Varispeed L7
INSTRUCTION MANUAL

INVERTER FOR LIFT

MODEL: CIMR-L7C □□□□

200V CLASS 3.7 to 55kW (7 to 93kVA)
400V CLASS 3.7 to 55kW (7 to 106kVA)

Upon receipt of the product and prior to initial operation, read these instructions thoroughly, and retain for future reference.

YASKAWA

MANUAL NO. TOEP C710676 03B

Preface

This manual is designed to ensure correct and suitable application of Varispeed L7-Series Inverters. Read this manual before attempting to install, operate, maintain, or inspect an Inverter and keep it in a safe, convenient location for future reference. Be sure you understand all precautions and safety information before attempting application.

General Precautions

- The diagrams in this manual may be indicated without covers or safety shields to show details. Be sure to restore covers or shields before operating the Units and run the Units according to the instructions described in this manual.
- Any illustrations, photographs, or examples used in this manual are provided as examples only and may not apply to all products to which this manual is applicable.
- The products and specifications described in this manual or the content and presentation of the manual may be changed without notice to improve the product and/or the manual.
- When ordering a new copy of the manual due to damage or loss, contact your Yaskawa representatives or the nearest Yaskawa sales office and provide the manual number shown on the front cover.
- If nameplates become warn or damaged, order new ones from your Yaskawa representatives or the nearest Yaskawa sales office.

Safety Information

The following conventions are used to indicate precautions in this manual. Failure to heed precautions provided in this manual can result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.

Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

Failure to heed a precaution classified as a caution can result in serious consequences depending on the situation.

Indicates important information that should be memorized.

Safety Precautions

■ Confirmations upon Delivery

⚠ CAUTION

- Never install an Inverter that is damaged or missing components.
  Doing so can result in injury.

■ Installation

⚠ CAUTION

- Always hold the case when carrying the Inverter.
  If the Inverter is held by the front cover, the main body of the Inverter may fall, possibly resulting in injury.
- Attach the Inverter to a metal or other noncombustible material.
  Fire can result if the Inverter is attached to a combustible material.
- Install a cooling fan or other cooling device when installing more than one Inverter in the same enclosure so that the temperature of the air entering the Inverters is below 45°C.
  Overheating can result in fires or other accidents.

■ Wiring

⚠ WARNING

- Always turn OFF the input power supply before wiring terminals.
  Otherwise, an electric shock or fire can occur.
- Wiring must be performed by an authorized person qualified in electrical work.
  Otherwise, an electric shock or fire can occur.
- Be sure to ground the ground terminal. (200 V Class: Ground to 100 Ω or less, 400 V Class: Ground to 10 Ω or less)
  Otherwise, an electric shock or fire can occur.
- Always check the operation of any emergency stop circuits after they are wired.
  Otherwise, there is the possibility of injury. (Wiring is the responsibility of the user.)
- Never touch the output terminals directly with your hands or allow the output lines to come into contact with the Inverter case. Never short the output circuits.
  Otherwise, an electric shock or ground short can occur.

⚠ CAUTION

- Check to be sure that the voltage of the main AC power supply satisfies the rated voltage of the Inverter.
  Injury or fire can occur if the voltage is not correct.
- Do not perform voltage withstand tests on the Inverter.
  Otherwise, semiconductor elements and other devices can be damaged.
- Connect braking resistors, Braking Resistor Units, and Braking Units as shown in the I/O wiring examples.
  Otherwise, a fire can occur.
- Tighten all terminal screws to the specified tightening torque.
  Otherwise, a fire may occur.
- Do not connect AC power to output terminals U, V, and W.
  The interior parts of the Inverter will be damaged if voltage is applied to the output terminals.
- Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits.
  The Inverter can be damaged or internal parts burnt if these devices are connected.

■ Setting User Constants

⚠ WARNING

- Do not change the factory setting (0) in b1-03 (Run Command source selection).
  Doing so can cause the lift to drop.

⚠ CAUTION

- Disconnect the load (machine, device) from the motor before performing rotational autotuning.
  The motor may turn, possibly resulting in injury or damage to equipment. Also, motor constants cannot be correctly set with the motor attached to a load.
- Stay clear of the motor during rotational autotuning.
  The motor may start operating suddenly when stopped, possibly resulting in injury.

■ Trial Operation

⚠ WARNING

- Check to be sure that the front cover is attached before turning ON the power supply.
  An electric shock may occur.
- Do not come close to the machine when the fault reset function is used. If the alarmed is cleared, the machine may start moving suddenly.
  Also, design the machine so that human safety is ensured even when it is restarted.
  Injury may occur.
- Provide a separate emergency stop switch; the Digital Operator STOP Key is valid only when its function is set.
  Injury may occur.
- Reset alarms only after confirming that the RUN signal is OFF.
  Injury may occur.

⚠ CAUTION

- Don't touch the radiation fins (heatsink), braking resistor, or Braking Resistor Unit. These can become very hot.
  Otherwise, a burn injury may occur.
- Be sure that the motor and machine is within the applicable ranges before starting operation.
  Otherwise, an injury may occur.
- Provide a separate holding brake if necessary.
  Always construct the external sequence to confirm that the holding brake is activated in the event of an emergency, a power failure, or an abnormality in the Inverter.
  Failure to observe this caution can result in injury.
- If using an Inverter with an lift, take safety measures on the lift to prevent the lift from dropping.
  Failure to observe this caution can result in injury.
- Don't check signals while the Inverter is running.
  Otherwise, the equipment may be damaged.
- Be careful when changing Inverter settings. The Inverter is factory set to suitable settings.
  Otherwise, the equipment may be damaged.

■ Maintenance and Inspection

⚠ WARNING

- Do not touch the Inverter terminals. Some of the terminals carry high voltages and are extremely dangerous.
  Doing so can result in electric shock.
- Always have the protective cover in place when power is being supplied to the Inverter. When attaching the cover, always turn OFF power to the Inverter through the MCCB.
  Doing so can result in electric shock.
- After turning OFF the main circuit power supply, wait until the CHARGE indicator light goes out before performing maintenance or inspections.
  The capacitor will remain charged and is dangerous.
- Maintenance, inspection, and replacement of parts must be performed only by authorized personnel.
  Remove all metal objects, such as watches and rings, before starting work. Always use grounded tools.
  Failure to heed these warning can result in electric shock.

⚠ CAUTION

- A CMOS IC is used in the control board. Handle the control board and CMOS IC carefully.
  The CMOS IC can be destroyed by static electricity if touched directly.
- Do not change the wiring, or remove connectors or the Digital Operator, during operation.
  Doing so can result in personal injury.

■ Other

⚠ WARNING

- Do not attempt to modify or alter the Inverter.
  Doing so can result in electrical shock or injury.

⚠ CAUTION

- Do not subject the Inverter to halogen gases, such as fluorine, chlorine, bromine, and iodine, at any time even during transportation or installation.
  Otherwise, the Inverter can be damaged or interior parts burnt.

Warning Information and Position

There is warning information on the Inverter in the position shown in the following illustration. Always heed the warnings.

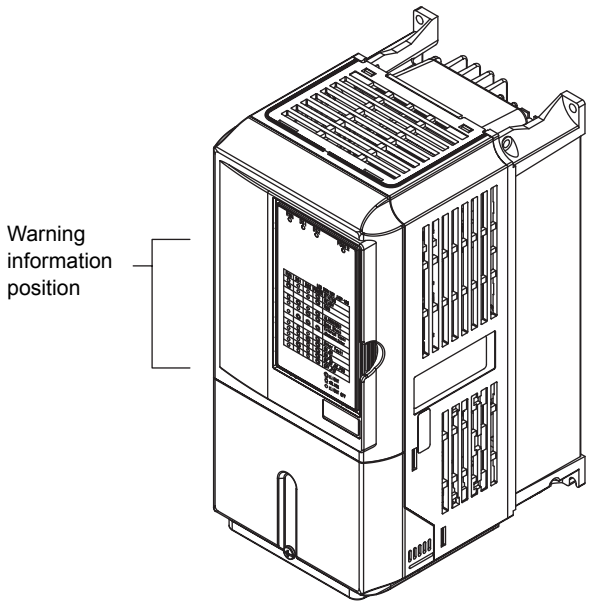


Illustration shows the CIMR-L7C23P7

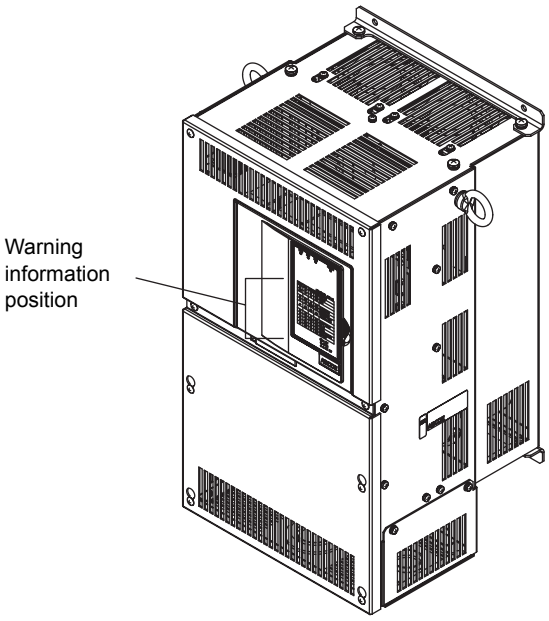


Illustration shows the CIMR-L7C2022

Warning Information

⚠ WARNING

Risk of electric shock.

- Read manual before installing.
- Wait 5 minutes for capacitor discharge after disconnecting power supply.

⚠ AVERTISSEMENT

Risque de décharge électrique.

- Lire le manuel avant l' installation.
- Attendre 5 minutes aprés la coupure de l' allmentation. Pour permettre la décharge des condensateurs.

⚠ 危険

けが・感電のおそれがあります。

- 据え付け・運転の前には必ず取扱説明書をお読み下さい。
- 通電中及び電源遮断後5分以内はフロントカバーを外さないで下さい。

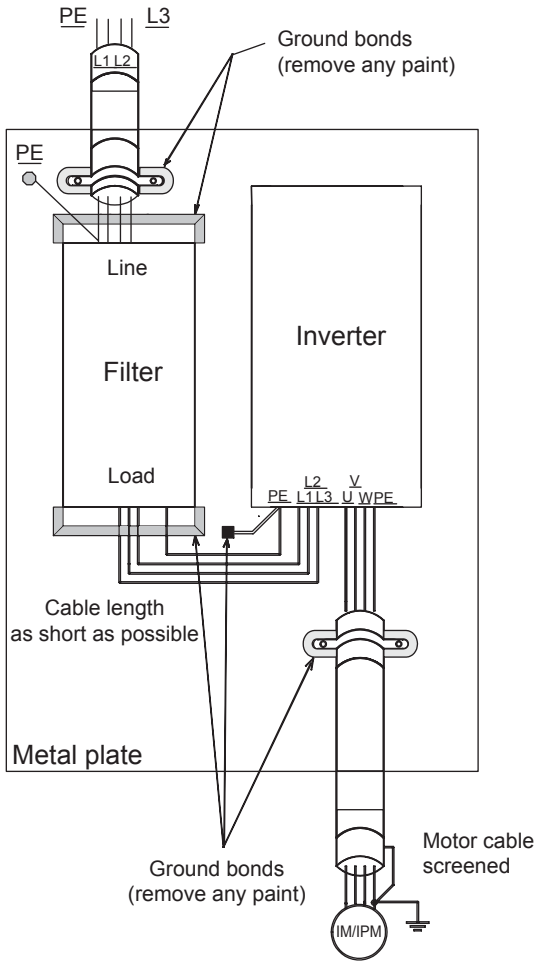
EMC Compatibility

Varispeed L7-Series Inverters satisfy testing for conformance to the EMC Directive under the conditions described in European Standard EN61800-3.

■ Installation Method

In order to ensure that the machinery or installation incorporating the Inverter conforms to the EMC Directive, perform installation according to the method below.

- Install a line filter that conforms to European Standards on the input side. (Refer to *EMC Line Filters (200 V Class)*, *EMC Line Filters (400 V Class)*.
- Use a shielded line or metal piping for wiring between the Inverter and Motor. Make the wiring as short as possible.



Installation Method for Filter and Inverter

■ Line Filters

EMC Line Filters (200 V Class)

Inverter Model	Line Filter			
Varispeed L7	Model	Rated Current (A)	Weight (kg)	Dimensions W x D x H
CIMR-L7C23P7	FS5973-35-07	35	1.4	141 × 46 × 330
CIMR-L7C25P5				
CIMR-L7C27P5	FS5973-60-07	60	3.0	206 × 60 × 355
CIMR-L7C2011				
CIMR-L7C2015	FS5973-100-07	100	4.9	236 × 80 × 408
CIMR-L7C2018				
CIMR-L7C2022	FS5973-130-35	130	4.3	90 × 180 × 366
CIMR-L7C2030				
CIMR-L7C2037	FS5973-160-40	160	6.0	120 × 170 × 451
CIMR-L7C2045	FS5973-240-37	240	11.0	130 × 240 × 610
CIMR-L7C2055				

Maximum Voltage : 3-phase 240 VAC
Ambient Temperature : 45°C max.

EMC Line Filters (400 V Class)

Inverter Model	Line Filter			
Varispeed L7	Model	Rated Current (A)	Weight (kg)	Dimensions W x D x H
CIMR-L7C43P7	FS5972-10-07	10	1.1	141 × 46 × 330
CIMR-L7C44P0	FS5972-18-07	18	1.3	141 × 46 × 330
CIMR-L7C45P5				
CIMR-L7C47P5	FS5972-21-07	21	1.8	206 × 50 × 355
CIMR-L7C4011	FS5972-35-07	35	2.1	206 × 50 × 355
CIMR-L7C4015	FS5972-60-07	60	4.0	236 × 65 × 408
CIMR-L7C4018				
CIMR-L7C4022	FS5972-70-52	70	3.4	80 × 185 × 329
CIMR-L7C4030				
CIMR-L7C4037	FS5972-100-35	100	4.5	90 × 150 × 326
CIMR-L7C4045				
CIMR-L7C4055	FS5972-130-35	130	4.7	90 × 180 × 366

Maximum Voltage : 3-phase 480 VAC
Ambient Temperature : 45°C max.

IMPORTANT

1. Max. motor cable length: 10 m Class A
2. Permissible emission of power drive systems for commercial and light environment (EN61800-3, A11) (general availability, 1st environment)

Registered Trademarks

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- 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.

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1

Handling Inverters

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

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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-L7C□□□□□□	Enclosed Wall-mounted (NEMA 1) CIMR-L7C□□□□□□
200 V Class	3.7	7	CIMR-L7C23P7	23P70□	23P71□
	5.5	10	CIMR-L7C25P5	25P50□	25P51□
	7.5	14	CIMR-L7C27P5	27P50□	27P51□
	11	20	CIMR-L7C2011	20110□	20111□
	15	27	CIMR-L7C2015	20150□	20151□
	18.5	33	CIMR-L7C2018	20180□	20181□
	22	40	CIMR-L7C2022	20220□	20221□
	30	54	CIMR-L7C2030	20300□	20301□
	37	67	CIMR-L7C2037	20370□	20371□
	45	76	CIMR-L7C2045	20450□	20451□
	55	93	CIMR-L7C2055	20550□	20551□
400 V Class	3.7	7	CIMR-L7C43P7	43P70□	43P71□
	4.0	9	CIMR-L7C44P0	44P00□	44P01□
	5.5	12	CIMR-L7C45P5	45P50□	45P51□
	7.5	15	CIMR-L7C47P5	47P50□	47P51□
	11	22	CIMR-L7C4011	40110□	40111□
	15	28	CIMR-L7C4015	40150□	40151□
	18.5	34	CIMR-L7C4018	40180□	40181□
	22	40	CIMR-L7C4022	40220□	40221□
	30	54	CIMR-L7C4030	40300□	40301□
	37	67	CIMR-L7C4037	40370□	40371□
	45	80	CIMR-L7C4045	40450□	40451□
	55	106	CIMR-L7C4055	40550□	40551□

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 Yaskawa 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 Inverter: 3-phase, 400 VAC, 3.7 kW, IEC IP20 NEMA1(Type1) standards.

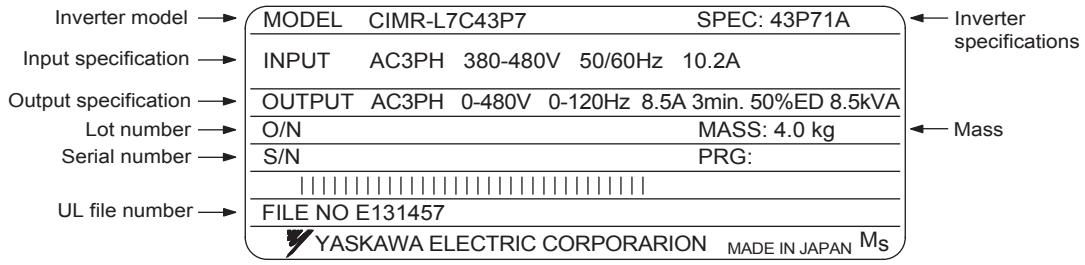
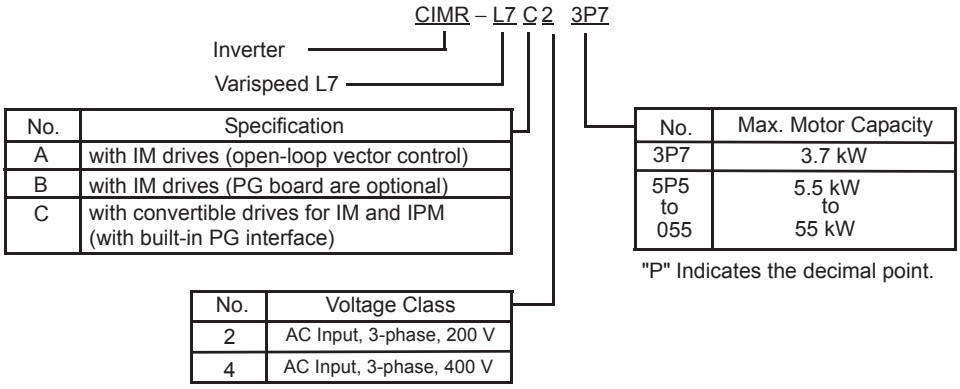


Fig 1.1 Nameplate

■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.



No.	Specification
A	with IM drives (open-loop vector control)
B	with IM drives (PG board are optional)
C	with convertible drives for IM and IPM (with built-in PG interface)

No.	Max. Motor Capacity
3P7	3.7 kW
5P5 to 055	5.5 kW to 55 kW

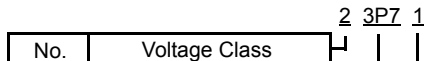
"P" Indicates the decimal point.

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

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.



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 055	5.5 kW to 55 kW

“P” Indicates the decimal point

No.	Protective Structure
0	Open chassis (IEC IP00)
1	Enclosed wall-mounted [IEC IP20, NEMA (Type 1)]
7	Enclosed wall-mounted (IEC IP20)

Fig 1.3 Inverter Specifications

TERMS

Open Chassis Type (IEC IP00)

Protected so that parts of the human body cannot reach electrically charged parts from the front when the Inverter is mounted in a control panel.

Enclosed Wall-mounted Type [IEC IP20, NEMA 1 (Type 1)]

The Inverter is structured so that the Inverter is shielded from the exterior, and can thus be mounted to the interior wall of a standard building (not necessarily enclosed in a control panel). The protective structure conforms to the standards of NEMA 1 (Type 1) in the USA. The protective covers (see *Fig. 1.4*) are required for an IEC IP20 or NEMA 1 (Type 1) protective structure.

◆ 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*.

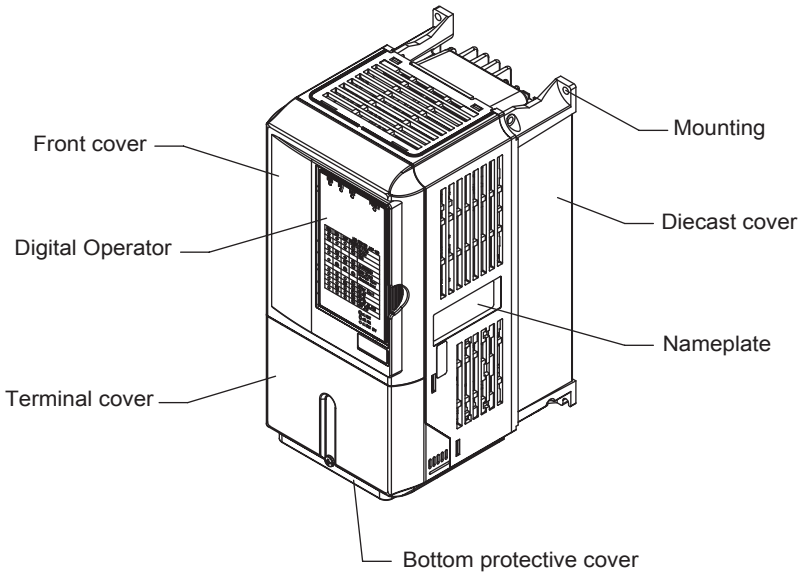


Fig 1.4 Inverter Appearance (18.5 kW or Less)

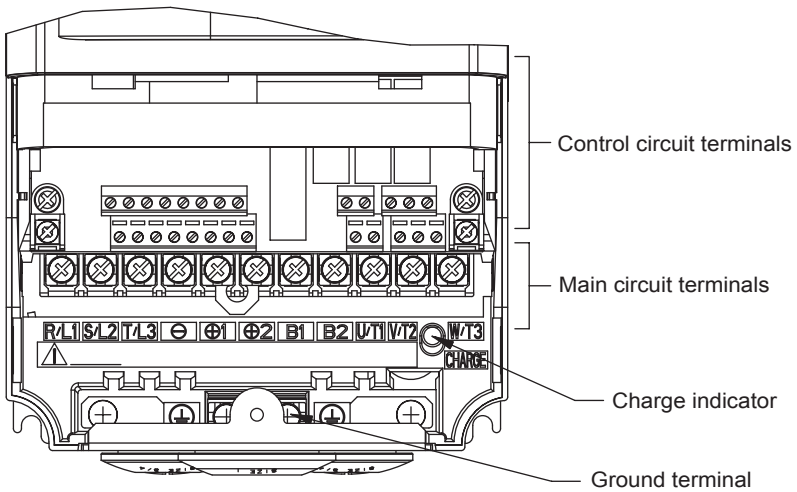


Fig 1.5 Terminal Arrangement (18.5 kW or Less)

■ 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*.

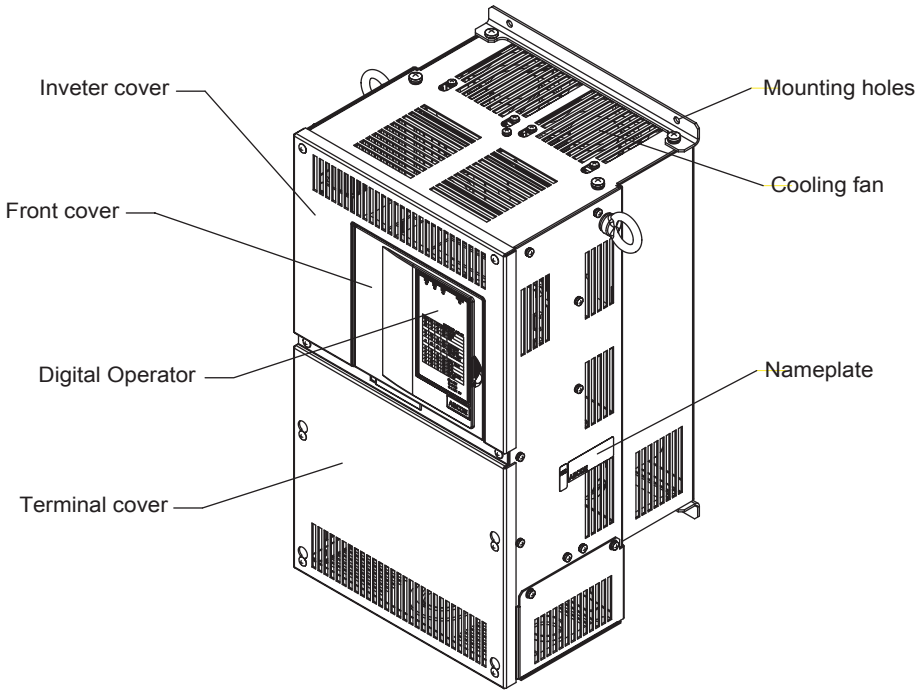


Fig 1.6 Inverter Appearance (22 kW or More)

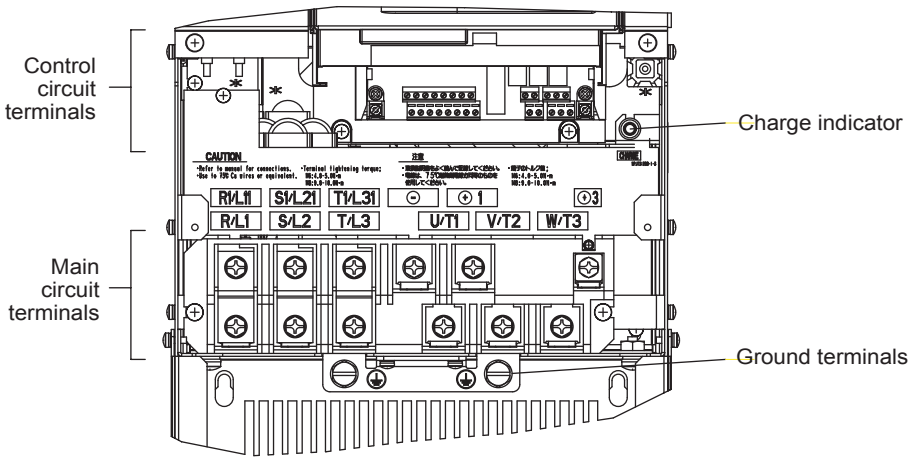
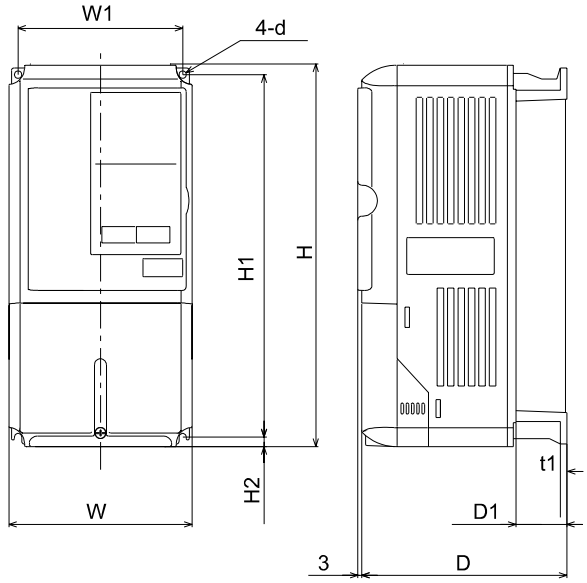


Fig 1.7 Terminal Arrangement (22 kW or More)

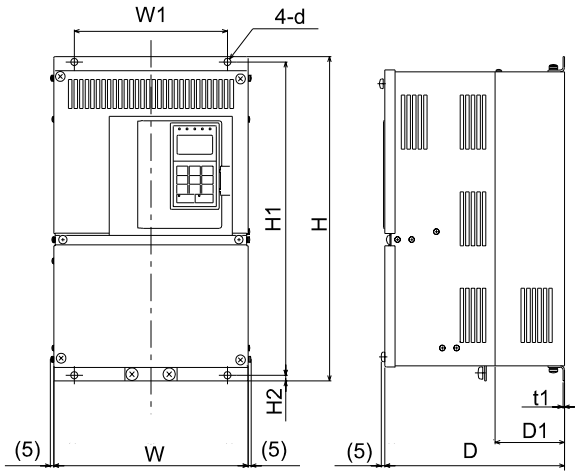
Exterior and Mounting Dimensions

◆ 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

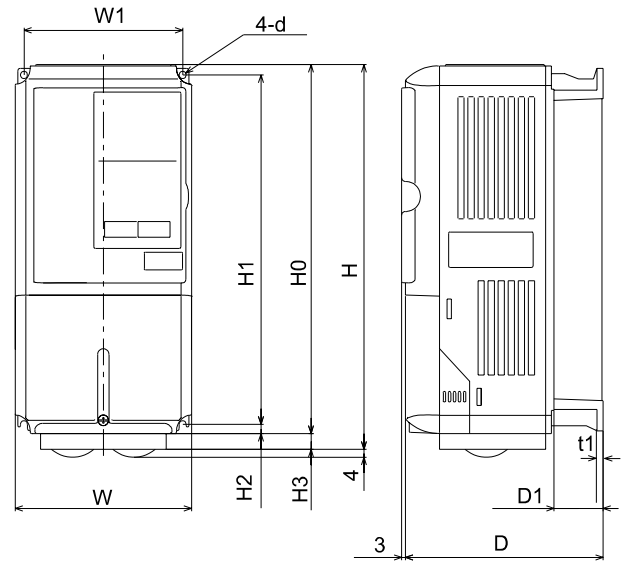


200 V/400 V Class Inverters of 22 or 55 kW

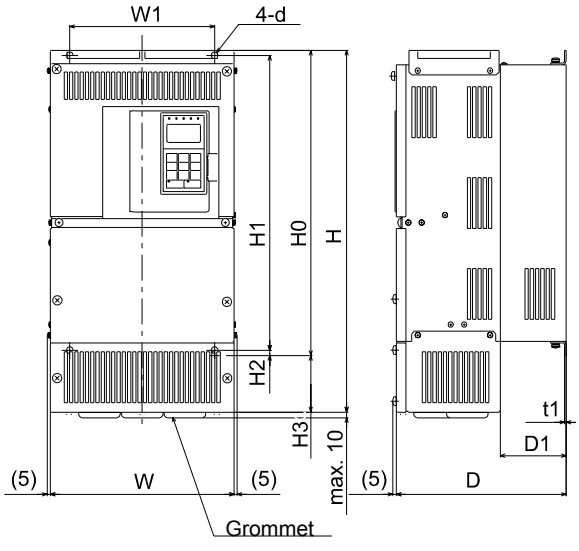
Fig 1.8 Exterior Diagrams of Open Chassis Inverters

◆ 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/400 V Class Inverters of 22 or 55 kW

Fig 1.9 Exterior Diagrams of Enclosed Wall-mounted Inverters

Table 1.3 200 VAC and 400 VAC (3.7 kW to 55 kW) Inverter Dimensions (mm) and Masses (kg)

Voltage Class	Max. Applicable Motor Output [kW]	Dimensions (mm)																				Heat Generation (W)			Cooling Method
		Open Chassis (IP00)									Enclosed Wall-mounted (NEMA1and IEC IP20)										Mounting Holes d*	External	Internal	Total Heat	
		W	H	D	W1	H1	H2	D1	t1	Approx. Mass	W	H	D	W1	H0	H1	H2	H3	D1	t1	Approx. Mass					
200V (3 Phase)	3.7	140	280	177	126	266	7	59	5	4	140	280	177	126	280	266	7	0	59	5	4	M5	112	74	186	Fan
	5.5																						164	84	248	
	7.5	200	300	197	186	285	8	65.5	2.3	6	200	300	197	186	300	285	8	0	65.5	2.3	6	M6	219	113	332	
	11									7		310						10			7		374	170	544	
	15	240	350	207	216	335	7.5	78		11	240	350	207	216	350	335	7.5	0	78		11		429	183	612	
	18.5											380						30					501	211	712	
	22	250	400	258	195	385		100		21	254	535	258	195	400	385		135	100		24		586	274	860	
	30	275	450		220	435				24	279	615		220	450	435		165			27		865	352	1217	
	37	375	600	298	250	575	12.5	100	3.2	57	380	809	298	250	600	575	12.5	209		3.2	62	M10	1015	411	1426	
	45			328				130		63			328						130		68		1266	505	1771	
	55	450	725	348	325	700				86	453	1027	348	325	725	700		302			94		1588	619	2207	
400V (3 Phase)	3.7	140	280	177	126	266	7	59	5	4	140	280	177	126	280	266	7	0	59	5	4	M5	80	68	148	Fan
	4																						91	70	161	
	5.5																						127	82	209	
	7.5	200	300	197	186	285	8	65.5	2.3	6	200	300	197	186	300	285	8	0	65.5	2.3	6	M6	193	114	307	
	11																						252	158	410	
	15	240	350	207	216	335	7.5	78		10	240	350	207	216	350	335	7.5		78		10		326	172	498	
	18.5																						426	208	634	
	22	275	450	258	220	435		100		21	279	535	258	220	450	435		85	100		24		466	259	725	
	30																						678	317	995	
	37	325	550	283	260	535		105		36	329	635	283	260	550	535		165	105		40		784	360	1144	
	45											715											901	415	1316	
	55																						1203	495	1698	

* Same for Open Chassis and 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 (UL standard).

Table 1.4 Installation Site

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

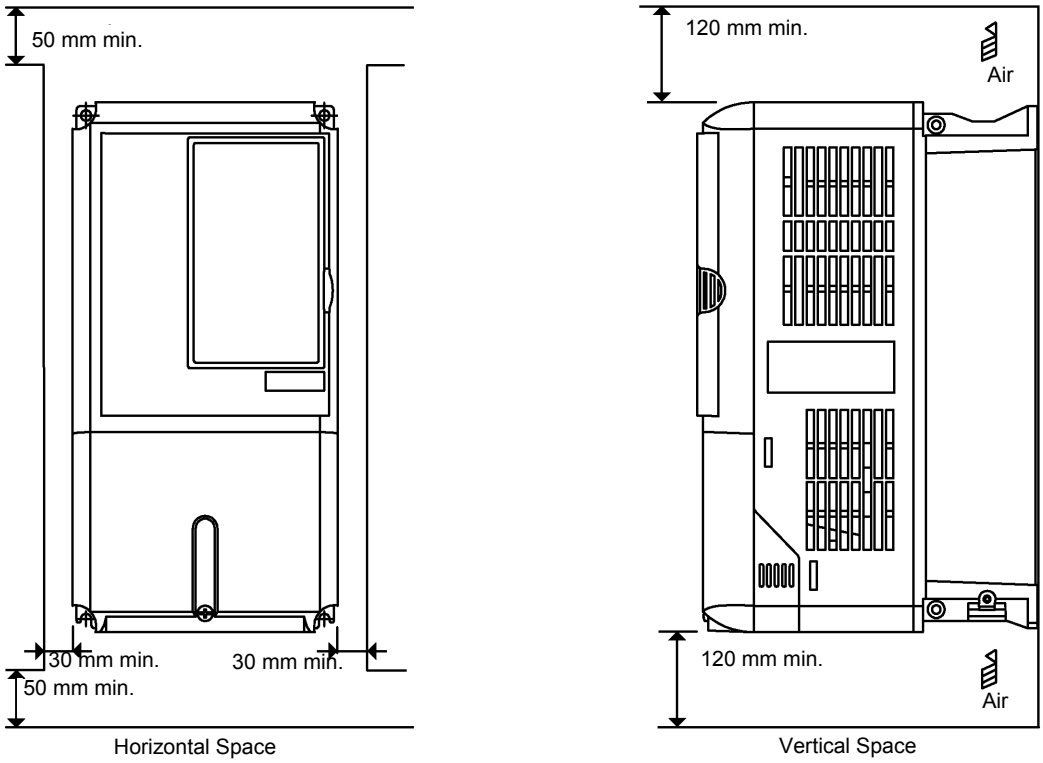


Fig 1.10 Inverter Installation Orientation and Space

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.

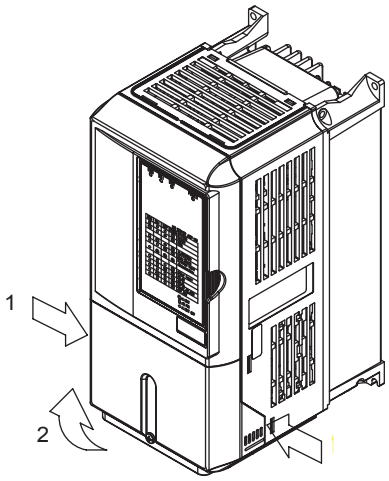


Fig 1.11 Removing the Terminal Cover (Model CIMR-L7C43P7 Shown Above)

■ 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.

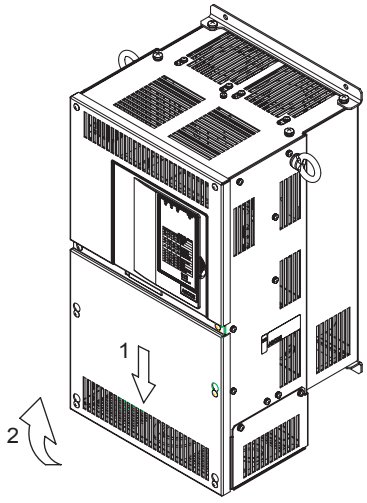


Fig 1.12 Removing the Terminal Cover (Model CIMR-L7C4022 Shown Above)

◆ 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

The methods of removing and attaching the Digital Operator and Front Cover are described in this section.

◆ Inverters of 18.5 kW or Less

To attach option boards or change the terminal board 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.

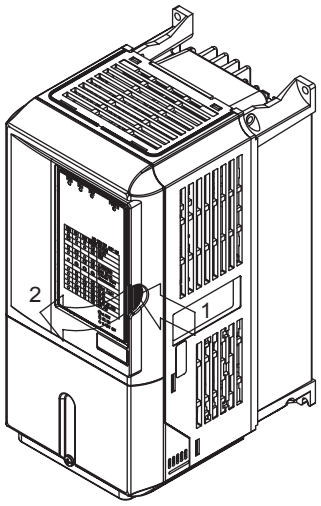


Fig 1.13 Removing the Digital Operator/Monitor (Model CIMR-L7C43P7 Shown Above)

■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.

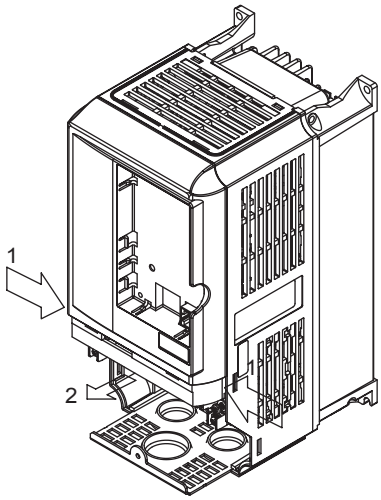


Fig 1.14 Removing the Front Cover (Model CIMR-L7C43P7 Shown Above)

■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).

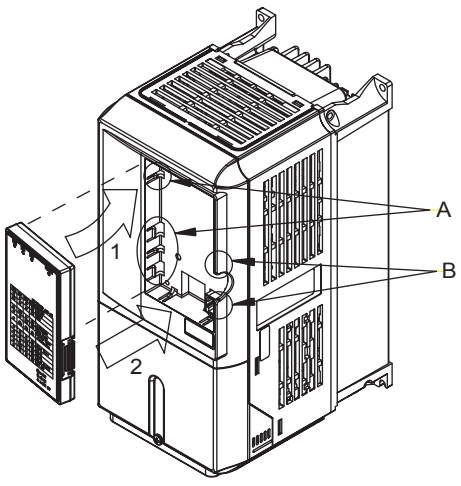


Fig 1.15 Mounting the Digital Operator/Monitor

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 front 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 board in the direction of arrow 2.

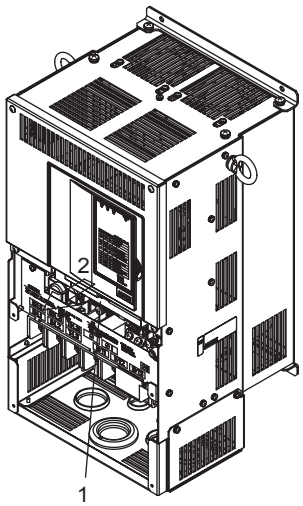


Fig 1.16 Removing the Front Cover (Model CIMR-L7C4022 Shown Above)

■ Attaching the Front Cover

After completing required work, such as mounting an option board or setting the terminal board, 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.

2 Wiring

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

Connections to Peripheral Devices 2-2
Connection Diagram 2-3
Terminal Block Configuration 2-5
Wiring Main Circuit Terminals 2-6
Wiring Control Circuit Terminals 2-18
Wiring Check 2-26
Installing and Wiring Option Boards 2-27

Connections to Peripheral Devices

Examples of connections between the Inverter and typical peripheral devices are shown in *Fig 2.1*.

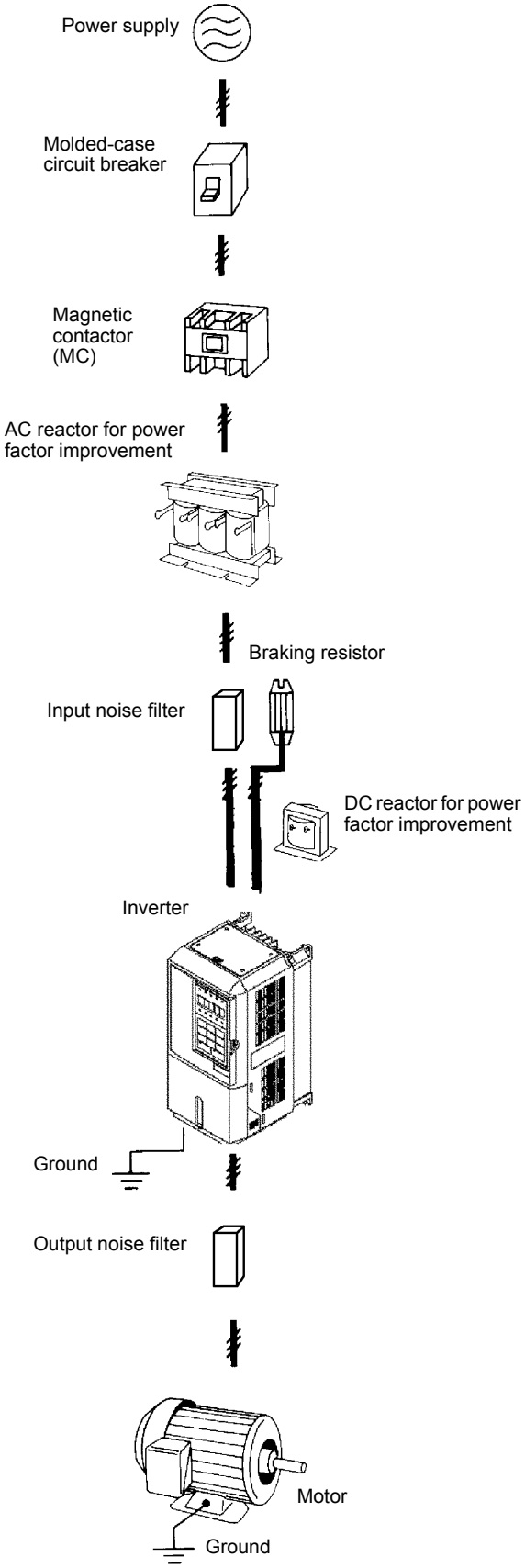


Fig 2.1 Example Connections to Peripheral Devices

Connection Diagram

The connection diagram of the Inverter is shown in *Fig 2.2*.

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

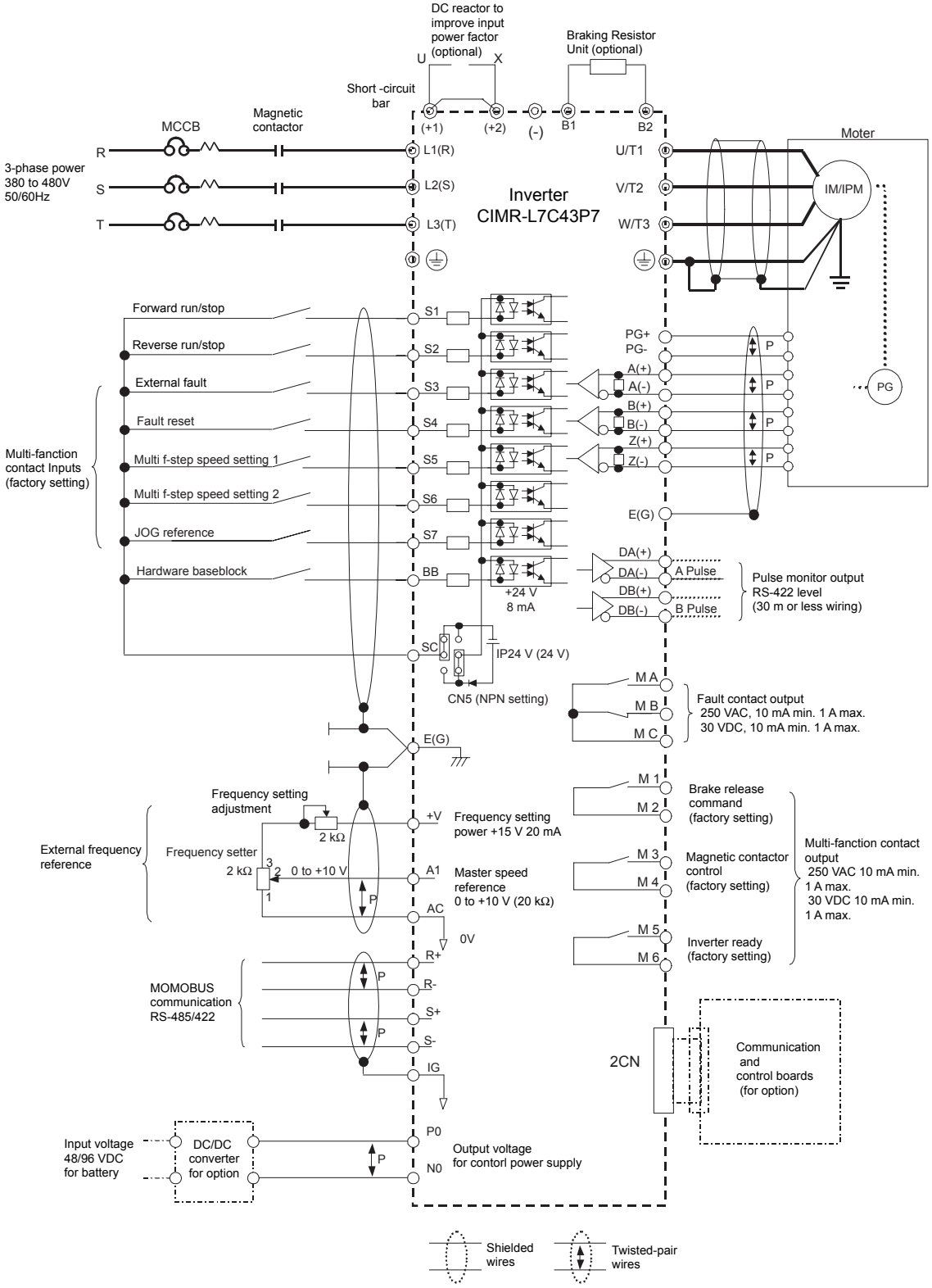
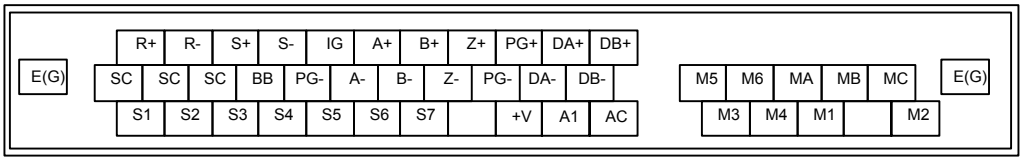


Fig 2.2 Connection Diagram (Model CIMR-L7C43P7 Shown Above)

IMPORTANT

1. Control circuit terminals are arranged as shown below.



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 sequence input signals 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 PNP transistor sequence connections (+24 V common and sourcing mode) or to provide a 24 V external power supply, refer to *Table 2.12*.
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.
6. The minimum permissible load of a multi-function contact output and an error contact output is 10 mA.
7. The master frequency reference is set to a voltage input reference as the default setting.

Terminal Block Configuration

The terminal arrangements are shown in *Fig 2.3* and *Fig 2.4*.

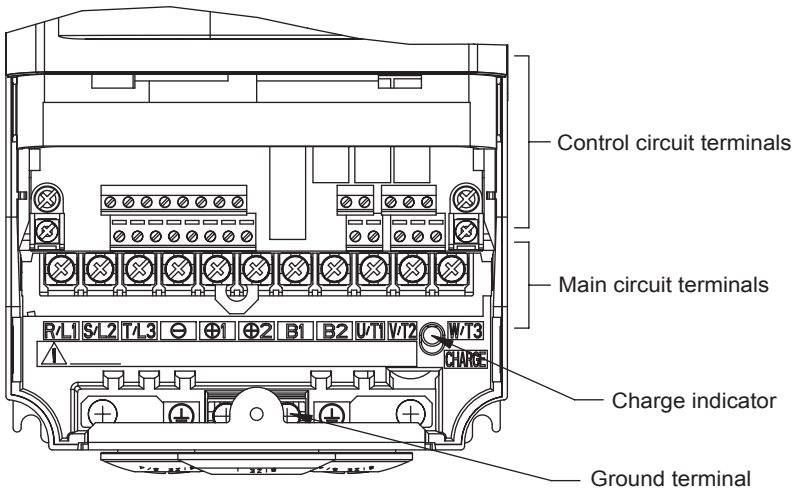


Fig 2.3 Terminal Arrangement (200 V/400 V Class Inverter of 3.7 kW)

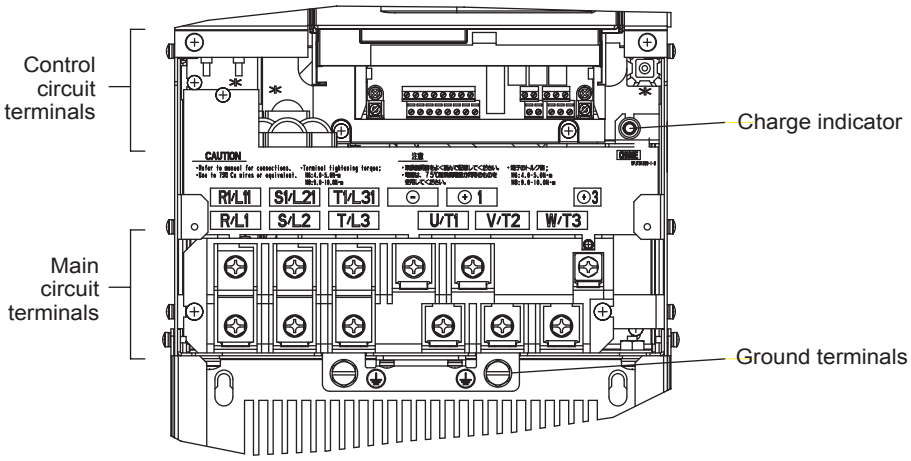


Fig 2.4 Terminal Arrangement (200 V/400 V Class Inverter of 22 kW or more)

Wiring Main Circuit Terminals

◆ Applicable Wire Sizes and Closed-loop Connectors

Select the appropriate wires and crimp terminals from *Table 2.1* to *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
L7C23P7	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO	M4	1.2 to 1.5	3.5 to 5.5 (12 to 10)	3.5 (12)	Power cables, e.g., 600 V vinyl power cables
	⏚					
L7C25P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO	M4	1.2 to 1.5	5.5 (10)	5.5 (10)	
	⏚					
L7C27P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO	M5	2.5	8 to 14 (8 to 6)	8 (8)	
	⏚					
L7C2011	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO	M5	2.5	14 to 22 (6 to 4)	14 (6)	
	⏚					
L7C2015	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, U/T1, V/T2, W/T3, NO	M6	4.0 to 5.0	30 to 38 (4 to 2)	30 (4)	
	B1, B2, PO	M5	2.5	8 to 14 (8 to 6)	-	
	⏚	M6	4.0 to 5.0	22 (4)	22 (4)	
L7C2018	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, U/T1, V/T2, W/T3, NO	M8	9.0 to 10.0	30 to 38 (3 to 2)	30 (3)	
	B1, B2, PO	M5	2.5	8 to 14 (8 to 6)	-	
	⏚	M6	4.0 to 5.0	22 (4)	22 (4)	
L7C2022	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	30 to 60 (3 to 1)	30 (3)	
	⊕3, PO	M6	4.0 to 5.0	8 to 22 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	22 to 38 (4 to 2)	22 (4)	
L7C2030	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 to 60 (1 to 1/0)	50 (1)	
	⊕3, PO	M6	4.0 to 5.0	8 to 22 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	22 to 38 (4 to 2)	22 (4)	
L7C2037	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	60 to 100 (2/0 to 4/0)	60 (2/0)	
	⊕3, PO	M8	8.8 to 10.8	5.5 to 22 (10 to 4)	–	
	⏚	M10	17.6 to 22.5	30 to 60 (2 to 2/0)	30 (2)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 5.5 (20 to 10)	1.25 (16)	

Table 2.1 200 V Class Wire Sizes (Continued)

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
L7C2045	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	80 to 100 (3/0 to 4/0)	80 (3/0)	Power cables, e.g., 600 V vinyl power cables
	⊕3, PO	M8	8.8 to 10.8	5.5 to 22 (10 to 4)	–	
	⏚	M10	17.6 to 22.5	38 to 60 (1 to 2/0)	38 (1)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 5.5 (20 to 10)	1.25 (16)	
L7C2055	R/L1, S/L2, T/L3, ⊖, ⊕1, NO	M12	31.4 to 39.2	50 to 100 (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	100 (4/0)	100 (4/0)	
	⊕3, PO	M8	8.8 to 10.8	5.5 to 60 (10 to 2/0)	–	
	⏚	M10	17.6 to 22.5	30 to 60 (3 to 4/0)	50 (1/0)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 5.5 (20 to 10)	1.25 (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 mm^2 (AWG)	Recommended Wire Size mm^2 (AWG)	Wire Type
L7C43P7	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 to 5.5 (14 to 10)	3.5 (12)	Power cables, e.g., 600 V vinyl power cables
	⏚				2 (14)	
L7C44P0	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 to 5.5 (14 to 10)	3.5 (12)	
	⏚				2 (14)	
L7C45P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	3.5 to 5.5 (12 to 10)	3.5 (12)	
	⏚			2 to 5.5 (14 to 10)	2 (14)	
L7C47P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	5.5(10)	5.5 (10)	
	⏚			3.5 to 5.5 (12 to 10)	3.5 (12)	
L7C4011	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M5	2.5	5.5 to 14 (10 to 6)	8 (8)	
	⏚				5.5 (10)	
L7C4015	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M5	2.5	8 to 14 (8 to 6)	8 (8)	
	⏚	M5 (M6)	2.5 (4.0 to 5.0)	5.5 to 14 (10 to 6)	5.5 (10)	
L7C4018	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, U/T1, V/T2, W/T3, NO	M6	4.0 to 5.0	8 to 38 (8 to 2)	8 (8)	
	B1, B2, PO	M5	2.5	8 (8)	8 (8)	
	⏚	M6	4.0 to 5.0	8 to 22 (8 to 4)	8 (8)	

Table 2.2 400 V Class Wire Sizes (Continued)

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
L7C4022	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	14 to 22 (6 to 4)	14 (6)	Power cables, e.g., 600 V vinyl power cables
	⏚	M8	9.0 to 10.0	14 to 38 (6 to 2)	14 (6)	
L7C4030	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	22 (4)	22 (4)	
	⏚	M8	9.0 to 10.0	22 to 38 (4 to 2)	22 (4)	
L7C4037	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	22 to 60 (4 to 1/0)	38 (2)	
	⊕3, PO	M6	4.0 to 5.0	8 to 22 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	22 to 38 (4 to 2)	22 (4)	
L7C4045	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	38 to 60 (2 to 1/0)	38 (2)	
	⊕3, PO	M6	4.0 to 5.0	8 to 22 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	22 to 38 (4 to 2)	22 (4)	
L7C4055	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 to 60 (1 to 1/0)	50 (1)	
	⊕3, PO	M6	4.0 to 5.0	8 to 22 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	22 to 38 (4 to 2)	22 (4)	

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

Table 2.3 Lug Sizes (JIS C 2805) (200 V Class and 400 V Class)

Wire Thickness (mm^2)	Terminal Screws	Size
0.5	M3.5	1.25 to 3.5
	M4	1.25 to 4
0.75	M3.5	1.25 to 3.5
	M4	1.25 to 4
1.25	M3.5	1.25 to 3.5
	M4	1.25 to 4
2	M3.5	2 to 3.5
	M4	2 to 4
	M5	2 to 5
	M6	2 to 6
	M8	2 to 8
3.5/5.5	M4	5.5 to 4
	M5	5.5 to 5
	M6	5.5 to 6
	M8	5.5 to 8
8	M5	8 to 5
	M6	8 to 6
	M8	8 to 8
14	M6	14 to 6
	M8	14 to 8
22	M6	22 to 6
	M8	22 to 8
30/38	M8	38 to 8
50/60	M8	60 to 8
	M10	60 to 10
80	M10	80 to 10
100		100 to 10
100	M12	100 to 12
150		150 to 12
200		200 to 12
325	M12 × 2	325 to 12
	M16	325 to 16

IMPORTANT

Determine the wire size for the main circuit so that line voltage drop is within 2% of the rated voltage. Line voltage drop is calculated as follows:

Line voltage drop (V) = $\sqrt{3}$ x wire resistance (W/km) x wire length (m) x current (A) x 10^{-3}

◆ Main Circuit Terminal Functions

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

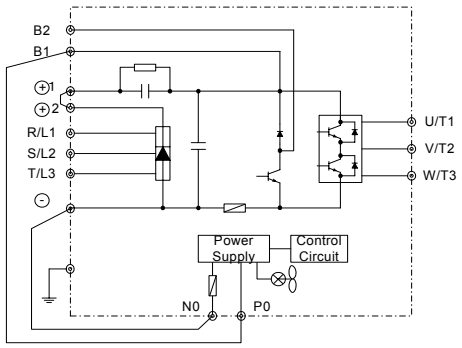
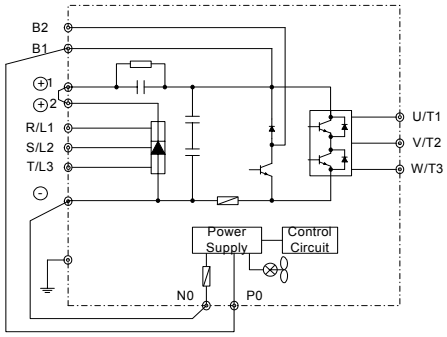
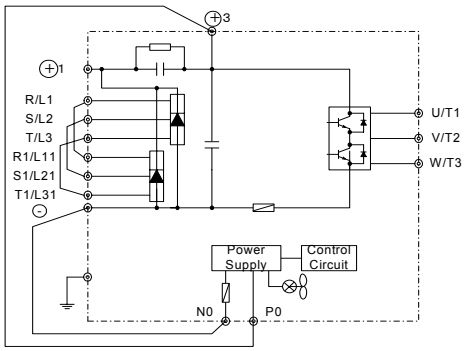
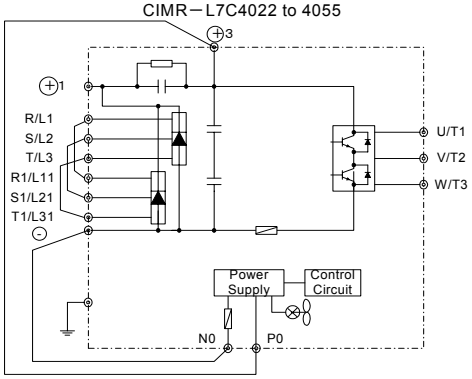
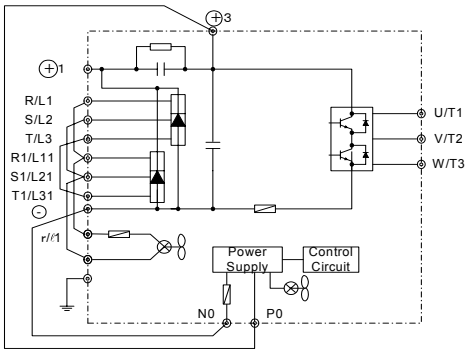
Table 2.4 Circuit Terminal Functions (200 V Class and 400 V Class)

Purpose	Terminal Symbol	Model: CIMR-L7C□□□□	
		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 connection	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

◆ Main Circuit Configurations

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

Table 2.5 Inverter Main Circuit Configurations

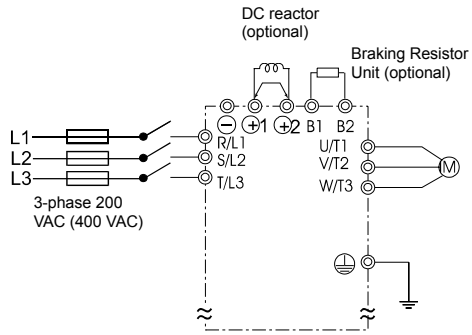
200 V Class	400 V Class
CIMR−L7C23P7 to 2018 	CIMR−L7C43P7 to 4018 
CIMR−L7C2022,2030 	CIMR−L7C4022 to 4055 
CIMR−L7C2037 to 2055 	

Note 12-phase rectification is not available.

◆ Standard Connection Diagrams

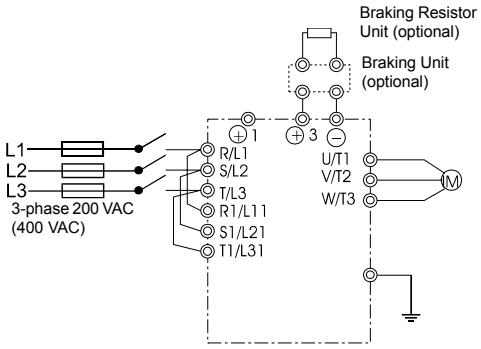
Standard Inverter connection diagrams are shown in *Fig 2.5.* These are the same for both 200 V Class and 400 V Class Inverters. The connections depend on the Inverter capacity.

■CIMR-L7C23P7 to 2018 and 43P7 to 4018

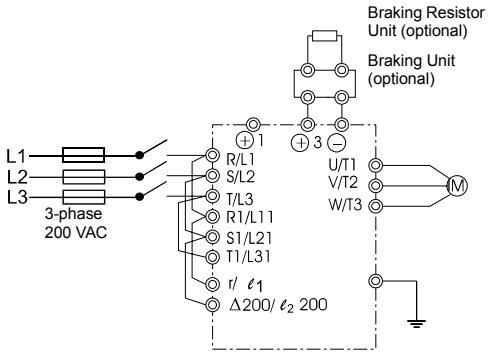


Be sure to remove the short-circuit bar before connecting the DC reactor.

■CIMR-L7C2022, 2030, and 4022 to 4055



■CIMR-L7C2037 to 2055



Control power is supplied internally from the DC bus at all Inverter models.

Fig 2.5 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 *Table 2.6*.

Table 2.6 Input Fuses

Inverter Type	FUSE		
	Voltage (V)	Current (A)	I^2t (A^2s)
23P7	240	30	82 to 220
25P5	240	40	220 to 610
27P5	240	60	290 to 1300
2011	240	80	450 to 5000
2015	240	100	1200 to 7200
2018	240	130	1800 to 7200
2022	240	150	870 to 16200
2030	240	180	1500 to 23000
2037	240	240	2100 to 19000
2045	240	300	2700 to 55000
2055	240	350	4000 to 55000
43P7	480	15	34 to 72
44P0	480	20	50 to 570
45P5	480	25	100 to 570
47P5	480	30	100 to 640
4011	480	50	150 to 1300
4015	480	60	400 to 1800
4018	480	70	700 to 4100
4022	480	80	240 to 5800
4030	480	100	500 to 5800
4037	480	125	750 to 5800
4045	480	150	920 to 13000
4055	480	150	1500 to 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 (30 seconds 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

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 upper hour.
- When the Inverter is operated with the Digital Operator, 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 AC Reactor or a DC 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.

■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 or Noise Filter

Never connect a phase advancing capacitor or LC/RC noise filter 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.

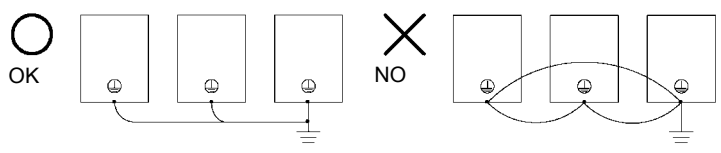


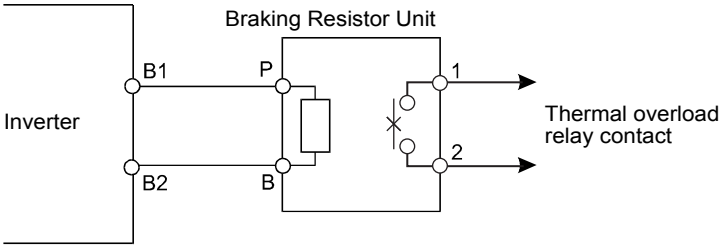
Fig 2.6 Ground Wiring

■Connecting a Braking Resistor and Braking Unit (CDBR)

Connect a Braking Resistor and Braking Unit to the Inverter like shown in the *Fig 2.7*.

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 2.7*.

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

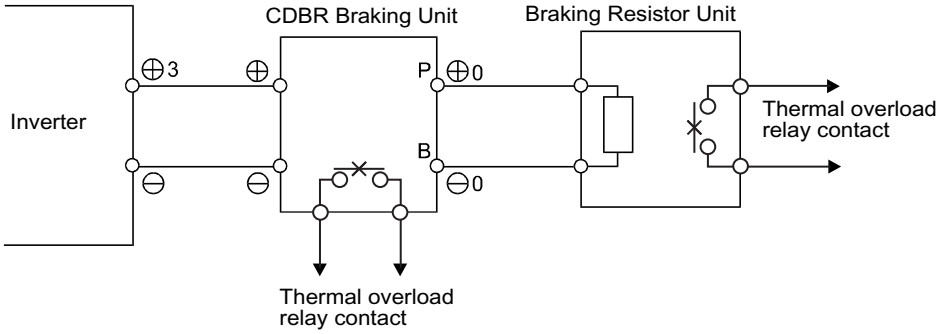


Fig 2.7 Connecting the Braking Resistor and Braking Unit

Connecting Braking Units in Parallel

When connecting two or more Braking Units in parallel, use the wiring and jumper settings like shown in *Fig 2.8*. 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).

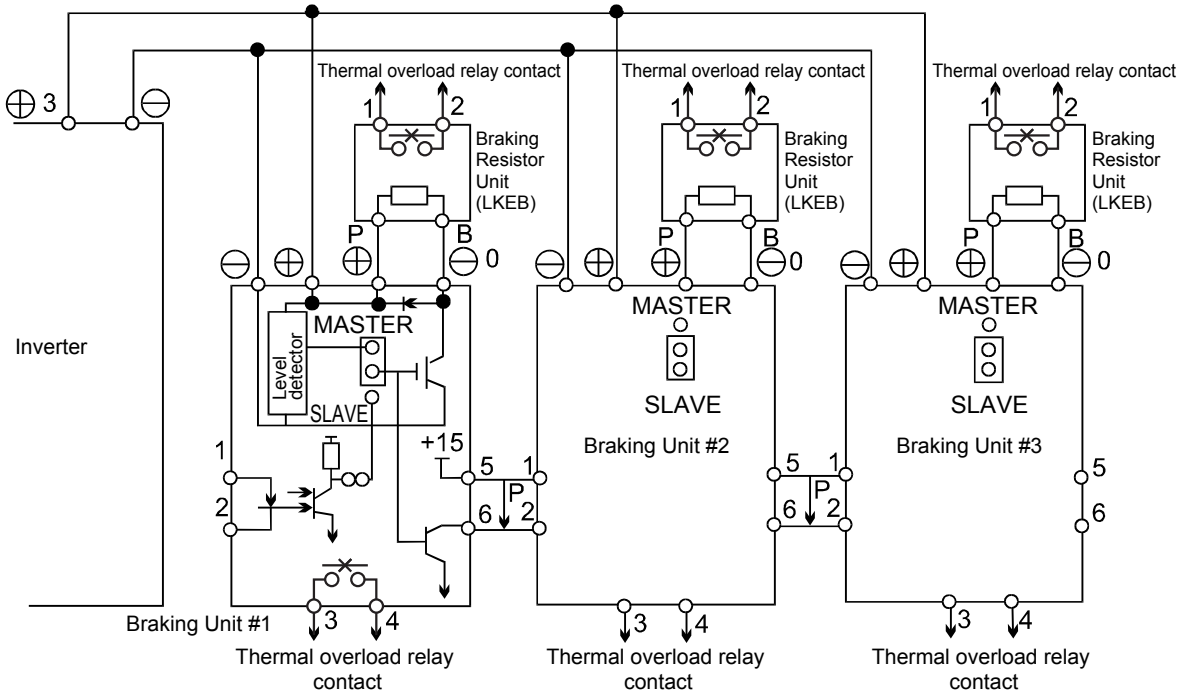


Fig 2.8 Connecting Braking Units in Parallel

■Connecting the battery power supply

The Varispeed L7 is equipped with a cable for connection to a battery as a standard feature.
Detach the twisted-pair cable connected with main circuit terminal B1/+3 and -.
Connect the twisted-pair cable to the relay terminal for UPS/Battery.
For connecting the battery power supply, refer to *Fig 2.9*.

Table 2.7

L2-11 (Battery Voltage)	Set the battery voltage
H1-05 (Terminal S7 function selection)	Set 85 (Battery operation command)

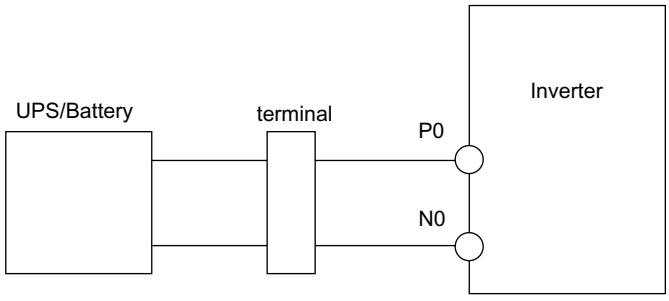


Fig 2.9 Connecting the battery power supply

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), use shielded twisted-pair wires and connect the shield to the terminal E (G). Do not ground the shield.

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
R+, R-, S+, S-, IG, A+, A-, B+, B-, Z+, Z-, PG+, PG-, DA+, DA-, DB+, DB-, 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: 0.14 to 2.5 Stranded wire: 0.14 to 1.5 (26 to 14)	0.75 (18)	• Shielded, twisted-pair wire*1 • Shielded, polyethylene-covered, vinyl sheath cable (KPEV-S by Hitachi Electrical Wire or equivalent)
E (G)	M3.5	0.8 to 1.0	0.5 to 2*2 (20 to 14)	1.25 (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	Phoenix Contact
0.5 (20)	AI 0.5 - 8WH	1.1	2.5	14	
0.75 (18)	AI 0.75 - 8GY	1.3	2.8	14	
1.25 (16)	AI 1.5 - 8BK	1.8	3.4	14	
2 (14)	AI 2.5 - 8BU	2.3	4.2	14	

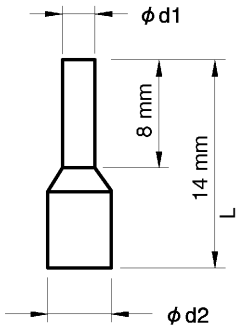


Fig 2.10 Straight Solderless Terminal Sizes

■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.

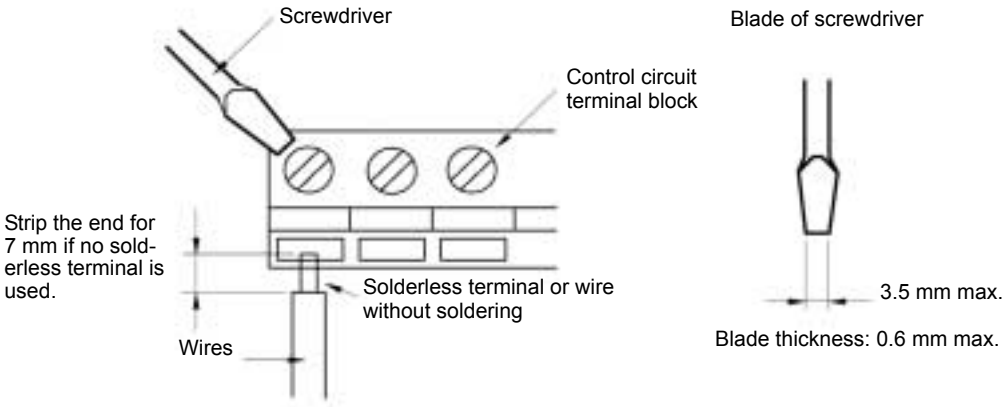


Fig 2.11 Connecting Wires to Terminal Block

◆ 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	Terminal	Signal Function	Description	Signal Level
Sequence input signals	S1	Forward run/stop	Forward run at “closed”, stop at “open”	Photocoupler isolation Input +24 VDC 8 mA
	S2	Reverse run/stop	Reverse run at “closed”, stop at “open”	
	S3	External Fault	Nominal speed at “closed”	
	S4	Fault Reset	Fault reset at “closed”	
	S5	Multi-function input selection 1	Multi-step speed reference 1 at “closed”	
	S6	Multi-function input selection 2	Multi-step speed reference 2 at “closed”	
	S7	JOG Reference	JOG Reference at “closed”	
	BB	Hardware baseblock	Baseblock release at “closed”, effective at “open”	
	SC	Sequence control input common terminal		
Analog input signals	+V	+15 V Power supply output	For analog reference +15 V power supply	+15 V (Allowable current 20 mA max.)
	A1	Master speed reference	0 to 10 V/100 %	0 to +10 V (Input impedance 20 kΩ)
	AC	Analog common	0 V	–
Sequence output signals	M1	Multi-function contact output 1 (NO contact)	Brake Release Command	Dry contact contact capacity 250 VAC 10 mA min. 1 A max., 30 VDC 10 mA min. 1 A max.
	M2			
	M3	Multi-function contact output 2 (NO contact)	Magnetic Contactor Control	
	M4			
	M5	Multi-function contact output 3 (NO contact)	During Inverter Ready	
	M6			
	MA	Fault output (NO contact)	“closed” between terminals MA and MC at fault	
	MB	Fault output (NC contact)	“open” between terminals MB and MC at fault	
	MC	Relay contact output common	–	
PG pulse input	PG+	+12 V/+5 V	PG power supply 12 V/5 V can be selected	+12 V: 200 mA max. +5 V: 200 mA max. Impossible to use both
	PG-	0 V	PG power supply common	
	A(+)	+	A phase positive pulse input	PG signal input RS-422 level input Maximum response frequency 300 kHz.
	A(-)	-	A phase negative pulse input	
	B(+)	+	B phase positive pulse input	
	B(-)	-	B phase negative pulse input	
	Z(+)	+	Z phase positive pulse input	
	Z(-)	-	Z phase negative pulse input	
	PG-	0 V	PG pulse input common	

Table 2.10 Control Circuit Terminals with default settings (Continued)

Type	Terminal	Signal Function	Description	Signal Level
PG pulse monitor	DA+	+	A phase positive pulse monitor	PG pulse monitor output RS-422 level output
	DA-	-	A phase negative pulse monitor	
	DB+	+	B phase positive pulse monitor	
	DB-	-	B phase negative pulse monitor	
RS-422/ 485 MEMOBUS Commu-nication	R+	MEMOBUS communication input	When using two RS-485 wires, short-circuit between R+ and S+, R- and S-	Differential input Photocoupler isolation
	R-			
	S+	MEMOBUS communication output		Differential output Photocoupler isolation
	S-			
	IG	Shielded wire for communication	–	–

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

* 2. When driving a reactive load, such as a relay coil, always insert a flywheel diode as shown in *Fig 2.12*.

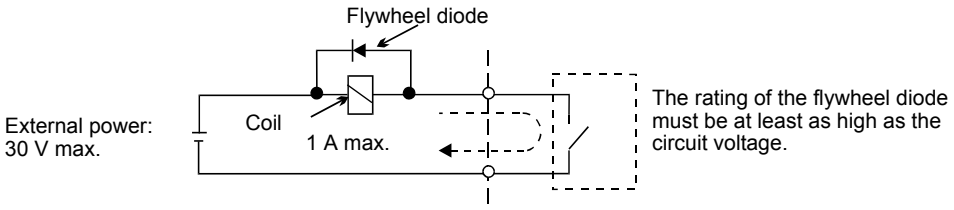


Fig 2.12 Flywheel Diode Connection

■Shunt Connector CN5 and DIP Switch S1

The shunt connector CN5 and DIP switch S1 are described in this section.

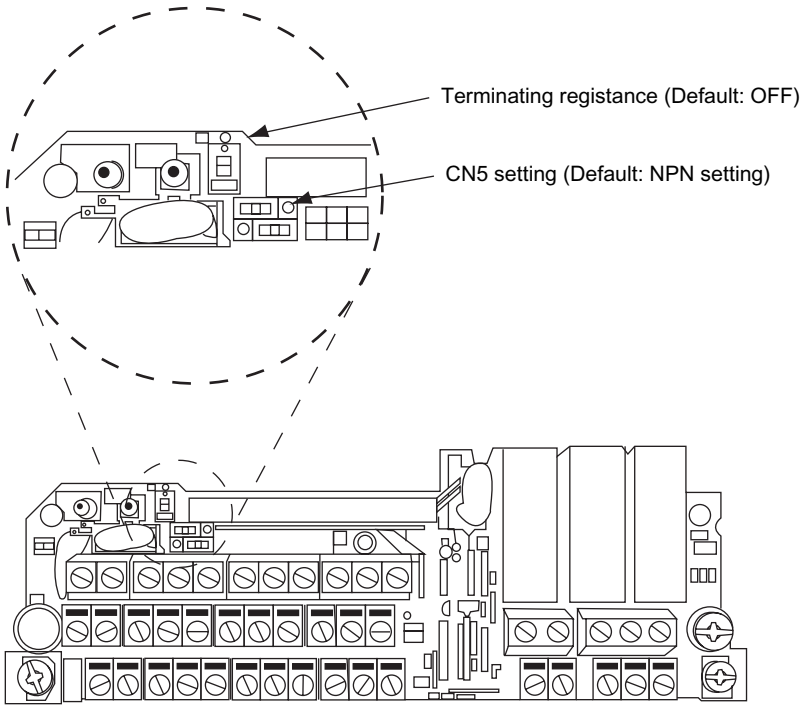
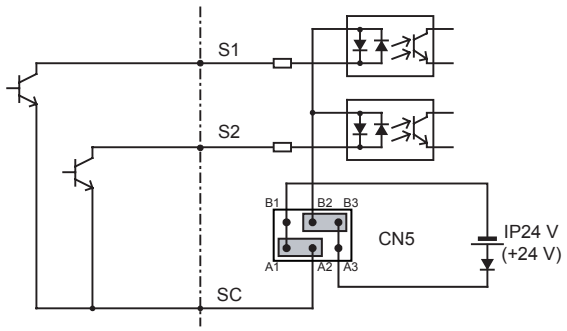
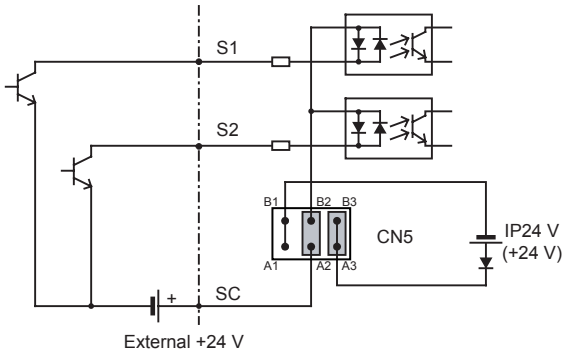
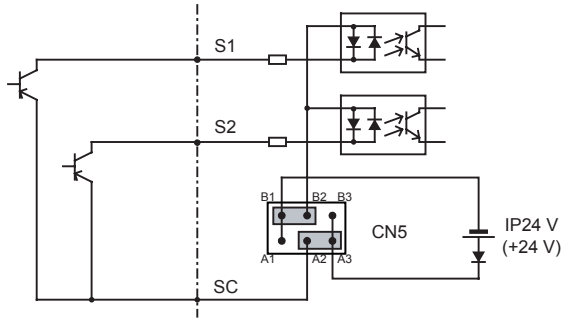
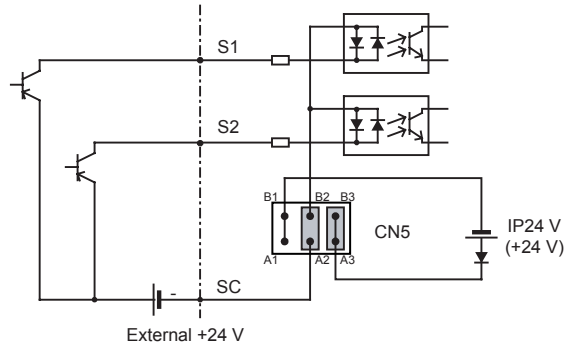


Fig 2.13 Shunt Connector CN5 and DIP Switch S1

■ Sinking/Sourcing Mode

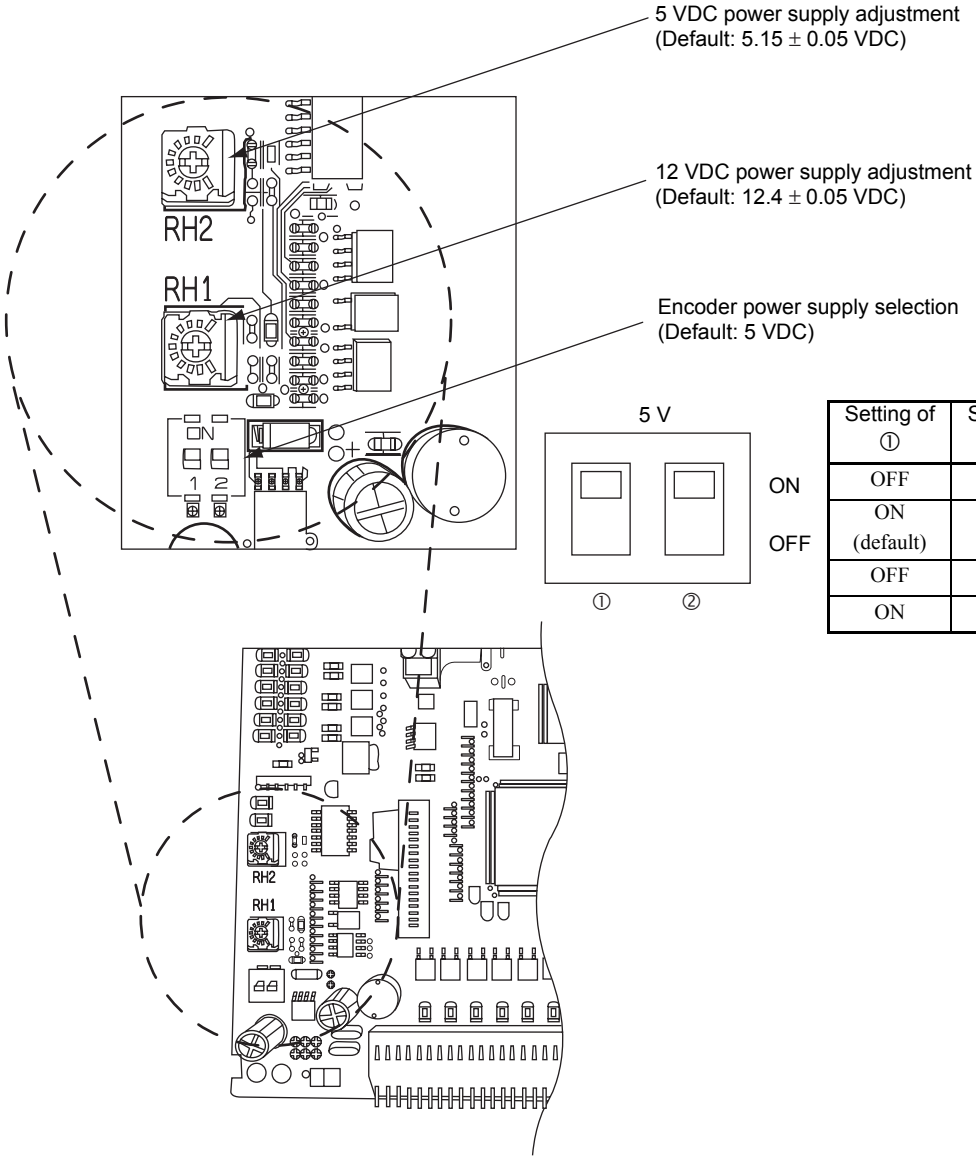
The input terminal logic can be switched between sinking mode (0-V common, NPN) and sourcing mode (+24 V common, PNP) by using the jumper CN5. An external +24-V power supply is also supported, providing more freedom in signal input methods.

Table 2.11 Sinking/Sorcing Mode and Input Signals

	Internal Power Supply	External Power Supply
Sinking Mode		
Sourcing Mode		

■The setting of S1 DIP switch on the control board

The Varispeed L7 control board has the S1 DIP switch for selecting a encorder power supply voltage. Select the appropriate voltage setting before connecting a motor encorder. The default setting is that both ① and ② switches are ON position, which the power supply voltage is selected 5 VDC.



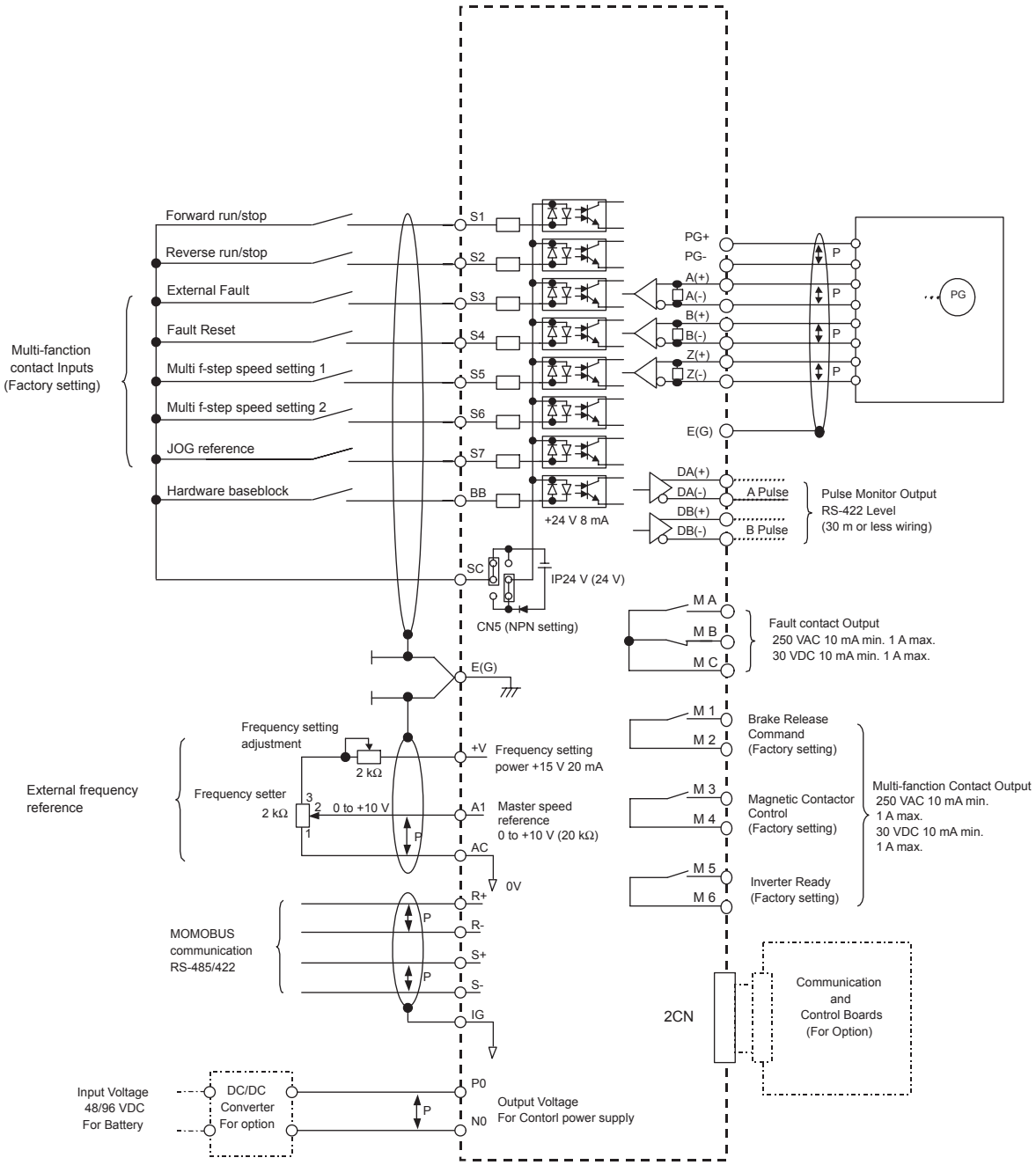
Setting of ①	Setting of ②	Voltage of Power supply
OFF	OFF	12 VDC *1
ON (default)	ON (default)	5 VDC *2
OFF	ON	Do not use *3
ON	OFF	Do not use *3

Fig 2.14 DIP switch S1

* 1. Default voltage setting is 12.4 ± 0.05 VDC
* 2. Default voltage setting is 5.15 ± 0.05 VDC
* 3. This voltage isn't regulated, therefore DO NOT SELECT and DO NOT USE FOR A ENCODER POWER SUPPLY.

◆ Control Circuit Terminal Connections

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



Note:
1. Main circuit terminals are indicatied with double circles and control circuit terminals are indicatied with single circles
2. The output current capacity of the +V terminal is 20 mA
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 .
   For PNP transistor sequence connections (+24 V common and sourcing mode) or to provide a 24 V external power supply, refer to *Table 2.11*.
4. The master frequency reference is set to a voltage input reference as the default setting .

Fig 2.15 Control Circuit Terminal Connections

◆ 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 must be a UL-listed Class 2 power supply source.
- Use twisted-pair or shielded twisted-pair cables for control circuits to prevent operating faults. Process cable ends as shown in *Fig 2.16*. Wiring length must be 30 mm or less.
- Connect the shield wire to terminal E (G).
- Insulate the shield with tape to prevent contact with other signal lines and equipment.
- Use a class 2 power supply (UL standard) when connecting to the control terminals.

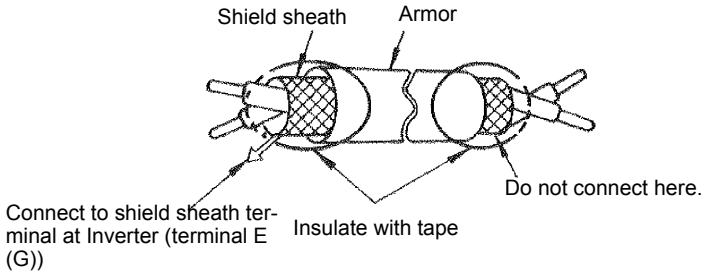


Fig 2.16 Processing the Ends of Twisted-pair Cables

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?

Installing and Wiring Option Boards

◆ Option Board Models and Specifications

Up to two option boards can be mounted on the control board (C and D) shown in *Fig 2.17*.

Table 2.12 lists the type of option boards and their specifications.

Table 2.12 Option Board Specifications

Option Board	Model	Specifications	Mounting Location
DeviceNet communication board	SI-N1	Option board for DeviceNet fieldbus	C
Profibus-DP communication board	SI-P1	Option board for Profibus-DP fieldbus	C
InterBus-S communication board	SI-R1	Option board for InterBus-S fieldbus	C
CANOpen communication board	SI-S1	Option board for CANOpen fieldbus	C
Analog input boards	AI-14U	Input signal levels Channel 1: 0 to 10 V (20 kΩ) Channel 2: 4 to 20 mA (250 Ω) Resolution: 14 Bit	C
	AI-14B	Input signal levels Signal level: -10 to +10 V (20 kΩ) 4 to 20 mA (250 Ω) Resolution: 13 Bit + sign	C
Analog monitor board	AO-08	8 bit analog outputs, 2 channels	D
	AO-12	12-bit analog outputs, 2 channels	D
Digital output board	DO-08	Six photocoupler outputs and 2 relay outputs	D
	DO-02C	2 relay outputs	D

◆ Installation

Before mounting an option board, remove the terminal cover and be sure that the charge indicator inside the Inverter is not lit anymore. After that remove the Digital Operator/Monitor and front cover and then mount the option board.

Refer to documentation provided with the option board for the mounting instructions for option slot C and D.

■ Preventing C and D Option Board Connectors from Rising

After installing an option board 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.

Remove the option clip before installing an option board into slot C or D. The option board can not be installed completely and may not function properly if it is installed with the option clip attached.

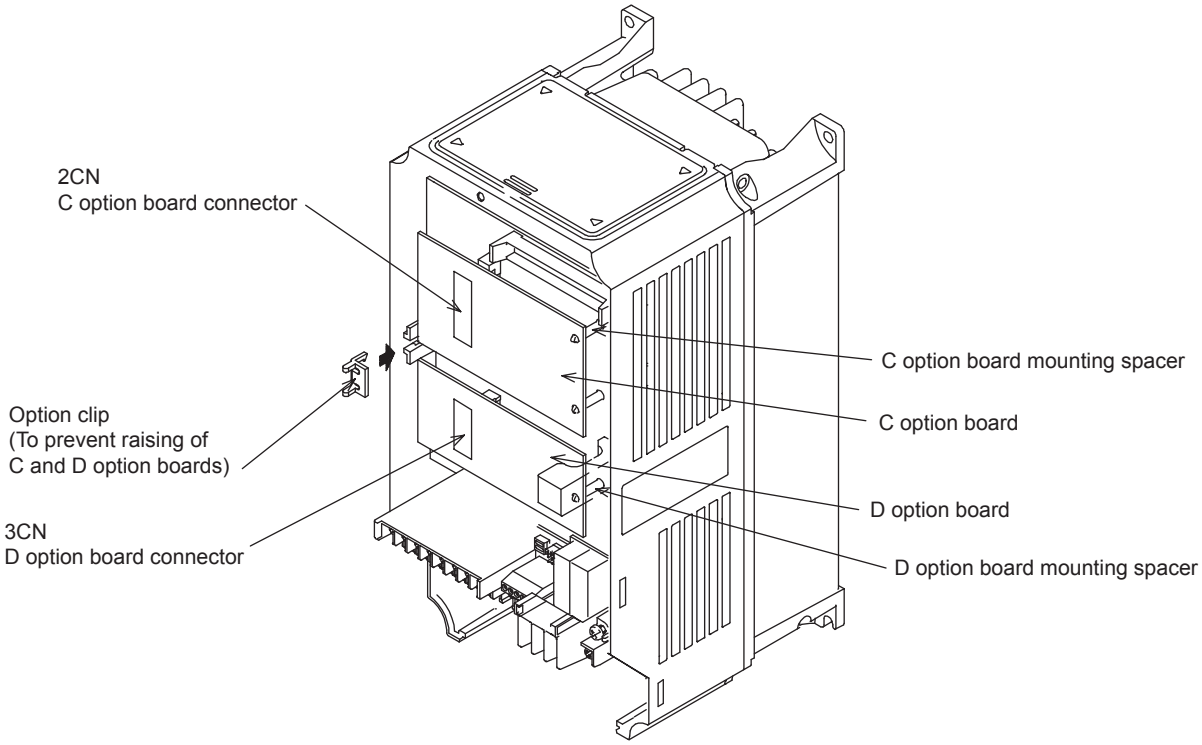


Fig 2.17 Mounting Option Boards

3

Digital Operator and Modes

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

LED Monitor for JVOP-163 3-2
Digital Operator (Optional) 3-3
Modes 3-6

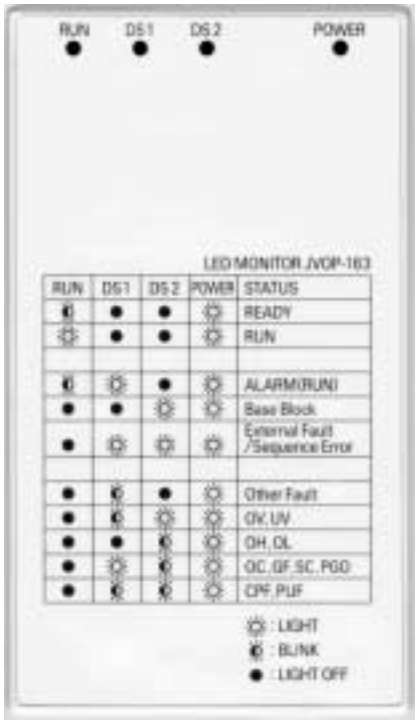
LED Monitor for JVOP-163

This section describes the displays and functions of the LED monitor.

◆ LED Monitor

Indicates the operation status by the combination of the LED displays (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: Fault Status 1
DS2: Fault Status 2
The combination of the three LEDs Run, DS1 and DS2 indicates the drive status.

Drive Status Indications

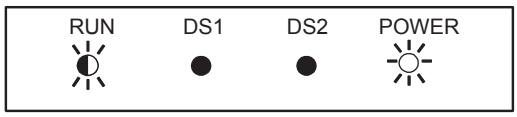
Alarm Indications

Fault Indications

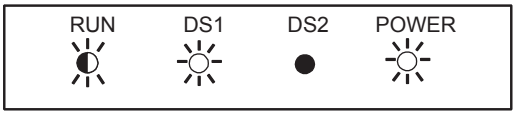
Note: When a combination of LED pattern different from above figure occurs, it is CPF00 or CPF01 fault.

◆ LED Display when the Power is ON

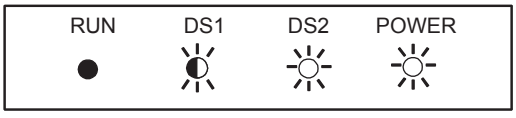
Normal operation: The figure below shows the LED display when the drive is ready and no FWD/REV signal is active



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 occurs.



Digital Operator (Optional)

This section describes the displays and functions of the Digital Operator.

◆ Digital Operator Display

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

Drive Mode Indicators
FWD: Lit when there is a Forward Run Command input.
REV: Lit when there is a Reverse Run Command input.
SEQ: Lit when the run command from the control circuit terminal is enabled.
REF: Lit when the frequency reference from control circuit terminals A1 and A2 is enabled.
ALARM: Lit when an error or alarm has occurred.

Data Display (LCD)
Displays monitor data, constant numbers, and settings.

Mode Display (Displayed at upper left of data display.)
DRIVE: Lit in Drive Mode.
QUICK: Lit in Quick Programming Mode.
ADV: Lit in Advanced Programming Mode.
VERIFY: Lit in Verify Mode.
A. TUNE: Lit in Autotuning Mode.

Keys

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

Fig 3.1 Digital Operator Component Names and Functions

◆ Digital Operator Keys

The names and functions of the Digital Operator Keys are described in *Table 3.1*.

Table 3.1 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 menu items (modes).
ESC	ESC Key	Returns to the status before the DATA/ENTER Key was pressed.
JOG	JOG Key	Enables jog operation when the Inverter is being operated from the Digital Operator.

Table 3.1 Key Functions (Continued)

Key	Name	Function
FWD/REV	FWD/REV Key	Selects the rotation direction of the motor when the Inverter is being operated from the Digital Operator.
RESET	Shift/RESET Key	Sets the number of digits for parameter settings. 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	DATA/ENTER Key	Pressed to enter menu items, parameters, and set values. Also used to switch from one display 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 using 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 of the dynamic brake. The relationship between the indicators on the RUN and STOP Keys and the Inverter status is shown in the *Fig 3.2*.

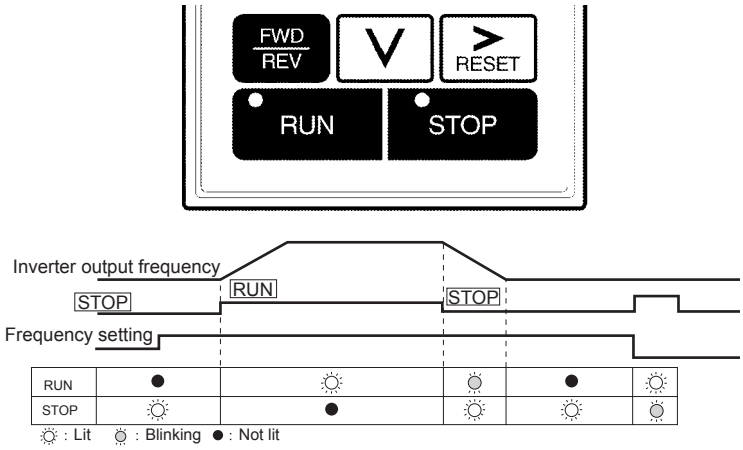


Fig 3.2 RUN and STOP Indicators

The following table shows the relationship between the indicators on the RUN and STOP Keys and the Inverter conditions.

The indicators are lit, unlit or blinking reflecting the order of priority.

Table 3.2 Relation of Inverter to RUN and STOP Indicators

Priority	RUN Indicator	STOP Indicator	Inverter Status	Conditions
1	●	●	Stopped	Power supply is shut down.
2	●	☼	Stopped*	Emergency stop • Stop Command is sent from the Digital Operator when the control circuit terminals were used to operate the Inverter. • Emergency Stop Command is sent from the control circuit terminal. Switched from LOCAL (operation using the Digital Operator) to REMOTE (operation using the control circuit terminals) when the Run Command is sent from the external terminal. Switched from the Quick or Advanced Quick programming mode to the Drive mode when the Run Command is sent from the external terminal.
3	☼	☼	Stopped	The Inverter is run at a frequency below the minimum output frequency. The Run Command is carried out when the External Baseblock Command using the multi-function contact input terminal is issued.
4	●	☼	Stopped	Stopped
5	☼	☼	Running	During deceleration to a stop During DC injection braking when using the multi-function contact input terminal. During initial excitation of DC injection braking while the Inverter is stopped.
6	☼	☼	Running	During emergency deceleration • Stop Command is sent from the Digital Operator when operating the Inverter using the control circuit terminals. • Emergency Stop Command is sent from the control circuit terminal.
7	☼	●	Running	Run Command is issued. During initial excitation of DC injection braking when starting the Inverter.

Note ☼: Lit ☼: Blinking ●: Not lit

* If planning to run the Inverter again, first turn OFF the Run Command and Emergency Stop Command from the control circuit terminal and send the Run Command.

Modes

This section describes the Inverter's modes and switching between modes.

◆ Inverter Modes

The Inverter's parameters and monitoring functions are organized in groups called modes that make it easier to read and set parameters.The Inverter is equipped with 5 modes.

The 5 modes and their primary functions are shown in the *Table 3.3*.

Table 3.3 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 methods. 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 methods.

◆ 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.

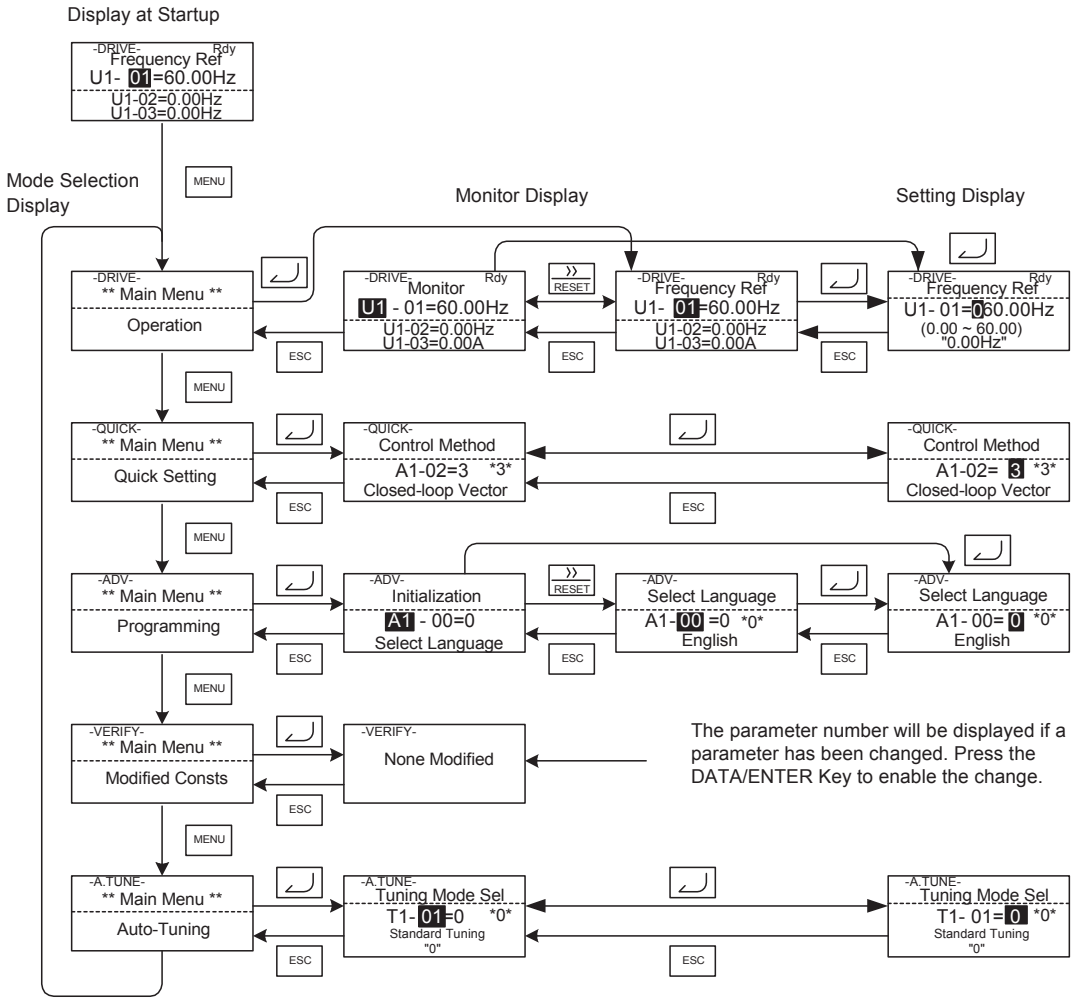


Fig 3.3 Mode Transitions

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.

◆ 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 frequency can be changed from the frequency setting display using the Increment, Decrement, and Shift/RESET 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.

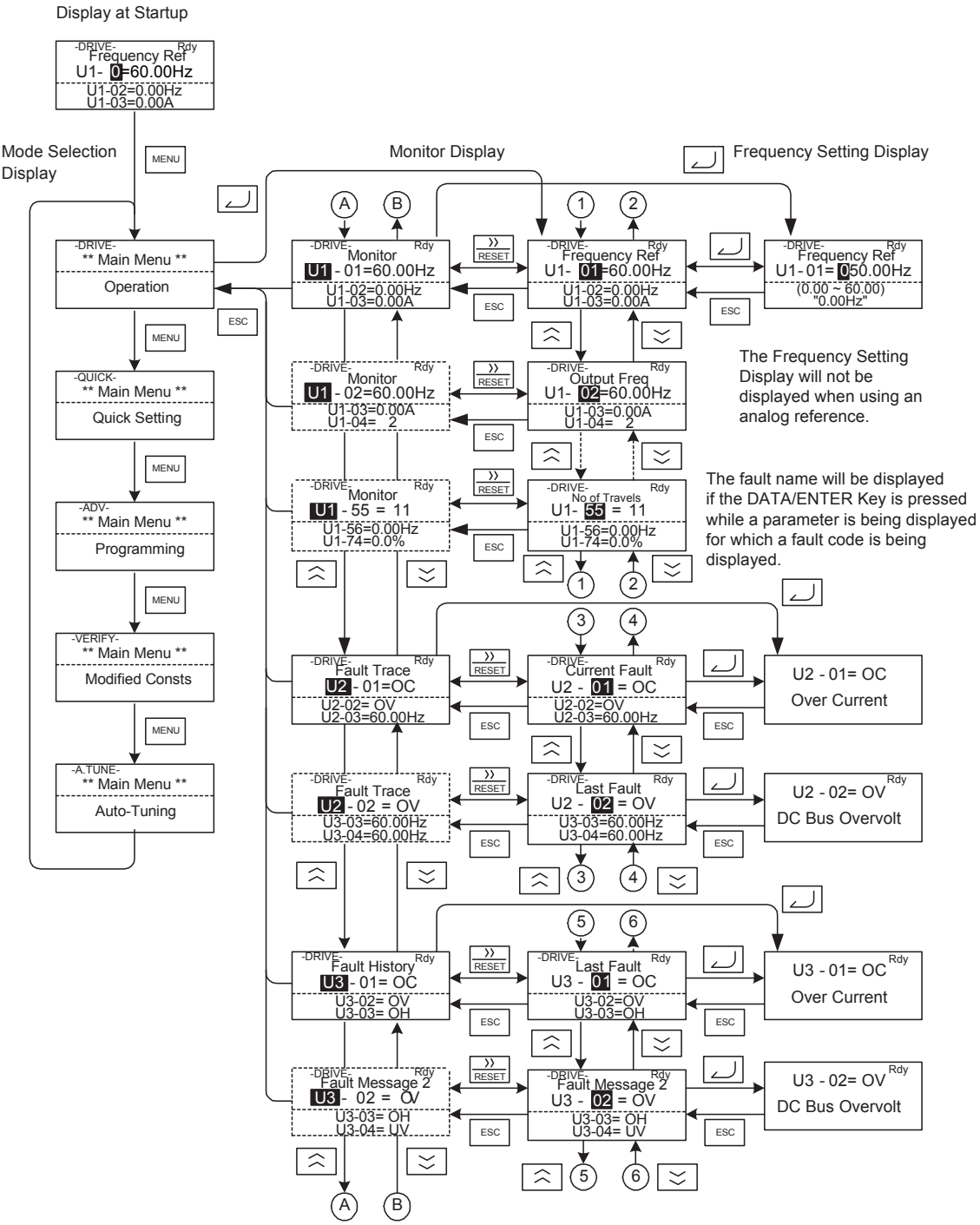


Fig 3.4 Operations in Drive Mode

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 U1-40. 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 Inverter trial operation can be monitored and set.

The parameters can be changed from the setting displays using the Increment, Decrement, and Shift/RESET Keys. 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 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.

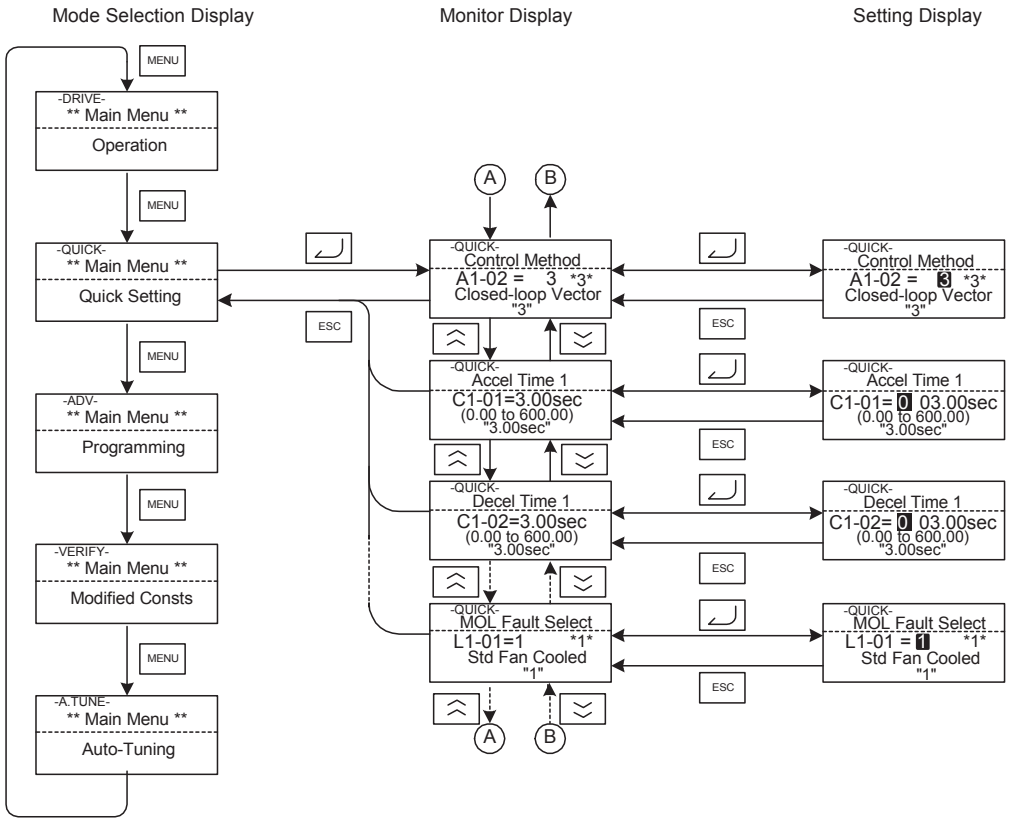


Fig 3.5 Operations in Quick Programming Mode

◆ 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 written and the monitor display will be returned to when the DATA/ENTER Key is pressed after changing the setting.

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

■Example Operations

Example key operations in advanced programming mode are shown in the following figure.

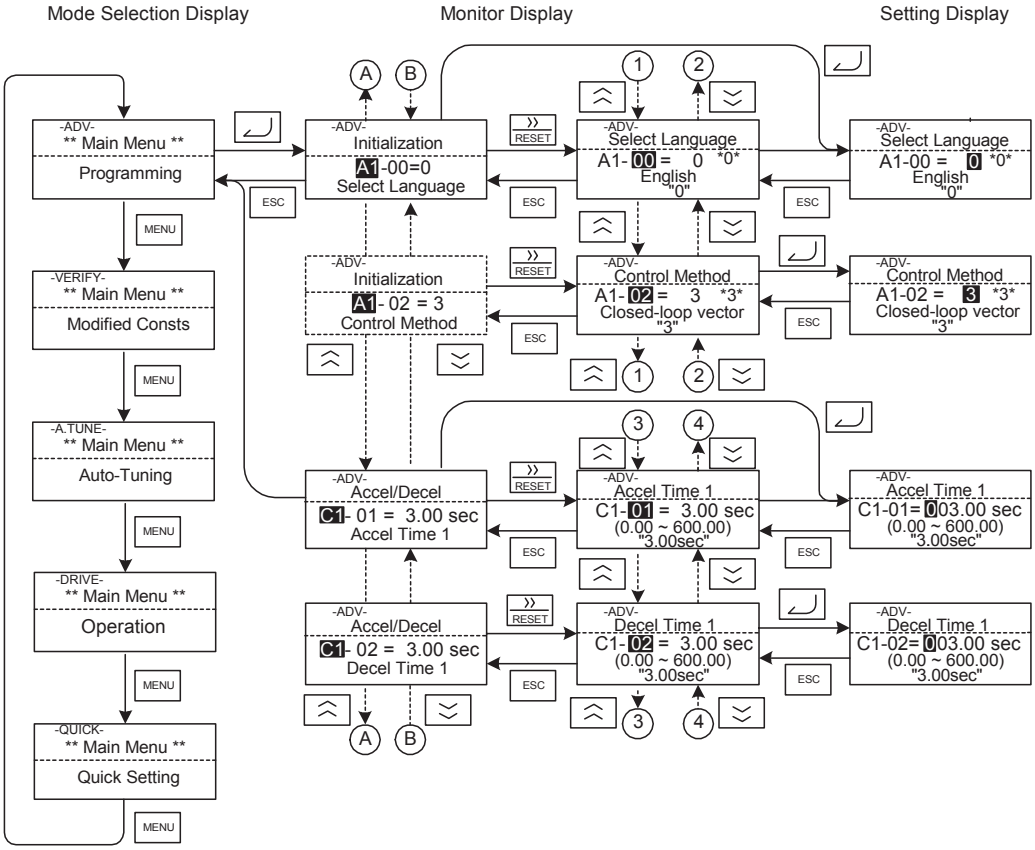


Fig 3.6 Operations in Advanced Programming Mode

■Setting Parameters

Here the procedure to change C1-01 (Acceleration Time 1) from 3.0 s to 4.0 s is shown.

Table 3.4 Setting Parameters in Advanced Programming Mode

Step No.	Digital Operator Display	Description
1	-DRIVE- -Rdy- Frequency Ref U1-01 =60.00Hz U1-02=0.00Hz U1-03=0.00A	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	
4	-ADV- ** Main Menu ** Programming	
5	-ADV- Initialization A1-00=0 Select Language	Press the DATA/ENTER Key to access the monitor display.
6	-ADV- Accel / Decel C1-01 = 3.00 sec 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 = 03.00sec (0.00 ~ 600.00) "3.00 sec"	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 = 03.00sec (0.00 ~ 600.00) "3.00 sec"	Press the Shift/RESET Key to move the flashing digit to the right.
9	-ADV- Accel Time 1 C1-01 = 003.00sec (0.00 ~ 600.00) "3.00 sec"	Press the Increment Key to change set value to 4.00 s.
10	-ADV- Accel Time 1 C1-01 = 004.00sec (0.00 ~ 600.00) "3.00 sec"	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= 4.00 sec (0.00 ~ 600.00) "3.00 sec"	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. The parameter will be written and the monitor display will be returned to when the DATA/ENTER Key is pressed after changing the setting.

■Example Operations

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

- b1-01 (Reference Selection)
- C1-01 (Acceleration Time 1)
- E1-01 (Input Voltage Setting)
- E2-01 (Motor Rated Current).

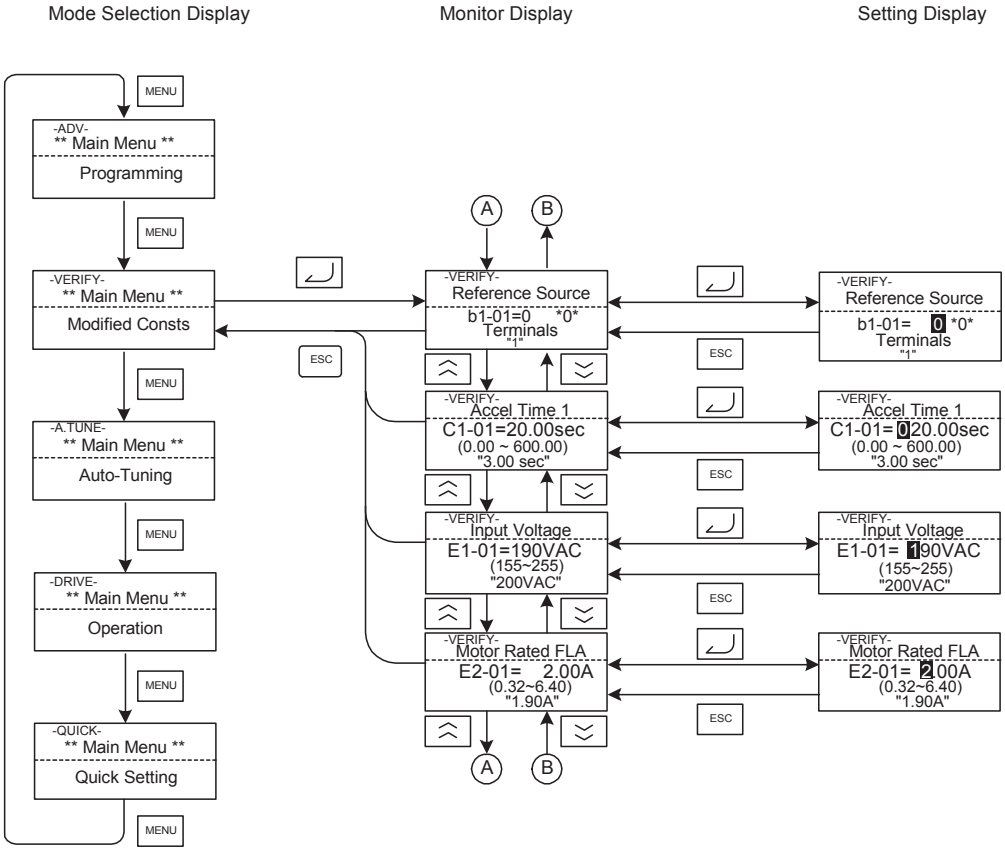


Fig 3.7 Operations in Verify Mode

◆ 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 methods.

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

When the motor cannot be disconnected from the load, and open-loop or closed-loop vector control shall be used to perform stationary autotuning.

■Example of Operation

Enter the motor rated output power (in kW), rated voltage, rated current, rated frequency, rated speed, and number of poles specified on the nameplate of the motor and then press the RUN Key. The motor is automatically run and the measured motor data are set in the E2-□□ parameters.

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 written and the monitor display will be returned to when the DATA/ENTER Key is pressed after changing the setting.

The following example shows autotuning for open-loop vector control while operating the motor.

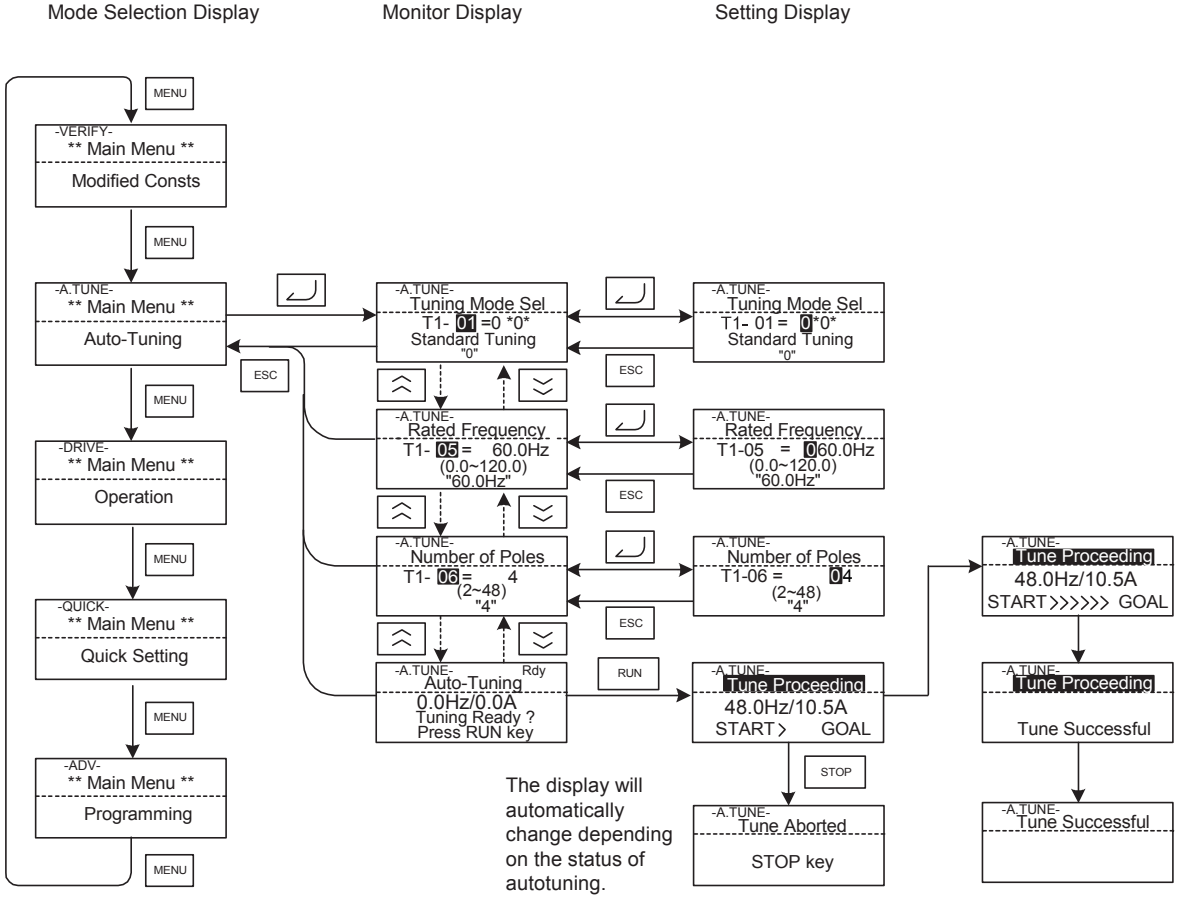


Fig 3.8 Operation in Autotuning Mode

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

4

Parameters

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

Parameter Descriptions 4-2
Digital Operation Display Functions and Levels 4-3
Parameter Tables.....4-8

Parameter Descriptions

This section describes the contents of the parameter tables.

◆ Description of Parameter Tables

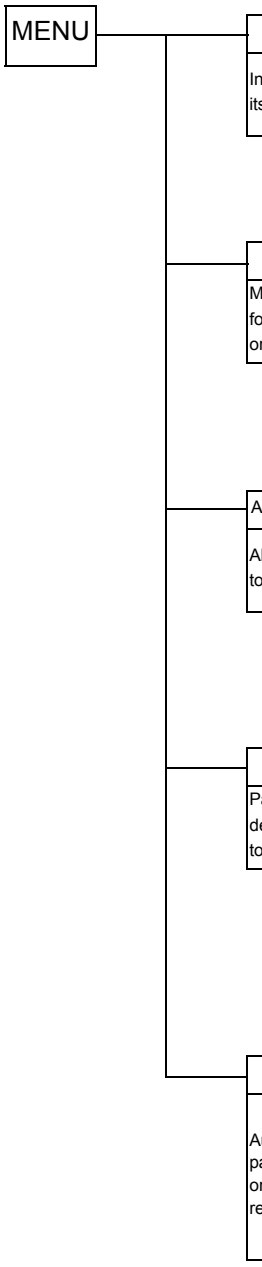
Parameter tables are structured as shown below. Here, b1-01 (Frequency Reference Selection) is used as an example.

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
b1-01	Reference source selection / Reference Source	Sets the frequency reference input method. 0: Digital Operator 1: Control circuit terminal (analog input) 2: MEMOBUS communications 3: Option Board	0 to 3	0	No	A	A	A	180H	–

- Parameter Number: The number of the parameter.
- Name: The name of the parameter.
- Description: Details on the function or settings of the parameter.
- Display: The display shown in the Digital Operator JVOP-160.
- Setting Range: The setting range for the 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 *4-61, Factory Settings that Change with the Control Method (A1-02)* 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 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 display hierarchy for the Inverter.

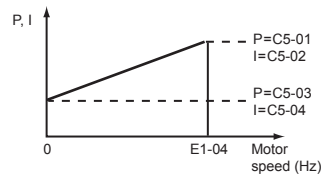
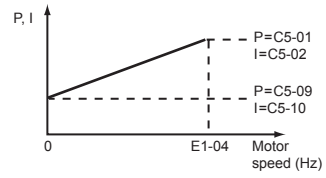


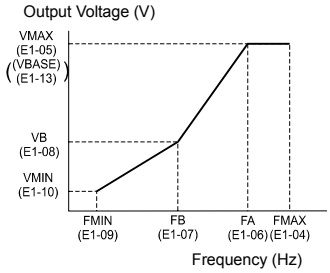
No.	Function	Page
U1	Status Monitor Parameters	*4-52*
U2	Fault Trace	*4-57*
U3	Fault History	*4-59*
A1	Initialize Mode	*4-8*
A2	User-set Parameters	*4-9*
b1	Operation Mode Selections	*4-10*
b2	DC Injection Braking	*4-11*
b4	Timer Functions	*4-11*
b6	Dwell Functions	*4-12*
C1	Acceleration/Deceleration	*4-13*
C2	S-curve Acceleration/Deceleration	*4-14*
C3	Motor Slip Compensation	*4-15*
C4	Torque Compensation	*4-16*
C5	Speed Control (ASR)	*4-17*
C6	Carrier Frequency	*4-18*
d1	Preset Reference	*4-19*
d6	Field Weakening	*4-20*
E1	V/f Pattern	*4-21*
E2	Motor Setup	*4-22*
F1	PG Option Setup	*4-24*
F4	Analog Monitor Boards	*4-26*
F5	Digital Output Boards	*4-27*
F6	Serial Communications Option Boards	*4-28*
H1	Multi-function Contact Inputs	*4-29*
H2	Multi-function Contact Outputs	*4-30*
H3	Analog Inputs	*4-32*
H5	MEMOBUS Communications	*4-34*
L1	Motor Overload	*4-35*
L2	Power Loss Ridethrough	*4-35*
L3	Stall Prevention	*4-36*
L4	Reference Detection	*4-37*
L5	Feed Restart	*4-38*
L6	Torque Detection	*4-39*
L7	Torque Limits	*4-40*
L8	Hardware Protection	*4-41*
N2	Automatic Frequency Regulator	*4-42*
N5	Feed Forward	*4-43*
o1	Monitor Selections	*4-43*
o2	Digital Operator Functions	*4-44*
o3	Copy Functions	*4-46*
S1	Brake Sequence	*4-47*
S2	Slip Compensation for lift	*4-50*
S3	Lift Specific Function	*4-50*
T1	Motor Autotuning	*4-51*

◆ Parameters Setable in Quick Programming Mode

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

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
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 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	Q	Q	Q	101H
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, 2, 3	3	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.	0.00 to 600.00 *1	3.00 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.			Yes	Q	Q	Q	201H
C2-01	S-curve characteristic time at acceleration start / S-Crv Acc @ Start	All sections of the S-curve characteristic time are set in seconds units. 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				No	Q	Q	Q	20CH
C2-03	S-curve characteristic time at deceleration start / S-Crv Dec @ Start				No	Q	Q	Q	20DH
C2-04	S-curve characteristic time at deceleration end / S-Crv Dec @ End				No	Q	Q	Q	20EH
C2-05	S-curve Characteristic time below leveling speed / Scurve @ leveling				No	Q	Q	Q	232H
C5-01	ASR proportional (P) gain 1 / ASR P Gain 1	Sets the proportional gain of the speed loop (ASR).	0.00 to 300.00	40.00	Yes	No	No	Q	21BH

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
C5-02	ASR integral (I) time 1 ASR I Time 1	Sets the integral time of the speed loop (ASR).	0.000 to 10.000	0.500 s	Yes	No	No	Q	21CH
C5-03	ASR proportional (P) gain 2 ASR P Gain 2	Usually changing this setting is not necessary. 	0.00 to 300.00	20.00	Yes	No	No	Q	21DH
C5-04	ASR integral (I) time 2 ASR I Time 2		0.000 to 10.000	0.500 s	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	No	No	No	Q	220H
C5-07	ASR switching frequency ASR Gain SW Freq	Sets the frequency for switching between Proportion Gain 1, 2 and Integral Time 1, 2.	0.0 to 120.0	0.0 Hz	No	No	No	Q	221H
C5-09	ASR proportional (P) gain 3 ASR P Gain 3	Usually changing this setting is not necessary. 	0.00 to 300.00	40.00	Yes	No	No	Q	22EH
C5-10	ASR integral (I) time 3 ASR I Time 3		0.000 to 10.000	0.500 s	Yes	No	No	Q	231H
d1-09 *10	Vn reference Nomin Speed vn	Sets the frequency reference when Nominal speed reference is ON for a multi-function input.	0 to 120.00 *2 *3	50.00 Hz	Yes	Q	Q	Q	288H
d1-14 *10	Inspection reference Inspect Speed vi	Sets the frequency reference when Inspection Run Command is ON for a multi-function input.		25.00 Hz	Yes	Q	Q	Q	28FH
d1-17	Vl (Leveling) reference Level Speed vl	Sets the frequency reference when Leveling speed reference is ON for a multi-function input.		4.00 Hz	Yes	Q	Q	Q	292H
E1-01	Input voltage setting Input Voltage	Sets the Inverter input voltage. This setting is used as a reference value for protection functions.	155 to 255 *4	200 V *4	No	Q	Q	Q	300H

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
E1-04	Max. output frequency (FMAX) Max Frequency	 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	60.0 Hz	No	Q	Q	Q	303H
E1-05	Max. output voltage (VMAX) Max Voltage		0.0 to 255.0 *4	200.0 V *4	No	Q	Q	Q	304H
E1-06	Base frequency (FA) Base Frequency		0.0 to 120.0	60.0 Hz	No	Q	Q	Q	305H
E1-08	Mid. output frequency voltage (VB) Mid Voltage A		0.0 to 255.0 *4	11.0 V *4 *5	No	Q	Q	No	307H
E1-09	Min. output frequency (FMIN) Min Frequency		0.0 to 120.0	0.5 Hz *5	No	Q	Q	A	308H
E1-10	Min. output frequency voltage (VMIN) Min Voltage		0.0 to 255.0 *4	2.0 V *4 *5	No	Q	Q	No	309H
E2-01	Motor rated current Motor Rated FLA	Sets the motor rated current. This set value will become the reference value for motor protection and torque limits. This parameter is an input data for autotuning.	1.75 to 35.00 *6	14.00 A *7	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 *7	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 *8	4.50 A *7	No	Q	Q	Q	310H
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
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 *7	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 *7	No	Q	Q	Q	318H
F1-01	PG constant PG Pulses/Rev	Sets the number of PG pulses per revolution	0 to 60000	600 *9	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

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
L1-01	Motor protection selection / MOL Fault Select	Sets whether the motor thermal overload protection function is enabled or disabled. 0: Disabled 1: General-purpose motor protection 2: Inverter motor protection 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. When several motors are connected to one Inverter, set to L1-01 to 0 and ensure that each motor is installed with a protection device.	0 to 3	1	No	Q	Q	Q	480H

* 1. The setting range for acceleration/deceleration times depends on the setting for C1-10. When C1-10 is set to 0, the setting range for acceleration/deceleration times becomes 0.00 to 600.00 seconds.

* 2. 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.

* 3. The maximum setting value depends on the setting of the maximum output frequency (E1-04).

* 4. This value is set according to o2-09. Values for a 200 V Class Inverter when o2-09=0 (Asia) are given. Values for a 400 V Class Inverter are double.

* 5. The factory setting will change when the control method is changed. Open-loop vector control factory settings are given.

* 6. 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.

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

* 8. The setting range depends on the Inverter capacity. The value for a 200 V Class Inverter of 3.7 kW is given.

* 9. The factory setting is set according to o2-09. The value when o2-09=0 (Asia) is given. The value is 1024 when o2-09 is 1 or 2.

* 10.Not displayed when d1-18 is 0.

Parameter Tables

◆ A: Setup Settings

The following settings are made with the environment parameters (A parameters): Language displayed on the Digital Operator, access level, control method, and initialization of parameters.

■ Initialize Mode: A1

Parameters for the environment modes are shown in the following table.

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
A1-00	Language selection for Digital Operator display / Select Language	Used to select the language displayed on the Digital Operator. 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 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	Q	Q	Q	101H	*5-74*
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, 2, 3	3	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 parameters 2220: Initializes using a two-wire sequence. (Initializes to the factory setting.)	0 to 2220	0	No	A	A	A	103H	–

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
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	*5-75*
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	*5-75*

■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: V/f	Control Methods: Open-loop Vector	Control Methods: Closed-loop Vector	MEMOBUS Register	Page
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. Parameters are the only accessible parameters if Parameter Access Level is set to parameters (A1-01=1)	b1-01 to S3-01	–	No	A	A	A	106H to 125H	*5-75*

◆ Application Parameters: b

The following settings are made with the application parameters (B parameters): Operation method selection, DC injection braking, timer functions, and dwell functions.

■Operation Mode Selections: b1

⚠ WARNING

- Do not change the factory setting (0) in b1-03 (Run Command source selection).
  Doing so can cause the lift to drop.

Parameters for operation mode selection are shown in the following table.

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
b1-01	Reference source selection / Reference Source	Sets the frequency reference input method. 0: Digital Operator 1: Control circuit terminal (analog input) 2: MEMOBUS communications 3: Option Board	0 to 3	0	No	A	A	A	180H	*5-5*
b1-02	Run Command source selection / Run Source	Sets the Run Command input method. 0: Digital Operator 1: Control circuit terminal (digital multi-function inputs) 2: MEMOBUS communications 3: Option Board	0 to 3	1	No	A	A	A	181H	*5-4*
b1-03	Stopping method selection / Stopping Method	Used to set the stopping method used when a Stop Command is input. Do not change the factory setting. 0: Ramp to stop 1: Coast to stop	0 or 1	0	No	A	A	A	182H	–
b1-06	Control input scan / Cntl Input Scans	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	–

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
b1-07	Operation selection after switching to remote mode / LOC/REM RUN Sel	Used to set the operation mode by switching to the Remote mode using the Local/Remote Key. 0: Run signals that are input during mode switching are disregarded. (Input Run signals after switching the mode.) 1: Run signals become effective immediately after switching to the Remote mode.	0 or 1	0	No	A	A	A	186H	–
b1-08	Run Command selection in programming modes / RUN CMD at PRG	Used to set an operation prohibition in programming modes. 0: Operation prohibited. 1: Operate permitted (Disabled when Digital Operator is the selected Run Command source (b1-02 = 0)).	0 or 1	1	No	A	A	A	187H	–

■DC Injection Braking: b2

Parameters for DC injection braking are shown in the following table.

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
b2-08	Magnetic flux compensation volume / Field Comp	Sets the magnetic flux compensation as a percentage of the no-load current.	0 to 1000	0 %	No	No	A	No	190H	–

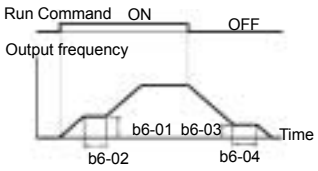
■Timer Functions: b4

Parameters for timer functions are shown in the following table.

Constant 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
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 300.0	0.0 s	No	A	A	A	1A3H	*5-55*
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 300.0	0.0 s	No	A	A	A	1A4H	*5-55*

■Dwell Functions: b6

Parameters for dwell functions are shown in the following table.

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
b6-01	Dwell frequency at start / Dwell Ref @ Start	 The dwell function can be used to hold the output frequency temporarily when driving a motor with a heavy load.	0.0 to 120.0	0.0 Hz	No	A	A	A	1B6H	*5-22*
b6-02	Dwell time at start / Dwell Time @ Start		0.0 to 10.0	0.0 s	No	A	A	A	1B7H	*5-22*
b6-03	Dwell frequency at stop / Dwell Ref @ Stop		0.0 to 120.0	0.0 Hz	No	A	A	A	1B8H	*5-22*
b6-04	Dwell time at stop / Dwell Time @ Stop		0.0 to 10.0	0.0 s	No	A	A	A	1B9H	*5-22*

◆ Tuning Parameters: C

The following settings are made with the tuning parameters (C parameters): Acceleration/deceleration times, S-curve characteristics, slip compensation, torque compensation, speed control, and carrier frequency funtions.

■Acceleration/Deceleration: C1

Parameters for acceleration and deceleration times are shown in the following table.

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
C1-01	Acceleration time 1 / Accel Time 1	Sets the acceleration time to accelerate from 0 Hz to the maximum output frequency.	0.00 to 600.00 *	3.00 s	Yes	Q	Q	Q	200H	*5-19*
C1-02	Deceleration time 1 / Decel Time 1	Sets the deceleration time to decelerate from the maximum output frequency to 0 Hz.			Yes	Q	Q	Q	201H	*5-19*
C1-03	Acceleration time 2 / Accel Time 2	Sets the acceleration time when the multi-function input "accel/decel time 1" is set to ON.			Yes	A	A	A	202H	*5-19*
C1-04	Deceleration time 2 / Decel Time 2	Sets the deceleration time when the multi-function input "accel/decel time 1" is set to ON.			Yes	A	A	A	203H	*5-19*
C1-05	Acceleration time 3 / Accel Time 3	Sets the acceleration time when the multi-function input "accel/decel time 2" is set to ON.			No	A	A	A	204H	*5-19*
C1-06	Deceleration time 3 / Decel Time 3	Sets the deceleration time when the multi-function input "accel/decel time 2" is set to ON.			No	A	A	A	205H	*5-19*
C1-07	Acceleration time 4 / Accel Time 4	Sets the acceleration time when the multi-function input "accel/decel time 1" and "accel/decel time 2" are set to ON.			No	A	A	A	206H	*5-19*
C1-08	Deceleration time 4 / Decel Time 4	Sets the deceleration time when the multi-function input "accel/decel time 1" and "accel/decel time 2" are set to ON.			No	A	A	A	207H	*5-19*
C1-09	Emergency stop time / Fast Stop Time	Sets the deceleration time when the multi-function input "Emergency (fast) stop" is set to ON. This functions can be used as a stopping method when a fault has been detected.			No	A	A	A	208H	*5-11*
C1-10	Accel/decel time setting unit / Acc/Dec Units	0: 0.01-second units 1: 0.1-second units	0 or 1	0	No	A	A	A	209H	*5-19*

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
C1-11	Accel/decel time switching frequency / Acc/Dec SW Freq	Sets the frequency for automatic acceleration/deceleration switching. 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 The multi-function input "accel/decel time 1" or "accel/decel time 2" has priority.	0.0 to 120.0	0.0 Hz	No	A	A	A	20AH	*5-19*

* The setting range for acceleration/deceleration times depends on the setting for C1-10. When C1-10 is set to 0, the setting range for acceleration/deceleration times becomes 0.00 to 600.00 seconds.

■S-Curve Acceleration/Deceleration: C2

Parameters for S-curve characteristics are shown in the following table.

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
C2-01	S-curve characteristic time at acceleration start / S-Crv Acc @ Start	All sections of the S-curve characteristic time are set in seconds units. 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	*5-21*
C2-02	S-curve characteristic time at acceleration end / S-Crv Acc @ End				No	Q	Q	Q	20CH	*5-21*
C2-03	S-curve characteristic time at deceleration start / S-Crv Dec @ Start				No	Q	Q	Q	20DH	*5-21*
C2-04	S-curve characteristic time at deceleration end / S-Crv Dec @ End				No	Q	Q	Q	20EH	*5-21*
C2-05	S-curve Characteristic time below leveling speed / Scurve @ leveling				No	Q	Q	Q	232H	*5-21*

■Motor Slip Compensation: C3

Parameters for slip compensation are shown in the following table.

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
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.	0.0 to 2.5	1.0	Yes	A	A	A	20FH	*5-30*
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	*5-30*
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	*5-30*
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	*5-30*
C3-05	Output voltage limit operation selection / Output V Lim 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	*5-30*

■Torque Compensation: C4

Parameters for torque compensation are shown in the following table.

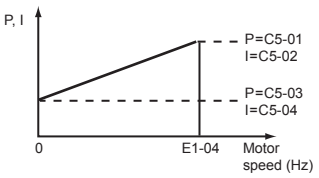
Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector	Control Methods: Closed-loop Vector	MEMOBUS Register	Page
C4-01	Torque compensation gain / Torq Comp Gain	Sets the torque compensation gain. Usually 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 alter 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	*5-32*
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	*5-32*
C4-03	Starting torque compensation (FWD) / FTorqCmp @ start	Sets the torque compensation value at start in FWD direction as a percentage of the motor rated torque.	0.0 to 200.0 %	0.0 %	No	No	A	No	217H	*5-33*
C4-04	Starting torque compensation (REV) / RTorqCmp @ start	Sets the torque compensation value at start in REV direction as a percentage of the motor rated torque.	-200.0 % to 0.0	0.0 %	No	No	A	No	218H	*5-33*
C4-05	Starting torque compensation time constant / TorqCmpDelayT	Sets starting torque start-up time. When 0 to 4 ms is set, it is operated without filter.	0 to 200	10 ms	No	No	A	No	219H	*5-33*

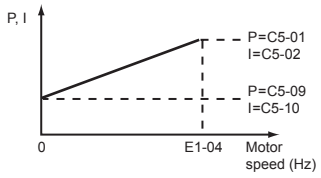
Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector	Control Methods: Closed-loop Vector	MEMOBUS Register	Page
C4-06	Torque compensation delay time constant 2 / Start Torq-Time	Increase the setting if overvoltage (OV) failures occur at the completion of acceleration or when the load changes radically. Usually setting is not necessary.	0 to 10000	150 ms	No	No	A	No	21AH	–

* The factory setting will change when the control method is changed. (Open-loop vector control factory settings are given.)

■Speed Control (ASR): C5

Parameters for speed control are shown in the following table.

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
C5-01	ASR proportional (P) gain 1 / ASR P Gain 1	Sets the proportional gain of the speed loop (ASR).	0.00 to 300.00	40.00	Yes	No	No	Q	21BH	*5-35*
C5-02	ASR integral (I) time 1 / ASR I Time 1	Sets the integral time of the speed loop (ASR).	0.000 to 10.000	0.500 s	Yes	No	No	Q	21CH	*5-35*
C5-03	ASR proportional (P) gain 2 / ASR P Gain 2	Usually changing this setting is not necessary. 	0.00 to 300.00	20.00	Yes	No	No	Q	21DH	*5-35*
C5-04	ASR integral (I) time 2 / ASR I Time 2		0.000 to 10.000	0.500 s	Yes	No	No	Q	21EH	*5-35*
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	*5-35*
C5-07	ASR switching frequency / ASR Gain SW Freq	Sets the frequency for switching between Proportion Gain 1, 2 and Integral Time 1, 2.	0.0 to 120.0	0.0 Hz	No	No	No	Q	221H	*5-35*
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 maximum output frequency.	0 to 400	400 %	No	No	No	A	222H	*5-35*

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
C5-09	ASR proportional (P) gain 3 ASR P Gain 3	Usually changing this setting is not necessary. 	0.00 to 300.00	40.00	Yes	No	No	Q	22EH	*5-35*
C5-10	ASR integral (I) time 3 ASR I Time 3		0.000 to 10.000	0.500 s	Yes	No	No	Q	231H	*5-35*

■Carrier Frequency: C6

Parameters for carrier frequency are shown in the following table.

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
C6-02	Carrier frequency selection Carrier Freq 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 *1	3 *2	No	A	A	A	224H	*5-2*
C6-03	Carrier frequency upper limit Carrier Freq Max	Set the carrier frequency upper limit in kHz units.	2.0 to 15.0 *3	8.0 kHz *4	No	A	A	A	225H	–
C6-09	Carrier frequency selection during autotuning (Rotational type) Carrier in tune	Selects the carrier frequency during rotational autotuning. (Motor no-load current, Motor iron saturation coefficient 1, 2, Motor rated slip) 0: 5 kHz 1: the value in C6-03	0 or 1	0	×	×	A	A	22BH	–
C6-10	Carrier frequency selection during autotuning (Stationary type) Fc Static Tuning	Selects the carrier frequency during stationary autotuning. 0: 0.5 kHz 1: 1.0 kHz 2: 1.5 kHz 3: 2.0 kHz	0 to 3	1	×	×	A	A	22CH	–

* 1. For Inverters of 200/400 V 3.7 kW to 22 kW, 1 to 6 can be set.
For Inverters of 200/400 V 30 kW to 55 kW, 1 to 4 can be set.

* 2. For Inverters of 200/400 V 3.7 kW to 22 kW, the value is 3.
For Inverters of 200/400 V 30 kW to 55 kW, the value is 2.

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

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

◆ Reference Parameters: d

The following settings are made with the reference parameters (d parameters): Frequency references.

■Preset Reference: d1

Parameters for frequency references are shown in the following table.

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
d1-01 *3	Frequency reference 1 / Reference 1	Sets the frequency reference.	0 to 120.00 *1*2	0.00 Hz	Yes	A	A	A	280H	*5-6*
d1-02 *3	Frequency reference 2 / Reference 2	Sets the frequency reference when multi-step speed reference 1 is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	281H	*5-6*
d1-03 *3	Frequency reference 3 / Reference 3	Sets the frequency reference when multi-step speed reference 2 is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	282H	*5-6*
d1-04 *3	Frequency reference 4 / Reference 4	Sets the frequency reference when multi-step speed references 1 and 2 are ON for multi-function inputs.		0.00 Hz	Yes	A	A	A	283H	*5-6*
d1-05 *3	Frequency reference 5 / Reference 5	Sets the frequency when multi-step speed reference 3 is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	284H	*5-6*
d1-06 *3	Frequency reference 6 / Reference 6	Sets the frequency reference when multi-step speed references 1 and 3 are ON for multi-function inputs.		0.00 Hz	Yes	A	A	A	285H	*5-6*
d1-07 *3	Frequency reference 7 / Reference 7	Sets the frequency reference when multi-step speed references 2 and 3 are ON for multi-function inputs.		0.00 Hz	Yes	A	A	A	286H	*5-6*
d1-08 *3	Frequency reference 8 / Reference 8	Sets the frequency reference when multi-step speed references 1, 2, and 3 are ON for multi-function inputs.		0.00 Hz	Yes	A	A	A	287H	*5-6*
d1-09 *4	Vn reference / Nomin Speed vn	Sets the frequency reference when Nominal speed reference is ON for a multi-function input.		50.00 Hz	Yes	Q	Q	Q	288H	*5-7*
d1-10 *4	V1 reference / Interm Speed v1	Sets the frequency reference when Intermediate speed reference is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	28BH	*5-7*
d1-11 *4	V2 reference / Interm Speed v2	Sets the frequency reference when Nominal speed reference, Intermediate speed reference, and Releveling speed reference are ON for multi-function inputs.		0.00 Hz	Yes	A	A	A	28CH	*5-7*

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
d1-12 *4	V3 reference / Interm Speed v3	Sets the frequency reference when Intermediate speed reference and Releveling speed reference are ON for multi-function inputs.	0 to 120.00 *1*2	0.00 Hz	Yes	A	A	A	28DH	*5-8*
d1-13 *4	Vr reference / Relevel Speed vr	Sets the frequency reference when Releveling speed reference is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	28EH	*5-8*
d1-14 *4	Inspection reference / Inspect Speed vi	Sets the frequency reference when Inspection Run Command is ON for a multi-function input.		25.00 Hz	Yes	Q	Q	Q	28FH	*5-11*
d1-17	Vl(Leveling) reference / Level Speed vl	Sets the frequency reference when Leveling speed reference is ON for a multi-function input.		4.00 Hz	Yes	Q	Q	Q	292H	*5-8*
d1-18	Speed priority selection / Speed Priority Sel	Speed reference priority selection 0: Use multi-step speed reference (d1-01 to d1-08) 1: High speed reference has priority. 2: Leveling speed reference has priority.	0 to 2	0	Yes	A	A	A	2A7H	*5-6*

* 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).

* 3. Not displayed when d1-18 is 1 or 2.

* 4. Not displayed when d1-18 is 0.

■Field Weakening: d6

Parameters for the field weakening command are shown in the following table.

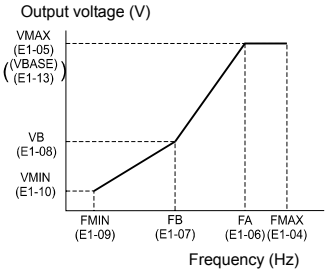
Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector	Control Methods: Closed-loop Vector	MEMOBUS Register	Page
d6-03	Field forcing function selection / Field Force Sel	Enables or disables field forcing function. 0: Disabled 1: Enabled	0 or 1	0	No	No	A	A	2A2H	*5-40*
d6-06	Field forcing function limit / Field Force 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	*5-40*

◆ Motor Parameters: E

The following settings are made with the motor parameters (E parameters): V/f characteristics and motor parameters.

■V/f Pattern: E1

Parameters for V/f characteristics are shown in the following table.

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
E1-01	Input voltage setting / 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	*5-64*
E1-03	V/f pattern selection / V/F Selection	0 to E: Select from the 15 preset patterns. F: Custom user-set patterns (Applicable for settings E1-04 to E1-10.) FF: Custom user-set patterns No internal voltage limit	0 to FF	F	No	A	No	No	302H	*5-64*
E1-04	Max. output frequency (FMAX) / Max Frequency		0.0 to 120.0	60.0 Hz	No	Q	Q	Q	303H	*5-64*
E1-05	Max. output voltage (VMAX) / Max Voltage	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 255.0 *1	200.0 V *1	No	Q	Q	Q	304H	*5-64*
E1-06	Base frequency (FA) / Base Frequency		0.0 to 120.0	60.0 Hz	No	Q	Q	Q	305H	*5-64*
E1-07	Mid. output frequency (FB) / Mid Frequency A		0.0 to 120.0	3.0 Hz *2	No	A	A	No	306H	*5-64*
E1-08	Mid. output frequency voltage (VB) / Mid Voltage A		0.0 to 255.0 *1	11.0 V *1 *2	No	Q	Q	No	307H	*5-64*
E1-09	Min. output frequency (FMIN) / Min Frequency		0.0 to 120.0	0.5 Hz *2	No	Q	Q	A	308H	*5-64*
E1-10	Min. output frequency voltage (VMIN) / Min Voltage		0.0 to 255.0 *1	2.0 V *1 *2	No	Q	Q	No	309H	*5-64*
E1-13	Base voltage (VBASE) / Base Voltage	Set only to fine-adjust V/f for the output range. Normally, this setting is not required.	0.0 to 255.0 *1	0.0 V *3	No	A	A	A	30CH	*5-64*

* 1. This value is set according to o2-09. Values for a 200 V Class Inverter when o2-09=0 (Asia) are given. 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. E1-13 is set to the same value as E1-05 by autotuning.

■Motor Setup: E2

Parameters for motor setup are shown in the following table.

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
E2-01	Motor rated current / Motor Rated FLA	Sets the motor rated current. This set value will become the reference value for motor protection and torque limits. This parameter is automatically set during autotuning.	1.75 to 35.00 *1	14.00 A *2	No	Q	Q	Q	30EH	*5-47* *5-61*
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	*5-61*
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	*5-61*
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	*5-61*
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	*5-61*
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	*5-61*
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 autotuning.	0.00 to 0.50	0.50	No	No	A	A	314H	*5-61*
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 autotuning.	0.00 to 0.75	0.75	No	No	A	A	315H	*5-61*
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 when the torque loss is large due to motor bearing. The set mechanical loss will be compensated.	0.0 to 10.0	0.0 %	No	No	A	A	316H	*5-61*

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
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	*5-62*
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	*5-62*
E2-12	Motor iron saturation coefficient 3 / Saturation Comp 3	Sets the motor iron saturation coefficient at 130 % of magnetic flux. This parameter is automatically set during autotuning.	1.30 to 1.60	1.30	No	No	A	A	328H	*5-62*

* 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 on 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.

◆ Option Parameters: F

The following settings are made with the option parameters (F parameters): Settings for Option Boards.

■PG Option Setup: F1

Parameters for PG Speed Control Board are shown in the following table.

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
F1-01	PG constant / PG Pulses/ Rev	Sets the number of PG pulses per revolution	0 to 60000	600 *	No	No	No	Q	380H	*5-76*
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	*5-76*
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	*5-76*
F1-04	Operation selection at 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	*5-76*

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
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	*5-76*
F1-06	PG division rate (PG pulse monitor) / PG Output Ratio	Sets the division ratio for the PG speed control board 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	*5-76*
F1-08	Overspeed detection level / PG Overspd 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	*5-77*
F1-09	Overspeed detection delay time / PG Overspd Time		0.0 to 2.0	0.0 s	No	No	No	A	388H	*5-77*
F1-10	Excessive speed deviation detection level / PG Deviate 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	*5-77*
F1-11	Excessive speed deviation detection delay time / PG Deviate Time		0.0 to 10.0	0.5 s	No	No	No	A	38AH	*5-77*
F1-14	PG open-circuit detection delay time / PGO Detect 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	*5-77*

* The factory setting is set according to o2-09. The value when o2-09=0 (Asia) is given. The value is 1024 when o2-09 is 1 or 2.

■Analog Monitor Boards: F4

Parameters for the Analog Monitor Board are shown in the following table.

Constant 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
F4-01	Channel 1 monitor selection / AO Ch1 Select	Effective when the Analog Monitor Board is used. Monitor selection: Set the number of the monitor item to be output. (U1-□□) Gain: Set the multiple of 10 V for outputting monitor items. 4, 10 to 14, 25, 28, 35, 39, 40, 42 cannot be set. 29 to 31 are not used. When the AO-12 Analog Monitor Board is used, outputs of ± 10 V are possible. To output ± 10 V, set F4-07 or F4-08 to 1. When the AO-08 Analog Monitor Board is used, only outputs of 0 to +10 V are possible. A meter calibration function is available.	1 to 99	2	No	A	A	A	391H	–
F4-02	Channel 1 gain / AO Ch1 Gain		0.0 to 1000.0	100.0 %	Yes	A	A	A	392H	–
F4-03	Channel 2 monitor selection / AO Ch2 Select		1 to 99	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	Sets the channel 1 item bias to 100 %/10 V when the Analog Monitor Board is used.	-110.0 to 110.0	0.0 %	Yes	A	A	A	395H	–
F4-06	Channel 2 output monitor bias / AO Ch2 Bias	Sets the channel 2 item bias to 100 %/10 V when the Analog Monitor Board is used.	-110.0 to 110.0	0.0 %	Yes	A	A	A	396H	–
F4-07	Analog output signal level for channel 1 / AO Opt Level Ch1	0: 0 to 10 V 1: -10 to +10 V	0 or 1	0	No	A	A	A	397H	–
F4-08	Analog output signal level for channel 2 / AO Opt Level Ch2	0: 0 to 10 V 1: -10 to +10 V	0 or 1	0	No	A	A	A	398H	–

■Digital Output Boards (DO-02C and DO-08): F5

Parameters for the Digital Output Board are shown in the following table.

Constant 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
F5-01	Channel 1 output selection / DO Ch1 Select	Effective when a Digital Output Board (DO-02C or DO-08) is used. Set the number of the multi-function output to be output.	0 to 43	0	No	A	A	A	399H	–
F5-02	Channel 2 output selection / DO Ch2 Select	Effective when a Digital Output Board (DO-02C or DO-08) is used. Set the number of the multi-function output to be output.	0 to 43	1	No	A	A	A	39AH	–
F5-03	Channel 3 output selection / DO Ch3 Select	Effective when a DO-08 Digital Output Board is used. Set the number of the multi-function output to be output.	0 to 43	2	No	A	A	A	39BH	–
F5-04	Channel 4 output selection / DO Ch4 Select	Effective when a DO-08 Digital Output Board is used. Set the number of the multi-function output to be output.	0 to 43	4	No	A	A	A	39CH	–
F5-05	Channel 5 output selection / DO Ch5 Select	Effective when a DO-08 Digital Output Board is used. Set the number of the multi-function output to be output.	0 to 43	6	No	A	A	A	39DH	–
F5-06	Channel 6 output selection / DO Ch6 Select	Effective when a DO-08 Digital Output Board is used. Set the number of the multi-function output to be output.	0 to 43	37	No	A	A	A	39EH	–
F5-07	Channel 7 output selection / DO Ch7 Select	Effective when a DO-08 Digital Output Board is used. Set the number of the multi-function output to be output.	0 to 43	0F	No	A	A	A	39FH	–
F5-08	Channel 8 output selection / DO Ch8 Select	Effective when a DO-08 Digital Output Board is used. Set the number of the multi-function output to be output.	0 to 43	0F	No	A	A	A	3A0H	–
F5-09	DO-08 output mode selection / DO-08 Selection	Effective when a DO-08 Digital Output Board 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	–

■Serial Communications Option Boards: F6

Parameters for the Serial Communications Option Board are shown in the following table.

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
F6-01	Operation selection after communications error Comm Bus Flt 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 board 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 board 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	–
F6-04	Trace sampling from communications option board Trace Sample Tim	–	0 to 60000	0	No	A	A	A	3A5H	–
F6-05	Current monitor unit selection Current Unit Sel	Sets the unit of current monitor 0: A (Ampere) 1: 100 %/8192	0 or 1	0	No	A	A	A	3A6H	–
F6-06	Torque reference/torque limit selection from communications option board Torq Ref/Lmt Sel	0: Torque reference/torque limit by communications option disabled. 1: Torque reference/torque limit by communications option enabled.	0 or 1	0	No	No	No	A	3A7H	–

◆ Terminal Function Parameters: H

The following settings are made with the terminal function parameters (H parameters): Settings for external terminal functions.

■Multi-function Contact Inputs: H1

Parameters for multi-function contact inputs are shown in the following tables.

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
H1-01	Terminal S3 function selection / Terminal S3 Sel	Multi-function input 1	0 to 88	24	No	A	A	A	400H	*5-54*
H1-02	Terminal S4 function selection / Terminal S4 Sel	Multi-function input 2		14	No	A	A	A	401H	*5-54*
H1-03	Terminal S5 function selection / Terminal S5 Sel	Multi-function input 3		3	No	A	A	A	402H	*5-54*
H1-04	Terminal S6 function selection / Terminal S6 Sel	Multi-function input 4		4	No	A	A	A	403H	*5-54*
H1-05	Terminal S7 function selection / Terminal S7 Sel	Multi-function input 5		6	No	A	A	A	404H	*5-54*

Multi-function Contact Input Functions

Setting Value	Function	Control Methods: V/f	Control Methods: Open-loop Vector	Control Methods: Closed-loop Vector	Page
3	Multi-step speed reference 1 If H3-09 is set to 2, this function is combined with the master/auxiliary speed switch.	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	Yes	Yes	Yes	*5-20*
8	External baseblock NO (NO contact: Baseblock at ON)	Yes	Yes	Yes	*5-54*
9	External baseblock NC (NC contact: Baseblock at OFF)	Yes	Yes	Yes	*5-54*
F	Not used (Set when a terminal is not used)	–	–	–	–
14	Fault reset (Reset when turned ON)	Yes	Yes	Yes	*6-2*
15	Emergency stop. (NO: Deceleration to stop in deceleration time set in C1-09 when ON.)	Yes	Yes	Yes	*5-11*

Setting Value	Function	Control Methods			Page
		V/f	Open-loop Vector	Closed-loop Vector	
17	Emergency stop (NC: Deceleration to stop in deceleration time set in C1-09 when OFF)	Yes	Yes	Yes	*5-11*
18	Timer function input (Functions are set in b4-01 and b4-02 and the timer function outputs are set in H1-□□ and H2-□□.)	Yes	Yes	Yes	*5-56*
1A	Accel/decel time 2	Yes	Yes	Yes	*5-20*
20 to 2F	External fault Input mode: NO contact/NC contact, Detection mode: Normal/during operation	Yes	Yes	Yes	–
60	DC injection braking command (ON: performs DC injection braking) (can be set when o2-09=1)	Yes	Yes	Yes	–
67	Communications test mode	Yes	Yes	Yes	–
80	Nominal speed reference	Yes	Yes	Yes	*5-14*
81	Intermediate speed reference	Yes	Yes	Yes	*5-14*
82	Releveling speed reference	Yes	Yes	Yes	*5-14*
83	Leveling speed reference	Yes	Yes	Yes	*5-14*
84	Inspection Run Command	Yes	Yes	Yes	*5-12*
85	Battery operation command	Yes	Yes	Yes	*5-79*
86	Magnetic contactor answer back signal	Yes	Yes	Yes	*5-14* *5-57*
87	High speed limit switch (Up)	Yes	Yes	Yes	*5-29*
88	High speed limit switch (Down)	Yes	Yes	Yes	*5-29*

■ Multi-function Contact Outputs: H2

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		
H2-01	Terminal M1-M2 function selection Term M1-M2 Sel	Multi-function contact output 1	0 to 43	40	No	A	A	A	40BH	*5-58*
H2-02	Terminal M3-M4 function selection Term M3-M4 Sel	Multi-function contact output 2	0 to 43	41	No	A	A	A	40CH	*5-58*
H2-03	Terminal M5-M6 function selection Term M5-M6 Sel	Multi-function contact output 3	0 to 43	6	No	A	A	A	40DH	*5-58*

Multi-function Contact Output Functions

Setting Value	Function	Control Methods			Page
		V/f	Open-loop Vector	Closed-loop Vector	
0	During run (ON: Run Command is ON or voltage is being output)	Yes	Yes	Yes	*5-58*
1	Zero-speed	Yes	Yes	Yes	*5-59*
2	f_{ref}/f_{out} agree 1 (detection width L4-02 is used.)	Yes	Yes	Yes	*5-28*
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	*5-28*

Setting Value	Function	Control Methods			Page
		V/f	Open-loop Vector	Closed-loop Vector	
4	Frequency detection 1 (ON: +L4-01 ≥ output frequency ≥ -L4-01, with detection width L4-02 used)	Yes	Yes	Yes	*5-28*
5	Frequency detection 2 (ON: Output frequency ≥ +L4-01 or output frequency ≤ -L4-01, with detection width L4-02 used)	Yes	Yes	Yes	*5-28*
6	Inverter operation ready READY: After initialization or no faults	Yes	Yes	Yes	*5-59*
7	During DC bus undervoltage (UV) detection	Yes	Yes	Yes	*5-59*
8	During baseblock (ON: during baseblock)	Yes	Yes	Yes	*5-59*
9	Frequency reference source selection (ON: Frequency reference from Operator)	Yes	Yes	Yes	*5-59*
A	Run Command source selection status (ON: Run Command from Operator)	Yes	Yes	Yes	*5-59*
B	Overtorque/undertorque detection 1 NO (NO contact, ON: Overtorque/undertorque detection)	Yes	Yes	Yes	*5-43*
C	Loss of frequency reference (Effective when 1 is set for L4-05)	Yes	Yes	Yes	–
D	Braking resistor fault (ON: Resistor overheat or braking transistor fault)	Yes	Yes	Yes	–
E	Fault (ON: Digital Operator communications error or fault other than CPF00 and CPF01 has occurred.)	Yes	Yes	Yes	*5-59*
F	Not used. (Set when the terminal is not used.)	Yes	Yes	Yes	–
10	Minor fault (ON: Alarm displayed)	Yes	Yes	Yes	*5-59*
11	Fault reset command active	Yes	Yes	Yes	*5-60*
12	Timer function output	Yes	Yes	Yes	*5-56*
13	f_{ref}/f_{out} agree 2 (detection width L4-04 is used)	Yes	Yes	Yes	*5-28*
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	*5-28*
15	Frequency detection 3 (ON: Output frequency ≤ L4-03, detection width L4-04 is used)	Yes	Yes	Yes	*5-28*
16	Frequency detection 4 (ON: Output frequency ≥ L4-03, detection width L4-04 is used)	Yes	Yes	Yes	*5-28*
17	Overtorque/undertorque detection 1 NC (NC Contact, OFF: Overtorque/Undertorque detection)	Yes	Yes	Yes	*5-43*
18	Overtorque/undertorque detection 2 NO (NO Contact, ON: Overtorque/Undertorque detection)	Yes	Yes	Yes	*5-43*
19	Overtorque/undertorque detection 2 NC (NC Contact, OFF: Overtorque/Undertorque detection)	Yes	Yes	Yes	*5-43*
1A	During reverse run (ON: During reverse run)	Yes	Yes	Yes	*5-60*
1B	During baseblock 2 (OFF: During baseblock)	Yes	Yes	Yes	*5-60*
1D	During regenerative operation (ON: During regenerative operation)	No	No	Yes	*5-60*
1E	Restart enabled (ON: Restart enabled)	Yes	Yes	Yes	*5-82*
1F	Motor overload (OL1, including OH3) pre-alarm (ON: 90 % or more of the detection level)	Yes	Yes	Yes	*5-47*
20	Inverter overheat (OH) pre-alarm (ON: Temperature exceeds L8-02 setting)	Yes	Yes	Yes	*5-50*
30	During torque limit (current limit) (ON: During torque limit)	No	Yes	Yes	*5-46*
31	During speed limit (ON: During speed limit)	No	No	Yes	–
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	*5-58*
38	During cooling fan operation	Yes	Yes	Yes	*5-52*
40	Brake release command	Yes	Yes	Yes	*5-14*
41	Magnetic contactor close command	Yes	Yes	Yes	*5-14*
42	Speed detection at deceleration (Door zone)	Yes	Yes	Yes	*5-60*
43	Not zero-speed	Yes	Yes	Yes	*5-60*

■Analog Inputs: H3

User parameters for analog inputs are shown in the following table.

Constant 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
H3-01	Signal level selection (AI-14B CH1) / AI-14 CH1 LvlSel	0: 0 to +10V [11-bit + polarity (positive/negative) input] 1: 0 to ±10V	0 or 1	0	No	A	A	A	410H	*5-25*
H3-02	Gain (AI-14B CH1) / AI-14 CH1 gain	Sets the frequency when 10 V is input, as a percentage of the maximum output frequency.	0.0 to 1000.0	100.0 %	Yes	A	A	A	411H	*5-25*
H3-03	Bias (AI-14B CH1) / AI-14 CH1 bias	Sets the frequency when 0 V is input, as a percentage of the maximum frequency.	-100.0 to +100.0	0.0 %	Yes	A	A	A	412H	*5-25*
H3-04	Signal level selection (AI-14B CH3) / AI-14 CH3 LvlSel	0: 0 to +10V [11-bit + polarity (positive/negative) input] 1: 0 to ±10V	0 or 1	0	No	A	A	A	413H	*5-25*
H3-05	Multi-function analog input (AI-14B CH3) / AI-14 CH3 FuncSel	Select from the functions listed in the following table. Refer to the next page.	2,3,14	2	No	A	A	A	414H	*5-25*
H3-06	Gain (AI-14B CH3) / AI-14 CH3 gain	Sets the input gain (level) when 10 V is input. Set according to the 100 % value selected from H3-05.	0.0 to 1000.0	100.0 %	Yes	A	A	A	415H	*5-25*
H3-07	Bias (AI-14B CH3) / AI-14 CH3 bias	Sets the input gain (level) when 0 V is input. Set according to the 100 % value selected from H3-05.	-100.0 to +100.0	0.0 %	Yes	A	A	A	416H	*5-25*
H3-08	Multi-function analog input AI-14B CH2 signal level selection / AI-14 CH2 LvlSel	0: Limit negative frequency settings for gain and bias settings to 0. 1: Do not limit negative frequency settings for gain and bias settings to 0 (i.e., allow reverse operation). 2: 4 to 20 mA (9-bit input). Switch current and voltage input using the switch on AI-14B.	0 to 2	0	No	A	A	A	417H	*5-25*
H3-09	Multi-function analog input AI-14B CH2 function selection / AI-14 CH2 FuncSel	Select multi-function analog input function for AI-14B CH2. Refer to the next table.	0 to 1F	3	No	A	A	A	418H	*5-25*

Constant 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
H3-10	Gain (AI-14B CH2) / AI-14 CH2 gain	Sets the input gain (level) when 10 V (20 mA) is input. Set according to the 100 % value for the function set for H3-09.	0.0 to 1000.0	100.0 %	Yes	A	A	A	419H	*5-25*
H3-11	Bias (AI-14B CH2) / AI-14 CH2 bias	Sets the input gain (level) when 0 V (4 mA) is input. Set according to the 100 % value for the function set for H3-09.	-100.0 to +100.0	0.0 %	Yes	A	A	A	41AH	*5-26*
H3-12	Analog input filter time constant / CH1-3 Filter-Time	Sets primary delay filter time constant in seconds for the four analog input (AI-14B CH1, AI-14B CH2, AI-14B CH3, and Terminal A1). Effective for noise control etc.	0.00 to 2.00	0.03 s	No	A	A	A	41BH	*5-26*
H3-15	Terminal A1 function selection / Terminal A1 func	Sets the multi-function analog input function for terminal A1. 0: Frequency reference 1: Torque compensation	0 or 1	0	No	No	No	A	434H	*5-12* *5-26*
H3-16	Gain (Terminal A1) / Terminal A1 gain	Sets the frequency when 10 V is input, as a percentage of the maximum output frequency.	0.0 to 1000.0	100.0 %	Yes	A	A	A	435H	*5-26*
H3-17	Bias (Terminal A1) / Terminal A1 bias	Sets the frequency when 0 V is input, as a percentage of the maximum frequency.	-100.0 to +100.0	0.0 %	Yes	A	A	A	436H	*5-26*

Note These parameters are displayed when AI-14B is installed.

H3-05,H3-09 Settings

Setting Value	Function	Contents (100 %)	Control Methods: V/f	Control Methods: Open-loop Vector	Control Methods: Closed-loop Vector	Page
2	Auxiliary frequency reference 1 (is used as frequency reference 2)	Maximum output frequency	Yes	Yes	Yes	*5-6*
3	Auxiliary frequency reference 2 (is used as frequency reference 3)	Maximum output frequency	Yes	Yes	Yes	*5-6*
14	Torque compensation	Motor's rated torque	No	No	Yes	–

Note H3-05 and H3-09 can be set when AI-14B is installed.

■MEMOBUS Communications: H5

Parameters for MEMOBUS communications are shown in the following table.

Constant Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register	Page
						V/f	Open-loop Vector	Closed-loop Vector		
H5-01	Station address / Serial Comm Adr	Set the Inverter's node address.	0 to 20 *	1F	No	A	A	A	425H	–
H5-02	Communication speed selection / Serial Baud Rate	Set the baud rate for MEMOBUS communications. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps	0 to 4	3	No	A	A	A	426H	–
H5-03	Communication parity selection / Serial Com Sel	Set the parity for MEMOBUS communications. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0	No	A	A	A	427H	–
H5-04	Stopping method after communication error / Serial Fault Sel	Set the stopping method for communications errors. 0: Deceleration to stop using deceleration time in C1-02 1: Coast to stop 2: Emergency stop using deceleration time in C1-09 3: Continue operation	0 to 3	3	No	A	A	A	428H	–
H5-05	Communication error detection selection / Serial Flt Dtct	Set whether or not a communications timeout is to be detected as a communications error. 0: Do not detect. 1: Detect	0 or 1	1	No	A	A	A	429H	–
H5-06	Send wait time / Transmit WaitTIM	Set the time from the Inverter receiving data to when the Inverter starts to send.	5 to 65	5 ms	No	A	A	A	42AH	–
H5-07	RTS control ON/OFF / RTS Control Sel	Select to enable or disable RTS control. 0: Disabled (RTS is always ON) 1: Enabled (RTS turns ON only when sending)	0 or 1	1	No	A	A	A	42BH	–

* Set H5-01 to 0 to disable Inverter responses to MEMOBUS communications.

◆ Protection Function Parameters: L

The following settings are made with the protection function parameters (L parameters): Motor selection function, power loss ridethrough function, stall prevention function, reference detection, fault restart, torque detection, torque limits, and hardware protection.

■Motor Overload: L1

Parameters for motor overloads are shown in the following table.

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
L1-01	Motor protection selection / MOL Fault Select	Sets whether the motor thermal overload protection function is enabled or disabled. 0: Disabled 1: General-purpose motor protection 2: Inverter motor protection 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. When several motors are connected to one Inverter, set to L1-01 to 0 and ensure that each motor is installed with a protection device.	0 to 3	1	No	Q	Q	Q	480H	*5-47*
L1-02	Motor protection time constant / 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 resistance protection time for when the motor is hot started.	0.1 to 5.0 *	1.0 min *	No	A	A	A	481H	*5-47*

* This value is set according to o2-09. The value when o2-09=0 is given.

■Power Loss Ridethrough: L2

Parameters for power loss ridethrough are shown in the following table.

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
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 *	190 V *	No	A	A	A	489H	–
L2-11	Battery Voltage / Volt@batterydr	Sets the battery voltage.	0 to 400 *	0 V *	No	A	A	A	4CBH	*5-79*

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

■Stall Prevention: L3

Parameters for the stall prevention function are shown in the following table.

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
L3-01	Stall prevention selection during accel / StallP Accel Sel	0: Disabled (Acceleration as set. With a 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 disregarded.)	0 to 2	1	No	A	A	No	48FH	*5-23*
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	*5-23*
L3-03	Stall prevention limit during accel / StallP CHP Lvl	Sets the lower limit for stall prevention during acceleration, as a percentage of the Inverter rated current, when operation is in the frequency range above E1-06. Usually setting is not necessary.	0 to 100	50 %	No	A	A	No	491H	*5-23*
L3-04	Stall prevention selection during decel / StallP Decel Sel	0: Disabled (Deceleration as set. If deceleration time is too short, a main circuit overvoltage may result.) 1: Enabled (Deceleration is stopped when the main circuit voltage exceeds the overvoltage level. Deceleration restarts when voltage is returned.) 2: Intelligent deceleration mode (Deceleration rate is automatically adjusted so that the Inverter can decelerate in the shortest possible time. Set deceleration time is disregarded.) 3: Enabled (with Braking Resistor Unit) When a braking option (Braking Resistor, Braking Resistor Unit, Braking Unit) is used, always set to 0 or 3. Usually setting is not necessary.	0 to 3*	0	No	A	A	A	492H	–

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
L3-05	Stall prevention selection during running / StallP Run Sel	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	*5-41*
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	*5-41*

* The setting range for Closed vector control is 0 to 2.

■Reference Detection: L4

Parameters for the reference detection function are shown in the following table.

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
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	*5-27*
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	*5-27*
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	*5-27*
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	*5-27*
L4-05	Operation when frequency reference is missing / Ref Loss Sel	0: Stop (Operation follows the frequency reference.) 1: Operation continues at the frequency, set in parameter L4-06. Frequency reference loss means that the frequency reference value drops over 90 % in 400 ms.	0 or 1	0	No	A	A	A	49DH	–

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
L4-06	Frequency reference value at frequency reference loss / Fref at Floss	Sets the frequency reference value when the frequency reference is missing	0.0 to 100.0 %	80.0 %	No	A	A	A	4C2H	–

■Fault Restart: L5

Parameters for restarting faults are shown in the following table.

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
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	*5-82*
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	*5-82*
L5-03	Auto restart interval time / retry time	While attempting automatic fault restarts, if a fault can not be reset even though the set time in L5-03 has passed, the fault contact output will operate.	0.5 to 180.0	2.0 sec	No	A	A	A	A40H	–

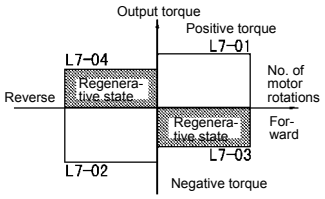
■Torque Detection: L6

Parameters for the torque detection function are shown in the following table.

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
L6-01	Torque detection selection 1 / Torq Det 1 Sel	0: Overtorque/undertorque detection disabled. 1: Overtorque detection only with speed agreement; operation continues (warning is output). 2: Overtorque detected continuously during operation; operation continues (warning is output). 3: Overtorque detection only with speed agreement; output stopped upon detection. 4: Overtorque 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	*5-42*
L6-02	Torque detection level 1 / Torq Det 1 Lvl	Open-loop 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	*5-42*
L6-03	Torque detection time 1 / Torq Det 1 Time	Sets the overtorque/undertorque detection time.	0.0 to 10.0	10.0 s	No	A	A	A	4A3H	*5-42*
L6-04	Torque detection selection 2 / Torq Det 2 Sel	See L6-01 to L6-03 for a description.	0 to 8	0	No	A	A	A	4A4H	*5-43*
L6-05	Torque detection level 2 / Torq Det 2 Lvl		0 to 300	150 %	No	A	A	A	4A5H	*5-43*
L6-06	Torque detection time 2 / Torq Det 2 Time		0.0 to 10.0	0.1 s	No	A	A	A	4A6H	*5-43*

■Torque Limits: L7

Parameters for torque limits are shown in the following table.

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
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	200 %*	No	No	A	A	4A7H	*5-45*
L7-02	Reverse drive torque limit / Torq Limit Rev				No	No	A	A	4A8H	*5-45*
L7-03	Forward regenerative torque limit / Torq Lmt Fwd Rgn				No	No	A	A	4A9H	*5-45*
L7-04	Reverse regenerative torque limit / Torq Lmt Rev Rgn				No	No	A	A	4AAH	*5-45*
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	*5-45*
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 Usually 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	*5-45*

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

■Hardware Protection: L8

Parameters for hardware protection functions are shown in the following table.

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
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 heatsink temperature reaches the set value.	50 to 130	75 °C*	No	A	A	A	4AEH	*5-50*
L8-03	Operation selection after overheat pre-alarm / OH Pre-Alarm Sel	Sets the operation for when the Inverter overheat pre-alarm occurs. 0: Deceleration to stop using the deceleration time in C1-02. 1: Coast to stop 2: Emergency stop using deceleration time in 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	*5-50*
L8-07	Output open-phase protection selection / Ph Loss Out Sel	0: Disabled 1: Enabled, 1 phase observatioin 2: Enabled, 2 and more 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 to 2	2	No	A	A	A	4B3H	*5-51*
L8-09	Ground protection selection / Ground Fault Sel	0:Disabled 1:Enabled Usually changing this setting is not necessary.	0 or 1	1	No	A	A	A	4B5H	*5-51*
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	0 or 1	0	No	A	A	A	4B6H	*5-52*
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.	0 to 300	60 s	No	A	A	A	4B7H	*5-52*
L8-12	Ambient temperature / Ambient Temp	Sets the ambient temperature.	45 to 60	45 °C	No	A	A	A	4B8H	*5-53*
L8-18	Soft CLA selection / Soft CLA Sel	0: Disable 1: Enable	0 or 1	1	No	A	A	A	4BFH	–

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
L8-20	LF detection time / Pha loss det T	Sets the detection time of LF.	0.0 to 2.0	0.2 s	No	A	A	A	4C0H	–

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

◆ N: Special Adjustments

The following settings are made with the special adjustments parameters (N parameters): Automatic frequency regulator and feed forward control.

■Automatic Frequency Regulator: N2

Parameters for automatic frequency regulator are shown in the following table.

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	MEMOBUS Register	Page
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	*5-37*
N2-02	Speed feedback detection control (AFR) time constant 1 / 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	*5-37*
N2-03	Speed feedback detection control (AFR) time constant 2 / AFR Time 2	Increase the setting if overvoltage (OV) failures occur at the completion of acceleration or when the load changes radically.	0 to 2000	750 ms	No	No	A	No	586H	*5-37*

■Feed Forward: N5

Parameters 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	Control Methods: Open-loop Vector	Control Methods: Closed-loop Vector	MEMOBUS Register	Page
N5-01	Feed forward control selection / Feedfoward Sel	Select the feed forward control. 0: Disabled 1: Enabled	0 or 1	1	No	No	No	A	5B0H	*5-38*
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: $GD^2/4$, P: Motor rated output $ta = \frac{2\pi \cdot J[kgm^2] \cdot Nr[min^{-1}]}{60 \cdot T_{100}[N \cdot m]}$ [s] However, $T_{100} = \frac{60}{2\pi} \cdot \frac{P[kW]}{Nr[min^{-1}]} \times 10^3 [N \cdot m]$	0.000 to 10.000	0.154 s *	No	No	No	A	5B1H	*5-38*
N5-03	Feed forward proportional gain / Feedfoward Gain	Set 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	*5-38*

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

◆ Digital Operator Parameters: o

The following settings are made with the Digital Operator parameters (o parameters): Monitor selections, Digital Operator functions, and copy functions.

■Monitor Selections: o1

Parameters for the monitor selections are shown in the following table.

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
o1-01	Monitor selection / User Monitor Sel	Set the number of the 4rd. monitor item to be displayed in the Drive Mode. (U1-□□)	4 to 99	6	Yes	A	A	A	500H	*5-66*
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	*5-66*

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
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: min^{-1} 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	*5-66*
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	*5-66*
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	*5-66*

■Digital Operator Functions: o2

Parameters for Digital Operator functions are shown in the following table.

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
o2-01	LOCAL/REMOTE key enable/disable / Local/Remote Key	Enables/Disables the Digital Operator Local/Remote key 0: Disabled 1: Enabled (Switches between the Digital Operator and the parameter settings b1-01, b1-02.)	0 or 1	0	No	A	A	A	505H	–

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
o2-02	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	*5-67*
o2-03	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	*5-67*
o2-04	kVA selection / Inverter Model#	Do not set unless after replacing the control board. (Refer to *page 5-62* for the setting values).	0 to FF	4 *	No	A	A	A	508H	*5-67*
o2-05	Frequency reference setting method selection / Operator M.O.P.	When the frequency reference is set on the Digital Operator 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	*5-67*
o2-06	Operation selection when digital operator is disconnected / Oper Detection	Sets the operation when the Digital Operator is disconnected. 0: Disabled (Operation continues even if the Digital Operator is disconnected.) 1: Enabled (OPR is detected at Digital Operator disconnection. Inverter output is switched off, and the fault contact is operated.)	0 or 1	0	No	A	A	A	50AH	*5-67*
o2-07	Cumulative operation time setting / Elapsed Time Set	Sets the cumulative operation time in hour units. Operation time is calculated from the set value.	0 to 65535	0 hr	No	A	A	A	50BH	*5-67*
o2-08	Cumulative operation time selection / Elapsed Time Run	0: Accumulated Inverter power on time. 1: Accumulated Inverter run time.	0 or 1	0	No	A	A	A	50CH	*5-67*
o2-09	Initialize Mode / InitModeSet	0: Asia 1: America 2: Europe	0 to 2	0	No	A	A	A	50DH	*5-67*

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
o2-10	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	*5-67*
o2-12	Fault trace initialize / FLT Trace Init	0: Disabled (U2 and U3 constants are on hold.) 1: Enabled (Initializes U2 and U3 parameters)	0 or 1	0	No	A	A	A	510H	*5-67*
o2-15	Operation counter initialize / Initialize Sel	0: Disabled (Operation counters are on hold.) 1: Enabled (Initializes operation counters to 0)	0 or 1	0	No	A	A	A	513H	*5-68*

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

■Copy Functions: o3

Parameters for copy functions are shown in the following table.

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
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	*5-70*
o3-02	Read permission selection / Read Allowable	0: READ prohibited 1: READ permitted	0 or 1	0	No	A	A	A	516H	*5-70*

◆ Lift Function Parameters: S

The following settings are made with the lift function parameters (S parameters): Brake sequence, Slip compensation for lift, and lift specific function.

■Brake Sequence: S1

Parameters for brake sequence are shown in the following table.

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
S1-01	Zero-speed level (DC injection braking starting frequency) / ZeroSpeed@ stop	Used to set the frequency which starts DC injection braking in units of Hz when deceleration to stop is selected. When b2-01 is less than E1-09, E1-09 becomes the DC injection braking starting frequency. (For closed-loop vector control, S1-01 is the zero-speed operation starting frequency)	0.0 to 10.0	1.2 Hz *	No	A	A	A	680H	*5-12*
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	*5-13*
S1-03	DC injection braking current 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	*5-13*
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	0.50 s *	No	A	A	A	683H	*5-13*
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	684H	*5-13*
S1-06	Brake release delay time / Brake open delay	Used to set the time to output Brake release command in units of 1second.	0.00 to 10.00	0.20	No	A	A	A	685H	*5-13*
S1-07	Brake close delay time / Brake CloseDelay	Used to set the time to output Brake close command in units of 1second.	0.00 to S1-05	0.10	No	A	A	A	686H	*5-13*

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
S1-14	SE2 detection delay time / SE2 det T	Used to set the time to detect SE2 fault in units of 1ms. When the Inverter output current is below S1-08 setting after passing S1-06+S1-14 time,SE2 will be detected.	0 to S1-04 - S1-06	200 ms	No	A	A	A	68DH	*5-49*
S1-15	SE3 detection delay time / SE3 det T	Used to set the time to detect SE3 fault in units of 1ms. When Inverter output current is below S1-08 setting for S1-15 time continuously, SE3 will be detected.	0 to 5000	200 ms	No	A	A	A	68EH	*5-49*
S1-16	RUN delay time / Run Delay T	Used to set RUN-delay time in units of 1 second.	0.00 to 1.00	0.10 s	No	A	A	A	68FH	*5-13*
S1-17	DC injection current gain at regeneration / DC Inj gain@gen	Used to set the DC injection gain when Inverter is in the regenerative mode.	0 to 400	100 %	No	No	A	No	690H	*5-13* *5-40*
S1-18	DC injection current gain at motoring / DC Inj gain@mot	Used to set the DC injection gain when Inverter is in the motoring mode.	0 to 400	20 %	No	No	A	No	691H	*5-13* *5-40*
S1-19	Magnetic contactor close delay time / Cont open delay	Used to set the delay time to close the magnetic contactor in units of 1 second.	0.00 to 1.00	0.10 s	No	A	A	A	6A6H	*5-13*
S1-20	Zero-servo gain / Zero-servo gain	Adjust the strength of the zero-servo lock. When the closed-loop vector control is selected, a position control loop is created and the motor stops at start or stop. Increasing the zero-servo gain in turn increases the strength of the lock. Increasing it by too much will cause oscillation.	0 to 100	5	No	No	No	A	693H	*5-13*
S1-21	Zero-servo completion width / Zero-servo Count	Sets the output width of the zero-servo completion signal. The zero-servo completion signal is ON when the current position is within the range (the zero-servo position + zero-servo completion width.) Set the allowable position displacement from the zero-servo position to 4 times the pulse rate of the PG (pulse generator, encoder) in use.	0 to 16383	10	No	No	No	A	694H	*5-14*
S1-22	Torque compensation time at start / torque incr T	Sets the time to torque reference to reach to 300 % torque reference in units of 1ms.	0 to 5000	500 ms	No	No	No	A	695H	*5-14*

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
S1-23	Torque compensation gain during lowering / TorqComp-gain@red	Sets the torque compensation gain at lowering.	0.500 to 10.000	1.000	No	No	No	A	696H	*5-14*
S1-24	Torque compensation bias during raising / TorqComp-Bias@ri	Sets the torque compensation bias at raising.	-200.0 to +200.0	0.0 %	No	No	No	A	697H	*5-14*
S1-25	Torque compensation bias during lowering / TorqComp-Bias@red	Sets the torque compensation bias at lowering.	-200.0 to +200.0	0.0 %	No	No	No	A	698H	*5-14*
S1-26	Dwell speed reference / DWELL speed	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	0.0 Hz	No	A	A	A	699H	–
S1-27	Frequency detection during deceleration / Door Zone Level	S1-27 setting is enable during deceleration. Multi-function digital output (setting 42) is closed when output frequency or motor speed (CLV) is below S1-27 setting. This signal is used for lift door control.	0.0 to 120.0	0.0 Hz	No	A	A	A	69AH	–

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

■Slip compensation for lift: S2

Parameters for slip compensation for lift are shown in the following table.

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
S2-01	Motor rated speed / Rated rpm	Sets the motor rated speed in units of 1 min^{-1}.	300 to 1800	1380 min^{-1}	No	A	No	No	6AEH	*5-39*
S2-02	Slip compensation gain at motoring / SlipComp gainMot	Sets the slip compensation gain when the leveling accuracy is needed.	0.00 to 2.50	0.70	Yes	A	A	No	6AFH	*5-39*
S2-03	Slip compensation gain at regenerating / SlipComp gainGen	Sets the slip compensation gain when the leveling accuracy is needed.	0.00 to 2.50	1.00	Yes	A	A	No	6B0H	*5-39*
S2-07	Slip compensation primary delay time / SlipComp-Delay T	Slip compensation primary delay time is set in ms units. Usually setting is not necessary. Adjust this constant at the following times. • Reduce the setting when slip compensation responsive is slow. • When speed is not stabilized, increase the setting.	0 to 10000	200 ms	No	No	A	No	6B4H	*5-39*
S2-15	Slip compensation selection during regeneration / Slip Comp @gene	0: Disabled. 1: Enabled. When the slip compensation during regeneration function has been activated, as regeneration capacity increases momentarily, it may be necessary to use a braking option (Braking resistor, Braking Resistor Unit or Braking Unit.)	0 or 1	1	No	A	A	No	6BCH	*5-39*

■Lift specific function: S3

Parameters for lift specific function are shown in the following table.

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
S3-01	Short-floor function selection / Short floor sel	Short-floor function selection 0: Disabled 1: Enabled	0 or 1	0	No	A	A	A	6BDH	*5-18*

◆ T: Motor Autotuning

The following settings are made with the motor autotuning parameters (T parameters): Settings for 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	MEMOBUS Register	Page
T1-01	Autotuning mode selection / Tuning Mode Sel	Sets the autotuning mode. 0: Rotational autotuning 1: Stationary autotuning 2: Stationary autotuning for line-to-line resistance only	0 to 2 *1	1	No	Yes	Yes	Yes	701H	–
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	–
T1-03	Motor rated voltage / Rated Voltage	Sets the rated voltage of the motor.	0.0 to 255.0 *3	200.0 V *3	No	No	Yes	Yes	703H	–
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	–
T1-05	Motor base frequency / Rated Frequency	Sets the base frequency of the motor.	0.0 to 120.0	60.0 Hz	No	No	Yes	Yes	705H	–
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	–
T1-07	Motor base speed / Rated Speed	Sets the base speed of the motor in min^{-1}.	0 to 24000	1450 min^{-1}	No	No	Yes	Yes	707H	–
T1-08	Number of PG pulses / PG Pulses/ Rev	Set the number of pulses per revolution for the PG being used (pulse generator or encoder) without any multiplication factor.	0 to 60000	600 *5	No	No	No	Yes	708H	–
T1-09	No load current / No load current	Sets the no load current of motor.	0.00 to 35.00 *2	4.50 A (E2-03)	No	No	Yes	Yes	709H	–

* 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 of 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 3.7 kW is given.
* 5. The factory setting is set according to o2-09. The value when o2-09=0 (Asia) is given. The value is 1024 when o2-09 is 1 or 2.

◆ U: Monitor Parameters

The following settings are made with the monitor parameters (U parameters): Setting parameters for monitoring in drive made.

■ Status Monitor Parameters: U1

Parameters for monitoring status are shown in the following table.

Parameter Number	Name / Display	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods			MEMOBUS Register
					V/f	Open-loop Vector	Closed-loop Vector	
U1-01	Frequency reference / Frequency Ref	Monitors/sets the frequency reference value.*	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	A	A	A	40H
U1-02	Output frequency / Output Freq	Monitors the output frequency.*	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	A	A	A	41H
U1-03	Output current / 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
U1-04	Control method / Control Method	Displays the current control method.	(Cannot be output.)	-	A	A	A	43H
U1-05	Motor speed / Motor Speed	Monitors the detected motor speed.*	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	No	A	A	44H
U1-06	Output voltage / 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
U1-07	DC bus voltage / 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
U1-08	Output power / Output kWatts	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
U1-09	Torque reference / Torque Reference	Monitors the internal torque reference value for vector control.	10 V: Motor rated torque (0 to ± 10 V possible)	0.1 %	No	A	A	48H

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

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	MEMOBUS Register
U1-10	Input terminal status / Input Term Sts	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 1: External base block is ON	(Cannot be output.)	–	A	A	A	49H
U1-11	Output terminal status / Output Term Sts	Shows output ON/OFF status. U1-11=□□□□□□□□ 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=□□□□□□□□ 1: 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 or AI-14B CH1 input level / Term A1 Level	Monitors the input level of analog input A1 or AI-14B CH1. A value of 100 % corresponds to 10V input.	10 V: 100 % (0 to ± 10 V possible)	0.1 %	A	A	A	4EH

Parameter Number	Name / Display	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods			MEMOBUS Register
					V/f	Open-loop Vector	Closed-loop Vector	
U1-16	Multi-function analog input AI-14B CH2 input voltage / AI-14B CH2 Level	Monitors the input level of multi-function analog input AI-14B CH2. A value of 100 % corresponds to 10 V input.	10 V: 100 % (0 to ±10 V possible)	0.1 %	A	A	A	4FH
U1-17	Multi-function analog input AI-14B CH3 input voltage / AI-14B CH3 Level	Monitors the input level of multi-function analog input AI-14B CH3. A value of 100 % corresponds to 10 V input.	10 V: 100 % (0 to ±10 V possible)	0.1 %	A	A	A	50H
U1-18	Motor secondary current (Iq) / Mot SEC Current	Monitors the calculated value of the motor secondary current. The motor rated secondary current corresponds to 100 %.	10 V: Motor rated secondary 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 secondary current corresponds to 100 %.	10 V: Motor rated secondary 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)	0.01 Hz	A	A	A	53H
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 Board. 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

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	MEMOBUS Register
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-servo 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 number 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 (always 0) 1: Parity error 1: Overrun error 1: Framing error 1: Timeout Not used (always 0)	(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
U1-41	Inverter heat radiation fin temperature / Actual Fin Temp	Monitors the temperature of the heatsink.	10 V: 100 °C	1 °C	A	A	A	68H
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 (-10 V to 10 V)	0.01 %	A	A	A	71H
U1-51	Max Current during acceleration / Max Amp at accel	Monitors the maximum current during acceleration. Cleared each time the Inverter operates.	10 V: Rated current of Inverter (0 V to 10 V)	0.1 A	A	A	A	72H

Parameter Number	Name / Display	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods			MEMOBUS Register
					V/f	Open-loop Vector	Closed-loop Vector	
U1-52	Max Current during deceleration / Max Amp at decel	Monitors the maximum current during deceleration. Cleared each time the Inverter operates.	10 V: Rated current of Inverter (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 current at top speed. Cleared each time the Inverter operates.	10 V: Rated current of Inverter (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 current at Vl speed. Cleared each time the Inverter operates.	10 V: Rated current of Inverter (0 V to 10 V)	0.1 A	A	A	A	75H
U1-55	Operation counter / Operation Cnt	Monitors the lift operation counter. O2-15 can clear this counter.	(Cannot be output.)	–	A	A	A	76H

■ Fault Trace: U2

Parameters for error tracing are shown in the following table.

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	MEMOBUS Register
U2-01	Current fault / Current Fault	The content of the current fault.	(Cannot be output.)	–	A	A	A	80H
U2-02	Last fault / Last Fault	The error content of the last fault.		–	A	A	A	81H
U2-03	Reference frequency at fault / Frequency Ref	The reference frequency when the last fault occurred.		0.01 Hz	A	A	A	82H
U2-04	Output frequency at fault / Output Freq	The output frequency when the last fault occurred.		0.01 Hz	A	A	A	83H
U2-05	Output current at fault / Output Current	The output current when the last fault occurred.		0.1 A	A	A	A	84H
U2-06	Motor speed at fault / Motor Speed	The motor speed when the last fault occurred.		0.01 Hz	No	A	A	85H
U2-07	Output voltage reference at fault / Output Voltage	The output reference voltage when the last fault occurred.		0.1 V	A	A	A	86H
U2-08	DC bus voltage at fault / DC Bus Voltage	The main current DC voltage when the last fault occurred.		1 V	A	A	A	87H
U2-09	Output power at fault / Output kWatts	The output power when the last fault occurred.		0.1 kW	A	A	A	88H
U2-10	Torque reference at fault / Torque Reference	The reference torque when the last fault occurred. The motor rated torque corresponds to 100 %.		0.1 %	No	A	A	89H
U2-11	Input terminal status at fault / Input Term Sts	The input terminal status when the last fault occurred. The format is the same as for U1-10.		–	A	A	A	8AH
U2-12	Output terminal status at fault / Output Term Sts	The output terminal status when the last fault occurred. The format is the same as for U1-11.		–	A	A	A	8BH
U2-13	Operation status at fault / Inverter Status	The operating status when the last fault occurred. The format is the same as for U1-12.		–	A	A	A	8CH

Parameter Number	Name / Display	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods			MEMOBUS Register
					V/f	Open-loop Vector	Closed-loop Vector	
U2-14	Cumulative operation time at fault / Elapsed Time	The operating time when the last fault occurred.	(Cannot be output.)	1 hr	A	A	A	8DH

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

■Fault History: U3

Parameters for error log are shown in the following table.

Parameter Number	Name	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods			MEMOBUS Register
					V/f	Open-loop Vector	Closed-loop Vector	
U3-01	Last fault / Last Fault	The error content of 1st last fault.	(Cannot be output.)	–	A	A	A	90H (800H)
U3-02	Second last fault / Fault Message 2	The error content of 2nd last fault.		–	A	A	A	91H (801H)
U3-03	Third last fault / Fault Message 3	The error content of 3rd last fault.		–	A	A	A	92H (802H)
U3-04	Fourth last fault / Fault Message 4	The error content of 4th last fault.		–	A	A	A	93H (803H)
U3-05	Cumulative operation time at fault / Elapsed Time 1	The total operating time when the 1st previous fault occurred.		1 hr	A	A	A	94H (80AH)
U3-06	Accumulated time of second fault / Elapsed Time 2	The total operating time when the 2nd previous fault occurred.		1 hr	A	A	A	95H (80BH)
U3-07	Accumulated time of third fault / Elapsed Time 3	The total operating time when the 3rd previous fault occurred.		1 hr	A	A	A	96H (80CH)
U3-08	Accumulated time of fourth/oldest fault / Elapsed Time 4	The total operating time when the 4th previous fault occurred.		1 hr	A	A	A	97H (80DH)
U3-09	Fifth last fault / Fault Message 5	The error content of 5th last fault		–	A	A	A	804H
U3-10	Sixth last fault / Fault Message 6	The error content of 6th last fault		–	A	A	A	805H
U3-11	Seventh last fault / Fault Message 7	The error content of 7th last fault		–	A	A	A	806H
U3-12	Eighth last fault / Fault Message 8	The error content of 8th last fault		–	A	A	A	807H

Parameter Number	Name	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods			MEMOBUS Register
					V/f	Open-loop Vector	Closed-loop Vector	
U3-13	Ninth last fault Fault Message 9	The error content of 9th last fault	(Cannot be output.)	–	A	A	A	808H
U3-14	Tenth last fault Fault Message 10	The error content of 10th last fault		–	A	A	A	809H
U3-15	Accumulated time of fifth/oldest fault Elapsed Time 5	The total operating time when the 5th previous fault occurred.		1 hr	A	A	A	80EH
U3-16	Accumulated time of sixth/oldest fault Elapsed Time 6	The total operating time when the 6th previous fault occurred.		1 hr	A	A	A	80FH
U3-17	Accumulated time of seventh/oldest fault Elapsed Time 7	The total operating time when the 7th previous fault occurred.		1 hr	A	A	A	810H
U3-18	Accumulated time of eighth/oldest fault Elapsed Time 8	The total operating time when the 8th previous fault occurred.		1 hr	A	A	A	811H
U3-19	Accumulated time of ninth/oldest fault Elapsed Time 9	The total operating time when the 9th previous fault occurred.		1 hr	A	A	A	812H
U3-20	Accumulated time of tenth/oldest fault Elapsed Time 10	The total operating time when the 10th previous fault occurred.		1 hr	A	A	A	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)

The factory settings of the following parameters will change if the control method (A1-02) is changed.

Parameter Number	Name	Setting Range	Unit	Factory Setting		
				V/f A1-02=0	Open-loop Vector A1-02=2	Closed-loop Vector A1-02=3
C4-02	Torque compensation delay time constant	0 to 10000	1 ms	200	50	–
E1-07	Mid. output frequency voltage (FB)	0.0 to 120.0	0.1 Hz	3.0	3.0	0.0
E1-08	Mid. output frequency voltage (VB)*1	0.0 to 255.0 (0.0 to 510.0)	0.1 V	15.0 *1*2	11.0	0.0
E1-09	Min. output frequency (FMIN)	0.0 to 120.0	0.1 Hz	1.5 *1	0.5	0.0
E1-10	Min. output frequency voltage (VMIN)*1	0.0 to 255.0 (0.0 to 510.0)	0.1 V	9.0 *1*2	2.0	0.0
S1-04	DC injection braking time at start	0.00 to 10.00	0.01 s	0.50	0.30	0.00

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

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

■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	60.0	60.0	60.0
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	200.0	200.0	200.0
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	60.0	60.0	60.0
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	14.0	11.0	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	1.5	0.5	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	7.0	2.0	0.0

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

■200 V and 400 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	60.0	60.0	60.0
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	200.0	200.0	200.0
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	60.0	60.0	60.0
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	12.0	11.0	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	1.5	0.5	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	6.0	2.0	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)

The factory settings of the following parameters will change if the Inverter capacity (o2-04) is changed.

■200 V Class Inverters

Parameter Number	Name	Unit	Factory Setting				
–	Inverter Capacity	kW	3.7	5.5	7.5	11	15
o2-04	kVA selection	-	4	5	6	7	8
E2-01	Motor rated current	A	14.00	19.60	26.60	39.7	53.0
E2-02	Motor rated slip	Hz	2.73	1.50	1.30	1.70	1.60
E2-03	Motor no-load current	A	4.50	5.10	8.00	11.2	15.2
E2-05	Motor line-to-line resistance	Ω	0.771	0.399	0.288	0.230	0.138
E2-06	Motor leak inductance	%	19.6	18.2	15.5	19.5	17.2
E2-10	Motor iron loss for torque compensation	W	112	172	262	245	272
L8-02	Overheat pre-alarm level	°C	75	73	75	80	65

Parameter Number	Name	Unit	Factory Setting					
–	Inverter Capacity	kW	18.5	22	30	37	45	55
o2-04	kVA selection	-	9	A	B	C	D	E
E2-01	Motor rated current	A	65.8	77.2	105.0	131.0	160.0	190.0
E2-02	Motor rated slip	Hz	1.67	1.70	1.80	1.33	1.60	1.43
E2-03	Motor no-load current	A	15.7	18.5	21.9	38.2	44.0	45.6
E2-05	Motor line-to-line resistance	Ω	0.101	0.079	0.064	0.039	0.030	0.022
E2-06	Motor leak inductance	%	20.1	19.5	20.8	18.8	20.2	20.5
E2-10	Motor iron loss for torque compensation	W	505	538	699	823	852	960
L8-02	Overheat pre-alarm level	°C	75	75	70	85	90	80

■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	-	24	25	26	27	28	29
E2-01	Motor rated current	A	7.00	7.00	9.80	13.30	19.9	26.5
E2-02	Motor rated slip	Hz	2.70	2.70	1.50	1.30	1.70	1.60
E2-03	Motor no-load current	A	2.30	2.30	2.60	4.00	5.6	7.6
E2-05	Motor line-to-line resistance	Ω	3.333	3.333	1.595	1.152	0.922	0.550
E2-06	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	-	2A	2B	2C	2D	2E	2F
E2-01	Motor rated current	A	32.9	38.6	52.3	65.6	79.7	95.0
E2-02	Motor rated slip	Hz	1.67	1.70	1.80	1.33	1.60	1.46
E2-03	Motor no-load current	A	7.8	9.2	10.9	19.1	22.0	24.0
E2-05	Motor line-to-line resistance	Ω	0.403	0.316	0.269	0.155	0.122	0.088
E2-06	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	72	80	82	73

5

Parameter Settings by Function

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Current Derating and Limitation

The Inverter rated current derating and limitation are changed by carrier frequency setting.

◆ Current Derating and Limitation depending on the carrier frequency

■Related Parameters

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
C6-02	Carrier frequency selection / Carrier Freq Sel	Selects the carrier frequency. 1: 2 k Hz 2: 5 k Hz 3: 8 k Hz 4: 10 k Hz 5: 12.5 k Hz 6: 15 k Hz	1 to 6 *1	3 *2	No	A	A	A	224H

* 1. For Inverters of 200/400 V 3.7 kW to 22 kW, 1 to 6 can be set.
For Inverters of 200/400 V 30 kW to 55 kW, 1 to 4 can be set.

* 2. For Inverters of 200/400 V 3.7 kW to 22 kW, the value is 3.
For Inverters of 200/400 V 30 kW to 55 kW, the value is 2.

■Rated Current Derating

The Inverter overload capability depends on the carrier frequency setting.

If the carrier frequency is increased, a derating for the rated current like shown in *Fig 5.1* must be considered.

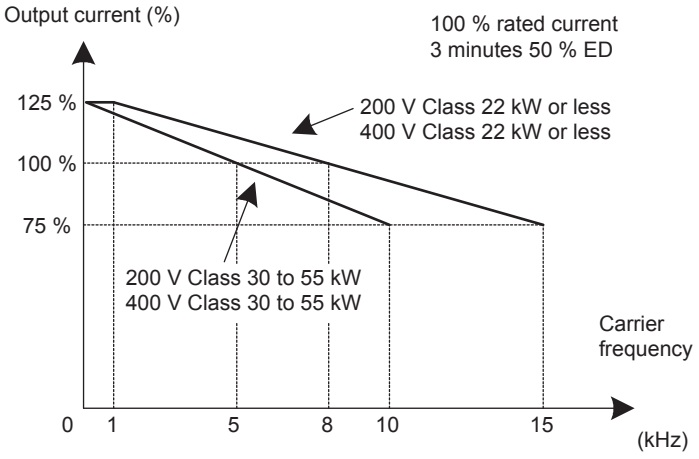


Fig 5.1 Current Derating depending on the carrier frequency

■Current limit level

The Varispeed L7 limits the output current at low frequencies. Current limit level that change with the Inverter capacity. The current limitation in the low frequency is as follows.

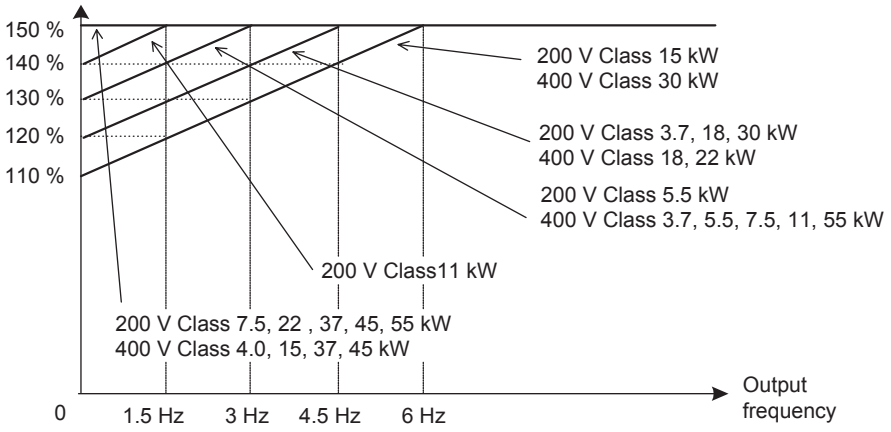


Fig 5.2 Low frequency current limitation

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.
- Check the motor data settings to reduce the starting current.
- If the starting current is bigger than the current limit, apply the bigger size Inverter.

Control Sequence

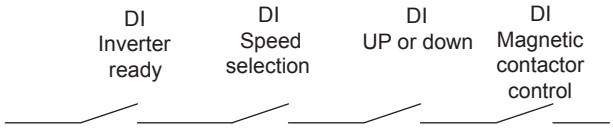
This section explains the control sequence.

◆ Run Commands

■Run

To start the lift in up or down direction, the following conditions have to be fulfilled:

- Speed reference must be selected.
- The hardware base block signal must be released (not base block condition).
- The magnetic contactor confirmation signal must be closed when it is selected.
- To start in the up direction, the forward run signal must be set. To start in the down direction the reverse run signal must be set.



■Stop

The lift can be stopped as follows:

- The Run Command (forward or reverse) signal is removed.
- The speed reference selection signal is removed.

■Run Command Source Selection

The input source for the forward/reverse signal can be selected in parameter b1-02.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
b1-02	Run Command source selection Run Source	Sets the Run Command input method. 0: Digital Operator 1: Control circuit terminal (digital multi-function inputs) 2: MEMOBUS communications 3: Option Board	0 to 3	1	No	A	A	A	181H

■Forward/Reverse Commands Using the Digital Operator (b1-02=0)

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

■Forward/Reverse Commands Using Control Circuit Terminals (b1-02=1, factory setting)

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

■Forward/Reverse Commands Using Memobus Communications (b1-02=2)

When b1-02 is set to 2 the Forward/Reverse Command can be set using Memobus communications.

■Forward/Reverse Commands Using an Input Option Board (b1-02=3)

When b1-02 is set to 3 the Forward/Reverse Command can be set using an input option board, for example a field bus communication board.

◆ Speed Reference Source Selection

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

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
b1-01	Reference source selection Reference Source	Sets the frequency reference input method. 0: Digital Operator 1: Control circuit terminal (analog input) 2: MEMOBUS communications 3: Option Board	0 to 3	0	No	A	A	A	180H

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

When b1-01 is set to 0, the speed reference can be selected from preset speeds using the multi-function contact inputs of the Inverter. Refer to *page 5-6, Speed Selection Sequence Using Multi-function Contact Inputs* for details.

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

When b1-01 is set to 1, d1-18=0 and H3-15 (Terminal A1 function selection) 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 board AI-14B is installed, the A1 signal is replaced by the Channel 1 input of the AI-14B board.
The analog reference signal can be used as well as 1st speed if multi-step speed operation is selected (d1-18=0) (Refer to *page 5-6, Speed Selection Sequence Using Multi-function Contact 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 Board (b1-01=3)

When b1-01 is set to 3 the speed reference can be input using an input option board, for example a field bus communication board.

◆ Speed Selection Sequence Using Multi-function Contact Inputs

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

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
d1-18	Speed priority selection Speed Priority Sel	Speed reference priority selection 0: Use multi-step speed reference (d1-01 to d1-08) 1: High speed reference has priority. 2: Leveling speed reference has priority.	0 to 2	0	Yes	A	A	A	2A7H

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

Maximum 8 preset speed steps can be selected. The Inverter is started using the Forward/Reverse Command. It stops when the Forward/Reverse Command is removed.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
d1-01 to d1-08 *3	Frequency reference 1-8 Reference 1-8	Sets the frequency reference.	0 to 120.00 *1*2	0.00 Hz	Yes	A	A	A	280H to 287H

* 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).

* 3. Not displayed when d1-18 is 1 or 2.

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

Terminal	Parameter Number	Set Value	Details
S4	H1-02	3	Multi-step speed reference 1 [When H3-09 is set to 2 (Auxiliary frequency reference) this function is combined with the master/auxiliary speed switch.]
S5	H1-03	4	Multi-step speed reference 2
S6	H1-04	5	Multi-step speed reference 3

Setting Precautions

When setting analog inputs to step 1 to step 2, observe the following precautions.

- **Step 1**
  When setting terminal A1's analog input to step 2, set b1-01 to 1, and when setting d1-01 (Frequency Reference 1) to step 1, set b1-01 to 0.

- **Step 2**
  When setting AI-14B CH2's analog input to step 2, set H3-09 to 2 (auxiliary frequency reference 1).
- **Step 3**
  When setting AI-14B CH3's analog input to step 3, set H3-05 to 3 (auxiliary frequency reference 2).

■Speed Selection Table

The following table shows the combinations of the multi-function contact 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 board AI-14B if it is installed.

If an AI-14B option board is used and the functions for channels CH2 and CH3 are set for “Auxiliary frequency reference 1” (H3-05/09=2) and “Auxiliary frequency reference 2” (H3-05/09=3) the speeds 2 and 3 are set at the CH2 and CH3 inputs of the option board.

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 multi-function contact inputs.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
d1-09 *3	Vn reference Nomin Speed vn	Sets the frequency reference when Nominal speed reference is ON for a multi-function input.	0 to 120.00 *1*2	50.00 Hz	Yes	Q	Q	Q	288H
d1-10 *3	V1 reference Interm Speed v1	Sets the frequency reference when Intermediate speed reference is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	28BH
d1-11 *3	V2 reference Interm Speed v2	Sets the frequency reference when Nominal speed reference, Intermediate speed reference, and Releveling speed reference are ON for multi-function inputs.		0.00 Hz	Yes	A	A	A	28CH

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
d1-12 *3	V3 reference Interm Speed v3	Sets the frequency reference when Intermediate speed reference and Releveling speed reference are ON for multi-function inputs.	0 to 120.00 *1*2	0.00 Hz	Yes	A	A	A	28DH
d1-13 *3	Vr reference Relevel Speed vr	Sets the frequency reference when Releveling speed reference is ON for a multi-function input.		0.00 Hz	Yes	A	A	A	28EH
d1-17	Vl (Leveling) reference Level Speed vl	Sets the frequency reference when Leveling speed reference is ON for a multi-function input.		4.00 Hz	Yes	Q	Q	Q	292H

* 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).

* 3. Not displayed when d1-18 is 0.

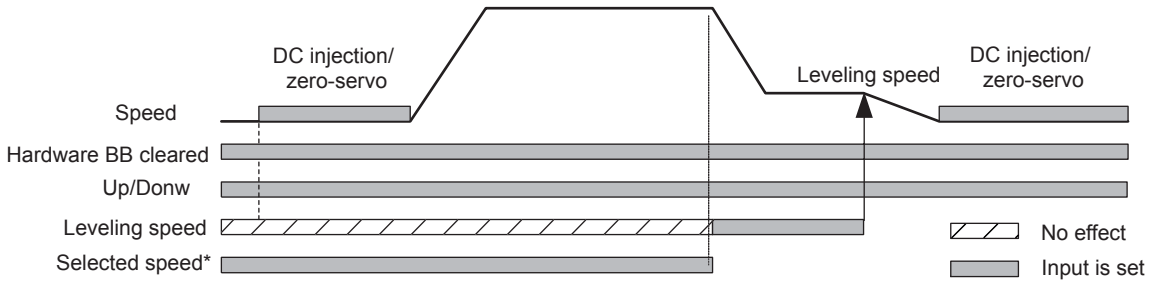
■Multi-function Contact Input Factory Settings

Terminal	Parameter Number	Set Value	Details
S3	H1-01	24	External fault
S4	H1-02	14	Fault reset
S5	H1-03	3	Multi-step speed reference 1
S6	H1-04	4	Multi-step speed reference 2
S7	H1-05	6	JOG frequency command

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

If d1-18 is set to 1 and one multi-function contact 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 Forward/Reverse Command signal is removed.



* Nominal speed, Intermediate speed, or Releveling speed

The following speed selection table shows the different speeds and the according multi-function contact inputs.

When the speed selection, which is not shown in the table, is selected, the Inverter keeps running the previous speed reference.

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	0 Hz
Nominal speed reference (H1-□□=80)	1	0	1	0	0	0	0
Intermediate speed reference (H1-□□=81)	0	1	1	1	0	0	0
Releveling speed reference (H1-□□=82)	0	0	1	1	1	0	0
Leveling speed reference (H1-□□=83)	N/A	N/A	N/A	N/A	N/A	1	0

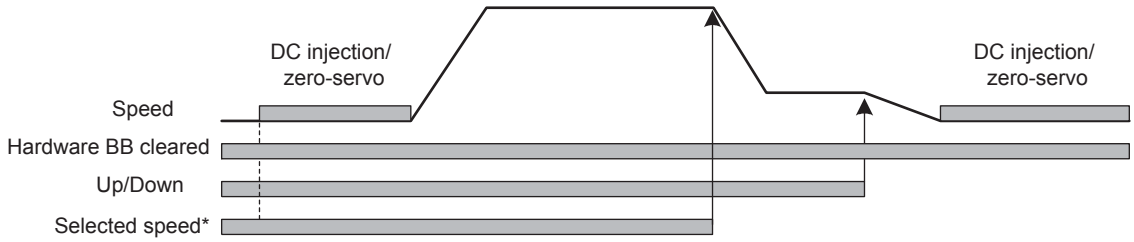
* 0 = disabled, 1 = enabled

■Higher Speed Priority is Selected and no Leveling Speed Input is Selected (H1-□□≠83)

When the leveling speed reference is not selected for any multi-function contact input, the Inverter decelerates to the leveling speed (d1-17) when all selected speed signals are removed. The selected speed must be different from leveling and inspection speed.

The Inverter stops when the Forward/Reverse Command signal is removed.

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



* Nominal speed, Intermediate speed, or Releveling speed

The following speed selection table shows the different speeds and the according multi-function contact 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

To stop the Inverter, remove the direction signal (forward/reverse signal).

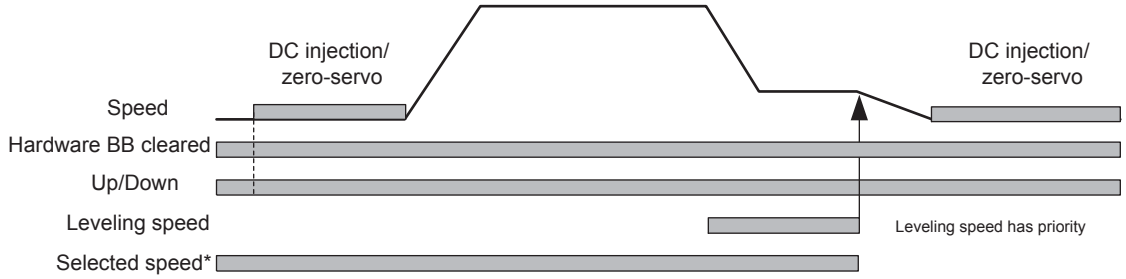
■Separate Speed Selection Inputs, Leveling Speed Has Priority (d1-18=2)

The related parameters and the multi-function contact 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 contact 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. The selected speed must be different from leveling speed and inspection speed.

The Inverter stops when all speed reference is removed or the Forward/Reverse Command signal is removed.



* Nominal speed, Intermediate speed, or Releveling speed

The following speed selection table shows the different speeds and the according multi-function contact 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 reference (H1-□□=80)	1	0	1	0	0	N/A
Intermediate speed reference (H1-□□=81)	0	1	1	1	0	N/A
Releveling speed reference (H1-□□=82)	0	0	1	1	1	N/A
Leveling speed reference (H1-□□=83)	0	0	0	0	0	1

* 0 = disabled, 1 = enabled

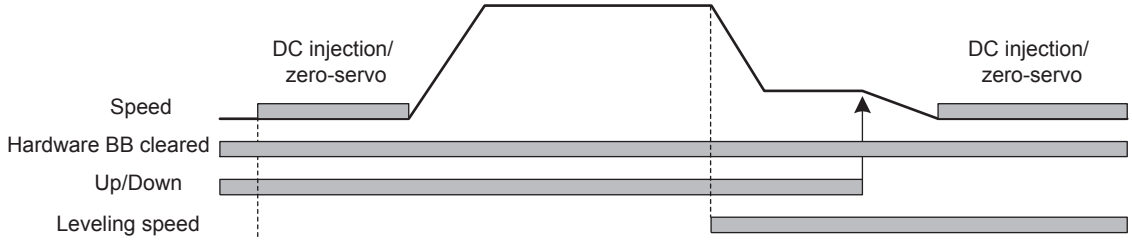
■Leveling Speed Priority is Selected and no Nominal Speed Input is Selected (H1-□□≠80)

If d1-18 is set to 2 and no multi-function contact input is set for the nominal speed 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 Forward/Reverse Command signal.

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 multi-function contact 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 reference (H1-□□=80)	N/A	N/A	–	N/A	N/A	N/A
Intermediate speed reference (H1-□□=81)	0	1	–	1	0	N/A
Releveling speed reference (H1-□□=82)	0	0	–	1	1	N/A
Leveling speed reference (H1-□□=83)	0	0	–	0	0	1

* 0 = disabled, 1 = enabled

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

◆ Emergency Stop

If a multi-function contact input (H1-□□) is set to 15 or 17 (emergency stop), this input can be used to fast stop the Inverter in 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 contact input (H1-□□) to 15, and if inputting the emergency stop with an NC contact, set the multi-function contact input (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 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
C1-09	Emergency stop time / Fast Stop Time	Sets the deceleration time when the multi-function input "Emergency (fast) stop" is set to ON. This functions can be used as a stopping method when a fault has been detected.	0.00 to 600.00 *	3.00 s	No	A	A	A	208H

* The setting range for acceleration/deceleration times depends on the setting for C1-10. When C1-10 is set to 0, the setting range for acceleration/deceleration times becomes 0.00 to 600.00 seconds.

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

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

◆ Inspection RUN

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

■Related parameters

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
d1-14 *3	Inspection reference / Inspect Speed vi	Sets the frequency reference when Inspection Run Command is ON for a multi-function input.	0 to 120.00 *1*2	25.00 Hz	Yes	Q	Q	Q	28FH

* 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).

* 3. Not displayed when d1-18 is 0.

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

Set Value	Function	Control Methods		
		V/f	Open-loop Vector	Closed-loop Vector
84	Inspection Run Command	Yes	Yes	Yes

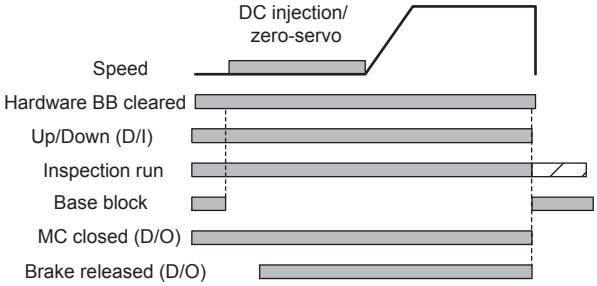
The Inspection Run Command must be set before setting the forward/reverse signal. During start of the inspection run the normal brake sequence is used and the Inverter accelerates to the inspection speed (d1-14).

To stop the Inverter, the Inspection Run Command or the Forward/Reverse Command must be removed. In this case:

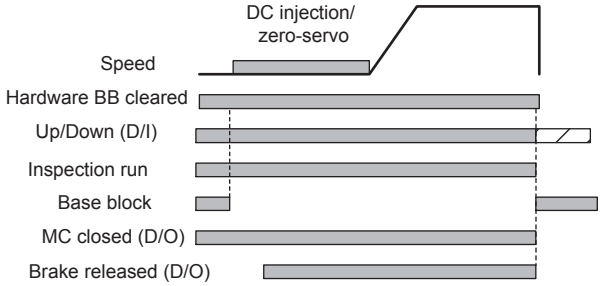
- The Inverter output is cut by baseblock immediately
- The brake release signal is removed immediately
- The magnetic contactor control output is removed immediately

The falling edge of the Inspection Run Command or Forward/Reverse Commands triggers the magnetic contactor open command, the motor brake close command, and the base block.

Inspection run
(Stop with up/down signal removed)



Inspection run
(Stop with Inspection run signal removed)



◆ Brake Sequence

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

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
H3-15	Terminal A1 function selection / Terminal A1 func	Sets the multi-function analog input function for terminal A1. 0: Frequency reference 1: Torque compensation	0 or 1	0	No	No	No	A	434H
S1-01	Zero-speed level (DC injection braking starting frequency) / ZeroSpeed@stop	Used to set the frequency which starts DC injection braking in units of Hz when deceleration to stop is selected. When b2-01 is less than E1-09, E1-09 becomes the DC injection braking starting frequency. (For closed-loop vector control, S1-01 is the zero-speed operation starting frequency)	0.0 to 10.0	1.2 Hz *	No	A	A	A	680H

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
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
S1-03	DC injection braking current 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
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	0.50 s *	No	A	A	A	683H
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	684H
S1-06	Brake release delay time / Brake open delay	Used to set the time to output Brake release command in units of 1second.	0.00 to 10.00	0.20	No	A	A	A	685H
S1-07	Brake close delay time / Brake CloseDelay	Used to set the time to output Brake close command in units of 1second.	0.00 to S1-05	0.10	No	A	A	A	686H
S1-16	RUN delay time / Run Delay T	Used to set RUN delay time in units of 1 second.	0.00 to 1.00	0.10 s	No	A	A	A	68FH
S1-17	DC injection current gain at regeneration / DC Inj gain@gen	Used to set the DC injection gain when Inverter is in the regenerative mode.	0 to 400	100 %	No	No	A	No	690H
S1-18	DC injection current gain at motoring / DC Inj gain@mot	Used to set the DC injection gain when Inverter is in the motoring mode.	0 to 400	20 %	No	No	A	No	691H
S1-19	Magnetic contactor close delay time / Cont open delay	Used to set the delay time to close the magnetic contactor in units of 1 second.	0.00 to 1.00	0.10 s	No	A	A	A	6A6H
S1-20	Zero-servo gain / Zero Servo gain	Adjust the strength of the zero-servo lock. When the closed-loop vector control is selected, a position control loop is created and the motor stops at start or stop. Increasing the zero-servo gain in turn increases the strength of the lock. Increasing it by too much will cause oscillation.	0 to 100	5	No	No	No	A	693H

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
S1-21	Zero-servo completion width / Zero Servo Count	Sets the output width of the zero-servo completion signal. The zero-servo completion signal is ON when the current position is within the range (the zero-servo position + zero-servo completion width.) Set the allowable position displacement from the zero-servo position to 4 times the pulse rate of the PG (pulse generator, encoder) in use.	0 to 16383	10	No	No	No	A	694H
S1-22	Torque compensation time at start / torque incr T	Sets the time to torque reference to reach to 300 % torque reference in units of 1ms.	0 to 5000	500 ms	No	No	No	A	695H
S1-23	Torque compensation gain during lowering / TorqComp-gain@red	Sets the torque compensation gain at lowering.	0.500 to 10.000	1.000	No	No	No	A	696H
S1-24	Torque compensation bias during raising / TorqCompBias@ri	Sets the torque compensation bias at raising.	-200.0 to +200.0	0.0 %	No	No	No	A	697H
S1-25	Torque compensation bias during lowering / TorqComp-Bias@red	Sets the torque compensation bias at lowering.	-200.0 to +200.0	0.0 %	No	No	No	A	698H

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

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

Set Value	Function	Control Methods: V/f	Control Methods: Open-loop Vector	Control Methods: Closed-loop Vector
80 to 83	Speed selection inputs (refer to *page 5-6, Speed Selection Sequence Using Multi-function Contact Inputs*)	Yes	Yes	Yes
86	Magnetic contactor answer back signal	Yes	Yes	Yes

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

Set Value	Function	Control Methods: V/f	Control Methods: Open-loop Vector	Control Methods: Closed-loop Vector
40	Brake release command	Yes	Yes	Yes
41	Magnetic 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 to other than 14.(H3-05/09 ≠ 14, torque reference not selected)

The figure below shows the timing chart for this brake sequence when high speed has priority and a leveling speed input is selected.

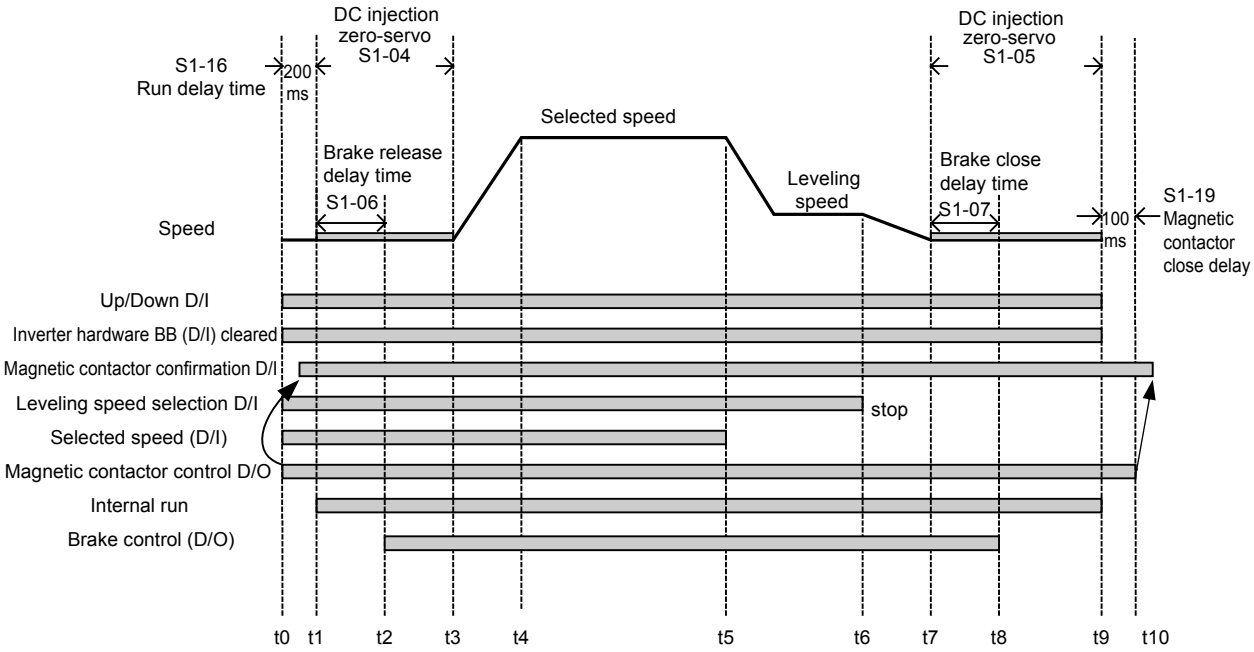


Fig 5.3 Timing chart of brake sequence without torque compensation at start

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 (Forward/Reverse)
	The Inverter gets the hardware base block disable signal (Not BB condition).
	The Inverter receives the speed reference signal.
	The Inverter sets the magnetic contactor close signal.
	The Inverter waits for the magnetic contactor confirmation signal. If no multi-function contact input is set for "Magnetic contactor conformation signal", the sequence is proceeded after exceeding the Run 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 release delay time (S1-06), the Inverter starts releasing the brake.
t2-t3	The Inverter keeps DC injection/zero-servo 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 (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 selected speed 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 until S1-05 – S1-07 time has 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 Magnetic contactor close delay time (S1-19) has passed, the Inverter releases the magnetic contactor control signal.

■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, make either of the following settings.

- Set the Terminal A1 function selection to “Torque compensation” (H3-15=1)
- Set one of the input channels CH2 or CH3 of the optional analog input board AI-14B to “Torque Compensation” (H3-05,H3-09=14).

Fig 5.4 shows the timing chart for this brake sequence.

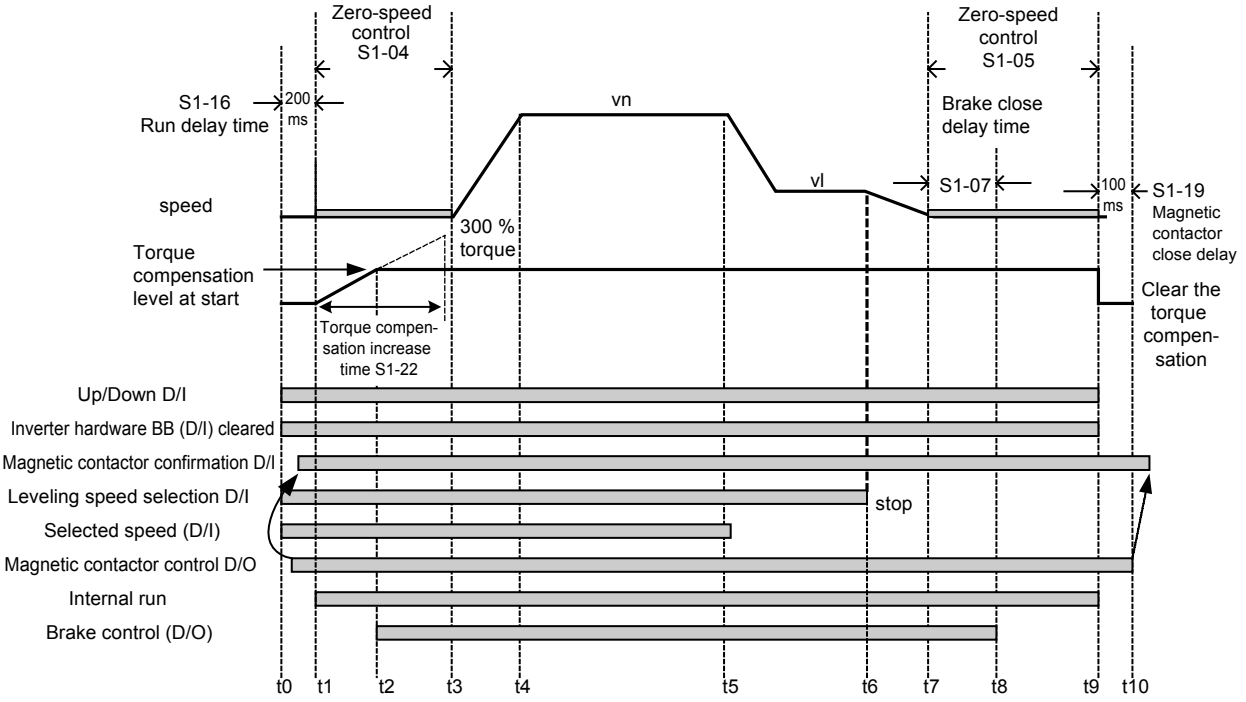


Fig 5.4 Timing chart of Brake sequence with torque compensation at start

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

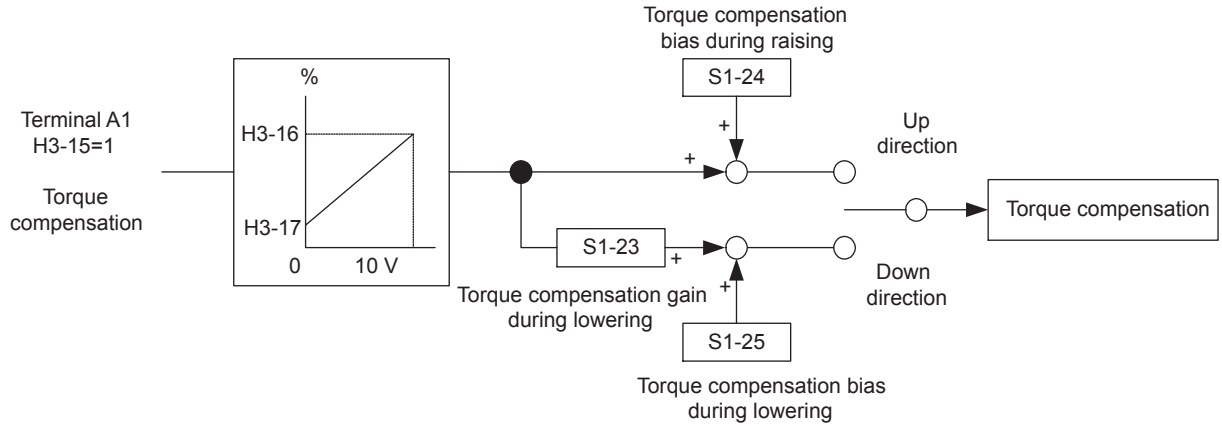
Timing	Description
t0-t1	The Inverter gets the direction signal (Forward/Reverse)
	The Inverter gets the hardware base block signal disable signal (Not BB condition).
	The Inverter receives the speed reference signal.
	The Inverter sets the magnetic contactor close signal.
	The Inverter waits for the magnetic contactor confirmation signal. If no multi-function contact input is set for “Magnetic contactor conformation signal”, the sequence is proceeded after exceeding the RUN delay time (S1-16).
t1-t2	The Inverter will activate the output. The zero-speed operation is started. The analog torque compensation value is latched and start producing the torque compensation value from zero based on the Torque compensation time at start (S1-22).
	After reaching torque compensation level at start, the Inverter sets the brake release 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	Select zero-speed, the Inverter ramps to stop.

Timing	Description
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 command.
t8-t9	The Inverter continues zero-speed operation until the time S1-05 – S1-07 time has 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 Magnetic contactor close delay time (S1-19), the Inverter releases the magnetic contactor control signal.

■Torque compensation at start

If a load measuring device is installed in the lift, 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 lift is balanced.



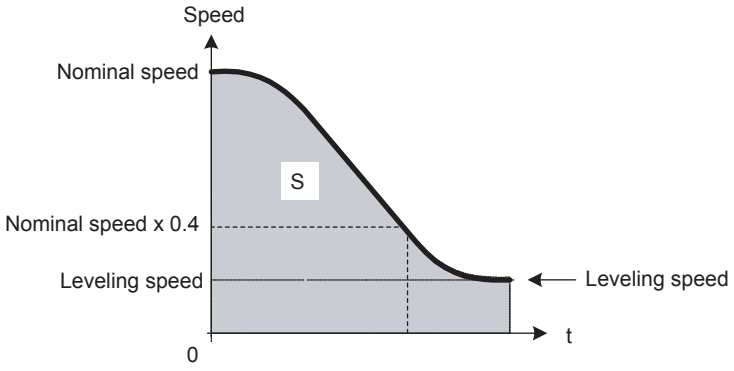
◆ Short Floor Operation

■Related parameters

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
S3-01	Short-floor function selection / Short floor sel	Short-floor function selection 0: Disabled 1: Enabled	0 or 1	0	No	A	A	A	6BDH

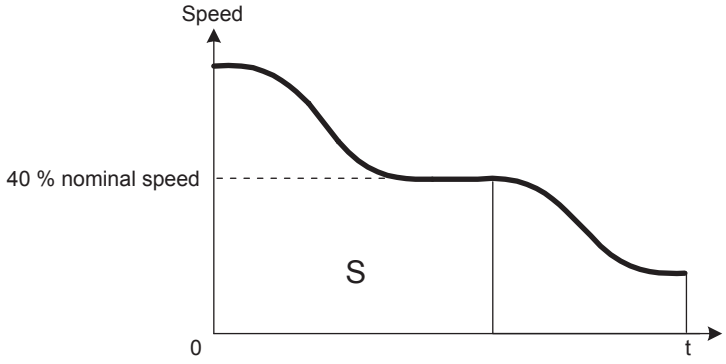
■Principle

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 the leveling 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 the 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 equal to area S is reached. After that it decelerates to the leveling speed.



Acceleration and Deceleration Characteristics

This section explains the acceleration and deceleration characteristics of the Inverter.

◆ Setting Acceleration and Deceleration Times

The acceleration time indicates the time to increase the speed from 0 % to 100 %.
The deceleration time indicates the time to decrease the speed from 100 % to 0 %.

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

- using multi-function contact 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 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
C1-01	Acceleration time 1 / Accel Time 1	Sets the acceleration time to accelerate from 0 Hz to the maximum output frequency.	0.00 to 600.00 *	3.00 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.			Yes	Q	Q	Q	201H
C1-03	Acceleration time 2 / Accel Time 2	Sets the acceleration time when the multi-function input “accel/decel time 1” is set to ON.			Yes	A	A	A	202H
C1-04	Deceleration time 2 / Decel Time 2	Sets the deceleration time when the multi-function input “accel/decel time 1” is set to ON.			Yes	A	A	A	203H
C1-05	Acceleration time 3 / Accel Time 3	Sets the acceleration time when the multi-function input “accel/decel time 2” is set to ON.			No	A	A	A	204H
C1-06	Deceleration time 3 / Decel Time 3	Sets the deceleration time when the multi-function input “accel/decel time 2” is set to ON.			No	A	A	A	205H
C1-07	Acceleration time 4 / Accel Time 4	Sets the acceleration time when the multi-function input “accel/decel time 1” and “accel/decel time 2” are set to ON.			No	A	A	A	206H
C1-08	Deceleration time 4 / Decel Time 4	Sets the deceleration time when the multi-function input “accel/decel time 1” and “accel/decel time 2” are set to ON.			No	A	A	A	207H
C1-10	Accel/decel time setting unit / Acc/Dec Units	0: 0.01-second units 1: 0.1-second units	0 or 1	0	No	A	A	A	209H
C1-11	Accel/decel time switching frequency / Acc/Dec SW Freq	Sets the frequency for automatic acceleration/deceleration switching. 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 The multi-function input “accel/decel time 1” or “accel/decel time 2” has priority.	0.0 to 120.0	0.0 Hz	No	A	A	A	20AH

* The setting range for acceleration/deceleration times depends on the setting for C1-10. When C1-10 is set to 0, the setting range for acceleration/deceleration times becomes 0.00 to 600.00 seconds.

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

Set Value	Function	Control Methods		
		V/f	Open-loop Vector	Closed-loop Vector
7	Accel/decel time 1	Yes	Yes	Yes
1A	Accel/decel time 2	Yes	Yes	Yes

■Setting Acceleration and Deceleration Time Units

Set the acceleration/deceleration time units using C1-10. The factory setting is 0.

Set value	Details
0	The acceleration/deceleration time setting range is 0.00 to 600.00 in units of 0.01 s.
1	The acceleration/deceleration time setting range is 0.0 to 600.0 in units of 0.1 s.

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

Four acceleration and deceleration times can be set. When two multi-function contact input terminals are set for "Accel/decel time 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

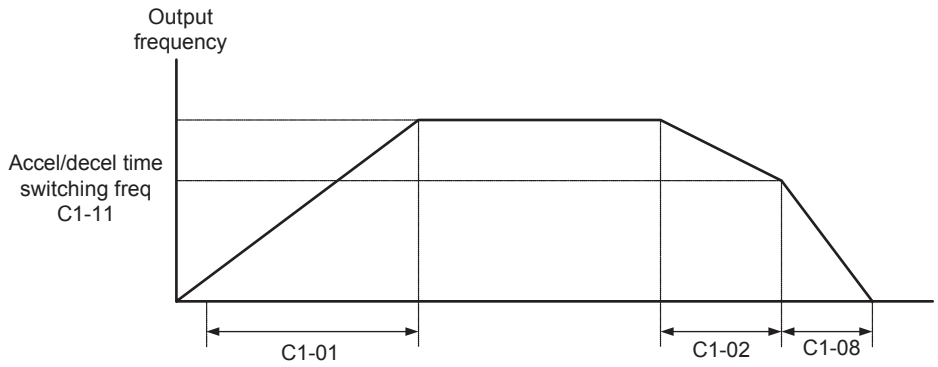
■Automatic Deceleration Time Switch Over Using a Speed Level

This function can be used to switch a deceleration time at the set frequency.

The deceleration times can be switched over automatically at a certain speed which can be set in parameter C1-11, when S1-26 is set 0.0 Hz.

Fig 5.5 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, deceleration are performed using deceleration Time 1 (C1-02).
When output frequency < C1-11, deceleration are performed using deceleration Time 4 (C1-08).

Fig 5.5 Acceleration/deceleration Time Switching Frequency

◆ Acceleration and S-curve Settings

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

■Related Parameters

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
C2-01	S-curve characteristic time at acceleration start / S-Crv Acc @ Start	All sections of the S-curve characteristic time are set in seconds units. 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				No	Q	Q	Q	20CH
C2-03	S-curve characteristic time at deceleration start / S-Crv Dec @ Start				No	Q	Q	Q	20DH
C2-04	S-curve characteristic time at deceleration end / S-Crv Dec @ End				No	Q	Q	Q	20EH
C2-05	S-curve Characteristic time below leveling speed / Scurve @ leveling				No	Q	Q	Q	232H

Fig 5.6 shows the influence of the different S-curve times.

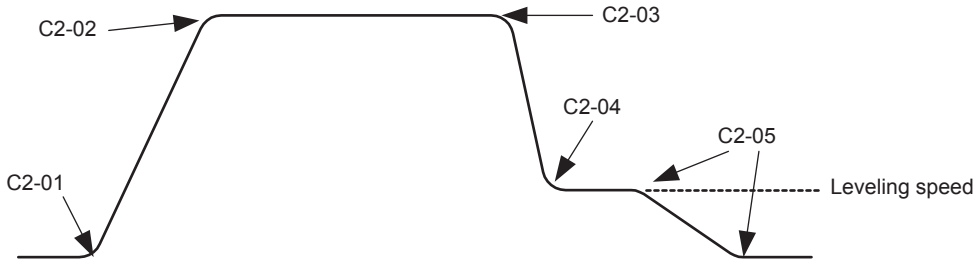


Fig 5.6 S-curve settings

◆ Dwell at Start Function

When S1-26 (dwell speed reference) is set and frequency reference is above S1-26, the dwell at start function is activated.

When the Inverter starts, the Inverter accelerates to S1-26 speed with C1-07 acceleration time. Once the motor speed exceeds the C1-11 frequency, the Inverter will use the original acceleration time.

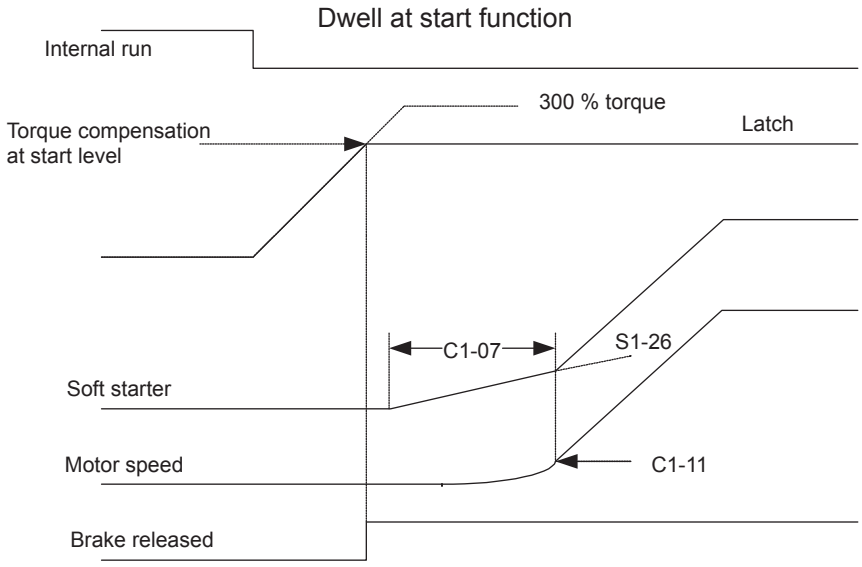
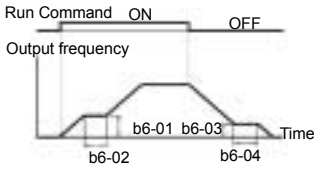


Fig 5.7 Dwell at start function

◆ Output Speed Hold (Dwell Function)

The dwell function holds the speed temporarily.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
b6-01	Dwell frequency at start Dwell Ref @ Start	 The dwell function can be used to hold the output frequency temporarily when driving a motor with a heavy load.	0.0 to 120.0	0.0 Hz	No	A	A	A	1B6H
b6-02	Dwell time at start Dwell Time @ Start		0.0 to 10.0	0.0 s	No	A	A	A	1B7H
b6-03	Dwell frequency at stop Dwell Ref @ Stop		0.0 to 120.0	0.0 Hz	No	A	A	A	1B8H
b6-04	Dwell time at stop Dwell Time @ Stop		0.0 to 10.0	0.0 s	No	A	A	A	1B9H

■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 5.8*.

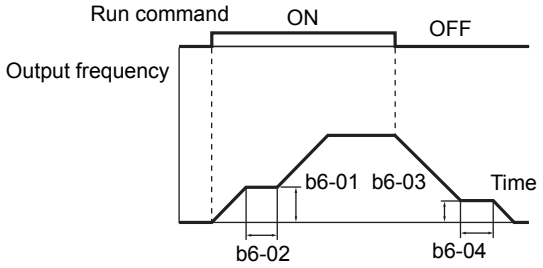


Fig 5.8 Output Frequency Dwell Settings

◆ 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						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 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 disregarded.)	0 to 2	1	No	A	A	No	48FH
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
L3-03	Stall prevention limit during accel StallP CHP Lvl	Sets the lower limit for stall prevention during acceleration, as a percentage of the Inverter rated current, when operation is in the frequency range above E1-06. Usually setting is not necessary.	0 to 100	50 %	No	A	A	No	491H

■Time Chart

The following figure shows the frequency characteristics when L3-01 is set to 1.

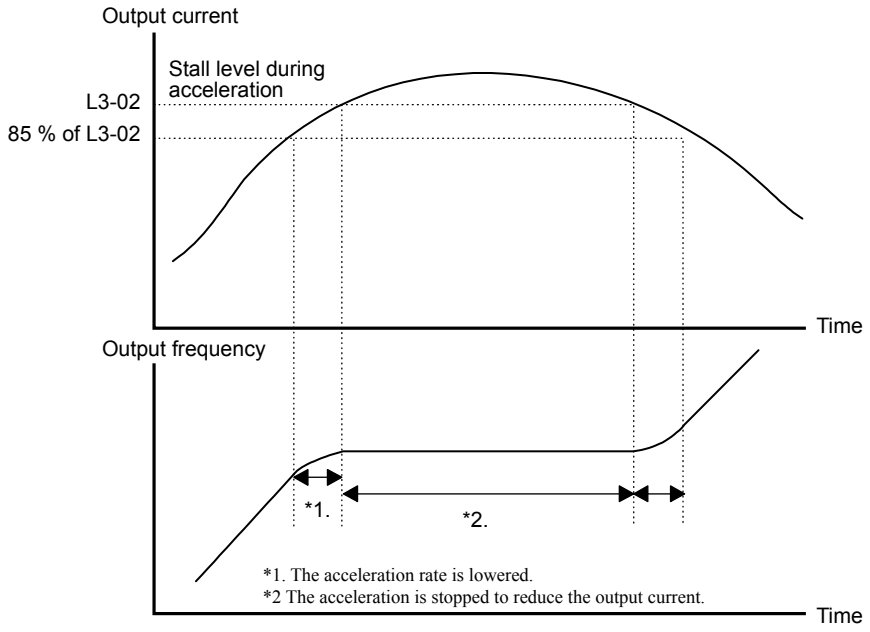


Fig 5.9 Time Chart for Stall Prevention During Acceleration

■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 lift running, consider to use a one size bigger Inverter.

Adjusting Analog Input Signals

This section explains methods of adjusting frequency references.

◆ 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 board AI-14B can be adjusted.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
H3-01	Signal level selection (AI-14B CH1) AI-14 CH1 LvlSel	0: 0 to +10V [11-bit + polarity (positive/negative) input] 1: 0 to ±10V	0 or 1	0	No	A	A	A	410H
H3-02	Gain (AI-14B CH1) AI-14 CH1 gain	Sets the frequency when 10 V is input, as a percentage of the maximum output frequency.	0.0 to 1000.0	100.0 %	Yes	A	A	A	411H
H3-03	Bias (AI-14B CH1) AI-14 CH1 bias	Sets the frequency when 0 V is input, as a percentage of the maximum frequency.	-100.0 to +100.0	0.0 %	Yes	A	A	A	412H
H3-04	Signal level selection (AI-14B CH3) AI-14 CH3 LvlSel	0: 0 to +10V [11-bit + polarity (positive/negative) input] 1: 0 to ±10V	0 or 1	0	No	A	A	A	413H
H3-05	Multi-function analog input (AI-14B CH3) AI-14 CH3 FuncSel	Select from the functions listed in the following table. Refer to the next page.	2,3,14	2	No	A	A	A	414H
H3-06	Gain (AI-14B CH3) AI-14 CH3 gain	Sets the input gain (level) when 10 V is input. Set according to the 100 % value selected from H3-05.	0.0 to 1000.0	100.0 %	Yes	A	A	A	415H
H3-07	Bias (AI-14B CH3) AI-14 CH3 bias	Sets the input gain (level) when 0 V is input. Set according to the 100 % value selected from H3-05.	-100.0 to +100.0	0.0 %	Yes	A	A	A	416H
H3-08	Multi-function analog input AI-14B CH2 signal level selection AI-14 CH2 LvlSel	0: Limit negative frequency settings for gain and bias settings to 0. 1: Do not limit negative frequency settings for gain and bias settings to 0 (i.e., allow reverse operation). 2: 4 to 20 mA (9-bit input). Switch current and voltage input using the switch on AI-14B.	0 to 2	0	No	A	A	A	417H
H3-09	Multi-function analog input AI-14B CH2 function selection AI-14 CH2 FuncSel	Select multi-function analog input function for AI-14B CH2. Refer to the next table.	0 to 1F	3	No	A	A	A	418H
H3-10	Gain (AI-14B CH2) AI-14 CH2 gain	Sets the input gain (level) when 10 V (20 mA) is input. Set according to the 100 % value for the function set for H3-09.	0.0 to 1000.0	100.0 %	Yes	A	A	A	419H

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
H3-11	Bias (AI-14B CH2) AI-14 CH2 bias	Sets the input gain (level) when 0 V (4 mA) is input. Set according to the 100 % value for the function set for H3-09.	-100.0 to +100.0	0.0 %	Yes	A	A	A	41AH
H3-12	Analog input filter time constant CH1-3 FilterTime	Sets primary delay filter time constant in seconds for the four analog input (AI-14B CH1, AI-14B CH2, AI-14B CH3, and Terminal A1). Effective for noise control etc.	0.00 to 2.00	0.03 s	No	A	A	A	41BH
H3-15	Terminal A1 function selection Terminal A1 func	Sets the multi-function analog input function for terminal A1. 0: Frequency reference 1: Torque compensation	0 or 1	0	No	No	No	A	434H
H3-16	Gain (Terminal A1) Terminal A1 gain	Sets the frequency when 10 V is input, as a percentage of the maximum output frequency.	0.0 to 1000.0	100.0 %	Yes	A	A	A	435H
H3-17	Bias (Terminal A1) Terminal A1 bias	Sets the frequency when 0 V is input, as a percentage of the maximum frequency.	-100.0 to +100.0	0.0 %	Yes	A	A	A	436H

Note These parameters are displayed when AI-14B is installed.

■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 board 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 adjusted using the following parameters.

- H3-02 (Gain) and H3-03 (Bias) for Channel 1 of the AI-14B option board
- H3-06 (Gain) and H3-07 (Bias) for Channel 3 of the AI-14B option board
- H3-10 (Gain) and H3-11 (Bias) for Channel 2 of the AI-14B option board
- 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

This section explains how to detect and limit the motor speed.

◆ Speed Agreement Function

There are eight different types of frequency detection methods available. The multi-function contact 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						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
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
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
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

■Multi-function Contact Output Settings: H2-01 to H2-03 (M1 to 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.

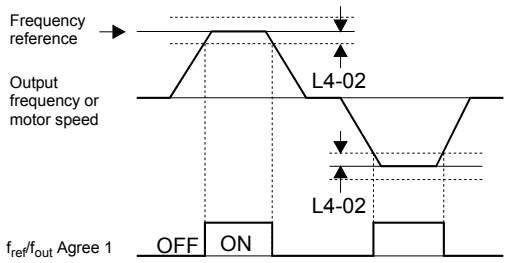
Function	Setting
f_{ref}/f_{out} Agree 1	2
f_{ref}/f_{set} Agree 1	3
Frequency detection 1	4
Frequency detection 2	5
f_{ref}/f_{out} Agree 2	13
f_{ref}/f_{set} Agree 2	14
Frequency detection 3	15
Frequency detection 4	16

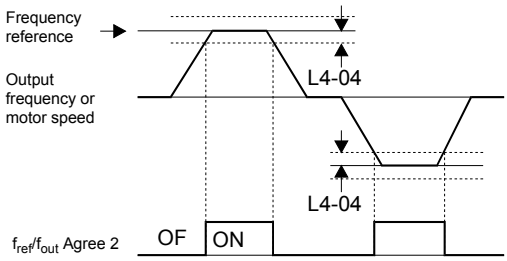
■Setting Precautions

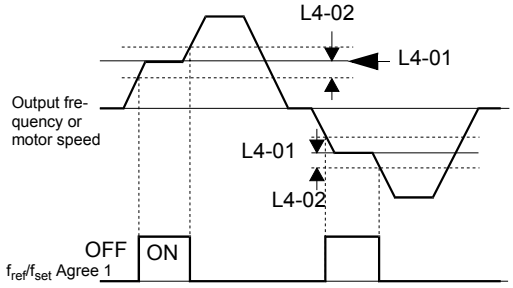
- With L4-01 an absolute speed agreement level is set, i.e. a speed agreement is detected in both directions (up and down).
- With L4-03 a signed speed agreement level is set, i.e. a speed agreement is detected only in the set direction (positive level → up direction, negative level → down direction).

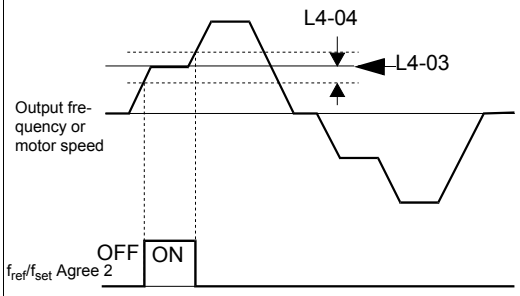
■Time Charts

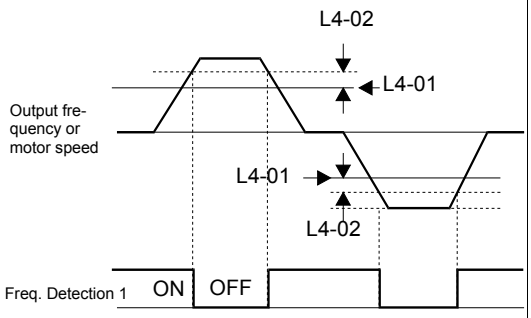
The following table shows the time charts for each of the speed agreement functions.

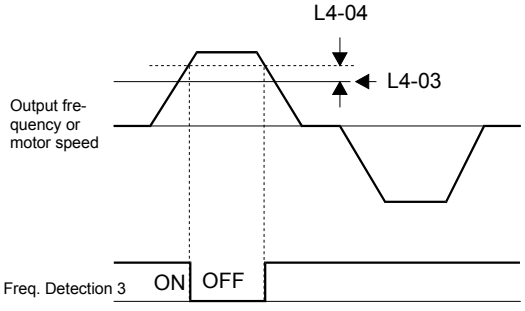
<table>
<tr><th>Related parameter</th><th>L4-01: Speed Agree Level
L4-02: Speed Agree Width</th><th>L4-03: Speed Agree Level +/–
L4-04: Speed Agree Width +/–</th></tr>
<tr><td>f_{ref}/f_{out} Agree</td><td>f_{ref}/f_{out} Agree 1
 

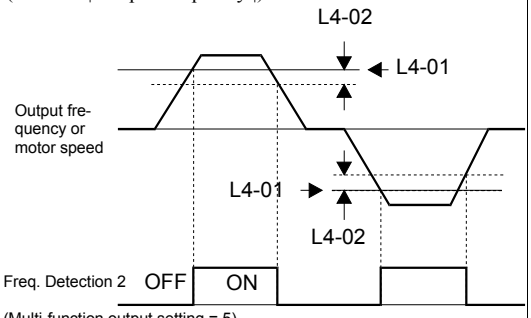
(Multi-function output setting = 2)</td><td>f_{ref}/f_{out} Agree 2
 

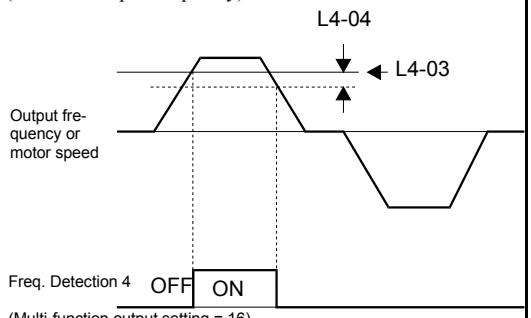
(Multi-function output setting = 13)</td></tr>
<tr><td>f_{ref}/f_{set} Agree</td><td>f_{ref}/f_{set} Agree 1
(ON at the following conditions during frequency agree)
 

(Multi-function output setting = 3)</td><td>f_{ref}/f_{set} Agree 2
(ON at the following conditions during frequency agree)
 

(Multi-function output setting = 14)</td></tr>
<tr><td rowspan="2">Frequency Detection</td><td>Frequency (FOUT) Detection 1
(L4-01 > | Output frequency |)
 

(Multi-function output setting = 4)</td><td>Frequency (FOUT) Detection 3
(L4-03 > Output frequency)
 

(Multi-function output setting = 15)</td></tr>
<tr><td>Frequency (FOUT) Detection 2
(L4-01 < | Output frequency |)
 

(Multi-function output setting = 5)</td><td>Frequency (FOUT) Detection 4
(L4-03 < Output frequency)
 

(Multi-function output setting = 16)</td></tr>
</table>

◆ Limiting the Lift Speed

To use the high speed limit of up direction or down direction, one of the multi-function contact inputs must be set for “High speed limit switch (Up)” or “High speed limit switch (Down)” (H1-□□ = 87/88).

■Multi-function Contact 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)	Yes	Yes	Yes
88	High speed limit switch (Down)	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 (Forward) 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 (Reverse) signal is given, the up direction has no speed limit.

Improving the Operation Performance

This section explains functions for improving motor operating efficiency.

◆ 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						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.	0.0 to 2.5	1.0	Yes	A	A	A	20FH
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
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
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
C3-05	Output voltage limit operation selection Output V Lim 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

■Adjusting Slip Compensation Gain (C3-01)

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:

$$\text{Motor rated slip (Hz)} = \text{Motor rated frequency (Hz)} - \frac{\text{Rated motor speed (min}^{-1}\text{)} \times \text{Number of motor poles}}{120}$$

   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)

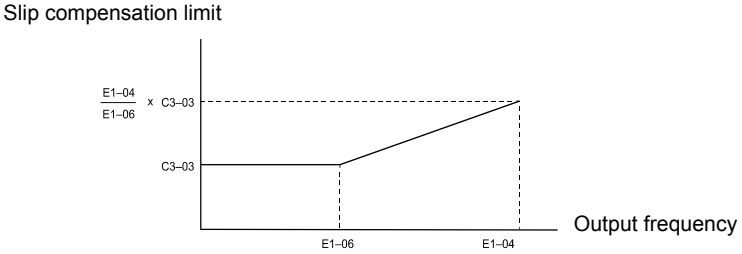
The slip compensation delay time constant is set in ms. The factory setting of C3-02 is 2000ms. Normally, there is no need to change these settings. When the slip compensation response is low, lower the set value. When the speed is unstable, increase the set value.

■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 total 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.



E1-06: Base frequency
E1-04: Maximum output frequency

Fig 5.10 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 motor line to resistance (E2-05) and adjusts the output voltage (V) to compensate insufficient torque at startup and during low-speed operation.

In 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.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						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 alter 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
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

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
C4-03	Starting torque compensation (FWD) FTorqCmp@start	Sets the torque compensation value at start in FWD direction as a percentage of the motor rated torque.	0.0 to 200.0 %	0.0 %	No	No	A	No	217H
C4-04	Starting torque compensation (REV) RTorqCmp@start	Sets the torque compensation value at start in REV direction as a percentage of the motor rated torque.	-200.0 % to 0.0	0.0 %	No	No	A	No	218H
C4-05	Starting torque compensation time constant TorqCmpDelayT	Sets starting torque start-up time. When 0 to 4 ms is set, it is operated without filter.	0 to 200	10 ms	No	No	A	No	219H

* The factory setting will change when the control method is changed. (Open-loop vector control factory settings are given.)

■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 method. The factory settings are:

- V/f control: 200 ms
- Open-loop vector control: 50 ms

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

- If the motor is vibrating, 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.

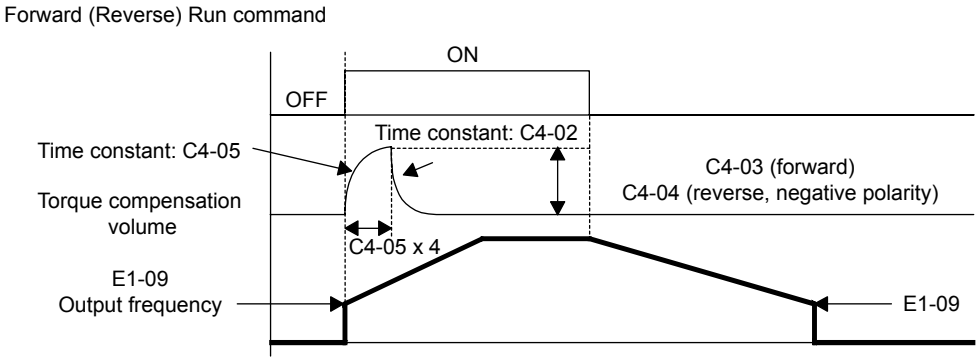


Fig 5.11 Time Chart for Starting Torque Frequency

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)

◆ 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 5.12* shows the ASR structure.

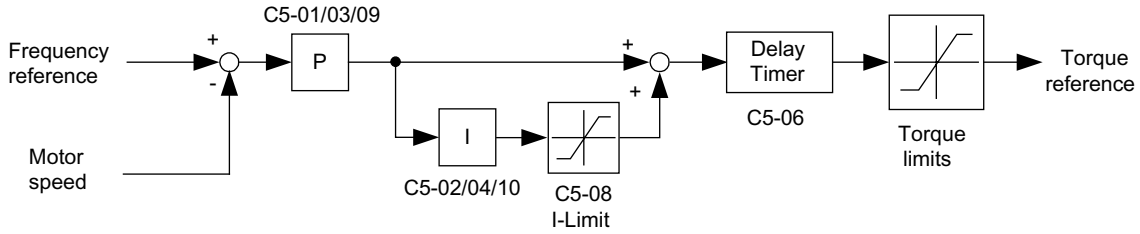
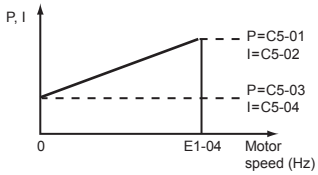
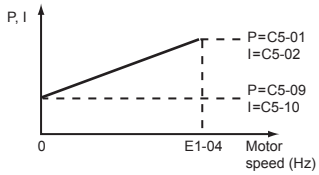


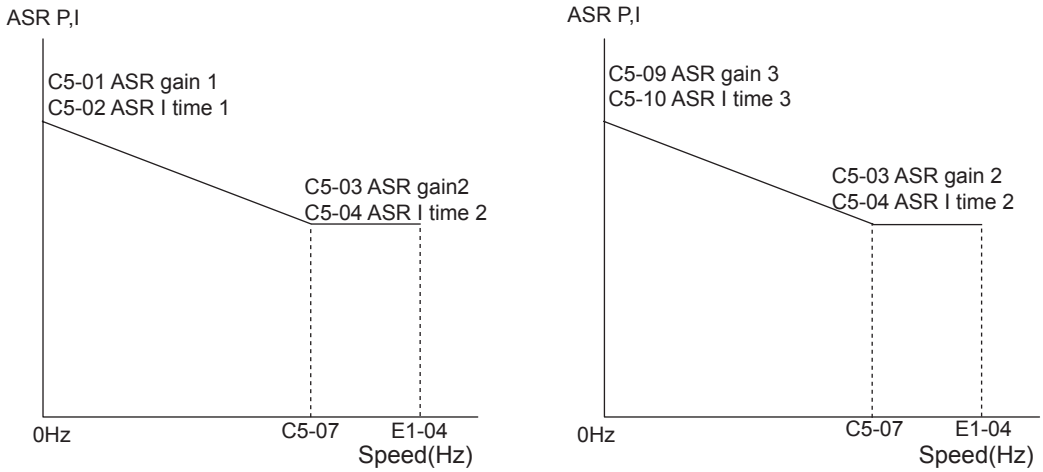
Fig 5.12 ASR Structure Block Diagram

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
C5-01	ASR proportional (P) gain 1 ASR P Gain 1	Sets the proportional gain of the speed loop (ASR).	0.00 to 300.00	40.00	Yes	No	No	Q	21BH
C5-02	ASR integral (I) time 1 ASR I Time 1	Sets the integral time of the speed loop (ASR).	0.000 to 10.000	0.500 s	Yes	No	No	Q	21CH
C5-03	ASR proportional (P) gain 2 ASR P Gain 2	Usually changing this setting is not necessary. 	0.00 to 300.00	20.00	Yes	No	No	Q	21DH
C5-04	ASR integral (I) time 2 ASR I Time 2		0.000 to 10.000	0.500 s	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	No	No	No	Q	220H
C5-07	ASR switching frequency ASR Gain SW Freq	Sets the frequency for switching between Proportion Gain 1, 2 and Integral Time 1, 2.	0.0 to 120.0	0.0 Hz	No	No	No	Q	221H
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 maximum output frequency.	0 to 400	400 %	No	No	No	A	222H
C5-09	ASR proportional (P) gain 3 ASR P Gain 3	Usually changing this setting is not necessary. 	0.00 to 300.00	40.00	Yes	No	No	Q	22EH
C5-10	ASR integral (I) time 3 ASR I Time 3		0.000 to 10.000	0.500 s	Yes	No	No	Q	231H

■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 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 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.

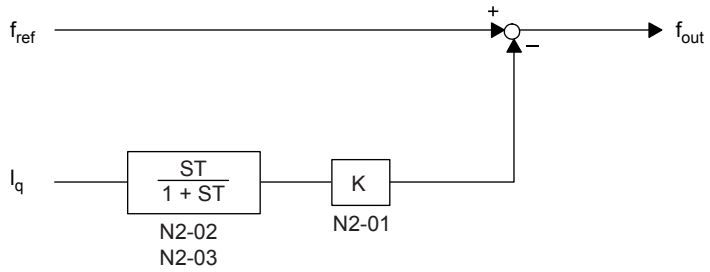


Fig 5.13 AFR Control Loop

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						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
N2-02	Speed feedback detection control (AFR) time constant 1 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
N2-03	Speed feedback detection control (AFR) time constant 2 AFR Time 2	Increase the setting if overvoltage (OV) failures occur at the completion of acceleration or when the load changes radically.	0 to 2000	750 ms	No	No	A	No	586H

■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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
N5-01	Feed forward control selection Feedfoward Sel	Select the feed forward control. 0: Disabled 1: Enabled	0 or 1	1	No	No	No	A	5B0H
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: $GD^2/4$, P: Motor rated output $ta = \frac{2\pi \cdot J[kgm^2] \cdot Nr[min^{-1}]}{60 \cdot T_{100}[N \cdot m]}$ [s] However, $T_{100} = \frac{60}{2\pi} \cdot \frac{P[kW]}{Nr[min^{-1}]} \times 10^3 [N \cdot m]$	0.000 to 10.000	0.154 s *	No	No	No	A	5B1H
N5-03	Feed forward proportional gain Feedfoward Gain	Set 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

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

■Adjustments

Motor acceleration time (N5-02)

The motor acceleration time N5-02 is the time which is needed to accelerate to 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 lift (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)

Usually this value 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 5.14*).

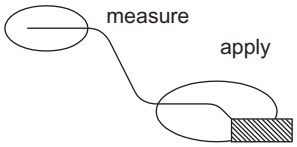


Fig 5.14 Slip Compensation Working Principle

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
S2-01	Motor rated speed Rated rpm	Sets the motor rated speed in units of 1 min^{-1}	300 to 1800	1380 min^{-1}	No	A	No	No	6AEH
S2-02	Slip compensation gain at motoring SlipComp gainMot	Sets the slip compensation gain when the leveling accuracy is needed.	0.00 to 2.50	0.70	Yes	A	A	No	6AFH
S2-03	Slip compensation gain at regenerating SlipComp gainGen	Sets the slip compensation gain when the leveling accuracy is needed.	0.00 to 2.50	1.00	Yes	A	A	No	6B0H
S2-07	Slip compensation primary delay time SlipCompDelay T	Slip compensation primary delay time is set in ms units. Usually setting is not necessary. Adjust this constant at the following times. • Reduce the setting when slip compensation responsive is slow. • When speed is not stabilized, increase the setting.	0 to 10000	200 ms	No	No	A	No	6B4H
S2-15	Slip compensation selection during regeneration slip comp @gene	0: Disabled. 1: Enabled. When the slip compensation during regeneration function has been activated, as regeneration capacity increases momentarily, it may be necessary to use a braking option (Braking resistor, Braking Resistor Unit or Braking Unit.)	0 or 1	1	No	A	A	No	6BCH

■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 do the following in motoring and regenerative mode:

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

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
d6-03	Field forcing function selection Field Force Sel	Enables or disables field forcing function. 0: Disabled 1: Enabled	0 or 1	0	No	No	A	A	2A2H
d6-06	Field forcing function limit Field Force 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

◆ Adjusting DC injection current level

When open-loop vector control method 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
S1-17	DC injection current gain at regeneration DC Inj gain@gen	Used to set the DC injection gain when Inverter is in the regenerative mode.	0 to 400	100 %	No	No	A	No	690H
S1-18	DC injection current gain at motoring DC Inj gain@mot	Used to set the DC injection gain when Inverter is in the motoring mode.	0 to 400	20 %	No	No	A	No	691H

Protective Functions

This section explains functions for protecting the machine.

◆ 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
L3-05	Stall prevention selection during running StallP Run Sel	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
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

■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 lift running check the mechanical system or consider to use a one size bigger Inverter.

◆ Motor Torque Detection / Stacked Car Detection

The Inverter provides a torque detection function to detect overtorque or undertorque. An alarm signal can be output to the multi-function contact 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 (multi-function contact output terminals M1-M2, M3-M4, or M5-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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
L6-01	Torque detection selection 1 Torq Det 1 Sel	0: Overtorque/undertorque detection disabled. 1: Overtorque detection only with speed agreement; operation continues (warning is output). 2: Overtorque detected continuously during operation; operation continues (warning is output). 3: Overtorque detection only with speed agreement; output stopped upon detection. 4: Overtorque 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
L6-02	Torque detection level 1 Torq Det 1 Lvl	Open-loop 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
L6-03	Torque detection time 1 Torq Det 1 Time	Sets the overtorque/undertorque detection time.	0.0 to 10.0	10.0 s	No	A	A	A	4A3H

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
L6-04	Torque detection selection 2 Torq Det 2 Sel	See L6-01 to L6-03 for a description.	0 to 8	0	No	A	A	A	4A4H
L6-05	Torque detection level 2 Torq Det 2 Lvl		0 to 300	150 %	No	A	A	A	4A5H
L6-06	Torque detection time 2 Torq Det 2 Time		0.0 to 10.0	0.1 s	No	A	A	A	4A6H

■Multi-function Contact Outputs (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: ON: Overtorque/undertorque detection)	Yes	Yes	Yes
17	Overtorque/undertorque detection 1 NC (NC contact: OFF: Overtorque/undertorque detection)	Yes	Yes	Yes
18	Overtorque/undertorque detection 2 NO (NO contact: ON: Overtorque/undertorque detection)	Yes	Yes	Yes
19	Overtorque/undertorque detection 2 NC (NC contact: OFF: Overtorque/undertorque detection)	Yes	Yes	Yes

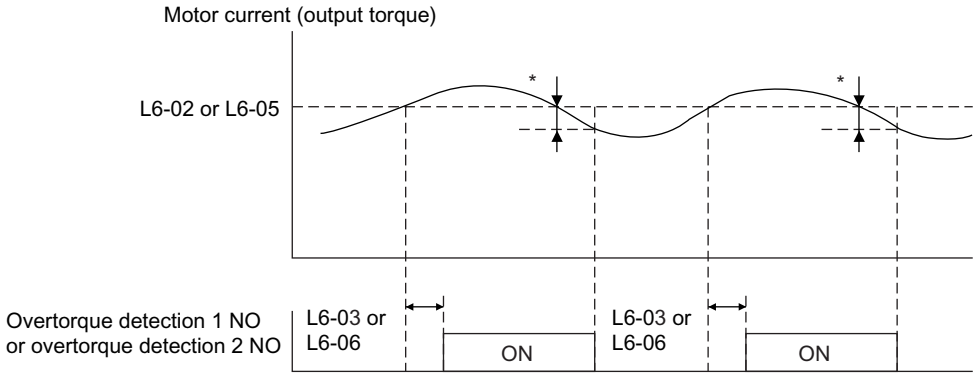
■L6-01 and L6-04 Set Values and Operator Display (JVOP-160 only)

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 detection only with speed agree; operation continues (warning is output).	OL3 flashes	OL4 flashes
2	Overtorque detected continuously during operation; operation continues (warning is output).	OL3 flashes	OL4 flashes
3	Overtorque detection only with speed agree; output is stopped upon detection.	OL3 lights up	OL4 lights up
4	Overtorque 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 agree; 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

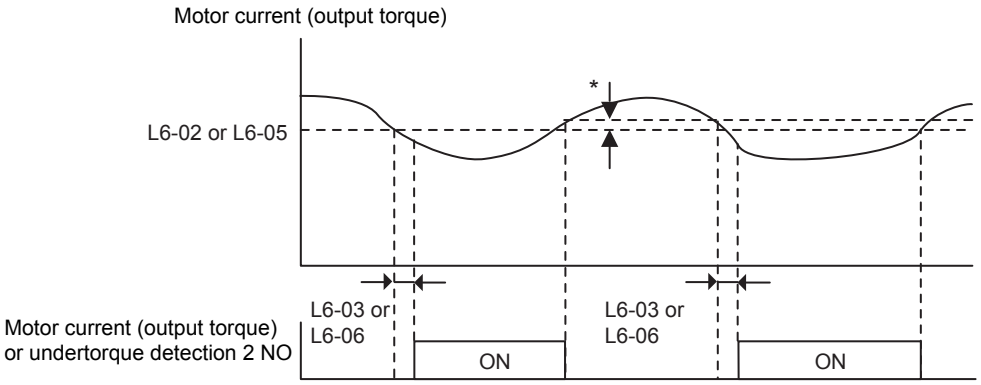
■Timing Charts

Fig 5.15 and *Fig 5.16* show the timing charts for overtorque and undertorque detection.



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

Fig 5.15 Overtorque Detection



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

Fig 5.16 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 multi-function contact 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) if the torque or 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 off and an OL3 fault will be indicated (see *Fig 5.17*.)

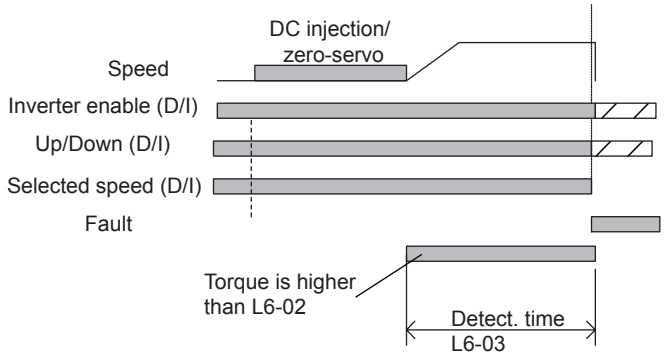
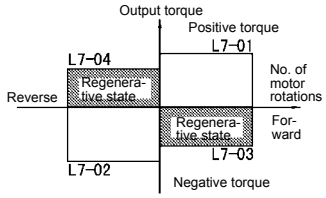


Fig 5.17 Car Stuck Fault Detection

◆ 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
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	200 %*	No	No	A	A	4A7H
L7-02	Reverse drive torque limit / Torq Limit Rev				No	No	A	A	4A8H
L7-03	Forward regenerative torque limit / Torq Lmt Fwd Rgn				No	No	A	A	4A9H
L7-04	Reverse regenerative torque limit / Torq Lmt Rev Rgn				No	No	A	A	4AAH
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
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 Usually 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

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

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

Set Value	Function	Control Methods		
		V/f	Open-loop Vector	Closed-loop Vector
30	During torque limit (current limit) (ON: During torque limit)	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 5.18*)

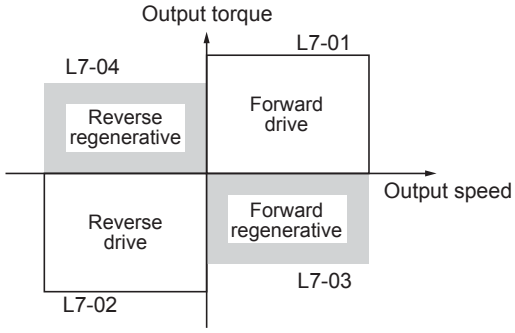


Fig 5.18 Torque Limit Parameters

■Using a Multi-function Contact Output to Signalize Operation at the Torque Limit

If a multi-function contact 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.

■ 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
E2-01	Motor rated current Motor Rated FLA	Sets the motor rated current. This set value will become the reference 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
L1-01	Motor protection selection MOL Fault Select	Sets whether the motor thermal overload protection function is enabled or disabled. 0: Disabled 1: General-purpose motor protection 2: Inverter motor protection 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. When several motors are connected to one Inverter, set to L1-01 to 0 and ensure that each motor is installed with a protection device.	0 to 3	1	No	Q	Q	Q	480H
L1-02	Motor protection time constant 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 resistance protection time for when the motor is hot started.	0.1 to 5.0 *3	1.0 min *3	No	A	A	A	481H

* 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 on the Inverter capacity. The value for a 200 V Class Inverter of 3.7 kW is given.
* 3. This value is set according to o2-09. The value when o2-09=0 is given.

■Multi-Function Contact 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)

Set the motor protection operation time in L1-02.

If, after operating the motor continuously at the rated current, a 150 % overload is experienced, set the (hot start) electric thermal protection operation time. The factory setting is resistance to 150 % for 30 seconds.

Fig 5.19 shows an example of the characteristics of the electronic thermal protection operation time (L1-02 = 1.0 min., operation at 60 Hz, general-purpose motor characteristics, when L1-01 is set to 1)

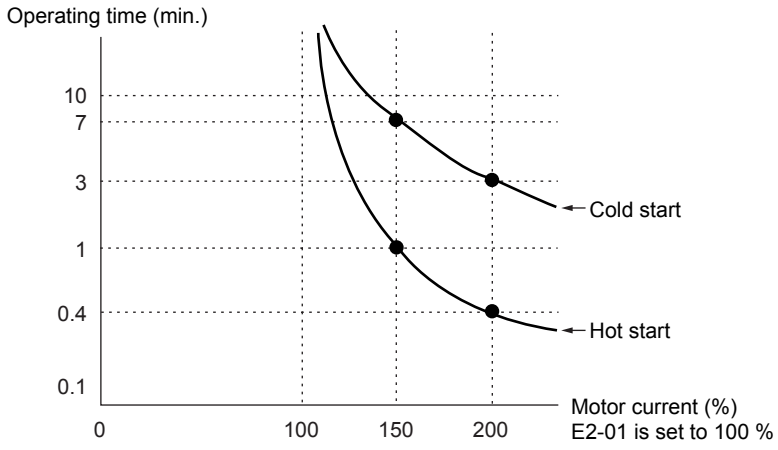


Fig 5.19 Motor Protection Operation Time

■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 to H2-03 (output terminals M1-M2, M3-M4, and M5-M6 function selection) is set to 1F (Motor overload OL1 pre-alarm), the motor overload pre-alarm will be output. 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
S1-14	SE2 detection delay time SE2 det T	Used to set the time to detect SE2 fault in units of 1ms. When the Inverter output current is below S1-08 setting after passing S1-06+S1-14 time,SE2 will be detected.	0 to S1-04 -S1-06	200 ms	No	A	A	A	68DH
S1-15	SE3 detection delay time SE3 det T	Used to set the time to detect SE3 fault in units of 1ms. When Inverter output current is below S1-08 setting for S1-15 time continuously, SE3 will be detected.	0 to 5000	200 ms	No	A	A	A	68EH

SE2 fault (SE2, Sequence Error 2)

At the Brake release 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, Sequence Error 3)

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 fault will be output.

Inverter Protection

This section explains the functions for protecting the Inverter.

◆ 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 sudden and unexpected stop of the Inverter due to overheat, 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 overheat occurs can be selected.

If a multi-function contact 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
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 heatsink temperature reaches the set value.	50 to 130	75 °C*	No	A	A	A	4AEH
L8-03	Operation selection after overheat pre-alarm OH Pre-Alarm Sel	Sets the operation for when the Inverter overheat pre-alarm occurs. 0: Deceleration to stop using the deceleration time in C1-02. 1: Coast to stop 2: Emergency stop using deceleration time in 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

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

Multi-function Contact Outputs (H2-01 to H2-03)

Set Value	Function	Control Methods		
		V/f	Open-loop Vector	Closed-loop Vector
20	Inverter overheat (OH) pre-alarm (ON: Temperature exceeds L8-02 setting)	Yes	Yes	Yes

◆ 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

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
L8-07	Output open-phase protection selection Ph Loss Out Sel	0: Disabled 1: Enabled, 1 phase observatioin 2: Enabled, 2 and more 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 to 2	2	No	A	A	A	4B3H

◆ Ground Fault Protection

This function detects the earth leakage current by calculating the sum of the three output currents. If the earth leakage current gets too high, the Inverter output will be switched off and a GF fault is shown on the Digital Operator. The fault contact is activated.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
L8-09	Ground protection selection Ground Fault Sel	0: Disabled 1: Enabled Usually changing this setting is not necessary.	0 or 1	1	No	A	A	A	4B5H

■Setting Precautions

- It is not recommended to disable this function.
- A ground fault can also be detected if magnetic 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 off or base blocked before opening magnetic contactors.

◆ Cooling Fan Control

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

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
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	0 or 1	0	No	A	A	A	4B6H
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.	0 to 300	60 s	No	A	A	A	4B7H

■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 cooling fan control delay time 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.

■Cooling Fan Control Delay Time

If operating for more than 60 sec, set the value according to the operation time.

◆ Setting the Ambient Temperature

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
L8-12	Ambient temperature Ambient Temp	Sets the ambient temperature.	45 to 60	45 °C	No	A	A	A	4B8H

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 5.20*. To ensure a safe Inverter protection at high ambient temperatures, always set parameter L8-12 to the actual ambient temperature.

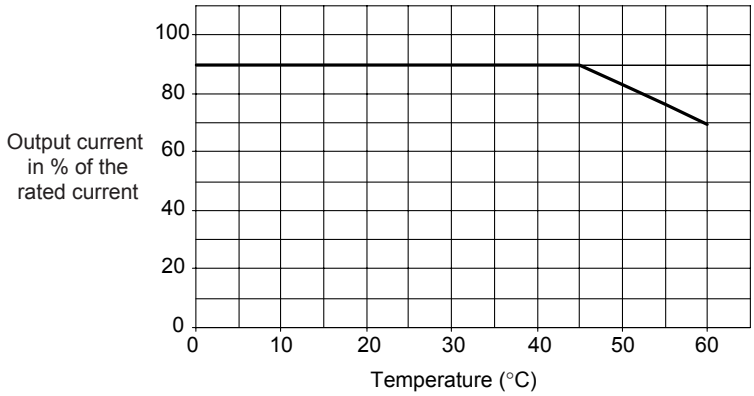


Fig 5.20 Ambient Temperature Derating Curve

Input Terminal Functions

The multi-function contact input terminals can be set for several functions using the H1-01 to H1-05 parameters (terminal S3 to S7 function selection). These functions are described in the following section.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
H1-01	Terminal S3 function selection Terminal S3 Sel	Multi-function input 1	0 to 88	24	No	A	A	A	400H
H1-02	Terminal S4 function selection Terminal S4 Sel	Multi-function input 2		14	No	A	A	A	401H
H1-03	Terminal S5 function selection Terminal S5 Sel	Multi-function input 3		3	No	A	A	A	402H
H1-04	Terminal S6 function selection Terminal S6 Sel	Multi-function input 4		4	No	A	A	A	403H
H1-05	Terminal S7 function selection Terminal S7 Sel	Multi-function input 5		6	No	A	A	A	404H

◆ Blocking Inverter Outputs (Hardware Baseblock)

Set 8 or 9 (Baseblock command NO/NC) in one of the constants H1-01 to H1-05 (multi-function contact input terminal S3 to S7 function selection) to perform baseblock commands using the terminal's ON/OFF operation, and prohibit Inverter output using the baseblock commands.

Clear the baseblock command to restart the operating using speed search from frequency references from the previous baseblock command input.

◆ 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 (multi-function contact 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

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

Set Value	Input Level *1		Error Detection Method *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 contact input terminals S3 to S7 can be used as timer function input terminals, and multi-function contact 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 (multi-function contact input terminals S3 to S7) to 18 (Timer function input).
- Set H2-01 to H2-03 (multi-function contact output terminals M1-M2, M3-M4, and M5-M6 function selection) to 12 (Timer function output).

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						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 300.0	0.0 s	No	A	A	A	1A3H
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 300.0	0.0 s	No	A	A	A	1A4H

■Multi-function Contact 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

■Multi-function Contact 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.

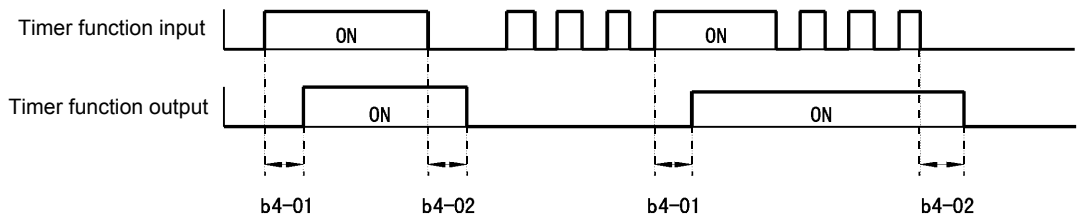


Fig 5.21 Timer Function Operation Example

◆ Magnetic Contactor Answer Back Detection

The magnetic contactors can be observed using the magnetic contactor answer back function. Therefore an auxiliary contact of the magnetic contactors must be connected to a contact input which is set to for this function (H1-□□=86). If answer back signal comes from the magnetic contactor, the Inverter detects a SE1 fault (see below).

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

Set Value	Function	Control Methods		
		V/f	Open-loop Vector	Closed-loop Vector
86	Magnetic contactor answer back signal	Yes	Yes	Yes

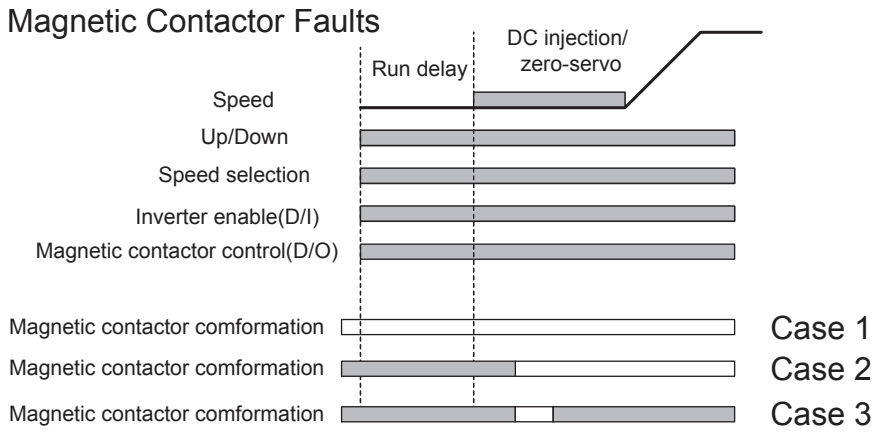
SE1 fault (SE1: Sequence Error 1)

There are 3 possibilities of fault condition

Case 1: Magnetic contactor of output Inverter closes before magnetic contactor close command is input.

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

Case 3: Magnetic contactor opens while Inverter running.



Output Terminal Functions

The multi-function contact 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	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	40BH
H2-02	Terminal M3-M4 function selection Term M3-M4 Sel	Multi-function contact output 2	0 to 43	41	No	A	A	A	40CH
H2-03	Terminal M5-M6 function selection Term M5-M6 Sel	Multi-function contact output 3	0 to 43	6	No	A	A	A	40DH

■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.

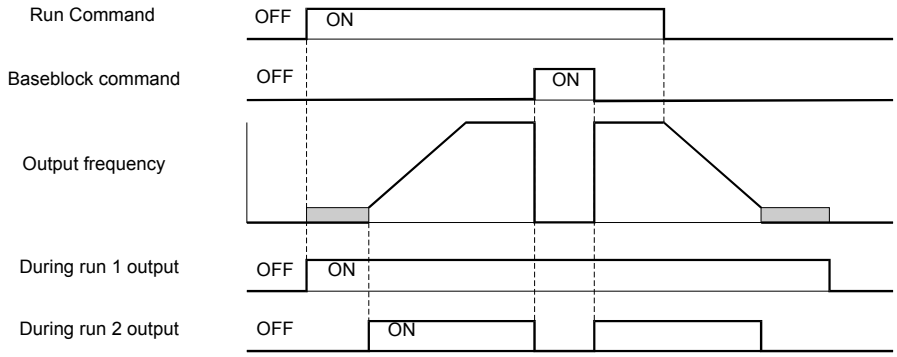


Fig 5.22 Timing Chart for "During RUN" Output

■Zero-Speed (Setting: 1)

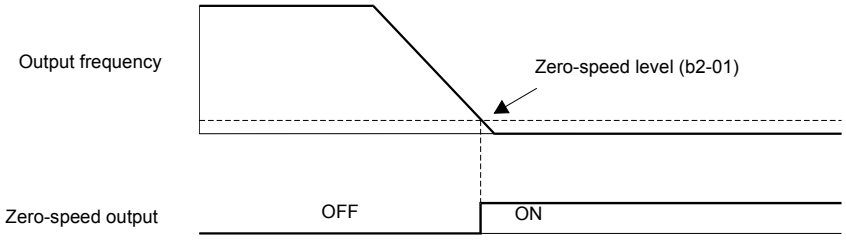


Fig 5.23 Timing Chart for Zero-speed

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).

■Inverter Operation Ready (Setting: 6)

If a multi-function contact output is programmed for this function, the output will be switched ON when the initialization of the Inverter at startup has finished without any faults.

■During DC Bus Undervoltage (UV) Detection (Setting: 7)

If a multi-function contact output is programmed for this function, the output is switched ON as long as a DC bus undervoltage is detected.

■During Baseblock (Setting: 8)

If a multi-function contact 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 multi-function contact 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 Source Selection Status (Setting: A)

If a multi-function contact 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 (Setting: E)

If a multi-function contact 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 *Fault Detection* on page 6-2 for a fault list.)

■Minor Fault (Setting: 10)

If a multi-function contact output is programmed for this function, the output is switched ON when a minor fault occurs (refer to *Alarm Detection* on page 6-9 for an alarm list).

■Fault Reset Command Active (Setting: 11)

If a multi-function contact output is set for this function, the output is switched ON when a fault reset command is input.

■During Reverse Run (Setting: 1A)

If a multi-function contact 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 or baseblock. It will not work when a Forward Run Command is input.

■During Baseblock 2 (Setting: 1B)

If a multi-function contact output is programmed for this function, the output is switched OFF as long as a baseblock command is input at terminal BB.

■During Regenerative Operation (Setting: 1D)

If a multi-function contact output is programmed for this function, the output is switched ON when the motor is in the regenerative state, i.e. when energy is feedback to the Inverter.

■Speed Detection at Deceleration (Door Zone) (Setting:42)

This output can be used to detect 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).

Motor and V/f Pattern Setup

This section explains motor parameters and how to set V/f patterns.

◆ Setting Motor Parameters

In vector control method, the motor parameters are set automatically during autotuning. If autotuning does not complete normally, set them manually. Refer to *Autotuning Mode* on the page 3-13.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
E2-01	Motor rated current Motor Rated FLA	Sets the motor rated current. This set value will become the reference 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
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. This value is an input data for autotuning.	2 to 48	4 poles	No	No	No	Q	311H
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
E2-06	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
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 autotuning.	0.00 to 0.50	0.50	No	No	A	A	314H
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 autotuning.	0.00 to 0.75	0.75	No	No	A	A	315H
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 when 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	A	A	316H

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
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
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
E2-12	Motor iron saturation coefficient 3 Saturation Comp 3	Sets the motor iron saturation coefficient at 130 % of magnetic flux. This parameter is automatically set during autotuning.	1.30 to 1.60	1.30	No	No	A	A	328H

* 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 on 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.

■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.

$$\text{Motor rated slip} = \text{Motor rated frequency (Hz)} - \frac{\text{Rated speed (min}^{-1}\text{) x No. of motor poles}}{120}$$

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 low. (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, E2-08)

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

Motor Iron Loss for Torque Compensation Setting (E2-10)

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.

Motor Mechanical Loss

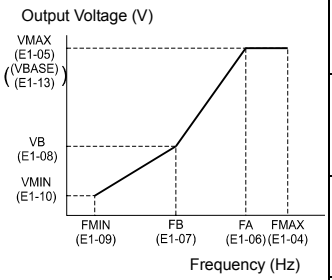
When using closed vector control, adjust mechanical loss in the following cases. (There is normally no reason to make this adjustment.) The mechanical loss setting is used to compensate the torque.

- There is excessive torque loss from the motor bearings.
- There is excessive torque loss from a fan, pump, etc.

◆ 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 method.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
E1-01	Input voltage setting 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
E1-03	V/f pattern selection V/F Selection	0 to E: Select from the 15 preset patterns. F: Custom user-set patterns (Applicable for settings E1-04 to E1-10.) FF: Custom user-set patterns No internal voltage limit	0 to FF	F	No	A	No	No	302H
E1-04	Max. output frequency (FMAX) Max Frequency		0.0 to 120.0	60.0 Hz	No	Q	Q	Q	303H
E1-05	Max. output voltage (VMAX) Max Voltage		0.0 to 255.0 *1	200.0 V *1	No	Q	Q	Q	304H
E1-06	Base frequency (FA) Base Frequency		0.0 to 120.0	60.0 Hz	No	Q	Q	Q	305H
E1-07	Mid. output frequency (FB) Mid Frequency A		0.0 to 120.0	3.0 Hz *2	No	A	A	No	306H
E1-08	Mid. output frequency voltage (VB) Mid Voltage 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 255.0 *1	11.0 V *1 *2	No	Q	Q	No	307H
E1-09	Min. output frequency (FMIN) Min Frequency		0.0 to 120.0	0.5 Hz *2	No	Q	Q	A	308H
E1-10	Min. output frequency voltage (VMIN) Min Voltage		0.0 to 255.0 *1	2.0 V *1 *2	No	Q	Q	No	309H
E1-13	Base voltage (VBASE) Base Voltage	Sets the output voltage of the base frequency (E1-06).	0.0 to 255.0 *1	0.0 V *3	No	A	A	A	30CH

* 1. This value is set according to o2-09. Values for a 200 V Class Inverter when o2-09=0 (Asia) are given. 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. 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. This setting is used as a reference value for protection functions.

■Setting the V/f Pattern

If E1-03 is set to F (Custom user-set patterns) can be set individually using the parameters E1-04 to E1-10. See *Fig 5.24* for details.

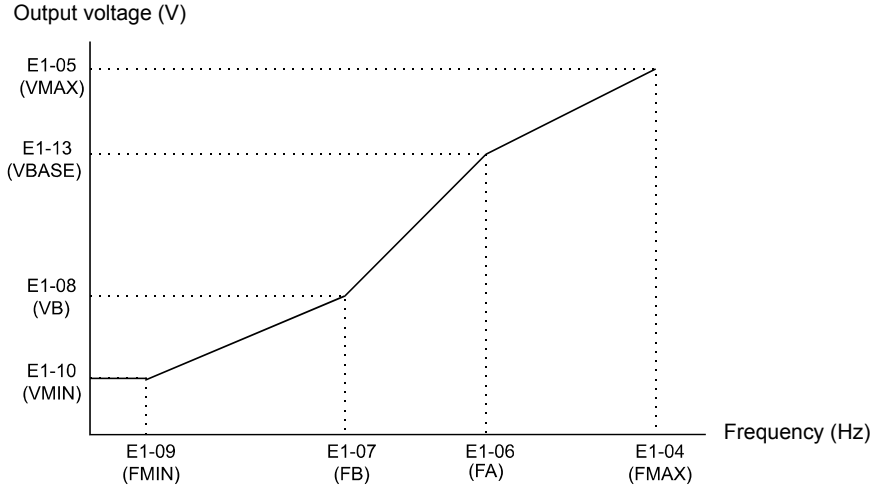


Fig 5.24 V/f pattern setting

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 setting a custom user-set 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 Functions

This section explains the Digital Operator functions.

◆ Setting Digital Operator Functions

You can set Digital Operator-related parameters such as selecting the Digital Operator display, multi-function selections, and copy functions.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
o1-01	Monitor selection User Monitor Sel	Set the number of the 4rd. monitor item to be displayed in the Drive Mode. (U1-□□)	4 to 99	6	Yes	A	A	A	500H
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
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: min^{-1} 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
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
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

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
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
o2-03	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
o2-04	kVA selection Inverter Model#	Do not set unless after replacing the control board. (Refer to *page 5-69* for the setting values).	0 to FF	4 *	No	A	A	A	508H
o2-05	Frequency reference setting method selection Operator M.O.P.	When the frequency reference is set on the Digital Operator 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
o2-06	Operation selection when digital operator is disconnected Oper Detection	Sets the operation when the Digital Operator is disconnected. 0: Disabled (Operation continues even if the Digital Operator is disconnected.) 1: Enabled (OPR is detected at Digital Operator disconnection. Inverter output is switched off, and the fault contact is operated.)	0 or 1	0	No	A	A	A	50AH
o2-07	Cumulative operation time setting Elapsed Time Set	Sets the cumulative operation time in hour units. Operation time is calculated from the set value.	0 to 65535	0 hr	No	A	A	A	50BH
o2-08	Cumulative operation time selection Elapsed Time Run	0: Accumulated Inverter power on time. 1: Accumulated Inverter run time.	0 or 1	0	No	A	A	A	50CH
o2-09	Initialize Mode Init Mode Sel	0: Asia 1: America 2: Europe	0 to 2	0	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
o2-12	Fault trace initialize FLT Trace Init	0: Disabled (U2 and U3 constants are on hold.) 1: Enabled (Initializes U2 and U3 parameters)	0 or 1	0	No	A	A	A	510H

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
o2-15	Operation counter initialize Initialize Sel	0: Disabled (Operation counters are on hold.) 1: Enabled (Initializes operation counters to 0)	0 or 1	0	No	A	A	A	513H

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

■Monitor Selection (o1-01)

Using parameter o1-01 the third monitor item that is displayed in drive mode can be selected.

■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 when the power supply is turned ON can be selected. For monitors that can be displayed, refer to U1-□□ in *Chapter 4 Parameters*.

■Changing Frequency Reference and Display Units (o1-03)

Set the Digital Operator 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 min^{-1}.

■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.

■Disabling the STOP Key (o2-02)

This parameter is used to set whether the STOP key on the Digital Operator is active during remote control (b1-02 ≠ 0) or not.

If o2-02 is set to 1, a Stop Command from the Digital Operator STOP key will be accepted. If o2-02 is set to 0 it will be disregarded.

■Initializing Changed Parameter Values (o2-03)

The current Inverter parameter setting values can be saved as user-set parameter initial values. To save current Inverter parameter setting values, set o2-03 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 4-62, Factory Settings that Change with the Inverter Capacity (o2-04)* to see parameters that depend on this setting.

■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. When o2-05 is set to 1, the frequency reference can be incremented or decremented using the Up and Down keys without using the Enter key.

■Operation Selection when the Digital Operator is Disconnected (o2-06)

This function selects the Inverter operation after the Digital Operator is 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.

■Operation 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 can perform the following three functions using a built-in EEPROM (non-volatile memory).

- Store Inverter parameter set values in the Digital Operator by setting o3-01 to 1 (READ)
- Write parameter set values stored in the Digital Operator to the Inverter by setting o3-01 to 2 (COPY)
- Compare parameter set values stored in the Digital Operator with Inverter parameters settings by setting o3-01 to 3 (VERIFY)

The data saved in the Digital 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.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						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
o3-02	Read permission selection Read Allowable	0: READ prohibited 1: READ permitted	0 or 1	0	No	A	A	A	516H

■Storing Inverter set values in the Digital Operator (READ)

To store Inverter set values in the Digital Operator use the following method.

Table 5.1 READ Function Procedure

Step No.	Explanation	Digital Operator 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.	-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 6-16, Digital Operator Copy Function Faults* for corrective actions.

■Writing Parameter Set Values Stored in the Digital Operator to the Inverter (COPY)

To write parameter set values stored in the Digital Operator to the Inverter, use the following method.

Table 5.2 COPY Function Procedure

Step No.	Explanation	Digital Operator 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.	-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, press any key to cancel the error display and return to the o3-01 display. Refer to *page 6-16, Digital Operator Copy Function Faults* for corrective actions.

■Comparing Inverter Parameters and Digital Operator Parameter Set Values (VERIFY)

To compare Inverter parameters and Digital Operator parameter set values, use the following method.

Table 5.3 VERIFY Function Procedure

Step No.	Explanation	Digital Operator 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 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.	-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 *page 6-16, Digital Operator Copy Function Faults* 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 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.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
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 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	Q	Q	Q	101H

◆ 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 cannot 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
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 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	Q	Q	Q	101H

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
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
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

■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.

◆ 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 refer in A2-01 to A2-32, and then set A1-01 to 1. Using the advanced programming mode A1-01 to A1-03 and the parameters set in A2-01 to A2-32 can be read and modified.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						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. Parameters are the only accessible parameters if Parameter Access Level is set to parameters (A1-01=1)	b1-01 to S3-01	–	No	A	A	A	106H to 125H

PG Interface

To get a more precise speed control the Inverter has PG interface to connect a pulse generator.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
F1-01	PG constant PG Pulses/Rev	Sets the number of PG pulses per revolution	0 to 60000	600 *	No	No	No	Q	380H
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
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
F1-04	Operation selection at 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
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
F1-06	PG division rate (PG pulse monitor) PG Output Ratio	Sets the division ratio for the PG speed control board 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

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
F1-08	Overspeed detection level PG Overspd 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
F1-09	Overspeed detection delay time PG Overspd Time		0.0 to 2.0	0.0 s	No	No	No	A	388H
F1-10	Excessive speed deviation detection level PG Deviate 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
F1-11	Excessive speed deviation detection delay time PG Deviate Time		0.0 to 10.0	0.5 s	No	No	No	A	38AH
F1-14	PG open-circuit detection delay time PGO Detect 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

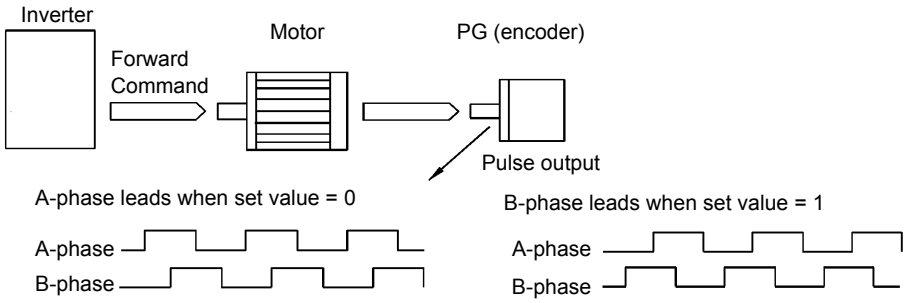
* The factory setting is set according to o2-09. The value when o2-09=0 (Asia) is given. The value is 1024 when o2-09 is 1 or 2.

■Setting Number of PG Pulses (F1-01)

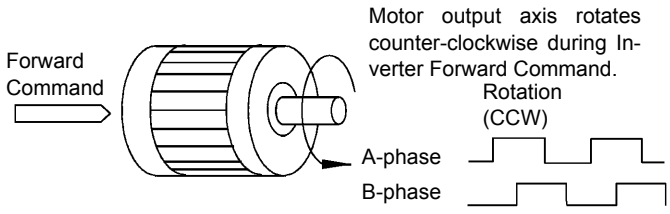
Set the number of PG (Pulse Generator/Encoder) pulses in pulses per revolution.

■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.



Example: Forward rotation of standard motor (PG)



Yaskawa standard PG used is A-phase driven (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 Dividing Ratio (F1-06)

Set the dividing 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

F1-06 = $\frac{\square}{n}\ \frac{\square\square}{m}$

The dividing ratio can be set within the following range: 1/32 ≤ F1-06 ≤ 1. For example, if the dividing 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.

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 multi-function contact input (H1-□□ = 85).

The battery voltage must be set in parameter L2-11.

■Related Constants

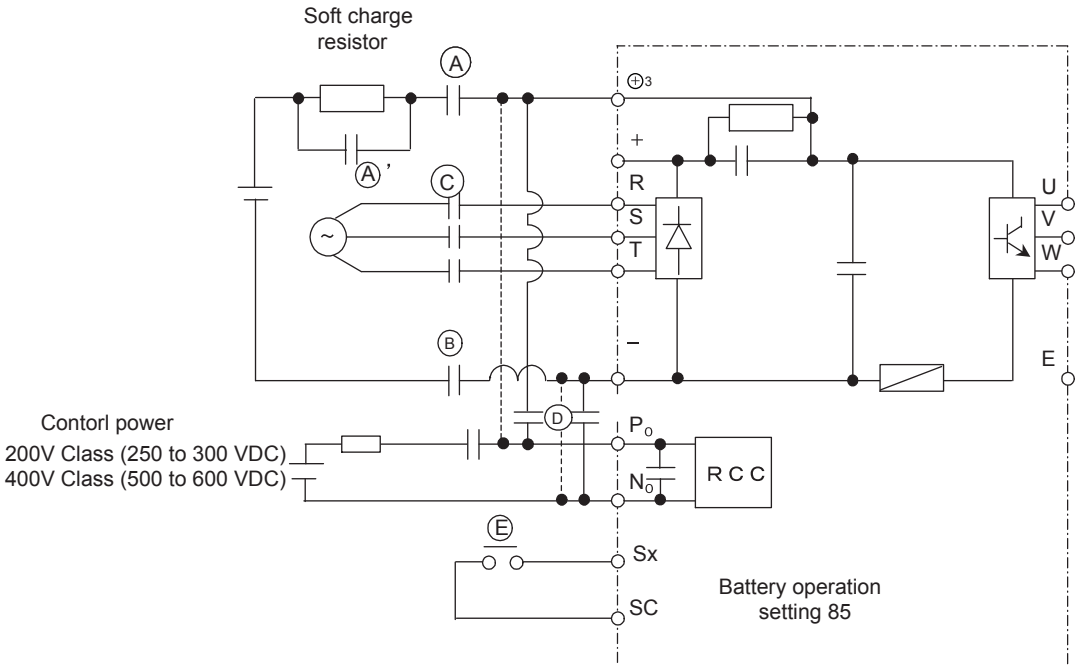
Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						V/f	Open-loop Vector	Closed-loop Vector	
L2-11	Battery Voltage Volt@batterydr	Sets the battery voltage.	0 to 400 *	0 V *	No	A	A	A	4CBH

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

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

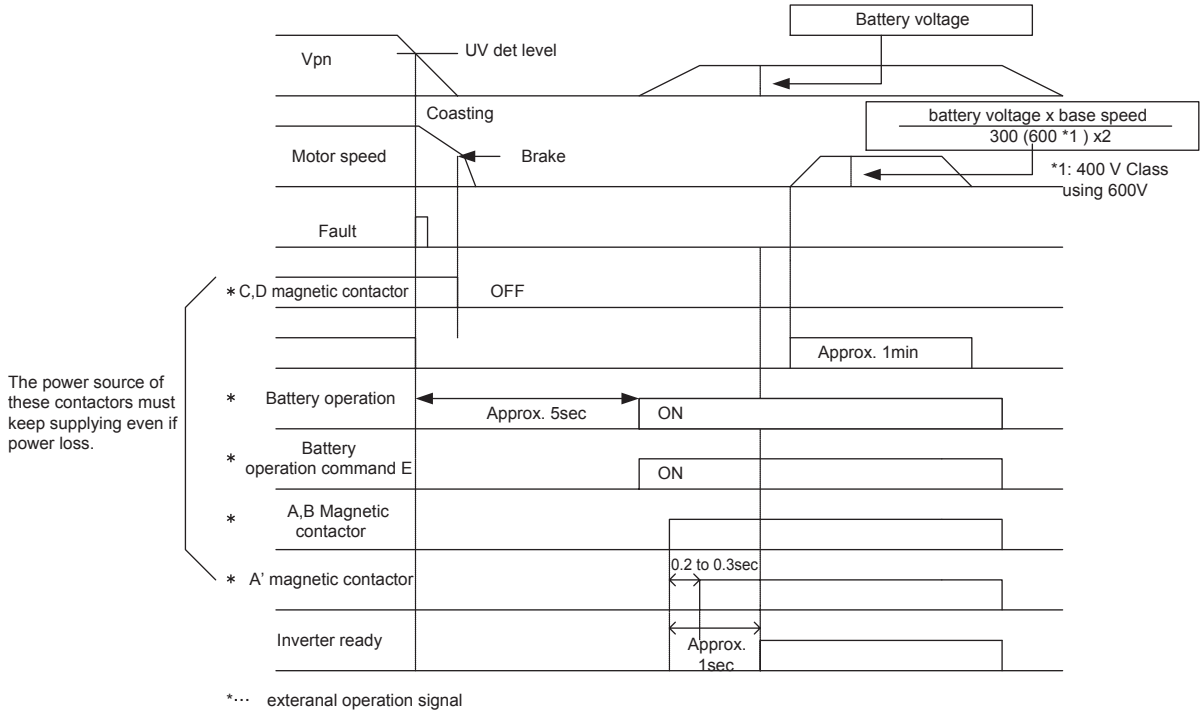
Setting	Function mane	V/f	Open-loop Vector	Closed-loop Vector
85	Battery operation command	Yes	Yes	Yes

■Battery operation wiring



■Battery sequence

The following timing chart shows the sequence of battery operation.



No.	Description
1	When the bus voltage is below the undervoltage level, the Inverter detects the undervoltage (UV) fault.
2	Turn off the Run Command.
3	C and D magnetic contactors must be turned off and turn on the motor mechanical brake.
4	Need the approx. 5 sec to start battery operation.
5	The multi-function contact input which is assigned with the battery operation command (E) must be turned ON.
6	A' magnetic contactor must be turned ON after passing 0.2 to 0.3 sec when A and B magnetic contactors are turned ON.
7	The Run Command turns ON after Inverter ready status set. The battery operation time must be within 1min.
8	E, A, B and A' magnetic 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 × base speed) / (300 V × 2)

When the 400V Class will be 600 V × 2

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.

■Battery selection

Use the following battery

	200 V Class	400 V Class
Main bus voltage	48 V or more	96 V or more
Control voltage	200 V	400 V

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 × speed during battery operation × 200 %) /

[battery voltage × 60 % (motor efficiency) × motor base speed]

Automatic Fault Restart

If an Inverter error occurs during operation, the Inverter will perform self-diagnosis. If no error is detected, the Inverter will automatically restart. This is called the auto restart function.

Set the number of auto restarts in constant L5-01.

The auto restart function can be applied to the following errors. If an error not listed below occurs, the protection function will operate and the auto restart function will not.

- OC (Overcurrent)
- GF (Ground fault)
- OV (Main circuit overvoltage)
- UV1 (Main Circuit Undervoltage, Main Circuit MC Operation Failure)*
- PF (Main circuit voltage fault)
- LF (Output phase failure)
- OL2 (Inverter overload)
- OL3 (Overtorque)
- OL4 (Overtorque)
- UL3 (Undertorque)
- UL4 (Undertorque)

* When L2-01 is set to 1 or 2 (continue operation during momentary power loss)

■Auto Restart External Outputs

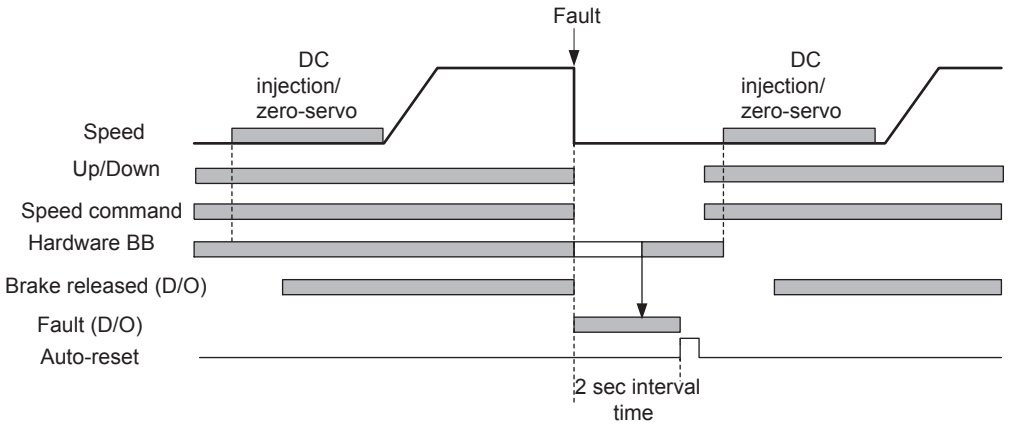
To output auto restart signals externally, set H2-01 to H2-03 (multi-function contact output terminals M1-M2, M3-M4, M5-M6 function selection) to 1E (Restart enabled).

■Related Constants

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods			MEMOBUS Register
						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
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

■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.

- L5-02 = 1 enables the fault relay.
- L5-02 = 0 disables the fault relay.

6

Troubleshooting

This chapter describes the fault displays and countermeasures for Inverter and motor problems.

Protective and Diagnostic Functions 6-2
Troubleshooting 6-17

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 autotuning 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.

The faults can be categorized in two groups:

- Faults that can be rested using the Shift/RESET Key or the DATA/ENTER Key on 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 table to identify and correct the cause of the fault.
To reset a fault, it is necessary to remove the fault and the run signal. Only then a reset signal is accepted.

Table 6.1 Fault Detection

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 • Magnetic 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 Open The fuse in the main circuit is open.	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. **Warning:** **Never run the Inverter after replacing the DC bus fuse without checking for shorted components.**

* "OC" contains "SC", which is displayed on the JVOP-163.
"SC" is a Short-Circuit.

Table 6.1 Fault Detection (Continued)

Display	Meaning	Probable Causes	Corrective Actions
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.
UV1 DC Bus Undervolt	DC Bus Undervoltage The DC bus voltage is below the Undervoltage Detection Level (L2-05). The default settings are: 200 V Class: 190 VDC 400 V Class: 380 VDC	• The voltage fluctuations of the power supply are too high. • An open-phase error occurred at the input terminals.	Check the input voltage.
		A momentary power loss occurred.	Check the wiring of the input terminals.
		The terminal screws of the input power supply are loose.	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 magnetic contactor stopped responding during Inverter operation. (Applicable Inverter Capacities 200 V Class: 37 to 55 kW)	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 magnetic contactor of the charging circuit did not respond 10 sec. after the magnetic contactor ON signal has been output. (Applicable Inverter Capacities 200 V Class: 37 to 55 kW)	The magnetic 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. • 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.	Check the power supply voltage.

Table 6.1 Fault Detection (Continued)

Display	Meaning	Probable Causes	Corrective Actions
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.
OH Heatsink Overtemp	Heatsink Overheat The temperature of the Inverter's heatsink exceeded the setting in L8-02 and L8-03 = 0 to 2.	The ambient temperature is too high.	Install a cooling unit.
		There is a heat source nearby.	Remove the heat source.
		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.	
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.	
RR DynBrk Transistr	Dynamic Braking Transistor The built-in dynamic braking transistor failed.	Defective or failed dynamic braking transistor 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 curve.	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 size of the Inverter is too small.	Replace the Inverter with one that has a larger capacity.
OL3 Cur Stuck 1	Cur Stuck 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.

Table 6.1 Fault Detection (Continued)

Display	Meaning	Probable Causes	Corrective Actions
OL4 Cur Stuck 2	Cur Stuck 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 L6-01 = 3 or 4.	Motor was overloaded.	• Ensure the values in L6-05 and L6-06 are appropriate. • Check application/machine status to eliminate fault.
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 L6-01 = 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 L6-01 = 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 = 0, 2, 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 = 0, 2, 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 = 0, 2, 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.

Table 6.1 Fault Detection (Continued)

Display	Meaning	Probable Causes	Corrective Actions
EF0 Opt External Flt	External fault input from Communications Option Board	An external fault condition was present, input from a communication option board.	• Eliminate the cause of the external fault condition. • Verify the parameters. • Verify communication signals.
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		
OPR Oper Disconnect	Digital Operator Connection Fault Detected when the Digital Operator is removed and the Inverter receives its Run Command through the Digital Operator. (b1-02=0)	The Digital Operator was removed during running or the Digital Operator cable is broken.	Check the connection of the Digital Operator.
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	Sequence Error 1 Detected no magnetic contactor answer back for S1-16 time setting.	The magnetic contactor or auxiliary switch is malfunction.	Check the magnetic contactor.
SE2 Sequence Error 2	Sequence Error 2 Detected the output current below 25% of no-load current at opening motor brake.	The magnetic contactor is opened.	Check the magnetic contactor.
SE3 Sequence Error 3	Sequence Error 3 Detected the output current below 25% of no-load current during running.	The magnetic contactor is opened.	Check the magnetic contactor.
CPF00 COM-ERR(OP&INV)	Digital Operator 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.	• Disconnect the Digital Operator and then connect it again. • Replace the Inverter.
		• Digital Operator is defective. • Control board is defective.	
	CPU External RAM Fault	The control board is damaged.	• Cycle the power to the Inverter. • Replace the Inverter.

Table 6.1 Fault Detection (Continued)

Display	Meaning	Probable Causes	Corrective Actions
CPF01 COM-ERR(OP&INV)	Digital Operator 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.	Disconnect the Digital Operator and then connect it again.
		• Digital Operator is defective. • Control board is defective.	• Cycle the power to the Inverter. • Replace the Inverter.
CPF02 BB Circuit Err	Baseblock circuit error A baseblock circuit error occurred at power-up.	The control board is damaged.	• Perform an initialization to factory defaults. • Cycle the power to the Inverter. • Replace the Inverter.
CPF03 EEPROM Error	EEPROM error Checksum is not valid.	The control board is damaged.	• Perform an initialization to factory defaults. • Cycle the power to the Inverter. • Replace the Inverter.
CPF04 Internal A/D Err	CPU Internal A/D Converter Fault	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	The control board is damaged.	• Perform an initialization to factory defaults. • Cycle the power to the Inverter. • Replace the Inverter.
CPF06 Option Error	Option Board Connection Fault	The Option Board is not connected properly.	Turn off the power and re-install the Option Board again.
		The Inverter or Option Board is damaged.	Replace the Option Board 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 Board 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 Board A/D converter is faulty.	• Perform an initialization to factory defaults. • Cycle the power to the Inverter. • Replace the Option Board. • Replace the Inverter.

Table 6.1 Fault Detection (Continued)

Display	Meaning	Probable Causes	Corrective Actions
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.

◆ 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 display flashes and an alarm output is generated at the multi-function contact outputs (H2-01 to H2-03) if programmed.

When an alarm occurs, take appropriate countermeasures according to the table below.

Table 6.2 Alarm Detection

Display	Meaning	Probable causes	Corrective Actions
EF External Fault (flashing)	Forward/Reverse Run Commands Input Together Both the Forward/Reverse Run Commands are input simultaneously for 500 ms or more.	The external Forward/Reverse Run Commands were input simultaneously.	Check the sequence of the Forward/Reverse Run Commands. Since the rotational direction is unknown, the motor will be decelerated to a stop when this minor fault occurs.
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 magnetic contactor of the inrush current prevention circuit opened. • The control power supply voltage was below the CUV level. UV Alarm is only detected when the drive is in a stopped condition.	For the probable causes, refer to UV1, UV2 and UV3 in *Table 6.1*.	For the corrective actions, refer to UV1, UV2 and UV3 in *Table 6.1*.
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 heatsink exceeded the temperature programmed in L8-02. Enabled when L8-03 = 3.	The ambient temperature is too high.	Install a cooling unit.
		There is a heat source nearby.	Remove the heat source.
		The Inverter cooling fan(s) has stopped.	Replace the cooling fan(s).
OH2 Over Heat 2 (flashing)	Overheat Alarm An OH2 alarm signal is input from a multi-function contact input terminal (S3 to S7) that is programmed to OH2 Alarm Signal Input.	An external overheat occurred.	Clear the multi-function input terminal's overheating alarm input.
OL3 Cur Stuck 1 (flashing)	Cur Stuck 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.

Table 6.2 Alarm Detection (Continued)

Display	Meaning	Probable causes	Corrective Actions
OL4 Cur Stuck 2 (flashing)	Cur Stuck 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 = 1 or 2.	Motor was overloaded.	• Ensure the values in L6-05 and L6-06 are appropriate. • Check application/machine status to eliminate fault.
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 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.
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 Board External Fault	An external fault condition was present, input from a communication option board.	• Eliminate the cause of the external fault condition. • Verify the parameters. • Verify communication signals.

Table 6.2 Alarm Detection (Continued)

Display	Meaning	Probable causes	Corrective Actions
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		
CE MEMOBUS Com Err	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	Option Communications Alarm After initial communications 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.
CALL ComCall	Communications on Standby Communications 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 6.3*. 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 6.3 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 *Factory Settings that Change with the Inverter Capacity (o2-04)* on page *4-62*.
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 contact 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 Command source selection b1-02 are set to 3 (option board) but no option board is installed. option board is installed incorrectly.	• Verify that the option board is installed. Remove the power supply and re-install the option board again. • Recheck the setting of b1-01 and b1-02.
OPE07 Analog Selection	Multi-function Analog Input Error	Reference source selection (b1-01) is set to Control circuit terminal (analog input) (1) when Multi-function analog input (H3-05) is set to Torque compensation (14).	Check the parameters b1-01, H3-09 and H6-01.
OPE08 Constant Selection	Function Selection Error	A setting has been made that is not 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-□□, E3-□□). A frequency/voltage value may be set higher than the maximum frequency/voltage.

Table 6.3 Operator Programming Errors (Continued)

Display	Meaning	Probable Causes	Corrective Actions
OPE11 CarrFrq/On-Delay	Carrier Frequency Parameter Setting Error	One of the following parameter setting errors exists. • Carrier frequency Gain C6-05 > 6 and C6-03 (Carrier frequency upper limit) < C6-04 (Carrier frequency lower limit) • Upper/lower limit error in C6-03 and 04. • C6-01 = 0 and C6-02 = 2 to 6. • C6-01 = 1 and C6-02 = 7 to E.	Check the parameter settings.
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).

◆ Autotuning Fault

Autotuning 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 6.4 Autotuning 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 autotuning 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 autotuning.	• 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 autotuning result is outside the parameter setting range.	• Check the input data. • Check motor wiring. • If the motor is connected to the machine, disconnect it. • Set a value higher than Inverter input power supply voltage (E1-01) to Motor rated voltage (T1-03).
Er-05 No-Load Current	No-Load Current Fault		
Er-08 Rated slip	Rated Slip Fault		
Er-09 Accelerate	Acceleration Fault Detected only for rotational autotuning.	The motor did not accelerate in the specified time (C1-01 + 10 sec).	• 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 rotational autotuning.	The torque reference exceeded 100% during acceleration. Detected when A1-02 = 2 or 3 (Open-loop 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. • Any of U/T1, V/T2 and W/T3 has open-phase.	Check motor wiring, current detector, and installation methods.
Er-13 Leakage Inductance Fault	Leakage Inductance Fault	• Autotuning was not completed in the specified time. • Autotuning result is outside the parameter setting range.	Check motor wiring.

Table 6.4 Autotuning Fault (Continued)

Display	Meaning	Probable causes	Corrective Actions
End-1 V/f Over Setting	V/f Settings Alarm Displayed after autotuning is complete.	The torque reference exceeded 100% and the no-load current exceeded 70% during autotuning.	• 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 autotuning is complete. Detected only for rotational autotuning.	During autotuning, the measured values of motor iron 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 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 autotuning is complete.	During autotuning, the measured value of motor rated current (E2-01) was greater than the set value.	Check the motor rated current value.

◆ 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 Digital Operator. A fault does not activate the fault contact output or alarm output.

Table 6.5 Digital Operator Copy Function Faults

Function	Digital Operator Display	Probable Causes	Corrective Actions
READ Function	PRE READ IMPOSSIBLE	o3-01 was set to 1 to write parameter into the Digital Operator when the Digital Operator was write-protected (o3-02 = 0).	Set o3-02 to enable writing parameters into the Digital Operator's memory.
	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). • Check the Digital Operator's cable. • Replace the Digital Operator.
	RDE DATA ERROR	An attempted writing of the Inverter data to the Digital Operator's EEPROM failed.	• A low Inverter voltage has been detected. • Retry the READ command (o3-01 = 1). • Replace the Digital Operator.
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.
	VAE INV. KVA UNMATCH	The capacity of the Inverter and the capacity of the stored data in the Digital Operator are different.	Use stored data for the same Inverter capacity only (o2-04).
	CRE CONTROL UNMATCHED	The control method of the Inverter and the control method of the stored data in the Digital Operator are different.	Use stored data for the same control method (A1-02).
	CYE COPY ERROR	A parameter setting written to the Inverter was different from the setting stored in the Digital Operator.	Retry the COPY function (o3-01 = 2).
	CSE CHECKSUM 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 COPY and Verify function (o3-01 = 2 and 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 6.3* in this chapter and correct the settings.

■CPF00 or CPF01 is displayed.

This is a Digital Operator communication error. The connection between the Digital Operator and the Inverter may be faulty. Remove the Digital Operator and then re-install it.

◆ If the Motor Does Not Operate Properly

Use the following information if the motor does not operate.

■The motor does not operate when an external operation signal is input.

The following causes are possible:

No frequency reference is input.

The frequency reference is 0.00 Hz or a no speed is selected by the multi-function contact 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 the current is larger than 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 Motor Stalls or Acceleration is Slow

Use the following information if the motor does not output torque or if acceleration is too 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 speed will drop before outputting torque. Check that the set value is suitable and that the load is not too large for the motor.

■Autotuning has not been performed for vector control

Vector control will not work properly if autotuning has not been performed. Perform autotuning, or set the motor parameters through calculations.

◆ If There is Low Speed Control Accuracy At High-speed Rotation in Open-loop Vector Control Method

The motor's rated voltage is high.

The Inverter's maximum output voltage is determined by its input voltage. (For example, if 400 VAC is input, then the maximum output voltage will be 200 VAC). Vector control uses voltage to control the currents within the motor. If the vector control voltage reference value exceeds the Inverter output voltage capability, the speed control accuracy will decrease because the motor currents cannot be properly controlled. Use a motor with a low rated voltage compared to the input voltage (i.e., a special motor for use with the vector control), or change to closed-loop vector control.

◆ 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.

◆ 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.

■Autotuning has not been performed for vector control

Vector control may not perform efficiently if autotuning has not been performed. Perform autotuning, or set the motor parameters through calculations.

◆ 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

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 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 autotuning has not been performed, proper performance may not be achieved for Vector control. Perform autotuning or set the motor parameters through calculations. Alternatively, change the Control method selection to V/f Control (A1-02 = 0).

■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 C5-01 (ASR proportional gain). If the oscillation points overlap with those of the machine and cannot be eliminated, increase the ASR delay time (C5-06), and then readjust the ASR gain (C5-01).

If autotuning has not been performed, proper performance may not be achieved for closed-loop vector control. Perform autotuning or set the motor parameters through calculations.

7

Maintenance and Inspection

This chapter describes basic maintenance and inspection for the Inverter.

Maintenance and Inspection 7-2

Maintenance and Inspection

◆ Outline of Maintenance

The maintenance period of the Inverter is as follows:

Maintenance Period: Within 18 months of shipping from the factory or within 12 months of being delivered to the final user, whichever comes first.

◆ Daily 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 cooling fan in the Inverter should be operating normally.

◆ Periodic Inspection

Check the following items during periodic maintenance.

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 10 VDC. 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.
Heatsinks	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 for 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 magnetic 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

◆ Types and Number of Cooling Fans Used in the Drive

Cooling fans used for the Inverter has two types; Heatsink cooling fan and heatsink circulation fan. Heatsink cooling fan blows air to the Inverter heatsink. Heatsink circulation fan stirs up the air inside the Inverter unit.

Table 7.4 shows the number of cooling fans used in the Inverter.

When replacing the fan, use the specified type of the fan. If the inapplicable fans are used, performance of the Inverter will not be fully obtained.

Table 7.4 Number of Cooling Fans to be Used

Maximum Motor Capacity (kW)	200 V Class		400 V Class	
	Heatsink Cooling Fan	Heatsink Circulation Fan	Heatsink Cooling Fan	Heatsink Circulation Fan
3.7	1	–	1	–
4.0	–		1	–
5.5	2	–	2	1
7.5	2	1	2	1
11	2	–	2	1
15	2	1	2	1
18.5	2	–	2	–
22	2	–	2	–
30	2	1	2	–
37	2	1	2	–
45	2	1	2	–
55	2	1	2	1

◆ Cooling Fan Replacement Outline

■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 installation panel.

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 then 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.

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 power connector securely and place the power 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.

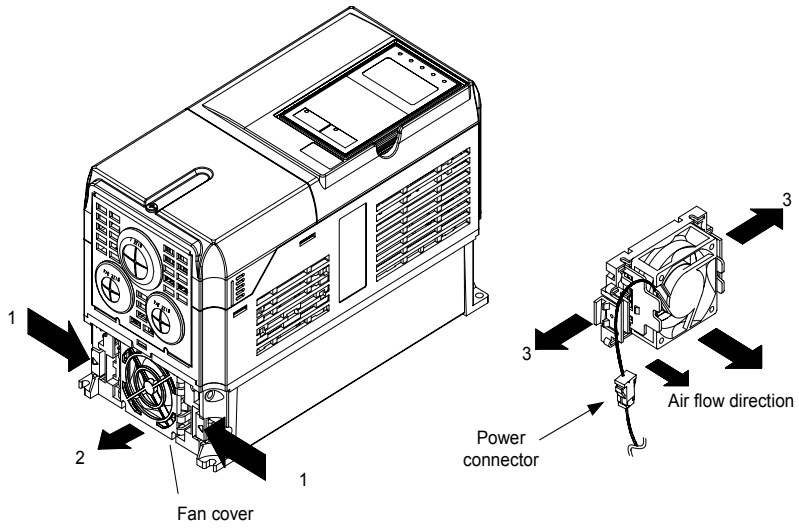


Fig 7.1 Cooling Fan Replacement (Inverters of 18.5 kW or Less)

■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.
2. Remove the terminal cover, Inverter cover, Digital Operator/Monitor, and front cover from the Inverter.
3. Remove the control board (if necessary) bracket to which the control boards are mounted. Remove all cables connected to the control board. The cables connected to the terminal board can be removed at the same time by removing them together with the control circuit terminal board.
4. Remove the cooling fan power connectors from the gate drive board positioned at the back of the control board.
5. Remove the fan cover screws and pull out the fan cover from the Inverter.
6. Remove the cooling fan(s) from the fan cover.

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 fan cover, be sure that the air flow direction faces the top of the Inverter.

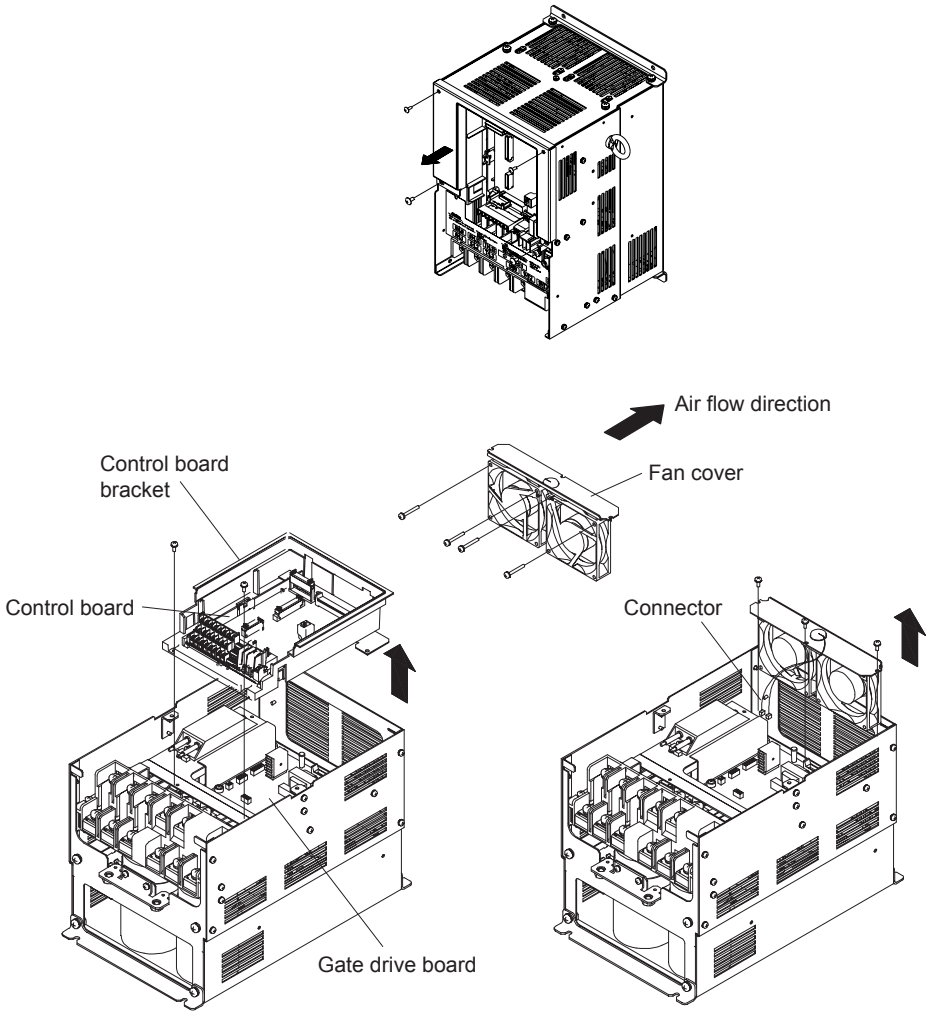


Fig 7.2 Cooling Fan Replacement (Inverters of 22 kW or More)

◆ Circulation Fan Replacement Outline

With some capacities, there is a small fan installed inside the Inverter for the purpose of increasing circulation in areas where heat has built up. These fans have built-in fan sensors that output an alarm when the rotation rate of the fan drops to indicate that replacement is necessary.

■200 V Class Inverters of 7.5 kW/400 V Class Inverters of 5.5 kW and 7.5 kW

The circulation fan is installed behind the control circuit terminal board inside the Inverter.

The circulation fan can be replaced by removing the control circuit terminal board.

Removing the Circulation Fan

1. Remove the Digital Operator, the terminal cover, and the front cover.
2. Remove the control circuit terminal board. Remove the cables connected to the terminals if necessary.
3. While pushing the two tabs (A) in direction 1, pull the fan out in direction 2.
4. Remove the power connector connected to the fan.

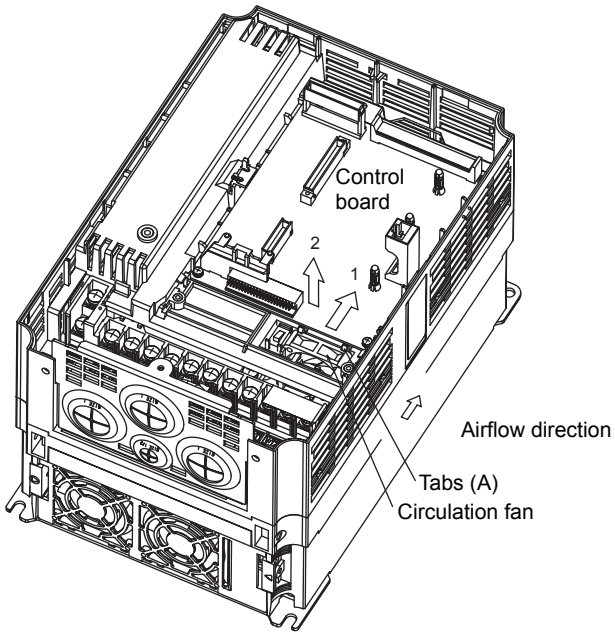
Mounting the Circulation Fan

Reverse the above procedure to mount the fan.

Be sure to mount the fan so that the air flows towards the top of the Inverter (direction indicated by the arrow).

Mount the fan securely using the tabs (A).

Confirm that there are no cables in contact with the fan's rotating parts.



Inverter with Control Circuit Terminal Board Removed

Fig 7.3 Circulation Fan Replacement (200 V Class Inverters of 7.5 kW/400 V Class Inverters of 5.5 kW and 7.5 kW)

■200 V Class Inverters of 15 kW/400 V Class Inverters of 11 kW and 15 kW

The circulation fan is installed at the top-left corner of the Inverter interior.

Removing the Circulation Fan

1. Remove the Digital Operator, the terminal cover, and the front cover.
2. While pushing the power connector tab (A) in direction 1, pull the power connector out in direction 2.
3. While pushing the fan tabs (B) in direction 3, pull the fan out in direction 2.
4. Remove the power connector connected to the fan.

Mounting the Circulation Fan

Reverse the above procedure to mount the fan.

Be sure to mount the fan so that the air flows towards the bottom of the Inverter (direction indicated by the arrow).

Mount the fan securely using the fan tabs (B).

Confirm that there are no cables in contact with the fan's rotating parts.

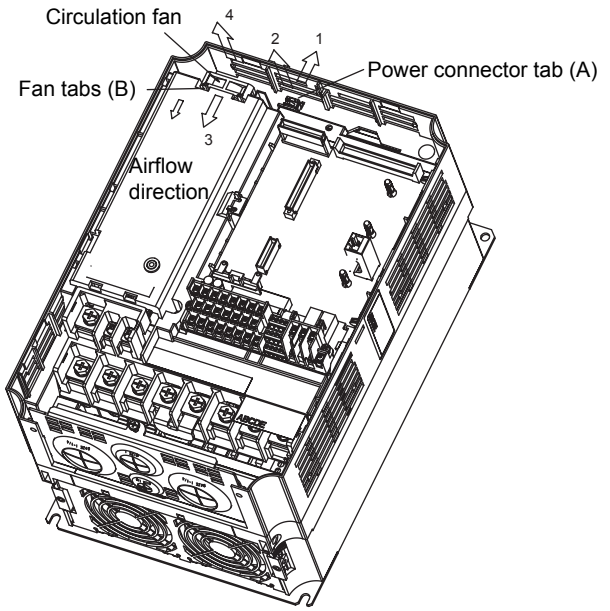


Fig 7.4 Circulation Fan Replacement (200 V Class Inverters of 15 kW/400 V Class Inverters of 11 kW and 15 kW)

◆ Removing and Mounting the Control Circuit Terminal Board

The control circuit terminal board can be removed and mounted without disconnecting the control wiring.

IMPORTANT

Always confirm that the input power is removed and the Charge LED is not lit before removing or mounting the control circuit terminal board.

■Removing the Control Circuit Terminal Board

1. Remove the terminal cover, Digital Operator/Monitor and front cover.
2. Remove the wires connected to FE and/or NC on the control circuit terminal board.
3. Loosen the mounting screws on the left and right sides of the control circuit terminal board “1” until they are free. It is not necessary to remove these screws completely. They are captive and self-rising.
4. Pull the control circuit terminal board out in the direction of the block arrow “2”.

■Mounting the Control Circuit Terminal Board

Reverse the removal procedure to mount the control circuit terminal board.

Confirm that the control circuit terminal board and the control board properly meet at connector CN8 before insertion.

The connector pins may be damaged if the control circuit terminal board is forced into place, possibly preventing correct Inverter operation.

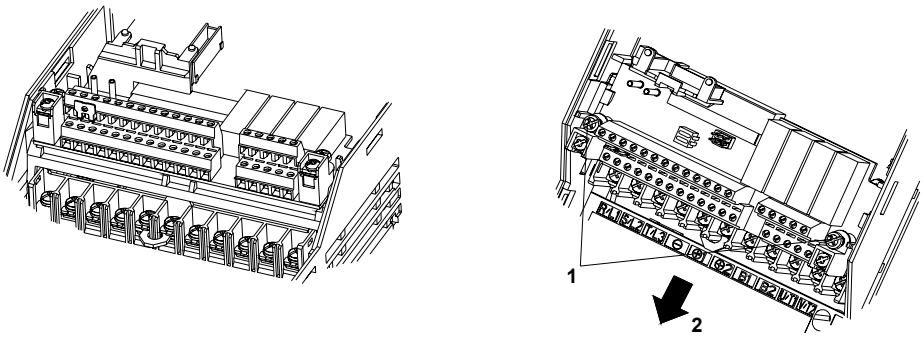


Fig 7.5 Removing the Control Circuit Terminal Board

8

Specifications

This chapter describes the basic specifications of the Inverter and specifications for options and peripheral devices.

Standard Inverter Specifications 8-2

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 8.1 200 V Class Inverters

Model Number CIMR-L7C □			23P7	25P5	27P5	2011	2015	2018	2022	2030	2037	2045	2055
Max. applicable motor output (kW)*			3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output ratings	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 programming.										
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%										
Control characteristics	Measures for power supply harmonics	DC reactor	Optional						–				
		12-pulse rectification	Not possible										

* 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.

■400 V Class

Table 8.2 400 V Class Inverters

Model Number CIMR-L7C □			43P7	44P0	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055
Max. applicable motor output (kW) *			3.7	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55
Output ratings	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)		Up to 120 Hz available by programming.											
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%											
Control characteristics	Measures for power supply harmonics	DC reactor	Optional							–				
		12-phase rectification	Not possible											

* 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 higher than the motor's rated current.

◆ Common Specifications

The following specifications apply to both 200 V and 400 V Class Inverters.

Table 8.3 Common Specifications

Model Number CIMR-L7C □		Specification
Control characteristics	Control method	Sine wave PWM Closed-loop vector control, Open-loop vector control, V/f control (switched by parameter setting)
	Torque characteristics	Normal Duty: 8 kHz carrier frequency, 150% overload for 30 sec, 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 (Open-loop vector control) 40 Hz (Closed-loop vector control)
	Torque limits	Provided (4 quadrant steps can be changed by parameter 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	Normal Duty: 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)
	Braking torque	Approximately 20% (Approximately 125% with Braking Resistor option, braking transistor built into Inverters of 18.5 kW or less)
	Main control functions	Overtorque/undertorque detection, torque limits, 8-speed control (maximum), 4 acceleration and deceleration times, S-curve acceleration/deceleration, autotuning (rotational or stationary), dwell function, cooling fan ON/OFF control, slip compensation, torque compensation, auto-restart after fault, DC braking for starting and stopping, fault reset, parameter copy function, special lift function and sequence, brake sequence, short floor, hardware baseblock
Protective functions	Motor protection	Protection by electronic thermal overload relay.
	Instantaneous overcurrent protection	Stops at approx. 200% of rated output current.
	Fuse blown protection	Stops for fuse blown.
	Overload protection	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.
	Momentary power loss ridethrough	By selecting the momentary power loss method, operation can be continued if power is restored within 2 s.
	Heatsink 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 approx. 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 40°C (Enclosed wall-mounted type) –10°C to 45°C (Open chassis type)
	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

9

Appendix

This chapter provides precautions for the Inverter, motor, and peripheral devices and also provides lists of parameters.

Inverter Application Precautions 9-2
Motor Application Precautions 9-4
Parameters 9-6

Inverter Application Precautions

This section provides precautions for selecting, installing, setting, and handling Inverters.

◆ 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 phase advancing 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.

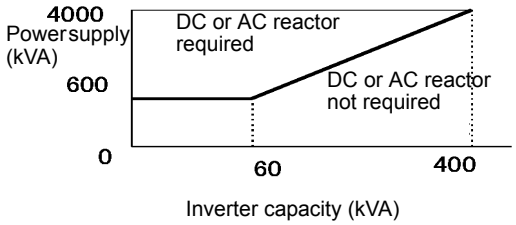


Fig 9.1

◆ 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 120 Hz (depends on the carrier frequency). 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, which 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. The stall prevention functions will increase the acceleration or deceleration time by the amount of time the stall prevention function is active.

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 indicator, indicating if the DC bus is charged, glows above a voltage of 10 VDC.

Motor Application Precautions

This section provides precautions for motor application.

◆ Using the Inverter for an Existing Standard Motor

When a standard motor is operated with the Inverter, power loss is slightly higher than when operated with a commercial power supply.

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, ensure that the motor insulation class is suitable. Contact Yaskawa for the details.

■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.

■Gearmotor

The speed range for continuous operation differs according to the lubrication method and motor manufacturer. In particular, continuous operation of an oil-lubricated motor in the low speed range may result in damaging. If the motor is to be operated at a speed higher than 50 Hz, consult the manufacturer.

■Synchronous Motor

A synchronous motor is not suitable for Inverter control.

■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.

◆ Power Transmission Mechanism (Speed Reducers, Belts and Chains)

If an oil-lubricated gearbox or speed reducer is used in the power transmission mechanism, oil lubrication will be affected when the motor operates only in the low speed range. The power transmission mechanism will make noise and experience problems with service life and durability if the motor is operated at low speeds continuously.

Parameters

Factory settings are given in the following table.

Table 9.1 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	3	
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	
b1-03	Stopping method selection	0	
b1-06	Control input scan	1	
b1-07	Operation selection after switching to remote mode	0	
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	3.00 s	
C1-02	Deceleration time 1		
C1-03	Acceleration time 2		
C1-04	Deceleration time 2		
C1-05	Acceleration time 3		
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	0	
C1-11	Accel/decel time switching frequency	0.0 Hz	
C2-01	S-curve characteristic time at acceleration start	0.50 s	
C2-02	S-curve characteristic time at acceleration end	0.50 s	
C2-03	S-curve characteristic time at deceleration start	0.50 s	
C2-04	S-curve characteristic time at deceleration end	0.50 s	

Table 9.1 User Constants (Continued)

No.	Name	Factory Setting	Setting
C2-05	S-curve Characteristic time below leveling speed	0.50 s	
C3-01	Slip compensation gain	1.0	
C3-02	Slip compensation delay time	2000 ms	
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	
C4-06	Torque compensation delay time constant 2	150 ms	
C5-01	ASR proportional (P) gain 1	40.00	
C5-02	ASR integral (I) time 1	0.500	
C5-03	ASR proportional (P) gain 2	20.00	
C5-04	ASR integral (I) time 2	0.500	
C5-06	ASR delay time	0.004	
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	3 *2	
C6-03	Carrier frequency upper limit	8.0 k Hz *5	
C6-09	Carrier frequency selection during autotuning (Rotational type)	0	
C6-10	Carrier frequency selection during autotuning (Stationary type)	1	
d1-01 *11	Frequency reference 1	0.00 Hz	
d1-02 *11	Frequency reference 2	0.00 Hz	
d1-03 *11	Frequency reference 3	0.00 Hz	
d1-04 *11	Frequency reference 4	0.00 Hz	
d1-05 *11	Frequency reference 5	0.00 Hz	
d1-06 *11	Frequency reference 6	0.00 Hz	
d1-07 *11	Frequency reference 7	0.00 Hz	
d1-08 *11	Frequency reference 8	0.00 Hz	
d1-09 *12	Vn reference	0.00 Hz	
d1-10 *12	V1 reference	0.00 Hz	

Table 9.1 User Constants (Continued)

No.	Name	Factory Setting	Setting
d1-11 *12	V2 reference	0.00 Hz	
d1-12 *12	V3 reference	0.00 Hz	
d1-13 *12	Vr reference	0.00 Hz	
d1-14 *12	Inspection reference	25.00 Hz	
d1-17	Vl (Leveling) reference	4.00 Hz	
d1-18	Speed priority selection	0	
d6-03	Field forcing function selection	0	
d6-06	Field forcing function limit	400 %	
E1-01	Input voltage setting	200 V *3	
E1-03	V/f pattern selection	F	
E1-04	Max. output frequency (FMAX)	60.0 Hz	
E1-05	Max. output voltage (VMAX)	200.0 V *3	
E1-06	Base frequency (FA)	60.0 Hz	
E1-07	Mid. output frequency (FB)	3.0 Hz *1	
E1-08	Mid. output frequency voltage (VB)	11.0 V *1 *3	
E1-09	Min. output frequency (FMIN)	0.5 Hz *1	
E1-10	Min. output frequency voltage (VMIN)	2.0 V *1 *3	
E1-13	Base voltage (VBASE)	0.0 V *4	
E2-01	Motor rated current	14.00 A *5	
E2-02	Motor rated slip	2.73 Hz *5	
E2-03	Motor no-load current	4.50 A *5	
E2-04	Number of motor poles	4 poles	
E2-05	Motor line-to-line resistance	0.771 Ω *5	
E2-06	Motor leak inductance	19.6 % *5	
E2-07	Motor iron saturation coefficient 1	0.50	
E2-08	Motor iron saturation coefficient 2	0.75	
E2-09	Motor mechanical losses	0.0 %	
E2-10	Motor iron loss for torque compensation	112 W *5	
E2-11	Motor rated output power	3.70 *5	
E2-12	Motor iron saturation coefficient 3	1.30	
F1-01	PG constant	600 *6	
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	

Table 9.1 User Constants (Continued)

No.	Name	Factory Setting	Setting
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	
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 board	0	
F6-03	Stopping method for external error from communications option board	1	
F6-04	Trace sampling from communications option board	0	
F6-05	Current monitor unit selection	0	
F6-06	Torque reference/torque limit selection from communications option board	0	
H1-01	Terminal S3 function selection	24	
H1-02	Terminal S4 function selection	14	
H1-03	Terminal S5 function selection	3	
H1-04	Terminal S6 function selection	4	
H1-05	Terminal S7 function selection	6	
H2-01	Terminal M1-M2 function selection	40	
H2-02	Terminal M3-M4 function selection	41	

Table 9.1 User Constants (Continued)

No.	Name	Factory Setting	Setting
H2-03	Terminal M5-M6 function selection	6	
H3-01	Signal level selection (AI-14B CH1)	0	
H3-02	Gain (AI-14B CH1)	100.0 %	
H3-03	Bias (AI-14B CH1)	0.0 %	
H3-04	Signal level selection (AI-14B CH3)	0	
H3-05	Multi-function analog input (AI-14B CH3)	2	
H3-06	Gain (AI-14B CH3)	100.0 %	
H3-07	Bias (AI-14B CH3)	0.0 %	
H3-08	Multi-function analog input AI-14B CH2 signal level selection	0	
H3-09	Multi-function analog input AI-14B CH2 function selection	3	
H3-10	Gain (AI-14B CH2)	100.0 %	
H3-11	Bias (AI-14B CH2)	0.0 %	
H3-12	Analog input filter time constant	0.03 s	
H3-15	Terminal A1 function selection	0	
H3-16	Gain (Terminal A1)	100.0 %	
H3-17	Bias (Terminal A1)	0.0 %	
H5-01	Station address	1F	
H5-02	Communication speed selection	3	
H5-03	Communication parity selection	0	
H5-04	Stopping method after communication error	3	
H5-05	Communication error detection selection	1	
H5-06	Send wait time	5 ms	
H5-07	RTS control ON/OFF	1	
L1-01	Motor protection selection	1	
L1-02	Motor protection time constant	1.0 min *7	
L2-05	Undervoltage detection level	190 V *8	
L2-11	Battery Voltage	0 V *8	
L3-01	Stall prevention selection during accel	1	
L3-02	Stall prevention level during accel	150 %	
L3-03	Stall prevention limit during accel	50 %	
L3-04	Stall prevention selection during decel	0	
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	

Table 9.1 User Constants (Continued)

No.	Name	Factory Setting	Setting
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	1	
L5-03	Auto restart interval time	2.0 sec	
L6-01	Torque detection selection 1	4	
L6-02	Torque detection level 1	150 %	
L6-03	Torque detection time 1	10.0 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	200 % *9	
L7-02	Reverse drive torque limit	200 % *9	
L7-03	Forward regenerative torque limit	200 % *9	
L7-04	Reverse regenerative torque limit	200 % *9	
L7-06	Torque limit time constant	200 ms	
L7-07	Torque Limit Operation during accel/decel	0	
L8-02	Overheat pre-alarm level	75 °C *5	
L8-03	Operation selection after overheat pre-alarm	3	
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	0.2 sec	
N2-01	Speed feedback detection control (AFR) gain	1.00	
N2-02	Speed feedback detection control (AFR) time constant 1	50 ms	
N2-03	Speed feedback detection control (AFR) time constant 2	750 ms	
N5-01	Feed forward control selection	1	
N5-02	Motor acceleration time	0.154 s *5	
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	

Table 9.1 User Constants (Continued)

No.	Name	Factory Setting	Setting
o1-04	Setting unit for frequency parameters related to V/f characteristics	0	
o1-05	LCD Display contrast adjustment	3	
o2-01	LOCAL/REMOTE key enable/disable	0	
o2-02	STOP key during control circuit terminal operation	0	
o2-03	Parameter initial value	0	
o2-04	kVA selection	4 *5	
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	0	
o2-10	Fan operation time setting	0 hr	
o2-12	Fault trace initialize	0	
o2-15	Operation counter initialize	0	
o3-01	Copy function selection	0	
o3-02	Read permission selection	0	
S1-01	Zero-speed level (DC injection braking starting frequency)	1.2 Hz *10	
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	0.50 s *10	
S1-05	DC injection braking time at stop	0.60 s	
S1-06	Brake release delay time	0.20	
S1-07	Brake close delay time	0.10	
S1-14	SE2 detection delay time	200 ms	
S1-15	SE3 detection delay time	200 ms	
S1-16	RUN delay time	0.10 s	
S1-17	DC injection current gain at regeneration	100 %	
S1-18	DC injection current gain at motoring	20 %	
S1-19	Magnetic contactor close delay time	0.10 s	
S1-20	Zero-servo gain	5	
S1-21	Zero-servo completion width	10	
S1-22	Torque compensation time at start	500 ms	
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 reference	0.0 Hz	

Table 9.1 User Constants (Continued)

No.	Name	Factory Setting	Setting
S1-27	Frequency detection during deceleration	0.0 Hz	
S2-01	Motor rated speed	1380 min^{-1}	
S2-02	Slip compensation gain at motoring	0.70	
S2-03	Slip compensation gain at regenerating	1.00	
S2-07	Slip compensation primary delay time	200 ms	
S2-15	Slip compensation selection during regeneration	1	
S3-01	Short-floor function selection	0	
T1-01	Autotuning mode selection	1	
T1-02	Motor output power	3.70 kW *5	
T1-03	Motor rated voltage	200.0 V *8	
T1-04	Motor rated current	14.00 A *5	
T1-05	Motor base frequency	60.0 Hz	
T1-06	Number of motor poles	4 poles	
T1-07	Motor base speed	1450 min^{-1}	
T1-08	Number of PG pulses	600 *6	
T1-09	No load current	4.50 A (E2-03)	

* 1. The factory setting will change when the control method is changed. Open-loop vector control factory settings are given.
* 2. For Inverters of 200/400 V 3.7 kW to 22 kW, the value is 3.
For Inverters of 200/400 V 30 kW to 55 kW, the value is 2.
* 3. This value is set according to o2-09. Values for a 200 V Class Inverter when o2-09=0 (Asia) are given. Values for a 400 V Class Inverter are double.
* 4. E1-13 is set to the same value as E1-05 by autotuning.
* 5. The factory setting depends upon the Inverter capacity. The value for a 200 V Class Inverter of 3.7 kW is given.
* 6. The factory setting is set according to o2-09. The value when o2-09=0 (Asia) is given. The value is 1024 when o2-09 is 1 or 2.
* 7. This value is set according to o2-09. The value when o2-09=0 is given.
* 8. These are values for a 200 V Class Inverter. The value for a 400 V Class Inverter is the double.
* 9. A setting value of 100 % is equal to the motor rated torque.
* 10. The factory setting will change when the control method is changed. The V/f control factory setting is given.
* 11. Not displayed when d1-18 is 1 or 2.
* 12. Not displayed when d1-18 is 0.

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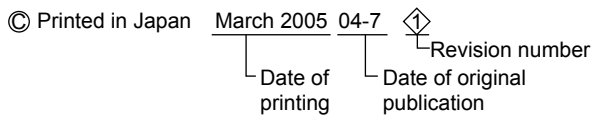

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