134	160	192	231	287	318	
	Rated output current (*2) [A]	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	
	Overload capability	150% of rated output current for 1 min. 200% of rated output current for 0.5 s											150% of rated output current for 1 min. 180% of rated output current for 0.5 s											
	Starting torque	200% or more (under torque vector control)											180% or more (under torque vector control)											
	Braking torque (*3) [%]	50% or more		100% or more					20% or more				10 to 15%											
	Braking time [s]	5		5					No limit															
	Braking duty cycle [%ED]	5	3	5	3	2	3	2	No limit															
	Mass [kg]	2.2	2.5	3.8	3.8	3.8	6.5	6.5	10	10	10.5	10.5	29	34	39	40	48	70	70	100	100	140	140	
P11	Type FRN□□□P11S-4	-	-	-	-	-	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	200	220	280
	Rated capacity (*1) [kVA]	-	-	-	-	-	9.5	12.5	17.5	22.8	28.1	33.5	45	57	69	85	114	134	160	192	231	287	316	396
	Rated output current (*2) [A]	-	-	-	-	-	12.5	16.5	23	30	37	44	60	75	91	112	150	176	210	253	304	377	415	520
	Overload capability	110% of rated output current for 1 min.																						
	Starting torque	50% or more																						
	Braking torque (*3) [%]	Approx. 20%											Approx. 10 to 15%											
	Braking time [s]	No limit																						
	Braking duty cycle [%ED]	No limit																						
	Mass [kg]	-	-	-	-	-	6.1	6.1	6.1	10	10	10.5	29	29	34	39	40	48	70	70	100	100	140	140	
Output ratings	Rated output voltage(*4) [V]	3-phase, 380V, 400V, 415V(440V)/50Hz, 380V, 400V, 440V, 460V/60Hz																						
	Rated output frequency [Hz]	50,60Hz																						
Input ratings	Phases, voltage, frequency	3-phase,380 to 480V,50/60Hz											3-phase, 380 to 440V/50Hz *5) 3-phase, 380 to 480V/60Hz											
	Voltage/frequency variations	Voltage: +10% to -15% (Imbalance rate between phases: 3% or less (*6) , Frequency: +5% to -5%																						
	Momentary voltage dip capability (*7)	Operation will continue with 310V or more. If voltage drops below 310V, operation will continue for up to 15 ms. If "Continuous operation" is selected, the output frequency will be lowered to withstand the load until normal voltage is resumed.																						
	Required power supply capacity (*8)	0.7	1.2	2.2	3.1	5.0	7.2	9.7	15	20	24	29	38	47	56	69	93	111	134	160	193	239	263	335

(*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 a 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).

$$\text{Imbalance rate between phases [\%]} = \frac{(\text{Max. Voltage [V]} - \text{Min. Voltage [V]})}{\text{3-phase average voltage [V]}} \times 67[\%]$$

(*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 applied motor.

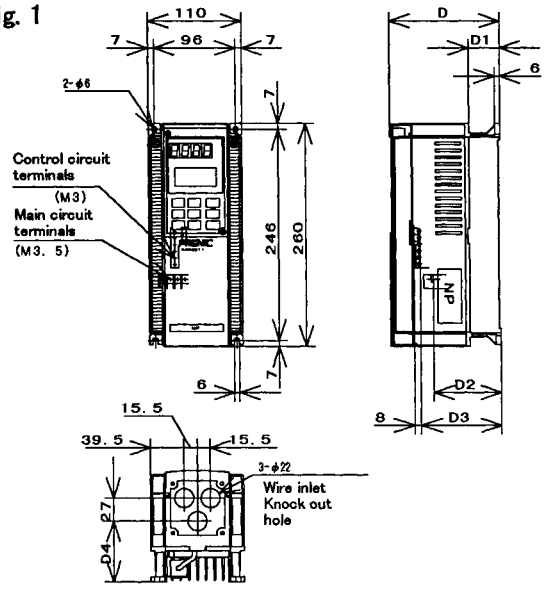
9-2 Common Specifications

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	G11S: 50 to 400Hz variable setting P11S: 50-120Hz variable setting
		Base frequency	G11S: 25 to 400Hz variable setting P11S: 25-120Hz variable setting
		Starting frequency	0.1 to 60Hz variable setting Holding time: 0.0 to 10.0 s
		Carrier frequency	G11: 0.75 to 15kHz (55kW or less) 0.75 to 10kHz (75kW or more) P11: 0.75 to 15kHz (22kW or less) 0.75 to 10kHz (30 to 75kW) 0.75 to 6kHz (90kW or more)
		Accuracy (stability)	Analog setting: +/- 0.2% or less of the max. Frequency (at 25 +/- 10℃) Digital setting: +/- 0.01% or less of the max. Frequency (-10 to +50℃)
		Setting resolution	Analog setting: 1/1000 of max. frequency (22kW or less) 1/3000 of max. frequency (30kW or more) Digital setting: 0.01Hz (99.99Hz or less), 0.1Hz (100.0Hz or more)
	Voltage/frequency characteristics		Output voltage at base frequency can be adjusted separately, such as 80 to 240V (200V series) or 320 to 480V (400V series). Output voltage at max. frequency can be adjusted separately, such as 80 to 240V (200V series) or 320 to 480V (400V series).
	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.)
	Accelerating/decelerating time		0.01 to 3600s Four accelerating and decelerating 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 60.0Hz, braking time: 0.0 to 30.0s, Braking level: 0 to 100% (G11S), 0-80% (P11S)
	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.
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.
	Frequency setting		Keypad panel: Setting by ∧ , ∨ keys External potentiometer: External freq.setting POT (VR) (1 to 5k Ω) Analog input: 0 to +10V (0 to +5V), 4 to 20mA, 0 to +/- 10V (FWD/REV operation) +10 V to 0 (reverse operation), 20 to 4mA (reverse 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
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 1000m, free from corrosive gas, dust, and direct sunlight (Pollution degree 2)
	Ambient temperature		-10 to +50℃ (ventilating cover must be removed under conditions exceeding +40℃ for models rated at 22kW 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 9Hz, 9.8m/s^2 at from 9 to less than 20Hz, 2m/s^2 at from 20 to less than 55Hz, 1m/s^2 at from 55 to less than 200Hz,
	Storage	Ambient temperature	-25 to +65℃
		Ambient humidity	5 to 95%RH (no condensation)

9-3 Outline Dimensions

■ Outline Dimensions (22kW or less)

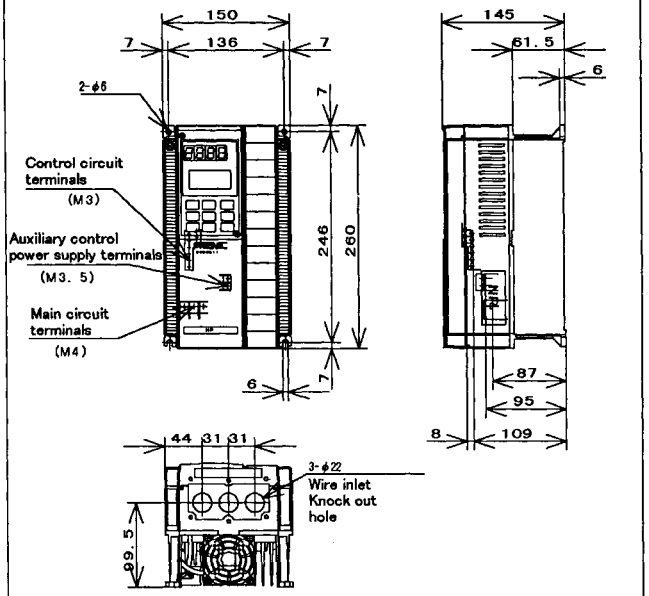
Fig. 1



Type	D	D1	D2	D3	D4
FRN0.2G11S-2 to FRN0.4G11S-2 FRN0.4G11S-4	130	36. 5	80	94	71. 5
FRN0.75G11S-2 FRN0.75G11S-4	145	51. 5	95	109	86. 5

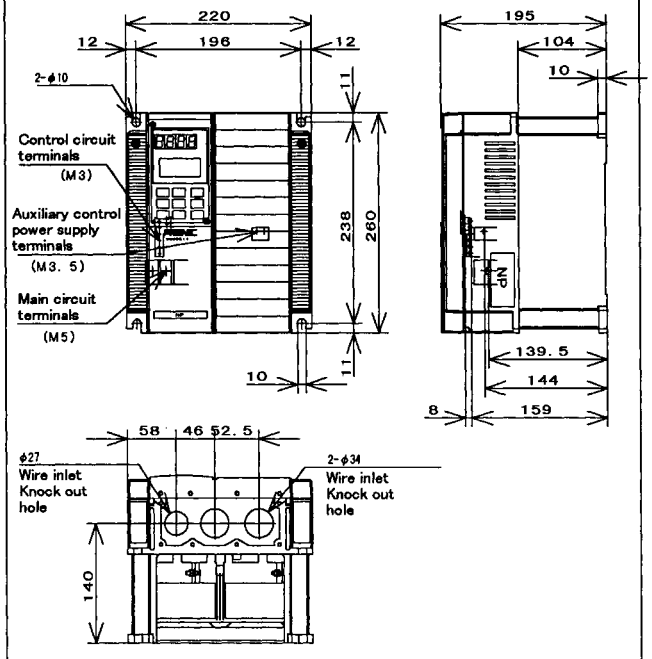
FRN0.2G11S-2 to FRN0.75G11S-2
FRN0.4G11S-4 to FRN0.75G11S-4

Fig. 2



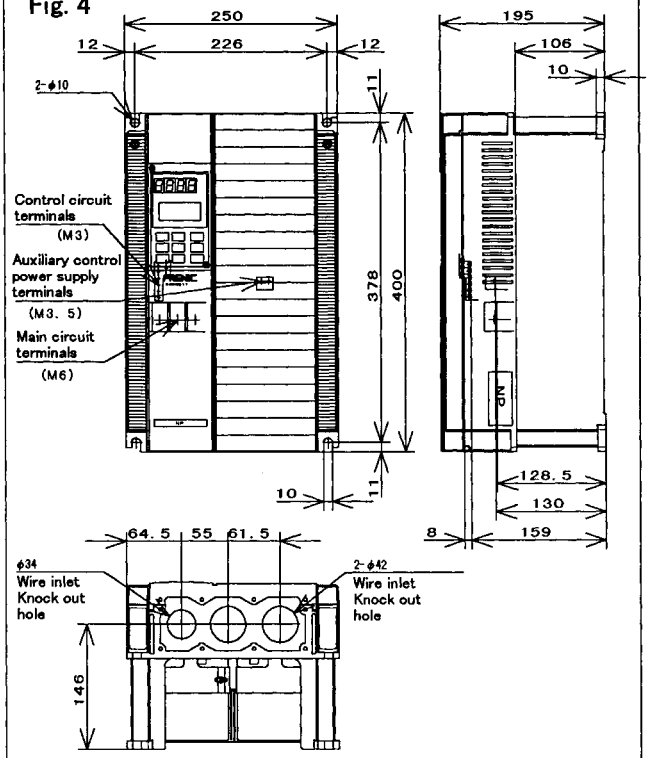
FRN1.5G11S-2 to FRN3.7G11S-2
FRN1.5G11S-4 to FRN3.7G11S-4

Fig. 3



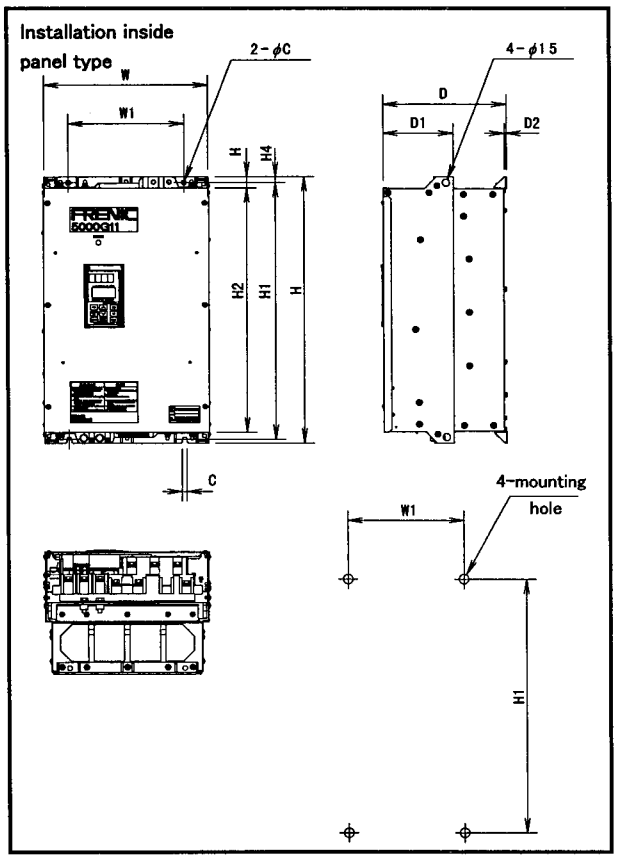
FRN5.5G11S-2 to FRN7.5G11S-2
FRN5.5G11S-4 to FRN7.5G11S-4
FRN5.5P11S-2 to FRN11P11S-2
FRN5.5P11S-4 to FRN11P11S-4

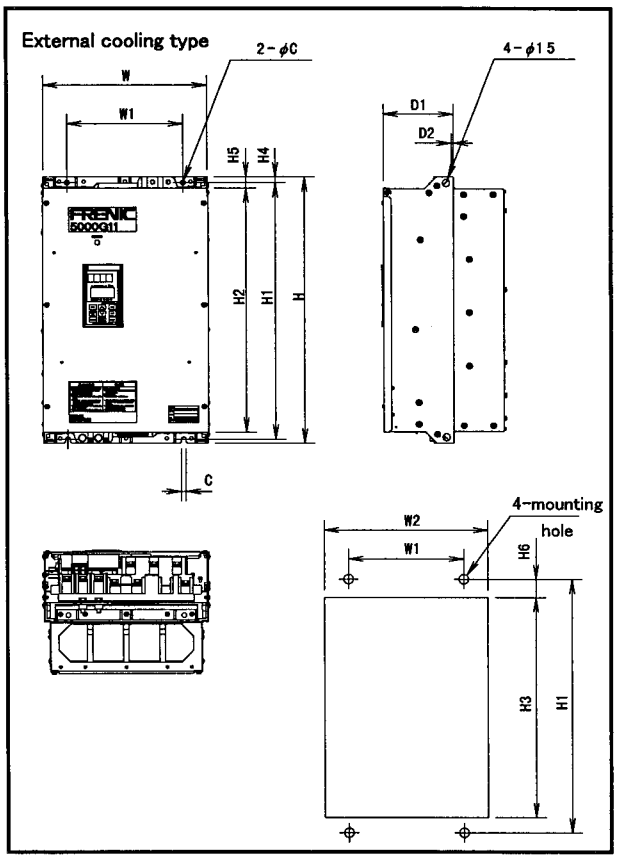
Fig. 4



FRN11G11S-2 to FRN22G11S-2
FRN11G11S-4 to FRN22G11S-4
FRN15P11S-2 to FRN22P11S-2
FRN15P11S-4 to FRN22P11S-4

■ Outline Dimensions (30kW or more)





200V Series

Nominal applied motor [kW]	Inverter type		Dimensions Unit [mm]														Mounting bolt
	FRN-G11S series	FRN-P11S series	W	W1	W2	H	H1	H2	H3	H4	H5	H6	D	D1	D2	C	
30	—	FRN30P11S-2	340	240	326	550	530	500	512	12	25	9	255	145	4	10	M8
	FRN30G11S-2	—															
37	—	FRN37P11S-2															
	FRN37G11S-2	—	375	275	361	615	595	565	577				270				
45	—	FRN45P11S-2															
	FRN45G11S-2	—				740	720	690	702								
55	—	FRN55P11S-2															
	FRN55G11S-2	—															

400V Series

30	—	FRN30P11S-4	340	240	326	550	530	500	512	12	25	9	255	145	4	10	M8
	FRN30G11S-4	—															
37	—	FRN37P11S-4															
	FRN37G11S-4	—	375	275	361								270				
45	—	FRN45P11S-4															
	FRN45G11S-4	—				675	655	625	637								
55	—	FRN55P11S-4															
	FRN55G11S-4	—															
75	—	FRN75P11S-4															
	FRN75G11S-4	—				740	720	690	702								

9-4 RS485 Communication

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 technical documentation.

Table 9-4-1 Transmission specifications

Item	Specifications
Applicable model	Fuji Electric general-purpose inverter 11 series
Physical level	EIA RS485
Maximum length of cable	500m
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 7bit
Character length	8bit ,7bit
Stop bit length	1bit ,2bit
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

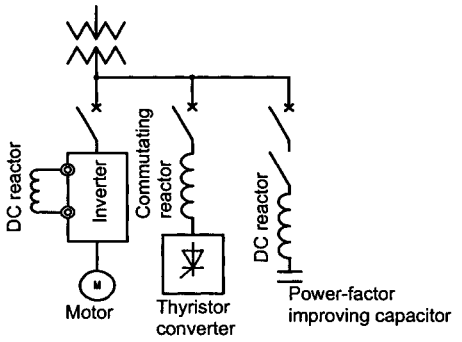
10. Options

10-1 Built-in Options

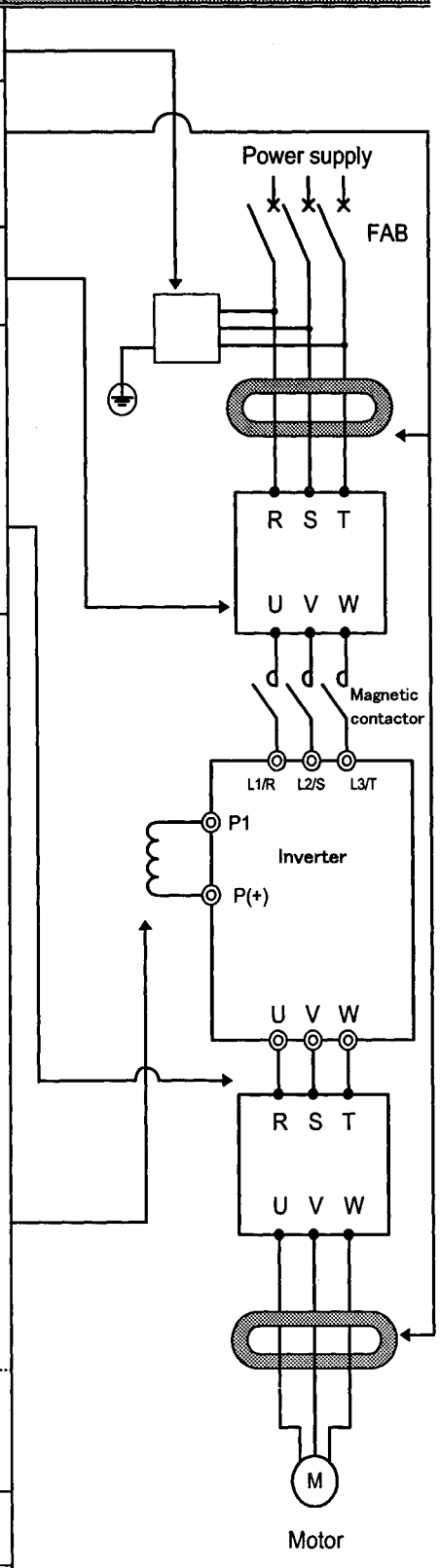
The following are optional cards that can be stored in the inverter.

Name	Function
Relay output card (OPC-G11S-RY)	• Relay output card The transistor output from the inverter control output terminals Y1 to Y4 is converted to the relay output (1SPDT).
Digital interface card (OPC-G11S-DIO)	• Frequency setting by binary code (max. 16 bits) • Monitoring (8 bits) of frequency, output current, and output voltage
Analog interface card (OPC-G11S-AIO)	• Auxiliary input for analog frequency setting (0 to +/-10 V) • Monitoring of inverter output frequency, current, and torque in analog voltage
PG feedback card (OPC-G11S-PG)	• This will enable vector control by pulse generator feedback signals. • Proportional operation, tuning operation
Synchronized operation card (OPC-G11S-SY)	• Two motors are driven synchronously.

10-2 Separately Installed Options

Name (Type)	Explanation
Arrester (CN23232) (CN2324E)	Absorbs power surges from the power source and protects the whole equipment connected to the power source.
Radio interference suppressing reactor (Zero-phase noise suppression reactor) (ACL-40B) (ACL-74B)	Used to reduce radio noise. This device should be inserted in the power supply side if the wiring between the motor and inverter is relatively short (e.g., 20m) and inserted in the output side if the wiring exceeds 20m.
EMC compliance filter (EFL-□□□SP-2) (EFL-□□□G11-4)	An exclusive filter to conform to the EMC Directive (emissions) in European standard. Note: Refer to the "Installation Manual" when installing the filter.
Output circuit filter (OFL-□□□-2) (OFL-□□□-4)	Connected to the output circuit of the low-noise type inverter (Carrier frequency :8kHz to 15kHz, 6kHz when exceeding 30kW) and used for the following purposes. ① Voltage vibration suppression at the motor terminals. Prevent damage to the motor insulation by surge voltage for the 400V series inverter. ② Leakage current reduction on the output side wiring. Reduce leakage current by parallel operation by multiple motors or long-distance wiring. - Length of wiring should be 400m or less. ③ To reduce induced noise and radiating noise from output wiring. Efective in long-distance wiring such as plant lines.
DC reactor (DCR2-□□□) (DCR4-□□□)	(For power cordination) ① Used when the capacity of the power supply transformer exceeds 500kVA and exceeds the rated capacity of the inverter tenfold. ② Used when a thyristor converter is connected as a common load on the same transformer. - If the commutating reactor is not used for the thyristor converter, an AC reactor is necessary at the inverter input side. Confirm. ③ Used to prevent an inverter OV trip from occurring when the phase advanced capacitor in the power line is switched on and off. ④ Used when the voltage imbalance exceeds 2%. Imbalance rate between phases [%] = (Max. Voltage [V] - Min. Voltage [V]) / 3-phase average voltage [V] x67% Power supply capacity 
	(For improving the input power-factor and reducing harmonics) Used to reduce the harmonic current (improvement of power-factor). * For details on the degree of reduction, see the materials attached to the guidelines, etc.
Surge suppressor (SZ-Z)	For magnetic contactor [Product of Fuji Electric Technica Co., Ltd.]
Frequency meter (TRM-45)(FM-60)	Analog frequency meter (45, 60 square) [Product of Fuji Electric Technica Co., Ltd.]
Frequency setting POT (VR) (RJ-13)(WA3W-1kΩ)	Frequency setting variable resistor [Product of Fuji Electric Technica Co., Ltd.]

Installation Position



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,Fuji Electric Co., Ltd. has chosen to classify the FRENIC 5000G11S/P11S 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 FRENIC Inverters and to his customer or the installer and the user.
FRENIC Inverters is 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**

Immunity : **Second environment** (Industrial environment)
Emission : **First environment** (Domestic environment) ;22kW or less
Second environment (Industrial environment) ;30kW or more

Finally, it is customer's responsibility to check whether the equipment conforms to EMC directive.

11-2 Recommended Installation Instructions

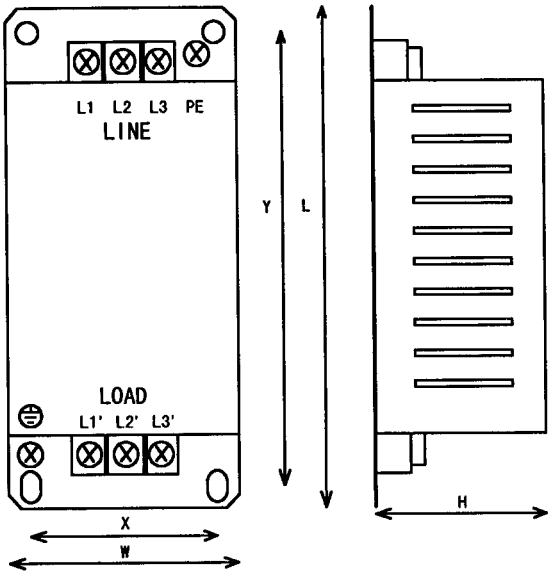
It is necessary that to conformed to EMC Directive, these instructions must be followed.
Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, Inverter and motor must be made by a qualified electrical technician.

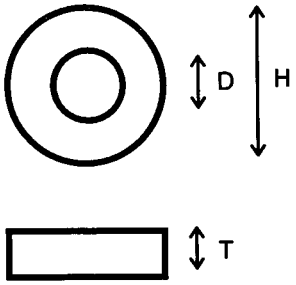
1) Use the correct filter according to Table 11-1.
2) Install the Inverter and filter in the electrically shielded metal wiring cabinet.
3) The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc. from the 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 systems, the length of the motor-cable should be as short as possible. "
6) In case of a ferrite ring is provided with the filter, fit a ferrite ring to the motor cable with the 3 phase conductors only passing twice through the center of the ferrite.

Table 11-1 RFI filters

Applied Inverter	Filter Type	Rated Current	Max. Rated Voltage	RFI filter			
				Dimensions LxWxH [mm]	Mount Dims Y x X[mm]	Ferrite Ring	Note
FRN0.2G11S-2 FRN0.4G11S-2 FRN0.75G11S-2	EFL-0.75SP-2	6A	3ph 230Vac	243x85x93	228x59	OF1	Fig. 11-1
FRN1.5G11S-2 FRN2.2G11S-2 FRN3.7G11S-2	EFL-3.7SP-2	25A		233x105x136	215x80	OF2	
FRN5.5G11S-2/P11S-2 FRN7.5G11S-2/P11S-2	EFL-7.5SP-2	50A		273x120x158	254x95	OF2	
FRN11G11S-2/P11S-2 FRN15G11S-2/P11S-2	EFL-15SP-2	100A		513x205x193	487x160	OF3	
FRN18.5G11S-2/P11S-2 FRN22G11S-2/P11S-2	EFL-22SP-2	150A		513x205x193	487x160	OF3	
FRN30G11S-2/P11S-2	RF3180-F11	180A		495x200x160	468x166	-	Fig. 11-3
FRN37G11S-2/P11S-2 FRN45G11S-2/11S-2	RF3280-F11	280A		250x587x205	560x85	-	Fig. 11-4
FRN55P11S-2/P11S-2 FRN75G11S-2/P11S-2 FRN90G11S-2/P11S-2 FRN110P11S-2	RF3400-F11	400A		250x587x205	560x85	-	
FRN0.4G11S-4 FRN0.75G11S-4	EFL-0.75G11-4	5A	3ph 480Vac	320x116x42	293x90	-	Fig. 11-2
FRN1.5G11S-4 FRN2.2G11S-4 FRN3.7G11S-4	EFL-4.0G11-4	12A		320x155x45	293x105	-	
FRN5.5G11S-4/P11S-4 FRN7.5G11S-4/P11S-4	EFL-7.5G11-4	35A		341x225x47.5	311x167	-	
FRN11G11S-4/P11S-4 FRN15G11S-4/P11S-4	EFL-15G11-4	50A		500x250x70	449x185	-	
FRN18.5G11S-4/P11S-4 FRN22G11S-4/P11S-4	EFL-22G11-4	72A		500x250x70	449x185	-	
FRN30G11S-4/P11S-4	RF3100-F11	100A		435x200x130	408x166	-	Fig. 11-3
FRN37G11S-4/P11S-4 FRN45G11S-4/P11S-4 FRN55G11S-4/P11S-4 FRN75G11S-4/P11S-4 FRN90G11S-4/P11S-4	RF3180-F11	180A		495x200x160	468x166	-	
FRN110G11S-4/P11S-4 FRN132G11S-4/P11S-4	RF3280-F11	280A		250x587x205	560x85	-	Fig. 11-4
FRN160G11S-4/P11S-4 FRN200G11S-4/P11S-4 FRN220G11S-4/P11S-4	RF3400-F11	400A		250x587x205	560x85	-	
FRN280G11S-4/P11S-4	RF3880-F11	880A		688x364x180	648x150	-	Fig. 11-5

Note : For detail, refer to the instruction manual that came with the RFI filters.





Ferrite Ring Dimensions

Part No.	D mm	H mm	T mm
OF1	25	51	17
OF2	41	71	18
OF3	72	100	27

Fig.11-1

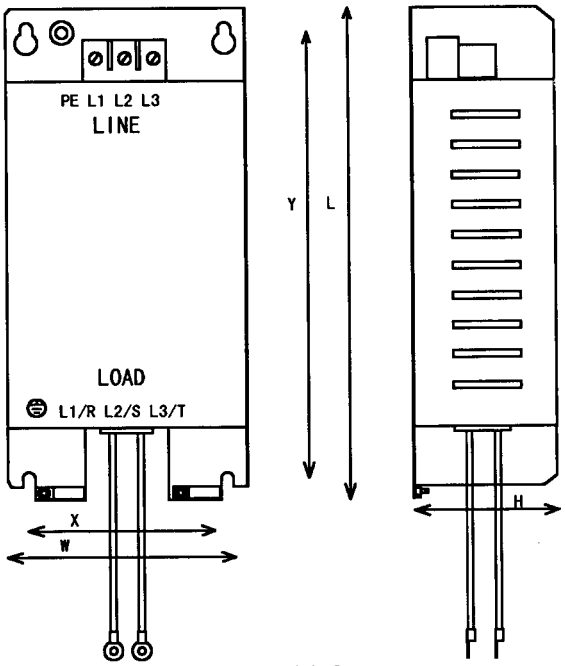
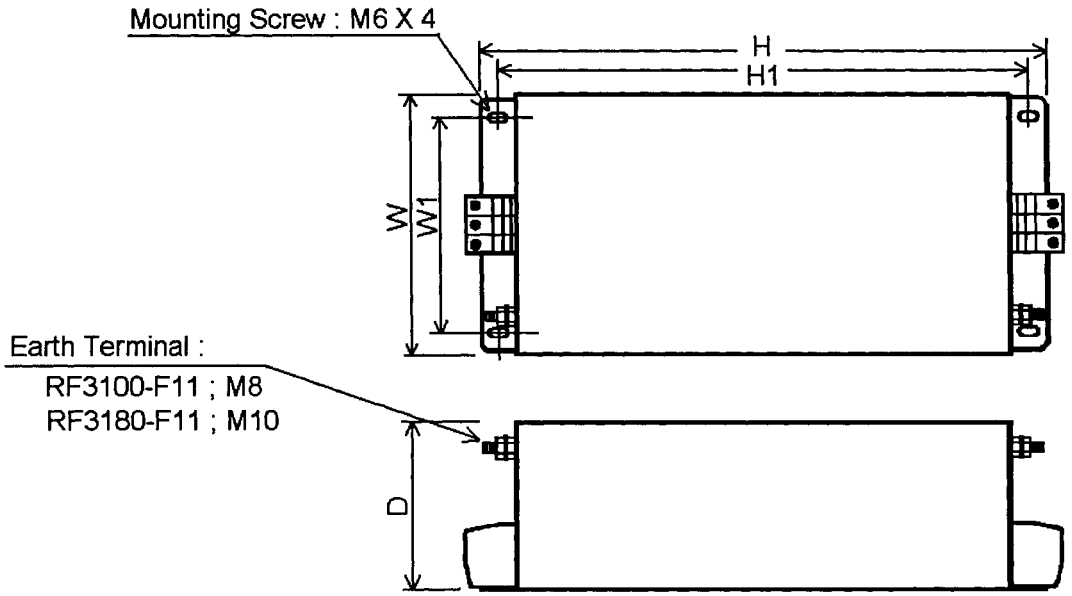


Fig.11-2



	Dimensions (mm)				
	W	W1	H	H1	D
RF3100-F11	200	166	435	408	130
RF3180-F11	200	166	495	468	160

Fig.11-3 Outline Dimensions (RF3100-F11, RF3180-F11)

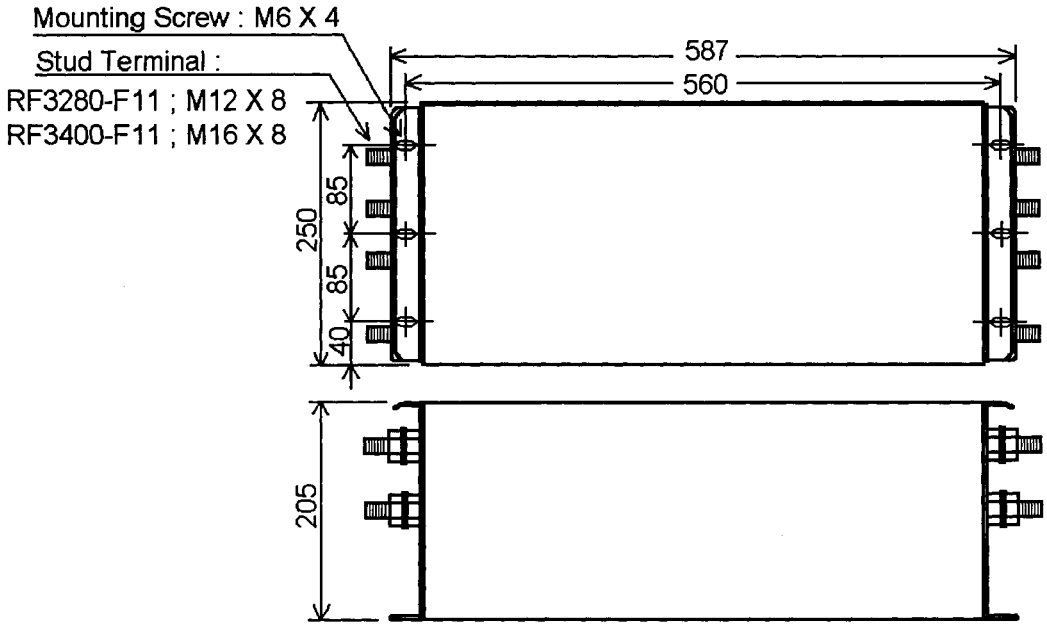


Fig.11-4 Outline Dimensions (RF3280-F11, RF3400-F11)

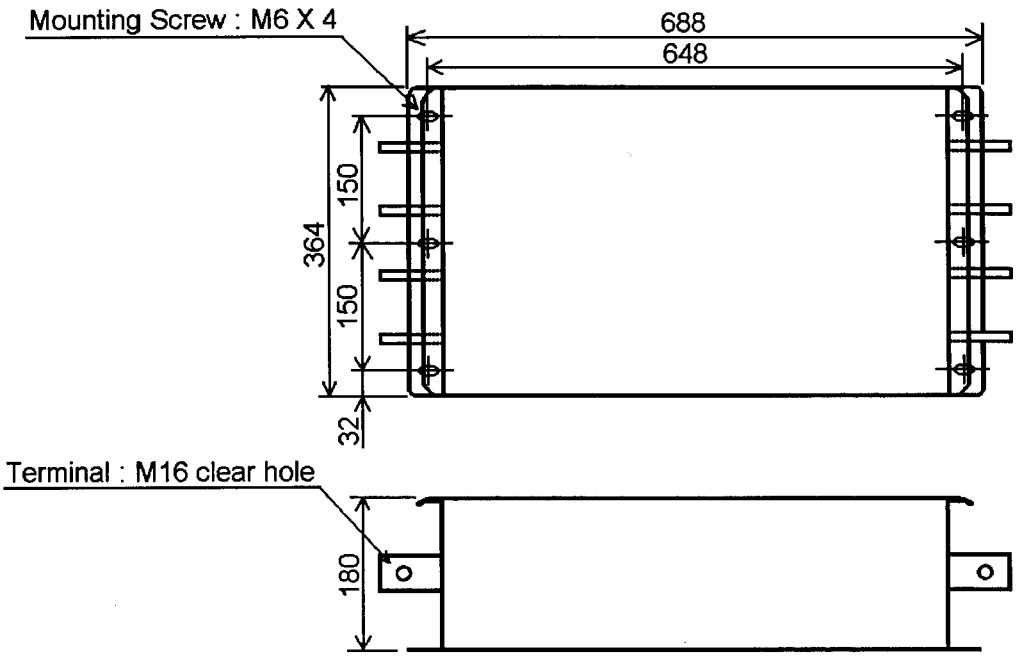


Fig.11-5 Outline Dimensions (RF3880-F11)

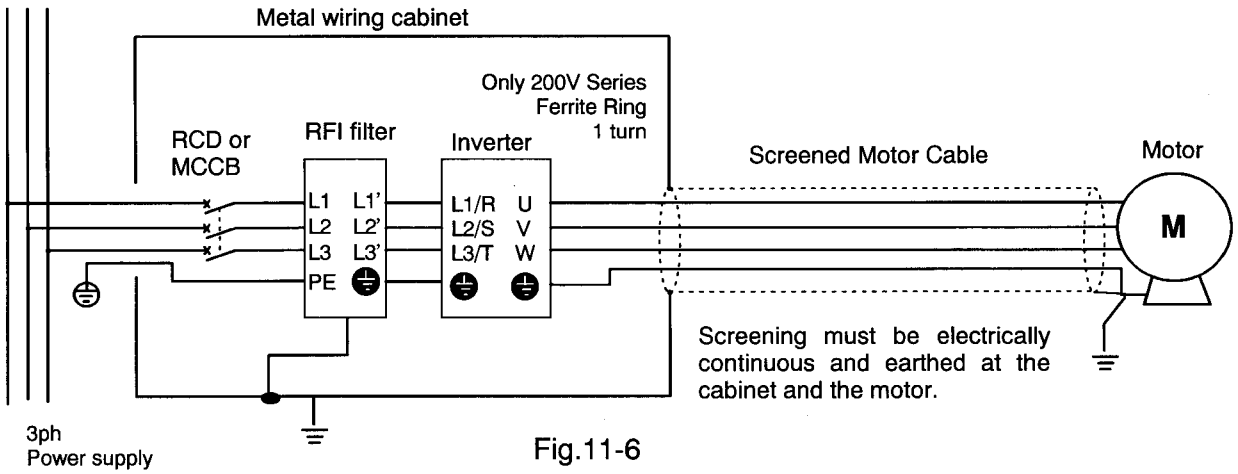


Fig.11-6