GEI-100497

FUJI ELECTRIC
GE Fuji Drives USA

AF-300 F11™

User's Guide

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WARNING:

This equipment contains a potential hazard of electric shock or burn. Only personnel who are adequately trained and thoroughly familiar with the equipment and the instructions should install, operate, or maintain this equipment.

Isolation of test equipment from the equipment under test presents potential electrical hazards. If the test equipment cannot be grounded to the equipment under test, the test equipment's case must be shielded to prevent contact by personnel.

To minimize hazard of electrical shock or burn, approved grounding practices and procedures must be strictly followed.

WARNING:

To prevent personal injury or equipment damage caused by equipment malfunction, only adequately trained personnel should modify any programmable machine.

Table of Contents

i. Preface i

Safety Instructions iii
Model Numbering System Diagram vi
Dimensions & Weights vii

1. Before Using This Product 1-1

Receiving Instructions 1-1
Appearance 1-1
Handling the Product 1-2
Carrying 1-3
Storage 1-3
Ratings Efficiency and Watts Loss 1-4

2. Installation Environment and Connection 2-1

Operating Environment 2-1
Installation Method 2-1
Connection 2-3
Basic Connection Diagrams 2-4
Connecting the Main Circuit and Ground Terminals 2-8
Connecting the Control Terminals 2-11
Terminal Configuration 2-15
Cable Size, Tightening Torque & Circuit Protection Rating 2-16
DC Link Reactor 2-17

3. Operation 3-1

Inspection and Preparation Before Operation 3-1
Operation Method 3-1
Trial Run 3-1

4. Keypad 4-1

Appearance of Keypad 4-1
Remote/Local mode change while the drive is running 4-2
Operation From the Keypad 4-3
Normal Operation 4-3
Alarm Modes 4-3
Entering Data on the Keypad 4-5
Operation Mode 4-5
Setting Digital Frequency 4-5
Switching to LED Digital Monitor 4-6
Program Menu Screen 4-6
Setting Function Data 4-6
Checking Function Data 4-8
Monitoring Operating Status 4-8
I/O Check 4-9
Maintenance Information 4-10
Load Rate Measurement 4-11
Alarm Information 4-12
Alarm History and Factors 4-13
Data Copy 4-14
Alarm Mode 4-16

5. Function Selection 5-1

Function Selection List 5-1
Alphabetical Function List 5-3
Function Explanation 5-4
F: Fundamental Functions 5-4
E: Extensions Terminal Functions 5-13
C: Control Functions of Frequency 5-21

6. Protective Operations 6-1

List of Protective Functions 6-1
Alarm Reset 6-2

7. Troubleshooting 7-1

Activation of Protective Function 7-1
Abnormal Motor Rotation 7-5

8. Maintenance and Inspection 8-1

Daily Inspections 8-1
Periodic Inspections 8-1
Main Circuit Measurements 8-4
Insulation Test 8-5
Replacement Parts 8-5

9. Warranty Parts and Service 9-1

In-Warranty Failure Checklist 9-2

10. Replacement Parts 10-1

11. Specifications 11-1

Standard Specifications 11-1
Common Specifications 11-3
Outline Dimensions 11-5
Keypad Mounting Hole 11-12

12. RS485 Modbus RTU Serial Communications 12-1

Transmission Specification 12-1
Connection 12-1
Serial Interface Configuration 12-1
Modbus RTU Functions 12-1
Drive Function Code Access 12-2
Command and Monitor Data Registers 12-2
Data Format Specification 12-4
Communication Errors 12-8

13. Options 13-1

Built-in Options 13-1

Safety Instructions

Read this manual carefully before installing, connecting (wiring), operating, servicing, or inspecting the drive.

Familiarize yourself with all safety features before using the drive.

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

Instructions on Installation

WARNING

- Do not place combustible or flammable material near this drive.

CAUTION

- Do not hold or carry this drive by its cover. Do not drop the converter, as injury may result.
- Ensure that the drive and heat sink surfaces are kept free of foreign matter (lint, paper dust, small chips of wood or metal, and dust).
- Do not install or operate a damaged drive or a drive with missing parts, as electric shock or injury may occur.

Instructions on Wiring

WARNING

- Connect the drive 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 all wiring work, as electric shock may result.
- Turn off the power before wiring, as electric shock may result.
- Wire the drive after mechanical installation is complete, as electric shock or injury may occur.

CAUTION

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

Instructions on Operation

WARNING

- Be sure to install the cover before turning on the power. Do not remove the cover while power to the drive 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 drive 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 parameters (acceleration/deceleration time or speed). In this case, personal safety must be assured. An accident may result.
- Operations can start up suddenly, after an alarm is reset, if there is a run signal present. Confirm that the run signal input is not present before resetting the alarm. Accident may result.
- Do not touch drive terminals when energized, even if the drive has stopped. Electric shock may result.

CAUTION

- Do not start or stop the drive 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.
- Since the drive can reach high speed operation easily, carefully check the performance of motor or machine before changing any speed settings. Injury may result.
- Do not use the drive braking function for mechanical holding. Injury may result.

Instructions on Maintenance, Inspection, and Replacement

WARNING

- Wait a minimum of five minutes (6KF11L080, 6KF11H044 and below) or ten minutes (6KF11L115, 6KF11H060 and above) 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(-) does not exceed 25V. Electrical shock may result.
- Only authorized personnel should perform maintenance, inspection, and replacement operations. Remove all metal jewelry such as watches and rings. Use insulated tools only. Electric shock or injury may result.

Instructions on Disposal

CAUTION

- Treat as industrial waste when disposing of drive. Injury may result.

Instructions for UL/cUL Requirements

CAUTION

- Hazard of electrical shock. Disconnect incoming power before working on this control.
- Dangerous voltage exist until charge light is off.
- Type1 - indoor use only.
- Tightening torque and wire size for field wiring terminal are marked adjacent to the terminal or on the wiring diagram.
- In case of using auxiliary control-power input, connect it by referring to the basic connection diagram (2-3-1).
- Suitable for use on a circuit capable of delivering not more than 100,000rms symmetrical amperes.
- Use 60/75 °C CU wire only.
- A Class 2 circuit wired with Class 1 wire (6KF11L080, 6KF11H044 and below). Use Class 1 wire only (6KF11L115, 6KF11H060 and above).
- 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.
- Solid state motor overload protection is provided in each model.

Other Instructions

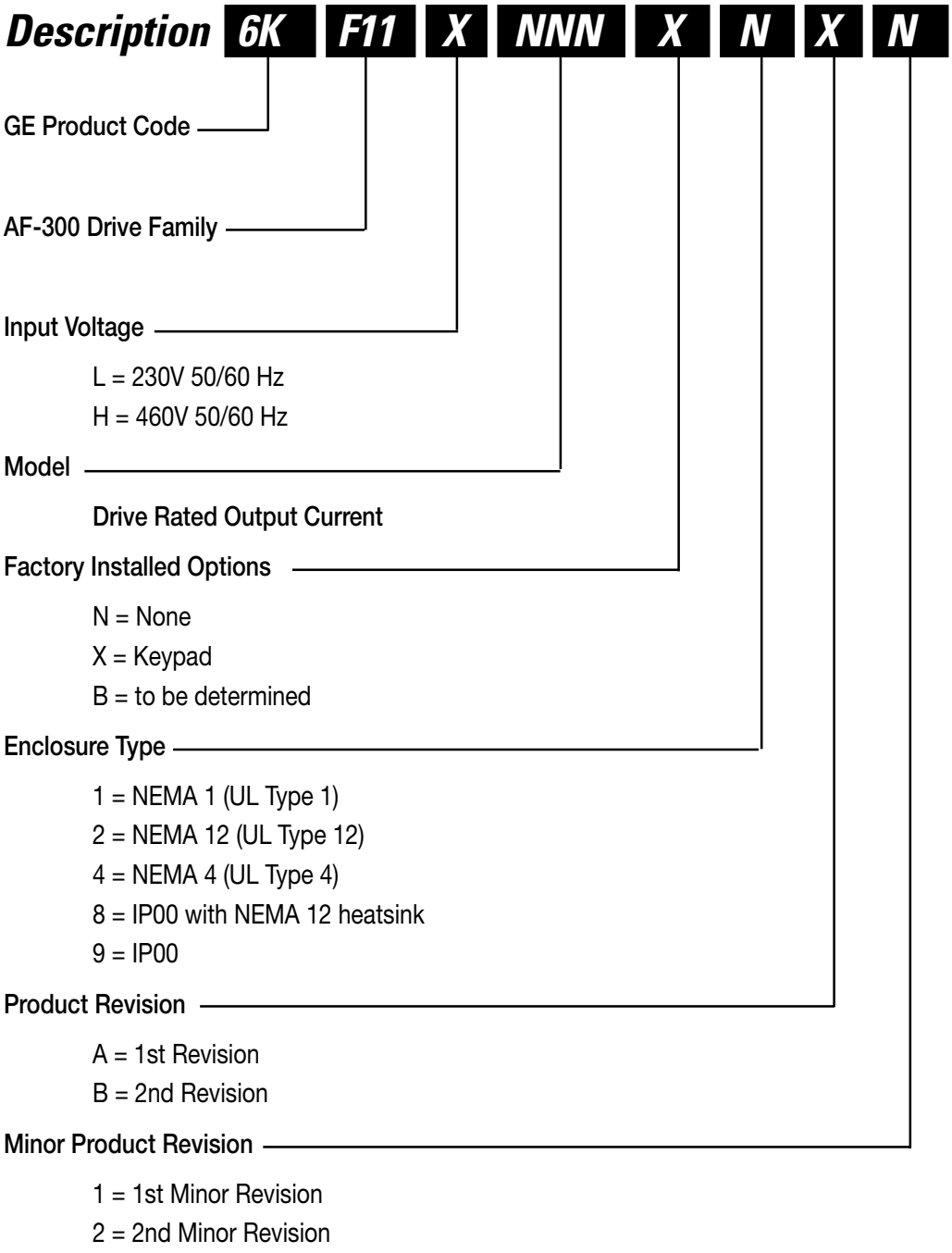
WARNING

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

General Instructions

For clarity, some figures in this manual may show the drive with covers and safety screens removed for explanation purposes. Do not operate the device until all such covers and screens have been replaced.

AF-300 F11™ Model Numbering System Diagram



AF-300 F11 Dimensions & Weights

AF-300 F11

AF-300 F11 Model No.	NEMA Enclosure	Rated Output Current (A)	Overload (110% 1min.)	HP Rating	Catalog No.	Dimensions H x W x D (inches)	Weight (lbs)
230VAC, 3 phase, 50/60Hz Input, NEMA 1							
6KF11L002X1##	1	1.5	1.7	0.25	D7000	10.24 x 4.33 x 5.12	4.8
6KF11L003X1##	1	3	3.3	0.5	D7001	10.24 x 4.33 x 5.12	4.8
6KF11L005X1##	1	5	5.5	1	D7002	10.24 x 4.33 x 5.71	5.5
6KF11L008X1##	1	8	8.8	2	D7003	10.24 x 5.91 x 5.71	8.4
6KF11L011X1##	1	11	12	3	D7004	10.24 x 5.91 x 5.71	8.4
6KF11L017X1##	1	17	19	5	D7005	10.24 x 5.91 x 5.71	8.4
6KF11L022X1##	1	22	24	7.5	D7006	10.24 x 8.66 x 7.68	12.6
6KF11L029X1##	1	29	32	10	D7007	10.24 x 8.66 x 7.68	12.6
6KF11L042X1##	1	42	46	15	D7008	10.24 x 8.66 x 7.68	12.6
6KF11L055X1##	1	55	61	20	D7009	15.75 x 9.84 x 7.68	22.0
6KF11L068X1##	1	68	75	25	D7010	15.75 x 9.84 x 7.68	22.0
6KF11L080X1##	1	80	88	30	D7011	15.75 x 9.84 x 7.68	23.1
6KF11L115X1##	1	115	127	40	D7012	29.7 x 13.5 x 10.0	70
6KF11L145X1##	1	145	160	50	D7013	29.7 x 13.5 x 10.0	70
6KF11L180X1##	1	180	198	60	D7014	33.1 x 14.9 x 10.6	86
6KF11L215X1##	1	215	237	75	D7015	38.0 x 14.9 x 10.6	106
6KF11L283X1##	1	283	311	100	D7016	38.0 x 14.9 x 10.6	110
6KF11L346X1##	1	346	381	125	D7017	41.3 x 21.0 x 11.2	172
6KF11L415X1##	1	415	457	150	D7018	50.4 x 26.9 x 14.2	282
230VAC, 3 phase, 50/60Hz Input, NEMA 4							
6KF11L002X4##	4	1.5	1.7	0.25	D7019	10.24 x 4.33 x 5.12	4.8
6KF11L003X4##	4	3	3.3	0.5	D7020	10.24 x 4.33 x 5.12	4.8
6KF11L005X4##	4	5	5.5	1	D7021	10.24 x 4.33 x 5.71	5.5
6KF11L008X4##	4	8	8.8	2	D7022	10.24 x 5.91 x 5.71	8.4
6KF11L011X4##	4	11	12	3	D7023	10.24 x 5.91 x 5.71	8.4
6KF11L017X4##	4	17	19	5	D7024	10.24 x 5.91 x 5.71	8.4
6KF11L022X4##	4	22	24	7.5	D7025	10.24 x 8.66 x 7.68	12.6
6KF11L029X4##	4	29	32	10	D7026	10.24 x 8.66 x 7.68	12.6
6KF11L042X4##	4	42	46	15	D7027	10.24 x 8.66 x 7.68	12.6
230VAC, 3 phase, 50/60Hz Input, NEMA 12							
6KF11L055X2##	12	55	61	20	D7028	15.75 x 9.84 x 7.68	22.0
6KF11L068X2##	12	68	75	25	D7029	15.75 x 9.84 x 7.68	22.0
6KF11L080X2##	12	80	88	30	D7030	15.75 x 9.84 x 7.68	23.1
230VAC, 3 phase, 50/60Hz Input, Open							
6KF11L115X9##	Open	115	127	40	---	21.7 x 13.4 x 10.0	64
6KF11L145X9##	Open	145	160	50	---	21.7 x 13.4 x 10.0	64
6KF11L180X9##	Open	180	198	60	---	24.2 x 14.8 x 10.6	79
6KF11L215X9##	Open	215	237	75	---	29.1 x 14.8 x 10.6	97
6KF11L283X9##	Open	283	311	100	---	29.1 x 14.8 x 10.6	101
6KF11L346X9##	Open	346	381	125	---	29.5 x 20.9 x 11.2	154
6KF11L415X9##	Open	415	457	150	---	34.6 x 26.8 x 14.2	253

Indicates product revision.

Note: Hp rating is shown for 230V and 460V nominal systems.

When applying at lower voltage, select the drive by rated current and not Hp rating.

AF-300 F11 Dimensions & Weights

AF-300 F11

AF-300 F11 Model No.	NEMA Enclosure	Rated Output Current (A)	Overload (110% 1min.)	HP Rating	Catalog No.	Dimensions H x W x D (inches)	Weight (lbs)
230VAC, 3 phase, 50/60Hz Input, Open with NEMA 12 Heatsink							
6KF11L115X8##	Open	115	127	40	---	21.7 x 13.4 x 10.0	64
6KF11L145X8##	Open	145	160	50	---	21.7 x 13.4 x 10.0	64
6KF11L180X8##	Open	180	198	60	---	24.2 x 14.8 x 10.6	79
6KF11L215X8##	Open	215	237	75	---	29.1 x 14.8 x 10.6	97
6KF11L283X8##	Open	283	311	100	---	29.1 x 14.8 x 10.6	101
6KF11L346X8##	Open	346	381	125	---	29.5 x 20.9 x 11.2	154
6KF11L415X8##	Open	415	457	150	---	34.6 x 26.8 x 14.2	253
460VAC, 3 phase, 50/60Hz Input, NEMA 1							
6KF11H002X1##	1	1.5	1.7	0.5	D7031	10.24 x 4.33 x 5.12	4.8
6KF11H003X1##	1	2.5	2.8	1	D7032	10.24 x 4.33 x 5.71	5.5
6KF11H004X1##	1	3.7	4.1	2	D7033	10.24 x 5.91 x 5.71	8.4
6KF11H006X1##	1	5.5	6.1	3	D7034	10.24 x 5.91 x 5.71	8.4
6KF11H009X1##	1	9	9.9	5	D7035	10.24 x 5.91 x 5.71	8.4
6KF11H013X1##	1	12.5	14	7.5	D7036	10.24 x 8.66 x 7.68	13.4
6KF11H017X1##	1	16.5	18	10	D7037	10.24 x 8.66 x 7.68	13.4
6KF11H023X1##	1	23	25	15	D7038	10.24 x 8.66 x 7.68	13.4
6KF11H030X1##	1	30	33	20	D7039	15.75 x 9.84 x 7.68	22.0
6KF11H037X1##	1	37	41	25	D7040	15.75 x 9.84 x 7.68	22.0
6KF11H044X1##	1	44	48	30	D7041	15.75 x 9.84 x 7.68	23.1
6KF11H060X1##	1	60	66	40	D7042	29.7 x 13.5 x 10.0	70
6KF11H075X1##	1	75	83	50	D7043	29.7 x 13.5 x 10.0	70
6KF11H091X1##	1	91	100	60	D7044	29.7 x 14.9 x 10.6	82
6KF11H112X1##	1	112	123	75	D7045	34.6 x 14.9 x 10.6	95
6KF11H150X1##	1	150	165	100	D7046	34.6 x 14.9 x 10.6	97
6KF11H176X1##	1	176	194	125	D7047	38.0 x 14.9 x 10.6	115
6KF11H210X1##	1	210	231	150	D7048	38.0 x 21.0 x 12.4	174
6KF11H253X1##	1	253	278	200	D7049	38.0 x 21.0 x 12.4	174
6KF11H304X1##	1	304	334	250	D7050	53.1 x 21.0 x 14.2	245
6KF11H377X1##	1	377	415	300	D7051	53.1 x 21.0 x 14.2	245
6KF11H415X1##	1	415	457	350	D7052	55.1 x 26.9 x 14.2	337
6KF11H485X1##	1	485	534	400	D7053	55.1 x 26.9 x 14.2	337
6KF11H520X1##	1	520	572	450	D7054	55.1 x 26.9 x 14.2	337
6KF11H650X1##	1	650	715	500	D7055	57.1 x 26.8 x 17.7	562
6KF11H740X1##	1	740	814	600	D7056	57.1 x 26.8 x 17.7	562
6KF11H840X1##	1	840	924	700	D7057	57.1 x 34.6 x 17.7	804
6KF11H960X1##	1	960	1056	800	D7058	57.1 x 34.6 x 17.7	804
460VAC, 3 phase, 50/60Hz Input, NEMA 4							
6KF11H002X4##	4	1.5	1.7	0.5	D7059	10.24 x 4.33 x 5.12	4.8
6KF11H003X4##	4	2.5	2.8	1	D7060	10.24 x 4.33 x 5.71	5.5
6KF11H004X4##	4	3.7	4.1	2	D7061	10.24 x 5.91 x 5.71	8.4
6KF11H006X4##	4	5.5	6.1	3	D7062	10.24 x 5.91 x 5.71	8.4
6KF11H009X4##	4	9	9.9	5	D7063	10.24 x 5.91 x 5.71	8.4
6KF11H013X4##	4	12.5	14	7.5	D7064	10.24 x 8.66 x 7.68	13.4
6KF11H017X4##	4	16.5	18	10	D7065	10.24 x 8.66 x 7.68	13.4
6KF11H023X4##	4	23	25	15	D7066	10.24 x 8.66 x 7.68	13.4

Indicates product revision.

Note: Hp rating is shown for 230V and 460V nominal systems.

When applying at lower voltage, select the drive by rated current and not Hp rating.

AF-300 F11 Dimensions & Weights

AF-300 F11

AF-300 F11 Model No.	NEMA Enclosure	Rated Output Current (A)	Overload (110% 1min.)	HP Rating	Catalog No.	Dimensions H x W x D (inches)	Weight (lbs)
460VAC, 3 phase, 50/60Hz Input, NEMA 12							
6KF11H030X2##	12	30	33	20	D7067	15.75 x 9.84 x 7.68	22.0
6KF11H037X2##	12	37	41	25	D7068	15.75 x 9.84 x 7.68	22.0
6KF11H044X2##	12	44	48	30	D7069	15.75 x 9.84 x 7.68	23.1
460VAC, 3 phase, 50/60Hz Input, Open							
6KF11H060X9##	Open	60	66	40	---	21.7 x 13.4 x 10.0	64
6KF11H075X9##	Open	75	83	50	---	21.7 x 13.4 x 10.0	64
6KF11H091X9##	Open	91	100	60	---	21.7 x 14.8 x 10.6	75
6KF11H112X9##	Open	112	123	75	---	26.6 x 14.8 x 10.6	86
6KF11H150X9##	Open	150	165	100	---	26.6 x 14.8 x 10.6	88
6KF11H176X9##	Open	176	194	125	---	29.1 x 14.8 x 10.6	106
6KF11H210X9##	Open	210	231	150	---	29.1 x 20.9 x 12.4	154
6KF11H253X9##	Open	253	278	200	---	29.1 x 20.9 x 12.4	154
6KF11H304X9##	Open	304	334	250	---	39.4 x 20.9 x 14.2	220
6KF11H377X9##	Open	377	415	300	---	39.4 x 20.9 x 14.2	220
6KF11H415X9##	Open	415	457	350	---	39.4 x 26.8 x 14.2	308
6KF11H485X9##	Open	485	534	400	---	39.4 x 26.8 x 14.2	308
6KF11H520X9##	Open	520	572	450	---	39.4 x 26.8 x 14.2	308
6KF11H650X9##	Open	650	715	500	---	55.1 x 26.8 x 17.7	551
6KF11H740X9##	Open	740	814	600	---	55.1 x 26.8 x 17.7	551
6KF11H840X9##	Open	840	924	700	---	55.1 x 35.6 x 17.7	793
6KF11H960X9##	Open	960	1056	800	---	55.1 x 35.6 x 17.7	793
460VAC, 3 phase, 50/60Hz Input, Open with NEMA 12 Heatsink							
6KF11H060X8##	Open	60	66	40	---	21.7 x 13.4 x 10.0	64
6KF11H075X8##	Open	75	83	50	---	21.7 x 13.4 x 10.0	64
6KF11H091X8##	Open	91	100	60	---	21.7 x 14.8 x 10.6	75
6KF11H112X8##	Open	112	123	75	---	26.6 x 14.8 x 10.6	86
6KF11H150X8##	Open	150	165	100	---	26.6 x 14.8 x 10.6	88
6KF11H176X8##	Open	176	194	125	---	29.1 x 14.8 x 10.6	106
6KF11H210X8##	Open	210	231	150	---	29.1 x 20.9 x 12.4	154
6KF11H253X8##	Open	253	278	200	---	29.1 x 20.9 x 12.4	154
6KF11H304X8##	Open	304	334	250	---	39.4 x 20.9 x 14.2	220
6KF11H377X8##	Open	377	415	300	---	39.4 x 20.9 x 14.2	220
6KF11H415X8##	Open	415	457	350	---	39.4 x 26.8 x 14.2	308
6KF11H485X8##	Open	485	534	400	---	39.4 x 26.8 x 14.2	308
6KF11H520X8##	Open	520	572	450	---	39.4 x 26.8 x 14.2	308
6KF11H650X8##	Open	650	715	500	---	55.1 x 26.8 x 17.7	551
6KF11H740X8##	Open	740	814	600	---	55.1 x 26.8 x 17.7	551
6KF11H840X8##	Open	840	924	700	---	55.1 x 35.6 x 17.7	793
6KF11H960X8##	Open	960	1056	800	---	55.1 x 35.6 x 17.7	793

Indicates product revision.

Note: Hp rating is shown for 230V and 460V nominal systems.

When applying at lower voltage, select the drive by rated current and not Hp rating.

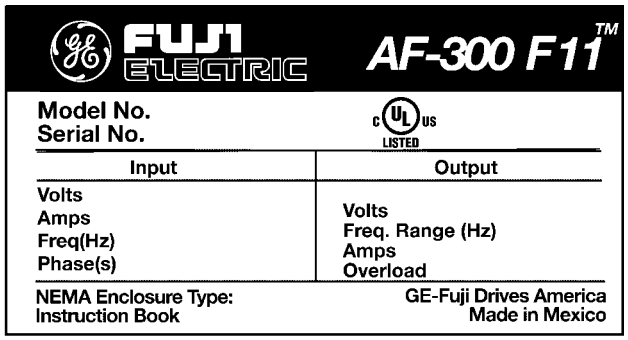
1. Before Using This Product

1.1 Receiving Instructions

Unpack and check the product as explained below.

If you have any questions about the product, contact GE Fuji Drives or your local GE Drives distributor.

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



Ratings Nameplate

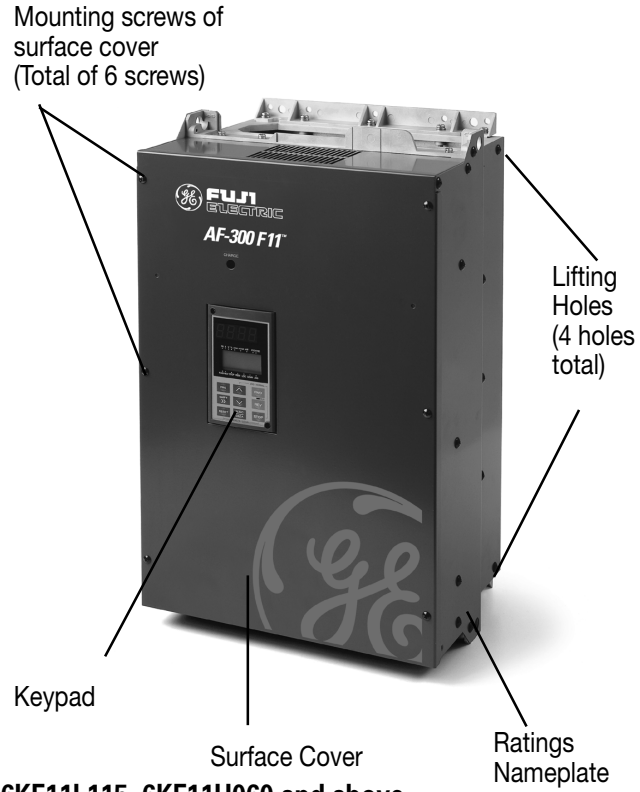
SER. No. : 02 1 0 - 0 0 0 1 2 M 0 0 01

- Production lot serial number
- Production week: Fiscal week (01 to 53)
- Production year: Last two digits of year (02 = 2002)

2. Check for damaged and/or missing parts upon delivery.
3. In addition to the drive unit and this manual, the package contains rubber bushings (for products with 6KF11L080, 6KF11H044and below) and a terminating resistor (1/2 W, 120 ohm). The terminating resistors for products with 6KF11L080, 6KF11H044 and below are packaged separately. The terminating resistors for products with 6KF11L115, 6KF11H060 and above are installed internal to the drive unit. To connect the internal terminating resistor, place hardware jumper J2 to the "ON" position. This terminating resistor is required for RS485 Modbus RTU communication.
4. On drives rated 6KF11L283,6KF11H150 and above, a separately mounted DC Link Reactor is provided. The reactor should be checked for proper rating before installation.

1.2 Appearance

6KF11L080, 6KF11H044 and below



6KF11L115, 6KF11H060 and above

1.3 Handling the Product

(1) Removing the Cover

For drives 6KF11L080, 6KF11H044 and below, loosen the cover mounting screws, then remove the cover by pulling from the top (see Figure 1.3.1).

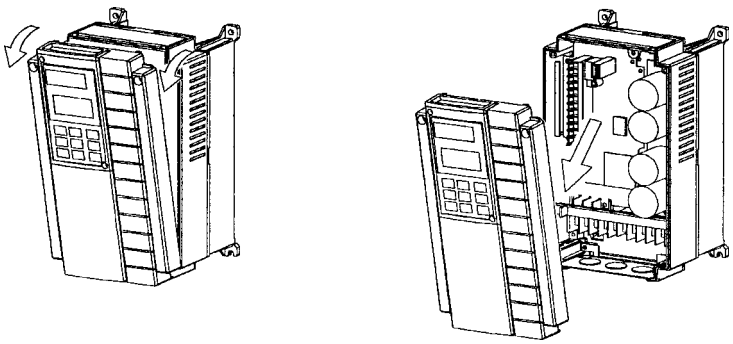


Fig.1-3-1 Removing the Cover

For drives 6KF11L115, 6KF11H060 and above, first remove the six cover mounting screws, then remove the cover.

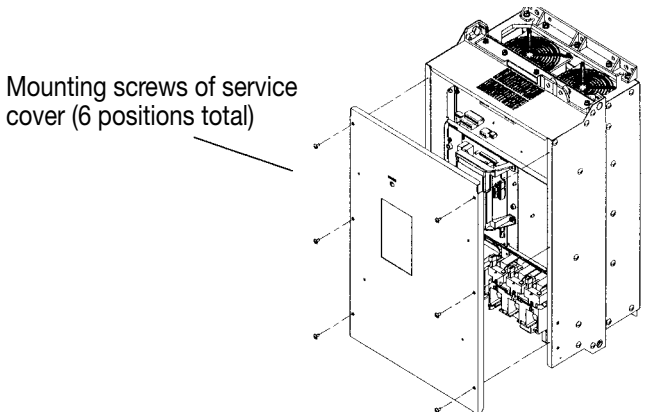


Fig.1-3-2 Removing the Cover

(2) Removing the Keypad

After removing the cover as explained in (1), loosen the keypad mounting screws and remove as shown in Figure 1.3.3 for drives 6KF11L080, 6KF11H044 and below.

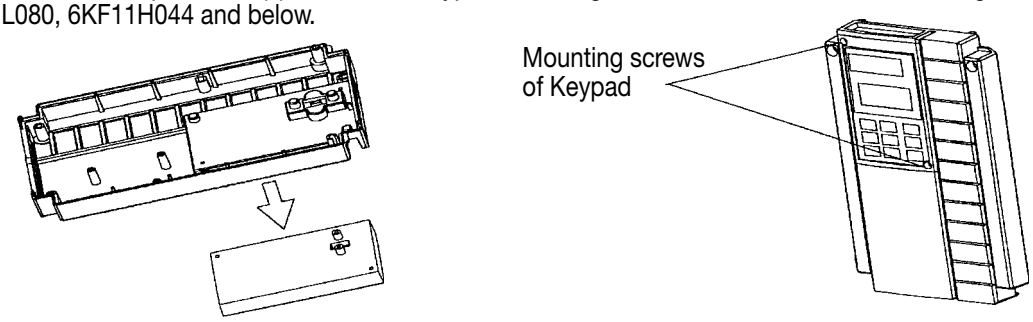


Fig.1-3-3 Removing the Keypad

For drives 6KF11L115, 6KF11H060 and above, loosen the keypad mounting screws and remove, using the finger holds on the keypad case.

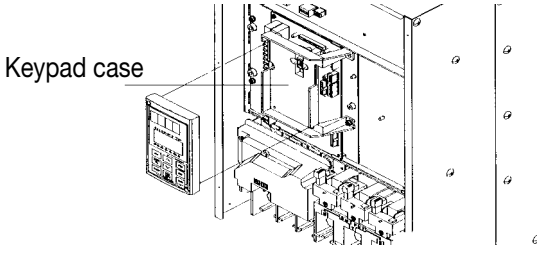


Fig.1-3-4 Removing the Keypad

1.4 Carrying

Carry the product by the main unit. Do not carry the product by its 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 the conditions listed in Table 1-5-1.

Table 1-5-1 Storage Environment

Item		Specifications
Ambient Temperature	-10 to +50°C (+14 to +122°F)	Condensation or freezing, as a result of sudden temperature changes, must not occur.
Storage Temperature	-25 to +65°C[1] (-4 to +149°F)	
Relative Humidity	5 to 95%[2]	
Atmosphere	The standard product must not be exposed to dust, direct sunlight, corrosive gas, flammable gas, oil mist, vapor, water drops, or vibration. The salt content in the atmosphere should be minimized.	

Note 1: The storage temperature applies only to short periods of time, such as during transport. Refer to comments on extended storage guidelines.

Note 2: Since a large change in temperature within this humidity range may result in condensation or freezing, do not store where such temperature changes may occur.

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

Long-term Storage

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

The general long-term storage method is as follows:

1. The above conditions for temporary storage must be satisfied.If the storage period exceeds three months, the upper limit of ambient temperature must be reduced to 30°C (86°F) to prevent the deterioration of the electrolytic capacitors.
2. Pack the product thoroughly to eliminate exposure to moisture and include a drying agent to ensure a relative humidity of about 70% or less.
3. Do not leave the product mounted in a control panel and exposed to the elements like moisture or dust (particularly on a construction site). In this case, remove the product and store in a suitable environment.
4. Electrolytic capacitors will deteriorate if not provided with power for an extended period of time. Do not store electrolytic capacitors for one year or longer without providing power.

1.6 AF-300 F11 Drive Ratings Efficiency and Watts Loss

	Rated Output Current (A)	Rated Output Power (KVA)	Efficiency at 2KHz (%)	Efficiency at 15KHz (%)	Watts Loss at 2KHz (W)	Watts Loss at 15KHz (W)
230VAC						
6KF11L002	1.5	0.59	92.0	90.5	25	30
6KF11L003	3	1.1	93.5	91.7	35	45
6KF11L005	5	1.9	94.9	94.0	50	60
6KF11L008	8	3.1	95.7	94.1	80	110
6KF11L011	11	4.3	95.9	94.9	110	140
6KF11L017	17	6.7	96.2	95.4	170	210
6KF11L022	22	8.7	96.2	95.2	210	280
6KF11L029	29	11	96.5	95.3	290	370
6KF11L042	42	16	96.4	95.2	410	550
6KF11L055	55	21	96.9	95.9	500	670
6KF11L068	68	26	96.8	95.8	630	840
6KF11L080	80	31	96.5	95.5	770	1030
			2KHz (%)	10KHz (%)	2KHz (W)	10KHz (W)
6KF11L115	115	45	97.2	96.8	950	1100
6KF11L145	145	57	97.0	96.7	1250	1400
6KF11L180	180	71	97.1	96.6	1500	1750
6KF11L215	215	85	97.3	96.6	1700	1950
6KF11L283	283	112	97.4	97.0	2200	2500
			2KHz (%)	6KHz (%)	2KHz (W)	6KHz (W)
6KF11L346	346	137	97.4	97.2	2650	2800
6KF11L415	415	165	97.4	97.3	3200	3350
460VAC						
6LF11H002	1.5	1.1	93.5	89.3	35	60
6LF11H003	2.5	1.9	95.4	91.7	45	85
6LF11H004	3.7	2.9	96.7	94.1	60	110
6LF11H006	5.5	4.3	97.0	94.5	80	150
6LF11H009	9	7.1	97.1	95.0	130	230
6LF11H013	12.5	9.9	97.3	95.3	160	290
6LF11H017	16.5	13.1	97.3	95.4	210	370
6LF11H023	23	18.3	97.6	95.9	300	520
6LF11H030	30	23.9	97.9	96.5	360	610
6LF11H037	37	29.4	97.8	96.4	460	770
6LF11H044	44	35	97.8	96.4	530	870
			2KHz (%)	10KHz (%)	2KHz (W)	10KHz (W)
6LF11H060	60	47	97.8	96.9	750	1050
6LF11H075	75	59	97.7	96.9	950	1300
6LF11H091	91	72	97.8	97.0	1100	1550
6LF11H112	112	89	97.8	97.0	1350	1900
6LF11H150	150	119	97.8	97.1	1800	2450
			2KHz (%)	6KHz (%)	2KHz (W)	6KHz (W)
6LF11H176	176	140	98.1	97.8	1850	2200
6LF11H210	210	167	98.0	97.8	2400	2750
6LF11H253	253	202	98.0	97.7	2900	3350
6LF11H304	304	242	98.1	97.8	3250	3800
6LF11H377	377	300	98.1	97.8	4250	4900
6LF11H415	415	330	98.2	97.9	4350	5100
6LF11H485	485	386	98.1	97.8	5100	5900
6LF11H520	520	414	98.1	97.8	5700	6650
6LF11H650	650	518	98.2	97.9	6900	8050
6LF11H740	740	590	98.1	97.8	8050	9350
6LF11H840	840	669	98.2	97.9	8900	10400
6LF11H960	960	765	98.1	97.8	10300	12100

2. Installation Environment and Connection

2.1 Operating Environment

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

Table 2-1-1 Operating Environment

Item	Specifications
Location	Indoors
Ambient Temperature	-10 to +50°C (+14 to +122°F) - for products of 6KF11L080, 6KF11H044 and below, the ventilating covers must be removed if ambient temperature exceeds in the panel+40°C (104°F), NEMA Type 4 & 12 Unit -10 to +40°C (+14 to +104°F)
Relative Humidity	5 to 95% (No condensation).
Atmosphere	The product must not be exposed to dust, direct sunlight, corrosive gas, oil mist, vapor, or water. There must be a minimum salt content in the atmosphere. Do not store where condensation may occur as a result of sudden changes in temperature.
Altitude	1000 m (3300 feet) or lower - For altitude above 1000 m (3300 feet), see Table 2-1-2.
Vibration	3mm peak from 2 to 9Hz, 9.8m/s2 from 9 to 20Hz, 2m/s2 from 20-55Hz, 1m/s2 from 55 to 200Hzs.

2.2 Installation Method

1. Securely fasten the product in an upright position on a solid structure with the tag AF-300 F11 facing the front. Do not turn the product upside down or install in a horizontal position. Fig. 2-2-1
2. Since heat is generated during drive operation, the spaces shown in Fig. 2-2-1 are required to ensure sufficient cooling. Do not install the product beneath a device sensitive to heat as heat radiates upward.
3. The heat sink may reach a temperature of 90°C (+194°F) during drive 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 the drive's ambient temperature 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 drives must be installed in the same device or control panel, arrange the units horizontally to minimize the effect of heat. If two or more drives must be installed vertically, place an insulated plate between the drives to minimize the effect of heat.
6. When shipped from the factory, drives provide internal cooling inside the panel. A drive of 6KF11L080,6KF11H044 and below can be converted to external cooling simply by adding an optional mounting adapter.

CAUTION
Ensure that the drive and heat sink surfaces are kept free of foreign matter such as lint, paper dust, small chips of wood or metal, and dust.

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

Altitude	Output current reduction rate
3300 feet (1000m or lower)	1
3300-4950 feet (1000-1500m)	0.97
4950-6600 feet (1500-2000m)	0.95
6600-8250 feet (2000-2500m)	0.91
8250-9900 feet (2500-3000m)	0.88

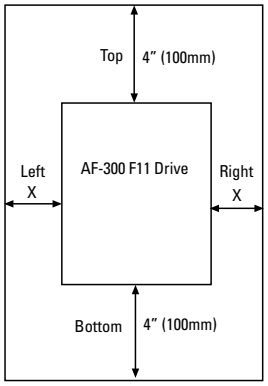


Fig. 2-2-1 6KF11L080,6KF11H044 and below: Gap X can be 0. (side-by-side installation) 6KF11L115, 6KF11H060 and above: Gap X >= 2.0" (50mm)

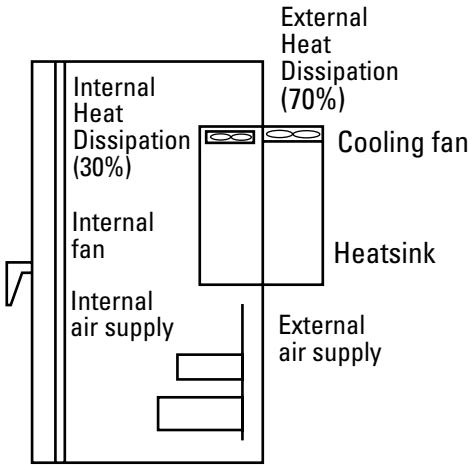


Fig. 2-2-2 Through Panel Mount

A drive of 6KF11L115, 6KF11H060 and above can be converted to external cooling simply by moving the 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.)

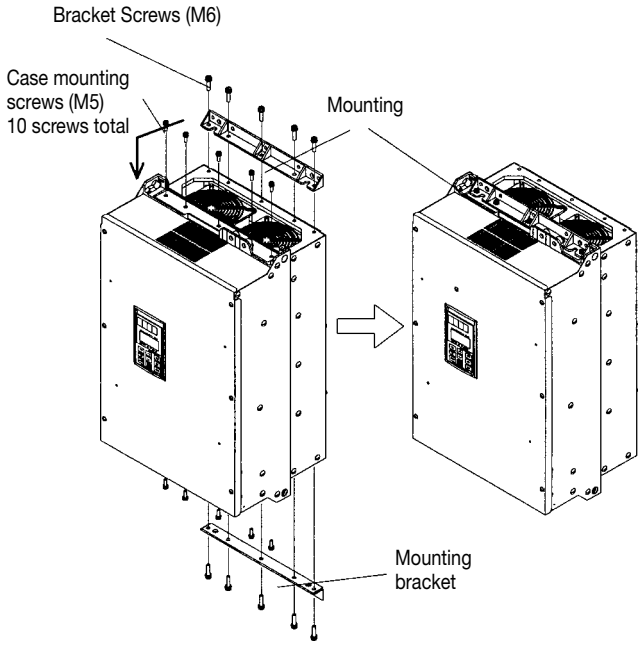


Fig. 2-2-3

In an external cooling system, a heat sink radiating about 70% of total drive heat (total loss) can be placed outside the device or control panel, as shown in Fig. 2-2-2.

7. For drives of 6KF11L080,6KF11H044 and below, remove the ventilating covers if ambient temperature exceeds +40°C (104°F) in the panel.

1. Removing the Ventilating Covers

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

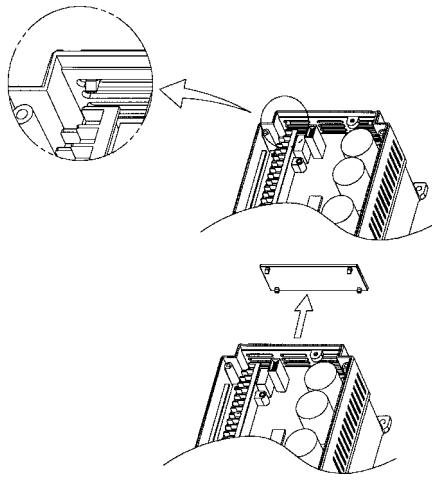


Fig. 2-2-4 Removing the ventilating cover

Installation of Open Type with NEMA 12 Heatsink Drive (6KF11L115, 6KF11H060 and above)

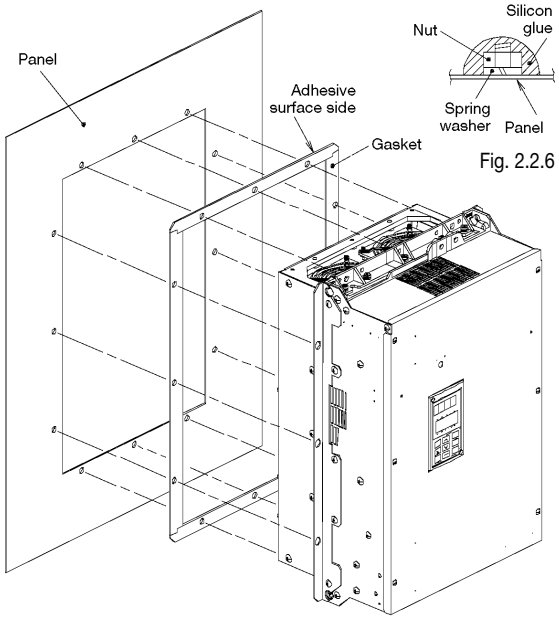


Fig.2.2.5

Fig. 2.2.6

1. Remove adhesive protection strip from gasket and then mount gasket to panel/enclosure, carefully aligning cutout and mounting holes.
2. Install the drive unit and tighten the mounting bolt and nut. (Tightening torque: 119 lbs-inch [M8], 425 lbs-inch [M12]). Mounting hardware to be supplied by customer. (refer to figure 2.2.5)
3. After proper torque has been applied to all mounting hardware, seal the outside end of the hardware with silicon glue. Silicon glue to be supplied by the customer. (Refer to Fig. 2.2.6)

2.3 Connection

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

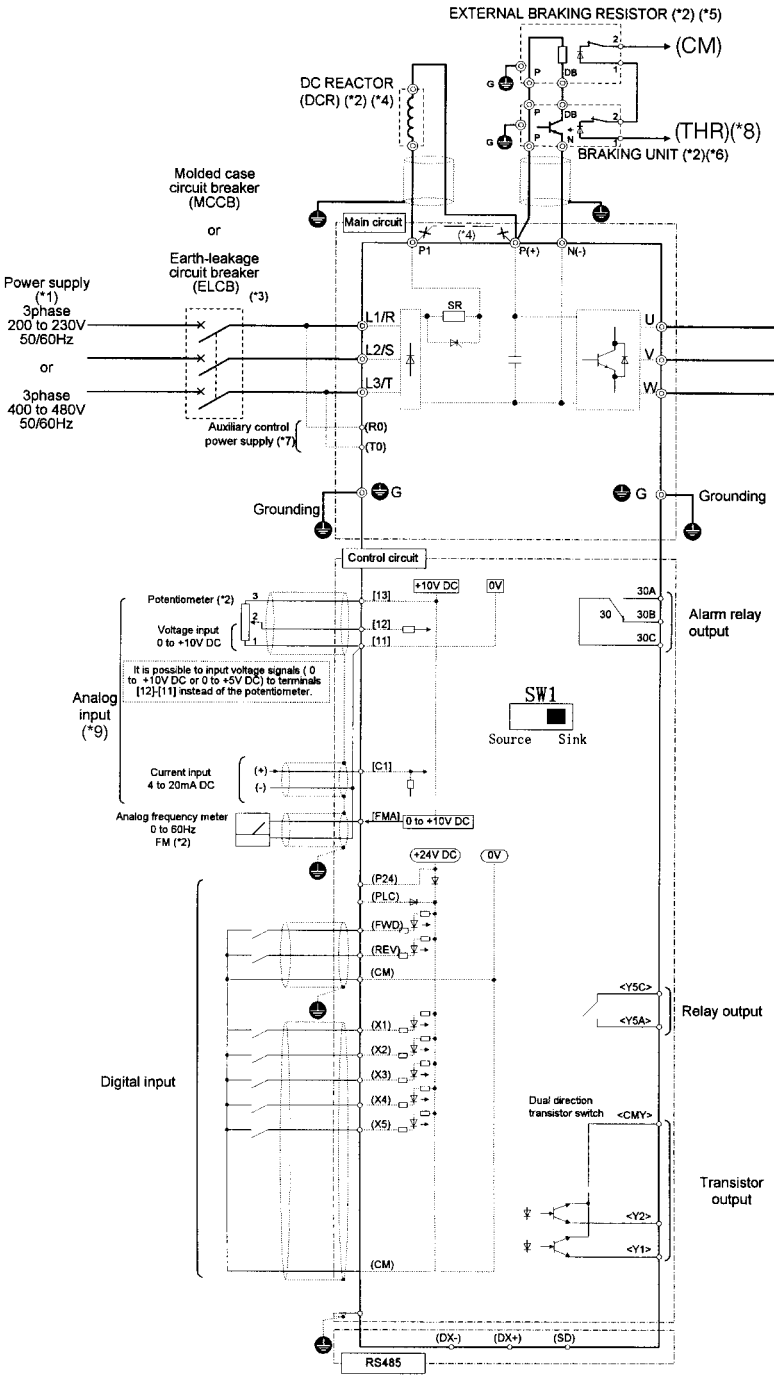
2-3-1 Basic Connection

1. Always connect power to the L1/R, L2/S, and L3/T main circuit power terminals on the drive. Connecting power to another terminal will damage the drive. Check that the input voltage is within the maximum allowable voltage marked on the nameplate, etc.
2. Always wire the ground terminal to ground to prevent problems such as fire or electric shock and to minimize noise.
3. Use a reliable crimp terminal for connection between a power terminal and a power wire.
4. After terminating the wiring connection, 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 the terminals and wire.
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 insure safety, use a multimeter to check that the direct current (DC) voltage 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 cause sparks.

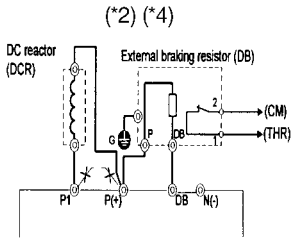
WARNING
Always connect a ground wire. Electric shock or fire may result. Ensure that a trained specialist performs all wiring. Confirm that the power is turned off (open) before beginning any wiring operations. Electrical shock may result.

2.3.1 Basic Connection Diagram (Sink Logic)

6KF11L055 (230V)
6KF11H030 (460V) and above



6KF11L042 (230V)
6KF11H023 (460V) and below



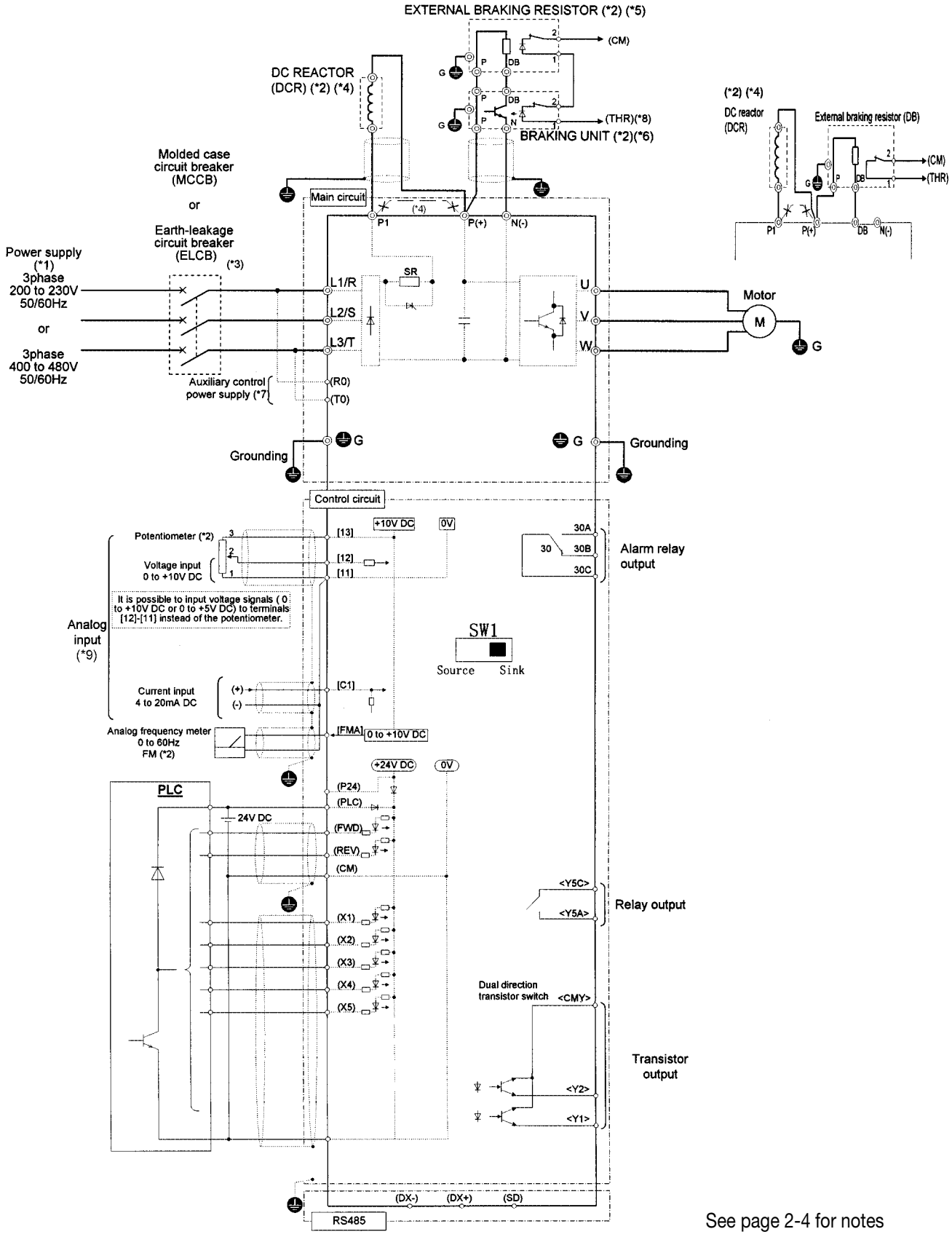
Note: The control circuit common terminals [11], (CM) and <CMY> are isolated

(*1) Use a drive with rated voltage matching the power supply voltage.
(*2) Use as required.
(*3) Use this peripheral device when necessary.
(*4) Remove the jumper wire between P1 and P(+) before connecting a DC REACTOR.
(*5) Be sure to use the braking unit (option) when connecting the external braking resistor (option)
(*6) Connect the braking unit to P(+) ans N(-). The auxiliary terminals [1] and [2] have polarity.
Connect them as shown in the figure above.
(*7) The drive can be operated without connecting the auxiliary control power supply.
(*8) Terminal (X1) to (X5) can be set to 6 (THR) - Braking unit thermal trip input.
(*9) It is possible to input voltage signals (0 to +10 VDC or 0 to +5 VDC) to terminals [12] [11] instead of the potentiometer.

Basic Connection Diagram to PLC (Sink Logic)

6KF11L055 (230V)
6KF11H030 (460V) and above

6KF11L042 (230V)
6KF11H023 (460V) and below

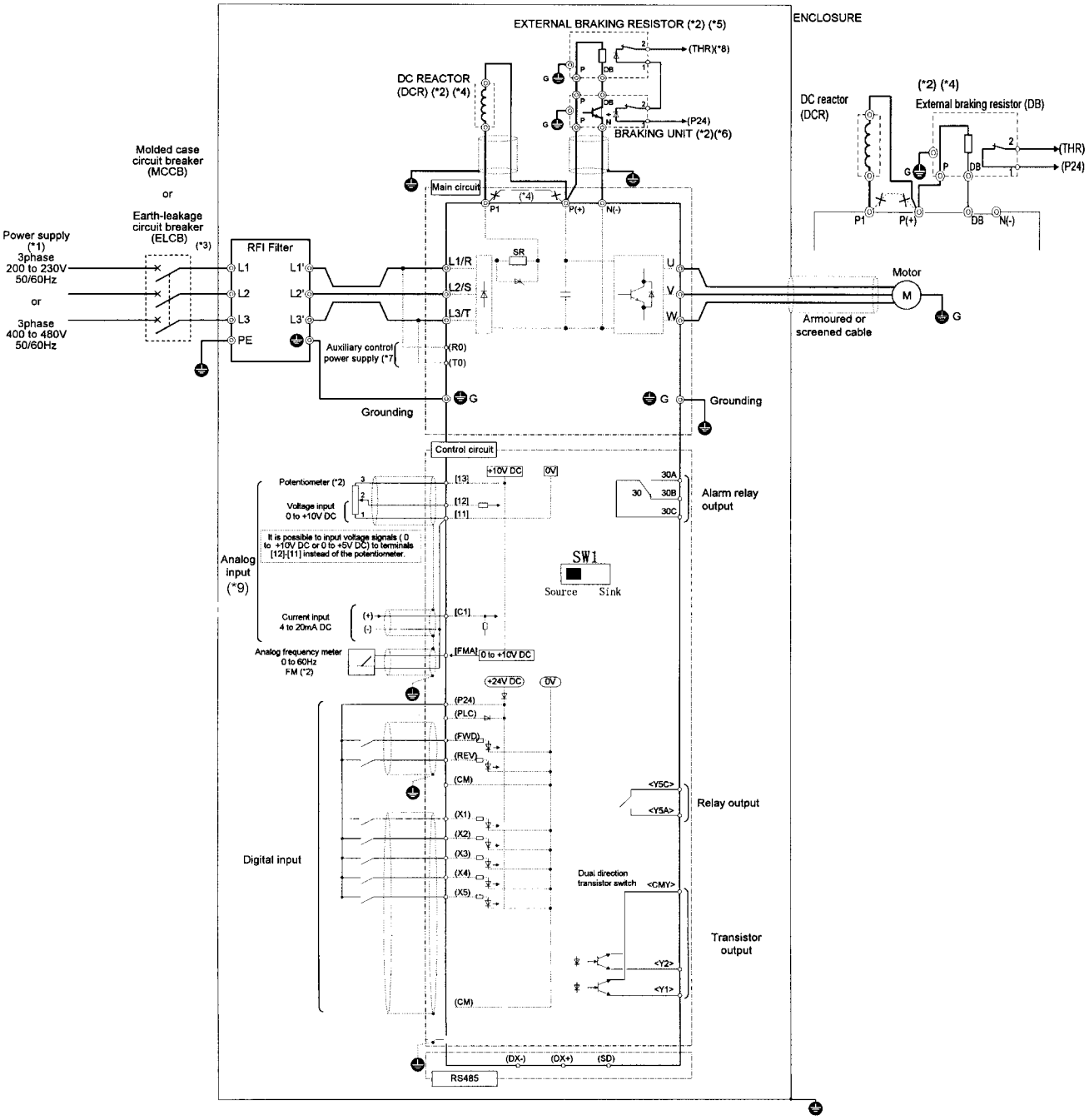


See page 2-4 for notes

Basic Connection Diagram (Source Logic, Typically used in Europe)

6KF11L055 (230V)
6KF11H030 (460V) and above

6KF11L042 (230V)
6KF11H023 (460V) and below



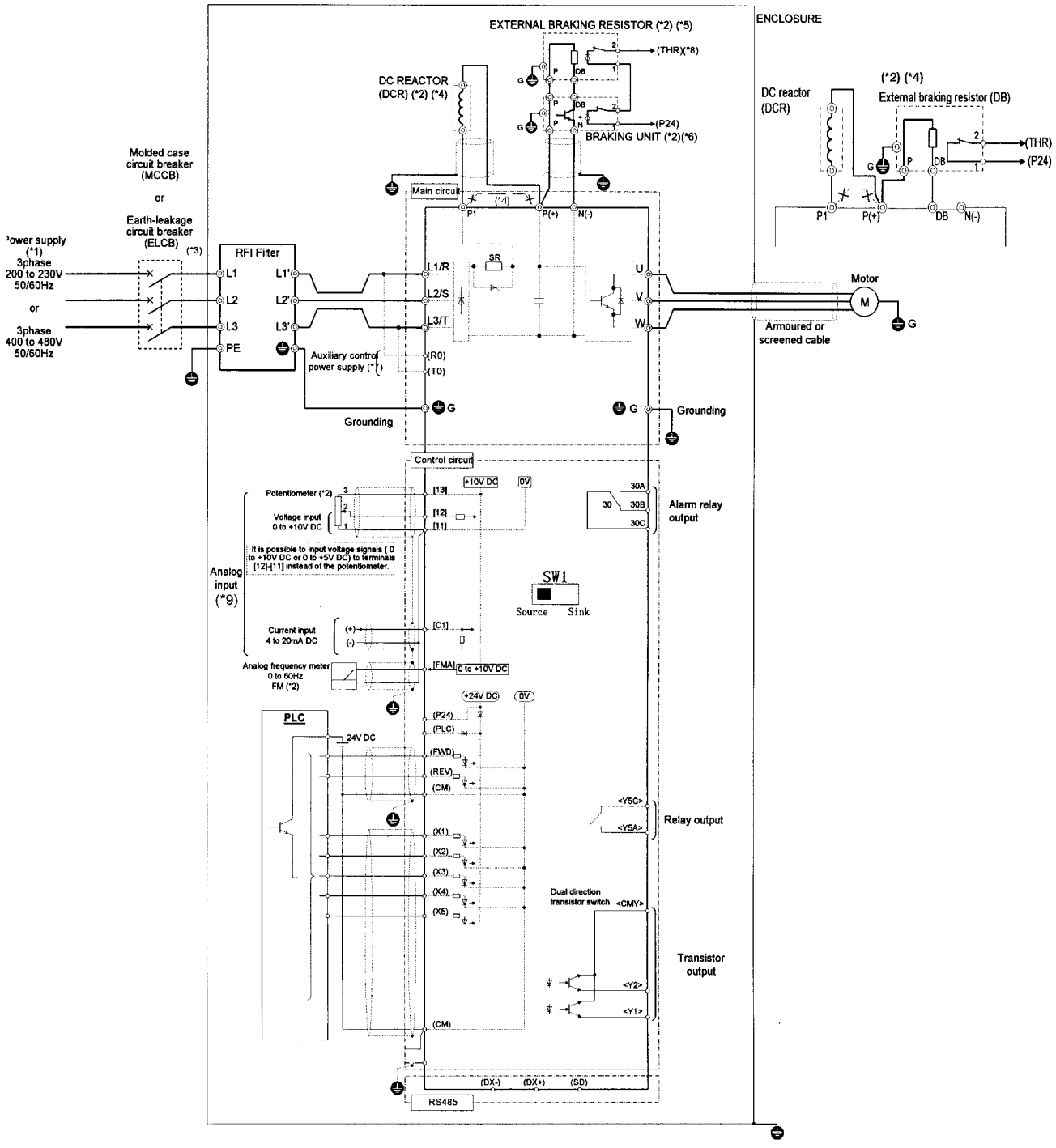
Note: The control circuit common terminals [11], (CM) and <CMY> are isolated

(*1) Use a drive with rated voltage matching the power supply voltage.
(*2) Use as required.
(*3) Use this peripheral device when necessary.
(*4) Remove the jumper wire between P1 and P(+) before connecting a DC REACTOR.
(*5) Be sure to use the braking unit (option) when connecting the external braking resistor (option).
(*6) Connect the braking unit to P(+) ans N(-). The auxiliary terminals [1] and [2] have polarity.
Connect them as shown in the figure above.
(*7) The drive can be operated without connecting the auxiliary control power supply.
(*8) Terminal (X1) to (X5) can be set to 6 (THR) - Braking unit thermal trip input.
(*9) It is possible to input voltage signals (0 to +10 VDC or 0 to +5 VDC) to terminals [12] [11] instead of the potentiometer.

Basic Connection Diagram to PLC (Source logic, Typically used in Europe)

6KF11L055 (230V)
6KF11H030 (460V) and above

6KF11L042 (230V)
6KF11H023 (460V) and below



See page 2-6 for notes

2.3.2 Connecting the Main Circuit and Ground Terminals

Table 2.3.1 Functions of main circuit terminals and ground termnals

Symbol	Terminal Name	Description
L1/R,L2/S,L3/T	Main circuit power terminals	Connects a 3-phase power supply
U,V,W	Inverter output terminals	Connects a 3-phase motor
R0,T0	Input terminals for auxiliary control power	Connects a backup AC power supply to the control circuit (not supported for drives of 6KF11L005, 6KF11H003 and below)
P1,P(+)	DC reactor terminals	Connects the optional power correcting DC reactor
P(+),DB	Terminals for external braking resistor	Connects the optional external braking resistor (for drives of 6KF11L022,6KF11H013 and below)
P(+),N(-)	Terminals for DC link circuit	Supplies DC link circuit voltage to the external braking unit (option) or power regeneration unit (option).
G	Ground terminal	Connects the drive chassis (case) to ground.

(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 ground-leakage circuit breaker for circuit protection. Phase-sequence matching is unnecessary.
2. To insure safety, a magnetic contactor should be used to disconnect the drive from the power supply when the drive protective function activates.
3. Use control circuit terminal FWD/REV or the RUN/STOP key on the keypad to start or stop the drive. The main circuit power should be used to start or stop the drive only if absolutely necessary and then should not be used more than once every hour.
4. If you need to connect these terminals to a single-phase power supply, please contact the factory.

(2) Drive output terminals (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 power factor correction capacitor or surge absorber to the drive output.
3. If the cable from the drive 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 drive, an increase in leakage current, or a reduction in current indication precision.

When a motor is driven by a PWM-type drive, the motor terminals may be subject to surge voltage generated by drive element switching. If the motor cable (with 460V series motors, in particular) is particularly long, surge voltage will deteriorate motor insulation. To prevent this, use the following guidelines:

Drives 6KF11L022, 6KF11H013 and above			
Motor Insulation Level	1000V	1300V	1600V
460 VAC Input Voltage	66 ft (20 m)	328 ft (100 m)	1312 ft (400 m) *
230 VAC Input Voltage	1312 ft (400 m) *	1312 ft (400 m) *	1312 ft (400 m) *

Drives 6KF11L017, 6KF11H009 and below			
Motor Insulation Level	1000V	1300V	1600V
460 VAC Input Voltage	66 ft (20 m)	165 ft (50 m) *	165 ft (50 m) *
230 VAC Input Voltage	328 ft (100 m) *	328 ft (100 m) *	328 ft (100 m) *
* For this case the cable length is determined by secondary effects and not voltage spiking.			

Note: When a motor protective thermal O/L relay is inserted between the drive and the motor, the thermal O/L relay may malfunction (particularly in the 460V series), even when the cable length is 165 feet (50m) or less. To correct, insert a filter or reduce the carrier frequency. (Use function code “F26 Motor sound”.)

(3) Input terminals for auxiliary control power (R0 and T0)

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

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

(4) DC reactor 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 drives of 6KF11L283, 6KF11H150 and above, the DC reactor is provided as a separate standard component and should always be connected to the terminals. DC reactor is provided as open type, enclosure to be provided by other.

> **CAUTION**
> A DC reactor does not come with drives rated 6KF11L283, 6KF11H150 and below, however, use a DC reactor or AC reactor under the following conditions otherwise the drive may be damaged or malfunction.

1) Used when the capacity of the power supply transformer exceeds 500k VA and exceeds the rated capacity of the drive tenfold.
2. Used when a thyrister converter is connected as a common load on the same transformer.
3. Used to prevent a drive OV trip from occuring when the power factor capacitor in the power line is switched on and off.
4. Used when the voltage imbalance exceds 2%.

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

(5) Terminals for external braking resistor (P(+) and DB) (6KF11L062, 6KF11H025 and below)

The F11 drive 6KF11L062, 6KF11H025 and below, does not contain a braking resistor. To improve braking performance, an external braking resistor must be installed.

1. Connect terminals P(+) and DB on the external braking resistor to terminals P(+) and DB on the drive.
2. The wiring length (twisted pair cables, etc.) should not exceed 16.5 feet (5m).

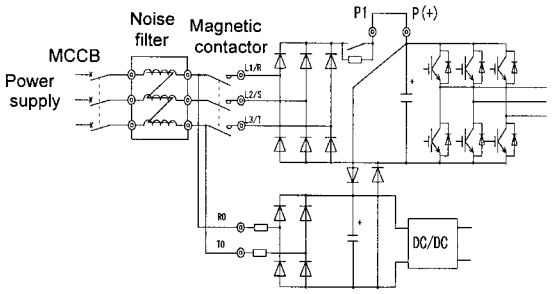


Fig. 2-3-2 Connection the auxiliary control-power input terminals

(6) Terminals for DC link circuit (P(+) and N(-))

The F11 drive of 6KF11L055, 6KF11H030 and above, 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(-) on the braking unit to terminals P(+) and N(-) on the drive. The wiring length (twisted pair cables, etc.) should not exceed 16.5 feet (5m).
2. Connect terminals P(+) and DB on the braking resistor to terminals P(+) and DB on the braking unit. The wiring length (twisted pair cables, etc.) should not exceed 33 feet (10m). If terminals P(+) and N(-) on the drive are not used, leave the terminals open. If P(+) is connected to N(-), or the braking resistor is connected directly, the resistor will burn up.
3. Auxiliary contacts 1 and 2 of the braking unit have polarity.
4. Refer to DB unit instruction book for paralleled resistors.

Note: Braking units and resistors are rated on degree of braking, duration and system frequency of braking cycle. Verify units meet application requirements.

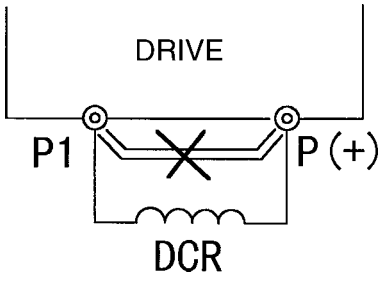


Fig. 2-3-3

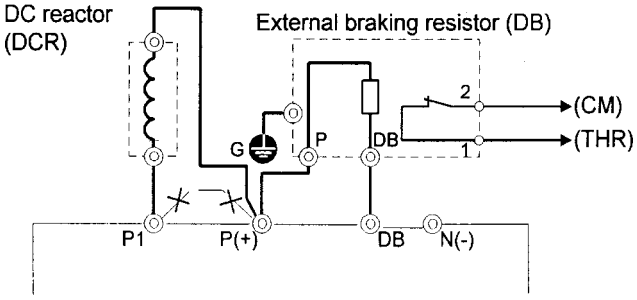


Fig. 2-3-4 Connection (6KF11L062, 6KF11H025 and below)

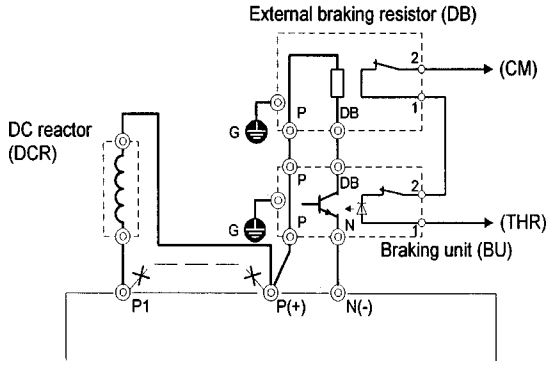


Fig. 2-3-5 Connection 6KF11L055, 6KF11H030 and above

(7) Ground terminal

The grounding connector should be sized in accordance with the NEC or Canadian Electrical Code. The connection should be made by a UL listed or CSA certified closed-loop terminal connector sized for the wire gauge involved. The connector is to be fixed using the crimp tool specified by the connector manufacturer.

(8) Auxiliary power switching connector (CN UX) (for drives of 6KF11L115, 6KF11H060 and above)

When a drive of 6KF11L115, 6KF11H060 and above requires main circuit power voltage as listed in Table 2-3-3, disconnect the auxiliary power switching connector CN UX from U1 and connect to U2. For the switching method, see Fig. 2-3-7.

Table 2-3-3 Main Voltage Requiring Auxiliary Power Switching Connector

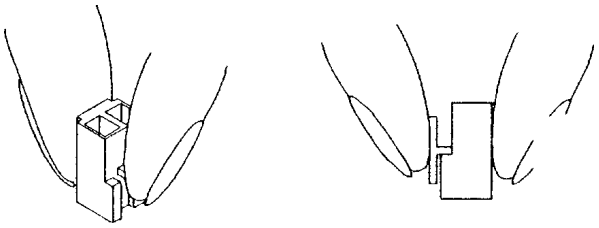
Frequency [Hz]	Power Voltage Range [VAC]
50	380 - 398
60	380 - 430

CAUTION

- Check that the number of phases and rated voltage 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 directly connect a braking resistor to the DC terminals (P[+] and N[-]). Fire may result.

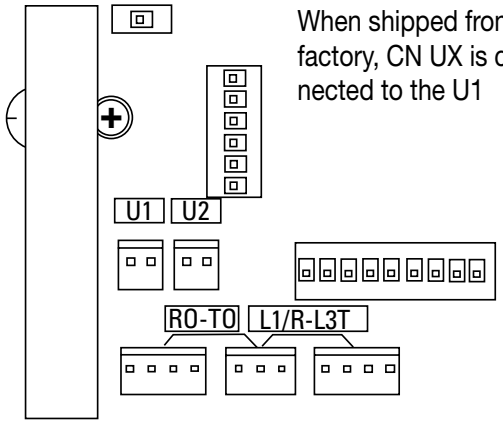
The switching connectors are mounted on the power PCB above the control PCB as shown on the right.

Note: To remove a connector, unlock the connector (using the locking mechanism) and pull. To install, firmly push the connector until it clicks into place.



CN UX

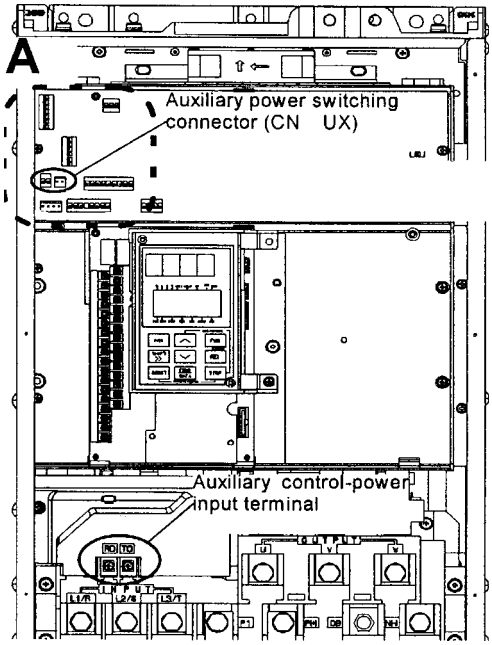
<Enlarged view of part A>

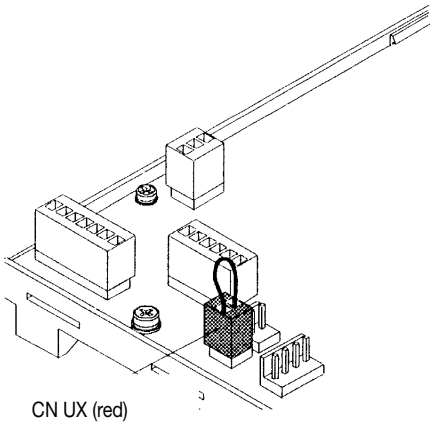


When shipped from the factory, CN UX is connected to the U1 side.

<3D view of part A>

Factory Shipment Status Connector CN UX: U1



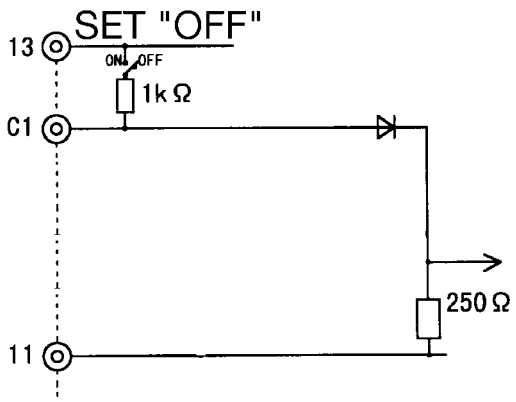


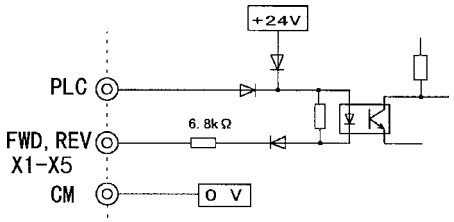
CN UX (red)

2.3.3 Connecting the Control Terminals

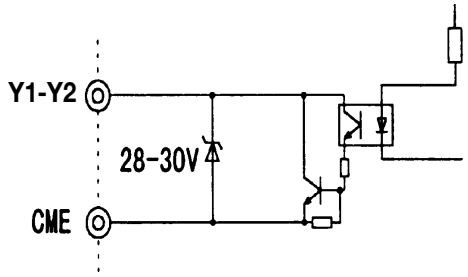
Table 2.3.3 lists the functions of the control circuit terminals. A control circuit terminal should be connected according to its function setting.

Table 2-3-3

Classification	Terminal Symbol	Terminal Name	Function
Analog input	13	Potentiometer power supply	Used for +10V DC power supply for frequency setting POT (resistance of 1 to 5k Ohms)
	12	Voltage input	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. Input feedback signal for PID control is input. 3. The analog input value from the external circuit is used for torque control * Input resistance: 22 k Ohms
	C1	Current input	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.  * Input resistance: 250 Ohms
	11	Analog input common	Common terminal for analog input signals

<table>
<tr><td rowspan="8">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 opened)</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 opened)</td></tr>
<tr><td>X1</td><td>Digital input 1</td><td rowspan="5">The coast-to-stop command, external alarm, alarm reset, multi-step frequency selection, and other functions (from an external circuit) can be assigned to terminals X1 to X5. For details, see "Setting the Terminal Functions E01 to E05" in Section 5.2 Function Explanation.
<Specifications of digital input circuit>
<table><tr><td>Item</td><td></td><td>min.</td><td>typ.</td><td>max.</td></tr><tr><td rowspan="2">Operating voltage</td><td>ON</td><td>0V</td><td>–</td><td>2V</td></tr><tr><td>OFF</td><td>22V</td><td>24V</td><td>27V</td></tr><tr><td>Maximum load current</td><td>ON</td><td>–</td><td>3.2mA</td><td>4.5 mA</td></tr><tr><td>Leakage current</td><td>OFF</td><td>–</td><td>–</td><td>0.5 mA</td></tr></table>  </td></tr>
<tr><td>X2</td><td>Digital input 2</td></tr>
<tr><td>X3</td><td>Digital input 3</td></tr>
<tr><td>X4</td><td>Digital input 4</td></tr>
<tr><td>X5</td><td>Digital input 5</td></tr>
<tr><td>P24</td><td>Control Unit power Supply</td><td>+24VDC power supply for control input. Maximum output current 100mA</td></tr>
<tr><td>PLC</td><td>PLC signal power</td><td>Used to connect PLC power supply for output signals; rated nominal voltage = 24 VDC (22 to 27 V DC range) at sink logic operation.</td></tr>
<tr><td>CM</td><td>Digital input common</td><td>Common terminal for digital input signals and P24</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 signal indicates one of the following:
- Output frequency (before slip compensation)
- Load factor
- Output frequency (after slip compensation)
- Power consumption
- Output current
- PID feedback value
- Output voltage
- Output torque
- DC link circuit voltage
* Connectable impedance: min. 5k ohms</td></tr>
</table>

<table>
<tr><td rowspan="3">Transistor Output</td><td>Y1</td><td>Transistor output 1</td><td rowspan="3">A running signal, frequency equivalence signal, overload early warning output signal, and other signals from the drive are output (as transistor output) to arbitrary ports. For details, see "Setting the Terminal Functions E20 to E21" in Section 5.2 Function Explanation.
* <Specifications of transistor output circuit>
<table><tr><td>Item</td><td></td><td>min.</td><td>typ.</td><td>max.</td></tr><tr><td rowspan="2">Operating voltage</td><td>ON</td><td>–</td><td>1V</td><td>2V</td></tr><tr><td>OFF</td><td>–</td><td>24V</td><td>27V</td></tr><tr><td>Maximum load current</td><td>ON</td><td>–</td><td>–</td><td>50 mA</td></tr><tr><td>Leakage current</td><td>OFF</td><td>–</td><td>–</td><td>0.1 mA</td></tr></table>
  </td></tr>
<tr><td>Y2</td><td>Transistor output 2</td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td>CMY</td><td>Transistor output common</td><td>Common terminal for transistor output signals. This terminal is insulated from terminals (CM) and [11].</td></tr>
<tr><td>Relay output</td><td>30A,30B,30C</td><td>Alarm outputs for any fault.</td><td>If the drive is stopped by an alarm (protective function), the alarm signal is output from the relay contact output terminal (1SPDT). Contact rating: 250 VAC.
An excitation mode (excitation at alarm occurrence or at normal operation) can be selected.</td></tr>
<tr><td></td><td>Y5A,Y5C</td><td>Multi-purpose signal</td><td>These signals can be output similar to the Y1 to Y2 signals above. The contact rating is the same as that of the alarm output above.</td></tr>
<tr><td>Communic-ation</td><td>DX+,DX–</td><td>RS 485 Modus RTU communication</td><td>Input/output signal terminals for RS 485 Modus RTU communication input/output
Up to 31 inverters can be connected using the daisy chain method.</td></tr>
<tr><td></td><td>SD</td><td>Communication cable shield connection terminal</td><td>Terminal for connecting the cable shield. The terminal is electrically floating.-</td></tr>
</table>

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

1. These terminals receive low level 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 the shields must be grounded. 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) contacts for handling low level 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 drive noise. To prevent malfunction, connect a ferrite core or capacitor to the external analog signal output device.

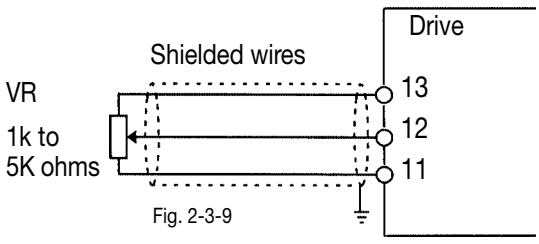


Fig. 2-3-9

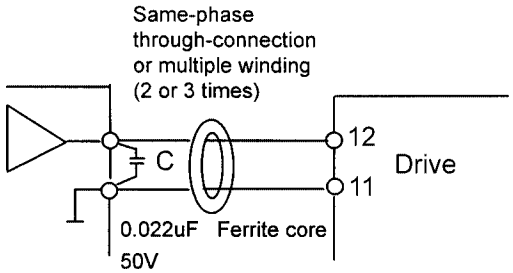


Fig. 2-3-10 Example of Noise Prevention

(2) Digital input terminals (FWD, REV, X1 to X5, PLC, and CM)

1. Digital input terminals (e.g., FWD, REV, X1 to X5) 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 PLC's open collector output using an external power supply, a resulting bypass circuit may cause the drive to malfunction. To prevent a malfunction, connect the PLC terminal as shown in Fig. 2-3-11.

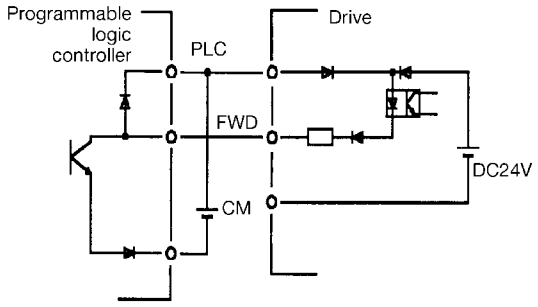


Fig. 2-3-11 Prevention of Bypass Current by External Power

2. When using a contact input, a high-quality relay with reliable contacts must be used.

(3) Transistor output terminals (Y1 to Y2, CMY)

1. These terminals have a circuit configuration as shown in Table 2-3-3, "Transistor Output". Confirm the polarity of the external power supply.
2. To connect a control relay, connect a surge absorbing diode to both ends of its exciting coil.

(4) Sink or Source Logic Selection.

1. Set SWI for Sink or Source Connection to the PLC. The factory default setting is Sink and this instruction manual explains Sink logic function only.
2. When you need to connect source type logic, refer to Basic Connection Diagram Fig. 2-3-3 and Fig. 2-3-4 and Technical Information Manual. (Sink Logic is commonly used in the USA and Source Logic is commonly used in Europe.)

(5) 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 the main circuit (e.g., main circuit terminal block).

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.

(6) Wiring of control circuit (inverter of 6KF11L115, 6KF11H060 and above)

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 0.14" (3.5mm) in width and 0.06" (1.5mm) in thickness.
3. When the optional PC board is mounted, the signal lines must be secured to cable binding hole B.

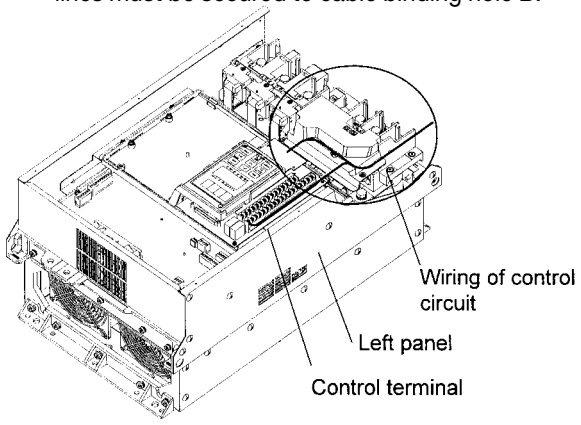


Fig. 2-3-12 The Control Wiring Route

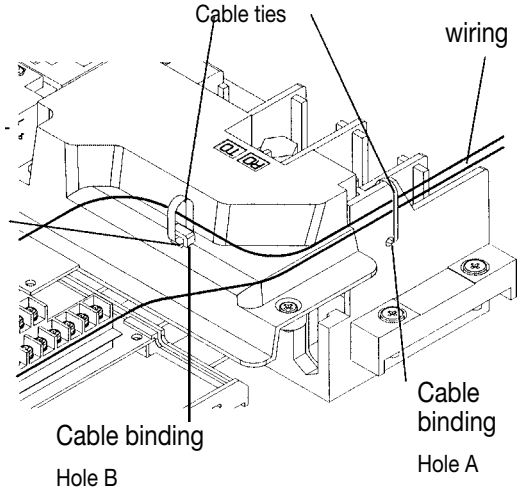
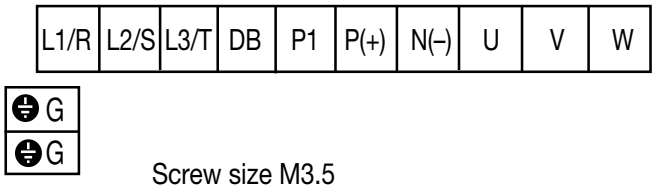


Fig. 2-3-13 Securing Positions for Inverter Control Circuit Wiring (6KF11L115, 6KF11H060 and above)

2.3.4 Terminal Configuration

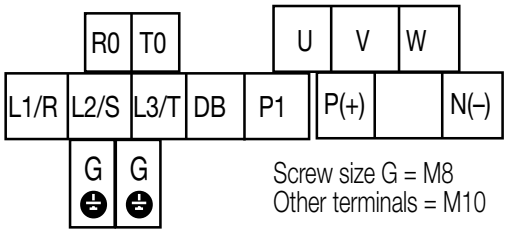
(1) Main circuit terminals

6KF11L002-005, 230 VAC
6KF11H002-003, 460 VAC



Screw size M3.5

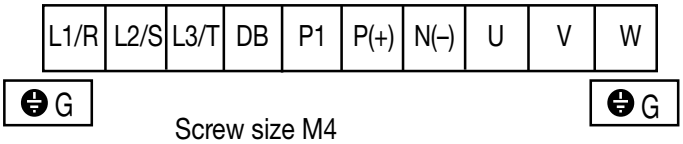
6KF11L180-283, 230 VAC
6KF11H176-253, 460 VAC



Screw size G = M8
Other terminals = M10

6KF11L008-017, 230 VAC
6KF11L004-009,460 VAC

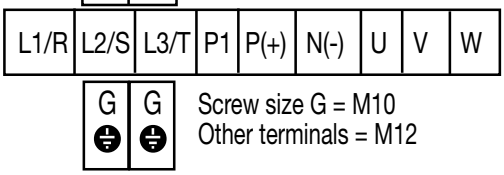
Screw size M3.5



Screw size M4

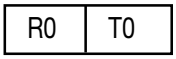
6KF11L346, 230 VAC

Screw size M4

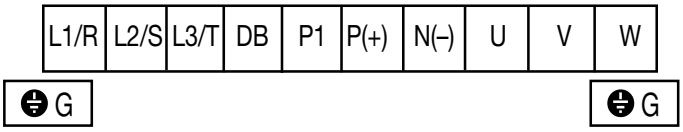


Screw size G = M10
Other terminals = M12

6KF11L022-042, 230 VAC
6KF11H013-023, 460 VAC

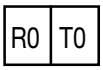


Screw size M3.5

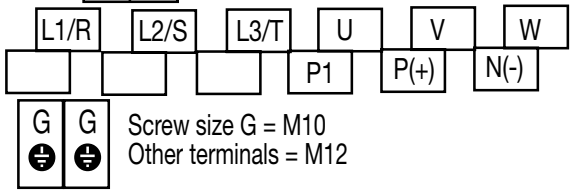


Screw size M5

6KF11L145, 230 VAC
6KF11H304-520, 460 VAC

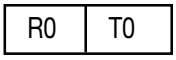


Screw size M4

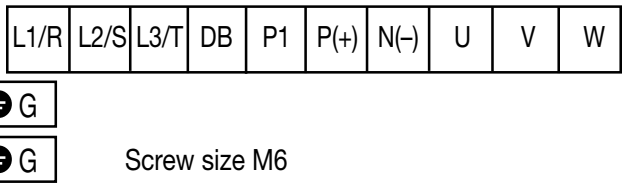


Screw size G = M10
Other terminals = M12

6KF11L055-080, 230 VAC
6KF11H030-044, 460 VAC

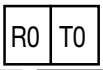


Screw size M3.5

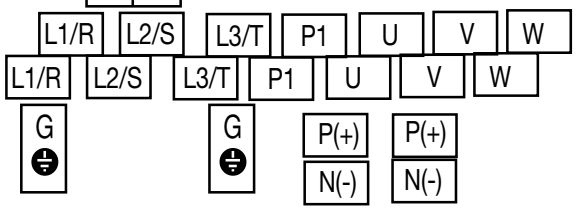


Screw size M6

6KF11H650-740, 460 VAC

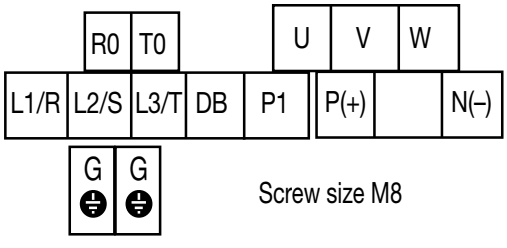


Screw size M4



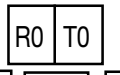
Screw size G = M10
Other terminals = M12

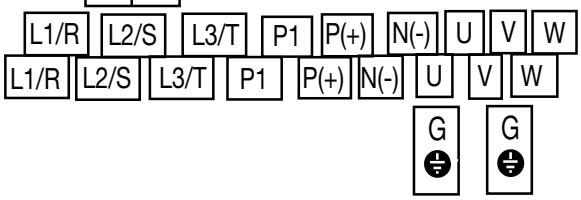
6KF11L115-145, 230 VAC
6KF11H060-150, 460 VAC
Screw size M4



Screw size M8

6KF11H840-960, 460 VAC





Screw size RO,TO = M4 G = M10
Other terminals = M12

(2) Control circuit terminals

30A	Y5A	CMY		Y1	C1	FMA		PLC	X1	X2	X3	X4	X5				
30C	30B	Y5C		Y2	11	12	13		CM	CM	FWD	REV	P24	P24	DX-	DX+	SD

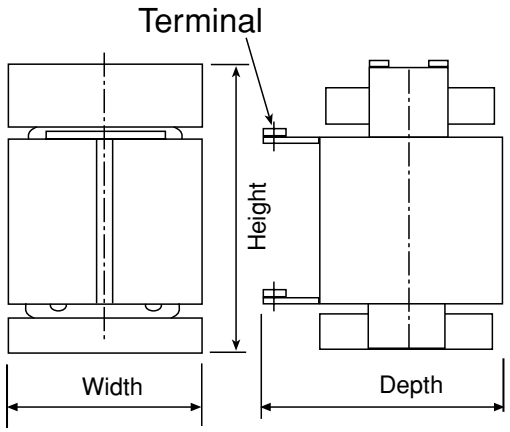
2.3.5 AF-300 F11 Drive Cable Size, Tightening Torque and Circuit Protection Rating

Model No.	Recommended device			Tightening Torque lb-Inch (Nm)					Cable size AWG					
	Input Fuse		Input Circuit Breaker	L1/R, L2/S, L3/T, U, V, W, P1, P(+)	E(G)	DB circuit (*1) P(+), N(-), DB	R0, T0	Control	L1/R, L2/S, L3/T	U, V, W	DC Reactor P1, P(+)	DB circuit (*1) P(+), N(-), DB	R0, T0	Control
	L1/R, L2/S, L3/T (Nominal)	Auxiliary Input R0, T0												
230 VAC Input														
6KF11L002	3	3	15	10.6 (1.2)		10.6	-	6.2 (0.7)	14			16	-	22
6KF11L003	5	3	15			(1.2)	-						-	
6KF11L005	10	3	20				-						-	
6KF11L008	15	3	30	20.8 (2.36)		20.8	10.6 (1.2)						14	
6KF11L011	20	3	40			(2.36)			14			14		
6KF11L017	35	3	60						12					
6KF11L022	60	3	100	31.0 (3.5)		31.0			8					
6KF11L029	70	3	125			(3.5)			6					
6KF11L042	100	3	175	51.3 (5.8)					4					
6KF11L055	125	3	225						2					
6KF11L068	150	3	250											
6KF11L080	175	3	300						1					
6KF11L115	200	5	200	119(13.5)					2/0	1/0	2/0		10	
6KF11L145	225	5	225						4/0	3/0	4/0	10		
6KF11L180	300	5	300	239(27)	119(13.5)	119			Qty2 - 1	4/0	Qty2 - 1			
6KF11L215	350	5	350			(13.5)			Qty2 - 2	Qty2 - 1/0	Qty2 - 2/0	8		
6KF11L283	300	5	300						Qty2 - 2/0	Qty2 - 3/0	Qty2 - 4/0	6		
6KF11L346	400	5	400	425(48)	239(27)				Qty2 - 4/0	Qty2 - 4/0	Qty2 - 250	4		
6KF11L415	450	5	450						Qty2 - 250	Qty2 - 300	Qty2 - 350			
460 VAC Input														
6LF11H002	3	3	15	10.6 (1.2)		10.6	-	6.2 (0.7)	14			16	-	22
6LF11H003	5	3	15			(1.2)	-						-	
6LF11H004	10	3	15	20.8 (2.36)		20.8	10.6 (1.2)						14	
6LF11H006	15	3	20			(2.36)								
6LF11H009	20	3	35									14		
6LF11H013	30	3	50	31.0 (3.5)		31.0								
6LF11H017	40	3	70			(3.5)			12					
6LF11H023	50	3	90	51.3 (5.8)					8					
6LF11H030	70	3	110						6					
6LF11H037	80	3	150											
6LF11H044	100	3	175						4					
6LF11H060	100	10	100	119(13.5)					3	3	3		10	
6LF11H075	125	10	125						2	2	2			
6LF11H091	150	10	150			51.3			1	2	1			
6LF11H112	175	10	175			(5.8)			2/0	1/0	2/0			
6LF11H150	150	10	150						2/0	3/0	4/0			
6LF11H176	200	10	200	239(27)	119(13.5)				3/0	4/0	Qty2 - 1	10		
6LF11H210	225	10	225		239(27)	119			Qty2 - 1	Qty2 - 1/0	Qty2 - 1/0	8		
6LF11H253	300	10	300			(13.5)			Qty2 - 1/0	Qty2 - 2/0	Qty2 - 3/0			
6LF11H304	400	10	400	425(48)		239			Qty2 - 3/0	Qty2 - 3/0	Qty2 - 4/0	6		
6LF11H377	450	10	450			(27)			Qty2 - 4/0	Qty2 - 250	Qty2 - 300	4		
6LF11H415	500	10	500						Qty2 - 250	Qty2 - 300	Qty2 - 350			
6LF11H485	600	10	600			(*3)			Qty2 - 350	Qty2 - 350	Qty2 - 500	(*2)		
6LF11H520	700	10	700						Qty2 - 350	Qty2 - 400	Qty2 - 500			
6LF11H650	700	10	700						Qty2 - 500	Qty3 - 300	Qty3 - 300			
6LF11H740	1000	10	1000						Qty3 - 300	Qty3 - 350	Qty3 - 500			
6LF11H840	1000	10	1000						Qty3 - 400	Qty3 - 500	Qty3 - 600			
6LF11H960	1200	10	1200						Qty3 - 500	Qty3 - 600	Qty3 - 600			

(*1)Based on GE Fuji standard DB unit and DB resistor designs. Other rating require careful review.
(*2) Consult factory
Device ratings such as system coordination, short-circuit rating and type must be carefully reviewed by the user.
Wire size from NEC tables 310-16. Copper wire rated 60 Deg. C for 100amps or less, 75 Deg. C for over 100 amps in 30 Deg. C ambient and 1.25 times Drive rated amps.
These are minimum wire sizes : consult and conform to local and national codes.

2.3.6 DC Link Reactor

Dimensions in inches



Model No.	Model No.	Width	Depth	Height	Weight	Loss [W]
230V F11						
6KF11L283	DCR2-75B	7.87	10.63	7.09	37	55
6KF11L346	DCR2-90B	7.09	11.02	8.46	37	57
6KF11L415	DCR2-110B	7.48	12.99	9.05	46	67
460V F11						
6KF11H150	DCR4-75B	7.48	10.63	6.89	35	58
6KF11H176	DCR4-90B	7.48	11.02	7.87	44	64
6KF11H210	DCR4-110B	7.48	11.02	7.87	46	73
6KF11H253	DCR4-132B	7.87	11.02	8.07	55	84
6KF11H304	DCR4-160B	8.27	12.6	8.07	68	90
6KF11H377	DCR4-200B	8.27	12.99	9.06	75	126
6KF11H415	DCR4-220B	8.66	13.78	9.06	81	131
6KF11H485	DCR4-280B	8.66	14.57	9.65	95	133
6KF11H520	DCR4-280B	8.66	14.57	9.65	95	150
6KF11H650	DCR4-355B	9.84	12.99	8.78	99	205
6KF11H740	DCR4-400B	9.84	13.78	9.17	106	215
6KF11H840	DCR4-450B	10.63	13.78	10.35	121	272
6KF11H960	DCR4-500B	11.1	14.17	10.35	143	292

Note:

- AF-300 F11 Drives rated and above are furnished with a DC link reactor. This reactor must be installed between terminal P1 and P+ prior to commissioning of the Drive.
- The weight of the DC Link Reactor is not included with that of the Drive.
- DC Link Reactor is provided as open type and is separately mounted. Enclosure to be provided by others.

3. Operation

3.1 Inspection and Preparation Before Operation

Check the following before operation:

1. Check that the connections are correct.
   In particular, check that the power supply is not connected to any of the U, V, or W output terminals and that the ground terminal is securely grounded.
2. Check for short circuits and ground faults between the terminals and sections under power.
3. Check for loose terminals, connectors, or screws.
4. Check that the motor is disconnected from the mechanical equipment.
5. Turn off switches before turning on power to ensure that the drive will not start or operate abnormally at power-on.
6. Check the following after power-on:
   a. No alarm message is displayed on the keypad (see Figure 3-1-2).
   b. The fan inside the drive is rotating. (For drives with 6KF11L008, 6KF11H004 and above.)

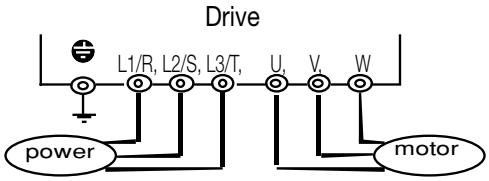


Fig. 3-1-1 Drive connection

Fig. 3-1-2 Display on keypad at power-on

WARNING

Be sure to have the drive cover in place before turning on the power (closed). Never remove the cover while power is applied to the drive. 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 the operating requirements and specifications; refer to Section 4-2 Operating the Keypad, and Chapter 5 Function Selection. Table 3-2-1 lists general methods of operation.

Operation Command	Frequency Setting	Operation Command
Operation using keypad	Keys on keypad ▲ ▼	FWD REV STOP
Operation using external terminal signals	▲ ▼	Input from Terminals FWD-CM and REV-CM
	Frequency Setting POT(VR), analog voltage, analog current	

3.3 Trial Run

Once inspection is completed (see Section 3-1), proceed with a trial run. The motor is initially disconnected and the drive is operated (factory setting) using the keypad.

1. Turn power on and confirm that the LED monitor display 0.00 Hz is blinking.
2. Set the frequency to about 5 Hz using ▲ key.
3. To start the run, press **FWD** key (for forward rotation) or **REV** key (for reverse rotation). To stop, press **STOP** key. Verify frequency increases for zero to the set point.

Connect motor and repeat steps 1-3

4. Check the following items:
   a. Is the direction of rotation correct?
   b. Is the rotation smooth (no buzzing or abnormal vibration)?
   c. Are acceleration and deceleration smooth?
5. If no abnormality is detected, increase the frequency and check the above items again. If the results of the trial run are normal, start a formal run.

Notes: If an error is detected in the drive or motor's operation, immediately stop and attempt to determine the cause of error by referring to Chapter 7 Troubleshooting.

Since voltage is still present at the main circuit terminals (L1/R, L2/S, L3/T) and auxiliary control power terminals (R0, T0), even when the output from the drive is terminated, do not touch the terminals. The smoothing capacitor in the drive is 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 use a multimeter to check that the volatge has decreased below 25 VDC at the DC (P-N) terminals.

4. Keypad

The keypad has various functions for specifying operations such as frequency setting, run/stop command, confirming and changing function data, confirming status, and copying function code settings.

Review the use of each function before attempting to operate the drive from the keypad.

The keypad can also be removed or inserted during drive operation. However, if the keypad is removed during keypad operation (e.g., run/stop, frequency setting), the drive stops and outputs an alarm.

4.1 Appearance of Keypad

Control keys (valid during keypad operation):

Used for drive run and stop

FWD Forward operation command

REV Reverse operation

STOP Stop command

Operation keys:

Used for switching screens, data change,frequency setting, etc.

LED monitor

4-digit display. Used to display data such as setting frequency, output frequency and alarm code.

Auxiliary Information Related to LED Monitor

Indicates selected units or multiple of the data shown on the LED monitor and is displayed on the top line of the LCD monitor. The ■ symbol indicates selected units or multiple number. The symbol ▲ indicates that there is an upper screen not currently displayed.

LCD Monitor:

Used to display various items of information such as operation status and function data. An operating guide message, is scrolled and displayed at the bottom of the LCD monitor. This LCD monitor has a backlight feature which turns on when the control power is applied or any keypad key is pressed, and stays on approximately 5 minutes after the last key stroke.

Status Indicators on LCD Monitor:

Displays current operating status:

FWD: Forward operation
REV: Reverse operation
STOP: Stop

Displays the selected operating mode:

MODE	RUN command (F02, H30)	Freq. Command (F01, C30, H30)	LCD indicator			
			REM	LOC	COMM	HAND
REMOTE	Keypad	Keypad	ON			ON
	Keypad	Analog, UP/DOWN	ON			ON
	Keypad	Communication	ON			ON
	Terminal	Keypad	ON			
	Terminal	Analog, UP/DOWN	ON			
	Terminal	Communication	ON			
	Communication	Keypad	ON		ON	
	Communication	Analog, UP/DOWN	ON		ON	
	Communication	Communication	ON		ON	
LOCAL	Keypad	Keypad		ON		ON

Note : Local Mode is selected by Keypad key or Terminal input "LOC"

The symbol ▼ indicates that there is a lower screen not currently displayed.

RUN LED (valid during operation from keypad):
Indicates that an operation command was input by pressing the FWD or REV key.

Operation Keys	Primary Function
PRG	Used to switch the current screen to the menu screen or switch to the initial screen in 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.
REM/LOC 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 initial alarm mode screen is displayed) Used to change the control mode from Remote (terminal block) to Local (keypad) operation or vice versa from operation mode screen of the keypad by pressing this key for 1 second ore more.

4.1.1 Remote/Local mode change

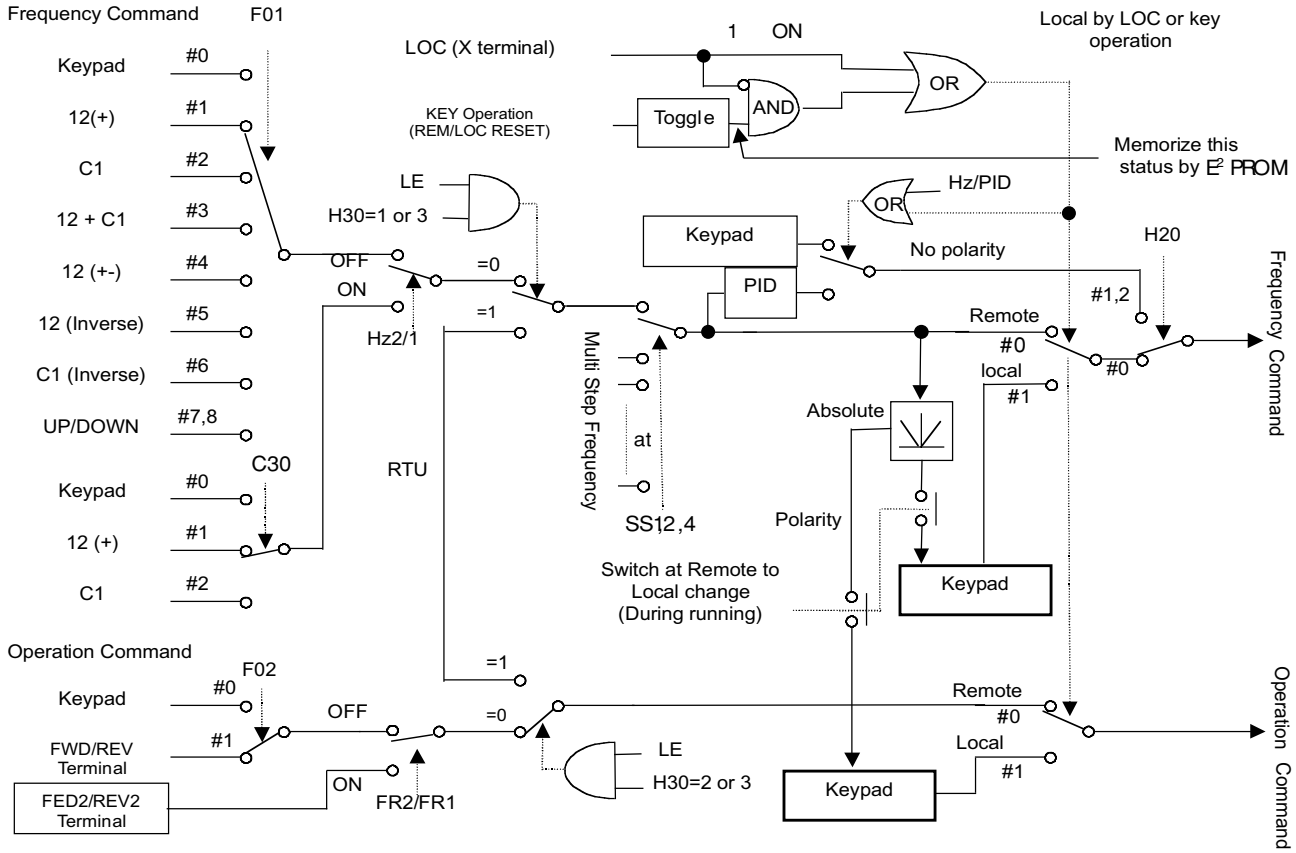
1. From Remote to Local by REM/LOC RESET key

   At the operation mode screen of the keypad, press the REM/LOC RESET key for 1 second or more. The drive will continue to run without changing speed and control is transferred to the keypad.
2. From Remote to Local by terminal input “LOC”
   When the terminal input “LOC” is turned on (close), the drive will continue to run without changing speed and control is transferred to the keypad.
3. From Local to Remote by REM/LOC RESET key

   At the operation mode screen of the keypad, press the REM/LOC RESET key for 1 second or more. The drive will continue to run and will follow the acceleration or deceleration ramp to the setting defined by the reference and the direction at the terminals.
4. From Local to Remote by terminal input “LOC”
   When the terminal input “LOC” is turned off (open), the drive will continue to run and will follow the acceleration or deceleration ramp to the setting defined by the reference and the direction at the terminals.

Note : When terminal input “LOC” is turned on (close) for Local operation, the REM/LOC RESET key for Remote/Local change is inactive.

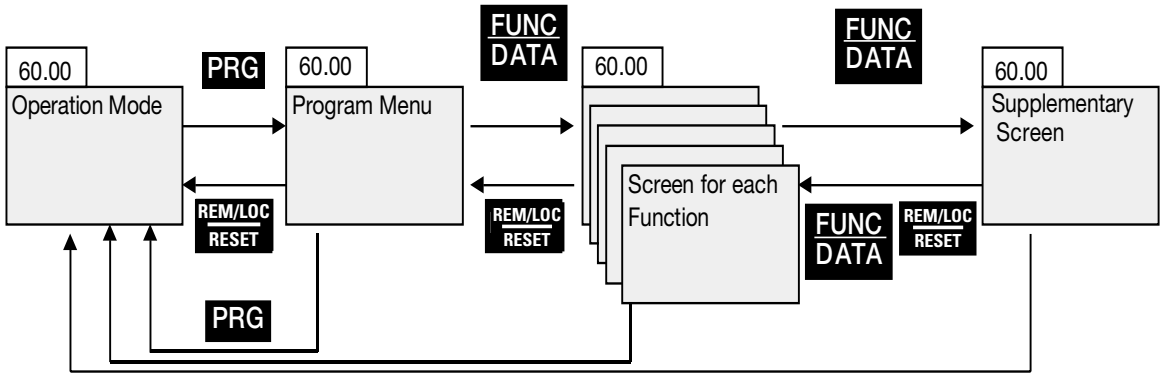
Remote/Local Mode Change Block Diagram



4.2 Operation From the Keypad (LCD Screen, Level Structure)

4.2.1 Normal Operation

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



4.2.2 Alarm Modes

If an alarm is activated, operation is changed from normal keypad 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.

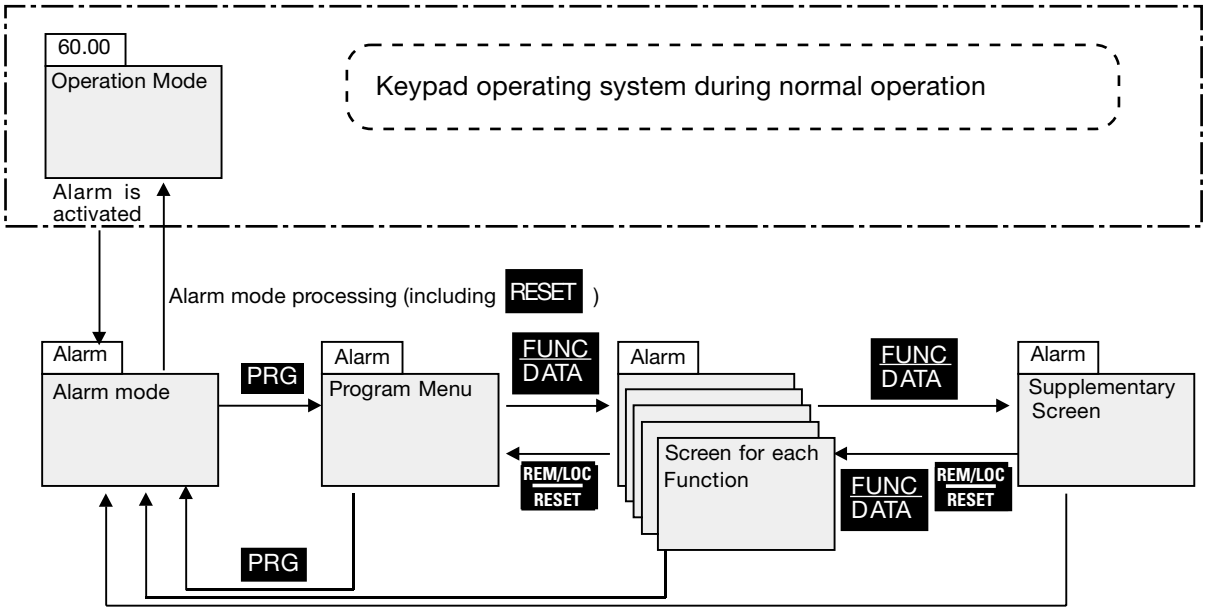


Table 4.2.1 Overview of Contents Displayed for each Level

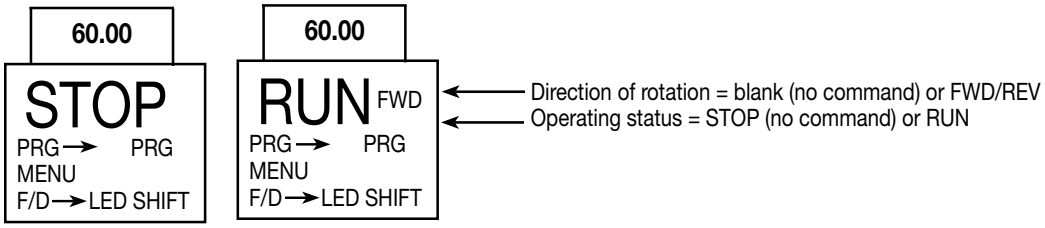
<table>
<tr><th>No.</th><th>Level name</th><th colspan="3">Content</th></tr>
<tr><td>1</td><td>Operation Mode</td><td colspan="3">This screen is for normal operation. Frequency setting from the keypad and LED monitor switching are possible only when this screen is displayed.</td></tr>
<tr><td>2</td><td>Program Menu</td><td colspan="3">Each function of the keypad is displayed in menu form and can be selected. By selecting the desired function from the list and pressing FUNC DATA the corresponding function screen is displayed. The following functions are available as keypad functions (menus).
<table>
<tr><th>No.</th><th>Menu Name</th><th>Purpose</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</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/outputs for the inverter and options as an I/O checker.</td></tr>
<tr><td>5</td><td>MAINTENANCE</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 occurring alarms and alarm history. Selecting the alarm and pressing FUNC DATA displays alarm contents for troubleshooting.</td></tr>
<tr><td>9</td><td>DATA COPY</td><td>Places the function of one inverter in memory for copying to another drive.</td></tr>
</table></td></tr>
<tr><td>3</td><td>Screen for each Function</td><td></td><td colspan="2">The function screen selected on the program menu appears, hence completing the function.</td></tr>
<tr><td>4</td><td>Supplementary individual</td><td></td><td colspan="2">Functions not completed (e.g., modifying function data, displaying alarm factors) onScreen function screens are displayed on the supplementary screen.</td></tr>
</table>

4.3 Entering Data on the Keypad

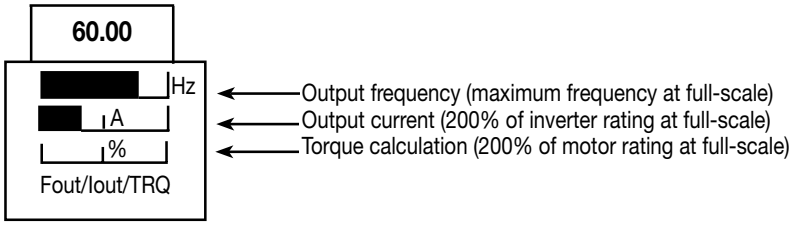
4.3.1 Operation Mode

The screen for normal drive operation includes a screen for displaying drive operating status and a screen for graphically displaying the status in the form of a bar graph. The operator can switch between both screens by using the function (E45).

1) Operating Status (E45=0)



2) Bar Graph (E45=1)

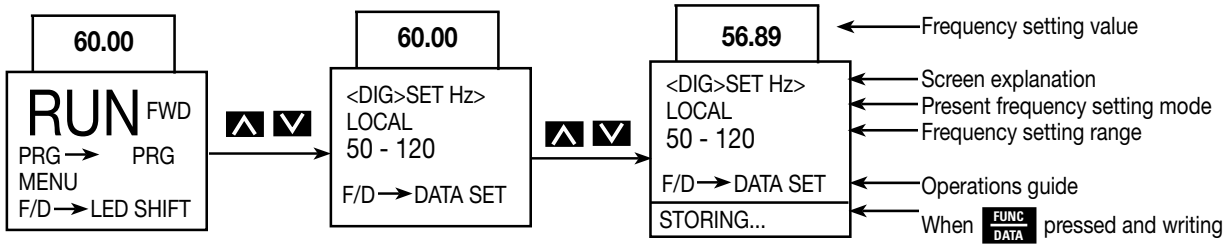


4.3.2 Setting Digital Frequency

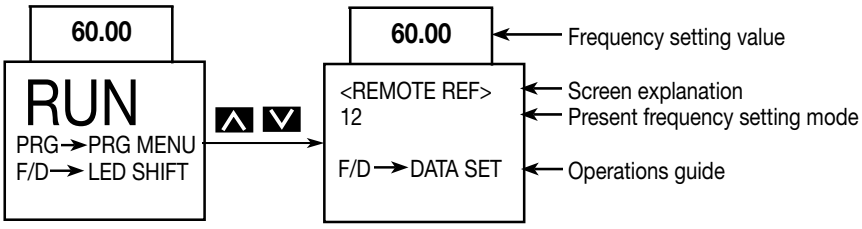
On the operation mode screen, press ∧ or ∨ to display the set frequency on the LED. Data is increased or decreased in the smallest possible unit, depending on which key is pressed. The adjustments in data will occur rapidly if the operator holds down ∧ or ∨ . To select a digit use SHIFT and then data can be set directly. To save the frequency settings press FUNC DATA.

Press REM/LOC RESET and PRG to to return to the operation mode. If keypad settings are not selected, the present frequency setting mode appears on the LCD. When selecting the PID function, the PID command can be set with a process value (refer to technical documentation for details).

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



2) Non-digital setting



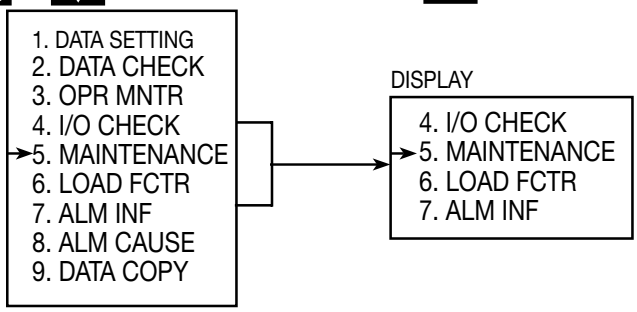
4.3.3 Switching to LED Digital Monitor

During normal operation, press FUNC DATA to switch to LED monitor display. When monitored data is switched, the LED monitor contents are displayed. 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 frquency 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 lasr 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		—	
11	PID remote setting value	PID remote setting value		—	Displayed only when PID is effective in PID operation selection.
12	PID feedback value	PID feedback value		—	

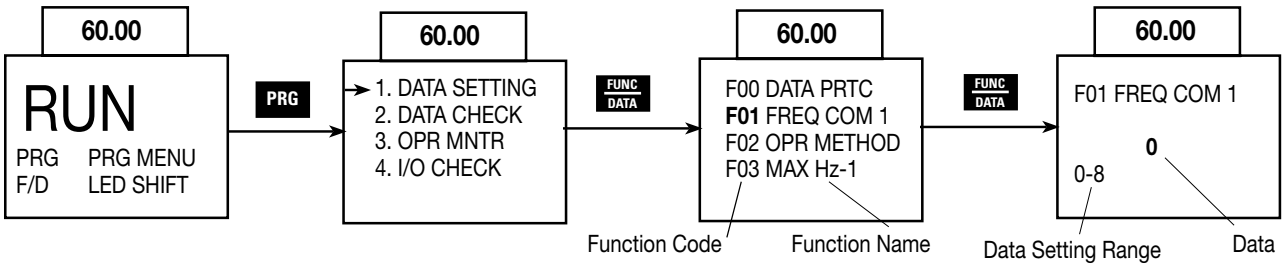
4.3.4 Program Menu Screen

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.** The Function Select screen appears with function codes and names on it. Select the desired function.

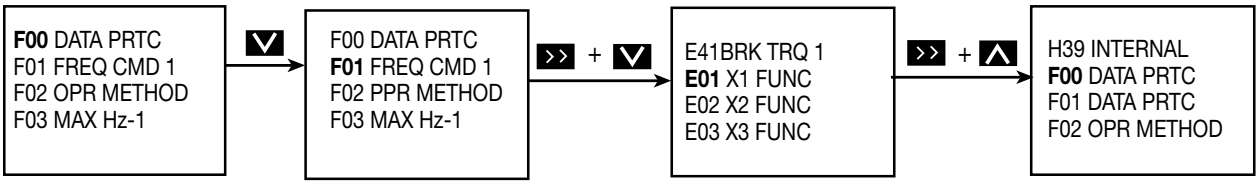


The function code consists of alphanumeric characters with unique letters assigned to each function group.

Table 4-3-1

Function Code	Function	Remarks
F00 - F41	Fundamental functions	
E01 - E47	Terminal Extension Functions	
C01 - C33	Frequency Control Functions	
P01 - P09	Motor Parameters	
H03 - H39	High Performance Functions	
o01 - o29	Optional Functions	Can only be selected with an option connected

To scroll the Function Select screen rapidly, use [>>] + [∧] or [>>] + [∨] to move the screen as a unit sorted alphabetically.



Select the desired function and press [FUNC DATA] to switch to the Data Setting screen.

On the Data Setting screen, the data values on the LCD can be increased or decreased in the smallest possible unit by pressing [∧] or [∨] . Holding down [∧] or [∨] causes the values to increase or decrease more rapidly. Otherwise, select the digit to be modified using [>>] and 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 cancels the changes made and returns control to the Function Select screen. The modified data will be effective in inverter operation after the data has been saved by [FUNC DATA]. If the data is not saved, there is no change to the inverter operation.

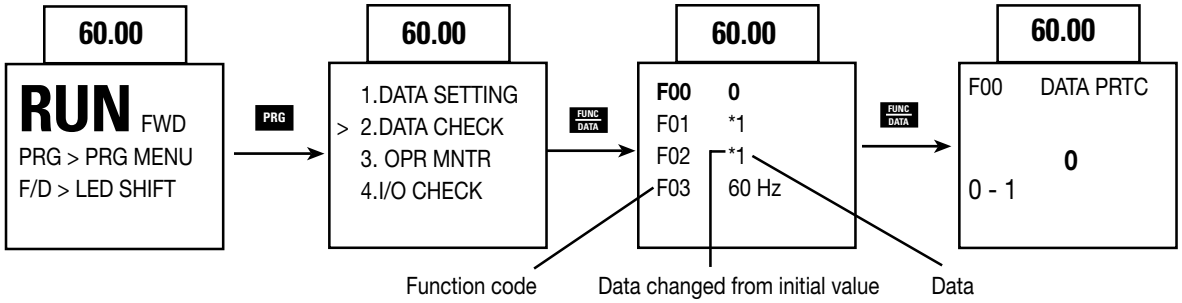
When data setting is disabled in the case of “Data protected” or “Data setting invalid during inverter running,” make the necessary changes as indicated in Table 4-3-2 below.

Table 4-3-2

Display	Reason for No Modification	Release Method
LINK ACTIVE	Currently writing from RS485 Modbus RTU option to function is being made	Send a cancel command to function writing from RS485 Modbus RTU. Stops a “write” operation from the link communication option.
NO SIGNAL(WE)	The edit enabling command function is selected using a general-purpose input terminal	For functions E01 to E05, turn data terminal 19 (edit enabling command selection) ON
DATA PRTCTD	Data protection is selected for function F00.	Change function F00 to 0
INV RUNNING	An attempt was made to change a function that cannot be changed during inverter operation.	Stop inverter operation
FWD/REV ON	An attempt was 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

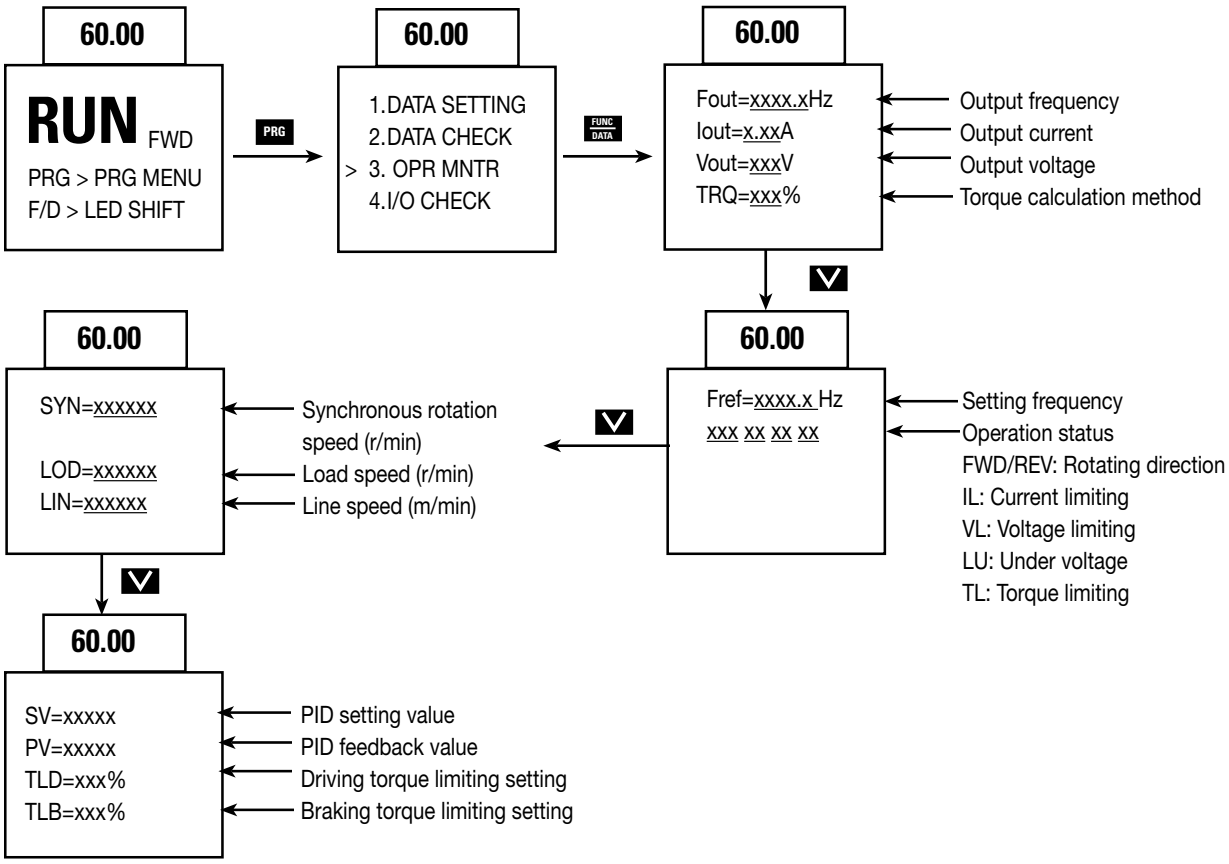
Select 2. DATA CHECK on the Program Menu screen. The Function Select screen then appears with function codes and names.



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, where data can be modified.

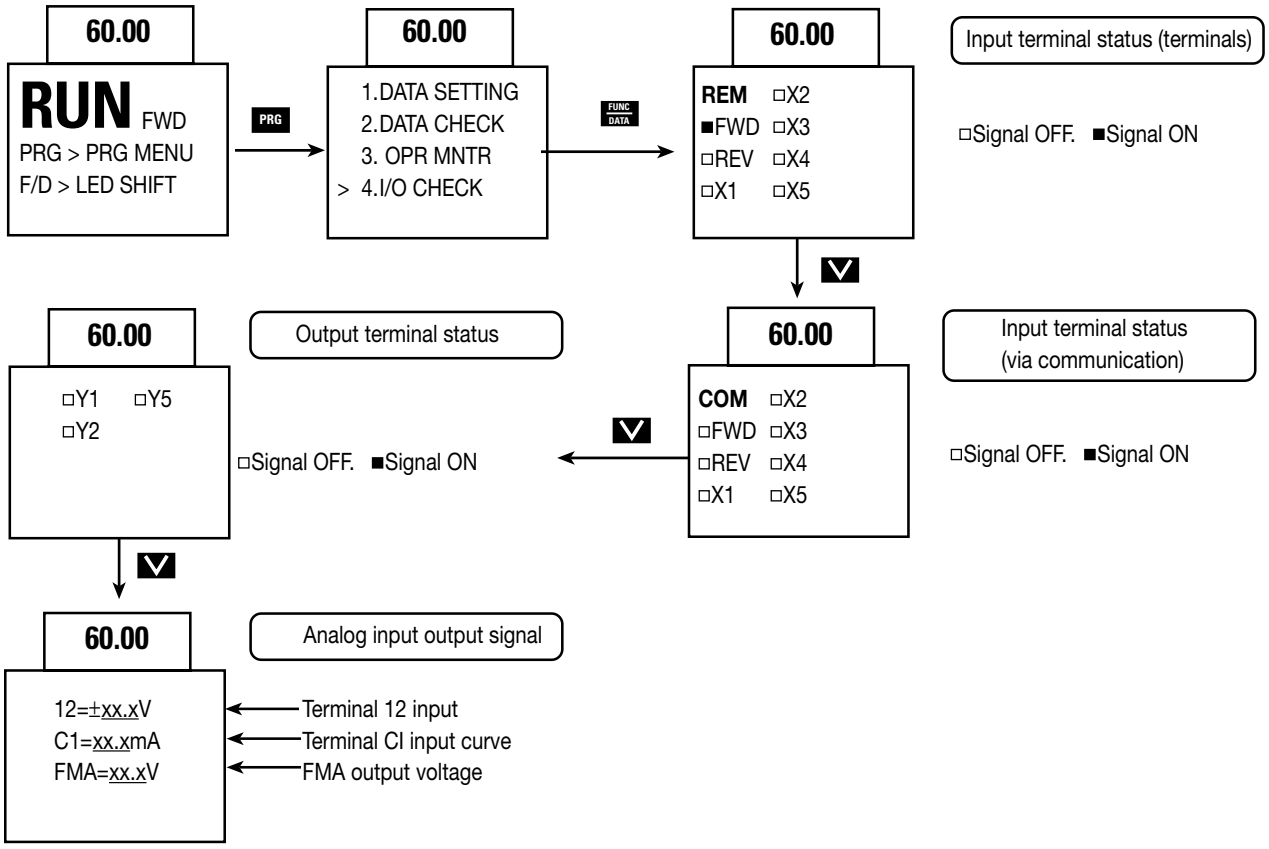
4.3.7 Monitoring Operating Status

Select 3. OPR MNTR on the Program Menu screen to display the current inverter operating status. Use ∧ and ∨ to switch between the four operation monitor screens.



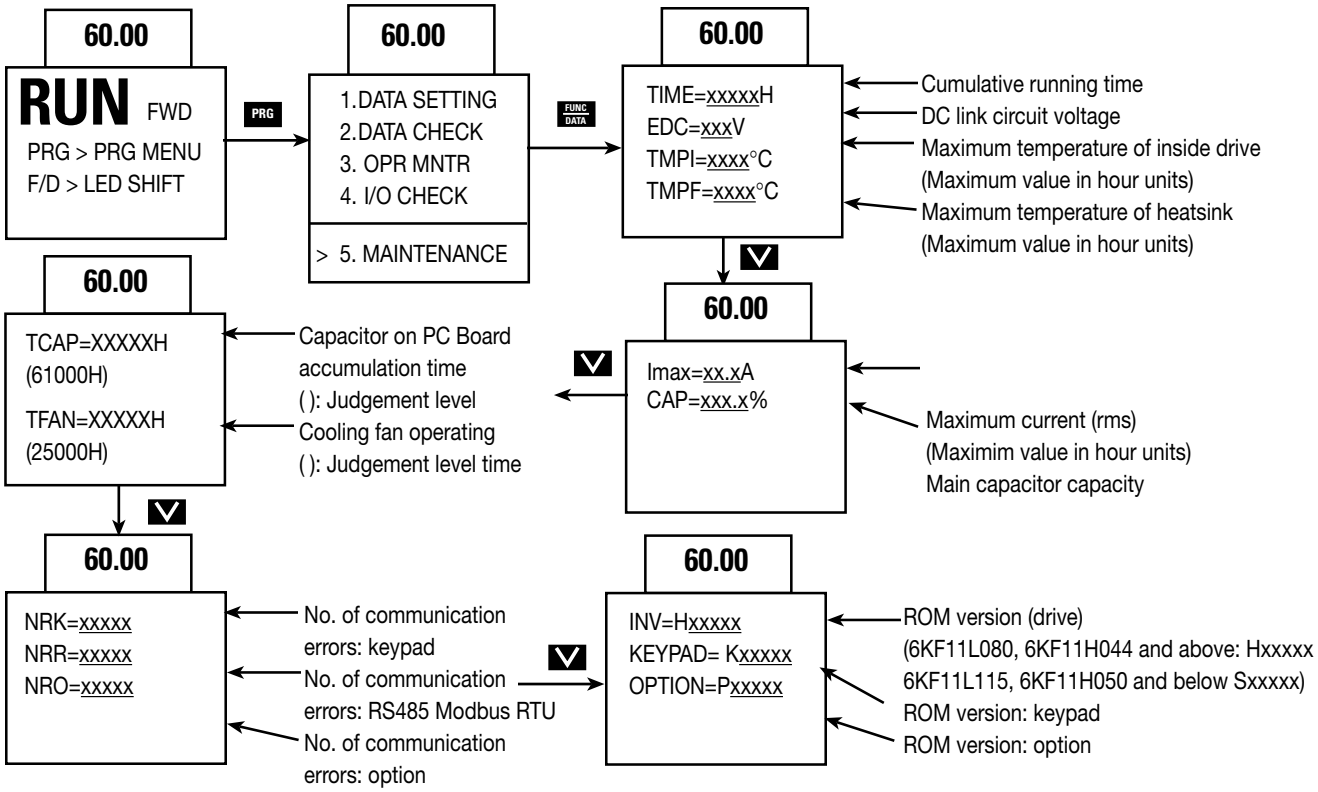
4-3-8 I/O Check

Select 4. I/O on the Program Menu screen. Check to display analog and digital input/output signal status for the drive and options. Use ∧ and ∨ to switch between the seven screens of data.



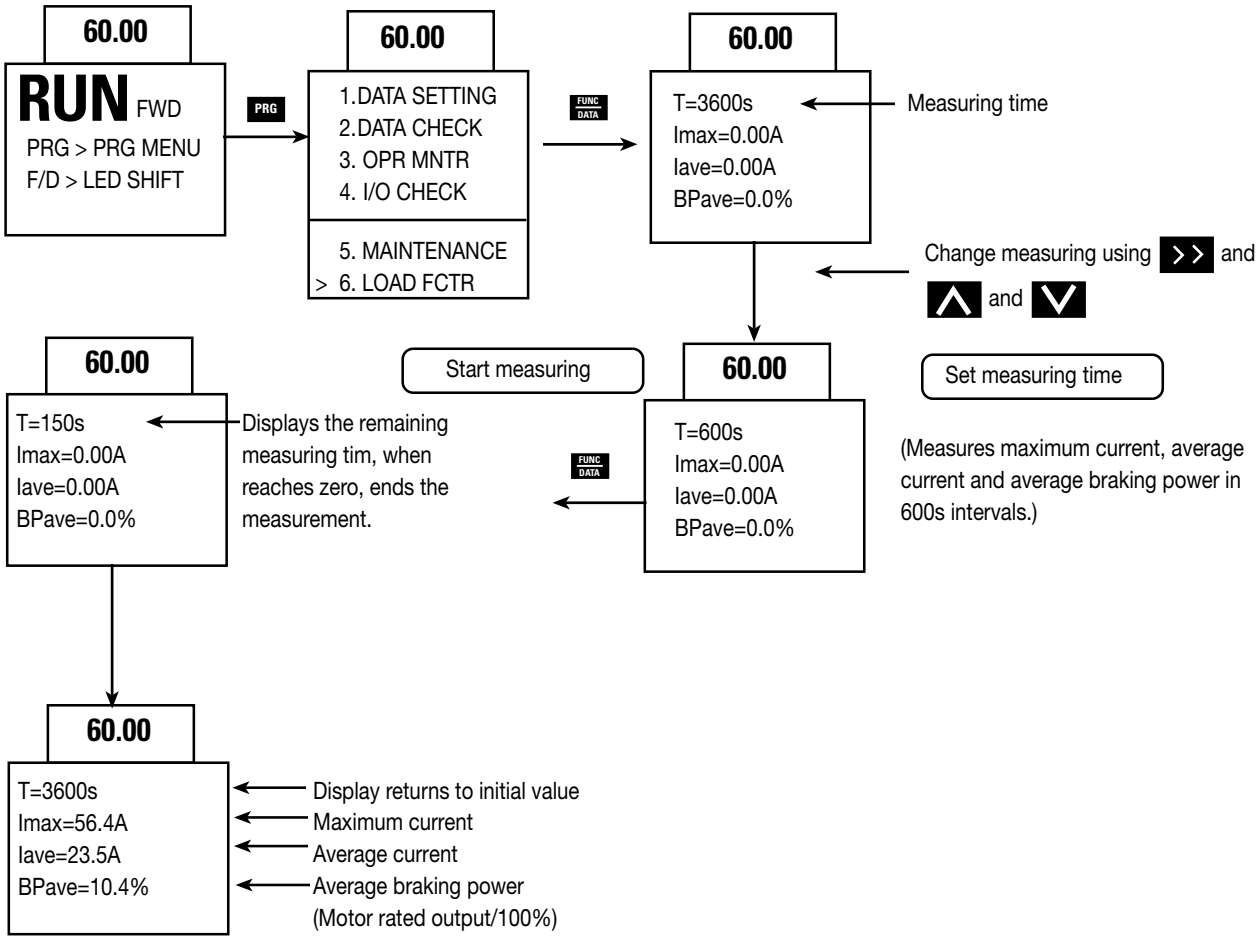
4-3-9 Maintenance Information

Select 5. on the Program Menu screen. Maintenance to display information necessary for maintenance and inspection.
Use ∧ and ∨ to switch between the five screens of data.



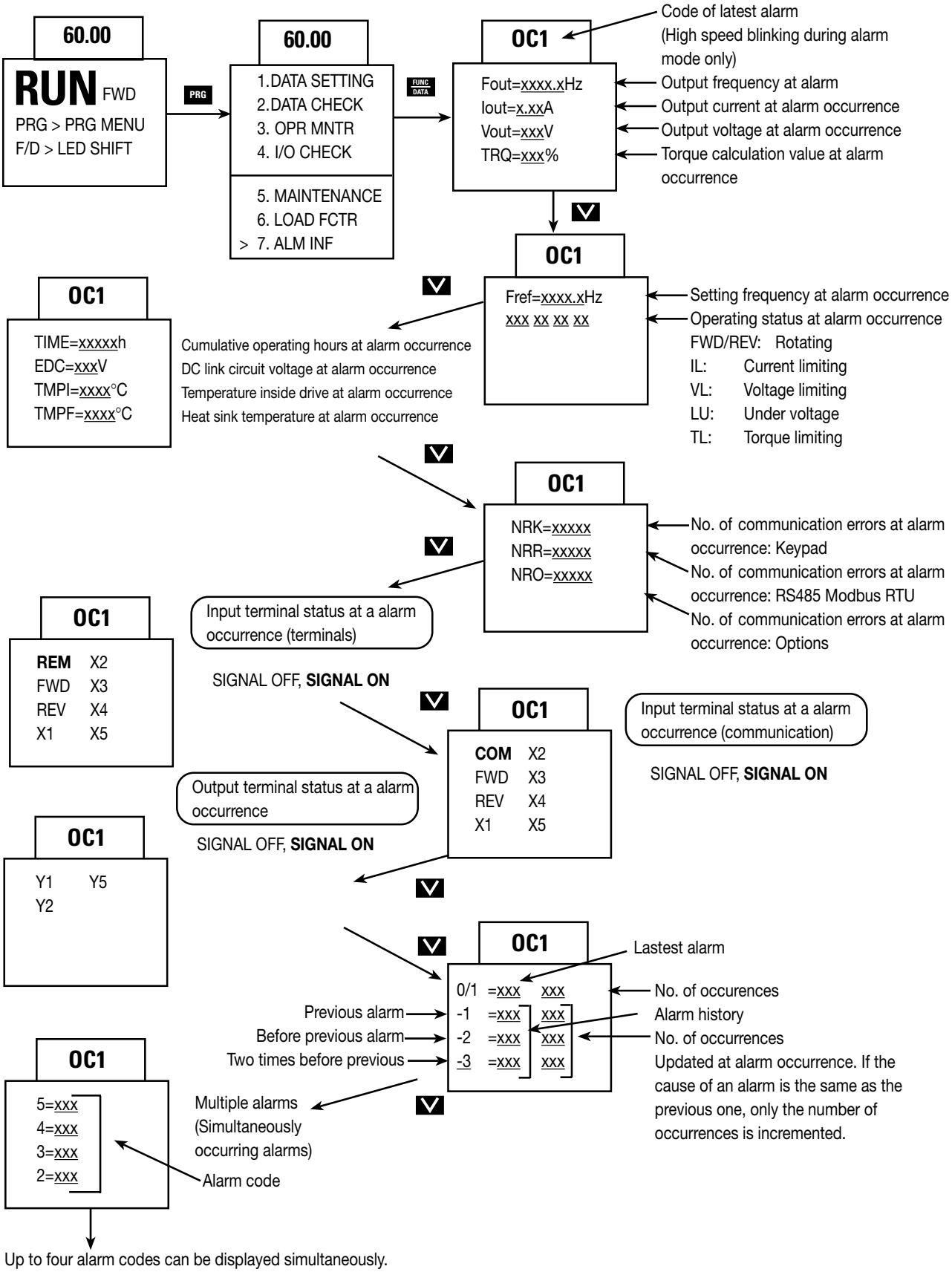
4-3-10 Load Rate Measurement

Select 6. Load Rate Measurement (LOAD FCTR) on the Program Menu screen. The maximum current, average current, and average braking power during the set measuring time are measured and displayed.



4-3-11 Alarm Information

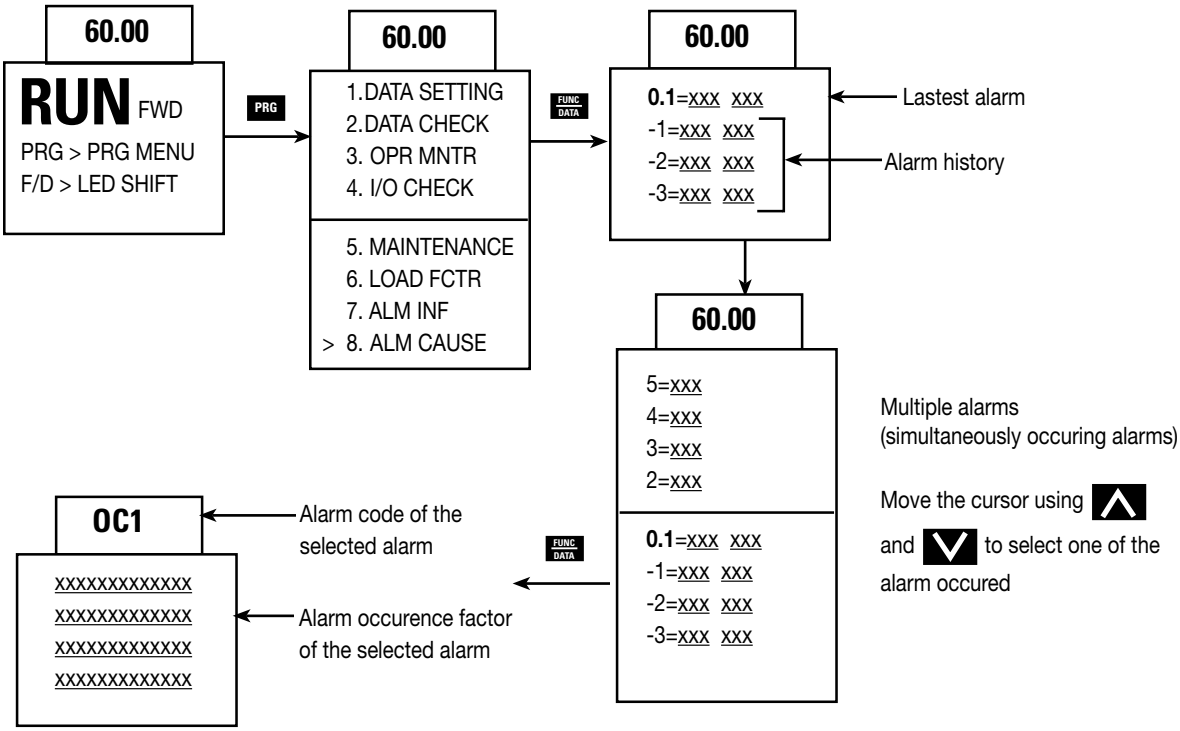
Select 7. Alarm Information (ALM INF) on the Program Menu screen. A variety of operating data at the time the latest alarm occurred is displayed. Use UP and DOWN to switch between the nine screens of alarm information data.



4-3-12 Alarm History and Factors

Select 8. Alarm Cause on the Program Menu screen, to display the alarm history.

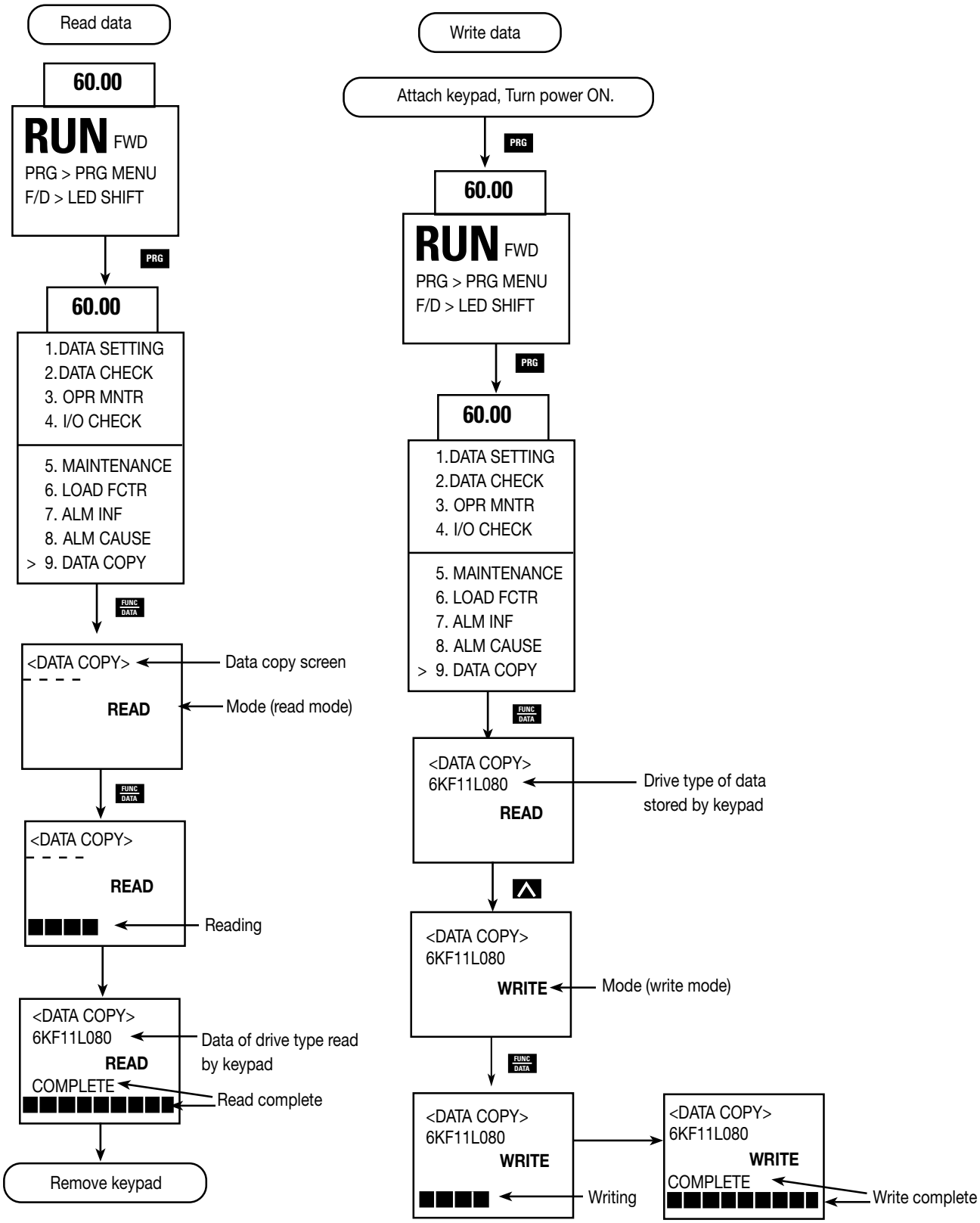
Press FUNC/DATA to display troubleshooting information for the alarm selected.

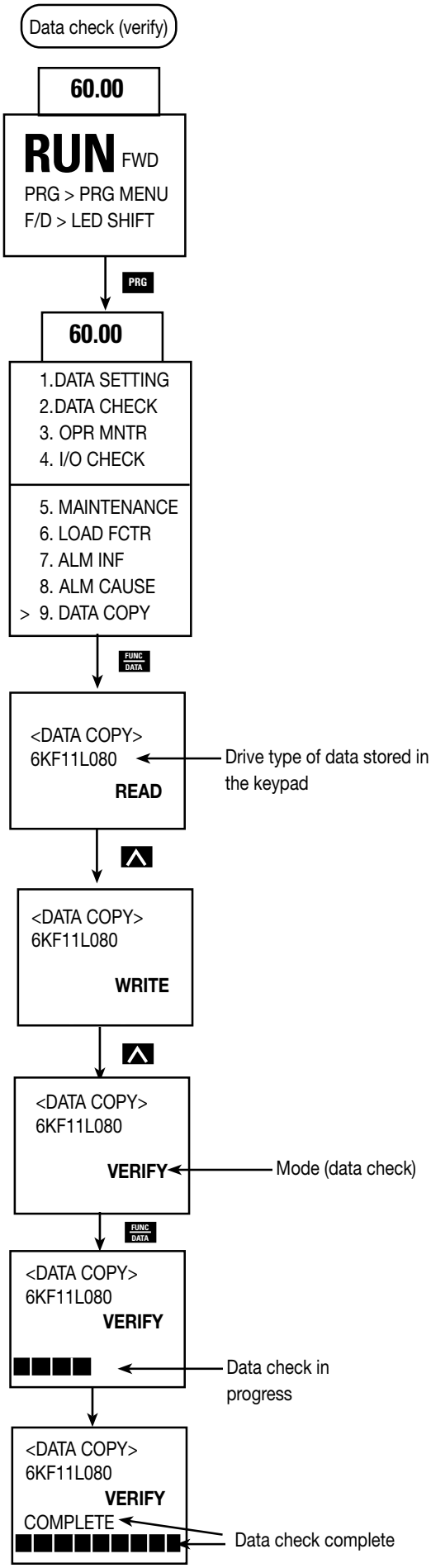


4-3-13 Data Copy

Select 9. Data Copy to display the Data Copy on the Program Menu screen. Read screen. A copy operation is then performed in the following order: function data is read from the first inverter, the keypad is removed and attached to a second drive, the data from the first inverter is written to and stored in the second drive.

The “verify” feature also makes it possible to compare and check differences in the data stored in the keypad and the data stored in the inverter.





Error processing

1. Change disabled during operation

If a write operation is attempted during a drive operation, or vice versa, the error message below will appear. After stopping the drive and pressing REM/LOC RESET retry the write operation.

<DATA COPY>
6KF11L080
WRITE
INV RUNNING

2. Memory error

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

<DATA COPY>
WRITE
MEMORY ERROR

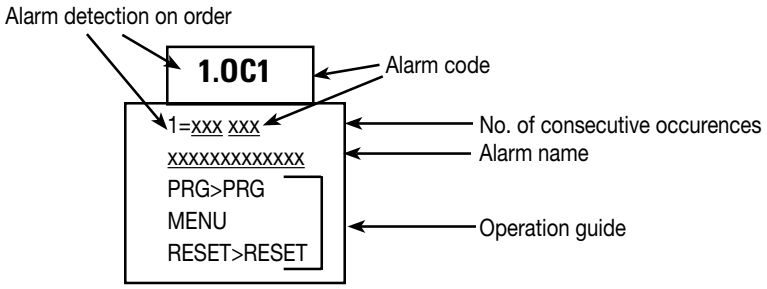
3. Verify error

During a data check (verify) operation, if data stored in the keypad differs from data stored in the drive, the following error message is displayed to indicate the function number. The data 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 REM/LOC RESET .

<DATA COPY>
6KF11L115
WRITE
ERR-F25

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 Selection

5.1 Function Selection List

F: Fundamental Functions

Pg.	Func. No.	Name	LCD Display	Setting Range	Unit	Min.	Default Setting: 6KF11L080 and below 6KF11H044 and below	Default Setting: 6KF11L115 and above 6KF11H060 and above	Data Forms	Change during op
5-4	F00	Data protection	F00 DATA PRTC	0, 1	-	-	0		1	N
	F01	Frequency command 1	F01 FREQ CMD 1	0 to 8	-	-	0		1	N
	F02	Operation method	F02 OPR METHOD	0 to 1	-	-	0		1	N
5-6	F03	Maximum frequency 1	F03 MAX Hz-1	50 to 120Hz	Hz	1	60		1	N
	F04	Base frequency 1	F04 BASE Hz-1	25 to 120Hz	Hz	1	60		1	N
	F05	Rated voltage 1 (at Base frequency 1)	F05 RATED V-1	0V: (Output voltage proportional to source voltage) 230V class: 80 to 240V 460V class: 320 to 480V	V	1	230: (230V class) 460: (460V class)		1	N
	F07	Acceleration time 1	F07 ACC TIME1	0.01 to 3600 s	s	0.01	30.0	30.0	12	Y
	F08	Deceleration time 1	F08 DEC TIME1							
5-7	F09	Torque boost 1	F09 TRQ BOOST1	0.1 to 20.0	-	0.1	0.1		12	Y
	F10	Electronic (Select)	F10 ELCTRN OL1	0, 1, 2	-	-	1		3	Y
	F11	Thermal 1 (level)	F11 OL LEVEL1	20 to 135% of drive rated current	A	0.01	Motor rated current		1	Y
	F12	(time constant)	F12 TIME CNST1	0.5 to 75.0 min	min	0.1	5.0	10.0	19	Y
5-8	F14	Restart mode after momentary power failure	F14 RESTART	0 to 5	-	-	0		1	N
5-10	F15	Frequency (high)	F15 H LIMITER	0 to 120 Hz	Hz	1	70		1	Y
	F16	Limiter (low)	F16 L LIMITER				0		1	N
	F17	Gain (for frequency set signal)	F17 FREQ GAIN	0.0 to 200.0%	%	0.1	100.0		1	Y
	F18	Bias frequency	F18 FREQ BIAS	-120.0 to +120.0 Hz	Hz	0.1	0.0		1	Y
	F20	DC brake (starting frequency)	F20 DC BRK Hz	0.0 to 60.0 Hz	Hz	0.1	0.0		3	Y
	F21	(braking level)	F21 DC BRK LVL	0 to 80%	%	1	0		1	
	F22	(braking time)	F22 DC BRK t	0.0s (inactive)	s	0.1	0.0		3	
5-11	F23	Starting frequency	F23 START Hz	0.1 to 60.0 Hz	Hz	0.1	0.5		3	N
	F24	(holding time)	F24 HOLDING t	0.0 to 10.0 s	s	0.1	0.0		3	
	F25	Stop frequency	F25 STOP Hz	0.1 to 6.0 Hz	Hz	0.1	0.2		1	
	F26	Motor sound (carrier freq.)	F26 MTR SOUND	0.75 to 15 kHz (6kHz)	kHz	1	2		1	Y
	F27	(sound tone)	F27 SOUND TONE	0 to 3	-	-	0		1	Y
	F30	FMA (voltage adjust)	F30 FMA V-ADJ	0 to 200%	%	1	100		1	Y
	F31	(function)	F31 FMA FUNC	0 to 10	-	-	0		1	Y
5-12	F36	30RY operation mode	F36 30RY MODE	0, 1	-	-	0		1	Y
	F40	Torque limiter1 (driving)	F40 DRV TRQ 1	20 to 150%, 999	%	1	999		1	Y
	F41	(braking)	F41 BRK TRQ 1	0%, 20 to 150%, 999			999		1	

E: Terminal Extensions Functions

Pg.	Func. No.	Name	LCD Display	Setting Range	Unit	Min.	Default Setting: 6KF11L080 and below 6KF11H044 and below	Default Setting: 6KF11L115 and above 6KF11H060 and above	Data Forms	Change during op
5-13	E01	X1 terminal function	E01 X1 FUNC	0 to 23	-	-	3		1	N
	E02	X2 terminal function	E02 X2 FUNC				4		1	N
	E03	X3 terminal function	E03 X3 FUNC				5		1	N
	E04	X4 terminal function	E04 X4 FUNC				7		1	N
	E05	X5 terminal function	E05 X5 FUNC				20		1	N
5-16	E20	Y1 terminal function	E20 Y1 FUNC	0 to 14	-	-	1		1	N
	E21	Y2 terminal function	E21 Y2 FUNC				2		1	N
	E24	Y5A, Y5C terminal function	E24 Y5 FUNC				0		1	N
5-18	E25	Y5 RY operation mode	E25 Y5RY MODE	0,1	-	1	0		1	N
	E30	FAR function (Hysteresis)	E30 FAR HYSTR	0.0 to 10.0 Hz	Hz	0.1	2.5		3	Y
	E31	FDT function (level)	E31 FDT1 LEVEL	0 to120 Hz	Hz	1	60		1	Y
	E32	signal (Hysteresis)	E32 FDT1 HYSTR	0.0 to 30.0 Hz	Hz	0.1	1.0		3	
5-19	E33	OL function (mode select)	E33 OL1 WARNING	0: Thermal calculation 1: Output current	-	-	0		1	Y
	E34	signal (level)	E34 OL1 LEVEL	5 to 150% of rated drive current	A	0.01	motor rated current		19	
	E35	(timer)	E35 OL1 TIMER	0.1 to 60.0 s	s	0.1	10.0		3	
	E36	Underload detection (level)	E36 UL LEVEL	0 to 100%	%	1	20		1	Y
	E37	Underload detection (time)	E37 UL TIME	0.0 to 60.0S	s	0.1	20.0		3	
	E40	Display coefficient A	E40 COEF A	-999.00 to 999.00	-	0.01	0.01		12	
	E41	Display coefficient B	E41 COEF B	-999.00 to 999.00	-	0.01	0.00		12	Y
	E43	LED Monitor (function)	E43 LED MNTR	0 to 12	-	-	0		1	Y
	E44	(display in STOP mode)	E44 LED MNTR2	0, 1	-	-	0		1	Y
5-20	E45	LCD Monitor (function)	E45 LCD MNTR	0, 1	-	-	0		1	Y
	E46	(language)	E46 LANGUAGE	0 to 5	-	-	1		1	Y
	E47	(contrast)	E47 CONTRAST	0(soft) to 10(hard)	-	-	5		1	Y

Pg.	Func. No.	Name	LCD Display		Setting Range	Unit	Min.	Default Setting		Data Forms	Change during op
								6KF11L080 and below 6KF11H044 and below	6KF11L115 and above 6KF11H060 and above		
C:Frequency Control Functions											
	C01	Jump (Jump freq. 1)	C01	JUMP Hz 1	0 to 120 Hz	Hz	1	0		1	Y
	C02	frequency (Jump freq. 2)	C02	JUMP Hz 2				0		1	
	C03	(Jump freq. 3)	C03	JUMP Hz 3				0		1	
	C04	(Hysteresis)	C04	JUMP HYSTR	0 to 30 Hz	Hz	1	3		1	
5-21	C05	Multistep (Freq. 1)	C05	MULTI Hz-1	0.00 to 120.00 Hz	Hz	0.01	0.00		5	Y
	C06	frequency (Freq. 2)	C06	MULTI Hz-2				0.00		5	
	C07	setting (Freq. 3)	C07	MULTI Hz-3				0.00		5	
	C08	(Freq. 4)	C08	MULTI Hz-4				0.00		5	
	C09	(Freq. 5)	C09	MULTI Hz-5				0.00		5	
	C10	(Freq. 6)	C10	MULTI Hz-6				0.00		5	
	C11	(Freq. 7)	C11	MULTI Hz-7				0.00		5	
5-22	C30	Frequency command 2	C30	FREQ CMD 2	0 to 2	-	-	1		1	N
	C31	Offset adjust (terminal [12])	C31	BIAS 12	-100.0 to +100.0%	%	0.1	0.0		4	Y
	C32	(terminal [C1])	C32	GAIN 12	0.0 to +200.0%	%	0.1	100.0		3	Y
	C33	Analog setting signal filter	C33	REF FILTER	0.00 to 5.00s	s	0.01	0.05		5	Y
P:Motor Parameters											
	P01	Number of motor 1 poles	P01	M1 POLES	2 to 14	-	2	4		9	N
5-23	P02	Motor 1 (capacity)	P02	M1-CAP	Up to 30 HP: 0.01 to 60 HP 40 HP and above: 0.01 to 800 HP	Hp	0.01	motor capacity		5	N
	P03	(rated current)	P03	M1-Ir	0.00 to 2000 A	A	0.01	motor rated current		19	N
	P04	(tuning)	P04	M1 TUN1	0, 1, 2	-	-	0		21	N
	P05	(on-line tuning)	P05	M1 TUN2	0, 1	-	-	0		1	N
	P06	(no-load current)	P06	M1-Io	0.00 to 2000 A	A	0.01	standard rated value		19	N
5-24	P07	(%R1 setting)	P07	M1-%R1	0.00 to 50.00%	%	0.01	standard rated value		5	Y
	P08	(%X setting)	P08	M1-%X	0.00 to 50.00%	%	0.01	standard rated value		5	Y
	P09	Slip compensation control	P09	SLIP COMP1	0.00 to 15.00 Hz	Hz	0.01	0.00		5	Y
H:High Performance Functions											
	H03	Data initializing	H03	DATA INIT	0, 1	-	-	0		1	N
	H04	Auto-reset (times)	H04	AUTO-RESET	0, 1 to 10 times	-	1	0		1	Y
5-25	H05	(reset interval)	H05	RESET INT	2 to 20 s	s	1	5		1	Y
	H06	Fan stop operation	H06	FAN STOP	0, 1	-	-	0		1	Y
	H07	ACC/DEC pattern (mode select)	H07	ACC PTN	0,1,2,3	-	-	0		1	N
5-26	H08	Rev. phase sequence lock	H08	REV LOCK	0, 1	-	-	1		1	N
	H09	Start mode	H09	START MODE	0, 1, 2	-	--	0		1	N
	H10	Energy-saving operation	H10	ENERGY SAV	0, 1	-	-	1		1	Y
	H11	DEC mode	H11	DEC MODE	0, 1	-	-	0		1	Y
5-27	H13	Auto-restart (restart time)	H13	RESTART t	0.1 to 10.0 s	s	0.1	0.1	0.5	3	N
	H14	(freq. fall rate)	H14	FALL RATE	0.00 to 100.00 Hz/s	Hz/s	0.01	10.00		5	Y
	H15	(holding DC voltage)	H15	HOLD V	3-phase, 230V class: 200 to 300V 3-phase, 460V class: 400 to 600V	V	1	200V class: 235V 400V class: 470V		1	
	H16	(OPR command self hold time)	H16	SELFHOLD t	0.0 to 30.0 s, 999	s	0.1	999		3	N
5-28	H19	Active drive	H19	AUT RED	0, 1	-	-	0		1	Y
	H20	PID control (mode select)	H20	PID MODE	0, 1, 2	--	-	0		1	N
	H21	(feedback signal)	H21	FB SIGNAL	0, 1, 2, 3	-	-	1		1	N
	H22	(P-gain)	H22	P-GAIN	0.01 to 10.00 times	-	0.01	0.1		5	Y
5-29	H23	(I-gain)	H23	I-GAIN	0.0, 0.1 to 3600 s	s	0.1	0.0		3	Y
	H24	(D-gain)	H24	D-GAIN	0.00 s , 0.01 to 10.0 s	s	0.01	0.00		5	Y
	H25	(feedback filter)	H25	FB FILTER	0.0 to 60.0 s	s	0.1	0.5		3	Y
5-31	H30	Serial link (function select)	H30	LINK FUNC	0, 1, 2, 3	-	-	0		1	Y
	H31	Modbus-RTU (address)	H31	ADDRESS	0 (broadcast), 1 to 247	-	1	1		1	N
	H32	(mode select on no response error)	H32	MODE ON ER	0, 1, 2, 3	-	-	0		1	Y
	H33	(timer)	H33	TIMER	0.0 to 60.0 s	s	-	2.0		3	Y
	H34	(baud rate)	H34	BAUD RATE	0, 1, 2, 3	-	-	1		1	Y
5-32	H35	(data length)	H35	LENGTH	0 (8-bit fixed)	-	-	0		1	Y
	H36	(parity check)	H36	PARITY	0, 1, 2	-	-	0		1	Y
	H37	(stop bits)	H37	STOP BITS	0 (2-bit), 1(1-bit)	-	-	0		1	Y
	H38	(no response error detection time)	H38	NO RES t	0 (no detection), 1 to 60 s	s	1	0		1	Y
	H39	(response interval)	H39	INTERVAL	0.00 to 1.00 s	s	0.01	0.01		5	Y

5.1 Alphabetical Function List

PG.	NAME	LCD Display	
5-12	30RY operation mode	F36	30RY MODE
5-6	Acceleration time 1	F07	ACC TIME1
5-25	ACC/DEC Pattern	H07	ACC PTN
5-28	Active Drive	H19	AUT RED
5-22	Analog setting signal filter	C33	REF FILTER
5-6	Base frequency 1	F04	BASE Hz-1
5-10	Bias frequency	F18	FREQ BIAS
5-25	Data initializing	H03	DATA INIT
5-4	Data protection	F00	DATA PRTC
5-10	DC brake (Braking level)	F21	DC BRK LVL
5-10	DC brake (Braking time)	F22	DC BRK t
5-10	DC brake (Starting freq.)	F20	DC BRK Hz
5-27	DEC mode	H11	DEC MODE
5-6	Deceleration time 1	F08	DEC TIME1
5-19	Display coefficient A	E40	COEF A
5-19	Display coefficient B	E41	COEF B
5-7	Electronic Thermal 1 (Level)	F11	OL LEVEL1
5-7	Electronic Thermal 1 (Select)	F10	ELCTRN OL1
5-7	Electronic Thermal 1 (Thermal time constant)	F12	TIME CNST1
5-27	Energy-saving operation	H10	ENERGY SAV
5-25	Fan stop operation	H06	FAN STOP
5-11	FAR function (Hysteresis)	E30	FAR HYSTR
5-11	FDT function (Level)	E31	FDT1 LEVEL
5-18	FDT signal (Hysteresis)	E32	FDT1 HYSTR
5-18	FMA (Voltage adjust)	F30	FMA V-ADJ
5-18	FMA (Function)	F31	FMA FUNC
5-4	Frequency command 1	F01	FREQ CMD 1
5-22	Frequency command 2	C30	FREQ CMD 2
5-10	Frequency limiter (High)	F15	H LIMITER
5-10	Frequency limiter (Low)	F16	L LIMITER
5-10	Gain (for freq set signal)	F17	FREQ GAIN
5-21	Jump frequency (Hysteresis)	C04	JUMP HYSTR
5-21	Jump frequency (Jump freq 1)	C01	JUMP Hz 1
5-21	Jump frequency (Jump freq 2)	C02	JUMP Hz 2
5-21	Jump frequency (Jump freq 3)	C03	JUMP Hz 3
5-20	LCD Monitor (Contrast)	E47	CONTRAST
5-20	LCD Monitor (Function)	E45	LCD MNTR
5-20	LCD Monitor (Language)	E46	LANGUAGE
5-19	LED Monitor (Function)	E43	LED MNTR
5-19	LED Monitor (Display @ STOP mode)	E44	LED MNTR2
5-6	Maximum frequency 1	F03	MAX Hz-1
5-31	Modbus-RTU (Address)	H31	ADDRESS
5-32	Modbus-RTU (Baud rate)	H34	BAUD RATE
5-32	Modbus-RTU (Data length)	H35	LENGTH
5-32	Modbus-RTU (Mode select on no response error)	H32	MODE ON ER
5-32	Modbus-RTU (No response error detection time)	H38	NO RES t
5-32	Modbus-RTU (Parity check)	H36	PARITY
5-32	Modbus-RTU (Response interval)	H39	INTERVAL
5-32	Modbus-RTU (Stop bits)	H37	STOP BITS
5-32	Modbus-RTU (Timer)	H33	TIMER
5-24	Motor 1 (%R1 setting)	P07	M1-%R1
5-24	Motor 1 (%X setting)	P08	M1-%X

PG.	NAME	LCD Display	
5-23	Motor 1 (Capacity)	P02	M1 -CAP
5-24	Motor 1 (No-load current)	P06	M1-Io
5-24	Motor 1 (On-line Tuning)	P05	M1 TUN2
5-23	Motor 1 (Rated current)	P03	M1-Ir
5-23	Motor 1 (Tuning)	P04	M1 TUN1
5-11	Motor sound (Carrier freq.)	F26	MTR SOUND
5-11	Motor sound (Sound tone)	F27	SOUND TONE
5-21	Multistep frequency setting (Freq. 1)	C05	MULTI Hz-1
5-21	Multistep frequency setting (Freq. 2)	C06	MULTI Hz-2
5-21	Multistep frequency setting (Freq. 3)	C07	MULTI Hz-3
5-21	Multistep frequency setting (Freq. 4)	C08	MULTI Hz-4
5-21	Multistep frequency setting (Freq. 5)	C09	MULTI Hz-5
5-21	Multistep frequency setting (Freq. 6)	C10	MULTI Hz-6
5-21	Multistep frequency setting (Freq. 7)	C11	MULTI Hz-7
5-23	Number of motor 1 poles	P01	M1 POLES
5-22	Offset adjust (terminal [12])	C31	BIAS 12
5-22	Offset adjust (terminal [C1])	C32	GAIN 12
5-19	OL function (Mode select)	E33	OL1 WARNING
5-19	OL function siganl (Timer)	E35	OL1 TIMER
5-19	OL function signal (Level)	E34	OL1 LEVEL
5-4	Operation method	F02	OPR METHOD
5-30	PID control (D-gain)	H24	D-GAIN
5-31	PID control (Feedback filter)	H25	FB FILTER
5-28	PID control (Feedback signal)	H21	FB SIGNAL
5-30	PID control (I-gain)	H23	I-GAIN
5-28	PID control (Mode select)	H20	PID MODE
5-29	PID control (P-gain)	H22	P-GAIN
5-6	Rated voltage	F05	RATED V-1
5-8	Restart mode after momentary power failure	F14	RESTART
5-26	Rev. phase sequence lock	H08	REV LOCK
5-31	Serial link (Function select)	H30	LINK FUNC
5-24	Slip compensation control	P09	SLIP COMP1
5-26	Start mode	H09	START MODE
5-11	Starting frequency (Freq.)	F23	START Hz
5-11	Starting frequency (Holding time)	F24	HOLDING t
5-11	Stop frequency	F25	STOP Hz
5-7	Torque boost 1	F09	TRQ BOOST1
5-12	Torque limiter (braking)	F41	BRK TRQ 1
5-12	Torque limiter (Driving)	F40	DRV TRQ 1
5-19	Underload detector (level)	E36	UL LEVEL
5-19	Underload detector (time)	E37	UL TIME
5-13	X1 terminal function	E01	X1 FUNC
5-13	X2 terminal function	E02	X2 FUNC
5-13	X3 terminal function	E03	X3 FUNC
5-13	X4 terminal function	E04	X4 FUNC
5-13	X5 terminal function	E05	X5 FUNC
5-16	Y1 terminal function	E20	Y1 FUNC
5-16	Y2 terminal function	E21	Y2 FUNC
5-18	Y5 RY operation mode	E25	Y5RY MODE
5-16	Y5A, Y5C terminal func.	E24	Y5 FUNC

F: Fundamental Functions

F00 Data protection

F 0 0 DATA PRTC

Setting range 0 : data can be changed
1 : data cannot be changed

This function protects the system by blocking any data changes from the keypad.

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 setting 1

F 0 1 FREQ CMD1

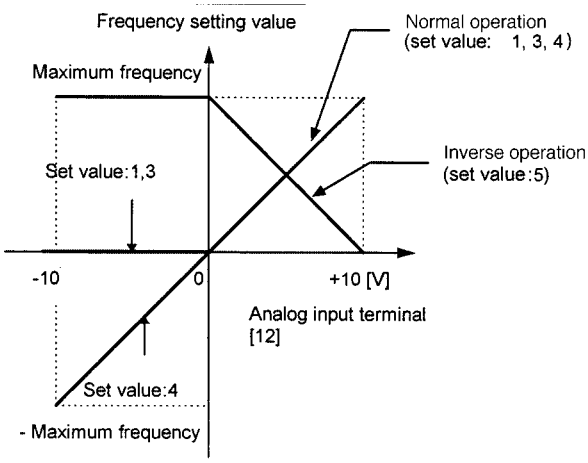
This function determines the method to be used for setting frequency.

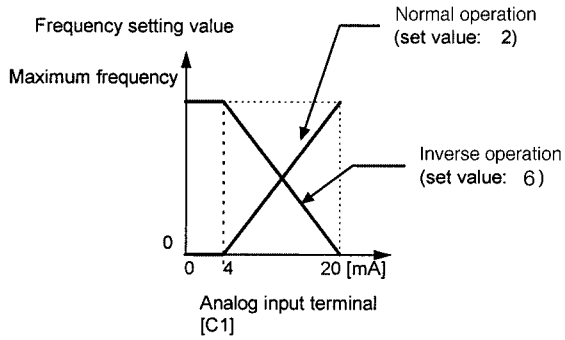
0: Keypad operation (∨ or ∧ key)
1: Voltage input (terminal 12) (0 to +10 VDC, 0 to +5VDC)
2: Current input (terminal C1) (4 to 20 mA DC)
3: Voltage and current input (terminals 12 and C1)
4: Reversible operation with polarity (terminal 12) (0 to ± 10 VDC)

Related functions E01 to E05 (Set values 21)5

5: Inverse mode operation (terminal 12) (+10 to 0 VDC)
6: Inverse mode operation (terminal C1)(20 to 4 mA DC)
7: UP/DOWN control 1 (initial freq. = 0 Hz)
8: UP/DOWN control 2 (initial freq. = last value)

Related functions E01 to E05 (Set values 11, 12)





Note: When Local mode is selcted (as indicated "LOC" on LCD display), futures configured by this function are inactive.

F02 Operation method

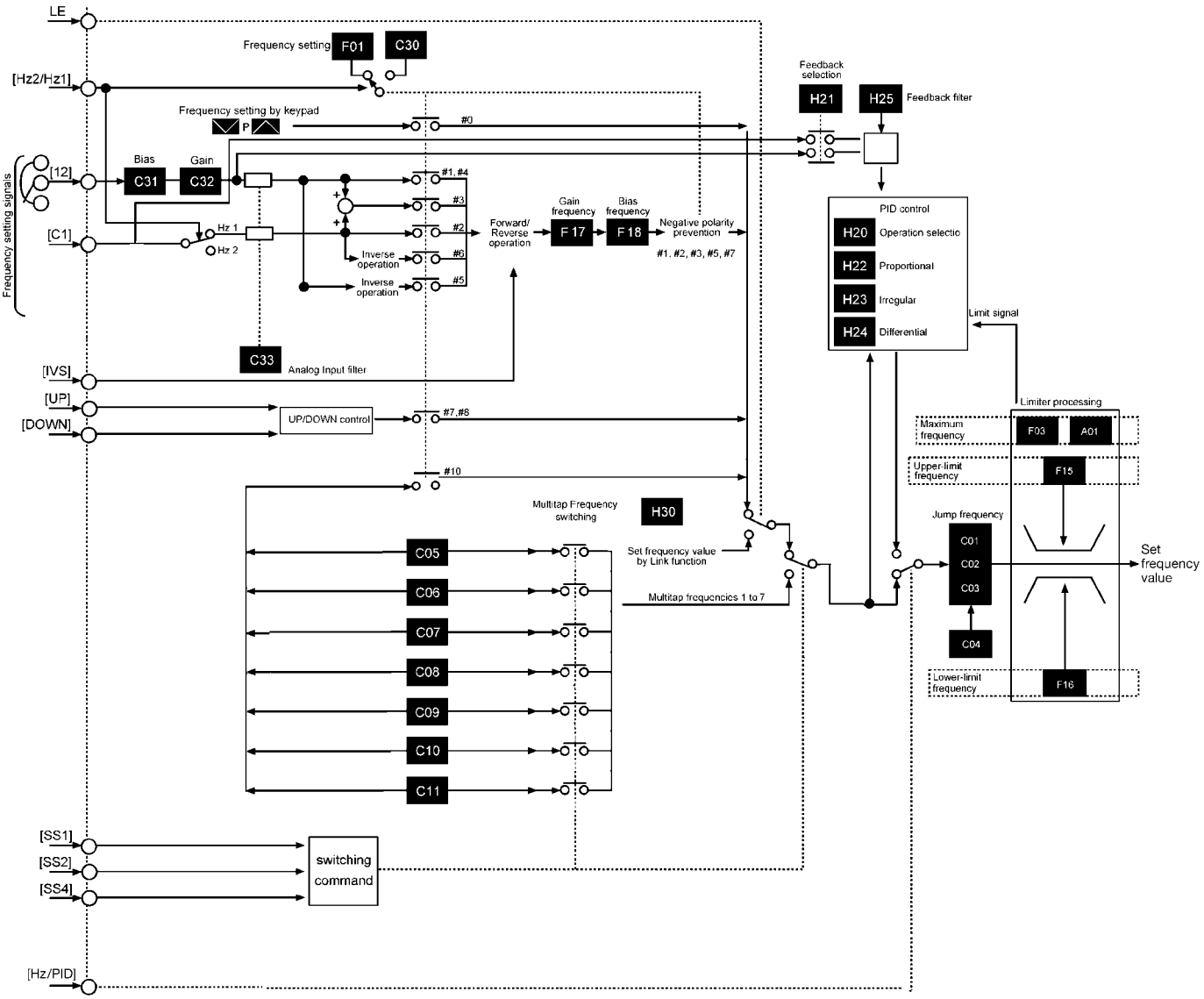
F 0 2 OPR METHOD

This function determines the input method for operation commands when in "REM" mode.

0: Keypad operation (FWD or REV or STOP key)
1: Terminal operation (STOP key active)

Note: When Local mode is selcted (as indicated "LOC" on LCD display), keypad operation (FWD or REV or STOP) is set automatically.

Frequency Setting Block Diagram



F03 Maximum output frequency 1

F	0	3	M	A	X		H	z	–	1		

Setting range 50 to 120 Hz

This function sets the maximum output frequency.

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

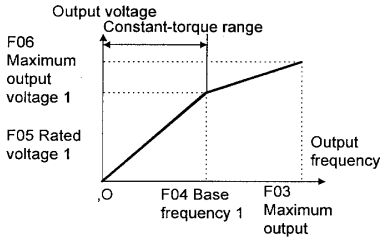
F04 Base frequency 1

F	0	4	B	A	S	E		H	z	–	1	

Setting range 25 to 120Hz

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

Note: If the value of Base frequency 1 is set higher than that of Maximum output frequency 1, the output voltage does not increase to the rated voltage. The maximum frequency limits the output frequency.



F05 Rated voltage 1

F	0	5	R	A	T	E	D		V	–	1	

Setting range 230V AC series: 0, 80 to 240V
460 V series: 0, 320 to 480V

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

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

Note: If the value of Rated voltage 1 is set higher than Maximum output voltage 1, the output voltage does not increase to the rated voltage. The maximum output voltage limits the output voltage.

F07 Acceleration time 1
F08 Deceleration time 1

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

Setting range ACC TIME1: 0.01 to 3,600 seconds
DEC TIME1: 0.01 to 3,600 seconds

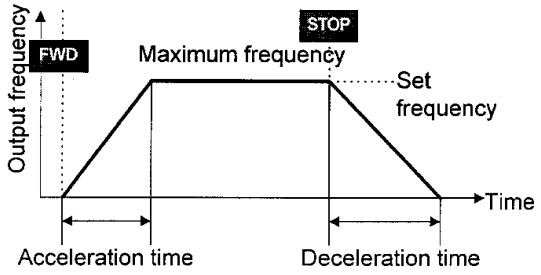
These functions set the acceleration time for the output frequency from startup to maximum frequency, as well as the deceleration time from maximum frequency to operation stop.

Acceleration and deceleration times are represented by the three most significant (high-order) digits.

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

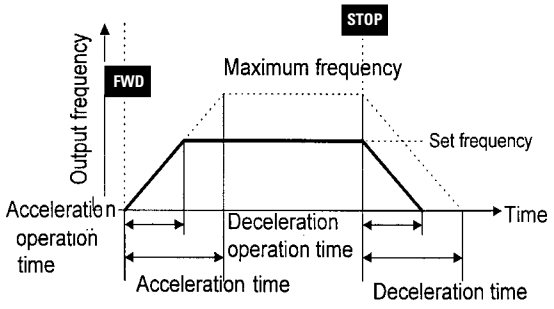
The actual operation time matches the set value.



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 set too low, even though the resistance torque and moment of inertia of the load are great, if the torque limiting functions or stall prevention function are activated, it prolongs the operation time beyond the set value.

F09 Torque Boost 1

F09 TRQ BOOST 1

The following can be selected:

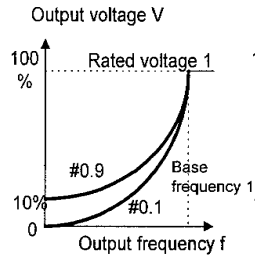
Selection of load characteristics such as automatic torque boost, square law reduction torque load, proportional torque load, constant torque load.

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.

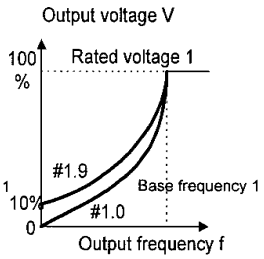
Setting Range	Characteristics Selected
0.1 to 0.9	Square law reduction torque for fan and pump loads
1.0 to 1.9	Proportional torque for middle class loads between square law reduction torque and constant torque (linear change)
2.0 to 20.0	Constant torque (linear change)

Torque characteristics

< Square law reduction torque >

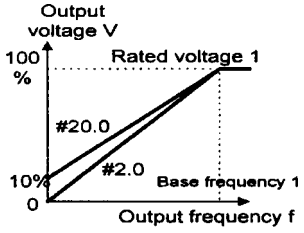


< Proportional torque >



< Constant torque >

Since a large torque boost value creates over-excitation in the low-speed range, continued operation may cause the motor to overheat. Check the characteristics of the driven motor.



F10 Electric thermal O/L relay (operation selection)

F11 Electric thermal O/L relay (level)

F12 Electric thermal O/L relay (thermal time)

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).

F10 ELCTRN OL1

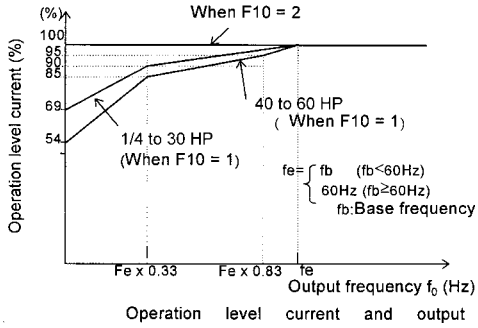
Setting range 0: Inactive
1: Active (for general-purpose motor)
2: Active (for forced air motor)

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.

F11 OL LEVEL1

The setting range is 20 to 135% of the rated drive current.

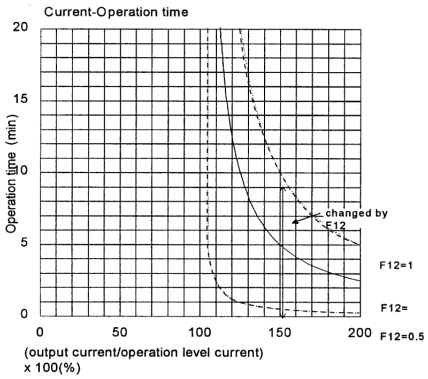
This function sets the operation level current for the electronic thermal O/L relay. Enter a value from 1 to 1.1 times the rated motor current value.



F12 TIME CNST1

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

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



F14 Restart after momentary power failure (operation selection)

F14 RESTART

Setting range: 0 to 5

The following table lists the function details.

This function selects operation if a momentary power failure occurs.

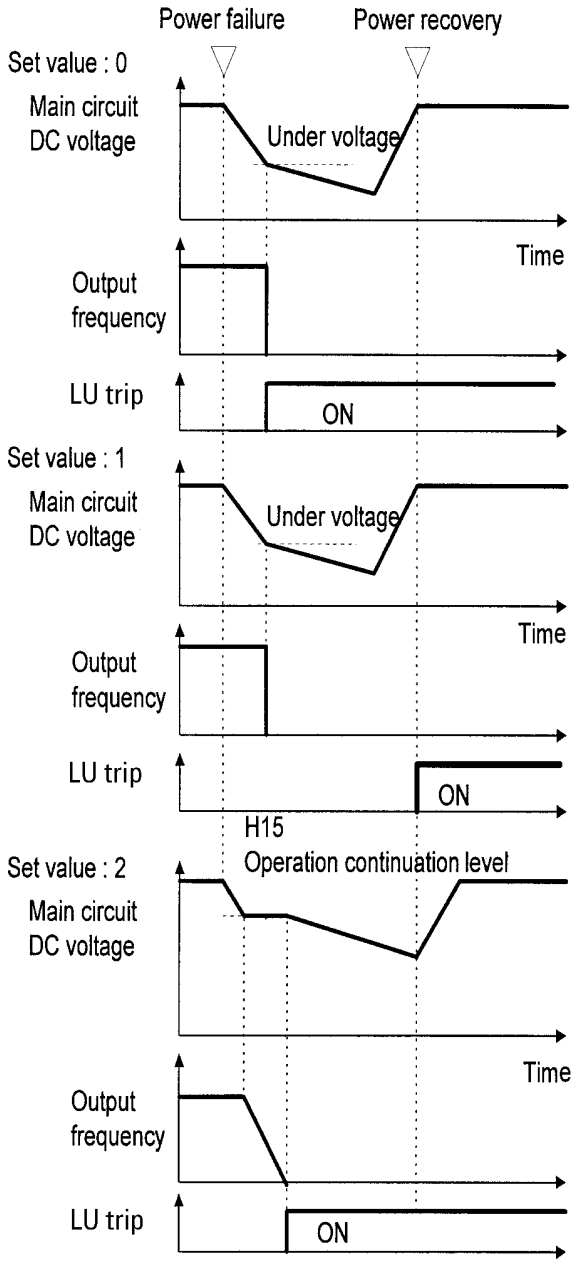
The function for detecting power failure and activating protective operation (i.e., alarm output, alarm display, drive output cutoff) for undervoltage can be selected. The automatic restart function (for automatically restarting a coasting motor without stopping) when the supply voltage is recovered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

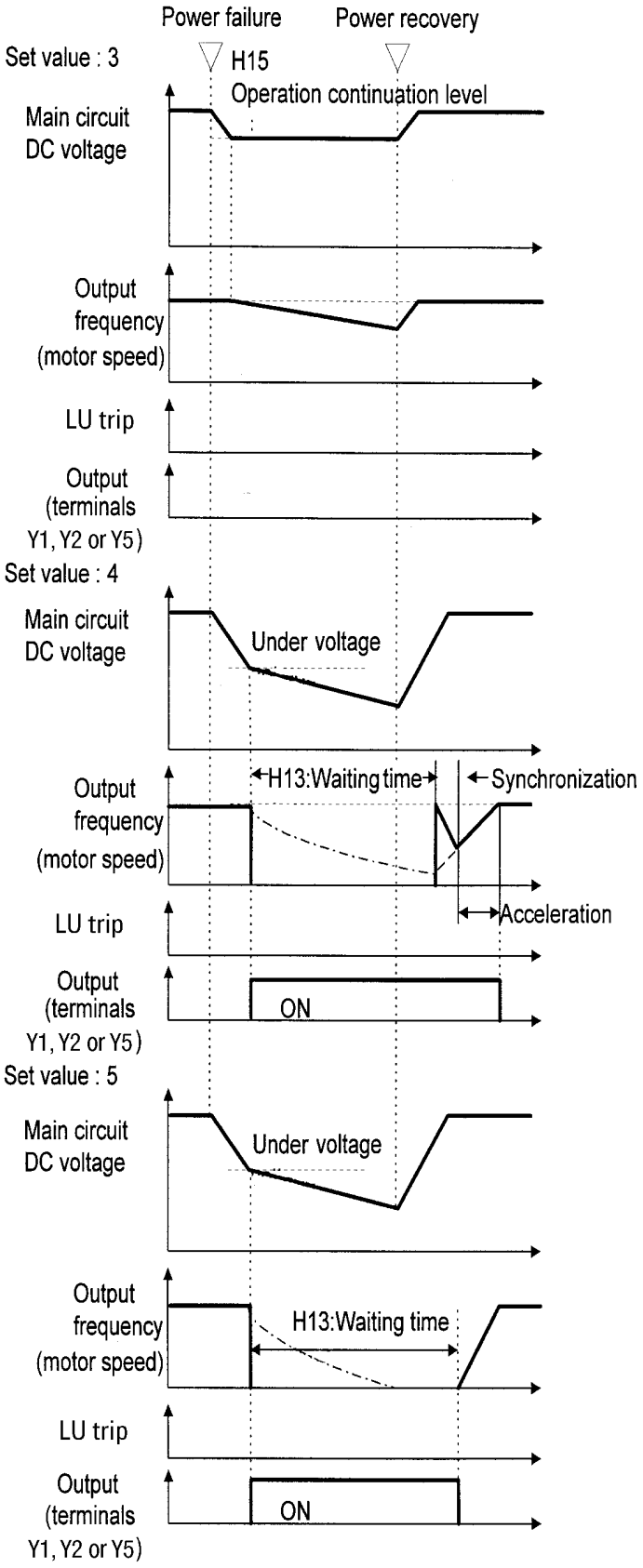
Set Value	Function Name	Operation at Power Failure	Operation at Power Recovery
0	Inactive (intermediate drive trip)	If undervoltage is detected, the drive will immediately trip and an undervoltage fault (LU) is displayed. The drive output stops and the motor will coast to a stop.	The drive operation is not automatically restarted. Input a reset command and operation command to restart.
1	Inactive (drive trip at recovery)	If undervoltage is detected, the drive output stops and the motor will immediately coast to a stop. A drive fault is not activated.	An undervoltage fault (LU) is activated at power recovery. Drive operation is not automatically restarted. Input a reset command to restart operation.
2	Inactive (drive trip after deceleration to a stop at power failure)	When the DC bus voltage reaches the operation voltage level (H15), a controlled deceleration to a stop occurs. The drive collects the inertial energy of the load to maintain the DC bus voltage and controls the motor until it stops, then an undervoltage fault (LU) is activated. The drive will automatically decrease the deceleration time if necessary. If the amount of inertial energy from the load is small, and the undervoltage level is achieved before the motor stops, the undervoltage fault is immediately activated and the motor will coast to a stop.	The drive operation is not automatically restarted. Input a reset command and operation command to restart operation.
3	Active (operation ride-through; for high-inertia loads)	When the DC bus voltage reaches the operation voltage level (H15), energy is collected from the inertia of the load to maintain the DC bus voltage and extend the ride-through time. The drive will automatically adjust the deceleration rate to maintain DC bus voltage level. If undervoltage is detected, the protective function is not activated, but drive output stops and the motor coast to a stop.	Operation is automatically restarted. For power recovery during ride-through, the drive will accelerate directly to the original frequency. If undervoltage is detected, operation automatically restarts with the frequency selected at the time that the undervoltage was detected.
4	Active (restart with the frequency at the time of power failure)	If undervoltage is detected, the protective function is not activated. The drive output stops and the motor will coast to a stop.	Operation is automatically restarted with the frequency selected at the time of power failure.
5	Active (restart with start frequency; for low-inertia loads)	If undervoltage is detected, the protective function is not activated, but drive output stops.	Operation is automatically restarted with the frequency set by F23, "Starting frequency".

Note: Function codes H13 to H16 are provided to control a restart 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 after 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 search 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 is 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.

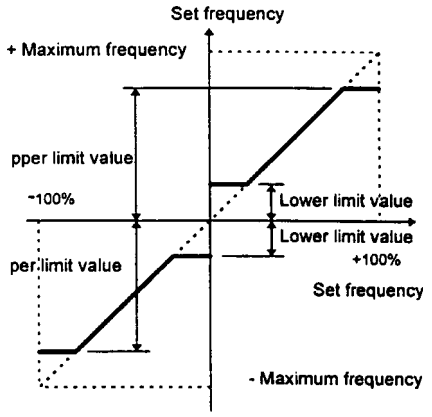
F15 Frequency limiter (High)

F16 Frequency limiter (Low)

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

Setting range 0 to 120 Hz

These functions are used to define the upper and lower limits of the set frequency.



The drive 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.

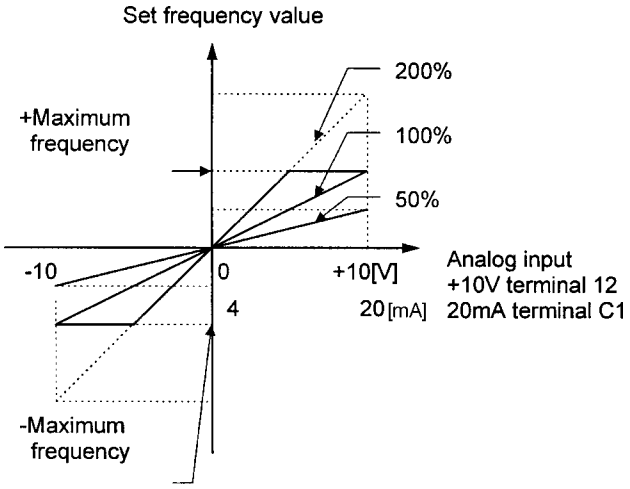
F17 Gain

F	1	7	F	R	E	Q		G	A	I	N	

Setting range: 0.0 to 200.0%

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

Operation follows the figure below.



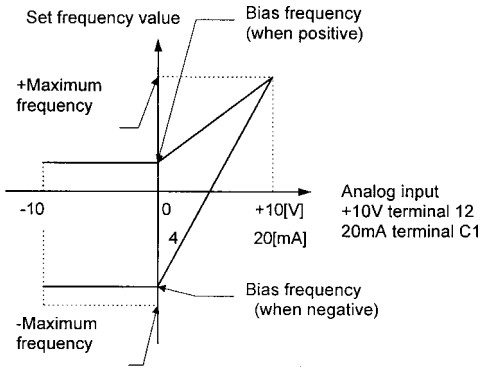
F18 Bias frequency

F	1	8	F	R	E	Q		B	I	A	S	

Setting range: -120.0 to 120.0 Hz

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

The operation follows the figure below. If 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 injection Brake (starting)

F21 DC injection brake (operation level)

F22 DC injection brake (time)

F	2	0	D	C		B	R	K		H	z	

Setting range: 0 to 60 Hz

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

F	2	1	D	C		B	R	K		L	V	L

Setting range: 0 to 80%

Operation level: This function sets the output current level, when a DC injection brake is applied, as a percentage of the rated output current in 1% increments.

F	2	2	D	C		B	R	K		t		

Setting range: 0.0: Inactive

0.1 to 30.0 seconds

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

CAUTION

Do not use the drive brake function for mechanical holding. **Injury may result.**

F23 Starting frequency (frequency)

F24 Start frequency (Holding time)

F25 Stop frequency

F23 START Hz

Setting range: 0.1 to 60 Hz
Frequency: This function sets the frequency at startup.

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

F24 HOLDING t

Setting range: 0.1 to 10.0 seconds

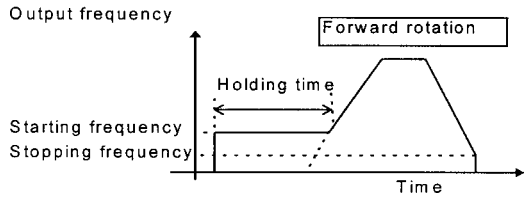
Holding time: This function sets the holding time during which the start frequency is sustained at startup.

- The holding time does not apply during switching between forward and reverse.
- The holding time is not included in the acceleration time.

F25 STOP Hz

Setting range: 0.1 to 60.0 Hz

This function sets the frequency at stop.



The operation will not start if the starting frequency is less than the stopping frequency or if the set frequency is less than the stopping frequency.

F26 Motor sound (carrier frequency)

F26 MTR SOUND

This function adjusts the carrier frequency to prevent resonance with the machine system, reduce motor and drive noise, and also reduce leakage current from output circuit wiring.

Drive Capacity	Setting Range
6KF11L080 or less 6KF11H044 or less	0.75 to 15kHz
6KF11L115-285 6KF11H060-150	0.75 to 10kHz
6KF11L346 or more 6KF11H176 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 (RFI)	Extremely low – High

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

F27 Motor sound (sound tone)

F27 MTR TONE

Setting range: 0 , 1, 2 , 3

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

F30 FMA terminal (voltage adjustment)

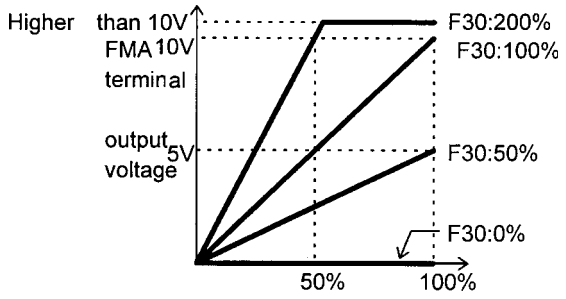
F31 FMA terminal (function selection)

F30 FMA V–ADJ

Setting range: 0 to 200%

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

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



F31 FMA FUNC

This function selects the monitor item to be output to Terminal FMA.

Value	Monitor Item	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	2x rated output current of drive
3	Output voltage	230V series: 250V 460V series: 500V
4	Output torque	2x rated motor torque
5	Load rate	2x rated load of motor
6	Output	2x rated drive output
7	PID feedback amount	Feedback amount at 100%
9	DC link circuit voltage	230V series: 500V 460V series: 1,000V
10	Universal AO	Output from RS485 Modbus RTU or Bus option

F36 30Ry operation mode

F	3	6	3	0	R	Y		M	O	D	E	

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

Value	Operation	
0	Drive no power	30A - 30C: OFF, 30B - 30C: ON
	At normal	30A - 30C: OFF, 30B - 30C: ON
	At alarm	30A - 30C: ON, 30B - 30C:OFF
1	Drive no power	30A - 30C: OFF, 30B - 30C: ON
	At normal	30A - 30C: ON, 30B - 30C: OFF
	At alarm	30A - 30C: OFF, 30B - 30C: ON

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

F40 Torque limit 1 (drive)

F41 Torque limit 1 (brake)

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

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 drive to continue operation under the limit even if a sudden change in load torque occurs.

Limits are set for driving torque and braking torque.

When this function is activated, acceleration and deceleration operation times are longer than the set values.

Function	Set Value	Operation
Torque limit (driving)	20% to 150%	The torque is limited to the set value.
	999	Torque limiting inactive
Torque limit (braking)	20% to 150%	The torque is limited to the set value.
	0	Automatically prevents OU2 trip due to power regeneration effect
	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 the set values.

E01 Terminal X1

E05 Terminal X5

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		

Functions can be individually set from each of the digital input terminals X1 to X5.

Value	Function
0,1,2	Multi-step frequency selection (1 to 7 steps)
3	Self-hold selection (HLD)
4	Coast-to-stop command (BX)
5	Alarm reset (RST)
6	External alarm (THR)
7	Frequency setting 2 / Frequency setting 1 (Hz 2 / Hz1)
8	DC injection brake command (DCBRK)
9	Switching operation from line to drive (50 Hz) (SW50)
10	Switching operation from line to drive (60 Hz) (SW60)
11	UP command (UP)
12	DOWN command (DOWN)
13	Edit permission command (WE-KP)
14	PID control cancellation (Hz / PID)
15	Normal/Inverse switching (Terminals 12 and C1) (IVS)
16	Interlock (52-2) (IL)
17	Link communication selection (LE)
18	Universal DI (U-DI)
19	Timed alarm stop command (STOP1)
20	Local operation (LOC)
21	Forward command 2 (FWD2)
22	Reverse command 2 (REV2)
23	Operation command2/Operation command 1 (FR2/FR1)

Note: Values which are not set in the functions from E01 to E05 are assumed to be inactive.

Multi-step frequency selection

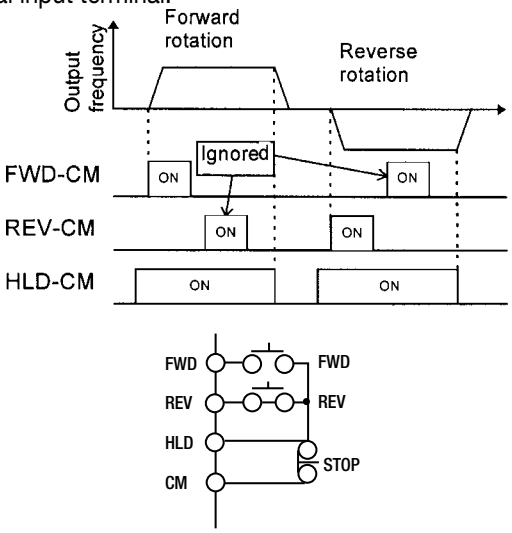
Value 0,1, 2: The frequency can be switched to a preset frequency in function codes C05 to C11 by switching the external digital input signal. Assign values 0 to 2 to the target digital input terminal. The combination of input signals determines the frequency.

Combination of Input Signals			Selected Frequency	
2 (SS4)	1 (SS2)	0 (SS1)		
off	off	on	C05 MULTI Hz-1	Related
off	on	off	C06 MULTI Hz-2	Functions:
off	on	on	C07 MULTI Hz-3	C05-C11
on	off	off	C08 MULTI Hz-4	Setting
on	off	on	C09 MULTI Hz-5	Setting
on	on	off	C10 MULTI Hz-6	0.00 to
on	on	on	C11 MULTI Hz-7	-120.00

Note: When Local mode is selcted (as indicated “LOC” on LCD display), futures configured by this function are inactive.

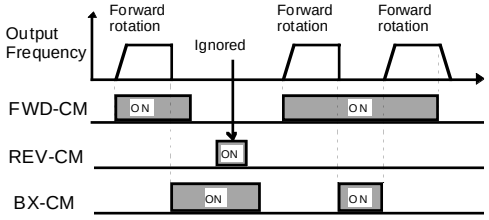
Self-hold selection (HLD)

Value 3: This selection is used for 3-wire operation. The FWD or REV signal is self-held when HLD-CM is on, and this 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) / Drive Disabled

Value 4: When BX and CM are connected, drive output is cut off immediately, and the motor starts to coast to a 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 begins at the start frequency. To use this BX terminal function, assign value 7 to the target digital input terminal.



Alarm reset (RST)

Value 5: If a drive trip occurs, connecting RST to CM clears the alarm output (for any fault). Disconnecting them clears the trip indication and restarts operation. To use this RST terminal function, assign value 5 to the target digital input terminal.

External alarm (THR)

Value 6: Disconnecting THR and CM during operation cuts off drive output (i.e., motor starts to coast to a 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 if this terminal function is not set.

Frequency setting 2/frequency setting 1

Value 7: This function switches the frequency setting method defined by function codes F01 and C30 using an external digital input signal.

Input Signal	Selected Frequency Setting
7	
off	F01 FREQ CMD1
on	C30 FREQ CMD2

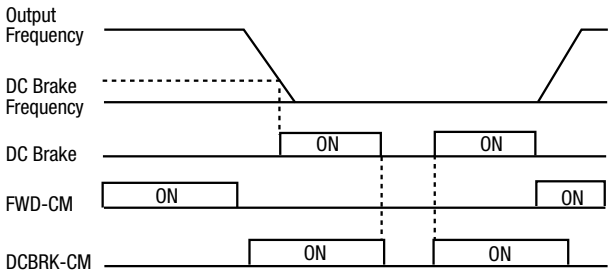
Note: When Local mode is selcted (as indicated "LOC" on LCD display), futures configured by this function are inactive.

DC injection brake command (DCBRK)

Value 8: This function is used for DC Brake time control by digital input including extending braking operation during stopping as well as during start up into a rotating load. When the external digital input signal is on, DC injection braking starts when the drive'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 during keypad operation or when both terminals FWD and REV go off during terminal block operation.) The DC injection braking continues while the digital input signal is on. In this case, the longer of the following times is selected:

- The time set with function code F22
- The time during which the input signal is set ON

Input Signal	Selected Operation
8	
off	DC injection brake command not given
on	DC injection brake command given



Switching operation from line drive (60Hz)(SW60)/(50Hz)(SW50)

Value 9, 10: Motor operation can be switched from 60 Hz/50 Hz commercial power to drive operation without stopping the motor by switching the external digital input signal.

Input Signal 10/9	Function
off > on	Drive operation to line operation (60 Hz)/(50 Hz)
on > off	Line operation to drive operation (60 Hz)/(50 Hz)

Following a momentary power failure, if the digital input signal goes off, 50 or 60 Hz (according to the input signal) is output after the restart waiting time (function code H13). The motor is then directed to drive operation.

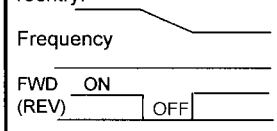
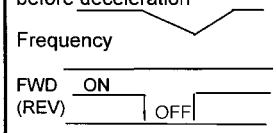
UP command (UP)/DOWN command (DOWN)

Value 11, 12: When an operation command is input (on), the output frequency can be increased or decreased using 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 Input Signals		Selected Function (when operation command is on)
12	11	
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. Select the desired type by setting the frequency (F01 or C30).

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

Edit permission command (data change permission)(WE-KP) (data protection)

Value 13: This function allows the data to be changed only when input is received from an external signal, thereby preventing function code data changes.

13	Selected Function
off	Prohibit data changes
on	Allow data changes

Note: If a terminal is assigned the value 13, the data cannot be changed. To change data, turn the terminal on and change its setting to another number.

PID control cancellation (Hz/PID)

Value 14: The PID control can be disabled by an external digital input signal.

Input Signal	Selected Function
14	[Related Functions: H20-H25]
off	Enable PID control
on	Disable PID control

(When the PID control is disabled, the frequency is set from keypad)

Normal operation/inverse

Value 15: Analog input (Terminals 12 and C1) can be switched between normal and inverse operations using an external digital input signal.

Input Signal	Selected Function
15	[Related Function: F01]
off	Normal operation if normal operation is set and vice versa
on	Inverse operation if normal operation is set and vice versa

Interlock (52-2)

Value 16: When a contactor is installed on the output side of the drive, the contactor opens at the time of a momentary power failure. This prevents the reduction of the DC circuit voltage and may prevent the detection of a power failure and a correct restart operation after power is recovered. The restart operation, in the event of a momentary power failure, can be performed effectively with power failure information provided by an external digital input signal.

Input Signal	Function
16	
off	No momentary power failure detection by digital input
on	Momentary power failure detection by digital input

Link Operation selection (LE)

Value 17: Frequency and operation commands from the data communications link can be enabled or disabled by switching the external digital input signal. Select the command source in **H30-Link function** and assign 17 to the target digital input terminal to enable or disable commands in this input signal state.

Input Signal	Selected Function
17	[Related Function: H30]
off	Link command disabled
on	Link command enabled

Universal DI (U-DI)

Value 18: Assigning 18 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 Modbus RTU and BUS option.

This input terminal is only used to check for an incoming input signal through communication and does not affect drive operation.

Timed alarm stop command (STOP1)

Value 19: Disconnecting STOP1 and CM during operation, the drive decelerates and stops by a present deceleration time (STOP1) setting and then outputs alarm Er6 which is latched internally and cleared by RST input. ON input is assumed when this terminal function is not set.

Local operation command (LOC)

Value 20 : Frequency and operation command from the Keypad can be enabled when this is turned on (close). To use LOC terminal function, assign value 20 to the target digital input (X inputs).

Forward command2

Value 21 : This is the alternate Forward command. It is selected from the terminal by the Operation command2/ Operation command1 switch. To use the Forward command 2 terminal function, assign 21 to the target digital input (X input).

Reverse command2

Value 22 : This is the alternate Reverse command. It is selected from the terminal by the Operation command2 Operation command1 switch. To use the Reverse command 2 terminal function, assign 22 to the target digital input (X input).

Operation command2/Operation command1

Value 23 : This function switches the operation commands from FWD, REV to Forward command2, Reverse command 2 when it is turned on (close). To use the Operation command2/Operation command1 function, assign 23 to the target digital input (X input).

Note: When Local mode is selcted (as indicated “LOC” on LCD display), futures configured by this function are inactive.

Digital Input	Value	Factory Settings at Shipment Description
Terminal X1	3	Self-hold selection (HLD)
Terminal X2	4	Coast-to-stop command (BX)
Terminal X3	5	Alarm reset (RST)
Terminal X4	7	Frequency setting 2/1 (Hz2/Hz1)
Terminal X5	20	Local operation (LOC)

E20 Terminal Y1 (function selection)

E21 Terminal Y2 (function selection)

E24 Terminals Y5A and Y5C (funtion selection)

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

Some control and monitor signals can be selected and output from terminals Y1, Y2 and Y5. Terminals Y1 and Y4 use transistor output; terminals Y5A and Y5C use relay contacts.

Value	Output Signal
0	Drive Running (RUN)
1	Frequency arrival (FAR)
2	Frequency detection (FDT1)
3	Stopping due to undervoltage (LV)
4	Torque limiting (TL)
5	Restart after momentary power failure (IPF)
6	Overload - early warning (OLI)
7	Keypad operation (KP)
8	Drive stopping (STP)
9	Ready for operation (RDY)
10	Terminal AX function (AX)
11	Retry function operating (TRY)
12	Universal DO (U-DO) *
13	Heat sink overheat - early warning (OH)
14	Under load detection (UL)

Drive running (RUN)

Value 0: The RUN signal is output when there is output speed (drive is outputting a frequency). When the DC injection brake function is active, the RUN signal is off.

Frequency arrival (FAR)

Value 1: See the explanation for function code E30 (frequency arrival [detection width]).

Frequency detection (FDT1)

Value 2: See the explanation for function codes E31 and E32 (frequency detection).

Stopping due to undervoltage (LV)

Value 3: If the undervoltage protective function activates, i.e. if 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 as long as the undervoltage protective function is active.

Undervoltage detection level:	230V series: 200V 460V series: 400

Torque limiting (TL)

Value 4: When torque limiting is active, 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 while the current or torque is limited or power regeneration is prevented.

Restart after momentary power failure (IPF)

Value 5: Following a momentary power failure, this function reports the start of 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 after a frequency level equal to that prior to power failure has been recovered.

For 0 Hz restart at power recovery, no signal is output because synchronization ends when power is recovered. The frequency is not recovered to the level before the power failure occurred.

Overload early warning (OL1)

Value 6: Before the motor is stopped by a 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).

Keypad operation

Value 7: An ON signal is output when the operation command keys (FWD, REV and STOP) on the keypad panel can be used (i.e., F02 Operation = 0) to issue operation and stop commands.

Drive stopping (STOP)

Value 8: This function outputs an inverted signal to RUN to indicate zero speed. An ON signal is output when the DC injection brake function is operating.

Ready for operation (RDY)

Value 9: This function outputs an ON signal when the drive is ready to operate. The drive is ready to operate after the main circuit and control circuit power have been established where the drive protective function is not activated.

About one second is required from power-on to ready for operation under normal conditions.

Terminal AX function (AX)

Value 10: When an operation command (FWD or REV) is entered, this function outputs an ON signal. When a stop command is entered, the signal goes off after drive output stops. When a coast-to-stop command is entered, and the drive protective function is operating, the signal goes off immediately.

Retry function operating (TRY)

Value 11: When H04 Retry operating is set to 1 or higher, the signal is output during the retry operation, if the drive protective function has been activated.

Universal DO(U-DO)

Value 12: Assigning a value of 12 to a transistor output terminal renders the terminal a universal DO terminal.

This function enables ON/OFF through the RS485 Modbus RTU and BUS option.

This function serves only to turn the transistor output on or off through communication and is not related to drive operation.

Heat sink overheat early warning (OH)

Value 13: This function outputs an early warning signal when the heat sink temperature (overheat detection level) is within 10°C of the overtemp trip point.

Under load detection (UL)

Value 14: When output torque is lower than level setting (E36) and longer than time setting (E37), under load signal will be output to transistor output (E20, E21) or relay output (E24)

Y1-Y5 SETTINGS WHEN SHIPPED FROM THE FACTORY

Digital Output	Factory Setting at Shipment	
	Value	Description
Terminal Y1	1	Frequency arrival (FAR)
Terminal Y2	2	Frequency detection (FDT)
Terminal Y5	0	Operating (RUN)

E25 Y5 Ry operation mode

E25 Y5RY MODE

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

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 drive control voltage is established (about one second after power on).

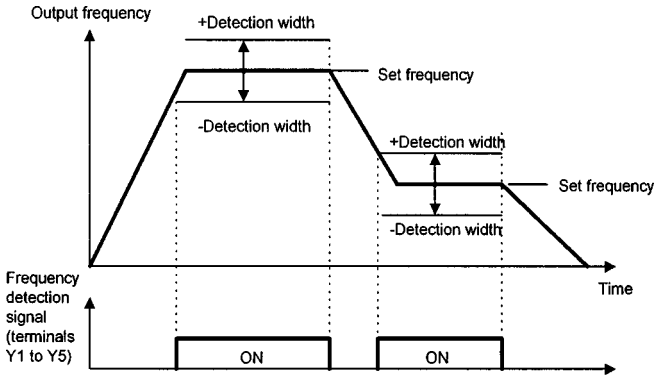
E30 Frequency arrival (detection width)

E30 FAR HYSTR

Setting range: 0.0 to 10.0 Hz

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

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



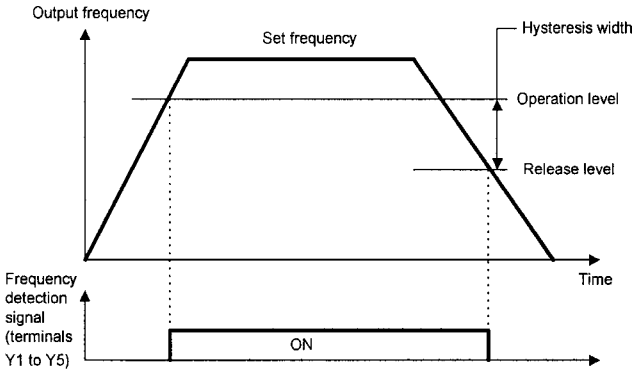
E31 Frequency detection (operation level)
E32 Frequency detection (hysteresis width)

E31 FDT LEVEL
E32 FDT HYSTR

Setting range (Operation level): 0 to 120 Hz

These functions determine the operation level of the output frequency and hysteresis width for operation release. If the output frequency exceeds the set operation level, an ON signal can be output from terminals Y1 to Y5.

(Hysteresis width): 0.0 to 30.0 Hz



E33 Overload early warning (operation)

E	3	3	O	L		L	E	V	E	L		

Setting range: 0: Electronic thermal O/L relay

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.
1: Output current

Value	Function	Description
0	Electronic thermal O/L relay	Overload early warning by electronic thermal O/L relay (with 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 Overload early warning (operation level)

E	3	4	O	L	1		L	E	V	E	L	

Setting range: Drive rated output current x (5 to 150%)

This function determines the operation level for the electronic thermal O/L relay or output current.
The operation release level is 90% of the set value.

E35 Overload early warning (operation time)

E	3	5	O	L		T	I	M	E	R		

Setting range: 0.0 to 60.0 seconds

This function is used when E33 Overload early warning (operation selection) is set to 1.

Sets the time from when the operation level is attained until the overload early warning function is activated.

E36 Underload detection (level)

E	3	6	U	L				L	E	V	E	L

Setting range: 0 to 150%

This function sets the torque level for the underload detection.

E37 Underload detection (time)

E	3	7	U	L			T	I	M	E		

Setting range: 0.0 to 60.0 second

This function is the time parameter for the underload detection.

When the output torque is lower than the level setting (E36) for longer than the time setting (E37), the Underload signal will be active. It can be monitored with a transistor output (E20, E21) or relay output (E24) by setting value 14.

E40 Display coefficient A
E41 Display coefficient B

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

Setting range:

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

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

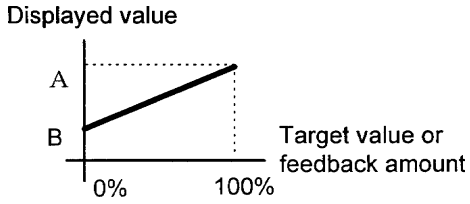
Load and line speed
Use display coefficient A.
Displayed value = output frequency x (0.01 to 200.00)

Although the setting range is ±999.00, the effective 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



Monitored items in E43 LED monitor (display selection)

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

E43 LED monitor (display selection)
E44 LED monitor (display at stopping)

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

The data during drive operation, 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 selected items or the same items as during running.

Value of E43	E44 = 0		E44 = 1	
	at stopping	during running	at stopping	during running
0	set frequency value (Hz)	output frequency before slip compensation (Hz)		
1	set frequency value (Hz)	output frequency before slip compensation (Hz)		
2	set frequency value (Hz)			
3	output current (A)			
4	output voltage command value (V)			
5	synchronous speed set value (rpm)	synchronous speed (rpm)		
6	line speed set value (m/min)	line speed (m/min)		
7	set load speed (rpm)	load speed (rpm)		
8	calculated torque value (%)			
9	output power (kW)			
10	PID target value 1 (direct input from keypad)			
11	PID target value 2 (input from F02 Frequency 1)			
12	PID feedback amount			

Note: For E43 = 10 to 12, the data is displayed only if selected in H20 PID control (operation selection).

Display at frequency setting

When a set frequency is checked or changed by the keypad, the 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 of E43	Frequency Setting
0,1,2,3,4	set value of frequency (Hz)
5	set value of synchronous speed (rpm)
6	set value of line speed (m/min.)
7	set value of load speed (rpm)
8,9	set value of frequency (Hz)
10,11,12	set value of frequency (Hz)

Note: For E43 = 10 to 12 the data is displayed only if selected in H20 PID control (operation selection).

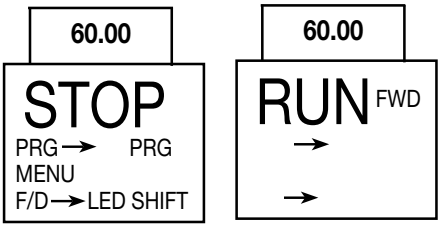
E45 LCD monitor (display selection)

E45 LCD MNTR

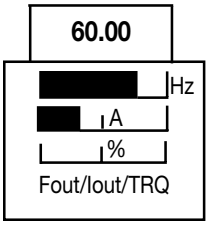
This function selects the items to be displayed on the LCD monitor in operation mode.

Value	Display Items
0	Operation status, direction of rotation, operation guide
1	Output frequency before slip compensation, output current, calculated torque 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 current	200% of drive rated value
Calculated torque value	200% of motor rated value

Note: The scale cannot be adjusted.

E46 LCD monitor (language)

E46 LANGUAGE

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

Value	Language	Value	Language
0	Japanese	3	French
1	English	4	Spanish
2	German	5	Italian

Note: English language is used for all LCD screens in this manual.

E47 LCD monitor (contrast adjustment)

E47 CONTRAST

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

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

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	

Setting range: 0 to 120 Hz in 1Hz increments (min.)

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

Setting range: 0 to 30 Hz in 1Hz increments (min.)

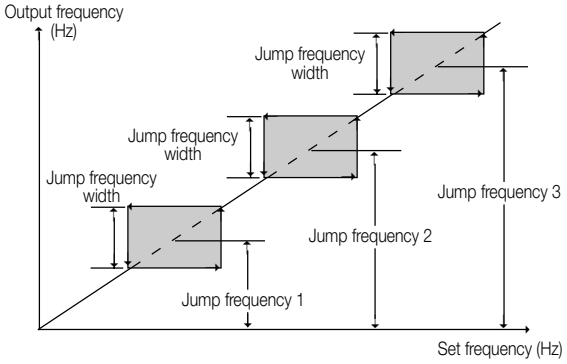
This function makes the set frequency jump so that the drive's output frequency does not match the mechanical resonance point of the load.

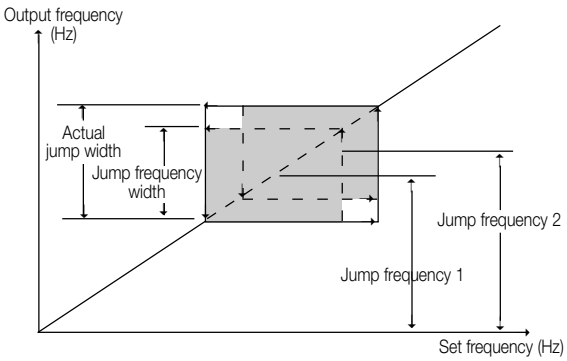
Up to three jump points can be set.

This function is ineffective if jump frequencies 1 to 3 are set to 0 Hz.

A jump does not occur during acceleration or deceleration.

If a jump frequency setting range overlaps another range, both ranges are added to determine the actual jump area.





C05-C11 Multi-step frequency 1 to 7

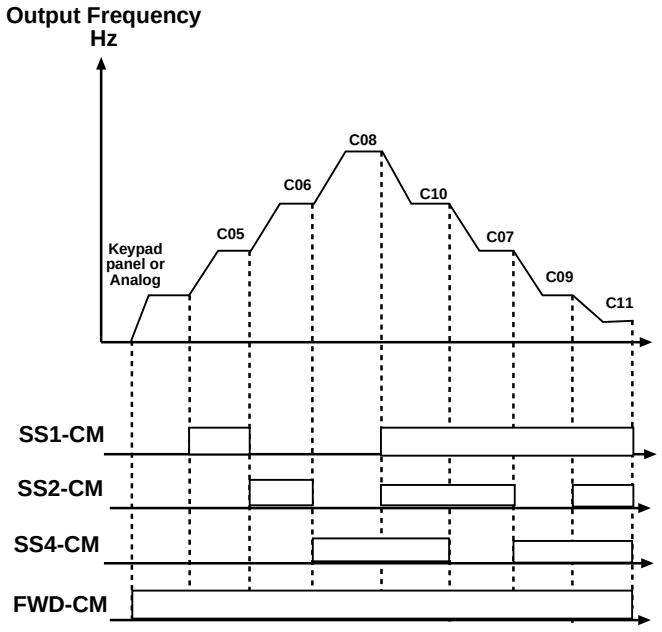
C	0	5	M	U	L	T	I		H	z	–	1
C	0	6	M	U	L	T	I		H	z	–	2
C	0	7	M	U	L	T	I		H	z	–	3
C	0	8	M	U	L	T	I		H	z	–	4
C	0	9	M	U	L	T	I		H	z	–	5
C	1	0	M	U	L	T	I		H	z	–	6
C	1	1	M	U	L	T	I		H	z	–	7

Setting range: 0 to 120 Hz In 0.01 Hz increments (min.)

Multistep frequencies 1 to 7 can be switched by turning terminal functions SS1, SS2 and SS4, on and off. (See E01 to E05 for terminal function definitions.)

OFF is the default value any undefined SS1, SS2 and SS4 terminals.

Related functions: E01 to E05 (Set value: 0 to 2)



C30 Frequency setting 2

C	3	0	F	R	E	Q		C	M	D		2

For the setting method, see the explanation for F01.
Setting range: 0, 1, 2

This function determines the frequency setting method.

Note: When Local mode is selcted (as indicated “LOC” on LCD display), futures configured by this function are inactive.

C31 Analog input bias adjustment

The setting range is -100.0 to +100.0% (in 0.1% increments) of the maximum output frequency.

C32 Analog input gain adjustment

The gain adjustment range is 0.0 to 200%.

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

These functions set the gain and bias for analog input Terminals 12, in conjunction with functions F17 (freq. gain) and F18 (freq. bias).

For details, see the explanation for F17 and F18.

C33 Analog setting signal

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

Setting range: 0.00 to 5.00 seconds

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

A value that is set too large delays control response although stabilizing the control. A value that is set too small speeds up control response but renders the control unstable.

If the optimum value is not known, adjust the setting if the control is unstable or response is delayed.

Note:

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

P01 Number of motor 1 poles

P	0	1	M	1		P	O	L	E	S		

Setting range:: 2, 4, 6, 8, 10, 12, 14

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

P02 Motor 1 (capacity)

P	0	2	M	1	–	C	A	P				

Set values for models with nominal motor capacity of 30Hp or less: 0.01 to 60Hp

Set values for models with nominal motor capacity of 40Hp or more: 0.01 to 800Hp

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

Set the nominal motor capacity listed in 9-1 Standard Specifications. A value in the range from two ratings lower to one rating higher than the nominal motor capacity can be set. If a value outside this range is set, accurate control cannot be guaranteed. If a value between two nominal motor capacities is set, data for the lower capacity is automatically stored for related function data.

If this function setting is changed, the following related functions are automatically set to data values for 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 values for the GE 3-phase standard motor are 230V, 60Hz, 4 poles for the 230V series; 460V, 60Hz, 4 poles for the 460V series.

P03 Motor 1 (rated current)

P	0	3	M	1	–	I	R					

Setting range: 0.00 to 2,000 A

This function sets the rated current value for Motor 1.

P04 Motor 1 (Tuning)

P	0	4	M	1		T	U	N	1			

This function measures and automatically stores motor data.

Value	Operation
0	Inactive
1	Measure the motor's primary resistance (%R1) and base frequency leakage reactance (%X) when the motor is stopping and automatically store both values in P07 and P08.
2	Measure the motor's primary resistance (%R1) and base frequency leakage reactance (%X) when the motor is stopping, measure the no-load current (Io) when the motor is running, and automatically store these values in P06, P07, and P08.

Perform auto tuning if the previously stored data in P06 No-load current, P07 %R1, and P08 %X differs from the actual motor data. Some typical examples are listed below. Auto tuning improves control and calculation accuracy.

- When a motor other than the GE standard 3-phase motor is used, and accurate data is required for close control.
- When output-side impedance cannot be ignored, e.g. when the cable between the drive and the motor is too long or when a reactor is connected.
- When %R1 or %X is unknown, e.g. when a non-standard or special motor is used.

Tuning Procedure

1. Adjust the voltage and frequency according to motor data. Adjust functions F03 Maximum output frequency, F04 Base frequency, F05 Rated voltage.
2. First enter motor constants that cannot be tuned. Set functions P02 Capacity, P03 Rated current, and P06 No-load current (no-load current setting is not required if P04=2).
3. When tuning the no-load current, beware of motor rotation.
4. Set function P04 Auto tuning = 1 (motor stop) or 2 (motor rotation). Press the FUNC/DATA key to store the set value and press the FWD key or REV key. Tuning will start.
5. Tuning may take several seconds. If P04=2, 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 the settings for acceleration and deceleration time.
6. Press the STOP key, and the procedure will end.

WARNING

If 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)

P 0 5 M 1 T U N 2

Long-time operation affects motor temperature and motor speed. On-line tuning minimizes speed changes related to these temperature changes.

Value	Operation
0	Inactive
1	Active

P06 Motor 1 (no-load current)

P 0 6 M 1 – I O

Setting range: 0.00 to 2,000 A
This function sets the no-load current (exciting current) for Motor 1.

P07 Motor 1 (%R1 setting)

P08 Motor 1 (%X setting)

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

These functions are used to set data if using a motor other than the GE standard 3-phase motor and when the motor constant and the impedance between the drive and motor are known.

Calculate %R1 using the following formula:

$$\%R1 = \frac{R1 + CableR}{V / (\sqrt{3} \bullet I)} \times 100\ [\%]$$

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

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

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

For reactance, use a value from the data stored 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

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

Setting range: 0.00 to 15.00 Hz

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 drive output frequency. This will minimize variations in motor speed due to changes in torque.

Calculate the amount of slip compensation using the following formula:

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

Slippage = Synchronous speed - Rated speed

H03 Data initializing

H03 DATA INIT

Setting rnage: 0: Disabled
1: Initializes data

This function returns all function data changed by the customer to the original factory settings (initialization).

To perform initialization, press the STOP and ^ keys together to set H03=1, then press the FUNC/DATA key. The values for 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)

H04 AUTO–RESET

H05 RESET INT

Set the protective function release count and waiting time from its startup to release.

Setting range:
(Count) : 0, 1 to 10
(Waiting time) : 2 to 20 seconds

When a drive protective function which invokes the retry operation is activated, these functions release operation of the protective function and restarts operation without issuing an alarm or terminating output.

To disable the retry function, set H04 Retry (count) = 0.

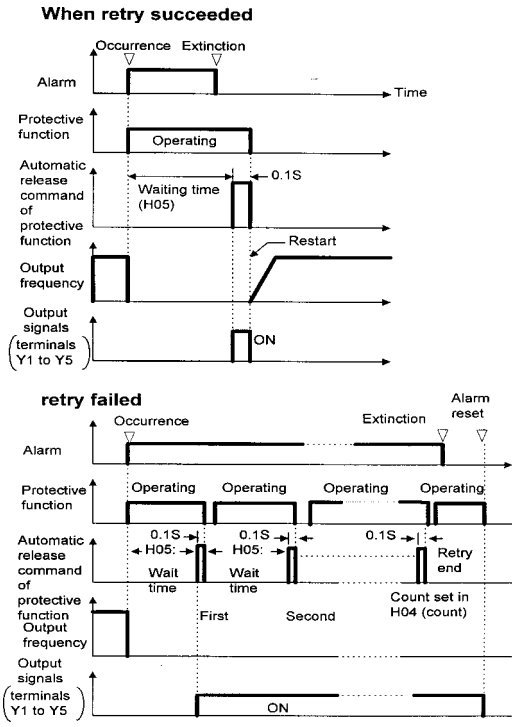
Drive protective functions that can invoke the retry function:

OC1, OC2, OC3: Overcurrent	dBH: braking resistor overheating
OV1, OV2, OV3: Overvoltage	OL1: Motor 1 overload
OH1: Heat sink overheating	
OH3: Drive overheating internally	OLU: Drive overload

If the value of H04 Retry (count) is set from 1 to 10, a drive 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 drive 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, Y2 and Y5.

WARNING

When the retry function is selected, operation will automatically restart, depending on the cause of the stop. (The machine should be designed to ensure safety during a restart.) When the retry function is selected, GE start software (F02 set 3 or 4) does not work.



H06 Fan stop operation

H06 FAN STOP

Setting range: 0: ON/OFF control disabled
1: ON/OFF control enabled

This function specifies whether ON/OFF control for the cooling fan is automatic. While power is applied to the drive, the automatic fan control detects the temperature of the heatsink and turns the fan on or off. When this control is not selected, the cooling fan rotates continuously.

The cooling fan operating status can be monitored from terminals Y2 and Y5.

H07 ACC/DEC (Mode select) pattern

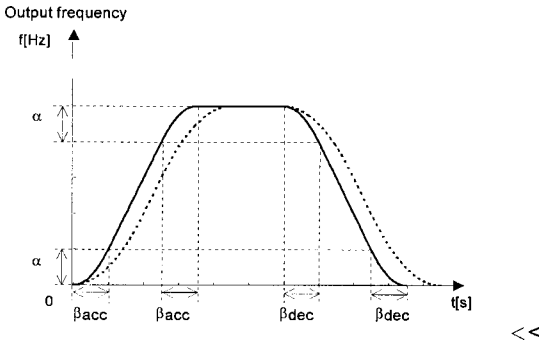
H07 ACC PTN

Setting range: 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

This function selects the acceleration and deceleration pattern.

S-shape Acceleration and Deceleration

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



<<

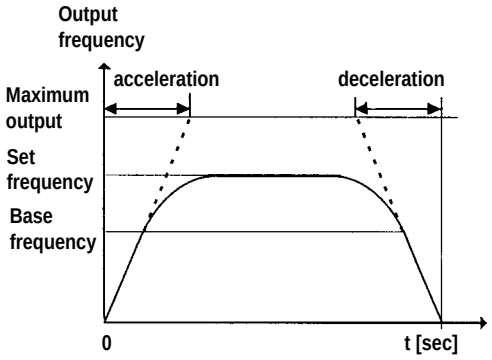
Pattern constants>		
	When 1 is selcted in H07 (mid S-shape pattern)	When 2 is selcted in H07 (mid S-shape pattern)
Range of S-shaped	0.05 x maximum output frequency (Hz)	0.10 x maximum output frequency (Hz)
Time for S-shaped at acceleration	0.10 x acceleration time (s)	0.20 x acceleration time (s)
Time for S-shaped at deceleration	0.10 x deceleration (s)	0.20 x deceleration (s)

*

When acceleration and deceleration times are very long or short, acceleration and deceleration are almost 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

H08 REV LOCK

Setting range: 0: Inactive
1: Active

If accidental reversing could result in 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 Terminals 12.

H09 Start mode

H09 START MODE

Setting range 0, 1, 2

This function smoothly catches a spinning motor which is coasting after a momentary power failure or after the motor has been subject to external force, without stopping the motor, i.e. windmilling fan.

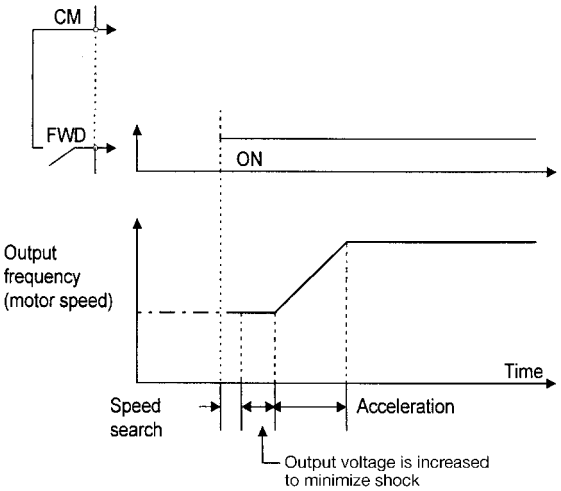
At startup, this function detects the motor speed and outputs the corresponding frequency, thereby enabling a shock-free motor startup. The normal startup method is used if the coasting speed of the motor is 120 Hz or more as a drive frequency and if the value of F03 Maximum frequency exceeds the value of F15 Frequency limiter (upper limit).

Note: To use this function, execute PO4, page 5-23.

Value	Normal startup	Restart after a momentary power failure	Line-to-drive switching
0	Inactive	Inactive	Inactive
1	Inactive	Active	Active
2	Active	Active	Active

Explanation

1. This function is effective if F14 Restart after momentary power failure (operation selection) is set to 3, 4, or 5. This function is also effective when operation is switched from the line to the drive. The motor is started with the same frequency as the current coasting speed (speed search).
2. In addition to restarting following a momentary power failure and switching between the line and the drive, 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).



Note: The dotted-dashed line indicates motor speed.

H10 Energy-saving operation

H10 ENERGY SAV

Setting range: 0: Inactive 1: Active

With constant-speed operation at light loads (fixed output frequency), this function automatically reduces the output voltage while minimizing the product of voltage and current (power).

[Exception: If F09 Torque boost 1 = 0.0]

Notes:
Use this function for variable torque loads (e.g., fans, pumps). If 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 or when the torque limiting function is activated.

For optimal Energy Savings Run "Tuning" see PO4, page 5-23.

H11 DEC mode

H11 DEC MODE

Setting range: 0: Deceleration-to-stop based on data set with H07 Non-linear acceleration and deceleration
1: Coasting-to-stop

This function determines the drive stopping method when a STOP command is entered.

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

H13 Auto-restart (Restart time)

H13 RESTART T

Setting range: 0.1 to 10.0 seconds

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, store 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.

If the momentary power failure time is shorter than the wait time value, a restart occurs following the wait time. If the power failure time is longer than the wait time value, a restart occurs when the drive is ready to operate (after about 0.2 to 0.5 seconds).

H14 Auto-restart (freq. fall rate)

H14 FALL RATE

Setting range: 0.00, 0.01 to 100.00 Hz/s

If H14 = 0.00, the frequency is reduced according to the set deceleration time.

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

Note:
A frequency reduction rate that is set too large 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 drive overload protective function.

H15 Auto-restart (holding DC voltage)

H15 HOLD V

Setting range 230V series: 200 to 300V
460 V series: 400 to 600V

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

If power supply voltage to the drive is high, control can be stabilized even under an excessive load by raising the operation continuation level. However, if the level is too high, this function activates during normal operation and causes unexpected motion. Please contact GE Fuji before changing the factory default value.

H16 Auto-restart (OPR command selfhold time)

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

Setting range: 0.0 to 30.0 seconds, 999

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

If H16 = 999, an operation command will be held until control power in the drive is established or until the main circuit DC voltage is about 0.

H19 Active drive

H	1	9	A	U	T		R	E	D			

Setting range: 0: Inactive
1: Active

This function automatically extends accelerating time by 60 seconds or longer to prevent an inverter trip resulting from a temperature rise in the inverter due to overcurrent.

(If the active drive function is activated, the acceleration time will be three times the selected time.)

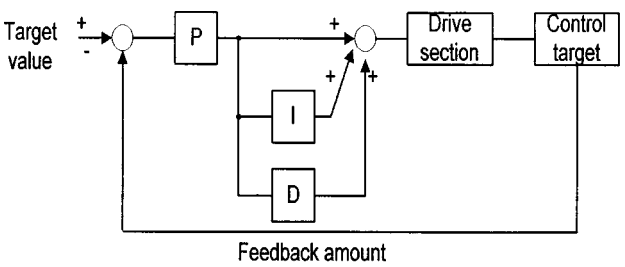
H20 PID control (mode select)

H	2	0	P	I	D		M	O	D	E		

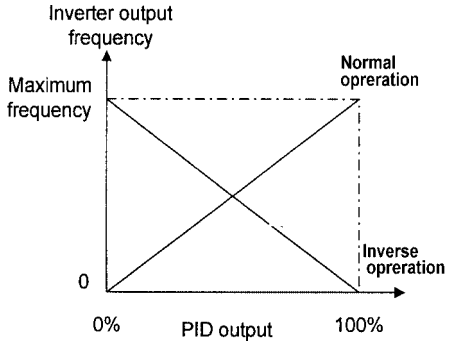
Setting range: 0: No operation
1: Normal operation
2: Inverse operation

PID control detects the amount of feedback from a sensor and compares it with the target value (e.g., reference temperature). If the values differ, this function produces an output 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.



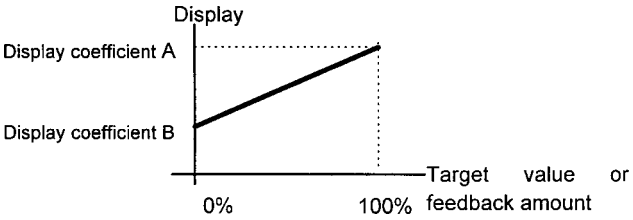
Forward or reverse operations can be selected for PID controller output. This enables motor revolutions to be faster or slower according to PID controller output.



The target value can be entered using F01, Frequency setting 1, or directly from the keypad.

For entry from F01, Frequency setting 1, input a signal to the selected terminal. For direct entry from the keypad panel, turn on keypad operation. Select any of the digital Terminals X1 (E01) to X5 (E05) and assign a value of 11 (frequency setting switching).

NOTE: 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.

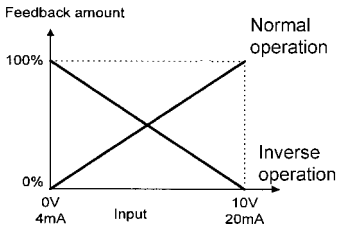


H21 PID control (feedback signal)

H	2	1	F	B		S	I	G	N	A	L	

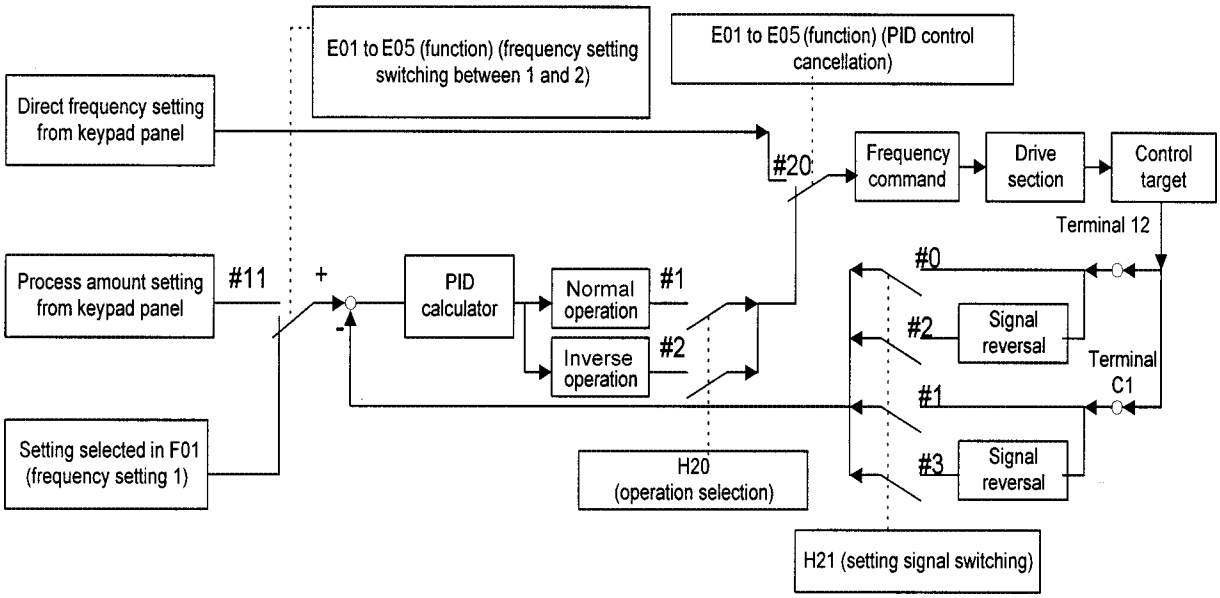
This function selects the terminal, direction of operation, and feedback input. Select a value from the table below according to sensor specifications.

Value	Description
0	Terminal 12, forward operation, 0 to 10V voltage input
1	Terminal C1, forward operation, 4 to 20mA current input
2	Terminal 12, reverse operation, 10 to 0V voltage input
3	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.

Feedback signal setting (H21) must be different from the type of setpoint value.



H22 PID control (P-gain)

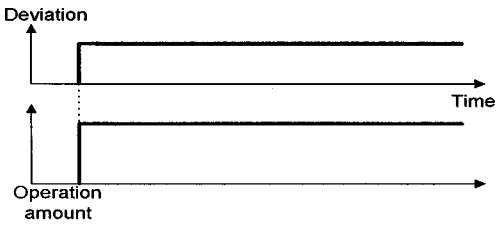
H23 PID control (I-gain)

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-gain operation

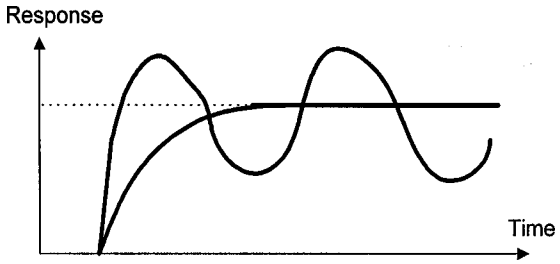
An operation using an output frequency proportional to deviation is called **P** operation, which outputs an operation amount proportional to deviation, though it cannot eliminate deviation alone.



H	2	2	P	–	G	A	I	N				

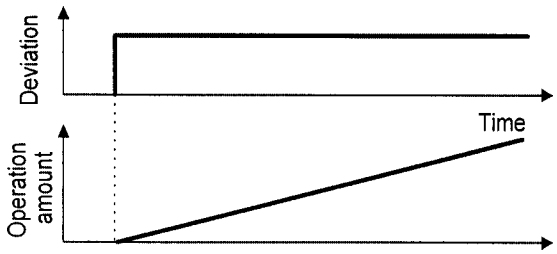
Setting range: 0.01 to 10.0 times

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-gain operation

An operation where the change speed of the 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 feedback control amount to the target value (e.g., set frequency), though it deteriorates response for significant changes in deviation.



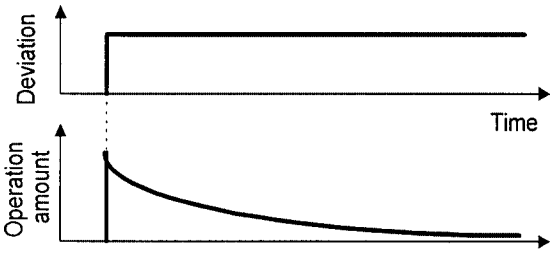
H23 I-GAIN

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-gain operation

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



H24 D-GAIN

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 output frequency larger than that of D operation alone occurs rapidly and prevents the 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 value

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

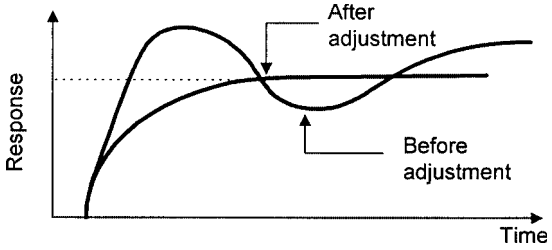
Increase the value of H22 P-gain without generating vibration.

Decrease the value of H23 I-gain without generating vibration.

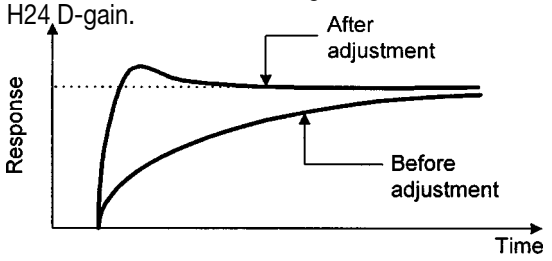
Increase the value of H24 D-gain without generating vibration.

Adjust the response waveform as follows:

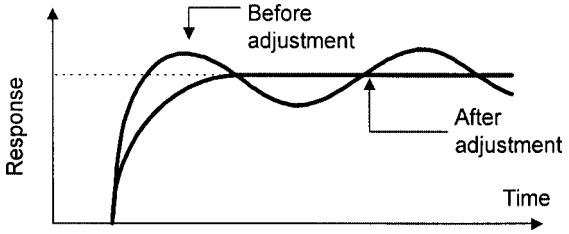
To remove the overshoot, increase the value of H23 I-gain, then decrease the value of H24 D-gain.



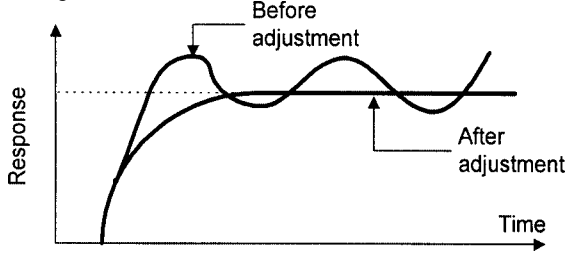
To stabilize response quickly, allowing for min. overshoot, decrease the value of H23 **I**-gain or increase the value of H24 D-gain.



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)

H25 FB FILTER

Setting range: 0.0 to 60.0 seconds

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

H30 Serial link (Function select)

H30 LINK FUNC

Setting range: 0 to 3

The link function (communication) provides a standard RS485 serial interface and optional fieldbus connections.

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

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

Value	Frequency Command	Operation Command
0	Disabled	Disabled
1	Enabled	Disabled
2	Disabled	Enabled
3	Enabled	Enabled

The data monitoring and write functions are always enabled. Disabling communication by a digital input produces the same results as if this function were set to 0. If the bus option is installed, this setting selects the bus function, and the RS485 Modbus RTU interface is restricted to monitoring and writing function data. If the bus option is not installed, this setting selects the RS485 Modbus RTU function.

Note: When Local mode is selcted (as indicated “LOC” on LCD display), futures configured by this function are inactive.

H31 RS485 (Address)

H39 RS485 (Response interval)

These functions set the conditions for RS485 RTU serial communication. Set the conditions according to the host device.

H31 ADDRESS

Setting range: 1 to 247

This function sets the station address of RS485 Modbus RTU.
Maximum connected devices is 31 for an RS485 Modbus RTU network.

H32 MODE ON ER

Setting range: 0 to 3

These functions configure the drive behavior in the event of a communication error.

Value	Processing at Communication Error
0	Immediate Er 8 trip (forced stop)
1	Continue operation within timer time, Er 8 trip after time expires
2	Continue operation and 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.

H33 TIMER

Setting range: 0 to 60.0 sec.

This function sets the error processing timer value.

H34 BAUD RATE

Setting range: 0 to 3

This function sets the baud rate.

Value	Baud Rate
0	19200 bits/s
1	9600 bits/s
2	4800 bits/s
3	2400 bits/s

H35 LENGTH

This function sets data length.

Value	Data Length
0	8 bit

.

H36 PARITY

This function sets the parity bit

Value	Parity Bit
0	None
1	Even
2	Odd

.

H37 STOP BITS

This function sets the stop bit

Value	Stop Bit
0	2 bits
1	1 bit

The stop bit is automatically configured by the value of the parity bit. For parity “NONE” the stop bit is 2 bits. For parity “EVEN” or “ODD” the stop bit is 1 bit.

H38 NO RESP T

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

In a system where the drive is continuously polled within a specific time, this function detects that access was stopped due to an open circuit or other network fault and results in an Er 8 trip.

H39 INTERVAL

Setting range: 0.00 to 1.00 second

This function sets the time from when a request is issued from the host device to when a response is returned.

6. Protective Operations

6.1 List of Protective Functions

In the event of an abnormality in the drive's operation, the protective function will activate immediately to trip the drive and display the alarm name on the LED monitor while the motor coasts to a stop. A list of the alarms with their explanations is included in the table below, and troubleshooting charts in Section 7.

Table 6.1.1 List of Alarms and Causes

Alarm Name	Keypad Display		Cause of Activation	
	LED	LCD		
Overcurrent	OC1	OC DURING ACC	During acceleration	If the drive output current momentarily exceeds the overcurrent detection level, due to an overcurrent in the motor, or a short-circuit or ground fault in the output circuit, the protective function is activated during heavy load.
	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 drive output circuit is detected, the protective function is activated (for 6KF11L115, 6KF11H060 and above). If a ground fault occurs in a drive rated at 6KF11L080, 6KF11H044 and below, the drive is protected by the overcurrent protection. If protection against personal injury or property damage is required, install a separate ground-fault protective relay or ground leakage circuit breaker.	
Overvoltage	OU1	OV DURING ACC	During acceleration	If the DC link voltage in the main circuit exceeds the overvoltage detection level (230V series: 400V DC, 460V series: 800V DC), due to an increase in the regenerating current from the motor, the output is shut down. However, protection against inadvertent overvoltage (e.g., high-voltage line) may not be provided
	OU2	OV DURING DEC	During deceleration	
	OU3	OV AT SET SPD	Running at constant speed	
Undervoltage	LU	UNDERVOLTAGE	If the DC link voltage in the main circuit falls below the undervoltage detection level (230V series: 400V DC, 460V series: 800V DC) due to a lowered power supply, the output is shut down. If function F14 Restart after momentary power failure was 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	Lin	PHASE LOSS	If input power L1/R, L2/S and L3/T has any phase of the 3 phase power "OPEN" or if there is a significant disparity between the phases, the retifying diodes or smoothing capacitors may be damaged. An Alarm is displayed and the protective function is activated during heavy load.	
Overheating of heat sink	OH1	FIN OVERHEAT	If the temperature of the heat sink rises due to a cooling fan failure, or the temperature of the heatsink is too low, the protective function is activated during heavy load.	
External alarm	OH2	EXT ALARM	If the external alarm contacts on 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.	
Overheating internally	OH3	HIGH AMB TEMP	If the temperature inside the drive rises due to poor ventilation, etc., the protective function is activated.	
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 F10 has been selected.	
Drive overload	OLU	INVERTER OL	If the output current exceeds the rated overload current, the protective function is activated to provide thermal protection against overheating of the semiconductor elements in the drive's main circuit.	
Blown fuse	FUS	DC FUSE OPEN	If the fuse in the drive is blown out following a short-circuit or damage to the internal circuit, the protective function is activated (6KF11L115, 6KF11H060 and above).	
Memory error	Er1	MEMORY ERROR	If a memory error occurs, such as missing or invalid data, the protective function is activated.	
Keypad communication error	Er2	KEYPD COM ERR	If a communication error or interrupt between the keypad and control circuit is detected, the protective function is activated.	
CPU error	Er3	CPU ERROR	If a CPU error occurs due to noise, etc., the protective function is activated.	
Option error	Er4	OPTN COM ERR	Error occurred while using an optional unit.	
	Er5	OPTION ERROR		
Operating error	Er6	OPR PROCD ERR	Stop key on keypad is pressed in terminal operation. Detected timed alarm stop command.	
Output wiring error	Er7	TUNING ERROR	If there is an open circuit or connection error in the drive output wiring during an auto-tuning procedure, the protective function is activated.	
Modbus RTU error	Er8	RS485 COM ERR	If an error occurs while using RS485 Modbus RTU, the protective function is activated.	

Note: Number in fron of Alarm Code indicates multiple alarms. See page 4-15.

6.2 Alarm Reset

To release the trip status, enter the reset command by pressing the RESET key on the keypad or sending the appropriate signal to the RST terminal after removing the cause of the trip. Since the reset command is an edge operation, input a command sequence 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.

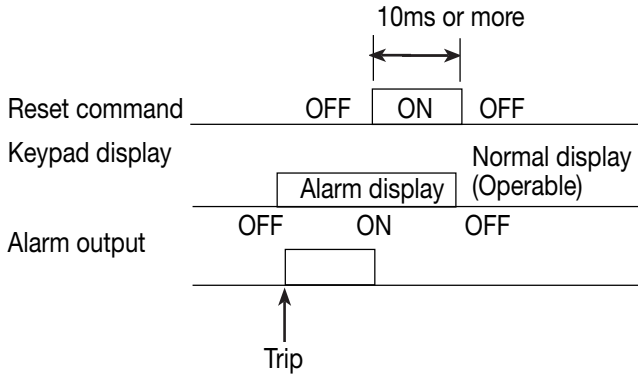


Fig. 6-2-1

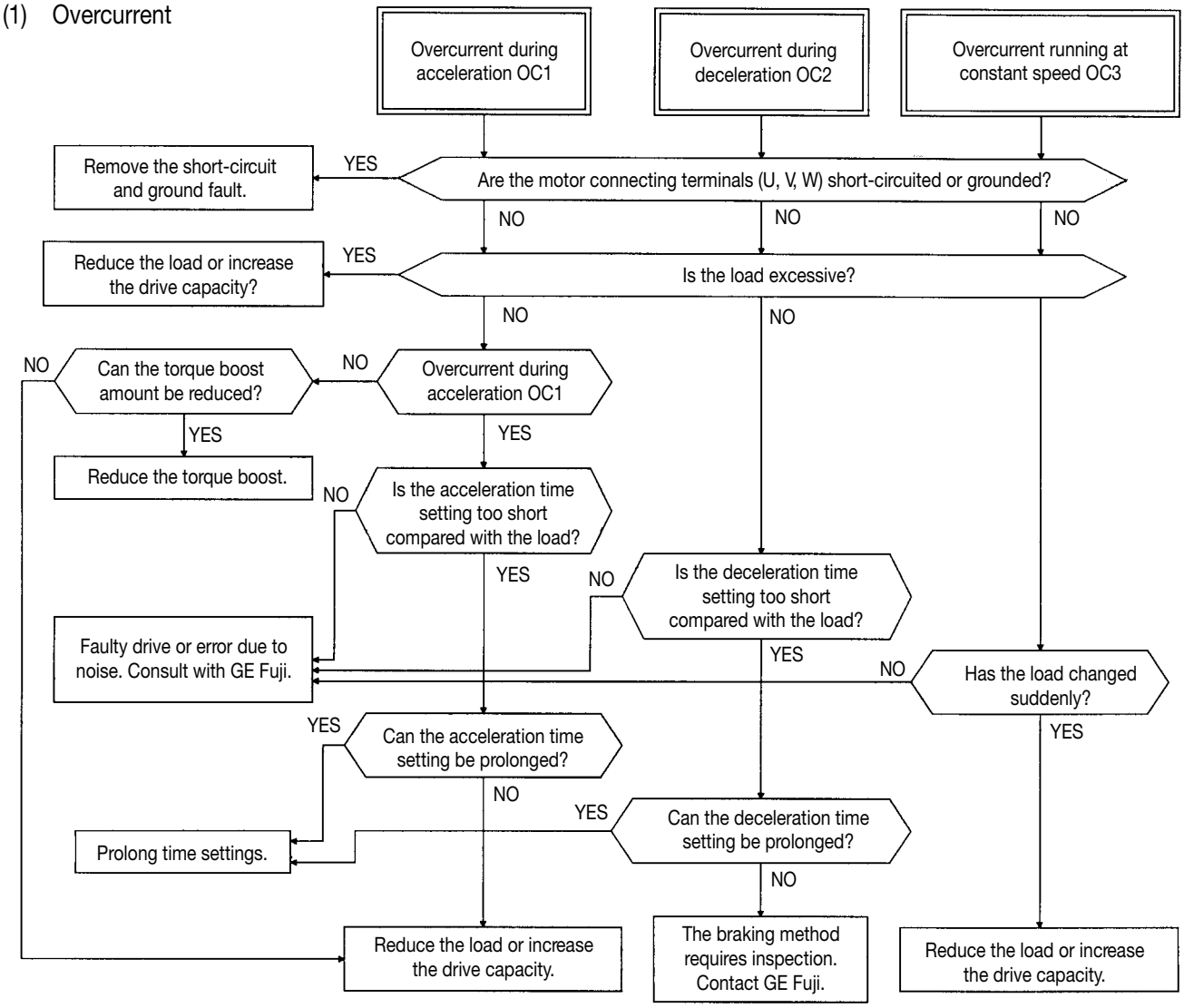
WARNING

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.

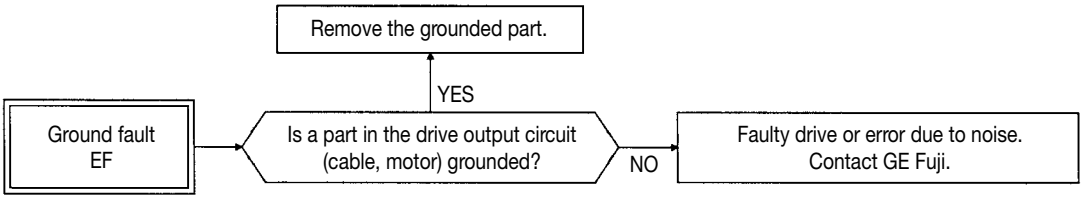
7. Troubleshooting

7.1 Activation of Protective Function

(1) Overcurrent

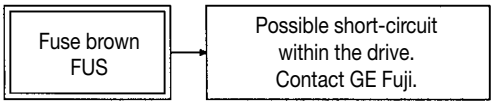


(2) Ground fault

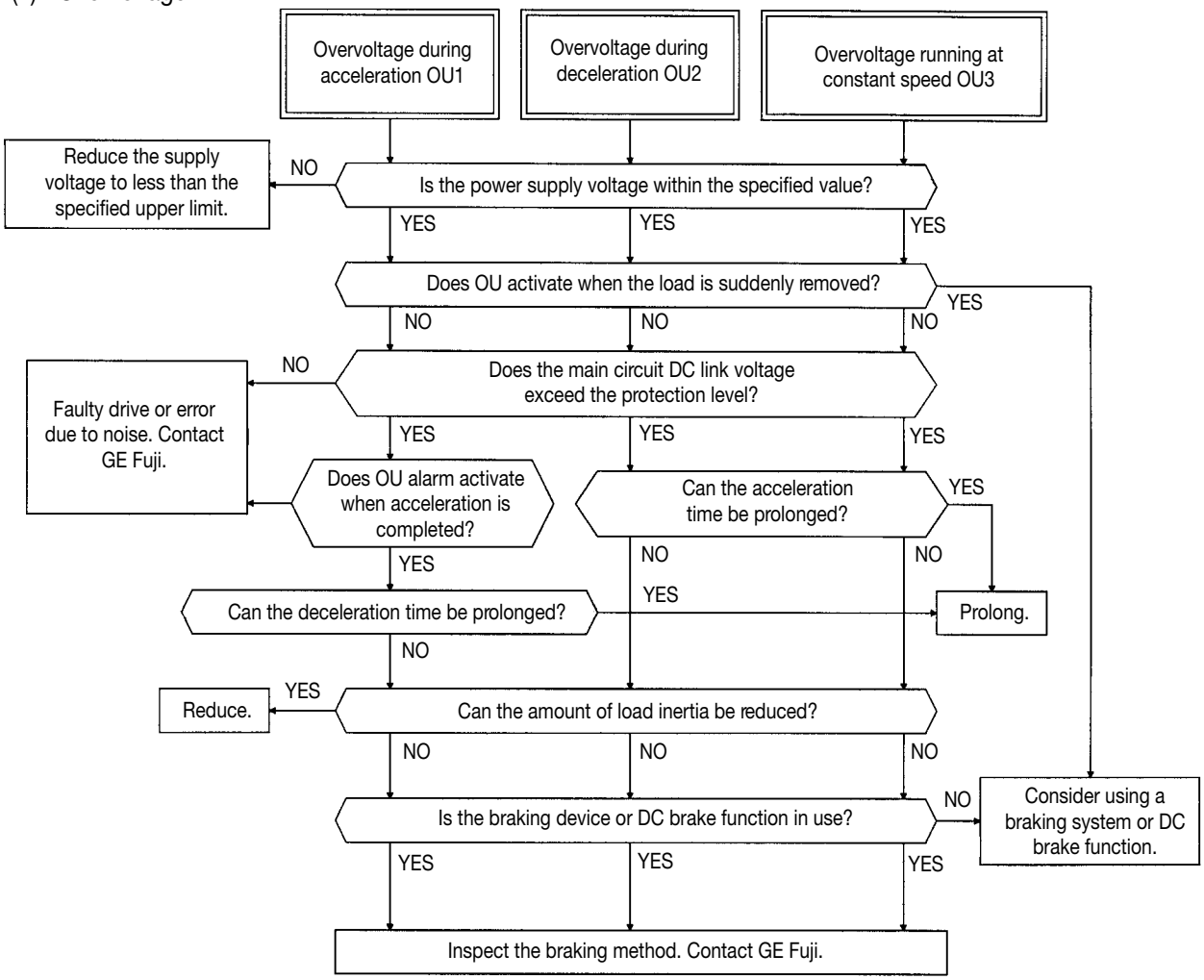


Note: The ground fault protective function is provided only for drive for nominal applied motors rated at 6KF11L115, 6KF11H060 or more.

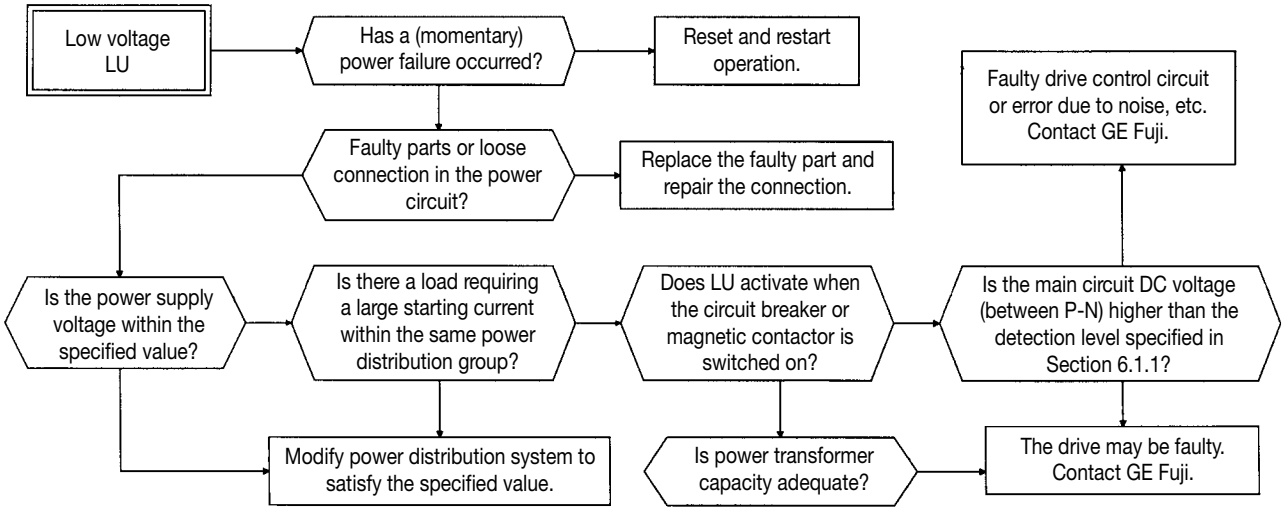
(3) Fuse brown



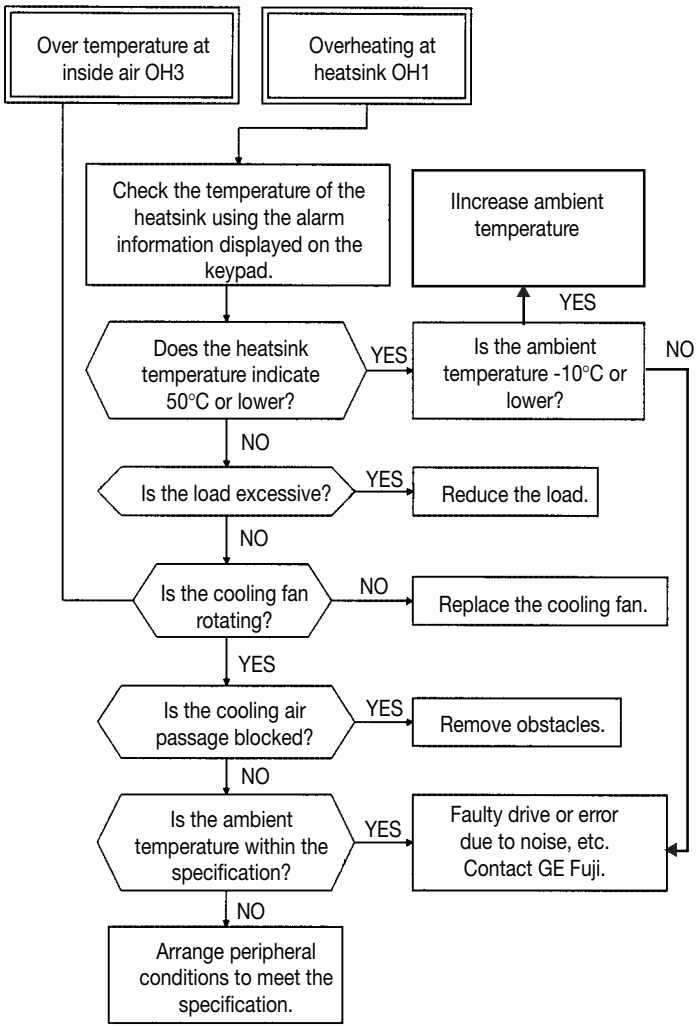
(4) Overvoltage



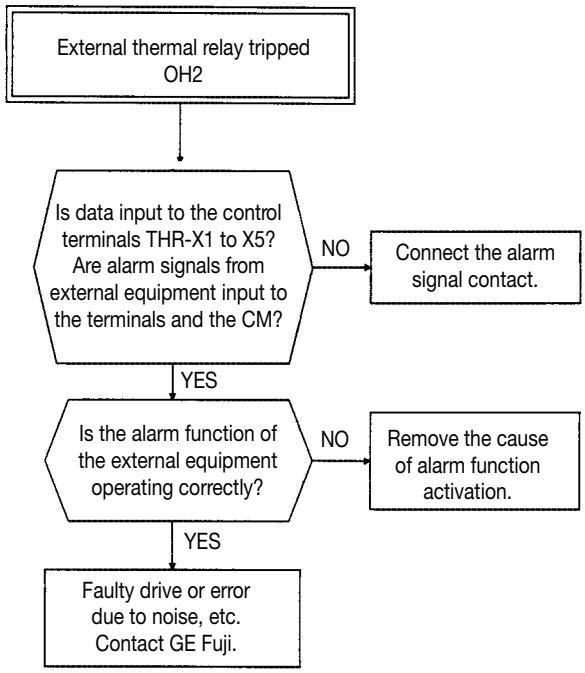
(5) Low voltage



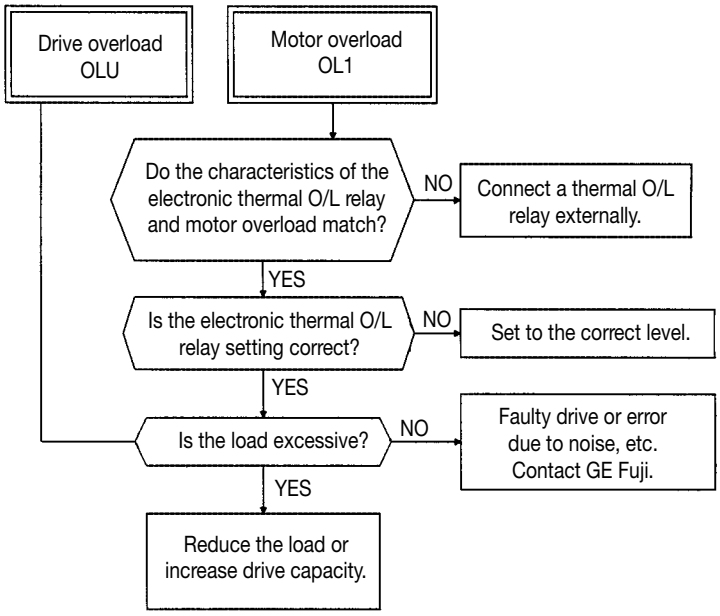
(6) Overheating internally and overheating of heat sink



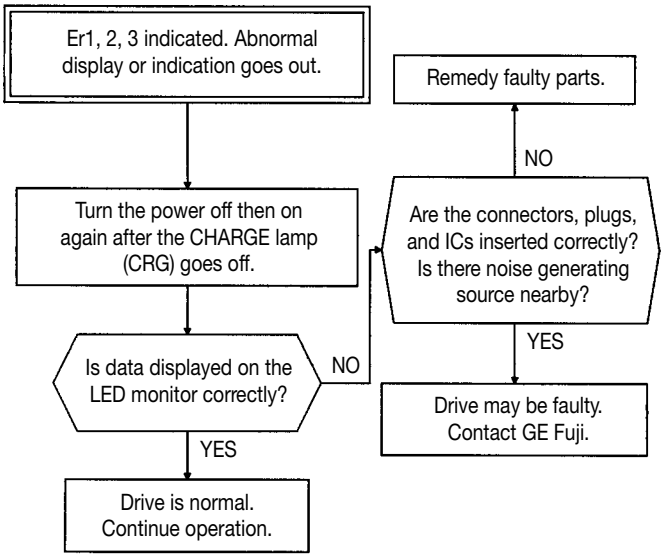
(7) External thermal relay tripped



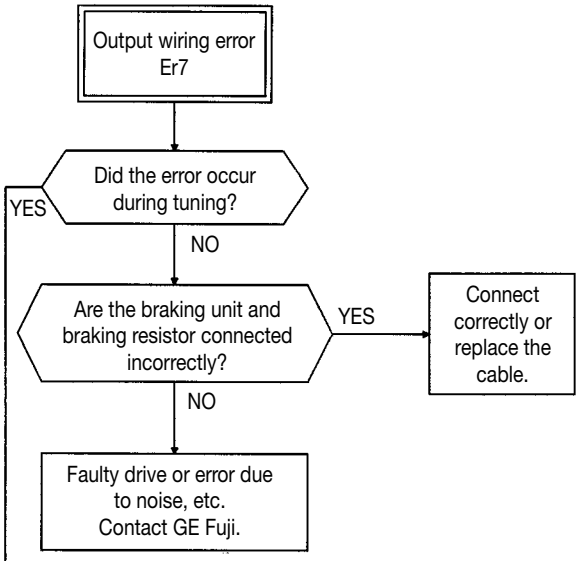
(8) Drive overload and motor overload



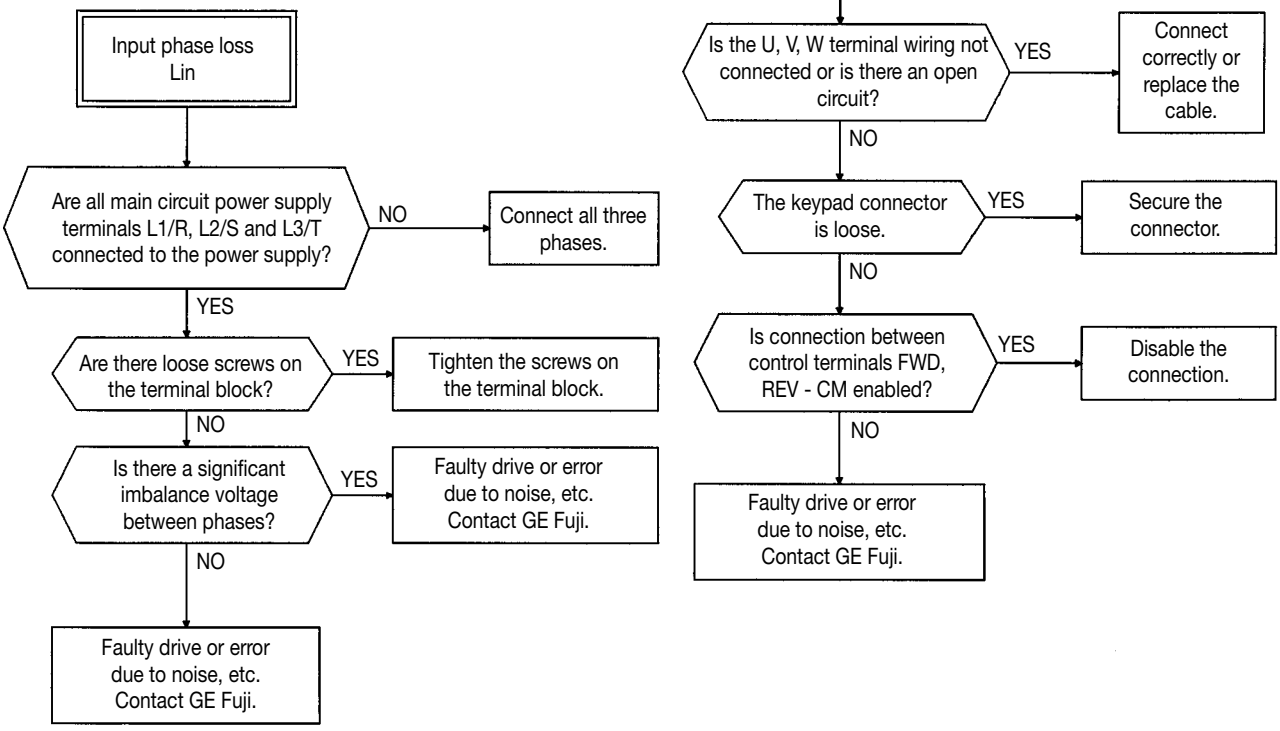
(9) Memory error Er1,
Keypad communication error Er2,
CPU error Er3



(10) Output wiring error

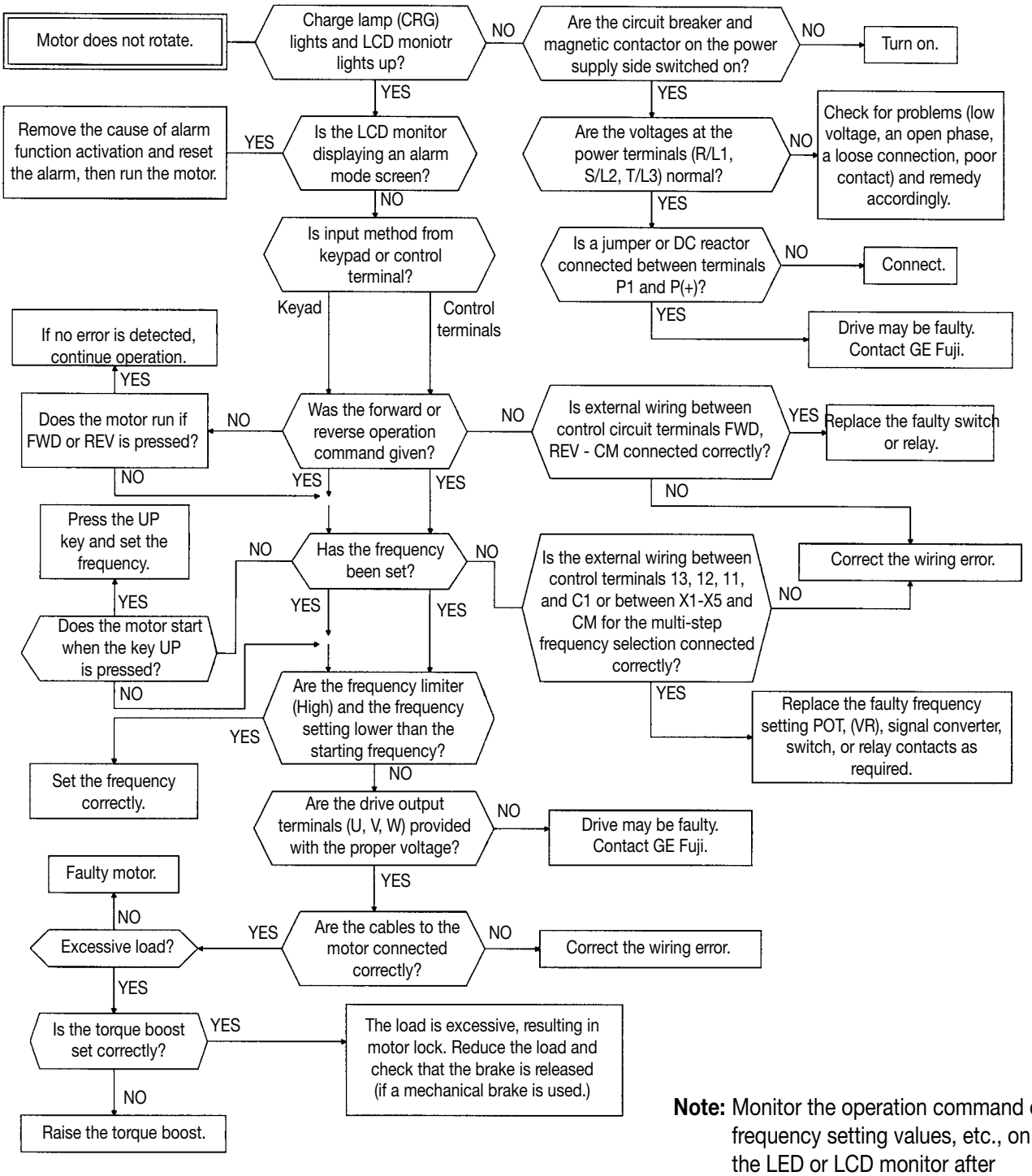


(11) Input Phase/Loss



7.2 Abnormal Motor Rotation

(1) If motor does not rotate

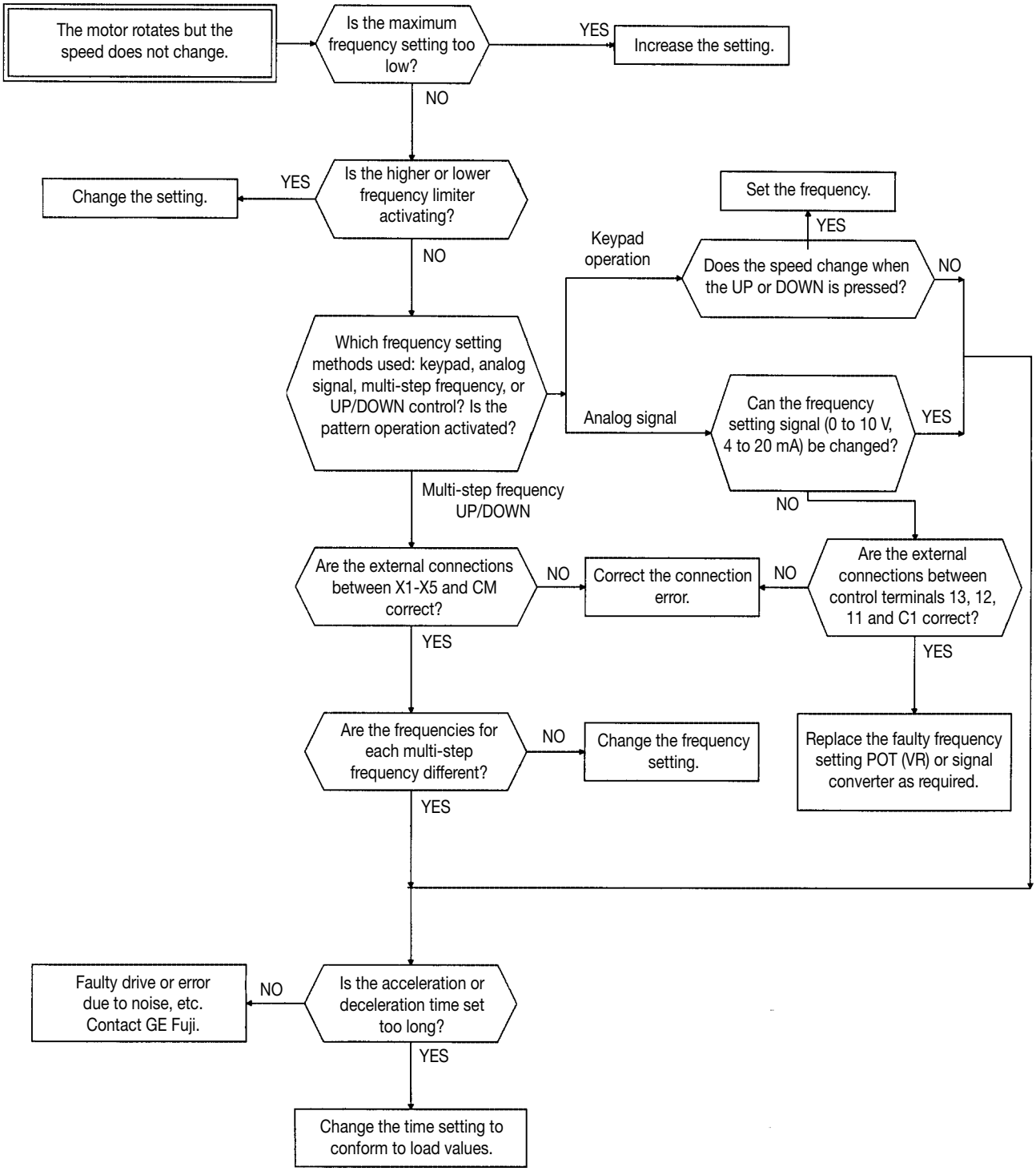


Note: Monitor the operation command or frequency setting values, etc., on the LED or LCD monitor after selecting the respective functions.

The motor does not rotate if the following commands are issued.

- An operation command is issued while the coast-to-stop or DC braking command is output.
- A reverse operation command is issued with the " H08 Rev. phase sequence lock" value set ot 1.

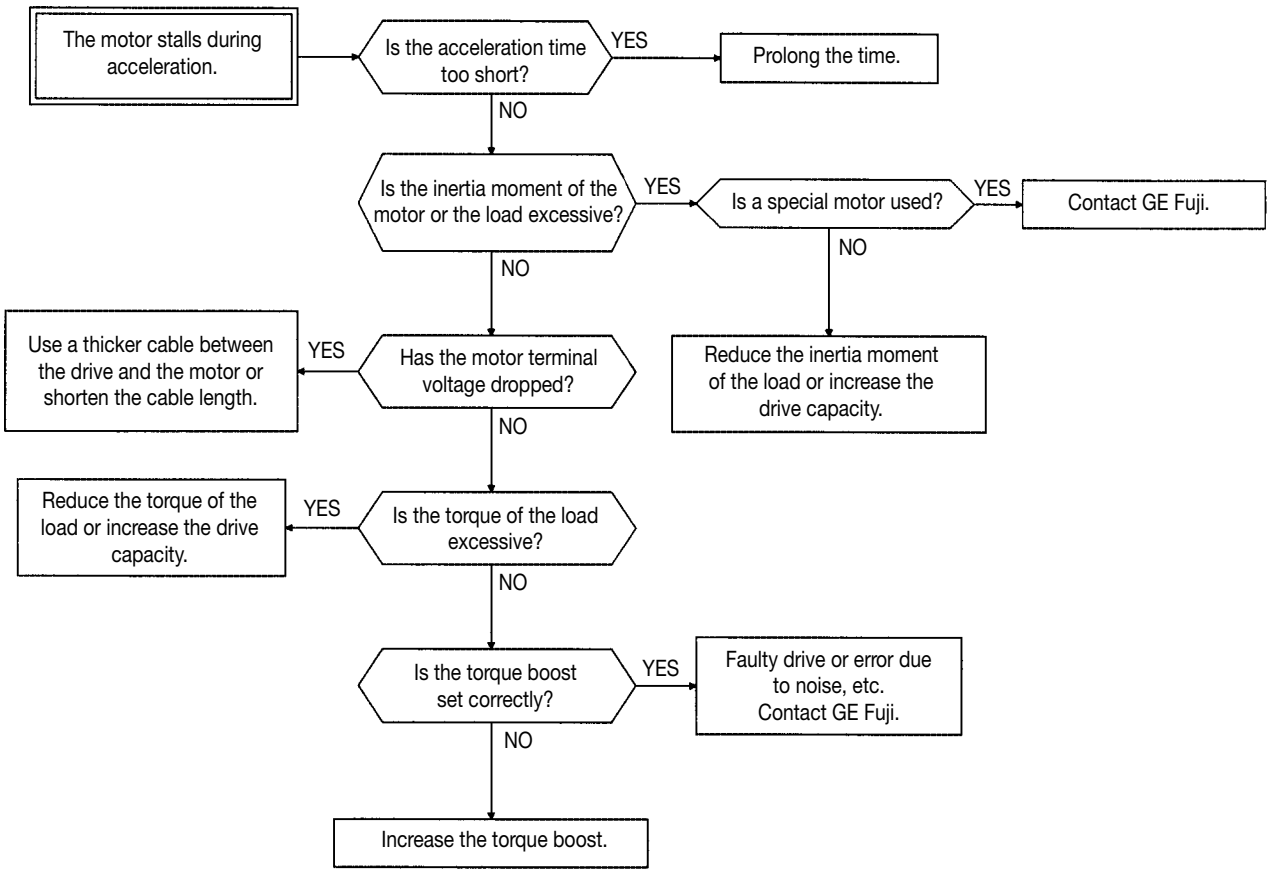
(2) If the motor rotates but the speed does not change

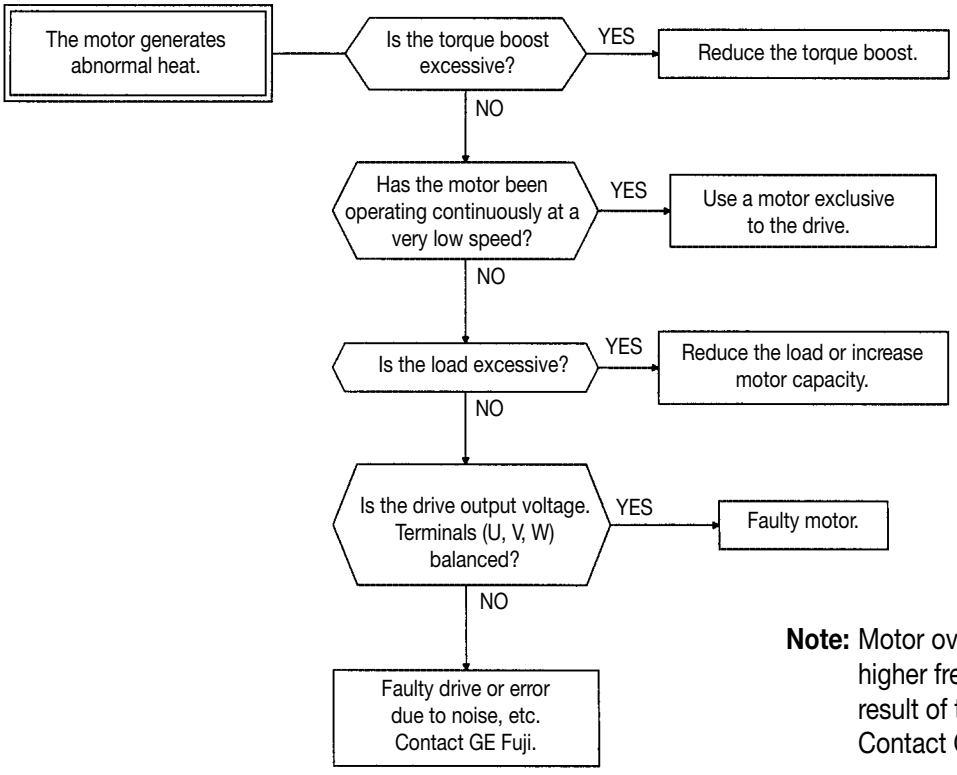


In the following cases, changing the motor speed is also restricted.

- Signals are input from control terminals both 12 and C1 when “F01 Frequency command 1” is set to 3, and there is no significant change in the added value.
- The load is excessive, and the torque limiting and current limiting functions are activated.

(3) If the motor stalls during acceleration





Note: Motor overheating following a higher frequency setting is likely the result of the current wave form. Contact GE Fuji.

8. Maintenance and Inspection

Proceed with daily inspection and periodic inspection to prevent malfunction and ensure long-term reliability. Some tips regarding things to look for during these inspections are listed below.

8.1 Daily Inspections

During operation, a visual inspection for abnormal operation can take place externally without removing the covers.

The inspection should cover the following areas:

(1) The performance, according to standard specifications, is as expected.
(2) The environment conforms to standard specifications.
(3) The keypad display is normal.
(4) There are no abnormal sounds, vibrations, or odors.
(5) There are no indications of overheating or discoloration.

8.2 Periodic Inspections

Periodic inspections should be made 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 of the main circuit take time to discharge. To prevent electric shock, confirm with 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 inverters rated at 6KF11L080, 6KF11H044 and below. Wait at least ten minutes for inverters rated at 6KF11L115, 6KF11H060 and above. Check that the charge lamp (CRG) went 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, and always use insulated tools.
- Never modify the drive. Electric shock or injury may result.

Area to Check		Items to Check	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 free of foreign objects.	1) Conduct a visual inspection and use appropriate meters. 2) Visual inspection	1) Results comply with all standard specifications. 2) The area is clear.
Voltage		Are the voltages in the main circuit and the control circuit normal?	Measure with a multi-meter.	Results comply with all standard specifications.
Keypad		1) Is the display hard to read? 2) Are the characters complete?	1) Visual inspection 2) Visual inspection	1), 2) The display can be easily read and characters are normal.
Structure (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) No abnormalities
Main Circuit	Common	1) Are there loose or missing nuts or bolts? 2) Are there deformations, cracks, damage, or 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) No abnormalities Note: Discolorationof the bus bar does not indicate a problem.
	Conductors and wiring	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) No abnormalities
	Terminal block	Is there damage?	Visual inspection	No abnormalities
	Smoothing capacitor	1) Is there electrolyte leakage, discoloration, cracking, or swelling in 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) No abnormalities 3) Capacitance is within 85% of initial value
	Resistor	1) Is there any 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 multi-meter by removing the connection on one side.	1) No abnormalities 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	No abnormalities
	Magnetic conductor and relay	1) Is there a rattling noise during operation? 2) Are the contacts rough?	1) Aural inspection. 2) Visual inpection.	1), 2) No abnormalities
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) Aural inspection. 2) Visual and olfactory inspection 3) Visual inspection 4) *Estimate life expectancy by visual inspection and maintenace information	1), 2), 3), 4) No abnormalities
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 poewr is off). 2) Tighten. 3) Visual inspection 4) *Estimate life expectancy by maintenance information	1) The fan must rotate smoothly. 2), 3) No abnormalities
	Ventilation	Is there foreign matter on the heat sink or intake and exhaust ports?	Visual inspection	No abnormalities

See additional notes on following page.

Note: If equipment is stained, wipe with a clean cloth. Use a vacuum to remove dust. *Estimate of life expectancy based on maintenance information.

The maintenance information is stored in the drive keypad. It indicates the electrostatic capacitance of the main circuit capacitors and the life expectancy of the electrolytic capacitors on the control PC board and the cooling fans. Use this data as the basis to estimate the life expectancy of parts.

1) Determining the capacitance of the main circuit capacitors

This drive is equipped with a function to automatically indicate the capacitance of the capacitors installed in the main circuit when powering up the drive after disconnecting the power according to the prescribed conditions.

The initial capacitance values are set in the drive when shipped from the factory, and the decrease ratio (%) to those values can be displayed.

Use this function as follows:

(1) Remove any option boards from the drive. Disconnect the DC bus connections to the main circuit [Terminals P(+) and N(-)] from the braking unit or other drives, if connected. The power factor correcting reactor (DC reactor) does not need 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-X5) on the control terminals. Also disconnect RS485 Modbus RTU serial communication, if used.

Turn on the main power supply. Confirm that the cooling fan is rotating and that the drive is not operating. (There is no problem if the "OH2 External thermal relay tripped" function is activated by the digital input terminal.)

(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 and confirm the capacitance values of the built-in capacitors.

2) Life expectancy of the PC control board

The actual capacitance of a capacitor is not measured in this case. However, the integrated operating hours for the control power supply, multiplied by the life expectancy coefficient as defined by the temperature inside the drive, 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 in 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 in unit hours, power input for less than one hour will be disregarded.

The displayed value should be considered a rough estimate because the actual life of a cooling fan is influenced significantly by the temperature.

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

Parts	Recommended Level
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 (6KF11L017, 6KF11H009 and below), 25,000 hours (6KF11L022, 6KF11H013 and above)*

* Estimated life expectancy of a ventilation-fan at drive ambient temperature of 40°C

8.3 Main Circuit Measurements

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. If measuring with a meter for commercial power frequency use, use the meters shown in Table 8.3.1.

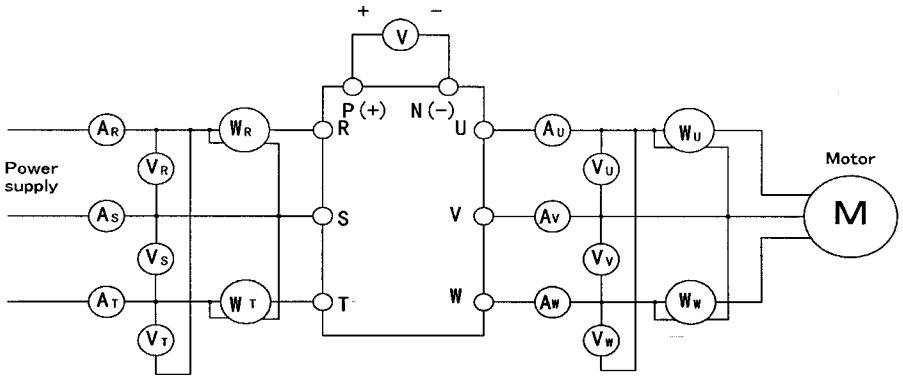
The power factor cannot be measured using power factor meters currently available on the market, which measure the phase difference between voltage and current. If power factors must be measured, measure the power, voltage, and current on the input side and output side, then calculate the power factor using the following formula:

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

Table 8.3-. 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 AR,S,T	Voltmeter VR,S,T	Powermeter WR,S,T	Ammeter AU,V,W	Voltmeter VU,V,W	Powermeter WU,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: If the output voltage is measured with a rectifier type meter, an error may occur. Use a digital AC power meter to ensure accuracy.



8.4 Insulation Test

Avoid megger testing on an drive since an insulation test was completed at the factory. If a megger test must be completed, proceed as described below. Incorrect testing methods may result in product damage.

If the specifications for the dielectric strength test are not followed, the drive may be damaged. If a dielectric strength test must be completed, contact your local distributor or GE Fuji.

(1) Megger test for the main circuit

1. Use a 500V DC megger and isolate the main power before starting 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. Perform the megger test only between the common cables connected to the main circuit and ground (Terminal ⏚).
5. A megger indicating 5M Ohm or more is normal. (This is the value measured with only the drive connected.)

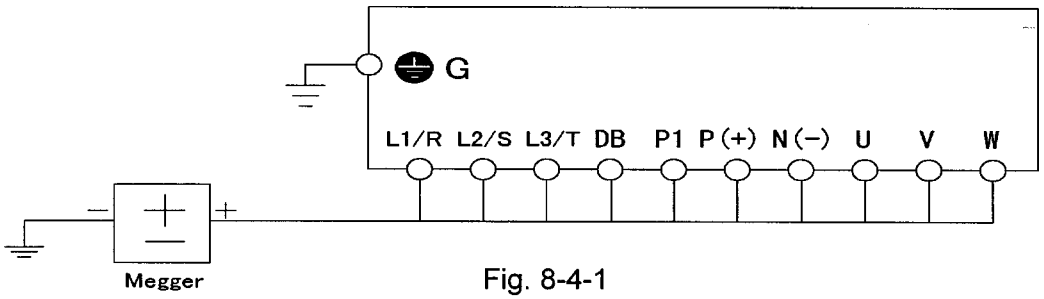


Fig. 8-4-1
Megger test

(2) Insulation test in the control circuit

Megger and dielectric strength tests are not performed on the control circuit. Use a resistance multimeter with a high resistance range to check the control circuit.

1. Remove all external cables from the control circuit terminals.
2. Conduct a continuity test between grounds. A result of 1M Ohm or more is normal.

(3) Exterior main circuit and sequence control circuit

Remove all cables from drive terminals to ensure that test voltage is not applied to the drive.

8.5 Replacement Parts

The life expectancy of a part depends on the type of part, the environment, and operating 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
Electrlytic 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

9. Warranty Parts and Service

The purpose of this section is to provide specific instructions to the user of the standard drive referenced in this book regarding warranty administration and how to obtain assistance on both in-warranty and out-of-warranty equipment.

For all warranty procedures, refer to section 10 of this instruction manual to identify the part or assembly.

If assistance is required to determine warranty status, identify defective parts, or obtain the name of your local distributor, call:

GE Industrial Systems

Product Service Engineering

1501 Roanoke Blvd.
Salem, VA 24153-6492 USA
Phone: 1 800 533 5885 (United States)
+ 1 540 378 3280 (International)
Fax: + 1 540 387 8606 (All)

("+" indicates the international access code required when calling from outside of the USA.)

WARRANTY COVERAGE

The warranty covers all major parts of the drive such as the main printed circuit boards, transistor modules, etc. The warranty does not cover replacement of fuses or of the entire drive.

"Warranty period is 12 months after installation or 18 months after shipment from the Company, whichever occurs 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 or modification.
2. The product was used in an environment outside the standard specified range.
3. Damage was caused by dropping the product after purchase or occurred during transportation.
4. Damage was caused by an earthquake, fire, flooding, lightning, abnormal voltage, or other natural calamities and secondary disasters.

Before calling the number at left to determine warranty status, the drive serial number will be required. This is located on the drive nameplate. If the drive is still under warranty, further information will be required per the "In-Warranty Failure Checklist" shown on page 9-2 of this instruction manual.

OUT-OF WARRANTY PROCEDURES

When the defective part has been identified, contact your local authorized GE standard drives distributor to order replacement parts.

MOTORS

Motor repairs on General Electric motors are generally handled by GE Authorized Electric Motor Servicenters or GE Apparatus Service Shops. For specific instructions on your motor, call the distributor from which it was purchased and be prepared to furnish complete nameplate data.

IN-WARRANTY FAILURE CHECKLIST

To assist with warranty troubleshooting, the following information is required. This data is needed to evaluate the cause in an effort to eliminate any further failures.

Model No.: _____

Serial No.: _____

Start-Up Date: _____

Failure Date: _____

Status When Failure Occurred (check one):

Power-Up _____ Running _____ Accel _____ Decel _____

Explanation of Failure _____

Application Information (check Yes or No)

Input Transformer: Yes _____ No _____

If Yes: KVA _____

L1 Volts _____ L2 Volts _____ L3 Volts _____

Power Factor Correction Capacitors: Yes _____ No _____

If Yes: Microfarrad _____

Other Equipment on Same Power Yes _____ No _____

If Yes, what?

Line Reactor on Input Yes _____ No _____

Input Starter Yes _____ No _____

Output Starter Yes _____ No _____

Motor Overloads Yes _____ No _____

Control Terminals Used (circle if used)

30A	**Y5A**	**CMY**		**Y1**	**C1**	**FMA**		**PLC**	**X1**	**X2**	**X3**	**X4**	**X5**				
30C	**30B**	**Y5C**		**Y2**	**11**	**12**	**13**		**CM**	**CM**	**FWD**	**REV**	**P24**	**P24**	**DX-**	**DX+**	**SD**

Function Codes Different From Factory Settings

Function Code	Setting	Function Code	Setting

Failure Message (see Section 4)

Latest Fault _____ Previous Faults: No Message _____

Hz _____ 1. _____

A _____ 2. _____

V _____ 3. _____

After all of the Checklist information is acquired, contact the following number for assistance: (800) 533-5885

When returning failed parts, reference the C_ _ _ _ # on the shipping documents that came with the replacement parts and ship failed parts to: GE Fuji Drives.

(Marked C _ _ _ _ #)

10. AF-300 F11 Replacement Parts

Catalog No.	Rating	Model											
		L002	L003	L005	L008	L011	L017	L022	L029	L042	L055	L068	L080
AF-300 F11 230VAC													
Main Control Card													
G11CPCB(F)		1	1	1	1	1	1	1	1	1	1	1	1
Gate Driver & Power Supply Card													
G11PPCBG2002		1											
G11PPCBG2004			1										
G11PPCBG2008				1									
G11PPCBG2015					1								
G11PPCBG2022						1							
G11PPCBG2037							1						
G11PPCBG2055								1	1				
G11PPCBG2075										1			
G11PPCBG2110											1		
G11PPCBG2150												1	
G11PPCBG2185													1
KEYPAD (Only one type per drive)													
TPA-F11	NEMA Type1	1	1	1	1	1	1	1	1	1	1	1	1
TPA-F11-4	NEMA Type4	1	1	1	1	1	1	1	1	1	1	1	1
CAPACITOR UNIT		*	*	*									
G11CAP01	PCB				1								
G11CAP02	PCB					1							
G11CAP03	PCB						1						
G11CAP09	2700µFx1							1	1		2		
G11CAP10	3900µFx1									1		2	
G11CAP11	4700µFx2												2
	* Located on Gate drive & Power supply Card												
FAN													
G11FAN01					1	1	1						
G11FAN202								1	1	1	2	2	2
POWER MODULE		*	*	*									
PS11046	30A 600V				1	1							
PS11047	50A 600V						1						
6MBP75RS060	75A 600V							1	1				
6MBP100RS060	100A 600V									1			
6MBP150RS060	150A 600V										1	1	
6MBP200RS060	200A 600V												1
	* Located on Gate drive & Power supply Card												
RECTIFIER MODULE		*	*	*	*	*	*						
PVC758	75A 800V							1	1	1			
CLK120AA80	120A 800V										1	1	
CLK180AA80	180A 800V												1
	* Located on Gate drive & Power supply Card												
CHARGE RESISTOR		*	*	*	*	*	*						
30W66	30W 6.6WJ							1	1	1			
80W25	80W 2.5WJ										1	1	1
	* Located on Gate drive & Power supply Card												
FRONT COVER													
F11UPCG008P		1	1	1									
F11UPCG040P					1	1	1						
F11UPCG075P								1	1	1			
F11UPCG220P											1	1	1

10. AF-300 F11 Replacement Parts (continued)

Catalog No.	Rating	Model						
		L115	L145	L180	L215	L283	L346	L415
AF-300 F11 230VAC								
Main Control Card								
EP4113F		1	1	1	1	1	1	1
Gate Driver & Power Supply Card								
EP3956C1		1	1					
EP3956C2				1				
EP3956C3					1	1		
EP3957C1							1	
EP3957C2								1
KEYPAD								
TPA-F11-4		1	1	1	1	1	1	1
DC CAPACITOR								
LNT2G302MSMAFF	400V 3000µF	4	4					
HCGHA2G362N3K	400V 3600µF			4				
HCGHA2G452NE3K	400V 4500µF				4			
HCGHA2G592N3K	400V 5900µf					4	5	6
FAN								
FBA09A24H1B0		1	1	1	2	2	2	4
(Standard)								
4715PS22TB30		2	2					
2750MTP15				2	2		3	4
6250MG1						2		
(For NEMA12 Heatsink)								
UHS4556MLOT1		2	2					
2750MTP15OT1				2	2		3	4
U6250MKG1LTPOT1						2		
IGBT MODULE								
2MBi300NB060		3	3					
CM400DU12H206				3				
2MBi300NB06001					6	6	9	12
RECTIFIER MODULE								
PD1008AC		3	3	6	6	9	9	9
CHARGE RESISTOR								
HF5C5504	80W 7.5ohm	1	1	1	1	1	2	2
DC CONTACTOR								
FC3UL	AC220VAUX2B	1	1					
FC1UL	AC220VAUX2B			2	2	2		
FC4UL	AC220VAUX2B						2	
SC7NUL	AC200-240V							1
DC FUSE								
CR2L260UL		1	1	1				
CR2L400UL					1	1		
A50P6004							1	1
INPUT MODULE CARD								
EP3985C1		1	1	1	1	1		
EP3985C3							1	1

10. AF-300 F11 Replacement Parts (continued)

Catalog No.	Rating	Model										
		H002	H003	H004	H006	H009	H013	H017	H023	H030	H037	H044
AF-300 F11 460VAC												
Main Control Card												
G11CPCB(F)		1	1	1	1	1	1	1	1	1	1	1
Gate Driver & Power Supply Card												
G11PPCBG4004		1										
G11PPCBG4008			1									
G11PPCBG4015				1								
G11PPCBG4022					1							
G11PPCBG4037						1						
G11PPCBG4055							1	1				
G11PPCBG4075									1			
G11PPCBG4110										1		
G11PPCBG4150											1	
G11PPCBG4185												1
KEYPAD (Only one type per drive)												
TPA-F11	NEMA Type1	1	1	1	1	1	1	1	1	1	1	1
TPA-F11-4	NEMA Type4	1	1	1	1	1	1	1	1	1	1	1
CAPACITOR UNIT		*	*									
G11CAP04	PCB			1								
G11CAP05	PCB				1							
G11CAP06	PCB					1						
G11CAP07	1500µFx2						2	2				
G11CAP08	2000µFx2								2			
G11CAP09	2700µFx2									2		
G11CAP10	3900µFx2										2	
G11CAP11	4700µFx2											2
	* Located on Gate drive & Power supply Card											
FAN												
G11FAN01				1	1	1						
G11FAN02							1	1	1	2	2	2
POWER MODULE		*	*									
PS12046	15A 1200V			1	1							
PS12047	25A 1200V					1						
6MBP50RS120	50A 1200V						1	1	1			
6MBP75RS120	75A 1200V									1	1	
6MBP100RS120	100A 1200V											1
	* Located on Gate drive & Power supply Card											
RECTIFIER MODULE		*	*	*	*	*						
PVC7516	75A 1600V						1	1	1			
CLK70AA160	70A 1600V									1	1	
CLK100AA160	100A 1600V											1
	* Located on Gate drive & Power supply Card											
CHARGE RESISTOR		*	*	*	*	*						
30W200	30W 20WJ						1	1	1			
80W100	80W 10WJ									1	1	1
	* Located on Gate drive & Power supply Card											
FRONT COVER												
G11UPCG008P		1	1									
G11UPCG040P				1	1	1						
G11UPCG075P							1	1	1			
G11UPCG220P										1	1	1

10. AF-300 F11 Replacement Parts (continued)

Catalog No.	Rating	Model																
		H060	H075	H091	H112	H150	H196	H210	H253	H304	H377	H415	H485	H520	H650	H470	H840	H960
AF-300 F11 460VAC																		
Main Control Card																		
EP4113F		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gate Driver & Power Supply Card																		
EP3959C1		1	1															
EP3959C2				1														
EP3959C3					1	1												
EP3959C4							1											
EP3959C5								1	1									
EP3957C3										1	1							
EP3957C4												1	1	1				
EP3957C5															1	1	1	1
GATE DRIVE AMPLIFIER CARD																		
EP4142															3	3	3	3
KEYPAD																		
TPA-F11-4		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
DC CAPACITOR																		
LNT2G302MSMAFF	400V 3000µF	4	4															
HCGHA2G362N3K	400V 3600µF			4														
HCGHA2G452NE3K	400V 4500µF				4			6										
HCGHA2G592N3K	400V 5900µf					4	4		6	8		12						
HCGHA2G742N3K	400V 7400µF										8		12	12				
HCGHA2G932N3KG	400V 9300µF														20	20	26	26
FAN UNIT																		
FBA09A24H1B0		1	1	1	1	1	2	2	2	3	3	4	4	4	4	4		
MRS18-DUL															3	3	4	4
THB1-UHS4556M																	4	4
(Standard)																		
4715PS22TB30		2	2															
2750MTP15				2	2			3	3									
6250MG1						2	2			3	3	4	4	4				
(For NEMA12 Heatsink)																		
UHS4556MLOT1		2	2															
2750MTP15OT1				2	2			3	3									
U6250MKG1LTPOT1						2	2			3	3	4	4	4				
IGBT MODULE																		
2MBi150PC14002		3	3															
CM200DU24H203				3														
2MBi300P14002					3	3												
CM200DU24H202							6											
2MBi300P14003								6	6	9	9	12	12	12	18	18	24	24
RECTIFIER MODULE																		
PD6016A		3	3	3						12	12							
PD10016A					3	3	6	6	6			12	12	12	24	24	30	30

10. AF-300 F11 Replacement Parts (continued)

Catalog No.	Rating	Model																
		H060	H075	H091	H112	H150	H196	H210	H253	H304	H377	H415	H485	H520	H650	H470	H840	H960
AF-300 F11 460VAC																		
IGBT MODULE																		
2MBi150PC14002		3	3															
CM200DU24H203				3														
2MBi300p14002					3	3												
CM200DU24H202							6											
2MBi300P14003								6	6	9	9	12	12	12	18	18	24	24
RECTIFIER MODULE																		
PD6016A		3	3	3						12	12							
PD10016A					3	3	6	6	6			12	12	12	24	24	30	30
CHARGE RESISTOR																		
HF5C5504	80W 7.5ohm	1	1	1	1	1	1	2	2	2	3	3	4	4				
GRZG400															2	2	2	2
DC CONTACTOR																		
FC1UL	AC220VAUX2B	1	1	1	1	1	2	2	2									
FC4UL	AC220VAUX2B									2	2							
SC7NUL	AC200-240V											1						
SC8NUL	AC200-240V												1	1				
SCN8	AC200-240V														2	2	2	2
DC FUSE																		
CR6L150UL	600V 150A	1	1	1														
CR6L200UL	600V 200A				1													
CR6L300UL	600V 300A					1	1											
A70Q4004								1	1									
A70Q5004										1								
A70Q6004											1	1						
A70QS8004													1	1				
A70P16004TA															1	1		
A70P20004																	1	1
TRANSFORMER																		
HF5C55025512VA		1	1															
HF5C550312524VA				1	1	1	1											
HF5B661330016VA								1	1	1	1	1	1	1				
HF5B395170020VA															1	1	1	1
INPUT MODULE CARD																		
EP3985C2		1	1	1	1	1	1	1	1									
EP3985C4										1	1	1	1	1	1	1	1	1

Three-phase 230V series

Type designation 6KF11L___X1** (NEMA Type1) 6KF11L___X2** (NEMA Type12) 6KF11L___X4** (NEMA Type4) 6KF11L___X8** (Open, Type 12 Heatsink) 6KF11L___X9** (Open) ** Indicates product revision			002	003	005	008	011	017	022	029	042	055	068	080	115	145	180	215	283	346	415
Nominal 230V system applied motor		HP	1/4	1/2	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150
Output ratings	Rated Capacity *1)	kVA	0.59	1.1	1.9	3.1	4.3	6.7	8.7	11	16	21	26	31	45	57	71	85	112	137	165
	Rated Voltage *2)	V	3-phase, 200V /50Hz; 200V ,220V ,230V /60Hz																		
	Rated Current *3)	A	1.5	3.0	5.0	8.0	11	17	22	29	42	55	67	78	115	145	180	215	283	346	415
	Overload Capability		110% of rated current for 1min																		
	Rated Frequency	Hz	50, 60Hz																		
Input rating	Phases, Voltage, Frequency Voltage / frequency variations		3-phase, 200 to 230V , 50/60Hz -Voltage : +10 to -15% (Voltage imbalance *5) : 2% or less												3-phase, 200 to 220V /50Hz , 200 to 230V /60Hz -Frequency : +5 to -5%						
	Momentary voltage dip capability *6)		When the input voltage is 165V or more, the inverter can be operated continuously. If the AC Line voltage is below rated, the drive will not provide the 15ms ride-thru. The smooth recovery method is selectable.																		
Output frequency	Setting	Maximum Freq.	50 to 120Hz																		
		Base Freq.	25 to 120Hz																		
		Starting Freq.	0.1 to 60Hz , Continuous time : 0.0 to 10.0s																		
		Carrier Freq. *8)	0.75 to 15kHz The minimum carrier frequency changes depend on maximum output frequency.												0.75 to 10kHz					0.75 to 6kHz	
	Accuracy (Stability)		-Analog setting : ±0.2% of Maximum frequency (at 25 ±10 degrees C) -Digital setting : ±0.01% of Maximum frequency (at -10 to +50 degrees C)																		
	Setting resolution		-Analog setting : 1/3000 of Maximum frequency ex.) 0.02Hz at 60Hz , 0.04Hz at 120Hz -Digital setting : 0.01Hz at Maximum frequency of up to 99.99Hz (0.1Hz at Maximum frequency of 100Hz and above) -Link setting :Two methods are selectable. 1/20000 of Maximum frequency ex. 0.003Hz at 60Hz , 0.01Hz at 400Hz 0.01Hz (Fixed)																		
Control	Volt/Freq Characteristic		80 to 240V (with AVR control) at base and maximum frequency, adjustable																		
	Torque boost							Constant torque load						Variable torque load							
			Manual (setting code) :					2.0 to 20.0						0.1 to 1.9							
Enclosure			NEMA Type1, Type4										NEMA Type1, Type12		Open, Open with NEMA Type 12 Heatsink, NEMA 1						
Cooling method			Natural					Fan cooling													
Standards			-UL/cUL																		

NOTES

*1) Inverter output capacity [kVA] at 230V.

*2) Output voltage is proportional to the power supply voltage and can't exceed the power supply voltage.

*3) Current derating may be required in case of low impedance load such as high frequency motor.

*5) Reference to the IEC 61800-3(5.2.3)

$$\text{Imbalance in power supply voltage [\%]} = \frac{\text{(Maximum voltage[V] - Minimum voltage[V])}}{\text{3-phase averaging voltage[V]}} \text{ - 67 [\%]}$$

*6) 85% load

*8) If carrier frequency is set at more than 10kHz and an overheat condition (detected by internal thermal sensor) occurs, drive will automatically reduce carrier frequency to 8kHz , in order to avoid trip. (6KF11L080, 6KF11H044 and below)

Three-phase 460V series

Type designation 6KF11H___X1** (NEMA Type1) 6KF11H___X2** (NEMA Type12) 6KF11H___X4** (NEMA Type 4) 6KF11H___X8** (Open, Type 12 Heatsink) 6KF11H___X9** (Open)			002	003	004	006	009	013	017	023	030	037	044	060	075	091	112	150	176	210	253	304	377	415	485	520	650	740	840	960
Norminal 460V system applied motor		HP	1/2	1	2	3	5	7.5	10	15	20	25	30	40	50	60	75	100	125	150	200	250	300	350	400	450	500	600	700	800
	Rated Capacity *1)	kVA	1.1	1.9	2.9	4.3	7.1	9.9	13.1	18.3	23.9	29.4	35.0	47	59	72	89	119	140	167	242	242	300	330	386	414	578	590	669	765
	Rated Voltage *2)	V	3-phase, 380V , 400V , 415V /50Hz , 380V , 400V , 440V , 460V /60Hz																											
	Rated Current *3)	A	1.5	2.5	3.7	5.5	9.0	12.5	16.5	23	30	37	44	60	75	91	112	150	176	210	304	304	377	415	485	520	650	740	840	960
	Overload Capability		110% of rated current for 1min ,											110% of rated current for 1min ,																
	Rated Frequency	Hz	50, 60Hz																											
Input ratings	Phases, Voltage, Frequency		3-phase, 380 to 480V , 50/60Hz											3-phase, 380 to 440V /50Hz , 380 to 480V /60Hz * 380V/50Hz and 380 to 415V/60Hz *4)																
	Voltage / frequency variations		-Voltage : +10 to -15% (Voltage imbalance *5) : 2% or less -Frequency :+5 to -5%																											
	Momentary voltage dip capability *6)		When the input voltage is 310V or more, the inverter can be operated continuously. If the AC Line voltage is below rated, the drive will not provide the 15ms ride-thru. The smooth recovery method is selectable.																											
Output frequency	Setting	Maximum Freq.	50 to 120Hz																											
		Base Freq.	25 to 120Hz																											
		Starting Freq.	0.1 to 60Hz , Continuous time : 0.0 to 10.0s																											
		Carrier Freq. *8)	0.75 to 15kHz The minimum carrier frequency changes depend on maximum output frequency.											0.75 to 10kHz				0.75 to 6kHz												
	Accuracy (Stability)		-Analog setting : ±0.2% of Maximum frequency (at 25 ±10 degrees C) -Digital setting : ±0.01% of Maximum frequency (at -10 to +50 degrees C)																											
	Setting resolution		-Analog setting : 1/3000 of Max. frequency ex.) 0.02Hz at 60Hz , 0.04Hz at 120Hz -Digital setting : 0.01Hz at Maximum frequency of up to 99.99Hz (0.1Hz at Maximum frequency of 100Hz and above) -Link setting : Two methods are selectable. 1/20000 of Maximum frequency ex. 0.003Hz at 60Hz , 0.01Hz at 400Hz 0.01Hz (Fixed)																											
Control	Volt/Freq Characteristic		320 to 480V (with AVR control) at base and maximum frequency, adjustable																											
	Torque boost													Constant toruque load				Variable torque load											
														:				-											
			Manual (setting code)											: 2.0 to 20.0				: 0.1 to 1.9											
Enclosure			NEMA Type1, Type 4								NEMA Type1, Type12			Open, Open with NEMA Type 12 Heatsink, NEMA Type 1															
Cooling method			Natural								Fan cooling																			
Standards			-UL/cUL																											

NOTES
*1) Inverter output capacity [kVA] at 460V.
*2) Output voltage is proportional to the power supply voltage and can't exceed the power supply voltage.
*3) Current derating may be required in case of low impedance load such as high frequency motor.
*4) Change the tap of auxiliary transformer.
380V/50Hz and 380 to 415V/60Hz : Change over CN UX connector from U1 part to U2 part. (Reference to the Instruction manual)

Input voltage	CN UX connector
400 to 440V/50Hz, 440 to 480V/60Hz	U1 (Factory setting)
380V/50Hz (398V or smaller), 380 to 415V/60Hz (430V or smaller)	U2

*5) Reference to the IEC 61800-3(5.2.3)

$$\text{Imbalance in power supply voltage [\%]} = \frac{\text{(Maximum voltage[V] - Minimum voltage[V])}}{\text{3-phase averaging voltageV}} - 67 \text{ [\%]}$$

*6) 85% load
*8) If carrier frequency is set at more than 10kHz and an overheat condition (detected by internal thermal sensor) occurs, drive will automatically reduce carrier frequency to 8kHz , in order to avoid trip. (6KF11L080, 6KF11H044 and below)

11.2 Common Specifications

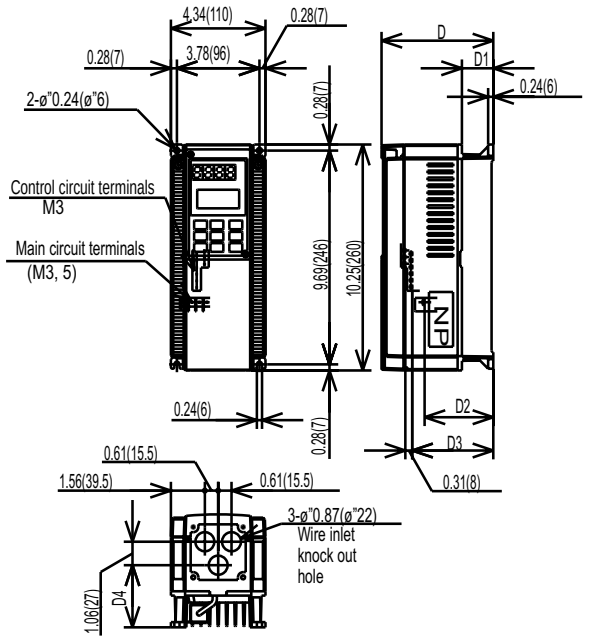
Item			Explanation
Control	Control Method		Sinusoidal wave PWM control (with V/F control)
	Output frequency	Maximum frequency	50 to 120 Hz variable setting
		Base frequency	25 to 120 Hz variable setting
		Starting frequency	0.1 to 60 Hz variable setting Holding time: 0.0 to 10.0 s
		Carrier frequency	0.75 to 15k Hz (6KF11L080, 6KF11H044 and below) 0.75 to 10k Hz (6KF11L115-285, 6KF11H060-150) 0.75 to 6k Hz (6KF11L346, 6KF11H176 and above)
		Accuracy (stability)	Analog setting: +/- 0.2% or less of the max. frequency (at 25 +/- 10°C) Digital Setting: +/- 0.01% or less of the max frequency (-10 to +50°C)
		Setting resolution	Analog setting: 1/3000 of max. frequency (e.g. 0.02 Hz / 60 Hz, 0.05 Hz / 150 Hz) Digital setting: 0.01 Hz (99.99 Hz or less), 0.1 Hz (100.0 Hz or more)
	Voltage/frequency Characteristics		Output voltage at base frequency can be adjusted separately, such as 80 to 240V (200V series) or 320 to 480V (400V series)
	Torque Boost		Manual: 0.1 to 20.0 code setting (energy savings reduced torque to 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 Hz, braking time: 0.0 to 30.0s Braking levels: 0 to 80%
	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 drive, slip compensation control, automatic energy saving operation, regeneration avoiding control, torque limiting, PID control, cooling fan ON/OFF control.
Operation	Operation method		Keypad: 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: setting by UP and DOWN keys External potentiometer: External freq. Setting POT (VR) (1 to 5k ohm) Analog input: 0 to +10V (0 to 5V), 4 to 20 mA, o to ± 10V (FWD/REV operation) +10 to 0 (reverse operation), 20 to 4 mA (reverse operation) UP/DOWN control: Frequency increases or decreases as long as the digital input signals are turned on. Multistep frequency selection: Up to 7 steps are selectable by a combination of digital input signals (four kinds) Link operation: Operation by RS485 Modbus RTU (standard)
	Operation status signal		Transistor output (2 signals): Running, frequency, arrival, frequency detection, overload early warning, etc. Relay output (2 signals): Alarm output (for any fault), multi-purpose output signals Analog output (1 signal): Output frequency, output current, output voltage, output torque, power consumption, etc.

11.2 Common Specifications (continued)

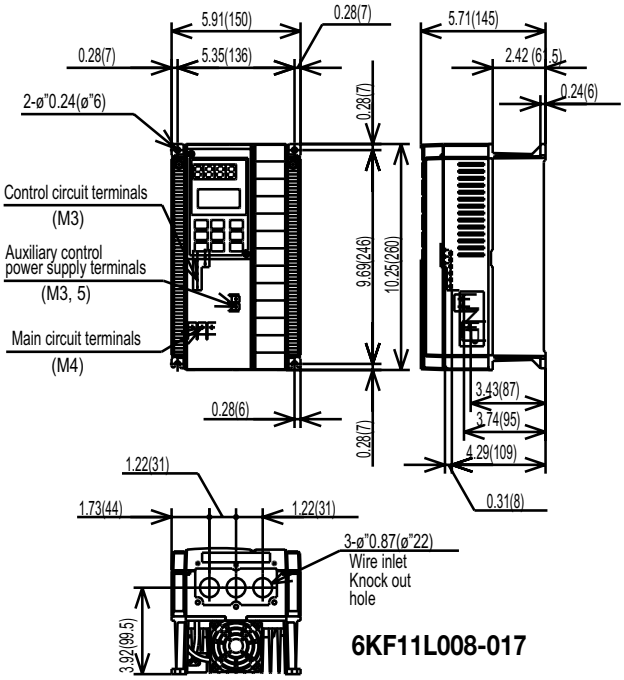
	Item		Explanation
Indication	Digital display LED		Output frequency, setting frequency, output current, output voltage, motor synchronous speed, line speed, load rotation speed, calculated PID value, PID command value, PID feedback value, alarm code.
	Liquid crystal display		Operation information, operational 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, heatsink temperature, etc.
	Language		Six languages (Japanese, English, German, French, Spanish, Italian)
	Lamp display		Charging (voltage residual), operation indication
	Protective function		Overcurrent, short-circuit, ground fault, overvoltage, undervoltage, overload, overheating, blown fuse, motor overload, external alarm, input open-phase, output open0phase (when tuning), braking resistor protection, CPU and memory error, keypad communications error, surge protection, stall prevention, etc.
Environment	Installation location		Indoor, altitude less than 3300 feet (1000m), free from corrosive gas, dust and direct sunlight.
	Ambient temperature		-10 to +50°C (+14 to 122°F) (ventilating cover must be removed under conditions exceeding +40°C (+104°F) in the panel for models rated at6KF11L080, 6KF11H044 and below)
	Vibration		3mm peak from 2-9 Hz, 9.8 m/s^2 from 9-20 Hz, 2m/s^2 from 20-55 Hz, 1 m/s^2 from 55-200 Hz,
	Storage	Ambient temperature	-25 to 65°C (-13 to 149°F)
		Ambient humidity	5 to 95% (no condensation)

11.3 Outline Dimensions

Inches (mm)

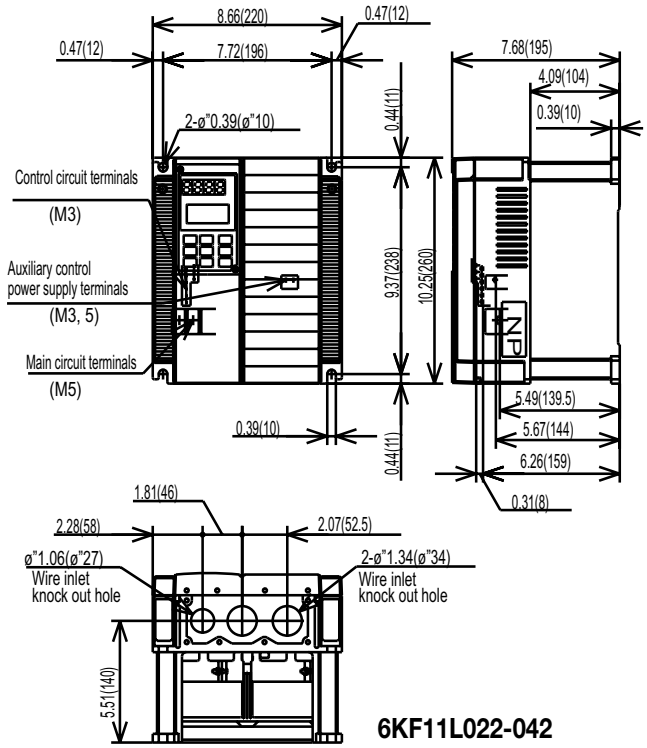


Type	D	D1	D2	D3	D4
6KF11L002,003	5.12	1.44	3.15	3.7	2.81
6KF11H002	(130)	(26.5)	(80)	(94)	(71.5)
6KF11L005	5.71	2.03	3.74	4.29	3.41
6KF11H003	(145)	(51.5)	(95)	(109)	(86.5)



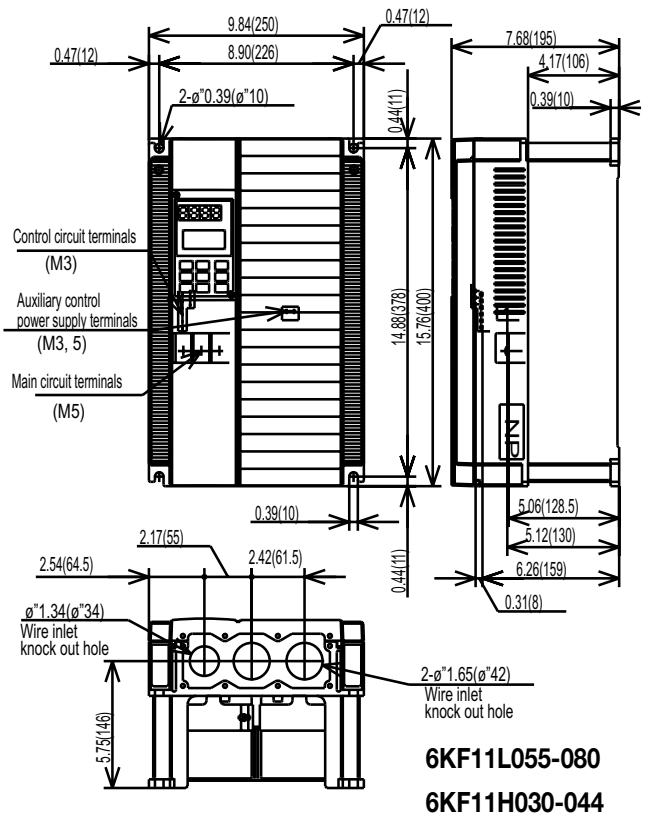
6KF11L008-017

6KF11H004-009



6KF11L022-042

6KF11H013-023

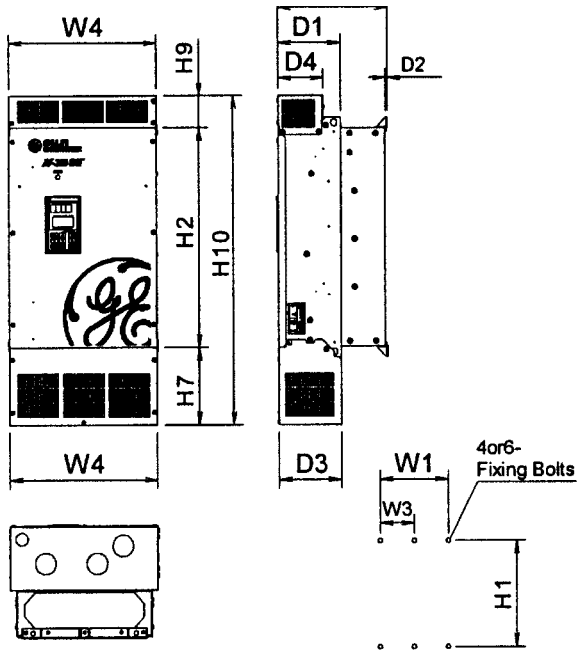


6KF11L055-080

6KF11H030-044

11.3.1 Outline Dimensions NEMA 1

Inches (mm)



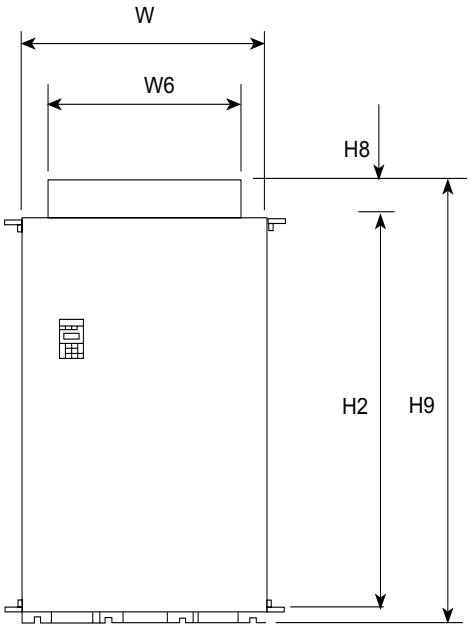
230V Series NEMA 1

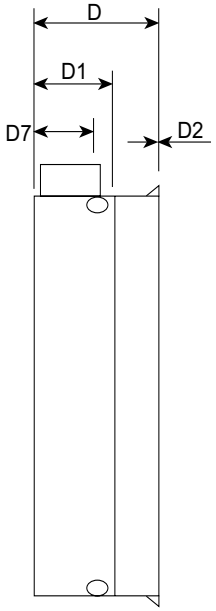
Model	DIMENSIONS inches (mm)														Mtg. Bolts	Wt. Lb (kg)
	W1	W3	W4	H1	H2	H3	H6	H7	H9	H10	D	D2	D3	D4		
6KF11L115	9.4	–	13.5	20.9	19.7	20.2	0.4	7.1	3	29.7	10	0.2	5.7	4.1	M8	70
6KF11L145	(240)		(342)	(530)	(500)	(512)	(9)	(180)	(75)	(755)	(255)	(4)	(145)	(105)		(32)
6KF11L180	10.8		14.9	23.4	22.2	22.7		7.9		33.1	10.6					86
	(275)		(377)	(595)	(565)	(577)		(200)		(840)	(270)					(39)
6KF11L215				28.3	27.2	27.6				38						106
				(720)	(690)	(702)				(965)						(48)
6KF11L283																110
																(50)
6KF11L346	16.9		21		27	27.4	0.5	11.1	3.3	41.3	11.2			3.6	M12	172
	(430)		(533)		(685)	(695)	(13)	(283)	(83)	(1050)	(285)			(91)		(78)
6KF11L415	22.8	11.4	26.9	33.5	32.1	32.5		15.1		50.4	14.2		8.7	6.5		282
	(580)	(290)	(683)	(850)	(815)	(825)		(383)		(1280)	(360)		(220)	(166)		(128)

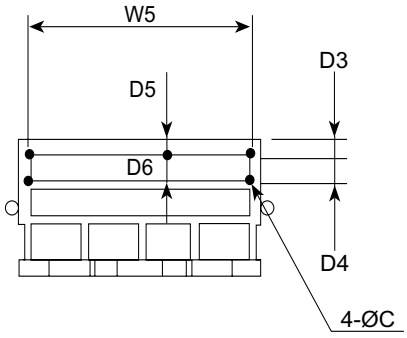
460V Series NEMA 1

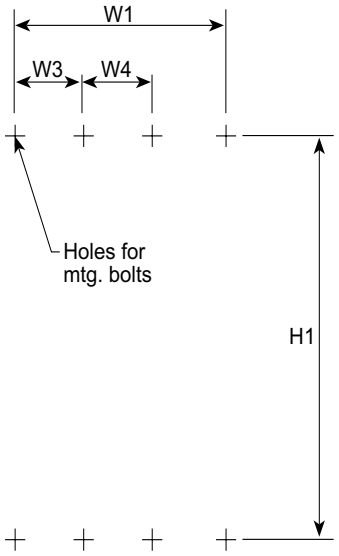
Model	DIMENSIONS inches (mm)														Mtg. Bolts	Wt. Lb (kg)
	W1	W3	W4	H1	H2	H3	H6	H7	H9	H10	D	D2	D3	D4		
6KF11H060	9.4	–	13.5	20.9	19.7	20.2	0.4	7.1	3	29.7	10	0.2	5.7	4.1	M8	70
6KF11H075	(240)		(342)	(530)	(500)	(512)	(9)	(180)	(75)	(755)	(255)	(4)	(145)	(105)		(32)
6KF11H091	10.8		14.9								10.6					82
	(275)		(377)								(270)					(37)
6KF11H112				25.8	24.6	25.1				34.6						95
				(655)	(625)	(637)				(880)						(43)
6KF11H150																97
																(44)
6KF11H176				28.3	27.2	27.6		7.9		38						115
				(720)	(690)	(702)		(200)		(965)						(52)
6KF11H210	16.9		21	28	26.6	27	0.5	8.2	3.3		12.4		6.9	4.7	M12	174
6KF11H253	(430)		(533)	(710)	(675)	(685)	(13)	(208)	(83)		(315)		(175)	(121)		(79)
6KF11H304				38	37	37		13		53.1	14.2		8.7	7		245
6KF11H377				(970)	(935)	(945)		(333)		(1350)	(360)		(220)	(166)		(111)
6KF11H415	22.8	11.4	26.9					15.1		55.1						337
6KF11H485	(580)	(290)	(683)					(383)		(1400)						(153)
6KF11H520																

Surface Mount









460V Series NEMA 1

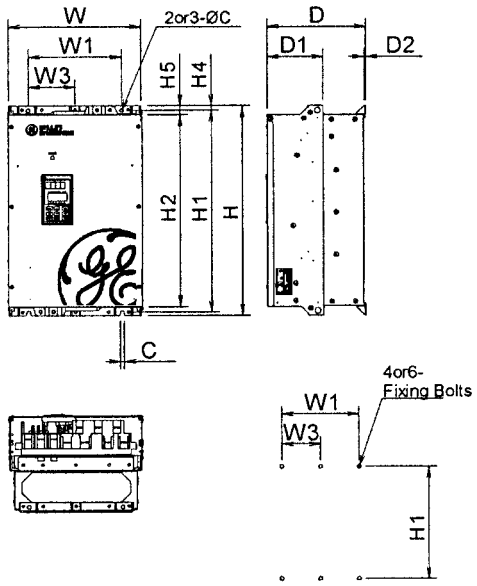
Model	DIMENSIONS inches (mm)												
	W	W1	W3	W4	W5	W6	H1	H2	H4	H8	H9	D	D1
6KF11H650 6KF11H740	26.8 (680)	22.8 (580)	11.4 (290)	–	24.0 (610)	21.9 (555)	53.9 (1370)	52.4 (1330)	52.6 (1335)	3.3 (084)	57.1 (1450)	17.7 (450)	11.2 (285)
6KF11H840 6KF11H960	34.6 (880)	30.7 (780)	10.2 (260)	10.2 (260)	31.9 (810)	29.7 (755)							

Model	DIMENSIONS inches (mm)							
	D2	D3	D4	D5	D6	D7	Mtg. Bolts	Wt. Lb (kg)
6KF11H650 6KF11H740	0.3 (6)	2.0 (50)	3.9 (100)	1.4 (35)	4.5 (115)	8.7 (220)	M12	562 (255)
6KF11H840 6KF11H960								804 (365)

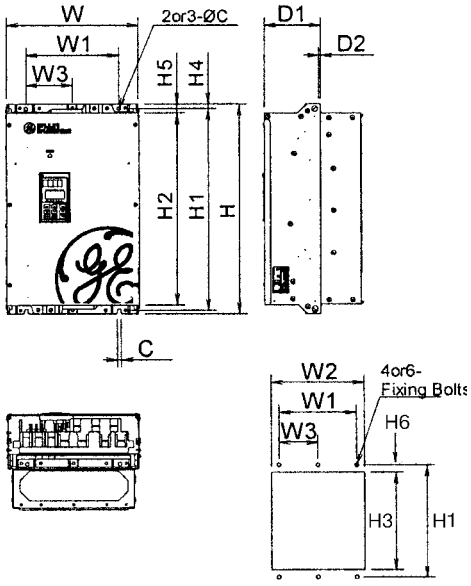
11.3.2 Outline Dimensions Open Type

Inches (mm)

Surface Mount



Through Panel Mount



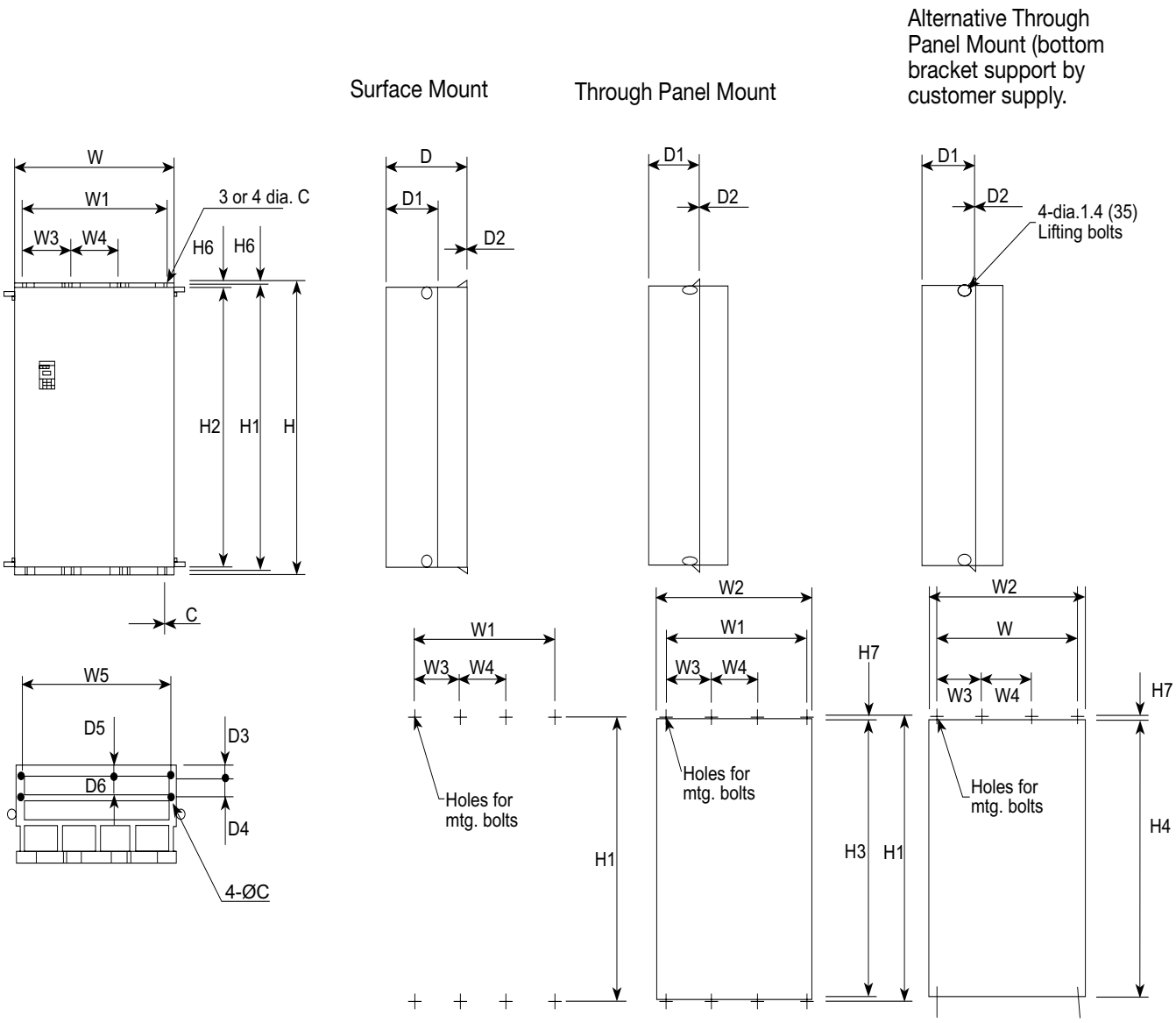
230V Series

Model	DIMENSION Inch (mm)															Mtg. Bolts	Weight Lb (kg)
	W	W1	W2	W3	H	H1	H2	H3	H4	H5	H6	D	D1	D2	C		
6KF11L115	13.4	9.4	12.8		21.7	20.9	19.7	20.2	0.5	1	0.4	10	5.7	0.2	0.4	M8	64
6KF11L145	(340)	(240)	(326)		(550)	(530)	(500)	(512)	(12)	(25)	(9)	(255)	(145)	(4)	(10)		(29)
6KF11L180	14.8	10.8	14.2		24.2	23.4	22.2	22.7				10.6					79
	(375)	(275)	(361)		(615)	(595)	(565)	(577)				(270)					(36)
6KF11L215					29.1	28.3	27.2	27.6									97
					(740)	(720)	(690)	(702)									(44)
6KF11L283																	101
																	(46)
6KF11L346	20.9	16.9	20.1		29.5		27	27.4	0.6	1.3	0.5	11.2			0.6	M12	154
	(530)	(430)	(510)		(750)		(685)	(695)	(16)	(33)	(13)	(285)			(15)		(70)
6KF11L415	26.8	22.8	26		34.6	33.5	32.1	32.5				14.2	8.7				253
	(680)	(580)	(660)		(880)	(850)	(815)	(825)				(360)	(220)				(115)

460V Series

Model	DIMENSION Inch (mm)															Mtg. Bolts	Weight Lb (kg)
	W	W1	W2	W3	H	H1	H2	H3	H4	H5	H6	D	D1	D2	C		
6KF11H060	13.4	9.4	12.8		21.7	20.9	19.7	20.2	0.5	1	0.4	10	5.7	0.2	0.4	M8	64
6KF11H075	(340)	(240)	(326)		(550)	(530)	(500)	(512)	(12)	(25)	(9)	(255)	(145)	(4)	(10)		(29)
6KF11H091	14.8	10.8	14.2									10.6					75
	(375)	(275)	(361)									(270)					(34)
6KF11H112					26.6	25.8	24.6	25.1									86
					(675)	(655)	(625)	(637)									(39)
6KF11H150																	88
																	(40)
6KF11H176					29.1	28.3	27.2	27.6									106
					(740)	(720)	(690)	(702)									(48)
6KF11H210	20.9	16.9	20.1			28	26.6	27	0.6	1.3	0.5	12.4	6.9		0.6	M12	154
6KF11H253	(530)	(430)	(510)			(710)	(675)	(682)	(16)	(33)	(13)	(315)	(175)		(15)		(70)
6KF11H304					39.4	38.2	36.8	37.2				14.2	8.7				220
6KF11H377					(1000)	(970)	(935)	(945)				(360)	(220)				(100)
6KF11H415	26.8	22.8	26	11.4													308
6KF11H485	(680)	(580)	(660)	(290)													(140)
6KF11H520																	

Inche (mm)

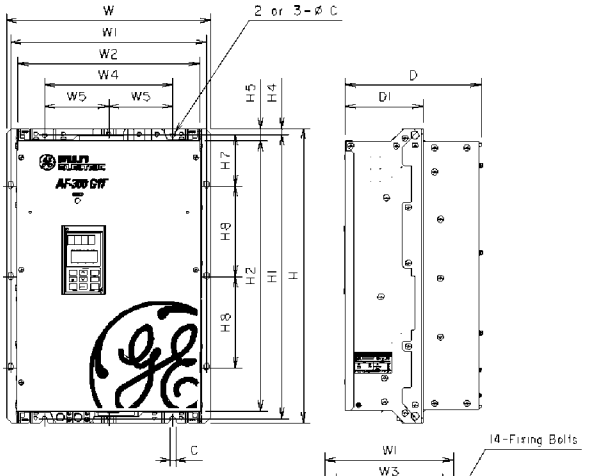


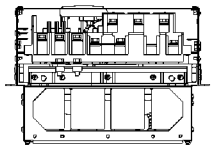
460V Series Open Type

Model	DIMENSIONS inches (mm)															
	W	W1	W2	W3	W4	W5	H	H1	H2	H3	H4	H5	H6	H7	D	D1
6KF11H650 6KF11H740	26.8 (680)	22.8 (580)	26.0 (660)	11.4 (290)	–	24.0 (610)	55.1 (1400)	53.9 (1370)	52.4 (1330)	52.8 (1340)	52.6 (1335)	0.6 (016)	1.4 (035)	0.6 (015)	17.7 (450)	11.2 (285)
6KF11H840 6KF11H960	34.6 (880)	30.7 (780)	33.8 (860)	10.2 (260)	10.2 (260)	31.9 (810)										

Model	DIMENSIONS inches (mm)						Mtg. Bolts	Wt. Lb (kg)
	D2	D3	D4	D5	D6	C		
6KF11H650 6KF11H740	0.3 (6)	2 (50)	3.9 (100)	1.4 (35)	4.5 (115)	0.6 (015)	M12	551 (250)
6KF11H840 6KF11H960								793 (360)

11.3.3 Outline Dimensions Open Type with NEMA 12 Heatsink





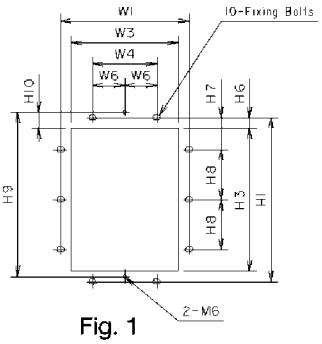


Fig. 1

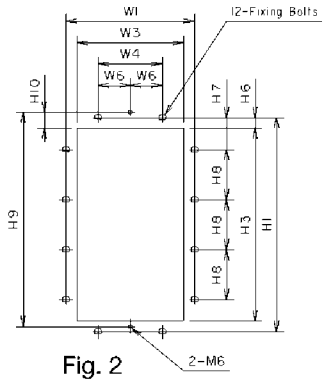


Fig. 2

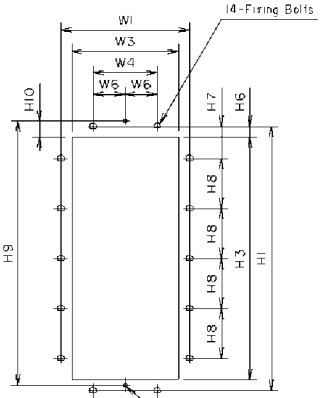


Fig. 3

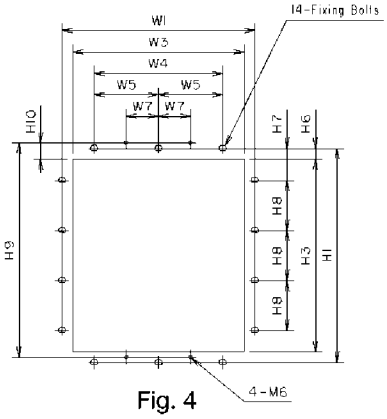


Fig. 4

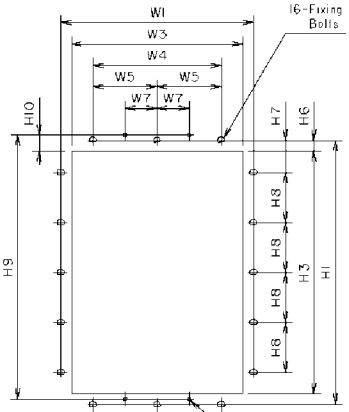
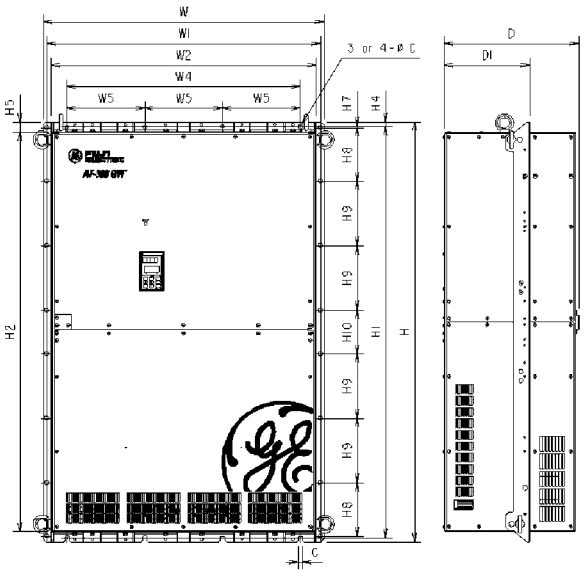
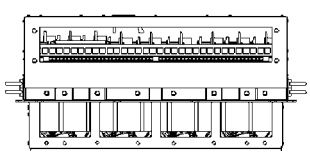


Fig. 5





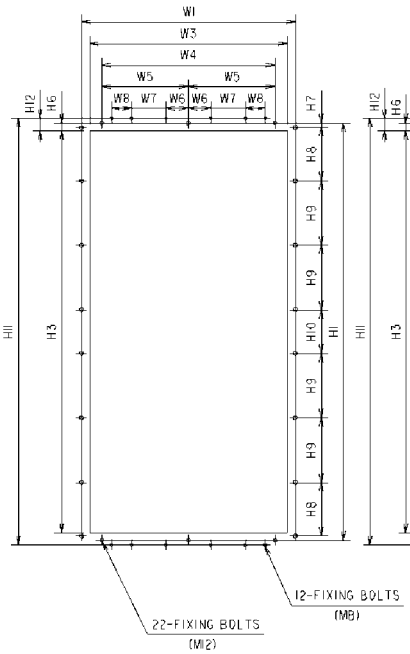


Fig. 6

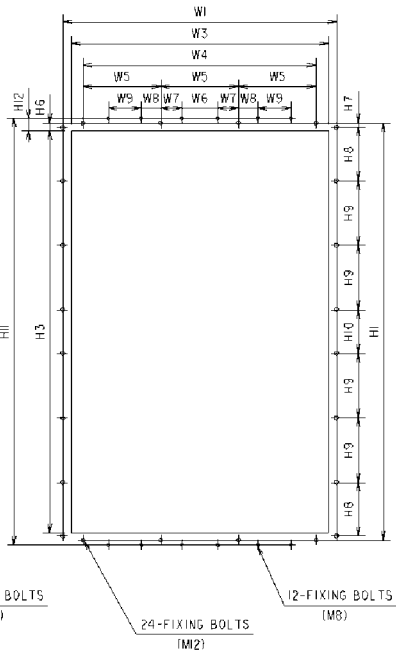


Fig. 7

Inches (mm)

AF-300 F11 230 VAC Series

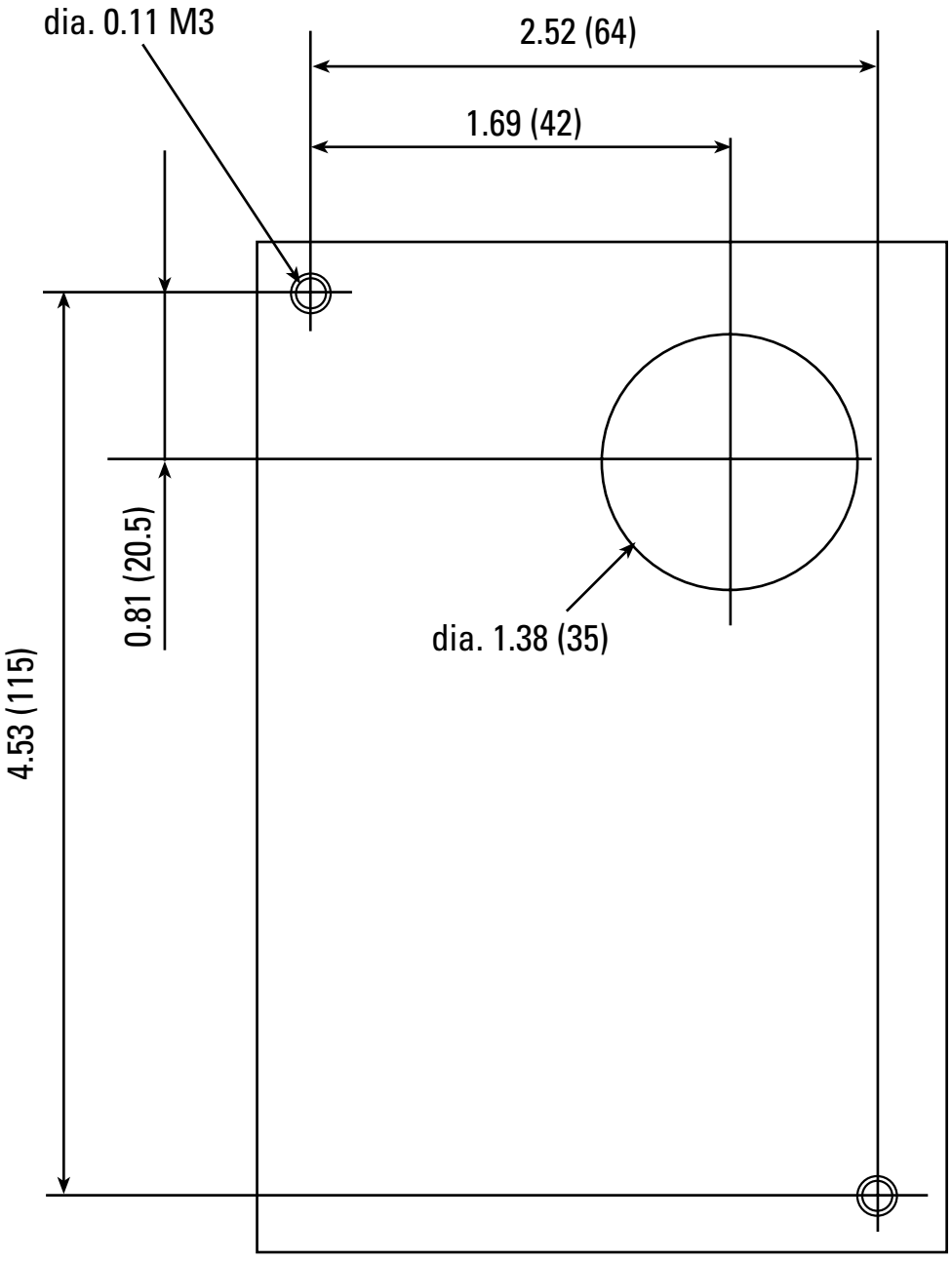
Model	DIMENSIONS Inch(mm)																									Fixing	Wt.	Fig
	W	W1	W2	W3	W4	W5	W6	W7	W8	W9	H	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12	C	D	D1	Bolts	Lb(kg)	
6KH11L115	15.04	14.41	13.39	12.83	9.45		4.72				21.65	20.87	19.69	20.16				3.74		20.87					8.86			66	1
6KH11L145	(382)	(366)	(340)	(326)	(240)		(120)				(550)	(530)	(500)	(512)				(95)		(530)					(225)			(30)	
6KH11L180											24.21	23.43	22.24	22.72	0.47	0.98	0.35	1.67	6.69	23.43	0.43			0.4		5.71	M6	81	
	16.42	15.79	14.76	14.21	10.83		5.41				(615)	(595)	(565)	(577)	(12)	(25)	(9)	(42.5)	(170)	(595)	(11)			(10)	10.63	(145)	and	(37)	
6KH11L215	(417)	(401)	(375)	(361)	(275)	-	(137.5)	-	-	-	29.13		27.17	27.64				4.13				-	-		(270)		M8	99	
											(740)	28.35	(690)	(702)				(105)		28.35								(45)	2
6KH11L283												(720)								(720)								104	
																												(47)	
6KH11L346	23.23	22.28	20.87	20.08	16.93		8.46				29.53		26.97	27.36				1.75	8.27						11.22	5.71	M6	161	
	(590)	(566)	(530)	(510)	(430)		(215)				(750)		(685)	(695)	0.61	1.28	0.49	(44.5)	(210)		0.51			0.6	(285)	(145)	and	(73)	
6KH11L415	29.13	28.19	26.77	25.98	22.83	11.42	-	2.95			34.65	33.46	32.09	32.48	(15.5)	(32.5)	(12.5)	4.02	8.46	33.46	(13)			(15)	14.17	8.66	M12	260	4
	(740)	(716)	(680)	(660)	(580)	(290)		(75)			(880)	(850)	(815)	(825)				(102)	(215)	(850)					(360)	(220)		(118)	

AF-300 F11 460 VAC Series

Model	DIMENSIONS Inch(mm)																									Fixing	Wt	Fig
	W	W1	W2	W3	W4	W5	W6	W7	W8	W9	H	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10	H11	H12	C	D	D1	Bolts	Lb(kg)	
6KH11H060	15.04	14.41	13.39	12.83	9.45		4.72																		8.86			66	
6KH11H075	(382)	(366)	(340)	(326)	(240)		(120)				21.65	20.87	19.69	20.16				3.74		20.87					(225)			(30)	1
6KH11H091											(550)	(530)	(500)	(512)				(95)		(530)							M6	77	
															0.47	0.98	0.35		6.69		0.43			0.4		5.71	and	(35)	
6KH11H112	16.42	15.79	14.76	14.21	10.83		5.41				26.57	25.79	24.61	25.08	(12)	(25)	(9)	2.85	(170)	25.79	(11)			(10)	10.63	(145)	M8	88	
	(417)	(401)	(375)	(361)	(275)		(137.5)				(675)	(655)	(625)	(637)				(72.5)		(655)					(270)			(40)	
6KH11H150						-		-	-	-																		90	2
																												(41)	
6KH11H176											29.13	28.35	27.17	27.64				4.13		28.35								108	
											(740)	(720)	(690)	(702)				(105)		(720)		-	-					(49)	
											29.13	27.95	26.57	26.97				1.56	8.27	27.95					12.4	6.89		161	
6KH11H210											(740)	(710)	(675)	(685)				(39.5)	(210)	(710)					(315)	(175)		(73)	
6KH11H253	23.23	22.28	20.87	20.08	16.93		8.46								0.61	1.28	0.49				0.51			0.6			M6		
6KH11H304	(590)	(566)	(530)	(510)	(430)		(215)								(15.5)	(32.5)	(12.5)				(13)			(15)			and	229	3
6KH11H377											39.37	38.19	36.81	37.20				2.15	8.46	38.19					14.17	8.66	M12	(104)	
6KH11H415	29.13	28.19	26.77	25.98	22.83	11.42		2.95			(1000)	(970)	(935)	(945)				(54.5)	(215)	(970)					(360)	(220)		317	
6KH11H485	(740)	(716)	(680)	(660)	(580)	(290)	-	(75)																				(144)	5
6KH11H520																													
6KH11H650	29.13	28.19	26.77	25.98	22.83	11.42	2.95	4.55	2.60																		M8	551	6
6KH11H740	(740)	(716)	(680)	(660)	(580)	(290)	(75)	(115.5	(66)		55.12	53.94	52.36	52.76	0.61	1.38	0.57	0.18	6.99	8.46	5.71	54.37	0.81	0.59	17.72	11.22	and	(250)	
6KH11H840	37.01	36.06	34.65	33.86	30.71	10.24	4.72	2.76	2.56	4.33	(1400)	(1370)	(1330)	(1340)	(15.5)	(35)	(14.5)	(4.5)	(177.5)	(215)	(145)	(1381)							
6KH11H960																													

Keypad Mounting Hole (Panel Cutting)

Dimensions in inches (mm)



12. RS485 Modbus RTU Serial Communications

The serial interface supports operation, configuration and monitoring of drive functions through an EIA/RS485 connection. The serial interface is based on Modbus RTU protocol. This protocol allows the drive to function as an RTU slave on an industrial network.

12.1 Transmission Specification

Item	Specification
Physical level	EIA/RS485
Transmission distance	500 m max.
Number of nodes	32 total
Transmission speed	19200, 9600, 4800, 2400 [bits/s]
Transmission mode	Half duplex
Transmission protocol	Modbus RTU
Character code	Binary
Character length	8 bits
Error check	CRC

12.2 Connection

Connection method

Use shielded wire and connect to the control terminals (DX-, DX+ and SD). A termination resistor should be added between the data lines on the each end of the network. The value of the termination resistor depends on the characteristic impedance of the cable. A common value for termination resistors is 120 ohms.

Control terminals

Terminal marking	Terminal name	Function description
DX+	RS485 Modbus RTU communication data (+)	Input/output terminals for RS485 communication.
DX-	RS485 Modbus RTU communication data (–)	
SD	Cable shield	Electrically floating

12.3 Serial Interface Configuration

Drive function codes H30 to H39 are used to configure the serial interface parameters, such as device address, baud rate and error response.

12.4 Modbus RTU Functions

The following RTU functions are supported. The maximum number of consecutive parameters for function 03 and 16 messages is 16.

Code	Description
03	Read Holding Registers (16 registers maximum)
06	Preset Single Register
16	Preset Multiple Registers (16 registers maximum)

12.5 Drive Function Code Access

All of the drive function codes are accessible through the RS485 serial interface. Drive function codes are mapped to RTU holding registers. A drive function code RTU address is 2 bytes in length. The high byte corresponds to a code that represents the drive parameter sort (F–M). The low byte corresponds to the drive parameter number within the sort (0 - 99).

Code	Sort	Name	Code	Sort	Name
0	**F**	Basic function	**5**		
1	**E**	Terminal function	**6**	**o**	Option function
2	**C**	Control function	**7**	**S**	Command/function data
3	**P**	Motor 1 function	**8**	**M**	Monitor data
4	**H**	High level function			

For example, drive function code M11, output current, is addressed as RTU parameter number 080B hexadecimal or 2059 decimal.

high byte	low byte
drive parameter sort code	drive parameter number

12.6 Command and Monitor Data Registers

The command and monitor function codes are used to control the operation of the drive and monitor the status variables through the serial interface. The command and monitor function codes are not accessible from the drive keypad interface. Drive parameter H30 and digital input signal LE must be enabled to operate the drive from the Modbus interface. If LE is not assigned to a digital input (X1-X5), the signal will default to ON.

Frequency Setting Registers

Address	Code	Name	Unit	Variable Range	Min. unit	Read/ Write	Data Format
1793	S01	Frequency command	-	-20000–20000 (max. frequency at ± 20000)	1	R/W	2
1797	S05	Frequency command	Hz	0.00–400.00	0.01	R/W	5

Note:

1) If both S01 and S05 are set, the drive will ignore the setting of S05.

2) A data setting that exceeds the setting range is possible, but the actual action will be limited by the drive configuration.

Operation command data Registers

Address	Code	Name	Unit	Variable Range	Min. unit	Read/ Write	Data Format
1798	S06	Operation command	-	Refer to the data format [14]	-	R/W	14
1799	S07	Universal Do	-	Refer to the data format [15]	-	R/W	15
1804	S12	Universal Ao	-	-20000–20000 (100% output at ± 20000)	1	R/W	2

Note:

1) Since X1–X5 are configurable input commands, it is necessary to set the functions by E01–E05.

2) The alarm reset is executed, when RST signal changes from ON to OFF even if there are no alarms.

3) Universal Do is a function that utilizes the drive's digital outputs via communication.

Function data Registers

Address	Code	Name	Unit	Variable range	Min. unit	Read/ Write	Data Format
1800	S08	Acceleration time F07	s	0.1–3600.0	0.1	R/W	3
1801	S09	Deceleration time F08	s	0.1–3600.0	0.1	R/W	3
1802	S10	Torque limit level 1 (driving) F40	%	-20.00 –200.00, 999	1	R/W	5
1803	S11	Torque limit level 2 (braking) F41	%	0.00, 20.00–200.00, 999	1	R/W	5

Note:

1) The writing of data out of range is treated as out of range error.

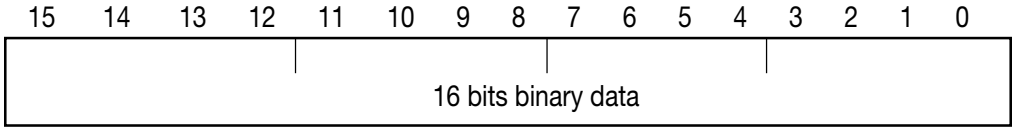
2) Use a value of $7FFF_H$ to enter 999 for torque limit functions.

Monitoring parameter registers

Address	Code	Description	Unit	Range	Min. unit	Read / Write	Data Format
2049	M01	Frequency command (final command)	-	- 20000–20000 (max. frequency at ± 20000)	1	R	2
2053	M05	Frequency command (final command)	Hz	0–400.00	0.01	R	5
2054	M06	Actual frequency	-	- 20000–20000 (max. frequency at ± 20000)	1	R	2
2055	M07	Actual torque value	%	- 200.00–200.00	0.01	R	6
2056	M08	Torque current	%	- 200.00–200.00	0.01	R	6
2057	M09	Output frequency	Hz	0.00–400.00	0.01	R	5
2058	M10	Motor output (input electric power)	%	0.00–200.00	0.01	R	5
2059	M11	Output current r. m. s.	%	0.00–200.00 (inverter rating at 100.00)	0.01	R	5
2060	M12	Output voltage r. m. s.	V	0.0–600.0	1	R	3
2061	M13	Operation command (final command)	-	Refer to data format [14]	-	R	14
2062	M14	Operating state	-	Refer to data format [16]	-	R	16
2063	M15	Universal output terminal data	-	Refer to data format [15]	-	R	15
2064	M16	Fault memory 0	-	Refer to data format [10]	-	R	10
2065	M17	Fault memory 1	-				10
2066	M18	Fault memory 2	-				10
2067	M19	Fault memory 3	-				10
2068	M20	Integrated operating time	h	0–65535	1	R	1
2069	M21	DC link voltage	V	0–1000	1	R	1
2071	M23	Type code	-	Refer to data format [17]	-	R	17
2072	M24	Drive capacity code	-	Refer to data format [11]	-	R	11
2073	M25	ROM version	-	0–64999	1	R	1
2074	M26	Transmission error processing code	-	Refer to data format [20]	-	R	20
2075	M27	Frequency command at alarm (final command)	-	- 20000–20000 (max. frequency at ±20000)	1	R	2
2079	M31	Frequency command at alarm (final command)	Hz	0–400.00	0.01	R	5
2080	M32	Actual frequency at alarm	-	- 20000–20000 (max. frequency a t ± 20000)	1	R	2
2081	M33	Actual torque at alarm	%	- 200.00 – 200.00	0.01	R	6
2082	M34	Torque current at alarm	%	- 200.00 – 200.00	0.01	R	6
2083	M35	Output frequency at alarm	Hz	0.00 – 400.	0.01	R	5
2084	M36	Motor output at alarm (input power)	%	0.00–200.00	0.01	R	5
2085	M37	Output current r.m.s. at alarm	%	0.00 – 200.00 (inverter rating at 100.00)	0.01	R	5
2086	M38	Output voltage effective value at alarm	V	0.0 – 600.0	1	R	3
2087	M39	Operation command at alarm	-	Refer to data format [14]	-	R	14
2088	M40	Operating state at alarm	-	Refer to data format [16]	-	R	16
2089	M41	Universal output terminal data at alarm	-	Refer to data format [15]	-	R	15
2090	M42	Integrated operation time at alarm	h	0–65535	1	R	1
2091	M43	DC link voltage at alarm	V	0–1000	1	R	1
2092	M44	Inverter internal air temp. at alarm	°C	0–120	1	R	1
2093	M45	Cooling fin temp. at alarm	°C	0–120	1	R	1
2094	M46	Life of main circuit capacitor.	%	0.0–100.0	0.1	R	3
2095	M47	Life of printed circuit board capacitor.	h	0–65535	1	R	1
2096	M48	Life of cooling fan.	h	0–65535	1	R	1
2097	M49	Input Voltage (12)	-	-20000–20000 (-10V – +10V)	1	R	2
2098	M50	Input Current (C1)	-	0–20000 (0 – 20mA)	1	R	1

12.7 Data Format Specification

All data in the data field of communication frame shall be represented by a 16 bit length word.



Data format [1] **Unsigned Integer data (Positive): Min. unit 1**

Example If F15 (Frequency limit, upper)= 60Hz

60 = $003C_H$

Data format [2]] **Integer data (Positive, negative): Min. unit 1**

Example data = -20

-20 = $FFEC_H$

Data format [3] **Unsigned Decimal data (Positive): Min. unit 0.1**

Example: If F17 (frequency gain setting signal) = 100.0%

100.0 X 10 = 1000 = $03E8_H$

Data format [4] **Decimal data (Positive, negative): Min. unit 0.1**

Example If: C31 (Analog input offset adjust, terminal12) = - 5.0%

- 5.0 X 10= - 50 = $FFCE_H$

Data format [5] **Unsigned Decimal data (Positive): Min. unit 0.01**

Example: If C05 (multi-step frequency 1) = 50.25Hz

50.25 X 100 = 5025 = $13A1_H$

Data format [6] **Decimal data (Positive, negative): Min. unit 0.01**

Example: If M07 (actual torque value)= - 85.38%

- 85.38 X 100= - 8538=$DEA6_H$

Data format [7] **Unsigned Decimal data (Positive): Min. unit 0.001**

Example: If o05 (follow - up side ASR 1 constant) = 0.105s

0.105 X 1000 = 105 = 0069_H

Data format [8] **Decimal data (Positive, negative): Min. unit 0.001**

Example: Data = -1.234

- 1.234 X 1000 = - 1234 = $FB2E_H$

Data format [9] **Unsigned Integer data (Positive): Min. unit 2**

Example If P01 (Motor 1 number of poles) =2pole

2 = 0002_H

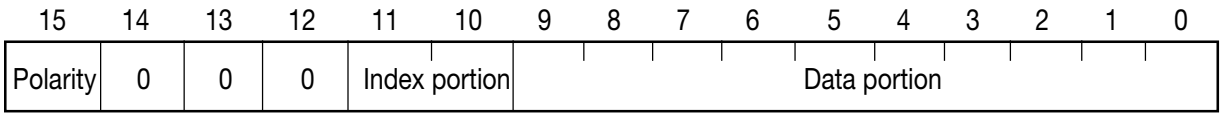
Data format [10] **Alarm Code**

Code	Description		Code	Description	
0	No alarm	—-	22	Overheat, DB resistor	dbH
1	Overcurrent, during acceleration (INV output)	OC1	23	Overload, motor 1	OL1
2	Overcurrent, during deceleration (INV output)	OC2			
3	Overcurrent, during steady state operation (INV output)	OC3	25	Overload, drive	OLU
5	Ground fault	EF	27	Overspeed	OS
6	Overvoltage, during acceleration	OU1			
7	Over voltage, during deceleration	OU2	31	Memory error	Er1
8	Overvoltage, during steady state operation	OU3	32	Keypad error	Er2
10	DC undervoltage	LU	33	CPU error	Er3
11	Power supply open phase	Lin	34	Option comm error	Er4
14	Blown DC fuse	FUS	35	Option error	Er5
16	Output wiring error	Er7	36	PL error	Er6
17	Overheat, heat sink, inverter	OH1	37	Output wiring error	Er7
18	Overheat, outside thermal	OH2	38	RS485 comm error	Er8
19	Overheat, unit inside temp	OH3			

Data format [11] Capacity code

Code	Capacity (HP)	Code	Capacity (HP)	Code	Capacity (HP)
7	0.07 (spare)	2000	20	17500	175
15	0.15 (spare)	2500	25	20000	200
25	0.25	3000	30	25000	250
50	0.5	4000	40	30000	300
100	1	5000	50	35000	350
200	2	6000	60	40000	400
300	3	7500	75	45000	450
500	5	10000	100	50000	500
750	7.5	12500	125	60600	600
1000	10	15000	150	60700	700
1500	15			60800	800

Data format [12] Index data (ACC/DEC time, display coefficient)



1: Negative (-)

0: Positive (+),

0: 0.01	X	001–999	(0.00–9.99)
1: 0.1	X	00–999	(10.0–99.9)
2: 1	X	100–999	(100–999)
3: 10	X	100–999	(1000–9990)

Example: If F07 (acceleration time 1) = 20.0 s

10.0 < 20< 99.9 ➞ index =1

20.0 = 0.1 X 200 ➞ $0400_H + 00C8_H = 04C8_H$

Data format [14] **Operation command**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
RST	0	0	0	0	0	0	0	0	X5	X4	X3	X2	X1	REV	FWD

(All bit are ON by 1)

Example If S06 (operation command) = FWD, X1 and X5 = ON

$0000\ 0000\ 0100\ 0101_b = 0045_H$

Data format [15] **Universal output terminal**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	Y5	0	0	Y2	Y1

(All bit are ON by 1)

Example) If M15 (Universal output terminal)=Y1 and Y5 = ON

$0000\ 0000\ 0001\ 0001_b = 0011_H$

Data format [16] **Operating state**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
BUSY	WR		RL	ALM	DEC	ACC	IL	VL	TL	NUV	BRK	INT	EXT	REV	FWD

(All bit are ON or active by 1)

FWD:	Forward operation	IL:	Current limiting
REV:0:	Reverse operation	ACC:	Under acceleration
EXT:	DC braking active (or pre-excitation)	DEC:	Under deceleration
		ALM:	Drive fault
INT:	No Output	RL:	Transmission valid
BRK:	Braking active	WR:	Function writing privlege
NUV:	DC link voltage is established		0: Keypad
	(undervoltage at 0)		1: RS485 Modbus RTU
TL:	Torque limiting		2: Fieldbus (option)
VL:	Voltage limiting	BUSY:	Processing data write

Data format [17] **Type code**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Type				Generation				Series				Voltage series			

Code	Type	Generation	Series	Voltage series
1	-	11	-	-
2	-	-	-	-
3	-	-	-	230V three phase
4	-	-	-	460V three phase
5	-	-	USA	-
6	-	-	-	-
B	F	-		

Data format [18] **Code setting (1–4 figures)**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Data 4				Data 3				Data 2				Data 1			

Data format [19] **Amperage value Decimal data (positive):**
Min. unit 0.01 inverter capacity is not more than 6KF11L080, 6KF11H044
Min unit 0.01 for not less than 6KF11L115, 6KF11H060

Example) If F11 (electronics thermal overload relay 1 level)107.0A (6KF11L115)
107.0 X 10=1070=042E$_H$
If F11 (electronics thermal overload relay 1 level)=3.60A (6KF11L005)
Since 3.60 X 100=360=0168$_H$

Data format [20] **Transmission error code**

Code	Description	Code	Description
1	FC (function code) error	71	CRC error (no response)
2	Illegal address	72	Parity error (no response)
3	Illegal address (Data range error)	73	Other errors (no response) -Framing error -Overrun error -Buffer full error
7	NAK -Priority for comm -No privilege for writing error -Forbidden writing error		

Data format [21] **Auto tuning**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	REV	FWD	Data portion							

0: Without forward rotation command
1: With forward rotation command.
0: Without reverse rotation command.
1: With reverse rotation command.

Example) If P04 (motor 1 auto - tuning)=1: Forward rotation
0000 0001 0000 0001_b=0101_H

12-7 Communication Errors

Exception Response

When the drive receives a message that does not contain communication errors but the message can not be processed, the drive will return an exception response. The exception response contains an error sub-code in the data field that represents the problem.

Exception Response Errors

Sub-Code	Name	Causes
1	Illegal Function	Received RTU Function other than 03, 06 or 16
2	Illegal Data Address	• The starting parameter address is an unused drive parameter.. The starting parameter address plus the offset refers to drive • parameter greater than the last parameter in a Function Code sort. • The number of registers is greater than 16.
3	Illegal Data Value	Data contains an out of range value for a drive parameter
7	Negative Acknowledge	• Requested data cannot be changed while the drive is running. The drive parameter function is owned by the network interface • option card and cannot be changed.

Communication errors

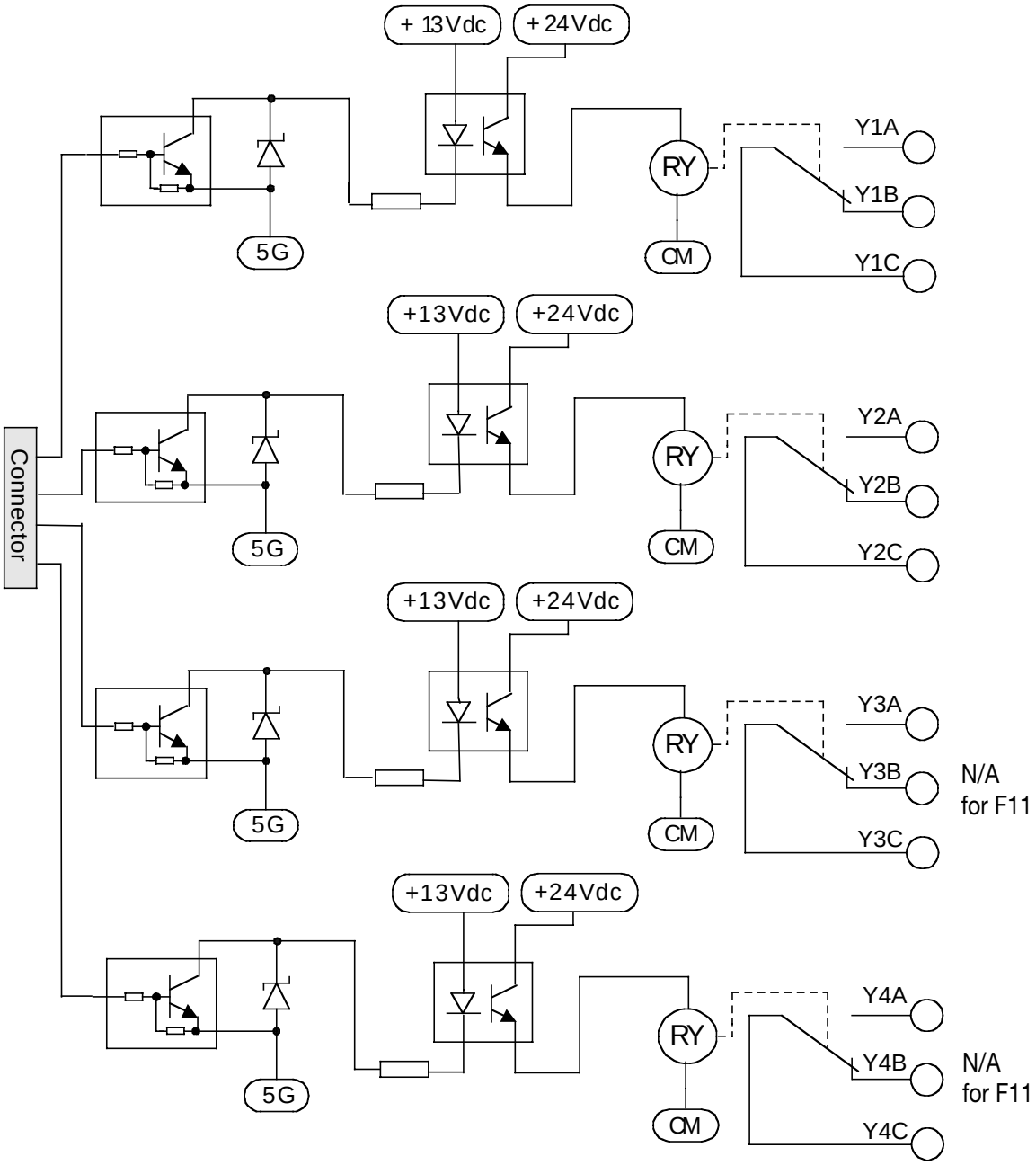
Communication errors occur when the drive receives an invalid message. The drive will not return a response to a communication error. A code that represents the last communication error is stored in drive parameter M26. Typical communication message errors include parity, framing, and CRC errors.

13. Options

13.1 Built-in Options

The drive supports two internally mounted cards. One option card is mounted under the main cover (Location A) and the other option card is mounted in a special adapter under the keypad (Location B). Only one card can be mounted in these locations. There are two different types of option cards, Type 1 and Type 2. You cannot use two Type 1 or Two Type 2 cards but you can mix any combination of Type 1 and Type 2 provided you only have one option per mounting location. Each option card must be mounted in the designated location. The chart below lists the option card, their types, and their mounting locations.

Name	Type	Loc	2nd Option Type/Loc	Function
OPCG11SRY (Relay output card)	1	A	2/B	• Relay output card • The transistor output from the drive control output terminals Y1 and Y2 are converted to the relay output (1SPDT).
OPCG11SCIO (Interface card)	1	A	2/B	• 115 VAC Control input, an isolation amplifier, relay output, analog output 4-20mA
OPCG11SLON (Communication card)	2	B	1/A	• Serial communication card for LonWorks
OPCG11SMN2 (Communication card)	2	B	1/A	• Serial communication card for N2

Name		Relay Output Card
Type	Card type Unit type	OPCG11SRY
Function	• Includes 2 relay output circuits • Converts transistor output signals from drive control output terminals Y1 to Y2 to relay (1SPDT) output signals.	
Specifications	Input	None
	Output	Four-channel contact (12 terminals from Y1A to Y2C) 250 VAC, 0.3A, ocs dia. = 0.3
	Power source	The power source to drive the relay card is supplied from the drive.
Connection diagram		
Remarks		

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