VARISPEED L7

The frequency inverter for the lifts

USER´S MANUAL

OMRON

Contents

5 Parameter Settings by Function 5-1

Warnings

<div>

⚠ **CAUTION**

Cables must not be connected or disconnected, nor signal tests carried out, while the power is switched on.

The Varispeed L7 DC bus capacitor remains charged even after the power has been switched off. To avoid an electric shock hazard, disconnect the frequency inverter from the mains before carrying out maintenance. Then wait for at least 5 minutes after all LEDs have gone out.
Do not perform a withstand voltage test on any part of the inverter. It contains semiconductors, which are not designed for such high voltages.

Do not remove the digital operator while the mains supply is switched on. The printed circuit board must also not be touched while the inverter is connected to the power.

</div>

<div>

Never connect general LC/RC interference suppression filters, capacitors or overvoltage protection devices to the inverter input or output.

To avoid unnecessary overcurrent faults, etc, being displayed, the signaling contacts of any contactor or switch fitted between inverter and motor must be integrated into the inverter control logic (eg baseblock).

This is absolutely imperative!
This manual must be read thoroughly before connecting and operating the inverter. All safety precautions and instructions for use must be followed.

The inverter must be operated with the appropriate line filters, following the installation instructions in this manual and with all covers closed and terminals covered.
Only then will adequate protection be provided. Please do not connect or operate any equipment with visible damage or missing parts. The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

</div>

Safety Precautions and Instructions for Use

■ 1. General

Please read these safety precautions and instructions for use thoroughly before installing and operating this inverter. Also read all of the warning signs on the inverter and ensure they are never damaged or removed.

Live and hot inverter components may be accessible during operation. Removal of housing components, the digital operator or terminal covers runs the risk of serious injuries or damage in the event of incorrect installation or operation. The fact that frequency inverters control rotating mechanical machine components can give rise to other dangers.

The instructions in this manual must be followed. Installation, operation and maintenance may only be carried out by qualified personnel. For the purposes of the safety precautions, qualified personnel are defined as individuals who are familiar with the installation, starting, operation and maintenance of frequency inverters and have the proper qualifications for this work. Safe operation of these units is only possible if they are used properly for their intended purpose.

The DC bus capacitors can remain live for about 5 minutes after the inverter is disconnected from the power. It is therefore necessary to wait for this time before opening its covers. All of the main circuit terminals may still carry dangerous voltages.

Children and other unauthorized persons must not be allowed access to these inverters.

Keep these Safety Precautions and Instructions for Use readily accessible and supply them to all persons with any form of access to the inverters.

■ 2. Intended Use

Frequency inverters are intended for installation in electrical systems or machinery.

Their installation in machinery and systems must conform to the following product standards of the Low Voltage Directive:
EN 50178, 1997-10,   Equipping of Power Systems with Electronic Devices
EN 60204-1, 1997-12   Machine Safety and Equipping with Electrical Devices
                       Part 1: General Requirements (IEC 60204-1:1997)/
                       Please note: Includes Corrigendum of September 1998
EN 61010-1, A2, 1995   Safety Requirements for Information Technology Equipment
                       (IEC 950, 1991 + A1, 1992 + A2, 1993 + A3, 1995 + A4, 1996, modified)

CE marking is carried out to EN 50178, using the line filters specified in this manual and following the appropriate installation instructions.

■ 3. Transportation and storage

The instructions for transportation, storage and proper handling must be followed in accordance with the technical data.

■ 4. Installation

Install and cool the inverters as specified in the documentation. The cooling air must flow in the specified direction. The inverter may therefore only be operated in the specified position (e.g. upright). Maintain the specified clearances. Protect the inverters against impermissible loads. Components must not be bent nor insulation clearances changed. To avoid damage being caused by static electricity, do not touch any electronic components or contacts.

■ 5. Electrical Connection

Carry out any work on live equipment in compliance with the national safety and accident prevention regulations. Carry out electrical installation in compliance with the relevant regulations. In particular, follow the installation instructions ensuring electromagnetic compatibility (EMC), e.g. shielding, grounding, filter arrangement and laying of cables. This also applies to equipment with the CE mark. It is the responsibility of the manufacturer of the system or machine to ensure conformity with EMC limits.

Your supplier or OYMC representative must be contacted when using leakage current circuit breaker in conjunction with frequency inverters.

In certain systems it may be necessary to use additional monitoring and safety devices in compliance with the relevant safety and accident prevention regulations. The frequency inverter hardware must not be modified.

■ 6. Notes

The Varispeed L7 frequency inverters are certified to CE, UL, and c-UL.

EMC Compatibility

■ 1. Introduction

This manual was compiled to help system manufacturers using OYMC frequency inverters to design and install electrical switch gear. It also describes the measures necessary to comply with the EMC Directive. The manual's installation and wiring instructions must therefore be followed.

Our products are tested by authorized bodies using the standards listed below.

Product standard: **EN 61800-3:1996**
                                 EN 61800-3; A11:2000

■ 2. Measures to Ensure Conformity of OYMC Frequency inverters to the EMC Directive

OYMC frequency inverters do not necessarily have to be installed in a switch cabinet.

It is not possible to give detailed instructions for all of the possible types of installation. This manual therefore has to be limited to general guidelines.

All electrical equipment produces radio and line-borne interference at various frequencies. The cables pass this on to the environment like an aerial.

Connecting an item of electrical equipment (e.g. drive) to a supply without a line filter can therefore allow HF or LF interference to get into the mains.

The basic countermeasures are isolation of the wiring of control and power components, proper grounding and shielding of cables.

A large contact area is necessary for low-impedance grounding of HF interference. The use of grounding straps instead of cables is therefore definitely advisable.

Moreover, cable shields must be connected with purpose-made ground clips.

■ 3. Laying Cables

Measures Against Line-Borne Interference:

Line filter and frequency inverter must be mounted on the same metal plate. Mount the two components as close to each other as possible, with cables kept as short as possible.

Use a power cable with well-grounded shield. Use a shielded motor cable not exceeding 20 meters in length. Arrange all grounds so as to maximize the area of the end of the lead in contact with the ground terminal (e.g. metal plate).

Shielded Cable:

- Use a cable with braided shield.
- Ground the maximum possible area of the shield. It is advisable to ground the shield by connecting the cable to the ground plate with metal clips (see following figure).

Ground clip   Ground plate
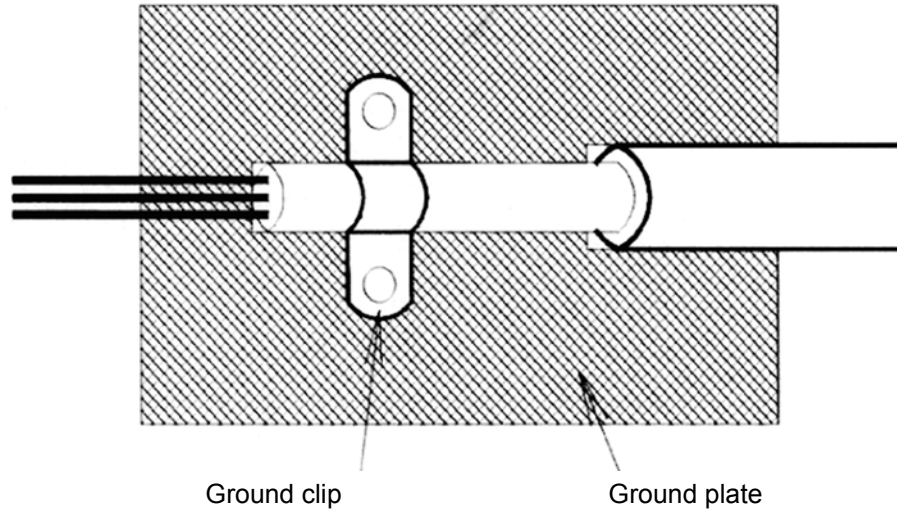
The grounding surfaces must be highly conductive bare metal. Remove any coats of varnish and paint.

–   Ground the cable shields at both ends.

–   Ground the motor of the machine.

Line Filters

■ **Recommended Line Filters for Varispeed L7**

Inverter Model	Line Filter			
Varispeed L7	Model	Current (A)	Weight (kg)	Dimensions W x D x H
CIMR-L7Z43P77	3G3RV-PFI3018-SE	18	1.3	141 x 46 x 330
CIMR-L7Z44P07				
CIMR-L7Z45P57				
CIMR-L7Z47P57	3G3RV-PFI3035-SE	35	2.1	206 x 50 x 355
CIMR-L7Z40117				
CIMR-L7Z40157	3G3RV-PFI3060-SE	60	4.0	236 x 65 x 408
CIMR-L7Z40187				
CIMR-L7Z40227	3G3RV-PFI3070-SE	70	3.4	80 x 185 x 329
CIMR-L7Z40307				
CIMR-L7Z40377	3G3RV-PFI3130-SE	130	4.7	90 x 180 x 366
CIMR-L7Z40457				
CIMR-L7Z40557				

Maximum Voltage   : AC 480V 3phase
Ambient Temperature : 45°C (max.)

* Permissible emission of power drive systems for commercial and light environment (EN61800-3, A11) (general availability, 1st environment)

Inverter Model	Line Filter			
Varispeed L7	Model	Current (A)	Weight (kg)	Dimensions W x D x H
CIMR-L7Z23P77	3G3RV-PFI2035-SE	35	1.4	141 x 46 x 330
CIMR-L7Z25P57				
CIMR-L7Z27P57	3G3RV-PFI2060-SE	60	3.0	206 x 60 x 355
CIMR-L7Z20117				
CIMR-L7Z20157	3G3RV-PFI2100-SE	100	4.9	236 x 80 x 408
CIMR-L7Z20187				
CIMR-L7Z20227	3G3RV-PFI2130-SE	130	4.3	90 x 180 x 366
CIMR-L7Z20307				
CIMR-L7Z20377	3G3RV-PFI2160-SE	160	6.0	120 x 170 x 451
CIMR-L7Z20457	3G3RV-PFI2200-SE	200	11.0	130 x 240 x 610
CIMR-L7Z20557				

Maximum Voltage   : AC 240V 3phase
Ambient Temperature : 45°C (max.)

* max. motor cable length: 10 m Class B, 50 m Class A

Rated Voltage: AC240V 3 ph.
Ambient Temperature: 45°C (max.)

■ **Installation inverters and EMC filters**

PE   L3

L1 L2

PE

Ground Bonds
(remove any paint)

Line

Filter

Inverter

Load

L2   V
PE L1 L3 U WPE

Cable Length
as short as possible

Metal Plate

Ground Bonds
(remove any paint)

Motor cable
screened

M
3~
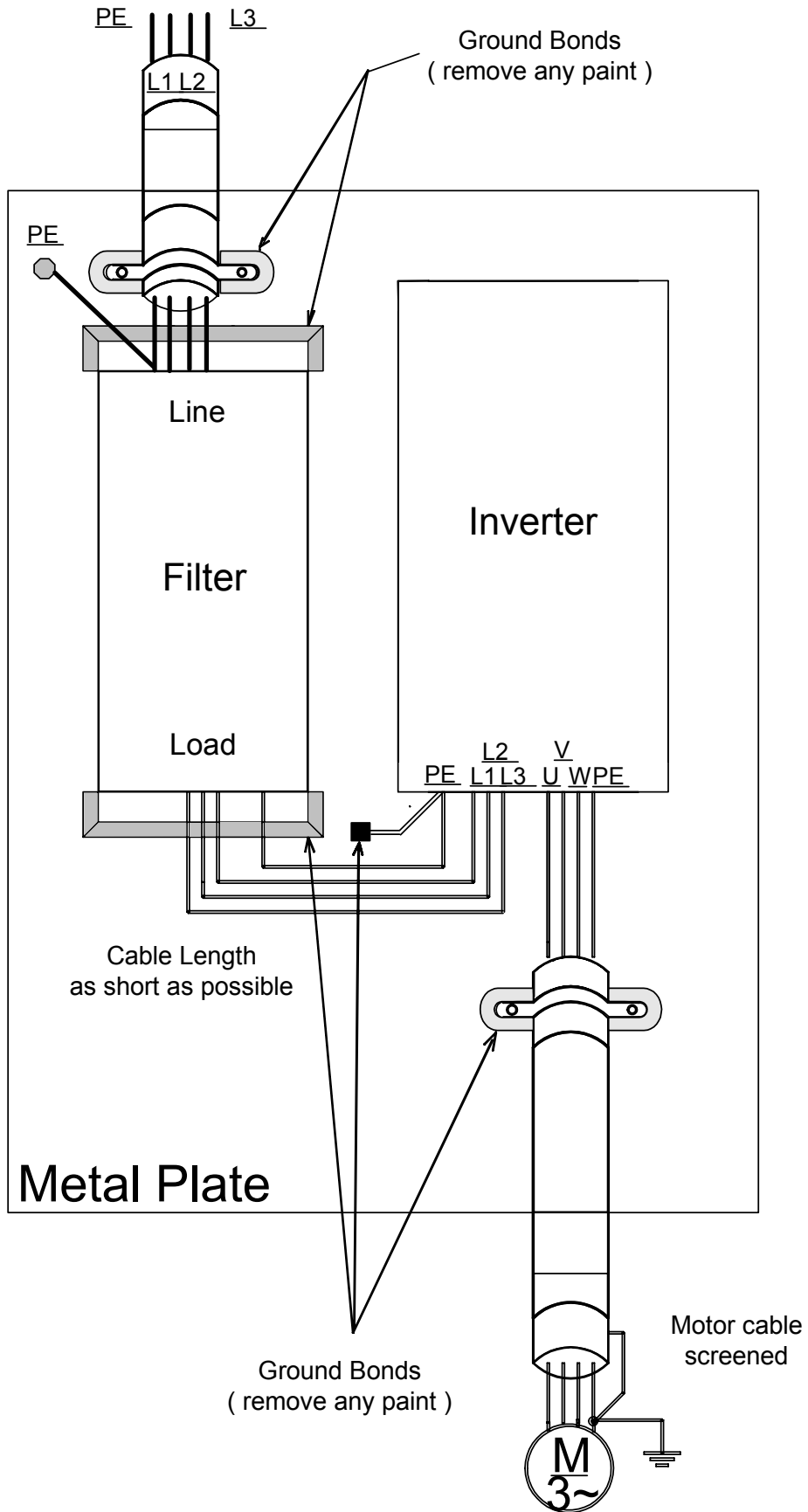
Registered Trademarks

The following registered trademarks are used in this manual.

- DeviceNet is a registered trademark of the ODVA (Open DeviceNet Vendors Association, Inc.).

- InterBus is a registered trademark of Phoenix Contact Co.

- Profibus is a registered trademark of Siemens AG.

1

Handling Inverters

This chapter describes the checks required upon receiving or installing an Inverter.

Varispeed L7 Introduction

◆ Varispeed L7 Models

The Varispeed L7 Series includes Inverters in two voltage classes: 200 V and 400 V. The maximum motor capacities vary from 3.7 to 55 kW (23 models).

Table 1.1 Varispeed L7 Models

Voltage Class	Maximum Motor Capacity kW	Varispeed L7		Specifications (Always specify through the protective structure when ordering.)		
		Output Capacity kVA	Basic Model Number	Open Chassis (IEC IP00) CIMR-L7Z	Enclosed Wall-mounted (NEMA 1) CIMR-L7Z	Enclosed Wall-mounted (IEC IP20) CIMR-L7Z
200 V class	3.7	7	CIMR-L7Z23P7	Remove the top and bottom covers from the Enclosed Wall-mounted model.	23P71□	23P77□
	5.5	10	CIMR-L7Z25P5		25P51□	25P57□
	7.5	14	CIMR-L7Z27P5		27P51□	27P57□
	11	20	CIMR-L7Z2011		20111□	20117□
	15	27	CIMR-L7Z2015		20151□	20157□
	18.5	33	CIMR-L7Z2018		20181□	20187□
	22	40	CIMR-L7Z2022	20220□	20221□	20227□
	30	54	CIMR-L7Z2030	20300□	20301□	20307□
	37	67	CIMR-L7Z2037	20370□	20371□	20377□
	45	76	CIMR-L7Z2045	20450□	20451□	20457□
	55	93	CIMR-L7Z2055	20550□	20551□	20557□
400 V class	3.7	7	CIMR-L7Z43P7	Remove the top and bottom covers from the Enclosed Wall-mount model.	43P71□	43P77□
	4.0	9	CIMR-L7Z44P0		44P01□	43P77□
	5.5	12	CIMR-L7Z45P5		45P51□	45P57□
	7.5	15	CIMR-L7Z47P5		47P51□	47P57□
	11	22	CIMR-L7Z4011		40111□	40117□
	15	28	CIMR-L7Z4015		40151□	40157□
	18.5	34	CIMR-L7Z4018		40181□	40187□
	22	40	CIMR-L7Z4022	40220□	40221□	40227□
	30	54	CIMR-L7Z4030	40300□	40301□	40307□
	37	67	CIMR-L7Z4037	40370□	40371□	40377□
	45	80	CIMR-L7Z4045	40450□	40451□	40457□
	55	106	CIMR-L7Z4055	40550□	40551□	40557□

* 200V/400V class 30KW-55KW model is developing.

Confirmations upon Delivery

◆ Checks

Check the following items as soon as the Inverter is delivered.

Table 1.2 Checks

Item	Method
Has the correct model of Inverter been delivered?	Check the model number on the nameplate on the side of the Inverter.
Is the Inverter damaged in any way?	Inspect the entire exterior of the Inverter to see if there are any scratches or other damage resulting from shipping.
Are any screws or other components loose?	Use a screwdriver or other tools to check for tightness.

If you find any irregularities in the above items, contact the agency from which you purchased the Inverter or your OYMC representative immediately.

◆ Nameplate Information

There is a nameplate attached to the side of each Inverter. The nameplate shows the model number, specifications, lot number, serial number, and other information on the Inverter.

■ Example Nameplate

The following nameplate is an example for a standard domestic European Inverter: 3-phase, 400 VAC, 3.7 kW, IEC IP20 standards

Inverter model →
Input specification →
Output specification →
Lot number →
Serial number →
UL file number →

```
MODEL    CIMR-L7Z43P7              SPEC: 43P77A
INPUT    AC3PH   380-480V   50/60Hz   10.2A
OUTPUT   AC3PH   0-480V   0-120Hz   8.5A 3min. 50%ED 8.5kVA
O/N                                MASS: 4.0 kg
S/N                                PRG:
        ||||||||||||||||||||||||||||||||||
FILE NO E131457
        YASKAWA ELECTRIC CORPORARION    MADE IN JAPAN  Ms
```

← Inverter specifications
← Mass
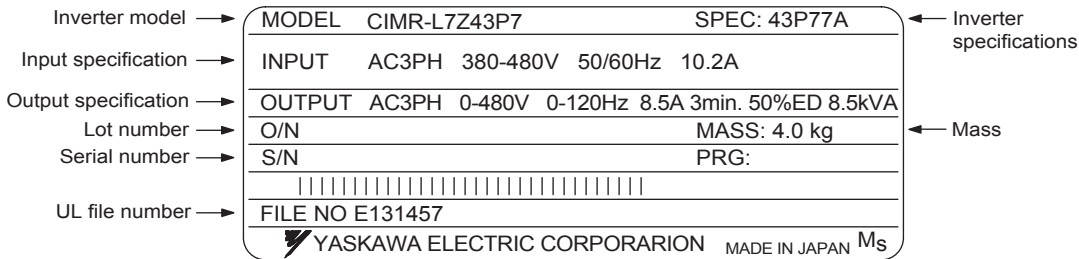
Fig 1.1 Nameplate

■Inverter Model Numbers

The model number of the Inverter on the nameplate indicates the specification, voltage class, and maximum motor capacity of the Inverter in alphanumeric codes.

CIMR – L7 Z 2 3P7

Inverter

Varispeed L7

No.	Specification
Z	OYMC Europ. Std.

No.	Voltage Class
2	AC Input, 3-phase, 200 V
4	AC Input, 3-phase, 400 V

No.	Max. Motor Capacity
3P7	3.7 kW
5P5 to 55	5.5 kW to 55 kW

"P" Indicates the decimal point.
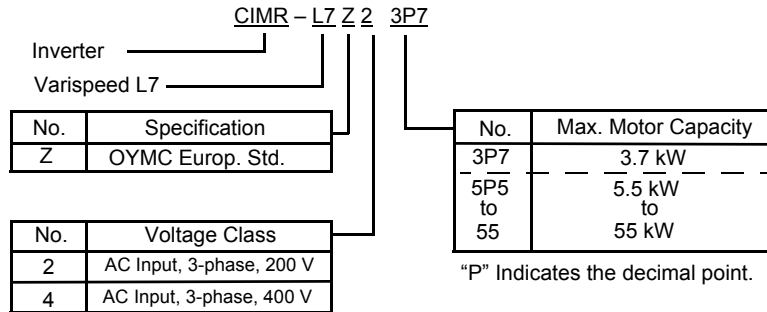
Fig 1.2   Inverter Model Numbers

■Inverter Specifications

The Inverter specifications ("SPEC") on the nameplate indicate the voltage class, maximum motor capacity, the protective structure, and the revision of the Inverter in alphanumeric codes.

2 3P7 1

No.	Voltage Class
2	AC Input, 3-phase, 200 V
4	AC Input, 3-phase 400 V

No.	Max. Motor Capacity
3P7	3.7 kW
5P5 to 55	5.5 kW to 55 kW

"P" Indicates the decimal point

No.	Protective Structure
0	Open chassis (IEC IP00)
1	Enclosed wall-mounted (NEMA Type 1)
7	Enclosed wall-mounted (IEC IP20)
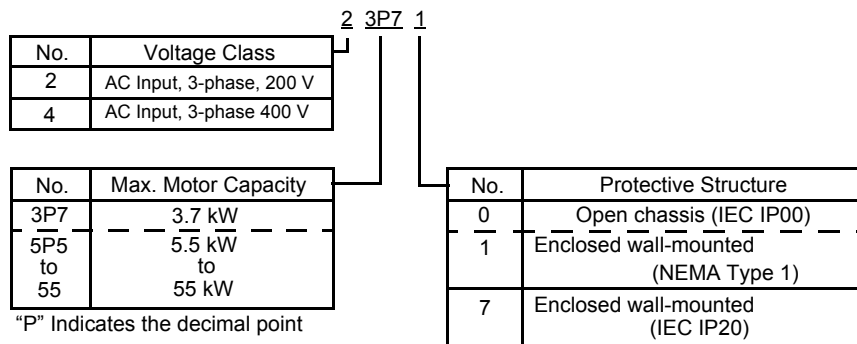
Fig 1.3   Inverter Specifications

◆ Component Names

■ Inverters of 18.5 kW or Less

The external appearance and component names of the Inverter are shown in *Fig 1.4*. The Inverter with the terminal cover removed is shown in *Fig 1.5*.
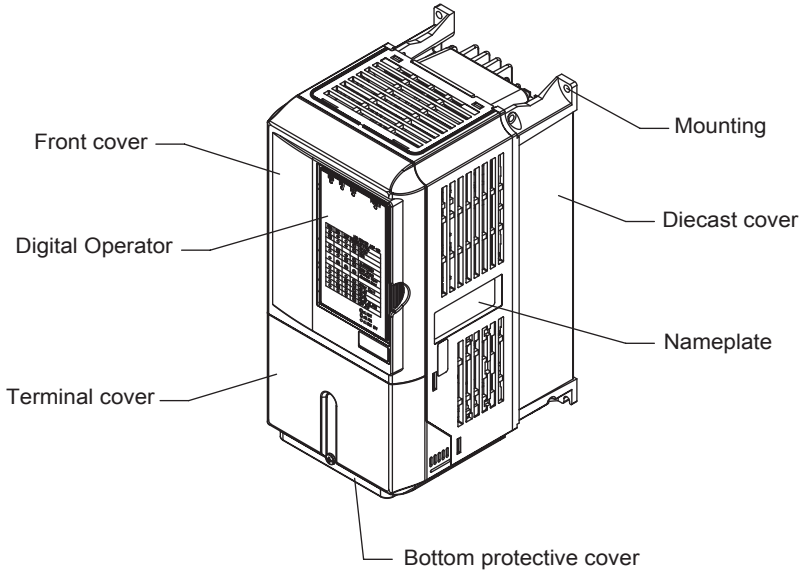
Fig 1.4 Inverter Appearance (18.5 kW or Less)
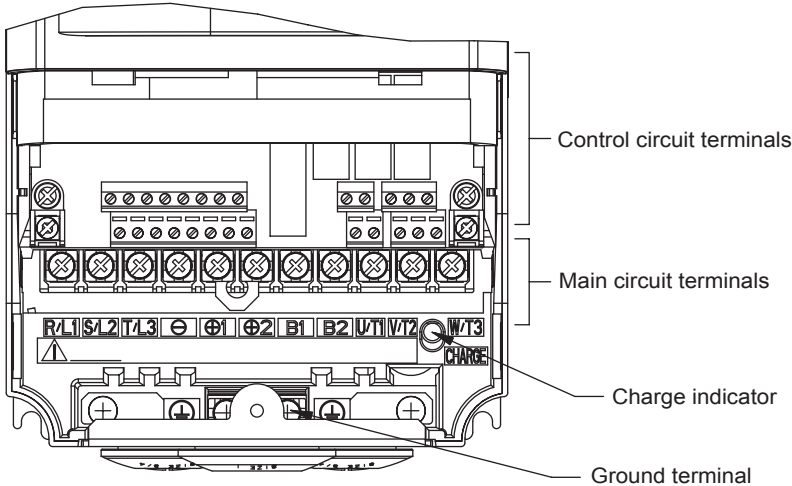
Fig 1.5 Terminal Arrangement (18.5 kW or Less)

1

■ Inverters of 22 kW or More

The external appearance and component names of the Inverter are shown in *Fig 1.6*. The Inverter with the terminal cover removed is shown in *Fig 1.7*.
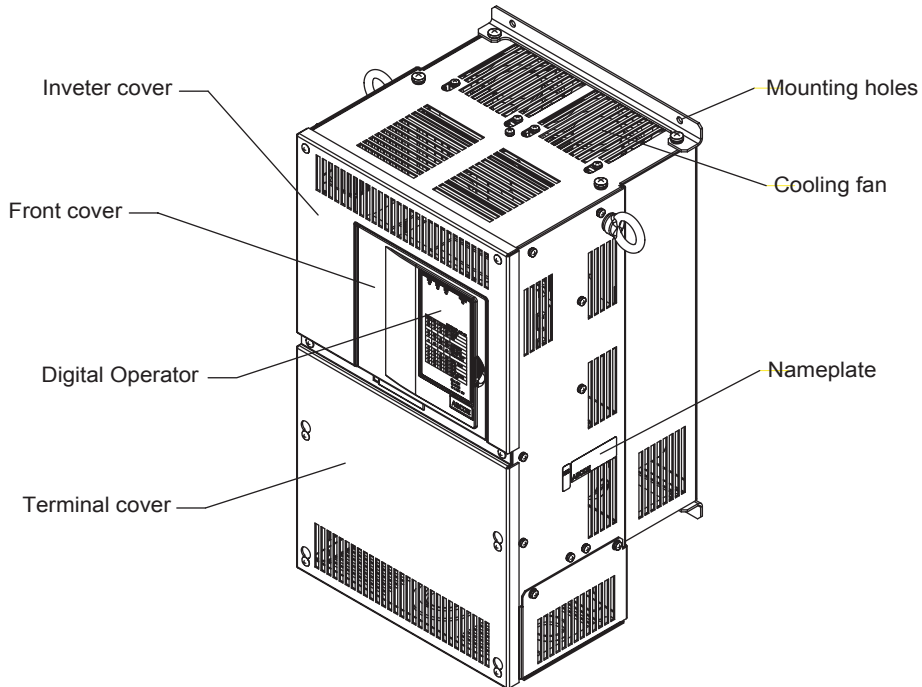
Fig 1.6 Inverter Appearance (22 kW or More)
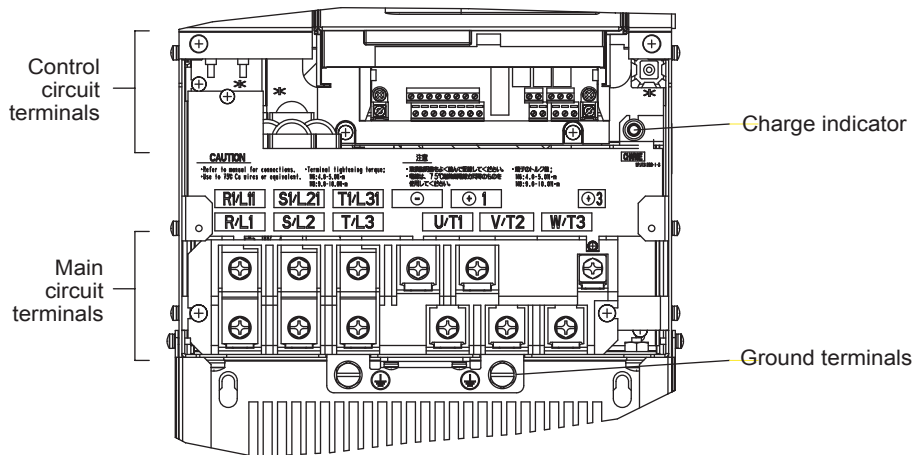
Fig 1.7 Terminal Arrangement (22 kW or More)

Exterior and Mounting Dimensions

◆ Open Chassis Inverters (IP00)

Exterior diagrams of the Open Chassis Inverters are shown below.

200 V/400 V Class Inverters of 3.7 to 18.5 kW

200 V Class Inverters of 22 or 55 kW
400 V Class Inverters of 22 to 55 kW

Fig 1.8 Exterior Diagrams of Open Chassis Inverters

◆ Enclosed Wall-mounted Inverters (NEMA1·IEC IP20)

Exterior diagrams of the Enclosed Wall-mounted Inverters (NEMA1 • IEC IP20) are shown below.

200 V/400 V Class Inverters of 3.7 to 18.5 kW

200 V Class Inverters of 22 or 55 kW
400 V Class Inverters of 22 to 55 kW

Fig 1.9 Exterior Diagrams of Enclosed Wall-mounted Inverters

Checking and Controlling the Installation Site

Install the Inverter in the installation site described below and maintain optimum conditions.

◆ Installation Site

Install the Inverter under the following conditions in a pollution degree 2 environment.

Table 1.3 Installation Site

Type	Ambient Operating Temperature	Humidity
Enclosed wall-mounted (NEMA1)	-10 to + 40 °C	95% RH or less (no condensation)
Open chassis and IEC IP20	-10 to + 45 °C	95% RH or less (no condensation)

Protection covers are attached to the top and bottom of the Inverter. Be sure to remove the protection covers before installing a 200 or 400 V Class Inverter with an output of 18.5 kW or less in a panel.

Observe the following precautions when mounting the Inverter.

- Install the Inverter in a clean location which is free from oil mist and dust. It can be installed in a totally enclosed panel that is completely shielded from floating dust.

- When installing or operating the Inverter, always take special care so that metal powder, oil, water, or other foreign matter does not get into the Inverter.

- Do not install the Inverter on combustible material, such as wood.

- Install the Inverter in a location free from radioactive materials and combustible materials.

- Install the Inverter in a location free from harmful gasses and liquids.

- Install the Inverter in a location without excessive oscillation.

- Install the Inverter in a location free from chlorides.

- Install the Inverter in a location not in direct sunlight.

◆ Controlling the Ambient Temperature

To enhance the reliability of operation, the Inverter should be installed in an environment free from extreme temperature increases. If the Inverter is installed in an enclosed environment, such as a box, use a cooling fan or air conditioner to maintain the internal air temperature below 45°C.

◆ Protecting the Inverter from Foreign Matter

Place a cover over the Inverter during installation to shield it from metal power produced by drilling.

Always remove the cover from the Inverter after completing installation. Otherwise, ventilation will be reduced, causing the Inverter to overheat.

Installation Orientation and Space

Install the Inverter vertically so as not to reduce the cooling effect. When installing the Inverter, always provide the following installation space to allow normal heat dissipation.

Horizontal Space   Vertical Space
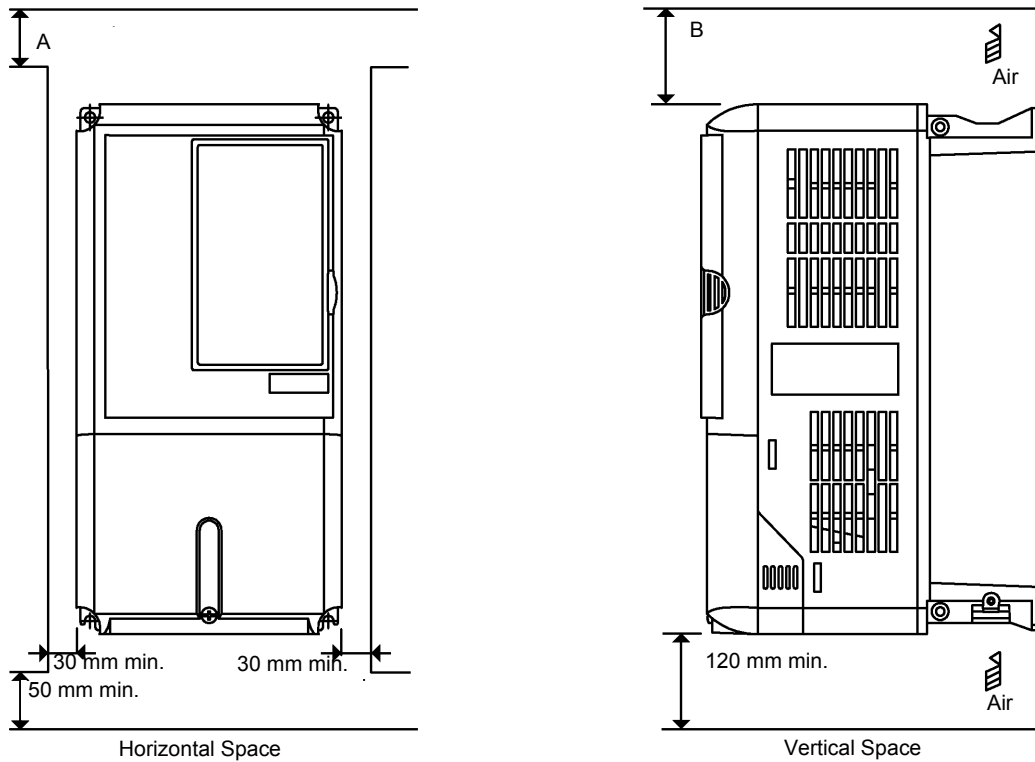
	A	B
200V class inverter, 3.7 to 55 kW 400V class inverter, 3.7 to 55 kW	50 mm	120 mm

Fig 1.10 Inverter Installation Orientation and Space

IMPORTANT

1. The same space is required horizontally and vertically for both Open Chassis (IP00) and Enclosed Wall-mounted (IP20, NEMA 1) Inverters.
2. Always remove the protection covers before installing a 200 or 400 V Class Inverter with an output of 18.5 kW or less in a panel.
   Always provide enough space for suspension eye bolts and the main circuit lines when installing a 200 or 400 V Class Inverter with an output of 22 kW or more in a panel.

Removing and Attaching the Terminal Cover

Remove the terminal cover to wire cables to the control circuit and main circuit terminals.

◆ Removing the Terminal Cover

■ Inverters of 18.5 kW or Less

Loosen the screw at the bottom of the terminal cover, press in on the sides of the terminal cover in the directions of arrows 1, and then lift up on the terminal in the direction of arrow 2.
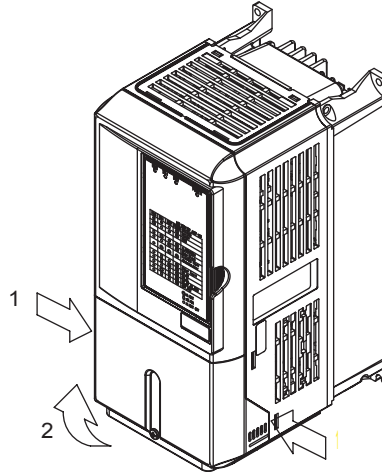
Fig 1.1 Removing the Terminal Cover (Model CIMR-L7Z43P7 Shown Above)

■ Inverters of 22 kW or More

Loosen the screws on the left and right at the top of the terminal cover, pull out the terminal cover in the direction of arrow 1 and then lift up on the terminal in the direction of arrow 2.
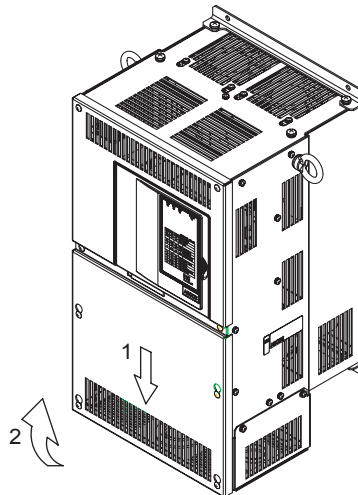
Fig 1.2 Removing the Terminal Cover (Model CIMR-L7Z4022 Shown Above)

◆ Attaching the Terminal Cover

When wiring the terminal block has been completed, attach the terminal cover by reversing the removal procedure.

For Inverters with an output of 18.5 kW or less, insert the tab on the top of the terminal cover into the groove on the Inverter and press in on the bottom of the terminal cover until it clicks into place.

Removing/Attaching the Digital Operator/Monitor and Front Cover

◆ Inverters of 18.5 kW or Less

To attach optional cards or change the terminal card connector, remove the Digital Operator/Monitor and front cover in addition to the terminal cover. Always remove the Digital Operator/Monitor from the front cover before removing the front cover.

The removal and attachment procedures are described below.

■Removing the Digital Operator/Monitor

Press the lever on the side of the Digital Operator/Monitor in the direction of arrow 1 to unlock the Digital Operator/Monitor and lift the Digital Operator/Monitor in the direction of arrow 2 to remove the Digital Operator/Monitor as shown in the following illustration.
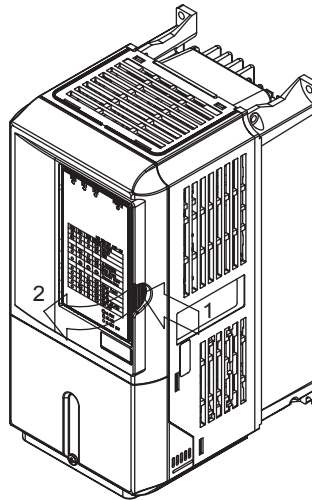
Fig 1.11 Removing the Digital Operator/Monitor (Model CIMR-L7Z43P7 Shown Above)

1

■Removing the Front Cover

Press the left and right sides of the front cover in the directions of arrows 1 and lift the bottom of the cover in the direction of arrow 2 to remove the front cover as shown in the following illustration.
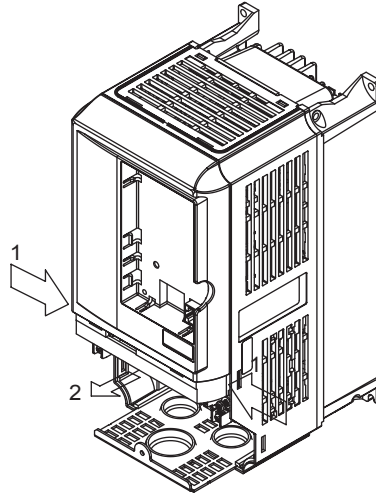
Fig 1.12 Removing the Front Cover (Model CIMR-L7Z43P7 Shown Above)

■Mounting the Front Cover

After wiring the terminals, mount the front cover to the Inverter by performing the steps to remove the front cover in reverse order.

1. Do not mount the front cover with the Digital Operator/Monitor attached to the front cover; otherwise, Digital Operator/Monitor may malfunction due to imperfect contact.

2. Insert the tab of the upper part of the front cover into the groove of the Inverter and press the lower part of the front cover onto the Inverter until the front cover snaps shut.

■Mounting the Digital Operator/Monitor

After attaching the terminal cover, mount the Digital Operator/Monitor onto the Inverter using the following procedure.

1. Hook the Digital Operator/Monitor at A (two locations) on the front cover in the direction of arrow 1 as shown in the following illustration.

2. Press the Digital Operator/Monitor in the direction of arrow 2 until it snaps in place at B (two locations).
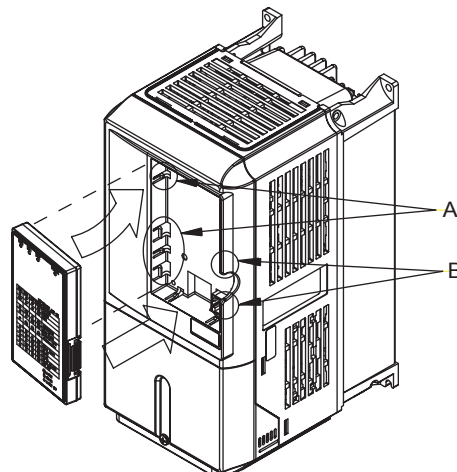
Fig 1.13 Mounting the Digital Operator/Monitor

IMPORTANT

1. Do not remove or attach the Digital Operator/Monitor or mount or remove the front cover using methods other than those described above, otherwise the Inverter may break or malfunction due to imperfect contact.
2. Never attach the front cover to the Inverter with the Digital Operator/Monitor attached to the front cover. Imperfect contact can result.
   Always attach the front cover to the Inverter by itself first, and then attach the Digital Operator/Monitor to the front cover.

◆ Inverters of 22 kW or More

For inverters with an output of 22 kW or more, remove the terminal cover and then use the following procedures to remove the Digital Operator/Monitor and main cover.

■Removing the Digital Operator/Monitor

Use the same procedure as for Inverters with an output of 18.5 kW or less.

■Removing the Front Cover

Lift up at the location label 1 at the top of the control circuit terminal card in the direction of arrow 2.
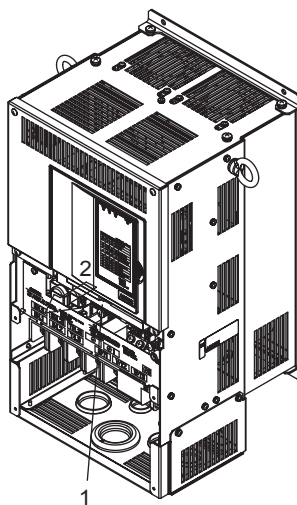
Fig 1.14 Removing the Front Cover (Model CIMR-L7Z4022 Shown Above)

■ Attaching the Front Cover

After completing required work, such as mounting an optional card or setting the terminal card, attach the front cover by reversing the procedure to remove it.

1. Confirm that the Digital Operator/Monitor is not mounted on the front cover. Contact faults can occur if the cover is attached while the Digital Operator/Monitor is mounted to it.
2. Insert the tab on the top of the front cover into the slot on the Inverter and press in on the cover until it clicks into place on the Inverter.

■Attaching the Digital Operator/Monitor

Use the same procedure as for Inverters with an output of 18.5 kW or less.

1

2

Wiring

This chapter describes wiring terminals, main circuit terminal connections, main circuit terminal wiring specifications, control circuit terminals, and control circuit wiring specifications.

Connection Diagram

The connection diagram of the Inverter is shown in *Fig 2.4*.

When using the Digital Operator/Monitor, the motor can be operated by wiring only the main circuits.

Fig 2.4 Connection Diagram (Model CIMR-L7Z43P7 Shown Above)

◆ Circuit Descriptions

Refer to the numbers indicated in *Fig 2.4*.

①   These circuits are hazardous and are separated from accessible surfaces by protective separation

②   These circuits are separated from all other circuits by protective separation consisting of double and reinforced insulation. These circuits may be interconnected with SELV (or equivalent) or non-SELV circuits, but not both.

③   **Inverters supplied by a four-wire-system source (neutral grounded)**
These circuits are SELV circuits and are separated from all other circuits by protective separation consisting of double and reinforced insulation. These circuits may only be interconnected with other SELV (or equivalent) circuits.

      Inverters supplied by a three-wire-system source (ungrounded or corner grounded)
These circuits are not separated from hazardous circuits other circuits by protective separation, but only with basic insulation. These circuits must not be interconnected with any circuits which are accessible, unless they are isolated from accessible circuits by supplemental insulation

2

IMPORTANT

1. Control circuit terminals are arranged as shown below.

	SC	SC	SC	BB		+V	A1	AC		M5	M6	MA	MB	MC	
E(G)	S1	S2	S3	S4	S5	S6	S7			M3	M4	M1		M2	E(G)
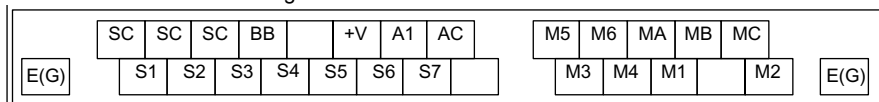
2. The output current capability of the +V terminal is 20 mA.
3. Main circuit terminals are indicated with double circles and control circuit terminals are indicated with single circles.
4. The wiring of the digital inputs S1 to S7 and BB is shown for the connection of contacts or NPN transistors (0V common and sinking mode). This is the default setting.
   For the connection of PNP transistors or for using a 24V external power supply, refer to *Table 2.11*.
5. A DC reactor is an option only for Inverters of 18.5 kW or less. Remove the short circuit bar when connecting a DC reactor.

Terminal Block Configuration

The terminal arrangements are shown in *Fig 2.5* and *Fig 2.6*.

Fig 2.5 Terminal Arrangement (200 V/400 V Class Inverter of 3.7 kW)

Fig 2.6 Terminal Arrangement (200 V/400 V Class Inverter of 22 kW or more)

2

Wiring Main Circuit Terminals

◆ Applicable Wire Sizes and Closed-loop Connectors

Select the appropriate wires and crimp terminals from *Table 2.1* to *Table 2.3*. Refer to instruction manual TOE-C726-2 for wire sizes for Braking Resistor Units and Braking Units.

Table 2.1 200 V Class Wire Sizes

Inverter Model CIMR-□	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2(AWG)	Recommended Wire Size mm^2 (AWG)	Wire Type
L7Z23P7	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO ⏚	M4	1.2 to 1.5	4 (12 to 10)	4 (12)	
L7Z25P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO ⏚	M4	1.2 to 1.5	6 (10)	6 (10)	
L7Z27P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO ⏚	M5	2.5	10 (8 to 6)	10 (8)	
L7Z2011	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO ⏚	M5	2.5	16 (6 to 4)	16 (6)	
L7Z2015	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, U/T1, V/T2, W/T3, NO	M6	4.0 to 5.0	25 (4 to 2)	25 (4)	
	B1, B2, PO	M5	2.5	10 (8 to 6)	-	
	⏚	M6	4.0 to 5.0	25 (4)	25 (4)	
L7Z2018	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, U/T1, V/T2, W/T3, NO	M8	9.0 to 10.0	25 to 35 (3 to 2)	25 (3)	Power cables, e.g., 600 V vinyl power cables
	B1, B2, PO	M5	2.5	10 to 16 (8 to 6)	-	
	⏚	M6	4.0 to 5.0	25 (4)	25 (4)	
L7Z2022	R/L1, S/L2, T/L3, ⊖, ⊕1, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	25 to 35 (3 to 1)	25 (3)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	
L7Z2030	R/L1, S/L2, T/L3, ⊖, ⊕1 U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	50 (1 to 1/0)	50 (1)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	
L7Z2037	R/L1, S/L2, T/L3, ⊖, ⊕1 U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M10	17.6 to 22.5	70 to 95 (2/0 to 4/0)	70 (2/0)	
	⊕3, PO	M8	8.8 to 10.8	6 to 16 (10 to 4)	–	
	⏚	M10	17.6 to 22.5	35 to 70 (2 to 2/0)	35 (2)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 4 (20 to 10)	1.5 (16)	

2

Inverter Model CIMR-□	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm²(AWG)	Recommended Wire Size mm²(AWG)	Wire Type
L7Z2045	R/L1, S/L2, T/L3, ⊖, ⊕1 U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M10	17.6 to 22.5	95 (3/0 to 4/0)	95 (3/0)	Power cables, e.g., 600 V vinyl power cables
	⊕3, PO	M8	8.8 to 10.8	6 to 16 (10 to 4)	–	
	⏚	M10	17.6 to 22.5	50 to 70 (1 to 2/0)	50 (1)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 4 (20 to 10)	1.5 (16)	
L7Z2055	R/L1, S/L2, T/L3, ⊖, ⊕1, NO	M12	31.4 to 39.2	50 to 95 (1/0 to 4/0)	50 × 2P (1/0 × 2P)	
	U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31	M10	17.6 to 22.5	90 (4/0)	90 (4/0)	
	⊕3, PO	M8	8.8 to 10.8	6 to 70 (10 to 2/0)	–	
	⏚	M10	17.6 to 22.5	35 to 95 (3 to 4/0)	50 (1/0)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 4 (20 to 10)	1.5 (16)	

* The wire thickness is set for copper wires at 75°C

Table 2.2 400 V Class Wire Sizes

Inverter Model CIMR-□	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm² (AWG)	Recommended Wire Size mm² (AWG)	Wire Type
L7Z43P7	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	2.5 to 4 (14 to 10)	4 (12)	Power cables, e.g., 600 V vinyl power cables
	⏚				2.5 (14)	
L7Z44P0	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	2.5 to 4 (14 to 10)	4 (12)	
	⏚				2.5 (14)	
L7Z45P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	4 (12 to 10)	4 (12)	
	⏚			2.5 to 4 (14 to 10)	2.5 (14)	
L7Z47P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	4 (10)	4 (10)	
	⏚			4 (12 to 10)	4 (12)	
L7Z4011	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M5	2.5	6 to 10 (10 to 6)	10 (8)	
	⏚				6 (10)	
L7Z4015	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M5	2.5	10 (8 to 6)	10 (8)	
	⏚	M5 (M6)	2.5 (4.0 to 5.0)	6 to 10 (10 to 6)	6 (10)	
L7Z4018	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, U/T1, V/T2, W/T3, NO	M6	4.0 to 5.0	10 to 35 (8 to 2)	10 (8)	
	B1, B2, PO	M5	2.5	10 (8)	10 (8)	
	⏚	M6	4.0 to 5.0	10 to 25 (8 to 4)	10 (8)	
L7Z4022	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕3, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO, PO	M6	4.0 to 5.0	16 (6 to 4)	16 (6)	
	⏚	M8	9.0 to 10.0	16 to 35 (6 to 2)	16 (6)	

Inverter Model CIMR-□	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2 (AWG)	Recommended Wire Size mm^2 (AWG)	Wire Type
L7Z4030	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕3, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO, PO	M6	4.0 to 5.0	25 (4)	25 (4)	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	
L7Z4037	R/L1, S/L2, T/L3, ⊖, ⊕1, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	25 to 50 (4 to 1/0)	35 (2)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	
L7Z4045	R/L1, S/L2, T/L3, ⊖, ⊕1, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	35 to 50 (2 to 1/0)	35 (2)	Power cables, e.g., 600 V vinyl power cables
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	
L7Z4055	R/L1, S/L2, T/L3, ⊖, ⊕1, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	50 (1 to 1/0)	50 (1)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	

* The wire thickness is set for copper wires at 75°C.

Table 2.3 Lug Sizes (JIS C2805) (200 V Class and 400 V Class)

Wire Thickness (mm^2)	Terminal Screws	Size
0.5	M3.5	1.25 / 3.5
	M4	1.25 / 4
0.75	M3.5	1.25 / 3.5
	M4	1.25 / 4
1.25	M3.5	1.25 / 3.5
	M4	1.25 / 4
2	M3.5	2 / 3.5
	M4	2 / 4
	M5	2 / 5
	M6	2 / 6
	M8	2 / 8
3.5/5.5	M4	5.5 / 4
	M5	5.5 / 5
	M6	5.5 / 6
	M8	5.5 / 8
8	M5	8 / 5
	M6	8 / 6
	M8	8 / 8
14	M6	14 / 6
	M8	14 / 8
22	M6	22 / 6
	M8	22 / 8

2

Wire Thickness (mm^2)	Terminal Screws	Size
30/38	M8	38 / 8
50/60	M8	60 / 8
	M10	60 / 10
80	M10	80 / 10
100		100 / 10
100	M12	100 / 12
150		150 / 12
200		200 / 12
325	M12 x 2	325 / 12
	M16	325 / 16

◆ Main Circuit Terminal Functions

Main circuit terminal functions are summarized according to terminal symbols in *Table 2.4*. Wire the termi-nals correctly for the desired purposes.

Table 2.4   Main Circuit Terminal Functions (200 V Class and 400 V Class)

Purpose	Terminal Symbol	Model: CIMR-L7Z□□□□	
		200 V Class	400 V Class
Main circuit power input	R/L1, S/L2, T/L3	23P7 to 2055	43P7 to 4055
	R1/L11, S1/L21, T1/L31	2022 to 2055	4022 to 4055
Inverter outputs	U/T1, V/T2, W/T3	23P7 to 2055	43P7 to 4055
DC bus terminals	⊕1, ⊖	23P7 to 2055	43P7 to 4055
Braking Resistor Unit connec-tion	B1, B2	23P7 to 2018	43P7 to 4018
DC reactor connection	⊕1, ⊕2	23P7 to 2018	43P7 to 4018
Braking Unit connection	⊕3, ⊖	2022 to 2055	4022 to 4055
Ground	⏚	23P7 to 2055	43P7 to 4055
Battery power input	PO, NO	23P7 to 2055	43P7 to 4055

2

◆ Main Circuit Configurations

The main circuit configurations of the Inverter are shown in *Table 2.5*.

Table 2.5 Inverter Main Circuit Configurations

200 V Class	400 V Class
CIMR - L7Z23P7 to 2018	CIMR - L7Z43P7 to 4018
CIMR - L7Z2022,2030	CIMR - L7Z4022 to 4055
CIMR - L7Z2037 to 2055	
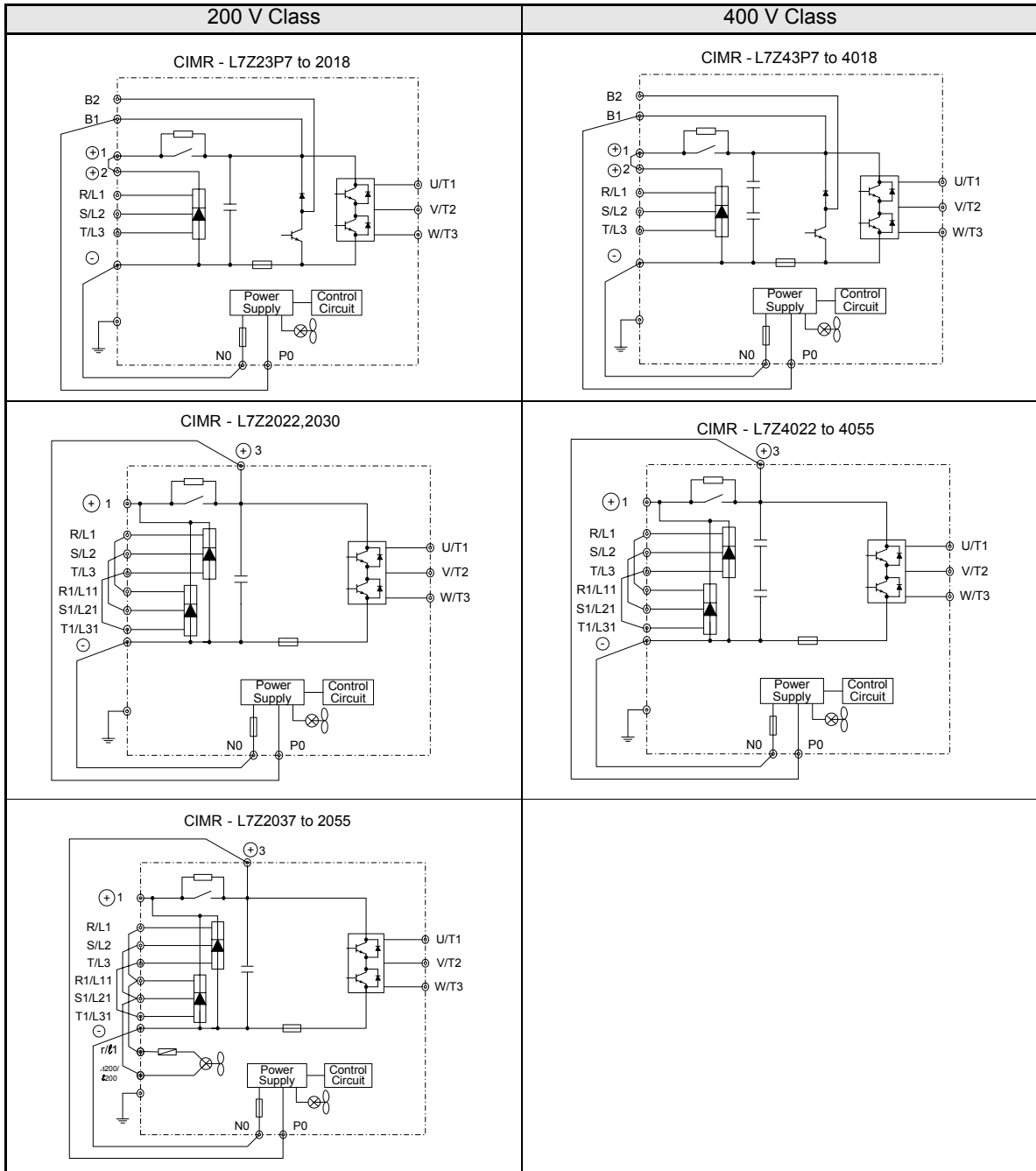
Note: Consult your OYMC representative before using 12-phase rectification.

◆ Standard Connection Diagrams

Standard Inverter connection diagrams are shown in *Fig 2.7*. These are the same for both 200 V Class and 400 V Class Inverters. The connections depend on the Inverter capacity.

■CIMR-L7Z3P7 to 2018 and 43P7 to 4018

Be sure to remove the short-circuit bar before connecting the DC reactor.

■CIMR-L7Z2022, 2030, and 4022 to 4055

The DC reactor is built in.

■CIMR-L7Z2037 to 2055
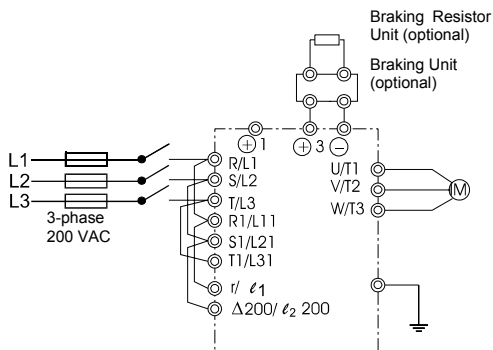
Control power is supplied internally from the DC bus at all inverter models.

Fig 2.7 Main Circuit Terminal Connections

◆ Wiring the Main Circuits

This section describes wiring connections for the main circuit inputs and outputs.

■ Wiring Main Circuit Inputs

Observe the following precautions for the main circuit power supply input.

Installing Fuses

To protect the inverter, it is recommended to use semiconductor fuses like they are shown in the table below.

Table 2.6 Input Fuses

Inverter Type	Fuse		
	Voltage (V)	Current (A)	I^2t (A^{2}s)
23P7	240	30	82~220
25P5	240	40	220~610
27P5	240	60	290~1300
2011	240	80	450~5000
2015	240	100	1200~7200
2018	240	130	1800~7200
2022	240	150	870~16200
2030	240	180	1500~23000
2037	240	240	2100~19000
2045	240	300	2700~55000
2055	240	350	4000~55000

Inverter Type	Fuse		
43P7	480	15	34~72
44P0	480	20	50~570
45P5	480	25	100~570
47P5	480	30	100~640
4011	480	50	150~1300
4015	480	60	400~1800
4018	480	70	700~4100
4022	480	80	240~5800
4030	480	100	500~5800
4037	480	125	750~5800
4045	480	150	920~13000
4055	480	150	1500~13000

Installing a Moulded-case Circuit Breaker

When connecting the power input terminals (R/L1, S/L2, and T/L3) to the power supply using a moulded-case circuit breaker (MCCB) observe that the circuit breaker is suitable for the Inverter.

- Choose an MCCB with a capacity of 1.5 to 2 times of the inverter's rated current.
- For the MCCB's time characteristics, be sure to consider the inverter's overload protection (one minute at 150% of the rated output current).

Installing an Earth Leakage Breaker

Inverter outputs use high-speed switching, so high-frequency leakage current is generated. If an earth leakage breaker should be used, select one that detects only the leakage current which is in the frequency range that is hazardous to humans but not high-frequency leakage currents.

- For a special-purpose earth leakage breaker for Inverters, choose one with a sensitivity amperage of at least 30 mA per Inverter.
- When using a general earth leakage breaker, choose one with a sensitivity amperage of 200 mA or more per Inverter and with an operating time of 0.1 s or more.

Installing a Magnetic Contactor at the Input

If the power supply for the main circuit is to be shut off by a control circuit, a magnetic contactor can be used.

The following things should be considered:

- The Inverter can be started and stopped by opening and closing the magnetic contactor on the primary side. Frequently opening and closing the magnetic contactor, however, may cause the Inverter to break down. Do not exceed one power up per hour.
- When the Inverter is operated with the Digital Operator/Monitor, automatic operation cannot be performed after recovery from a power interruption.

Connecting Input Power Supply to the Terminal Block

Input power supply can be connected to any terminal R, S or T on the terminal block; the phase sequence of input power supply is irrelevant to the output phase sequence.

Installing an Input AC Reactor

If the Inverter is connected to a large-capacity power transformer (600 kW or more) or a phase advancing capacitor is switched, an excessive peak current may flow through the input power circuit, causing the inverter unit to break down.

To prevent this, install an optional AC Reactor on the input side of the Inverter or a DC reactor to the DC reactor connection terminals.

This also improves the power factor on the power supply side.

Installing a Surge Absorber

Always use a surge absorber or diode for inductive loads near the Inverter. These inductive loads include magnetic contactors, electromagnetic relays, solenoid valves, solenoids, and magnetic brakes.

2

■Wiring the Output Side of Main Circuit

Observe the following precautions when wiring the main output circuits.

Connecting the Inverter and Motor

Connect output terminals U/T1, V/T2, and W/T3 respective to the motor lead wires U, V, and W.

Check that the motor rotates forward with the forward run command. Switch over any two of the output terminals to each other and reconnect if the motor rotates in reverse with the forward run command.

Never Connect a Power Supply to Output Terminals

Never connect a power supply to output terminals U/T1, V/T2, and W/T3. If voltage is applied to the output terminals, the internal circuits of the Inverter will be damaged.

Never Short or Ground Output Terminals

If the output terminals are touched with bare hands or the output wires come into contact with the Inverter case, an electric shock or grounding may occur. This is extremely hazardous. Do not short the output wires.

Do Not Use a Phase Advancing Capacitor

Never connect a phase advancing capacitor to an output circuit. The high-frequency components of the Inverter output may overheat and be damaged and may cause other parts to burn.

Using a Magnetic Contactor

Check the control sequence to make sure, that the magnetic contactor (MC) between the Inverter and motor is not turned ON or OFF during inverter operation. If the MC is turned ON while the Inverter is operating, a large inrush current will be created and the inverter's overcurrent protection may operate.

Cable Length between Inverter and Motor

The cable between the Inverter and motor is 30 m max.

■Ground Wiring

Observe the following precautions when wiring the ground line.

- Always use the ground terminal of the 200 V Inverter with a ground resistance of less than 100 Ω and that of the 400 V Inverter with a ground resistance of less than 10 Ω.
- Do not share the ground wire with other devices, such as welding machines or power tools.
- Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire.
  Leakage current flows through the Inverter. Therefore, if the distance between the ground electrode and the ground terminal is too long, potential on the ground terminal of the Inverter will become unstable.
- When using more than one Inverter, be careful not to loop the ground wire.
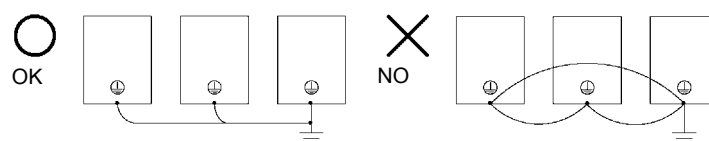
Fig 2.8 Ground Wiring

■**Connecting a Braking Resistor and Braking Unit (CDBR)**

Connect a Braking Resistor and Braking Unit to the Inverter like shown in the *Fig 2.9*.

The example shows a braking resistor with integrated thermal overload switch. To prevent the braking unit/braking resistor from overheating, design the control circuit to turn OFF the power supply using the thermal overload relay contacts of the units as shown in *Fig 2.9*.

200 V and 400 V Class Inverters with 3.7 to 18.5 kW Output Capacity
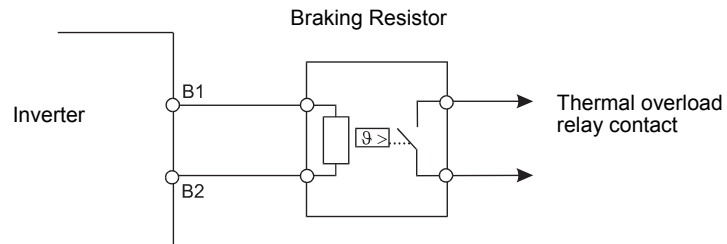
200 V and 400 V Class Inverters with 22 kW or higher Output Capacity
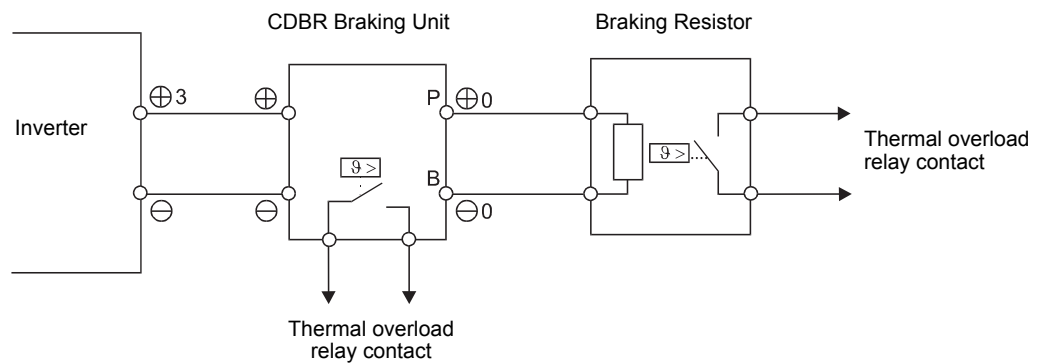
Fig 2.9 Connecting the Braking Resistor and Braking Unit

Connecting Braking Units in Parallel

When connecting two or more Braking Units in parallel, use the wiring and jumper settings like shown in *Fig 2.10*. There is a jumper for selecting whether each Braking Unit is to be a master or slave. Select "Master" for the first Braking Unit only, and select "Slave" for all other Braking Units (i.e. from the second Unit onwards).
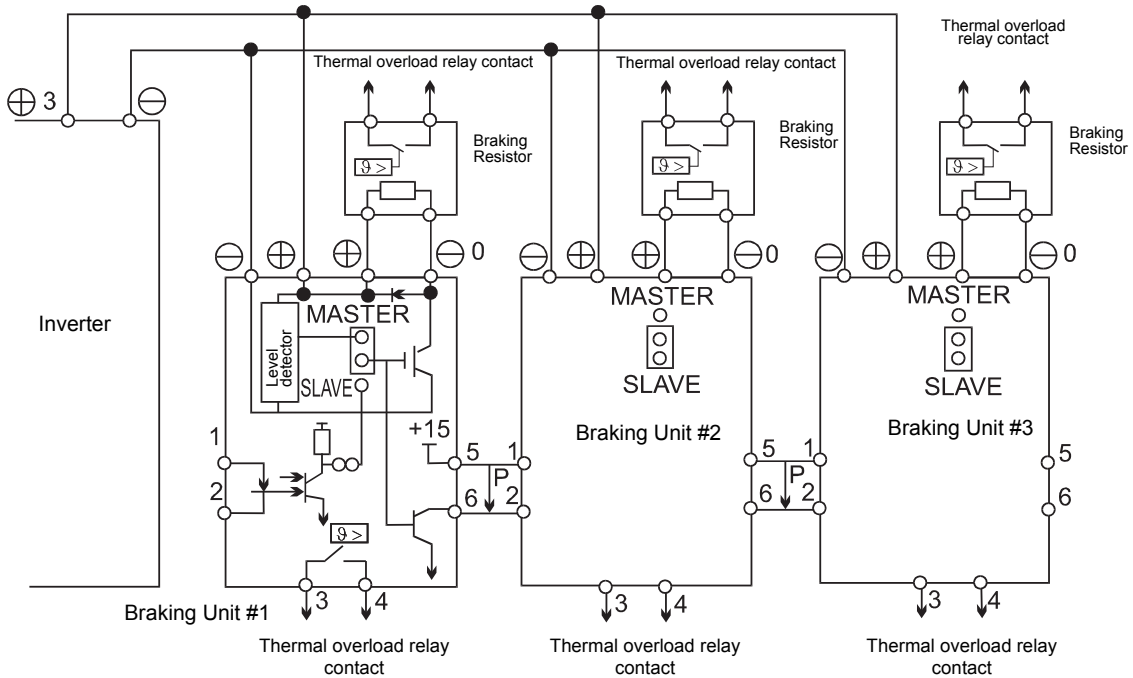
Fig 2.10 Connecting Braking Units in Parallel

■Connecting the battery power supply

Varispeed L7 is equipped with the cable for the battery power supply connection by the standard.
Please detach the twisted-pair cable connected with main circuit terminal B1/+3 and -.
Please connect the twisted-pair cable by using the relay terminal for UPS/Battery.
Connecting the battery power supply as shown in *Fig 2.11*.

Table 2.7

L2-11 (Battery Voltage)	To use the battery voltage is input
H1-05 (Terminal S7 function selection)	Setting "85" Battery operation command
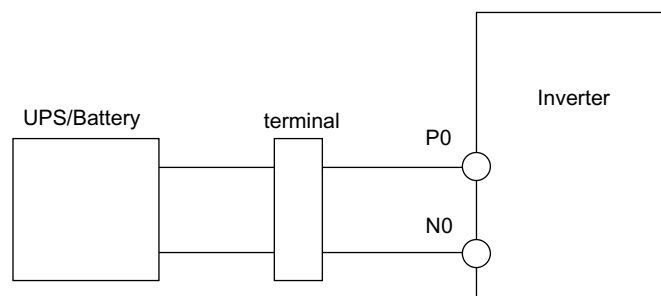
Fig 2.11 Connecting the battery power supply

Wiring Control Circuit Terminals

◆ Wire Sizes

For remote operation using analog signals, keep the control line length between the Analog Operator or operation signals and the Inverter to 30 m or less, and separate the lines from main power lines or other control circuits to reduce induction from peripheral devices.

When setting frequencies from an external frequency source (and not from a Digital Operator/Monitor), used shielded twisted-pair wires and ground the shield for the largest area of contact between shield and ground.

The terminal numbers and the appropriate wire sizes are shown in *Table 2.8*.

Table 2.8 Terminal Numbers and Wire Sizes (Same for all Models)

Terminals	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2(AWG)	Recommended Wire Size mm^2(AWG)	Wire Type
AC, SC, A1, +V, S1, S2, S3, S4, S5, S6, S7, BB, MA, MB, MC, M1, M2, M3, M4, M5, M6	Phoenix type	0.5 to 0.6	Single wire[3:] 0.5 to 2.5 Stranded wire: 0.5 to 1.5 (26 to 14)	0.75 (18)	• Shielded, twisted-pair wire[1] • Shielded, polyethylene-covered, vinyl sheath cable
E (G)	M3.5	0.8 to 1.0	0.5 to 2.5[2] (20 to 14)	1.0 (12)	

* 1. Use shielded twisted-pair cables to input an external frequency reference.
* 2. Refer to *Table 2.3* for suitable lug sizes for the wires.
* 3. We recommend using straight solderless terminal on signal lines to simplify wiring and improve reliability.

■ Straight Solderless Terminals for Signal Lines

Models and sizes of straight solderless terminal are shown in the following table.

Table 2.9 Straight Solderless Terminal Sizes

Wire Size mm^2 (AWG)	Model	d1	d2	L	Manufacturer
0.25 (24)	AI 0.25 - 8YE	0.8	2	12.5	
0.5 (20)	AI 0.5 - 8WH	1.1	2.5	14	
0.75 (18)	AI 0.75 - 8GY	1.3	2.8	14	Phoenix Contact
1.5 (16)	AI 1.5 - 8BK	1.8	3.4	14	
2 (14)	AI 2.5 - 8BU	2.3	4.2	14	
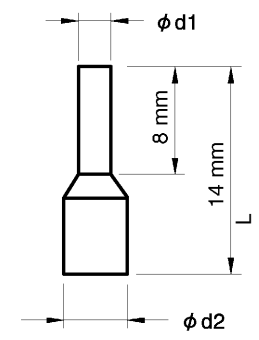
Fig 2.12 Straight Solderless Terminal Sizes

2

■Wiring Method

Use the following procedure to connect wires to the terminal block.

1. Loosen the terminal screws with a thin-slot screwdriver.

2. Insert the wires from underneath the terminal block.

3. Tighten the terminal screws firmly.
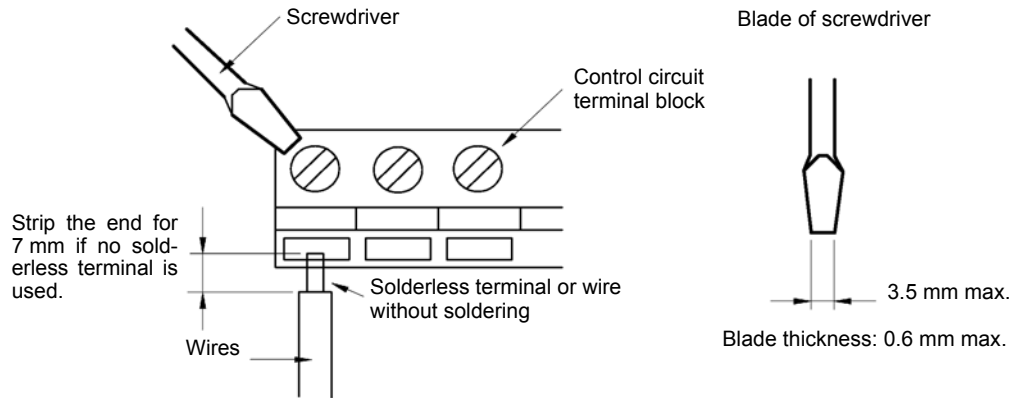
Fig 2.13 Connecting Wires to Terminal Block

◆ Control Circuit Terminal Functions

The functions of the control circuit terminals are shown in *Table 2.10*. Use the appropriate terminals for the correct purposes.

Table 2.10 Control Circuit Terminals with default settings

Type	No.	Signal Name	Function		Signal Level
Digital input signals	S1	Forward run/stop command	Forward run when ON; stopped when OFF.		24 VDC, 8 mA Photo-coupler
	S2	Reverse run/stop command	Reverse run when ON; stopped when OFF.		
	S3	Nominal speed	Nominal speed when ON.	Functions are selected by setting H1-01 to H1-05.	
	S4	Inspection run	Inspection RUN when ON.		
	S5	Intermediate speed	Intermediate speed when ON.		
	S6	Leveling speed	Leveling speed when ON.		
	S7	Not used	–		
	BB	Hardware baseblock	–		–
	SC	Digital input common	–		–
Analog input signals	+V	15 V power output	15 V power supply for analog references		15 V (Max. current: 20 mA)
	A1	Frequency reference	0 to +10 V/100%		0 to +10 V(20 kΩ)
	AC	Analog reference neutral	–		–
	E(G)	Shield wire, optional ground line connection point	–		–
Digital output signals	M1	Brake command (1NO contact)	Brake command when ON.	Multi-function contact outputs	Relay contacts Contact capacity: 1 A max. at 250 VAC 1 A max. at 30 VDC[*3]
	M2				
	M3	Contactor Control (1NO contact)	Contactor Control when ON		
	M4				
	M5	Inverter Ready (1NO contact)	Inverter Ready when ON.		
	M6				
	MA	Fault output signal (SPDT) (1 Change over contact)	Fault when CLOSED across MA and MC Fault when OPEN across MB and MC		
	MB				
	MC				

* 1. Do not use this power supply for supplying any external equipment.

* 2. When driving a reactive load, such as a relay coil with DC power supply, always insert a flywheel diode as shown in *Fig 2.14*.
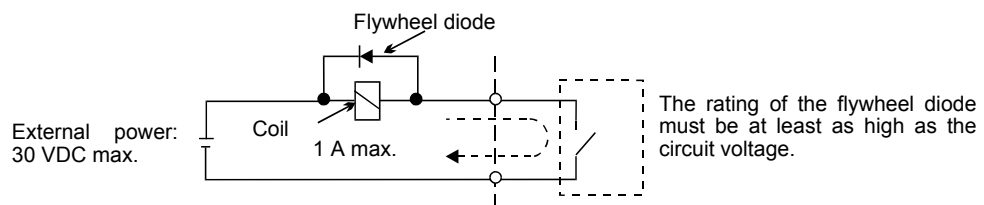
Fig 2.14 Flywheel Diode Connection

■ **Sinking/Sourcing Mode (NPN/PNP Selection)**

The input terminal logic can be switched between sinking mode (0-V common, NPN) and sourcing mode (+24V common, PNP) by using the jumper CN5. An external power supply is also supported, providing more freedom in signal input methods.

Table 2.11 Sinking/Sourcing Mode and Input Signals

2
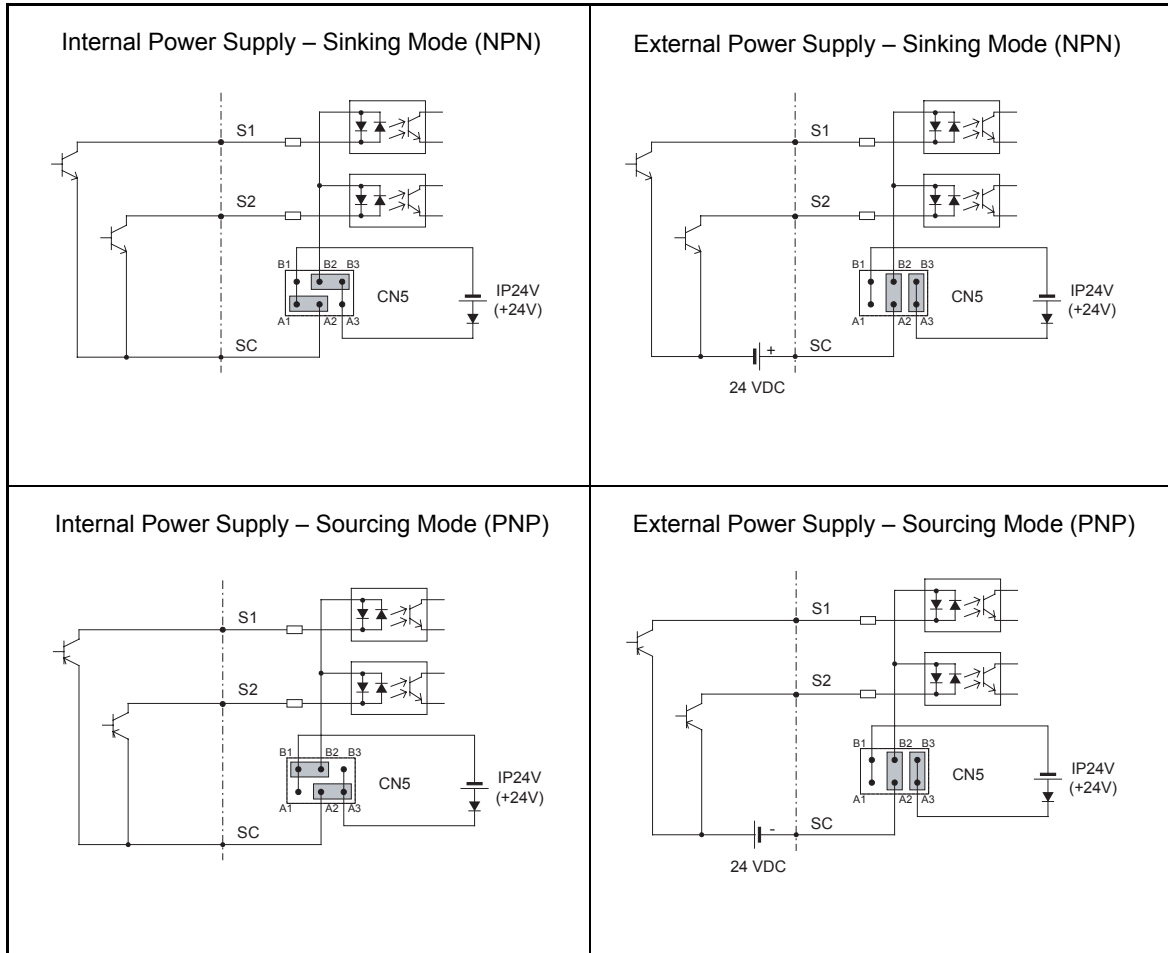
◆ Control Circuit Terminal Connections

Connections to Inverter control circuit terminals are shown in *Fig 2.15*.

Fig 2.15 Control Circuit Terminal Connections
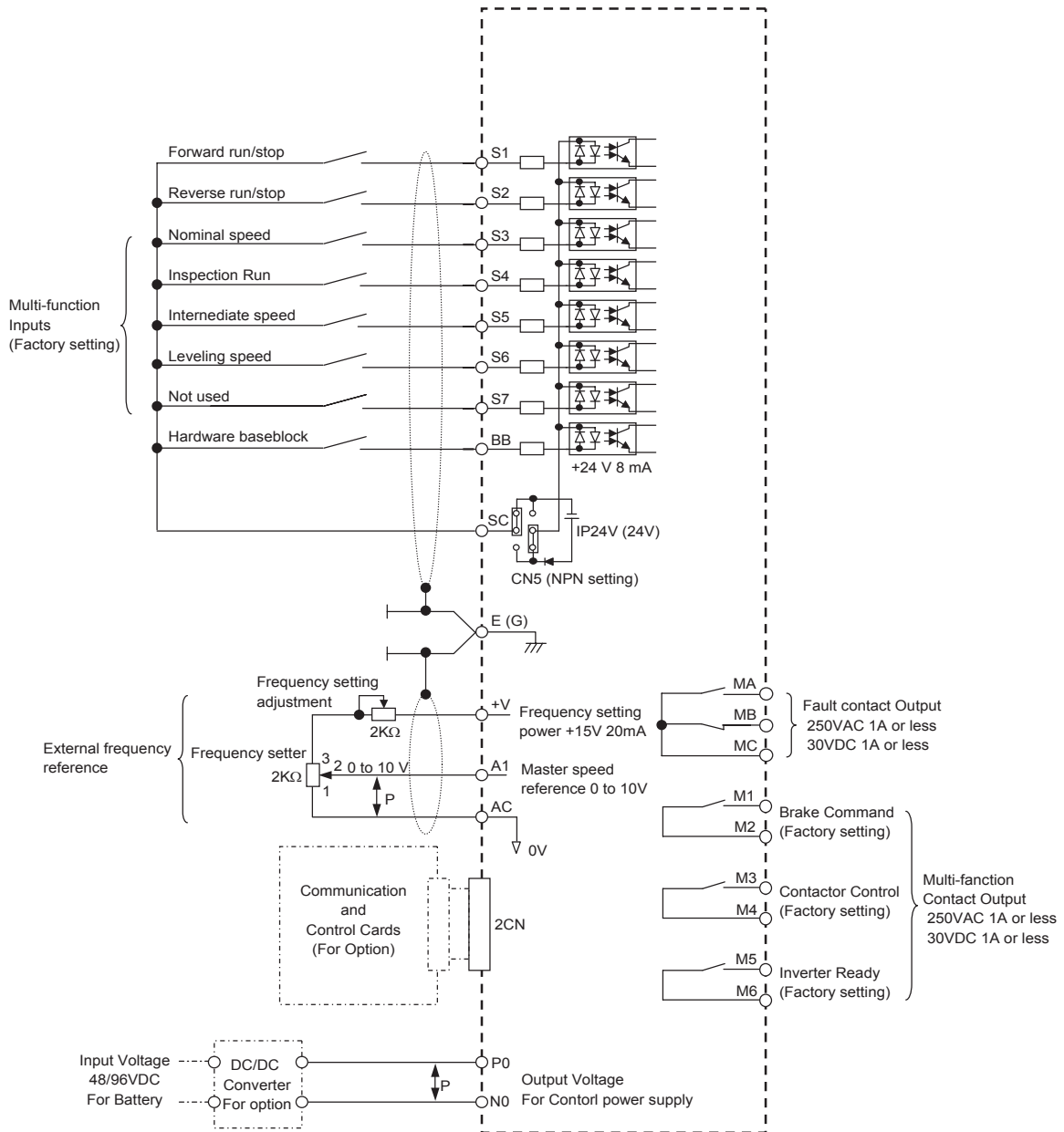
Note:
1. Main circuit terminals are indicatied with double circles and control circuit terminals are indicatied with a single circles
2. The output current capacity of the +V terminal is 20mA
3. Sequence input signal S1 to S7 and BB are labelled for sequence connections for no-voltage contacts or NPN transistors as the default setting.

◆ Control Circuit Wiring Precautions

Observe the following precautions when wiring control circuits.

- Separate control circuit wiring from main circuit wiring (terminals R/L1, S/L2, T/L3, B1, B2, U/T1, V/T2, W/T3, ⊖, ⊕1, ⊕2, and ⊕3, PO, NO) and other high-power lines.
- Separate wiring for control circuit terminals MA, MB, MC, M1, M2, M3, M4, M5, and M6 (contact outputs) from wiring to other control circuit terminals.
- If using an optional external power supply, it shall be a UL Listed Class 2 power supply source.
- Use twisted-pair or shielded twisted-pair cables for control circuits to prevent operating faults.
- Ground the cable shields with the maximum contact area of the shield and ground.
- Cable shields have to be grounded on both cable ends.

Wiring Check

◆ **Checks**

Check all wiring after wiring has been completed. Do not perform continuity check on control circuits. Perform the following checks on the wiring.

- Is all wiring correct?
- Have no wire clippings, screws, or other foreign material been left?
- Are all screws tight?
- Are any wire ends contacting other terminals?

2

Installing and Wiring Option Cards

◆ Option Card Models and Specifications

Up to three Option Cards can be mounted in the Inverter. You can mount up one card into each of the three places on the controller card (A, C and D) shown in *Fig 2.16*.

Table 2.12 lists the type of Option Cards and their specifications.

Table 2.12   Option Card Specifications

Card	Model	Specifications	Mounting Location
PG Speed Control Cards	PG-B2	Two phase (phase A and B), +12V inputs, max. response frequency: 50 kHz	A
	PG-X2	Three phase (phase A, B, Z), line driver inputs (RS422), max. response frequency: 300 kHz	A
DeviceNet communications card	SI-N1	Option card for DeviceNet fieldbus	C
Profibus-DP communications card	SI-P1	Option card for Profibus-DP fieldbus	C
InterBus-S communications card	SI-R1	Option card for InterBus-S fieldbus	C
CANOpen communications card	SI-S1	Option card for CANOpen fieldbus	C
Analog Output Cards	AO-08	2 channel analog output card Signal level: 0 to 10 V Resolution: 8 Bit	D
	AO-12	2 channel high resolution analog output card Signal level: -10 to +10 V Resolution: 11 Bit + sign	D
Digital Output Cards	DO-08	6 channel digital output card for monitoring the inverter status (fault, zero speed, running, etc.)	D
	DO-02C	2 channel relay contact output	D

◆ Installation

Before mounting an Option Card, remove the terminal cover and be sure that the charge indicator inside the Inverter does not glow anymore. After that remove the Digital Operator/Monitor and front cover and then mount the Option Card.

Refer to documentation provided with the Option Card for the mounting instructions for option slots A and C.

2

■ **Preventing C and D Option Card Connectors from Rising**

After installing an Option Card into slot C or D, insert an Option Clip to prevent the side with the connector from rising. The Option Clip can be easily removed by holding onto the protruding portion of the Clip and pulling it out.

A Option Card mounting spacer hole

CN4
A Option Card connector

CN2
C Option Card connector

A Option Card mounting spacer
(Provided with A Option Card)

C Option Card mounting spacer

C Option Card

D Option Card

Option Clip
(To prevent raising of
C and D Option Card)

D Option Card mounting spacer

A Option Card

A Option Card mounting spacer
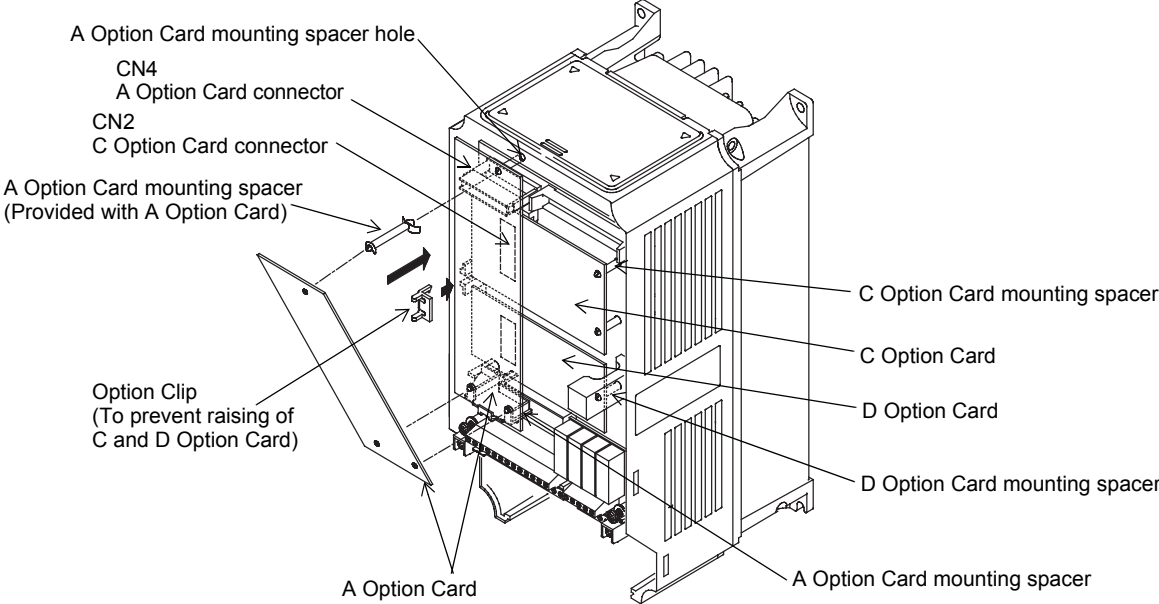
Fig 2.16 Mounting Option Cards

2

◆ PG Speed Control Card Terminals and Specifications

■PG-B2

The terminal specifications for the PG-B2 are given in the following table.

Table 2.13 PG-B2 Terminal Specifications

Terminal	No.	Contents	Specifications
TA1	1	Power supply for pulse generator	12 VDC (±5%), 200 mA max.
	2		0 VDC (GND for power supply)
	3	Pulse input terminals phase A	H: +8 to 12 V (max. input frequency: 50 kHz)
	4		GND pulse input phase A
	5	Pulse input terminals phase B	H: +8 to 12 V (max. input frequency: 50 kHz)
	6		GND pulse input phase B
TA2	1	Pulse monitor output terminals phase A	Open collector output, 24 VDC, 30 mA max.
	2		
	3	Pulse monitor output terminals phase B	Open collector output, 24 VDC, 30 mA max.
	4		
TA3	(E)	Shield connection terminal	-

■PG-X2

The terminal specifications for the PG-X2 are given in the following table.

Table 2.14 PG-X2 Terminal Specifications

Terminal	No.	Contents	Specifications
TA1	1	Power supply for pulse generator	12 VDC (±5%), 200 mA max.*
	2		0 VDC (GND for power supply)
	3		5 VDC (±5%), 200 mA max.*
	4	Pulse input terminal phase A (+)	Line driver input (RS422 level) (maximum input frequency: 300 kHz)
	5	Pulse input terminal phase A (−)	
	6	Pulse input terminal phase B (+)	
	7	Pulse input terminal phase B (−)	
	8	Pulse input terminal phase Z (+)	
	9	Pulse input terminal phase Z (−)	
	10	Common terminal inputs	−
TA2	1	Pulse monitor output terminal phase A (+)	Line driver output (RS422 level output)
	2	Pulse monitor output terminal phase A (−)	
	3	Pulse monitor output terminal phase B (+)	
	4	Pulse monitor output terminal phase B (−)	
	5	Pulse monitor output terminal phase Z (+)	
	6	Pulse monitor output terminal phase Z (−)	
	7	Common terminal monitor outputs	−
TA3	(E)	Shield connection terminal	−

◆ Wiring

■ Wiring the PG-B2

The following illustrations show wiring examples for the PG-B2 using the option cards power supply or an external power source for supplying the PG.
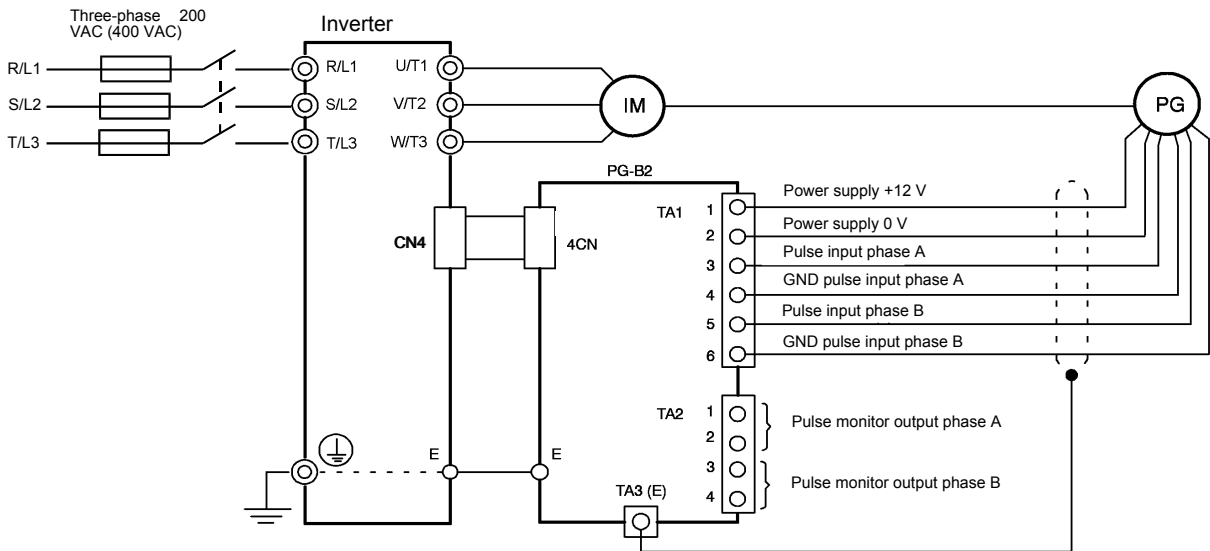
Fig 2.17 PG-B2 Wiring Using the Option Cards Power Supply

2
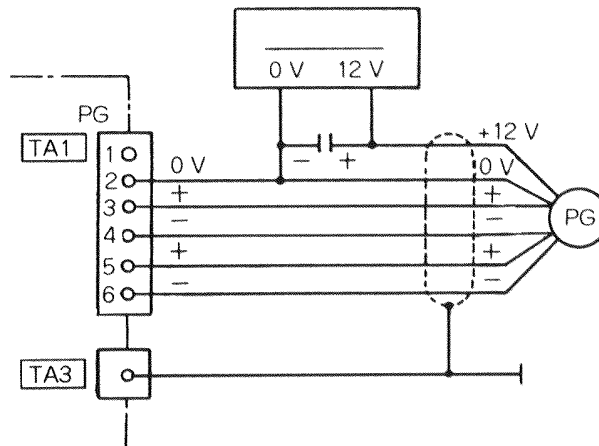
Fig 2.18 PG-B2 Wiring Using a 12 V External Power Supply

- Shielded twisted-pair wires must be used for signal lines.
- Do not use the pulse generator's power supply for anything other than the pulse generator (encoder). Using it for another purpose can cause malfunctions due to noise.
- The length of the pulse generator's wiring must not be more than 100 meters.
- The direction of rotation of the PG can be set in user parameter F1-05. The factory preset if for forward rotation, A-phase advancement.

A-phase pulses

B-phase pulses
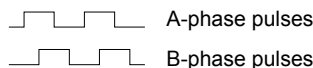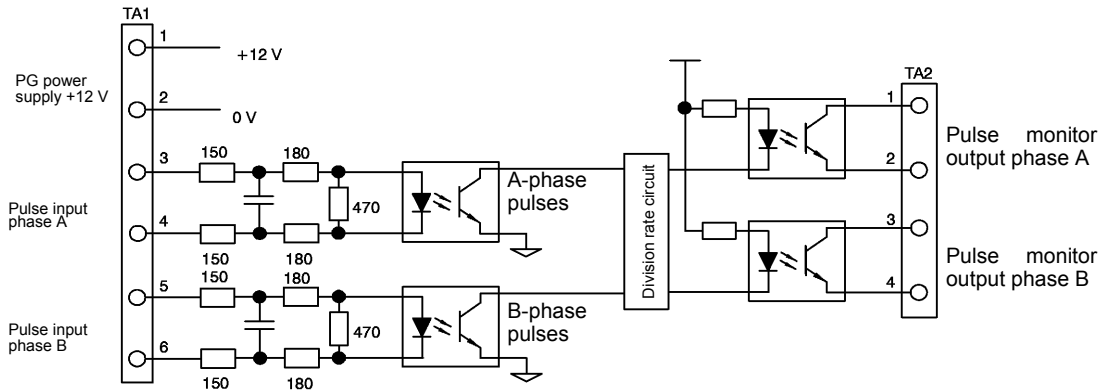
- When connecting to a voltage-output-type PG (encoder), select a PG that has an output impedance with a current of at least 12 mA to the input circuit photocoupler (diode).
- The pulse monitor dividing ratio can be changed using parameter F1-06.

Fig 2.19 I/O Circuit Configuration of the PG-B2

■Wiring the PG-X2

The following illustrations show wiring examples for the PG-X2 using the option cards power supply or an external power source for supplying the PG.
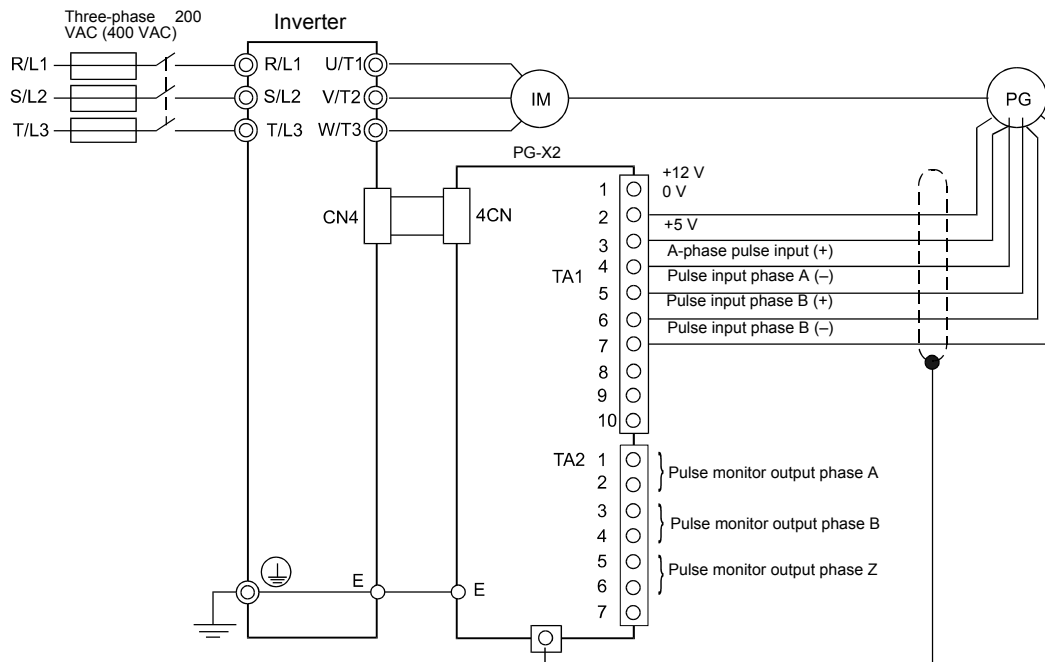
Fig 2.20 PG-X2 Wiring Using the Option Cards Power Supply
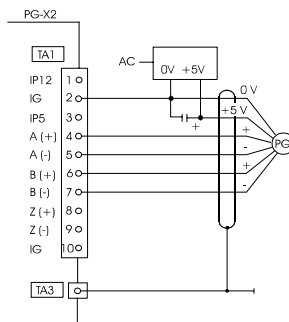
Fig 2.21 PG-X2 Wiring Using a 5 V External Power Supply

- Shielded twisted-pair wires must be used for signal lines.
- Do not use the pulse generator's power supply for anything other than the pulse generator (encoder). Using it for another purpose can cause malfunctions due to noise.
- The length of the pulse generator's wiring must not be more than 100 meters.
- The direction of rotation of the PG can be set in user parameter F1-05 (PG Rotation). The factory preset if for motor forward rotation, A-phase advancement.

◆ Wiring Terminal Blocks

Use not more than 100 meters of wiring for PG (encoder) signal lines and keep them separate from power lines.

Use shielded, twisted-pair wires for pulse inputs and pulse output monitor wires, and connect the shield to the shield connection terminal.

■Wire Sizes (Same for All Models)

Terminal wire sizes are shown in *Table 2.15*.

Table 2.15 Wire Sizes

Terminal	Terminal Screws	Wire Thickness (mm^2)	Wire Type
Pulse generator power supply Pulse input terminal Pulse monitor output terminal	-	0.5 to 1.0	• Shielded, twisted-pair wire • Shielded, polyethylene-covered, vinyl sheath cable
Shield connection terminal	M3.5	0.5 to 2.5	

■Straight Solderless Terminals

We recommend using straight solderless terminal on signal lines to simplify wiring and improve reliability.

Refer to *Table 2.9* for specifications.

2

■Cable Lug Connector Sizes and Tightening Torque

The lug sizes and tightening torques for various wire sizes are shown in *Table 2.16*.

Table 2.16 Cable Lugs and Tightening Torques

Wire Thickness [mm^2]	Terminal Screws	Crimp Terminal Size	Tightening Torque (N • m)
0.5		1.25 - 3.5	
0.75	M3.5	1.25 - 3.5	0.8
1.25		1.25 - 3.5	
2		2 - 3.5	

■Precautions

The wiring method is the same as the one used for straight solderless terminals. Refer to . Observe the following precautions when wiring.

- Separate the control signal lines for the PG Speed Control Card from main power lines and other control circuits.
- The shield must be connected to prevent operational errors caused by noise.
- Connect the shield (green grounding cable of the option card) to the shield terminal (E).
- Do not solder the ends of wires. Doing so may cause contact faults.
- A separate power supply is required if the PG power supply consumption is higher than 200 mA. (If momentary power loss must be handled, use a backup capacitor or other method.)
- Make sure not to exceed the PG cards maximum input frequency. The output frequency of the pulse generator can be calculated using the following formula.

$$f_{PG} \ (Hz) = \frac{\text{Motor speed at maximum output frequency (min}^{-1})}{60} \times \text{PG rating (p/rev)}$$

3

Digital Monitor/ Operator and Modes

The Varispeed L7 is equipped with the Digital Monitor JVOP-163 which shows the drive status. The optional Digital Operator JVOP-160 can be used to adjust parameters as required.

A This chapter describes Digital Operator displays and functions, and provides an overview of operating modes and switching between modes.

LED Monitor JVOP-163

◆ LED Monitor

Indicators the operation status by the combination of the LED display (Lights up, Blink, and Off) at RUN, DS1, and DS2.

The LED pattern is as follows at each mode.

Operation Mode Indicators
RUN: Lights up during inverter run, Off if the inverter is stopped
DS1: Drive Status 1
DS2: Drive Status 2
The combination of the three LEDs Run, DS1 and DS2 indicates the drive status.

Drive Status Indications

Alarm Indications

Fault Indications

LED MONITOR JVOP-163

RUN	DS1	DS2	POWER	STATUS
	●	●		READY
	●	●		RUN
		●		ALARM(RUN)
●	●			Base Block
●				External Fault /Sequence Error
●		●		Other Fault
●				OV,UV
●	●			OH,OL
●				OC,GF,SC,PGO
●				CPF,PUF

☼ : LIGHT
◑ : BLINK
● : LIGHT OFF

◆ LED Display Examples

Normal operation: The figure below shows the LED display when the drive is ready and no FWD/REV signal is active
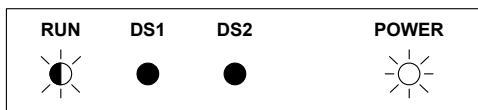
Alarm: The figure below shows an example of the LED display when a minor fault occurs. Refer to Chapter 6 and take appropriate countermeasures.
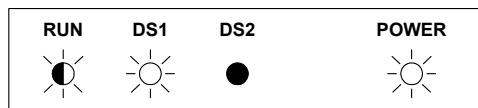
Fault: The figure below shows an example of the LED display when an OV or UV fault has occurred
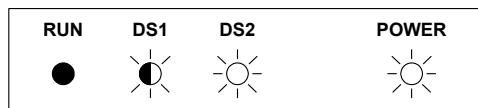
Digital Operator JVOP-160

◆ **Digital Operator Display**

The key names and functions of the Digital Operator are described below.

Drive Status Indicators

FWD: Lights up when a forward run command is input.
REV: Lights up when a reverse run command is input.
SEQ: Lights up when any other run command source than the digital operator is selected
REF: Lights up when any other frequency reference source than the digital operator is selected
ALARM: Lights up when an error or alarm has occurred.

Data Display

Displays monitor data, parameter numbers, and settings.

Mode Display (displayed at the upper left of data display)

DRIVE: Lights up in Drive Mode.
QUICK: Lights up in Quick Programming Mode.
ADV: Lights up in Advanced Programming Mode.
VERIFY: Lights up in Verify Mode.
A. TUNE: Lights up in Autotuning Mode.

Keys

Execute operations such as setting parameters, monitoring, jogging, and autotuning.

Fig 3.22 Digital Operator Component Names and Functions

◆ **Digital Operator Keys**

The names and functions of the Digital Operator Keys are described in .

Table 3.17 Key Functions

Key	Name	Function
LOCAL REMOTE	LOCAL/REMOTE Key	Switches between operation via the Digital Operator (LOCAL) and control circuit terminal operation (REMOTE). This key can be enabled or disabled by setting parameter o2-01.
MENU	MENU Key	Selects modes.
ESC	ESC Key	Returns to the status before the DATA/ENTER key was pressed.

Table 3.17 Key Functions (Continued)

Key	Name	Function
JOG	JOG Key	Enables jog operation when the Inverter is operated from the Digital Operator.
FWD / REV	FWD/REV Key	Selects the rotation direction of the motor when the Inverter is operated from the Digital Operator.
» RESET	Shift/RESET Key	Sets the active digit when programming parameters. Also acts as the Reset key when a fault has occurred.
⌃	Increment Key	Selects menu items, sets parameter numbers, and increments set values. Used to move to the next item or data.
⌄	Decrement Key	Selects menu items, sets parameter numbers, and decrements set values. Used to move to the previous item or data.
↵	DATA/ENTER Key	Pressed to enter menu items, parameters, and set values. Also used to switch from one screen to another.
RUN	RUN Key	Starts the Inverter operation when the Inverter is being controlled by the Digital Operator.
STOP	STOP Key	Stops Inverter operation. This key can be enabled or disabled when operating from the control circuit terminal by setting parameter o2-02.

Note: Except in diagrams, Keys are referred to the key names listed in the above table.

There are indicators on the upper left of the RUN and STOP keys on the Digital Operator. These indicators will light and flash to indicate operating status.

The RUN key indicator will flash and the STOP key indicator will light during initial excitation or DC braking. The relationship between the indicators on the RUN and STOP keys and the Inverter status is shown in *Fig 3.23*.
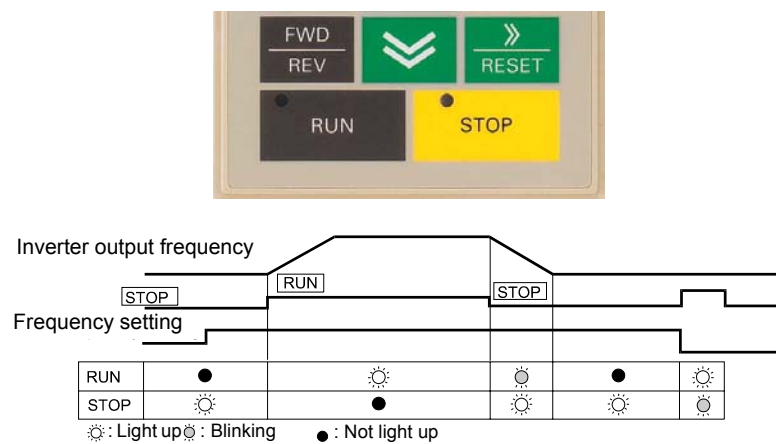
Fig 3.23 RUN and STOP Indicators

◆ Inverter Modes

The Inverter's parameters and monitoring functions are organized in five groups that make it easier to read and adjust parameters.

The 5 modes and their primary functions are shown in the *Table 3.18*.

Table 3.18 Modes

Mode	Primary function(s)
Drive mode	Use this mode to start/stop the inverter, to monitor values such as the frequency references or output current and for displaying fault information or the fault history.
Quick programming mode	Use this mode to read and set the basic parameters.
Advanced programming mode	Use this mode to reference and set all parameters.
Verify mode	Use this mode to read/set parameters that have been changed from their factory-set values.
Autotuning mode*	Use this mode when running a motor with unknown motor data in the vector control modes. The motor data are measured/calculated and set automatically. This mode can also be used to measure only the motor line-to-line resistance.

* Always perform autotuning with the motor before operating in the vector control modes.

3

◆ Switching Modes

The mode selection display will appear when the MENU key is pressed. Press the MENU key from the mode selection display to switch through the modes in sequence.

Press the DATA/ENTER key to enter a mode and to switch from a monitor display to the setting display.
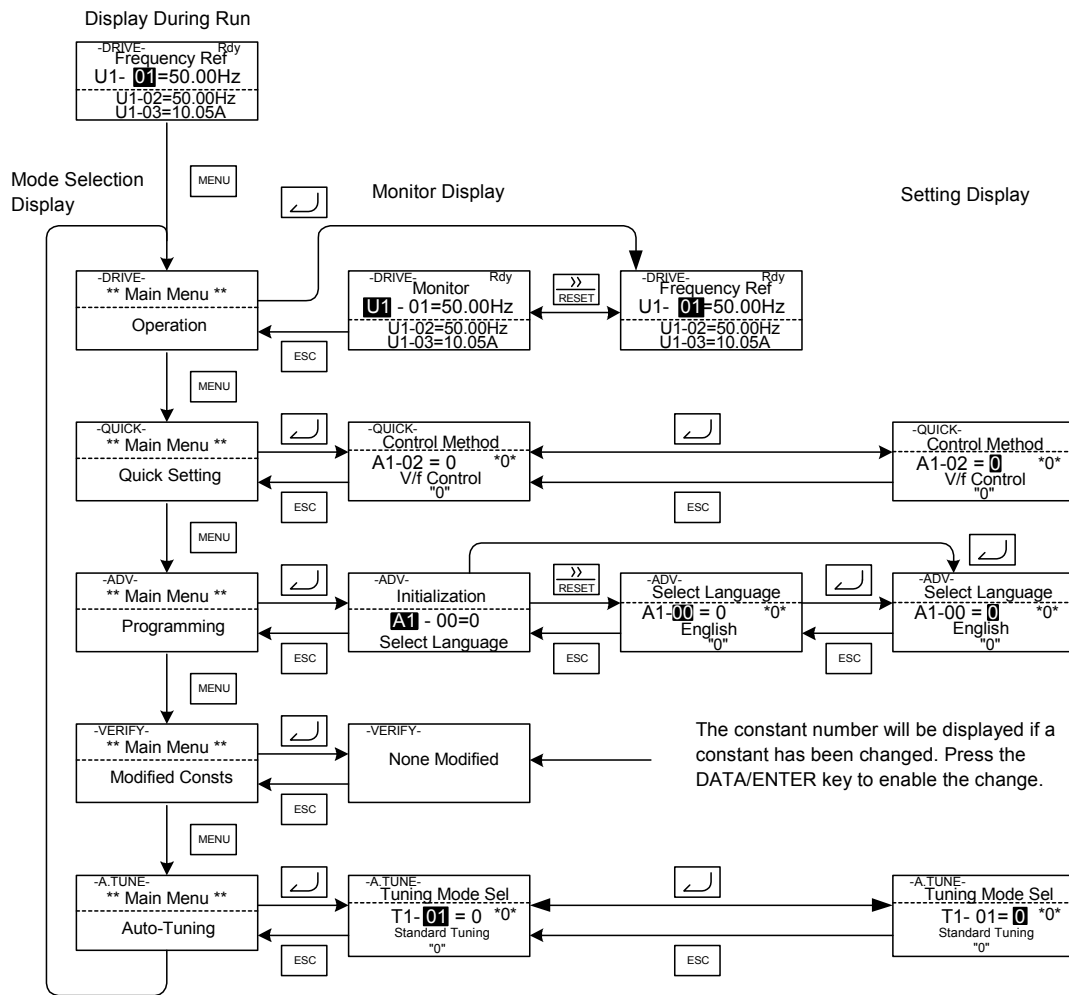
Fig 3.24 Mode Transitions

To run the inverter after viewing/changing parameters press the MENU key and the DATA/ENTER key in sequence to enter the Drive mode. A Run command is not accepted as long as the drive is in any other mode.
To enable Run commands from the terminals during programming set parameter b1-08 to "1".

3

◆ Drive Mode

The Drive mode is the mode in which the Inverter can be operated. All monitor parameters (U1-□□) as well as fault information and the fault history can be displayed in this mode

When b1-01 (Reference selection) is set to 0, the selected frequency reference value (d1-□□) can be changed in the frequency setting display using the Increment, Decrement, Shift/RESET and Enter keys. The parameter will be written and the display returns to the Monitor display.

■Example Operations

Example key operations in drive mode are shown in the following figure.
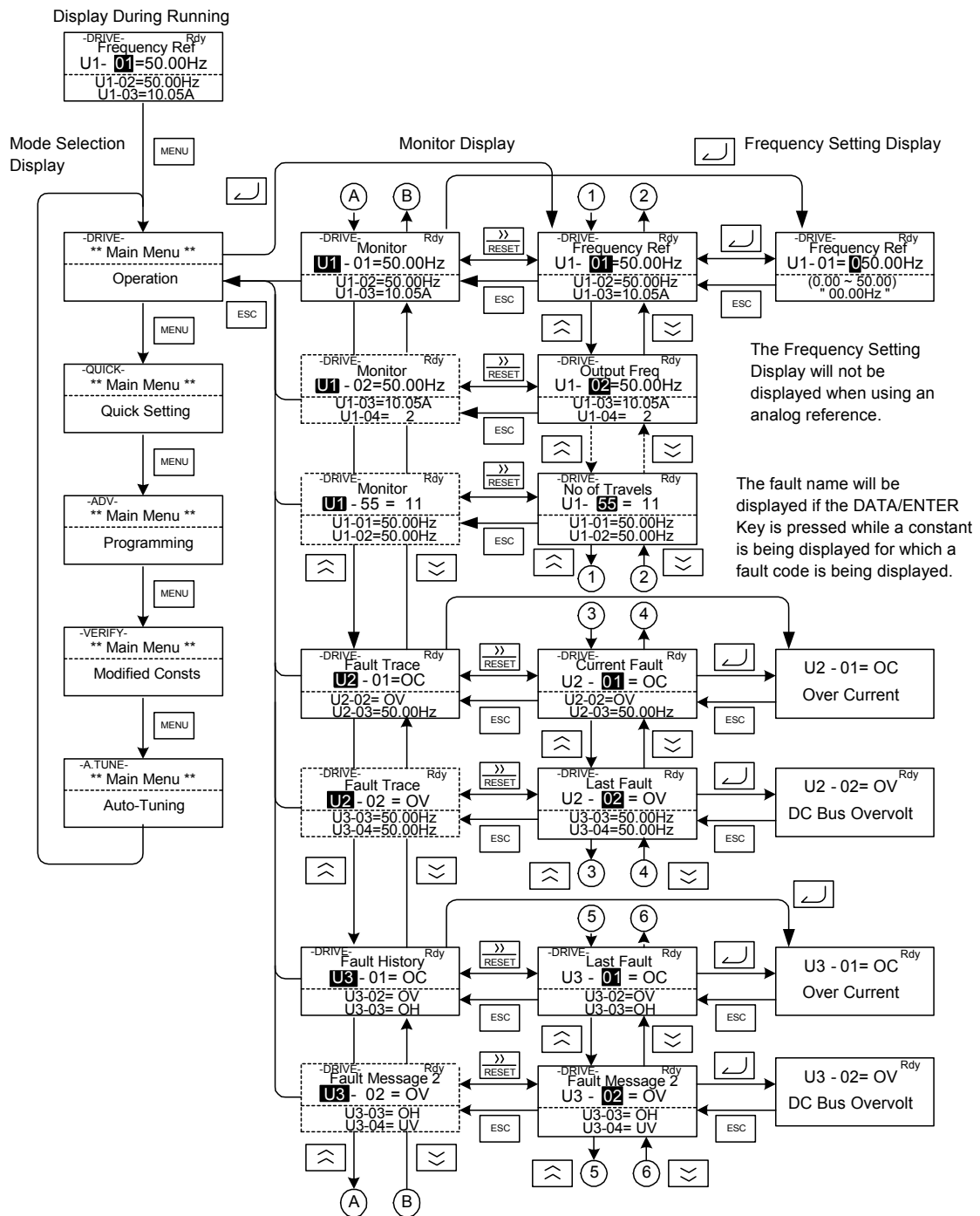
Fig 3.25 Operations in Drive Mode

Note: 1. When changing the display with the Increment / Decrement keys, the next display after the one for the last parameter number will be the one for the first parameter number and vice versa. For example, the next display after the one for U1-01 will be U1-55. This is indicated in the figures by the letters A and B and the numbers 1 to 6.

2. The display for the first monitor parameter (frequency reference) will be displayed when power is turned ON. The monitor item displayed at startup can be set in o1-02 (Monitor Selection after Power Up).Operation cannot be started from the mode selection display.

◆ Quick Programming Mode

In quick programming mode, the basic parameters required for the elevator operation like speeds, acceleration/deceleration times etc. can be monitored and set.

The parameters can be changed from the setting displays. Use the Increment, Decrement, and Shift/RESET keys to change the frequency. The parameter will be written and the monitor display will be returned to when the DATA/ENTER key is pressed after changing the setting.

Refer to *Chapter 4, User Parameters* for details on the parameters displayed in quick programming mode.

■Example Operations

Example key operations in quick programming mode are shown in the following figure.
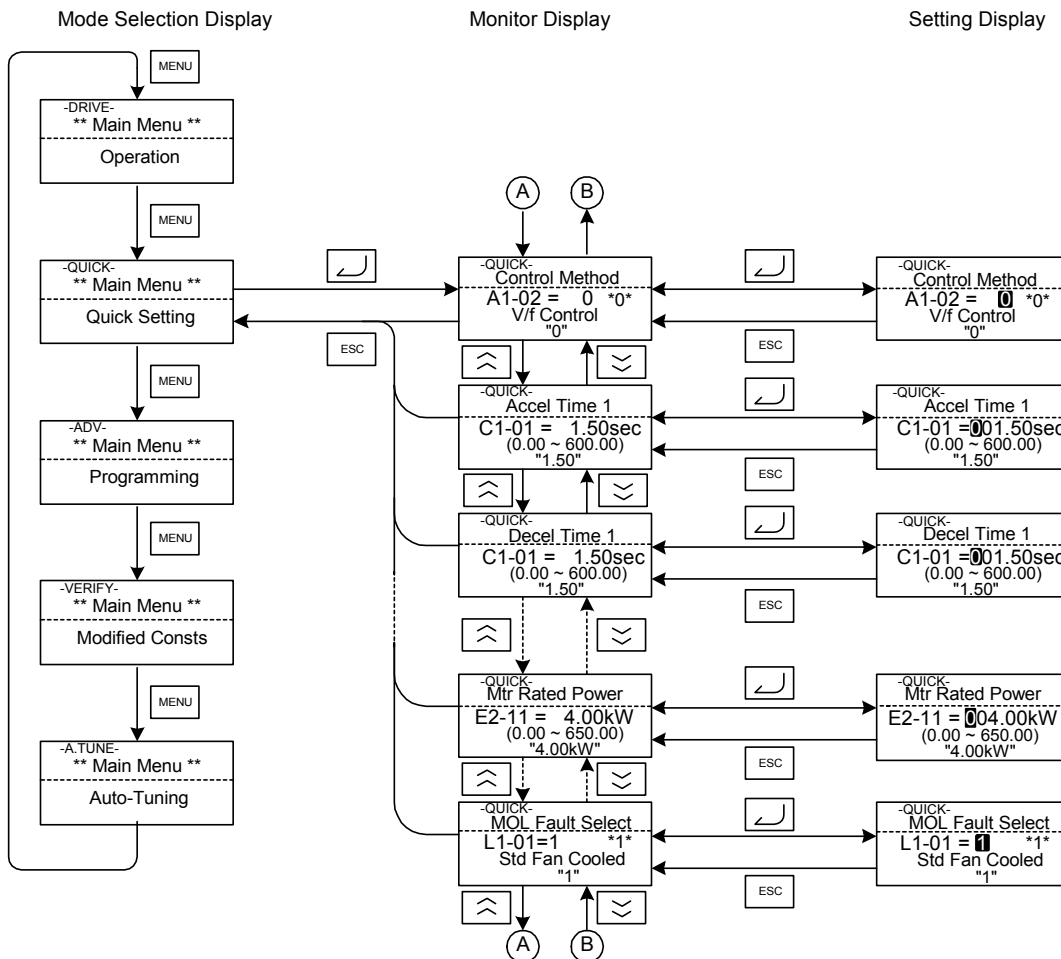
Fig 3.26 Operations in Quick Programming Mode

◆ Advanced Programming Mode

In advanced programming mode all Inverter parameters can be monitored and set.

A parameter can be changed from the setting displays using the Increment, Decrement, and Shift/RESET keys. The parameter will be saved and the display will return to monitor display when the DATA/ENTER key is pressed after changing the setting.

Refer to *Chapter 4, User Parameters* for details on the parameters.

■Example Operations

Example key operations in advanced programming mode are shown in the following figure.
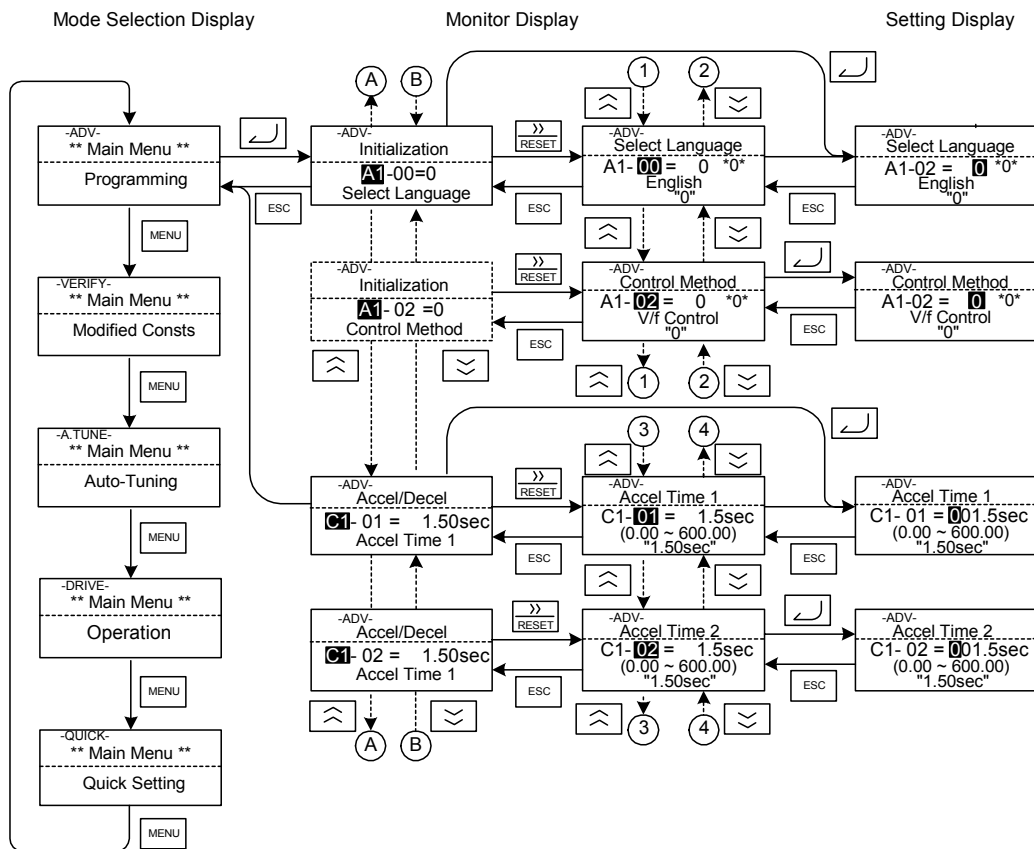
Fig 3.27 Operations in Advanced Programming Mode

■Setting Parameters

Here the procedure to change C1-01 (Acceleration Time 1) from 1.5 s to 2.5 s is shown.

Table 3.19 Setting Parameters in Advanced Programming Mode

Step No.	Digital Operator Display	Description
1	-DRIVE-　　　Rdy Frequency Ref U1- **01**=50.00Hz U1-02=50.00Hz U1-03=10.05A	Power supply turned ON.
2	-DRIVE- ** Main Menu ** ------------------ Operation	Press the MENU key 3 times to enter the advanced programming mode.
3	-QUICK- ** Main Menu ** ------------------ Quick Setting	Press the MENU key 3 times to enter the advanced programming mode.
4	-ADV- ** Main Menu ** ------------------ Programming	Press the MENU key 3 times to enter the advanced programming mode.
5	-ADV- Initialization ------------------ **A1**-00=1 Select Language	Press the DATA/ENTER to access the monitor display.
6	-ADV- Accel / Decel ------------------ **C1**-00 = 1.50sec Accel Time 1	Press the Increment or Decrement key to display the parameter C1-01 (Acceleration Time 1).
7	-ADV- Accel Time 1 ------------------ C1-01 = **0**01.50sec (0.00 ~ 600.0) "1.50sec"	Press the DATA/ENTER key to access the setting display. The current setting value of C1-01 is displayed.
8	-ADV- Accel Time 1 ------------------ C1-01 = 0**0**1.50sec (0.00 ~ 600.0) "1.50sec"	Press the Shift/RESET key to move the flashing digit to the right.
9	-ADV- Accel Time 1 ------------------ C1-01 = 00**1**.50sec (0.00 ~ 600.0) "1.50sec"	Press the Increment key to change set value to 2.50 s.
10	-ADV- Accel Time 1 ------------------ C1-01 = 00**2**.50sec (0.00 ~ 600.0) "1.50sec"	Press the DATA/ENTER key to save the set data.
11	-ADV- Entry Accepted	"Entry Accepted" is displayed for 1 sec after pressing the DATA/ENTER key.
12	-ADV- Accel Time 1 ------------------ C1-**01** = 2.50sec (0.00 ~ 600.0) "1.50sec"	The display returns to the monitor display for C1-01.

◆ Verify Mode

The Verify mode is used to display any parameters that have been changed from their default settings in a programming mode or by autotuning. "None" will be displayed if no settings have been changed.

The parameter A1-02 is the only parameter from the A1-☐☐ group, which will be displayed in the modified constant list if it has been changed before. The other parameters will not be displayed, even if they are different from the default setting.

In the verify mode, the same procedures can be used to change settings as they are used in the programming mode. Use the Increment, Decrement, and Shift/RESET keys to change a setting. When the DATA/ENTER key is pressed the parameter setting are written and the display returns to the Monitor display.

■ Example Operations

In the example below the following settings have been changed from their default settings:

- C1-01 (Acceleration Time 1)
- C1-02 (Acceleration Time 2)
- E1-01 (Input Voltage Setting)
- E2-01 (Motor Rated Current).

Mode Selection Display   Monitor Display   Setting Display
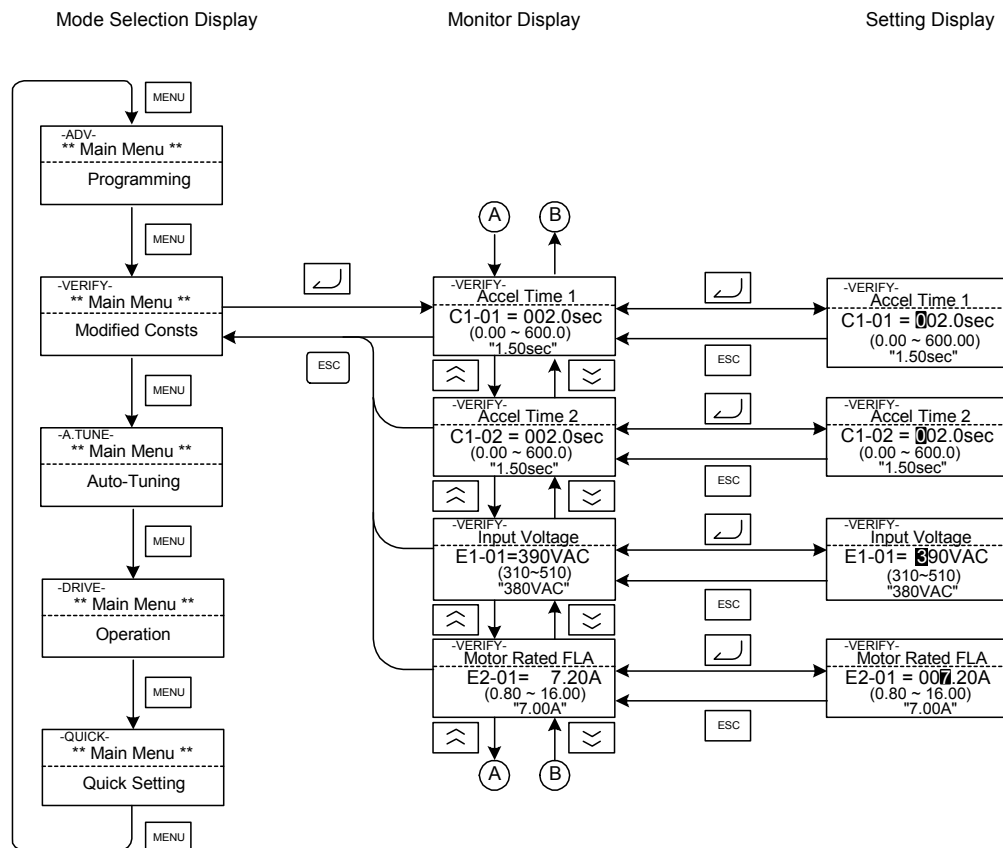
Fig 3.28 Operations in Verify Mode

◆ Autotuning Mode

Autotuning automatically measures and sets the required motor data in order to achieve the maximum performance. Always perform autotuning before starting operation when using the vector control modes.

When V/f control has been selected, stationary autotuning for line-to-line resistance can be selected only.

When the motor cannot be operated (e.g. if the ropes cannot be removed from the traction sheave), and Open Loop or Closed Loop Vector Control shall be used, perform stationary autotuning.

■Example of Operation for V/f control

The tuning method for V/f control is fixed to the measurement of the terminal resistance (T1-01=1). Input the the rated output power and the rated current specified on the nameplate of the motor and then press the RUN key. The motor data are measured automatically.

Always set the above items. Otherwise autotuning cannot be started, e.g. it cannot be started from the motor rated voltage input display.

A parameter can be changed from the setting displays using the Increment, Decrement, and Shift/RESET keys. The parameter will be saved when the DATA/ENTER key is pressed.

The following flowchart shows a V/f control Autotuning example.
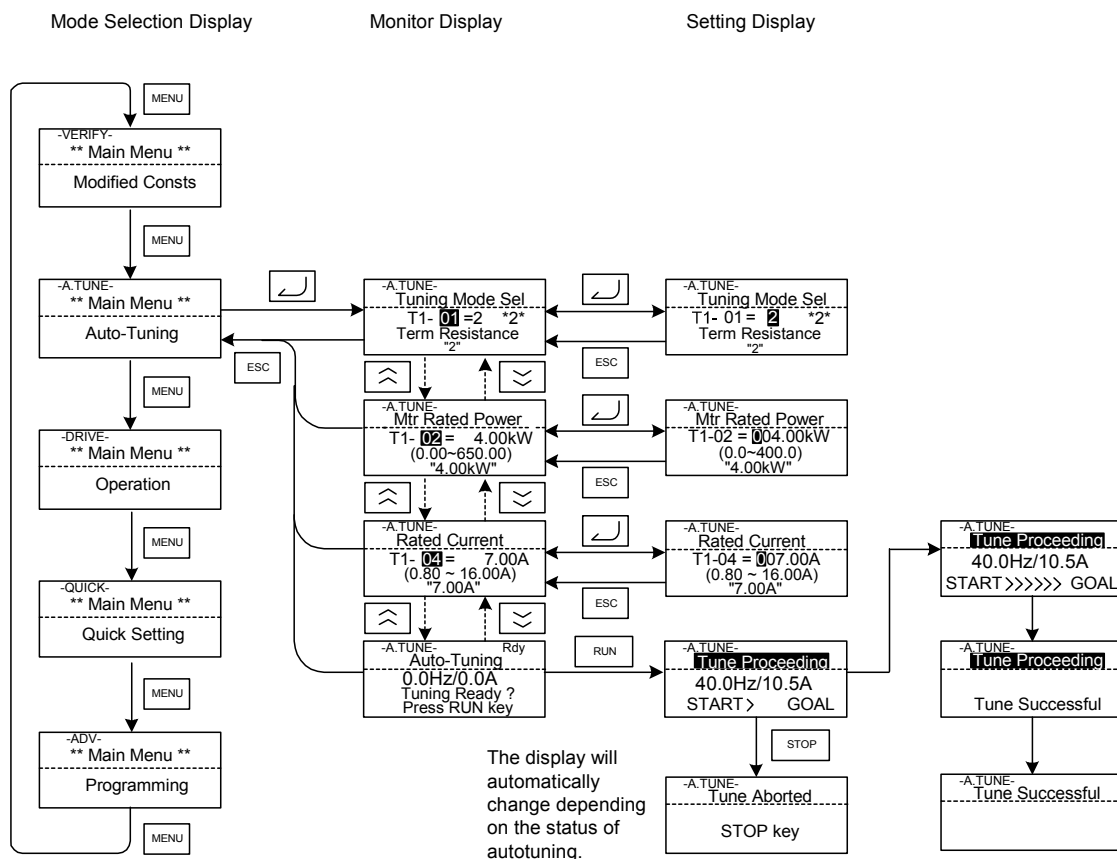
Fig 3.29 Operation in Autotuning Mode

If a fault occurs during autotuning, refer to *Chapter 6, Troubleshooting.*

4

User Parameters

This chapter describes all user parameters that can be set in the Inverter.

4

User Parameter Descriptions

This section describes the contents of the user parameter tables.

◆ Description of User Parameter Tables

User parameter tables are structured as shown below. Here, b1-01 (Frequency Reference Selection) is used as an example.

Parame-ter Num-ber	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Regis-ter	Page
						V/f	Open Loop Vector	Closed Loop Vector		
b1-01	Reference selection	Sets the frequency reference input method. 0: Digital Operator/Monitor 1: Control circuit terminal (analog input) 2: MEMOBUS communications 3: Option Card	0 to 3	0	No	Q	Q	Q	180H	-

- Parameter Number: The number of the user parameter.

- Name: The name of the user parameter.

- Display The display shown in the Digital Operator JVOP-160

- Description: Details on the function or settings of the user parameter.

- Setting Range: The setting range for the user parameter.

- Factory Setting: The factory setting (each control method has its own factory setting. Therefore the factory setting changes when the control method is changed.)

  Refer to page for factory settings that are changed by setting the control method.

- Change during Operation: Indicates whether the parameter can be changed or not while the Inverter is in operation.

  Yes: Changes are possible during operation.

  No: Changes are not possible during operation.

- Control Methods: Indicates the control methods in which the user parameter can be monitored or set.

  Q: The item can be monitored and set as well in quick programming mode as in advanced programming mode.

  A: The item can be monitored and set in advanced programming mode only.

  No: The item cannot be monitored or set in this control method.

- MEMOBUS Register: The register number used for MEMOBUS communications.

- Page: Reference page for more detailed information about the parameter.

Digital Operation Display Functions and Levels

The following figure shows the Digital Operator/Monitor display hierarchy for the Inverter.

MENU

Drive Mode

Inverter can be operated and its status can be displayed.

Quick Programming Mode

Minimum parameters required for operation can be monitored or set.

Advanced Programming Mode

All parameters can be monitored or set.

Verify Mode

Parameters changed from the default settings can be monitored or set.

Autotuning Mode

Automatically sets motor parameters for vector control or measures the line-to-line resistance for V/f control.

No.	Function	Page
U1	Status Monitor Parameters	4-45
U2	Fault Trace	4-49
U3	Fault History	4-50
A1	Initialize Mode	4-7
A2	User-specified Setting Mode	4-8
b1	Operation Mode Selections	4-9
b2	DC Injection Braking	4-9
b4	Timer Function	4-10
b6	Dwell Functions	4-10
C1	Acceleration/Deceleration	4-11
C2	S-curve Acceleration/Deceleration	4-12
C3	Motor Slip Compensation	4-13
C4	Torque Compensation	4-14
C5	Speed Control (ASR)	4-15
C6	Carrier Frequency	4-15
d1	Speed References	4-16
d6	Field Forcing	4-17
E1	V/f Pattern	4-18
E2	Motor Setup	4-18
F1	PG Option Setup	4-20
F4	Analog Momitor Card	4-22
F5	Digital Output Card	4-23
F6	Serial Communications Settings	4-24
H1	Multi-function Digital Inputs	4-25
H2	Multi-function Digital Outputs	4-26
H3	Multi-function Analog Inputs	4-28
L1	Motor Overload	4-30
L2	Power Loss Ridethrough	4-30
L3	Stall Prevention	4-31
L4	Reference Detection	4-32
L5	Fault Restart	4-32
L6	Torque Detection	4-33
L7	Torque Limits	4-34
L8	Hardware Protection	4-34
N2	Automatic Frequency Regulator	4-36
o1	Monitor Selection	4-37
o2	Digital Operator/Monitor Functions	4-38
o3	Copy Function	4-40
S1	Brake Sequence	4-40
S2	Slip Compensation	4-43
S3	Special Sequence Functions	4-43
T1	Motor Autotuning	4-44

4

◆ User Parameters Available in Quick Programming Mode

The minimum user parameters required for Inverter operation can be monitored and set in quick programming mode. The user parameters displayed in quick programming mode are listed in the following table. These, and all other user parameters, are also displayed in advanced programming mode.

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	MEMO-BUS Register
A1-02	Control method selection / Control Method	Sets the control method for the Inverter. 0: V/f control 2: Open-Loop Vector control 3: Closed Loop Vector control	0 to 3	0	No	Q	Q	Q	102H
C1-01	Acceleration time 1 / Accel Time 1	Sets the acceleration time to accelerate from 0 Hz to the maximum output frequency.	0.0 to 600.00 *1	1.50 s	Yes	Q	Q	Q	200H
C1-02	Deceleration time 1 / Decel Time 1	Sets the deceleration time to decelerate from the maximum output frequency to 0 Hz.							201H
C2-01	S-curve characteristic time at acceleration start / S-Crv Acc @ Start	When the S-curve characteristic time is set, the accel/decel times will increase by only half of the S-curve characteristic times at start and end.	0.00 to 2.50	0.50 s	No	Q	Q	Q	20BH
C2-02	S-curve characteristic time at acceleration end / S-Crv Acc @ End		0.00 to 2.50	0.50 s	No	Q	Q	Q	20CH
C2-03	S-curve characteristic time at deceleration start / S-Crv Dec @ Start		0.00 to 2.50	0.50 s	No	Q	Q	Q	20DH
C2-04	S-curve characteristic time at deceleration end / S-Crv Dec @ End		0.00 to 2.50	0.50 s	No	Q	Q	Q	20EH
C2-05	S-curve Characteristic time below leveling speed / Scurve @ leveling		0.00 to 2.50	0.50 s	No	Q	Q	Q	232H
C5-01	ASR proportional (P) gain 1 / ASR P Gain 1	Set the proportional gain 1 and the integral time 1 of the speed control loop (ASR) for the minimum frequency. The settings becomes active for acceleration only.	0.00 to 300.00 *1	40.00 *2	Yes	No	No	Q	21BH
C5-02	ASR integral time 1 / ASR I Time 1		0.000 to 10.000	0.500 s *2	Yes	No	No	Q	21CH
C5-03	ASR proportional (P) gain 2 / ASR P Gain 2	Set the proportional gain 2 and the integral time 2 of the speed control loop (ASR) for the maximum frequency.	0.00 to 300.00 *1	20.00 *2	Yes	No	No	Q	21DH
C5-04	ASR integral (I) time 2 / ASR I Time 2		0.000 to 10.000	0.500 s *2	Yes	No	No	Q	21EH
C5-06	ASR delay time / ASR Delay Time	Sets the filter time constant; the time from the speed loop to the torque command output. Usually changing this setting is not necessary.	0.000 to 0.500	0.004 ms	No	No	No	Q	220H

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	MEMOBUS Register
C5-09	ASR proportional (P) gain 3 / ASR P Gain 3	Set the proportional gain 3 and the integral time 3 of the speed control loop (ASR) for the minimum frequency. The settings becomes active for deceleration only.	0.00 to 300.00	40.00 *2	Yes	No	No	Q	22EH
C5-10	ASR integral (I) time 3 / ASR I Time 3		0.000 to 10.000	0.500 s *2	Yes	No	No	Q	231H
d1-09	Nominal speed reference / Nomin Speed vn	Sets the frequency reference when the nominal speed is selected by a digital input.		50.00 Hz	Yes	Q	Q	Q	288H
d1-14	Inspection speed reference / Inspect Speed vi	Sets the frequency reference when the inspection speed is selected by a digital input	0 to 120.00	25.00 Hz	Yes	Q	Q	Q	28FH
d1-17	Leveling speed reference / Level Speed vl	Sets the frequency reference when the leveling speed is selected by a digital input		4.00 Hz	Yes	Q	Q	Q	292H
E1-01	Input voltage setting / Input Voltage	Sets the inverter input voltage. This set value will be the basis for the protection functions.	155 to 255 *2	200 V *2	No	Q	Q	Q	300H
E1-04	Max. output frequency (FMAX) / Max Frequency		40.0 to 120.0	50.0 Hz	No	Q	Q	Q	303H
E1-05	Max. voltage (VMAX) / Max Voltage		0.0 to 255.0 *2	190.0 V *2	No	Q	Q	Q	304H
E1-06	Base frequency (FA) / Base Frequency		0.0 to 120.0	50.0 Hz *3	No	Q	Q	Q	305H
E1-08	Mid. output frequency voltage (VB) / Mid voltage A		0.0 to 255 *1	12.5 V *1 *2	No	Q	Q	No	307H
E1-09	Min. output frequency (FMIN) / Min Frequency		0.0 to 120.0	0.3 Hz *3	No	Q	Q	A	308H
E1-10	Min. output frequency voltage (VMIN) / Min Voltage		0.0 to 255.0 *1	2.5 V *1 *2	No	Q	Q	No	309H
E2-01	Motor rated current / Mtr Rated Power	Sets the motor rated current in Amps. This set value becomes the base value for motor protection and torque limit. It is an input data for autotuning.	1.75 to 35.00 *4	14.00 A *5	No	Q	Q	Q	30EH
E2-02	Motor rated slip / Motor Rated Slip	Sets the motor rated slip. This set value will become the reference value for the slip compensation. This parameter is automatically set during autotuning.	0.00 to 20.00	2.73 Hz *2	No	Q	Q	Q	30FH
E2-03	Motor no-load current / No-Load Current	Sets the motor no-load current. This parameter is automatically set during autotuning.	0.00 to 13.99 *3	4.50 A *2	No	Q	Q	Q	310H
E2-04	Number of motor poles / Number of Poles	Sets the number of motor poles. It is an input data for autotuning.	2 to 48	4	No	No	No	Q	311H

The Description cell spanning E1-04 to E1-10 contains a graph:

VMAX (E1-05) (V BASE) (E1-13) — VC (E1-08) — VMIN (E1-10); FMIN (E1-09), FB (E1-07), FA (E1-06), FMAX (E1-04)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Control Methods Open Loop Vector	Control Methods Closed Loop Vector	MEMO-BUS Register
E2-05	Motor line-to-line resistance / Term Resistance	Sets the motor phase-to-phase resistance. This parameter is automatically set during autotuning.	0.000 to 65.000	0.771 Ω *2	No	Q	Q	Q	312H
E2-11	Motor rated output power / Mtr Rated Power	Sets the rated output power of the motor. This parameter is an input data for autotuning.	0.00 to 650.00	3.70 *3	No	Q	Q	Q	318H
F1-01	PG constant / PG Pulses/Rev	Sets the number of PG pulses per revolution	0 to 60000	1024	No	No	No	Q	380H
F1-05	PG rotation / PG Rotation Sel	0: Phase A leads with forward run command. (Phase B leads with reverse run command.) 1: Phase B leads with forward run command. (Phase A leads with reverse run command.)	0 or 1	0	No	No	No	Q	384H
L1-01	Motor protection selection / MOL Select	Set to enable or disable the motor overload protection function using the electronic thermal relay. 0: Disabled 1: Protection for general purpose motor (fan cooled) 2: Protection for frequency converter motor (external cooled) 3: Protection for special vector control motor	0 to 3	1	No	Q	Q	Q	480H

* 1. The setting ranges for acceleration/deceleration times depends on the setting of C1-10 (Acceleration/deceleration Time Setting Unit). If C1-10 is set to 0, the setting range is 0.00 to 600.00 (s).
* 2. These are values for a 200 V class Inverter. Values for a 400 V class Inverter are double.
* 3. The factory setting will change when the control method is changed. (Open Loop Vector control factory settings are given.)
* 4. After autotuning, E1-13 will contain the same value as E1-05.
* 5. The factory setting depends on the Inverter capacity. (The value for a 200 V Class Inverter for 3.7 kW is given.)
* 6. The setting range is from 10% to 200% of the Inverter rated output current. (The value for a 200 V Class Inverter for 3.7 kW is given.)

User Parameter Tables

◆ A: Setup Settings

■ Initialize Mode: A1

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Control Methods Open Loop Vector	Control Methods Closed Loop Vector	MEMO-BUS Register	Page
A1-00	Language selection for Digital Operator display / Select Language	Used to select the language displayed on the Digital Operator (JVOP-160 only). 0: English 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese This parameter is not changed by the initialize operation.	0 to 6	0	Yes	A	A	A	100H	–
A1-01	Parameter access level / Access Level	Used to set the parameter access level (set/read.) 0: Monitoring only (Monitoring drive mode and setting A1-01 and A1-04.) 1: Used to select user parameters (Only parameters set in A2-01 to A2-32 can be read and set.) 2: Advanced (Parameters can be read and set in both, quick programming mode (Q) and advanced programming mode (A).)	0 to 2	2	Yes	A	A	A	101H	5-63 5-64
A1-02	Control method selection / Control Method	Used to select the control method for the Inverter 0: V/f control 2: Open loop vector 3: Closed Loop Vector This parameter is not changed by the initialize operation.	0 to 3	0	No	Q	Q	Q	102H	-
A1-03	Initialize / Init Parameters	Used to initialize the parameters using the specified method. 0: No initializing 1110: Initializes using the user parameters 2220: Initializes using a two-wire sequence. (Initializes to the factory setting.)	0 to 2220	0	No	A	A	A	103H	-
A1-04	Password / Enter Password	Password input when a password has been set in A1-05. This function write-protects some parameters of the initialize mode. If the password is changed, A1-01 to A1-03 and A2-01 to A2-32 parameters can no longer be changed. (Programming mode parameters can be changed.)	0 to 9999	0	No	A	A	A	104H	5-63

4

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
A1-05	Password setting / Select Password	Used to set a four digit number as the password. Usually this parameter is not displayed. When the Password (A1-04) is displayed, hold down the RESET key and press the Menu key. The password will be displayed.	0 to 9999	0	No	A	A	A	105H	5-63

■User-set Parameters: A2

The parameters set by the user are listed in the following table.

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
A2-01 to A2-32	User specified parameters / User Param 1 to 32	Used to select the function for each of the user specified parameters. User parameters are the only accessible parameters if Parameter Access Level is set to user parameters (A1-01=1)	b1-01 to S3-01	–	No	A	A	A	106H to 125H	5-64

◆ Application Parameters: b

■Operation Mode Selections: b1

Parameter Number	Name		Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register	Page
	Display						V/f	Open Loop Vector	Closed Loop Vector		
b1-01	Reference source selection		Sets the frequency reference input method. 0: Digital Operator/Monitor 1: Control circuit terminal (analog input) 2: MEMOBUS communications 3: Option Card	0 to 3	0	No	A	A	A	180H	*5-5*
	Reference Source										
b1-02	RUN command source selection		Sets the run command input method. 0: Digital Operator/Monitor 1: Control circuit terminal (digital multifunction inputs) 2: MEMOBUS communications 3: Option Card	0 to 3	1	No	A	A	A	181H	*5-4*
	Run Source										
b1-06	Control input scan		Used to set the responsiveness of the control inputs (forward/reverse and multi-function inputs.) 0: Fast reading 1: Normal reading (Can be used for possible malfunction due to noise.)	0 or 1	1	No	A	A	A	185H	-
	Cntl Input Scans										
b1-08	Run command selection in programming modes		Used to set an operation prohibition in programming modes. 0: Operation prohibited. 1: Operation permitted (Disabled when Digital Operator/Monitor is the selected Run command source (b1-02 = 0)).	0 or 1	1	No	A	A	A	187H	-
	RUN CMD at PRG										
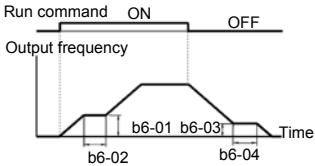
■DC Injection Braking: b2

Parameter Number	Name		Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register	Page
	Display						V/f	Open Loop Vector	Closed Loop Vector		
b2-08	Magnetic flux compensation volume		Sets the magnetic flux compensation as a percentage of the no-load current.	0 to 1000	0%	No	No	A	No	190H	-
	Field Comp										

4

■Timer Function: b4

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
b4-01	Timer function ON-delay time / Delay-ON Timer	Sets the timer function output ON-delay time (dead band) for the timer function input, in 1-second units. Enabled when a timer function is set in H1-□□ or H2-□□.	0.0 to 3000.0	0.0 s	No	A	A	A	1A3H	*5-44*
b4-02	Timer function OFF-delay time / Delay-OFF Timer	Sets the timer function output OFF-delay time (dead band) for the timer function input, in 1-second units. Enabled when a timer function is set in H1-□□ or H2-□□.	0.0 to 3000.0	0.0 s	No	A	A	A	1A4H	*5-44*

■Dwell Functions: b6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
b6-01	Dwell frequency at start / Dwell Ref @ Start		0.0 to 120.0	0.0 Hz	No	A	A	A	1B6H	*5-20*
b6-02	Dwell time at start / Dwell Time @ Start	The dwell function can be used to hold the output frequency temporarily.	0.0 to 10.0	0.0 s	No	A	A	A	1B7H	*5-20*
b6-03	Dwell frequency at stop / Dwell Ref @ Stop		0.0 to 120.0	0.0 Hz	No	A	A	A	1B8H	*5-20*
b6-04	Dwell time at stop / Dwell Time @ Stop		0.0 to 10.0	0.0 s	No	A	A	A	1B9H	*5-20*
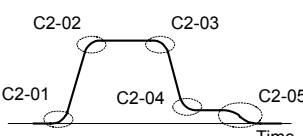
◆ Tuning Parameters: C

■Acceleration/Deceleration: C1

Parame-ter Number	Name	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Register	Page
	Display					V/f	Open Loop Vector	Closed Loop Vector		
C1-01	Acceleration time 1	Sets the acceleration time to accelerate from 0 Hz to the maximum output frequency.			Yes	Q	Q	Q	200H	*5-17*
	Accel Time 1									
C1-02	Deceleration time 1	Sets the deceleration time to decelerate from the maximum output frequency to 0 Hz.			Yes	Q	Q	Q	201H	*5-17*
	Decel Time 1									
C1-03	Acceleration time 2	Sets the acceleration time when the multi-function input "accel/decel time 1" is set to ON.			Yes	A	A	A	202H	*5-17*
	Accel Time 2									
C1-04	Deceleration time 2	Sets the deceleration time when the multi-function input "accel/decel time 1" is set to ON.	0.00 to 600.00 *1	1.50 s	Yes	A	A	A	203H	*5-17*
	Decel Time 2									
C1-07	Acceleration time 4	Sets the acceleration time when the frequency reference is below the value set in C1-11.			No	A	A	A	206H	*5-17*
	Accel Time 4									
C1-08	Deceleration time 4	Sets the deceleration time when the frequency reference is below the value set in C1-11.			No	A	A	A	207H	*5-17*
	Decel Time 4									
C1-09	Emergency stop time	Sets the deceleration time when the frequency reference is below the value set in C1-11.			No	A	A	A	208H	*5-10*
	Fast Stop Time									
C1-10	Accel/decel time setting unit	0: 0.01-second units 1: 0.1-second units	0 or 1	0	No	A	A	A	209H	-
	Acc/Dec Units									
C1-11	Accel/decel time switching frequency	Sets the frequency for auto-matic acceleration/deceleration switching.	0.0 to 120.0	0.0 Hz	No	A	A	A	20AH	*5-17* *5-18*
	Acc/Dec SW Freq	If the output frequency is below the set frequency: Accel/decel time 4 If the output frequency is above the set frequency: Accel/decel time 1.								

* 1. The setting range for acceleration/deceleration times depends on the setting of C1-10. If C1-10 is set to 1, the setting range for acceleration/deceleration times becomes 0.0 to 6000.0 seconds.

4

■S-Curve Acceleration/Deceleration: C2

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	MEMOBUS Register	Page
C2-01	S-curve characteristic time at acceleration start / S-Crv Acc @ Start	Set the S-curve times at speed changes to reduce the jerk. The S-curves can be set separately for every kind of speed change. $T_{accel} = \frac{C2\text{-}01}{2} + C1\text{-}01 + \frac{C2\text{-}02}{2}$ $T_{decel} = \frac{C2\text{-}03}{2} + C1\text{-}02 + \frac{C2\text{-}04}{2}$ When the S-curve characteristic time is set, the accel/decel times will increase by only half of the S-curve characteristic times at start and end.	0.00 to 2.50	0.50 s	No	Q	Q	Q	20BH	*5-19*
C2-02	S-curve characteristic time at acceleration end / S-Crv Acc @ End		0.00 to 2.50	0.50 s	No	Q	Q	Q	20CH	*5-19*
C2-03	S-curve characteristic time at deceleration start / S-Crv Dec @ Start		0.00 to 2.50	0.50 s	No	Q	Q	Q	20DH	*5-19*
C2-04	S-curve characteristic time at deceleration end / S-Crv Dec @ End		0.00 to 2.50	0.50 s	No	Q	Q	Q	20EH	*5-19*
C2-05	S-curve Characteristic time below leveling speed / Scurve @ leveling		0.00 to 2.50	0.50 s	No	Q	Q	Q	232H	*5-19*

■Motor Slip Compensation: C3

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
C3-01	Slip compensation gain / Slip Comp Gain	Used to improve speed accuracy when operating with a load. Usually changing this setting is not necessary. Adjust this parameter under the following circumstances. • When motor speed is lower than the frequency reference increase the set value. • When motor speed is higher than the frequency reference decrease the set value. In Closed Loop Vector control this value is the gain for compensating the slip caused by temperature variation.	0.0 to 2.5	1.0	Yes	A	A	A	20FH	5-26
C3-02	Slip compensation delay time / Slip Comp Time	Sets the Slip Compensation delay time. Usually changing this setting is not necessary. Adjust this parameter under the following circumstances. • Reduce the setting when Slip Compensation responsiveness is low. • When speed is not stable, increase the setting.	0 to 10000	2000 ms	No	A	A	No	210H	5-26
C3-03	Slip compensation limit / Slip Comp Limit	Sets the slip compensation limit as a percentage of motor rated slip.	0 to 250	200%	No	A	A	No	211H	5-26
C3-04	Slip compensation selection during regeneration / Slip Comp Regen	0: Disabled. 1: Enabled. When the slip compensation during regeneration function has been activated and regeneration capacity increases momentarily, it might be necessary to use a braking option (braking resistor, braking resistor unit or braking unit.)	0 or 1	1	No	A	A	No	212H	5-26
C3-05	Output voltage limit operation selection / Output V limit Sel	0: Disabled. 1: Enabled. (The motor flux will be lowered automatically when the output voltage become saturated.)	0 or 1	1	No	No	A	A	213H	5-26

4

■Torque Compensation: C4

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
C4-01	Torque compensation gain / Torq Comp Gain	Sets the torque compensation gain. Usually changing this setting is not necessary. Adjust it under the following circumstances: • When the cable is long increase the set value. • When the motor capacity is smaller than the Inverter capacity (Max. applicable motor capacity), increase the set values. • When the motor is oscillating, decrease the set values. Adjust the torque compensation gain so that at minimum speed the output current does not exceed the Inverter rated output current. Do not change the torque compensation gain from its default (1.00) when using Open Loop Vector control.	0.00 to 2.50	1.00	Yes	A	A	No	215H	*5-27*
C4-02	Torque compensation delay time constant / Torq Comp Time	The torque compensation delay time is set in ms units. Usually changing this setting is not necessary. Adjust it under the following circumstances: • When the motor is oscillating, increase the set values. • When the responsiveness of the motor is low, decrease the set values.	0 to 10000	200 ms *	No	A	A	No	216H	*5-26*
C4-03	Starting torque compensation (FWD) / FTorqCmp @ Start	Sets the torque compensation value at start in FWD direction	0.0 to 200.0%	0.0%	No	No	A	No	217H	*5-26*
C4-04	Starting torque compensation (REV) / RTorqCmp @ Start	Sets the torque compensation value at start in REV direction	-200.0% to 0.0	0.0%	No	No	A	No	218H	*5-26*
C4-05	Starting torque compensation time constant / TorqCmpDelayT	Sets starting torque start-up time. When 0 ~ 4 ms is set, it is operated without filter.	0 to 200	10 ms	No	No	A	No	219H	*5-26*

* The factory setting will change when the control method is changed. (V/f control factory settings are given.)

■**Speed Control (ASR): C5**

Param-eter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods V/f	Control Methods Open Loop Vector	Control Methods Closed Loop Vector	MEMO-BUS Register	Page
C5-01	ASR propor-tional (P) gain 1 / ASR P Gain 1	Set the proportional gain 1 and the integral time 1 of the speed control loop (ASR) for the minimum fre-quency. The settings becomes active for acceleration only.	1.00 to 300.00	40.00	Yes	No	No	Q	21BH	*5-29*
C5-02	ASR integral (I) time 1 / ASR I Time 1		0.000 to 10.000	0.500 s	Yes	No	No	Q	21CH	*5-26*
C5-03	ASR propor-tional (P) gain 2 / ASR P Gain 2	Set the proportional gain 2 and the integral time 2 of the speed control loop (ASR) for the maximum fre-quency.	1.00 to 300.00	20.00	Yes	No	No	Q	21DH	*5-26*
C5-04	ASR integral (I) time 2 / ASR I Time 2		0.000 to 10.000	0.500 s	Yes	No	No	Q	21EH	*5-26*
C5-06	ASR delay time / ASR Delay Time	Sets the filter time constant; the time from the speed loop to the torque command output. Usually changing this setting is not necessary.	0.000 to 0.500	0.004	No	No	No	Q	220H	*5-26*
C5-08	ASR integral (I) limit / ASR I Limit	Set the parameter to a small value to prevent any radical load change. A setting of 100% is equal to the maxi-mum output frequency.	0 to 400	400%	No	No	No	A	222H	*5-26*
C5-09	ASR propor-tional (P) gain 3 / ASR P Gain 3	Set the proportional gain 3 and the integral time 3 of the speed control loop (ASR) for the minimum fre-quency. The settings becomes active for deceleration only.	1.00 to 300.00	40.00	Yes	No	No	Q	22EH	*5-26*
C5-10	ASR integral (I) time 3 / ASR I Time 3		0.000 to 10.000	0.500 s	Yes	No	No	Q	231H	*5-26*

■**Carrier Frequency: C6**

Param-eter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods V/f	Control Methods Open Loop Vector	Control Methods Closed Loop Vector	MEMO-BUS Register	Page
C6-02	Carrier fre-quency selection / CarrierFreq Sel	Selects the carrier frequency. 1: 2 kHz 2: 5 kHz 3: 8 kHz 4: 10 kHz 5: 12.5 kHz 6: 15 kHz	1 to 6	3	No	A	A	A	224H	*5-2*

4

◆ Reference Parameters: d

■Preset Reference: d1

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
d1-01	Frequency refer-ence 1 / Reference 1	Sets the frequency reference.		0.00 Hz	Yes	A	A	A	280H	*5-6*
d1-02	Frequency refer-ence 2 / Reference 2	Sets the frequency reference when multi-step speed command 1 is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	281H	*5-6*
d1-03	Frequency refer-ence 3 / Reference 3	Sets the frequency reference when multi-step speed command 2 is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	282H	*5-6*
d1-04	Frequency refer-ence 4 / Reference 4	Sets the frequency reference when multi-step speed commands 1 and 2 are ON for multi-function inputs.		0.00 Hz	Yes	A	A	A	283H	*5-6*
d1-05	Frequency refer-ence 5 / Reference 5	Sets the frequency when multi-step speed command 3 is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	284H	*5-6*
d1-06	Frequency refer-ence 6 / Reference 6	Sets the frequency reference when multi-step speed commands 1 and 3 are ON for multi-function inputs.		0.00 Hz	Yes	A	A	A	285H	*5-6*
d1-07	Frequency refer-ence 7 / Reference 7	Sets the frequency reference when multi-step speed commands 2 and 3 are ON for multi-function inputs.		0.00 Hz	Yes	A	A	A	286H	*5-6*
d1-08	Frequency refer-ence 8 / Reference 8	Sets the frequency reference when multi-step speed commands 1, 2, and 3 are ON for multi-function inputs.	0 to 120.00 *1*2	0.00 Hz	Yes	A	A	A	287H	*5-6*
d1-09	Nominal speed / Nomin Speed vn	Sets the frequency reference when the nominal speed is selected by a digital input.		50.00 Hz	Yes	Q	Q	Q	288H	*5-7* *5-8*
d1-10	Intermediate speed 1 / Interm Speed v1	Sets the frequency reference when the intermediate speed 1 is selected by a digital input.		0.00 Hz	Yes	A	A	A	28BH	*5-7* *5-8*
d1-11	Intermediate speed 2 / Interm Speed v2	Sets the frequency reference when the intermediate speed 2 is selected by a digital input.		0.00 Hz	Yes	A	A	A	28CH	*5-7* *5-8*
d1-12	Intermediate speed 3 / Interm Speed v3	Sets the frequency reference when the intermediate speed 3 is selected by a digital input.		0.00 Hz	Yes	A	A	A	28DH	*5-7* *5-8*
d1-13	Releveling speed / Relevel Speed vr	Sets the frequency reference when the releveling speed is selected by a digital input.		0.00 Hz	Yes	A	A	A	28EH	*5-7* *5-8*
d1-14	Inspection speed / Inspect Speed vi	Sets the frequency reference when the inspection speed is selected by a digital input.		25.00 Hz	Yes	Q	Q	Q	28FH	*5-7* *5-8*
d1-17	Leveling Speed / Level Speed vl	Sets the frequency reference when the leveling speed is selected by a digital input.		4.00 Hz	Yes	Q	Q	Q	292H	*5-7* *5-8*

| Parameter Number | Name | Description | Setting Range | Factory Setting | Change during Operation | Control Methods | | | MEMO-BUS Register | Page |
	Display					V/f	Open Loop Vector	Closed Loop Vector		
d1-18	Speed priority selection	Speed reference priority selection 0: Use Multi-Speed reference (d1-01 to d1-08) 1: High Speed reference has priority. 2: Leveling speed reference has priority.	0 to 2	1	Yes	A	A	A	292H	*5-6* *5-7* *5-8*
	SpeedPrioritySel									

* 1. The unit is set in o1-03 (frequency units of reference setting and monitor, default: 0.01 Hz). If the display unit is changed, the setting range values also change
* 2. The maximum setting value depends on the setting of the maximum output frequency (E1-04).

∎Field Forcing: d6

| Parameter Number | Name | Description | Setting Range | Factory Setting | Change during Operation | Control Methods | | | MEMO-BUS Register | Page |
	Display					V/f	Open Loop Vector	Closed Loop Vector		
d6-03	Field forcing function selection	Enables or disables field forcing function. 0: Disabled 1: Enabled	0 or 1	0	No	No	A	A	2A2H	*5-33*
	Field Force Sel									
d6-06	Field forcing function Limit	Sets the upper limit for the excitation current applied by the field forcing function. A setting of 100% is equal to the motor no-load current. Field forcing is active during all types of operation except DC Injection.	100 to 400	400%	No	No	A	A	2A5H	*5-33*
	FieldForce Limit									

4

◆ Motor Parameters: E

■V/f Pattern: E1

Param-eter Number / Display	Name / Description	Description	Setting Range	Factory Setting	Change during Opera-tion	V/f	Open Loop Vector	Closed Loop Vector	MEMO-BUS Register	Page
E1-01	Input voltage set-ting / Input Voltage	Sets the Inverter input voltage. This setting is used as a reference value for protection functions.	155 to 255 *1	200 V *1	No	Q	Q	Q	300H	*5-55*
E1-04	Max. output frequency (FMAX) / Max Frequency		40.0 to 120.0 *2	50.0 Hz	No	Q	Q	Q	303H	*5-55*
E1-05	Max. output voltage (VMAX) / Max Voltage		0.0 to 255.0 *1	190.0 V *1	No	Q	Q	Q	304H	*5-55*
E1-06	Base frequency (FA) / Base Frequency		0.0 to 120.0 *2	50.0 Hz	No	Q	Q	Q	305H	*5-55*
E1-07	Mid. output frequency (FB) / Mid Frequency A	To set V/f characteristics in a straight line, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Always ensure that the four frequencies are set in the following manner: E1-04 (FMAX) ≥ E1-06 (FA) > E1-07 (FB) ≥ E1-09 (FMIN)	0.0 to 120.0	3.0 Hz *2	No	A	A	No	306H	*5-55*
E1-08	Mid. output frequency voltage (VB) / Mid Voltage A		0.0 to 255 *1	20.0 V *1 *2	No	Q	Q	No	307H	*5-55*
E1-09	Min. output frequency (FMIN) / Min Frequency		0.0 to 120.0	0.5 Hz *2	No	Q	Q	A	308H	*5-55*
E1-10	Min. output frequency voltage (VMIN) / Min Voltage		0.0 to 255.0 *1	12.5 V *1 *2	No	Q	Q	No	309H	*5-55*
E1-13	Base voltage (VBASE) / Base Voltage	Sets the output voltage of the base fre-quency (E1-06).	0.0 to 255.0 *1	0.0 V *3	No	A	No	No	30CH	*5-55*

(Diagram in Description column: Output Voltage (V) vertical axis with VMAX (E1-05), (VBASE) (E1-13), VB (E1-08), VMIN (E1-10); Frequency (Hz) horizontal axis with FMIN (E1-09), FB (E1-07), FA (E1-06), FMAX (E1-04).)

* 1. These are values for a 200 V Class Inverter. Values for a 400 V Class Inverter are double.
* 2. The factory setting will change when the control method is changed. (The V/f Control factory settings are given.)
* 3. E1-13 is set to the same value as E1-05 by autotuning.

■Motor Setup: E2

Parame-ter Num-ber / Display	Name / Description	Description	Setting Range	Factory Setting	Change during Opera-tion	V/f	Open Loop Vector	Closed Loop Vector	MEMO-BUS Register	Page
E2-01	Motor rated current / Motor Rated FLA	Sets the motor rated current. This set value will become the refer-ence value for motor protection and torque limits. This parameter is an input data for autotuning.	1.75 to 35.00 *1	14.00 A *2	No	Q	Q	Q	30EH	*5-50*

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Control Methods Open Loop Vector	Control Methods Closed Loop Vector	MEMO-BUS Register	Page
E2-02	Motor rated slip / Motor Rated Slip	Sets the motor rated slip. This set value will become the reference value for the slip compensation. This parameter is automatically set during autotuning.	0.00 to 20.00	2.73 Hz *2	No	Q	Q	Q	30FH	*5-50*
E2-03	Motor no-load current / No-Load Current	Sets the motor no-load current. This parameter is automatically set during autotuning.	0.00 to 13.99 *3	4.50 A *2	No	Q	Q	Q	310H	*5-50*
E2-04	Number of motor poles / Number of Poles	Sets the number of motor poles. This value is an input data for autotuning.	2 to 48	4 poles	No	No	No	Q	311H	*5-50*
E2-05	Motor line-to-line resistance / Term Resistance	Sets the motor phase-to-phase resistance. This parameter is automatically set during autotuning.	0.000 to 65.000	0.771 Ω *2	No	Q	Q	Q	312H	*5-50*
E2-06	Motor leak inductance / Leak Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of the motor rated voltage. This parameter is automatically set during autotuning.	0.0 to 40.0	19.6% *2	No	No	A	A	313H	*5-50*
E2-07	Motor iron saturation coefficient 1 / Saturation Comp1	Sets the motor iron saturation coefficient at 50% of magnetic flux. This parameter is automatically set during rotating autotuning.	0.00 to 0.50	0.50	No	No	A	A	314H	*5-50*
E2-08	Motor iron saturation coefficient 2 / Saturation Comp2	Sets the motor iron saturation coefficient at 75% of magnetic flux. This parameter is automatically set during rotating autotuning.	0.50 to 0.75	0.75	No	No	A	A	315H	*5-50*
E2-09	Motor mechanical losses / Mechanical loss	Sets the motor mechanical losses as a percentage of motor rated output. Usually changing this setting is not necessary. Adjust the value under the following the torque loss is large due e.g. to heavy friction in the machine. The set mechanical loss will be compensated.	0.0 to 10.0	0.0%	No	No	No	A	316H	*5-50*
E2-10	Motor iron loss for torque compensation / Tcomp Iron Loss	Sets motor iron losses.	0 to 65535	112 W *2	No	A	No	No	317H	*5-50*
E2-11	Motor rated output power / Mtr Rated Power	Sets the rated output power of the motor. This parameter is an input data for autotuning.	0.00 to 650.00	3.70 *2	No	Q	Q	Q	318H	*5-50*
E2-12	Motor iron saturation coefficient 3 / Saturation Comp3	This parameter is automatically set during rotating autotuning.	1.30 to 1.60	1.30	No	No	A	A		*5-50*

* 1. The setting range is 10% to 200% of the Inverter's rated output current. The value for a 200 V class inverter of 3.7 kW is given.

* 2. The factory setting depends upon the Inverter capacity. The value for a 200 V class inverter of 3.7 kW is given.

* 3. The setting range depends on the inverter capacity. The value for a 200 V class inverter of 3.7 kW is given.

4

◆ Option Parameters: F

■PG Option Setup: F1

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	MEMO-BUS Register	Page
F1-01	PG constant / PG Pulses/Rev	Sets the number of PG pulses per revolution	0 to 60000	1024	No	No	No	Q	380H	*5-65*
F1-02	Operation selection at PG open circuit (PGO) / PG Fdbk Loss Sel	Sets the PG disconnection stopping method. 0: Ramp to stop (Deceleration to stop using the deceleration time 1, C1-02.) 1: Coast to stop 2: Fast stop (Emergency stop using the deceleration time in C1-09.) 3: Continue operation (To protect the motor or machinery, avoid to use this setting.)	0 to 3	1	No	No	No	A	381H	*5-66*
F1-03	Operation selection at overspeed (OS) / PG Overspeed Sel	Sets the stopping method when an overspeed (OS) fault occurs. 0: Ramp to stop (Deceleration to stop using the deceleration time 1, C1-02.) 1: Coast to stop 2: Fast stop (Emergency stop using the deceleration time in C1-09.) 3: Continue operation (To protect the motor or machinery, avoid to use this setting.)	0 to 3	1	No	No	No	A	382H	*5-66*
F1-04	Operation selection at speed deviation / PG Deviation Sel	Sets the stopping method when a speed deviation (DEV) fault occurs. 0: Ramp to stop (Deceleration to stop using the deceleration time 1, C1-02.) 1: Coast to stop 2: Fast stop (Emergency stop using the deceleration time in C1-09.) 3: Continue operation (DEV is displayed and operation continued.)	0 to 3	3	No	No	No	A	383H	*5-67*
F1-05	PG rotation / PG Rotation Sel	0: Phase A leads with forward run command. (Phase B leads with reverse run command; Counter Clockwise rotation) 1: Phase B leads with forward run command. (Phase A leads with reverse run command; Clockwise rotation)	0 or 1	0	No	No	No	Q	384H	*5-65*

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMO-BUS Register	Page
	Display					V/f	Open Loop Vector	Closed Loop Vector		
F1-06	PG division rate (PG pulse monitor)	Sets the division ratio for the PG speed control card pulse output. Division ratio = (1+ n) /m (n=0 or 1 m=1 to 32) The first digit of the value of F1-06 stands for n, the second and the third stands for m. This parameter is effective only when a PG-B2 is used. The possible division ratio settings are: 1/32 ≤ F1-06 ≤ 1.	1 to 132	1	No	No	No	A	385H	*5-66*
	PG Output Ratio									
F1-08	Overspeed detection level	Sets the overspeed detection method. Motor speeds that continue to exceed the value set in F1-08 (set as a percentage of the maximum output frequency) for the time set in F1-09 are detected as overspeed faults.	0 to 120	115%	No	No	No	A	387H	*5-66*
	PG Overspd Level									
F1-09	Overspeed detection delay time		0.0 to 2.0	0.0 s	No	No	No	A	388H	*5-66*
	PG Overspd Time									
F1-10	Excessive speed deviation detection level	Sets the speed deviation detection method. Any speed deviation above the F1-10 set level (set as a percentage of the maximum output frequency) that continues for the time set in F1-11 is detected as a speed deviation. The speed deviation is the difference between actual motor speed and the speed reference command.	0 to 50	10%	No	No	No	A	389H	*5-67*
	PG Deviate Level									
F1-11	Excessive speed deviation detection delay time		0.0 to 10.0	0.5 s	No	No	No	A	38AH	*5-67*
	PG Deviate Time									
F1-14	PG open-circuit detection delay time	Used to set the PG disconnection detection time. PGO will be detected if the detection time exceeds the set time.	0.0 to 10.0	1.0 s	No	No	No	A	38DH	*5-66*
	PGO Detect Time									

4

■Analog Monitor Cards: F4

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Control Methods Open Loop Vector	Control Methods Closed Loop Vector	MEMO-BUS Register	Page
F4-01	Channel 1 monitor selection / AO Ch1 Select	Using an AO-08 option card the possible outputs signal is 0 to +10V only. The setting of F4-07 and F4-08 has no effect.	1 to 54	2	No	A	A	A	391H	–
F4-02	Channel 1 gain / AO Ch1 Gain	Sets the channel 1 item bias to 100%/10 V when the analog monitor card is used.	0.0 to 1000.0	100.0%	Yes	A	A	A	392H	–
F4-03	Channel 2 monitor selection / AO Ch2 Select	This function is enabled when the analog monitor card is used. Monitor selection: Sets the number of the monitor item to be output. (Numerical portion □□ of U1-□□)	1 to 54	3	No	A	A	A	393H	–
F4-04	Channel 2 gain / AO Ch2 Gain		0.0 to 1000.0	50.0%	Yes	A	A	A	394H	–
F4-05	Channel 1 output monitor bias / AO Ch1 Bias	4, 10, 11, 12, 13, 14, 25, 28, 35, 39 and 40 cannot be set. Gain: Sets the percentage of the monitor item, which is equal to 10V output.	-110.0 to 110.0	0.0%	Yes	A	A	A	395H	–
F4-06	Channel 2 output monitor bias / AO Ch2 Bias	Bias: Sets the percentage of the monitor item, which is equal to 0V output.	-110.0 to 110.0	0.0%	Yes	A	A	A	396H	–
F4-07	Analog output signal level for channel 1 / AO Opt Level Sel	Selects the analog output signal level for channel 1 (effective for the AO-12 option card only).	0 or 1	0	No	A	A	A	397H	-
F4-08	Analog output signal level for channel 2 / AO Opt Level Sel	0: 0 to 10V 1: -10 to +10 Using an AO-08 option card the possible outputs signal is 0 to +10V only. The setting of F4-07 and F4-08 has no effect.	0 or 1	0	No	A	A	A	398H	–

■**Digital Output Card (DO-02 and DO-08): F5**

Con-stant Number	Name		Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO BUS Regis-ter	Page
	Display						V/f	Open Loop Vector	Closed Loop Vector		
F5-01	Channel 1 output selection		Effective when a Digital Output Card (DO-02 or DO-08) is used. Set the number of the multi-function output to be output.	0 to 42	0	No	A	A	A	399H	-
	DO Ch1 Select										
F5-02	Channel 2 output selection		Effective when a Digital Output Card (DO-02 or DO-08) is used. Set the number of the multi-function output to be output.	0 to 42	1	No	A	A	A	39AH	-
	DO Ch2 Select										
F5-03	Channel 3 output selection		Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 42	2	No	A	A	A	39BH	-
	DO Ch3 Select										
F5-04	Channel 4 output selection		Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 42	4	No	A	A	A	39CH	-
	DO Ch4 Select										
F5-05	Channel 5 output selection		Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 42	6	No	A	A	A	39DH	-
	DO Ch5 Select										
F5-06	Channel 6 output selection		Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 42	37	No	A	A	A	39EH	-
	DO Ch6 Select										
F5-07	Channel 7 output selection		Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 42	0F	No	A	A	A	39FH	-
	DO Ch7 Select										
F5-08	Channel 8 output selection		Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 42	0F	No	A	A	A	3A0H	-
	DO Ch8 Select										
F5-09	DO-08 output mode selection		Effective when a DO-08 Digital Output Card is used. Set the output mode. 0: 8-channel individual outputs 1: Binary code output 2: Output according to F5-01 to F5-08 settings.	0 to 2	0	No	A	A	A	3A1H	-
	DO-08 Selection										

4

■Serial Communications Settings: F6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	MEMO-BUS Register	Page
F6-01	Operation selection after communications error / Comm Bus Fault Sel	Sets the stopping method for communications errors. 0: Deceleration to stop using the deceleration time in C1-02 1: Coast to stop 2: Emergency stop using the deceleration time in C1-09 3: Continue operation	0 to 3	1	No	A	A	A	3A2H	-
F6-02	Input level of external error from Communications Option Card / EF0 Detection	0: Always detect 1: Detect during operation	0 or 1	0	No	A	A	A	3A3H	-
F6-03	Stopping method for external error from Communications Option Card / EF0 Fault Action	0: Deceleration to stop using the deceleration time in C1-02 1: Coast to stop 2: Emergency stop using the deceleration time in C1-09 3: Continue operation	0 to 3	1	No	A	A	A	3A4H	-
F6-05	Current monitor unit selection / Current Unit Sel	Sets the unit of current monitor 0: Ampere 1: 100%/8192	0 or 1	0	No	A	A	A	3A6H	-
F6-06	Torque reference/torque limit selection from communications option card / Torque Ref/Lmt Sel	0: Torque reference/torque limit by communications option disabled. 1: Torque reference/torque limit by communications option enabled.	0 or 1	1	No	No	No	A	3A7H	-

◆ Terminal Function Parameters: H

■Multi-function Digital Inputs: H1

Parame-ter Num-ber	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
H1-01	Terminal S3 function selection / Terminal S3 Sel	Multi-function input 1	0 to 88	80	No	A	A	A	400H	*5-43*
H1-02	Terminal S4 function selection / Terminal S3 Sel	Multi-function input 2	0 to 88	84	No	A	A	A	401H	*5-43*
H1-03	Terminal S5 function selection / Terminal S3 Sel	Multi-function input 3	0 to 88	81	No	A	A	A	402H	*5-43*
H1-04	Terminal S6 function selection / Terminal S3 Sel	Multi-function input 4	0 to 88	83	No	A	A	A	403H	*5-43*
H1-05	Terminal S7 function selection / Terminal S3 Sel	Multi-function input 5	0 to 88	F	No	A	A	A	404H	*5-43*

Multi-function Digital Input Functions

Setting Value	Function	Control Methods			Page
		V/f	Open Loop Vector	Closed Loop Vector	
3	Multi-step speed reference 1	Yes	Yes	Yes	*5-6*
4	Multi-step speed reference 2	Yes	Yes	Yes	*5-6*
5	Multi-step speed reference 3	Yes	Yes	Yes	*5-6*
6	Jog frequency command (higher priority than multi-step speed reference)	Yes	Yes	Yes	-
7	Accel/decel time 1 switchover	Yes	Yes	Yes	*5-18*
8	External baseblock NO (NO contact: Baseblock at ON)	Yes	Yes	Yes	-
9	External baseblock NC (NC contact: Baseblock at OFF)	Yes	Yes	Yes	-
F	Not used (Set when a terminal is not used)	-	-		-
14	Fault reset (Reset when turned ON)	Yes	Yes	Yes	-
15	Emergency stop. (NO: Deceleration to stop in deceleration time set in C1-09 when ON.)	Yes	Yes	Yes	*5-10*
17	Emergency stop (NC: Deceleration to stop in deceleration time set in C1-09 when OFF)	Yes	Yes	Yes	*5-10*
18	Timer function input (the times are set in b4-01 and b4-02 and the timer function output is set in H2-□□.)	Yes	Yes	Yes	*5-44*
1A	Accel/decel time switchover 2	Yes	Yes	Yes	*5-18*
20 to 2F	External fault; Input mode: NO contact/NC contact, Detection mode: Normal/during operation	Yes	Yes	Yes	*5-43*
80	Nominal Speed Selection (d1-09)	Yes	Yes	Yes	*5-6*
81	Intermediate Speed Selection (d1-10)	Yes	No	No	*5-6*
82	Releveling Speed Selection (d1-13)	Yes	Yes	Yes	*5-6*
83	Leveling Speed Selection (d1-17)	Yes	Yes	Yes	*5-6*
84	Inspection Run Selection (d1-14)	Yes	Yes	Yes	*5-6*
85	Battery Operation Selection	Yes	Yes	Yes	*5-6*
86	Output Contactor Answer Back Signal	Yes	Yes	Yes	*5-6*

4

Setting Value	Function	Control Methods			Page
		V/f	Open Loop Vector	Closed Loop Vector	
87	High Speed Limit Switch (UP)	Yes	Yes	Yes	*5-25*
88	High Speed Limit Switch (Down)	Yes	Yes	Yes	*5-25*

■ Multi-function Contact Outputs: H2

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register	Page
						V/f	V/f with PG	Open Loop Vector	Closed Loop Vector		
H2-01	Terminal M1-M2 function selection / Term M1-M2 Sel	Multi-function contact output 1	0 to 43	40	No	A	A	A	A	40BH	*5-47*
H2-02	Terminal M3-M4 function selection / Term M3-M4 Sel	Multi-function contact output 2	0 to 43	41	No	A	A	A	A	40CH	*5-47*
H2-03	Terminal M5-M6 function selection / Term M5-M6 Sel	Multi-function contact output 3	0 to 43	6	No	A	A	A	A	40DH	*5-47*

Multi-function Contact Output Functions

Setting Value	Function	Control Methods			Page
		V/f	Open loop Vector	Closed Loop Vector	
0	During run 1 (ON: run command is ON or voltage is being output)	Yes	Yes	Yes	*5-47*
1	Zero-speed	Yes	Yes	Yes	*5-47*
2	f_{ref}/f_{out} agree 1 (detection width L4-02 is used.)	Yes	Yes	Yes	*5-23*
3	f_{ref}/f_{set} agree 1 (ON: Output frequency = ±L4-01, with detection width L4-02 used and during frequency agree)	Yes	Yes	Yes	*5-23*
4	Frequency detection 1 (ON: +L4-01 ≥ output frequency ≥ -L4-01, with detection width L4-02 used)	Yes	Yes	Yes	*5-23*
5	Frequency detection 2 (ON: Output frequency ≥ +L4-01 or output frequency ≤ -L4-01, with detection width L4-02 used)	Yes	Yes	Yes	*5-23*
6	Inverter operation ready; READY: After initialization or no faults	Yes	Yes	Yes	*5-48*
7	During DC bus undervoltage (UV) detection	Yes	Yes	Yes	*5-48*
8	During baseblock (NO contact, ON: during baseblock)	Yes	Yes	Yes	*5-48*
9	Frequency reference source selection (ON: Frequency reference from Operator)	Yes	Yes	Yes	*5-48*
A	Run command source selection status (ON: Run command from Operator)	Yes	Yes	Yes	*5-48*
B	Car stuck/undertorque detection 1 NO (NO contact, ON: Overtorque/undertorque detection)	Yes	Yes	Yes	*5-34*
D	Braking transistor fault	Yes	Yes	Yes	-
E	Fault (ON: Digital Operator/Monitor communications error or fault other than CPF00 and CPF01 has occurred.)	Yes	Yes	Yes	*5-48*
F	Not used. (Set when the terminal is not used.)	Yes	Yes	Yes	-
10	Minor fault (ON: Alarm displayed)	Yes	Yes	Yes	*5-48*
11	Fault reset command active	Yes	Yes	Yes	*5-48*
12	Timer function output	Yes	Yes	Yes	*5-44*
13	f_{ref}/f_{set} agree 2 (detection width L4-04 is used)	Yes	Yes	Yes	*5-23*

Setting Value	Function	Control Methods			Page
		V/f	Open loop Vector	Closed Loop Vector	
14	f$_{ref}$/f$_{set}$ agree 2 (ON: Output frequency = L4-03, with detection width L4-04 is used, and during frequency agree)	Yes	Yes	Yes	*5-23*
15	Frequency detection 3 (ON: Output frequency ≤ -L4-03, detection width L4-04 is used)	Yes	Yes	Yes	*5-23*
16	Frequency detection 4 (ON: Output frequency ≥ -L4-03, detection width L4-04 is used)	Yes	Yes	Yes	*5-23*
17	Car stuck/undertorque detection 1 NC (NC Contact, OFF: Torque detection)	Yes	Yes	Yes	*5-34*
18	Car stuck/undertorque detection 2 NO (NO Contact, ON: Torque detection)	Yes	Yes	Yes	*5-34*
19	Car stuck/undertorque detection 2 NC (NC Contact, OFF: Torque detection)	Yes	Yes	Yes	*5-34*
1A	During reverse run (ON: During reverse run)	Yes	Yes	Yes	*5-48*
1B	During baseblock 2 (OFF: During baseblock)	Yes	Yes	Yes	*5-48*
1D	During regenerative operation	No	No	Yes	*5-49*
1E	Restart enabled (ON: Automativ fault restart enabled)	Yes	Yes	Yes	-
1F	Motor overload (OL1, including OH3) pre-alarm (ON: 90% or more of the detection level)	Yes	Yes	Yes	*5-38*
20	Inverter overheat (OH) pre-alarm (ON: Temperature exceeds L8-02 setting)	Yes	Yes	Yes	*5-40*
30	During torque limit (current limit) (ON: During torque limit)	Yes	Yes	Yes	*5-37*
31	During speed limit	No	No	Yes	*5-23*
33	Zero-servo end (ON: Zero-Servo completed)	No	No	Yes	-
37	During run 2 (ON: Frequency output, OFF: Base block, DC injection braking, initial excitation, operation stop)	Yes	Yes	Yes	*5-47*
38	During cooling fan operation	Yes	Yes	Yes	-
40	Brake Release Command	Yes	Yes	Yes	*5-11*
41	Output Contactor Cloase Command	Yes	Yes	Yes	*5-11*
42	Speed detection at deceleration (Door zone)	Yes	Yes	Yes	*5-49*
43	Not Zero Speed	Yes	Yes	Yes	*5-49*

■Analog Inputs: H3

Con-stant Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	V/f	Open Loop Vector	Closed Loop Vector	MEMO BUS Regis-ter	Page
H3-01	AI-14B Channel 1 signal level selection / AI-14 CH1 LvlSel	Selects the input signal level of Channel 1 if an AI-14B option card is installed. 0: 0 to +10V 1: -10 to +10V	0 or 1	0	No	A	A	A	410H	*5-22*
H3-02	AI-14B Channel 1 gain / AI-14 CH1 Gain	Sets the frequency reference value when 10 V is input as a percentage of the maximum output frequency set in E1-04.	0.0 to 1000.0	100.0%	Yes	A	A	A	411H	*5-22*
H3-03	AI-14B Channel 1 bias / AI-14 CH1 Bias	Sets the frequency reference value when 0 V is input as a percentage of the maximum output frequency set in E1-04.	-100.0 to +100.0	0.0%	Yes	A	A	A	412H	*5-22*
H3-04	AI-14B Channel 3 signal level selection / AI-14 CH3 LvlSel	Selects the input signal level of Channel 3 if an AI-14B option card is installed. 0: 0 to 10V 1: -10 to +10V	0 or 1	0	No	A	A	A	413H	*5-22*
H3-05	AI-14B Channel 3 function selection / AI-14 CH3FuncSel	Selects the function for the channel 3 input if an AI-14B option card is installed. See the table below for the available functions.	2,3,14	2	No	A	A	A	414H	*5-22*
H3-06	AI-14B Channel3 gain / AI-14 CH3 Gain	Sets the input level according to the 100% value of the function set in parameter H3-05 when the voltage at channel 3 of the AI-14B option card is 10 V .	0.0 to 1000.0	100.0%	Yes	A	A	A	415H	*5-22*
H3-07	AI-14B Channel 3 Bias / AI-14 CH3 Bias	Sets the input level according to the 0% value of the function set in parameter H3-05 when the voltage at channel 3 of the AI-14B option card is 0 V.	-100.0 to +100.0	0.0%	Yes	A	A	A	416H	*5-22*
H3-08	AI-14B Channel 2 signal level selection / AI-14 CH2 LvlSel	Selects the input signal level of Channel 2 if an AI-14B option card is installed. 0: 0 to 10V 1: -10 to +10V 2: 4 to 20 mA. If current input is selected, channel 2 must be set to current input by hardware as well. Refer to the AI-14B manual.	0 to 2	0	No	A	A	A	417H	*5-22*
H3-09	AI-14B Channel 2 function selection / AI-14 CH2FuncSel	Selects the function for the channel 2 input if an AI-14B option card is installed. See the table below for the available functions.	2, 3, 14	3	No	A	A	A	418H	*5-22*
H3-10	AI-14B Channel 2 Gain / AI-14 CH2 Gain	Sets the input level according to the 100% value of the function set in parameter H3-09 when the voltage/current at channel 2 of the AI-14B option card is 10V/ 20mA.	0.0 to 1000.0	100.0%	Yes	A	A	A	419H	*5-22*
H3-11	AI-14B Channel 2 Bias / AI-14 CH2 Bias	Sets the input level according to the 0% value of the function set in parameter H3-09 when the voltage/current at channel 2 of the AI-14B option card is 0V/ 0mA.	-100.0 to +100.0	0.0%	Yes	A	A	A	41AH	*5-22*

| Con-stant Number | Name | Description | Setting Range | Factory Setting | Change during Opera-tion | Control Methods | | | MEMO BUS Regis-ter | Page |
	Display					V/f	Open Loop Vector	Closed Loop Vector		
H3-12	Analog input filter time constant	Sets delay filter time constant for the three analog input channels of the AI-14B option card . Effective for noise control etc.	0.00 to 2.00	0.03 s	No	A	A	A	41BH	*5-22*
	CH1-3 FilterTime									
H3-15	Terminal A1 func-tion selection	Sets the multi-function analog input function for terimnal A1. 0: Frequency Reference 1: Torque compensation	0 or 1	0	No	No	No	A	434H	*5-22*
	Terminal A1 Func									
H3-16	Terminal A1 input gain	Sets the frequency reference value when 10 V is input as a per-centage of the maximum output frequency set in E1-04.	0.0 to 1000.0	100.0%	Yes	A	A	A	435H	*5-22*
	Terminal A1 Gain									
H3-17	Terminal A1 input bias	Sets the frequency reference value when 0 V is input as a per-centage of the maximum fre-quency set in E1-04.	-100.0 to +100.0	0.0%	Yes	A	A	A	436H	*5-22*
	Terminal A1 Bias									

H3-05,H3-09 Settings

| Setting Value | Function | Contents (100%) | Control Methods | | | Page |
			V/f	Open Loop Vec-torop	Closed Loop Vector	
2	Auxiliary frequency reference (is used as multi speed reference 2)	Maximum output frequency (AI-14B use only)	Yes	Yes	Yes	-
3	Auxiliary frequency reference (is used as multi speed reference 3)	Maximum output frequency (AI-14B use only)	Yes	Yes	Yes	-
14	Torque compensation	Motor's rated torque	No	No	Yes	*5-11*

4

◆ Protection Function Parameters: L

■Motor Overload: L1

Parame-ter Num-ber	Name	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Register	Page
	Display					V/f	Open Loop Vector	Closed Loop Vector		
L1-01	Motor protec-tion selection MOL Fault Select	Sets whether the motor thermal over-load protection function is enabled or disabled. 0: Disabled 1: General-purpose motor protection (fan cooled motor) 2: Inverter motor protection (externally cooled motor) 3: Vector motor protection When the Inverter power supply is turned off, the thermal value is reset, so even if this parameter is set to 1, protection may not be effective.	0 to 3	1	No	Q	Q	Q	480H	*5-38*
L1-02	Motor protec-tion time con-stant MOL Time Const	Sets the electric thermal detection time in seconds units. Usually changing this setting is not necessary. The factory setting is 150% overload for one minute. When the motor's overload capability is known, also set the overload resis-tance protection time for when the motor is hot started.	0.1 to 5.0	1.0 min	No	A	A	A	481H	*5-38*

■Power Loss Settings: L2

Parame-ter Num-ber	Name	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Regis-ter	Page
	Display					V/f	Open Loop Vector	Closed Loop Vector		
L2-05	Undervoltage detection level PUV Det Level	Sets the DC bus undervoltage (UV) detection level (DC bus voltage). Usually changing this setting is not necessary.	150 to 210 *1	190VDC *1	No	A	A	A	489H	--
L2-11	Battery Voltage Volt@batterydr	Sets the battery voltage.	0 to 400	0VDC	No	A	A	A	4CBH	*5-68-*

* 1. These are values for a 200 V class Inverter. The value for a 400 V class Inverter is the double.

■Stall Prevention: L3

| Parameter Number | Name | Description | Setting Range | Factory Setting | Change during Operation | Control Methods | | | MEMO-BUS Register | Page |
	Display					V/f	Open Loop Vector	Closed Loop Vector		
L3-01	Stall prevention selection during accel / StallP Accel Sel	0: Disabled (Acceleration as set. With a too heavy load, the motor may stall.) 1: Enabled (Acceleration stopped when L3-02 level is exceeded. Acceleration starts again when the current has fallen below the stall prevention level). 2: Intelligent acceleration mode (Using the L3-02 level as a basis, acceleration is automatically adjusted. The set acceleration time is disreg-arded.)	0 to 2	1	No	A	A	No	48FH	*5-21*
L3-02	Stall prevention level during accel / StallP Accel Lvl	Sets the stall prevention during acceleration operation current level as a percentage of Inverter rated current. Effective when L3-01 is set to 1 or 2. Usually changing this setting is not necessary. Reduce the setting when the motor stalls.	0 to 200	150%	No	A	A	No	490H	*5-21*
L3-05	Stall prevention selection during running / StallP Run Sel	Selects the stall prevention during running. 0: Disabled (Runs as set. With a heavy load, the motor may stall.) 1: Deceleration using deceleration time 1 (C1-02.) 2: Deceleration using deceleration time 2 (C1-04.)	0 to 2	1	No	A	No	No	493H	*5-34*
L3-06	Stall prevention level during running / StallP Run Level	Set the stall prevention during running operation current level as a percentage of the Inverter rated current. Effective when L3-05 is 1 or 2. Usually changing this setting is not necessary. Reduce the setting when the motor stalls.	30 to 200	150%	No	A	No	No	494H	*5-34*

4

■Reference Detection: L4

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
L4-01	Speed agreement detection level / Spd Agree Level	Effective when "f_{out}/f_{set} agree 1", "Frequency detection 1" or "Frequency detection 2" is set for a multi-function output.	0.0 to 120.0	0.0 Hz	No	A	A	A	499H	*5-23*
L4-02	Speed agreement detection width / Spd Agree Width	Effective when "f_{ref}/f_{out} agree 1", "f_{out}/f_{set} agree 1" or "Frequency detection 1" or "Frequency detection 2" is set for a multi-function output.	0.0 to 20.0	2.0 Hz	No	A	A	A	49AH	*5-23*
L4-03	Speed agreement detection level (+/-) / Spd Agree Lvl+-	Effective when "f_{out}/f_{set} agree 2", "Frequency detection 3" or "Frequency detection 4" is set for a multi-function output.	-120.0 to +120.0	0.0 Hz	No	A	A	A	49BH	*5-23*
L4-04	Speed agreement detection width (+/-) / Spd Agree Wdth+-	Effective when "f_{ref}/f_{out} agree 2" "f_{out}/f_{set} agree 2", "Frequency detection 3" or "Frequency detection 4" is set for a multi-function output.	0.0 to 20.0	2.0 Hz	No	A	A	A	49CH	*5-23*

■Fault Restart: L5

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
L5-01	Number of auto restart attempts / Num of Restarts	Sets the number of auto restart attempts. Automatically restarts after a fault The retry fault code are the followings OV, UV1, GF, OC, OL2, OL3, OL4, UL3, UL4, PF, LF, SE1, SE2, SE3	0 to 10	2	No	A	A	A	49EH	*5-71*
L5-02	Auto restart operation selection / Restart Sel	Sets whether a fault contact output is activated during fault restart. 0: No output (Fault contact is not activated.) 1: Output (Fault contact is activated.)	0 or 1	1	No	A	A	A	49FH	*5-71*

■Torque Detection: L6

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMO-BUS Register	Page
	Display					V/f	Open Loop Vector	Closed Loop Vector		
L6-01	Torque detection selection 1 Torq Det 1 Sel	0: Torque detection disabled. 1: Car stuck detection only with speed agreement; operation continues (warning is output). 2: Car stuck detected continuously during operation; operation continues (warning is output). 3: Car stuck detection only with speed agreement; output stopped upon detection. 4: Car stuck detected continuously during operation; output stopped upon detection. 5: Undertorque detection only with speed agreement; operation continues (warning is output). 6: Undertorque detected continuously during operation; operation continues (warning is output). 7: Undertorque detection only with speed agreement; output stopped upon detection. 8: Undertorque detected continuously during operation; output stopped upon detection.	0 to 8	4	No	A	A	A	4A1H	*5-34*
L6-02	Torque detection level 1 Torq Det 1 Lvl	Vector control: Motor rated torque is set as 100%. V/f control: Inverter rated current is set as 100%.	0 to 300	150%	No	A	A	A	4A2H	*5-34*
L6-03	Torque detection time 1 Torq Det 1 Time	Sets the overtorque/undertorque detection time.	0.0 to 10.0	0.1 s	No	A	A	A	4A3H	*5-34*
L6-04	Torque detection selection 2 Torq Det 2 Sel		0 to 8	0	No	A	A	A	4A4H	*5-34*
L6-05	Torque detection level 2 Torq Det 2 Lvl	See L6-01 to L6-03 for a description.	0 to 300	150%	No	A	A	A	4A5H	*5-34*
L6-06	Torque detection time 2 Torq Det 2 Time		0.0 to 10.0	0.1 s	No	A	A	A	4A6H	*5-34*

4

■Torque Limits: L7

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	MEMO-BUS Register	Page
L7-01	Forward drive torque limit / Torq Limit Fwd	Sets the torque limit value as a percentage of the motor rated torque. Four individual regions can be set.	0 to 300	300%*	No	No	A	A	4A7H	5-37
L7-02	Reverse drive torque limit / Torq Limit Rev		0 to 300	300%*	No	No	A	A	4A8H	5-37
L7-03	Forward regenerative torque limit / Torq Lmt Fwd Rgn		0 to 300	300%*	No	No	A	A	4A9H	5-37
L7-04	Reverse regenerative torque limit / Torq Lmt Rev Rgn		0 to 300	300%*	No	No	A	A	4AAH	5-37
L7-06	Torque limit time constant / Torque Limit Time	Sets the torque limit integration time constant	5 to 10000	200 ms	No	No	A	No	4ACH	5-37
L7-07	Torque Limit Operation during accel/decel / Torque Limit Sel	Sets the torque limit operation during acceleration and deceleration. 0: P-control (I control is added at constant speed operation) 1: I-control Normally changing this setting is not necessary. If the torque limitation accuracy during accel/decel. has preference, I control should be selected. This may result in an increased accel./decel. time and speed deviations from the reference value.	0 or 1	0	No	No	A	No	4C9H	5-38

Diagram (L7-01 to L7-04): Output torque / Positive torque, L7-01 (No. of motor rotations, Forward), L7-04 Regenerative state, Reverse, L7-02, L7-03 Regenerative state, Negative.

■Hardware Protection: L8

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	MEMO-BUS Register	Page
L8-02	Overheat pre-alarm level / OH Pre-Alarm Lvl	Sets the detection temperature for the Inverter overheat detection pre-alarm in °C. The pre-alarm detects when the cooling fin temperature reaches the set value.	50 to 130	90 °C*	No	A	A	A	4AEH	5-40
L8-03	Operation selection after overheat pre-alarm / OH Pre-Alarm Sel	Sets the operation when an Inverter overheat pre-alarm occurs. 0: Decelerate to stop using the deceleration time C1-02. 1: Coast to stop 2: Fast stop in fast-stop time C1-09. 3: Continue operation (Monitor display only.) A fault will be given in setting 0 to 2 and a minor fault will be given in setting 3.	0 to 3	3	No	A	A	A	4AFH	5-40

Parame-ter Num-ber	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
L8-05	Input open-phase protection selection / Ph Loss In Sel	0: Disabled 1: Enabled (Detects power supply open-phase, power supply voltage imbalance or DC bus electrostatic capacitor deterioration.)	0 or 1	0	No	A	A	A	4B1H	*5-40*
L8-07	Output open-phase protection selection / Ph Loss Out Sel	0: Disabled 1: Enabled, 1 Phase Observatioin 2: Enabled, 2 and 3 Phase Observatioin An output open-phase is detected at less than 5% of Inverter rated current. When the applied motor capacity is small compared to the Inverter capacity, the detection may not work properly and should be disabled.	0 or 2	2	No	A	A	A	4B3H	*5-41*
L8-09	Ground fault detection selection / Ground Fault Sel	0:Disabled 1:Enabled	0 or 1	1	No	A	A	A	4B5H	*5-41*
L8-10	Cooling fan control selection / Fan On/Off Sel	Set the ON/OFF control for the cooling fan. 0: ON when Inverter is running only 1: ON whenever power is ON 2: When the temperature exceeds L8-21 setting.	0 or 2	0	No	A	A	A	4B6H	*5-42*
L8-11	Cooling fan control delay time / Fan Delay Time	Set the time in seconds to delay turning OFF the cooling fan after the inverter STOP command is given. (Valid only if L8-10 = 0)	0 to 300	60 s	No	A	A	A	4B7H	*5-42*
L8-12	Ambient temperature / Ambient Temp	Sets the ambient temperature.	45 to 60	45 °C	No	A	A	A	4B8H	*5-42*
L8-18	Soft CLA selection / Soft CLA Sel	0: Disable 1: Enable	0 or 1	1	No	A	A	A	4BFH	--
L8-20	Output phase loss detection time / Pha loss det T	Sets the detection time of outout phase loss detection (LF.)	0.0 to 2.0	0.2sec	No	A	A	A	4C0H	*5-41*

* The factory setting depends upon the Inverter capacity. The value for a 200 V Class Inverter of 3.7 kW is given.

4

◆ N: Special Adjustments

■Automatic Frequency Regulator: N2

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
N2-01	Speed feedback detection control (AFR) gain AFR Gain	Sets the internal speed feedback detection control gain. Normally, there is no need to change this setting. If necessary, adjust this parameter as follows: • If hunting occurs, increase the set value. • If response is low, decrease the set value. Adjust the setting by 0.05 at a time, while checking the response.	0.00 to 10.00	1.00	No	No	A	No	584H	*5-31*
N2-02	Speed feedback detection control (AFR) time constant AFR Time	Set the time constant 1 to decide the rate of change in the speed feedback detection control.	0 to 2000	50 ms	No	No	A	No	585H	*5-31*

■Feed Forward: N5

User constants for the feed forward control are shown in the following table.
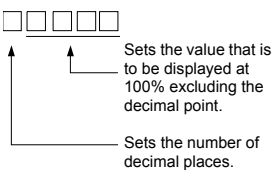
Constant Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open Loop Vector	Closed Loop Vector	MEMOBUS Register	Page
N5-01	Feed forward control selection / Feedfoward Sel	Enables or disables the feed forward control. 0: Disabled 1: Enabled	0 or 1	1	No	No	No	A	5B0H	5-31
N5-02	Motor acceleration time / Motor Accel Time	Set the time required to accelerate the motor at the rated torque (T_{100}) to the rated speed (Nr). J: $GO^2/4$, P: Motor rated output $t_a = \dfrac{2\pi \cdot J[kgm^2] \cdot N_r[rpm]}{60 \cdot T_{100}[Nm]}$ However, $T_{100} = \dfrac{60}{2\pi} \cdot \dfrac{P[kW]}{N_r[rpm]} \cdot 10^3 [Nm]$	0.001 to 10.000	0.178 s *	No	No	No	A	5B1H	5-31
N5-03	Feed forward proportional gain / Feedfoward Gain	Sets the proportional gain for feed forward control. Speed reference response will increase as the setting of N5-03 is increased.	0.00 to 100.00	1.00	No	No	No	A	5B2H	5-31

* The factory setting depends on the inverter capacity

◆ Digital Operator/Monitor Parameters: o

■Monitor Selections: o1

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open Loop Vector	Closed Loop Vector	MEMOBUS Register	Page
o1-01	Monitor selection / User Monitor Sel	Set the number of the 4rd. monitor item to be displayed in the Drive Mode. (U1-□□) (On LED operator JVOP-161 only.)	4 to 99	6	Yes	A	A	A	500H	5-57
o1-02	Monitor selection after power up / Power-On Monitor	Sets the monitor item to be displayed when the power is turned on. 1: Frequency reference 2: Output frequency 3: Output current 4: The monitor item set for o1-01	1 to 4	1	Yes	A	A	A	501H	5-57

4

Para-meter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
o1-03	Frequency units of reference setting and monitor / Display Scaling	Sets the units that will be set and displayed for the frequency reference and frequency monitor. 0: 0.01 Hz units 1: 0.01% units (Maximum output frequency is 100%) 2 to 39: rpm units (Set the motor poles.) 40 to 39999: User desired display Set the desired values for setting and display for the max. output frequency. ☐☐☐☐☐ Sets the value that is to be displayed at 100% excluding the decimal point. Sets the number of decimal places. Example: When the max. output frequency value is 200.0, set 12000	0 to 39999	0	No	A	A	A	502H	*5-57*
o1-04	Setting unit for frequency parameters related to V/f characteristics / Display Units	Set the setting unit for frequency reference-related parameters. 0: Hz 1: min^{-1}	0 or 1	0	No	No	No	A	503H	*5-57*
o1-05	LCD Display contrast adjustment / LCD Contrast	Sets the contrast on the optional LCD operator (JVOP-160). 1: light 2: 3: normal 4: 5: dark	0 to 5	3	Yes	A	A	A	504H	*5-58*

■Digital Operator/Monitor Functions: o2

Parame-ter Num-ber	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
o2-01	LOCAL/REMOTE key enable/disable / Local/Remote Key	Enables/Disables the Digital Operator/Monitor Local/Remote key 0: Disabled 1: Enabled (Switches between the Digital Operator/Monitor and the parameter settings b1-01, b1-02.)	0 or 1	0	No	A	A	A	505H	*5-58*
o2-02	STOP key during control circuit terminal operation / Oper Stop Key	Enables/Disables the Stop key in the run mode. 0: Disabled (When the run command is issued from an external terminal, the Stop key is disabled.) 1: Enabled (Effective even during run.)	0 or 1	0	No	A	A	A	506H	*5-58*

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Control Methods Open Loop Vector	Control Methods Closed Loop Vector	MEMOBUS Register	Page
o2-03	User parameter initial value / User Defaults	Clears or stores user initial values. 0: Stores/not set 1: Begins storing (Records the set parameters as user initial values.) 2: All clear (Clears all recorded user initial values) When the set parameters are recorded as user initial values, 1110 will be set in A1-03.	0 to 2	0	No	A	A	A	507H	*5-58*
o2-04	kVA selection / Inverter Model #	Do not set unless after replacing the control board. (Refer to *page 4-51* for the setting values).	0 to FF	0	No	A	A	A	508H	*5-58*
o2-05	Frequency reference setting method selection / Operator M.O.P.	When the frequency reference is set on the Digital Operator/Monitor frequency reference monitor, sets whether the Enter key is necessary or not. 0: Enter key needed 1: Enter key not needed When set to 1, the Inverter accepts the frequency reference without Enter key operation.	0 or 1	0	No	A	A	A	509H	*5-58*
o2-06	Operation selection when digital operator is disconnected / Oper Detection	Sets the operation when the Digital Operator/Monitor is disconnected. 0: Operation continues even if the Digital Operator/Monitor is disconnected. 1: OPR is detected at Digital Operator/Monitor disconnection. Inverter output is switched off, and the fault contact is operated.	0 or 1	0	No	A	A	A	50AH	*5-58*
o2-07	Cumulative operation time setting / Elapsed Time Set	Sets the cumulative operation time in hour units.	0 to 65535	0 hr	No	A	A	A	50BH	*5-58*
o2-08	Cumulative operation time selection / Elapsed Time Run	0: Accumulated inverter power on time. 1: Accumulated inverter run time.	0 or 1	1	No	A	A	A	50CH	*5-59*
o2-09	Initialize Mode / InitModeSet	2: Europe	2	2	No	A	A	A	50DH	-
o2-10	Fan operation time setting / Fan ON Time Set	Sets the initial value of the fan operation time. The operation time is accumulated starting from this set value.	0 to 65535	0 hr	No	A	A	A	50EH	*5-59*
o2-12	Fault trace initialize / Fault Trace Init	0: No initialisation 1: Initialize (= zero clear) after setting ”1“ o2-12 will be returned to ”0“	0 or 1	0	No	A	A	A	510H	*5-59*
o2-15	Number of Travels counter initialize / Initialize Sel	Operation counter initilalization 0: Number of travels counter is kept 1: Number of travels counter monitor clear	0 or 1	0	No	A	A	A	513H	*5-59*

4

■ Copy Function: o3

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
o3-01	Copy function selection / Copy Function Sel	0: Normal operation 1: READ (Inverter to Operator) 2: COPY (Operator to Inverter) 3: Verify (compare)	0 to 3	0	No	A	A	A	515H	*5-59*
o3-02	Read permission selection / Read Allowable	0: READ prohibited 1: READ permitted	0 or 1	0	No	A	A	A	516H	*5-59*

◆ Lift Function Parameters: S

■ S1 Brake Sequence

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
S1-02	DC injection braking current at start / DC Inj I @start	Sets the DC injection braking current as a percentage of the Inverter rated current.	0 to 100	50%	No	A	A	No	681H	*5-11*
S1-03	DC injection braking currnet at stop / DC Inj I @stop	Sets the DC injection braking current as a percentage of the Inverter rated current.	0 to 100	50%	No	A	A	No	682H	*5-11*
S1-04	DC injection braking time at start / DC Inj T@start	Used to set the time to perform DC injection braking at start in units of 1 second. Used to stop coasting motor and restart it. When the set value is 0, DC injection braking at start is not performed.	0.00 to 10.00	0.30 s	No	A	A	A	18BH	*5-11*
S1-05	DC injection braking time at stop / DC Inj T@stop	Used to set the time to perform DC injection braking at stop in units of 1 second. Used to prevent coasting after the stop command is input. When the set value is 0.00, DC injection braking at stop is not performed.	0.00 to 10.00	0.60 s	No	A	A	A	18CH	*5-11*
S1-06	Brake release delay time / Brake open delay	Sets the time delay from the brake open command to the start of acceleration. This timer can be used to avoid running against the closed brake at start.	0.00 to 10.00	0.20	No	A	A	A	685H	*5-11*
S1-07	Brake close delay time / Brake CloseDelay	Sets the time delay from the internal brake close command until the brake control output is switched. This timer can be used to avoid closing the brake when the motor is still turning.	0.00 to S1-05	0.10	No	A	A	A	685H	*5-11*

| Para-meter Number | Name | Description | Setting Range | Factory Setting | Change during Opera-tion | Control Methods | | | MEMO-BUS Register | Page |
	Display					V/f	Open Loop Vector	Closed Loop Vector		
S1-14	SE2 detection delay time	Used to set the delay time for the detectio of a SE2 fault. At the time S1-06 + S1-14 after the Fwd/Rev command was given the output current is measured. If it is below 25% of the no-load current (E2-03) setting a SE2 fault will be output.	0 to S1-04 - S1-06	200ms	No	A	A	A	6A1H	*5-39*
	SE2 det T									
S1-15	SE3 detection delay time	Used to set the delay time for the detection of a SE3 fault. At the time S1-15 after the fwd/rev command was given, the inverter-starts to observe the output current continuously. If it falls below 25% of the no-load current (E2-03) set-ting a SE3 will be output.	0 to 5000	200ms	No	A	A	A	6A2H	*5-39*
	SE3 det T									
S1-16	RUN delay time	Sets the delay time from the Run signal input to the internal run enable.	0.00 to 1.00	0.10sec	No	A	A	A	6A3H	*5-11*
	Run Delay T									
S1-17	DC injection current gain at regenerative operation	Used to set the DC injection gain when inveter is in the regerenative mode.	0 to 400	100%	No	No	A	No	6A4H	*5-11*
	DC Inj gain@gen									
S1-18	DC injection current gain at motoring opera-tion	Used to set the DC injection gain when inveter is in the motoring mode.	0 to 400	20%	No	No	A	No	6A5H	*5-11*
	DC Inj gain@mot									
S1-19	Output contac-tor open delay time	Sets the contactor control output delay time after stop.	0.00 to 1.00	0.10sec	No	A	A	A	6A6H	*5-11*
	Cont open delay									
S1-20	Zero-servo gain	Adjust the strength of the zero-servo lock. When Closed Loop Vector control is selected, a position control loop is created at stop. Increasing the zero-servo gain increases the strength of the lock. Increasing it by too much will cause oscillation.	0 to 100	5	No	No	No	A	6A7H	*5-11*
	Zero Servo Gain									
S1-21	Zero-servo com-pletion width	Sets the bandwidth of the Zero Servo completion output. Enabled when the "zero-servo completion (end)" is set for a multi-function output. The zero-servo completion signal is ON when the current position is within the range (the zero-servo position + zero-servo completion width.) Set S1-21 to 4 times of the allow-able displacement pulse amount at the PG.	0 to 16383	10	No	No	No	A	6A8H	*5-11*
	Zero Servo Count									
S1-22	Starting torque compensation increase time	Sets the increase time for the ana-log input torque compensation sig-nal. Sets the time the torque reference needs to reach 300% torque reference.	0 to 5000	500ms	No	No	No	A	6A9H	*5-11*
	Torque incr T									

4

| Para-meter Number | Name | Description | Setting Range | Factory Setting | Change during Operation | Control Methods | | | MEMO-BUS Register | Page |
	Display					V/f	Open Loop Vector	Closed Loop Vector		
S1-23	Torque compensation gain during lowering	Sets the torque compensation gain at lowering when the torque compensation at start function is used.	0.500 to 10.000	1.000	No	No	No	A	6AAH	*5-11*
	TorqComp-gain@low									
S1-24	Torque compensation bias during raising	Sets the torque compensation bias at raising when the torque compensation at start function is used.	-200.0 to +200.0	0.0%	No	No	No	A	6ABH	*5-11*
	TorqComp-Bias@ri									
S1-25	Torque compensation bias during lowering	Sets the torque compensation bias at lowering when the torque compensation at start function is used.	-200.0 to +200.0	0.0%	No	No	No	A	6ACH	*5-11*
	TorqComp-Bias@red									
S1-26	Dwell speed reference	Hold speed reference when the load is heavy.The frequency reference follows the C1-07 acceleration 4 setting time. Acceleration time will be changed when the motor speed exceeds the C1-11 setting frequency.	0.0 to 120.0	0.0Hz	No	A	A	A	6ADH	*5-18*
	DWELL speed									
S1-27	Door zone speed level	Sets the door zone speed level. If the motor speed (in CLV and OLV) or the output frequency (in V/f control) falls below S1-27 and a multifunction output is set for the "Door zone" signal (H2-□□=42), this output will be closed.	0.0 to 120.0	0.0Hz	No	A	A	A	6ADH	*5-49*
	Door Zone Level									

■S2 Slip Compensation

Para-meter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
S2-01	Motor rated speed / Rated rpm	Sets the motor rated speed.	300 to 1800	1380 rpm	No	A	No	No	6AEH	*5-32*
S2-02	Slip compensation gain in motoring mode / SlipComp gainMot	Sets the slip compensation gain in motoring mode. It can be used to improve the leveling accuracy.	0.0 to 2.5	0.7	Yes	A	A	No	6AFH	*5-32*
S2-03	Slip compensation gain in regenerative mode / SlipComp gain-Gen	Sets the slip compensation gain in regenerative mode. It can be used to improve the leveling accuracy.	0.0 to 2.5	1.0	Yes	A	A	No	6B0H	*5-32*
S2-07	Slip compensation delay time / SlipCompDelay T	Sets the Slip compensation delay time.	0 to 10000	200ms	No	No	A	No	6B4H	*5-32*

■S3 Special Sequence Functions

Parame-ter Num-ber	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods			MEMO-BUS Register	Page
						V/f	Open Loop Vector	Closed Loop Vector		
S3-01	Short-floor funci-ton selection / Short floor sel	Enables or disables the short floor operation function 0:disabled 1:enabled	0 or 1	0	No	A	A	A	6BDH	*5-16*

4

■T: Motor Autotuning

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Control Methods Open Loop Vector	Control Methods Closed Loop Vector	MEMO-BUS Register	Page
T1-01	Autotuning mode selection / Tuning Mode Sel	Sets the autotuning mode. 0: Rotating autotuning 1: Non-rotating autotuning 2: Non-rotating autotuning for line-to-line resistance only	0 to 2 *1	1	No	Yes	Yes	Yes	701H	5-51
T1-02	Motor output power / Mtr Rated Power	Sets the output power of the motor in kilowatts.	0.00 to 650.00	3.70 kW *2	No	Yes	Yes	Yes	702H	5-51
T1-03	Motor rated voltage / Rated Voltage	Sets the rated voltage of the motor.	0 to 255.0 *3	190.0 V *3	No	No	Yes	Yes	703H	5-51
T1-04	Motor rated current / Rated Current	Sets the rated current of the motor.	1.75 to 35.00 *4	14.00 A *2	No	Yes	Yes	Yes	704H	5-51
T1-05	Motor base frequency / Rated Frequency	Sets the base frequency of the motor.	0 to 120.0	50.0 Hz	No	No	Yes	Yes	705H	5-51
T1-06	Number of motor poles / Number of Poles	Sets the number of motor poles.	2 to 48 poles	4 poles	No	No	Yes	Yes	706H	5-51
T1-07	Motor base speed / Rated Speed	Sets the base speed of the motor in r/min.	0 to 24000	1450 r/min	No	No	Yes	Yes	707H	-5-51
T1-08	Number of PG pulses / PG Pulses/Rev	Sets the number of PG pulses per revolution.	0 to 24000	1024	No	No	No	Yes	708H	5-51
T1-09	No load current / No load current	Sets the no load currnet of motor.	0.0 to 13.99 *2	E2-03	No	No	Yes	Yes	709H	5-51

* 1. Set T1-02 and T1-04 when 2 is set for T1-01. For V/f control a set value 2 is possible only.
* 2. The factory setting depends on the Inverter capacity. (The value for a 200 V Class Inverter for 3.7 kW is given.)
* 3. These are values for a 200 V class Inverter. Values for a 400 V class Inverter are double.
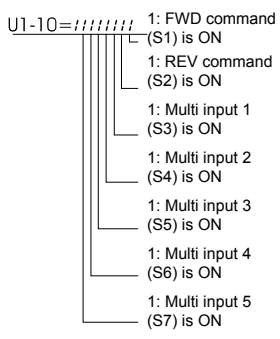* 4. The setting range is from 10% to 200% of the Inverter rated output current. (The value for a 200 V Class Inverter for 0.4 kW is given.)

◆ U: Monitor Parameters

■ Status Monitor Parameters: U1

| Para-meter Number | Name | Description | Output Signal Level at Multi-Function Analog Output (AO-option card) | Min. Unit | Control Methods | | | MEMO-BUS Register |
	Display				V/f	Open Loop Vector	Closed Loop Vector	
U1-01	Frequency reference	Monitors/sets the frequency reference value.*	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	A	A	A	40H
	Frequency Ref							
U1-02	Output frequency	Monitors the output frequency.*	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	A	A	A	41H
	Output Freq							
U1-03	Output current	Monitors the output current.	10 V: Inverter rated output current (0 to +10 V, absolute value output)	0.1 A	A	A	A	42H
	Output Current							
U1-04	Control method	Displays the current control method.	(Cannot be output.)	-	A	A	A	43H
	Control Method							
U1-05	Motor speed	Monitors the detected motor speed.*	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	No	A	A	44H
	Motor Speed							
U1-06	Output voltage	Monitors the output voltage reference value.	10 V: 200 VAC (400 VAC) (0 to +10 V output)	0.1 V	A	A	A	45H
	Output Voltage							
U1-07	DC bus voltage	Monitors the main DC bus voltage.	10 V: 400 VDC (800 VDC) (0 to +10 V output)	1 V	A	A	A	46H
	DC Bus Voltage							
U1-08	Output power	Monitors the output power (internally detected value).	10 V: Inverter capacity (max. applicable motor capacity) (0 to ± 10 V possible)	0.1 kW	A	A	A	47H
	Output kWatts							
U1-09	Torque reference	Monitors the internal torque reference value for open vector control.	10 V: Motor rated torque (0 to ± 10 V possible)	0.1%	No	A	A	48H
	Torque Reference							

* The unit is set in o1-03 (frequency units of reference setting and monitor).

| Parame-ter Number | Name | Description | Output Signal Level During Multi-Function Analog Output | Min. Unit | Control Methods | | | MEMO-BUS Register |
	Display				V/f	Open Loop Vector	Closed Loop Vector	
U1-10	Input terminal status	Shows input ON/OFF status. U1-10 = //////// 1: FWD command (S1) is ON 1: REV command (S2) is ON 1: Multi input 1 (S3) is ON 1: Multi input 2 (S4) is ON 1: Multi input 3 (S5) is ON 1: Multi input 4 (S6) is ON 1: Multi input 5 (S7) is ON	(Cannot be output.)	-	A	A	A	49H
	Input Term Sts							

Parameter Number	Name / Display	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods V/f	Control Methods Open Loop Vector	Control Methods Closed Loop Vector	MEMO-BUS Register
U1-11	Output terminal status / Output Term Sts	Shows output ON/OFF status. U1-11= *o,,,,,,,,* 1: Multi-function contact output 1 (M1-M2) is ON 1: Multi-function contact output 2 (M3-M4) is ON 1: Multi-function contact output 3 (M5-M6) is ON Not used (Always 0). 1: Error output (MA/MB-MC) is ON	(Cannot be output.)	-	A	A	A	4AH
U1-12	Operation status / Int Ctl Sts 1	Inverter operating status. U1-12= *,,,,,,,,* Run 1: Zero speed 1: Reverse 1: Reset signal input 1: Speed agree 1: Inverter ready 1: Minor fault 1: Major fault	(Cannot be output.)	-	A	A	A	4BH
U1-13	Cumulative operation time / Elapsed Time	Monitors the total operating time of the Inverter. The initial value and the operating time/power ON time selection can be set in o2-07 and o2-08.	(Cannot be output.)	1 hr	A	A	A	4CH
U1-14	Software No. (flash memory) / FLASH ID	(Manufacturer's ID number)	(Cannot be output.)	-	A	A	A	4DH
U1-15	Terminal A1 input level / Term A1 Level	Monitors the input level of analog input A1. A value of 100% corresponds to 10V input.	10 V: 100% (0 to ± 10 V possible)	0.1%	A	A	A	4EH
U1-16	Terminal A2 input level / Term A2 Level	Monitors the input level of analog input A2. A value of 100% corresponds to 10V/20mA input.	10 V/20mA: 100% (0 to ±10 V possible)	0.1%	A	A	A	4FH
U1-18	Motor secondary current (Iq) / Mot SEC Current	Monitors the calculated value of the motor secondary current. The motor rated current corresponds to 100%.	10 V:Motor rated current) (0 to ±10 V output)	0.1%	A	A	A	51H
U1-19	Motor excitation current (Id) / Mot EXC current	Monitors the calculated value of the motor excitation current. The motor rated current corresponds to 100%.	10 V:Motor rated current) (0 to ±10 V output)	0.1%	No	A	A	52H
U1-20	Frequency reference after soft-starter / SFS Output	Monitors the frequency reference after the soft starter. This frequency value does not include compensations, such as slip compensation. The unit is set in o1-03.	10 V: Max. frequency (0 to ± 10 V possible)	0.01Hz	A	A	A	53H

Parameter Number	Name / Display	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods V/f	Open Loop Vector	Closed Loop Vector	MEMOBUS Register
U1-21	ASR input / ASR Input	Monitors the input to the speed control loop. The maximum frequency corresponds to 100%.	10 V: Max. frequency (0 to ± 10 V possible)	0.01%	No	No	A	54H
U1-22	ASR output / ASR output	Monitors the output from the speed control loop. The maximum frequency corresponds to 100%.	10 V:Max. frequency (0 to ± 10 V possible)	0.01%	No	No	A	55H
U1-25	DI-16H2 input status / DI-16 Reference	Monitors the reference value from a DI-16H2 Digital Reference Card. The value will be displayed in binary or BCD depending on user constant F3-01.	(Cannot be output.)	-	A	A	A	58H
U1-26	Output voltage reference (Vq) / Voltage Ref(Vq)	Monitors the Inverter internal voltage reference for motor secondary current control.	10 V: 200 VAC (400 VAC) (0 to ± 10 V possible)	0.1 V	No	A	A	59H
U1-27	Output voltage reference (Vd) / Voltage Ref(Vd)	Monitors the Inverter internal voltage reference for motor excitation current control.	10 V: 200 VAC (400 VAC) (0 to ± 10 V possible)	0.1 V	No	A	A	5AH
U1-28	Software No. (CPU) / CPU ID	(Manufacturer's CPU software No.)	(Cannot be output.)	-	A	A	A	5BH
U1-32	ACR output of q axis / ACR(q) Output	Monitors the current control output value for the motor secondary current.	10 V: 100% (0 to ± 10 V possible)	0.1 %	No	A	A	5FH
U1-33	ACR output of d axis / ACR(d) axis	Monitors the current control output value for the motor excitation current.	10 V: 100% (0 to ± 10 V possible)	0.1 %	No	A	A	60H
U1-34	OPE fault parameter / OPE Detected	Shows the first parameter number when an OPE fault is detected.	(Cannot be output.)	-	A	A	A	61H
U1-35	Zero sevo movement pulses / Zero Servo Pulse	Shows the number of PG pulses of the movement range when zero servo was activated. The shown value is the actual pulse numer times 4.	(Cannot be output.)	-	No	No	A	62H
U1-39	MEMOBUS communications error code / Transmit Err	Shows MEMOBUS errors. U1-39= ,,,,,,,, └ 1: CRC error, 1: Data length error, Not used, 1: Parity error, 1: Overrun error, 1: Framing error, 1: Timeout	(Cannot be output.)	-	A	A	A	66H
U1-40	Cooling fan operating time / FAN Elapsed Time	Monitors the total operating time of the cooling fan. The time can be set in 02-10.	(Cannot be output.)	1 hr	A	A	A	67H

4

4-47

Parameter Number	Name / Display	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	V/f	Open Loop Vector	Closed Loop Vector	MEMO-BUS Register
U1-44	ASR output without filter / ASR Output w Fil	Monitors the output from the speed control loop (i.e., the primary filter input value). 100% is displayed for rated secondary current of the motor.	10 V: Rated secondary current of motor (-10 V to 10 V)	0.01%	No	No	A	6BH
U1-45	Feed forward control output / FF Cout Output	Monitors the output from feed forward control. 100% is displayed for rated secondary current of the motor.	10 V: Rated secondary current of motor (-10 V to 10 V)	0.01%	No	No	A	6CH
U1-50	Slip compensation value / Slip comp value	Monitors the slip compensation value. 100% is displayed for rated slip	10 V: Rated slip of motor (-10 V to 10 V)	0.01%	A	A	A	71H
U1-51	Max Current during acceleration / Max Amp at accel	Monitors the maximum currnet during acceleration.	10 V: Rated current of motor (0 V to 10 V)	0.1 A	A	A	A	72H
U1-52	Max Current during deceleration / Max Amp at decel	Monitors the maximum currnet during deceleration.	10 V: Rated current of motor (0 V to 10 V)	0.1 A	A	A	A	73H
U1-53	Max Current during Top speed / Max Amp at top speed	Monitors the maximum currnet at top speed.	10 V: Rated current of motor (0 V to 10 V)	0.1 A	A	A	A	74H
U1-54	Max Current during leveling speed / Max Amp at Vl sped	Monitors the maximum currnet at Vl speed.	10 V: Rated current of motor (0 V to 10 V)	0.1 A	A	A	A	75H
U1-55	Operation counter / Operation Cnt	Monitors the lift operation coumter . O2-15 can clear this counter.	(Cannot be output.)	times	A	A	A	76H

■ Fault Trace: U2

Parameter Number	Name	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods			MEMO-BUS Register
	Display				V/f	Open Loop Vector	Closed Loop Vector	
U2-01	Current fault	The content of the current fault.		-	A	A	A	80H
	Current Fault							
U2-02	Last fault	The error content of the last fault.		-	A	A	A	81H
	Last Fault							
U2-03	Reference frequency at fault	The reference frequency when the last fault occurred.		0.01 Hz	A	A	A	82H
	Frequency Ref							
U2-04	Output frequency at fault	The output frequency when the last fault occurred.		0.01 Hz	A	A	A	83H
	Output Freq							
U2-05	Output current at fault	The output current when the last fault occurred.		0.1 A	A	A	A	84H
	Output Current							
U2-06	Motor speed at fault	The motor speed when the last fault occurred.		0.01 Hz	No	A	A	85H
	Motor Speed							
U2-07	Output voltage reference at fault	The output reference voltage when the last fault occurred.	(Cannot be output.)	0.1 V	A	A	A	86H
	Output Voltage							
U2-08	DC bus voltage at fault	The main current DC voltage when the last fault occurred.		1 V	A	A	A	87H
	DC Bus Voltage							
U2-09	Output power at fault	The output power when the last fault occurred.		0.1 kW	A	A	A	88H
	Output kWatts							
U2-10	Torque reference at fault	The reference torque when the last fault occurred. The motor rated torque corresponds to 100%.		0.1%	No	No	A	89H
	Torque Reference							
U2-11	Input terminal status at fault	The input terminal status when the last fault occurred. The format is the same as for U1-10.		-	A	A	A	8AH
	Input Term Sts							
U2-12	Output terminal status at fault	The output terminal status when the last fault occurred. The format is the same as for U1-11.		-	A	A	A	8BH
	Output Term Sts							
U2-13	Operation status at fault	The operating status when the last fault occurred. The format is the same as for U1-12.		-	A	A	A	8CH
	Inverter Status							
U2-14	Cumulative operation time at fault	The operating time when the last fault occurred.	(Cannot be output.)	1 hr	A	A	A	8DH
	Elapsed Time							

The following errors are not recorded in the error log: CPF00, 01, 02, 03, UV1, and UV2.

4

■Fault History: U3

Parameter Number	Name / Display	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	MEMOBUS Register
U3-01	Last fault / Last Fault	The error content of 1st last fault.		-	90H
U3-02	Second last fault / Fault Message 2	The error content of 2nd last fault.		-	91H
U3-03	Third last fault / Fault Message 3	The error content of 3rd last fault.		-	92H
U3-04	Fourth last fault / Fault Message 4	The error content of 4th last fault.		-	93H
U3-05	Cumulative operation time at fault / Elapsed Time 1	The total operating time when the 1st previous fault occurred.		1 hr	94H
U3-06	Accumulated time of second fault / Elapsed Time 2	The total operating time when the 2nd previous fault occurred.	(Cannot be output.)	1 hr	95H
U3-07	Accumulated time of third fault / Elapsed Time 3	The total operating time when the 3rd previous fault occurred.		1 hr	96H
U3-08	Accumulated time of fourth/oldest fault / Elapsed Time 4	The total operating time when the 4th previous fault occurred.		1 hr	97H
U3-09 – U3-14	Fifth last to tenth last fault / Fault Message 5 to 10	The error content of the 5th to 10th last fault		–	804 805H 806H 807H 808H 809H
U3-15 – U3-20	Accumulated time of fifth to tenth fault / Elapsed Time 5 to 10	Total generating time when 5th ... 10th pevious fault occured		1hr	806H 80FH 810H 811H 812H 813H

The following errors are not recorded in the error log: CPF00, 01, 02, 03, UV1, and UV2.

◆ Factory Settings that Change with the Control Method (A1-02)

Param-eter Number	Name	Setting Range	Unit	Factory Setting		
				V/f Control A1-02=0	Open Loop Vector A1-02=2	Closed Loop Vector A1-02=3
C3-01	Slip compensation gain	0.0 to 2.5	-	1.0	1.0	1.0
E1-08	Mid. output frequency voltage (VB)[2]	0.0 to 255.0 (0.0 to 510.0)	0.1 V	20.0 [2][3]	12.5	0.0
E1-09	Min. output frequency (FMIN)	0.0 to 120.0 [4]	0.1 Hz	0.5 [2]	0.3	0.0
E1-10	Min. output frequency voltage (VMIN)[2]	0.0 to 255.0 (0.0 to 510.0)	0.1 V	12.5 [2][3]	2.0	0.0
S1-01	O speed level	0.0 to 10.0	0.1 Hz	1.2	0.5	0.1
S1-04	DC injection braking time at stop	0.00 to 10.00	0.01 sec	0.50	0.30	0.00

* 1. The settings are 0.05 (Closed Loop Vector) / 2.00 (Open Loop vector) for inverters of 55kW or larger.

* 2. Settings vary as shown in the following tables depending on the Inverter capacity and E1-03.

* 3. The settings shown are for 200 V class Inverters. The values will double for 400 V class Inverters.

4

■200 V and 400 V Class Inverters of 3.7 to 45 kW*

Parameter Number	Unit	Factory Setting																Open Loop Vector Control	Closed Loop Vector Control
E1-03	-	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	50.0	50.0	50.0
E1-05 *	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	190.0	190.0	190.0
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	50.0	50.0	50.0
E1-07 *	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.0
E1-08 *	V	14.0	14.0	14.0	14.0	35.0	50.0	35.0	50.0	18.0	23.0	18.0	23.0	14.0	14.0	14.0	18.6	12.5	0.0
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	0.5	0.3	0.0
E1-10 *	V	7.0	7.0	7.0	7.0	6.0	7.0	6.0	7.0	9.0	11.0	9.0	13.0	7.0	7.0	7.0	9.7	2.5	0.0

* The settings shown are for 200 V class Inverters. The values will double for 400 V class Inverters.

■200 V Class Inverters of 55 kW

Parameter Number	Unit	Factory Setting																Open Loop Vector Control	Closed Loop Vector Control
E1-03	-	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F		
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	50.0	50.0	50.0
E1-05 *	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	190.0	190.0	190.0
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	50.0	50.0	50.0
E1-07 *	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0	0.0
E1-08 *	V	12.0	12.0	12.0	12.0	35.0	50.0	35.0	50.0	15.0	20.0	15.0	20.0	12.0	12.0	12.0	16.0	12.5	0.0
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	0.5	0.3	0.0
E1-10 *	V	6.0	6.0	6.0	6.0	5.0	6.0	5.0	6.0	7.0	9.0	7.0	11.0	6.0	6.0	6.0	8.3	2.5	0.0

* The settings shown are for 200 V class Inverters. The values will double for 400 V class Inverters.

◆ Factory Settings that Change with the Inverter Capacity (o2-04)

■200 V Class Inverters

Parameter Number	Name	Unit	Factory Setting						
-	Inverter Capacity	kW	3.7	5.5	7.5	11	15	18.5	22
o2-04	kVA selection	-	4	5	6	7	8	9	A
C6-02	Carrier frequency	-	3	3	3	3	3	3	3
E2-01 (E4-01)	Motor rated current	A	14.00	19.60	26.60	39.7	53.0	65.8	77.2
E2-02 (E4-02)	Motor rated slip	Hz	2.73	1.50	1.30	1.70	1.60	1.67	1.70
E2-03 (E4-03)	Motor no-load current	A	4.50	5.10	8.00	11.2	15.2	15.7	18.5
E2-05 (E4-05)	Motor line-to-line resistance	W	0.771	0.399	0.288	0.230	0.138	0.101	0.079
E2-06 (E4-06)	Motor leak inductance	%	19.6	18.2	15.5	19.5	17.2	20.1	19.5
E2-10	Motor iron loss for torque compensation	W	112	172	262	245	272	505	538
L8-02	Overheat pre-alarm level	°C	75	68	75	80	65	75	75

Parameter Number	Name	Unit	Factory Setting			
-	Inverter Capacity	kW	30	37	45	55
o2-04	kVA selection	-	B	C	D	E
C6-02	Carrier frequency	-	2	2	2	2
E2-01 (E4-01)	Motor rated current	A	105.0	131.0	160.0	190.0
E2-02 (E4-02)	Motor rated slip	Hz	1.80	1.33	1.60	1.43
E2-03 (E4-03)	Motor no-load current	A	21.9	38.2	44.0	45.6
E2-05 (E4-05)	Motor line-to-line resistance	W	0.064	0.039	0.030	0.022
E2-06 (E4-06)	Motor leak inductance	%	20.8	18.8	20.2	20.5
E2-10	Motor iron loss for torque compensation	W	699	823	852	960
L8-02	Overheat pre-alarm level	°C				

4

■400 V Class Inverters

Parameter Number	Name	Unit	Factory Setting					
-	Inverter Capacity	kW	3.7	4.0	5.5	7.5	11	15
o2-04	kVA selection	-	4	5	5	6	7	8
C6-02	Carrier frequency	-	3	3	3	3	3	3
E2-01 (E4-01)	Motor rated current	A	7.00	7.00	9.80	13.30	19.9	26.5
E2-02 (E4-02)	Motor rated slip	Hz	2.70	2.70	1.50	1.30	1.70	1.60
E2-03 (E4-03)	Motor no-load current	A	2.30	2.30	2.60	4.00	5.6	7.6
E2-05 (E4-05)	Motor line-to-line resistance	W	3.333	3.333	1.595	1.152	0.922	0.550
E2-06 (E4-06)	Motor leak inductance	%	19.3	19.3	18.2	15.5	19.6	17.2
E2-10	Motor iron loss for torque compensation	W	130	130	193	263	385	440
L8-02	Overheat pre-alarm level	°C	90	90	85	90	73	90

Parameter Number	Name	Unit	Factory Setting					
-	Inverter Capacity	kW	18.5	22	30	37	45	55
o2-04	kVA selection	-	4	5	6	7	8	9
C6-02	Carrier frequency	-	3	3	2	2	2	2
E2-01 (E4-01)	Motor rated current	A	32.9	38.6	52.3	65.6	79.7	95.0
E2-02 (E4-02)	Motor rated slip	Hz	1.67	1.70	1.80	1.33	1.60	1.46
E2-03 (E4-03)	Motor no-load current	A	7.8	9.2	10.9	19.1	22.0	24.0
E2-05 (E4-05)	Motor line-to-line resistance	W	0.403	0.316	0.269	0.155	0.122	0.088
E2-06 (E4-06)	Motor leak inductance	%	20.1	23.5	20.7	18.8	19.9	20.0
E2-10	Motor iron loss for torque compensation	W	508	586	750	925	1125	1260
L8-02	Overheat pre-alarm level	°C	80	80				

5

Parameter Settings by Function

5

Carrier Frequency Derating and Current Limitation

◆ Carrier Frequency Setting

The carrier frequency selection has a direct influence on the motor noise. The higher the carrier frequency the lower is the motor noise. On the other hand the overload capability of the inverter reduces with a higher carrier frequency. Both have to be considered when the setting is changed. Read the following for details.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
C6-02	Carrier frequency selection	3	No	Q	Q	Q

■Carrier Frequency Selection

The factory setting is 8 kHz for units from 3.7 to 22 kW and 5 kHz for units from 30 to 55 kW. Usually the value has not to be changed. However, if it necessary to change it, observe the following precautions:

- If speed and torque vary at low speeds: Lower the carrier frequency.
- If Inverter noise is affecting peripheral devices: Lower the carrier frequency.
- If leakage current from the Inverter too is large: Lower the carrier frequency.
- If metallic noise from the motor is large: Increase the carrier frequency.

■Carrier Frequency and Inverter Overload Capability

The inverter overload capability depends on the carrier frequency setting. The overload capability is 150% of the inverter rated current for 30 sec. After that an inverter overload fault (OL2) is shown.

If the carrier frequency is increased, a derating for the continuous output current like shown in *Fig 5.30* must be considered. The overload capability (OL2 Level) does not change. It will be 150% of the derated current for 30 sec.
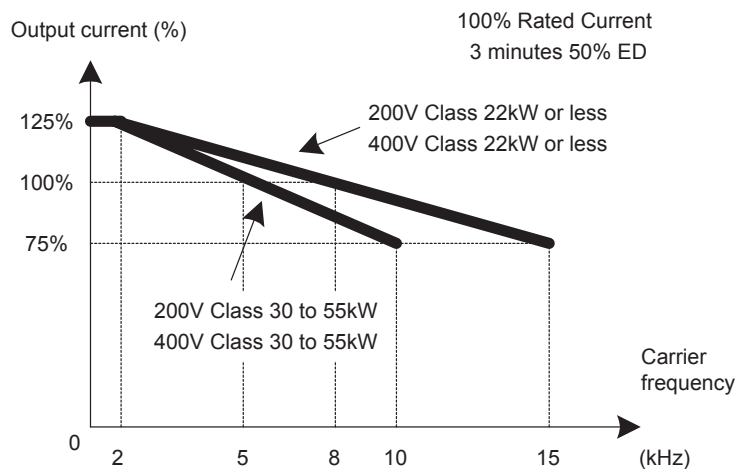
Fig 5.30 Current Derating depending on the carrier frequency

◆ Current limitation level at low speeds

Varispeed L7 limits the output current at low frequencies. This current limitation does not change with the carrier frequency selection. The current limitation in the low frequency is as follows.
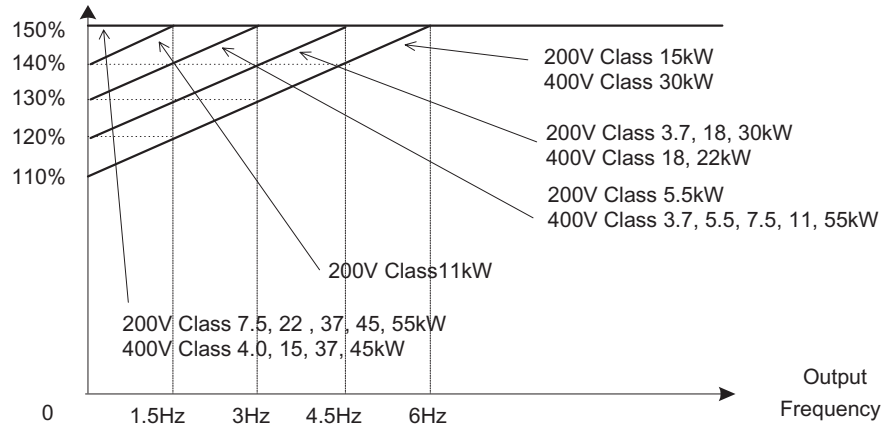
Fig 5.31 Low frequency current limitation

IMPORTANT

- If the torque at low frequencies is too low, check whether the current runs into the limitation explained above. If so, check the motor data settings (E2-□□) and the V/f pattern (E1-□□).
- If the current still runs into the limit it might be necessary to install a one size bigger inverter.
- When selecting an inverter please consider the low frequency current limit as described above and select an inverter with an appropriate current margin.

5

Control Sequence

◆ Up and Down Commands

■Travel start in Up or Down direction

UP and Down commands are the travel direction information.

To start in the elevator in Up or Down direction the following conditions have to be fulfilled:

- At least one speed reference must be selected.
- The hardware base block signal must be set (not base block condition).
- When a digital input is set as contactor confirmation input, the contactor confirmation signal must be present before the travel starts.
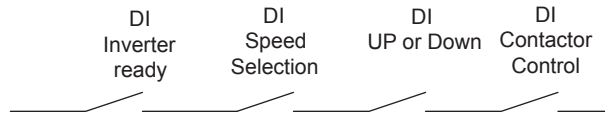- To start to the UP direction the UP direction. To start in Down direction the Down signal must be set.

■Travel stop

The inverter can be stopped as follows:

- The direction command (UP or Down) signal is removed.
- The speed reference selection signal is removed.

■Up / Down Command Source Selection

The input source for the Up and Down signal can be selected in parameter b1-02.

Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
b1-02	RUN command source selection	1	No	Q	Q	Q

Up/Down Commands Using the Digital Operator (b1-02=0)

When b1-02 is set to 0 the Up/Down command must be input using the Digital Operator keys (RUN, STOP, and FWD/REV). For details on the Digital Operator refer to *page 3-1, Digital Monitor/ Operator and Modes*. This operation can be used for test purposes only.

Up/Down Commands Using Control Circuit Terminals (b1-02=1, factory setting)

When b1-02 is set to 1 the Up/Down command is input at the control circuit terminals S1 and S2. This is the factory setting and the most common configuration.

Up/Down Commands Using Memobus Communications (b1-02=2)

When b1-02 is set to 2 the Up/Down command can be set using Memobus communications.

Up/Down Commands Using an Input Option Card (b1-02=3)

When b1-02 is set to 2 the Up/Down command can be set using an input option card, for example a field bus communications card.

◆ Speed Reference Source Selection

■Speed Reference Source Selection

The speed reference source can be selected using parameter b1-01.

Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
b1-01	Frequency reference source selection	0	No	Q	Q	Q

Input the Speed Reference from the Digital Inputs (b1-01=0)

When b1-01 is set to 0 the speed reference can be selected from preset speeds using the digital inputs of the inverter. Refer to *page 5-6, Speed Selection Sequence Using Digital Inputs* for details.

Input the Speed Reference Using a Voltage Signal (b1-01=1)

When b1-01 is set to 1 and H3-15 (Input function for A1) is set to 0 (Frequency reference) the speed reference can be input by the terminal A1 as a 0 to +10V signal. If an analog option card AI-14B is installed, the A1 signal is replaced by the Channel 1 input of the AI card.
The analog reference signal can be used as well as 1st speed if multispeed operation is selected (Refer to *page 5-6, Speed Selection Sequence Using Digital Inputs* for details)

Input the Speed Reference Using Memobus Communications (b1-01=2)

When b1-01 is set to 2 the speed reference can be input using Memobus communications.

Input the Speed Reference Using an Input Option Card (b1-01=3)

When b1-01 is set to 2 the speed reference can be input using an input option card, for example a field bus communications card.

5

◆ Speed Selection Sequence Using Digital Inputs

If the digital inputs are used for speed selection, the speed selection method and the speed priority depends on the setting of parameter d1-18.

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
d1-18	Speed Priority Selection	1	No	Q	Q	Q

■ Multi-Step Speed Operation (Binary Input) (d1-18=0)

Maximum 8 preset speed steps can be selected using 3 binary coded digital inputs. The inverter is started using the Up/Down command. It stops when the Up/Down command is removed.

Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
d1-01 to d1-08	Multi-Step speed 1 to 8 reference value	0.00 Hz	Yes	A	A	A

Multi-function Digital Input Settings (H1-01 to H1-05) (Example)

Terminal	Parameter Number	Set Value	Details
S4	H1-02	3	Multi-step speed command 1
S5	H1-03	4	Multi-step speed command 2
S6	H1-04	5	Multi-step speed command 3

Speed Selection Table

The following table shows the combinations of the digital input and the according speed.

If b1-02 is set to "1", speed 1 is input as analog reference at terminal A1 or Channel CH1 of an analog input option card AI-14B if it is installed.

If an AI-14B option card is used and the function for channel 2 and 3 is set for "Auxiliary Frequency 2" (H3-05/09=2) and "Auxiliary Frequency 3" (H3-05/09=3) the speeds 2 and 3 are set at the CH2 and CH3 input of the option card.l

Speed	Multi-step Speed Command 1	Multi-step Speed Command 2	Multi-step Speed Command 3	Selected Frequency
1	OFF	OFF	OFF	Frequency reference 1 d1-01 or A1/AI-14B CH1
2	ON	OFF	OFF	Frequency reference 2 d1-02 or AI-14B CH2
3	OFF	ON	OFF	Frequency reference 3 d1-03 or AI-14B CH3
4	ON	ON	OFF	Frequency reference 4 d1-04
5	OFF	OFF	ON	Frequency reference 5 d1-05
6	ON	OFF	ON	Frequency reference 6 d1-06
7	OFF	ON	ON	Frequency reference 7 d1-07
8	ON	ON	ON	Frequency reference 8 d1-08

■Separate Speed Selection Inputs, High Speed Has Priority (d1-18=1)

With this setting 6 different speeds can be set and selected using four digital inputs.

Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			Digital Input Setting (H1-01 to H1-05)
				V/f	Open Loop Vector	Closed Loop Vector	
d1-09	Nominal Speed	50.00 Hz	Yes	Q	Q	Q	80
d1-10	Intermediate Speed 1	0.00 Hz	Yes	A	A	A	81
d1-11	Intermediate Speed 2	0.00 Hz	Yes	A	A	A	-*
d1-12	Intermediate Speed 3	0.00 Hz	Yes	A	A	A	-*
d1-13	Releveling Speed	0.00 Hz	Yes	A	A	A	82
d1-17	Leveling Speed	4.00 Hz	Yes	Q	Q	Q	83

* This speed can be selected by a combination of two inputs

Digital Input Factory Settings

Terminal	Parameter Number	Set Value	Details
S3	H1-01	80	Nominal speed selection (d1-09)
S4	H1-02	84	Inspection speed selection (d1-14)
S5	H1-03	81	Intermediate speed selection (d1-10)
S6	H1-04	83	Leveling speed selection (d1-17)

Higher Speed has Priority and a Leveling Speed Input is Selected (H1-□□=83)

If d1-18 is set to 1 and one multi-function digital input is set for the leveling speed (H1-□□=83) after removing the selected speed signal the inverter decelerates to the leveling speed (d1-17). The selected speed must be different from leveling speed and inspection speed. The higher speed has priority over the leveling speed, i.e. as long as a higher speed is selected the leveling signal is disregarded (see the fig. below)

The inverter stops when the leveling signal or the Up/Down signal is removed.

The following speed selection table shows the different speeds and the according digital inputs.

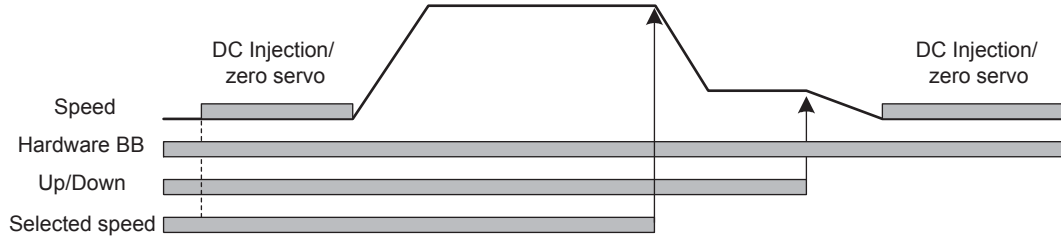| Terminal function	Nominal Speed d1-09	Intermed. Speed 1 d1-10	Intermed. Speed 2 d1-11	Intermed. Speed 3 d1-12	Relevel. Speed d1-13	Leveling Speed d1-17	0Hz
Nominal Speed command (H1-□□=80)	1	0	1	0	0	0	0
Intermediate speed command (H1-□□=81)	0	1	1	1	0	0	0
Releveling speed command (H1-□□=82)	0	0	1	1	1	0	0
Leveling speed command (H1-□□=83)	X	X	X	X	X	1	0

* 0 = disabled, 1 = enabled, X = no meaning

Higher Speed Priority is Selected and a Leveling Speed Input is Not Selected (H1-□□≠83)

When the leveling speed command is not selected for any digital input, the inverter decelerates to the leveling speed (d1-17) when the selected speed signal is removed. The selected speed must be different from leveling and inspection speed.

The inverter stops when the direction signal Up/Down is removed.

When no speed selection input is enabled, leveling speed is the speed reference.

The following speed selection table shows the different speeds and the according digital inputs.

Terminal function	Nominal Speed d1-09	Intermed. Speed 1 d1-10	Intermed. Speed 2 d1-11	Intermed. Speed 3 d1-12	Relevel. Speed d1-13	Leveling Speed d1-17
Nominal Speed command (H1-□□=80)	1	0	1	0	0	0
Intermediate speed command (H1-□□=81)	0	1	1	1	0	0
Releveling speed command (H1-□□=82)	0	0	1	1	1	0
Leveling speed command (H1-□□=83)	N/A	N/A	N/A	N/A	N/A	N/A

    * 0 = disabled, 1 = enabled, N/A = not available

To make the inverter stop must be remove the direction signal (UP or DOWN signal).

■ **Separate Speed Selection Inputs, Leveling Speed Has Priority (d1-18=2)**

The related parameters and the digital input pre-settings are the same as for the High Speed Priority setting (d1-18=1).

Leveling Speed has Priority and a Leveling Speed Input is Selected (H1-□□=83)

If d1-18 is set to "2" and one multi-function digital input is set for the leveling speed (H1-□□=83) the inverter decelerates to the leveling speed (d1-17) as soon as the leveling speed selection input is activated. The leveling signal has priority over the selected speed, i.e. the selected speed is disregarded. The selected speed must be different from leveling speed and inspection speed.

The inverter stops when the leveling speed command is removed.

The following speed selection table shows the different speeds and the according digital inputs.

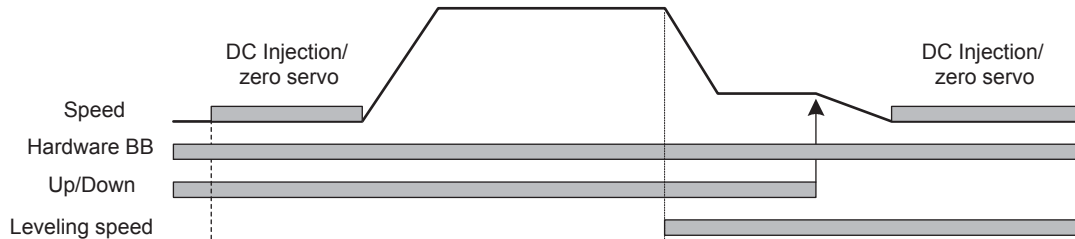| Terminal function	Nominal Speed d1-09	Intermed. Speed 1 d1-10	Intermed. Speed 2 d1-11	Intermed. Speed 3 d1-12	Relevel. Speed d1-13	Leveling Speed d1-17	0Hz
Nominal Speed command (H1-□□=80)	1	0	1	0	0	0	0
Intermediate speed command (H1-□□=81)	0	1	1	1	0	0	0
Releveling speed command (H1-□□=82)	0	0	1	1	1	0	0
Leveling speed command (H1-□□=83)	X	X	X	X	X	1	0

* 0 = disabled, 1 = enabled, X = no meaning

Leveling Speed Priority is Selected and a Nominal Speed Input is Not Selected (H1-□□≠80)

If d1-18 is set to "2" and no digital input is set for the nominal speed at no speed selection input the speed reference is nominal speed (d1-09). When the leveling speed signal is set, the inverter starts to decelerate to the leveling speed. The leveling speed signal has priority over all other speed signals, i.e. the intermediate speed 1 and 2 and the releveling signals are disregarded when leveling speed is selected.

The inverter can be stopped by removing the leveling speed signal or the Up/Down command.

CAUTION: When the speed selection wires are broken, the nominal speed will be selected instead of stop.

The following speed selection table shows the different speeds and the according digital inputs.

Terminal function	Nominal Speed d1-09	Intermed. Speed 1 d1-10	Intermed. Speed 2 d1-11	Intermed. Speed 3 d1-12	Relevel. Speed d1-13	Leveling Speed d1-17
Nominal Speed command (H1-□□=80)	N/A	N/A	N/A	N/A	N/A	N/A
Intermediate speed command (H1-□□=81)	0	1		1	0	X
Releveling speed command (H1-□□=82)	0	0		1	1	X
Leveling speed command (H1-□□=83)	0	0		0	0	1

* 0 = disabled, 1 = enabled, N/A = not available, X = no meaning

The intermediate speed 2 can not be selected using this configuration.

5

◆ Emergency Stop

If a digital input terminal (H1-□□) is set to 15 or 17 (emergency stop), this input can be used to fast stop the inverter in the case of emergency. In this case the emergency stop deceleration time set in C1-09 is used. If inputting the emergency stop with an NO contact, set the multi-function input terminal (H1-□□) to 15, and if inputting the emergency stop with an NC contact, set the multi-function input terminal (H1-□□) to 17.

After the emergency stop command has been input, operation cannot be restarted until the Inverter has stopped. To cancel the emergency stop, turn OFF the run command and emergency stop command.

■ Related parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
C1-09	Emergency stop time	1.50 s	No	A	A	A

■ Multi-function Digital Inputs (H1-01 to H1-05)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
15	Emergency Stop, NO contact	Yes	Yes	Yes
17	Emergency Stop, NC contact	Yes	Yes	Yes

◆ Inspection RUN

A digital input can be used to activate the inspection run. Therefore a inspection speed must be set and one digital input must be set for "Inspection Run Selection" (H1-□□=84).

■ Related parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
d1-14	Inspection Speed	25.00 Hz	No	A	A	A

■ Multi-function Digital Inputs (H1-01 to H1-05)

| Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
84	Inspection Run Selection	Yes	Yes	Yes

The inspection run command must be set before setting the Up/Down signal. During start of the inspection RUN the normal brake sequence is used and the inverter accelerates to the inspection speed (d1-14).

To stop the inverter, the Inspection Run command or the Up/Down command must be removed. In this case:

- The inverter output is cut by baseblock immediately
- The brake open signal is removed immediately
- The contactor control output is removed immediately

The falling edge of the inspection RUN command or UP/DOWN commands triggers the contactor open command, the motor brake close command and the base block.

Inspection RUN
(Stop with Up/Down signal remove)
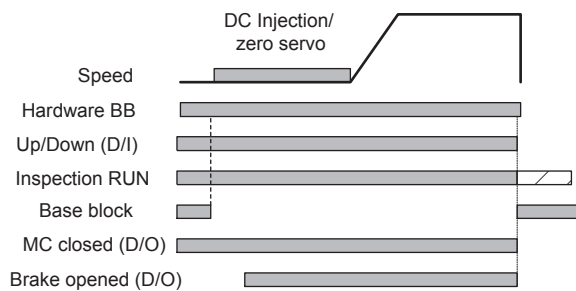
Inspection RUN
(Stop with Inspection Run signal remove)
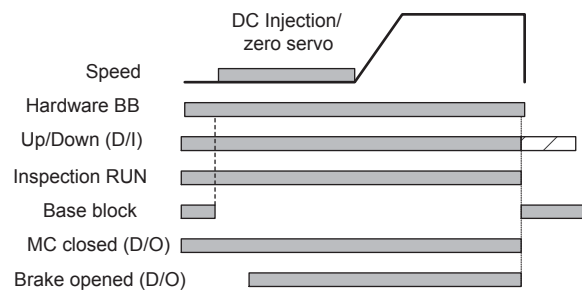
◆ Brake Sequence

The L7 supports two types of brake sequences, one with torque compensation at start using an analog input value and one without torque compensation at start.

■Related Parameters

Parameter No.	Name	Factory setting	Change during operation	Control Method		
				V/f	Open Loop Vector	Closed Loop Vector
H3-15	Terminal A1 function selection	0	No	No	No	A
S1-02	DC injection braking current at start	50%	No	A	A	No
S1-03	DC injection braking current at sop	50%	No	A	A	No
S1-04	DC injection braking time at start	0.30 sec	No	A	A	A
S1-05	DC injection braking time at stop	0.60 sec	No	A	A	A
S1-06	Brake open delay time	0.20 sec	No	A	A	A
S1-07	Brake close delay time	0.10 sec	No	A	A	A
S1-16	Run delay time	0.10 sec	No	A	A	A
S1-17	DC injection current gain at regeneration	100%	No	No	A	No
S1-18	DC injection current gain at motoring	20%	No	No	A	No
S1-19	Output contactor open delay time	0.10 sec	No	A	A	A
S1-20	Zero-servo gain	5	No	No	No	A
S1-21	Zero-servo completion width	10	No	No	No	A
S1-22	Starting torque compensation increase time	500 ms	No	No	No	A
S1-23	Torque compensation gain in Down direction	1.0	No	No	No	A
S1-24	Torque compensation bias in Up direction	0.0%	No	No	No	A
S1-25	Torque compensation bias in Down direction	0.0%	No	No	No	A

5

■Multi-function Digital Inputs (H1-01 to H1-05)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
80 to 83	Speed selection inputs (refer to *page 5-6, Speed Selection Sequence Using Digital Inputs*)	Yes	Yes	Yes
86	Contactor closed answer back signal	Yes	Yes	Yes

■Multi-function Digital Outputs (H2-01 to H2-03)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
40	Brake release command	Yes	Yes	Yes
41	Output contactor close command	Yes	Yes	Yes

■Brake Sequence without torque compensation at start

To use the brake sequence without torque compensation at start,

- the Terminal A1 function must be set to 0 (H3-15 = 0, speed reference input)
- the AI-14B Ch2 and Ch3 input functions must be set other than 14.(H3-05/09 ≠ 14, torque reference not selected)

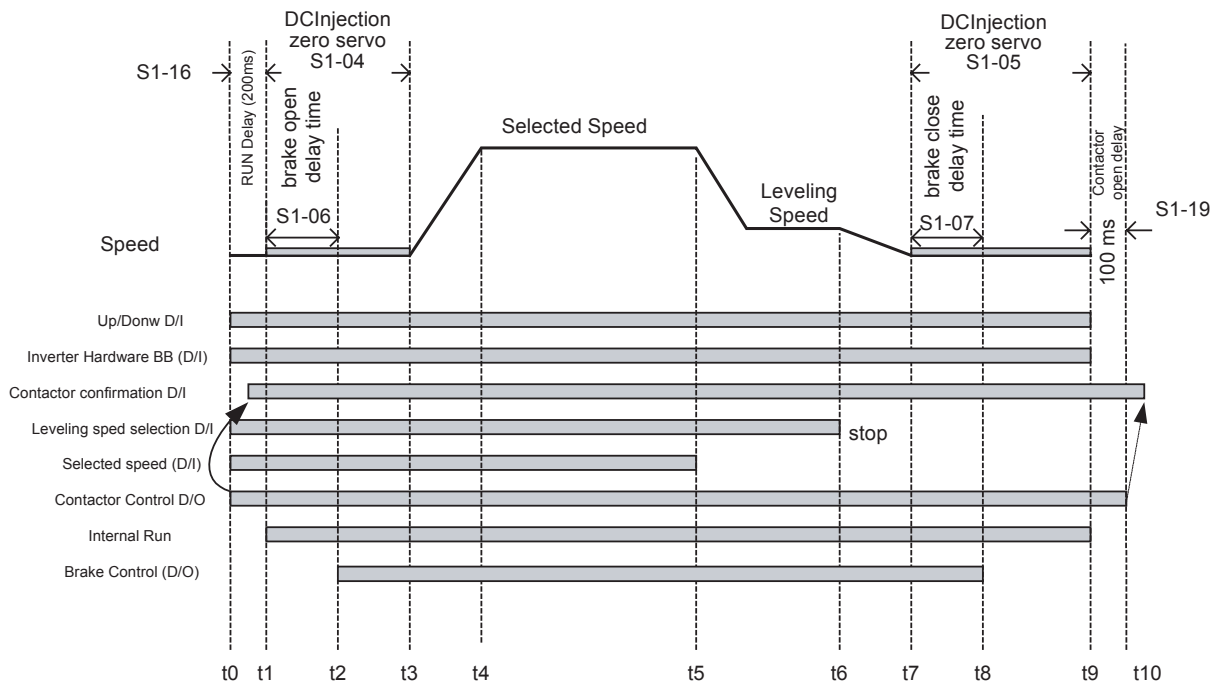The figure below shows the timing chart for this brake sequence.

Fig 5.32 Timing chart of Brake sequence without torque compensation at start

The timing chart above is divided in time zones. The following table explains the sequence in each time zone.

Timing	Description
t0-t1	The inverter gets the direction signal (UP/DOWN)
	The inverter gets the hardware base block disable signal (Not BB condition).
	The inverter receives the speed reference signal.
	The inverter sets the contactor closed signal.
	The inverter waits for the contactor confirmation signal. If no digital input is set for "Contactor conformation signal", the sequence is proceeded after exceeding the operation start delay time (S1-16).
t1-t2	Inverter will activate the output after passing the "RUN Delay Time" (S1-16). DC Injection/zero servo or zero speed operation is started.
	After passing the "Brake Open delay time" (S1-06), the inverter starts opening the brake.
t2-t3	The inverter keeps DC injection/zero servo or zero speed operation until * the time S1-04 – S1-06 has exceeded if S1-06 < S1-04 * the time S1-06 has exceeded if S1-06 > S1-04 (try avoid this setting since the inverter could run against the brake)
t3-t4	The inverter starts to accelerate.
t4-t5	The inverter speed reaches the selected speed.
t5-t6	The speed is selection is changed to the leveling speed, the inverter starts to decelerate. After reaching the leveling speed the inverter keeps operating at this speed.
t6-t7	The leveling signal is removed, the inverter ramps to stop.
t7-t8	The inverter reaches the zero speed. The inverter starts DC injection/zero servo for the time set in S1-05.
	After passing "Brake Close Delay Time" (S1-07), the inverter activates the brake close command.
t8-t9	The inverter continues DC Injection/zero speed or zero speed operation until S1-06 – S1-07 has time passed. Remove the direction signal. The inverter shuts down the output voltage and the hardware base block signal must be set.
t9-t10	After the "Output contactor open delay time"(S1-19) has passed, the inverter releases the output contactor control signal.

5

■Brake Sequence with torque compensation at start

This sequence works in Closed Loop Vector control only. To use the brake sequence with torque compensation at start,

- the A1 function must be selected for "Torque compensation" (H3-15=1) or
- one of the input channels Ch2 or Ch3 of the optional analog input card AI-14B must be set to "Torque Compensation" (H3-05,H3-09=14).

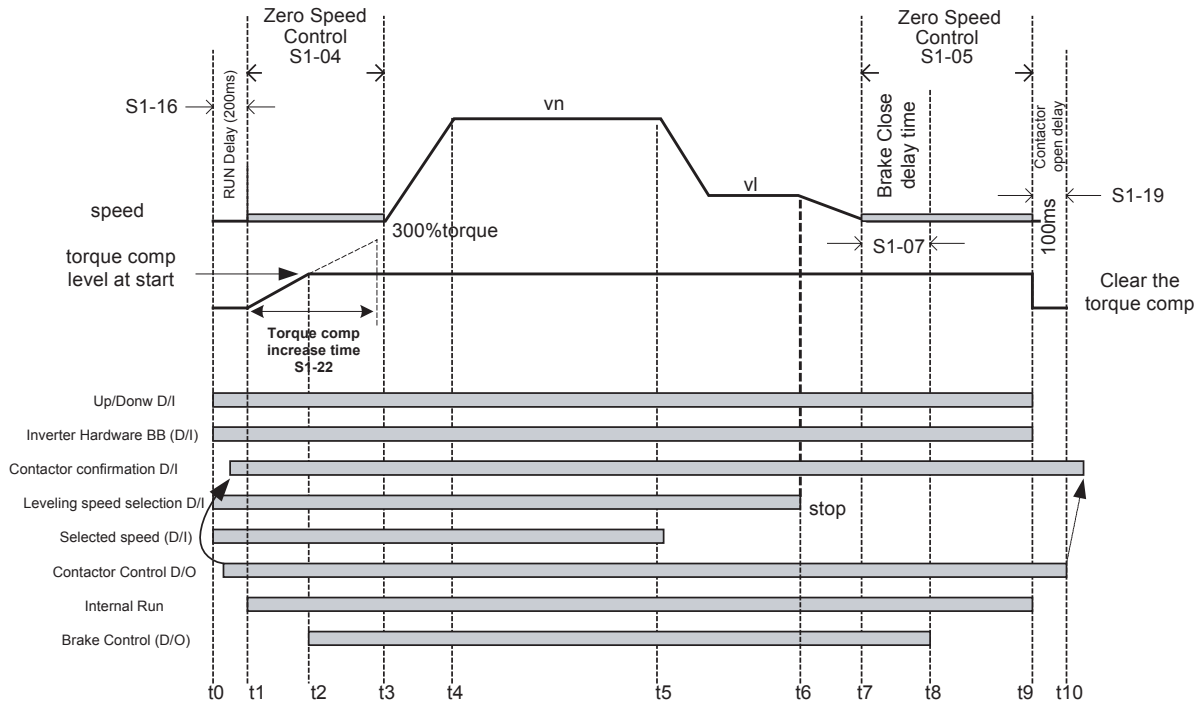The figure below shows the timing chart for this brake sequence.

Fig 5.33 Timing chart of Brake sequence with torque compensation at start

The timing chart above is divided in time zones. The following table explains the sequence in each time zone

Timing	Description
t0-t1	The inverter gets the direction signal (UP/DOWN)
	The inverter gets the hardware base block signal disable signal (Not BB condition).
	The inverter receives the speed reference signal.
	The inverter sets the contactor closed signal.
	The inverter waits for the contactor confirmation signal. If no digital input is set for "Contactor conformation signal", the sequence is proceeded after exceeding the operation start delay time (S1-16).
t1-t2	The Inverter will activate the output. The DC Injection/zero servo or zero speed operation is started. The analog torque compensation value is latched and start producing the torque compensation value from Zero based on the S1-22 ("Starting torque compensation increase time".
	After reaching torque comp level at start, the inverter sets the brake open and holds the torque compensation value until stop.
t2-t3	After passing zero speed operation time set in S1-04, the inverter starts accelerating. The Dwell at start function can be activated.
t3-t4	The inverter starts to accelerate.
t4-t5	The inverter speed reaches the selected speed.
t5-t6	When the leveling speed is selected, the inverter starts to decelerate. The inverter keeps operating at the leveling speed.
t6-t7	The leveling signal is removed, the inverter ramps to stop.
t7-t8	The inverter reaches the zero speed. The inverter keeps zero speed control.
	After passing "Brake Close Delay Time(S1-07)", the inverter sets the brake close.

Timing	Description
t8-t9	The inverter continues zero speed operation until the time S1-06 – S1-07 time be passed. Remove the direction signal. The inverter shuts down the output voltage and the hardware base block signal must be set.
t9-t10	After the "Output contactor open delay time" (S1-19), the inverter releases the output contactor control signal.

Torque compensation at start

If a load measuring device is installed in the elevator, in Closed Loop Vector mode an analog input can be used to give a torque compensation value to the inverter.

The adjusted torque compensation value is latched when the direction command is given. At start it is increased from zero to the latched value using the torque increase time set in parameter S1-22. The torque compensation value is kept during the whole ride and is cleared when the direction command is removed.

The torque compensation function can be adjusted using the parameters shown in the block diagram below. Adjust the parameter so that the torque compensation value is zero when the elevator is balanced.

5
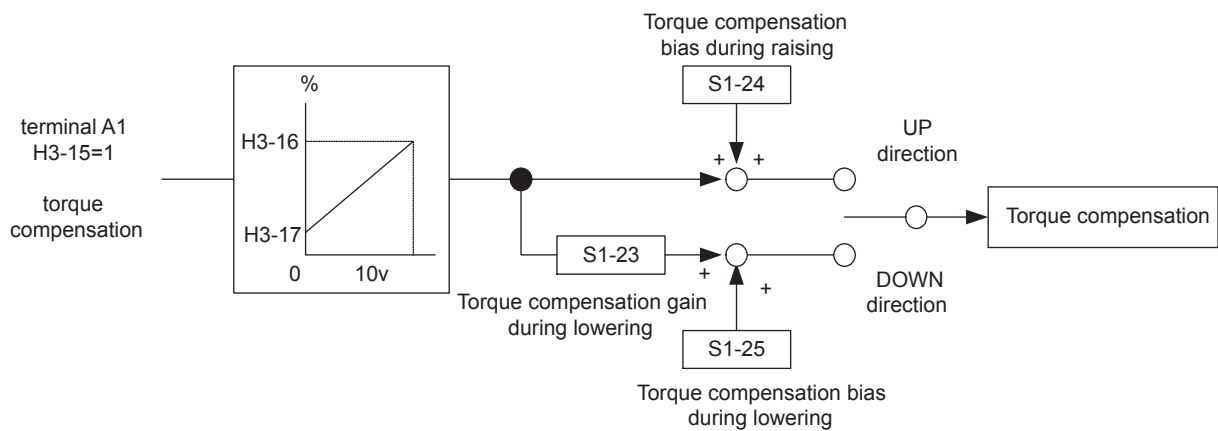
◆ Short Floor Operation

■Related parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
S3-01	Short floor operation	0	No	A	A	A

■Principle

The short floor operation is activated when the leveling signal is set before the nominal speed was reached. The inverter calculates the distance for deceleration from nominal speed to 0.4 x the nominal speed, which is equal to the area S in the figure below.
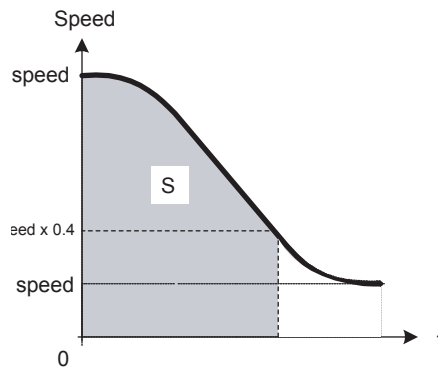
There are two ways:

- If the leveling speed is set when 40% of the nominal speed was reached already, the inverter keeps the reached speed until the distance equal to area S is reached. After that it decelerates to leveling speed.

- If the leveling signal is set before 40% of the nominal speed was reached, the inverter accelerates to 40% of the nominal speed and keeps it until the distance is equal to area S is reached. After that it decelerates to leveling speed.
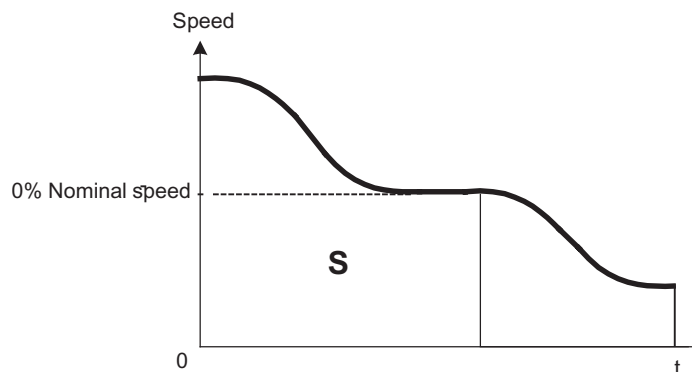
Acceleration and Deceleration Characteristics

◆ Setting Acceleration and Deceleration Times

The acceleration time indicates the time to increase the speed from 0% to 100% of the maximum speed set in E1-04. The deceleration time indicates the time to decrease the speed from 100% to 0% of E1-04.

Four separate acceleration and deceleration times can be set. It can be switched over between them

- using digital input signals
- using the automatic accel./decel. time switch over function with a changeable switching speed level

The display unit and the setting range for the times can be selected between 0.0 sec. or 0.00sec.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
C1-01	Acceleration time 1		Yes	Q	Q	Q
C1-02	Deceleration time 1		Yes	Q	Q	Q
C1-03	Acceleration time 2		Yes	A	A	A
C1-04	Deceleration time 2		Yes	A	A	A
C1-05	Acceleration time 3	1.5 sec	No	A	A	A
C1-06	Deceleration time 3		No	A	A	A
C1-07	Acceleration time 4		No	A	A	A
C1-08	Deceleration time 4		No	A	A	A
C1-10	Acceleration/deceleration time setting unit	1	No	A	A	A
C1-11	Deceleration time switching frequency	0.0 Hz	No	Q	Q	Q
S1-26	Dwell at start speed reference	0.0 Hz	No	A	A	A

Multi-function Digital Inputs (H1-01 to H1-05)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
7	Acceleration/Deceleration switch over 1	Yes	Yes	Yes
1A	Acceleration/Deceleration switch over 2	Yes	Yes	Yes

■Setting Acceleration and Deceleration Time Units

Set the acceleration/deceleration time units using C1-10. The factory setting is 1.

Set value	Details
0	The acceleration/deceleration time setting range is 0.00 to 6000.0 in units of 0.01 s.
1	The acceleration/deceleration time setting range is 0.00 to 600.00 in units of 0.1 s.

5

■**Switching Acceleration and Deceleration Time Using Multi-Function Input Terminal Commands**

When two digital input terminals are set for "Accel./Decel. time switch over 1 and 2" (H1-□□=7 and 1A), the acceleration/deceleration times can be switched over even during operation by combining the ON/OFF status of the terminals.

The following table shows the acceleration/deceleration time switching combinations.

Acceleration/Deceleration Time Selection 1 Terminal	Acceleration/Deceleration Time Selection 2 Terminal	Acceleration Time	Deceleration Time
OFF	OFF	C1-01	C1-02
ON	OFF	C1-03	C1-04
OFF	ON	C1-05	C1-06
ON	ON	C1-07	C1-08

■**Automatic Deceleration Time Switch Over Using a Speed Level**

The deceleration times C1-02 and C1-08 can be switched over automatically at a certain speed which can be set in parameter C1-11. *Fig 5.34* shows the working principle of the function.

Set C1-11 to a value other than 0.0 Hz. If C1-11 is set to 0.0 Hz, the function will be disabled.
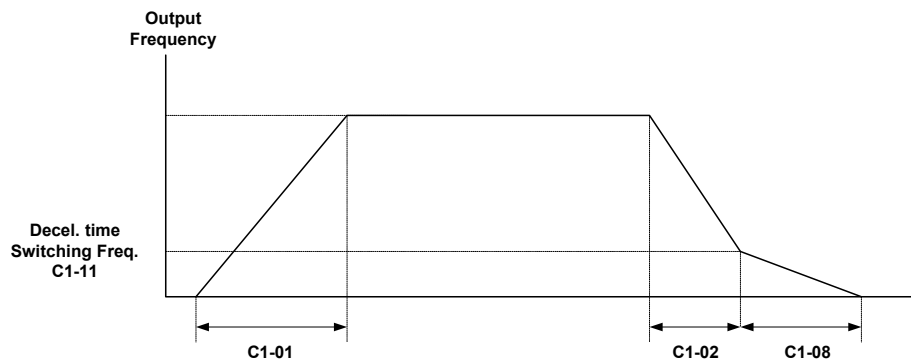
When output frequency ≥ C1-11 the deceleration time 1 (C1-02) is used.
When output frequency < C1-11 the deceleration time 4 (C1-08) is used.

Fig 5.34   Acceleration/deceleration Time Switching Frequency

■**Dwell at Start Function**

This function can be used to have a low acceleration at start. The parameter S1-26 must be set to a certain speed level (dwell speed) to activate the function.

When the inverter starts, the inverter accelerates to the S1-26 speed level using the acceleration time C1-07. Once the motor speed exceeds the S1-26, the inverter will use the original acceleration time.
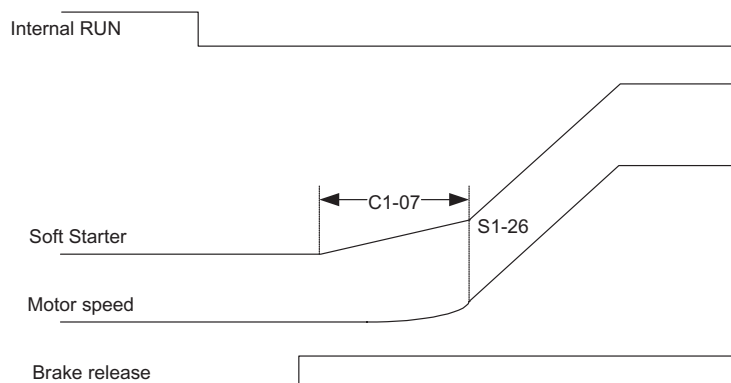
Fig 5.35   Dwell at start function

◆ Acceleration and S-curve Settings

Five different S-curve times are used to reduce the jerk when the speed changes.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods			
				V/f	V/f with PG	Open Loop Vector	Closed Loop Vector
C2-01	S-curve characteristic time at acceleration start	0.5 s	No	Q	Q	Q	Q
C2-02	S-curve characteristic time at acceleration end	0.5 s	No	Q	Q	Q	Q
C2-03	S-curve characteristic time at deceleration start	0.5 s	No	Q	Q	Q	Q
C2-04	S-curve characteristic time at deceleration end	0.5 s	No	Q	Q	Q	Q
C2-05	S-curve characteristic time below leveling	0.5 s	No	Q	Q	Q	Q

Fig 5.36 shows the influence of the different S-curve times.
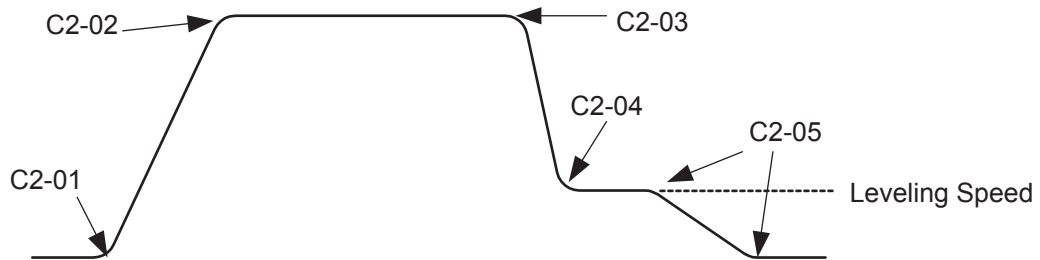
Fig 5.36 S-curve settings

5

◆ Output Speed Hold (Dwell Function)

The dwell function holds the speed temporarily.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
b6-01	Dwell frequency at start	0.0 Hz	No	A	A	A
b6-02	Dwell time at start	0.0 s	No	A	A	A
b6-03	Dwell frequency at stop	0.0 Hz	No	A	A	A
b6-04	Dwell time at stop	0.0 s	No	A	A	A

■Applying an Output Speed Dwell

The dwell function at start is applied when the speed level set in parameter b6-01 is reached and is kept for the time set in parameter b6-02. The dwell function at stop is applied when the speed reaches the level set in parameter b6-03 and is kept for the time set in parameter b6-04. The setting is shown in *Fig 5.37*.
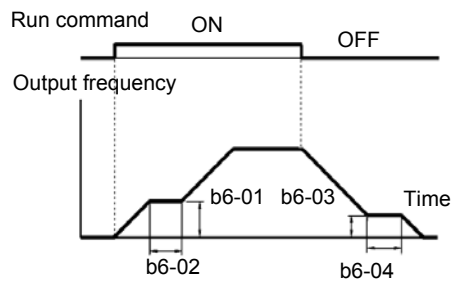
Fig 5.37 Output Frequency Dwell Settings

◆ Stall Prevention During Acceleration

The Stall Prevention During Acceleration function prevents the motor from stalling if the load is too heavy.

If L3-01 is set to 1 (enabled) and the Inverter output current reaches 85% of the set value in L3-02, the acceleration rate will begin to slow down. When L3-02 is exceeded, the acceleration will stop.

If L3-01 is set to 2 (optimum adjustment), the motor accelerates so that the current is held at the level set in L3-02. With this setting, the acceleration time setting is ignored.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L3-01	Stall prevention selection during acceleration	1	No	A	A	No
L3-02	Stall prevention level during acceleration	150%*	No	A	A	No

■Time Chart

The following figure shows the frequency characteristics when L3-01 is set to 1.
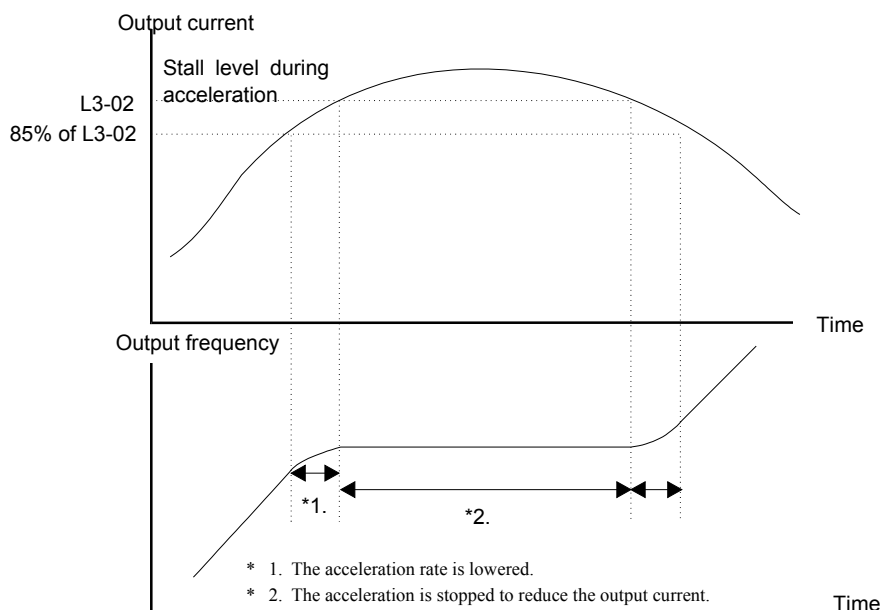
Fig 5.38   Time Chart for Stall Prevention During Acceleration

■Setting Precautions

• Set the parameters as a percentage taking the inverter rated current to be 100%.

• Do not increase the stall prevention level unnecessarily. An extremely high setting can reduce the inverter lifetime. Also do not disable the function.

• If the motor stalls with the factory settings check the V/f pattern settings (E1-□□) and the motor setup (E2-□□).

• If the stall level has to be increased very much to get the elevator running, consider to use a one size bigger inverter.

5

Adjusting Analog Input Signals

◆ Adjusting Analog Frequency References

Using the H3-□□ parameters, the analog input values of terminal A1 or the Channels 1 to 3 of the optional analog input card AI-14B can be adjusted.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
H3-01	Frequency reference AI-14B CH1signal level selection	0	No	A	A	A
H3-02	Frequency reference AI-14B CH1 input gain	100.0%	Yes	A	A	A
H3-03	Frequency reference AI-14B CH1 input bias	0.0%	Yes	A	A	A
H3-04	AI-14B CH3 signal level selection	0	No	A	A	A
H3-05	AI-14B CH3 function selection	2	No	A	A	A
H3-06	AI-14B CH3 input gain	100.0%	Yes	A	A	A
H3-07	AI-14B CH3 input bias	0.0%	Yes	A	A	A
H3-08	AI-14B CH2 signal level selection	3	No	A	A	A
H3-09	AI-14B CH2 function selection	0	No	A	A	A
H3-10	AI-14B CH2 input gain	100.0%	Yes	A	A	A
H3-11	AI-14B CH2 input bias	0.0%	Yes	A	A	A
H3-12	Analog input filter time constant for the AI-14B	0.03 s	No	A	A	A
H3-15	Terminal A1 function selection	0	No	No	No	A
H3-16	Terminal A1 input gain	100.0%	Yes	A	A	A
H3-17	Terminal A1 input bias	0.0%	Yes	A	A	A

■Adjusting Analog Input Signals

The frequency reference can be input from the control circuit terminals using analog voltage. The voltage level at terminal A1 is 0 to +10V. The analog input channels of the AI-14B option card can be used with 0 to +10V or -10 to +10V.

The input signal levels can be selected using,

- H3-01 for AI-14B CH1
- H3-04 for AI-14B CH3
- H3-08 for AI-14B CH2

The signals can be adjustments to the signals can be made using:

- H3-02 (Gain) and H3-03 (Bias) for Channel 1 of the AI-14B option card
- H3-06 (Gain) and H3-07 (Bias) for Channel 3 of the AI-14B option card
- H3-10 (Gain) and H3-11 (Bias) for Channel 2 of the AI-14B option card
- H3-16 (Gain) and H3-17 (Bias) for analog input A1

The gain sets the level of the selected input value if 10V are input, the bias sets the level of the selected input value if 0V is input.

Speed Detection and Speed Limitation

◆ Speed Agreement Function

There are eight different types of frequency detection methods available. The digital outputs M1 to M6 can be programmed for this function and can be used to indicate a frequency detection or agreement to any external equipment.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L4-01	Speed agreement detection level	0.0 Hz	No	A	A	A
L4-02	Speed agreement detection width	2.0 Hz	No	A	A	A
L4-03	Speed agreement detection level (±)	0.0 Hz	No	A	A	A
L4-04	Speed agreement detection width (±)	2.0 Hz	No	A	A	A

■Multifunction Output Settings: H2-01 to H2-03 (M1 – M6 function selection)

The table below shows the necessary H2-01 to H2-03 parameter setting for each of the speed agreement functions. Refer to the timing charts on the following page for details.

Function	Setting
f_{ref}/f_{out} Agree 1	2
f_{out}/f_{set} Agree 1	3
Frequency detection 1	4
Frequency detection 2	5
f_{ref}/f_{out} Agree 2	13
f_{out}/f_{set} Agree 2	14
Frequency detection 3	15
Frequency detection 4	16

■Setting Precautions

• With L4-01 an absolute speed agreement level is set, i.e. a speed agreement is detected in both directions (Up and Down).

• With L4-03 a signed speed agreement level is set, i.e. a speed agreement is detected only in the set direction (positive level → Up direction, negative level → Down direction).

5

■Time Charts

The following table shows the time charts for each of the speed agreement functions.

Related parameter	L4-01: Speed Agree Level L4-02: Speed Agree Width	L4-03: Speed Agree Level +/– L4-04: Speed Agree Width
f_{ref}/f_{out} Agree	f_{ref}/f_{out} Agree 1 (Multi-function output setting = 2)	f_{ref}/f_{out} Agree 2 (Multi-function output setting = 13)
f_{out}/f_{set} Agree	f_{out}/f_{set} Agree 1 (ON at the following conditions during frequency agree) (Multi-function output setting = 3)	f_{out}/f_{set} Agree 2 (ON at the following conditions during frequency agree) (Multi-function output setting = 14)
Frequency Detection	Frequency (FOUT) Detection 1 (L4-01 > | Output frequency |) (Multi-function output setting = 4) Frequency (FOUT) Detection 2 (L4-01 < | Output frequency |) (Multi-function output setting = 5)	Frequency (FOUT) Detection 3 (L4-03 > Output frequency) (Multi-function output setting = 15) Frequency Detection 4 (L4-03 < Output frequency) (Multi-function output setting = 16)

◆ Limiting the Elevator Speed

To use the high speed limit of UP direction or DOWN direction, one of the digital inputs must be set for "High speed limit switch Up" or "Down" (H1-□□ = 87/88).

Multifunction Digital Inputs (H1-01 to H1-05)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
87	High speed limit switch (Up direction)	Yes	Yes	Yes
88	High speed limit switch (Down direction)	Yes	Yes	Yes

High speed limit switch Up

The high speed limit switch UP function is to limit the speed to the leveling speed when the UP direction signal is given. The DOWN direction has no speed limit.

High speed limit switch Down

The high speed limit switch DOWN function is to limit the speed to the leveling speed when the DOWN direction signal is given, the UP direction has no speed limit.

5

Improving the Operation Performance

◆ Reducing the Motor Speed Fluctuation (Slip Compensation Function)

When the load is large, the motor slip also grows and the motor speed decreases. The slip compensation function keeps the motor speed constant, regardless of changes in load. When the motor is operating at the rated load, parameter E2-02 (Motor Rated Slip) × the slip compensation gain value in parameter C3-01 is added to the output frequency. The function can be used in V/f control or Open Loop Vector control.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
C3-01	Slip compensation gain	1.0	Yes	A	A	No
C3-02	Slip compensation delay time	2000 ms	No	A	A	No
C3-03	Slip compensation limit	200%	No	A	A	No
C3-04	Slip compensation during regeneration	0	No	A	A	No
C3-05	Output voltage limit operation selection	0	No	No	A	A

■Adjusting Slip Compensation Gain (C3-01)

The set value of C3-01 depends on the control method. The factory settings are:

• Open Loop Vector control: 1.0

• Closed Loop Vector control: 1.0

Set C3-01 to 1.0 to compensate the slip depending on the actual torque output status using the rated slip (E2-02) as reference.

Adjust the slip compensation gain using the following procedure.

1. With Open Loop Vector control set E2-02 (Motor Rated Slip) and E2-03 (Motor No-load Current). The motor rated slip can be calculated using the values on the motor nameplate and the following formula:

$$\text{slip (Hz)} = \text{Motor rated frequency (Hz)} - \frac{\text{Rated motor speed (rpm)} \times \text{Number of motor poles}}{120}$$

The motor data can be set automatically using the autotuning function.

2. With V/f control set C3-01 to 1.0.

3. Apply a load and compare the speed reference and the actual motor speed during run with constant speed. Adjust the slip compensation gain by 0.1 at a time. If the speed is less than the target value, increase the slip compensation gain, and if the speed is higher than the target value, reduce the slip compensation gain.

4. Setting C3-01 to 0.0 disables the slip compensation function.

■Adjusting Slip Compensation Primary Delay Time Constant (C3-02)

The slip compensation delay time constant is set in ms. The setting value of C3-02 is 2000ms. Normally, there is no need to change these settings. When the slip compensation response is low, lower the set value. When the speed is unstable, increase the set value.

■**Adjusting Slip Compensation Limit (C3-03)**

Using parameter C3-03 the upper limit for the slip compensation can be set as a percentage, taking the motor rated slip as 100%.

If the speed is lower than the target value but does not change even after adjusting the slip compensation gain, the slip compensation limit may have been reached. Increase the limit, and check the speed again. Always make sure that the value of the slip compensation limit and reference frequency does not exceed the tolerance of the machine.

The following diagram shows the slip compensation limit for the constant torque range and fixed output range.

Slip compensation limit

$\frac{E1-04}{E1-06}$ × C3-03

C3-03

Output frequency

E1-06   E1-04

E1-06: Base frequency
E1-04: Maximum output frequency
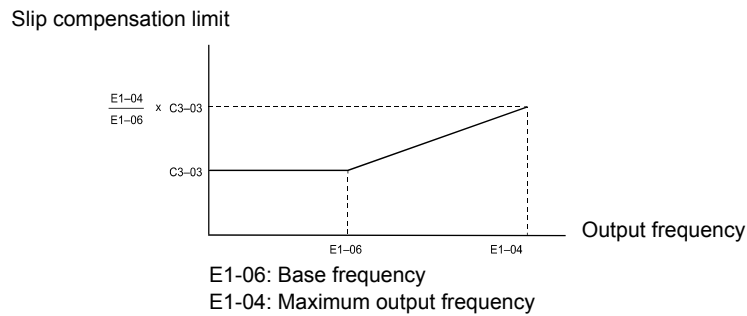
Fig 5.39 Slip Compensation Limit

■**Selecting Slip Compensation Function During Regeneration (C3-04)**

Enables or disables the slip compensation function during regeneration. The factory setting is enabled.

■**Operation Selection when Output Voltage Saturated (C3-05)**

Generally the Inverter cannot output a voltage that is higher than the input voltage. If the output voltage reference for the motor (monitor parameter U1-06) exceeds the input voltage in the high-speed range, the output voltage becomes saturated, and inverter cannot respond to speed or load changes. This function automatically reduces the output voltage to avoid voltage saturation.
Thereby the speed control accuracy can be maintained even at high speeds (around the rated speed of the motor). By the lowered voltage the current can be around 10% higher compared to the operation without voltage limiter.

◆ **Torque Compensation Function Adjustments**

The torque compensation function detects a rising motor load, and increases the output torque.

In V/f control the inverter calculates the motor primary loss voltage using the terminal resistance value (E2-05) and adjusts the output voltage (V) to compensate insufficient torque at startup and during low-speed operation.
The compensation voltage is calculated by the calculated Motor primary voltage loss × parameter C4-01.

In Open Loop Vector control the motor excitation current and the torque producing current are calculated and controlled separately. The torque compensation affects the torque producing current only.
The torque producing current is calculated by the calculated torque reference × C4-01.

5

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
C4-01	Torque compensation gain	1.00	Yes	A	A	No
C4-02	Torque compensation delay time constant	2000 ms	No	A	A	No
C4-03	Starting torque compensation value (forward direction)	0.0	No	No	A	No
C4-04	Starting torque compensation value (reverse direction)	0.0	No	No	A	No
C4-05	Starting torque compensation time constant	1 ms	No	No	A	No

■Adjusting Torque Compensation Gain (C4-01)

Normally, there is no need to change this setting. If adjustments are necessary do the following:

Open Loop Vector control

- If the torque response is slow increase the setting value.
- If vibrations occur decrease the setting value.

V/f control

- If the cable is very long, increase the set value.
- If the motor capacity is smaller than the Inverter capacity (max. applicable motor capacity), increase the set value.
- If the motor is vibrating, reduce the set value.

Setting precautions

- Adjust this parameter so that the output current during low-speed rotation does not exceed the Inverter rated output current range.
- Adjust the value in steps of 0.05 only.

■Adjusting the Torque Compensation Delay Time Constant (C4-02)

The factory setting depends on the control mode. The factory settings are:
- V/f control: 200 ms
- Open loop vector control: 20 ms

Normally, there is no need to change this setting. If adjustments are necessary do the following:
- If the motor is vibrating or if overshooting occurs, increase the set value.
- If the torque response is slow, decrease the set value.

■**Starting Torque Compensation Function (C4-03 to C4-05)**

A starting torque compensation can be applied to speed up the torque establishment at start in Open Loop Vector control.

It works like shown in the following diagram.
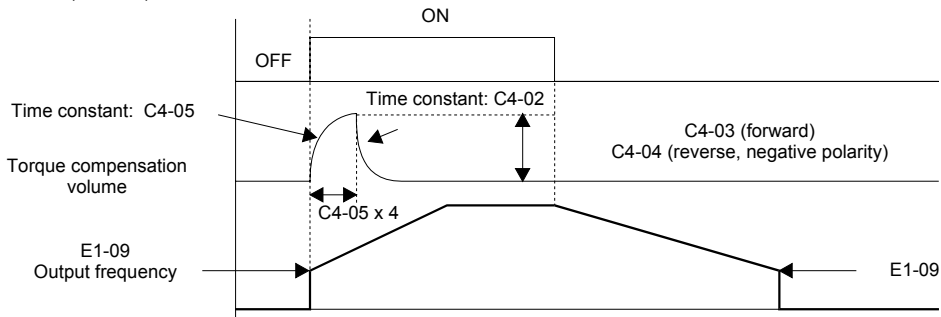
Fig 5.40 Time Chart for Starting Torque Frequency

When this function is used, the following should be considered:

• Both values, C4-03 and C4-04 have to be set.

• The compensation works for motoring operation only. It can not be used for regenerative operation.

• If the starting torque compensation is used and a large shock is generated at the start, increase the starting torque compensation time constant (C4-05)

• The function can be not be used unrestricted for elevators, since the load is not know before the start.

5

◆ **Automatic Speed Regulator (ASR) (Closed Loop Vector only)**

In Closed Loop Vector control the automatic speed regulator (ASR) adjusts the *torque reference* in order to eliminate the deviation between the speed reference and the measured speed (PG feedback).*Fig 5.1* shows the ASR structure.
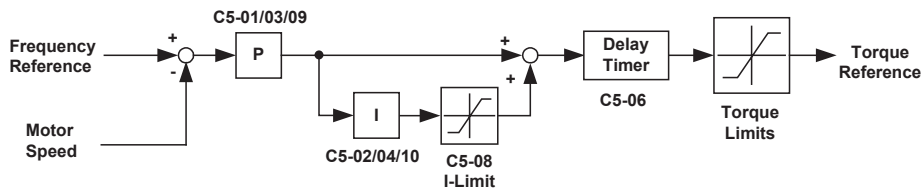
Fig 5.1 ASR Structure Block Diagram

■**Related Parameters**

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
C5-01	ASR proportional (P) gain 1	40.00	Yes	No	No	A
C5-02	ASR integral (I) time 1	0.500 s	Yes	No	No	A
C5-03	ASR proportional (P) gain 2	20.00	Yes	No	No	A
C5-04	ASR integral (I) time 2	0.500 s	Yes	No	No	A
C5-06	ASR delay time	0.004 s	No	No	No	A
C5-08	ASR integral limit	400%	No	No	No	A
C5-09	ASR proportional (P) gain 3	40.00	Yes	No	No	A
C5-10	ASR integral (I) time 3	0.500 s	Yes	No	No	A

◼ASR Gain and Integral Time Adjustments

There are three sets of ASR gain and bias, one for the maximum speed (C5-01/02), one the minimum speed for acceleration (C5-03/04) and one for the minimum speed for deceleration (C5-09/10) (see the figure

During Acceleration

During Deceleration
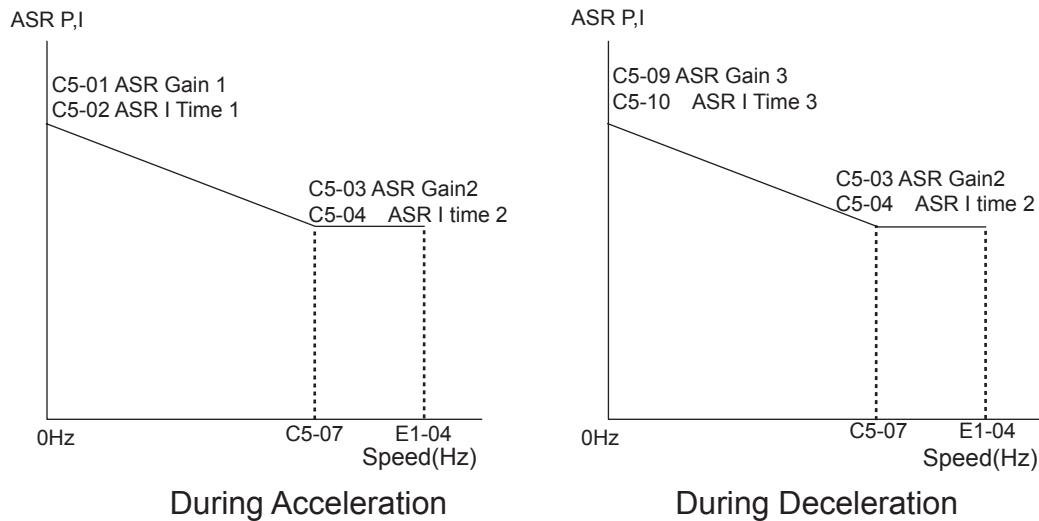
below).

Adjusting ASR Proportional Gains (C5-01/03/09)

This gain adjusts the responsiveness of the speed control (ASR). The responsiveness of the ASR is increased when this setting is increased. Oscillation will occur if this setting is increased too much.

- Increase C5-01 if the ASR is too slow at start or very low frequencies, decrease it if vibrations occur.
- Increase C5-03 if the ASR is too slow at high speed or if overshooting occurs at speed changes in the high speed area, decrease it if vibrations occur
- Increase C5-09 if ASR is slow in the low speed area or if undershooting occurs at leveling speed. If vibrations occur in the low speed area during deceleration decrease the value.

Adjusting ASR Integral Times (C5-02/04/10)

This parameter sets the speed control (ASR) integral time. Lengthening the integral time lowers the responsiveness and the speed accuracy when the load changes suddenly. Oscillation and overshooting can occur if this setting value is too low.

- Decrease C5-02 if a speed deviation is compensated too slow at start or at very low frequencies, increase it if vibrations occur.
- Decrease C5-04 if a speed deviation is compensated too slow at high speeds or if overshooting occurs at speed changes in the high speed area, increase it if vibrations occur.
- Decrease C5-10 if a speed deviation is compensated too slow in the low speed area or if undershooting occurs at leveling speed. If vibrations occur in the low speed area during deceleration increase the value.

◆ **Stabilizing Speed (Automatic Frequency Regulator) (Open Loop Vector)**

The speed feedback detection control (AFR) function controls the stability of the speed when a load is suddenly applied or removed. It calculates the amount of speed fluctuation using the torque current (Iq) feedback value and compensates the output frequency with the amount of fluctuation.
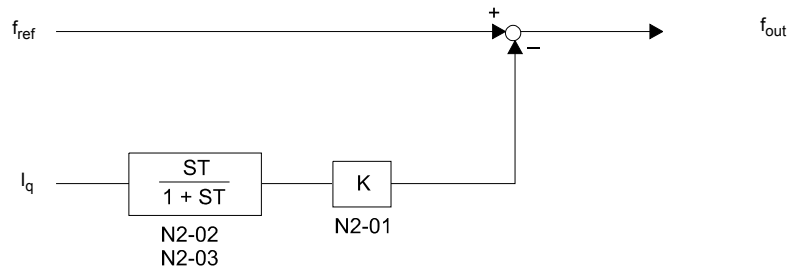
Fig 5.41 AFR Control Loop

■**Related Parameters**

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
N2-01	Speed feedback detection control (AFR) gain	1.00	No	No	A	No
N2-02	Speed feedback detection control (AFR) time constant	50 ms	No	No	A	No

■**Setting the AFR Gain (N2-01)**

Normally there is no need to change this setting. If adjustments are necessary do the following:

If hunting occurs increase N2-01.

If the response is too low, decrease N2-01.

Adjust the setting by 0.05 at a time while checking the response.

◆ **Inertia Compensation (Closed Loop Vector Only)**

The Feed Forward Control is used to eliminate the speed overshoot or undershoot.

The function can be enabled using parameter n5-01.

■**Related Parameters**

Parameter No.	Name	Factory setting	Change during operation	V/f	Open Loop Vector	Closed Loop Vector
n5-01	Feed forward control selection	0:disabled	No	No	No	A
n5-02	Motor acceleration time	kVA dependent	No	No	No	A
n5-03	Feed forward proportional gain	1.0	No	No	No	A

5

■Adjustments

Motor acceleration time (n5-02)

The motor acceleration time n5-02 the time which is needed to accelerate the to the rated speed with the rated torque of the motor. The time can be estimated like follows:

- Make the general setup (V/f pattern, Motor Setup, etc.)
- Balance the elevator (car in middle position, Car weight = Counter weight)
- Set the torque limits to 100% using the L7-□□ parameters.
- Set the acceleration time very short (the inverter must reach the torque limit very fast).
- Start in any direction and measure the time from zero speed to top speed.
- Set this time in n5-02.

Feed Forward Gain (n5-03)

This value usually has not to be changed.

- Increase the time to improve the response to the speed reference
- Decrease the time if vibrations occur

◆ Improving the Leveling Accuracy by Slip compensation

This function can be used in V/f and Open Loop Vector control to compensate the motor slip influence at low speed under different load conditions. Thereby the leveling accuracy can be improved.

The inverter measures the current level or torque reference 1.0 sec after speed-agree condition (acceleration finished) for 0.5 sec and calculates the average value to estimate the load. This value is used for the calculation of slip which is added to the speed reference at leveling speed (see *Fig 5.42*).
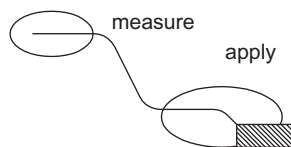
Fig 5.42 Slip Compensation Working Principle

■Related Parameters

Parameter No.	Name	Factory setting	Change during operation	V/f	Open Loop Vector	Closed Loop Vector
S2-01	Motor Rated rpm	1380rpm	No	A	No	No
S2-02	Slip Compensation Gain at Motoring	0.7	No	A	A	No
S2-03	Slip Compensation Gain at Regenerating	1.0	No	A	A	No
S2-07	Slip Compensation primary Delay Time	200ms	No	No	A	No

■**Adjustments**

The Slip compensation values can be set separately for motoring and regenerative operation. Before adjusting this function the general setup should have been done (Motor Setup, V/f pattern, Speeds, ASR settings etc.). To adjust the Slip compensation function do the following in motoring and regenerative mode:

• Set the motor speed in S2-01 if V/f control is used.

• Try to measure the actual motor speed during leveling.

• If the motor speed is lower than the leveling speed reference increase S2-02 in motoring mode or decrease S2-03 in regenerative mode.

• If the motor speed is higher than the leveling speed reference decrease S2-02 in motoring mode or increase S2-03 in regenerative mode.

◆ Field Forcing

The field forcing function controls the motor flux and compensates the flux establishment delay of the motor. Thereby it improves the motor responsiveness on changes in the speed reference or the load.
Field forcing is applied during all operation conditions except DC Injection.

Using parameter d6-06 a field forcing limit can be applied. A setting of 100% is equal to the no-load current set in parameter E2-03.

5

■**Related Parameters**

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
d6-03	Field forcing selection	0	No	No	No	A
d6-06	Field forcing limit	400%	No	No	A	A

◆ Adjusting DC injection current level

When Open Loop Vector control mode is used, the DC injection current level at stop for motoring and regenerative operation can be adjusted individually. The motor condition (Regenerative or motoring) is detected when the inverter is running at another speed than leveling speed.

The function can be used to improve the stopping behavior.

■**Related Parameters**

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
S1-17	DC injection current regenerative	100%	No	No	A	No
S1-18	DC injection current motoring	20%	No	No	A	No

Protective Functions

◆ Preventing Motor Stalling During Operation

Stall prevention during operation prevents the motor from stalling by automatically lowering the inverter output frequency when a transient overload occurs while the motor is operating at a constant speed.

Stall prevention during operation can be enabled in V/f control only. If the Inverter output current continues to exceed the setting in parameter L3-06 for 100 ms or longer, the motor speed is reduced. Enable or disable the stall prevention using parameter L3-05. Set the according deceleration times using C1-02 (Deceleration time 1) or C1-04 (Deceleration Time 2).

If the Inverter output current reaches the set value in L3-06 – 2%, the motor will accelerate again to the set frequency.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L3-05	Stall prevention selection during running function selection	1	No	A	No	No
L3-06	Stall prevention level during running	150%	No	A	No	No

■Precautions

If the motor capacity is smaller than the Inverter capacity or the motor stalls when operating at the factory settings, lower the stall prevention level during operation.

■Setting Precautions

• Set the parameters as a percentage taking the inverter rated current to be 100%.

• Do not increase the stall prevention level unnecessarily. An extremely high setting can reduce the inverter lifetime. Also do not disable the function.

• If the motor stalls with the factory settings check the V/f pattern (E1-□□) and the motor setup (E2-□□).

• If the stall level has to be increased very much to get the elevator running check the mechanical system or consider to use a one size bigger inverter.

◆ Motor Torque Detection / Car Stuck Detection

The inverter provides a torque detection function to detect overtorque (Car stuck) or undertorque. An alarm signal can be output to the digital output terminals M1-M2, M3-M4, or M5-M6.

To use the overtorque/undertorque detection function, set B, 17, 18, 19 (overtorque/undertorque detection NO/NC) in one of the parameter H2-01 to H2-03 (digital output terminals M1 to M6 function selection).

Overtorque/undertorque is detected by:

• observing the output current in V/f control (the inverter rated output current is equal to 100%).

• observing the torque reference value in Open Loop and Closed Loop Vector control (the motor rated torque is equal to 100%).

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L6-01	Torque detection selection 1	4	No	A	A	A
L6-02	Torque detection level 1	150%	No	A	A	A
L6-03	Torque detection time 1	10.0 s	No	A	A	A
L6-04	Torque detection selection 2	0	No	A	A	A
L6-05	Torque detection level 2	150%	No	A	A	A
L6-06	Torque detection time 2	0.1 s	No	A	A	A

Multi-function Output (H2-01 to H2-03)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
B	Overtorque/undertorque detection 1 NO (NO contact: Overtorque detection and undertorque detection enabled when contact is ON)	Yes	Yes	Yes
17	Overtorque/undertorque detection 1 NC (NC contact: Overtorque detection and undertorque detection enabled when contact is OFF)	Yes	Yes	Yes
18	Overtorque/undertorque detection 2 NO (NO contact: Overtorque detection and undertorque detection enabled when contact is ON)	Yes	Yes	Yes
19	Overtorque/undertorque detection 2 NC (NC contact: Overtorque detection and undertorque detection enabled when contact is OFF)	Yes	Yes	Yes

■L6-01 and L6-04 Set Values and Operator Display (JVOP-160 only)

The relationship between alarms displayed on the digital operator when overtorque or undertorque is detected, and the set values in L6-01 and L6-04, is shown in the following table.

Set Value	Function	Operator Display	
		Overtorque/ Undertorque Detection 1	Overtorque/ Undertorque Detection 2
0	Overtorque/undertorque detection disabled.	–	–
1	Overtorque/Car stuck detection only with speed agree; operation continues (warning is output).	OL3 flashes	OL4 flashes
2	Overtorque/Car stuck detected continuously during operation; operation continues (warning is output).	OL3 flashes	OL4 flashes
3	Overtorque/Car stuck detection only with speed agree; output is stopped upon detection.	OL3 lights up	OL4 lights up
4	Overtorque/Car stuck detected continuously during operation; output is stopped upon detection.	OL3 lights up	OL4 lights up
5	Undertorque detection only with speed agree; operation continues (warning is output).	UL3 flashes	UL4 flashes
6	Undertorque detected continuously during operation; operation continues (warning is output).	UL3 flashes	UL4 flashes
7	Undertorque detection only with speed matching; output is stopped upon detection.	UL3 lights up	UL4 lights up
8	Undertorque detected continuously during operation; output is stopped upon detection.	UL3 lights up	UL4 lights up

5

■Timing Charts

Fig 5.43 and *Fig 5.44* show the timing charts for overtorque and undertorque detection.

Motor current (output torque)

L6-02 or L6-05

Overtorque detection 1 NO
or overtorque detection 2 NO

L6-03 or
L6-06

ON

L6-03 or
L6-06

ON

*Overtorque detection switch off bandwidth is approximately 10% of the Inverter rated output current
(or motor rated torque).
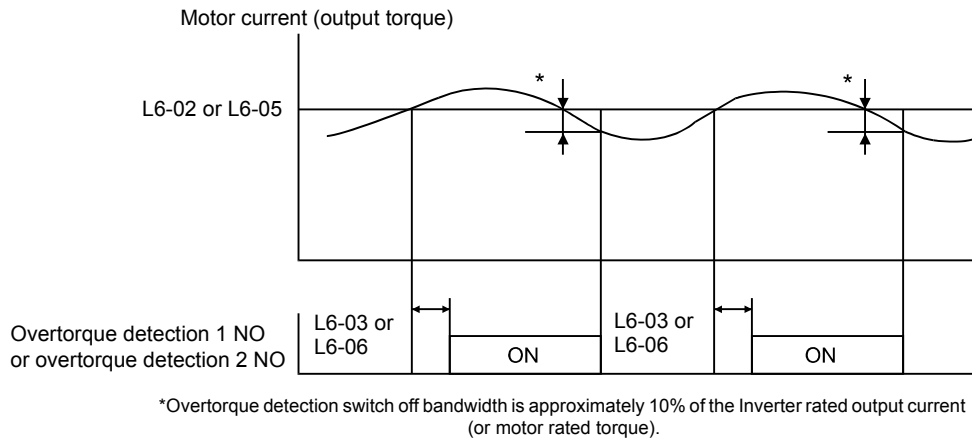
Fig 5.43 Overtorque Detection

Motor current (output torque)

L6-02 or L6-05

Undertorque detection 1 NO
or undertorque detection 2 NO

L6-03 or
L6-06

ON

L6-03 or
L6-06

ON

*Undertorque detection switch off bandwidth is approximately 10% of the Inverter rated output
current (or motor rated torque).
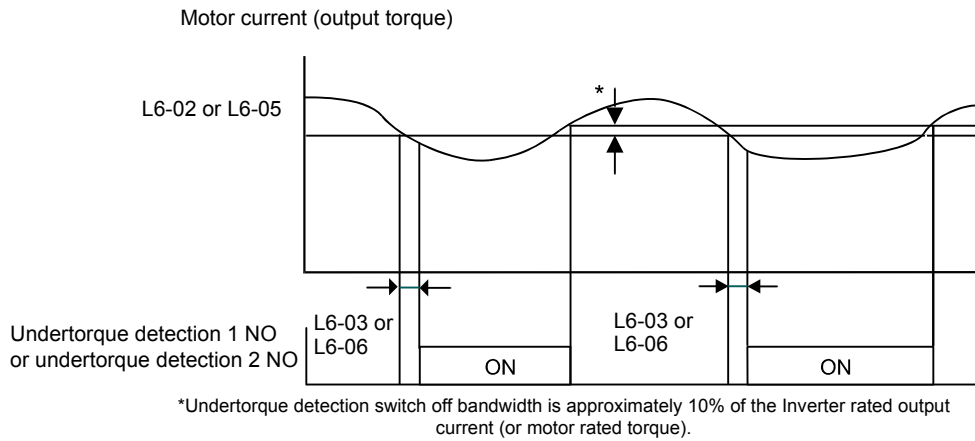
Fig 5.44 Undertorque Detection

■Car Stuck Detection (OL3, Using Overtorque detection)

The Overtorque detection function can be used to detect a stuck car. The torque detection function 1 can be used for this. Therefore a digital output has to be programmed for "Overtorque detection 1" (H2-□□ = B or 17). Using this with the factory setting car stuck is detected (output is switched) torque/current is higher than 150% for 10 sec. The level can be adjusted in L6-02, the time in L6-03. The output is switched of and an OL3 fault will be indicated (see *Fig 5.45*)

DC Injection/
zero servo

speed

Inverter enable (D/I)

Up/Down (D/I)

Selected Speed (D/I)

Fault

Torque is higher
than L6-02

detect. time
L6-03
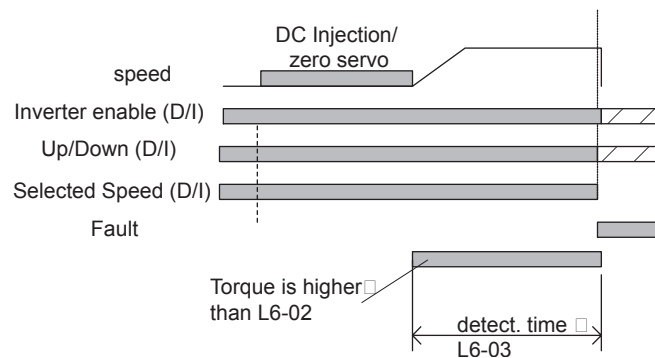
Fig 5.45 Car Stuck fault detection

◆ Limiting Motor Torque (Torque Limit Function)

This function allows limitation of motor shaft torque independently for each of the four quadrants. The torque limit can be set as fixed value using parameters or as variable value using an analog input. The torque limit function can be used with Open Loop Vector and Closed Loop Vector control only.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L7-01	Forward drive torque limit	300%*	No	No	A	A
L7-02	Reverse drive torque limit	300%*	No	No	A	A
L7-03	Forward regenerative torque limit	300%*	No	No	A	A
L7-04	Reverse regenerative torque limit	300%*	No	No	A	A
L7-06	Torque limit time constant	200 ms	No	No	A	No
L7-07	Torque limit operation during accel./decel.	0	No	No	A	No

* A setting value of 100% is equal to the motor rated torque.

Multi-function Output (H2-01 to H2-03)

Set Value	Function	Control Methods			
		V/f	V/f with PG	Open Loop Vector	Closed Loop Vector
30	During torque limit	No	No	Yes	Yes

■Setting the Torque Limit Using Parameters

Using L7-01 to L7-04, four torque limits in the following directions can be set individually: Forward drive, reverse drive, forward regenerative and reverse regenerative (see *Fig 5.46*)

Fig 5.46 Torque Limit Parameters

■Using a Digital Output to Signalize Operation at the Torque Limit

If a multifunction output is set for this function (H2-01 to H2-03 is set to "30"), the output is switched ON when the motor output torque reaches one of the torque limits.

5

■ Enabling Integral Torque Limit Operation (L7-06 and L7-07)

In Open Loop Vector control an integral operation can be applied to the torque limit function (P-control is standard). This improves the torque limit responsiveness and smoothes the torque limit operation. To enable the integral operation set parameter L7-07 to 1. The integral time constant can be set in parameter L7-06.

■Setting Precautions
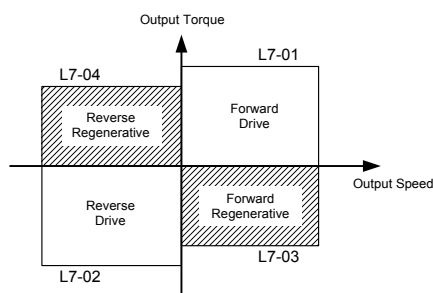
- When the output torque reaches the torque limit, control and compensation of the motor speed is disabled to prevent the output torque from exceeding the torque limit. The torque limit has the priority.

- The torque limit accuracy is ±5% at an output frequency of 10 Hz or above. When output frequency is lower than 10 Hz, the accuracy is lowered.

◆ Motor Overload Protection

The motor can be protected from overload using the built-in electronic thermal overload relay function.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
E2-01	Motor rated current	1.90 A *	No	Q	Q	Q
L1-01	Motor protection selection	1	No	Q	Q	Q
L1-02	Motor protection time constant	1.0 min	No	A	A	A

* Factory settings depend on Inverter capacity. (The values shown are for a 200 V Class Inverter with 0.4 kW.)

Multi-Function Outputs (H2-01 to H2-03)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
1F	Motor overload (OL1, including OH3) pre-alarm (ON: 90% or more of the detection level)	Yes	Yes	Yes

■Setting Motor Rated Current (E2-01)

Set the rated current value on the motor nameplate in parameters E2-01 (for motor 1). This set value is the base current for the internal thermal overload calculation.

■Setting Motor Overload Protection Characteristics (L1-01)

Set the overload protection function in L1-01 according to the used motor.

The induction motor's cooling abilities vary with the motor type. Consequently, you must select the electronic thermal protection characteristics.

Set L1-01 to:
0: to disable the thermal motor protection function.
1: to enable the thermal motor protection for a fan cooled general purpose motor (self-cooled).
2: to enable the thermal motor protection for an inverter motor (externally cooled).
3: to enable the thermal motor protection for a special vector motor (externally cooled).

■Setting Motor Protection Operation Time (L1-02)

The motor protection operation time is the time for that the motor can handle a 150% overload when it was running with the rated load before (i.e. operating temperature was reached before applying the 150% overload). Set the motor protection operation time in L1-02. The factory setting is 60 sec.

Fig 5.47 shows an example of the characteristics of the electronic thermal protection operation time (L1-02 = 1.0 min., operation at 50 Hz, general-purpose motor characteristics, when L1-01 is set to 1)
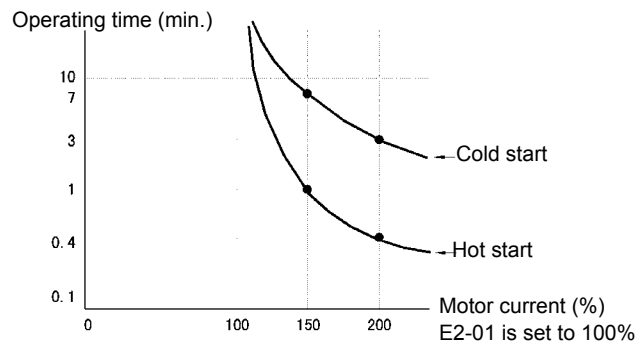
Fig 5.47 Motor Protection Operation Time

■Setting a Motor Overload Pre-Alarm

If the motor overload protection function is enabled (i.e., L1-01 is set to a value different from 0) and H2-01 is set to H2-03 (output terminals M1-M2, M3-M4, and M5-M6 function selection) to 1F (motor overload OL1 pre-alarm), the motor overload pre-alarm will be output at. If the electronic thermal value reaches minimum 90% of the overload detection level, the output terminal that has been set will be turned ON.

◆ Output Current Observation

The inverter can observe the output current and thereby detect if something is wrong in the sequence or with the motor connection. There are two observer functions, one for the start and one during run.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
S1-14	SE2 detection time	200 ms	No	A	A	A
S1-15	SE3 detection time	200 ms	No	A	A	A

SE2 fault (SE2, Current observation at start)

At the brake open delay time (S1-06) + S1-14 after the Up/Down command was given, the output current is measured. If it is below 25% of the motor no-load current (E2-03) a SE2 fault will be output.

SE3 fault (SE3, Current observation during Run)

From the time S1-15 after the Up/Down command was given, the inverter starts to observe the output current continuously. If it falls below 25% of the motor no-load current (E2-03) a SE3 will be output.

Inverter Protection

◆ Inverter Overheat Protection

The Inverter is protected against overheating using a thermistor that detects the heatsink temperature.

When the overheat temperature level is reached the inverter output is switched off.

To prevent a suddenly and unexpected stop of the inverter due to an over temperature, an overheating pre-alarm can be output. The temperature level for that pre-alarm can be set in parameter L8-02. Using parameter L8-03 the inverter operation when an over temperature occurs can be selected.

If a multifunction output is programmed for this function the output is switched ON when the heatsink temperature exceeds the overheat pre-alarm level set in L8-02.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L8-02	Overheat pre-alarm level	95°C *	No	A	A	A
L8-03	Inverter overheat (OH) pre-alarm operation selection	3	No	A	A	A

* The factory setting depends on the inverter capacity.

Multifunction Outputs (H2-01 to H2-03)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
20	Inverter overheat (OH)	Yes	Yes	Yes

◆ Input Open Phase Protection

This function detects an open input phase by observing the DC bus ripple level.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L8-05	Input open-phase protection selection	1	No	A	A	A

The factory setting is enabled. It is not recommended to disable this function.

◆ Output Open Phase Protection

This function detects an open output phase by comparing the output current value of each phase with an internal set output open phase detection level (5% of inverter rated current). The detection will not work when the output frequency is below 2% of the base frequency.

Three settings are available:

- L8-07=0, no output open phase detection
- L8-07=1, the loss of one phase is detected only
- L8-07=2, the loss of 2 or 3 phases is detected as well

The detection delay time can be set in parameter L8-20.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L8-07	Output open-phase protection selection	2	No	A	A	A
L8-20	Output phase loss detection time	0.2 sec	No	A	A	A

◆ Ground Fault Protection

This function detects the earth leakage current by calculating the sum of the three output currents. Normally it should be 0. If the earth leakage current gets too high, the inverter output will be switched off and a GF fault is shown on the display. The fault contact is activated.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L8-09	Ground protection selection	1	No	A	A	A

■Precautions

- It is not recommended to disable this function.
- A Ground Fault can also be detected if the contactors at the inverter output are opened when the output is still active. Therefore, to prevent false Ground Fault detection check the sequence and make sure, that the output is switched of or base blocked before opening the contactors.

5

◆ Cooling Fan Control

This function controls the fan which is mounted to the inverters heatsink.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L8-10	Cooling fan control selection	0	No	A	A	A
L8-11	Cooling fan control delay time	60 s	No	A	A	A

■Selecting the Cooling Fan Control

Using parameter L8-10 two modes can be selected:

0: The fan is ON only when the inverter output is ON, i.e. a voltage is output. This is the factory setting. The turn OFF delay time for the fan can be set in parameter L8-11. After a stop command the inverter waits for this time before switching OFF the cooling fan. The factory setting is 60 sec.

1: The fan is ON whenever the inverter power supply is switched ON.

◆ Setting the Ambient Temperature

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
L8-12	Ambient Temperature	45° C	No	A	A	A

At high ambient temperatures an output current derating has to be considered. The derating depends on the ambient temperature. The derating curve is shown in *Fig 5.48*. To ensure a safe inverter protection at high ambient temperatures, always set parameter L8-15 to the actual ambient temperature.
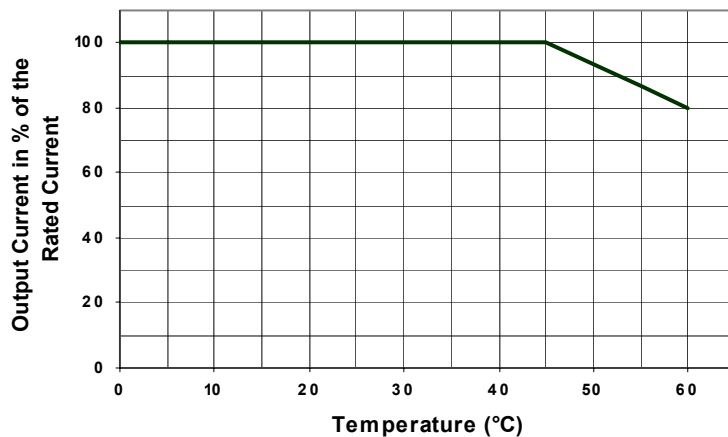

Fig 5.48 Ambient Temperature Derating Curve

Input Terminal Functions

The digital multifunction inputs can be set for several functions using the H1-01 to H1-05 parameters (terminal S3 to S7 function selection). These following section describes the input functions not mentioned in any other section.

■**Related Parameters**

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
H1-01	Terminal S3 function selection	80	No	A	A	A
H1-02	Terminal S4 function selection	84	No	A	A	A
H1-03	Terminal S5 function selection	81	No	A	A	A
H1-04	Terminal S6 function selection	83	No	A	A	A
H1-05	Terminal S7 function selection	F	No	A	A	A

◆ **Blocking Inverter Outputs (Hardware Baseblock)**

Using a baseblock command the inverter output can be cut immediately. When baseblock is activated the power supply of the IGBT driver circuit is cut off. In this case the motor will start coasting. If the baseblock command is cleared, the inverter output operation is resumed.

To use the baseblock function one of the digital input S8 must be used. The input is a NC input, i.e. if terminal S8 is open, the inverter is baseblocked.

◆ **Stopping the Inverter on External Device Errors (External Error Function)**

The external error function activates the error contact output and stops the Inverter operation. Using this function the inverter operation can be stopped on peripheral devices break down or other errors. The digital operator will display EFx (External error [input terminal Sx]). The x in EFx shows the number of the terminal at which the external error signal is input. For example, if an external error signal is input to terminal S3, EF3 will be displayed.

To use the external error function, set one of the values 20 to 2F in one of the parameters H1-01 to H1-05 (digital input terminal S3 to S7 function selection).

Select the value to be set in H1-01 to H1-05 from a combination of any of the following three conditions.

• Signal input level from peripheral devices

• External error detection method

• Operation after external error detection

5

The following table shows the relationship between the external fault conditions and the set value in H1-□□.

Set Value	Input Level (See Note 1.)		Error Detection Method (See Note 2.)		Operation During Error Detection			
	NO Contact	NC Contact	Constant Detection	Detection During Operation	Decelerate to Stop (Error)	Coast to Stop (Error)	Emergency Stop (Error)	Continue Operation (Warning)
20	Yes		Yes		Yes			
21		Yes	Yes		Yes			
22	Yes			Yes	Yes			
23		Yes		Yes	Yes			
24	Yes		Yes			Yes		
25		Yes	Yes			Yes		
26	Yes			Yes		Yes		
27		Yes		Yes		Yes		
28	Yes		Yes				Yes	
29		Yes	Yes				Yes	
2A	Yes			Yes			Yes	
2B		Yes		Yes			Yes	
2C	Yes		Yes					Yes
2D		Yes	Yes					Yes
2E	Yes			Yes				Yes
2F		Yes		Yes				Yes

1. Sets the input level at which errors are detected. (NO contact: External error when ON; NC contact: External error when OFF).
2. Set the detection method to detect errors using either constant detection or detection during operation.
   Constant detection: Detects while power is supplied to the Inverter.
   Detection during operation: Detects only during Inverter operation.

◆ Using the Timer Function

The multi-function digital input terminals S3 to S7 can be used as timer function input terminals, and multi-function output terminals M1-M2, M3-M4, and M5-M6 can be used as timer function output terminals. By setting the delay time, you can prevent chattering of the sensors and switches.

- Set one of the parameters H1-01 to H1-05 (digital input terminal S3 to S7) to 18 (timer function input).
- Set H2-01 to H2-03 (multi-function output terminals M1-M2, M3-M4, and M5-M6 function selection) to 12 (timer function output).

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
b4-01	Timer function ON-delay time	0.0 s	No	A	A	A
b4-02	Timer function OFF-delay time	0.0 s	No	A	A	A

■Multi-function Digital Inputs (H1-01 to H1-05)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
18	Timer function input	Yes	Yes	Yes

Multifunction Outputs (H2-01 to H2-03)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop Vector
12	Timer function output	Yes	Yes	Yes

■Setting Example

When the timer function input ON time is longer than the value set in b4-01, the timer output function is turned ON. When the timer function input OFF time is longer than the value set in b4-02, the timer output function is turned OFF. An example of timer function operation is given in the following diagram.
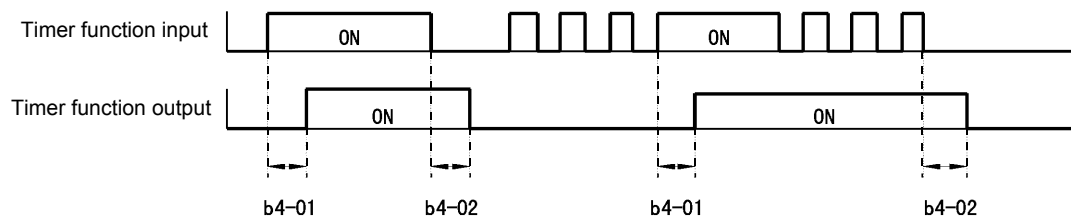
Fig 5.49   Timer Function Operation Example

5

◆ Output Contactor Answer Back Detection

The output contactors can be observed using the output contactor answer back function. Therefore an auxiliary contact of the motor contactors must be connected to a digital input which is set to for this function (H1-□□=86). If no answer back signal comes from the contactor, the inverter detects a SE1 fault (see below).

■Multi-function Digital Inputs (H1-01 to H1-05)

Set Value	Function	Control Methods		
		V/f	Open Loop Vector	Closed Loop´ Vector
86	Output contactor answer back	Yes	Yes	Yes

SE1 fault (SE1:Contactor Feed-back Faults)

There are 3 possibilities of fault condition

Case 1: Output contactor of output inverter kept closing before contactor closed command set.

Case 2: Output contactor cannot be closed within the contactor close delay time.

Case 3: Output contactor is opened during inverter running.
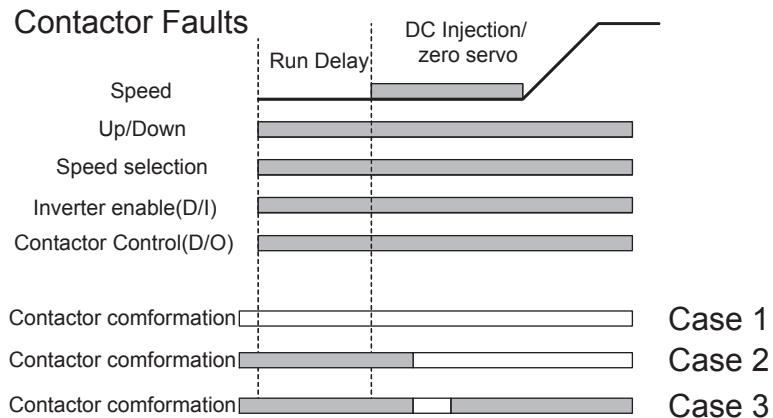
Output Terminal Functions

The digital multifunction outputs can be set for several functions using the H2-01 to H2-03 parameters (terminal M1 to M6 function selection). These functions are described in the following section.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
H2-01	Terminal M1-M2 function selection	0	No	A	A	A
H2-02	Terminal M3-M4 function selection	1	No	A	A	A
H2-03	Terminal M5-M6 function selection	2	No	A	A	A

■During Run (Setting: 0) and During Run 2 (Setting: 37)

During Run (Setting: 0)

OFF	The Run command is OFF and there is not output voltage.
ON	The Run command is ON or a voltage is being output.

During Run 2 (Setting: 37)

OFF	The inverter is not outputting a frequency. (Baseblock, DC injection braking or stopped)
ON	The inverter is outputting a frequency.

These outputs can be used to indicate the inverter's operating status.

Fig 5.50 Timing Chart for "During RUN" Output

■Zero Speed (Setting: 1)

Fig 5.51 Timing Chart for Zero-speed

OFF	The output frequency is higher than the zero speed level (b2-01).
ON	The output frequency is lower than the zero speed level (b2-01).

5

■Inverter Operation Ready (Setting: 6)

If a multifunction output is programmed for this function the output will be switched ON when the initialisation of the inverter at startup has finished without any faults.
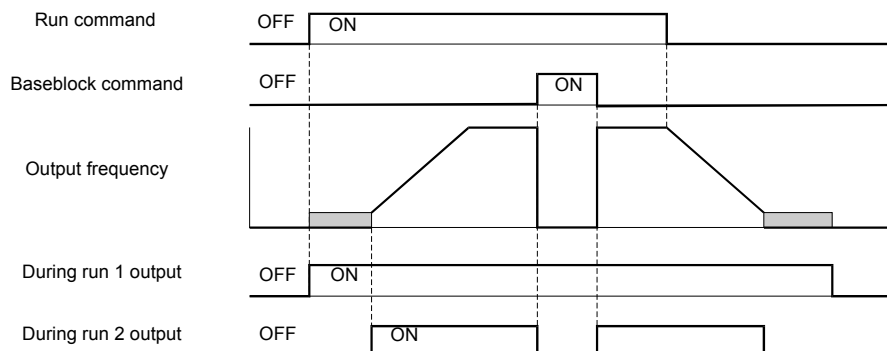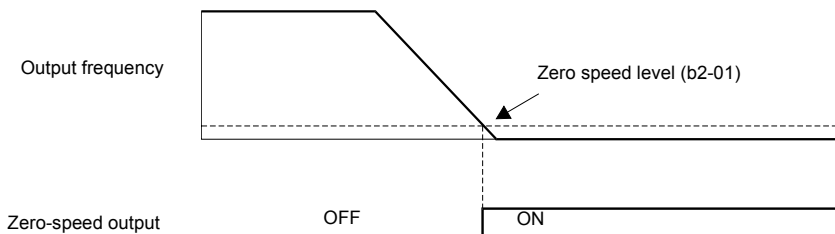
■During DC Bus Undervoltage (Setting: 7)

If a multifunction output is programmed for this function the output is switched ON as long as a DC bus under voltage is detected.

■During Baseblock (Setting: 8)

If a multifunction output is programmed for this function the output is switched ON as long as the inverter output is base blocked.

■Frequency Reference Source Selection (Setting: 9)

If a multifunction output is programmed for this function the output is ON when the digital operator is selected as frequency reference source. If any other frequency reference is selected the output is switched OFF.

■Run Command Selection Status (Setting: A)

If a multifunction output is programmed for this function the output is switched ON when the digital operator is selected as RUN command source. If any other RUN command source is selected output is switched OFF.

■Fault Output (Setting: E)

If a multifunction output is programmed for this function the output is switched ON when any fault different from CPF00 and CPF01 occurs. The output is also not switched at minor faults. (Refer to *page 6-2* pp. for a fault list.)

■Minor Fault Output (Setting: 10)

If a multifunction output is programmed for this function the output is switched ON when a minor fault occurs (refer to *page 6-8* pp. for an alarm list).

■Fault Reset Command Active (Setting: 11)

If a multifunction output is set for this function the output is switched ON as long as a fault reset command is input at one of the digital inputs.

■During Reverse Run (Setting: 1A)

If a multifunction output is programmed for this function the output is switched ON whenever a RUN command in reverse direction is active. The contact will also be ON during DC injection, Braking and Base Block. It will not work when a forward RUN command is input.

■During Base Block 2 (Setting: 1B)

If a multifunction output is programmed for this function the output is switched OFF as long as a Baseblock command is input at terminal S8

■**During Regenerative Operation (Setting: 1D)**

If a multifunction output is programmed for this function the output is switched ON when the motor works regenerative, i.e. when energy is fed back to the inverter.

■**Speed Detection at deceleration (Door Zone) (Setting:42)**

This output can be used to detect, that the car is in the door zone. The detection is speed dependent.

	V/f control and Open Loop Vector control	Closed Loop Vector control
OFF	The output frequency is lower than S1-27 during deceleration	The motor speed is lower than S1-27 during deceleration
ON	The output frequency is higher than S1-27 during deceleration	The motor speed is higher than S1-27 during deceleration

If the Up/Down command is released, this output is switched OFF.

■**Not Zero Speed (Setting:43)**

This function can be used for indicating the reverse condition of Zero speed status.

OFF	The output frequency is lower than the zero speed level (b2-01).
ON	The output frequency is higher than the zero speed level (b2-01).

5

Motor and V/f Pattern Setup

◆ Setting Motor Parameters

In vector control method, the motor parameters are set automatically during autotuning (refer to *page 5-51, Autotuning*. If autotuning does not complete normally, set them manually.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
E2-01	Motor rated current	14.00 A *	No	Q	Q	Q
E2-02	Motor rated slip	2.73 Hz *	No	A	A	A
E2-03	Motor no-load current	4.50 A *	No	A	A	A
E2-04	Number of motor poles (Number of poles)	4 poles	No	No	Q	Q
E2-05	Motor line-to-line resistance	0.771 Ω *	No	A	A	A
E2-06	Motor leak inductance	19.6%	No	No	A	A
E2-07	Motor iron saturation coefficient 1	0.50	No	No	A	A
E2-08	Motor iron saturation coefficient 2	0.75	No	No	A	A
E2-10	Motor iron loss for torque compensation	112 W *	No	A	No	No
E2-11	Motor rated output power	3.700 *	No	Q	Q	Q
E2-12	Motor iron saturation coefficient 3	1.30	No	No	A	A

Note All factory-set parameters are for a Yaskawa standard 4-pole motor.

* The factory settings depend on Inverter capacity (the values shown are for a 400 V Class Inverter for 3.7 kW).

■Manual Setting of the Motor Parameters

Motor Rated Current Setting (E2-01)

Set E2-01 to the rated current value on the motor nameplate.

Motor Rated Slip Setting (E2-02)

Set E2-02 to the motor rated slip calculated from the number of rated rotations on the motor nameplate.

$$\text{Motor rated slip} = \text{Motor rated frequency (Hz)} - \frac{\text{Rated speed (rpm) x No. of motor poles}}{120}$$

Motor No-Load Current Setting (E2-03)

Set E2-03 to the motor no-load current at the rated voltage and rated frequency. Normally, the motor no-load current is not written on the motor nameplate. Consult the motor manufacturer.

Factory setting is the no-load current value for a standard Yaskawa 4-pole motor.

Number of Motor Poles Setting (E2-04)

E2-04 is displayed only when Closed Loop Vector control method is selected. Set the number of motor poles as written on the motor nameplate.

Motor Line-to-Line Resistance Setting (E2-05)

E2-05 is set automatically when performing motor line-to-line resistance autotuning. When you cannot perform tuning, consult the motor manufacturer for the line-to-line resistance value. Calculate the resistance from

the line-to-line resistance value in the motor test report using the following formula, and then make the setting accordingly.

- E-type insulation: [Line-to line resistance (Ω) at 75°C of test report] × 0.92 (Ω)
- B-type insulation: [Line-to line resistance (Ω) at 75°C of test repor]t × 0.92 (Ω)
- F-type insulation: [Line-to line resistance (Ω) at 115°C of test report] × 0.87 (Ω)

Motor Leak Inductance Setting (E2-06)

Set the amount of voltage drop due to motor leakage inductance in E2-06 as percentage of the motor rated voltage. Make this setting when using high-speed motors because the standard value will be too high. (Normally, high speed motors have a low inductance compared to standard motors.) If the inductance is not written on the motor nameplate, consult the motor manufacturer.

Motor Iron Saturation Coefficients 1 and 2 Settings (E2-07)

E2-07 and E2-08 are set automatically during rotating autotuning.

Motor Iron Loss for Torque Compensation Setting (E2-08)

E2-10 is displayed only in V/f control method and can be set to increase the torque compensation accuracy. The motor iron loss has to be set in kW.

◆ Autotuning

Autotuning sets motor parameters automatically. Therefore some motor data which are usually written at the nameplate must be input and the autotuning has to be performed.

> 1. If the output contactors is controlled by the inverter it will be closed during autotuning. If the contactors are controlled by an external controller make sure to close the contacts during autotuning.
> 2. Make sure to close the baseblock contact during autotuning. Otherwise the autotuning can not be started and will terminate with a minor fault.
> 3. For rotating autotuning make sure to open the brake.

■ Setting the Autotuning Mode

One of the following three autotuning modes can be set.
- Rotating autotuning
- Non-rotating autotuning
- Non-rotating autotuning for line-to-line resistance only

Rotating Autotuning (T1-01 = 0)

Rotating autotuning can be used for Open Loop and Closed Loop Vector control only. Set T1-01 to 0, input the data from the motor nameplate, and then press the RUN key on the Digital Operator. The Inverter will operate the motor for approximately 1 minute and set the required motor parameters automatically.

> Use this tuning mode only, if the motor can rotate freely which means that the ropes are removed. The gearbox can be connected to the motor.

5

Non-rotating Autotuning (T1-01 = 1)

Non-rotating autotuning can be used for Open Loop and Closed Loop Vector control only. Set T1-01 to 1, input the data from the motor nameplate, and then press the RUN key on the Digital Operator. The inverter will supply power to the non-rotating motor for approximately 1 minute and some of the motor parameters will be set automatically. The remaining motor parameters will be set automatically during the first time operation.

Non-rotating Autotuning for Line-to-Line Resistance (T1-01 = 2)

Non-rotating autotuning for line-to-line resistance can be used in any control mode. This is the only possible autotuning for V/f control.

To perform autotuning in V/f control, set T1-02 (Motor rated power) and T1-04 (Motor rated current) and then press the RUN key on the Digital Operator. The Inverter will supply power to the non-rotating motor for approximately 20 seconds and the Motor line-to-line resistance and cable resistance will be automatically measured.

■ Precautions Before Using Autotuning

Read the following precautions before using autotuning.

- Use non-rotating autotuning whenever the load cannot be disconnected from the motor (e.g. the ropes can't be removed).
- Use rotating autotuning whenever performing autotuning when high precision is required or for a motor that is not connected to a load.
- If the wiring between the Inverter and motor changes by 50 m or more perform non-rotating autotuning for line-to-line resistance.
- If the motor cable is long (50 m or longer), perform non-rotating autotuning for line-to-line resistance.
- If a mechanical brake is used, make sure that it is *not* opened for non-rotating autotuning. Make sure that it is opened for rotating autotuning.
- Power will be supplied to the motor when non-rotating autotuning is performed even though the motor will not turn. Do not touch the motor until autotuning has been completed.
- To cancel autotuning, press the STOP key on the Digital Operator.

■Precautions for Rotating and Non-rotating Autotuning

If the motor rated voltage is higher than the power supply voltage, lower the base voltage value like shown in *Fig 5.52* to prevent saturation of the Inverter's output voltage. Use the following procedure to perform autotuning:

1. Input the voltage of the input power supply to T1-03 (Motor rated voltage).
2. Input the results of the following formula to T1-05 (Motor base frequency):

$$\text{T1-05} \;=\; \text{Base frequency from motor nameplate} \;\times\; \frac{\text{T1-03}}{\text{Motor rated voltage}}$$

3. Perform autotuning.

After the completion of autotuning, set E1-04 (Max. output frequency) to the base frequency from the motor's nameplate.
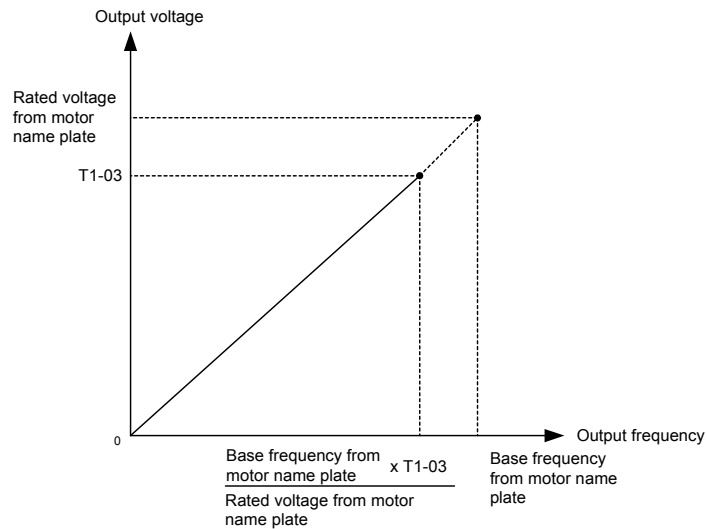
Fig 5.52 Motor Base Frequency and Inverter Input Voltage Setting

When speed precision is required at high speeds (i.e., 90% of the rated speed or higher), set T1-03 (Motor rated voltage) to the input power supply voltage × 0.9. In this case at high speeds the output current will increase as the input power supply voltage is reduced. Be sure to provide sufficient margin in the Inverter current.

■**Precautions after Rotating and Non-rotating Autotuning**

If the maximum output frequency and base frequency are different, set the maximum output frequency (E1-04) after autotuning.

5

■Parameter Settings for Autotuning

The following parameters must be set for autotuning.

Param-eter Number	Name	Display	Setting Range	Factory Setting	Data Displays during Autotuning		
					V/f	Open Loop Vector	Closed Loop Vector
T1-01	Autotuning mode selection	Set the autotuning mode. 0: Rotating autotuning 1: Non-rotating autotuning 2: Non-rotating autotuning for line-to-line resistance only	0 to 2	2 (V/f and V/f with PG) 1 (Open and Closed Loop Vector)[*1]	Yes (only 2)	Yes	Yes
T1-02	Motor rated power	Set the output power of the motor in Kilowatts.	10% to 200% of Inverter rated output	Same as Inverter rated output	Yes	Yes	Yes
T1-03	Motor rated voltage	Set the rated voltage of the motor.[*2]	0 to 255.0 V (200 V class) 0 to 510.0 V (400 V class)	200.0 V (200 V class) 400.0 V (400 V class)	No	Yes	Yes
T1-04	Motor rated current	Set the rated current of the motor in Amps.	10% to 200% of Inverter rated current	Same as general-purpose motor with same capacity as Inverter	Yes	Yes	Yes
T1-05	Motor rated frequency	Set the base frequency of the motor.[*2]	0 to 120.0 Hz	50.0 Hz	No	Yes	Yes
T1-06	Number of motor poles	Set the number of motor poles.	2 to 48 poles	4 poles	No	Yes	Yes
T1-07	Motor rated speed	Set the base speed of the motor in r/min.	0 to 24000	1450 r/min	No	Yes	Yes
T1-08	Number of PG pulses per revolution	Sets the number of pulses for the PG (pulse generator or encoder) per motor revolution without a multiplication factor	0 to 60000	1024	No	No	Yes
T1-09	No load current	Sets the no load current of motor.	0.0 to 13.99 [*2]	E2-03	No	Yes	Yes

* 1. Only setting 2 (non-rotating autotuning for line-to-line resistance only) is possible for V/f control or V/f control with PG.

* 2. For an inverter motor or vector control motor, the voltage and frequency may be lower than for a general-purpose motor. Always confirm setting on the nameplate or in test reports. Also, if you know the no-load values, set the no-load voltage in T1-03 and the no-load frequency in T1-05 to obtain better accuracy.

◆ Setting the V/f Pattern

Using the E1-□□ parameters the Inverter input voltage and the V/f pattern can be set as needed. It is not recommended to change the settings when the motor is used in Open Loop or Closed Loop vector control mode.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
E1-01	Input voltage setting	200 V [*1]	No	Q	Q	Q
E1-04	Max. output frequency (FMAX)	50.0 Hz	No	Q	Q	Q
E1-05	Max. voltage (VMAX)	190.0 V [*1]	No	Q	Q	Q
E1-06	Base frequency (FA)	50.0 Hz	No	Q	Q	Q
E1-07	Mid. output frequency (FB)	3.0 Hz [*2]	No	A	A	No
E1-08	Mid. output frequency voltage (VB)	20.0 V [*1*2]	No	Q	Q	No
E1-09	Min. output frequency (FMIN)	0.5 Hz [*2]	No	Q	Q	A
E1-10	Min. output frequency voltage (VMIN)	12.5 V [*1*2]	No	Q	Q	No
E1-13	Base voltage (VBASE)	0.0 V [*4]	No	A	No	No

* 1. These are values for a 200 V Class Inverter. Values for a 400 V Class Inverter are double.
* 2. The factory setting will change when the control method is changed. (Open Loop Vector control factory settings are given.)
* 3. The contents of parameters E1-11 and E1-12 are ignored when set to 0.00.
* 4. E1-13 is set to the same value as E1-05 by autotuning.

■Setting Inverter Input Voltage (E1-01)

Set the Inverter input voltage correctly in E1-01 so that it matches the power supply voltage.

5

■Setting the V/f Pattern

If E1-03 is set to F the V/f pattern can be set individually using the parameters E1-04 to E1-10. See *Fig 5.53* for details.
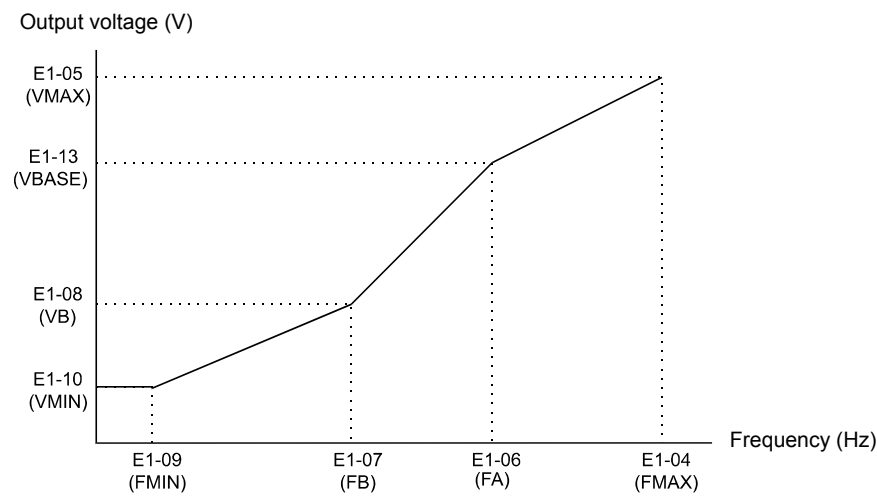
Fig 5.53 V/f pattern setting

> **INFO**
>
> To set the V/f characteristics linear, set E1-07 and E1-09 to the same value. In this case, E1-08 will be ignored.

■Setting Precautions

When the setting is to user-defined V/f pattern, beware of the following points:

• When changing control method, parameters E1-07 to E1-10 will change to the factory settings for that control method.

• Be sure to set the four frequencies as follows:
E1-04 (FMAX) ≥ E1-06 (FA) > E1-07 (FB) ≥ E1-09 (FMIN)

Digital Operator/Monitor Functions

◆ Setting Digital Operator/Monitor Functions

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
o1-01	Monitor selection	6	Yes	A	A	A
o1-02	Monitor selection after power up	1	Yes	A	A	A
o1-03	Frequency units of reference setting and monitor	0	No	A	A	A
o1-04	Setting unit for frequency reference related parameters	0	No	No	No	A
o1-05	LCD Display contrast	3	Yes	A	A	A
o2-02	STOP key during control circuit terminal operation	0	No	A	A	A
o2-03	Inverter kVA selection	0	No	A	A	A
o2-04	User parameter initial value	0	No	A	A	A
o2-05	Frequency reference setting method selection	0	No	A	A	A
o2-06	Operation selection when digital operator is disconnected	0	No	A	A	A
o2-07	Cumulative operation time setting	0	No	A	A	A
o2-08	Cumulative operation time selection	0	No	A	A	A
o2-09	Initialize Mode	2	No	A	A	A
o2-10	Fan operation time setting	0	No	A	A	A
o2-12	Fault trace initialize	0	No	A	A	A
o2-13	"Number of Travels" monitor initialize	0	No	A	A	A

■Monitor Selection (o1-01)

Using parameter o1-01 the third monitor item that is displayed in drive mode can be selected. This function has no effect on the optional LCD-operator (JVOP-160).

■Monitor Display when the Power Supply is Turned ON (o1-02)

Using parameter o1-02 the monitor item (U1-□□) that is to be displayed on the Digital Operator/Monitor when the power supply is turned ON can be selected.

■Changing Frequency Reference and Display Units (o1-03)

Set the Digital Operator/Monitor frequency reference and display units using parameter o1-03. The setting in o1-03 will affect the display units of the following monitor items:

• U1-01 (Frequency Reference)
• U1-02 (Output Frequency)
• U1-05 (Motor Speed)
• U1-20 (Output Frequency after Soft Start)
• d1-01 to d1-17 (Frequency references)

■Changing the Units for Frequency Parameters Related to V/f settings (o1-04)

Using parameter o1-04 the unit for frequency parameters related to the V/f setting can be changed. If o1-04 is set to 0 it will be Hz. If o1-04 is set to 1 it will be rpm.

5

■Changing the Display Contrast (o1-05)

Using o1-05 the contrast of the LCD display on the digital operator can be raised or lowered. Lowering the o1-05 value will decrease the contrast and vice versa.

■Enabling the LOCAL/REMOTE Key (o2-01)

Set o2-01 to 1 to enable the LOCAL/REMOTE Key on the Digital Operator.

If the key is enabled, frequency reference source or the RUN command source can be switched over between LOCAL (Operator) and REMOTE (b1-01/02 setting).

■Disabling the STOP Key (o2-02)

This parameter is used to set whether the STOP key on the operator is active during remote control (b1-02 ≠ 0) or not.

If o2-02 is set to 1, a STOP command from the operators STOP key will be accepted. If o2-02 is set to 0 it will be disregarded.

■Saving User Parameters (o2-03)

You can save the current Inverter parameter setting values as user-set parameter initial values. Therefore parameter o2-03 has to be set to 1.

To initialize the inverter parameters using the user-set initial values in memory set parameter A1-03 to 1110. To clear the user-set initial values in memory, set o2-03 to 2.

■Changing the Inverter Capacity Setting (o2-04)

The inverter capacity setting can be set using parameter o2-04. Refer to *page 4-53, Factory Settings that Change with the Inverter Capacity (o2-04)* to see parameters that depend on this setting.

Normally it not necessary to change this setting, unless the control card has been changed.

■Setting the Frequency Reference using the UP and DOWN Keys without Using the Enter Key (o2-05)

This function is active when frequency references are input from the Digital Operator/Monitor. When o2-05 is set to 1, you can increment and decrement the frequency reference using the UP and DOWN keys without using the Enter key.

■Operation Selection when the Digital Operator/Monitor is Disconnected (o2-06)

This function selects the operation when the digital operator gets disconnected when a RUN command is active.

If o2-06 is set to 0 the operation is continued.
If o2-06 is set to 1 the output is switched off and the motor coasts to stop. The fault contact is operated. When the operator is reconnected an OPR (Operator disconnected) is shown.

■Cumulative Operation Time (o2-07 and o2-08)

The inverter has a function that counts the operation time of the inverter cumulatively.

Using parameter o2-07 the cumulative operation time can be changed, e.g. after a replacement of the control board. If parameter o2-08 is set to 0 the inverter counts the time whenever the power supply is switched ON. If o2-08 is set to 1 the time when a RUN command is active is counted only. The factory setting is 0.

■**Cooling Fan Operation Time (o2-10)**

This function counts the operating time of the inverter mounted fan cumulatively.

Using parameter o2-10 the counter can be reset, e.g. when the fan was replaced.

■**Fault Trace Initialize (o2-12)**

This function can be used to initialize the fault trace by setting parameter o2-12 to 1.

■**"Number of Travels" counter Initialize (o2-15)**

Using this parameter the lift operation counter monitor (U1-55) can be initialized.

◆ **Copying Parameters (JVOP-160 only)**

The Digital Operator/Monitor can perform the following three functions using a built-in EEPROM (non-volatile memory).

- Store Inverter parameter set values in the Digital Operator/Monitor by setting o3-01 to 1 (READ)
- Write parameter set values stored in the Digital Operator/Monitor to the Inverter by setting o3-01 to 2 (COPY)
- Compare parameter set values stored in the Digital Operator/Monitor with Inverter parameters settings by setting o3-01 to 3 (VERIFY)

The data saved in the operator can be protected from overwriting by setting parameter o3-02 to 0. In the case a READ command can not be executed. If it is nevertheless still done, "PrE" will be displayed at the operator.

5

■**Related Parameters**

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
o3-01	Copy function selection	0	No	A	A	A
o3-02	Read permitted selection	0	No	A	A	A

■ Storing Inverter set values in the Digital Operator/Monitor (READ)

To store Inverter set values in the Digital Operator/Monitor use the following method.

Table 5.1 READ Function Procedure

Step No.	Explanation	Digital Operator/Monitor Display
1	Press the Menu Key and select advanced programming mode.	-ADV- ** Main Menu ** Programming
2	Press the DATA/ENTER Key.	-ADV- Initialization **A1** - 00=1 Select Language
3	Press the Increment and Decrement Key until parameter o3-01 is displayed (Copy Function Selection).	-ADV- COPY Function **o3** - 01=0 Copy Funtion Sel
4	Press the DATA/ENTER Key and select the constants setting display.	-ADV- Copy Function Sel o3-01= **0** *0* COPY SELECT
5	Change the set value to 1 using the Increment Key.	-ADV- Copy Function Sel o3-01= **1** *0* INV →OP READ
6	Set the changed data using the DATA/ENTER Key. The READ function will start.	-ADV- READ INV → OP READING
7	If the READ function ends normally, "End" is displayed on the Digital Operator/Monitor.	-ADV- READ READ COMPLETE
8	The display returns to o3-01 when a key is pressed.	-ADV- Copy Function Sel o3 - **01**=0 *0* COPY SELECT

If an error is displayed, press any key to cancel the error display and return to the o3-01 display. Refer to *page 6-14, Digital Operator Copy Function Faults* for corrective actions.

■**Writing Parameter Set Values Stored in the Digital Operator/Monitor to the Inverter (COPY)**

To write parameter set values stored in the Digital Operator/Monitor to the Inverter, use the following method.

Table 5.2 COPY Function Procedure

Step No.	Explanation	Digital Operator/Monitor Display
1	Press the MENU Key and select advanced programming mode.	-ADV- ** Main Menu ** Programming
2	Press the DATA/ENTER Key.	-ADV- Initialization **A1** - 00 = 1 Select Language
3	Press the Increment and Decrement Key until parameter o3-01 is displayed (Copy Function Selection).	-ADV- COPY Function **o3** - 01 = 0 Copy Funtion Sel
4	Press the DATA/ENTER Key and select the constants setting display.	-ADV- Copy Function Sel o3-01= **0** *0* COPY SELECT
5	Change the set value to 2 using the Increment Key.	-ADV- Copy Function Sel o3-01= **2** *0* OP→INV WRITE
6	Set the changed data using the DATA/ENTER Key. The COPY function will start.	-ADV- COPY OP→INV COPYING
7	If the COPY function ends normally, "End" is displayed on the Digital Operator/Monitor.	-ADV- COPY COPY COMPLETE
8	The display returns to o3-01 when a key is pressed.	-ADV- Copy Function Sel o3 - **01**=0 *0* COPY SELECT

If an error is displayed, set the parameters again. Refer to for corrective actions.

■Comparing Inverter Parameters and Digital Operator/Monitor Parameter Set Values (VERIFY)

To compare Inverter parameters and Digital Operator/Monitor parameter set values, use the following method.

Table 5.3 VERIFY Function Procedure

Step No.	Explanation	Digital Operator/Monitor Display
1	Press the MENU Key and select advanced programming mode.	-ADV- ** Main Menu ** -------- Programming
2	Press the DATA/ENTER Key.	-ADV- Initialization -------- **A1** - 00 = 1 Select Language
3	Press the Increment and Decrement Key until the parameter o3-01 is displayed (Copy Function Selection).	-ADV- COPY Function -------- **o3** - 01=0 Copy Funtion Sel
4	Press the DATA/ENTER Key and select the function setting display.	-ADV- Copy Function Sel -------- o3-01=**0** *0* COPY SELECT
5	Change the set value to 3 using the Increment Key.	-ADV- Copy Funtion Sel -------- o3-01= **3** *0* OP ←→INV VERIFY
6	Set the changed data using the DATA/ENTER Key. The VERIFY function will start.	-ADV- VERIFY DATA VERIFYING
7	If the VERIFY function ends normally, "End" is displayed on the Digital Operator/Monitor.	-ADV- VERIFY VERIFY COMPLETE
8	The display returns to o3-01 when a key is pressed.	-ADV- Copy Function Sel -------- o3 - **01** = 0 *0* COPY SELECT

If an error is displayed, press any key to cancel the error display and return to the o3-01 display. Refer to
for corrective actions.

■Application Precautions

INFO

When using the copy function, check that the following settings are the same between the Inverter data and the Digital
- Operator/Monitor data.
- Inverter product and type
- Software number
- Inverter capacity and voltage class
- Control method

◆ Prohibiting Overwriting of Parameters

If A1-01 is set to 0, all parameters except A1-01 and A1-04 are write protected, U1-□□, U2-□□ and U3-□□ will be displayed. If A1-01 is set to 1, only the parameters A1-01, A1-04 and A2-□□ can be read or written, U1-□□, U2-□□ and U3-□□ will be displayed. All other parameters will not be displayed.

If you set one of the parameters H1-01 to H1-05 (digital input terminal S3 to S7 function selection) to 1B (write parameters permitted), parameters can be written from the digital operator when the terminal that has been set is ON. When the set terminal is OFF, writing parameters other than the frequency reference is prohibited. However, the parameters can be read.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
A1-01	Parameter access level	2	Yes	A	A	A

◆ Setting a Password

When a password is set in A1-05 and if the set values in A1-04 and A1-05 do not match, only the settings of parameters A1-01 to A1-03, or A2-01 to A2-32 can be modified.

The setting of all parameters except A1-00 can be prohibited using the password function in combination with setting parameter A1-01 to 0 (Monitor only).

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
A1-01	Parameter access level	2	No	A	A	A
A1-04	Password	0	No	A	A	A
A1-05	Password setting	0	No	A	A	A

■Setting a Password

The password can be set in parameter A1-05. Normally A1-05 is not displayed. To display and modify A1-05 the MENU and Reset key must be pressed together in the A1-04 display.

5

◆ Displaying User-set Parameters Only

The A2 parameters (user-set parameters) and A1-01 (parameter access level) can be used to establish a parameter set that contains only the most important parameters.

Set the number of the parameter to which you want to refer in A2-01 to A2-32, and then set A1-01 to 1. Using the advanced programming mode you can read and modify A1-01 to A1-03 and the parameters set in A2-01 to A2-32 only.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
A2-01 to A2-32	User setting parameters	-	No	A	A	A

PG Option Cards

To get a more precise speed control the inverter can be equipped with a PG option card to connect a pulse generator. Two different PG cards can be used, the PG-B2 and the PG-X2. Refer to *page 2-24, Option Card Models and Specifications* to see details.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods		
				V/f	Open Loop Vector	Closed Loop Vector
F1-01	PG constant	1024	No	No	No	Q
F1-02	Operation selection at PG open circuit (PGO)	1	No	No	No	A
F1-03	Operation selection at overspeed (OS)	1	No	No	No	A
F1-04	Operation selection at deviation (DEV)	3	No	No	No	A
F1-05	PG rotation	0	No	No	No	Q
F1-06	PG division rate (PG pulse monitor)	1	No	No	No	A
F1-08	Overspeed (OS) detection level	115%	No	No	No	A
F1-09	Overspeed detection delay time (OS)	1.0 s	No	No	No	A
F1-10	Excessive speed deviation (DEV) detection level	10%	No	No	No	A
F1-11	Excessive speed deviation detection delay time (DEV)	0.5 s	No	No	No	A
F1-14	PG open-circuit detection delay time	2.0 s	No	No	No	A

■Using PG Speed Control Card

There are two types of PG Speed Control Card that can be used in Closed Loop Vector control:

- PG-B2: A/B-phase pulse input, compatible with complimentary outputs.
- PG-X2: A/B/Z-phase pulse input, compatible with line drivers (RS-422).

For the mounting instructions, specifications and connection diagrams refer to *page 2-24, Installing and Wiring Option Cards*.

IMPORTANT

If Open Loop Vector control is used and a PG card is installed, the speed detected by the PG card is displayed in the monitor parameter U1-05. Therefore the PG constant has to be set in parameter F1-01. The direction of the speed detection can be changed by parameter F1-05.
To change the U1-05 value to the internally calculated value remove the PG card.

■Setting Number of PG Pulses (F1-01)

Set the number of PG (Pulse Generator/Encoder) pulses in pulses per revolution.

■Suit the PG Rotation Direction and Motor Rotation Direction (F1-05)

Parameter F1-05 suits the PG rotation direction to the motor rotation direction. If the motor is rotating forwards, set whether it is A-phase leads or B-phase leads.

5
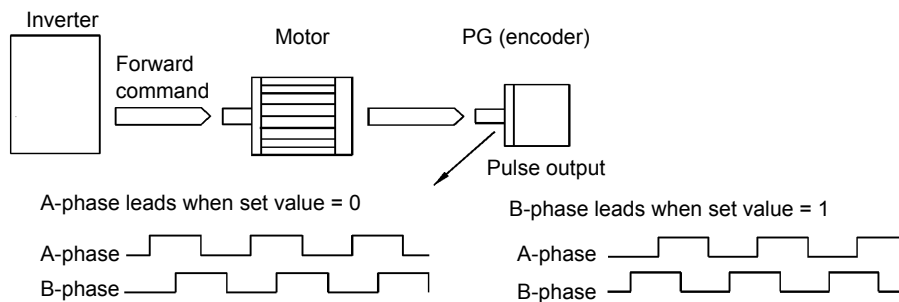
Example: Forward rotation of standard motor (PG)
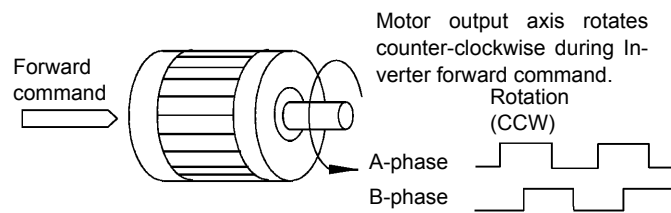
With the used PG the A-phase leads (CCW) when motor rotation is forward.

Generally, the A-phase leads when the rotation direction is counter-clockwise (CCW) seen from the shaft side (FWD command is input).

■Setting PG Pulse Monitor Output Division Ratio (F1-06)

This function is enabled only when using PG speed control card PG-B2. Set the division ratio for the PG pulse monitor output. The set value is expressed as n for the higher place digit, and m for the two lower place digits. The dividing ratio is calculated as follows:

Dividing ratio = $(1 + n)/m$ (Setting range) n: 0 or 1, m: 1 to 32

$$F1\text{-}06 = \quad \frac{\square}{n} \quad \frac{\square\square}{m}$$

The division ratio can be set within the following range: $1/32 \leq F1\text{-}06 \leq 1$. For example, if the division ratio is 1/2 (set value 2), half of the number of pulses from the PG are output at the pulse monitor.

■Detecting PG Open Circuit (F1-02 and F1-14)

Parameter F1-02 selects the stopping method when a PG disconnection is detected.

PG open (PGO) is only detected when the inverter is running at least with a frequency reference higher than 1% of the maximum output frequency or above the minimum frequency (E1-09) and the PG feedback signal is missing for the time set in F1-14 or longer.

■Detecting Motor Overspeed (F1-03, F1-08 and F1-09)

An overspeed (OS) is detected when the motor speed continues to exceed the set frequency value in F1-08 for a time longer than set in F1-09. After detecting an overspeed (OS), the Inverter stops according to the setting in F1-03.

■**Detecting Speed Difference between the Motor and Speed Reference (F1-04, F1-10 and F1-11)**

Speed deviation is detected when the speed deviation (i.e., the difference between the speed reference and the actual motor speed) is too large. Speed deviation (DEV) is detected only after a speed agreement (speed reference and actual motor speed are within the setting range of L4-02) and if a speed deviation higher than the set value in F1-10 continues for longer than the time set in F1-11. After a speed deviation is detected, the Inverter stops according to the setting in F1-04.

5

Battery Operation

Using battery operation the car can be moved to the next floor if the power supply fails. The battery operation, must be enabled by a digital input (H1-□□ = 85).

The battery voltage must be set in parameter L2-11.

■Related Constants.

Parameter No.	Name	Factory setting	Change during operation	V/f	Open Loop Vector	Closed Loop Vector
L2-11	Battery Voltage	0V	No	A	A	A

Multi-function Digital Inputs (H1-01 to H1-05)

Setting	Function mane	V/f	Open Loop Vector	Closed Loop Vector
85	Battery operation command	A	A	A

■Battery operation wiring
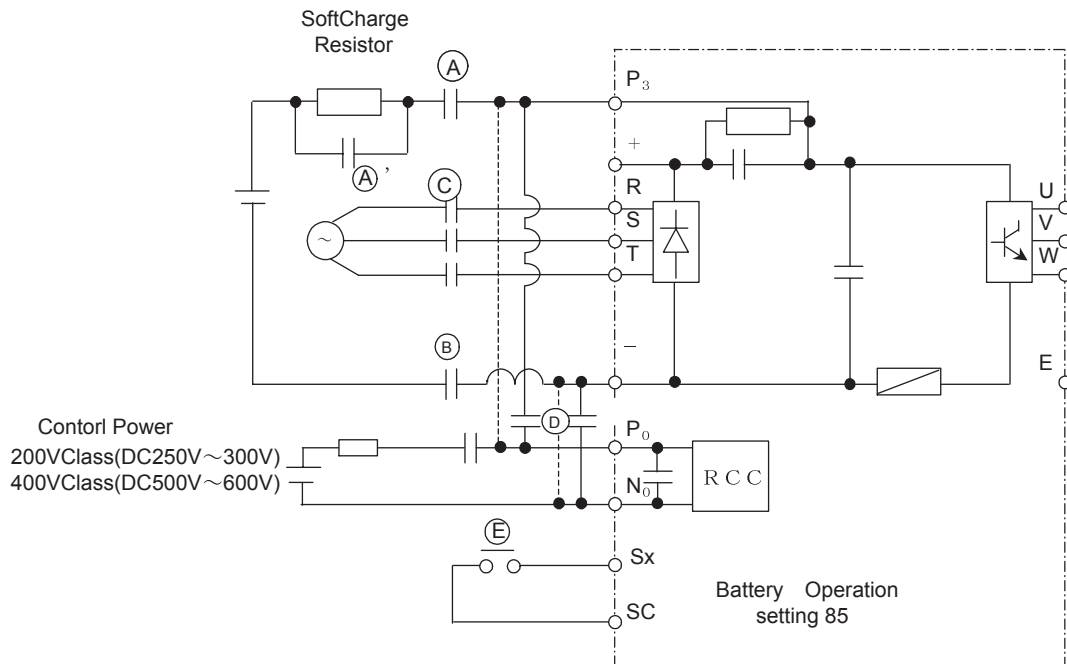
■Battery sequence

The following timing chart shows the sequence of battery operation.

*··· exteranal operation signal
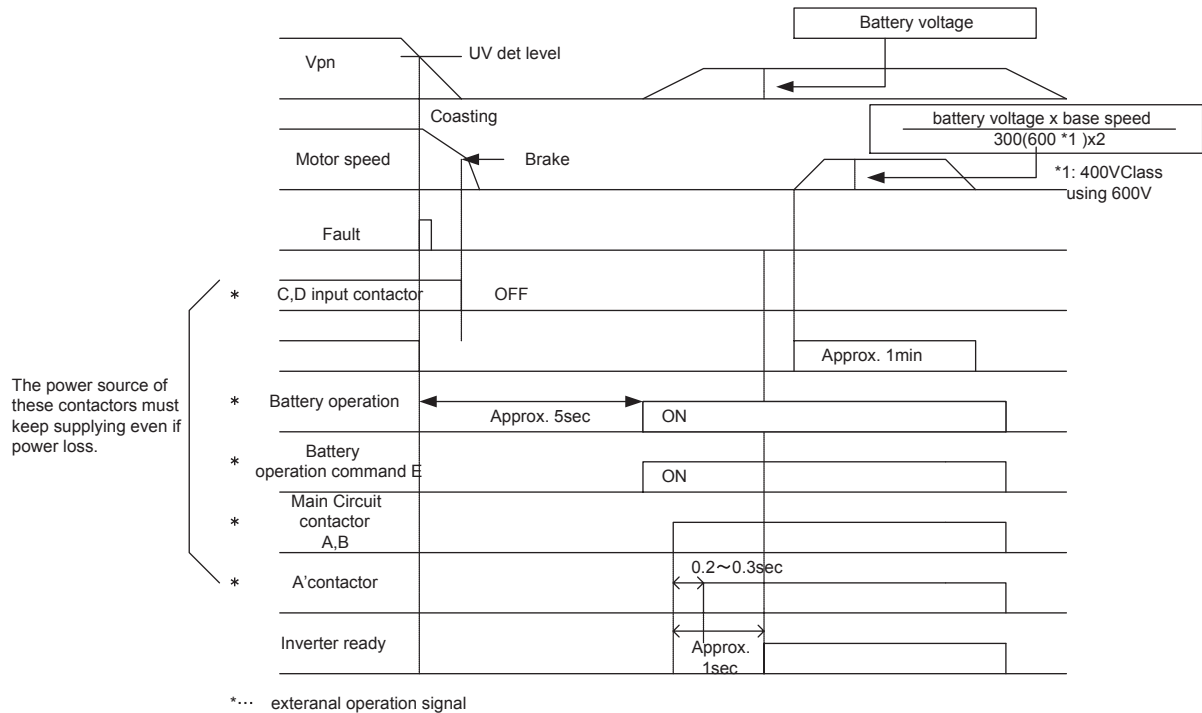
No.	Description
1	When the bus voltage is blow the under voltage level, the inverter detects the under voltage (UV) fault.
2	Turn off the RUN command.
3	C and D contactors must be turned off and turn on the motor mechanical brake.
4	Need the approximately 5sec to start battery operation.
5	The multi-function digital input which is assigned with the battery operation command (E) must be turned ON.
6	The A' contactor must be turned ON after passing 0.2~0.3 sec when A and B main contactors are turned ON.
7	The RUN commands turns ON after inverter ready status set. The battery operation time must be within 1min.
8	E, A, B and A' contactors must be turned OFF after RUN command OFF.

(CAUTION)

1. Battery operation speed

The speed during the battery operation will be limited as the following formula.

Speed during battery operation= (battery voltage x base speed) / (300Vx2)

When the 400V Class will be 600Vx2

2.Continuous operation is prohibited.

The cooling fan of inverter is stopped due to the low bus voltage.

Therefore the continuous operation of inverter is prohibited.

5

■Battery selection

Use the following battery

	200V Class	400V Class
Main bus voltage	48V	96V
Control voltage	200V	400V

Note Main bus voltage during battery operation is decided based on the 10% of motor base speed.

Voltage drop must be less than 5% under the following load condition.

Current of control power: 50W/ control voltage

Current of main power: (motor rated power x speed during battery operation x 200%) /

(battery voltage x 60% (motor efficiency) x motor base speed)

Automatic Fault Restart

The inverter can be set to restart automatically when a fault occurs. The maximum number of restarts can be selected as well as the operation mode of the fault relay.

Auto-resetable Fault codes are: UV1, GF, OC, OV, OL2, OL3, OL4, UL3, UL4, PF, LF

■Related Constants.

Parameter No.	Name	Factory setting	Change during operation	V/f	Open Loop Vector	Closed Loop Vector
L5-01	Number of restarts	2	No	A	A	A
L5-02	Restart operation selection	1	No	A	A	A

■Number of restarts

The number of restarts can be set in parameter L5-01. The fault restart interval time is 2.0 sec.
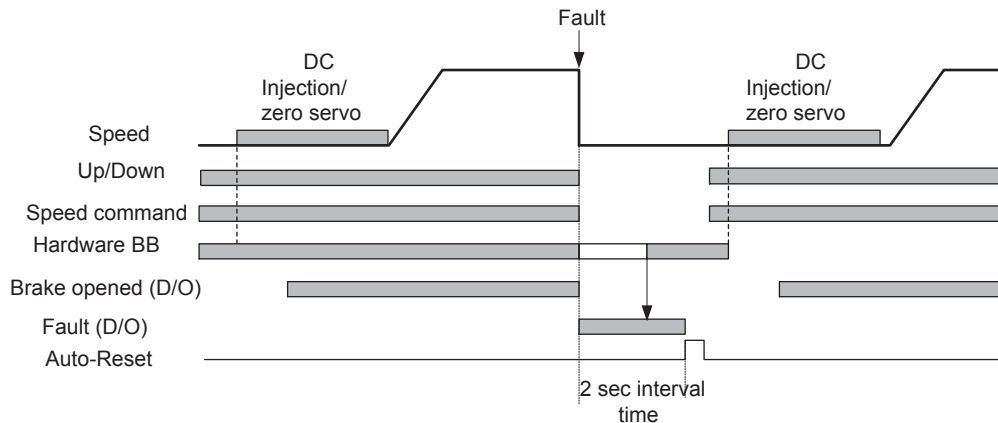
The auto-reset signal is accepted when the hardware base block signal is recieved .

■Fault Relay Operation

Parameter L5-02 can be used to enable or disable the fault relay (terminal MA-MB-MC) during fault retry condition.

- L2-02 = 1 enabled the fault relay.
- L2-02 = 0 disables the fault relay.

5

6

Troubleshooting

This chapter describes the fault displays and countermeasures for Inverter and motor problems.

6

Protective and Diagnostic Functions

This section describes the fault and alarm functions of the Inverter. These functions include fault detection, alarm detection, operator programming error detection and auto-tuning error detection.

◆ Fault Detection

When the Inverter detects a fault, the fault contact output operates and the Inverter output is switched OFF causing the motor to coast to stop. (The stopping method can be selected for some faults.) A fault code is displayed on the Digital Operator/Monitor.

The faults can be categorized in two groups:

- Faults that can be rested using an input or the reset key at the Digital Operator without cycling the power (resetable faults)
- Faults that require to cycle the power (non-resetable faults)

When a fault has occurred refer to the following identify the fault and to correct the causes.
To reset a fault it is necessary to remove the fault and the RUN signal. Only then a Reset signal is accepted.

See the following tables for the faults and corrective actions.

Table 6.20 Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
GF Ground Fault	Ground Fault The ground current at the Inverter output exceeded 50% of the Inverter rated output current and L8-09=1 (Enabled).	One Inverter output was shorted to ground and/or a DCCT is defective.	Remove the motor and run the Inverter without the motor. Check the motor for a phase to ground short. Check the output current with a clampmeter to verify the DCCT reading.
OC Over Current	Overcurrent The Inverter's output current exceeded the overcurrent detection level.	Shorted Inverter output phase-to-phase, shorted motor, locked rotor, load too heavy, accel/decel time too short, contactor on the Inverter output has opened or closed, a special motor or a motor with a rated current larger than the Inverter's output current is used.	Remove the motor and run the Inverter without the motor. Check the motor for a phase-to-phase short. Verify the accel/decel times (C1-□□). Check the Inverter for a phase-to-phase short at the output.
PUF DC Bus Fuse Open	DC Bus Fuse The fuse in the main circuit is open. Warning: Never run the Inverter after replacing the DC bus fuse without checking for shorted components.	Shorted output transistor(s) or terminals.	Check the motor and the motor cables for short circuits or insulation failures (phase-to-phase). Replace the inverter after correcting the fault.
OV DC Bus Overvolt	DC Bus Overvoltage The DC bus voltage has exceeded the overvoltage detection level. Default detection levels are: 200 V class: 410 VDC 400 V class: 820 VDC	The deceleration time is set too short and the regenerative energy from the motor is too large.	Increase the deceleration time (C1-02/04/06/08) or connect a braking option.
		The power supply voltage is too high.	Check the power supply and decrease the voltage to meet the inverter's specifications.

Table 6.20 Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
UV1 DC Bus Undervolt	DC Bus Undervoltage The DC bus voltage is below the Undervoltage Detection Level (L2-05). The default settings are: 200V class: 190 VDC 400 V class: 380 VDC	The voltage fluctuations of the power supply are too high.	Check the input voltage.
		A momentary power loss occurred.	
		The terminal screws of the input power supply are loose.	Check the wiring of the input terminals.
		An open-phase error occurred at the input terminals.	Check the input voltage and the wiring of the input terminals.
		The acceleration time is set too short.	Extend the settings in C1-01/03/05/07
	Main Circuit MC Operation Failure The MC stopped responding during Inverter operation.	An error occurred in the inrush current prevention circuit while the Inverter was running.	Replace the Inverter.
UV2 CTL PS Undervolt	Control Power Supply Undervoltage Undervoltage of the control circuit while the Inverter was running.	External load was pulling down the Inverter's power supplies or there was an internal short in the power/gate drive board.	Remove all connection to the control terminals and cycle the power to the Inverter.
			Replace the Inverter.
UV3 MC Answerback	Inrush Current Prevention Circuit Fault An overheating of the charging resistor for the DC bus capacitors occurred. The MC of the charging circuit did not respond 10 sec. after the MC ON signal has been output. (Applicable Inverter Capacities 200 V class: 37 to 110 kW 400 V class: 75 to 300 kW)	The contactor of the inrush current prevention circuit is defective.	Cycle the power to the Inverter.
			Replace the Inverter if the fault continues to occur.
PF Input Phase Loss	Main Circuit Voltage Fault An unusual big ripple on the DC bus voltage has been detected. Only detected when L8-05=1 (enabled)	The wiring terminals for the input power supply are loose.	Tighten the input terminal screws
		A phase loss occurred in the input power supply.	Check the power supply voltage
		A momentary power loss occurred	
		The voltage fluctuations in the input power supply are too high.	
		The voltage balance between the input phases is bad.	
LF Output Phase Loss	Output Open-phase An open-phase occurred at the Inverter output. The fault is detected when the output current falls below 5% of the inverter rated current and L8-07=1 (enabled)	There is a broken wire in the output cable. There is a broken wire in the motor-winding. The output terminals are loose.	Reset the fault after correcting its cause.
		The motor being used has a capacity less than 5% of the Inverter's maximum motor capacity.	Check the motor and Inverter capacity.

6

Table 6.20 Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
OH Heatsink Overtemp	Heatsink Overheat The temperature of the Inverter's cooling fin exceeded the setting in L8-02 and L8-03 = 0 to 2.	The ambient temperature is too high.	Check for dirt build-up on the fans or heatsink.
		There is a heat source nearby.	Reduce the ambient temperature around the drive.
		The Inverter's cooling fan(s) stopped.	Replace the cooling fan(s).
	Inverter's Cooling Fan Stopped	The Inverter's internal cooling fan has stopped (18.5 kW and larger).	
OH1 Heatsink Max Temp	Heatsink Overheat The temperature of the Inverter's heatsink exceeded 105 °C.	The ambient temperature is too high.	Check for dirt build-up on the fans or heatsink.
		There is a heat source nearby.	Reduce the ambient temperature around the drive.
		The Inverter's cooling fan(s) stopped.	Replace the cooling fan(s).
	Inverter's Cooling Fan Stopped	The Inverter's internal cooling fan has stopped (18.5 kW and larger).	
RR DynBrk Transistr	Dynamic Braking Transistor The built-in dynamic braking transistor failed.	Defective or failed dynamic braking resistor caused braking transistor damage.	Cycle power to the Inverter.
			Replace the Inverter.
OL1 Motor Overload	Motor Overload Detected when L1-01 = 1 to 3 and the Inverter's output current exceeded the motor overload curve. The overload curve is adjustable using parameter E2-01 (Motor Rated Current), L1-01 (Motor Protection Selection) and L2-02 (Motor Protection Time Constant)	The load is too large. The acceleration time, deceleration time or cycle time are too short.	Recheck the cycle time and the size of the load as well as the accel/decel times (C1-□□).
		The voltage settings of the V/f pattern is incorrect for the application.	Check the V/f characteristics (E1-□□).
		The setting of Motor Rated Current (E2-01) is incorrect.	Check the setting of Motor Rated Current Setting (E2-01).
OL2 Inv Overload	Inverter Overload The Inverter output current exceeded the Inverter's overload capability.	The load is too large. The acceleration time or deceleration times are too short.	Recheck the cycle time and the size of the load as well as the accel/decel times (C1-□□).
		The voltage settings of the V/f pattern is incorrect for the application.	Check the V/f characteristics (E1-□□).
		The size of the Inverter is too small.	Check the setting of Motor Rated Current Setting (E2-01).
OL3 Car Stuck	Overtorque/Car Stuck Detection 1 The Inverter's output current (V/f control) or the output torque (Vector Control) exceeded L6-02 for longer then the time set in L6-03 and L6-01 = 3 or 4.	Motor was overloaded.	Ensure the values in L6-02 and L6-03 are appropriate.
			Check application/machine status to eliminate fault.
OL4 Car Stuck	Overtorque/Car Stuck Detection 2 The Inverter's output current (V/f control) or the output torque (Vector Control) exceeded L6-05 for longer then the time set in L6-06 and L6-04 = 3 or 4.	Motor was overloaded.	Ensure the values in L6-05 and L6-06 are appropriate.
			Check application/machine status to eliminate fault.

Table 6.20 Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
UL3 Undertorq Det 1	Undertorque Detection 1 The Inverter's output current (V/f control) or the output torque (Vector control) fell below L6-02 for longer then the time set in L6-03 and L6-04 = 7 or 8.	Motor was underloaded.	Ensure the values in L6-02 and L6-03 are appropriate.
			Check application/machine status to eliminate fault.
UL4 Undertorq Det 2	Undertorque Detection 2 The Inverter's output current (V/f control) or the output torque (Vector control) fell below L6-05 for longer then the time set in L6-06 and L6-04 = 7 or 8.	Motor was underloaded.	Ensure the values in L6-05 and L6-06 are appropriate.
			Check application/machine status to eliminate fault.
OS Overspeed Det	Motor Overspeed Detected when F1-03 = 0 to 2 and A1-02 = 3. The motor speed feedback (U1-05) exceeded the setting in F1-08 for a longer time than the setting in F1-09.	Overshooting/Undershooting are occurring.	Adjust the ASR settings in the C5 parameter group.
		The reference was too high.	Check the reference circuit and reference gain.
		The settings in F1-08 and F1-09 are not appropriate.	Check the settings in F1-08 and F1-09.
PGO PG Open	PG Disconnection Detected when F1-02 = 0 to 2 and A1-02 = 3 Detected when no PG (encoder) pulses are received for a time longer than the setting in F1-14.	There is a break in the PG wiring.	Fix the broken/disconnected wiring.
		The PG is wired incorrectly.	Fix the wiring.
		Power is not being supplied to the PG.	Supply power to the PG properly.
		Wrong brake control sequence when a brake is used.	Check if the brake is opened when the RUN command is applied.
DEV Speed Deviation	Excessive Speed Deviation Detected when F1-04 = 0 to 2 and A1-02 = 3 The speed deviation is greater than the setting in F1-10 for a time longer than the setting F1-11	The load is too large.	Reduce the load.
		The acceleration time and deceleration time are too short.	Lengthen the acceleration time and deceleration time.
		The load is locked.	Check the mechanical system.
		The settings in F1-10 and F1-11 are not appropriate.	Check the settings in F1-10 and F1-11.
		Wrong brake control sequence when a brake is used.	Check if the brake is opened when the RUN command is applied.
SVE Zero Servo Fault	Zero Servo Fault The motor position moved during Zero Servo Operation.	The torque limit is too small.	Increase the torque limit.
		The load torque is too large.	Decrease the load torque.
		-	Check for signal noise.
CF Out of Control	Control Fault A torque limit was reached continuously for 3 seconds or longer during a deceleration stop in Open Loop Vector control.	Motor parameters were not set properly.	Check the motor parameters.
EF0 Opt External Flt	External fault input from Communications Option Card	An external fault condition was present, input from a communication option card.	Check for an external fault condition.
			Verify the parameters.
			Verify communication signals

6

Table 6.20 Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
EF3 Ext Fault S3	External fault at terminal S3	An "external fault" was input from a multi-function input terminal (S3 to S7).	Eliminate the cause of the external fault condition.
EF4 Ext Fault S4	External fault at terminal S4		
EF5 Ext Fault S5	External fault at terminal S5		
EF6 Ext Fault S6	External fault at terminal S6		
EF 7 Ext Fault S7	External fault at terminal S7		
CE Memobus Com Err	MEMOBUS Communication Error Detected when control data was not received correctly for two seconds and H5-04 = 0 to 2 and H5-05=1.	Connection is broken and/or the master has stopped the communication.	Check the connections and all user-side software configurations.
BUS Option Com Err	Option Communication Error After initial communication was established, the connection was lost.	Connection is broken and/or the master has stopped the communication.	Check the connections and all user-side software configurations.
SE1 Sequence Error 1	Detected no output contactor answer back for S1-16 time setting.	The output contactor or auxiliary switch is malfunction.	Check the output contactor.
SE2 Sequence Error 2	Detect the output current below 25% of no-load current at opening motor brake.	The output contactor is opened.	Check the output contactor.
SE3 Sequence Error 3	Detect the output current below 25% of no-load current during running.	The output contactor is opened.	Check the output contactor.

Fig 6.21 Non-resetable Faults

CPF00 COM-ERR(OP&INV)	Digital Operator/Monitor Communication Fault 1 Communication with the digital operator could not be established within 5 seconds after the power was supplied to the Inverter.	Digital operator cable was not securely connected or digital operator is defective and/or control board is defective	Disconnect the Digital Operator/Monitor and then connect it again.
			Replace the Inverter.
	CPU External RAM Fault	The control board is damaged.	Cycle the power to the Inverter.
			Replace the Inverter.
CPF01 COM-ERR(OP&INV)	Digital Operator/Monitor Communication Fault 2 After communications with the digital operator was established, the communication stopped for 2 seconds or more.	Digital operator cable was not securely connected or digital operator is defective	Disconnect the Digital Operator/Monitor and then connect it again.
		The control board is damaged.	Cycle the power to the Inverter.
			Replace the Inverter.
CPF02 BB Circuit Err	Baseblock circuit error A baseblock circuit error occurred at power-up.	Gate array hardware failure at power-up.	Perform an initialization to factory defaults.
			Cycle the power to the Inverter.
			Replace the Inverter.
CPF03 EEPROM Error	EEPROM error Check sum is not valid	Noise or spike was on the control circuit input terminals or the control board is damaged.	Perform an initialization to factory defaults.
			Cycle the power to the Inverter
			Replace the Inverter.

Fig 6.21 Non-resetable Faults

CPF04 Internal A/D Err	CPU Internal A/D Converter Fault	Noise or spike was on the control circuit input terminals or the control board is damaged.	Perform an initialization to factory defaults.
			Cycle the power to the Inverter.
			Replace the Inverter.
CPF05 External A/D Err	CPU External A/D Converter Fault	Noise or spike was on the control circuit input terminals or the control board is damaged.	Perform an initialization to factory defaults.
			Cycle the power to the Inverter.
			Replace the Inverter.
CPF06 Option Error	Option Card Connection Fault	The Option Card is not connected properly.	Turn off the power and re-install the Option Card again.
		The Inverter or Option Card is damaged	Replace the Option Card or the Inverter.
CPF07 RAM-Err	ASIC Internal RAM fault	-	Cycle the power to the Inverter
		The control circuit is damaged.	Replace the Inverter.
CPF08 WAT-Err	Watchdog Timer Fault	-	Cycle the power to the Inverter
		The control circuit is damaged.	Replace the Inverter.
CPF09 CPU-Err	CPU-ASIC Mutual Diagnosis Fault	-	Cycle the power to the Inverter
		The control circuit is damaged.	Replace the Inverter.
CPF10 ASIC-Err	ASIC version fault	The control circuit is damaged.	Replace the Inverter.
CPF20 Option A/D Error	Communication Option Card A/D Converter Error	Option board connection is not correct.	Turn off the power and re-install the option board again
			Remove all inputs to the option board
		Option card A/D converter is faulty.	Perform an initialization to factory defaults.
			Cycle the power to the Inverter
			Replace the option board
			Replace the inverter
CPF21 Option CPU Down	Self-diagnosis Fault of Option Board	Noise or spike was on the communication line and/or defective option board.	Perform an initialization to factory defaults.
			Cycle the power to the Inverter
			Replace the option board
			Replace the Inverter
CPF22 Option Type Err	Option Board Code Number Fault	Unrecognizable option board is connected to the control board.	Remove any option boards
			Perform an initialization to factory defaults
			Cycle the power to the Inverter
			Replace the option board
			Replace the Inverter
CPF23 Option DPRAM Err	Option Board Interconnection Fault	An option board was not correctly connected to the control board, or an option board that was not made for the Inverter is attached to the control board.	Turn off the power and reinstall the option board again
			Perform an initialization to factory defaults
			Cycle the power to the Inverter
			Replace the option board
			Replace the Inverter

6

◆ Alarm Detection

Alarms are Inverter protection function that do not operate the fault contact output. The system will automatically return to its original status when the cause of the alarm has been removed.

During an alarm condition, the Digital Operator/Monitor display flashes and an alarm output is generated at the multi-function outputs (H2-01 to H2-03) if programmed

When an alarm occurs, take appropriate countermeasures according to the table below.

Table 6.22 Alarm Detection

Display	Meaning	Probable causes	Corrective Actions
EF External Fault (flashing)	Forward/Reverse Run Commands Input Together Both the forward and the reverse run commands are input simultaneously for 500ms or more. This alarm stops the motor.	The external forward and reverse command were input simultaneously.	Check external sequence logic, so only one input is received at a time.
UV DC Bus Undervolt (flashing)	DC Bus Undervoltage The following conditions occurred • The DC bus voltage was below the Undervoltage Detection Level Setting (L2-05). • The MC of the inrush current prevention circuit opened. • The control power supply voltage when below the CUV level. UV Alarm is only detected when the drive is in a stopped condition	For the probable causes please have a look at UV1, UV2 and UV3 in table 7.1.	For the corrective actions please have a look at UV1, UV2 and UV3 in table 7.1
OV DC Bus Overvolt (flashing)	DC Bus Overvoltage The DC bus voltage exceeded the overvoltage detection level. 200 V class: 410 VDC 400 V class: 820 VDC OV Alarm is only detected when the drive is in a stopped condition	The power supply voltage is too high.	Check the power supply and decrease the voltage to meet the Inverter's specifications
OH Heatsnk Overtmp (flashing)	Heatsink Overheat The temperature of the Inverter's cooling fin exceeded the temperature programmed in L8-02. Enabled when L8-03 = 3	The ambient temperature is too high.	Check for dirt build-up on the fans or heatsink.
		There is a heat source nearby.	Reduce the ambient temperature around the Inverter
		The Inverter cooling fan(s) has stopped.	Replace the cooling fan(s).
OL3 Car Stuck (flashing)	Overtorque Detection 1 The Inverter's output current (V/f control) or the output torque (Vector control) exceeded L6-02 for longer then the time set in L6-03 and L6-01 = 1 or 2	Motor was overloaded	Ensure the values in L6-02 and L6-03 are appropriate.
			Check application/machine status to eliminate fault.
OL4 Car Stuck (flashing)	Overtorque Detection 1 The Inverter's output current (V/f control) or the output torque (Vector control) exceeded L6-02 for longer then the time set in L6-03 and L6-01 = 1 or 2	Motor was overloaded	Ensure the values in L6-05 and L6-06 are appropriate.
			Check application/machine status to eliminate fault.

Table 6.22 Alarm Detection

Display	Meaning	Probable causes	Corrective Actions
UL3 Undertorque Det 1 (flashing)	Undertorque Detection 1 The Inverter's output current (V/f control) or the output torque (Vector control) fell below L6-02 for longer then the time set in L6-03 and L6-01 = 5 or 6.	Motor was underloaded	Ensure the values in L6-02 and L6-03 are appropriate.
			Check application/machine status to eliminate fault.
UL4 Undertorque Det 2 (flashing)	Undertorque Detection 2 The Inverter's output current (V/f control) or the output torque (Vector control) fell below L6-05 for longer then the time set in L6-06 and L6-04 = 5 or 6.	Motor was underloaded	Ensure the values in L6-05 and L6-06 are appropriate.
			Check application/machine status to eliminate fault.
OS Overspeed Det (flashing)	Overspeed Alarm Detected when A1-02 = 1 or 3 and F1-03 = 3. The motor speed feedback (U1-05) exceeded the value set in F1-08 for a time longer than the setting in F1-09.	Overshooting/undershooting are occurring.	Adjust the ASR settings in the C5 parameter group.
		The reference was too high.	Check the reference circuit and reference gain.
		The settings in F1-08 and F1-09 are not appropriate.	Check the settings in F1-08 and F1-09
PGO PG Open (flashing)	PG Disconnection Detected when F1-02 = 3 and A1-02 = 1 or 3. Detected when no PG (encoder) pulses are received for a time longer than the setting in F1-14	There is break in the PG wiring.	Fix the broken/disconnected wiring.
		The PG is wired incorrectly.	Fix the wiring
		Power is not being supplied to the PG.	Fix the wiring.
		Power isn't being supplied to the PG.	Supply power to the PG properly.
DEV Speed Deviation (flashing)	Excessive Speed Deviation Detected when F1-04 = 3 and A1-02 = 1 or 3. The speed deviation is greater than the setting in F1-10 for longer than the setting in F1-11.	The load is too large.	Reduce the load.
		The acceleration time and deceleration time are too short.	Lengthen the acceleration time and deceleration time.
		The load is locked.	Check the mechanical system.
		The settings in F1-10 and F1-11 are not appropriate.	Check the settings in F1-10 and F1-11.
EF0 Opt External Flt (flashing)	Communication Option Card External Fault	An external fault condition was present, input from a communication option card.	Check for an external fault condition.
			Verify the parameters.
			Verify communication signals
EF3 Ext Fault S3 (flashing)	External fault at terminal S3	An external fault was input from a multi-function input terminal (S3 to S7) that is programmed for external fault function that alarms only and continues to run the Inverter.	Eliminate the cause of the external fault condition
EF4 Ext Fault S4 (flashing)	External fault at terminal S4		
EF5 Ext Fault S5 (flashing)	External fault at terminal S5		
EF6 Ext Fault S6 (flashing)	External fault at terminal S6		
EF7 Ext Fault S7 (flashing)	External fault at terminal S7		

6

Table 6.22 Alarm Detection

Display	Meaning	Probable causes	Corrective Actions
CE MEMOBUS Com Err (flashing)	MEMOBUS Communications Alarm Detected when control data was not received correctly for two seconds and H5-04 = 3 and H5-05 = 1.	Connection is broken and/or the master has stopped the communication.	Check the connections and all user-side software configurations.
BUS Option Com Err (flashing)	Option Communications Alarm After initial communication was established, the connection was lost.	Connection is broken and/or the master has stopped the communication.	Check the connections and all user-side software configurations.
Ext Run Active Cannot Reset	Detected when a RESET command is input while the RUN command is still active	The RUN command has not been removed and a RESET command is input by digital input or by the RESET button on the digital operator.	Remove the RUN signal first and reset the error.
CALL ComCall (flashing)	Communications on Standby Communication has not yet been established.	Connection was not made properly or user software was not configured to the proper baud rate or configuration (e.g. Parity).	Check the connections and all user-side software configurations.

◆ Operator Programming Errors

An Operator Programming Error (OPE) occurs when an inapplicable parameter is set or an individual parameter setting is inappropriate. The Inverter will not operate until the parameter is set correctly; however, no alarm or fault outputs will occur. If an OPE occurs, change the appropriate parameter by checking the cause shown in *Table 6.23*. When OPE error is displayed, press the ENTER key to display U1-34 (OPE Detected). This monitor will display the parameter that is causing the OPE error.

Table 6.23 Operator Programming Errors

Display	Meaning	Probable Causes	Corrective Actions
OPE01 kVA Selection	Inverter kVA Setting Error	The control board was replaced and the kVA parameter (o2-04) is set incorrectly	Enter the correct kVA setting (o2-04) by referring to the table "Factory settings that change with the Inverter kVA setting" on page 5-60.
OPE02 Limit	Parameter Setting Out of Range	Parameter setting was outside of the allowable range.	Verify the parameter settings.
OPE03 Terminal	Multi-function Input Selection Error	One of the following errors has been made in the multi-function input (H1-01 to H1-05) settings: • Duplicate functions were selected. • External Baseblock NO (8) and External Baseblock NC (9) were selected at the same time. • The Emergency Stop Command NO (15) and NC(17) are set simultaneously.	Verify the parameter settings in H1-□□
OPE05 Sequence Select	RUN/Reference Command Selection Error The Reference Source Selection b1-01 and/or the RUN Source Selection parameter b1-02 are set to 3 (option board) but no option board is installed.	Option board is not installed or is installed incorrectly	Verify that the board is installed. Remove the power supply and re-install the option board again
			Recheck the setting of b1-01 and b1-02.
OPE06 PG Opt Missing	Control method selection error	One of the control methods needing a PG feedback was selected (A1-02 =3), but a PG option board is not installed.	Verify the control method selection in parameter A1-02 and/or the installation of the PG option board.
OPE08 Constant Selection	Function Selection Error	A setting has been made that is applicable with the current control method. Example: A function used only with open loop vector control was selected for V/f control.	Verify the control method and the function.
OPE10 V/f Ptrn Setting	V/f Parameter Setting Error	V/f parameter settings were out of range.	Check parameters (E1-□□). A frequency/voltage value may be set higher than the maximum frequency/voltage.
ERR EEPROM R/W Err	EEPROM write error The NV-RAM data does not match the EEPROM data.	A verification error occurred when writing EEPROM.	Cycle power to the Inverter.
			Do a factory initialization (A1-03)

6

◆ Auto-tuning Fault

Auto-tuning faults are shown below. When the following faults are detected, the fault is displayed on the digital operator and the motor coasts to stop. No fault or alarm outputs will be operated.

Table 6.24 Auto-tuning Fault

Display	Meaning	Probable causes	Corrective Actions
Er - 01 Fault	Motor data fault	There is an error in the data input for autotuning.	Check the input data.
		There is an error in the relationship between the motor output and the motor rated current.	Check the Inverter and motor capacity.
		There is an error between the no-load current setting and the input motor rated current (when auto-tuning for line-to-line resistance is performed for vector control)	Check the motor rated current and no-load current.
Er - 02 Minor Fault	Alarm	An alarm is detected during auto-tuning.	Check the input data.
			Check wiring and the machine.
			Check the load.
Er - 03 STOP key	STOP key input	The STOP key was pressed to cancel autotuning.	-
Er - 04 Resistance	Line-to-Line Resistance Fault	Autotuning was not completed in the specified time. The auto-tuning result is outside the parameter setting range.	• Check the input data. • Check motor wiring. • If the motor is connected to the machine, disconnect it. • If the setting of T1-03 is higher than the Inverter input power supply voltage (E1-01), change the input data.
Er - 05 No-Load Current	No-Load Current Fault		
Er - 08 Rated slip	Rated Slip Fault		
Er - 09 Accelerate	Acceleration Fault Detected only for rotating auto-tuning	The motor did not accelerate in the specified time	• Increase C1-01 (Acceleration Time 1). • Increase L7-01 and L7-02 (Torque Limits) if they are low. • If the motor is connected to the machine, disconnect it.
Er - 11 Motor Speed	Motor speed Fault Detected only for rotating autotuning	The torque reference exceed 100% during acceleration. Detected when A1-02 = 2 or 3 (Vector control).	• If the motor is connected to the machine, disconnect it. • Increase C1-01 (Acceleration Time 1). • Check the input data (particularly the number of PG pulses and the number of motor poles).
Er - 12 I-det. Circuit	Current Detection Fault	The current exceeded the motor rated current.	Check wiring of the Inverter and the mounting.
		Any of U/T1, V/T2 and W/T3 has open-phase	

Table 6.24 Auto-tuning Fault

Display	Meaning	Probable causes	Corrective Actions
Er - 13 Leakage Induc- tance Fault	Leakage Inductance Fault	Auto-tuning was not completed in the specified time.	Check motor wiring.
		Auto-tuning result is outside the parameter setting range.	
End - 1 V/f Over Setting	V/f Settings Alarm Displayed after auto-tuning is complete	The torque reference exceeded 100% and the no-load current exceeded 70% during auto-tuning.	Check and correct the motor settings
			If the motor and the machine are connected, disconnect the motor from the machine.
End - 2 Saturation	Motor Core Saturation Fault Displayed after auto-tuning is complete. Detected only for rotating autotuning	During auto-tuning, the measured values of motor iron-core saturation coefficient 1 and 2 (E2-07 and E2-08) exceeded its setting range. A temporary value was set: E2-07 = 0.75, E2-08 = 0.50	Check the input data.
			Check the motor wiring.
			If the motor and the machine are connected, disconnect the motor from the machine.
End - 3 Rated FLA Alm	Rated Current Setting Alarm Displayed after auto-tuning is complete	During auto-tuning, the measured value of motor rated current (E2-01) was greater than the set value.	Check the motor rated current value.

6

◆ Digital Operator Copy Function Faults

These faults can occur during the digital operator COPY function. When a fault occurs, the fault content is displayed on the operator. A fault does not activate the fault contact output or alarm output.

Table 6.25 Digital Operator/Monitor Copy Function Faults

Function	Digital Operator/Monitor Display	Probable Causes	Corrective Actions
READ Function	PRE READ IMPOSSIBLE	o3-01 was set to 1 to write parameter into the Digital Operator/Monitor when the Operator was write-protected (o3-02 = 0).	Set o3-02 to enable writing parameters into the Operator's memory.
READ Function	IFE READ DATA ERROR	The data file read from the Inverter was of the wrong size indicating corrupted data.	Retry the READ command (o3-01 = 1).
READ Function	IFE READ DATA ERROR	The data file read from the Inverter was of the wrong size indicating corrupted data.	Check the Digital Operator/Monitor's cable.
READ Function	IFE READ DATA ERROR	The data file read from the Inverter was of the wrong size indicating corrupted data.	Replace the Digital Operator/Monitor.
READ Function	RDE DATA ERROR	An attempted writing of the Inverter data to the Digital Operator/Monitor's EEPROM failed.	A low Inverter voltage has been detected.
READ Function	RDE DATA ERROR	An attempted writing of the Inverter data to the Digital Operator/Monitor's EEPROM failed.	Retry the READ command (o3-01 = 1).
READ Function	RDE DATA ERROR	An attempted writing of the Inverter data to the Digital Operator/Monitor's EEPROM failed.	Replace the Digital Operator/Monitor.
COPY Function	CPE ID UNMATCHED	The Inverter type or software number was different from the stored data in the digital operator	Use stored data of the same product (L7) and software number (U1-14) only.
COPY Function	VAE INV. KVA UNMATCH	The capacity of the Inverter and the capacity of the stored data in the Digital Operator/Monitor are different.	Use stored data for the same Inverter capacity only (o2-04).
COPY Function	CRE CONTROL UNMATCHED	The control method of the Inverter and the control method of the stored data in the Digital Operator/ Monitor are different.	Use stored data for the same control method (A1-02).
COPY Function	CYE COPY ERROR	A parameter setting written to the Inverter was different from the setting stored in the Digital Operator/Monitor.	Retry the COPY function (o3-01 = 2)
COPY Function	CSE SUM CHECK ERROR	Upon completion of the COPY function, the Inverter's data checksum was different than the digital operator's data checksum.	Retry the COPY function (o3-01 = 2)
Verify Function	VYE VERIFY ERROR	The set value of the digital operator and the Inverter do not match	Retry the Verify function (o3-01 = 3)

Troubleshooting

Due to parameter setting errors, faulty wiring, and so on, the Inverter and motor may not operate as expected when the system is started. If that occurs, use this section as a reference and perform the appropriate countermeasures.

If the contents of the fault are displayed, refer to *page 6-2, Protective and Diagnostic Functions*.

◆ If A Parameter Cannot Be Set

Use the following information if a parameter cannot be set.

■The display does not change when the Increment and Decrement keys are pressed.

The following causes are possible:

The Inverter is operating (drive mode).

There are some parameters that cannot be set during operation. Turn off the RUN command and then set the parameters

Passwords do not match. (Only when a password is set.)

If the parameter A1-04 (Password) and A1-05 (Password Setting) settings are different, the parameters for the initialize mode cannot be changed. Enter the correct password in A1-04.

If you cannot remember the password, display A1-05 (Password Setting) by pressing the Shift/RESET key and the MENU key simultaneously while in the A1-04 display. Then set the password and input the set password in parameter A1-04.

■OPE01 through OPE11 is displayed.

The set value for the parameter is wrong. Refer to *Table 6.23* in this chapter and correct the settings.

■CPF00 or CPF01 is displayed.

This is a Digital Operator/Monitor communication error. The connection between the Digital Operator/Monitor and the Inverter may be faulty. Remove the Digital Operator/Monitor and then re-install it.

6

◆ If the Motor Does Not Operate Properly

The following causes are possible:

■The motor does not operate when an external operation signal is input.

The frequency reference is 0.00 Hz or a no speed is selected by the digital inputs. Check the input signals and the frequency reference settings.
Also make sure to set the Baseblock signal. The inverter does not accept any input if it is base blocked.

■The load is too heavy

Check the motor current. If it is at the limit of the inverter rated current the load might be too high. Check the inverter size and the mechanical system. Check also if the brake is operating or not.

◆ If the Direction of the Motor Rotation is Reversed

If the motor rotates in the wrong direction, the motor output wiring may be incorrect. When the Inverter operates in the forward direction, the forward direction of the motor will depend on the manufacturer and the motor type, so be sure to check the motor specification

The direction of the motor rotation can be reversed by switching two wires among U, V, and W. If using an encoder, the polarity will also have to be switched. If the Inverter is operated in V/f mode also parameter b1-04 can be used to change the rotation direction.

◆ If the Motor Stalls or Acceleration is Slow

■The torque limit has been reached.

When a torque limit has been set in parameters L7-01 to L7-04, the output torque will be limited according these settings. Therefore the motor may not develop enough torque to accelerate or the acceleration time might be very long.

■The stall prevention level during acceleration is too low.

If the value set for L3-02 (Stall Prevention Level during Acceleration) is too low, the acceleration time will be increased. Check that the set value is suitable and that the load is not too large for the motor.

■The stall prevention level during running is too low.

If the value set for L3-06 (Stall Prevention Level during Running) is too low, the motor speed and torque will be limited. Check that the set value is suitable and that the load is not too large for the motor.

■Auto-tuning has not been performed for vector control

Vector control will not work properly if auto-tuning has not been performed. Perform auto-tuning, or set the motor parameters through calculations.

◆ If Motor Deceleration is Slow

The following causes are possible:

■ The deceleration time is too long

The following causes are possible:

The deceleration time setting is too long.

Check the deceleration time setting (parameters C1-02, C1-04, C1-06, and C1-08).

Motor torque is insufficient.

If the parameters are correct and there is no overvoltage fault, then the motor's power may be insufficient. Consider increasing the motor and Inverter capacity.

The torque limit has been reached.

When a torque limit is reached (L7-01 to L7-04), the motor torque will be limited. This can cause the deceleration time to be extended. Check to be sure that the value set for the torque limit is suitable.

6

◆ If the Motor Overheats

The following causes are possible:

■ The load is too large.

If the motor load is too large and the torque exceeds the motor's rated torque, the motor may overheat. Reduce the loads by either reducing the load or increasing the acceleration/deceleration times. Also consider increasing the motor size.

■ The ambient temperature is too high.

The motor rating is determined by a particular ambient operating temperature range. The motor will overheat if it is run continuously at the rated torque in an environment where the maximum ambient operating temperature is exceeded. Lower the motor's ambient temperature to be within its acceptable range.

■ Auto-tuning has not been performed for vector control

Vector control may not perform efficiently if auto-tuning has not been performed. Perform auto-tuning, or set the motor parameters through hand calculations. Alternatively, change the Control Mode Selection (A1-02) to V/f Control (0 or 1).

◆ If Peripheral Devices are Influenced by the Starting or Running Inverter

The following solutions are possible:

- Change the Inverter's Carrier Frequency Selection (C6-02) to lower the carrier frequency. This will help to reduce the amount of transistor switching noise.
- Install an Input Noise Filter at the Inverter's input power terminals.
- Install an Output Noise Filter at the Inverter's motor terminals.
- Use shielded motor cables or a conduit. Metal shields electrical noise.
- Check the grounding of the Inverter and motor.
- Separate main circuit wiring from control circuit wiring.

◆ If the Earth Leakage Breaker Operates When the Inverter is Running

The Inverter's output is pulse modulated, i.e. the output voltage consists of high frequency pulses (PWM). This high frequency signal causes a certain amount of leakage current which may cause the earth leakage breaker to operate and cut off the power supply. Change to a ground fault interrupter with a high leakage detection level (i.e., a sensitivity current of 200 mA or higher, with an operating time of 0.1 s or more), or one that incorporates high frequencies countermeasures (i.e., one designed for use with Inverters). It will also help to some extent to lower the Inverter's Carrier Frequency Selection (C6-02). In addition, remember that the leakage current increases as the cable is lengthened.

◆ If There is Mechanical Oscillation

Use the following information when there is mechanical vibration:

■Oscillation and hunting occur with V/f control

The torque compensation parameter settings may be incorrect for the machine. Adjust parameters C4-01 (Torque Compensation Gain) and C4-02 (Torque Compensation Delay Time). Decrease C4-01 carefully in steps of 0.05 and/or increase C4-02.

Furthermore the Slip Compensation Delay Time (C3-02) can be decreased.

■Oscillation and hunting occur with Open Loop Vector control.

The torque compensation parameter settings may be incorrect for the machine. Adjust parameters C4-01 (Torque Compensation Gain), C4-02 (Torque Compensation Delay Time Parameter) and C3-02 (Slip Compensation Delay Time) in order. Lower the gain parameters and raise the delay time parameters.

If auto-tuning has not been performed, proper performance may not be achieved for Vector Control. Perform auto-tuning or set the motor parameters through hand calculations.

■Oscillation and hunting occur with Closed Loop Vector control

The gain adjustment may be insufficient. Adjust the speed control loop (Automatic Speed Regulator, ASR) by changing C5-□□ gain parameters. If the oscillation points overlap with those of the machine and cannot be eliminated, increase the ASR Delay Time, and then readjust the ASR gains.

If auto-tuning has not been performed, proper performance may not be achieved for Closed Loop Vector Control. Perform auto-tuning or set the motor parameters through hand calculations.

6

7

Maintenance and Inspection

7
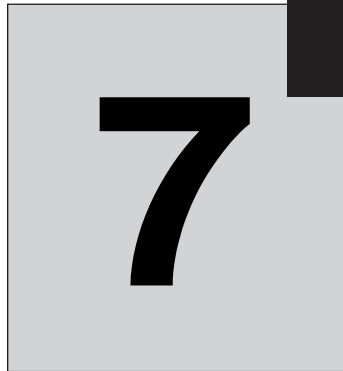
This chapter describes basic maintenance and inspection for the Inverter

Maintenance and Inspection

◆ Periodic Inspection

Check the following items during periodic maintenance.

- The motor should not vibrate or make unusual noises.
- There should be no abnormal heat generation from the Inverter or motor.
- The ambient temperature should be within the Inverter's specifications.
- The output current value shown in U1-03 should not be higher than the motor or the Inverter rated current for extended period of time.
- The cooling fan in the Inverter should be operating normally.

Before attempting any maintenance checks, make sure that the three-phase power is disconnected. With power removed from the unit, the DC bus capacitors will stay charged for several minutes. The Charge LED in the Inverter will glow red until the DC bus voltage is below 10VDC. To ensure that the DC bus is completely discharged, measure between the positive and negative bus with a DC voltmeter set to the highest scale. Be sure not to touch terminals immediately after the power has been turned off. Doing so can result in electric shock.

Table 7.1 Periodic Inspections With no Power Applied

Item	Inspection	Corrective Procedure
External terminals Mounting bolts Connectors	Are all screws and bolts tight?	Tighten loose screws and bolts firmly.
	Are connectors tight?	Reconnect the loose connectors.
Cooling fins	Are the fins dirty or dusty?	Clean off any dirt and dust with an air gun using dry air at a pressure of 4 x 10^5 to 6 x 10^5 Pa (4 to 6 bar, 55 to 85 psi).
All PCBs	Is there any conductive dirt or oil mist on the PCBs?	Clean off any dirt and dust with an air gun using dry air at a pressure of 4 x 10^5 to 6 x 10^5 Pa (4 to 6 bar, 55 to 85 psi). Replace the boards if they cannot be made clean.
Input Diodes Output Transistors Power Modules	Is there any conductive dirt or oil mist on the modules or components?	Clean off any dirt and dust with an air gun using dry air at a pressure of 4 x 10^5 to 6 x 10^5 Pa (4 to 6 bar, 55 to 85 psi).
DC bus capacitors	Are there any irregularities, such as discoloration or odor?	Replace the capacitor or Inverter.

Apply power to the Inverter and conduct the following inspection:

Table 7.2 Periodic Inspections With Power Applied

Item	Inspection	Corrective Procedure
Cooling Fan(s)	Is there any abnormal noise or vibration, or has the total operating time exceeded 20,000 hours. Check U1-40 for the elapsed cooling operation time.	Replace Cooling Fan

◆ Periodic Maintenance of Parts

In order to keep the Inverter operating normally over a long period of time, and to prevent down time due to an unexpected failure, it is necessary to perform periodic inspections and replace parts according to their service life.

The data indicated in the following table is to be used as a general guideline only. Periodic inspection standards vary depending on the Inverter's installation environment conditions and usage. The Inverter's suggested maintenance periods are noted below.

Table 7.3 Part Replacement Guidelines

Part	Standard Replacement Period	Replacement Method
Cooling fan(s)	2 to 3 years (20,000 hours)	Replace with new part.
DC bus capacitor	5 years	Replace with new part. (Determine need by inspection.)
Soft charge contactor	–	Determine need by inspection.
DC bus fuse Control power fuse	10 years	Replace with new part.
PCB capacitors	5 years	Replace with new board. (Determine need by inspection.)

Note The standard replacement period is based on the following usage conditions:
Ambient temperature: Yearly average of 30°C/86°F
Load factor: 80% maximum
Operating rate: 12 hours maximum per day

7

◆ Cooling Fan Replacement

■200 V and 400 V Class Inverters of 18.5 kW or Less

A cooling fan is attached to the bottom of the Inverter.

If the Inverter is installed using the mounting holes on the back of the Inverter, the cooling fan can be replaced without removing the Inverter from the installation panel.

If the Inverter is mounted with the heatsink external to the enclosure, the cooling fan can only be replaced by removing the Inverter from the enclosure.

Removing the Cooling Fan

1. Always turn OFF the input power before removing and installing the heatsink cooling fan.
2. Press in on the right and left sides of the fan cover in the direction of arrows "1" and when pull the fan out in the direction of arrow „2".
3. Pull out the cable connected to the fan from the fan cover and disconnect the power connector.
4. Open the fan cover on the left and right sides in direction of arrows "3" and remove the fan cover from the fan.

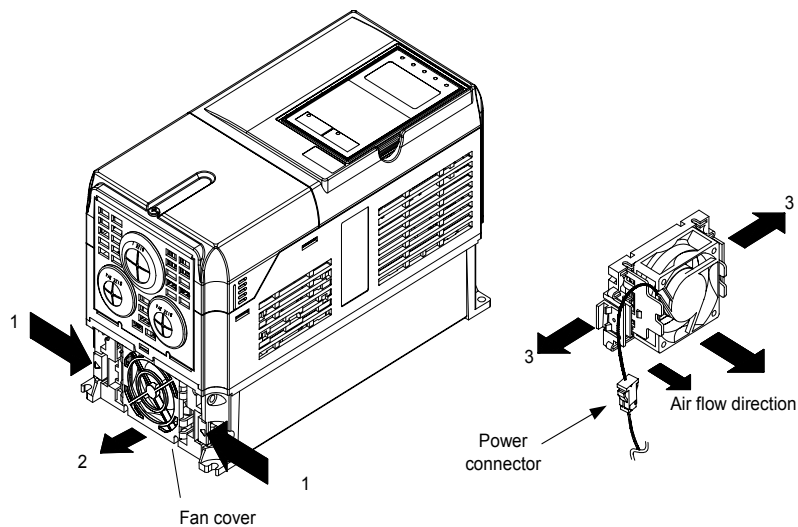Fig 7.1   Cooling Fan Replacement (Inverters of 18.5 kW or Less)

Mounting the Cooling Fan

1. Attach the fan cover to the cooling fan. Be sure that the air flow direction is correct (see figure above).
2. Connect the cables securely and place the connector and cable into the fan cover.
3. Mount the fan cover on the Inverter. Be sure that the tabs on the sides of the fan cover click into place on the Inverter heatsink.

■200 V and 400 V Class Inverters of 22 kW or More

The heatsink cooling fan is attached to the top of the heatsink inside the Inverter. The cooling fan(s) can be replaced without removing the Inverter from the installation panel.

Removing the Cooling Fan

1. Always turn OFF the input power before removing and installing the heatsink cooling fan assembly.

2. Remove the terminal cover, Inverter cover, Digital Operator/Monitor, and front cover from the Inverter.

3. Remove the control PCB (if necessary) bracket to which the cards are mounted. Remove all cables connected to the control PCB and remove the cooling fan power connector from the fan board positioned near the top of the Inverter.

4. Remove the cooling fan power connectors from the gate drive board positioned at the back of the Inverter.

5. Remove the fan assembly screws and pull out the fan assembly from the Inverter.

6. Remove the cooling fan(s) from the fan assembly.

Mounting the Cooling Fan

After attaching the new cooling fan(s), reverse the above procedure to attach all of the components.
When attaching the cooling fan to the mounting bracket, be sure that the air flow direction faces the top of the Inverter.
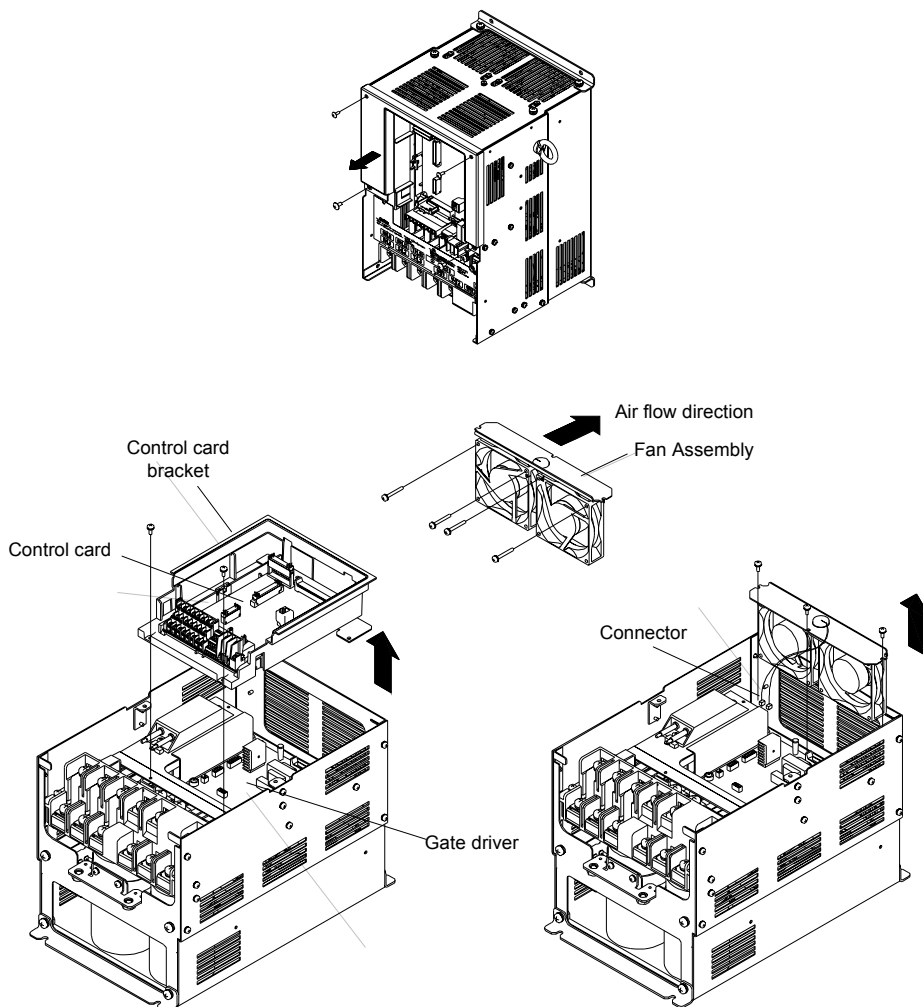
Fig 7.2 Cooling Fan Replacement (Inverters of 22 kW or More)

◆ Removing and Mounting the Terminal Card

The Terminal Card can be removed and mounted without disconnecting the control wiring.

■Removing the Terminal Card

1. Remove the terminal cover, Digital Operator/Monitor and front cover.
2. Remove the wires connected to FE and/or NC on the terminal card.
3. Loosen the mounting screws on the left and right sides of the terminal card („1") until they are free. It is not necessary to remove these screws completely. They are captive and self-rising.
4. Pull the terminal card out in the direction of the block arrow „2".

■Mounting the Terminal Card

Reverse the removal procedure to mount the terminal card.

Confirm that the terminal card and the control PCB properly meet at connector CN8 before insertion.

The connector pins may be damaged if the terminal card is forced into place, possibly preventing correct Inverter operation.
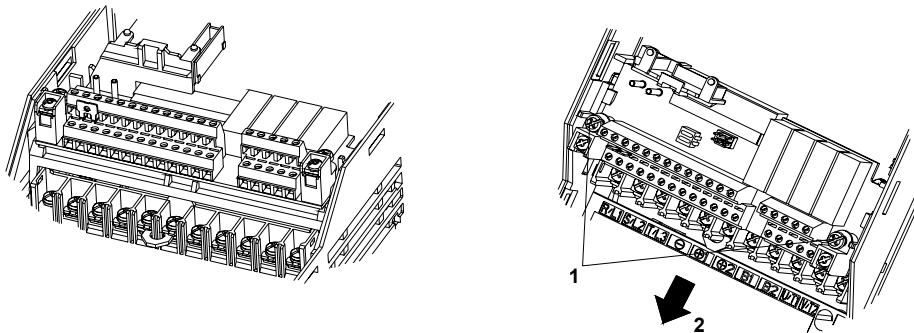
Fig 7.3   Removing the Control Circuit Terminal Card

Always confirm that the input power is removed and the Charge LED is not lit before removing or mounting the terminal card.

IMPORTANT

8
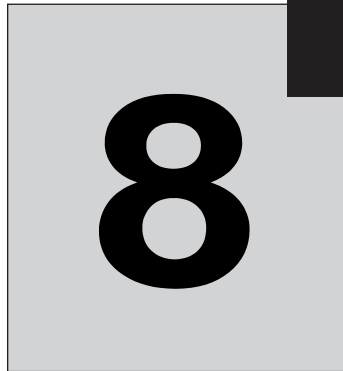
Specifications

This chapter describes the basic specifications of the Inverter.

8

Standard Inverter Specifications

The standard Inverter specifications are listed by capacity in the following tables.

◆ Specifications by Model

Specifications are given by model in the following tables.

■200V Class

Table 8.4 200 V Class Inverters

| Model Number CIMR-L7Z □		23P7	25P5	27P5	2011	2015	2018	2022	2030	2037	2045	2055
Max. applicable motor output (kW)[1]		3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output Rating	Rated output capacity (kVA)	7	10	14	20	27	33	40	54	67	76	93
	Rated output current (A)	17.5	25	33	49	64	80	96	130	160	183	224
	Max. output voltage (V)	3-phase; 200, 208, 220, 230, or 240 VAC (Proportional to input voltage.)										
	Max. output frequency (Hz)	Up to 120Hz available by programing.										
Power supply characteristics	Rated voltage (V) Rated frequency (Hz)	3-phase, 200/208/220/230/240 VAC, 50/60 Hz										
	Rated input current (A)	21	25	40	52	68	96	115	156	176	220	269
	Allowable voltage fluctuation	+ 10%, - 15%										
	Allowable frequency fluctuation	±5%										
	Measures for power supply — DC reactor	Optional						Built In				
	Measures for power supply — 12-pulse rectifica-	Not possible						Possible				

* 1. The maximum applicable motor output is given for a standard 4-pole Yaskawa motor. When selecting the actual motor and Inverter, be sure that the Inverter's rated current is applicable for the motor's rated current.

* 2. A transformer with dual star-delta secondary is required on the power supply for 12-pulse rectification.

■400 V Class

Table 8.5 400 V Class Inverters

Model Number CIMR-L7Z □		43P7	44P0	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055
Max. applicable motor output (kW) [1]		3.7	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55
Output Rating	Rated output capacity (kVA)	7	9	12	15	22	28	34	40	54	67	80	106
	Rated output current (A)	8.5	11	14	18	27	34	41	48	65	80	96	128
	Max. output voltage (V)	3-phase; 380, 400, 415, 440, 460, or 480 VAC (Proportional to input voltage.)											
	Max. output frequency (Hz)	120 Hz max.											
Power supply characteristics	Rated voltage (V) Rated frequency (Hz)	3-phase, 380, 400, 415, 440, 460 or 480 VAC, 50/60 Hz											
	Rated input current (A)	10.2	13.2	17	22	32	41	49	58	78	96	115	154
	Allowable voltage fluctuation	+ 10%, - 15%											
	Allowable frequency fluctuation	±5%											
	Measures for power supply — DC reactor	Optional							Built In				
	Measures for power supply — 12-phase rectifica-	Not possible							Possible				

* 1. The maximum applicable motor output is given for a standard 4-pole Yaskawa standard motor. When selecting the actual motor and Inverter, be sure that the Inverter's rated current is higher than the motor's rated current.

* 2. A transformer with dual star-delta secondary is required on the power supply for 12-pulse-rectification.

8

◆ Common Specifications

The following specifications apply to both 200 V and 400 V class Inverters.

Table 8.6 Common Specifications

Model Number CIMR-L7Z □		Specification
Control Characteristics	Control method	Sine wave PWM Closed Loop Vector control, Open Loop Vector control, V/f control
	Carrier Frequency	8 kHz higher carrier frequency possible with current derating.
	Speed control range	1:40 (V/f control) 1:100 (Open Loop Vector control) 1:1000 (Closed Loop Vector control)
	Speed control accuracy	± 3% (V/f control) ± 0.2% (Open Loop Vector control) ± 0.02% (Closed Loop Vector control) (25°C ± 10°C)
	Speed control response	5 Hz (control without PG) 30 Hz (control with PG)
	Torque limits	Provided (4 quadrant steps can be changed by constant settings.) (Vector control)
	Torque accuracy	± 5%
	Frequency range	0.01 to 120 Hz
	Frequency accuracy (temperature characteristics)	Digital references: ± 0.01% (-10°C to +40°C)
		Analog references: ± 0.1% (25°C ±10°C)
	Frequency setting resolution	Digital references: 0.01 Hz
		Analog references: 0.025/50 Hz (11 bits plus sign)
	Output frequency resolution	0.01 Hz
	Overload capacity and maximum current	150% of rated output current for 30 sec.
	Frequency setting signal	0 to +10V
	Acceleration/Deceleration time	0.01 to 600.00 s (4 selectable combinations of independent acceleration and deceleration time settings)
	Main control functions	Overtorque/undertorque detection, torque limits, 8-speed control (maximum), 4 acceleration and deceleration times, S-curve acceleration/deceleration, auto-tuning (rotational or stationary), dwell function, cooling fan ON/OFF control, slip compensation, torque compensation, auto-restart after fault, DC braking for starting and stopping, automatic fault reset and parameter copy function, special Lift functions and sequences, short floor, hardware baseblock

Table 8.6 Common Specifications

Model Number CIMR-L7Z □		Specification
Protective Functions	Motor protection	Protection by electronic thermal overload relay.
	Instantaneous overcurrent protection	Stops at approximately 200% of rated output current.
	Fuse blown protection	Stops for fuse blown.
	Overload protection	OL2 fault at 150% of rated output current for 30 sec
	Overvoltage protection	200 Class Inverter: Stops when main-circuit DC voltage is above 410 V. 400 Class Inverter: Stops when main-circuit DC voltage is above 820 V.
	Undervoltage protection	200 Class Inverter: Stops when main-circuit DC voltage is below 190 V. 400 Class Inverter: Stops when main-circuit DC voltage is below 380 V.
	Cooling fin overheating	Protection by thermistor.
	Stall prevention	Stall prevention during acceleration, deceleration and running independently.
	Grounding protection	Protection by electronic circuits.
	Charge indicator	Glows when the main circuit DC voltage is approximately 10 VDC or more.
Protective structure		Enclosed wall-mounted type (IP20): All models Enclosed wall-mounted type (NEMA 1): 18.5 kW or less (same for 200 V and 400 V class Inverters) Open chassis type (IP00): 22 kW or more (same for 200 V and 400 V class Inverters)
Environment	Ambient operating temperature	-–10°C to 45°C
	Ambient operating humidity	95% max. (with no condensation)
	Storage temperature	- 20°C to + 60°C (short-term temperature during transportation)
	Application site	Indoor (no corrosive gas, dust, etc.)
	Altitude	1000 m max.
	Vibration	10 to 20 Hz, 9.8 m/s^2 max.; 20 to 50 Hz, 2 m/s^2 max

8

9

Appendix

This chapter provides precautions for the Inverter, motor, and peripheral devices and also provides lists of constants.

9

Inverter Application Precautions

◆ Selection

Observe the following precautions when selecting an Inverter.

■Installing Reactors

A large peak current will flow in the power input circuit when the Inverter is connected to a large-capacity power transformer (600 kVA or higher) or when switching a compensating capacitor. Excessive peak current can destroy the converter section. To prevent this, install a DC or AC reactor to improve the power supply power factor.

If a thyristor convertor, such as a DC drive, is connected in the same power supply system, connect a DC or AC reactor regardless of the power supply conditions shown in the following diagram.
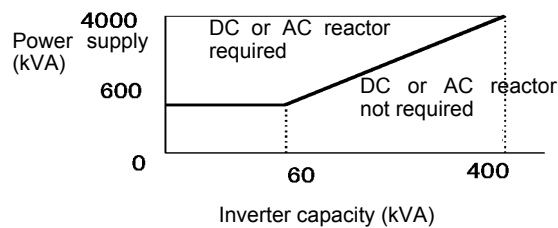
Fig 9.4

◆ Installation

Observe the following precautions when installing an Inverter.

■Installation in Enclosures

Install the Inverter in a clean location where it is not subjected to oil mist, dust, and other contaminants, or install the Inverter in a completely enclosed panel. Provide cooling measures and sufficient panel space so that the temperature surrounding the Inverter does not exceed the allowable temperature. Do not install the Inverter on wood or other combustible materials.

■Installation Direction

Mount the Inverter vertically to a wall or other vertical surface.

◆ Settings

Observe the following precautions when making settings for an Inverter.

■Upper Limits

The maximum output frequency can be set up to 120Hz. Setting the output frequency too high can damage the machine. So pay attention to the mechanical system and observe required limits for the output frequency.

■DC Injection Braking

If the DC Injection Braking Current or the Braking Time are set too high the motor can overheat what can damage the motor

■Acceleration/Deceleration Times

The motor's acceleration and deceleration times are determined by the torque generated by the motor, the load torque, and the load's inertial moment ($GD^2/4$). If the stall prevention functions are activated during acceleration or deceleration, it might be necessary to increase the acceleration or deceleration time.

To reduce the acceleration or deceleration times, increase the capacity of the motor and Inverter.

◆ Handling

Observe the following precautions when wiring or performing maintenance for an Inverter.

■Wiring Check

The Inverter will be internally damaged if the power supply voltage is applied to output terminal U, V, or W. Check wiring for any mistakes before supplying power. Check all wiring and control sequences carefully.

■Magnetic Contactor Installation

If a magnetic contactor is installed in the power supply line do not exceed one start per hour. Switching more often can damage the inrush current prevention circuit.

■Maintenance and Inspections

After turning OFF the main circuit power supply it can take several minutes before the DC bus is discharged completely. The CHARGE LED, indicating if the DC bus is charged, glows above a voltage of 10VD.

9

Motor Application Precautions

◆ Using the Inverter for an Existing Standard Motor

Observe the following precautions when using an Inverter for an existing standard motor.

■Low Speed Ranges

If a standard cooled motor is used at low speed the cooling effects are diminished. If the motor is used in constant torque applications in low speed area the motor may overheat. If full torque is required at low speed continuously an externally cooled motor must be used.

■Installation Withstand Voltage

If the inverter is used with an input voltage of 440 V or higher and long motor cables, voltage spikes at the motor terminals may occur which can damage the motor windings. Please ensure that the motor insulation class is sufficient.

■Noise

The noise generated in the motor depends on the carrier frequency. The higher the setting the less the generated noise is.

◆ Using the Inverter for Special Motors

Observe the following precautions when using a special motor.

■Pole-changing Motor

The rated input current of pole-changing motors differs from that of standard motors. Select an appropriate Inverter according to the maximum current of the motor.

■Single-phase Motor

Do not use an Inverter for a single-phase capacitor motor. Any capacitors directly connected to the inverter output may damage the Inverter.

User Constants

Factory settings are given in the following table. These are factory settings for a 200 V Class Inverter with 3.7 kW (open loop vector control).

Table 9.7 User Constants

No.	Name	Factory Setting	Setting
A1-00	Language selection for Digital Operator display	0	
A1-01	Parameter access level	2	
A1-02	Control method selection	0	
A1-03	Initialize	0	
A1-04	Password	0	
A1-05	Password setting	0	
A2-01 to A2-32	User specified parameters	–	
b1-01	Reference source selection	0	
b1-02	RUN command source selection	1	
b1-06	Control input scan	1	
b1-08	Run command selection in programming modes	1	
b2-08	Magnetic flux compensation volume	0%	
b4-01	Timer function ON-delay time	0.0 s	
b4-02	Timer function OFF-delay time	0.0 s	
b6-01	Dwell frequency at start	0.0 Hz	
b6-02	Dwell time at start	0.0 s	
b6-03	Dwell frequency at stop	0.0 Hz	
b6-04	Dwell time at stop	0.0 s	
C1-01	Acceleration time 1	10.0 s	
C1-02	Deceleration time 1		
C1-03	Acceleration time 2		
C1-04	Deceleration time 2		
C1-05	Acceleration time 3	1.5 s	
C1-06	Deceleration time 3		
C1-07	Acceleration time 4		
C1-08	Deceleration time 4		
C1-09	Emergency stop time		
C1-10	Accel/decel time setting unit	1	
C1-11	Accel/decel time switching frequency	0.0 Hz	
C2-01	S-curve characteristic time at acceleration start	0.5 s	
C2-02	S-curve characteristic time at acceleration end	0.5 s	
C2-03	S-curve characteristic time at deceleration start	0.5 s	

9

Table 9.7 User Constants

No.	Name	Factory Setting	Setting
C2-04	S-curve characteristic time at deceleration end	0.5 s	
C2-05	S-curve Characteristic time below leveling speed	0.50 s	
C3-01	Slip compensation gain	1.0 [*1]	
C3-02	Slip compensation delay time	2000 ms [*1]	
C3-03	Slip compensation limit	200%	
C3-04	Slip compensation selection during regeneration	1	
C3-05	Output voltage limit operation selection	1	
C4-01	Torque compensation gain	1.00	
C4-02	Torque compensation delay time constant	200 ms [*1]	
C4-03	Starting torque compensation (FWD)	0.0%	
C4-04	Starting torque compensation (REV)	0.0%	
C4-05	Starting torque compensation time constant	10 ms	
C5-01	ASR proportional (P) gain 1	40 [*1]	
C5-02	ASR integral (I) time 1	0.5 [*1]	
C5-03	ASR proportional (P) gain 2	20 [*1]	
C5-04	ASR integral (I) time 2	0.5 [*1]	
C5-06	ASR delay time	0.004 ms	
C5-07	ASR switching frequency	0.0 Hz	
C5-08	ASR integral (I) limit	400%	
C5-09	ASR proportional (P) gain 3	40.00	
C5-10	ASR integral (I) time 3	0.500 s	
C6-02	Carrier frequency selection	1	
d1-01	Frequency reference 1	0.00 Hz	
d1-02	Frequency reference 2	0.00 Hz	
d1-03	Frequency reference 3	0.00 Hz	
d1-04	Frequency reference 4	0.00 Hz	
d1-05	Frequency reference 5	0.00 Hz	
d1-06	Frequency reference 6	0.00 Hz	
d1-07	Frequency reference 7	0.00 Hz	
d1-08	Frequency reference 8	0.00 Hz	
d1-09	Frequency reference 9 Vn	50.00 Hz	
d1-10	Frequency reference 10 V_1	0.00 Hz	
d1-11	Frequency reference 11 V_2	0.00 Hz	
d1-12	Frequency reference 12 V_3	0.00 Hz	
d1-13	Frequency reference 13 V_r	0.00 Hz	

Table 9.7 User Constants

No.	Name	Factory Setting	Setting
d1-14	Frequency reference 14 Inspection	25 Hz	
d1-17	Jog frequency reference / Leveling speed	4.00 Hz	
d1-18	Speed priority selection	1	
d6-03	Field forcing function selection	0	
d6-06	Field forcing function Limit	400%	
E1-01	Input voltage setting	*1	
E1-04	Max. output frequency (FMAX)	50.0 Hz	
E1-05	Max. output voltage (VMAX)	*1	
E1-06	Base frequency (FA)	50.0 Hz	
E1-07	Mid. output frequency (FB)	*1	
E1-08	Mid. output frequency voltage (VB)	*1	
E1-09	Min. output frequency (FMIN)	*1	
E1-10	Min. output frequency voltage (VMIN)	*1	
E1-13	Base voltage (VBASE)	0.0 V	
E2-01	Motor rated current	*1	
E2-02	Motor rated slip	*1	
E2-03	Motor no-load current	*1	
E2-04	Number of motor poles	4 poles	
E2-05	Motor line-to-line resistance	*1	
E2-06	Motor leak inductance	*1	
E2-07	Motor iron saturation coefficient 1	0.50	
E2-08	Motor iron saturation coefficient 2	0.75	
E2-09	Monitor mechanical losses	0.0%	
E2-10	Motor iron loss for torque compensation	*1	
E2-11	Motor rated output power	*1	
F1-01	PG constant	1024	
F1-02	Operation selection at PG open circuit (PGO)	1	
F1-03	Operation selection at overspeed (OS)	1	
F1-04	Operation selection at deviation	3	
F1-05	PG rotation	0	
F1-06	PG division rate (PG pulse monitor)	1	
F1-08	Overspeed detection level	115%	
F1-09	Overspeed detection delay time	0.0 s	
F1-10	Excessive speed deviation detection level	10%	
F1-11	Excessive speed deviation detection delay time	0.5 s	
F1-14	PG open-circuit detection delay time	1.0 s	
F4-01	Channel 1 monitor selection	2	

9

Table 9.7 User Constants

No.	Name	Factory Setting	Setting
F4-02	Channel 1 gain	100.0%	
F4-03	Channel 2 monitor selection	3	
F4-04	Channel 2 gain	50.0%	
F4-05	Channel 1 output monitor bias	0.0%	
F4-06	Channel 2 output monitor bias	0.0%	
F4-07	Analog output signal level for channel 1	0	
F4-08	Analog output signal level for channel 2	0	
F5-01	Channel 1 output selection	0	
F5-02	Channel 2 output selection	1	
F5-03	Channel 3 output selection	2	
F5-04	Channel 4 output selection	4	
F5-05	Channel 5 output selection	6	
F5-06	Channel 6 output selection	37	
F5-07	Channel 7 output selection	0F	
F5-08	Channel 8 output selection	0F	
F5-09	DO-08 output mode selection	0	
F6-01	Operation selection after communications error	1	
F6-02	Input level of external error from Communications Option Card	0	
F6-03	Stopping method for external error from Communications Option Card	1	
F6-04	Trace sampling from Communications Option Card	0	
F6-05	Current monitor unit selection	0	
F6-06	Torque reference/torque limit selection from communications option card	0	
H1-01	Terminal S3 function selection	80	
H1-02	Terminal S4 function selection	84	
H1-03	Terminal S5 function selection	81	
H1-04	Terminal S6 function selection	83	
H1-05	Terminal S7 function selection	F	
H2-01	Terminal M1-M2 function selection	40	
H2-02	Terminal M3-M4 function selection	41	
H2-03	Terminal M5-M6 function selection	6	
H3-01	Frequency reference AI-14B CH1signal level selection	0	
H3-02	Frequency reference AI-14B CH1 input gain	100.0%	
H3-03	Frequency referenceAI-14B CH1 input bias	0.0%	
H3-04	AI-14B CH3 signal level selection	0	
H3-05	AI-14B CH3 function selection	2	
H3-06	AI-14B CH3 input gain	100.0%	
H3-07	AI-14B CH3 input bias	0.0%	

Table 9.7 User Constants

No.	Name	Factory Setting	Setting
H3-08	AI-14B CH2 signal level selection	0	
H3-09	AI-14B CH2 function selection	3	
H3-10	AI-14B CH2 input gain	100.0%	
H3-11	AI-14B CH2 input bias	0.0%	
H3-12	Analog input filter time constant for the AI-14B	0.03 s	
H3-15	Terminal A1 function selection	0	
H3-16	Terminal A1 input gain	100.0%	
H3-17	Terminal A1 input bias	0.0%	
L1-01	Motor protection selection	1	
L1-02	Motor protection time constant	1.0 min	
L2-05	Undervoltage detection level	190 V	
L2-11	Battery Voltage	0V	
L3-01	Stall prevention selection during accel	1	
L3-02	Stall prevention level during accel	150%	
L3-05	Stall prevention selection during running	1	
L3-06	Stall prevention level during running	150%	
L4-01	Speed agreement detection level	0.0 Hz	
L4-02	Speed agreement detection width	2.0 Hz	
L4-03	Speed agreement detection level (+/-)	0.0 Hz	
L4-04	Speed agreement detection width (+/-)	2.0 Hz	
L4-05	Operation when frequency reference is missing	0	
L4-06	Frequency reference value at frequency reference loss	80%	
L5-01	Number of auto restart attempts	2	
L5-02	Auto restart operation selection	0	
L6-01	Torque detection selection 1	0	
L6-02	Torque detection level 1	150%	
L6-03	Torque detection time 1	0.1 s	
L6-04	Torque detection selection 2	0	
L6-05	Torque detection level 2	150%	
L6-06	Torque detection time 2	0.1 s	
L7-01	Forward drive torque limit	300%	
L7-02	Reverse drive torque limit	300%	
L7-03	Forward regenerative torque limit	300%	
L7-04	Reverse regenerative torque limit	300%	
L7-06	Torque limit time constant	200 ms	
L7-07	Torque Limit Operation during accel/decel	0	

9

Table 9.7 User Constants

No.	Name	Factory Setting	Setting
L8-02	Overheat pre-alarm level	75 °C^{*1}	
L8-03	Operation selection after overheat pre-alarm	3	
L8-05	Input open-phase protection selection	0	
L8-07	Output open-phase protection selection	2	
L8-09	Ground protection selection	1	
L8-10	Cooling fan control selection	0	
L8-11	Cooling fan control delay time	60 s	
L8-12	Ambient temperature	45 °C	
L8-18	Soft CLA selection	1	
L8-20	LF detection time	0.2sec	
N2-01	Speed feedback detection control (AFR) gain	1.00	
N2-02	Speed feedback detection control (AFR) time constant	50 ms	
N5-01	Feed forward control selection	1	
N5-02	Motor Accel Time	0.178 s	
N5-03	Feed forward proportional gain	1.00	
o1-01	Monitor selection	6	
o1-02	Monitor selection after power up	1	
o1-03	Frequency units of reference setting and monitor	0	
o1-04	Setting unit for frequency parameters related to V/f characteristics	0	
o1-05	LCD Display contrast adjustment	3	
o2-02	STOP key during control circuit terminal operation	0	
o2-03	User parameter initial value	0	
o2-04	kVA selection	0	
o2-05	Frequency reference setting method selection	0	
o2-06	Operation selection when digital operator is disconnected	0	
o2-07	Cumulative operation time setting	0 hr.	
o2-08	Cumulative operation time selection	0	
o2-09	Initialize Mode	2	
o2-10	Fan operation time setting	0 hr	
o2-12	Fault trace initialize	0	
o2-15	"No of Travels" monitor initialize	0	
o3-01	Copy function selection	0	
o3-02	Read permission selection	0	
S1-02	DC injection braking current at start	50%	
S1-03	DC injection braking current at stop	50%	
S1-04	DC injection braking time at start	0.30 sec	

Table 9.7 User Constants

No.	Name	Factory Setting	Setting
S1-05	DC injection braking time at stop	0.60	
S1-06	Brake release delay time	0.20	
S1-07	Brake close delay time	0.10	
S1-14	SE2 detection delay time	200ms	
S1-15	SE3 detection delay time	200ms	
S1-16	Run delay time	0.10sec	
S1-17	DC injection current gain at regenerative operation	100%	
S1-18	DC injection current gain at motoring operation	20%	
S1-19	Output contactor open delay time	0.10sec	
S1-20	Zero servo gain	5	
S1-21	Zero servo completion width	10	
S1-22	Starting torque compensation increase time	500ms	
S1-23	Torque compensation gain during lowering	1.000	
S1-24	Torque compensation bias during raising	0.0%	
S1-25	Torque compensation bias during lowering	0.0%	
S1-26	Dwell speed at start reference	0.0Hz	
S1-27	Door zone speed level	0.0Hz	
S2-01	Motor rated speed	1380 rpm	
S2-02	Slip compensation gain in motoring mode	0.7	
S2-03	Slip compensation gain in regenerative mode	1.0	
S2-07	Slip compensation delay time	200ms	
S3-01	Short floor operation selection	0	
T1-01	Autotuning mode selection	0	
T1-02	Motor output power	*1	
T1-03	Motor rated voltage	*1	
T1-04	Motor rated current	*1	
T1-05	Motor base frequency	60.0 Hz	
T1-06	Number of motor poles	4 poles	
T1-07	Motor base speed	1450 r/min	
T1-08	Number of PG pulses	1024	
T1-09	Motor no-load current	E2-03 value	

* The factory setting depends on the inverter model and the control method.

9