YASKAWA
Mechatronics Solutions

Varispeed L7

Instruction Manual and Parameter Description

Model: CIMR-L7X□ □ □ □

TOEPC71067602A

Table of Contents

Warnings

CAUTION

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

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

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

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

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

This is absolutely imperative!

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

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

Safety Precautions and Instructions

■1. General

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

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

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

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

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

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

■2. Intended Use

Frequency inverters are intended for installation in electrical systems or machines. The systems and machines must be correspondent wiht the relevant directives and standards. Relevant guidelines like Low Voltage Directives , Machinery Directives , Emc Directives and other s are to be kept.

The Inverters may be put into operation, when the systems and machines in whitch they are inrested to the guidelines and laws correspondent.

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

■3. Transportation and storage

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

■4. Installation

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

■5. Electrical Connection

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

Contact your supplier or Yaskawa representative when using leakage current circuit breaker in conjunction with frequency inverters.

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

⚠ CAUTION
If a PM motor is turned by any external force, high voltage is generated in the windings. • During wiring, maintenance or inspection make sure, that the motor is stopped and can not turn. • If the inverter is turned off and the motor must be turned, make sure that motor and inverter output are electrically disconnected.

■6. Inverter Setup

This L7 inverter can drive induction motors as well as permanent magnet motors.
Always select the appropriate control mode:

- For induction motors use V/f, Open Loop Vector or Closed Loop Vector control (A1-01 = 0, 2 or 3).
- For permanent magnet motors use no other control mode than Closed Loop Vector for PM (A1-01 = 6).

A wrong control mode selection can damage the inverter and motor.

If a motor is exchanged or operated the first time, always set up the motor control relevant parameters using the nameplate data or perform autotuning. Do not change the parameters recklessly. To ensure a safe operation with PM motors always set the:

- correct motor data
- the PG open detection parameters
- the speed deviation detection parameters
- the over acceleration detection parameters

Wrong parameter settings can cause dangerous behavior or motor and inverter damage.

⚠ CAUTION
If a permanent magnet motor is used, the peak current capability of the motor should always be higher than the maximum inverter output current in order to prevent a demagnetization of the motor.

Refer to *page 4-2, Start Up* for details about the correct start up procedure.

■7. Notes

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

EMC Compatibility

■1. Introduction

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

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

EN 61800-3:2004

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

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

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

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

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

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

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

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

■3. Laying Cables

Measures Against Line-Borne Interference:

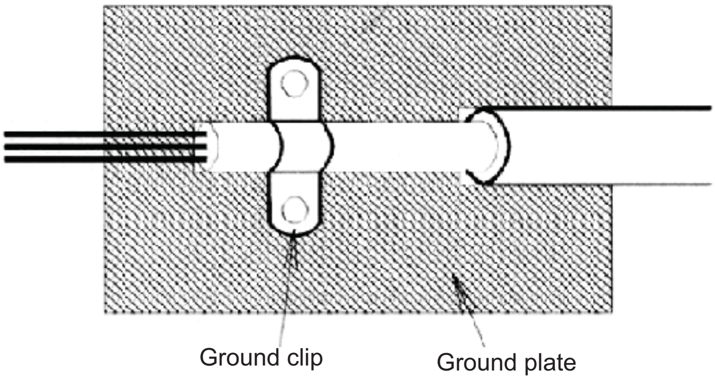
Line filter and frequency inverter must be mounted on the same metal plate. Mount the two components as close to each other as possible, with cables kept as short as possible.

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

Shielded Cable:

–Use a cable with braided shield.

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



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

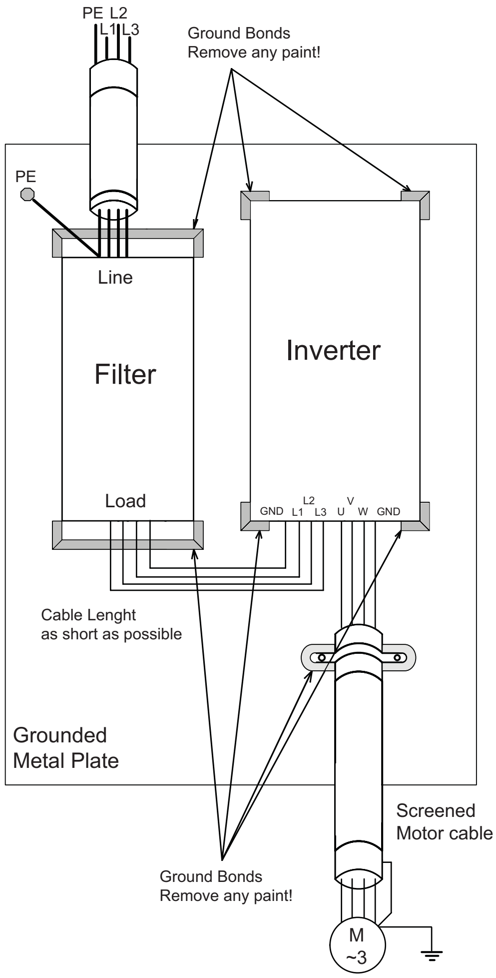
–Ground the cable shields at both ends.

–Ground the motor of the machine.

■Installation inverters and EMC filters

For an EMC rules compliant installation consider the following points:

- Use a line filter.
- Use shielded motor cables.
- Mount the inverter and filter on a grounded conductive plate.
- Remove any paint or dirt before mounting the parts in order to reach the lowest possible grounding impedance.



Line Filters

■Recommended Line Filters for Varispeed L7

Inverter Model	Line Filter			
Varispeed L7	Model	Current (A)	Weight (kg)	Dimensions W x D x H
CIMR-L7X43P77 CIMR-L7X44P07 CIMR-L7X45P57	3G3RV-PFI3018-SE	18	1.3	141 x 46 x 330
CIMR-L7X47P57 CIMR-L7X40117	3G3RV-PFI3035-SE	35	2.1	206 x 50 x 355
CIMR-L7X40157 CIMR-L7X40187	3G3RV-PFI3060-SE	60	4.0	236 x 65 x 408
CIMR-L7X40227 CIMR-L7X40307	3G3RV-PFI3070-SE	70	3.4	80 x 185 x 329
CIMR-L7X40377 CIMR-L7X40457 CIMR-L7X40557	3G3RV-PFI3130-SE	130	4.7	90 x 180 x 366

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

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

Inverter Model	Line Filter			
Varispeed L7	Model	Current (A)	Weight (kg)	Dimensions W x D x H
CIMR-L7X23P77 CIMR-L7X25P57	3G3RV-PFI2035-SE	35	1.4	141 x 46 x 330
CIMR-L7X27P57 CIMR-L7X20117	3G3RV-PFI2060-SE	60	3.0	206 x 60 x 355
CIMR-L7X20157 CIMR-L7X20187	3G3RV-PFI2100-SE	100	4.9	236 x 80 x 408
CIMR-L7X20227 CIMR-L7X20307	3G3RV-PFI2130-SE	130	4.3	90 x 180 x 366
CIMR-L7X20377	3G3RV-PFI2160-SE	160	6.0	120 x 170 x 451
CIMR-L7X20457 CIMR-L7X20557	3G3RV-PFI2200-SE	200	11.0	130 x 240 x 610

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

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

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

Registered Trademarks

The following registered trademarks are used in this manual.

- DeviceNet is a registered trademark of the ODVA (Open DeviceNet Vendors Association, Inc.).
- InterBus is a registered trademark of Phoenix Contact Co.
- Profibus is a registered trademark of Siemens AG.
- Hiperface® is a registered trademark of Sick Stegmann GmbH
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Handling Inverters

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

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	IEC IP00 CIMR-L7X	NEMA 1 CIMR-L7X	IEC IP20 CIMR-L7X
200 V class	3.7	7	CIMR-L7X23P7		23P71□	23P77□
	5.5	10	CIMR-L7X25P5		25P51□	25P57□
	7.5	14	CIMR-L7X27P5		27P51□	27P57□
	11	20	CIMR-L7X2011		20111□	20117□
	15	27	CIMR-L7X2015		20151□	20157□
	18.5	33	CIMR-L7X2018		20181□	20187□
	22	40	CIMR-L7X2022	20220□	20221□	20227□
	30	54	CIMR-L7X2030	20300□	20301□	20307□
	37	67	CIMR-L7X2037	20370□	20371□	20377□
	45	76	CIMR-L7X2045	20450□	20451□	20457□
	55	93	CIMR-L7X2055	20550□	20551□	20557□
400 V class	3.7	7	CIMR-L7X43P7		43P71□	43P77□
	4.0	9	CIMR-L7X44P0		44P01□	43P77□
	5.5	12	CIMR-L7X45P5		45P51□	45P57□
	7.5	15	CIMR-L7X47P5		47P51□	47P57□
	11	22	CIMR-L7X4011		40111□	40117□
	15	28	CIMR-L7X4015		40151□	40157□
	18.5	34	CIMR-L7X4018		40181□	40187□
	22	40	CIMR-L7X4022	40220□	40221□	40227□
	30	54	CIMR-L7X4030	40300□	40301□	40307□
	37	67	CIMR-L7X4037	40370□	40371□	40377□
	45	80	CIMR-L7X4045	40450□	40451□	40457□
	55	106	CIMR-L7X4055	40550□	40551□	40557□

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.

In case of any irregularities in the above items, contact the agency from which the Inverter was purchased or your Yaskawa representative immediately.

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◆ Nameplate Information

The nameplate attached to the side of each Inverter showing the model number, specifications, lot number, serial number and other information about the Inverter.

■ Example Nameplate

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

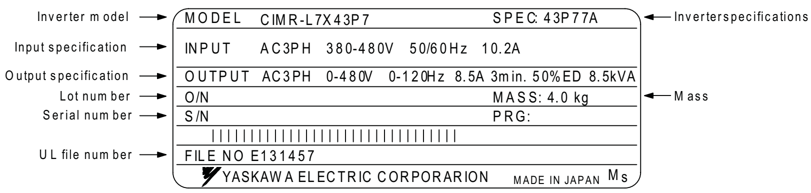


Fig 1.1 Nameplate

■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.

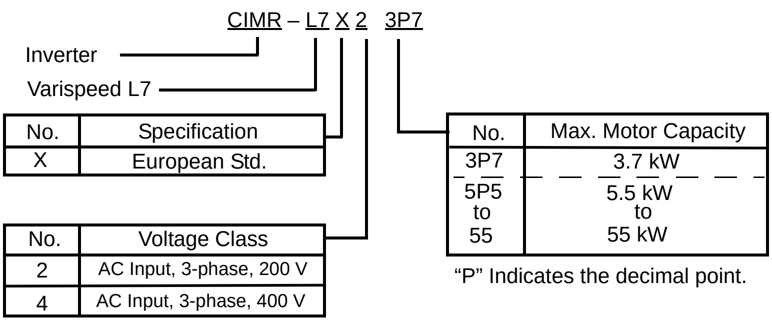


Fig 1.2   Inverter Model Numbers

■Inverter Specifications

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

2 3P7 1 B

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

No.	Hardware Revision
A	Spec A
B	Spec B

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

“P” Indicates the decimal point

No.	Protective Structure
0	IP00
1	NEMA 1
7	IP20

Fig 1.3 Inverter Specifications

◆ Inverter Software Version

The inverter software version can be read out from the monitor parameter U1-14. The parameter shows the last for digits of the software number (e.g. display is “2031” for the software version VSL702031).

IMPORTANT

This manual describes the functionality of the inverter software version VSL702031
Older software versions may not support all described functions. Check the software version before start working with this manual!

◆ 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*.

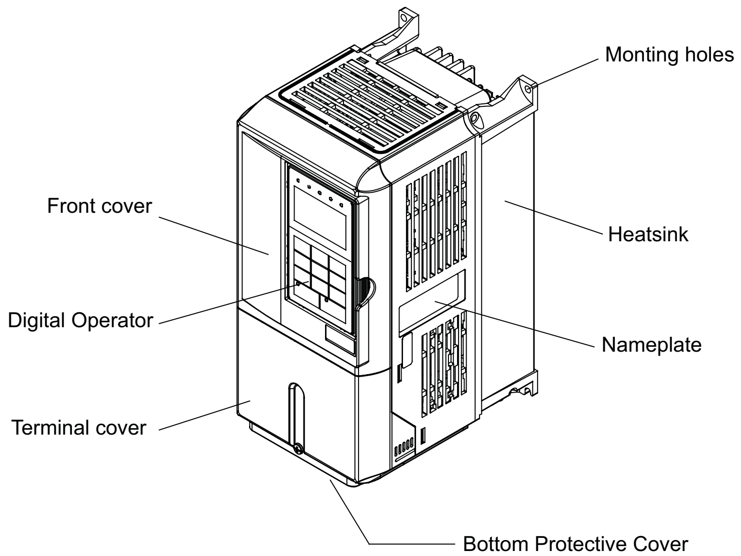


Fig 1.4 Inverter Appearance (18.5 kW or Less)

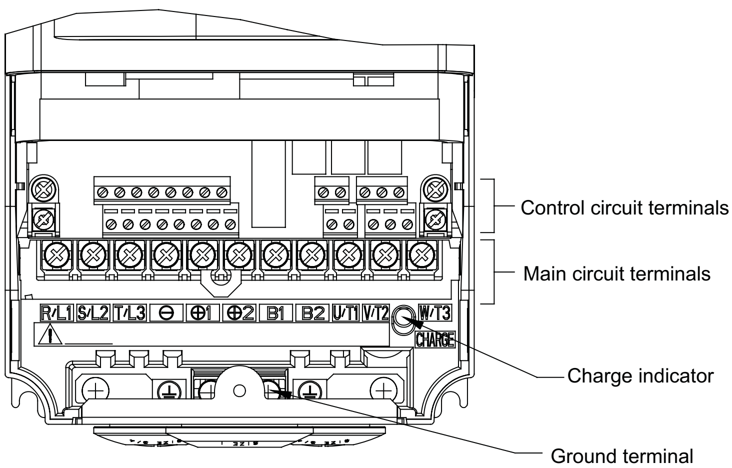


Fig 1.5 Terminal Arrangement (18.5 kW or Less)

■ 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*.

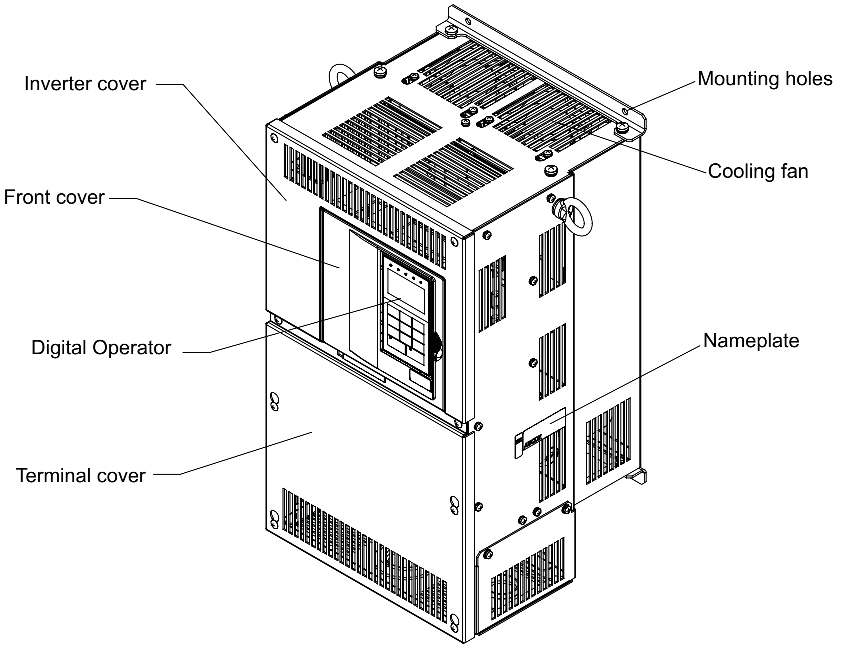


Fig 1.6 Inverter Appearance (22 kW or More)

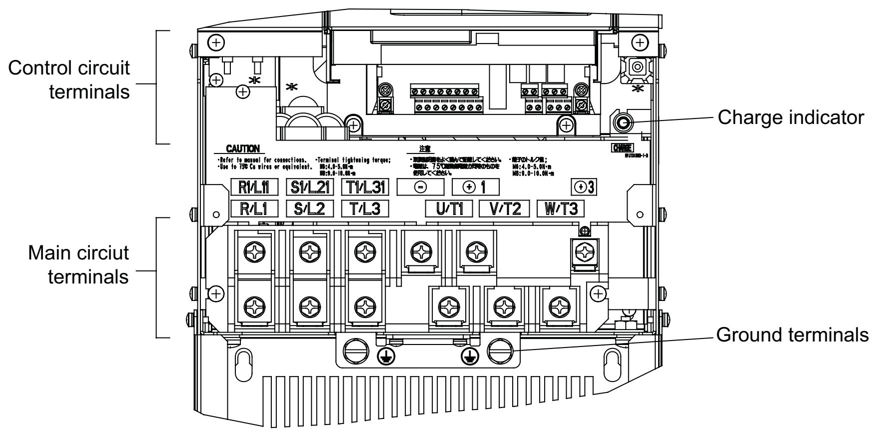
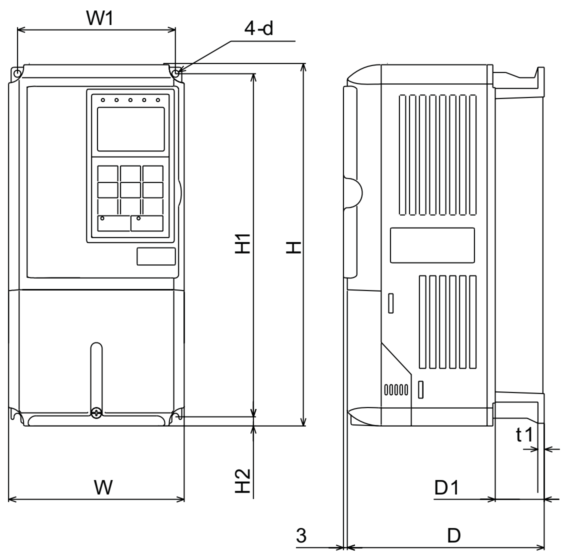


Fig 1.7 Terminal Arrangement (22 kW or More)

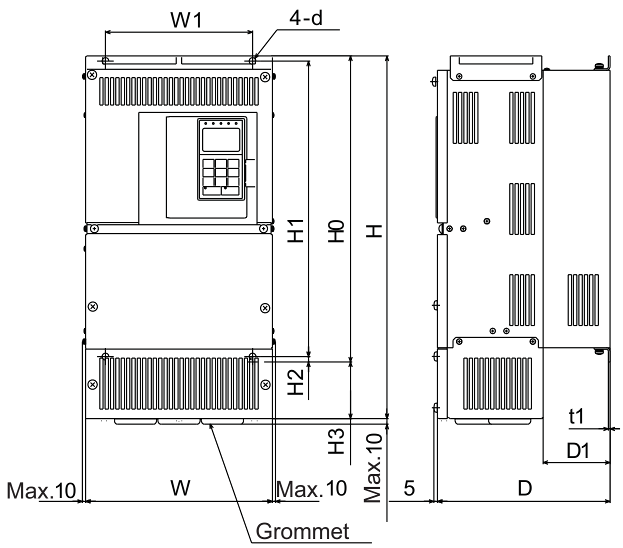
Exterior and Mounting Dimensions

◆ IP00 Inverters

Exterior diagrams of the IP00 Inverters are shown below.



200 V/400 V Class Inverters of 0.55 to 18.5 kW

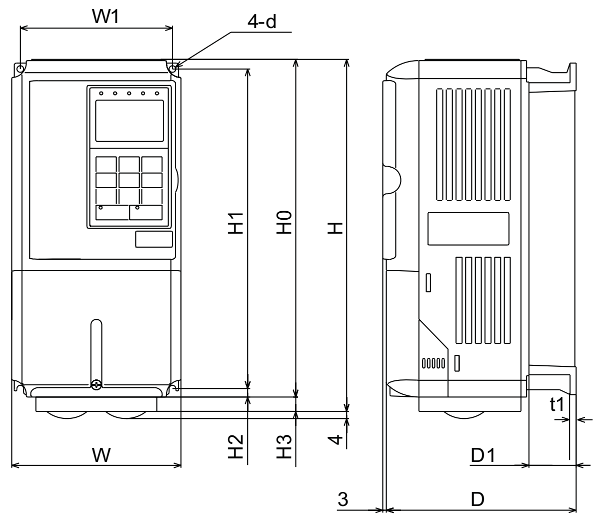


200 V Class Inverters of 22 or 55 kW
400 V Class Inverters of 22 to 55 kW

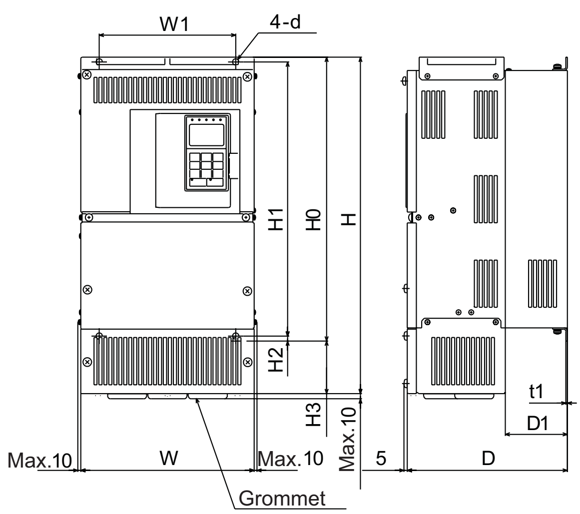
Fig 1.8 Exterior Diagrams of IP00 Inverters

◆ IP20 / NEMA 1 Inverters

Exterior diagrams of the IP20/NEMA1 Inverters are shown below.



200/400 V Class Inverters of 3.7 to 18.5 kW



200V Class inverters of 22kW or 55kW

400 V Class Inverters of 22kW or 55 kW

Fig 1.9 Exterior Diagrams of IP20/NEMA1 Inverters

Voltage Class	Max. Applicable Motor Output [kW]	IP00 W	IP00 H	IP00 D	IP00 W1	IP00 H1	IP00 H2	IP00 D1	IP00 t1	IP00 Approx Mass	NEMA1 W	NEMA1 H	NEMA1 D	NEMA1 W1	NEMA1 H0	NEMA1 H1	NEMA1 H2	NEMA1 H3	NEMA1 D1	NEMA1 t1	NEMA1 Approx. Mass	IP20 W	IP20 H	IP20 D	IP20 W1	IP20 H0	IP20 H1	IP20 H2	IP20 H3	IP20 D1	IP20 t1	IP20 Approx. Mass	Mounting Holes d*	Caloric Value (W) External	Caloric Value (W) Internal	Caloric Value (W) Total Heat Generation	Cooling Method
200 V (3-phase)	3.7	140	280	177	126	266	7	59	5	4	140	280	177	126	280	266	7	0	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		65.5		6	200	300	197	186	300	285	8		65.5		6	200	300	197	186	300	285	8		65.5		6		219	113	332	
	11									7		310						10			7		310						10			7		374	170	544	
	15	240	350	207	216	335	7.5	78	2.3	11	240	350	207	216	350	335		0	78	2.3	11	240	350	207	216	350	335		0	78	2.3	11	M6	429	183	612	
	18.5											380					7.5	30					380					7.5	30					501	211	712	
	22	250	400	258	195	385		100		17	254	535	258	195	400	385		135	100		20	254	464	258	195	400	385		64	100		19		586	274	860	
	30	275	450		220	435				20	279	615		220	450	435		165			23													865	352	1217	
	37	375	600	298	250	575		100		52	380	809	298	250	600	575		209	100		57													1015	411	1426	
	45			328			12.5	130	3.2	57			328				12.5		130	3.2	62													1266	505	1771	
	55	450	725	348	325	700				78	453	1027	350	325	725	700		302			86													1588	619	2207	
400 V (3-phase)	3.7																																	80	68	148	
	4.0	140	280	177	126	266	7	59	5	4	140	280	177	126	280	266	7		59	5	4	140	280	177	126	280	266	7		59	5	4	M5	91	70	161	
	5.5																																	127	82	209	
	7.5	200	300	197	186	285	8	65.5		6	200	300	197	186	300	285	8	0	65.5		6	200	300	197	186	300	285	8	0	65.5		6		193	114	307	
	11																																	252	158	410	
	15	240	350	207	216	335		78		10	240	350	207	216	350	335			78		10	240	350	207	216	350	335			78		10		326	172	498	Fan
	18.5																																	426	208	634	
	22	275	450	258	220	435		100	2.3	17	279	535	258	220	450	435		85	100	2.3	20	279	514.5	258	220	450	435		64	100	2.3	19	M6	466	259	725	
	30						7.5										7.5											7.5						678	317	995	
	37									31		635									35		614									34		784	360	1144	
	45	325	550	283	260	535		105		30	329	715	283	260	550	535		165	105		34	329	629.5	283	260	550	535		79.5	105				901	415	1316	
	55																															33		1203	495	1698	

Table 1.3 Inverter Dimensions (mm) and Masses (kg)

Checking and Controlling the Installation Site

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

◆ Installation Site

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

Table 1.4 Installation Site

Type	Ambient Operating Temperature	Humidity
NEMA1 / IP20	-10 to + 40 °C	95% RH or less (no condensation)
IEC IP00	-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 cabinet, use a cooling fan or air conditioner to maintain the internal air temperature below 45°C.

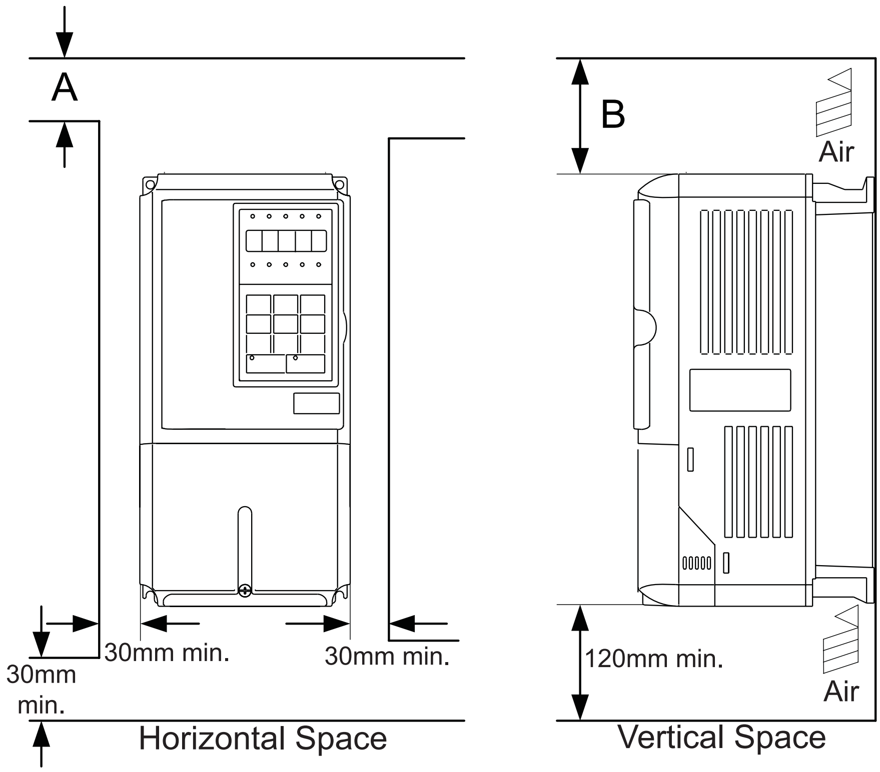
◆ Protecting the Inverter from Foreign Matter

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

Always remove the cover from the Inverter after the completion of the 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.



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

Fig 1.10 Inverter Installation Orientation and Space

IMPORTANT

1. The same space is required horizontally and vertically for IP00, IP20 and NEMA 1 Inverters.
2. Always remove the top protection cover after installing an 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 an 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.

IMPORTANT

Before opening the terminal cover, switch off the power supply and wait at least 5 min. to make sure, that the DC bus is discharged!

◆ 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.

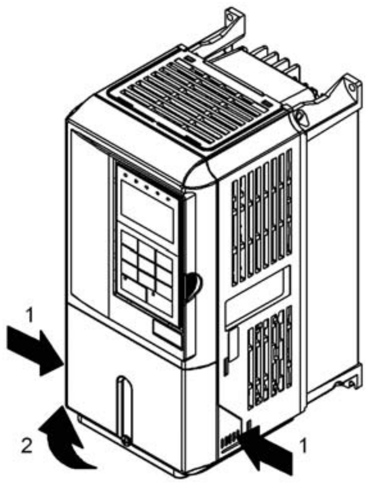


Fig 1.11 Removing the Terminal Cover (Model CIMR-L7X43P7 Shown Above)

■ 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.

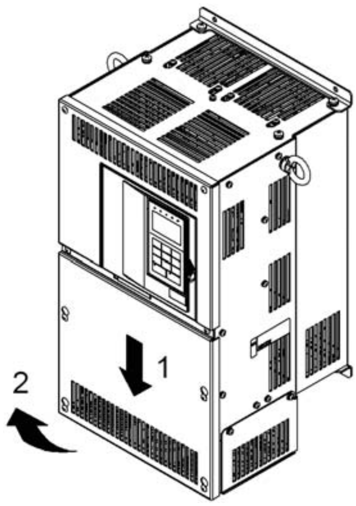


Fig 1.12 Removing the Terminal Cover (Model CIMR-L7X4022 Shown Above)

◆ Attaching the Terminal Cover

When the terminal block wiring 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/ LED Monitor and Front Cover

◆ Inverters of 18.5 kW or Less

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

The removal and attachment procedures are described below.

■Removing the Digital Operator/LED Monitor

Press the lever on the side of the Digital Operator/LED Monitor in the direction of arrow 1 to unlock the Digital Operator/LED Monitor and lift the Digital Operator/LED Monitor in the direction of arrow 2 to remove the Digital Operator/LED Monitor as shown in the following illustration.

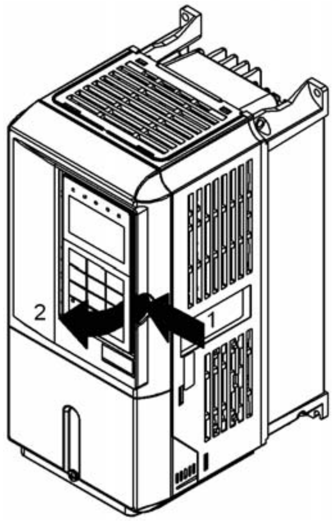


Fig 1.13 Removing the Digital Operator/LED Monitor (Model CIMR-L7X43P7 Shown Above)

■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.

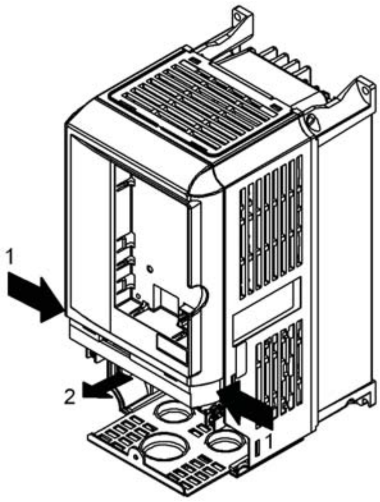


Fig 1.14 Removing the Front Cover (Model CIMR-L7X43P7 Shown Above)

■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/LED Monitor attached to the front cover; otherwise, Digital Operator/LED 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/LED Monitor

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

1. Hook the Digital Operator/LED 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/LED Monitor in the direction of arrow 2 until it snaps in place at B (two locations).

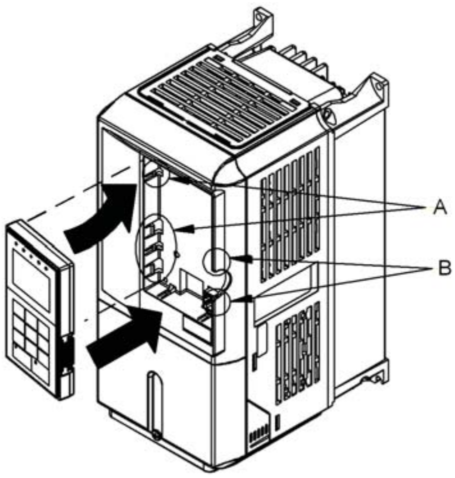


Fig 1.15 Mounting the Digital Operator/LED Monitor

1. Do not remove or attach the Digital Operator/LED 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/LED 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/LED Monitor to the front cover.

IMPORTANT

◆ 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/LED Monitor and front cover.

■Removing the Digital Operator/LED Monitor

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

■Removing the Front Cover

Lift up at the location label 1 at the top of the control circuit terminal card in the direction of arrow 2.

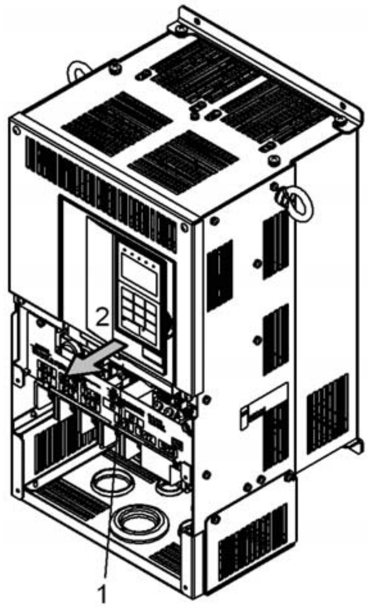


Fig 1.16 Removing the Front Cover (Model CIMR-L7X4022 Shown Above)

■ Attaching the Front Cover

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

1. Confirm that the Digital Operator/LED Monitor is not mounted on the front cover. Contact faults can occur if the cover is attached while the Digital Operator/LED 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/LED Monitor

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

1

2

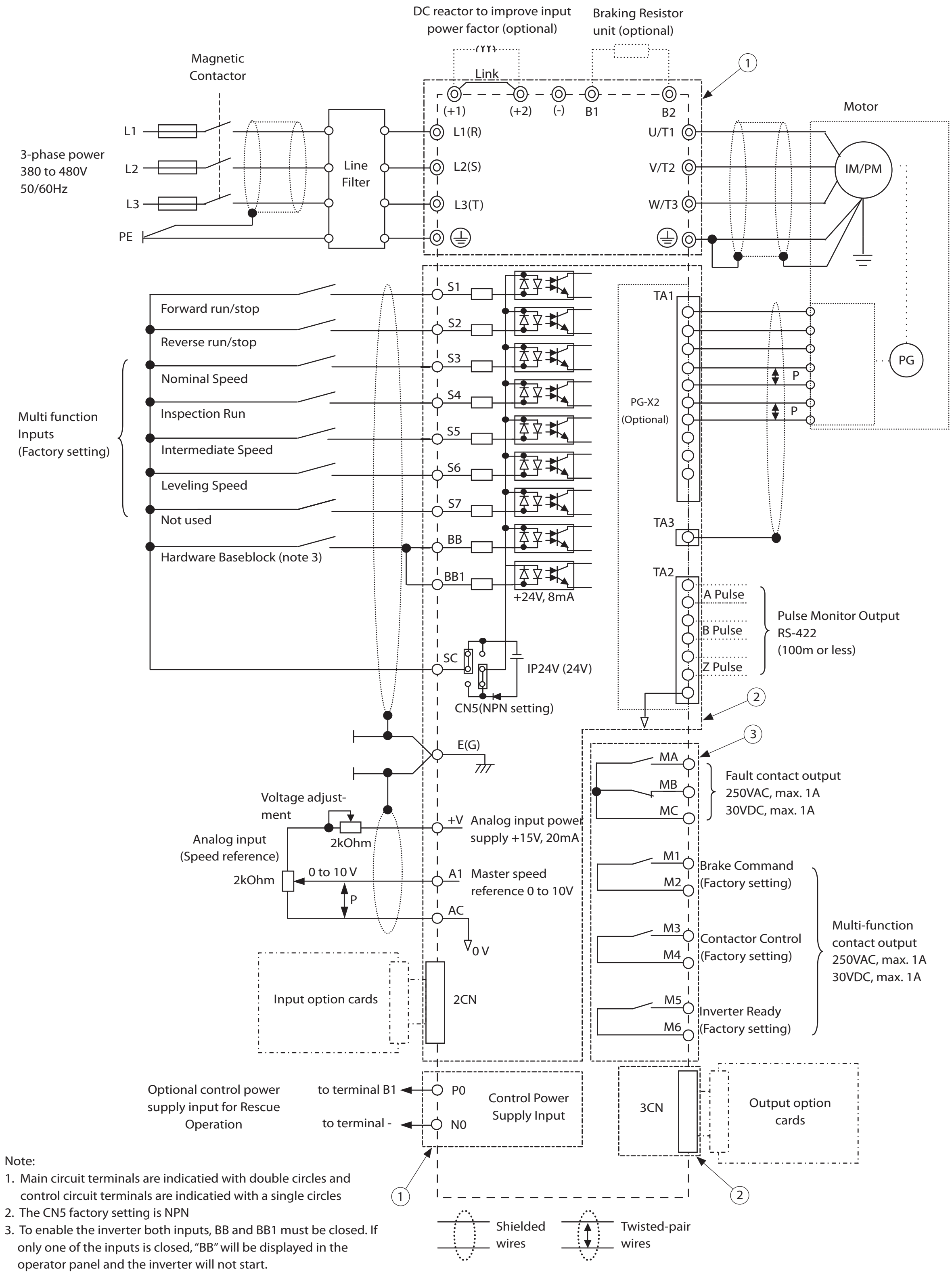
Wiring

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

Connection Diagram

The connection diagram of the Inverter is shown in *Fig 2.1*.

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



Note:
1. Main circuit terminals are indicatied with double circles and control circuit terminals are indicatied with a single circles
2. The CN5 factory setting is NPN
3. To enable the inverter both inputs, BB and BB1 must be closed. If only one of the inputs is closed, "BB" will be displayed in the operator panel and the inverter will not start.

Fig 2.1 Connection Diagram (Model CIMR-L7X43P7 Shown Above)

◆ Circuit Descriptions

Refer to the numbers indicated in *Fig 2.1*.

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

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

③ **Inverters supplied by a four-wire-system source (neutral grounded)**

These circuits are SELV* circuits and are separated from all other circuits by protective separation consisting of double and reinforced insulation. These circuits may only be interconnected with other SELV* (or equivalent) circuits.

Inverters supplied by a three-wire-system source (ungrounded or corner grounded)

These circuits are not separated from hazardous circuits other circuits by protective separation, but only with basic insulation. These circuits must not be interconnected with any circuits which are accessible, unless they are isolated from accessible circuits by supplemental insulation

* SELV (Safety Extra Low Voltage) circuits have no direct connection to the primary power and are supplied by a transformer or equivalent isolating device. The circuits are designed and protected, so that, under normal and single fault condition, its voltage does not exceed a safe value.

(See IEC 61010)

IMPORTANT

1. Control circuit terminals are arranged as shown below.

	SC	SC	SC	BB		+V	A1	AC		M5	M6	MA	MB	MC	
E(G)	S1	S2	S3	S4	S5	S6	S7	BB1		M3	M4	M1		M2	E(G)

2. The output current capability of the +V terminal is 20 mA.
3. Main circuit terminals are indicated with double circles and control circuit terminals are indicated with single circles.
4. The wiring of the digital inputs S1 to S7 and BB is shown for the connection of contacts or NPN transistors (0V common and sinking mode). This is the default setting.
   For the connection of PNP transistors or for using a 24V external power supply, refer to *Table 2.9*.
5. A DC reactor is an option only for Inverters of 18.5 kW or less. Remove the short circuit bar when connecting a DC reactor.

Terminal Block Configuration

The terminal arrangements are shown in *Fig 2.2* and *Fig 2.3*.

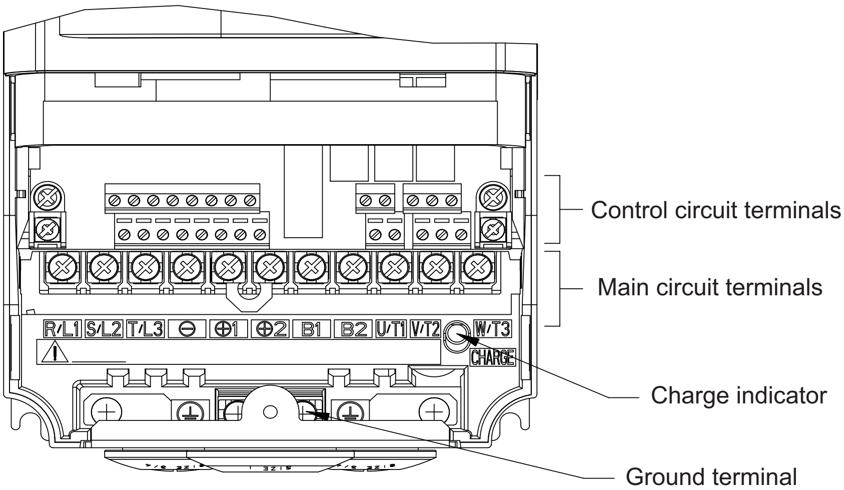


Fig 2.2 Terminal Arrangement (200 V/400 V Class Inverter of 3.7 kW)

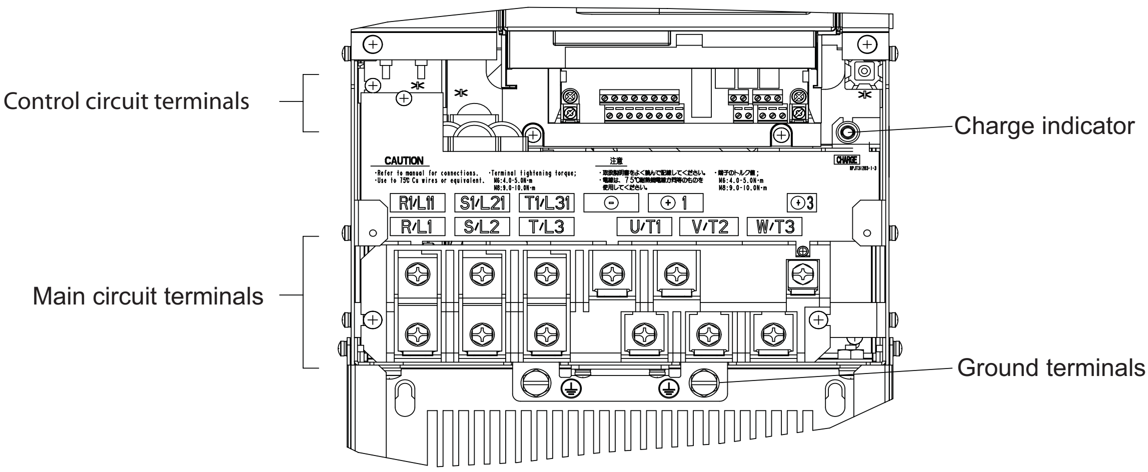


Fig 2.3 Terminal Arrangement (200 V/400 V Class Inverter of 22 kW or more)

Wiring Main Circuit Terminals

◆ Applicable Wire Sizes and Crimp Terminals

Select the appropriate wires and crimp terminals using *Table 2.1* to *1.*. Refer to instruction manual TOE-C726-2 for wire sizes for Braking Resistor Units and Braking Units.

■Wire Sizes

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)	Recom-mended Wire Size*1 mm^2 (AWG)	Wire Type
L7X23P7	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO	M4	1.2 to 1.5	4 (12 to 10)	4 (12)	Power cables, e.g., 600 V vinyl power cables
	⏚					
L7X25P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO	M4	1.2 to 1.5	6 (10)	6 (10)	
	⏚					
L7X27P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO	M5	2.5	10 (8 to 6)	10 (8)	
	⏚					
L7X2011	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, PO, NO	M5	2.5	16 (6 to 4)	16 (6)	
	⏚					
L7X2015	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, U/T1, V/T2, W/T3, NO	M6	4.0 to 5.0	25 (4 to 2)	25 (4)	
	B1, B2, PO	M5	2.5	10 (8 to 6)	-	
	⏚	M6	4.0 to 5.0	25 (4)	25 (4)	
L7X2018	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, U/T1, V/T2, W/T3, NO	M8	9.0 to 10.0	25 to 35 (3 to 2)	25 (3)	
	B1, B2, PO	M5	2.5	10 to 16 (8 to 6)	-	
	⏚	M6	4.0 to 5.0	25 (4)	25 (4)	
L7X2022	R/L1, S/L2, T/L3, ⊖, ⊕1, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	25 to 35 (3 to 1)	25 (3)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	
L7X2030	R/L1, S/L2, T/L3, ⊖, ⊕1 U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	50 (1 to 1/0)	50 (1)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	

2

Inverter Model CIMR-☐	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2(AWG)	Recom-mended Wire Size*1 mm^2 (AWG)	Wire Type
L7X2037	R/L1, S/L2, T/L3, ⊖, ⊕1 U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M10	17.6 to 22.5	70 to 95 (2/0 to 4/0)	70 (2/0)	Power cables, e.g., 600 V vinyl power cables
	⊕3, PO	M8	8.8 to 10.8	6 to 16 (10 to 4)	–	
	⏚	M10	17.6 to 22.5	35 to 70 (2 to 2/0)	35 (2)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 4 (20 to 10)	1.5 (16)	
L7X2045	R/L1, S/L2, T/L3, ⊖, ⊕1 U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M10	17.6 to 22.5	95 (3/0 to 4/0)	95 (3/0)	
	⊕3, PO	M8	8.8 to 10.8	6 to 16 (10 to 4)	–	
	⏚	M10	17.6 to 22.5	50 to 70 (1 to 2/0)	50 (1)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 4 (20 to 10)	1.5 (16)	
L7X2055	R/L1, S/L2, T/L3, ⊖, ⊕1, NO	M12	31.4 to 39.2	50 to 95 (1/0 to 4/0)	50 × 2P (1/0 × 2P)	
	U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31	M10	17.6 to 22.5	90 (4/0)	90 (4/0)	
	⊕3, PO	M8	8.8 to 10.8	6 to 70 (10 to 2/0)	–	
	⏚	M10	17.6 to 22.5	35 to 95 (3 to 4/0)	50 (1/0)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 4 (20 to 10)	1.5 (16)	

*1. The wire size is valid for PVC insulated copper cable, 30° ambient temperature

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)	Recom-mended Wire Size*1 mm^2 (AWG)	Wire Type
L7X43P7	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	2.5 to 4 (14 to 10)	4 (12)	Power cables, e.g., 600 V vinyl power cables
	⏚				2.5 (14)	
L7X44P0	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	2.5 to 4 (14 to 10)	4 (12)	
	⏚				2.5 (14)	
L7X45P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	4 (12 to 10)	4 (12)	
	⏚			2.5 to 4 (14 to 10)	2.5 (14)	
L7X47P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	6 to 10 (10 to 6)	6 (10)	
	⏚				4 (12)	
L7X4011	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M5	2.5	6 to 10 (10 to 6)	10 (8)	
	⏚				6 (10)	

Inverter Model CIMR-☐	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2 (AWG)	Recom-mended Wire Size*1 mm^2 (AWG)	Wire Type
L7X4015	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M5	2.5	10 (8 to 6)	10 (8)	Power cables, e.g., 600 V vinyl power cables
	⏚	M5 (M6)	2.5 (4.0 to 5.0)	6 to 10 (10 to 6)	6 (10)	
L7X4018	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, U/T1, V/T2, W/T3, NO	M6	4.0 to 5.0	10 to 35 (8 to 2)	10 (8)	
	B1, B2, PO	M5	2.5	10 (8)	10 (8)	
	⏚	M6	4.0 to 5.0	10 to 25 (8 to 4)	10 (8)	
L7X4022	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕3, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO, PO	M6	4.0 to 5.0	16 (6 to 4)	16 (6)	
	⏚	M8	9.0 to 10.0	16 to 35 (6 to 2)	16 (6)	
L7X4030	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕3, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO, PO	M6	4.0 to 5.0	25 (4)	25 (4)	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	
L7X4037	R/L1, S/L2, T/L3, ⊖, ⊕1, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	25 to 50 (4 to 1/0)	35 (2)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	
L7X4045	R/L1, S/L2, T/L3, ⊖, ⊕1, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	35 to 50 (2 to 1/0)	35 (2)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	
L7X4055	R/L1, S/L2, T/L3, ⊖, ⊕1, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	50 (1 to 1/0)	50 (1)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	

*1. The wire size is valid for PVC insulated copper cable, 30° ambient temperature

■Recommended Crimp Terminal Sizes (Ring type)

1. Crimp Terminal Sizes

Wire Cross Section (mm^2)	Terminal Screws	Crimp Terminal Type		
		Klauke®		JST
		A	B	
0.5 - 1.0	M4	620/4	1620/4	GS4-1
1.5	M4	630/4	1620/4	GS4-1
2.5	M4	630/4	1630/4	GS4-2.5
4	M4	650/4	1650/4	GS4-6
6	M4	650/4	1650/4	GS4-6
	M5	101 R/5	1650/5	GS5-6
	M6	101 R/6	1650/6	GS6-6
	M8	101 R/8	1650/8	GS6-8
10	M5	102 R/5	1652/5	GS5-10
	M6	102 R/6	1652/6	GS6-10
	M8	102 R/8	1652/8	GS8-10
16	M5	103 R/5*1	1653/5	GS5-16
	M6	103 R/6	1653/6	GS6-16
	M8	103 R/8	1653/8	GS8-16
25	M6	104 R/6	1654/6	GS6-25
	M8	104 R/8	1654/8	GS8-25
35	M6	105 R/6	1655/6	GS6-35
	M8	105 R/8	1655/8	GS8-35
	M10	105 R/10	1655/10	GS10-35
50	M8	106 R/8	1656/8	GS8-50
	M10	106 R/10	1656/10	GS10-50
	M12	106 R/12	1656/12	GS12-50
70	M8	107 R/8	1657/8	GS8-70
	M10	107 R/10	1657/10	GS10-70
	M12	107 R/12	1657/12	GS12-70
95	M10	108 R/10	1658/10	GS10-95
	M12	108 R/12	1658/12	GS12-95

*1. Not applicable for L7X2011

IMPORTANT

Select 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 (Ω/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 2.3*. Wire the terminals correctly for the desired purposes.

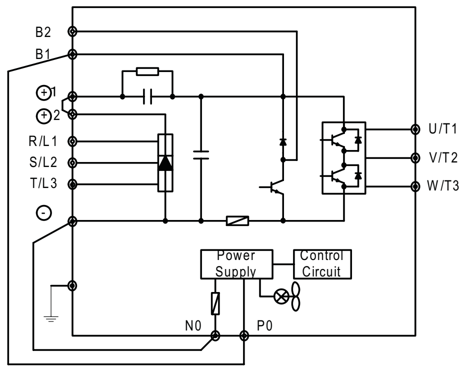
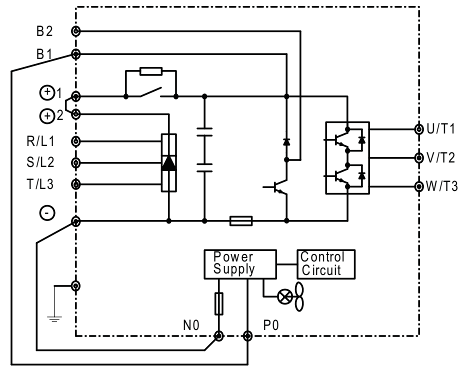
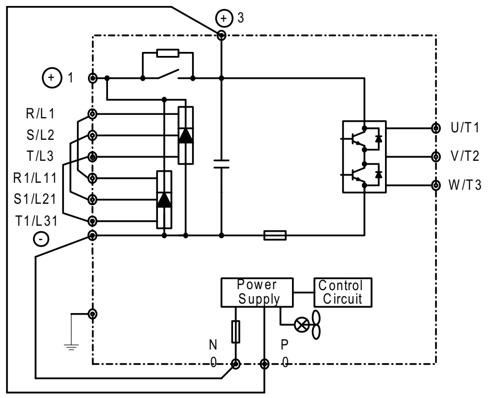
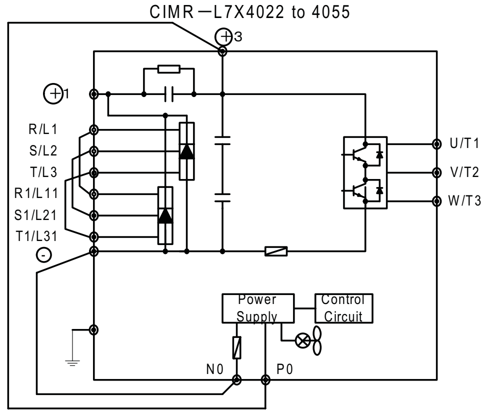
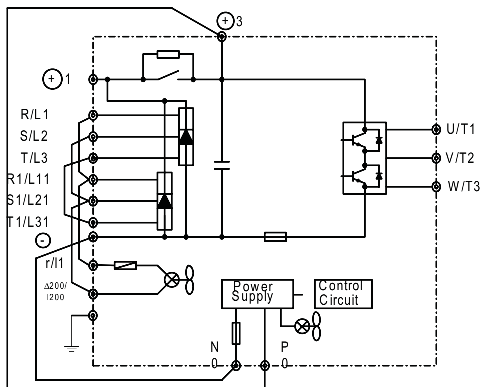
Table 2.3 Main Circuit Terminal Functions (200 V Class and 400 V Class)

Purpose	Terminal Symbol	Model: CIMR-L7X☐☐☐☐	
		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
Control Power Supply	PO, NO	23P7 to 2055	43P7 to 4055

◆ Main Circuit Configurations

The main circuit configurations of the Inverter are shown in *Table 2.4*.

Table 2.4 Inverter Main Circuit Configurations

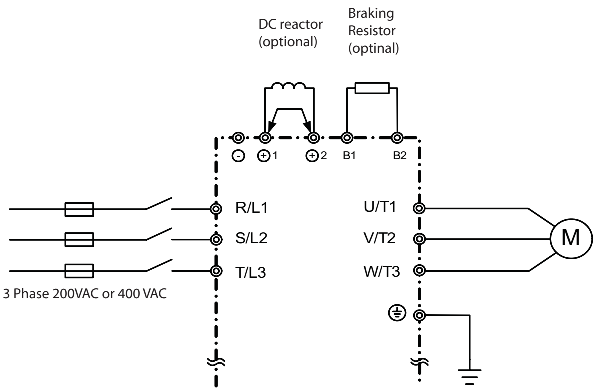
200 V Class	400 V Class
CIMR−L7X23P7 to 2018 	CIMR - L7X43P7 to 4018 
CIMR - L7X2022,2030 	CIMR−L7X4022 to 4055 
CIMR - L7X2037 to 2055 	

Note: Consult your Yaskawa representative for using 12-phase rectification.

◆ Standard Connection Diagrams

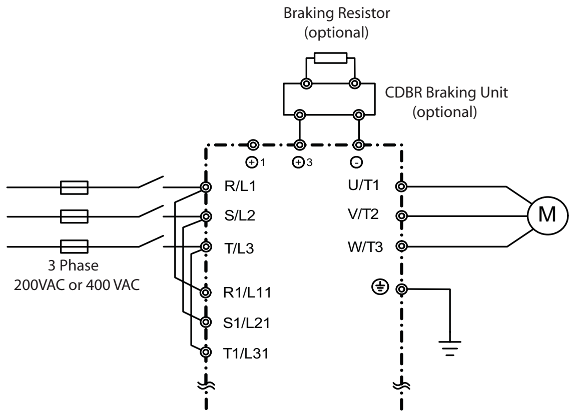
Standard Inverter connection diagrams are shown in *Fig 2.4*. These are the same for both 200 V Class and 400 V Class Inverters. The connections depend on the Inverter capacity.

■CIMR-L7X23P7 to 2018 and 43P7 to 4018



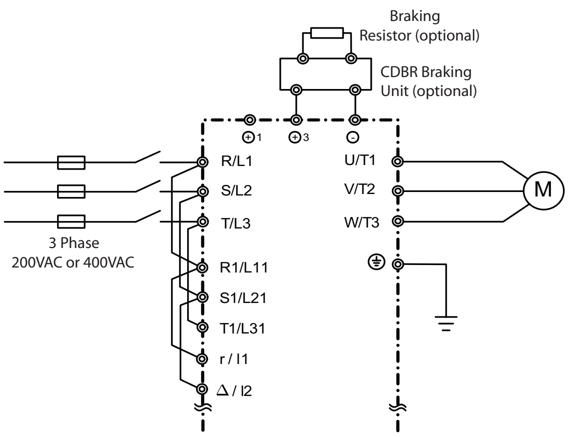
Be sure to remove the short-circuit bar before connecting the DC reactor.

■CIMR-L7X2022, 2030, and 4022 to 4055



The DC reactor is built in.

■CIMR-L7X2037 to 2055



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

Fig 2.4 Main Circuit Terminal Connections

◆ Wiring the Main Circuits

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

■Wiring Main Circuit Inputs

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

Installing Fuses

2

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

Table 2.5 Input Fuses

Inverter Type	Rated Inverter Input Current (A)	Fuse Selection			Selection Example (FERRAZ)		
		Voltage (V)	Current (A)	I^2t (A^2s)	Model	Rating	I^2t (A^2s)
23P7	21	240	30	82~220	A60Q30-2	600V / 30A	132
25P5	25	240	40	220~610	A50P50-4	500V / 50A	250
27P5	40	240	60	290~1300	A50P80-4	500V / 80A	640
2011	52	240	80	450~5000	A50P80-4	500V / 80A	640
2015	68	240	100	1200~7200	A50P125-4	500V / 125A	1600
2018	96	240	130	1800~7200	A50P150-4	500V / 150A	2200
2022	115	240	150	870~16200	A50P150-4	500V / 150A	2200
2030	156	240	180	1500~23000	A50P200-4	500V / 200A	4000
2037	176	240	240	2100~19000	A50P250-4	500V/ 250A	6200
2045	220	240	300	2700~55000	A50P300-4	500V / 300A	9000
2055	269	240	350	4000~55000	A50P350-4	500V / 350A	12000
43P7	10.2	480	15	34~72	A60Q20-2	600V / 20A	41
44P0	13.2	480	20	50~570	A60Q30-2	600V / 30A	132
45P5	17	480	25	100~570	A60Q30-2	600V / 30A	132
47P5	22	480	30	100~640	A60Q30-2	600V / 30A	132
4011	32	480	50	150~1300	A70P50-4	700V / 50A	300
4015	41	480	60	400~1800	A70P70-4	700V / 70A	590
4018	49	480	70	700~4100	A70P80-4	700V / 80A	770
4022	58	480	80	240~5800	A70P80-4	700V / 80A	770
4030	78	480	100	500~5800	A70P100-4	700V / 100A	1200
4037	96	480	125	750~5800	A70P125-4	700V / 125A	1900
4045	115	480	150	920~13000	A70P150-4	700V / 150A	2700
4055	154	480	200	1500~13000	A70P200-4	700V / 200A	4800

Installing a Moulded-Case Circuit Breaker

If a moulded case circuit breaker is used for the power supply connection (R/L1, S/L2, and T/L3) it must be suitable for the Inverter.

- The MCCB should have a capacity of 1.5 to 2 times of the inverter's rated current.
- For the MCCB's time characteristics selection the inverter's overload protection (one minute at 150% of the rated output current) must be considered.

Installing an Earth Leakage Breaker

An earth leakage breaker which is able to detect all kinds of current should be used in order to ensure a safe earth leakage current detection.

- If a special-purpose earth leakage breaker for Inverters is used, it should have an actuating current of at least 30 mA per Inverter.
- If a standard earth leakage breaker is used, it should have an actuating current of 200 mA or more per Inverter and a actuating time of 0.1 s or more.

Installing a Magnetic Contactor at the Input

If the power supply for the main circuit is 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 may cause an Inverter fault. Do not exceed one power up per hour.
- When the Inverter is operated using the Digital Operator, automatic operation cannot be performed after recovery from a power interruption.

Connecting Input Power Supply to the Terminal Block

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

Installing an Input AC Reactor

If the Inverter is connected to a large-capacity power transformer (600 kW or more) or a phase advancing capacitor is switched nearby, an excessive peak current could flow through the input power circuit, causing an inverter damage. As a countermeasure an optional AC Reactor the inverter input or a DC reactor at the DC reactor connection terminals can be installed.

In order to fulfill the EN12015 an AC reactor has to be installed. Refer to *Chapter 9, AC Reactors for EN 12015 Compatibility* for the available reactors. The AC reactor has to be installed between the power supply and the EMC filter (like shown in *Fig 2.5*)

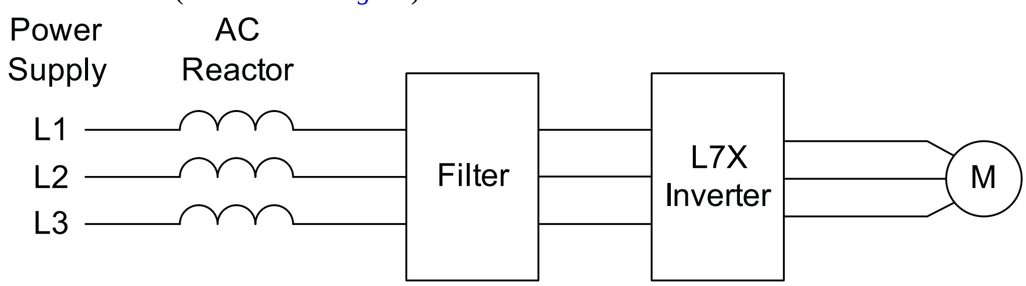


Fig 2.5 AC reactor installation

Installing a Surge Absorber

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

■Wiring the Output Side of the Main Circuit

The following precautions should be considered for the output circuit wiring.

Connecting the Inverter and Motor

The output terminals U/T1, V/T2 and W/T3 must be connected according to the motor lead wires U, V and W.

The motor should rotate forward with the forward run command. If not, two of the motor cable wires can be switched.

Never Connect a Power Supply to Output Terminals

A power supply must never be connected to the output terminals U/T1, V/T2, and W/T3. Otherwise 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 a short circuit may occur.

Do Not Use a Phase Advancing Capacitor

A phase advancing capacitor must never be connected to the inverter 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

A magnetic contactor (MC) between the Inverter and motor must not be turned ON or OFF during inverter operation. If the MC is turned ON during the Inverter is operation, a large inrush current will be created and the inverter's over current protection may operate.

■Ground Wiring

The following precautions should be considered for the ground connection.

- 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.
- Ground wires should not be shared with other devices, such as welding machines or power tools.
- A ground wire, that complies with technical standards on electrical equipment must be used. The length of the ground wire should be as low as possible.
  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 more than one Inverter is used the ground wires should not be looped.

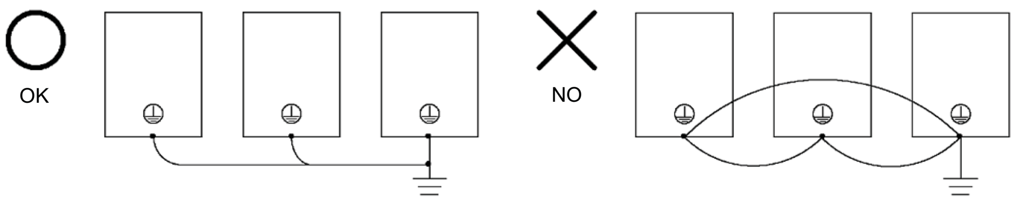


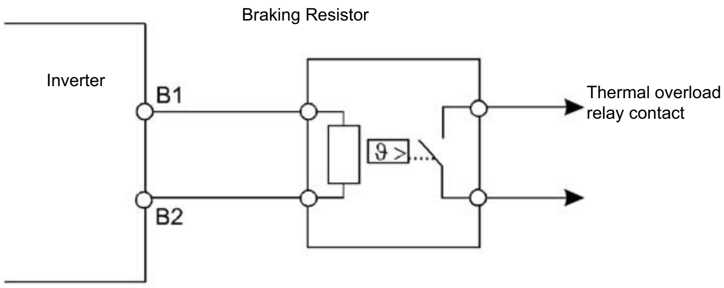
Fig 2.6 Ground Wiring

■Connecting a Braking Resistor and Braking Unit (CDBR)

A Braking Resistor and Braking Unit can be connected to the Inverter like shown in the *Fig 2.7*.

To prevent overheating of the braking unit/braking resistor, the inverter operation should be stopped when the overload contacts are operated.

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

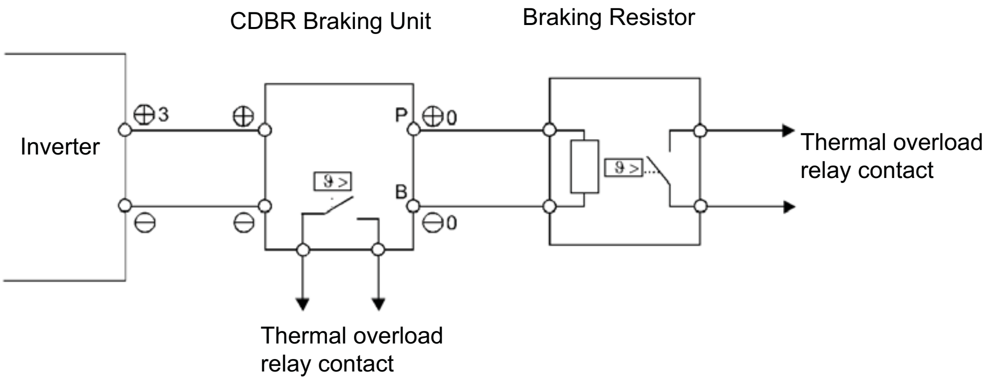


Fig 2.7 Connecting the Braking Resistor and Braking Unit

Connecting Braking Units in Parallel

When two or more Braking Units are connected in parallel the wiring and jumper settings must be done like shown in *Fig 2.8*. There is a jumper for selecting whether each Braking Unit is to be a master or slave. “Master” must be set for the first Braking Unit only, “Slave” must be set for all other Braking Units (i.e. from the second Unit onwards).

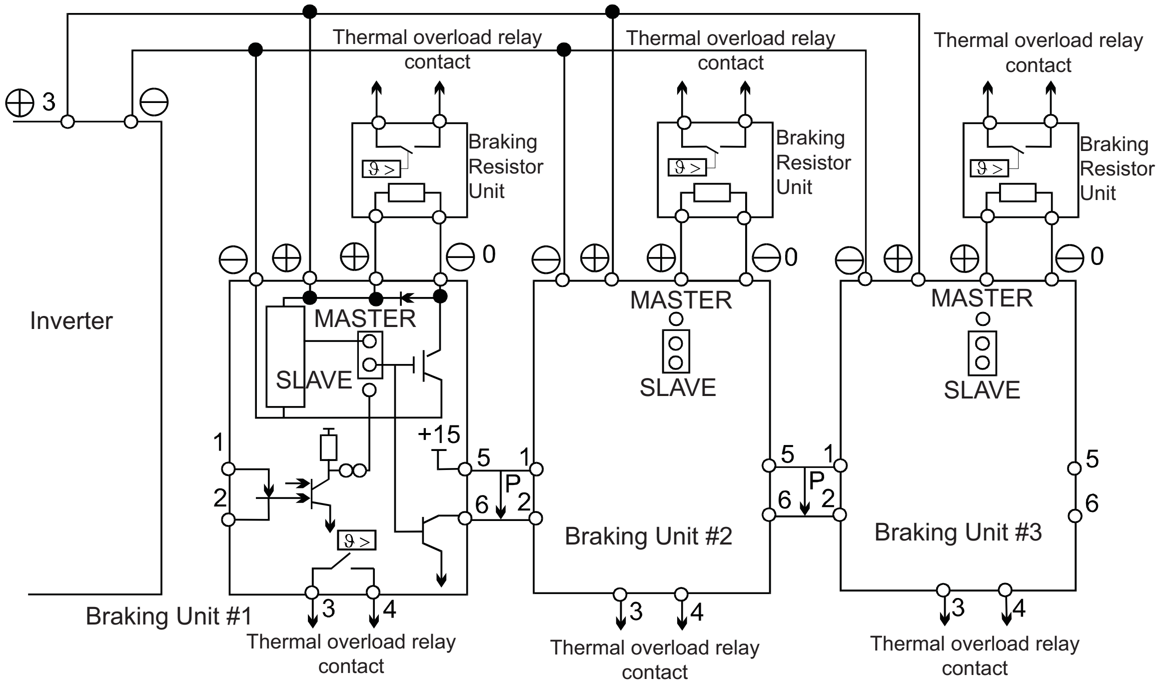


Fig 2.8 Connecting Braking Units in Parallel

■Control Power Supply Connection

The controller of the Varispeed L7 can be supplied by an external voltage source during rescue operation using the twisted wires marked with P0 and N0. Upon shipment the wires are connected to the main circuit terminal B1 (units up to 18.5 kW) or terminal +3 (units from 22 kW and above) and terminal -.

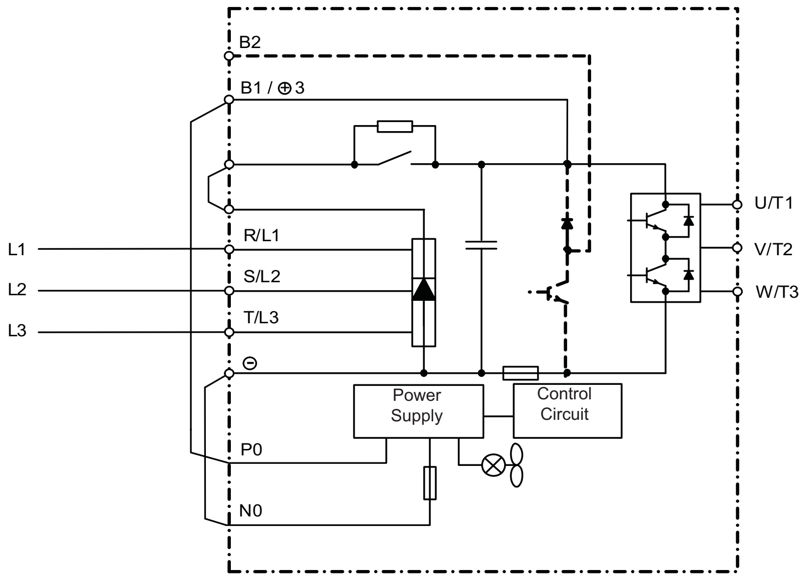


Fig 2.9 Control Power Supply Connection

Please refer to *page 6-80, Rescue System* for details about rescue operation.

Wiring Control Circuit Terminals

◆ Wire Sizes

For remote operation using analog signals, the control line length between the Analog Operator or operation signals and the Inverter should be less than 30 m. The controller wires should always be separated from main power lines or other control circuits in order to avoid disturbances.

It is recommended to use shielded twisted-pair wires and ground the shield for the largest area of contact between shield and ground.

The terminal numbers and the appropriate wire sizes are shown in *Table 2.6*.

Table 2.6 Terminal Numbers and Wire Sizes (Same for all Models)

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

*1. Ferrules with plastic sleeves should be used for the signal lines to simplify wiring and improve reliability.

■ Ferrules for Signal Lines

Models and sizes of ferrules with plastic sleeves for the signal lines are shown in the following table.

Table 2.7 Ferrule 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	
1.5 (16)	AI 1.5 - 8BK	1.8	3.4	14	
2 (14)	AI 2.5 - 8BU	2.3	4.2	14	

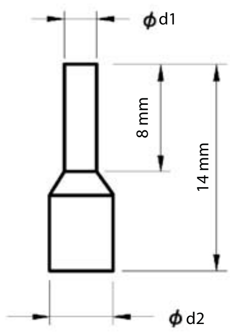


Fig 2.10 Ferrule Sizes

2

◆ Control Circuit Terminal Functions

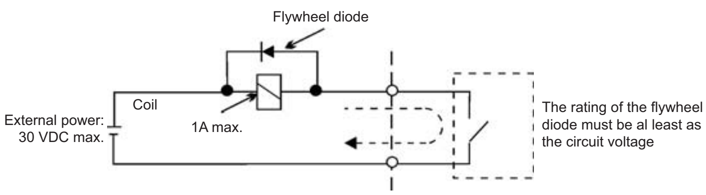
The functions of the control circuit terminals are shown in *Table 2.8*. Use the appropriate terminals for the correct purposes.

Table 2.8 Control Circuit Terminals with default settings

Type	No.	Signal Name	Function		Signal Level
Digital input signals	S1	Forward run/stop command	Forward run when ON; stopped when OFF.		24 VDC, 8 mA Photo-coupler
	S2	Reverse run/stop command	Reverse run when ON; stopped when OFF.		
	S3	Nominal speed	Nominal speed when ON.	Functions are selected by setting H1-01 to H1-05.	
	S4	Inspection Run	Inspection RUN when ON.		
	S5	Intermediate speed	Intermediate speed when ON.		
	S6	Leveling speed	Leveling speed when ON.		
	S7	Not used	–		
	BB	Hardware baseblock	–		–
	BB1[*1]	Hardware baseblock 1	–		–
	SC	Digital input common	–		–
Analog input signals	+V	15 V power supply[*2]	15 V power supply for analog references		15 V (Max. current: 20 mA)
	A1	Frequency reference	0 to +10 V/100%		0 to +10 V(20 kΩ)
	AC	Analog reference neutral	–		–
	E(G)	Shield wire, optional ground line connection point	–		–
Digital output signals	M1 M2	Brake command (1NO contact)	Brake command when ON.	Multi-function contact outputs	Relay contacts Contact capacity: 1 A max. at 250 VAC 1 A max. at 30 VDC[*3]
	M3 M4	Contactor Control (1NO contact)	Contactor Control when ON		
	M5 M6	Inverter Ready (1NO contact)	Inverter Ready when ON.		
	MA MB MC	Fault output signal (SPDT) (1 Change over contact)	Fault when CLOSED across MA and MC Fault when OPEN across MB and MC		

*1. This terminal is available on inverters with hardware SPEC B only. (*page 1-4, Inverter Specifications* describes how to find out the inverter hardware version).
*2. Do not use this power supply for supplying any external equipment.
*3. When driving a reactive load, such as a relay coil with DC power supply, always insert a flywheel diode as shown in *Fig 2.11*.

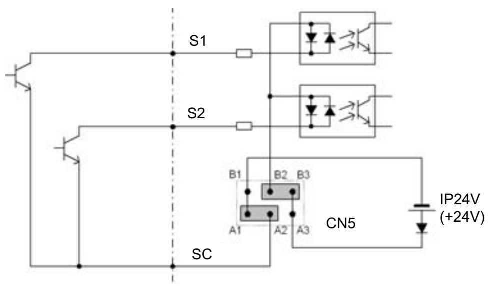
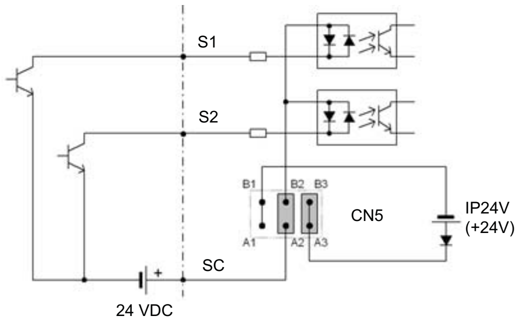
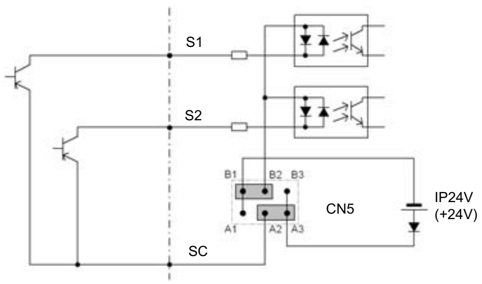
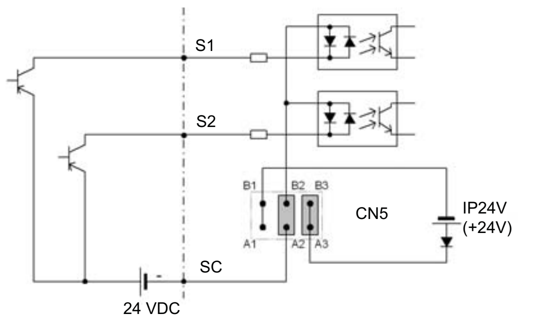
Fig 2.11 Flywheel Diode Connection



■ Sinking/Sourcing Mode (NPN/PNP Selection)

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

Table 2.9 Sinking/Sourcing Mode and Input Signals

Internal Power Supply – Sinking Mode (NPN)	External Power Supply – Sinking Mode (NPN)
	
Internal Power Supply – Sourcing Mode (PNP)	**External Power Supply – Sourcing Mode (PNP)**
	

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◆ Control Circuit Terminal Connections

Connections to Inverter control circuit terminals are shown in *Fig 2.12*.

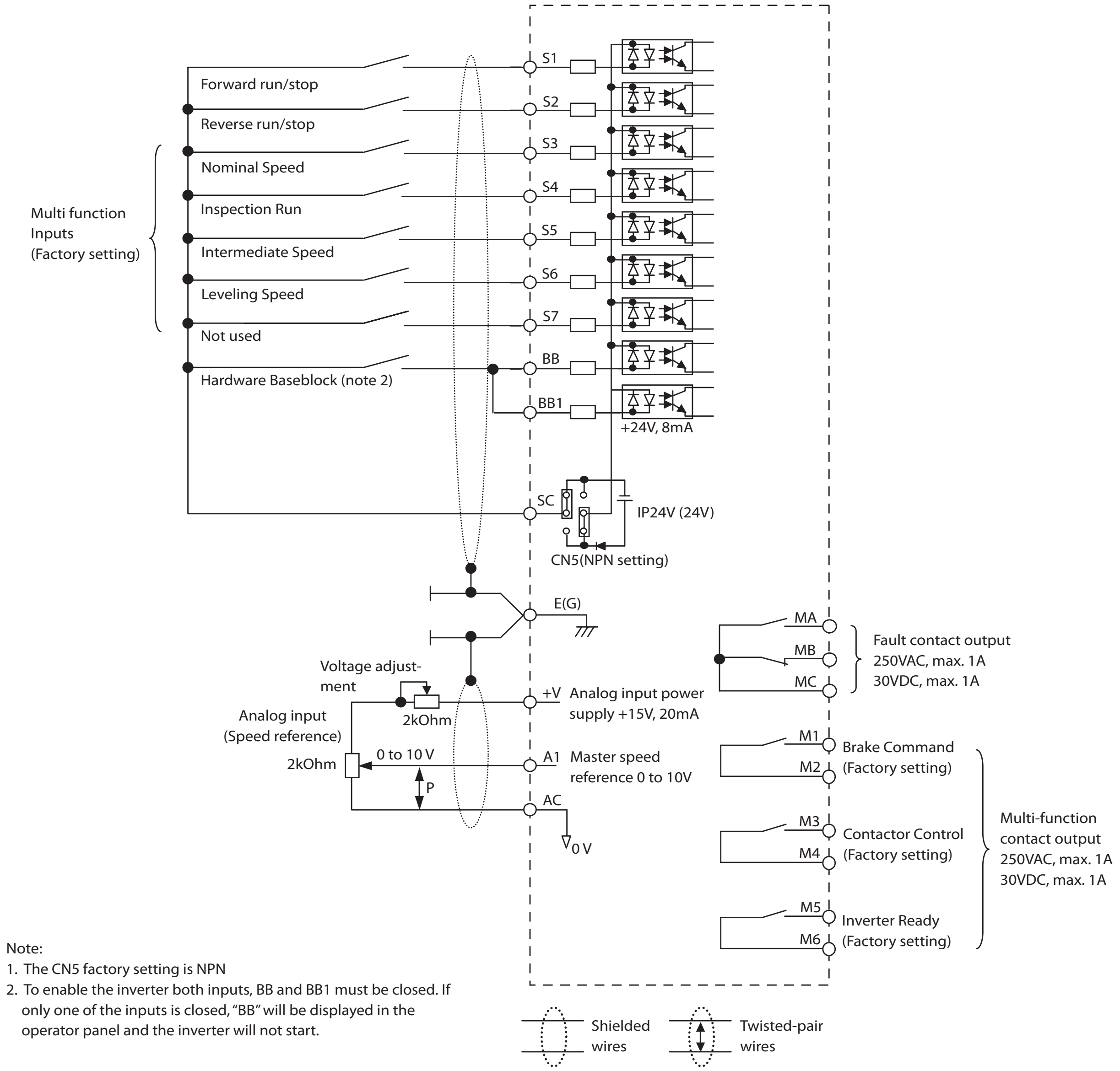


Fig 2.12 Control Circuit Terminal Connections

INFO

The base block circuit is a two channel circuit, i.e. always both channels (terminal BB and BB1) have to be enabled to enable the inverter output.
Generally the terminals BB and BB1 can be linked directly at the terminals. However, if an EN81-1 conform one motor contactor solution is required, the recommended BB and BB1 terminal wiring depends on the installation:

1. If the controller and inverter are mounted in the same cabinet the terminals BB and BB1 can be linked directly at the inverter terminal board. Only one wire from the controller to the inverter base block input is necessary.
2. If the inverter is mounted separated from the controller cabinet, two physically separated wires for the BB and BB1 terminal should be used in order to keep redundancy in case of a fault of one of the signal lines.

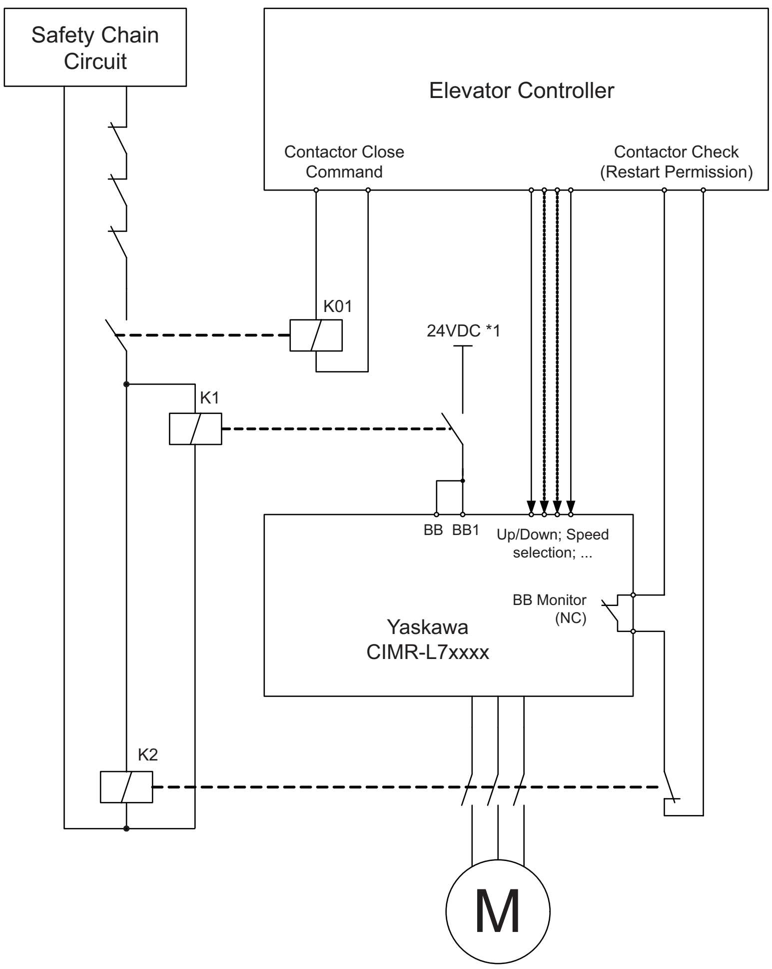
EN81-1 Conform Wiring with One Motor Contactor

In order to use the L7X with one motor contactor instead of two while keeping compliance to the EN81-1:1998, the following rules have to be followed:

- The hardware base block function using the terminals BB and BB1 must be used to enable / disable the drive. The input logic must be PNP.
- If the elevator safety chain is opened, the inverter output must be cut. This means that the base block signals at the terminals BB and BB1 must be opened, e.g. via an interposing relay.
- The base block monitor function must be programmed for one of the multi-function outputs (H2-☐☐ = 46/47). The regarding digital output contact must be implemented in the contactor supervision circuit of the controller in order to prevent a restart in case of an inverter base block or motor contactor malfunction.
- All contactors must be conform to the EN81-1:1998, paragraph 13.2.

Fig 2.13 shows an EN81-1:1998 wiring example.

Fig 2.13 EN81-1 Conform Wiring with One Motor Contactor (Example)



The wiring rules and the wiring example are approved by the TUEV Sued, Germany. For more details please contact your Yaskawa sales representative.

◆ Control Circuit Wiring Precautions

The following precautions for wiring the control circuits must be considered.

- Control circuit and main circuit wiring should be separated (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.
- The wiring for control circuit terminals MA, MB, MC, M1, M2, M3, M4, M5, and M6 (contact outputs) should be separated from wiring to other control circuit terminals.
- If an optional external power supply is used, it should be a UL Listed Class 2 power supply.
- Twisted-pair or shielded twisted-pair cables should be used for control circuits to prevent operating faults.
- The cable shields should be connected to the ground with the maximum contact area.
- Cable shields have to be grounded on both cable ends.

Wiring Check

◆ Checks

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

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

Installing and Wiring Option Cards

◆ Option Card Models and Specifications

Up to three option cards can be mounted simultaneously in the Inverter. Each of the three option board sockets on the controller card (A, C and D) can take up one option card like shown in *Fig 2.14*.

Table 2.10 shows the available option cards and their specifications.

Table 2.10 Option Card Specifications

Card	Model	Specifications	Mounting Location
PG speed control cards	PG-B2	Two phase (phase A and B), +12V inputs, max. response frequency: 50 kHz	A
	PG-X2	Three phase (phase A, B, Z), line driver inputs (RS422), max. response frequency: 300 kHz	A
	PG-F2	Hiperface® or EnDat 2.1 interface card	A
Communications cards	3G3RV-PDRT2	Intelligent DeviceNet option card	C
	SI-P1	Option card for Profibus-DP fieldbus	C
	SI-R1	Option card for InterBus-S fieldbus	C
	SI-S1	Option card for CANOpen fieldbus	C
	S1-J	Option card for LONworks	C
PLC option card	3G3RV-P10ST8-E	PLC option card	C
	3G3RV-P10ST8-DRT-E	PLC option card with DeviceNet communications port (Slave)	C
Analog Input card	AI-14B	3 Channel analog input card Signal level: -10 to 10 V or 0 to 10V Resolution: 13 Bit + sign	C
Analog Output Cards	AO-08	2 channel analog output card Signal level: 0 to 10 V Resolution: 8 Bit	D
	AO-12	2 channel high resolution analog output card Signal level: -10 to +10 V Resolution: 11 Bit + sign	D
Digital Output Cards	DO-08	6 channel digital output card for monitoring the inverter status (fault, zero speed, running, etc.)	D
	DO-02C	2 channel relay contact output	D

◆ Installation

Before mounting an Option Card, remove the terminal cover and be sure that the charge indicator inside the Inverter is OFF. After that, remove the Digital Operator/LED Monitor and front cover and mount the Option Card.

Refer to documentation provided with the Option Card for the mounting instructions.

■ Preventing C and D Option Card Connectors from Rising

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

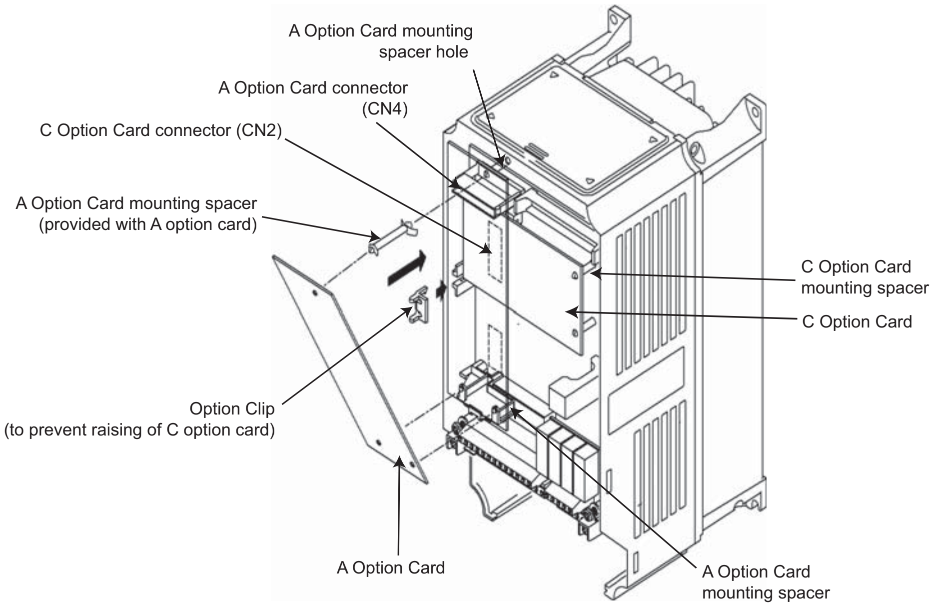


Fig 2.14 Mounting Option Cards

◆ PG Speed Control Card Terminals and Specifications

■PG-B2 Option Card

Input/Output Specifications

Table 2.11 PG-B2 I/O Specifications

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

2

Wiring the PG-B2 card

The following illustrations show wiring examples for the PG-B2 using the option cards power supply or an external power source for supplying the PG.

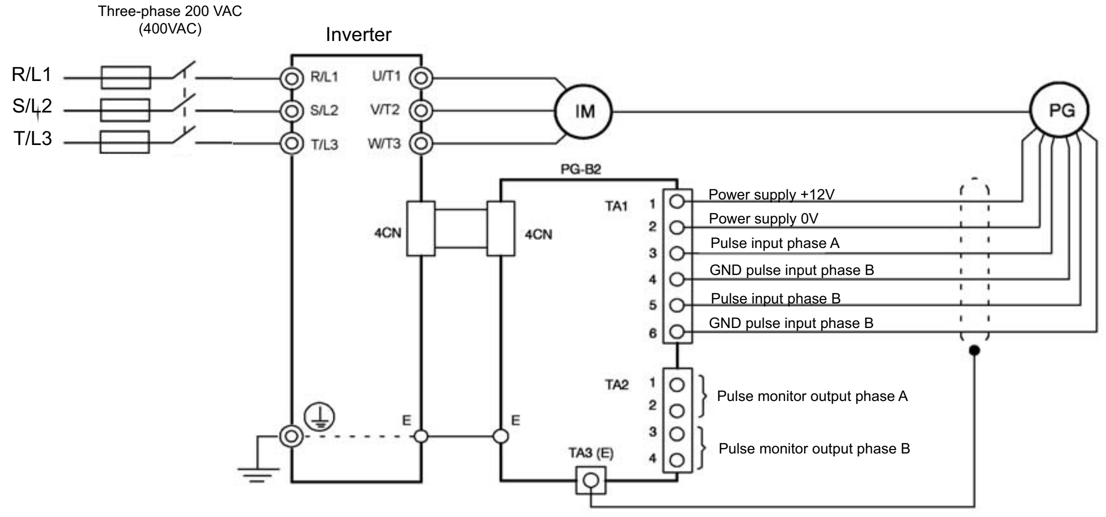


Fig 2.15 PG-B2 Wiring Using the Option Cards Power Supply

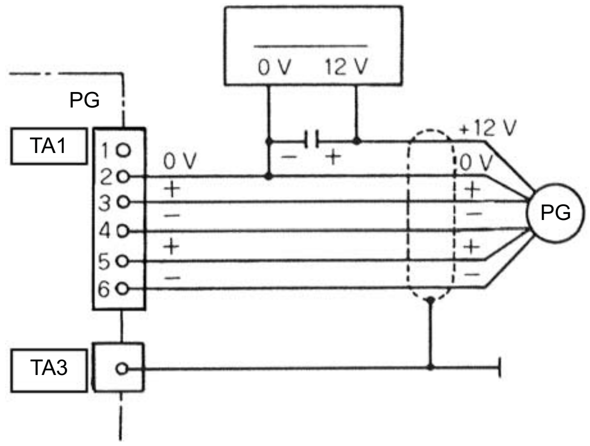
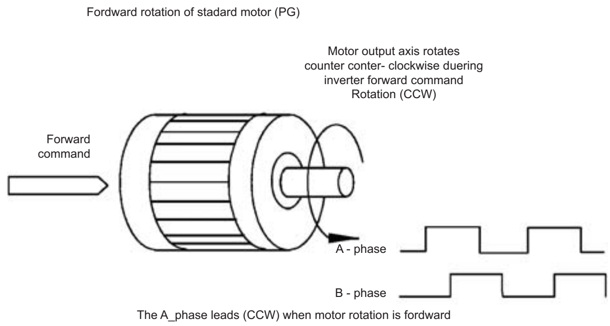


Fig 2.16 PG-B2 Wiring Using a 12 V External Power Supply

Precautions:

- The length of the pulse generator's wiring must not be more than 100 meters.
- The direction of rotation of the PG can be set in user parameter F1-05. The factory setting is A-phase leading in forward direction (motor shaft turning counterclockwise seen from motor shaft side).



- The pulse monitor output factor can be changed using parameter F1-05.
- Refer to *page 2-31, Wiring Precautions* for general precautions.

■PG-X2 Option Card

Input/Output Specifications

Table 2.12 PG-X2 I/O Specifications

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

*1. The 5V and 12V power supply should not be used at the same time.

Wiring the PG-X2 card

The following illustrations show wiring examples for the PG-X2 using the option cards power supply or an external power source for supplying the PG.

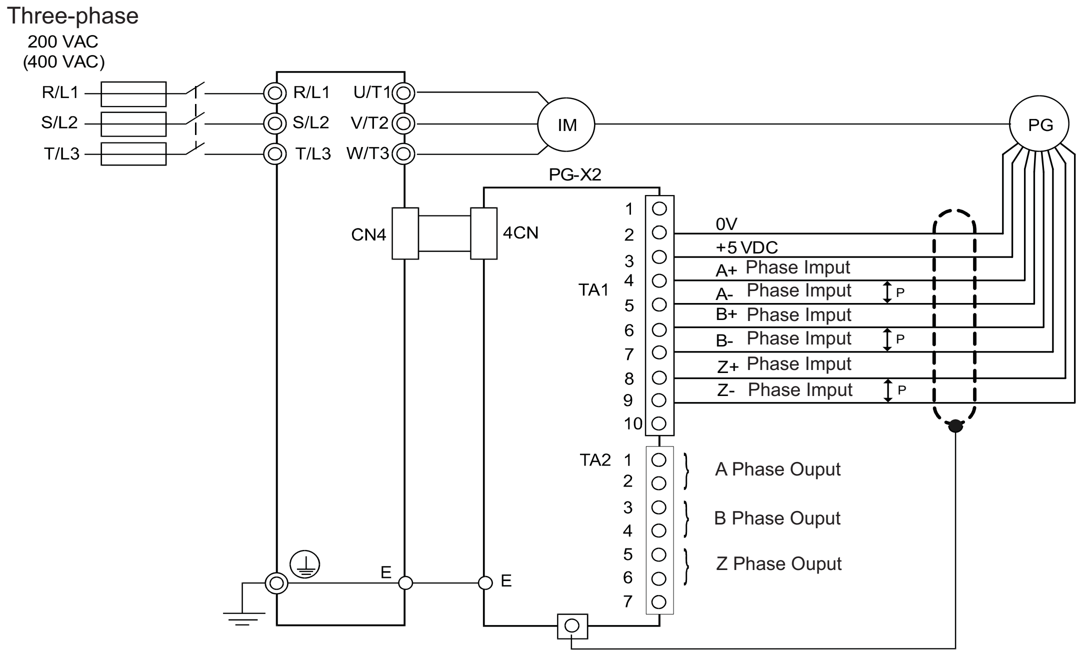


Fig 2.17 PG-X2 Wiring Using the Option Cards Power Supply

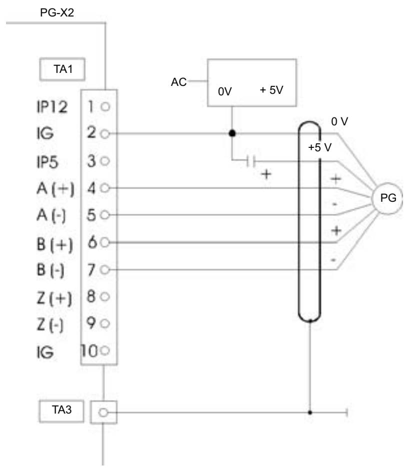


Fig 2.18 PG-X2 Wiring Using a 5 V External Power Supply

Precautions:

- The length of the pulse generator's wiring must not be more than 100 meters.
- The direction of rotation of the PG can be set in user parameter F1-05. The factory setting is A-phase leading in forward direction (motor shaft turning counterclockwise seen from motor shaft side).
- Refer to *page 2-31, Wiring Precautions* for general precautions.

■PG-F2 Option Card

Supported Encoders

The PG-F2 option card can be used in combination with the following encoder types:

- Hiperface®: SRS60/70
- EnDat 2.1: ECN1313, ECN113, ECN413

The maximum encoder speed shall not exceed 1200 min^{-1}.

Input/Output Specifications

Table 2.13 PG-F2 I/O Specifications

Terminal	No.	Contents: Hiperface®	Contents: EnDat	Specifications
TB1	1	Us 7-12V	5V U_P and U_P sensor	EnDat: 5VDC (±5%, max. 250 mA) Hiperface®: 8VDC (±5%, max. 150mA)
	2	GND	0V U_N and 0V sensor	0V
	3	REFSIN	B-	Differential inputs
	4	+SIN	B+	
	5	REFCOS	A-	
	6	+COS	A+	
	7	DATA+	DATA	RS-485 Data channel, Terminating resistance: 130 Ohm
	8	DATA-	/DATA	
TB2	1	-	CLOCK	Differential output, Clock frequency: 100 kHz
	2	-	/CLOCK	
TB3	1	Pulse monitor A+		Open Collector Outputs max 24 VDC, 30 mA
	2	Pulse monitor A-		
	3	Pulse monitor B+		
	4	Pulse monitor B-		
TB4	(E)	Shielded sheath connection terminal		

Encoder Power Supply Voltage Selection

The encoder power supply voltage must be set according to the encoder type using switch S1 on the PG-F2 card. Using potentiometer RH1 the encoder power supply voltage can be fine adjusted. The switch S1 factory setting is OFF (EnDat is preselected). The encoder power supply is pre adjusted to 5.0~5.25V upon shipment.

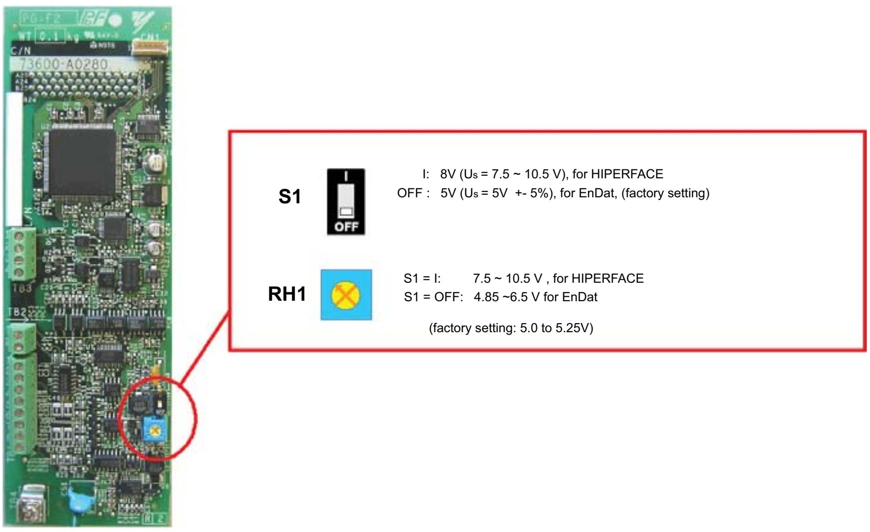


Fig 2.19 PG-F2 Encoder Power Supply Voltage Selection

Wiring the PG-F2 Card

The following illustration shows PG-F2 option card wiring with Hiperface® or EnDat 2.1 encoders.

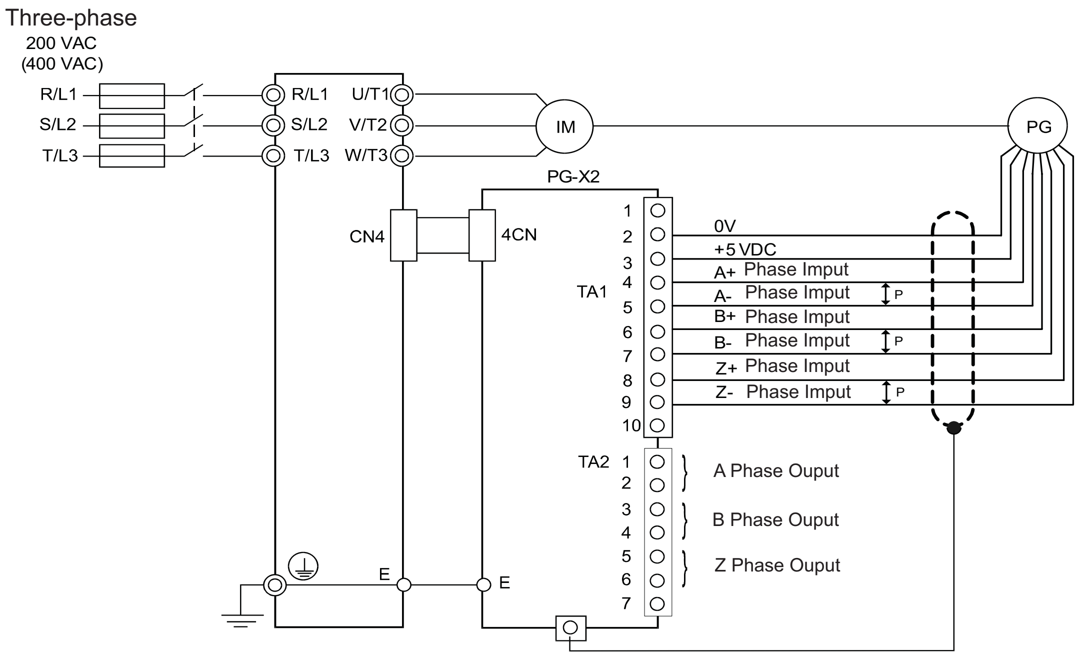
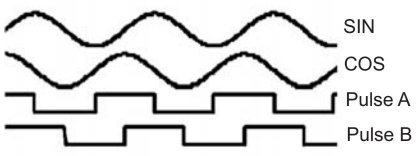


Fig 2.20 PG-F2 Wiring (EnDat signal names in brackets)

Precautions:

- The length of the pulse generator's wiring must not be more than 50m for the signal lines and 30m for the monitor output at terminal TB3.
- The direction of rotation of the PG can be set in user parameter F1-05 (PG Rotation). The factory setting is A-phase/SIN leading in forward direction (motor shaft turning counterclockwise seen from the shaft side).



- Refer to *page 2-31, Wiring Precautions* for general precautions.
- The signal voltage levels must be within the following limits:

REFSIN (B-), REFCOS (A-) offset:	2.2 ~ 2.8 V
+SIN (B+), +COS (B-) peak-to-peak voltage	0.9 ~ 1.1 V

◆ Wiring the Terminal Blocks

■Wire Sizes (Same for All PG-Card Models)

Terminal wire sizes are shown in *Table 2.14*. For the ferrule types refer to *Table 2.7*.

Table 2.14 Wire Sizes

Terminal	Terminal Screws	Wire Thickness	Wire Type	Tightening Torque
Pulse generator power supply Pulse input terminal Pulse monitor output terminal	-	• max. 1.0 mm² for flexible wire • max. 0.5 mm² for flexible wire with ferrules • max. 1.5 mm² for solid wire	Shielded, twisted-pair wire Shielded, polyethylene-covered, vinyl sheath cable	0.22 Nm
Shield connection terminal	M3.5	0.5 to 2.5 mm²		-

■Wiring Precautions

Consider the following precautions for wiring.

- Shielded twisted-pair wires must be used for signal lines. Use cables which are recommended by the encoder manufacturer only.
- For the cable connection to the encoder connectors which are recommended by the encoder manufacturer should be used.
- Ferrules should be used (refer to *Table 2.7*).
- The signal lines of the PG Speed Control Card should be separated from main power lines and other control circuits.
- The shield must be connected (green grounding cable of the option card) to the ground terminal to prevent operational errors caused by noise.
- The wire ends should not be soldered. Doing so may cause contact faults.
- The PG cards power supply must not be used for anything other than the pulse generator (encoder). Using it for another purpose can cause malfunctions due to noise.
- A separate power supply is required if the PG power supply consumption is higher than 200 mA. (If momentary power loss must be handled, use a backup capacitor or other method.)
- The PG cards maximum input frequency must not be exceeded. The output frequency of the pulse generator can be calculated using the following formula.

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

3

LED Monitor / Digital Operator and Modes

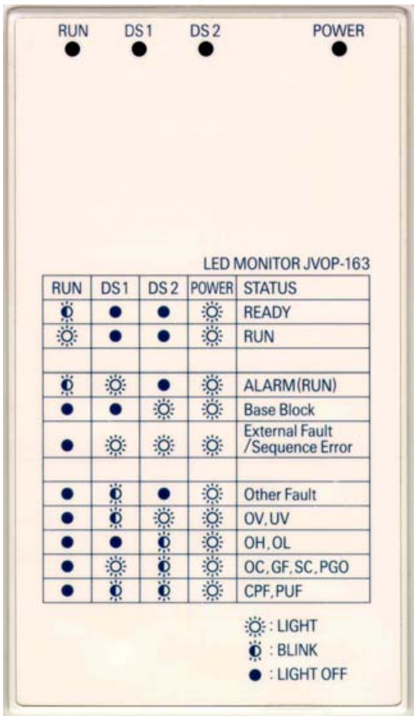
The Varispeed L7 is equipped with the LED Monitor JVOP-163 which shows the drive status. The optional Digital Operator JVOP-160-OY can be used to adjust parameters as required.
This chapter describes Digital Operator displays and functions, and provides an overview of operating modes and switching between modes.

LED Monitor JVOP-163

◆ LED Monitor

The LED monitor indicates the operation status by combinations of the LED display (Lights up, Blink, and Off) at RUN, DS1, and DS2.

The LED pattern is as follows at each mode.



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

Drive Status Indications

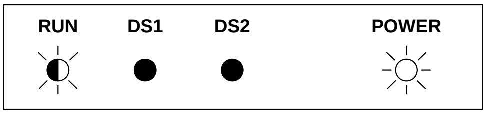
Alarm Indications

Fault Indications

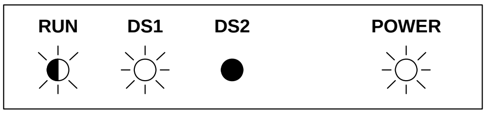
Fig 3.1 Digital Operator Component Names and Functions

◆ LED Display Examples

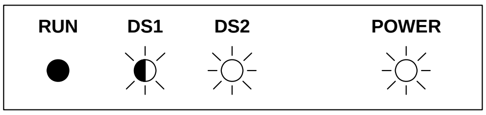
Normal operation: The figure below shows the LED display when the drive is ready and no FWD/REV signal is active



Alarm: The figure below shows an example of the LED display when a minor fault occurs.
Refer to Chapter 6 and take appropriate countermeasures.



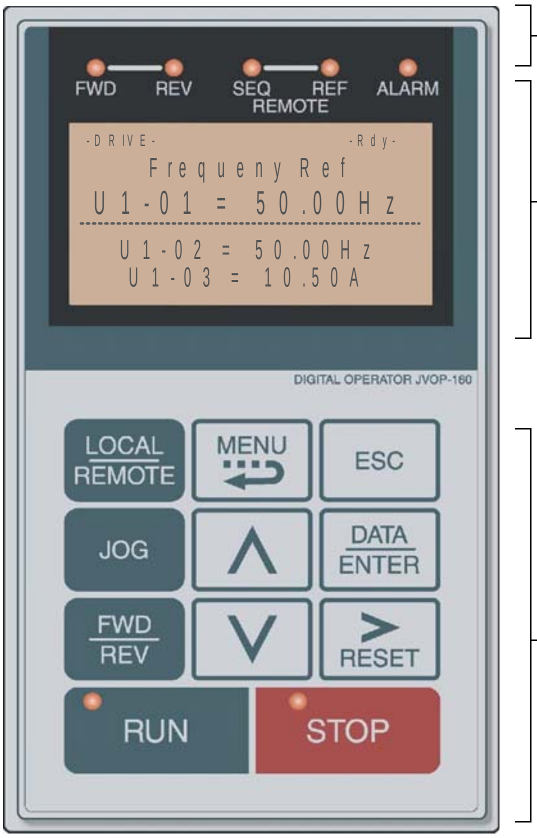
Fault: The figure below shows an example of the LED display when an OV or UV fault has occurred



Digital Operator JVOP-160-OY

◆ Digital Operator Display

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



Drive Status Indicators

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

Data Display

Displays monitor data, parameter numbers and parameter settings.

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

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

Keys

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

Fig 3.2 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 Key	Switches between operation via the Digital Operator (LOCAL) and the settings in b1-01 and b1-02 (REMOTE). This key can be enabled or disabled by setting parameter o2-01.
	MENU Key	Selects menu items (modes).
	ESC Key	Returns to the status before the DATA/ENTER key was pressed.
	JOG Key	Starts jog operation when the inverter is operated by the Digital Operator and d1-18 is set to 0.

3

Key	Name	Function
FWD / REV	FWD/REV Key	Selects the rotation direction of the motor when the Inverter is operated by the Digital Operator.
> RESET	Shift/RESET Key	Sets the active digit when programming parameters. Also acts as the Reset key when a fault has occurred.
∧	Increment Key	Selects menu items, sets parameter numbers, and increments set values. Used to move to the next item or data.
∨	Decrement Key	Selects menu items, sets parameter numbers, and decrements set values. Used to move to the previous item or data.
DATA / ENTER	DATA/ENTER Key	Enters menus and parameters, and set validates parameter changes.
RUN	RUN Key	Starts the Inverter operation when the Inverter is controlled by the Digital Operator.
STOP	STOP Key	Stops Inverter operation. This key can be enabled or disabled using parameter o2-02 when operating from a source different than the operator.

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

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

The RUN key indicator flashes and the STOP key indicator lights during initial excitation or DC braking. The relationship between the indicators on the RUN and STOP keys and the Inverter status is shown in *Fig 3.3*.

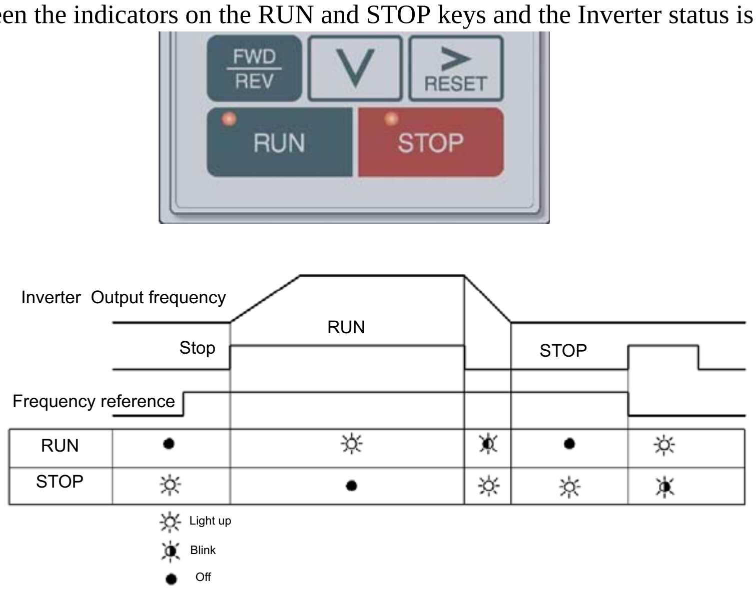


Fig 3.3 RUN and STOP Indicators

◆ Inverter Modes

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

The 5 modes and their primary functions are shown in the *Table 3.2*.

Table 3.2 Modes

Mode	Primary function(s)
Drive mode	Use this mode to start/stop the inverter, to monitor values such as the frequency reference or output current and to read out fault informations or the fault history.
Quick programming mode	Use this mode to read and set the basic parameters.
Advanced programming mode	Use this mode to read and set all parameters.
Verify mode	Use this mode to read and set parameters that have been changed from their factory-set values.
Autotuning mode*1	Use this mode when using a motor with unknown motor data in the vector control modes. The motor data are measured/calculated and set automatically. This mode can also be used to measure the motor line-to-line resistance only.

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

◆ Switching Modes

The mode selection display appears 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.

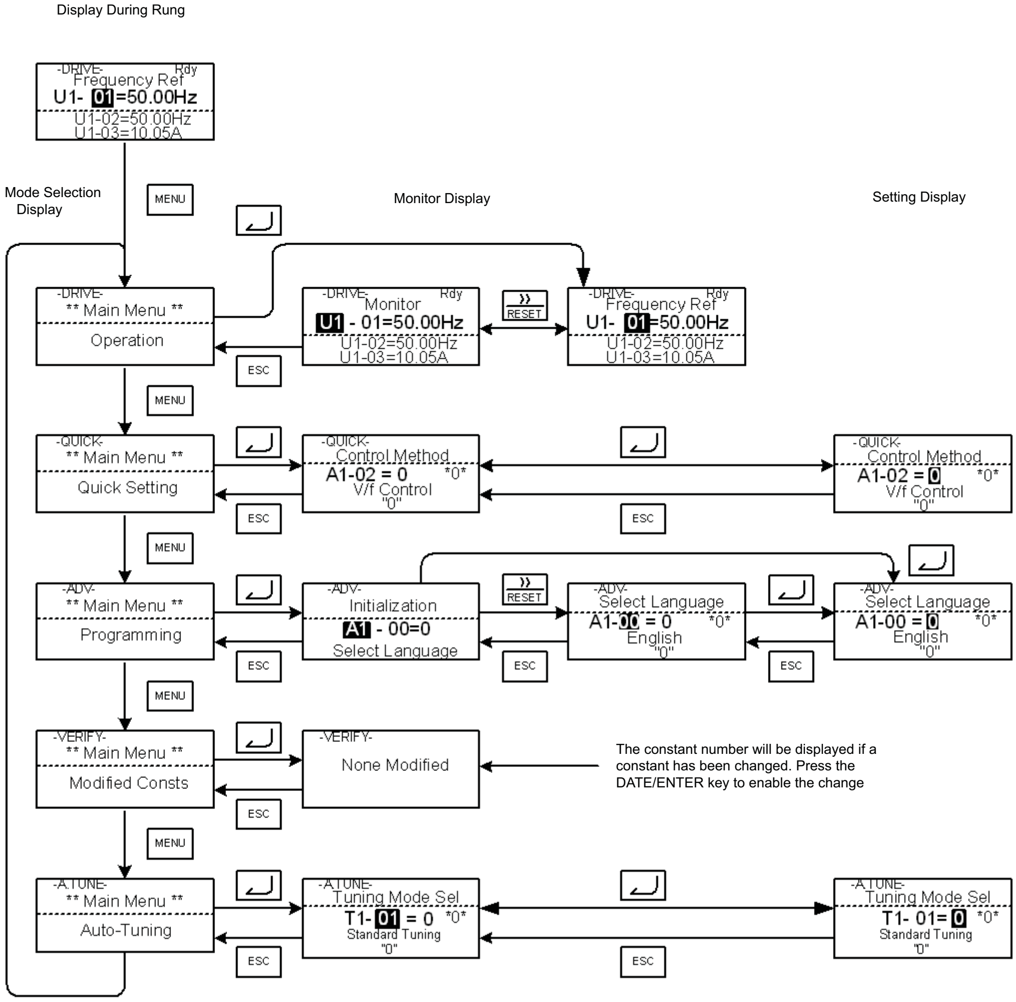


Fig 3.4 Mode Transitions

INFO

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

◆ Drive Mode

In the Drive mode the Inverter can be operated. All monitor parameters (U1-☐☐), fault informations and the fault history can be displayed in this mode

When b1-01 (Reference selection) is set to 0, 1 or 3, the selected frequency reference value (d1-☐☐) can be changed from the frequency setting display using the Increment, Decrement, Shift/RESET and Enter keys. After confirming the change by pressing the ENTER key, the display returns to the Monitor display.

■Example Operations

Example key operations in drive mode are shown in the following figure.

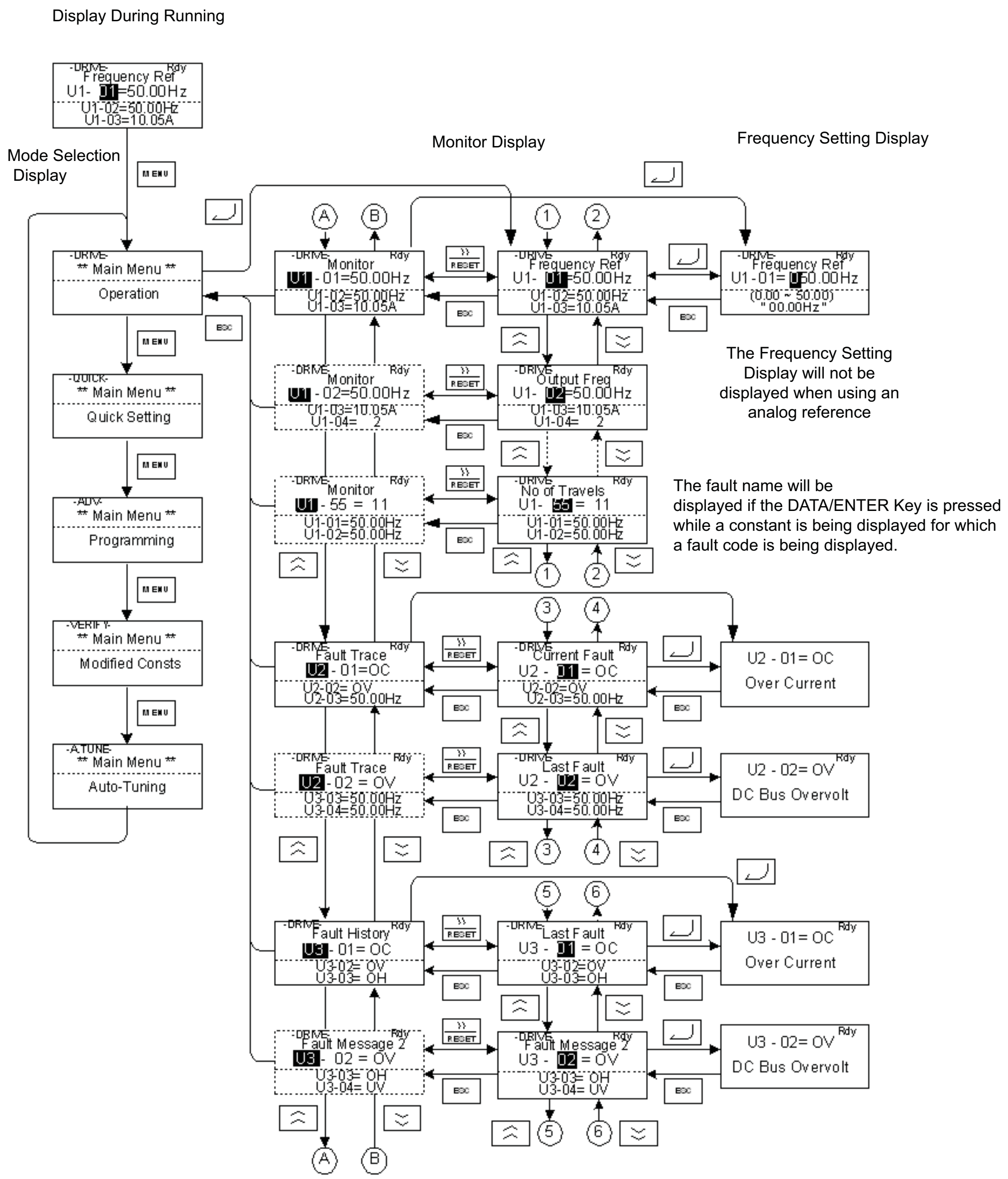


Fig 3.5 Operations in Drive Mode

Note: When changing the display with the Increment/Decrement keys, after the last monitor parameter the display jumps back to the first monitor parameter and vice versa (e.g. U1-55 is followed by U1-01).
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).

◆ Quick Programming Mode

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

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

Refer to *page 5-4, User Parameters Available in Quick Programming Mode* for details.

■Example Operations

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

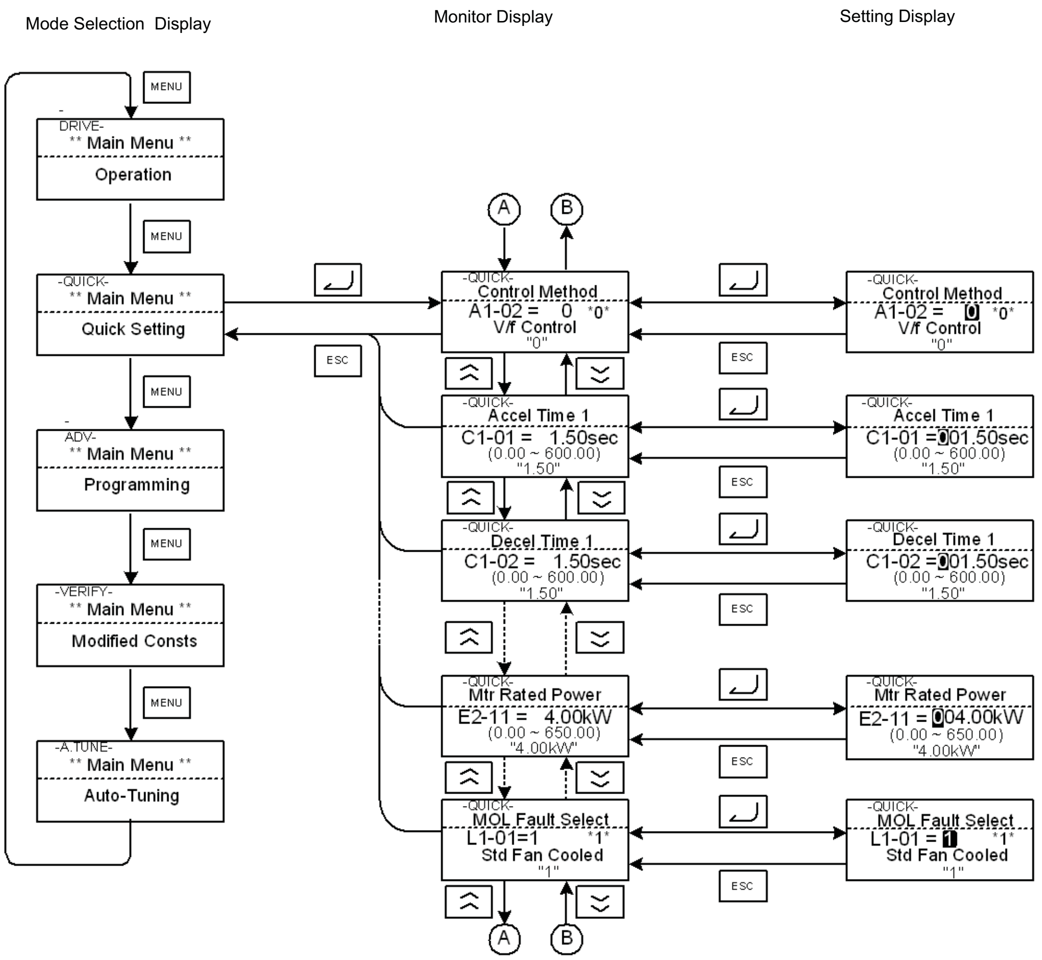


Fig 3.6 Operations in Quick Programming Mode

◆ Advanced Programming Mode

In the 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 is saved and the display returns to the monitor display when the DATA/ENTER key is pressed.

Refer to *page 5-1, User Parameters* for details about the parameters.

■Example Operations

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

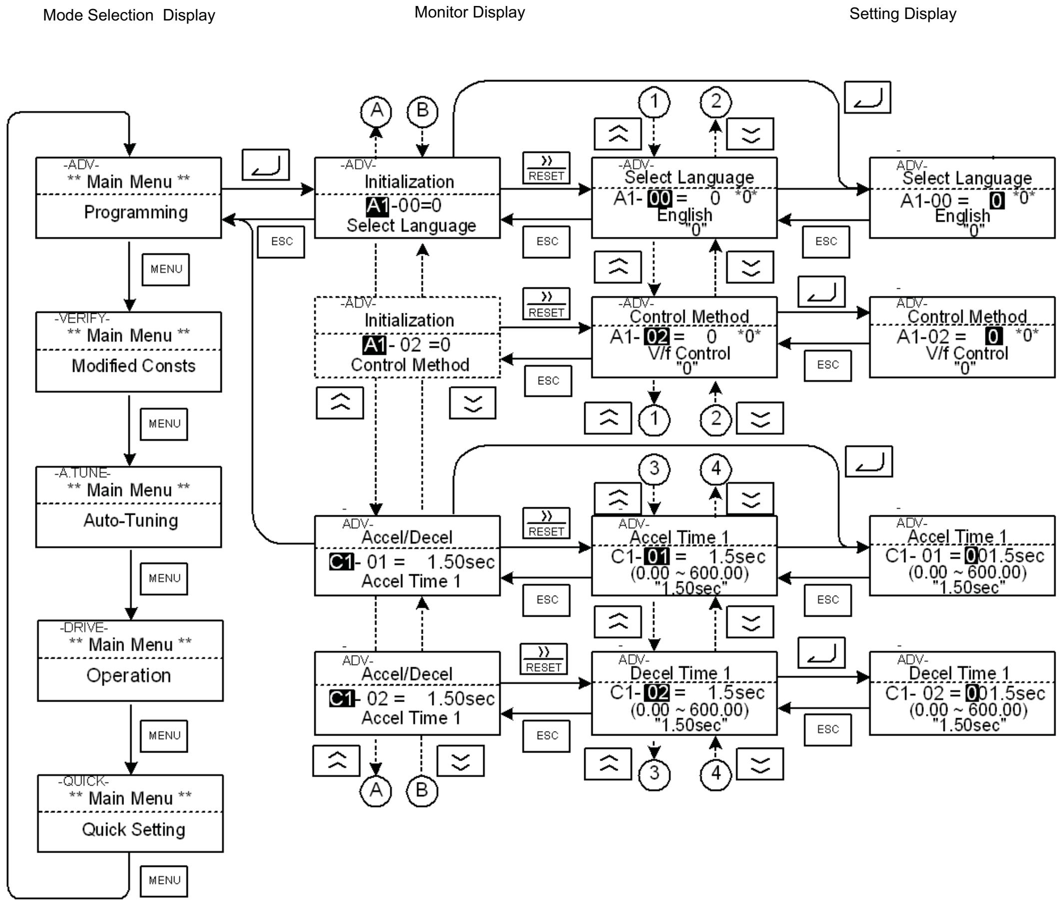


Fig 3.7 Operations in Advanced Programming Mode

■Setting Parameters

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

Table 3.3 Setting Parameters in Advanced Programming Mode

Step No.	Digital Operator Display	Description
1	-DRIVE- Rdy Frequency Ref U1- 01 =50.00Hz U1-02=50.00Hz U1-03=10.05A	Power supply turned ON.
2	-DRIVE- ** Main Menu ** Operation	Press the MENU key 3 times to enter the advanced programming mode.
3	-QUICK- ** Main Menu ** Quick Setting	
4	-ADV- ** Main Menu ** Programming	
5	-ADV- Initialization A1-00=1 Select Language	Press the DATA/ENTER to access the monitor display.
6	-ADV- Accel / Decel C1-01 = 1.50sec Accel Time 1	Press the Increment or Decrement key to display the parameter C1-01 (Acceleration Time 1).
7	-ADV- Accel Time 1 C1-01 = 001.50sec (0.00 ~ 600.0) "1.50sec"	Press the DATA/ENTER key to access the setting display. The current setting value of C1-01 is displayed.
8	-ADV- Accel Time 1 C1-01 = 001.50sec (0.00 ~ 600.0) "1.50sec"	Press the Shift/RESET key to move the flashing digit to the right.
9	-ADV- Accel Time 1 C1-01 = 001.50sec (0.00 ~ 600.0) "1.50sec"	Press the Increment key to change set value to 2.50 s.
10	-ADV- Accel Time 1 C1-01 = 002.50sec (0.00 ~ 600.0) "1.50sec"	Press the DATA/ENTER key to save the set data.
11	-ADV- Entry Accepted	"Entry Accepted" is displayed for 1 sec after pressing the DATA/ENTER key.
12	-ADV- Accel Time 1 C1-01 = 2.50sec (0.00 ~ 600.0) "1.50sec"	The display returns to the monitor display for C1-01.

◆ Verify Mode

The Verify mode is used to display the parameters that have been changed from their default settings, either by programming 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 as used in the programming mode can be used to change settings. Use the Increment, Decrement, and Shift/RESET keys to change a setting. When the DATA/ENTER key is pressed the parameter setting are written and the display returns to the Monitor display.

■Example Operations

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

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

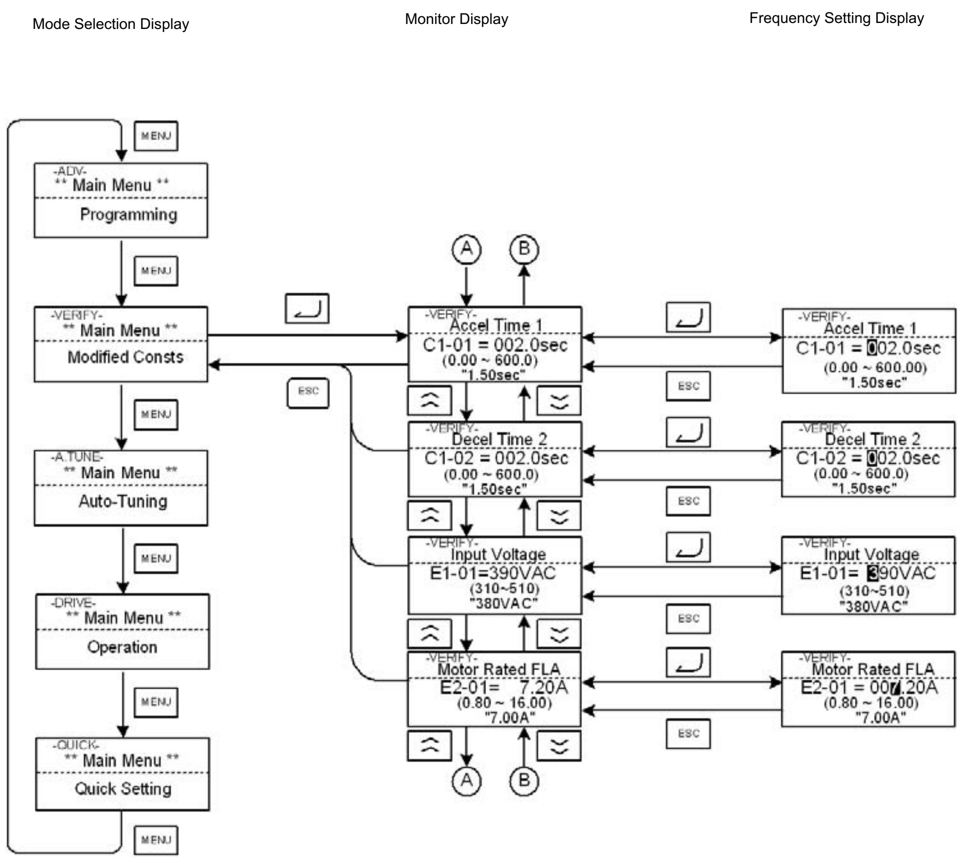


Fig 3.8 Operations in Verify Mode

3

◆ Autotuning Mode

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

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

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

■Example of Operation for V/f control

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

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

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

The following flowchart shows a V/f control Autotuning example.

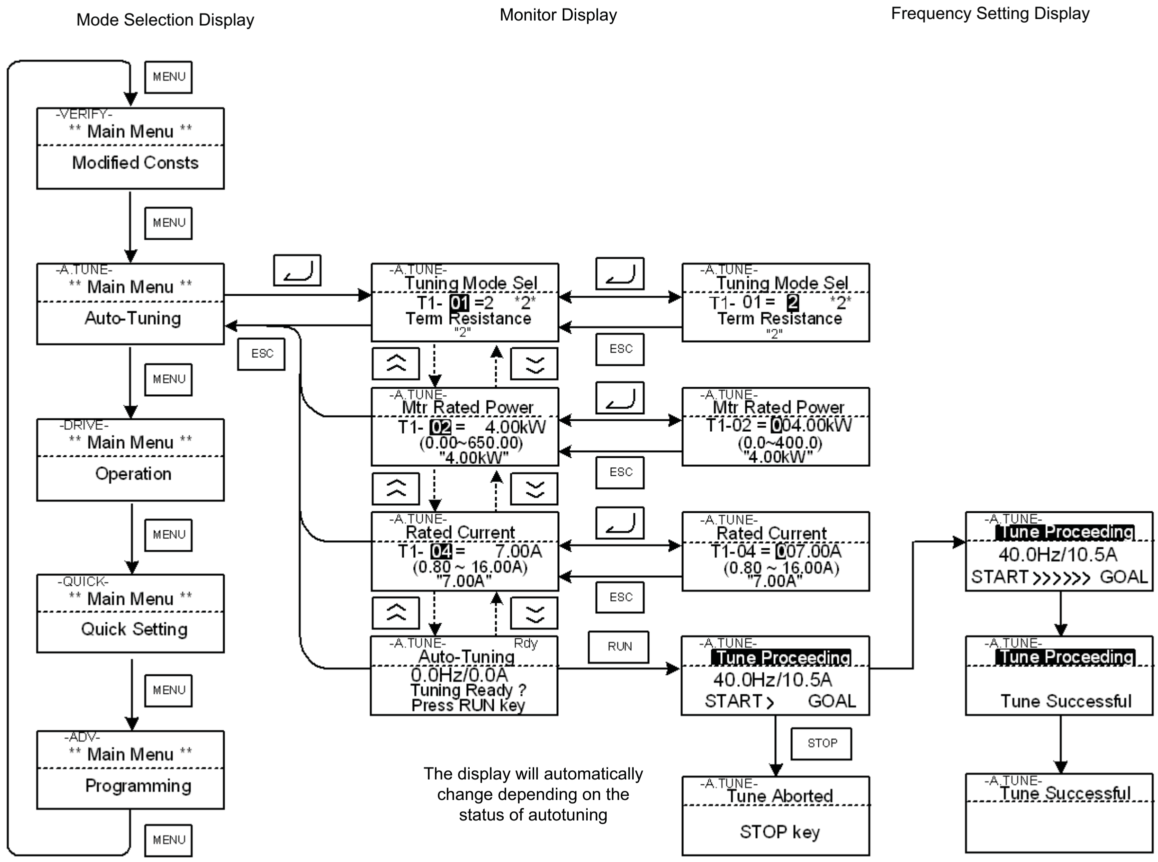


Fig 3.9 Operation in Autotuning Mode

If a fault occurs during autotuning, refer to *page 7-14, Auto-tuning Faults*.

4

Start Up Procedure

This chapter describes the basic setup procedure, the motor data autotuning for each control mode and gives advices if problems occur.

General Start Up Routine

◆ Start Up

The following chart shows the basic start up sequence.

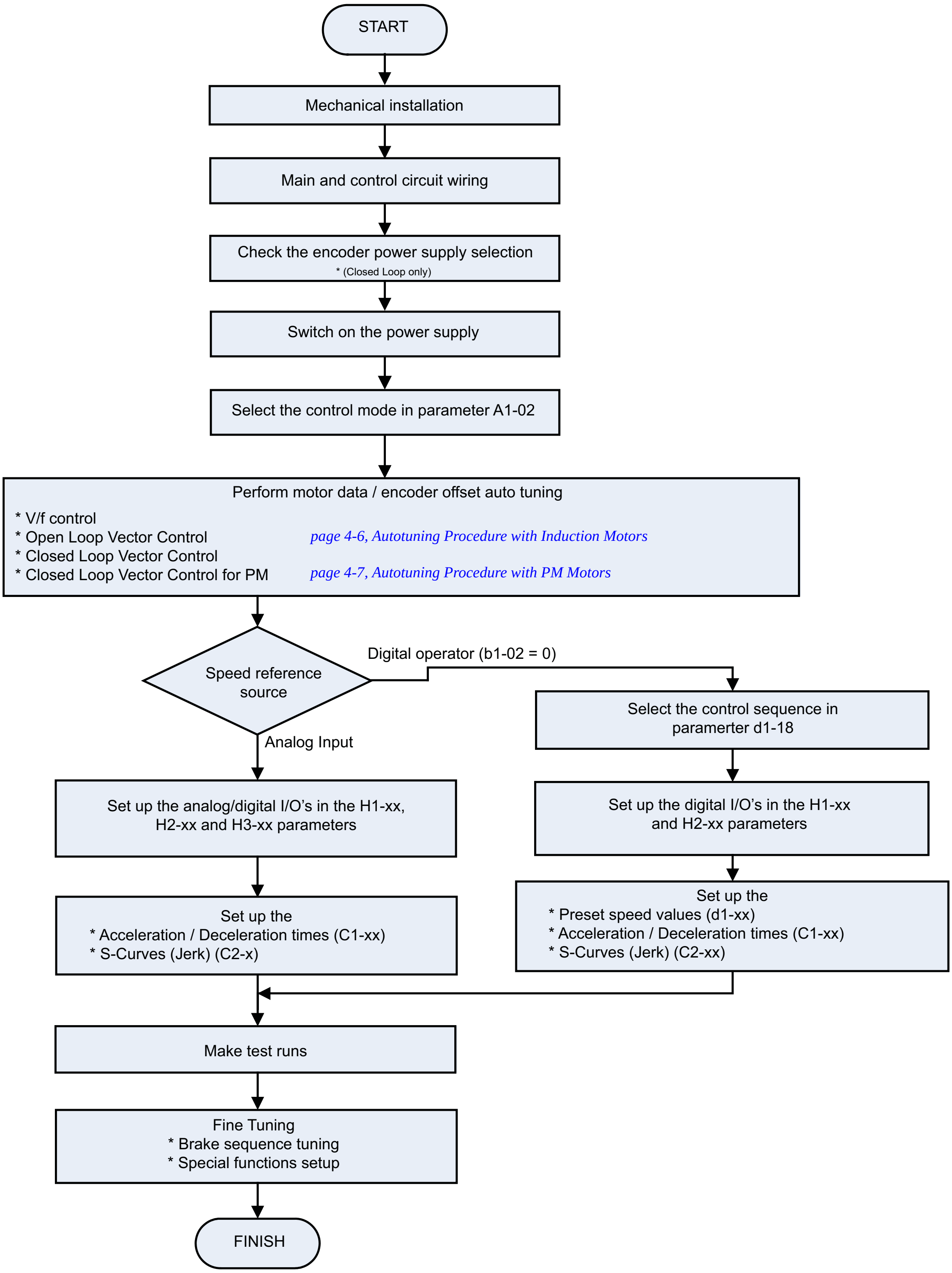


Fig 4.1 Basic Start Up Sequence

Power Up

◆ Before Power Up

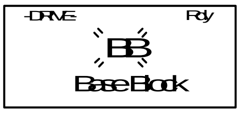
The following points should be checked carefully before the power is switched on.

- The power supply must meet the inverter specification (refer to *page 9-2, Specifications by Model*).
- The power supply cables must be tightly connected to the right terminals (L1, L2, L3).
- The motor cables must be tightly connected to the right terminals on the inverter side (U, V, W) as well as on the motor side.
- The braking unit / braking resistor must be connected correctly.
- The Inverter control circuit terminal and the control device must be wired correctly.
- All Inverter control circuit terminals should be switched OFF.
- When a PG card is used, the PG must be wired correctly.

◆ Display after Power Up

After normal power up without any problems the operator display shows the following messages

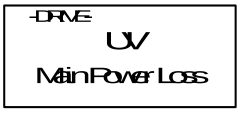
Display for normal operation



The Baseblock message blinks.

When a fault has occurred or an alarm is active a fault or alarm message will appear. In this case, refer to *Chapter 7, Troubleshooting*.

Display for fault operation



A fault or alarm message is shown on the display.
The example shows a low voltage alarm.

◆ Control Mode Selection

As the first thing after power up one of the four control modes must be selected depending on the machine type.

Table 4.1 Control Mode Selection

Machine Type	Control Mode	A1-02 setting	PG Card
Induction motor without encoder	V/f control	0	-
	Open Loop Vector Control	2	-
Induction motor with incremental encoder	Closed Loop Vector Control	3	PG-B2 / PG-X2
Permanent magnet motor with Hiperface® or EnDat 2.1 encoder	Closed Loop Vector Control for PM motors	6	PG-F2
Yaskawa IPM motor with incremental encoder	Closed Loop Vector Control for PM motors	6	PG-X2

⚠ CAUTION

- For Permanent Magnet motors do not use any other control mode than Closed Loop Vector for PM (A1-02 = 6). Using any other control mode can cause damage to the equipment or can cause dangerous behavior.

Autotuning

The motor data autotuning function sets the V/f pattern parameters (E1-□□), motor data parameters (E2-□□, E5-□□) and the encoder data (F1-01) automatically. The steps which have to be performed during the autotuning depend on the tuning mode selection. Refer to *page 5-57, Motor Autotuning: T* for an overview of the autotuning parameters.

◆ Autotuning Mode Selection

The autotuning mode has to be selected according to selected control mode and the mechanical system (motor no load rotation possible or not). *Table 4.1* shows the selectable tuning mode for each control mode.

Table 4.2 Motor Data Autotuning Modes

Autotuning Mode	Function	Tuning Mode Selection (T1-01)	Control Mode			
			V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
Standard tuning with rotating motor	Tunes all motor parameters.	0	No	Yes	Yes	Yes
IM tuning with not rotationg motor	Tunes the basic motor parameters.	1	No	Yes	Yes	No
IM Line-to-line resistance tuning	Tunes the line-to-line resistance only	2	Yes	Yes	Yes	No
Encoder offset tuning	Tunes the offset between the encoder and magnetic zero position.	4	No	No	No	Yes

■ Autotuning Modes

Autotuning with Rotating Motor (T1-01 = 0)

This autotuning mode can be used in any Vector control mode. After the motor nameplate data have been input, the inverter will operate the motor for approximately 1~2 minutes and set the required motor parameters automatically.

IMPORTANT

Use this tuning mode only, if the motor can rotate freely which means that the ropes must be removed and the brake must be open. The gearbox can remain connected to the motor.

Autotuning with Not Rotating Motor (T1-01 = 1)

This autotuning mode can be used for Open Loop and Closed Loop Vector control for IM only. The inverter supplies power to the motor for approximately 1 minute and some of the motor parameters are set automatically while the motor does not turn. The motor no-load current and the rated slip value will automatically be fine tuned during the first time operation.
Verify the rated slip value (E2-02) and the no-load current (E2-03) after the first run with nominal speed.

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

Non-rotating autotuning for line-to-line resistance can be used in V/f control, Open Loop Vector control and Closed loop Vector control. The Inverter supplies power to the motor for approximately 20 seconds to measure the motor line-to-line resistance and cable resistance. The motor does not turn during this tuning procedure.

Encoder Offset Tuning (T1-01=4)

This tuning mode is available in Closed Loop Vector control for PM motors only. It automatically sets the offset between the magnetic pole and the encoder zero postion. It can be used to retune the offset after an encoder change without changing the motor data settings.

◆ Auto Tuning Precautions

IMPORTANT

General Precautions:

1. Use rotating autotuning whenever high precision is required or for a motor that is not connected to a load.
2. Use not rotating autotuning whenever the load cannot be disconnected from the motor (e.g. the ropes can't be removed).
3. Make sure, that the mechanical brake is *not* open for not rotating autotuning.
4. During autotuning the motor contactors have to be closed.
5. For autotuning the BB and BB1 signals must be ON (Inverter must not be in base block condition).
6. Confirm, that the motor is mechanically fixed and can not move.
7. Power is supplied during auto tuning, even though the motor does not turn. Do not touch the motor until autotuning has been completed.
8. Remove the feather key from the motor shaft before performing a tuning with rotating motor with a stand alone motor (no traction sheave or gear mounted).
9. To cancel autotuning, press the STOP key on the Digital Operator.

Precautions for rotating and encoder offset autotuning:

1. The load should be disconnected which means, that the ropes have to be removed and the brake must be open.
2. If the load can't be removed, the tuning can be done with a balanced car. The tuning result accuracy will be lower which can result in a performance loss.
3. Make sure that the brake is open during autotuning.
4. During autotuning the motor can be started and stopped repeatedly. When the tuning is finished, "END" will be displayed in the operator panel. Do not touch the motor until this display is shown and the motor has completely stopped.

◆ Autotuning Procedure with Induction Motors

Fig 4.2 shows the autotuning procedure for an induction motor with or without encoder in V/f-, Open loop vector and Closed loop vector control.

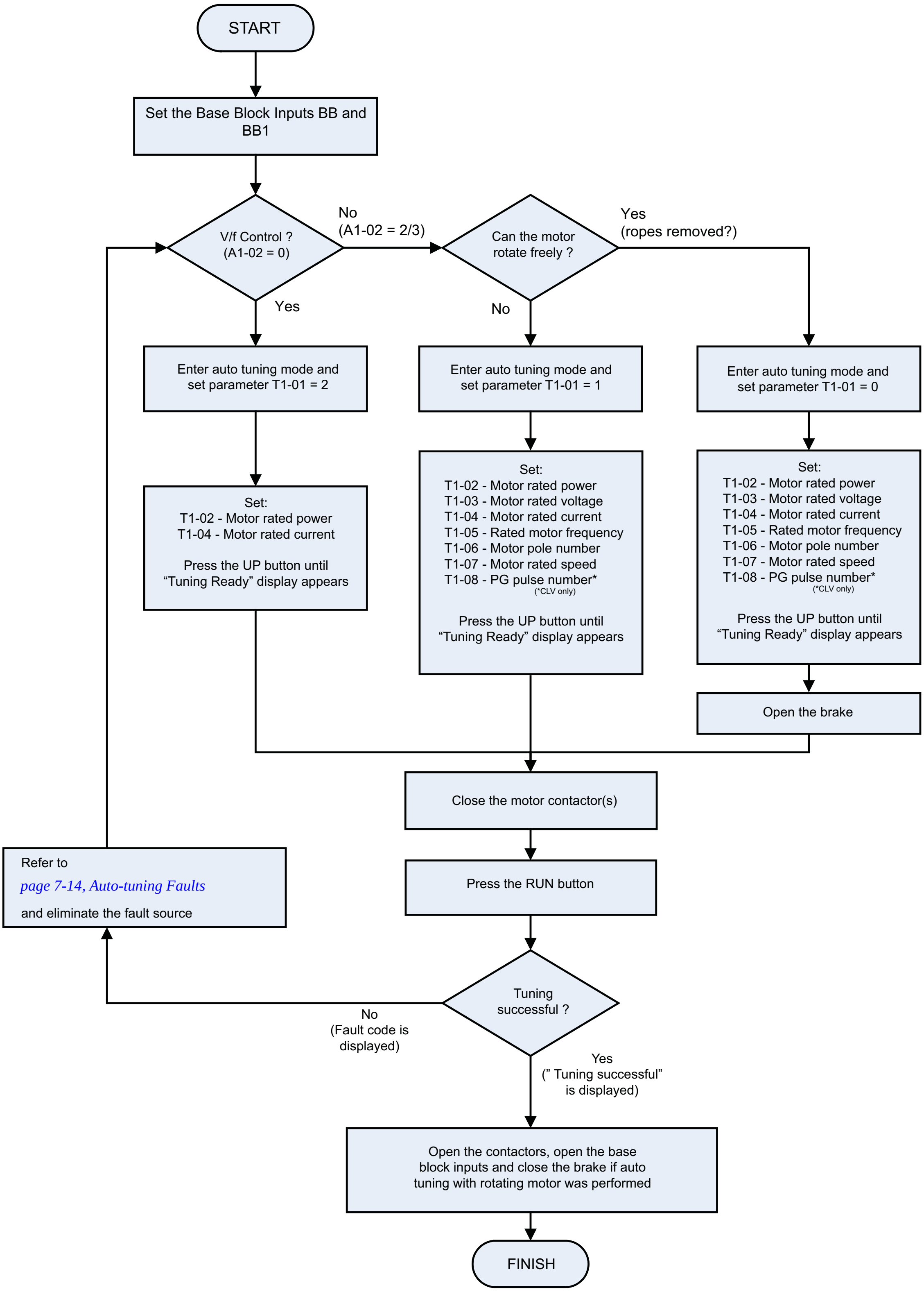
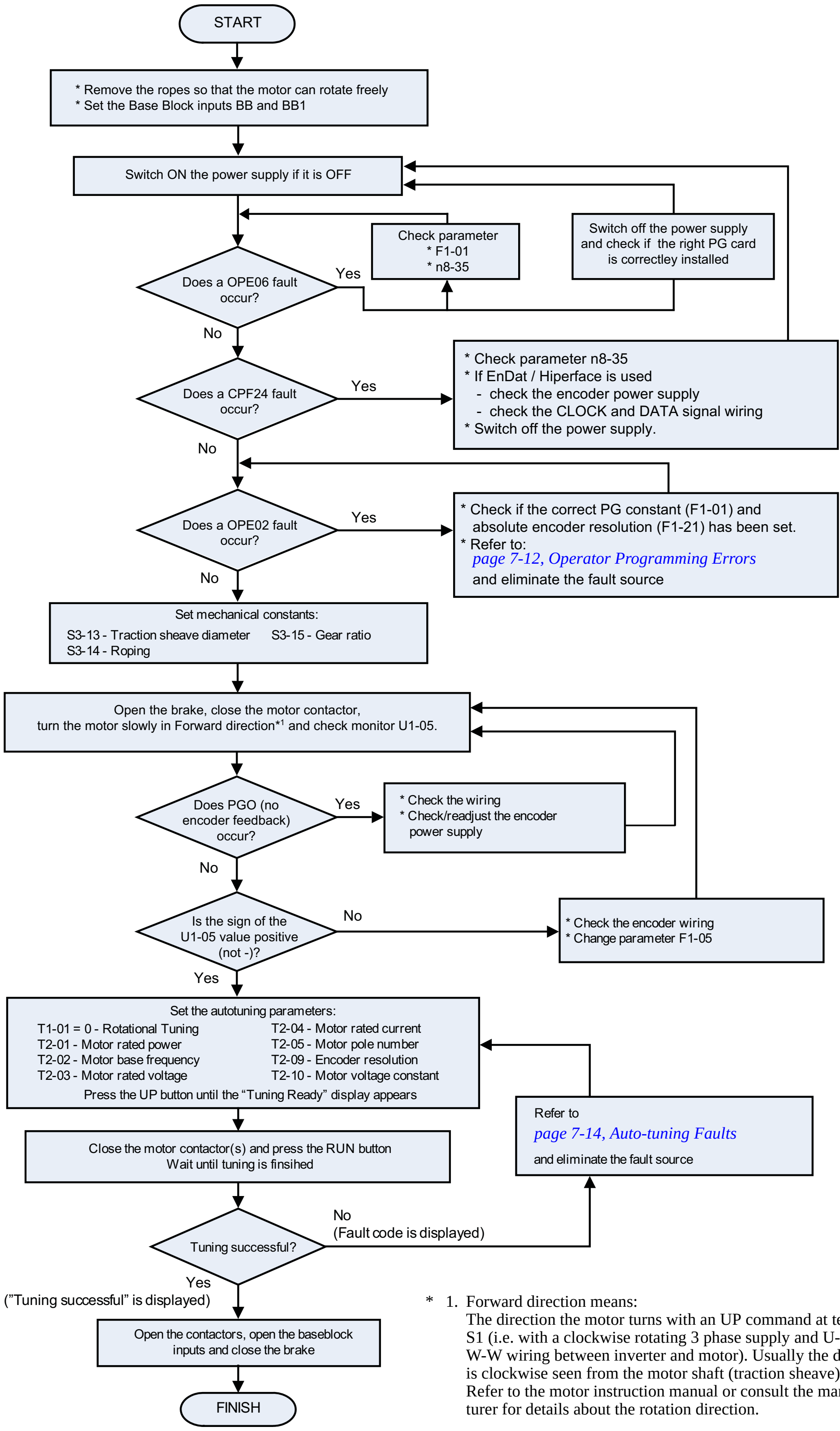


Fig 4.2 Autotuning for Induction Motors

◆ Autotuning Procedure with PM Motors

Fig 4.3 shows the autotuning procedure for permanent magnet motors. Before tuning make sure that the control mode is set to PM Closed Loop Vector (A1-02 = 6).



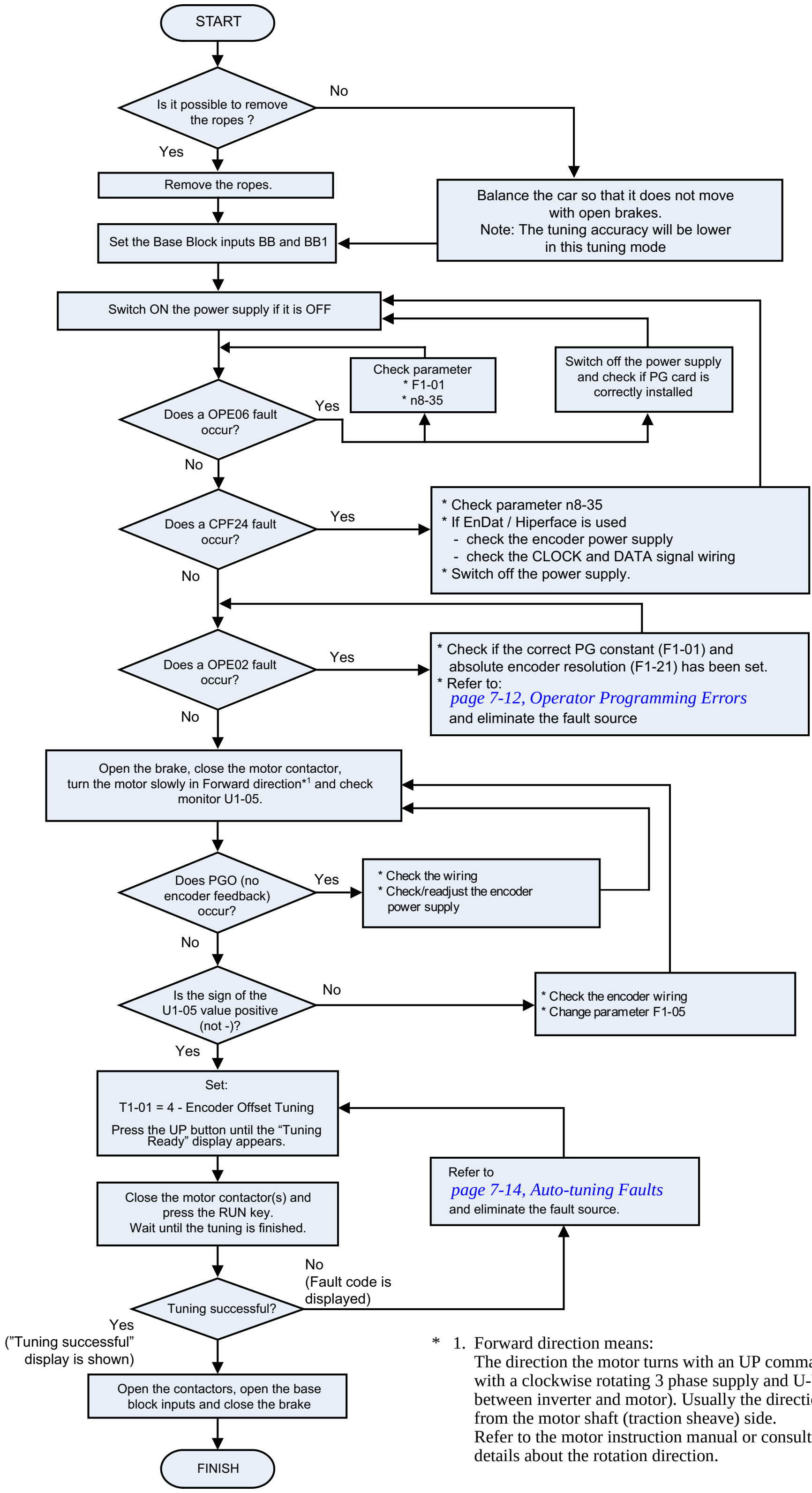
* 1. Forward direction means:
The direction the motor turns with an UP command at terminal S1 (i.e. with a clockwise rotating 3 phase supply and U-U, V-V, W-W wiring between inverter and motor). Usually the direction is clockwise seen from the motor shaft (traction sheave) side. Refer to the motor instruction manual or consult the manufacturer for details about the rotation direction.

Fig 4.3 Autotuning for Permanent Magnet Motors

4

◆ PM Motor Encoder Offset Tuning

Fig 4.4 shows the autotuning procedure for an encoder offset tuning. This procedure should be performed if the encoder has been changed or has not been aligned correctly. Before tuning make sure that PM losed loop vector conntrol is selected (A1-02 = 6) and that the E1-☐☐ and E5-☐☐ parameters are set up correctly.



* 1. Forward direction means:
The direction the motor turns with an UP command at terminal S1 (i.e. with a clockwise rotating 3 phase supply and U-U, V-V, W-W wiring between inverter and motor). Usually the direction is clockwise seen from the motor shaft (traction sheave) side.
Refer to the motor instruction manual or consult the manufacturer for details about the rotation direction.

Fig 4.4 Encoder Offset Autotuning

4

◆ Precautions for Induction Motor Autotuning

If the Motor Rated Voltage is Higher than the Power Supply Voltage

If the motor rated voltage is higher than the power supply voltage, lower the base voltage value like shown in *Fig 4.5* to prevent saturation of the Inverter's output voltage. Use the following procedure to perform autotuning:

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

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

3. Perform autotuning.

After the completion of autotuning, set E1-04 (Max. output frequency) to the base frequency from the motor's nameplate.

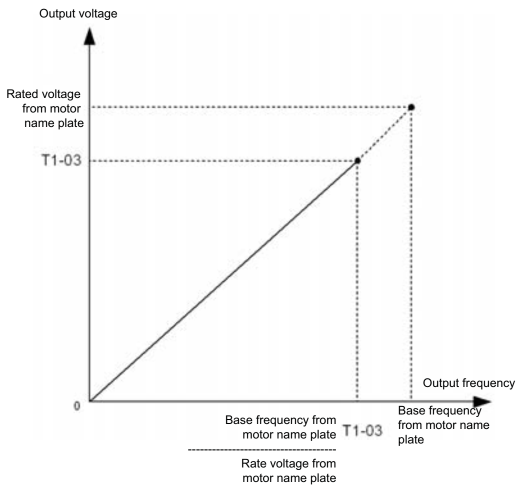


Fig 4.5 Motor Base Frequency and Inverter Input Voltage Setting

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

If the Maximum Frequency is Higher than the Motor Base Frequency

Set the maximum output frequency in parameter E1-04 after autotuning has been performed.

◆ Autotuning Alarms and Faults

■Data Input Errors

The inverter will show a “Data Invalid” message and will not perform autotuning if:

- the motor speed, rated frequency and pole pair number do not correspond.

$$\text{Motor Speed} < \frac{\text{Base Frequency} \cdot 60}{2 \cdot \text{Motor pole}}$$

- the rated current does not correspond to the rated power value
  The inverter calculates the motor power using the input current value and data from the internal motor data table. The calculated value must be between 50% and 150% of the input value for the rated power.

■Other Alarms and Faults During Autotuning

For an overview of possible autotuning alarms or faults and corrective actions refer to *page 7-14, Auto-tuning Faults*.

Performance Optimization

The following table gives adjustment advice for performance improvement after the basic setup has been done.

Table 4.3 Performance Optimization

Problem	Possible Reason		Countermeasure
Rollback at start	V/f and OLV	• Too less torque when the brake opens	• Increase the DC injection current at start in parameter S1-02. • Set the DC injection time at start S1-04 as short as possible, but make sure, that brake opens completely before the motor starts to turn. • Increase the minmum (E1-10) and medium (E1-08) V/f pattern voltages. Make sure, that the starting and leveling current does not rise too high.
	CLV	• Too slow ASR response when the brake opens.	• Increase the ASR gain at start (C5-03) and decrease the ASR I time at start (C5-04). If vibrations occur set the values back in small steps. • Increase the Zero servo gain in parameter S1-20.
	Common	• Motor torque is not fully established when the brake opens.	• Lengthen the brake release delay time S1-06 and the DC injection/zero servo time at start S1-04
		• Motor contactors close too late	• Make sure, that the contactors are cosed before the Up/Down command is set.
Jerk at start	Common	• Motor starts turning when the brake is not completely opened or runs against the brake	• Increase the DC injection time at start S1-04.
		• Too fast acceleration rate change	• Increase the S-Curve at start C2-01
Vibrations in low and medium speed area	V/f	• Too high output voltage	• Reduce the V/f pattern settings (E1-08 / E1-10)
	OLV	• Too fast torque compensation	• Increase the torque compesation delay time (C4-02)
		• Too high output voltage	• Reduce the V/f pattern settings (E1-08 / E1-10)
	CLV	• Too high ASR settings	• Decrease C5-01 / C5-03 and increase C5-02 / C5-04
		• Wrong motor slip value	• Check the motor slip value in parameter E2-02. Increase or decrease it in steps of 0.2 Hz.
Vibrations in the high and top speed area	OLV	• Too fast torque compensation	• Increase the torque compesation delay time (C4-02)
	CLV	• Too high ASR settings	• Decrease C5-01 / C5-03 and increase C5-02 / C5-04

Problem	Possible Reason		Countermeasure
Jerk caused by over-shooting when the top speed is reached	OLV	• Too fast torque compensation or slip compensation	• Increase the torque compensation delay time C4-02 • Increase the slip compensation delay time C3-02
	CLV	• Too soft or too hard ASR controller settings	• Readjust the ASR P gain C5-01 and the ASR integral time C5-02.
		• Wrong motor data	• Readjust the motor data (E2-□□), especially the slip (E2-02) and no-load current values (E2-03) or perform an autotuning
	Common	• Too hard acceleration change.	• Increase the S-curve at acceleration end C2-02.
Motor stops shortly when the leveling speed is reached (undershooting)	V/f	• Too low torque at low speed	• Increase the minmum (E1-10) and medium (E1-08) V/f pattern voltages. Make sure, that the starting and leveling current does not rise too high.
	OLV	• Too low torque at low speed	• Increase the minmum (E1-10) and medium (E1-08) V/f pattern voltages. Make sure, that the starting and leveling current does not rise too high.
		• Wrong motor data • Slip overcompensation	• Readjust the motor data (E2-□□), especially the slip (E2-02) and no-load current values (E2-03) or perform an autotuning
	CLV	• Wrong motor data	• Readjust the motor data (E2-□□), especially the slip (E2-02) and no-load current values (E2-03) or perform an autotuning
		• Too slow ASR controller	• Increase the ASR P gain C5-09 and decrease the ASR integral time C5-10
	Common	• Too fast deceleration rate change.	• Increase the S-curve at deceleration end C2-04.
Jerk at stop	Common	• Brake closed too early, so that the motor runs against the brake	• Increase the brake close delay time S1-07 and if necessary the DC injection time at stop S1-05.
		• Motor contactor opens when the brake is not yet completely closed	• Check the motor contactor sequence.
High frequency motor noise	Common	• The carrier frequency is too low.	• Increase the carrier frequency in parameter C6-02 or C6-11. If the carrier frequency increased higher than the factory setting, a current derating must be considered (refer to *page 9-6, Carrier Frequency Derating*)
Vibrations which increase with the speed	CLV	• Encoder vibrates	• Check the encoder mounting and the orientation to the motor shaft
	Common	• Mechanical problems	• Check bearings, gearbox
		• Rotational parts (motor armature, hand-wheel, brake disk/drum) have an unbalance	• Balance the rotating parts

5

User Parameters

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

User Parameter Descriptions

◆ Description of User Parameter Tables

User 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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS Register	Page
b1-01	Reference selection	Sets the frequency reference input method. 0: Digital Operator 1: Control circuit terminal (analog input) 2: MEMOBUS communications 3: Option Card	0 to 3	0	No	Q	Q	Q	Q	180H	-

• Parameter Number:	The number of the user parameter.
• Name:	The name of the user parameter.
• Display	The display shown in the Digital Operator JVOP-160-OY
• Description:	Details on the function or settings of the user parameter.
• Setting Range:	The setting range for the user parameter.
• Factory Setting:	The factory setting (each control method has its own factory setting. Therefore the factory setting changes when the control method is changed.) Refer to page *page 5-65, Settings which change with the Control Mode (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 user parameter can be monitored or set. Q: The item can be monitored and set as well in quick programming mode as in advanced programming mode. A: The item can be monitored and set in advanced programming mode only. No: The item cannot be monitored or set in this control method.
• MEMOBUS Register:	The register number used for MEMOBUS communications.
• Page:	Reference page for more detailed information about the parameter.

Digital Operation Display Functions and Levels

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

MENU

Drive Mode
Inverter can be operated and its status can be displayed.

Quick Programming Mode
Minimum parameters required for operation can be monitored or set.

Advanced Programming Mode
All parameters can be monitored or set.

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

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

No.	Function	Page
U1	Status Monitor Parameters	5-59
U2	Fault Trace	5-63
U3	Fault History	5-64
A1	Initialize Mode	5-8
A2	User-specified Setting Mode	5-9
b1	Operation Mode Selections	5-10
b2	DC Injection Braking	5-10
b4	Timer Function	5-11
b6	Dwell Functions	5-11
C1	Acceleration/Deceleration	5-12
C2	S-curve Acceleration/Deceleration	5-13
C3	Motor Slip Compensation	5-14
C4	Torque Compensation	5-15
C5	Speed Control (ASR)	5-16
C6	Carrier Frequency	5-17
d1	Speed References	5-18
d6	Field Forcing	5-20
E1	V/f Pattern 1	5-21
E2	Motor Setup 1	5-22
E3	V/f Pattern 2	5-23
E4	Motor Setup 2	5-24
E5	PM Motor Setup	5-25
F1	PG Option Setup	5-26
F4	Analog Monitor Card	5-29
F5	Digital Output Card	5-30
F6	Serial Communications Settings	5-31
H1	Multi-function Digital Inputs	5-32
H2	Multi-function Digital Outputs	5-33
H3	Multi-function Analog Inputs	5-35
L1	Motor Overload	5-37
L2	Power Loss Ridethrough	5-37
L3	Stall Prevention	5-38
L4	Reference Detection	5-38
L5	Fault Restart	5-39
L6	Torque Detection	5-40
L7	Torque Limits	5-41
L8	Hardware Protection	5-41
n2	Automatic Frequency Regulator	5-44
n5	Feed Forward Control	5-44
n8	PM Motor Adjustment	5-46
o1	Monitor Selection	5-48
o2	Digital Operator	5-49
o3	Copy Function	5-50
S1	Brake Sequence	5-50
S2	Slip Compensation	5-53
S3	Special Sequence Functions	5-54
T1	Motor Autotuning 1	5-57
T2	Motor Autotuning 2	5-58

◆ User Parameters Available in Quick Programming Mode

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

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open Loop Vector	Control Methods: Closed Loop Vector	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register
A1-01	Parameter access level	Access Level	Used to set the parameter access level (set/read.) 0: Monitoring only (Monitoring drive mode and setting A1-01 and A1-04.) 1: Used to select user parameters (Only parameters set in A2-01 to A2-32 can be read and set.) 2: Advanced (Parameters can be read and set in both, quick programming mode (Q) and advanced programming mode (A).)	0 to 2	2	Yes	Yes	Yes	Yes	Yes	101H
A1-02	Control method selection	Control Method	Sets the control method for the Inverter. 0: V/f control 2: Open-Loop Vector control 3: Closed Loop Vector control 6: Closed Loop Vector for PM motors	0 to 6	0	No	Yes	Yes	Yes	Yes	102H
C1-01	Acceleration time 1	Accel Time 1	Sets the acceleration time to accelerate from 0 Hz to the maximum output frequency.	0.0 to 600.00 *1	1.50 s	Yes	Yes	Yes	Yes	Yes	200H
C1-02	Deceleration time 1	Decel Time 1	Sets the deceleration time to decelerate from the maximum output frequency to 0 Hz.	0.0 to 600.00 *1	1.50 s	Yes	Yes	Yes	Yes	Yes	201H
C2-01	S-curve characteristic time at acceleration start	S-Crv Acc @ Start	When the S-curve characteristic time is set, the accel/decel times will increase by only half of the S-curve characteristic times at start and end.	0.00 to 2.50	0.50 s	No	Yes	Yes	Yes	Yes	20BH
C2-02	S-curve characteristic time at acceleration end	S-Crv Acc @ End		0.00 to 2.50	0.50 s	No	Yes	Yes	Yes	Yes	20CH
C2-03	S-curve characteristic time at deceleration start	S-Crv Dec @ Start		0.00 to 2.50	0.50 s	No	Yes	Yes	Yes	Yes	20DH
C2-04	S-curve characteristic time at deceleration end	S-Crv Dec @ End		0.00 to 2.50	0.50 s	No	Yes	Yes	Yes	Yes	20EH
C2-05	S-curve Characteristic time below leveling speed	Scurve @ leveling		0.00 to 2.50	0.50 s	No	Yes	Yes	Yes	Yes	232H
C5-01	ASR proportional (P) gain 1	ASR P Gain 1	Set the proportional gain 1 and the integral time 1 of the speed control loop (ASR) for the minimum frequency. The settings becomes active for acceleration only.	0.00 to 300.00	→	Yes	-	-	40.00 -	- 12.00	21BH
C5-02	ASR integral time 1	ASR I Time 1		0.000 to 10.000	→	Yes	-	-	0.500 s -	- 0.300 s	21CH

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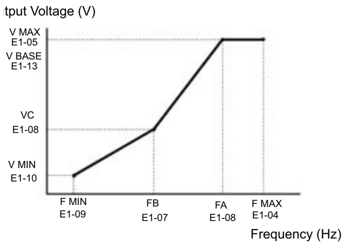
Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register
C5-03	ASR proportional (P) gain 2	Set the proportional gain 2 and the integral time 2 of the speed control loop (ASR) for the maximum frequency.	0.00 to 300.00	→	Yes	-	-	20.00	-	21DH
	ASR P Gain 2							-	6.00	
C5-04	ASR integral (I) time 2		0.000 to 10.000	0.500 s	Yes	-	-	Yes	Yes	21EH
	ASR I Time 2									
C5-06	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	0.020 sec	No	-	-	-	Yes	220H
	ASR Delay Time									
C5-07	ASR switching frequency	Sets the frequency for switching between Proportion Gain 1, 2,3 and Integral Time 1, 2, 3.	0.0 to 50.0 Hz	→	No	-	-	0.0 Hz	-	221H
	ASR Gain SW Freq		0.0 to 100.0 %					-	2.0 %	
C5-09	ASR proportional (P) gain 3	Set the proportional gain 3 and the integral time 3 of the speed control loop (ASR) for the minimum frequency. The settings becomes active for deceleration only.	0.00 to 300.00	→	Yes	-	-	40.00	-	22EH
	ASR P Gain 3							-	12.00	
C5-10	ASR integral (I) time 3		0.000 to 10.000	→	Yes	-	-	0.500s	-	231H
	ASR I Time 3							-	0.300s	
d1-09	Nominal speed reference	Sets the frequency reference when the nominal speed is selected by a digital input.	0 to 120.00	→	Yes	50.00 Hz	50.00 Hz	50.00 Hz	-	288H
	Nomin Speed vn		0 to 100.00			-	-	-	100.00 %	
d1-14	Inspection speed reference	Sets the frequency reference when the inspection speed is selected by a digital input	0 to 120.00	→	Yes	25.00 Hz	25.00 Hz	25.00 Hz	-	28FH
	Inspect Speed vi		0 to 100.00			-	-	-	50.00 %	
d1-17	Leveling speed reference	Sets the frequency reference when the leveling speed is selected by a digital input	0 to 120.00	→	Yes	4.00 Hz	4.00 Hz	4.00 Hz	-	292H
	Level Speed vl		0 to 100.00			-	-	-	8.00%	
E1-01	Input voltage setting	Sets the inverter input voltage. This set value will be the basis for the protection functions.	310 to 510 *2	400 V *2	No	Yes	Yes	Yes	Yes	300H
	Input Voltage									

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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register
E1-04	Max. output frequency (FMAX) Max Frequency		40.0 to 120.0 (with PG-F2) 0 to 1200 (with PG-X2) 0 to 3600	→	No	50.0 Hz -	50.0 Hz -	50.0 Hz -	- 150 rpm	303H
E1-05	Max. voltage (VMAX) Max Voltage		0.0 to 510.0 *2	380.0 V *2	No	Yes	Yes	Yes	No	304H
E1-06	Base frequency (FA) Base Frequency	 	0.0 to 120.0 (with PG-F2) 0 to 1200 (with PG-X2) 0 to 3600	→	No	50.0 Hz -	50.0 Hz -	50.0 Hz -	- 150 rpm	305H
E1-08	Mid. output frequency voltage (VB) Mid voltage A	Sets the output voltage of the base frequency (E1-06).	0.0 to 510 *2	→	No	37.3 V *2	25.0 V *2	-	-	307H
E1-09	Min. output frequency (FMIN) Min Frequency		0.0 to 120.0	→	No	0.5 Hz	0.3 Hz	-	-	308H
E1-10	Min. output frequency voltage (VMIN) Min Voltage		0.0 to 510.0 *2	→	No	19.4 V *2	5.0 V *2	-	-	309H
E1-13	Base voltage (VBASE) Base Voltage		0.0 to 510.0 *2	→	No	0.0 V -	0.0 V -	-	- 400 V	30CH
E2-01	Motor rated current Mtr Rated Current	Sets the motor rated current in Amps. This set value becomes the base value for motor protection and torque limit. It is an input data for autotuning.	0.85 to 17.00 *3	7.00 A *4	No	Yes	Yes	Yes	-	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	2.70 Hz *4	No	Yes	Yes	Yes	-	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 6.99	2.30 A *4	No	Yes	Yes	Yes	-	310H
E2-04	Number of motor poles Number of Poles	Sets the number of motor poles. It is an input data for autotuning.	2 to 48	4	No	-	-	Yes	-	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	3.333 Ω *4	No	Yes	Yes	Yes	-	312H

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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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register
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 kW *4	No	Yes	Yes	Yes	No	318H
E5-02	Motor rated output power	Rated Power	Sets the rated output power of the motor.	0.00 to 300.00	3.70 kW *4	No	-	-	-	Yes	0C2H
E5-03	Rated Motor Current	Rated Current	Sets the rated motor current.	0.00 to 200.00	7.31 A *4	No	-	-	-	Yes	0C3H
E5-04	Number of motor poles	Number of poles	Sets the motor pole number.	4 to 48	4	No	-	-	-	Yes	0C4H
E5-05	Motor terminal resistance	Term resistance	Sets the motor line-to-line resistance	0.000 to 65.000	1.326 Ohm *4	No	-	-	-	Yes	0C5H
E5-06	d-Axis Inductance	d-ax inductance	Sets the D-axis inductance.	0.00 to 300.00	19.11 mH *4	No	-	-	-	Yes	0C6H
E5-07	q-Axis Inductance	q-ax inductance	Sets the Q-axis inductance.	0.00 to 600.00	26.08 mH *4	No	-	-	-	Yes	0C7H
E5-09	Motor voltage constant	Voltage constant	Sets the voltage constant of the motor.	50.0 to 4000.0	478.6 mV *4	No	-	-	-	Yes	0C9H
F1-01	PG constant	PG Pulses/Rev	Sets the number of PG pulses per revolution	0 to 60000	→	No	-	-	Yes 1024	-	380H
									-	Yes 2048	
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	→	No	-	-	0	-	384H
									-	1	
L1-01	Motor protection selection	MOL Select	Set to enable or disable the motor overload protection function using the electronic thermal relay. 0: Disabled 1: Protection for general purpose motor (fan cooled) 2: Protection for frequency converter motor (external cooled) 3: Protection for special vector control motor 5: Permanent magnet constant torque motor	0 to 3	1	No	Yes	Yes	Yes	-	480H
				0 or 5	5					Yes	
n8-35	Magnetic pole position detection	Mag det sel	Sets the detection method for magnetic pole position of a PM motor. 0: Automatic detection (applicable for Yaskawa IPM motor only) 4: Hiperface® Data 5: EnDat Data	0, 4 or 5	5	No	-	-	-	Yes	192H

*1. The setting ranges for acceleration/deceleration times depends on the setting of C1-10 (Acceleration/deceleration Time Setting Unit). If C1-10 is set to 0, the setting range is 0.00 to 600.00 (s).
*2. The given values are for a 400 V class Inverter.
*3. The setting range is from 10% to 200% of the Inverter rated output current. The given values are for a 3.7 kW 400 V Class Inverter.
*4. The factory setting depends on the Inverter capacity. The given value is for a 3.7 kW 400 V Class Inverter.

User Parameter Tables

◆ Setup Settings: A

■ Initialize Mode: A1

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open Loop Vector	Control Methods: Closed Loop Vector	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register	Page
A1-00	Language selection for Digital Operator display Select Language	Used to select the language displayed on the Digital Operator (JVOP-160-OY only). 0: English 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese This parameter is not changed by the initialize operation.	0 to 6	0	Yes	A	A	A	A	100H	–
A1-01	Parameter access level Access Level	Used to set the parameter access level (set/read.) 0: Monitoring only (Monitoring drive mode and setting A1-01 and A1-04.) 1: Used to select user parameters (Only parameters set in A2-01 to A2-32 can be read and set.) 2: Advanced (Parameters can be read and set in both, quick programming mode (Q) and advanced programming mode (A).)	0 to 2	2	Yes	Q	Q	Q	Q	101H	6-72 6-74
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 6: Closed Loop Vector for PM motors This parameter is not changed by the initialize operation.	0 to 6	0	No	Q	Q	Q	Q	102H	-
A1-03	Initialize Init Parameters	Used to initialize the parameters using the specified method. 0: No initializing 1110: Initializes using the user parameters 2220: Initializes using a two-wire sequence. (Initializes to the factory setting.)	0 to 2220	0	No	A	A	A	A	103H	-
A1-04	Password Enter Password	Password input when a password has been set in A1-05. This function write-protects some parameters of the initialize mode. If the password is changed, A1-01 to A1-03 and A2-01 to A2-32 parameters can no longer be changed. (Programming mode parameters can be changed.)	0 to 9999	0	No	A	A	A	A	104H	6-73

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMO-BUS Register	Page
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	A	105H	*6-73*

■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	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMO-BUS 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. User parameters are the only accessible parameters if Parameter Access Level is set to user parameters (A1-01=1)	b1-01 to S3-24	–	No	A	A	A	A	106H to 125H	*6-74*

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◆ Application Parameters: b

■Operation Mode Selections: b1

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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS Register	Page
b1-01	Reference source selection Reference Source	Sets the frequency reference input method. 0: Digital Operator 1: Control circuit terminal (analog input) 3: Option Card	0, 1 or 3	0	No	A	A	A	A	180H	6-4
b1-02	RUN command source selection Run Source	Sets the run command input method. 0: Digital Operator 1: Control circuit terminal (digital multifunction inputs) 3: Option Card	0, 1 or 3	1	No	A	A	A	A	181H	6-3
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	A	185H	-
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: Operation permitted (Disabled when Digital Operator is the selected Run command source (b1-02 = 0)).	0 or 1	1	No	A	A	A	A	187H	-

■DC Injection Braking: b2

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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS 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	-	A	-	-	190H	-

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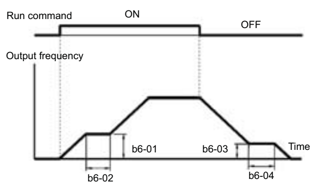
■Timer Function: b4

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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS 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	A	1A3H	6-54
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	A	1A4H	6-54

■Dwell Functions: b6

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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS Register	Page
b6-01	Dwell frequency at start Dwell Ref @ Start	 The dwell function can be used to hold the output frequency temporarily.	0.0 to 120.0	0.0 Hz	No	A	A	A	A	1B6H	6-23
b6-02	Dwell time at start Dwell Time @ Start		0.0 to 10.0	0.0 s	No	A	A	A	A	1B7H	6-23
b6-03	Dwell frequency at stop Dwell Ref @ Stop		0.0 to 120.0	0.0 Hz	No	A	A	A	A	1B8H	6-23
b6-04	Dwell time at stop Dwell Time @ Stop		0.0 to 10.0	0.0 s	No	A	A	A	A	1B9H	6-23

■Torque Monitor: b8

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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS Register	Page
b8-17	Torque monitor gain Torque Mon Gain		0 to 2.00	1.00	No	-	-	-	A	1F9H	6-23

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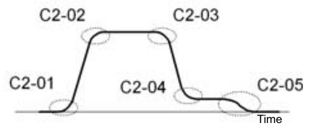
◆ Tuning Parameters: C

■Acceleration/Deceleration: C1

Param-eter Num-ber	Name Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods V/f	 Open Loop Vector	 Closed Loop Vector	 Closed Loop Vector (PM)	MEMO-BUS Register	Page
C1-01	Acceleration time 1 Accel Time 1	Sets the acceleration time to accelerate from 0 Hz to the maximum output frequency.			Yes	Q	Q	Q	Q	200H	6-21
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	Q	201H	6-21
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	A	202H	6-21
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	A	203H	6-21
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.	0.00 to 600.00 *1	1.50 s	Yes	A	A	A	A	204H	6-21
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	A	205H	6-21
C1-07	Acceleration time 4 Accel Time 4	Sets the acceleration time when the frequency reference is below the value set in C1-11.			No	A	A	A	A	206H	6-21
C1-08	Deceleration time 4 Decel Time 4	Sets the deceleration time when the frequency reference is below the value set in C1-11.			No	A	A	A	A	207H	6-21
C1-09	Emergency stop time Fast Stop Time	Sets the deceleration time when the frequency reference is below the value set in C1-11.			No	A	A	A	A	208H	6-10
C1-10	Accel/decel time setting unit Acc/Dec Units	Sets the number of decimals for the acceleration / deceleration time parameters. 0:0.01-second units 1:0.1-second units	0 or 1	0	No	A	A	A	A	209H	-
C1-11	Decel time switch-ing 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.	0.0 to 120.0	0.0 Hz	No	A	A	A	-	20AH	6-21 6-22
			0.0 to 100.0	0.0 %	No	-	-	-	A		

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

■S-Curve Acceleration/Deceleration: C2

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	Closed Loop Vector (PM)		
C2-01	S-curve characteristic time at acceleration start S-Crv Acc @ Start	Set the S-curve times at speed changes to reduce the jerk. The S-curves can be set separately for every kind of speed change.  $T_{accel} = \frac{C2\text{-}01}{2} + C1\text{-}01 + \frac{C2\text{-}02}{2}$ $T_{decel} = \frac{C2\text{-}03}{2} + C1\text{-}02 + \frac{C2\text{-}04}{2}$ When the S-curve characteristic time is set, the accel/decel times will increase by only half of the S-curve characteristic times at start and end.	0.00 to 2.50	0.50 s	No	Q	Q	Q	Q	20BH	6-23
C2-02	S-curve characteristic time at acceleration end S-Crv Acc @ End		0.00 to 2.50	0.50 s	No	Q	Q	Q	Q	20CH	6-23
C2-03	S-curve characteristic time at deceleration start S-Crv Dec @ Start		0.00 to 2.50	0.50 s	No	Q	Q	Q	Q	20DH	6-23
C2-04	S-curve characteristic time at deceleration end S-Crv Dec @ End		0.00 to 2.50	0.50 s	No	Q	Q	Q	Q	20EH	6-23
C2-05	S-curve Characteristic time below leveling speed Scurve @ leveling		0.00 to 2.50	0.50 s	No	Q	Q	Q	Q	232H	6-23

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■Motor Slip Compensation: C3

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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS 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. In Closed Loop Vector control this value is the gain for compensating the slip caused by temperature variation.	0.0 to 2.5	1.0	Yes	-	A	A	-	20FH	*6-30*
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	-	-	210H	*6-30*
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	-	-	211H	*6-30*
C3-04	Slip compensation selection during regeneration Slip Comp Regen	0: Disable 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	-	-	212H	*6-30*
C3-05	Output voltage limit operation selection Output V limit Sel	0: Disabled 1: Enabled. (The motor flux will be lowered automatically when the output voltage become saturated.)	0 or 1	1	No	-	A	A	-	213H	*6-30*

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■Torque Compensation: C4

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	Control Methods: Closed Loop Vector (PM)	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 change the torque compensation gain from its default (1.00) when using Open Loop Vector control.	0.00 to 2.50	1.00	Yes	A	A	-	-	215H	6-31
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	→	No	200 ms	50 ms	-	-	216H	6-31
C4-03	Starting torque compensation (FWD) FTorqCmp @ Start	Sets the torque compensation value at start in FWD direction	0.0 to 200.0%	0.0%	No	-	A	-	-	217H	6-31
C4-04	Starting torque compensation (REV) RTorqCmp @ Start	Sets the torque compensation value at start in REV direction	-200.0% to 0.0	0.0%	No	-	A	-	-	218H	6-31
C4-05	Starting torque compensation time constant TorqCmpDelayT	Sets starting torque start-up time. When 0 ~ 4 ms is set, it is operated without filter.	0 to 200	10 ms	No	-	A	-	-	219H	6-31

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■Speed Control (ASR): C5

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
C5-01	ASR proportional (P) gain 1	Set the proportional gain 1 and the integral time 1 of the speed control loop (ASR) for the maximum frequency.	0.00 to 300.00	→	Yes	-	-	Q 40.00	-	21BH	6-33
	ASR P Gain 1							-	Q 3.00		
C5-02	ASR integral (I) time 1		0.000 to 10.000 sec	→	Yes	-	-	Q 0.500	-	21CH	6-33
	ASR I Time 1							-	Q 0.300		
C5-03	ASR proportional (P) gain 2	Set the proportional gain 2 and the integral time 2 of the speed control loop (ASR) for the minimum frequency. The setting is active only for acceleration.	0.00 to 300.00	→	Yes	-	-	Q 20.00	-	21DH	6-33
	ASR P Gain 2							-	Q 3.00		
C5-04	ASR integral (I) time 2		0.000 to 10.000 sec	0.500 s	Yes	-	-	Q	Q	21EH	6-33
	ASR I Time 2										
C5-06	ASR delay time	Sets the ASR output delay time.	0.000 to 0.500	0.020 s	No	-	-	-	A	220H	6-33
	ASR Gain SW Freq										
C5-07	ASR switching frequency	Sets the frequency for switching between Proportion Gain 1, 2,3 and Integral Time 1, 2, 3.	0.0 to 120.0	→	No	-	-	Q 0.0 Hz	-	221H	6-33
	ASR Gain SW Freq		0.0 to 100.0					-	Q 2.0 %		
C5-08	ASR integral (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	-	-	A	A	222H	6-33
	ASR I Limit										
C5-09	ASR proportional (P) gain 3	Set the proportional gain 3 and the integral time 3 of the speed control loop (ASR) for the minimum frequency. The settings is active for deceleration only.	0.00 to 300.00	→	Yes	-	-	Q 40.00	-	22EH	6-33
	ASR P Gain 3							-	Q 3.00		
C5-10	ASR integral (I) time 3		0.000 to 10.000 sec	→	Yes	-	-	Q 0.500	-	231H	6-33
	ASR I Time 3							-	Q 0.300		
C5-15	ASR P gain for Auto-tuning	Sets the ASR P gain which is used for the encoder offset tuning if Hiperface or EnDat encoders are used.	0.00 to 300.00	5.00	No	-	-	-	A	238H	6-33
	Tune ASR P gain										
C5-16	ASR I time for Auto-tuning	Set the ASR Integral time which is used for the auto-tuning when PM Closed Loop Vector control is selected	0.00 to 100.00	0.20 sec	No	-	-	-	A	23BH	6-33
	Tune ASR I Time										

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■Carrier Frequency: C6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
C6-02	Carrier frequency selection 1 CarrierFreq Sel	Selects the carrier frequency for Induction motor control modes. 1:2 kHz 2:5 kHz 3:8 kHz 4:10 kHz 5:12.5 kHz 6:15 kHz	1 to 6	3	No	A	A	A	-	224H	6-2
C6-11	Carrier frequency selection 2 CarrierFreq Sel	Selects the carrier frequency for PM motor control modes 1:2 kHz 2:4 kHz 3:6 kHz 4:8 kHz 5:12 kHz 6:15 kHz	1 to 6	4	No	-	-	-	A	22DH	6-2
C6-12	Carrier frequency selection @Inspection Run LowCarr @ Inspect	0: Same carrier frequency setting as in normal operation (IM : C6-02, PM : C6-11) 1: 2 kHz fix	0, 1	1	No	A	A	A	A	22FH	6-2

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◆ Reference Parameters: d

■Preset Reference: d1

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
d1-01	Frequency reference 1	Sets the frequency reference.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	280H	6-5
	Reference 1		0 to 100.00 %			-	-	-	A 0.00 %		
d1-02	Frequency reference 2	Sets the frequency reference when multi-step speed command 1 is ON for a multi-function input.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	281H	6-5
	Reference 2		0 to 100.00 %			-	-	-	A 0.00 %		
d1-03	Frequency reference 3	Sets the frequency reference when multi-step speed command 2 is ON for a multi-function input.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	282H	6-5
	Reference 3		0 to 100.00 %			-	-	-	A 0.00 %		
d1-04	Frequency reference 4	Sets the frequency reference when multi-step speed commands 1 and 2 are ON for multi-function inputs.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	283H	6-5
	Reference 4		0 to 100.00 %			-	-	-	A 0.00 %		
d1-05	Frequency reference 5	Sets the frequency when multi-step speed command 3 is ON for a multi-function input.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	284H	6-5
	Reference 5		0 to 100.00 %			-	-	-	A 0.00 %		
d1-06	Frequency reference 6	Sets the frequency reference when multi-step speed commands 1 and 3 are ON for multi-function inputs.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	285H	6-5
	Reference 6		0 to 100.00 %			-	-	-	A 0.00 %		
d1-07	Frequency reference 7	Sets the frequency reference when multi-step speed commands 2 and 3 are ON for multi-function inputs.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	286H	6-5
	Reference 7		0 to 100.00 %			-	-	-	A 0.00 %		
d1-08	Frequency reference 8	Sets the frequency reference when multi-step speed commands 1, 2, and 3 are ON for multi-function inputs.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	287H	6-5
	Reference 8		0 to 100.00 %			-	-	-	A 0.00 %		
d1-09	Nominal speed	Sets the frequency reference when the nominal speed is selected by a digital input.	0 to 120.00 *1,*2	→	Yes	Q 50.00 Hz	Q 50.00 Hz	Q 50.00 Hz	-	288H	6-7 6-8
	Nomin Speed vn		0 to 100.00 %			-	-	-	Q 100.00 %		

5

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
d1-10	Intermediate speed 1	Sets the frequency reference when the intermediate speed 1 is selected by a digital input.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	28BH	6-7 6-8
	Interm Speed v1		0 to 100.00 %			-	-	-	A 0.00 %		
d1-11	Intermediate speed 2	Sets the frequency reference when the intermediate speed 2 is selected by a digital input.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	28CH	6-7 6-8
	Interm Speed v2		0 to 100.00 %			-	-	-	A 0.00 %		
d1-12	Intermediate speed 3	Sets the frequency reference when the intermediate speed 3 is selected by a digital input.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	28DH	6-7 6-8
	Interm Speed v3		0 to 100.00 %			-	-	-	A 0.00 %		
d1-13	Releveling speed	Sets the frequency reference when the releveling speed is selected by a digital input.	0 to 120.00 *1,*2	→	Yes	A 0.00 Hz	A 0.00 Hz	A 0.00 Hz	-	28EH	6-7 6-8
	Relevel Speed vr		0 to 100.00 %			-	-	-	A 0.00 %		
d1-14	Inspection speed	Sets the frequency reference when the inspection speed is selected by a digital input.	0 to 120.00 *1,*2	→	Yes	Q 25.00 Hz	Q 25.00 Hz	Q 25.00 Hz	-	28FH	6-7 6-11
	Inspect Speed vi		0 to 100.00 %			-	-	-	Q 50.00 %		
d1-15	Rescue Operation Speed	Sets the frequency reference when rescue operation is enabled by a digital input.	0 to 120.00 *1,*2	→	Yes	A 5.00 Hz	A 5.00 Hz	A 5.00 Hz	-	290H	6-80
	Rescue OP Spd		0 to 100.00 %			-	-	-	A 10.00 %		
d1-17	Leveling Speed	Sets the frequency reference when the leveling speed is selected by a digital input.	0 to 120.00 *1,*2	→	Yes	Q 4.00 Hz	Q 4.00 Hz	Q 4.00 Hz	-	292H	6-7 6-8
	Level Speed vl		0 to 100.00 %			-	-	-	Q 8.00 %		
d1-18	Speed priority selection / SpeedPriority-Sel	Speed reference priority selection 0: Use Multi-Speed reference (d1-01 to d1-08) 1: High Speed reference has priority. 2: Leveling speed reference has priority. 3: Use multi-speed reference With no speed selected, the up/down signal is switched off	0 to 3	1	Yes	A	A	A	A	2A7H	6-5 6-7 6-8
d1-19	Second motor speed / Spd@Door Motor	Sets the speed reference if motor 2 is selected.	0.00 to 120.00	0.00 Hz	No	A	A	A	-	2A8H	6-57

*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).

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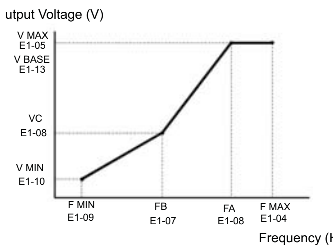
■Field Forcing: d6

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	Control Methods: Closed Loop Vector (PM)	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	-	A	A	-	2A2H	6-39
d6-06	Field forcing function Limit FieldForce 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	-	A	A	-	2A5H	6-39

◆ Motor Parameters: E

■V/f Pattern 1: E1

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	Control Methods: Closed Loop Vector (PM)	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.	310 to 510 *1	400 V *1	No	Q	Q	Q	Q	300H	6-62 6-65
E1-04	Max. output frequency (FMAX) Max Frequency		40.0 to 120.0 (PG-F2) 0 to 1200 (PG-X2) 0 to 3600	→	No	Q 50.00 Hz -	Q 50.00 Hz -	Q 50.00 Hz -	- Q 150 rpm	303H	6-62 6-65
E1-05	Max. output voltage (VMAX) Max Voltage		0.0 to 510.0 *1	380.0 V *1	No	Q	Q	Q	-	304H	6-62
E1-06	Base frequency (FA) Base Frequency		0.0 to 120.0 20 to 7200 rpm	→	No	Q 50.00 Hz -	Q 50.00 Hz -	Q 50.00 Hz -	- Q 150 rpm	305H	6-62 6-65
E1-07	Mid. output frequency (FB) Mid Frequency A	To set V/f characteristics in a straight line, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Always ensure that the four frequencies are set in the following manner: E1-04 (FMAX) ≥ E1-06 (FA) > E1-07 (FB) ≥ E1-09 (FMIN)	0.0 to 120.0	3.0 Hz	No	A	A	-	-	306H	6-62
E1-08	Mid. output frequency voltage (VB) Mid Voltage A		0.0 to 510 *1	→	No	Q 37.3 V *1	Q 25.0 V *1	-	-	307H	6-62
E1-09	Min. output frequency (FMIN) Min Frequency		0.0 to 120.0 0 to 7200	→	No No	Q 0.5 Hz -	Q 0.3 Hz -	A 0.0 Hz -	- A 0 rpm	308H	6-62 6-65
E1-10	Min. output frequency voltage (VMIN) Min Voltage		0.0 to 510.0 *1	→	No	Q 19.4 V *1	Q 5.0 V *1	-	-	309H	6-62
E1-13	Base voltage (VBASE) Base Voltage	Sets the output voltage of the base frequency (E1-06).	0.0 to 510.0 *1	→ *2	No	A 0.0 V	A 0.0V	-	Q 200 V	30CH	6-62



*1. The given values are for a 400 V Class Inverter.
*2. E1-13 is set to the same value as E1-05 by autotuning.

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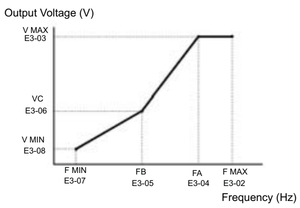
■Motor 1 Setup: E2

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	Control Methods: Closed Loop Vector (PM)	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 an input data for autotuning.	0.85 to 17.00 *1	7.00 A *2	No	Q	Q	Q	-	30EH	6-62
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	2.70 Hz *2	No	Q	Q	Q	-	30FH	6-62
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 6.99 *3	2.30 A *2	No	Q	Q	Q	-	310H	6-62
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	-	-	Q	-	311H	6-62
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	3.333 Ω *2	No	Q	Q	Q	-	312H	6-62
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	19.3% *2	No	-	A	A	-	313H	6-62
E2-07	Motor iron saturation coefficient 1 Saturation Comp1	Sets the motor iron saturation coefficient at 50% of magnetic flux. This parameter is automatically set during rotating autotuning.	0.00 to 0.50	0.50	No	-	A	A	-	314H	6-62
E2-08	Motor iron saturation coefficient 2 Saturation Comp2	Sets the motor iron saturation coefficient at 75% of magnetic flux. This parameter is automatically set during rotating autotuning.	0.50 to 0.75	0.75	No	-	A	A	-	315H	6-62
E2-09	Motor mechanical losses Mechanical loss	Sets the motor mechanical losses as a percentage of motor rated power. Usually changing this setting is not necessary. The value can be adjusted if there is e.g. a great torque loss due to heavy friction in the machine. The output torque will be compensated for the set mechanical loss.	0.0 to 10.0	0.0%	No	-	-	A	-	316H	6-62
E2-10	Motor iron loss for torque compensation Tcomp Iron Loss	Sets motor iron losses.	0 to 65535	130 W *2	No	A	-	-	-	317H	6-62

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	Closed Loop Vector (PM)		
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	6-62
E2-12	Motor iron saturation coefficient 3 Saturation Comp3	This parameter is automatically set during rotating autotuning.	1.30 to 1.60	1.30	No	-	A	A	-	328H	6-62

*1. The setting range is 10% to 200% of the Inverter's rated output current. The given value is for a 400 V inverter with 3.7 kW.
*2. The factory setting depends upon the Inverter capacity. The given value is for a 400 V inverter with 3.7 kW.
*3. The setting range depends on the inverter capacity and on the setting of E2-01. The maximum value is E2-01 minus 0.01A. The given setting range is for a 400 V inverter with 3.7 kW.

■V/f Pattern 2: E3

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	Closed Loop Vector (PM)		
E3-01	Control mode selection Control Method	Sets the contol mode for motor 2. 0: V/f control 2: Open Loop Vector control 3: Closed Loop Vector control for induction motors	0 to 3	0	No	A	A	A	-	319H	6-62
E3-02	Max. output frequency (FMAX) Max Frequency	 To set V/f characteristics in a straight line, set the same values for E3-05 and E3-07. In this case, the setting for E3-06 will be disregarded. Always ensure that the four frequencies are set in the following manner: E3-02 (FMAX) ≥ E3-04 (FA) > E3-05 (FB) ≥ E3-07 (FMIN)	40.0 to 120.0	50.00 Hz	No	A	A	A	-	31AH	6-62
E3-03	Max. output voltage (VMAX) Max Voltage		0.0 to 510.0 *1	400.0 V *1	No	A	A	A	-	31BH	6-62
E3-04	Base frequency (FA) Base Frequency		0.0 to 120.00	50.00 Hz	No	A	A	A	-	31CH	6-62
E3-05	Mid. output frequency (FB) Mid Frequency		0.0 to 120.0	→	No	A (2.5)	A (3.0)	-	-	31DH	6-62
E3-06	Mid. output frequency voltage (VB) Mid Voltage		0.0 to 510 *1	→	No	A 30.0 V *1	A 26.4 V *1	-	-	31EH	6-62
E3-07	Min. output frequency (FMIN) Min Frequency		0.0 to 120.0	→	No	A 1.2 Hz	A 0.5 Hz	A 0.0 Hz	-	31FH	6-62
E3-08	Min. output frequency voltage (VMIN) Min Voltage		0.0 to 510.0 *1	→	No	A 18.0 V *1	A 4.8 V *1	-	-	320H	6-62

*1. These are values for a 400 V Class Inverter.

■Motor 2 Setup: E4

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
E4-01	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.	0.85 to 17.00 *1	7.00 A *2	No	A	A	A	-	321H	6-62
E4-02	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	2.70 Hz *2	No	A	A	A	-	322H	6-62
E4-03	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	2.30 A *2	No	A	A	A	-	323H	6-62
E4-04	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	-	-	A	-	324H	6-62
E4-05	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	3.333 Ω *2	No	A	A	A	-	325H	6-62
E4-06	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	19.3% *2	No	-	A	A	-	326H	6-62
E4-07	Motor rated power Mtr Rated Power	Sets the motor rated power.	0.00 to 650.00	3.70 kW	No	A	A	A	-	327H	6-62

*1. The setting range is 10% to 200% of the Inverter's rated output current. The given value is for a 400 V inverter with 3.7 kW.
*2. The factory setting depends upon the Inverter capacity. The given value is for a 400 V inverter with 3.7 kW.
*3. The setting range depends on the inverter capacity and on the setting of E2-01. The maximum value is E2-01 minus 0.01A. The given setting range is for a 400 V inverter with 3.7 kW.

■PM Motor Setup: E5

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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register	Page
E5-02	Motor rated power Rated power	Sets the motor rated power.	0.00 to 300.00	3.7kW *1	No	-	-	-	Q	32AH	6-65
E5-03	Motor rated current Rated current	Sets the motor rated current. This set value will become the reference value for motor protection and torque limits.	0.00 to 200.00 *2	7.31A *1	No	-	-	-	Q	32BH	6-65
E5-04	Number of motor poles Number of Poles	Sets the number of motor poles.	2 to 48	4 poles	No	-	-	-	Q	32CH	6-65
E5-05	Motor line-to-line resistance Term Resistance	Sets the motor phase-to-phase resistance.	0.000 to 65.000	1.326 Ω *1	No	-	-	-	Q	32DH	6-65
E5-06	D-Axis Inductance Leak Inductance	Sets the motors d-axis inductance	0.00 to 600.00	19.11 mH *1	No	-	-	-	Q	32EH	6-65
E5-07	Q-Axis Inductance Leak Inductance	Sets the motors q-axis inductance	0.00 to 600.00	26.08 mH *1	No	-	-	-	Q	32FH	6-65
E5-09	Motor voltage constant Voltage constant	Sets the motor voltage constant.	50.0 to 4000.0	478.6 mV *1	No	-	-	-	Q	330H	6-65

*1. The factory setting depends upon the Inverter capacity. The given value is for a 400V class inverter with 3.7 kW.
*2. The setting range is 10% to 200% of the Inverter's rated output current. The given value is for a 400 V class inverter of 3.7 kW is given.

◆ Option Parameters: F

■PG Option Setup: F1

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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS Register	Page
F1-01	PG constant PG Pulses/Rev	Sets the number of PG pulses per revolution	0 to 60000 512, 1024*1, 2048	→	No	-	-	Q 1024 -	- Q 2048	380H	6-75
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	-	-	A	A	381H	6-77
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	-	-	A	A	382H	6-77
F1-04	Operation selection at speed deviation PG Deviation Sel	Sets the stopping method when a speed deviation (DEV) fault occurs. 0: Ramp to stop (Deceleration to stop using the deceleration time 1, C1-02.) 1: Coast to stop 2: Fast stop (Emergency stop using the deceleration time in C1-09.) 3: Continue operation (DEV is displayed and operation continued.)	0 to 3	3	No	-	-	A	A	383H	6-77
F1-05	PG rotation direction PG Rotation Sel	0: Phase A leads with forward run command. (Phase B leads with reverse run command; Counter Clockwise rotation) 1: Phase B leads with forward run command. (Phase A leads with reverse run command; Clockwise rotation)	0 or 1	0	No	-	-	Q	Q	384H	6-66 6-76
F1-06	PG division rate (PG pulse monitor) PG Output Ratio	Sets the division ratio for the PG speed control card pulse output. Division ratio = (1+ n) /m (n=0 or 1 m=1 to 32) The first digit of the value of F1-06 stands for n, the second and the third stands for m. This parameter is effective only when a PG-B2 is used. The possible division ratio settings are: 1/32 ≤ F1-06 ≤ 1.	1 to 132	1	No	-	-	A	A	385H	6-76

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Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	 Open Loop Vector	 Closed Loop Vector	 Closed Loop Vector (PM)	MEMOBUS Register	Page
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	-	-	A	A	387H	6-77
F1-09	Overspeed detection delay time PG Overspd Time		0.0 to 2.0	0.0 s	No	-	-	A	A	388H	6-77
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	-	-	A	A	389H	6-77
F1-11	Excessive speed deviation detection delay time PG Deviate Time		0.0 to 10.0	0.5 s	No	-	-	A	A	38AH	6-77
F1-12	Number of PG gear teeth 1 PG#Gear Teeth1	Sets the number of teeth on the gears if there are gears between the PG and the motor. $\frac{\text{PG Input Pulses x 60}}{\text{F1-01}} \times \frac{\text{F1-13}}{\text{F1-12}}$ A gear ratio of 1 will be used if one of these parameters is set to 0.	0 to 1000	0	No	-	-	A	No	38BH	6-76
F1-13	Number of PG gear teeth 2 PG#Gear Teeth2			0	No	-	-	A	No	38CH	6-76
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	2.0 s	No	-	-	A	A	38DH	6-76
F1-18	DV3 fault detection selection DV3 detect sel	Sets the number of scans (5ms) until a DV3 fault (wrong direction) is detected. 0: No DV3 detection n: A DV3 fault is detected after n x 5msec.	0 to 5	1	No	-	-	No	A	3ADH	6-77
F1-19	DV4 fault detection selection DV4 detect sel	Sets the number of pulses until a DV4 fault (wrong direction) is detected. 0: No DV4 detection n: A DV3 fault is detected after n pulses.	0 to 5000	1024	No	-	-	No	A	3AEH	6-77
F1-21	Absolute encoder resolution PG-F2 Resolution	Sets the serial line resolution for absolute encoders (Hiperface or EnDat). 0: 16384 1: 32768 2: 8192 (if EnDat is selected (n8-35=5), F1-21 is fixed to 2)	0 to 2	2	No	-	-	-	A	3B0H	6-76

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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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS Register	Page
F1-22	Magnet position offset Mag Theta Comp	Sets the Offset between the rotor magnet and encoder zero position.	0 to 360	60 °	No	-	-	-	A	3B1H	6-76
F1-25	Encoder copy selection Enc Copy Sel	Used to memorize encoder and motor data in the encoder memory (for Hiperface and EnDat encoders) 0: Normal operation 1: WRITE (Inverter to encoder) 2: COPY (Encoder to inverter) 3: VERIFY	0 to 3	0	No	-	-	-	A	3B4H	6-78
F1-26	Encoder copy write permission selection Write Allowable	Sets wether saving parameters in the encoder is permitted or not. 0: Write prohibited 1: Write permitted	0 or 1	0	No	-	-	-	A	3B5H	6-78

*1. Can be set only if HIPEFACE® is selected as encoder type.

■Analog Monitor Cards: F4

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open Loop Vector	Control Methods: Closed Loop Vector	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register	Page
F4-01	Channel 1 monitor selection	Using an AO-08 option card the possible outputs signal is 0 to +10V only. The setting of F4-07 and F4-08 has no effect. Sets the channel 1 item bias to 100%/10 V when the analog monitor card is used. This function is enabled when the analog monitor card is used. Monitor selection: Sets the number of the monitor item to be output. (Numerical portion □□ of U1-□□) 4, 10, 11, 12, 13, 14, 25, 28, 34, 35, 39 and 40 cannot be set. Gain: Sets the percentage of the monitor item, which is equal to 10V output. Bias: Sets the percentage of the monitor item, which is equal to 0V output.	1 to 56	→	No	A 2	A 2	A 2	-	391H	6-26
	AO Ch1 Select		1 to 75			-		-	A 5		
F4-02	Channel 1 gain AO Ch1 Gain		0.0 to 1000.0	100.0%	Yes	A	A	A	A	392H	6-26
F4-03	Channel 2 monitor selection		1 to 56	3	No	A	A	A	-	393H	6-26
	AO Ch2 Select		1 to 75			-	-	-	A		
F4-04	Channel 2 gain AO Ch2 Gain		0.0 to 1000.0	50.0%	Yes	A	A	A	A	394H	6-26
F4-05	Channel 1 output monitor bias AO Ch1 Bias		-110.0 to 110.0	0.0%	Yes	A	A	A	A	395H	6-26
F4-06	Channel 2 output monitor bias AO Ch2 Bias		-110.0 to 110.0	0.0%	Yes	A	A	A	A	396H	6-26
F4-07	Analog output signal level for channel 1 AO Opt Level Sel	Selects the analog output signal level for channel 1 (effective for the AO-12 option card only). 0: 0 to 10V 1: -10 to +10 Using an AO-08 option card the possible outputs signal is 0 to +10V only. The setting of F4-07 and F4-08 has no effect.	0 or 1	0	No	A	A	A	A	397H	6-26
F4-08	Analog output signal level for channel 2 AO Opt Level Sel		0 or 1	0	No	A	A	A	A	398H	6-26

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

Con-stant Number	Name		Description	Setting Range	Fac-tory Setting	Change during Opera-tion	Control Methods				MEMO BUS Regis-ter	Page
	Display						V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)		
F5-01	Channel 1 output selection	DO Ch1 Select	Effective when a Digital Output Card (DO-02 or DO-08) is used. Set the number of the multi-function output to be output.	0 to 47	0	No	A	A	A	A	399H	-
F5-02	Channel 2 output selection	DO Ch2 Select	Effective when a Digital Output Card (DO-02 or DO-08) is used. Set the number of the multi-function output to be output.	0 to 47	1	No	A	A	A	A	39AH	-
F5-03	Channel 3 output selection	DO Ch3 Select	Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 47	2	No	A	A	A	A	39BH	-
F5-04	Channel 4 output selection	DO Ch4 Select	Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 47	4	No	A	A	A	A	39CH	-
F5-05	Channel 5 output selection	DO Ch5 Select	Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 47	6	No	A	A	A	A	39DH	-
F5-06	Channel 6 output selection	DO Ch6 Select	Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 47	37	No	A	A	A	A	39EH	-
F5-07	Channel 7 output selection	DO Ch7 Select	Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 47	0F	No	A	A	A	A	39FH	-
F5-08	Channel 8 output selection	DO Ch8 Select	Effective when a DO-08 Digital Output Card is used. Set the number of the multi-function output to be output.	0 to 47	0F	No	A	A	A	A	3A0H	-
F5-09	DO-08 output mode selection	DO-08 Selection	Effective when a DO-08 Digital Output Card is used. Set the output mode. 0: 8-channel individual outputs 1: Binary code output 2: Output according to F5-01 to F5-08 settings.	0 to 2	0	No	A	A	A	A	3A1H	-

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■Serial Communications Settings: F6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
F6-01	Operation selection after communications error Comm Bus Fault Sel	Sets the stopping method for communications errors. 0: Deceleration to stop using the deceleration time in C1-02 1: Coast to stop 2: Emergency stop using the deceleration time in C1-09 3: Continue operation	0 to 3	1	No	A	A	A	A	3A2H	-
F6-02	Input level of external error from Communications Option Card EF0 Detection	0: Always detect 1: Detect during operation	0 or 1	0	No	A	A	A	A	3A3H	-
F6-03	Stopping method for external error from Communications Option Card EF0 Fault Action	0: Deceleration to stop using the deceleration time in C1-02 1: Coast to stop 2: Emergency stop using the deceleration time in C1-09 3: Continue operation	0 to 3	1	No	A	A	A	A	3A4H	-
F6-04	Trace Sampling Time Trace Sample Tim	-	0 to 60000	0	No	A	A	A	A	3A5H	-
F6-05	Current monitor unit selection Current Unit Sel	Sets the unit of current monitor 0: Ampere 1: 100%/8192	0 or 1	0	No	A	A	A	A	3A6H	-
F6-06	Torque reference/torque limit selection from communications option card Torque Ref/Lmt Sel	0: Torque reference/torque limit by communications option disabled. 1: Torque reference/torque limit by communications option enabled.	0 or 1	0	No	-	-	A	A	3A7H	-

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◆ Terminal Function Parameters: H

■Multi-function Digital Inputs: H1

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
H1-01	Terminal S3 function selection	Terminal S3 Sel	Multi-function input 1	0 to 89	80	No	A	A	A	A	400H	6-52
H1-02	Terminal S4 function selection	Terminal S3 Sel	Multi-function input 2	0 to 89	84	No	A	A	A	A	401H	6-52
H1-03	Terminal S5 function selection	Terminal S3 Sel	Multi-function input 3	0 to 89	81	No	A	A	A	A	402H	6-52
H1-04	Terminal S6 function selection	Terminal S3 Sel	Multi-function input 4	0 to 89	83	No	A	A	A	A	403H	6-52
H1-05	Terminal S7 function selection	Terminal S3 Sel	Multi-function input 5	0 to 89	F	No	A	A	A	A	404H	6-52

5

Multi-function Digital Input Functions

Setting Value	Function	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	Page
3	Multi-step speed reference 1	Yes	Yes	Yes	Yes	6-5
4	Multi-step speed reference 2	Yes	Yes	Yes	Yes	6-5
5	Multi-step speed reference 3	Yes	Yes	Yes	Yes	6-5
6	Jog frequency command (higher priority than multi-step speed reference)	Yes	Yes	Yes	Yes	-
7	Accel/decel time 1 switch over	Yes	Yes	Yes	Yes	6-22
8	External baseblock NO (NO contact: Baseblock at ON)	Yes	Yes	Yes	Yes	6-52
9	External baseblock NC (NC contact: Baseblock at OFF)	Yes	Yes	Yes	Yes	6-52
F	Not used (Set when a terminal is not used)	-	-			-
14	Fault reset (Reset when turned ON)	Yes	Yes	Yes	Yes	-
15	Emergency stop. (NO: Deceleration to stop in deceleration time set in C1-09 when ON.)	Yes	Yes	Yes	Yes	6-10
16	Motor 2 selection (NO: Motor 2 (E3-☐☐ and E4-☐☐) is selected when ON.)	Yes	Yes	Yes	No	6-65
17	Emergency stop (NC: Deceleration to stop in deceleration time set in C1-09 when OFF)	Yes	Yes	Yes	Yes	6-10
18	Timer function input (the times are set in b4-01 and b4-02 and the timer function output is set in H2-☐☐.)	Yes	Yes	Yes	Yes	6-54
1A	Accel/decel time switch over 2	Yes	Yes	Yes	Yes	6-22
20 to 2F	External fault; Input mode: NO contact/NC contact, Detection mode: Normal/during operation	Yes	Yes	Yes	Yes	6-53
79	Brake Release Check	Yes	Yes	Yes	Yes	6-13
80	Nominal Speed Selection (d1-09)	Yes	Yes	Yes	Yes	6-7
81	Intermediate Speed Selection (d1-10)	Yes	No	No	No	6-7
82	Releveling Speed Selection (d1-13)	Yes	Yes	Yes	Yes	6-7
83	Leveling Speed Selection (d1-17)	Yes	Yes	Yes	Yes	6-7
84	Inspection Run Selection (d1-14)	Yes	Yes	Yes	Yes	6-11
85	Rescue Operation Selection	Yes	Yes	Yes	Yes	6-5
86	Motor Contactor Answer Back Signal	Yes	Yes	Yes	Yes	6-55

Setting Value	Function	Control Methods				Page
		V/f	Open Loop Vec-tor	Closed Loop Vector	Closed Loop Vector (PM)	
87	High Speed Limit Switch (UP)	Yes	Yes	Yes	Yes	6-29
88	High Speed Limit Switch (Down)	Yes	Yes	Yes	Yes	6-29
89	PG direction change over (0: Clockwise, 1: Counterclockwise)	No	No	Yes	No	6-56

■ Multi-function Contact Outputs: H2

Param-eter Num-ber	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods					MEMO-BUS Register	Page
						V/f	V/f with PG	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)		
H2-01	Terminal M1-M2 function selection Term M1-M2 Sel	Multi-function contact output 1	0 to 47	40	No	A	A	A	A	A	40BH	6-58
H2-02	Terminal M3-M4 function selection Term M3-M4 Sel	Multi-function contact output 2	0 to 47	41	No	A	A	A	A	A	40CH	6-58
H2-03	Terminal M5-M6 function selection Term M5-M6 Sel	Multi-function contact output 3	0 to 47	6	No	A	A	A	A	A	40DH	6-58

Multi-function Contact Output Functions

Setting Value	Function	Control Methods				Page
		V/f	Open loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	
0	During run 1 (ON: run command is ON or voltage is being output)	Yes	Yes	Yes	Yes	6-58
1	Zero-speed	Yes	Yes	Yes	Yes	6-58
2	f_{ref}/f_{out} agree 1 (detection width L4-02 is used.)	Yes	Yes	Yes	Yes	6-27
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	Yes	6-27
4	Frequency detection 1 (ON: +L4-01 ≥ output frequency ≥ -L4-01, with detection width L4-02 used)	Yes	Yes	Yes	Yes	6-27
5	Frequency detection 2 (ON: Output frequency ≥ +L4-01 or output frequency ≤ -L4-01, with detection width L4-02 used)	Yes	Yes	Yes	Yes	6-27
6	Inverter operation ready; READY: After initialization or no faults	Yes	Yes	Yes	Yes	6-59
7	During DC bus undervoltage (UV) detection	Yes	Yes	Yes	Yes	6-59
8	During baseblock (ON: during baseblock)	Yes	Yes	Yes	Yes	6-59
9	Frequency reference source selection (ON: Frequency reference from Operator)	Yes	Yes	Yes	Yes	6-59
A	Run command source selection status (ON: Run command from Operator)	Yes	Yes	Yes	Yes	6-59
B	Car stuck/undertorque detection 1 NO (NO contact, ON: Overtorque/undertorque detection)	Yes	Yes	Yes	Yes	6-41
E	Fault (ON: Digital Operator/Monitor communications error or fault other than CPF00 and CPF01 has occurred.)	Yes	Yes	Yes	Yes	6-59
F	Not used. (Set when the terminal is not used.)	Yes	Yes	Yes	Yes	-
10	Minor fault (ON: Alarm displayed)	Yes	Yes	Yes	Yes	6-59

5

Setting Value	Function	Control Methods				Page
		V/f	Open loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	
11	Fault reset command active	Yes	Yes	Yes	Yes	6-59
12	Timer function output	Yes	Yes	Yes	Yes	6-54
13	f_{ref}/f_{set} agree 2 (detection width L4-04 is used)	Yes	Yes	Yes	Yes	6-27
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	Yes	6-27
15	Frequency detection 3 (ON: Output frequency ≤ -L4-03, detection width L4-04 is used)	Yes	Yes	Yes	Yes	6-27
16	Frequency detection 4 (ON: Output frequency ≥ -L4-03, detection width L4-04 is used)	Yes	Yes	Yes	Yes	6-27
17	Car stuck/undertorque detection 1 NC (NC Contact, OFF: Torque detection)	Yes	Yes	Yes	Yes	6-41
18	Car stuck/undertorque detection 2 NO (NO Contact, ON: Torque detection)	Yes	Yes	Yes	Yes	6-41
19	Car stuck/undertorque detection 2 NC (NC Contact, OFF: Torque detection)	Yes	Yes	Yes	Yes	6-41
1A	During reverse run (ON: During reverse run)	Yes	Yes	Yes	Yes	6-59
1B	During baseblock 2 (OFF: During baseblock)	Yes	Yes	Yes	Yes	6-60
1C	Motor 2 selected (ON: Motor 2 (E3-□□ and E4-□□) is selected)	Yes	Yes	Yes	No	6-65
1D	During regenerative operation	No	No	Yes	Yes	6-60
1E	Restart enabled (ON: Automatic fault restart enabled)	Yes	Yes	Yes	Yes	6-84
1F	Motor overload (OL1, including OH3) pre-alarm (ON: 90% or more of the detection level)	Yes	Yes	Yes	Yes	6-45
20	Inverter overheat (OH) pre-alarm (ON: Temperature exceeds L8-02 setting)	Yes	Yes	Yes	Yes	6-48
30	During torque limit (current limit) (ON: During torque limit)	No	Yes	Yes	Yes	6-44
33	Zero-servo end (ON: Zero-Servo completed)	No	No	Yes	Yes	6-16
37	During run 2 (ON: Frequency output, OFF: Base block, DC injection braking, initial excitation, operation stop)	Yes	Yes	Yes	Yes	6-58
38	Cooling fan running	Yes	Yes	Yes	Yes	6-61
40	Brake Release Command	Yes	Yes	Yes	Yes	6-13 6-60
41	Output Contactor Close Command	Yes	Yes	Yes	Yes	6-13 6-61
42	Speed detection at deceleration (Door zone)	Yes	Yes	Yes	Yes	6-61
43	Not Zero Speed	Yes	Yes	Yes	Yes	6-61
44	Light load direction output (ON: Forward, OFF: Reverse)	Yes	Yes	Yes	Yes	6-83
45	Light load detection status (ON: Ready for light load test, OFF: Light load test in progress)	Yes	Yes	Yes	Yes	6-83
46	Hardware base block monitor 1 (ON: terminal BB and BB1 closed)	Yes	Yes	Yes	Yes	6-61
47	Hardware base block monitor 2 (ON: terminal BB or BB1 off)	Yes	Yes	Yes	Yes	6-61

■Analog Inputs: H3

Constant Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
H3-01 *1	AI-14B Channel 1 signal level selection AI-14 CH1 LvlSel	Selects the input signal level of Channel 1 if an AI-14B option card is installed. 0:0 to +10V 1:-10 to +10V	0 or 1	0	No	A	A	A	A	410H	6-26
H3-02 *1	AI-14B Channel 1 gain AI-14 CH1 Gain	Sets the frequency reference value when 10 V is input as a percentage of the maximum output frequency set in E1-04.	0.0 to 1000.0	100.0%	Yes	A	A	A	A	411H	6-26
H3-03 *1	AI-14B Channel 1 bias AI-14 CH1 Bias	Sets the frequency reference value when 0 V is input as a percentage of the maximum output frequency set in E1-04.	-100.0 to +100.0	0.0%	Yes	A	A	A	A	412H	6-26
H3-04 *1	AI-14B Channel 3 signal level selection AI-14 CH3 LvlSel	Selects the input signal level of Channel 3 if an AI-14B option card is installed. 0:0 to 10V 1:-10 to +10V	0 or 1	0	No	A	A	A	A	413H	6-26
H3-05 *1	AI-14B Channel 3 function selection AI-14 CH3FuncSel	Selects the function for the channel 3 input if an AI-14B option card is installed. See the table below for the available functions.	2,3,14	2	No	A	A	A	A	414H	6-26
H3-06 *1	AI-14B Channel3 gain AI-14 CH3 Gain	Sets the input level according to the 100% value of the function set in parameter H3-05 when the voltage at channel 3 of the AI-14B option card is 10 V.	0.0 to 1000.0	100.0%	Yes	A	A	A	A	415H	6-26
H3-07 *1	AI-14B Channel 3 Bias AI-14 CH3 Bias	Sets the input level according to the 0% value of the function set in parameter H3-05 when the voltage at channel 3 of the AI-14B option card is 0 V.	-100.0 to +100.0	0.0%	Yes	A	A	A	A	416H	6-26
H3-08 *1	AI-14B Channel 2 signal level selection AI-14 CH2 LvlSel	Selects the input signal level of Channel 2 if an AI-14B option card is installed. 0:0 to 10V 1:-10 to +10V 2:4 to 20 mA. If current input is selected, channel 2 must be set to current input by hardware as well. Refer to the AI-14B manual.	0 to 2	0	No	A	A	A	A	417H	6-26
H3-09 *1	AI-14B Channel 2 function selection AI-14 CH2FuncSel	Selects the function for the channel 2 input if an AI-14B option card is installed. See the table below for the available functions.	2, 3, 14	3	No	A	A	A	A	418H	6-26
H3-10 *1	AI-14B Channel 2 Gain AI-14 CH2 Gain	Sets the input level according to the 100% value of the function set in parameter H3-09 when the voltage/current at channel 2 of the AI-14B option card is 10V/20mA.	0.0 to 1000.0	100.0%	Yes	A	A	A	A	419H	6-26
H3-11 *1	AI-14B Channel 2 Bias AI-14 CH2 Bias	Sets the input level according to the 0% value of the function set in parameter H3-09 when the voltage/current at channel 2 of the AI-14B option card is 0V/0mA.	-100.0 to +100.0	0.0%	Yes	A	A	A	A	41AH	6-26

Constant Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register	Page
	Display					V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)		
H3-12 *1	Analog input filter time constant CH1-3 FilterTime	Sets delay filter time constant for the three analog input channels of the AI-14B option card. Effective for noise control etc.	0.00 to 2.00	0.03 s	No	A	A	A	A	41BH	6-26
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	A	434H	6-26
H3-16	Terminal A1 input gain Terminal A1 Gain	Sets the frequency reference value when 10 V is input as a percentage of the maximum output frequency set in E1-04.	0.0 to 1000.0	100.0%	Yes	A	A	A	A	435H	6-26
H3-17	Terminal A1 input bias Terminal A1 Bias	Sets the frequency reference value when 0 V is input as a percentage of the maximum frequency set in E1-04.	-100.0 to +100.0	0.0%	Yes	A	A	A	A	436H	6-26

*1. This parameter is available only if an analog input option board AI-14B is installed.

H3-05,H3-09 Settings

Setting Value	Function	Contents (100%)	Control Methods				Page
			V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	
2	Auxiliary frequency reference (is used as multi speed reference 2)	Maximum output frequency (AI-14B use only)	Yes	Yes	Yes	Yes	6-6
3	Auxiliary frequency reference (is used as multi speed reference 3)	Maximum output frequency (AI-14B use only)	Yes	Yes	Yes	Yes	6-6
14	Torque compensation	Motor's rated torque	-	-	Yes	Yes	6-13

◆ Protection Function Parameters: L

■Motor Overload: L1

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	Control Methods: Closed Loop Vector (PM)	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 (fan cooled motor) 2: Inverter motor protection (externally cooled motor) 3: Vector motor protection When the Inverter power supply is turned off, the thermal value is reset, so even if this parameter is set to 1, protection may not be effective. 5: Permanent magnet constant torque motor protection	0 to 3	→	No	Q 1	Q 1	Q 1	-	480H	6-45
				0 or 5			-	-	-	A 5		
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	-A	481H	6-45

■Power Loss Settings: L2

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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register	Page
L2-05	Undervoltage detection level	PUV Det Level	Sets the DC bus undervoltage (UV) detection level (DC bus voltage).	150 to 210 *1	190 VDC *1	No	A	A	A	A	489H	-
L2-11	Rescue Operation DC bus Voltage	Volt@batterydr	Sets the DC bus voltage during rescue operation.	0 to 400*1	0 VDC	No	A	A	A	A	4CBH	6-80

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

■Stall Prevention: L3

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open Loop Vector	Control Methods: Closed Loop Vector	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register	Page
L3-01	Stall prevention selection during accel StallP Accel Sel	0: Disabled (Acceleration as set. With a too heavy load, the motor may stall.) 1: Enabled (Acceleration stopped when L3-02 level is exceeded. Acceleration starts again when the current has fallen below the stall prevention level). 2: Intelligent acceleration mode (Using the L3-02 level as a basis, acceleration is automatically adjusted. The set acceleration time is disregarded.)	0 to 2	1	No	A	A	-	-	48FH	6-24
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	-	-	490H	6-24
L3-05	Stall prevention selection during running StallP Run Sel	Selects the stall prevention during running. 0: Disabled (Runs as set. With a heavy load, the motor may stall.) 1: Deceleration using deceleration time 1 (C1-02.) 2: Deceleration using deceleration time 2 (C1-04.)	0 to 2	1	No	A	-	-	-	493H	6-41
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	-	-	-	494H	6-41

■Reference Detection: L4

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	Control Methods: Closed Loop Vector (PM)	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	→	No	A 0.0Hz	A 0.0Hz	A 0.0Hz	-	499H	6-27
			0.0 to 100.0			-	-	-	A 0.0%		
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	→	No	A 2.0Hz	A 2.0Hz	A 2.0Hz	-	49AH	6-27
			0.0 to 40.0%			-	-	-	A 4.0%		

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
L4-03	Speed agreement detection level (+/-)	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	→	No	A 0.0Hz	A 0.0Hz	A 0.0Hz	-	49BH	6-27
	Spd Agree Lvl+-		-100.0 to +100.0			-	-	-	A 0.0%		
L4-04	Speed agreement detection width (+/-)	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	→	No	A 2.0Hz	A 2.0Hz	A 2.0Hz	-	49CH	6-27
	Spd Agree Wdth+-		0.0 to 40.0%			-	-	-	A 4.0%		

■Fault Restart: L5

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
L5-01	Number of auto restart attempts Num of Restarts	Sets the number of auto reset attempts. The auto resetable faults are: OV, UV1, GF, OC, OL2, OL3, OL4, UL3, UL4, PF, LF, SE1, SE2, SE3	0 to 10	2	No	A	A	A	A	49EH	6-84
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	A	49FH	6-84
L5-05	Under voltage fault restart selection UV1 Restart Sel.	Selects the reset method for a UV1 fault. 0: UV1 fault is reset like set in parameter L5-01 1: UV1 fault is always automatically reset	0 or 1	0	No	A	A	A	A	4CCH	6-84

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■Torque Detection: L6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
L6-01	Torque detection selection 1 Torq Det 1 Sel	0: Torque detection disabled. 1: Car stuck detection only with speed agreement; operation continues (warning is output). 2: Car stuck detected continuously during operation; operation continues (warning is output). 3: Car stuck detection only with speed agreement; output stopped upon detection. 4: Car stuck detected continuously during operation; output stopped upon detection. 5: Undertorque detection only with speed agreement; operation continues (warning is output). 6: Undertorque detected continuously during operation; operation continues (warning is output). 7: Undertorque detection only with speed agreement; output stopped upon detection. 8: Undertorque detected continuously during operation; output stopped upon detection.	0 to 8	4	No	A	A	A	A	4A1H	6-41
L6-02	Torque detection level 1 Torq Det 1 Lvl	Vector control: Motor rated torque is set as 100%. V/f control: Inverter rated current is set as 100%.	0 to 300	150%	No	A	A	A	A	4A2H	6-41
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	A	4A3H	6-41
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	A	4A4H	6-41
L6-05	Torque detection level 2 Torq Det 2 Lvl		0 to 300	150%	No	A	A	A	A	4A5H	6-41
L6-06	Torque detection time 2 Torq Det 2 Time		0.0 to 10.0	10.0 s	No	A	A	A	A	4A6H	6-41

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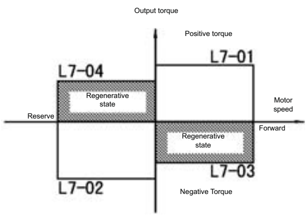
■Torque Limits: L7

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	Control Methods Closed Loop Vector (PM)	MEMO-BUS Register	Page
L7-01	Forward drive torque limit	Torq Limit Fwd	Sets the torque limit value as a percentage of the motor rated torque. Four individual regions can be set.  	0 to 300	300%	No	-	A	A	A	4A7H	6-44
L7-02	Reverse drive torque limit	Torq Limit Rev		0 to 300	300%	No	-	A	A	A	4A8H	6-44
L7-03	Forward regenerative torque limit	Torq Lmt Fwd Rgn		0 to 300	300%	No	-	A	A	A	4A9H	6-44
L7-04	Reverse regenerative torque limit	Torq Lmt Rev Rgn		0 to 300	300%	No	-	A	A	A	4AAH	6-44
L7-06	Torque limit integral time constant	Torque Limit Time	Sets the torque limit integration time constant	5 to 10000	200 ms	No	-	A	-	-	4ACH	6-44
L7-07	Torque limit integral operation selection during accel/decel	Torque Limit Sel	Sets the torque limit operation during acceleration and deceleration. 0: P-control (I control is added at constant speed operation) 1: I-control Normally changing this setting is not necessary. If the torque limitation accuracy during accel/decel. has preference, I control should be selected. This may result in an increased accel./decel. time and speed deviations from the reference value.	0 or 1	0	No	-	A	-	-	4C9H	6-45

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■Hardware Protection: L8

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	Control Methods Closed Loop Vector (PM)	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 cooling fin temperature reaches the set value.	50 to 130	90 °C*1	No	A	A	A	A	4AEH	6-48
L8-03	Operation selection after overheat pre-alarm OH Pre-Alarm Sel	Sets the operation when an Inverter overheat pre-alarm occurs. 0: Decelerate to stop using the deceleration time C1-02. 1: Coast to stop 2: Fast stop in fast-stop time C1-09. 3: Continue operation (Monitor display only.) A fault will be given in setting 0 to 2 and a minor fault will be given in setting 3.	0 to 3	3	No	A	A	A	A	4AFH	6-48
L8-05	Input open-phase protection selection Ph Loss In Sel	0: Disabled 1: Enabled (Detects if input current open- phase, super supply voltage imbalace or main circuit electrostatic capacitor deterioration occurs)	0,1	1	No	A	A	A	A	4B1H	6-49
L8-06	Input open-phase protection level Ph Loss In Lvl	Observes voltage ripple in the DC bus and determines the level at which input phase loss occurs. Phase loss is detected when the difference between the maximum ripple and minimum ripple is greater than the value set in L8-06. Detection level is set as a percentage of the Overvoltage trip level (400V for 200V Class Inverters, 800V for 400 V Class Inverters)	0,0-50.0	12.0% *1	No	A	A	A	A	4B2H	6-48
L8-07	Output open-phase detection selection Ph Loss Out Sel	0: Disabled 1: Enabled, 1 Phase Observation 2: Enabled, 2 and 3 Phase Observation 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	A-	4B3H	6-49

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Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMO-BUS Register	Page
L8-09	Ground fault detection selection Ground Fault Sel	0: Disabled 1: Enabled	0 or 1	1	No	A	A	A	A	4B5H	6-50
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	A	4B6H	6-51
L8-11	Cooling fan control delay time Fan Delay Time	Set the time in seconds to delay turning OFF the cooling fan after the inverter STOP command is given. (Valid only if L8-10 = 0)	0 to 300	60 s	No	A	A	A	A	4B7H	6-51
L8-12	Ambient temperature Ambient Temp	Sets the ambient temperature.	45 to 60	45 °C	No	A	A	A	A	4B8H	6-51
L8-18	Soft CLA selection Soft CLA Sel	0: Disable 1: Enable	0 or 1	1	No	A	A	A	-	4BFH	--
L8-20	Output phase loss detection time Pha loss det T	Sets the detection time of output phase loss detection (LF.)	0.0 to 2.0	0.2sec	No	A	A	A	A	4C0H	6-49

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

◆ Special Adjustments: n2 / n5

■Automatic Frequency Regulator: n2

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	 Open Loop Vector	 Closed Loop Vector	 Closed Loop Vector (PM)	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	-	A	-	-	584H	6-35
n2-02	Speed feedback detection control (AFR) time constant AFR Time	Set the time constant 1 to decide the rate of change in the speed feedback detection control.	0 to 2000	50 ms	No	-	A	-	-	585H	6-35
n2-03	Speed feedback detection control (AFR) time constant 2 AFR Time 2		0 to 2000	750 ms	No	-	A	-	-	586H	6-35

■Feed Forward: n5

Constant Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	 Open Loop Vector	 Closed Loop Vector	 Closed Loop Vector (PM)	MEMO BUS Register	Page
n5-01	Feed forward control selection Feedfoward Sel	Enables or disables the feed forward control. 0: Disabled 1: Enabled	0 or 1	→	No	-	-	A 1 - 	- A 0	5B0H	6-36
n5-02	Motor acceleration time Motor Accel Time	Set the time required to accelerate the motor at the rated torque (T_{100}) to the rated speed (Nr). J: $GO^2/4$, P: Motor rated output $t_a = \frac{2\pi \cdot J[kgm^2] \cdot N_r[rpm]}{60 \cdot T_{100}[Nm]}$ However, $_{100} = \frac{60}{2\pi} \cdot \frac{P[kW]}{N_r[rpm]} \cdot 10^3[Nm$	0.001 to 60.000	0.154 s *1	No	-	-	A	A	5B1H	6-36
n5-03	Feed forward proportional gain Feedfoward Gain	Sets the proportional gain for feed forward control. Speed reference response will increase as the setting of n5-03 is increased.	0.00 to 500.00	1.00	No	-	-	A	A	5B2H	6-36

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Con-stant Number	Name	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods				MEMO BUS Regis-ter	Page
	Display					V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)		
n5-05	Motor acceleration time tuning N5-02 Tuning	Enables or diables the tuning for the motor acceleration time N5-02. 0: Disabled 1: Enabled	0 or 1	0	No	-	-	A	A	5B4H	*6-36*

*1. The factory setting depends on the inverter capacity. The value for a 200 V Class Inverter of 3.7 kW is given.Automatic Frequency Regulator: n2

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◆ PM Motor Adjustments: n8 / n9

■PM Motor Adjustment 1: n8

Constant Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
n8-29	Automatic Current Regulator q axis P gain	ACR q gain	Sets the proportional gain for the q-axis current regulator (ACR)	0 to 2000	1000 rad/s	No	-	-	-	A	55CH	6-37
n8-30	Automatic Current Regulator q axis integral time	ACR q Itime	Sets the integral time for the q-axis current regulator (ACR)	0 to 100.0	10.0 ms	No	-	-	-	A	55DH	6-37
n8-32	Automatic Current Regulator d axis P gain	ACR d gain	Sets the proportional gain for d-axis current regulator (ACR)	0 to 2000	1000 rad/s	No	-	-	-	A	55FH	6-37
n8-33	Automatic Current Regulator q axis integral time	ACR d Itime	Sets the integral time for the d-axis current regulator (ACR)	0 to 100.0	10.0 ms	No	-	-	-	A	560H	6-37
n8-35	Magnet position detection method	Mag det sel	Sets the magnet position detection method. 0: Estimate method 4: Hiperface detection 5: EnDat detection	0, 4 or 5	5	No	-	-	-	Q	5B0H	4-7 4-8
n8-45	Inductance measuring frequency	Induct Meas Freq	Sets the frequency for the voltage to be applied to the motor during inductance tuning. Disabled when n8-61 is set to 1	0 to 1000	200Hz	No	-	-	-	A	56CH	-
n8-46	Inductance measurement current level	Induct Meas Lev	Sets the current which is used for the inductance measurement during rotating auto tuning. The value is set in % of the motor rated current.	0.0 to 99.9	10.0 %	No	-	-	-	A	.56DH	-
n8-61	n8-45 Auto calculation selection	n8-45 Auto CalcSel	0 : Disabled 1: Enabled	0, 1	1	No	-	-	-	A	57CH	-

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■PM Motor Adjustment 2: n9

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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register	Page
n9-60	A/D conversion start delay timer AD DelayT@Start	Sets the A/D conversion delay time.	0.0 to 40	0.0 μs	No	-	-	-	A	64DH	6-38
n9-74	Detected Current Averaging Selection CurrAvaraginSel	0: Disabled 1: Enabled	0-1	0	No	-	-	-	A	65BH	-

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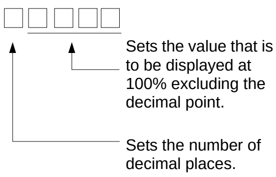
◆ Digital Operator/LED Monitor Parameters: o

■Monitor Selections: o1

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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register	Page
o1-01	Monitor selection	Set the number of the 4rd. monitor item to be displayed in the Drive Mode. (U1-□□) (On LED operator JVOP-161 only.)	4 to 56	6	Yes	A	A	A	-	500H	6-67
	User Monitor Sel		4 to 75			-	-	-	A		
o1-02	Monitor selection after power up	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	A	501H	6-67
	Power-On Monitor										
o1-03	Frequency units of reference setting and monitor	Sets the units that will be set and displayed for the frequency reference and frequency monitor. 0: 0:0.01 Hz units 1: 0.01% units (Maximum output frequency is 100%) 2: min^{-1} (2 poles) 3: 0.000 m/s 4 to 39: rpm units (Set the motor poles.) 40 to 39999:User desired display Set the desired values for setting and display for the max. output frequency.  Example: When the max. output frequency value is 200.0, set 12000.	0 to 39999	→	No	A 0	A 0	A 0	-	502H	6-67
	Display Scaling					-	-	-	A 1		
o1-04	Setting unit for V/f characteristics parameters	Set the setting unit for V/f pattern related parameters. 0: Hz 1: rpm	0 or 1	→	No	-	-	A 0	-	503H	6-68
	Display Units								A 1		
o1-05	LCD Display contrast adjustment	Sets the contrast on the optional LCD operator (JVOP-160-OY). 0: light 2: 3: normal 4: 5: dark	0 to 5	3	Yes	A	A	A	A	504H	6-68
	LCD Contrast										

■Digital Operator: o2

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	Control Methods: Closed Loop Vector (PM)	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	A	505H	6-68
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	A	506H	6-68
o2-03	User parameter initial value User Defaults	Clears or stores user initial values. 0: Stores/not set 1: Begins storing (Records the set parameters as user initial values.) 2: All clear (Clears all recorded user initial values) When the set parameters are recorded as user initial values, 1110 will be set in A1-03.	0 to 2	0	No	A	A	A	A	507H	6-68
o2-04	kVA selection Inverter Model #	Do not set unless after replacing the control board. (Refer to page 5-65 for the setting values).	0 to FF	0	No	A	A	A	A	508H	6-68
o2-05	Frequency reference setting method selection Operator M.O.P.	Sets whether the ENTER key is needed for a frequency reference change or not when the Digital Operator is selected as frequency reference source. 0: Enter key needed 1: Enter key not needed If "1" is selected, a frequency reference change is accepted without the need of pressing the Enter key.	0 or 1	0	No	A	A	A	A	509H	6-69
o2-06	Operation selection when digital operator is disconnected Oper Detection	Sets the operation when the Digital Operator/LED Monitor is disconnected. 0: Operation continues even if the Digital Operator/LED Monitor is disconnected. 1: OPR is detected at Digital Operator/LED Monitor disconnection. Inverter output is switched off, and the fault contact is operated.	0 or 1	0	No	A	A	A	A	50AH	6-69
o2-07	Cumulative operation time setting Elapsed Time Set	Sets the cumulative operation time in hour units.	0 to 65535	0 hr.	No	A	A	A	A	50BH	6-69
o2-08	Cumulative operation time selection Elapsed Time Run	0: Accumulated inverter power on time. 1: Accumulated inverter run time.	0 or 1	1	No	A	A	A	A	50CH	6-69

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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	Control Methods Closed Loop Vector (PM)	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	A	50EH	6-69
o2-12	Fault trace initialize Fault Trace Init	0: No initialisation 1: Initialize (= zero clear) after setting ”1“ o2-12 will be returned to ”0“	0 or 1	0	No	A	A	A	A	510H	6-69
o2-15	Number of Travels counter initialize Initialize Sel	Operation counter initialization. 0: Number of travels counter is kept 1: Number of travels counter monitor clear	0 or 1	0	No	A	A	A	A	513H	6-69

■ Copy Function: o3

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	Control Methods Closed Loop Vector (PM)	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	A	515H	6-69
o3-02	Read permission selection Read Allowable	0: READ prohibited 1: READ permitted	0 or 1	0	No	A	A	A	A	516H	6-69

◆ Lift Function Parameters: S

■Brake Sequence: S1

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	Control Methods Closed Loop Vector (PM)	MEMOBUS Register	Page
S1-01	Zero speed level at stop DC Inj I @start	Sets the speed level at which the DC injection / zero speed operation starts during stop.	0.0 to 10.0	→	No	A 1.2 Hz	A 0.5 Hz	A 0.1 Hz	A 0.1 Hz	680H	6-13
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	-	-	681H	6-40
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	-	-	682H	6-40
S1-04	DC injection braking/ Zero speed 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	0.40 s	No	A	A	A	A	683H	6-13

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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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register	Page
S1-05	DC injection braking/ Zero speed 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	A	684H	6-13
S1-06	Brake release delay time Brake open delay	Sets the time delay from the brake open command to the start of acceleration. This timer can be used to avoid running against the closed brake at start.	0.00 to 10.00	0.20	No	A	A	A	A	685H	6-13
S1-07	Brake close delay time Brake CloseDelay	Sets the time delay from the internal brake close command until the brake control output is switched. This timer can be used to avoid closing the brake when the motor is still turning.	0.00 to S1-05	0.10	No	A	A	A	A	686H	6-13
S1-14	SE2 detection delay time SE2 det T	Used to set the delay time for the detection of a SE2 fault. At the time S1-06 + S1-14 after the Fwd/Rev command was given the output current is measured. If it is below 25% of the no-load current (E2-03) setting a SE2 fault will be output.	0 to S1-04 - S1-06	200ms	No	A	A	A	-	68DH	6-47
S1-15	SE3 detection delay time SE3 det T	Used to set the delay time for the detection of a SE3 fault. At the time S1-15 after the fwd/rev command was given, the inverter starts to observe the output current continuously. If it falls below 25% of the no-load current (E2-03) setting a SE3 will be output.	0 to 5000	200ms	No	A	A	A	-	68EH	6-47
S1-16	RUN delay time Run Delay T	Sets the delay time from the Run signal input to the internal run enable.	0.00 to 1.00	0.10sec	No	A	A	A	A	68FH	6-13
S1-17	DC injection current gain at regenerative operation DC Inj gain@gen	Used to set the DC injection gain when inverter is in the regenerative mode.	0 to 400	100%	No	-	A	-	-	690H	6-40
S1-18	DC injection current gain at motoring operation DC Inj gain@mot	Used to set the DC injection gain when inverter is in the motoring mode.	0 to 400	20%	No	-	A	-	-	691H	6-40
S1-19	Output contactor open delay time Cont open delay	Sets the contactor control output delay time after stop.	0.00 to 1.00	0.10sec	No	A	A	A	A	692H	6-13

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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	Control Methods Closed Loop Vector (PM)	MEMO-BUS Register	Page
S1-20	Zero-servo gain @ start ZeroSev-Gain@Strt	Adjust the strength of the zero-servo lock at the starting of travel. When Closed Loop Vector control is selected, a position control loop is created at start and stop. Increasing the zero-servo gain increases the strength of the lock at the starting of the travel. Increasing to much can cause oscillation.	0 to 100	5	No	-	-	A	A	693H	6-13
S1-21	Zero-servo completion width Zero Servo Count	Sets the bandwidth of the Zero Servo completion output. Enabled when the “zero-servo completion (end)” is set for a multi-function output. The zero-servo completion signal is ON when the current position is within the range (the zero-servo position + zero-servo completion width.) Set S1-21 to 4 times of the allowable displacement pulse amount at the PG.	0 to 16383	10	No	-	-	A	A	694H	6-13
S1-22	Starting torque compensation increase time Torque incr T	Sets the increase time for the analog input torque compensation signal. Sets the time the torque reference needs to reach 300% torque reference.	0 to 5000	500ms	No	-	-	A	A	695H	6-13
S1-23	Torque compensation gain during lowering TorqComp-gain@low	Sets the torque compensation gain at lowering when the torque compensation at start function is used.	0.500 to 10.000	1.000	No	-	-	A	A	696H	6-13
S1-24	Torque compensation bias during raising TorqComp-Bias@ri	Sets the torque compensation bias at raising when the torque compensation at start function is used.	-200.0 to +200.0	0.0%	No	-	-	A	A	697H	6-13
S1-25	Torque compensation bias during lowering TorqComp-Bias@red	Sets the torque compensation bias at lowering when the torque compensation at start function is used.	-200.0 to +200.0	0.0%	No	-	-	A	A	698H	6-13
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	0.0Hz	No	-	-	A	A	699H	6-22
S1-27	Door zone speed level Door Zone Level	Sets the door zone speed level. If the motor speed (in CLV and OLV) or the output frequency (in V/f control) falls below S1-27 and a multifunction output is set for the “Door zone” signal (H2-□□=42), this output will be closed.	0.0 to 120.0	0.0Hz	No	A	A	A	A	69AH	6-61
S1-28	SE1 detection Selection SE1 Selection	Sets how a SE1 fault is reset. 0: Manual Reset 1: Automatic reset at stop 2: No SE1 detection	0 to 2	0	No	A	A	A	A	69BH	6-55

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Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
S1-29	Torque compensation fade-out level Torq Fadeout-Freq	Sets the frequency level at which the torque compensation value is started to fade out to zero.	0.0 to 120.0	0.0Hz	No	-	-	A	A	69CH	6-15
S1-30	Torque compensation fade-out time Torq Fadeout-Time	Sets the time constant which is used to fade out the torque compensation value. The set value is the time used to decrease the compensation value from 300% to 0%.	0~5000	1000 msec	No	-	-	A	A	69DH	6-15
S1-31	Torque limit time at stop TrqLimit T @Stop	Sets the time which is used to reduce the torque limit to 0 after zero speed .	0~1000	0 msec	No	-	-	-	A	69EH	6-17
S1-32	Zero servo gain at Stop ZeroSrv-Gain@Stop	Adjust the strength of the zero-servo lock at the end of travel. When Closed Loop Vector control is selected, a position control loop is created at start and stop. Increasing the zero-servo gain at stop increase the strength of the look at the end of the travel. Increasing is too much can cause oscilation.	0 to 100	5	No	-	-	A	A	69FH	6-13
S1-33	Zero Servo Gain 2 ZeroSrvGain2	Adjust the strength of the position loop gain at the starting of travel. Increasing the zero-servo gain2 increases the strength of the lock at the starting of the travel apart from zero-servo gain at start . Increasing it too much can cause oscillation.	0.00 to 30.00	0.00	No	-	-	-	A	6A0H	6-13
S1-34	SE4 Detection Time SE4 det T	SE4 is detected when the Brake open signal and Brake release check mismatch for longer than the time set in S1-34. SE4 detection is disabled when 0.00 sec is set to S1-34	0.00 to 10.00	0.50 sec	No	A	A	A	A	6A1H	6-13

■Slip Compensation: S2

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
S2-01	Motor rated speed Rated rpm	Sets the motor rated speed.	300 to 1800	1380 rpm	No	A	-	-	-	6AEH	6-38
S2-02	Slip compensation gain in motoring mode SlipComp gainMot	Sets the slip compensation gain in motoring mode. It can be used to improve the leveling accuracy.	0.0 to 5.0	0.7	Yes	A	A	-	-	6AFH	6-38
S2-03	Slip compensation gain in regenerative mode SlipComp gainGen	Sets the slip compensation gain in regenerative mode. It can be used to improve the leveling accuracy.	0.0 to 5.0	1.0	Yes	A	A	-	-	6B0H	6-38

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Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
S2-05	Slip compensation torque detection delay TorqueDet Delay T	Sets the delay time for the slip compensation torque detection. The torque detection is started at S2-05 sec. after speed agree	0.0 to 10.0	1.0 sec	No	A	A	-	-	6B2H	6-38
S2-06	Slip compensation torque detection time Torque detect T	Sets the time for which the torque is measured for the slip compensation calculation.	0.00 to 2.00	0.50 sec	No	A	A	-	-	6B3H	6-38
S2-07	Slip compensation delay time SlipCompDelay T	Sets the Slip compensation delay time.	0 to 10000	200ms	No	-	A	-	-	6B4H	6-38

■Special Sequence Functions: S3

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMOBUS Register	Page
S3-01	Short-floor function selection Short floor sel	Enables or disables the short floor operation function 0: disabled 1: enabled (Standard) 2: enabled (Advanced)	0 or 1	0	No	A	A	A	A	6BDH	6-18
S3-03	Inspection deceleration time Dec ramp inspec	Sets the deceleration time for the inspection run.	0.0 to 2.0	0.0sec	No	A	A	A	A	6BFH	6-11
S3-04	Nominal/Leveling speed detection level Vn/Vl level sel	Sets the speed level for Nominal/ Leveling speed detection when multispeed inputs are used. (d1-18=0/3)	0.0 to 120.0	0.0Hz	No	A	A	A	A	6C0H	6-6
S3-05	Nominal speed for short floor calculation Vn@ Short floor	Sets the nominal speed value which is used for the short floor calculation.	0.0 to 120.0	0.0Hz	No	A	A	A	A	6C1H	6-16
S3-06	Light load search for rescue operation LightLoad Search	Enables or disables the Light load search function for rescue operation. 0: disabled 1: enabled 2: enabled (for motor 1 only)	0 or 2	0	No	A	A	A	A	6C2H	6-83
S3-07	Light load search time LightLd Srch-Time	Sets the light load search time for the rescue operation.	0.0 to 5.0	1.0 sec	No	A	A	A	A	6C3H	6-83
S3-08	Output phase order Exchg Phase Sel	Sets the output phase order. 0: Output phase order is U-V-W 1: Output phase order is U-W-V	0 or 1	0	No	A	A	A	A	6C4H	6-66
S3-09	Frequency reference loss detection FRL selection	Enables or disables the frequency reference loss detection when d1-18 = 1 and H1-□□≠83. 0: Disabled 1: Enabled	0 or 1	1	No	A	A	A	A	6C5H	6-8

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	MEMO-BUS Register	Page
S3-10	Light load search frequency LightLd Srch-Freq	Sets the light load speed for the rescue operation.	0.00 to 20.00	3.00 Hz	No	A	A	A	A	6C6H	6-80
S3-11	Rescue operation torque limit Rescue OP TLM	Sets the torque limit for the rescue operation.	0 to 300	100 %	No	-	A	A	A	6C7H	6-80
S3-12	Base Block restart selection BB Restart	Sets the behaviour of the inverter if a Base Block command is set during run. 0: Disabled The Run command must be cycled to restart. 1: Enable The inverter restarts when the Base Block signal is released and the Run signal is still active.	0 or 1	0	No	A	A	A	A	6C8H	6-52
S3-13	Traction sheave diameter Sheave diameter	Sets the diameter of the traction sheave.	100 to 2000	400 mm	No	A	A	A	A	6C9H	6-68
S3-14	Roping Roping Ratio	Sets the roping ratio of the elevator 1: 1:1 2: 1:2	1 or 2	2	No	A	A	A	A	6CAH	6-68
S3-15	Gear Ratio Gear Ratio	Sets the mechanical gear ratio.	0.10 to 10.00	1.000	No	A	A	A	A	6CBH	6-68
S3-16	Over acceleration detection level Over Acc Det Lvl	Sets the maximum car acceleration value. If the acceleration rate is higher that this value the inverter trips with an over acceleration fault (DV6)	0.0 to 50.0	1.5 m/s²	No	-	-	-	A	6CCH	6-47
S3-17	Over acceleration deceleration time constant Over Acc Det Fil	Sets the time for which an over acceleration must be detected before the inverter stops with an over acceleration fault (DV6)	0.000 to 5.000	0.05 sec	No	-	-	-	A	6CDH	6-47
S3-18	Over acceleration detection method selection Over Acc Det Sel	Selects wether the over acceleration detection is always active or during run only. 0: Detection during power on 1: Detection during run only	0 or 1	0	No	-	-	-	A	6CEH	6-47
S3-19	Inspection speed upper limit Inspection UpLmt	Sets the upper frequency limit for the inspection speed detection if multi speed operation is selected (d1-18 = 0 or 3)	S3-04 to 120.0 Hz	25.0 Hz	No	A	A	A	A	6CFH	6-11
S3-20	Short floor minimum constant speed time ShortF2 MinTime	Sets the minimal constant speed time for the advanced short floor function. The parameter is effective only if paramter S3-01is set to “2” (Advanced short floor operation enabled)	0.0 to 2.0	0.0 sec	No	A	A	A	A	6D0H	6-19

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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	Closed Loop Vector (PM)		
S3-21	Distance calculation acceleration time gain Tacc Gain	Sets the acceleration time gain for the optimal speed calculation of the advanced short floor function.	50.0 to 200.0	150.0%	No	A	A	A	A	6D1H	6-19
S3-22	Distance calculation deceleration time gain Tdec Gain	Sets the deceleration time gain for the optimal speed calculation of the advanced short floor function.	50.0 to 200.0	150.0%	No	A	A	A	A	6D2H	6-19
S3-23	Distance calculation deceleration time gain	Sets the deceleration time gain for the optimal speed calculation of the advanced short floor function.	50.0 to 200.0	150.0%	No	A	A	A	A	6D3H	6-19
S3-24	Light Load Direction Search Method LLS method sel	Selects the light load direction search method. 0: Motor Current comparison 1: Regenerative direction detection	0 or 1	0	No	A	A	-	-	6D4H	6-80

5

◆ Motor Autotuning: T

■T1: Autotuning 1

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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register	Page
T1-01	Autotuning mode selection	Sets the autotuning mode. 0: Rotating autotuning 1: Non-rotating autotuning 2: Non-rotating autotuning for line-to-line resistance only 4: Encoder offset tuning	0 to 2	→	No	Yes (2)	Yes (1)	Yes (1)	-	701H	4-4
	Tuning Mode Sel		0 or 4			-	-	-	Yes (4)		
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 *1	No	Yes	Yes	Yes	-	702H	4-4
T1-03	Motor rated voltage Rated Voltage	Sets the rated voltage of the motor.	0 to 255.0 *2	190.0 V *2	No	-	Yes	Yes	-	703H	4-4
T1-04	Motor rated current Rated Current	Sets the rated current of the motor.	1.75 to 35.00 *3	14.00 A *1	No	Yes	Yes	Yes	-	704H	4-4
T1-05	Motor rated frequency Rated Frequency	Sets the rated frequency of the motor.	0 to 120.0	50.0 Hz	No	-	Yes	Yes	-	705H	4-4
T1-06	Number of motor poles Number of Poles	Sets the number of motor poles.	2 to 48 poles	4 poles	No	-	Yes	Yes	-	706H	4-4
T1-07	Motor base speed Rated Speed	Sets the base speed of the motor in r/min.	0 to 24000	1450 r/min	No	-	Yes	Yes	-	707H	-4-4
T1-08	Number of PG pulses PG Pulses/Rev	Sets the number of PG pulses per revolution.	0 to 60000	1024	No	-	-	Yes	-	708H	4-4
T1-09	No load current No load current	Sets the no load current of motor.	0.0 to 13.99 *1	E2-03	No	-	Yes	Yes	-	709H	4-4

*1. The factory setting depends on the Inverter capacity. (The value for a 200 V Class Inverter for 3.7 kW is given.)
*2. These are values for a 200 V class Inverter. Values for a 400 V class Inverter are double.
*3. The setting range is from 10% to 200% of the Inverter rated output current. (The value for a 200 V Class Inverter for 0.4 kW is given.)

■T2: Autotuning 2

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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS Register	Page
T2-01	Motor output power Mtr Rated Power	Sets the output power of the motor in kilowatts.	0.00 to 75.00	3.70 kW *1	No	-	-	-	Yes	730H	4-4
T2-02	Motor base frequency Base Frequency	Sets the motor base frequency.	20 to 3600	150 rpm	No	-	-	-	Yes	731H	4-4
T2-03	Motor rated voltage Rated Voltage	Sets the rated voltage of the motor.	0 to 480.0	200.0 V *2	No	-	-	-	Yes	732H	4-4
T2-04	Motor rated current Rated Current	Sets the rated current of the motor.	0.00 to 200.00	14.60 A *1	No	-	-	-	Yes	733H	4-4
T2-05	Number of motor poles Number of Poles	Sets the number of motor poles.	2 to 48 poles	4 poles	No	-	-	-	Yes	734H	4-4
T2-08	Motor voltage constant k_e Voltage constant	Sets the motor voltage constant if T2-99 was set to 0 before. (Otherwise this parameter is not displayed)	50.0 to 2000.0	239.3 mVsec/rad	No	-	-	-	Yes	737H	4-4
T2-09	Number of PG pulses PG Pulses/Rev	Sets the number of PG pulses per revolution.	512, 1024*2 or 2048	2048	No	-	-	-	Yes	738H	4-4
T2-10	Motor voltage constant calculation selection VoltConst-CalcSel	Selects if the voltage constant is calculated during auto tuning or if it has to input manually. 0: Manual input in parameter T2-08 1: Automatic calculation	0 or 1	1	No	-	-	-	Yes	72FH	4-4

*1. The factory setting depends on the Inverter capacity. (The value for a 200 V Class Inverter for 3.7 kW is given.)
*2. Can be set only if HIPEFACE® is selected as encoder type.

5

◆ Monitor Parameters: U

■ Status Monitor Parameters: U1

Parameter Number	Name	Display	Description	Output Signal Level at Multi-Function Analog Output (AO-option card)	Min. Unit	Control Methods: V/f	Control Methods: Open Loop Vector	Control Methods: Closed Loop Vector	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register
U1-01	Frequency reference	Frequency Ref	Monitors/sets the frequency reference value.*1	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	A	A	A	-	40H
					0.01 %	-	-	-	A	
U1-02	Output frequency	Output Freq	Monitors the output frequency.*1	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	A	A	A	-	41H
					0.01 %	-	-	-	A	
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	A	42H
U1-04	Control method	Control Method	Displays the current control method.	(Cannot be output.)	-	A	A	A	A	43H
U1-05	Motor speed	Motor Speed	Monitors the detected motor speed.*1	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	No	A	A	-	44H
					0.01 %		-	-	A	
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	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	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	A	47H
U1-09	Torque reference	Torque Reference	Monitors the internal torque reference value for open vector control.	10 V: Motor rated torque (0 to ± 10 V possible)	0.1%	No	A	A	A	48H

*1. 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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register
U1-10	Input terminal status	Input Term Sts	Shows input ON/OFF status. U1-10=11111111 1: FWD command (S1) is ON 1: REV command (S2) is ON 1: Multi input 1 (S3) is ON 1: Multi input 2 (S4) is ON 1: Multi input 3 (S5) is ON 1: Multi input 4 (S6) is ON 1: Multi input 5 (S7) is ON	(Cannot be output.)	-	A	A	A	A	49H

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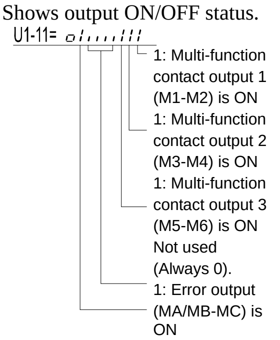
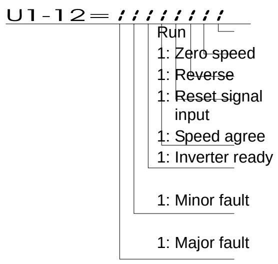
Parameter Number	Name / Display	Description	Output Signal Level During Multi-Function Analog Output	Min. Unit	Control Methods: V/f	Control Methods: Open Loop Vector	Control Methods: Closed Loop Vector	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register
U1-11	Output terminal status Output Term Sts	Shows output ON/OFF status. 	(Cannot be output.)	-	A	A	A	A	4AH
U1-12	Operation status Int Ctl Sts 1	Inverter operating status. 	(Cannot be output.)	-	A	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	A	4CH
U1-14	Software No. (flash memory) FLASH ID	(Manufacturer's ID number)	(Cannot be output.)	-	A	A	A	A	4DH
U1-15	Terminal A1 input level Term A1 Level	Monitors the input level of analog input A1. A value of 100% corresponds to 10V input.	10 V: 100% (0 to ± 10 V possible)	0.1%	A	A	A	A	4EH
U1-16 *1	AI-14B channel 2 input level AI-14 Ch2 InpLvl	Monitors the input level of analog input 2 on a AI-14B option board. A value of 100% is equal to 10V input.	10 V: 100% (0 to ± 10 V possible)	0.1%	A	A	A	A	4FH
U1-17 *1	AI-14B channel 3 input level AI-14 Ch3 InpLvl	Monitors the input level of analog input 3 on a AI-14B option board. A value of 100% is equal to 10V input.	10 V: 100% (0 to ± 10 V possible)	0.1%	A	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 current corresponds to 100%.	10 V:Motor rated current) (0 to ±10 V output)	0.1%	A	A	A	A	51H
U1-19	Motor excitation current (Id) Mot EXC current	Monitors the calculated value of the motor excitation current. The motor rated current corresponds to 100%.	10 V:Motor rated current) (0 to ±10 V output)	0.1%	-	A	A	A	52H

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	Control Methods: Closed Loop Vector (PM)	MEMOBUS Register
U1-20	Frequency reference after soft-starter	Monitors the frequency reference after the soft starter. This frequency value does not include compensations, such as slip compensation. The unit is set in o1-03.	10 V: Max. frequency (0 to ± 10 V possible)	0.01Hz	A	A	A	-	53H
	SFS Output			0.01%	-	-	-	A	
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%	-	-	A	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%	-	-	A	A	55H
U1-25	DI-16H2 input status / DI-16 Reference	Monitors the reference value from a DI-16H2 Digital Reference Card. The value will be displayed in binary or BCD depending on user constant F3-01.	(Cannot be output.)	-	A	A	A	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	-	A	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	-	A	A	A	5AH
U1-28	Software No. (CPU) / CPU ID	(Manufacturer's CPU software No.)	(Cannot be output.)	-	A	A	A	A	5BH
U1-32	ACR output of q axis / ACR(q) Output	Monitors the current control output value for the motor secondary current.	10 V: 100% (0 to ± 10 V possible)	0.1 %	-	A	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 %	-	A	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	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.)	-	-	-	A	A	62H
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	A	67H
U1-41	Inverter Heatsink Temperature / Actual Fin Temp	Shows the inverter heatsink temperature measured by the IGBT thermal protection sensor.	(Cannot be output)	°C	A	A	A	A	68H

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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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS Register
U1-44	ASR output without filter / ASR Out w/o 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%	-	-	A	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%	-	-	A	A	6CH
U1-50	Slip compensation value / Slip comp value	Monitors the slip compensation value.100% is displayed for rated slip	10 V: Rated slip of motor (-10 V to 10 V)	0.01%	A	A	-	-	71H
U1-51	Max Current during acceleration / MaxCurrent@Acc	Monitors the maximum current during acceleration.	10 V: Rated current of motor (0 V to 10 V)	0.1 A	A	A	A	A	72H
U1-52	Max Current during deceleration / MaxCurrent@Dec	Monitors the maximum current during deceleration.	10 V: Rated current of motor (0 V to 10 V)	0.1 A	A	A	A	A	73H
U1-53	Max Current during Top speed / MaxCurretn@Run	Monitors the maximum current at top speed.	10 V: Rated current of motor (0 V to 10 V)	0.1 A	A	A	A	A	74H
U1-54	Max Current during leveling speed / Max Amp at Vl sped	Monitors the maximum current at Vl speed.	10 V: Rated current of motor (0 V to 10 V)	0.1 A	A	A	A	A	75H
U1-55	Number of travels / No of travels	Monitors the lift operation counter. Using parameter O2-15 the counter can be cleared.	(Cannot be output.)	-	A	A	A	A	76H
U1-56 *1	AI-14B channel 1 input level / AI-14 Ch1 InpLvl	Monitors the input level of analog input 1 on a AI-14B option board. A value of 100% is equal to 10V input.	10 V: 100% (-10 to 10 V)	0.1%	A	A	A	A	77H
U1-57	Car acceleration rate / Cage accel	Shows the elevator car acceleration rate value.	10V: 9.8 m/s² (-10V to 10 V)	0.01 m/s²	A	A	A	A	57H
U1-74	q-axis motor current reference / Iq Reference	Monitors the q-axis current reference.	10 V: Motor rated current (-10 to 10 V)	0.1%	A	A	A	A	7C6H
U1-75	d-axis motor current reference / Id Reference	Monitors the d-axis current reference.	10 V: Motor rated current (-10 to 10 V)	0.1%	A	A	A	A	7C7H

*1. The parameter is displayed only if a AI-14B option board is installed.

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■ Fault Trace: U2

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	Control Methods: Closed Loop Vector (PM)	MEMO-BUS Register
U2-01	Current fault Current Fault	The content of the current fault.	(Cannot be output.)	-	A	A	A	A	80H
U2-02	Last fault Last Fault	The error content of the last fault.		-	A	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	A	82H
U2-04	Output frequency at fault Output Freq	The output frequency when the last fault occurred.		0.01 Hz	A	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	A	84H
U2-06	Motor speed at fault Motor Speed	The motor speed when the last fault occurred.		0.01 Hz	-	A	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	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	A	87H
U2-09	Output power at fault Output kWatts	The output power when the last fault occurred.		0.1 kW	A	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%	-	-	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	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	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	A	8CH
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	A	8DH

IMPORTANT

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

■Fault History: U3

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

IMPORTANT

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

◆ Settings which change with the Control Mode (A1-02)

Parameter Number	Name	Setting Range	Unit	Factory Setting			
				V/f Control A1-02=0	Open Loop Vector A1-02=2	Closed Loop Vec-tor A1-02=3	Closed Loop Vec-tor (PM) A1-02=5
C3-01	Slip compensation gain	0.0 to 2.5	-	1.0	1.0	1.0	1.0
C4-02	Torque compensation delay time	0 to 10000	msec	200	20	-	-
C5-01	ASR P gain 1	1.00 to 300.00	-	-	-	40.00	12.00
C5-02	ASR Integral time 1	0.000 to 10.000	sec	-	-	0.500	0.300
C5-03	ASR P gain 2	1.00 to 300.00	-	-	-	20.00	6.00
C5-07	ASR gain switching frequency	0.0to 120.0	→	-	-	0.0 Hz	2.0 %
C5-09	ASR P gain 3	1.00 to 300.00	-	-	-	40.00	12.00
C5-10	ASR Integral time 3	0.000 to 10.000	sec	-	-	0.500	0.300
E1-04	Max. Frequency	0 to 120.00 Hz	Hz	50.00	50.00	50.00	-
		20 to 7200 rpm	rpm	-	-	-	150
E1-06	Base Frequency	0 to 120.00 Hz	Hz	50.00	50.00	50.00	-
		20 to 7200 rpm	rpm	-	-	-	150
E1-08	Mid. output frequency voltage (VB)*1	0.0 to 510.0	V	37.4	25.0	-	-
E1-09	Min. output frequency (FMIN)	0 to 120.00 Hz	Hz	0.5	0.3	0.0	-
		20 to 7200 rpm	rpm	-	-	-	0
E1-10	Min. output frequency voltage (VMIN)	0.0 to 510.0	V	19.4	5.0	-	-
E1-13	Base Frequency	0.0 to 510.0	V	0.0	0.0	-	400
E2-05	Mid. output frequency (FB)	0 to 120.00 Hz	Hz	2.5	3.0	-	-
E3-06	Mid. output frequency voltage (VB)*1	0.0 to 510.0	V	30.0	26.4	-	-
E3-07	Min. output frequency (FMIN)	0.0 to 120.0	Hz	1.2	0.5	0.0	-
E3-08	Min. output frequency voltage (VMIN)*1	0.0 to 510.0	V	18.0	4.8	-	-
F1-01	PG constant	0 to 60000	-	-	-	1024	-
		512, 1024*2, 2048	-	-	-	-	2048
F1-05	PG rotation direction	0 or 1	-	-	-	0	-
				-	-	-	1
F1-04	AO-12 Channel 1 Signal selection	1 to 56	-	2	2	2	-
		1 to 75		-	-	-	5
L1-01	Motor protection selection	0 to 3	-	1	1	1	-
		0 or 5		-	-	-	5
L4-01/03	Speed agreement detection level	0 to 120.00	Hz	0.0	0.0	0.0	-
		0.0 to 100.0	%	-	-	-	0.0
L4-02/04	Speed agreement detection width	0.0 to 20.0	Hz	2.0	2.0	2.0	-
		0.0 to 40.o	%	-	-	-	4.0
L8-09	Output open phase detection selection	0 to 2	-	2	2	2	-
		0 or 1	-	-	-	-	0
n5-01	Feed forward control selection	0 or 1	-	-	-	1	0
o1-03	Frequency monitor/reference display	0 to 39999	-	0	0	0	1
o1-04	V/f pattern frequency parameter unit	0 or 1	-	-	-	0	1
S1-01	Zero speed level	0.00 to 10.00	Hz	1.2	0.5	0.1	0.5

*1. The given values are for a 400 V class Inverter.
*2. Can be set only if Hiperface is selected as interface.

■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	Closed Loop Vector (PM)
E1-03	-	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F			
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	50.0	50.0	50.0	-
	rpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150
E1-05 *1	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	190.0	190.0	190.0	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	50.0	50.0	50.0	-
	rpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150
E1-07 *1	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	-	-
	rpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E1-08 *1	V	14.0	14.0	14.0	14.0	35.0	50.0	35.0	50.0	18.0	23.0	18.0	23.0	14.0	14.0	14.0	18.6	12.5	-	-
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	0.5	0.3	0.0	-
	rpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
E1-10 *1	V	7.0	7.0	7.0	7.0	6.0	7.0	6.0	7.0	9.0	11.0	9.0	13.0	7.0	7.0	7.0	9.7	2.5	-	-
E1-13	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0

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

■200 V and 400V Class Inverters of 55 kW*

Parameter Number	Unit	Factory Setting																Open Loop Vector Control	Closed Loop Vector Control	Closed Loop Vector (PM)
E1-03	-	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F			
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	50.0	50.0	50.0	-
	rpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150
E1-05 *1	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	190.0	190.0	190.0	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	50.0	50.0	50.0	-
	rpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150
E1-07 *1	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	-	-
	rpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E1-08 *1	V	12.0	12.0	12.0	12.0	35.0	50.0	35.0	50.0	15.0	20.0	15.0	20.0	12.0	12.0	12.0	16.0	12.5	-	-
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	0.5	0.3	0.0	-
	rpm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
E1-10 *1	V	6.0	6.0	6.0	6.0	5.0	6.0	5.0	6.0	7.0	9.0	7.0	11.0	6.0	6.0	6.0	8.3	2.5	-	-
E1-13	V	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	200.0

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

5

◆ Factory Settings Changing with Inverter Capacity (o2-04)

■200 V Class Inverters

Parameter Number	Name	Unit	Factory Setting						
-	Inverter Capacity	kW	3.7	5.5	7.5	11	15	18.5	22
o2-04	kVA selection	-	4	5	6	7	8	9	A
C6-02	Carrier frequency	-	3	3	3	3	3	3	3
E2-01 (E4-01)	Motor rated current	A	14.00	19.60	26.60	39.7	53.0	65.8	77.2
E2-02 (E4-02)	Motor rated slip	Hz	2.73	1.50	1.30	1.70	1.60	1.67	1.70
E2-03 (E4-03)	Motor no-load current	A	4.50	5.10	8.00	11.2	15.2	15.7	18.5
E2-05 (E4-05)	Motor line-to-line resistance	W	0.771	0.399	0.288	0.230	0.138	0.101	0.079
E2-06 (E4-06)	Motor leak inductance	%	19.6	18.2	15.5	19.5	17.2	20.1	19.5
E2-10	Motor iron loss for torque compensation	W	112	172	262	245	272	505	538
E5-02	PM motor rated power	kW	3.70	5.50	7.50	11.00	15.00	18.50	22.00
E5-03	PM motor rated current	A	14.60	20.00	29.30	37.9	53.2	65.0	76.4
E5-04	PM number of poles	-	4	4	4	4	4	4	4
E5-05	PM motor line-to-line resistance	Ohm	0.331	0.370	0.223	0.153	0.095	0.069	0.054
E5-06	PM d-axis inductance	mH	0.478	0.539	0.358	0.346	0.246	0.199	0.170
E5-07	PM q-axis inductance	mH	0.652	0.736	0.489	0.469	0.370	0.299	0.255
E5-09	PM voltage constant	mV	2.393	2.543	3.270	2.700	2.543	2.567	2.611
L8-02	Overheat pre-alarm level	°C	75	73	75	80	65	75	75
L8-06	Input open-phase protection level	%	12	10	17	21	17	15	24
n5-02 (A1-02=3)	Motor acceleration time	sec	0.154	0.168	0.175	0.256	0.244	0.317	0.355
n5-02 (A1-02=5)	Motor acceleration time	sec	0.121	0.081	0.075	0.082	0.099	0.098	0.096

Parameter Number	Name	Unit	Factory Setting			
-	Inverter Capacity	kW	30	37	45	55
o2-04	kVA selection	-	B	C	D	E
C6-02	Carrier frequency	-	2	2	2	2
E2-01 (E4-01)	Motor rated current	A	105.0	131.0	160.0	190.0
E2-02 (E4-02)	Motor rated slip	Hz	1.80	1.33	1.60	1.43
E2-03 (E4-03)	Motor no-load current	A	21.9	38.2	44.0	45.6
E2-05 (E4-05)	Motor line-to-line resistance	W	0.064	0.039	0.030	0.022
E2-06 (E4-06)	Motor leak inductance	%	20.8	18.8	20.2	20.5
E2-10	Motor iron loss for torque compensation	W	699	823	852	960
E5-02	PM motor rated power	kW	30.00	37.00	45.00	55.00
E5-03	PM motor rated current	A	103.5	133.1	149.4	181.6
E5-04	PM number of poles	-	4	4	4	4
E5-05	PM motor line-to-line resistance	Ohm	0.041	0.027	0.022	0.016
E5-06	PM d-axis inductance	mH	0.129	0.091	0.090	0.072
E5-07	PM q-axis inductance	mH	0.200	0.141	0.139	0.111
E5-09	PM voltage constant	mV	2.604	2.451	2.760	2.771
L8-02	Overheat pre-alarm level	°C	70	85	90	80
L8-06	Input open-phase protection level	%	20	18	20	17
n5-02 (A1-02=3)	Motor acceleration time	sec	0.323	0.320	0.387	0.317
n5-02 (A1-02=5)	Motor acceleration time	sec	0.126	0.124	0.188	0.186

■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
C6-02	Carrier frequency	-	3	3	3	3	3	3
E2-01 (E4-01)	Motor rated current	A	7.00	7.00	9.80	13.30	19.9	26.5
E2-02 (E4-02)	Motor rated slip	Hz	2.70	2.70	1.50	1.30	1.70	1.60
E2-03 (E4-03)	Motor no-load current	A	2.30	2.30	2.60	4.00	5.6	7.6
E2-05 (E4-05)	Motor line-to-line resistance	W	3.333	3.333	1.595	1.152	0.922	0.550
E2-06 (E4-06)	Motor leak inductance	%	19.3	19.3	18.2	15.5	19.6	17.2
E2-10	Motor iron loss for torque compensation	W	130	130	193	263	385	440
E5-02	PM motor rated power	kW	3.70	4.00	5.50	7.50	11.0	15.0
E5-03	PM motor rated current	A	7.31	7.31	10.00	14.60	19.0	26.6
E5-04	PM number of poles	-	4	4	4	4	4	4
E5-05	PM motor line-to-line resistance	Ohm	1.326	1.326	1.479	0.892	0613	0.378
E5-06	PM d-axis inductance	mH	1.911	1.911	2.158	1.433	1.384	0.985
E5-07	PM q-axis inductance	mH	26.08	26.08	2.944	1.956	1.983	1.479
E5-09	PM voltage constant	mV	4.786	4.786	5.084	4.739	5.400	5.084
L8-02	Overheat pre-alarm level	°C	90	90	85	90	73	90
L8-06	Input open-phase protection level	%	12	10	10	20	23	17
n5-02 (A1-02=3)	Motor acceleration time	sec	0.154	0.154	0.168	0.175	0.265	0.244
n5-02 (A1-02=5)	Motor acceleration time	sec	0.121	0.081	0.081	0.075	0.082	0.099

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
C6-02	Carrier frequency	-	3	3	2	2	2	2
E2-01 (E4-01)	Motor rated current	A	32.9	38.6	52.3	65.6	79.7	95.0
E2-02 (E4-02)	Motor rated slip	Hz	1.67	1.70	1.80	1.33	1.60	1.46
E2-03 (E4-03)	Motor no-load current	A	7.8	9.2	10.9	19.1	22.0	24.0
E2-05 (E4-05)	Motor line-to-line resistance	W	0.403	0.316	0.269	0.155	0.122	0.088
E2-06 (E4-06)	Motor leak inductance	%	20.1	23.5	20.7	18.8	19.9	20.0
E2-10	Motor iron loss for torque compensation	W	508	586	750	925	1125	1260
E5-02	PM motor rated power	kW	18.5	22.0	30.0	37.0	45.0	55.0
E5-03	PM motor rated current	A	32.5	38.2	51.8	66.6	74.7	90.8
E5-04	PM number of poles	-	4	4	4	4	4	4
E5-05	PM motor line-to-line resistance	Ohm	0.276	0.217	0.165	0.107	0.087	0.064
E5-06	PM d-axis inductance	mH	0.795	0.680	0.515	0.362	0.359	0.287
E5-07	PM q-axis inductance	mH	1.194	1.022	0.800	0.563	0.555	0.444
E5-09	PM voltage constant	mV	5.137	5.223	5.208	4.902	5.520	5.544
L8-02	Overheat pre-alarm level	°C	80	80	72	80	82	73
L8-06	Input open-phase protection level	%	17	20	20	20	20	20
n5-02 (A1-02=3)	Motor acceleration time	sec	0.317	0.355	0.323	0.320	0.387	0.317
n5-02 (A1-02=5)	Motor acceleration time	sec	0.098	0.096	0.126	0.124	0.188	0.186

6

Parameter Settings by Function

Carrier Frequency Derating and Current Limitation

◆ Carrier Frequency Setting

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

■Related Parameters

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

■Carrier Frequency Selection

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

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

■Carrier Frequency and Inverter Overload Capability

If the carrier frequency is increased the rated current is decreased and vice versa (refer to *page 9-6, Carrier Frequency Derating*). The overload capability is always 150% of the derated inverter current for 30 sec. If this over load limit is exceeded the inverter trips with an inverter overload fault (OL2).

◆ Current limitation level at low speeds

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

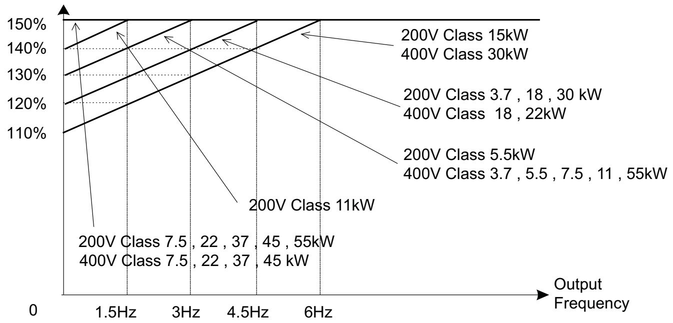


Fig 6.1 Low frequency current limitation

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.
- For selecting an inverter please consider the low frequency current limit as described above and select an inverter with an appropriate current margin.

Control / Brake Sequence

◆ Up and Down Commands

■Travel start in Up or Down direction

UP and Down commands are the travel direction information.

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

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

■Travel stop

The inverter can be stopped as follows:

- The direction command (UP or Down) signal is removed.
- The speed reference selection signal is removed if digital inputs are used for speed reference selection.
- If d1-18 is set to 3 and all speed inputs are removed

■Up / Down Command Source Selection

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

Related Parameters

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

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

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

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

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

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

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

◆ Speed Reference Source Selection

■Speed Reference Source Selection

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

Related Parameters

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

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

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

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

When b1-01 is set to 1 the speed reference can be input at terminal A1 as a 0 to +10V signal. If an analog option card AI-14B is installed, the A1 signal is replaced by the Channel 1 input of the AI card.
The analog reference signal can also be used as 1st speed if multispeed operation is selected (d1-18=0, refer to *page 6-5, Speed Selection Sequence Using Digital Inputs* for details).
If parameter d1-18 is set to 0 and b1-01 is set to 1, the analog input value replaces any speed selected by the digital inputs except the service speed.

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

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

◆ Speed Selection Sequence Using Digital Inputs

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

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

■Multi-Step Speed Operation 1/2 (Binary Input) (d1-18=0/3)

If d1-18 = 0

8 preset speed steps (defined in the parameters d1-01 to d1-08) can be selected using 3 binary coded digital inputs. The Up/Down command starts the inverter. It stops when the Up/Down command is removed.

If d1-18 = 3

7 preset speed steps (defined in the parameters d1-02 to d1-08) can be selected using 3 binary coded digital inputs. The Up/Down command starts the inverter. It is stopped when the Up/Down command is removed or when no speed is selected (all D/Is off).

Related Parameters

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

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

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

Speed Selection Table

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

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

If an AI-14B option card is used and the functions for channel CH2 and CH3 are set to “Auxiliary Frequency 2” (H3-05/09=2) and “Auxiliary Frequency 3” (H3-05/09=3).

Speed	Multi-step Speed Command 1	Multi-step Speed Command 2	Multi-step Speed Command 3	Selected Frequency	
				d1-18 = 0	d1-18 = 3
1	OFF	OFF	OFF	Frequency reference 1 d1-01 or A1/AI-14B CH1	Stop
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	

■Nominal / Leveling Speed Detection with Multi Speed Inputs

Using this function the inverter can distinguish between the nominal and leveling speed when the speed selection is done by multifunction inputs which is required by other functions like the ASR controller, short floor operation and slip compensation for V/f control.

Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
S3-04	Nominal/Leveling speed detection level	0.00 Hz	No	A	A	A	A

If the

- reference speed >= S3-04 the selected speed is regarded as nominal speed
- reference speed < S3-04 the selected speed is regarded as leveling speed

6

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

If d1-18 is set to 1, 6 different speeds can be set and selected using four digital inputs.

Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods				Digital Input Setting (H1-01 to H1-05)
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	
d1-09	Nominal Speed	50.00 Hz	Yes	Q	Q	Q	-	80
		100.00%		-	-	-	Q	
d1-10	Intermediate Speed 1	0.00 Hz	Yes	A	A	A	-	81
		0.00%		-	-	-	A	
d1-11	Intermediate Speed 2	0.00 Hz	Yes	A	A	A	-	-*1
		0.00%		-	-	-	A	
d1-12	Intermediate Speed 3	0.00 Hz	Yes	A	A	A	-	-*1
		0.00%		-	-	-	A	
d1-13	Releveling Speed	0.00 Hz	Yes	A	A	A	-	82
		0.00%		-	-	-	A	
d1-17	Leveling Speed	4.00 Hz	Yes	Q	Q	Q	-	83
		8.00%		-	-	-	Q	
S3-09	Frequency reference loss detection when d1-18 = 1 and H1-☐☐≠83. 0: Disabled 1: Enabled	1	No	A	A	A	A	-

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

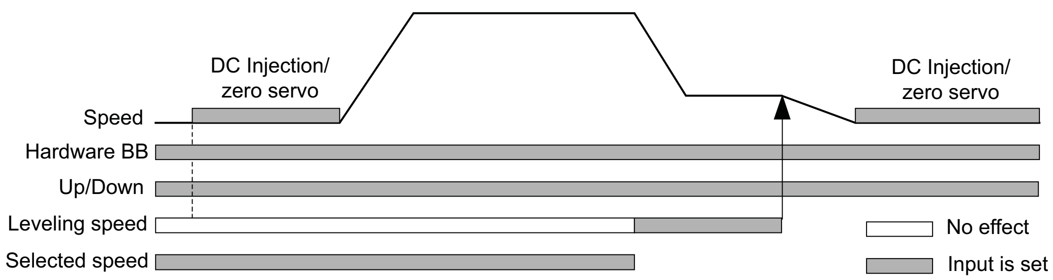
Digital Input Factory Settings

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

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

If d1-18 is set to 1 and one multi-function digital input is set to leveling speed selection (H1-☐☐=83), the inverter decelerates to the leveling speed (d1-17) when the selected speed signal is removed. Inspection Speed can not be selected as travel speed. The higher speed has priority over the leveling speed, i.e. as long as a higher speed is selected, the leveling signal is disregarded (see the fig. below)

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



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

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

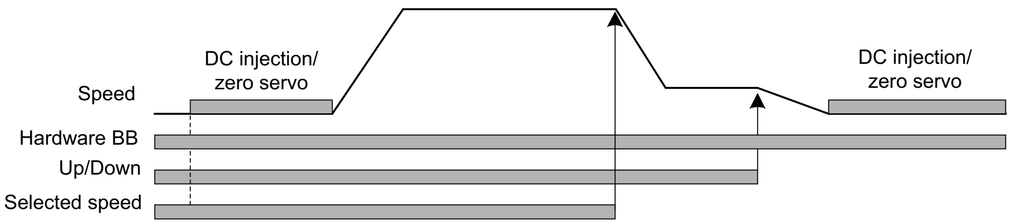
* 0 = disabled, 1 = enabled, X = no meaning

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

When the leveling speed command is not selected for any digital input, the inverter decelerates to the leveling speed (d1-17) when the selected speed signal is removed. Inspection Speed can not be selected as travel speed To select the leveling speed as travel speed the frequency reference loss detection must be disabled (S3-09=0).

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

When no speed selection input is set the leveling speed is taken as the speed reference.



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

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

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

The inverter stops when the direction signal (UP or DOWN signal) is removed.

IMPORTANT

With this configuration the drive stops with a “FRL” (frequency reference loss fault) when no speed reference input is selected during the start.
To disable the FRL detection, set parameter S3-09 to “0”.

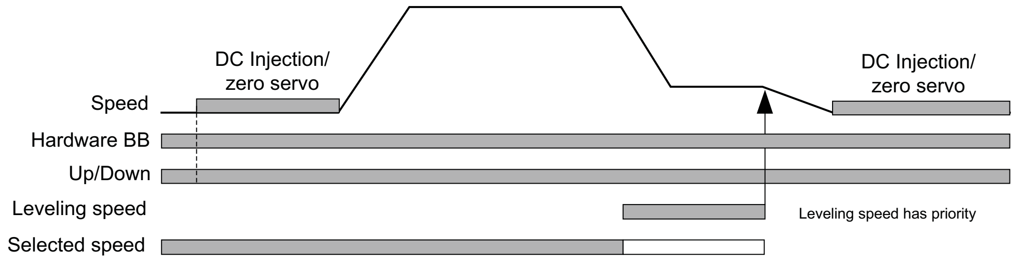
■Separate Speed Selection Inputs, Leveling Speed Has Priority (d1-18=2)

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

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

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

The inverter stops when the leveling speed command is removed.



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

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

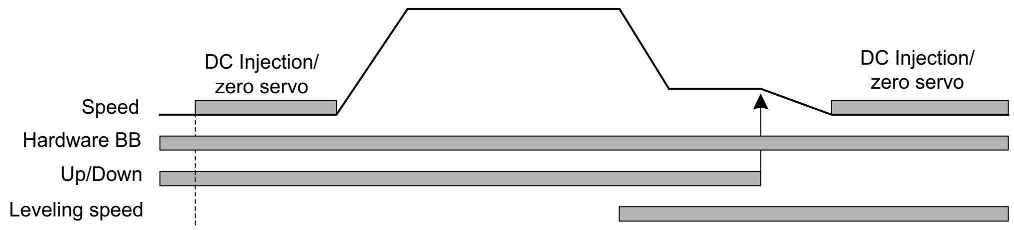
* 0 = disabled, 1 = enabled, X = no meaning

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

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

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

CAUTION: This sequence can be risky if e.g. the speed selection doesn’t work for any reason (broken wire etc.).



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

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

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

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

◆ Emergency Stop

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

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

■Related parameters

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

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

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

6

◆ Inspection RUN

The inspection run can be activated in two ways:

1. A digital input can be used if parameter d1-18 = 1 or 2. Therefore a inspection speed must be set and any of the digital inputs must be set to “Inspection Run Selection” (H1-☐☐=84) (see below).
2. A speed reference comparison value (parameter S3-19) decides if inspection run is activated or not. This function work only if parameter d1-18 = 0 or 3 and if the inspection speed command is not assigned to any digital input (H1-☐☐≠84).

■Related parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
d1-14	Inspection Speed	25.00 Hz	No	A	A	A	-
		50.00%		-	-	-	A
S3-03	Inspection Deceleration time	0.0 sec	No	A	A	A	A
S3-19	Inspection speed detection upper level	0.00 Hz	No	A	A	A	A

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

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

6

■Inspection Run Selection by Digital Input

The inspection run digital input must be set before the Up/Down signal is set. During the start of the inspection RUN, the normal brake sequence is used and the inverter accelerates to the inspection speed (d1-14). The stop method depends on the setting of parameter S3-03.

■Inspection Speed Selection by Comparison Value

Using this function the inverter can detect the inspection speed by the selected speed reference. The speed must be selected before the Up/Down signal is set. If S3-04 < selected speed ≦ S3-19 the selected speed is regarded as inspection speed. The normal start sequence is used, the stop method depends on the setting of parameter S3-03.

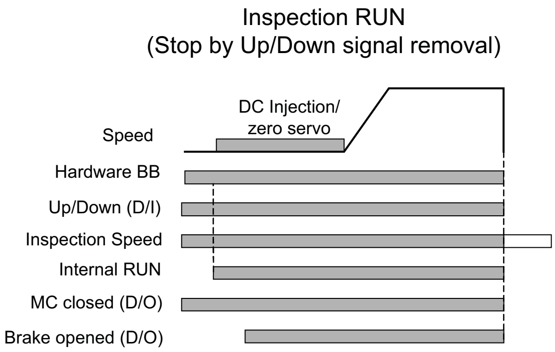
■Inspection Run Stop Behavior

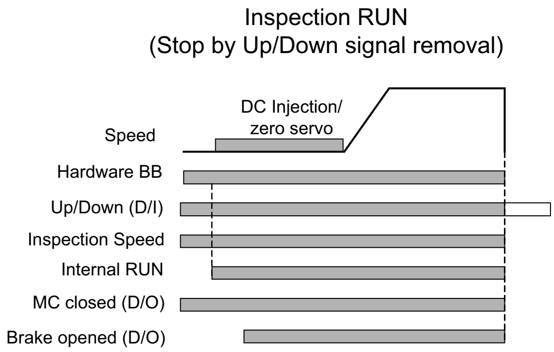
S3-03 = 0.0 sec., Stop without deceleration ramp

The inverter stops when the Inspection Speed command or the Up/Down command is removed. In this case:

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

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



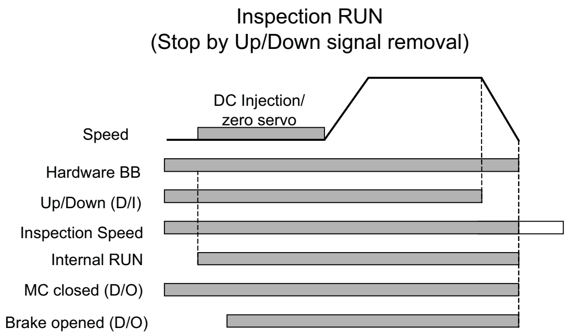


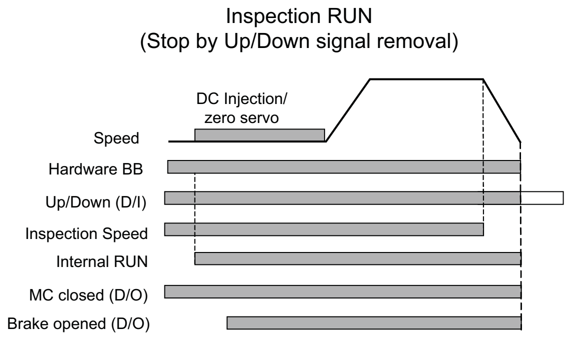
S3-03 > 0 sec., Stop with deceleration ramp

The inverter stops when the Inspection Speed command or the Up/Down command is removed. In this case:

- The output frequency is reduced using the deceleration time set in S3-03.
- When the minimum frequency is reached the brake open signal is removed immediately and the contactor control output is removed immediately
- The inverter output is cut after the brake open command removal.

The falling edge of the Inspection Speed command or UP/DOWN commands triggers the deceleration.





INFO

During inspection run the carrier frequency is reduced to 2 kHz.

6

◆ Brake Sequence

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

■Related Parameters

Parameter No.	Name	Factory setting	Change during operation	Control Method			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
H3-15	Terminal A1 function selection	0	No	-	-	A	A
S1-01	Zero speed level	→	No	A 1.2 Hz	A 0.5 Hz	A 0.1 Hz	A 0.5 Hz
S1-02	DC injection braking current at start	50%	No	A	A	-	-
S1-03	DC injection braking current at sop	50%	No	A	A	-	-
S1-04	DC injection braking/Zero speed time at start	0.40 sec	No	A	A	A	A
S1-05	DC injection braking/Zero speed time at stop	0.60 sec	No	A	A	A	A
S1-06	Brake open delay time	0.20 sec	No	A	A	A	A
S1-07	Brake close delay time	0.10 sec	No	A	A	A	A
S1-16	Run delay time	0.10 sec	No	A	A	A	A
S1-17	DC injection current gain at regeneration	100%	No	-	A	-	-
S1-18	DC injection current gain at motoring	20%	No	-	A	-	-
S1-19	Output contactor open delay time	0.10 sec	No	A	A	A	A
S1-20	Zero-servo gain start	5	No	-	-	A	A
S1-21	Zero-servo completion width	10	No	-	-	A	A
S1-22	Starting torque compensation increase time/ starting torque fade-out time	500 ms	No	-	-	A	A
S1-23	Torque compensation gain in Down direction	1.0	No	-	-	A	A
S1-24	Torque compensation bias in Up direction	0.0%	No	-	-	A	A
S1-25	Torque compensation bias in Down direction	0.0%	No	-	-	A	A
S1-29	Torque fade out speed level	0.0 Hz	No	-	-	A	A
S1-30	Torque fade out compensation time	1000 msec	No	-	-	A	A
S1-31	Torque limit fade out time at stop	0 msec	No	-	-	-	A
S1-32	Zero servo gain stop	5	No	-	-	A	A
S1-33	Zero servo gain 2	0.00	No	-	-	-	A
S1-34	SE4 Detection Time	0.50 sec	No	A	A	A	A

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

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
80 to 84	Speed selection inputs (refer to *page 6-5, Speed Selection Sequence Using Digital Inputs*)	Yes	Yes	Yes	Yes
86	Contactor closed answer back signal	Yes	Yes	Yes	Yes

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

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
33	Zero servo end	-	-	Yes	Yes

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
40	Brake release command	Yes	Yes	Yes	Yes
41	Output contactor close command	Yes	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 not be set to 14. (H3-05/09 ≠ 14, torque reference not selected)

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

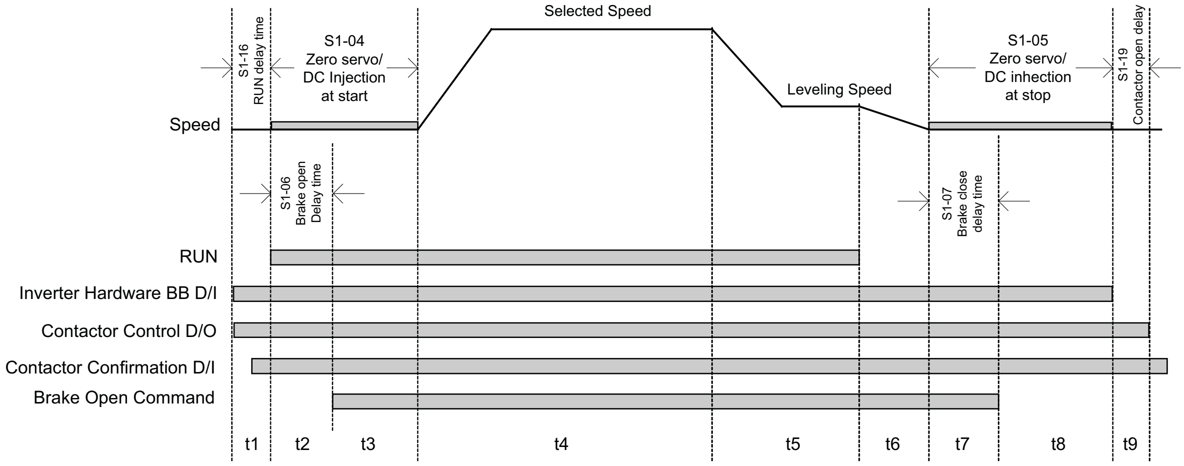


Fig 6.2 Timing chart of Brake sequence without torque compensation at start

6

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

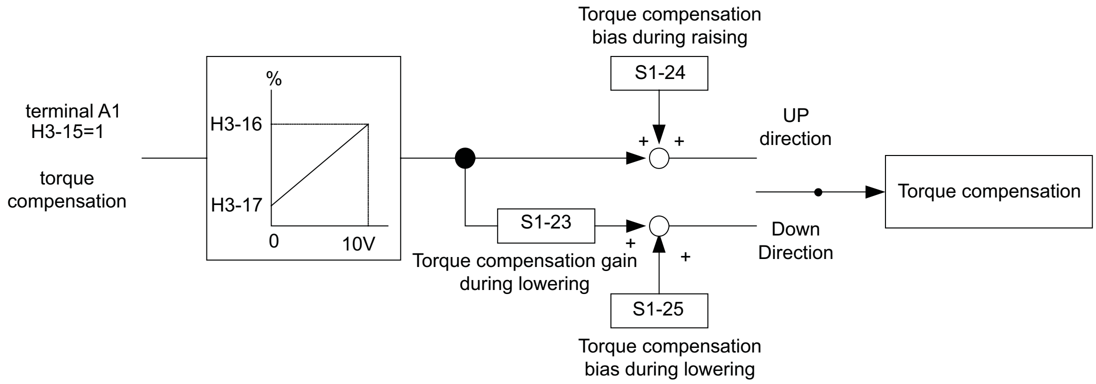
Timing	Description
t1	The inverter gets the direction signal (UP/DOWN)
	The inverter gets the hardware base block disable signal (Not BB condition).
	The inverter receives the speed reference signal.
	The inverter sets the contactor closed signal.
	The inverter waits for the contactor confirmation signal. If no digital input is set to contactor confirmation signal (H1-□□=86), the sequence is proceeded after exceeding the operation start delay time (S1-16).
t2	When the RUN delay time (S1-16) has elapsed, DC injection (Open Loop) or zero servo operation (position lock in Closed Loop) is started. When the brake open delay time (S1-06) has elapsed, the inverter sets the brake open command.
t3	The inverter keeps DC injection/zero speed operation until * the time S1-04 – S1-06 has elapsed if S1-06 < S1-04 or * the time S1-06 has elapsed if S1-06 > S1-04 (try to avoid this setting since the motor could be driven against the brake)
t4	The speed is increased to the selected speed and is kept constant until the leveling speed is selected.
t5	The speed is decreased to the leveling speed and is kept constant until the stop signal is given (depending on d1-18 either by removing the direction signal, by removing the leveling signal or by deleting the speed inputs, see *page 6-5, Speed Selection Sequence Using Digital Inputs*)
t6	The speed is decreased to the zero speed level.
t7	When the zero speed level is reached (S1-01), the DC injection (Open Loop) or zero servo operation (position lock in Closed Loop) is applied for the time set in S1-05. When the brake close delay time (S1-07) has elapsed, the brake open command is removed.
t8	The inverter continues DC Injection (Open Loop) or zero speed operation (Closed Loop) until the time S1-06 – S1-07 has elapsed. After that the inverter output is shut down and the hardware base block signal must be set.
t9	After the output contactor open delay time (S1-19) has elapsed, the output contactor close signal is removed.

■Brake Sequence with Torque Compensation at Start (Closed Loop Vector for IM and PM only)

Torque Compensation function

If a load measuring device is installed in the elevator, an analog input can be used to input a torque compensation value to the inverter. This function requires Closed Loop Vector control for IM or PM.
The input torque compensation value is latched when the direction command is given. At the start it is increased from zero to the latched value using the torque increase time set in parameter S1-22. The torque compensation value fades out to 0 using the time constant S1-30 after the speed has reached the torque compensation fade out level.

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



The torque compensation input source can be selected as follows:

- the analog input A1 can be used, if b1-01 is not set to 1 (speed reference source is not the A1 input) and the A1 function is selected for torque compensation (H3-15=1)
- the channel Ch1 of an AI-14B option card can be used, if b1-01 is not set to 1 (speed reference source is not the A1 input) and the A1 function is selected for torque compensation (H3-15=1)
- one of the input channels Ch2 or Ch3 of an AI-14B option card can be used when the input function for is set to “Torque Compensation” (H3-05 or H3-09=14). The setting of b1-01 has no influence here.

Brake Sequence

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

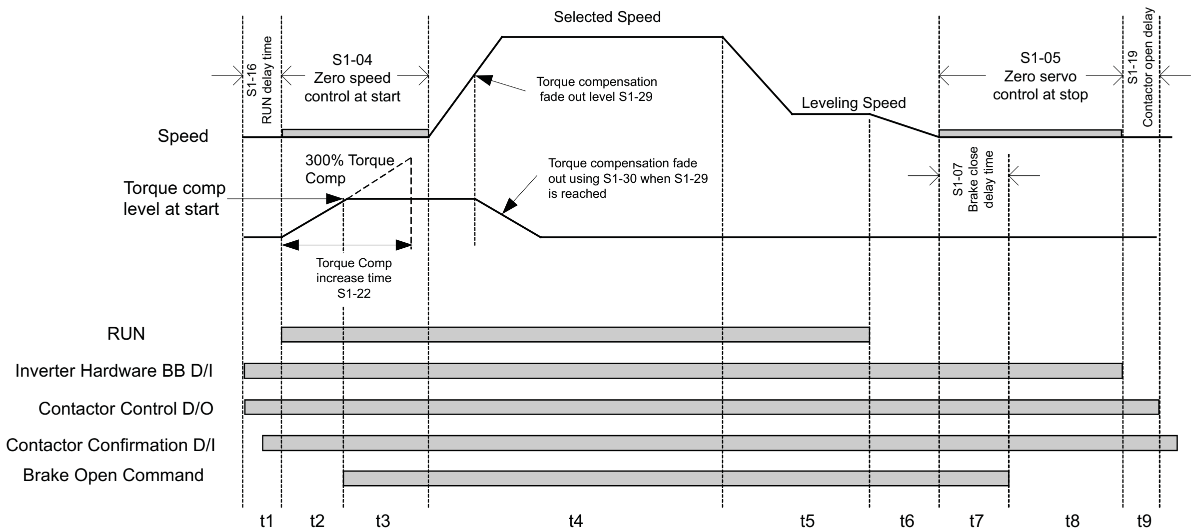


Fig 6.3 Timing chart of Brake sequence with torque compensation at start

6

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

Timing	Description
t1	The inverter gets the direction signal (UP/DOWN)
	The inverter gets the hardware base block signal disable signal (Not BB condition).
	The inverter receives the speed reference signal.
	The inverter sets the contactor close signal.
	The inverter waits for the contactor confirmation signal. If no digital input is set to contactor confirmation signal (H1-☐☐=86), the sequence is proceeded after exceeding the operation start delay time (S1-16).
t2	The zero speed control operation is started. The analog torque compensation input is latched and the torque compensation value is increased from zero to the latch value using the time constant set in parameter S1-22. After reaching the torque compensation level at start, the inverter sets the brake open command.
t3	The brake opens and the zero speed operation (no position lock) is continued until S1-04 has elapsed.
t4	The speed is increased to the selected speed and is kept constant until the leveling speed is selected. During acceleration, when the torque fade out speed level S1-29 is reached, the torque compensation value is fade out to 0 using the time constant set in S1-22.
t5	The speed is decreased to the leveling speed and is kept constant until the stop signal is given (depending on d1-18 either by removing the direction signal, by removing the leveling signal or by deleting the speed inputs, see *page 6-5, Speed Selection Sequence Using Digital Inputs*).
t6	The speed is decreased to the zero speed level.
t7	When the Zero Speed Level (S1-01) is reached, zero servo operation (position lock in Closed Loop) is applied for the time set in S1-05. When the brake close delay time (S1-07) has elapsed, the brake open command is removed.
t8	The inverter continues the zero speed operation until the time S1-06 – S1-07 has elapsed. After that the inverter output is shut down and the hardware base block signal must be set.
t9	After the output contactor open delay time (S1-19) has elapsed, the output contactor close signal is removed.

Torque Limit Fade Out Function (Closed Loop Vector for PM)

The torque limit fade out function smoothly reduced the torque limit to 0 after the zero speed time at stop has elapsed. It thereby can help to prevent shocks or vibrations when the motor stops and the brake is closed. The used time constant can be set in parameter S1-31. The function can be used in Closed Loop Vector control for PM motors only (A1-02 = 6).

6

■Zero Speed Control / Zero Servo (position lock)

In Closed Loop Vector control the inverter uses zero speed or zero servo control during the brake open or close procedure.

Zero Speed Control:

The inverter keeps the motor speed at zero, a roll-back is not compensated. This method is used for the start with a torque compensation value by analog input. The strength of the control can be tuned using the ASR parameters C5-☐☐. Refer to *page 6-33, Automatic Speed Regulator (ASR) (Closed Loop Vector only)* for tuning details.

Zero Servo Control:

The inverter tries to keep the rotor position, i.e. a roll back is compensated. This method is used for the start when no torque compensation is used and always for during stop (without and with torque compensation). Additionally to the ASR parameters C5-☐☐ the zero servo control can be tuned using the parameter S1-20 (Zero servo gain).

- Increase S1-20 if there is a rollback when the brake opens.
- Decrease S1-20 if vibrations occur when the zero servo function is active.

If a digital output is set to “Zero Servo End” (H2-☐☐=33), this output can be used to signalize, that the rotor position is within a certain bandwidth around the zero position which can be set in parameter S1-21 (the bandwidth is set in PG pulses and must be set 4 times of the allowable actual PG pulses).

■SE4 Detection

A Brake Answer Fault (SE4 Fault) will be detected when one of the digital multi-function outputs is programmed to Brake Release command (H2-xx = 40) and one of the digital multi-function inputs is programmed to Brake Release Check (H1-xx = 79) and both signals do not match for a longer time than set in S1-34 (SE4 Detection Time).

The Brake Asnwer Fault is not detected when:

- the second motor is selected
- S1-34 is set to 0.0 sec
- none of the digital multi-function inputs is set to 79 (Brake Release Check)

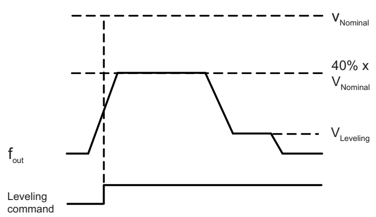
◆ Short Floor Operation

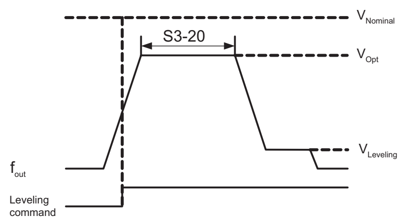
The short floor operation is activated if the leveling speed command is set before the nominal speed was reached. The L7 inverter supports 2 methods of short floor operation:

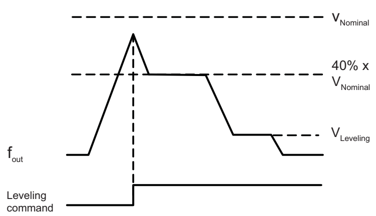
- Simple short floor operation which can be enabled by setting S3-01 = 1.
  When the leveling speed input is set and the reached speed is higher than 40% of the nominal speed, the inverter decelerates to 40% and keeps this speed for a calculated time before it decelerates to the leveling speed and finally stops. If the reached speed is below 40% of the nominal speed, the inverter accelerates to 40% speed and keeps it for a calculated time before it decelerates to the leveling speed.
  If the leveling input is set during constant speed run and the speed reference is lower than 40% of the nominal speed, the speed is hold for a calculated time in order to minimize the leveling distance. If the speed reference is higher than 40% but lower than the nominal speed, the speed is decreased to t 40% first, is hold for a calculated time an then decreased to the leveling speed.
- Advanced short floor operation which can be enabled by setting S3-01 = 2.
  If the leveling speed command is set the inverter calculates the optimal speed using the speed reference, two gain factors (S3-21/22) and a time constant (S3-20). If the leveling input is set before the optimal speed has been reached, the inverter accelerates to the optimal speed and keeps it for the time constant S3-20. If the leveling input is set when the optimal speed was exceeded, the inverter keeps the reached speed for a certain time before it decelerates to the leveling speed.

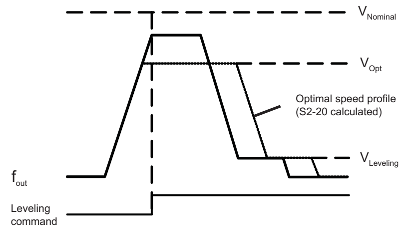
The table below shows the behavior of the short floor functions under different conditions.

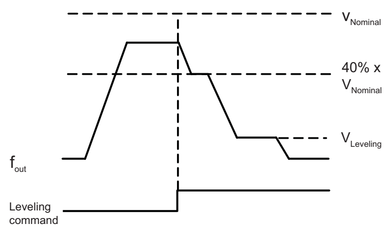
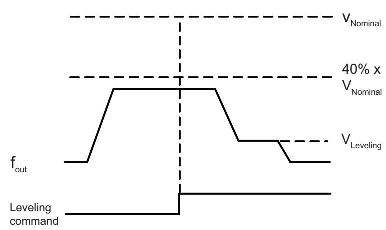
<table>
<tr><th>Condition</th><th>Standard Short Floor</th><th>Advanced Short Floor</th></tr>
<tr><td rowspan="2">During Acceleration</td><td>Leveling Signal before 40% of the nominal speed has been reached


</td><td>Leveling speed signal before V_{Opt} is reached


</td></tr>
<tr><td>Leveling Signal after 40% of the nominal speed has been reached.


</td><td>Leveling speed signal after V_{Opt} has been reached


</td></tr>
</table>

<table>
<tr><th>Condition</th><th>Standard Short Floor</th><th>Advanced Short Floor</th></tr>
<tr><td rowspan="2">During Run with constant speed</td><td>Leveling command during run with constant speed higher than 40%

</td><td rowspan="2">No effect</td></tr>
<tr><td>Leveling command during run with constant speed lower than 40%

</td></tr>
</table>

■Related parameters

<table>
<tr><th rowspan="2">Parameter No.</th><th rowspan="2">Name</th><th rowspan="2">Factory Setting</th><th rowspan="2">Change during Operation</th><th colspan="4">Control Methods</th></tr>
<tr><th>V/f</th><th>Open Loop Vector</th><th>Closed Loop Vector</th><th>Closed Loop Vector (PM)</th></tr>
<tr><td rowspan="2">d1-09</td><td rowspan="2">Nominal Speed</td><td>50.00 Hz</td><td rowspan="2">No</td><td>Q</td><td>Q</td><td>Q</td><td>-</td></tr>
<tr><td>100.00%</td><td>-</td><td>-</td><td>-</td><td>Q</td></tr>
<tr><td>d1-18</td><td>Speed reference priority selection</td><td>1</td><td>No</td><td>A</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>S3-01</td><td>Short floor operation</td><td>0</td><td>No</td><td>A</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>S3-04</td><td>Nominal / Leveling Speed detection level</td><td>0.0 Hz</td><td>No</td><td>A</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>S3-05</td><td>Nominal speed for short floor calculation</td><td>0.0Hz</td><td>No</td><td>A</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>S3-20</td><td>Minimum constant speed time</td><td>0.0 sec.</td><td>No</td><td>A</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>S3-21</td><td>Distance calculation acceleration time gain</td><td>150.0%</td><td>No</td><td>A</td><td>A</td><td>A</td><td>A</td></tr>
<tr><td>S3-22</td><td>Distance calculation deceleration time gain</td><td>150.0%</td><td>No</td><td>A</td><td>A</td><td>A</td><td>A</td></tr>
</table>

■Simple Short Floor Operation Setup

- The short floor function can be activated by setting parameter S3-01 to 1.
- If parameter d1-18 is set to 0 or 3 (multispeed input), the set value of parameter S3-05 is taken as nominal speed reference for the short floor calculation. Additionally it is required to use the nominal/leveling speed detection (refer to *page 6-6, Nominal / Leveling Speed Detection with Multi Speed Inputs*).
- If parameter d1-18 is set to 1 or 2 (dedicated speed inputs), the value of parameter d1-09 is taken as nominal speed. The set value of S3-05 has no meaning. The nominal/leveling speed detection must not be used.

■Advanced Short Floor Operation Setup

- The advanced short floor operation can be activated by setting parameter S3-01 to 2.
- If parameter d1-18 is set to 0 or 3 (multispeed input), the speed reference value, which was selected at the start, is taken as nominal speed for the speed pattern calculation. Parameter S3-04 is used for the leveling speed detection (refer to *page -6*).
- If parameter d1-18 is set to 1 or 2 (dedicated speed input), the value of parameter d1-09 is taken as nominal speed for the speed pattern calculation.

Setup the Acceleration and Deceleration Gain (S3-21, S3-22)

These parameters are used for the optimal speed calculation to compensate the S-curves (S-curves are not considered in the optimal speed calculation).

- Increase the gains S3-21 and S3-22 if the leveling time is too short or the calculated optimal speed is too high.
- Decreases the gains S3-21 and S3-22 if the leveling time is too short of the calculated optimal speed is too low.

IMPORTANT

1. S-Curves are not considered in the optimal speed calculation and have to be compensated by the gains S3-21 and S3-22.
2. A too low gain setting can result in a too high optimal speed and too short leveling time. Very low settings can lead to an overrun. Do not set the values lower than 100% (100% means, that the S-curve is not compensated.
3. If parameter d1-18 is set to 0 or 3 and the leveling speed input is released during short floor operation, the inverter accelerates or decelerates to the selected reference speed.
4. If the Dwell function (b6-□□ parameters) is activated, the dwell function is performed during short floor operation but it is not considered in the optimal speed calculation. The influence of the Dwell function must be compensated using the gains S3-21 and S3-22.
5. The advanced short floor function does not work during rescue operation and inspection run.
6. If the speed reference is input using an analog input the advanced short floor function should not be used.
7. If the advanced short floor function is used, the following parameter settings should be in given range:
   9.6 Hz ≦ E1-04 ≦ 100 Hz
   4.8 Hz ≦ d1-08 ≦ 100Hz
   0.1 sec. ≦ C1-□□ ≦ 50 sec.

6

Acceleration and Deceleration Characteristics

◆ Setting Acceleration and Deceleration Times

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

Four separate acceleration and deceleration times can be set. They can be switched over between using:

- digital input signals
- 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 0.00 sec.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
C1-01	Acceleration time 1	1.5 sec	Yes	Q	Q	Q	Q
C1-02	Deceleration time 1		Yes	Q	Q	Q	Q
C1-03	Acceleration time 2		Yes	A	A	A	A
C1-04	Deceleration time 2		Yes	A	A	A	A
C1-05	Acceleration time 3		No	A	A	A	A
C1-06	Deceleration time 3		No	A	A	A	A
C1-07	Acceleration time 4		No	A	A	A	A
C1-08	Deceleration time 4		No	A	A	A	A
C1-10	Acceleration/deceleration time setting unit	1	No	A	A	A	A
C1-11	Deceleration time switching frequency	0.0 Hz	No	Q	Q	Q	-
		0.00%		-	-	-	Q
S1-26	Dwell at start speed reference	0.0 Hz	No	-	-	A	A

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

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

■Setting Acceleration and Deceleration Time Units

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

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

6

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

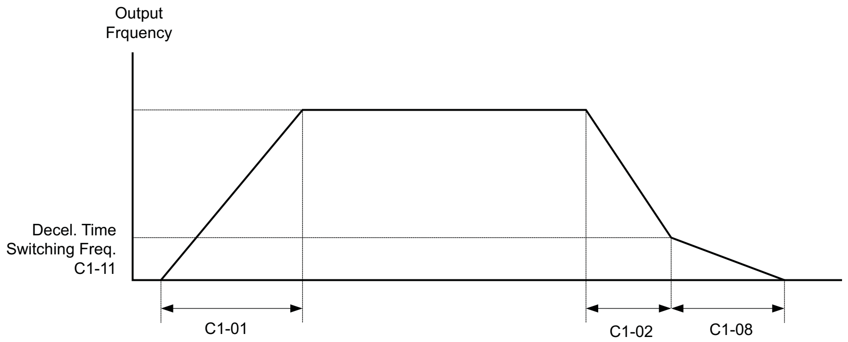
When two digital input terminals are set to “Accel./Decel. time switch over 1 and 2” (H1-☐☐=7 and 1A), the acceleration/deceleration times can be switched over even during operation by a binary combination of the inputs. The following table shows the acceleration/deceleration time switching combinations.

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

■Automatic Deceleration Time Switch Over Using a Speed Level

The deceleration times C1-02 and C1-08 can be switched over automatically at a certain speed which can be set in parameter C1-11. *Fig 6.4* 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 ≥ C1-11the deceleration time 1 (C1-02) is used.
When output frequency < C1-11the deceleration time 4 (C1-08) is used.

Fig 6.4 Acceleration/deceleration Time Switching Frequency

■Dwell at Start Function (Closed Loop Vector only)

The Dwell function can be used to reduce a staring jerk caused by high static friction.
After a start command, the output frequency is increased up to the Dwell speed set in parameter S1-26 using the acceleration time C1-07. As soon as the motor starts turning and the motor speed (PG feedback) reaches the acceleration time switching level C1-11, the acceleration is continued using the selected acceleration time starting with the S-curve set in parameter C2-01.

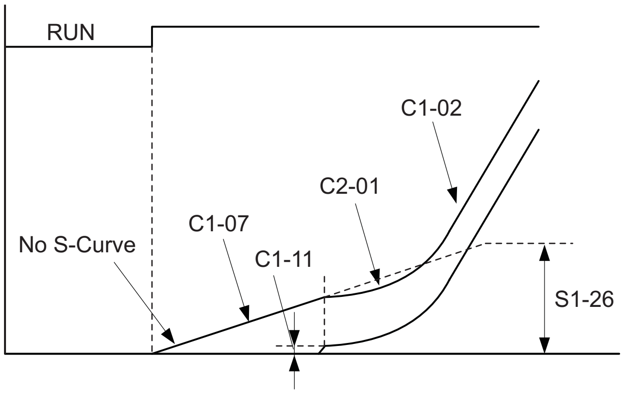


Fig 6.5 Dwell at start function

Note: When C1-11 is set much higher than S1-26, the motor speed cannot reach C1-11 and the motor can not accelerate to the selected speed. Therefore always set C1-11 equal or lower than S1-26!

6

◆ Acceleration and S-curve Settings

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

■Related Parameters

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

Fig 6.6 shows the influence of the different S-curve times.

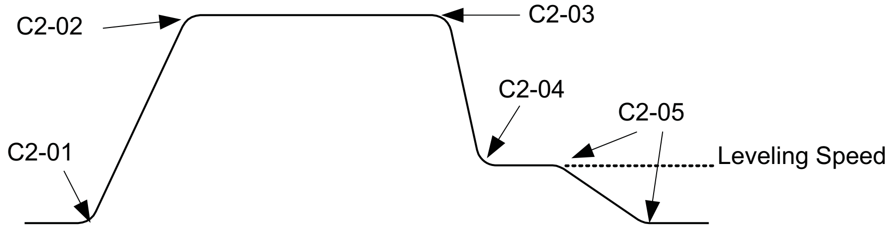


Fig 6.6 S-curve settings

6

◆ Output Speed Hold (Dwell Function)

The dwell function holds the speed temporarily.

■Related Parameters

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

■Applying an Output Speed Dwell

The dwell function at start is applied when the speed level set in parameter b6-01 is reached. The dwell speed 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. The dwell speed is kept for the time set in parameter b6-04. The setting is shown in *Fig 6.7*.

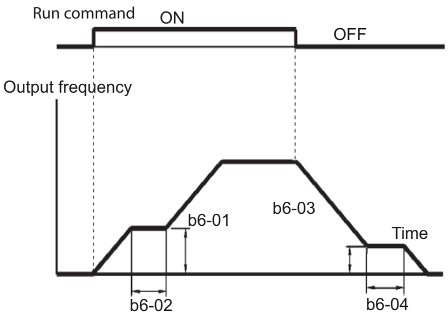


Fig 6.7 Output Frequency Dwell Settings

◆ 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 (optimal 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.

6

■Related Parameters

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

■Time Chart

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

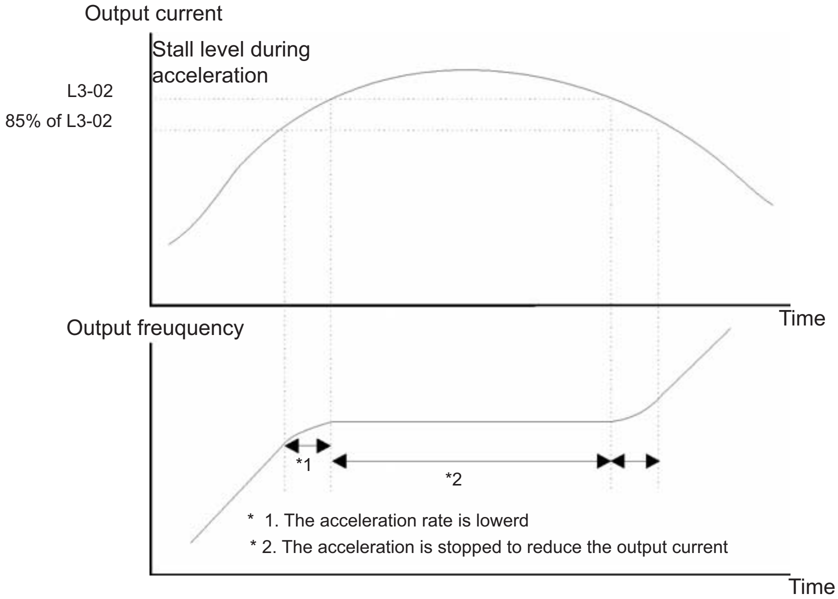


Fig 6.8 Time Chart for Stall Prevention During Acceleration

■Setting Precautions

- Set the parameters as a percentage taking the inverter rated current to be 100%.
- Do not increase the stall prevention level unnecessarily. An extremely high setting can reduce the inverter lifetime. Also do not disable the function.
- If the motor stalls with the factory settings check the V/f pattern settings (E1-☐☐) and the motor setup (E2-☐☐).
- If the stall level has to be increased very much to get the elevator running, consider to use a one size bigger inverter.

6

Adjusting Analog Input Signals

◆ Adjusting Analog Frequency References

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

■Related Parameters

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

6

■Adjusting Analog Input Signals

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

The input signal levels can be selected using,

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

The signals can be adjusted using the parameters:

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

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

Speed Detection and Speed Limitation

◆ Speed Agreement Function

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

■Related Parameters

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

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

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

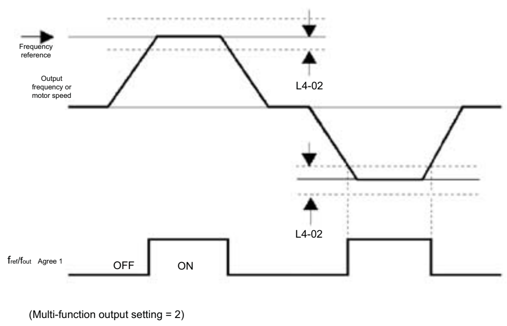
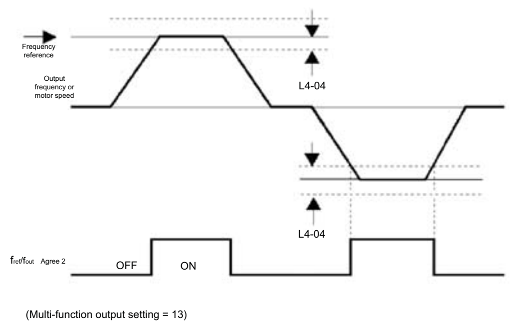
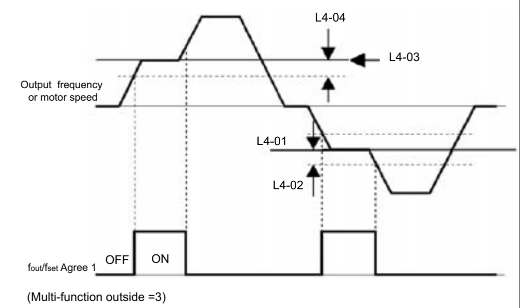
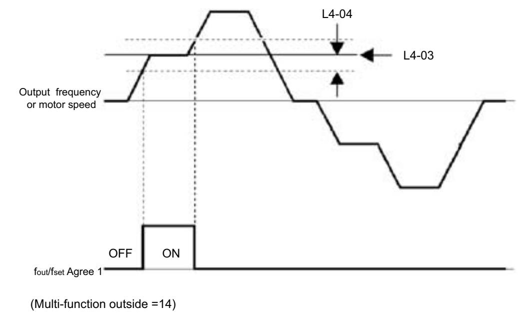
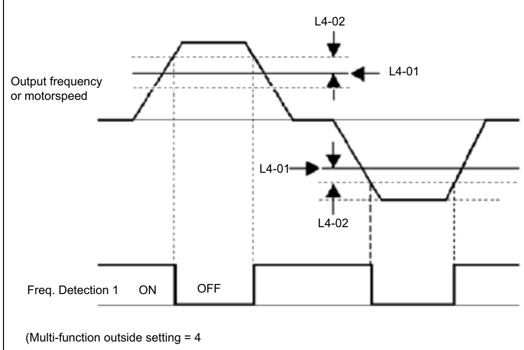
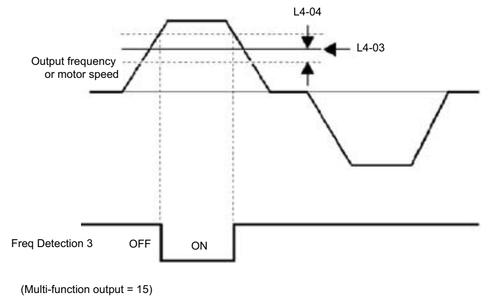
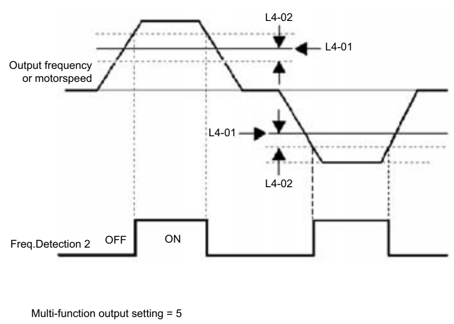
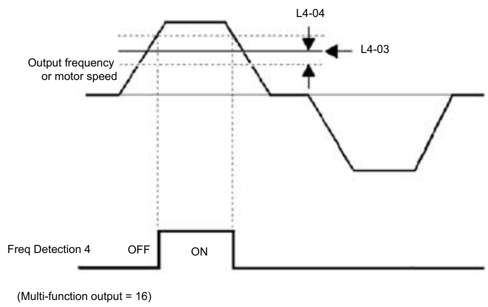
Function	Setting
f_{ref}/f_{out} Agree 1	2
f_{out}/f_{set} Agree 1	3
Frequency detection 1	4
Frequency detection 2	5
f_{ref}/f_{out} Agree 2	13
f_{out}/f_{set} Agree 2	14
Frequency detection 3	15
Frequency detection 4	16

■Setting Precautions

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

■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

</td><td>f_{ref}/f_{out} Agree 2

</td></tr>
<tr><td>f_{out}/f_{set} Agree</td><td>f_{out}/f_{set} Agree 1
(ON at the following conditions during frequency agree)

</td><td>f_{out}/f_{set} Agree 2
(ON at the following conditions during frequency agree)

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

</td><td>Frequency (FOUT) Detection 3
(L4-03 > Output frequency)

</td></tr>
<tr><td>Frequency (FOUT) Detection 2
(L4-01 < | Output frequency |)

</td><td>Frequency Detection 4
(L4-03 < Output frequency)

</td></tr>
</table>

6

◆ Limiting the Elevator Speed to the Leveling Speed (d1-17)

To use a high speed limit in the UP or DOWN direction to the leveling speed, one of the digital inputs must be set to “High speed limit switch Up” or “High speed limit Down” (H1-☐☐ = 87/88).

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

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

High speed limit switch Up

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

High speed limit switch Down

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

Improving the Operation Performance

◆ Reducing the Motor Speed Fluctuation (Slip Compensation Function)

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

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
C3-01	Slip compensation gain	1.0	Yes	A	A	-	-
C3-02	Slip compensation delay time	2000 ms	No	A	A	-	-
C3-03	Slip compensation limit	200%	No	A	A	-	-
C3-04	Slip compensation during regeneration	1	No	-	A	-	-
C3-05	Output voltage limit operation selection	0	No	-	A	A	-

■Adjusting Slip Compensation Gain (C3-01)

If C3-01 is set to 1.0, the slip compensation value at 100% load is equal to the rated slip set in parameter E2-02.

If necessary (motor speed is too high or too low) adjust the slip compensation gain as follows:

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

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

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

2. With V/f control set C3-01 to 1.0.
3. Apply a load and compare the speed reference and the actual motor speed during run with constant speed. Adjust the slip compensation gain by 0.1 at a time. If the speed is less than the target value, increase the slip compensation gain, if the speed is higher than the target value, reduce the slip compensation gain.
4. Setting C3-01 to 0.0 disables the slip compensation function.

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

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

■Adjusting Slip Compensation Limit (C3-03)

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

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

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

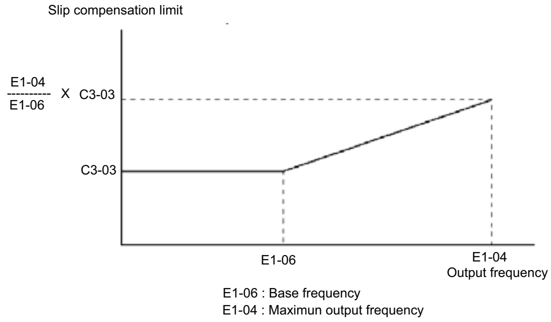


Fig 6.9 Slip Compensation Limit

■Enable the Slip Compensation Function During Regeneration (C3-04)

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

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

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

◆ Torque Compensation Function Adjustments

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

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

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

6

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
C4-01	Torque compensation gain	1.00	Yes	A	A	-	-
C4-02	Torque compensation delay time constant	2000 ms	No	A	A	-	-

■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 set value.
- If vibrations occur decrease the set 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 vibrates, reduce the set value.

Setting precautions

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

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

The factory setting depends on the control mode. The factory settings are:

- V/f control: 200 ms
- Open loop vector control: 20 ms

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

- If the motor vibrates or if overshooting occurs, increase the set value.
- If the torque response is slow, decrease the set value.

◆ Starting Torque Compensation Function (C4-03 to C4-05)

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

■Related Parameters

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

It works like shown in the following diagram.

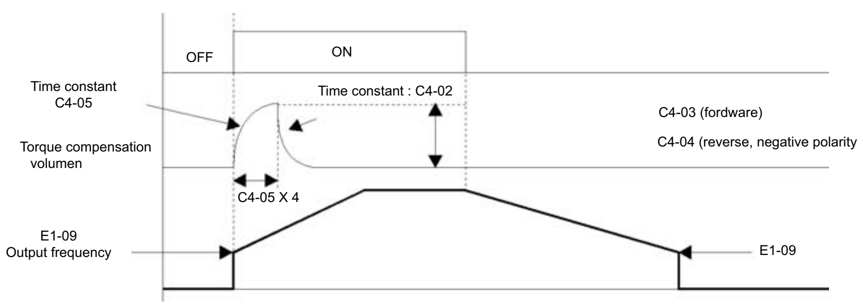


Fig 6.10 Time Chart for Starting Torque Frequency

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

- Both values, C4-03 and C4-04 have to be set.
- The compensation works for motoring operation only. It can not be used for regenerative operation.
- If the starting torque compensation is used and a large shock is generated at the start, increase the starting torque compensation time constant (C4-05)
- The function can be not be used unrestricted for elevators, since the load is not know before the start.

◆ 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). The ASR settings determine the motor speed accuracy and stability. *Fig 6.11* shows the ASR structure.

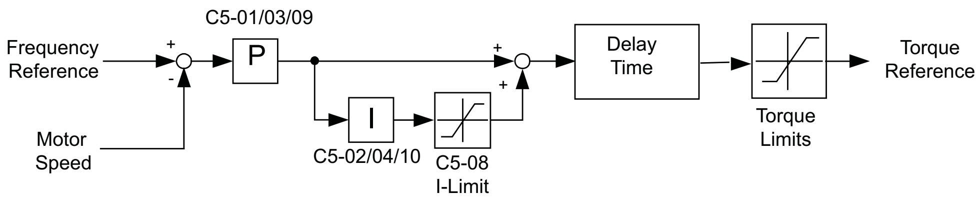


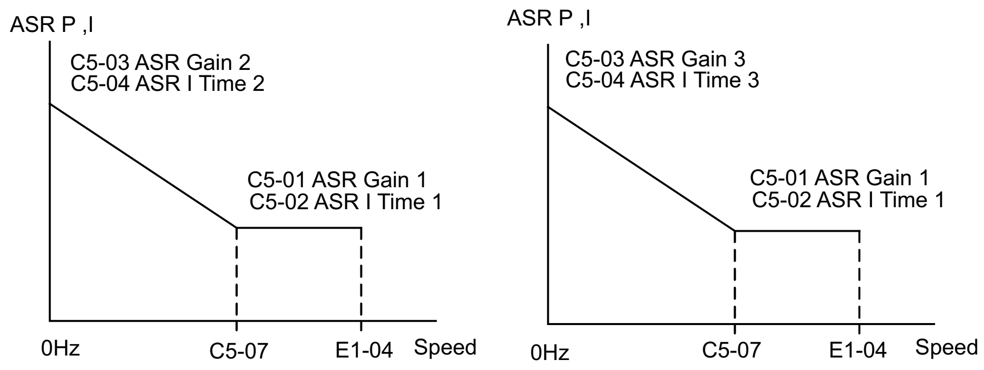
Fig 6.11 ASR Block Diagram

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
C5-01	ASR proportional (P) gain 1	40.00	Yes	-	-	Q	-
		12.00				-	Q
C5-02	ASR integral (I) time 1	0.500 sec.	Yes	-	-	Q	-
		0.300 sec.				-	Q
C5-03	ASR proportional (P) gain 2	20.00	Yes	-	-	Q	-
		6.00				-	Q
C5-04	ASR integral (I) time 2	0.500 sec.	Yes	-	-	Q	Q
C5-07	ASR switching frequency	0.0 Hz	No	-	-	Q	-
		2.0%				-	Q
C5-08	ASR integral limit	400%	No	-	-	A	A
C5-09	ASR proportional (P) gain 3	40.00	Yes	-	-	Q	-
		12.00				-	Q
C5-10	ASR integral (I) time 3	0.500 sec.	Yes	-	-	Q	-
		0.300 sec.				-	Q
C5-11	ASR gain for encoder offset tuning	5.00	No	-	-	-	A

■ASR Gain and Integral Time Adjustments

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



During Acceleretion During Deceleretion

When the ride starts with the nominal speed selected, the ASR P gain and I time change from C5-03/04 to C1-01/02 at nominal speed. When the speed selection changes to leveling speed, the P gain and I time are changed from C1-01/02 to C1-09/10.

If parameter d1-18 is set to 0 or 3, the nominal/leveling speed detection function must be enabled (refer to *page 6-6, Nominal / Leveling Speed Detection with Multi Speed Inputs*) in order to use the ASR 3 settings.

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

The gain settings determine how much the ASR input (= speed deviation) is amplified in order to eliminate the speed deviation. The responsiveness of the ASR is increased when the gain setting is increased but oscillations can occur when this setting is too high.

- Increase C5-03 if the ASR is too slow at start or very low frequencies, decrease it if vibrations occur.
- Increase C5-01 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)

The integral time determines how fast the ASR input is integrated in order to eliminate the speed deviation. Lengthening the integral time lowers the responsiveness of the ASR and the speed accuracy when the load changes suddenly. Oscillations can occur if the setting of this value is too low.

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

Adjusting the ASR Gain for Encoder Offset Tuning (C5-11)

During the encoder offset tuning for Hiperface® or EnDat uses the value of parameter C5-11 as ASR gain.

- Decrease C5-11 if vibrations occur during the tuning and repeat the tuning.
- Increase C5-11 if the accuracy of the tuning is low and repeat the tuning.

◆ 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.

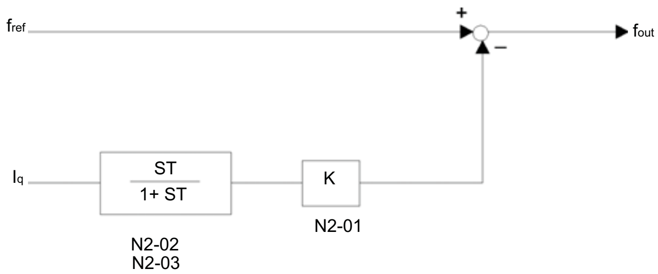


Fig 6.12 AFR Control Loop

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
n2-01	Speed feedback detection control (AFR) gain	1.00	No	-	A	-	-
n2-02	Speed feedback detection control (AFR) time constant 1	50 ms	No	-	A	-	-

■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.

6

■Setting the AFR Time Constants (n2-02)

Parameter n2-02 sets the time constant for the AFR control. If adjustments are necessary,

- Increase the setting if hunting occurs or the speed is over-compensated
- Decrease the setting if the compensation is too slow

Normally there is no need to change this setting.

◆ Inertia Compensation (Closed Loop Vector Only)

Feed Forward Control is used to eliminate the speed overshoot or undershoot by compensating inertia effects.

The function can be enabled using parameter n5-01.

■Related Parameters

Parameter No.	Name	Factory setting	Change during operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
n5-01	Feed forward control selection	1	No	-	-	A	-
		0				-	A
n5-02	Motor acceleration time	kVA dependent	No	-	-	A	A
n5-03	Feed forward proportional gain	1.0	No	-	-	A	A
n5-05	Motor acceleration time auto tuning	0	No	-	-	A	A

■Adjustments

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Motor acceleration time (n5-02)

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

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

Feed Forward Gain (n5-03)

This value usually has not to be changed.

- Increase the gain to improve the responsiveness to the speed reference.
- Decrease the gain if vibrations occur.

■Motor Acceleration Time Auto Tuning (n5-05)

The motor acceleration time n5-02 can be calculated by an auto tuning function. It sets the internal acceleration time to 0.1 sec., disabled the S-curve and sets the torque limit to 100%. After that a start in each direction must be performed. The measured acceleration times are used to calculate the n5-03 value.

Before the n5-02 auto tuning is performed, the motor data autotuning and the general setup should have been finished. Do the tuning with the factory settings for the n5-☐☐ parameters.

Use the following procedure:

1. Set n5-05 to “1” to enable the auto tuning and go back to the speed reference display.
2. Set the base block input.
3. Enable the inspection speed input. “FFCAL” will blink in the display to signalize that the calculation is active.
4. Set an UP command. The inverter will accelerate the motor up to the nominal speed. Release the UP command a few seconds after the top speed has been reached.
5. When the motor has stopped, apply a DOWN command. The inverter will accelerate the motor in the opposite direction to the nominal speed. Release the DOWN command a few seconds after the nominal speed has been reached.

To abort the tuning set parameter n5-05 to “0”.

IMPORTANT

1. The order of giving the UP or DOWN command has no influence.
2. n5-01 should not be changed from the factory value for the tuning.
3. After the run in both directions is finished, parameter n5-05 is automatically set back to “0”.
4. The autotuning will be performed only if the inspection speed input is set.
5. Do not change the mechanical constants (load, inertia) between the runs.

◆ Automatic Current Regulator (ACR) Tuning

The ACR controller consists of two PI control loops, one for the d-axis and one for the q-axis current. The ACR parameters can be accessed in the Closed Loop Vector control for PM mode only.

■Related Parameters

Parameter No.	Name	Factory setting	Change during operation	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
n8-29	ACR q axis proportional gain	1000 rad/s	No	-	-	-	A
n8-30	ACR q axis integral time	10.0 ms	No	-	-	-	A
n8-32	ACR d axis proportional gain	1000 rad/s	No	-	-	-	A
n8-33	ACR d axis integral time	10.0 ms	No	-	-	-	A

■Adjustments

Normally there is no need to change these values. However, if short cycle vibrations occur which can’t be eliminated by the ASR controller setup, it might help to adjust ACR values like follows:

- If the motor generates very strange high frequency noise (not carrier frequency related), reduce both ACR gains (n8-29 and n8-32) for the same value. If the gain is reduced too much, the performance will be reduced.
- If vibrations occur, reduce both integral times (n9-30 and n9-33) for the same value.

◆ A/D Conversion Delay Time Tuning

The A/D conversion delay timer sets a delay for the current signal A/D conversion.

■Related Parameters

Parameter No.	Name	Factory setting	Change during operation	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
n9-60	Current signal A/D conversion delay time	0.0 µsec.	No	-	-	-	A

■Adjustments

Normally an adjustment is no need to change this value. However, if cyclic oscillations like shown in *Fig 6.13* occur during constant speed run, the A/D conversion delay can be increased in order to eliminate the vibrations.

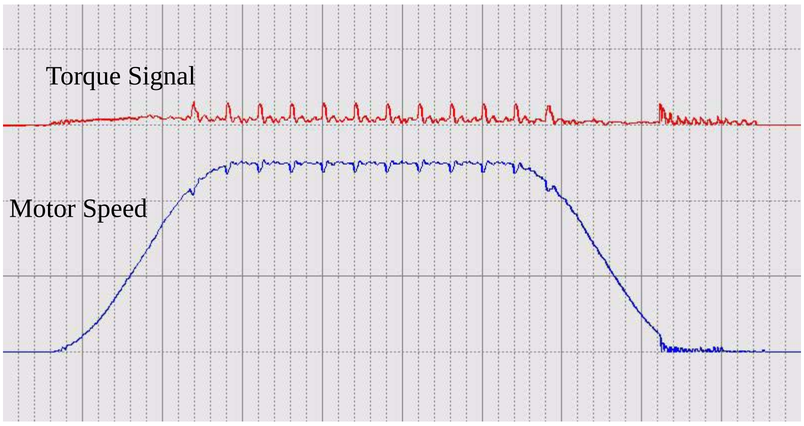


Fig 6.13 Oscillations caused by bad A/D conversion adjustment

◆ Improving the Leveling Accuracy by Leveling Speed Slip Compensation

This function can be used in V/f and Open Loop Vector control to improve the leveling accuracy by compensating the motor slip influence at leveling speed.

The inverter measures the current level or torque reference S2-05 sec. after the speed-agree condition (acceleration finished) for the time set in S2-06 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 6.14*).

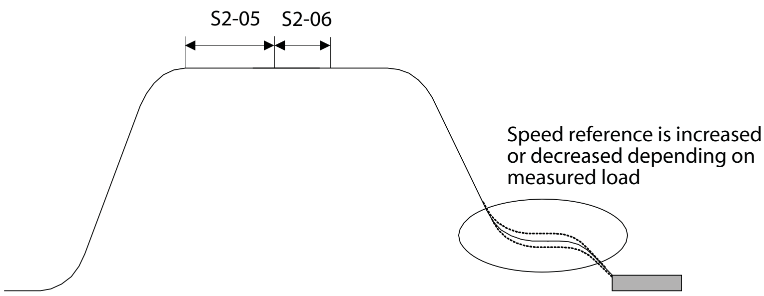


Fig 6.14 Slip Compensation Working Principle

■Related Parameters

Parameter No.	Name	Factory setting	Change during operation	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
S2-01	Motor Rated rpm	1380rpm	No	A	-	-	-
S2-02	Slip Compensation Gain at Motoring	0.7	No	A	A	-	-
S2-03	Slip Compensation Gain at Regenerating	1.0	No	A	A	-	-
S3-05	Slip Compensation Torque Detection Delay	1.0 sec.	No	A	A	-	-
S3-06	Slip Compensation Torque Detection Time	0.5 sec.	No	A	A	-	
S2-07	Slip Compensation primary Delay Time	200ms	No	-	A	-	-

■Adjustments

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

- Set the motor speed in S2-01 if V/f control is used.
- Try to measure the actual motor speed during leveling.
- If the motor speed is lower than the leveling speed reference increase S2-02 in motoring mode or decrease S2-03 in regenerative mode.
- If the motor speed is higher than the leveling speed reference decrease S2-02 in motoring mode or increase S2-03 in regenerative mode.
- S2-05 and S2-06 should not be modified, except if the stop accuracy is poor and the constant speed time after the speed agree is shorter than S2-05 + S2-06.

◆ Field Forcing

6

The field forcing function controls the motor flux and compensates the flux establishment delay of the motor. Thereby it improves the motor responsiveness to 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 No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
d6-03	Field forcing selection	0	No	-	A	A	-
d6-06	Field forcing limit	400%	No	-	A	A	-

◆ Adjusting the DC Injection Current

The DC current injection is used in V/f and Open Loop Vector Control in order to hold the motor when the brake is opened or closed.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
S1-02	DC injection current level at start	50%	No	A	A	-	-
S1-03	DC injection current level at stop	50%	No	A	A	-	-
S1-17	DC injection gain at stop in regenerative operation	100%	No	-	A	-	-
S1-18	DC injection gain at stop in motoring operation	20%	No	-	A	-	-

◆ Adjusting the DC Injection Current Levels (S1-02/03)

Two different DC injection current levels can be set to start and stop.

- Increase the corresponding set value when the holding torque during brake open or brake close is too low.
- Decrease the corresponding set value when the holding torque is enough but e.g. the DC injection noise is too loud.

Adjusting the DC Injection Gains for Stop (S1-17/18)

In Open Loop Vector control two different DC injection current gains for motoring and regenerative operation can be adjusted in order to improve the stopping behavior. The gains are related to the S1-03 set value. The function can be used to equalize jerk effects if the DC injection is too low with motoring load and too high with regenerative load. The load condition (regenerative or motoring) is detected when the inverter is running at another speed than the leveling speed.

- If the DC injection is ok with motoring load but not with regenerative load adjust parameter S1-17.
- If the DC injection is ok with regenerative load but not with motoring load adjust parameter S1-18.

◆ Preventing Motor Stalling During Operation

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

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

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

■Related Parameters

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

■Precautions

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

■Setting Precautions

- Set the parameters as a percentage taking the inverter rated current to be 100%.
- Do not increase the stall prevention level unnecessarily. An extremely high setting can reduce the inverter lifetime. Also do not disable the function.
- If the motor stalls with the factory settings check the V/f pattern (E1-☐☐) and the motor setup (E2-☐☐).
- If the stall level has to be increased very much to get the elevator running, check the mechanical system or consider using a one size bigger inverter.

6

◆ Motor Torque Detection / Car Stuck Detection

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

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

Overtorque/undertorque is detected by:

- observing the output current in V/f control (the inverter rated output current is equal to 100%).
- observing the torque reference value in Open Loop and Closed Loop Vector control (the motor rated torque is equal to 100%).

■Related Parameters

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

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

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

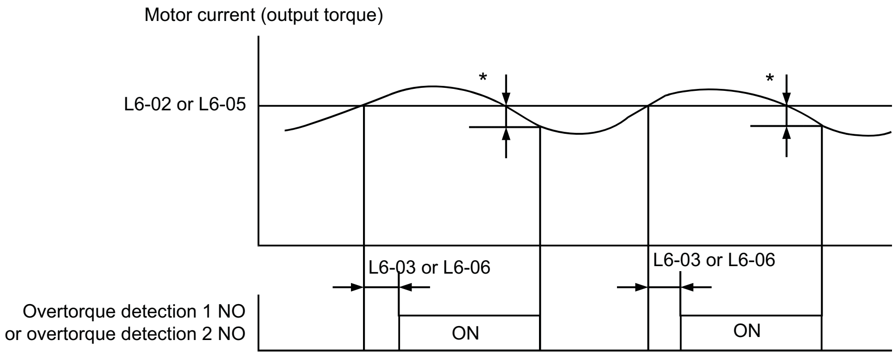
■L6-01 and L6-04 Set Values and Operator Display (JVOP-160-OY only)

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

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

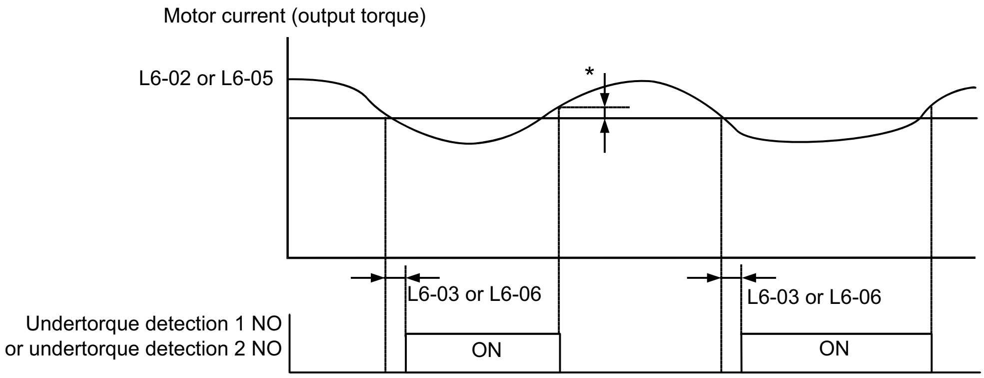
■Timing Charts

Fig 6.15 and *Fig 6.16* show the timing charts for over torque and under torque detection.



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

Fig 6.15 Overtorque Detection



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

Fig 6.16 Undertorque Detection

■Car Stuck Detection (OL3, Using the Overtorque detection)

The Over torque detection function can be used to detect a stuck car. The torque detection function 1 can be used for this. Therefore a digital output has to be set to “Over torque detection 1” (H2-☐☐ = B or 17). Using this with the factory settings a car stuck is detected (output is switched) when the torque/current is higher than 150% for 10 sec. The level can be adjusted in L6-02, the time in L6-03. The output is switched of and an OL3 fault will be indicated (see *Fig 6.17*)

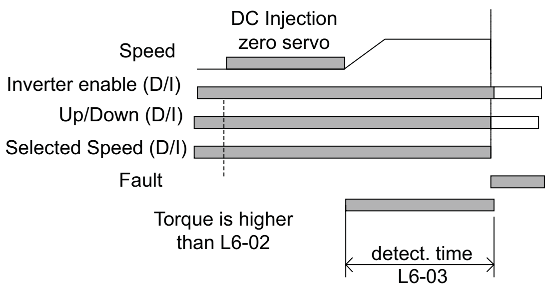


Fig 6.17 Car Stuck fault detection

6

◆ Limiting the 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 a fixed value using parameters or as a variable value using an analog input. The torque limit function can be used with Open Loop Vector and Closed Loop Vector control only.

■Related Parameters

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

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

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

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
30	During torque limit	No	Yes	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 6.18*)

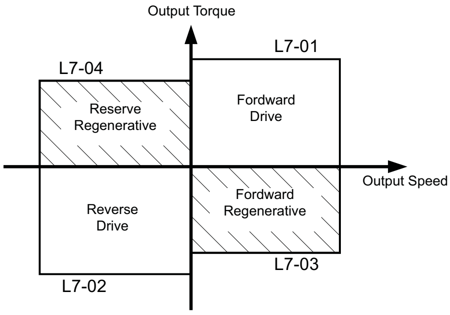


Fig 6.18 Torque Limit Parameters

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

If a multifunction output is set to 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.

6

■Adjusting the Torque Limit Integral Time (L7-06)

In Open Loop Vector control, during constant speed the limit function works with an integral control part (during acceleration and deceleration just a P-control is used). Normally there is no need to change this setting.

- Increase the setting if vibrations or short cycle oscillations occur when the motor is running at the set torque limit
- Decrease the setting if long cycle oscillations occur when the motor is running at the set torque limit.

■ Enabling the Torque Limit Integral Operation during Accel./Decel. (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 set in parameter L7-07 is used.

■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 lower.

◆ Motor Overload Protection

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

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
E2-01	Motor 1 rated current	7.00 A *1	No	Q	Q	Q	-
E4-01	Motor 2 rated current	7.00 A *1	No	Q	Q	Q	-
E5-02	PM Motor rated current	7.31 A *1	No	Q	Q	Q	-
L1-01	Motor protection selection	1	No	Q	Q	Q	A
L1-02	Motor protection time constant	1.0 min	No	A	A	A	-

*1. Factory settings depend on Inverter capacity. (The given value is for a 400 V Class Inverter with 3.7 kW.)

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

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

■Setting the Motor Rated Current (E2-01, E4-01 or E5-02))

Set the rated current value on the motor nameplate in parameters E2-01 (for motor 1), E4-01 (for motor 2) or E5-02 (PM motor). 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.

As the motors thermal behavior depends on the motor type, the thermal motor protection characteristics must be properly selected.

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).
5: to enable the thermal motor protection for a permanent magnet motor

■Setting Motor Protection Operation Time (L1-02)

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

Fig 6.19 shows an example of the characteristics of the electronic thermal protection operation time (L1-02 = 1.0 min., operation at 50 Hz, general-purpose motor characteristics, when L1-01 is set to 1)

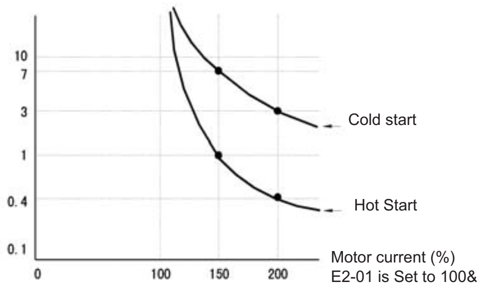


Fig 6.19 Motor Protection Operation Time

■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) to 1F (motor overload OL1 pre-alarm), the motor overload pre-alarm will be output at the selected terminals. 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 e.g a wrong motor contactor sequence or bad motor connection. There are two observation functions, one for the start and one during run.

■Related Parameters

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

SE2 fault (SE2, Current observation at start)

The current is measured for the time S1-06 + S1-14 (Brake open delay plus SE2 detection time) after the Up/Down command input. If it is/falls below 25% of the motor no-load current (E2-03) a SE2 fault is output.
S1-06 + S1-14 must be smaller than S1-04 (DC injection at start).

SE3 fault (SE3, Current observation during Run)

When the acceleration is started (DC injection/Zero Speed time S1-04 after the Up/Down command input), the inverter observes the output current continuously. If it falls below 25% of the motor no-load current (E2-03) a SE3 fault is output.

◆ Over Acceleration Detection (“DV6” Fault Detection)

Using this function an over acceleration of the car caused by too high load or wrong settings can be detected. The function works in Closed Loop Vector for PM motors only (A1-02 = 6). If an over acceleration is detected, the inverter stops and a “DV6” fault is displayed.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
S3-16	Over acceleration detection level	1.5 m/s²	No	-	-	-	A
S3-17	Over acceleration time constant	0.05 sec.	No	-	-	-	A
S3-18	Over acceleration detection method	0	No	-	-	-	A

■Adjusting the Over Acceleration Detection

Over acceleration is detected when the acceleration of the car exceeds the value set in S3-16 for longer than the time set in S3-17. The setting of parameter S3-18 decides the over acceleration is always activate if the power supply is on (S3-16 = 0) or only during run (S3-16 = 1).

Setting parameter S3-16 to 0.0 m/s² disables the over acceleration detection.

IMPORTANT

It is imperative to set up the parameters S3-13, S3-14 and S3-15 (traction sheave diameter, roping and gear ratio) in order to make this function working properly!

Inverter Protection

◆ Inverter Overheat Protection

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

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

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

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

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
L8-02	Overheat pre-alarm level	95°C *1	No	A	A	A	A
L8-03	Inverter overheat (OH) pre-alarm operation selection	3	No	A	A	A	A

*1. The factory setting depends on the inverter capacity.

Multifunction Outputs (H2-01 to H2-03)

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

◆ Input Phase Loss Detection*

For the Input Phase Loss Detection the drive monitors the DC bus ripple. The drive integrates this ΔV value over 10 scans (appr. 10 seconds). If the integrated ΔV value of any consecutive ten scan range is greater than the voltage determined by multiplying L8-06 times the drives rated OV Trip point (400 VDC/800 VDC), a PF fault will occur and the Drive will coast to stop.

Parameter L8-05 enables/disables the Input Phase Loss Detection

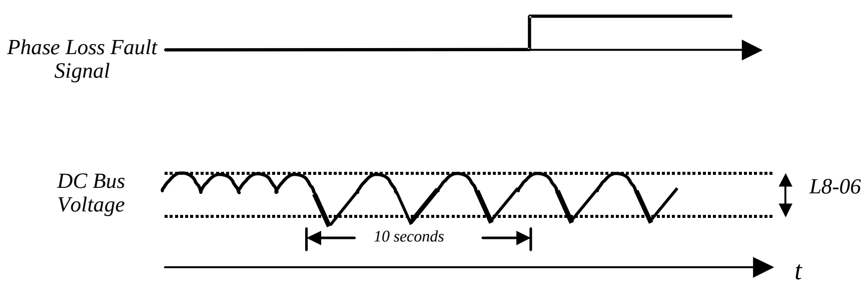


Fig 6.20 Input Phase Loss Detection

■Related Parameters

Parameter Number	Name	Setting Range	Factory Setting	Change during Operation	Access Level
L8-05	Input Phase Loss Protection Selection	0, 1	1	No	A
L8-06	Input Phase Loss Detection Level	0.0 to 25.0%	12.0%*1	No	A

*1. The factory setting depends on the Inverter Capacity. The value for a of 3.7kW 400 V Class Inverter is given

* This function is not available in software version VSL701034 and higher.

◆ Output Open Phase Detection

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

Three settings are available:

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

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

■Related Parameters

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

◆ Ground Fault Detection

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

■Related Parameters

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

■Precautions

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

◆ Cooling Fan Control

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

■Related Parameters

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

■Selecting the Cooling Fan Control

Using parameter L8-10 two modes can be selected:

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

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

◆ Setting the Ambient Temperature

■Related Parameters

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

At high ambient temperatures an output current derating has to be considered. The derating depends on the ambient temperature. The derating curve is shown in *Fig 6.21*. To ensure a safe inverter protection at high ambient temperatures, always set parameter L8-15 to the actual ambient temperature.

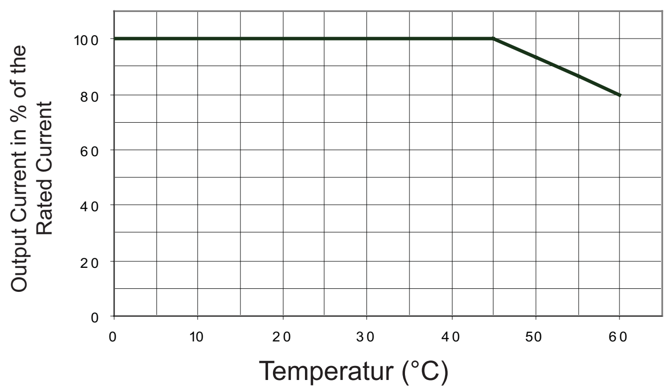


Fig 6.21 Ambient Temperature Derating Curve

Input Terminal Functions

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

■Related Parameters

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

◆ Disable the Inverter Output (Baseblock)

Using a baseblock command the inverter output can be cut immediately. There are two baseblock functions available, a hardware baseblock and a software baseblock.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
S3-12	Baseblock restart selection	0	No	A	A	A	A

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

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
8	External baseblock NO (NO contact: Baseblock at ON)	Yes	Yes	Yes	Yes
9	External baseblock NC (NC contact: Baseblock at OFF)	Yes	Yes	Yes	Yes

■Hardware Baseblock

When hardware baseblock is activated, the power supply of the IGBT driver circuit is cut off and the motor starts to coast. To use this baseblock function the digital input S8 must be used. The input is a NC input, i.e. if terminal S8 is open, the inverter is base block condition.

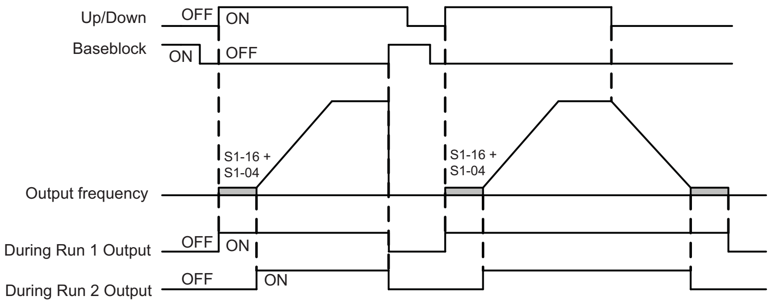
■Software Baseblock

When software baseblock is used, the inverter output is cut by a software function. To use this baseblock function one of the digital inputs must be set to baseblock, i.e. one of the parameters H1-01 to H1-05 (digital input terminal S3 to S7 function selection) must be set to 8 or 9 (Baseblock command NO/NC). The input can be used with a NC as well as with a NO contact.

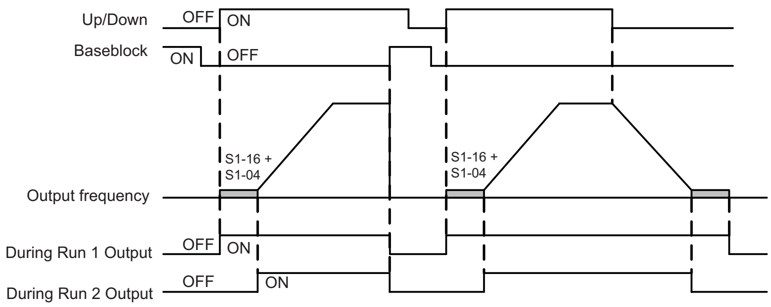
■Baseblock Restart Behavior

If baseblock is activated, the inverter output is immediately stopped. Using parameter S1-12 it can be selected, whether the Up/Down command input has to be cycled to restart when the baseblock is disabled or not.

- If S1-12 = 0 the Up/Down command has to be cycled.



- If S1-12=1 the Up/Down command must not be cycled. The inverter automatically restarts when baseblock is deactivated and the Up/Down command is still active.



◆ Stopping the Inverter on External Device Errors (External Fault Function)

6

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

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

Select the set value for H1-01 to H1-05 by a combination of any of the following three conditions.

- Signal input level from peripheral devices
- External fault detection method
- Operation after external fault detection

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

Set Value	Input Level (See Note 1.)		Error Detection Method (See Note 2.)		Operation During Error Detection			
	NO Contact	NC Contact	Constant Detection	Detection During Operation	Decelerate to Stop (Error)	Coast to Stop (Error)	Emergency Stop (Error)	Continue Operation (Warning)
20	Yes	-	Yes	-	Yes	-	-	-
21	-	Yes	Yes	-	Yes	-	-	-
22	Yes	-	-	Yes	Yes	-	-	-
23	-	Yes	-	Yes	Yes	-	-	-
24	Yes	-	Yes	-	-	Yes	-	-
25		Yes	Yes	-	-	Yes	-	-
26	Yes	-	-	Yes	-	Yes	-	-

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

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

◆ Using the Timer Function

The multi-function digital input terminals S3 to S7 can be used as a timer function input and the multi-function output terminals M1-M2, M3-M4, and M5-M6 can be used as a timer function output.

■Related Parameters

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

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

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

■Multifunction Outputs (H2-01 to H2-03)

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

■Setting Example

When the timer function input is ON for longer than b4-01, the timer output function is turned ON. When the timer function input is OFF for longer than b4-02, the timer output function is turned OFF. An example of timer function operation is given in the following diagram.

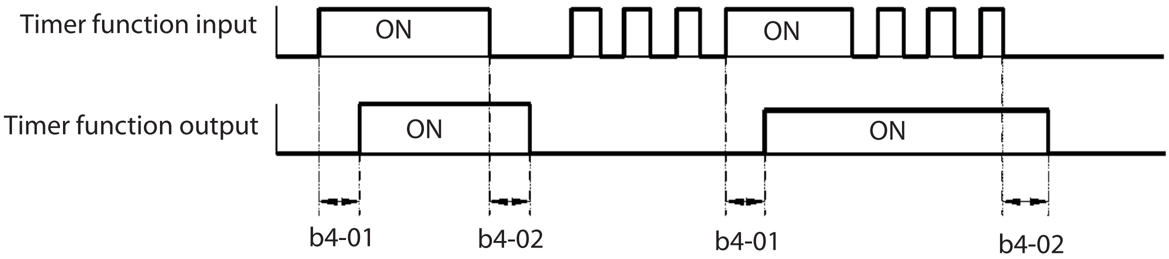


Fig 6.22 Timer Function Operation Example

◆ Motor Contactor Answer Back Detection

The motor contactors can be observed using the motor contactor answer back function. Therefore an auxiliary contact of the motor contactors must be connected to a digital input which is set to for this function (H1-☐☐=86). If the contactor close command is set and no answer back signal comes from the contactor, the inverter detects a SE1 fault (see below). Parameter S1-28 selects if the detection is enabled or disabled and whether the SE1 fault is reset automatically or if has to be reset manually.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
S1-28	Selects how a SE1 fault is reset. 0: Manual Reset 1: Automatic reset at stop 2: No SE1 detection	0	No	A	A	A	A

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

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop ´ Vector	Closed Loop Vector (PM)
86	Motor contactor answer back	Yes	Yes	Yes	Yes

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SE1 fault (SE1:Contactor Feed-back Faults)

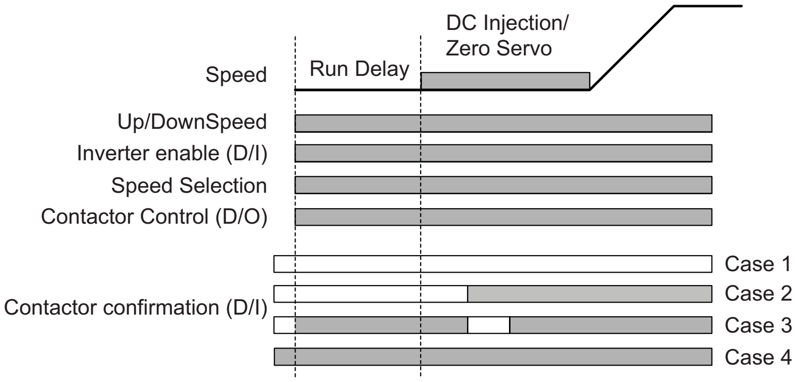
There are 3 possible fault conditions.

Case 1: The motor contactor was closed (Contactor feedback input was on) before the contactor close command was output.

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

Case 3: The motor contactor is opened during inverter run.

Case 4: The contactor confirmation input was enabled before the contactor close output was set.



◆ Changing the PG direction

A digital input can be used to change over the PG feedback signal direction. Therefore one of the parameters H1-☐☐ must be set to 89.

The PG direction is clockwise (CW) when the input is open and counterclockwise (CCW) when the input is closed. The parameter F1-05 has no effect if this function is activated.

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

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop ´ Vector	Closed Loop Vector (PM)
89	PG direction change over	No	No	Yes	Yes

◆ Motor 2 Selection

If a digital input is set to “Motor 2 selection” (H1-☐☐ = 16), this input can be used to switch over between motor 1 and motor 2 settings (E1/E2-☐☐ and E3/E4-☐☐). A digital output can be used to monitor the selection (H2-☐☐ = 1C).

If motor 2 is selected, the speed set in d1-19 will be the speed reference. d1-19 has priority over all speed inputs except the service speed input.

The output signal sequence (brake control, contactor etc.) is the same as for motor 1.

This function is not available for Closed Loop Vector for PM motors.

If motor 2 is selected, the brake sequence is active and rescue operation can be performed.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods				Set by Auto-tuning
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector for PM	
d1-19	Motor 2 speed reference	0.00 Hz	No	A	A	A	-	No

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

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop ´ Vector	Closed Loop Vector (PM)
16	Motor 2 selection (OFF: motor 1, ON: motor 2)	A	A	A	-

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Output Terminal Functions

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

■Related Parameters

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

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

During Run (Setting: 0)

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

During Run 2 (Setting: 37)

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

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

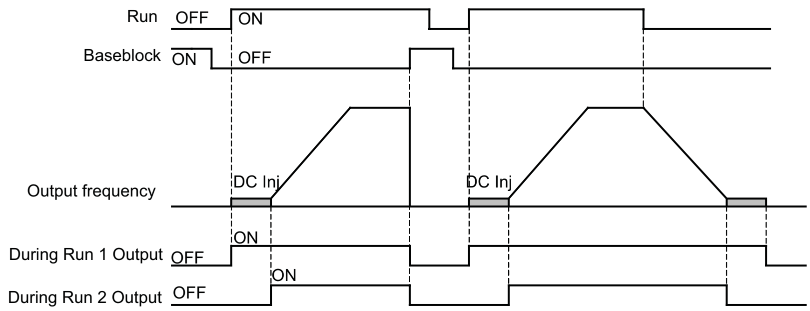

Fig 6.23 Timing Chart for “During RUN” Output

■Zero Speed (Setting: 1)

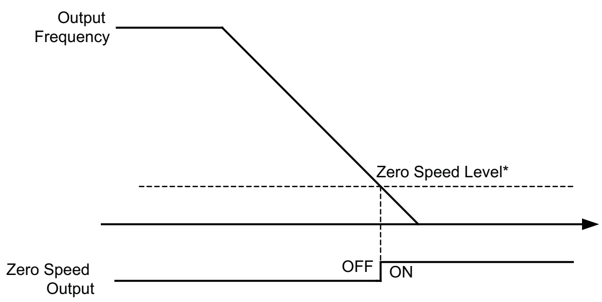

Fig 6.24 Timing Chart for Zero-speed

OFF	The output frequency is higher than the zero speed level*.
ON	The output frequency is lower than the zero speed level*.

* The Zero Speed Level depends on the control mode. It is 0.1 Hz for Closed Loop Vector, 0.5 Hz for Open Loop Vector and 1.2 Hz for V/f control.

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■Inverter Operation Ready (Setting: 6)

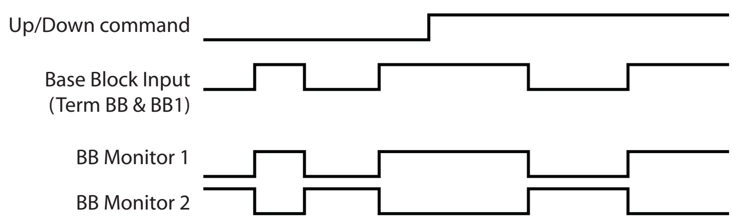
If a multifunction output is set to this function, the output is switched ON when the initialisation of the inverter at startup has been finished without any faults.

■During DC Bus Undervoltage (Setting: 7)

If a multifunction output is set to this function, the output is switched ON as long as a DC bus under voltage is detected.

■During Baseblock (Setting: 8)

If a multifunction output is set to this function, the output is switched ON as long as the inverter output is base blocked.



■Frequency Reference Source Selection (Setting: 9)

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

■Run Command Selection Status (Setting: A)

If a multifunction output is set to 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 the output is switched OFF.

■Fault Output (Setting: E)

If a multifunction output is set to this function, the output is switched ON when any fault different from CPF00 and CPF01 occurs. The output is also not switched at minor faults. (Refer to *page 7-2, Fault Detection* pp. for a fault list.)

■Minor Fault Output (Setting: 10)

If a multifunction output is set to this function, the output is switched ON when a minor fault occurs (refer to *page 7-9, Alarm Detection* pp. for an alarm list).

■Fault Reset Command Active (Setting: 11)

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

■Timer Function Output (Setting: 12)

Refer to *page 6-54, Using the Timer Function*.

■During Reverse Run (Setting: 1A)

If a multifunction output is set to this function, the output is switched ON whenever a RUN command in reverse direction is active (also during DC injection and base block) It is OFF when a forward RUN is input.

■During Base Block 2 (Setting: 1B)

If a multifunction output set to this function is switched OFF as long as a Baseblock command is input.

■Motor 2 selected (Setting: 1C)

If a multifunction output is set to this function, the output is switched OFF when motor 1 is selected and switched ON if motor 2 is selected.

■During Regenerative Operation (Setting: 1D)

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

■Restart Enabled (Setting: 1E)

Refer to *page 6-84, Automatic Fault Reset*.

■During Torque Limit (Setting: 30)

Refer to *page 6-44, Limiting the Motor Torque (Torque Limit Function)*.

■Zero Servo End (Setting: 33)

Refer to *page 6-16, Zero Speed Control / Zero Servo (position lock)*.

■Brake Release Command (Setting: 40)

This output signal can be used to control the brake. The output is closed when the brake shall be opened. Refer also to *page 6-13, Brake Sequence*.

■Motor Contactor Control Command (Setting: 41)

This output can be used to control the motor contactors. The output is closed when the contactors shall be closed. Refer also to *page 6-13, Brake Sequence*.

■Cooling Fan Running (Setting: 38)

This output can be used to indicate the inverters heatsink cooling fan operation. The output is on if the cooling fan(s) is (are) on.

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

This output can be used to detect if 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 inverse condition of the Zero speed status.

OFF	The output frequency is lower than the zero speed level.
ON	The output frequency is higher than the zero speed level.

■Light Load Search End (Setting: 44/45)

Refer to *page 6-83, Light Load Direction Detection*.

■Base Block Monitor 1 and 2 (Setting: 46/47)

If a multifunction output is programmed for this function, the output is switched if both base block inputs (BB and BB1) are enabled.

Motor and V/f Pattern Setup

The L7 inverter supports 2 motor settings (main motor and door motor, E2/E4-☐☐ parameters) for V/f control, Open Loop Vector and Closed Loop Vector for IM. The active motor setup can be selected by a digital input.

Closed Loop Vector Control for PM supports 1 motor setting (main motor, E5-☐☐ parameters) only.

◆ Setting Motor Parameters for Induction Motors (Motor 1 and 2)

In order to achieve the maximum performance the V/f pattern and the motor data must be set correctly.
The number of motor parameters which can be set, depend on the selected control mode.
In the vector control methods the motor parameters can be set automatically by using the autotuning function (refer to *page 4-4, Autotuning*).
However, if autotuning does not complete normally, the parameters must be set manually like described below.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods				Set by Auto-tuning
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector for PM	
d1-19	Motor 2 speed reference	0.00 Hz	No	A	A	A	-	No
E1-01	Input voltage setting	400 V *1	No	Q	Q	Q	Q	No
E3-01	Motor 2 control mode selection	0	No	A	A	A	A	No
E1-04/ E3-02	Max. output frequency (FMAX)	50.0 Hz	No	Q/ A	Q/ A	Q/ A	Q/ A	Yes
E1-05/ E3-03	Max. voltage (VMAX)	380.0 V *1	No	Q/ A	Q/ A	Q/ A	Q/ A	Yes
E1-06/ E3-04	Base frequency (FA)	50.0 Hz	No	Q/ A	Q/ A	Q/ A	Q/ A	Yes
E1-07/ E3-05	Mid. output frequency (FB)	3.0 Hz *1	No	A	A	-	-	Yes
E1-08/ E3-06	Mid. output frequency voltage (VB)	37.3 V *1,*2	No	Q/ A	Q/ A	-	-	Yes
E1-09/ E3-07	Min. output frequency (FMIN)	0.5 Hz *2	No	Q/ A	Q/ A	A	A	Yes
E1-10/ E3-08	Min. output frequency voltage (VMIN)	19.4 V *1,*2	No	Q/ A	Q/ A	-	-	Yes
E1-13	Base voltage (VBASE)	0.0 V	No	A	A	-	Q	Yes
E2-01/ E4-01	Motor rated current	7.00 A *3	No	Q/ A	Q/ A	Q/ A	-	Yes
E2-02 E4-02	Motor rated slip	2.70 Hz *3	No	A	A	A	-	Yes
E2-03/ E4-03	Motor no-load current	2.30 A *3	No	A	A	A	-	Yes
E2-04/ E4-04	Number of motor poles (Number of poles)	4 poles	No	-	Q/ A	Q/ A	-	Yes
E2-05/ E2-05	Motor line-to-line resistance	3.333 Ω *3	No	A	A	A	-	Yes
E2-06/ E4-06	Motor leak inductance	19.3%	No	-	A	A	-	Yes
E2-07	Motor iron saturation coefficient 1	0.50	No	-	A	A	-	Yes*4
E2-08	Motor iron saturation coefficient 2	0.75	No	-	A	A	-	Yes*4
E2-09	Motor mechanical losses	0.0%	No	-	-	A	-	No

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods				Set by Auto-tuning
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector for PM	
E2-10	Motor iron loss for torque compensation	130 W *3	No	A	-	-	-	No
E2-11/ E4-07	Motor rated output power	3.70 kW*3	No	Q/ A	Q/ A	Q/ A	-	Yes
E2-12	Motor iron saturation coefficient 3	1.30	No	-	A	A	-	Yes*4
F1-01	PG constant	1024	No	-	-	Q	Q	Yes

*1. The value is valid for a 400V, 3.7kW inverter
*2. The value depends on the control mode. The given value is valid if V/f control is selected.
*3. All factory-set parameters are for a Yaskawa standard 4-pole motor.
The factory settings depend on Inverter capacity (the values shown are for a 400 V Class Inverter for 3.7 kW).
*4. Rotating tuning only

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

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop ´ Vector	Closed Loop Vector (PM)
16	Motor 2 selection (OFF: Motor 1, ON: Motor 2)	A	A	A	-

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

Set Value	Function	Control Methods			
		V/f	Open Loop Vector	Closed Loop ´ Vector	Closed Loop Vector (PM)
1C	Motor selection (OFF: Motor 1, ON: Motor 2)	A	A	A	-

■Setting Inverter Input Voltage (E1-01)

Set the Inverter input voltage correctly in E1-01 so that it matches the power supply voltage.

■Setting the V/f Pattern

If E1-03 is set to F, the V/f pattern can be set individually using the parameters E1-04 to E1-10 (see *Fig 6.25)*.

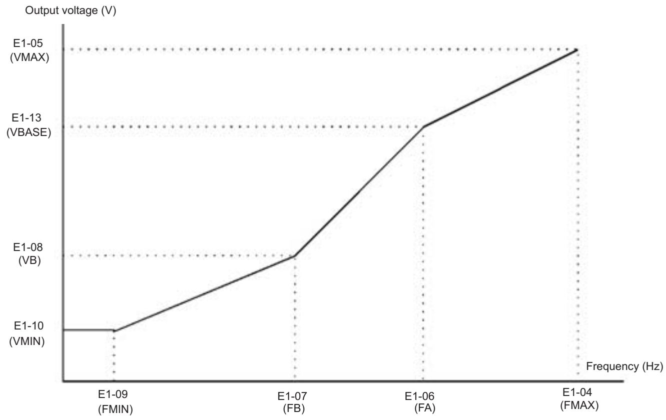


Fig 6.25 V/f pattern setting

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 a user-defined V/f pattern is used, consider the following points:

- By changing the control method, the parameters E1-07 to E1-10 are changed to the factory settings for the selected control method.
- Be sure to set the four frequencies as follows:
  E1-04 (FMAX) ≥ E1-06 (FA) > E1-07 (FB) ≥ E1-09 (FMIN)

■Manual Setting of the Motor Parameters

Motor Rated Current Setting (E2-01, E4-01)

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

Motor Rated Slip Setting (E2-02, E4-02)

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

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

Motor No-Load Current Setting (E2-03, E4-03)

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. The following formula can be taken as an indication:

$$I_0 = \sin(\operatorname{acos} \cos\varphi)$$

Number of Motor Poles Setting (E2-04, E4-04)

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, E4-05)

E2-05 is set automatically during motor line-to-line resistance autotuning. When it can not be performed for any reason, consult the motor manufacturer for the line-to-line resistance value. The set value should be calculate the motor test report line-to-line resistance value and the following formula:

- 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 report] × 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, E4-06)

Set the amount of voltage drop due to motor leakage inductance in E2-06 as a percentage of the motor rated voltage. If the inductance is not written on the motor nameplate, consult the motor manufacturer.

Motor Iron Saturation Coefficients 1 and 2 Settings (E2-07/08)

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

Motor Setting 1/2 Switch Over

Refer to *page 6-57, Motor 2 Selection*.

◆ Setting Motor Parameters for PM Motors

The autotuning with rotating motor can be used to let the inverter measure the voltage constant, the line-to-line resistance and the q- and d-axis inductances and the encoder offset (refer to *page 4-7, Autotuning Procedure with PM Motors*. It can be performed only if the motor can rotate freely (removed ropes and open brake). If the autotuning can not be performed for any reason, the following motor parameters must be set manually.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods				Set by Auto-tuning
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)	
E1-01	Input voltage setting	400 V *1	No	Q	Q	Q	Q	No
E1-04	Max. output frequency (FMAX)	150 rpm	No	Q	Q	Q	Q	Yes
E1-06	Base frequency (FA)	150 rpm	No	Q	Q	Q	Q	Yes
E1-09	Min. output frequency (FMIN)	0 rpm	No	Q	Q	A	A	Yes
E1-13	Base voltage (VBASE)	400 V*1	No	A	A	-	Q	Yes
E5-02	Motor rated power	3.7kW *2	No	-	-	-	A	Yes
E5-03	Motor rated current	7.31 A *2	No	-	-	-	A	Yes
E5-04	Number of motor poles	4 poles	No	-	-	-	A	Yes
E5-05	Motor line-to-line resistance	1.326 Ω *2	No	-	-	-	A	Yes
E5-06	Motor d-axis inductance	19.11 mH*2	No	-	-	-	A	Yes
E2-07	Motor q-axis inductance	26.08 mH*2	No	-	-	-	A	Yes
E5-09	Motor voltage constant	478.6 mV*2	No	-	-	-	A	Yes

*1. The given value is valid for 400V inverters.
*2. The factory settings depend on Inverter capacity (the values shown are for a 400 V Class Inverter for 3.7 kW).

Motor Rated Power (E5-02)

Set E5-02 to the rated power value as written on the motor nameplate or in the motor data sheet.

Motor Rated Current (E5-03)

Set E5-03 to the motor rated current as written on the motor nameplate or in the motor data sheet.

Number of Motor Poles Setting (E5-04)

Set the number of motor poles as written on the motor nameplate or in the motor data sheet.

Motor Line-to-Line Resistance Setting (E5-05)

Set the motor line-to-line resistance as written in the motor data sheet. Alternatively a measured value can be entered.

Motor d- and q-Axis Inductance (E5-06, E5-07)

Set the q-axis and d-axis inductance value in mH as written on the nameplate or the motor data sheet.

Motor Voltage Constant (E5-09)

Set the motor voltage constant k_e is set in mV as written on the nameplate or the motor data sheet.

◆ Motor Rotation Direction Change

If the motor operates in the wrong direction with an Up or Down command, the direction can be changed by parameter S3-08.

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■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
F1-05	Encoder direction change		No	No	No	Q	Q
S3-08	Output phase order	0	No	A	A	A	A

■Change Motor Direction in V/f or Open Loop Vector Control

To change the motor rotation direction without changing the wiring, parameter S3-08 can be changed.

- If S3-08 = 0 the output phase order will be U-V-W
- If S3-08 = 1 the output phase order will be U-W-V

■Change Motor Direction in Closed Loop Vector Control

If Closed Loop Vector Control for IM or PM is used, besides changing parameter S3-08 the encoder direction has to be changed by setting F1-05.

IMPORTANT

If Closed Loop Vector Control for PM motors is used, always perform an encoder offset tuning after parameter S3-08 of F1-05 has been changed.

Digital Operator/LED Monitor Functions

◆ Setting Digital Operator/LED Monitor Functions

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
o1-01	Monitor selection	6	Yes	A	A	A	A
o1-02	Monitor selection after power up	1	Yes	A	A	A	A
o1-03	Frequency units of reference setting and monitor	→	No	A 0	A 0	A 0	-
				-	-	-	A 1
o1-04	Setting unit for frequency reference related parameters	→	No	-	-	A 0	-
				-	-	-	A 1
o1-05	LCD Display contrast	3	Yes	A	A	A	A
o2-02	STOP key during control circuit terminal operation	0	No	A	A	A	A
o2-03	User parameter initial value	0	No	A	A	A	A
o2-04	Inverter kVA selection	0*1	No	A	A	A	A
o2-05	Frequency reference setting method selection	0	No	A	A	A	A
o2-06	Operation selection when digital operator/LED Monitor is dis-connected	0	No	A	A	A	A
o2-07	Cumulative operation time setting	0	No	A	A	A	A
o2-08	Cumulative operation time selection	0	No	A	A	A	A
o2-09	Initialize Mode	2	No	A	A	A	A
o2-10	Fan operation time setting	0	No	A	A	A	A
o2-12	Fault trace initialize	0	No	A	A	A	A
o2-15	“Number of Travels” monitor initialize	0	No	A	A	A	A
S3-13	Traction sheave diameter	400 mm	No	A	A	A	A
S3-14	Roping ratio	2	No	A	A	A	A
S3-15	Gear ratio	1.000	No	A	A	A	A

*1. Depends on the inverter capacity

■Monitor Selection (o1-01)

Using parameter o1-01 the third monitor item that is displayed in drive mode can be selected. This function has no effect on the LCD-operator (JVOP-160-OY).

■Monitor Display when the Power Supply is Turned ON (o1-02)

The parameter o1-02 selects the monitor item (U1-☐☐), which is to be displayed in the first line on the Digital Operator when the power supply is turned ON.

Changing Frequency Reference and Display Units (o1-03)

Parameter o1-03 sets the display units of some frequency/speed related parameters on the Digital Operator. The setting in o1-03 affects 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)

Display in Hz

Set o1-03 to “0” to change the display unit of the above mentioned parameters to Hz.

Display in%

Set o1-03 to “1” to change the display unit for the above mentioned parameters to % related to the maximal frequency/speed set in parameter E1-04.

Display in rpm

Set o1-03 to the number of poles of the used motor to display the mentioned parameters in rpm.

Display in m/s

Set o1-03 to 3 to enable the display in m/s. The inverter uses the parameters S3-13 (traction sheave diameter), S3-14 (roping ratio) and S3-15 (gear ratio) to calculate the m/s display. To achieve an accurate display value these parameters must be set accurately.

■Changing the Units for Frequency Parameters Related to V/f settings (o1-04)

Using parameter o1-04 the unit of the frequency parameters for the V/f setting can be set. If o1-04 is set to 0 the unit is “Hz”. If o1-04 is set to 1 it is “rpm”. The parameter is available in Closed Loop Vector control only.

■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 decreases the contrast and vice versa.

■Enable/Disable the LOCAL/REMOTE Key (o2-01)

Set o2-01 to 1 to enable the LOCAL/REMOTE Key on the Digital Operator.

If the key is enabled, the frequency reference source and the RUN command source can be switched over between LOCAL (Operator) and REMOTE (b1-01/02 setting).

■Disabling the STOP Key (o2-02)

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

If o2-02 is set to 1, a STOP command from the operators STOP key is accepted. If o2-02 is set to 0 it is disregarded.

■Saving User Parameters (o2-03)

The Inverter parameter setting values can be saved as user-set parameter initial values by setting parameter o2-03 to 1.

To initialize the inverter using the user-set initial values, set parameter A1-03 to 1110. To clear the user-set initial values 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 5-67, Factory Settings Changing with Inverter Capacity (o2-04)* to see parameters that depend on this setting.

Normally it is not necessary to change this setting, unless the control card has been changed.

■Setting the Frequency Reference using the UP and DOWN Keys without Using the Enter Key (o2-05)

This function is active when frequency references are input from the Digital Operator. When o2-05 is set to 1, the selected frequency reference can be incremented and decremented the UP and DOWN keys without using the Enter key. The function work only if parameter b1-01 is set to 0.

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

This function selects the operation when the digital operator/LED Monitor gets disconnected when a RUN command is active.

If o2-06 is set to 0 the operation is continued.
If o2-06 is set to 1 the output is switched off and the motor coasts to stop. The fault contact is operated. When the operator is reconnected an OPR (Operator disconnected) is shown.

■Cumulative Operation Time (o2-07 and o2-08)

The inverter has a function that counts the operation time of the inverter cumulatively.

Using parameter o2-07 the accumulated operation time can be changed, e.g. after a replacement of the control board. If parameter o2-08 is set to 0, the inverter accumulates 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 has been replaced.

■Fault Trace Initialize (o2-12)

This function can be used to initialize the fault trace by setting parameter o2-12 to 1.

■“Number of Travels” counter Initialize (o2-15)

Using this parameter the lift operation counter monitor (U1-55) can be initialized.

◆ Copying Parameters (JVOP-160-OY only)

The following three digital operator functions can be used in order to copy/verify parameter settings:

- 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 operator can be protected from overwriting by setting parameter o3-02 to 0. In this case a READ command can not be executed. If it is nevertheless still done, “PrE” will be displayed at the operator.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
o3-01	Copy function selection	0	No	A	A	A	A
o3-02	Read permitted selection	0	No	A	A	A	A

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

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

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 starts.	-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 7-16, 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.

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

Step No.	Explanation	Digital Operator Display
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 starts.	-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, set the parameters again. Refer to *page 7-16, 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.

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 the parameter o3-01 is displayed (Copy Function Selection).	-ADV- COPY Function o3 - 01=0 Copy Funtion Sel
4	Press the DATA/ENTER Key and select the function setting display.	-ADV- Copy Function Sel o3-01=0 *0* COPY SELECT
5	Change the set value to 3 using the Increment Key.	-ADV- Copy Funtion Sel o3-01=3 *0* OP ←→INV VERIFY
6	Set the changed data using the DATA/ENTER Key. The VERIFY function starts.	-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 7-16, 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

- 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.

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If one of the parameters H1-01 to H1-05 (digital input terminal S3 to S7 function selection) is set to 1B (write parameters permitted), parameters can be written from the digital operator when the terminal that has been set is ON. When the set terminal is OFF, writing parameters other than the frequency reference is prohibited. However, the parameters can be read.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
A1-01	Parameter access level	2	Yes	A	A	A	A

◆ Setting a Password

When a password is set in A1-05 and if the set values in A1-04 and A1-05 do not match, only the settings of parameters A1-01 to A1-03, or A2-01 to A2-32 can be modified.

The setting of all parameters except A1-00 can be prohibited using the password function in combination with setting parameter A1-01 to 0 (Monitor only).

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
A1-01	Parameter access level	2	No	A	A	A	A
A1-04	Password	0	No	A	A	A	A
A1-05	Password setting	0	No	A	A	A	A

■Setting a Password

The password can be set in parameter A1-05. Normally A1-05 is not displayed. To display and modify A1-05 the MENU and Reset key must be pressed together in the A1-04 display.

◆ Displaying User-set Parameters Only

The A2 parameters (user-set parameters) and A1-01 (parameter access level) can be used to establish a parameter set that contains only the most important parameters.

Set the number of the parameter to which should appear in the A2-□□ parameters, and then set A1-01 to 1. The advanced programming mode now allows to read and modify A1-01 to A1-03 and the parameters set in A2-01 to A2-32 only.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
A2-01 to A2-32	User setting parameters	-	No	A	A	A	

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PG Option Cards

To have a more precise speed control the inverter can be equipped with a PG option card for the connection of a pulse generator. Three different PG cards can be used, the PG-B2, the PG-X2 and the PG-F2 card. Refer to *page 2-24, Option Card Models and Specifications* to see details.

◆ PG Setup

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods				
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
F1-01	PG constant	→	No	No	No	Q 1024	-
						-	Q 2048
F1-05	PG rotation	→	No	No	No	Q 0	-
						-	Q 1
F1-06	PG division rate (PG pulse monitor)	1	No	No	No	A	A
F1-21	Absolute encoder resolution	2	No	No	No	No	A
F1-22	Magnet position offset	60°	No	No	No	No	A

■Using PG Speed Control Card

There are three types of PG Speed Control Card that can be used in Closed Loop Vector control:

- PG-B2: A/B-phase pulse input, compatible with open collector outputs.
- PG-X2: A/B/Z-phase pulse input, compatible with line drivers (RS-422).
- PG-F2: Hiperface® / EnDat encoder feedback.

For the mounting instructions, specifications and connection diagrams refer to *page 2-24, Installing and Wiring Option Cards*.

IMPORTANT

If Open Loop Vector control for IM is used and a PG-B2/X2 card is installed, the speed detected by the PG card is displayed in the monitor parameter U1-05. Therefore the PG constant has to be set in parameter F1-01. The direction of the speed detection can be changed by parameter F1-05.
To change the U1-05 value to the internally calculated speed value remove the PG card.

■Setting Number of PG Pulses (F1-01)

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

If a PG-F2 card is installed, the encoder type must be set in parameter n8-35 before the PG constant is set. The possible set values for F1-01 depend on the n8-35 setting. The following resolutions can be set:

- for Hiperface®: 1024
- for EnDat: 512, 1024, 2048

■Suit the PG Rotation Direction and Motor Rotation Direction (F1-05)

Parameter F1-05 can be used to change the encoder signal direction if it is wrong.

- If F1-05 is set to 0 the inverter expects channel A to lead 90° before channel B (Sin-channel leads 90° before Cos-channel on PG-F2 card) if a forward command is applied (FWD means counterclockwise rotation seen from the shaft side).
- If F1-05 is set to 1 the inverter expects channel B to lead 90° before channel B (Cos-channel leads 90° before Sin-channel on PG-F2 card) if a forward command is applied.

IMPORTANT

If Closed Loop Vector Control for PM motors is used, an encoder offset autotuning must be performed if parameter F1-05 is changed.

■Setting PG Pulse Monitor Output Division Ratio (F1-06)

This function is enabled only when a PG-B2 speed feedback card is used. Set the division ratio for the PG pulse monitor output. The set value is expressed as n for the higher place digit, and m for the two lower place digits. The dividing ratio is calculated as follows:

Dividing ratio = (1 + n)/m (Setting range) n: 0 or 1, m: 1 to 32

$$\text{F1-06} = \underbrace{\square}_{n}\ \underbrace{\square\square}_{m}$$

The division ratio can be set within the following range: 1/32 ≤ F1-06 ≤ 1. For example, if the division ratio is 1/2 (set value 2), half of the number of pulses from the PG are output at the pulse monitor.

■Setting Number of Gear Teeth Between PG and Motor (F1-12 and F1-13)

If there are gears between the motor and PG, the gear ratio can be set using F1-12 and F1-13.

When the number of gear teeth has been set, the number of motor rotations within the Inverter is calculated using the following formula.

No. of motor rotations (r/min.) = No. of input pulses from PG × 60 / F1-01 × F1-13 (No. of gear teeth on PG side) / F1-12 (No. of gear teeth on motor side)

■Setting the Absolute Encoder Resolution (F1-21)

If a Hiperface® encoder is used, the serial line resolution must be selected by parameter F1-21 according to the encoder data sheet. The possible resolution setting depends on the encoder selection (n8-35=5):

- Hiperface®: 0, 1 or 2 (16384, 32768, 8192)
- EnDat: 2 (fixed to 8192)

■Setting the Magnet Position Offset (F1-22)

Parameter F1-22 can be used to set the offset between the magnet and the encoder zero position. The value is automatically set during the PM motor autotuning or encoder offset auto tuning (refer to *page 4-8, PM Motor Encoder Offset Tuning*).

◆ Fault Detection

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
F1-02	Operation selection at PG open circuit (PGO)	1	No	-	-	A	A
F1-03	Operation selection at overspeed (OS)	1	No	-	-	A	A
F1-04	Operation selection at deviation (DEV)	3	No	-	-	A	A
F1-08	Overspeed detection level	115%	No	-	-	A	A
F1-09	Overspeed detection time	0.0 sec.	No	-	-	A	A
F1-10	Speed deviation detection level	10%	No	-	-	A	A
F1-11	Speed deviation detection time	0.5 sec.	No	-	-	A	A
F1-14	PG open-circuit detection delay time	2.0 s	No	-	-	A	A
F1-18	DV3 detection selection	1	No	-	-	-	A
F1-19	DV4 detection selection	1024	No	-	-	-	A
F1-21	Absolute encoder resolution	2	No	-	-	-	A
F1-22	Magnet position offset	60°	No	-	-	-	A
F1-24	PGO detection Level at stop	20%	No	-	-	-	A

■Detecting PG Open Circuit During Run (F1-02 and F1-14)

Parameter F1-02 selects the stopping method when a PG disconnection is detected.

PG open (PGO) is detected only 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 a Speed Deviation between the Motor and Speed Reference (F1-04, F1-10 and F1-11)

A speed deviation fault 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.

■Detecting a Wrong Rotation Direction DV3 (F1-18, Closed Loop Vector for PM only)

A DV3 fault indicates a wrong motor rotation direction. It is detected if

- the speed deviation is higher than 30% and
- the internal torque reference value and the acceleration have opposite signs

The fault is detected after the time F1-18 x 5 ms.

■Detecting a Wrong Rotation Direction DV4 (F1-19, Closed Loop Vector for PM only)

A DV4 fault indicates a wrong motor rotation direction. It is detected if

- the reference direction and the motor rotation direction have opposite signs and
- the deviation is higher than the value of parameter F1-19 (set in encoder pulses).

◆ Machine Data Copy Function

If a Hiperface® or an EnDat encoder is used, the motor and encoder data can be saved in the encoder memory and can be read out later, e.g. if a motor has been replaced to an equal type or if the inverter is replaced.

■Related Parameters

Parameter No.	Name	Factory Setting	Change during Opera-tion	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
F1-25	Encoder copy selection	0	No	No	No	No	A
F1-26	Encoder write protection	0	No	No	No	No	A

■Saved Parameters

The following parameters are saved in the encoder memory:

- E1-04 Motor maximal speed
- E1-06 Motor rated speed
- E1-13 Motor rated voltage
- E5-02 Motor rated power
- E5-03 Motor rated current
- E5-04 Motor pole number
- E5-05 Motor line-to-line resistance
- E5-06 Motor d axis inductance Ld
- E5-07 Motor q axis inductance Lq
- E5-09 Motor voltage constant Ke
- F1-01 PG pulse constant
- F1-05 PG rotation direction
- F1-21 Absolute encoder selection
- F1-22 Magnet position offset

■Saving Parameters Into the Encoder Memory

To save parameters in the encoder memory, the Encoder write protection must be off (F1-26 = 1) and the parameter F1-25 has to be set to 1 (“ERED, INV→ENC WRITING” is displayed during the save process). The display of F1-25 automatically returns to 0 when the operation is finished (“ERED, WRITE COMPLETE” is displayed). If any fault occurs the fault code will be displayed (refer to *page 7-17, Machine Data Copy Function Faults*).

Parameters which had been stored in the encoder before will be overwritten.

■Read Parameters From the Encoder Memory

To read parameters form the encoder memory the parameter F1-25 must be set to 2. Before reading the parameters make sure, that the correct control mode and encoder type are selected in the parameters A1-02 and n8-35. If parameter n8-35 has to be changed, cycle the power supply after changing it and set parameter F1-25 to 2 afterwards (“ECPY, ENC→INV COPIYING” is displayed during the read process). The display of F1-25 automatically returns to 0 when the operation is finished (“ECPY, COPY COMPLETE” is displayed). If any fault occurs the fault code will be displayed (refer to *page 7-17, Machine Data Copy Function Faults*).

■Verify Saved Parameters

To compare the parameters stored in the inverter and encoder the parameter F1-23 must be set to 3 (“EVRFY, DATA VERIFYING” is displayed during the verify process).
If the data are identically, the display will show “EVRFY, VERIFY COMPLETE”.
If the data do not match, “EVRFY, VERIFY ERROR” will be displayed.

IMPORTANT

In order to perform the WRITE/COPY function:
- The motor must not turn and the drive must be in baseblock condition
- for EnDat the OEM1 area1 of the EEPROM must be available (address 64 to 255)
- for Hiperface® the data field DF#0 must be available.
- A CPF03/24 must not be active.

Rescue System

Using rescue operation the car can be moved to the next floor if the power supply fails. In this case the inverter must be supplied by a UPS or a battery and the rescue operation must be enabled by a digital input (H1-☐☐ = 85). The DC bus voltage during rescue operation has to be set in parameter L2-11. A light load detection function can be used to detect the light load direction for the car evacuation.

■Related Parameters.

Parameter No.	Name	Factory setting	Change during operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
d1-05	Rescue operation speed	5 Hz	No	A	A	A	A
L2-11	DC bus voltage during rescue operation	0V	No	A	A	A	A
S3-06	Light Load Search for rescue operation	0	No	A	A	A	A
S3-07	Light Load Search time for rescue operation	1.0 sec.	No	A	A	A	A
S3-10	Light Load Search speed	3.00 Hz	No	A	A	A	A
S3-11	Rescue operation torque limit	100%	No	-	A	A	A
S3-24	Light load search method	0	No	A	A	-	-

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

Setting	Function mane	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
85	Rescue operation command	A	A	A	A

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

Setting	Function mane	V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
44	Light load direction output (ON: Forward, OFF: Reverse)	A	A	A	A
45	Light load detection status (ON: Ready for detection run, OFF: Detection in progress)	A	A	A	A

■Rescue Operation Power Supply Ratings

The power supply to the DC bus and to the control card during rescue operation must meet the following requirements:

Voltage class	DC Bus Power Supply	Control Power Supply
200 V	48 to 300 VDC	280 to 300 VDC
400 V	96 to 600 VDC	280 to 600 VDC

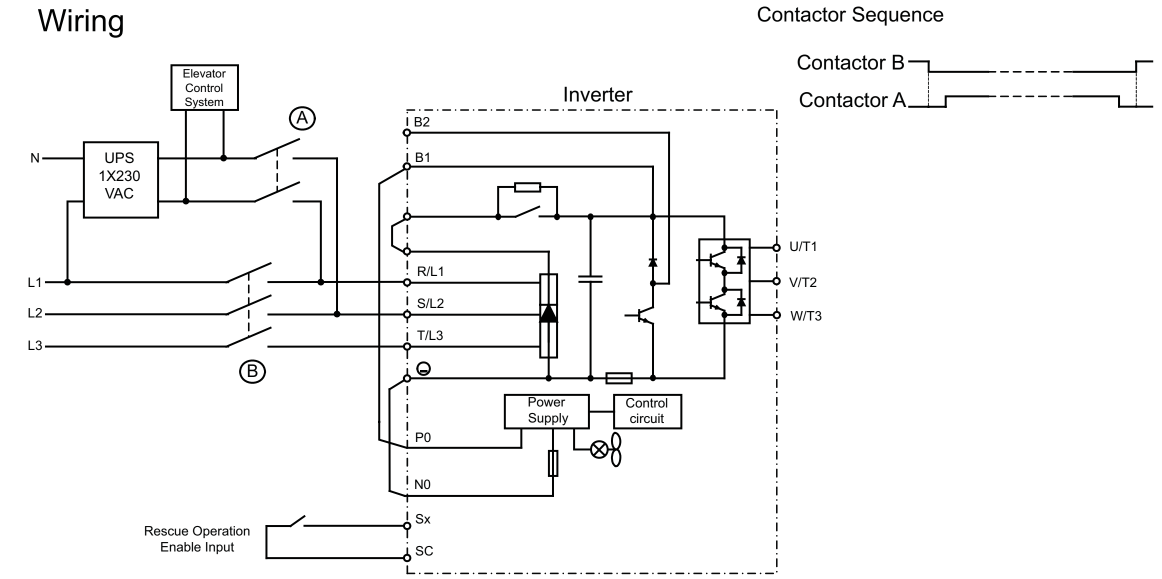
IMPORTANT

When an AC power supply (e.g. a single phase UPS like example 1 or 2 below) is used, make sure that the rectified voltage meets the voltage range above.

■Rescue operation wiring examples

The following diagrams show some wirings examples for rescue operation.

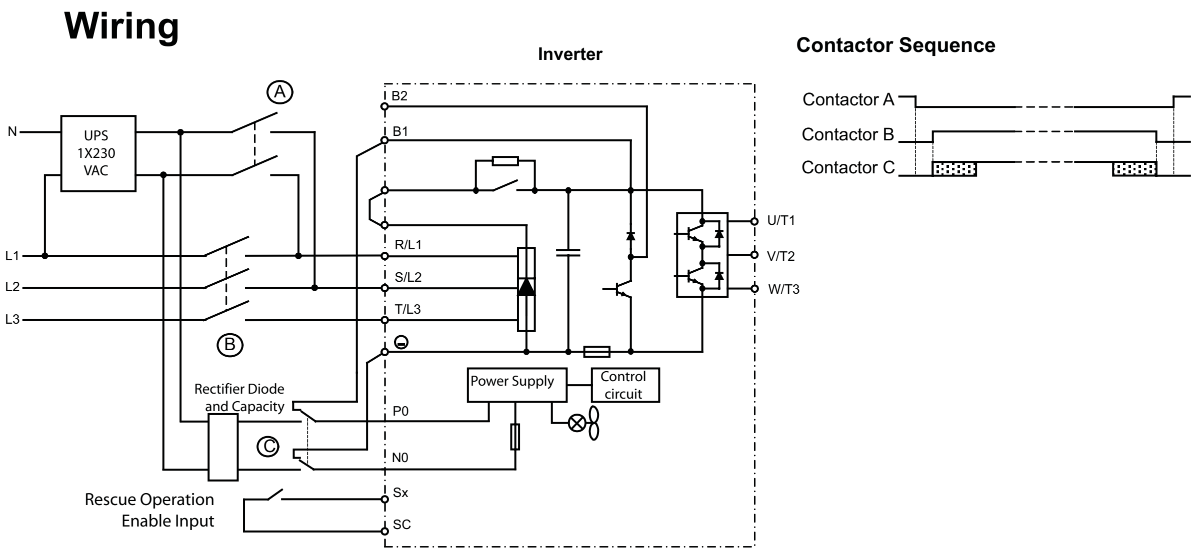
Example 1: 1 Phase, 230 V UPS Power Supply



The contactors must be operated, so that contactor B is always opened, before A is closed. When the rescue operation is finished, the contactor A must be opened, before B is closed.

If the UPS power is weak or Light load detection is not used, it can happen that the inverter trips with a UV2 fault. In this case increase the UPS power, use the light load detection function or use the configuration in example 2.

Example 2: 1 Phase, 230 V UPS Power Supply, Low power UPS or Light Load detection not used



The contactors must be operated, so that contactor B is always opened, before A and C are closed. Contactor C can be closed after A but not before. When the rescue operation is disabled, the contactors A and C must be opened, before B is closed.

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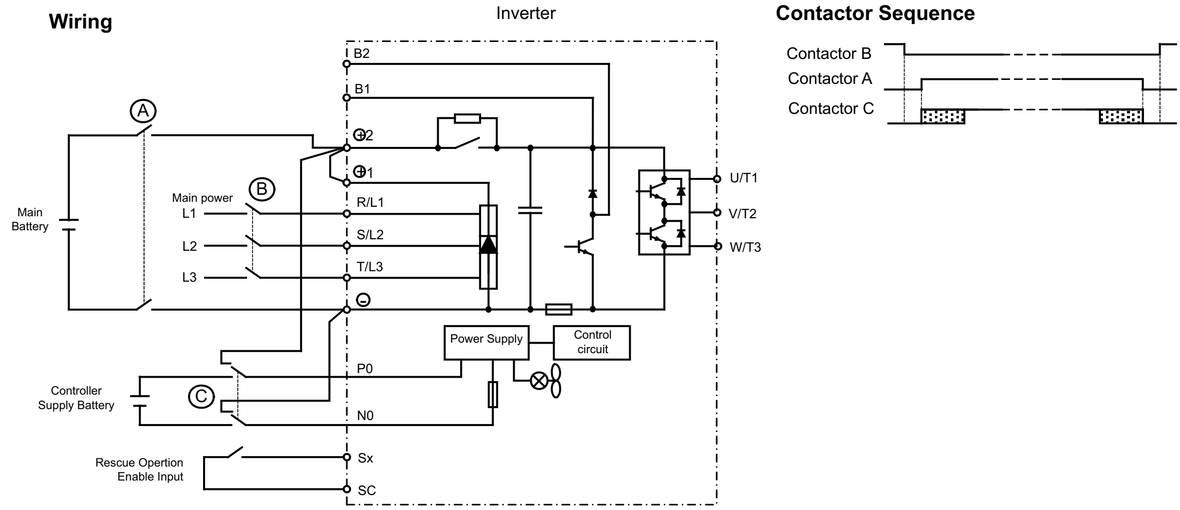
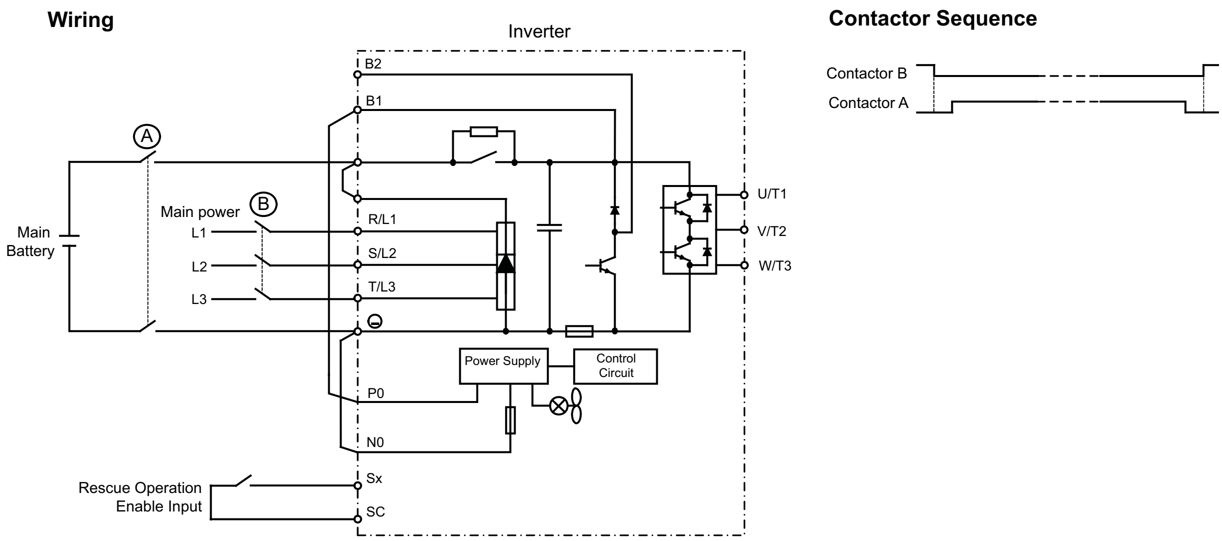
Example 3: Two Batteries, Main battery voltage lower than 280 VDC.



The contactors must be operated, so that contactor B is always opened, before A and C are closed. Contactor C can be closed after A but not before. When the rescue operation is disabled, the contactors A and C must be opened, before B is closed.

Example 4: Main battery voltage higher than 280 VDC.



The contactors must be operated, so that contactor B is always opened, before A is closed. When the rescue operation is disabled, the contactor A must be opened, before B is closed.

■Rescue Operation Speed

During rescue operation the speed is limited by the battery voltage using the following formula:

- for the 200 V class: $$\text{Rescue Operation Speed Limit} = \frac{\text{DC Bus Voltage L2-11} \times \text{Base frequency E1-04}}{300\ \text{V} \times 2}$$

- for the 400 V class: $$\text{Rescue Operation Speed Limit} = \frac{\text{DC Bus Voltage L2-11} \times \text{Base frequency E1-04}}{600\ \text{V} \times 2}$$

If the rescue speed reference (d1-15) is higher than the rescue operation speed limit, the output frequency is automatically limited to the calculated limit. It prevents a voltage saturation and a possible motor stalling.

■Precautions

Because of the possibly low DC bus voltage during rescue operation, the heatsink cooling fans may not work. A continuous operation under this condition can result in over heat faults and inverter damage.

■Torque Limits during Rescue Operation

Depending on the rescue system it might be useful to apply a torque limit. The torque limit for rescue operation can be set in parameter S3-11. It is active only if the rescue operation digital input is set an has no effect to the normal operation.

■Light Load Direction Detection

If the light load detection function is enabled (S3-06 is set to 1), the inverter can detect the light load direction for rescue operation. Therefore the elevator is driven with the light load detection speed (S3-10) sequentially in forward and reverse direction for the time set in parameter S3-07. The current/torque is measured in each direction and the values are compared to each other.

- If the detected light direction is forward, the inverter stops and restarts in the forward direction with the set rescue operation speed. At the restart the light load detection status output (H2-☐☐=45) and the light load direction output (H2-☐☐=44) are set.

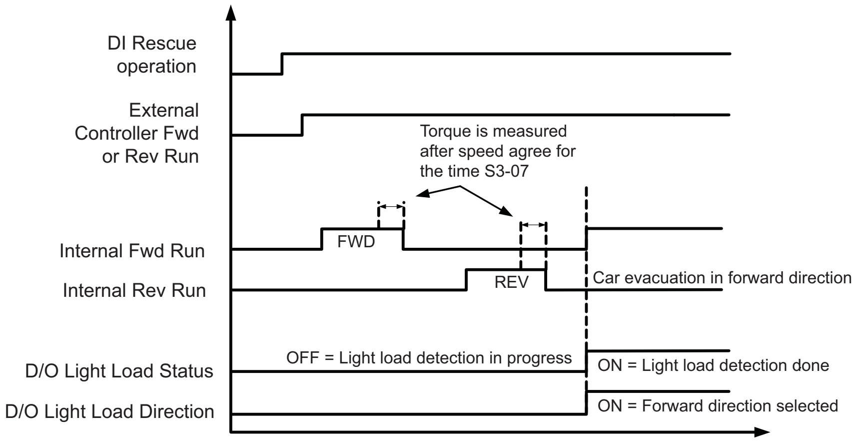


Fig 6.26 Light Load Direction Sequence - FWD is Light Direction

- If the detected light load direction is reverse, the inverter continues the operation with the set rescue operation speed. The light load detection status output (H1-☐☐=45) is set, the direction output is not changed.

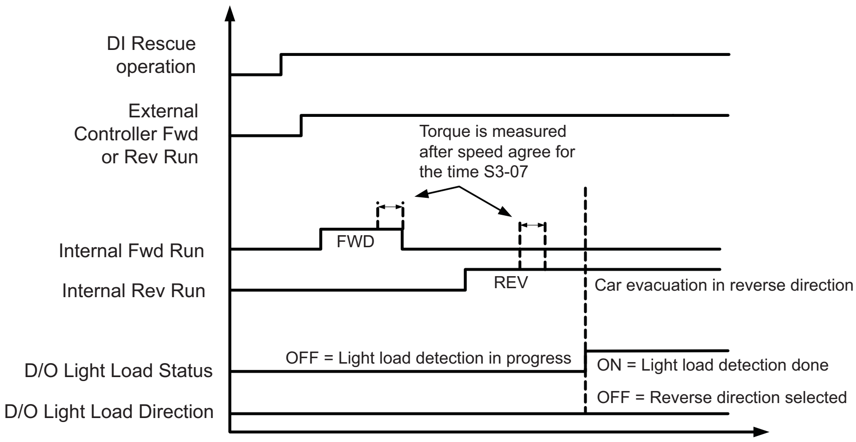


Fig 6.27 Light Load Direction Sequence - REV is Light Direction

■Light Load Direction Detection Method

If parameter S3-24 is set to “0”, the motor current values in Up and Down direction are compared. The direction with the lower current will be taken as light load direction.

If parameter S3-24 is set to “1”, in Open Loop Vector the motor speed values and V/f control the excitation currents value in both directions are compared.

6

Automatic Fault Reset

The inverter can reset faults automatically. The maximum number of resets can be selected as well as the operation mode of the fault relay.

Auto-resetable Fault codes are: UV1, GF, OC, OV, OL2, OL3, OL4, UL3, UL4, PF, LF, SE1, SE2, SE3

■Related Constants.

Parameter No.	Name	Factory setting	Change during operation	Control Methods			
				V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
L5-01	Number of restarts	2	No	A	A	A	A
L5-02	Restart operation selection	1	No	A	A	A	A
L5-05	UV1 auto reset selection	0	No	A	A	A	A

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

Setting	Function name	Control Methods			
		V/f	Open Loop Vector	Closed Loop Vector	Closed Loop Vector (PM)
1E	Fault restart active	A	A	A	A

■Working Principle

Whenever a fault occurs, the inverter output is cut and the brake is closed. A fault is output. When the automatic fault reset is enabled, the fault is reset 2 seconds after the Up/Down signal has been removed. The inverter can be restarted. This can be repeated for the number of times set in L5-02. The restart counter is reset when the power supply is switched off.

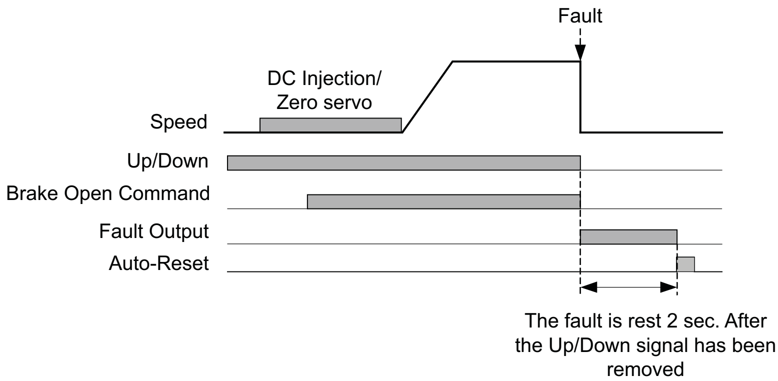


Fig 6.28 Automatic Fault Reset Sequence

■Fault Relay Operation

Parameter L5-02 can be used to enable or disable the fault relay (terminal MA-MB-MC) during the fault retry. Even if the fault relay is deactivated during the retries (L5-02=0), it is operated after the number of retries set in L5-01 has been reached.

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

■Fault Restart Indication

When the fault retry function is used, the inverter tries to reset the fault every 5 ms. If a digital output is programmed for the "Restart enable" function (H2-☐☐=1E), the output is set as long as the inverter tries to reset the fault. After a successful fault reset the output is cleared.

■UV1 Fault Restart Selection

Using parameter L5-05 the auto reset method for a UV1 (DC bus under voltage) fault can be selected.

- If L5-05 = 0 the UV1 fault is treated like set in parameter L5-01, i.e. the inverter tries to reset UV1 for the number of times set in L5-01 like described above.
- If L5-05 = 1 the UV1 fault is always automatically reset, regardless to the L5-01 setting.

Memobus Communications

◆ MEMOBUS Communications Configuration

The serial communication can be performed between one PC and one inverter in order to read / write parameters or monitor the drive. The inverter can not be controlled by Memobus communications.

To use the communications port the operator panel must be removed from the inverter. The operator panel connector on the inverter side has to be connected to the serial RS-232 port of the PC/PLC.

■Communications Specifications

The MEMOBUS communications specifications are shown in the following table.

Item	Specifications
Interface	RS-232 (not isolated)
Communications Parameters	Baud rate: 9,600 bps Data length: 8 bits fixed Parity: none Stop bits: 1 bit fixed
Communications Protocol	MEMOBUS
Number of Connectable Units	1

■Memobus Operations

MEMOBUS communications can perform the following operations:

- Monitoring operation status of the inverter
- Setting and reading parameters (for the parameter register numbers refer to the L7X manual)

6

◆ Message Content

■Message Format

In MEMOBUS communications, the master sends commands to the slave, and the slave responds. The message format is configured for both sending and receiving as shown below, and the length of data packets depends on the command (function) content.

Slave address
Function code
Data
Error check

Slave Address

The slave address can not be set in the inverter. The slave address field in the message can contain any address from 0 to 31.

Function Code

The function code specifies commands. The three function codes shown in the table below are available.

Function Code (Hexadecimal)	Function	Command Message		Response Message	
		Min. (Bytes)	Max. (Bytes)	Min. (Bytes)	Max. (Bytes)
03H	Read memory register contents	8	8	7	37
08H	Loop back test	8	8	8	8
10H	Write multiple memory registers	11	41	8	8

Data

Configure consecutive data by combining the memory register address (test code for a loop back address) and the data the register contains. The data length changes depending on the command details.

Error Check

Errors during communications are detected using CRC-16 (cyclic redundancy check, checksum method).

The result of the checksum calculation is stored in a data-word (16 bit), which starting value is FFFH. The value of this word is manipulated using Exclusive OR- and SHIFT operations together with the data package that should be sent (slave address, function code, data) and the fixed value A001H. At the end of the calculation the data-word contains the checksum value.

The checksum is calculated in the following way:

1. The starting value of the 16 Bit data-word, that is used for the calculation, has to be set to FFFFH.
2. An Exclusive OR operation has to be performed with the starting value and the slave address.
3. The result has to be shifted to the right until the overflow bit becomes 1.
4. When this bit becomes 1, an Exclusive OR operation with the result of step 3 and the fix value A001H has to be performed.
5. After 8 shift operations (every time when the overflow bit becomes 1, an Exclusive OR like in step 4 has to be done), perform an Exclusive OR operation with the result of the former operations and the next data package (8 bit function code). Again the result of this operation has to be shifted 8 times and if needed it has to be interconnected with the fix value A001H using an Exclusive OR operation.
6. The same steps have to be performed with the data, first with the higher byte and then with the lower byte until all data are proceeded.
7. The result of these operations is the checksum. It consists of a high and a low byte.

The following example clarifies the calculation method. It shows the calculation of a CRC-16 code with the slave address 02H (0000 0010) and the function code 03H (0000 0011). The resulting CRC-16 code is D1H for the lower and 40H for the higher byte. The example calculation in this example is not done completely (normally data would follow the function code).

Calculations	Overflow	Description
1111 1111 1111 1111		Initial value
0000 0010		Address
1111 1111 1111 1101		ExOr Result
0111 1111 1111 1110	1	Shift 1
1010 0000 0000 0001		
1101 1111 1111 1111		ExOr Result
0110 1111 1111 1111	1	Shift 2
1010 0000 0000 0001		
1100 1111 1111 1110		ExOr Result
0110 0111 1111 1111	0	Shift 3
0011 0011 1111 1111	1	Shift 4
1010 0000 0000 0001		
1001 0011 1111 1110		ExOr Result
0100 1001 1111 1111	0	Shift 5
0010 0100 1111 1111	1	Shift 6
1010 0000 0000 0001		
1000 0100 1111 1110		ExOr Result
0100 0010 0111 1111	0	Shift 7
0010 0001 0011 1111	1	Shift 8
1010 0000 0000 0001		
1000 0001 0011 1110		ExOr Result
0000 0011		Function Code
1000 0001 0011 1101		ExOr Result
0100 0000 1001 1110	1	Shift 1
1010 0000 0000 0001		
1110 0000 1001 1111		ExOr Result
0111 0000 0100 1111	1	Shift 2
1010 0000 0000 0001		
1101 0000 0100 1110		ExOr Result
0110 1000 0010 0111	0	Shift 3
0011 0100 0001 0011	1	Shift 4
1010 0000 0000 0001		
1001 0100 0001 0010		ExOr Result
0100 1010 0000 1001	0	Shift 5
0010 0101 0000 0100	1	Shift 6
1010 0000 0000 0001		
1000 0101 0000 0101		ExOr Result
0100 0010 1000 0010	1	Shift 7
1010 0000 0000 0001		
1110 0010 1000 0011		ExOr Result
0111 0001 0100 0001	1	Shift 8
1010 0000 0000 0001		
1101 0001 0100 0000		ExOr Result
D1H 40H		CRC-16 Result
Higher Byte Lower Byte		

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■MEMOBUS Message Example

An example of MEMOBUS command/response messages is given below.

Reading Inverter Memory Register Contents

The content of maximum 16 inverter memory registers can be read out at a time.

Among other things the command message must contain the start address of the first register to read out and the quantity of registers. The response message will contain the content of the first and the consecutive number of registers that has been set for the quantity.

The contents of the memory register are separated into higher 8 bits and lower 8 bits.

The following tables show message examples when reading status signals, error details, data link status, and frequency references from the slave 2 Inverter.

Command Message

Slave Address		02H
Function Code		03H
Start Address	Higher	00H
	Lower	20H
Quantity	Higher	00H
	Lower	04H
CRC-16	Higher	45H
	Lower	F0H

Response Message
(During Normal Operation)

Slave Address		02H
Function Code		03H
Data quantity		08H
1st storage register	Higher	00H
	Lower	65H
Next storage register	Higher	00H
	Lower	00H
Next storage register	Higher	00H
	Lower	00H
Next storage register	Higher	01H
	Lower	F4H
CRC-16	Higher	AFH
	Lower	82H

Response Message
(During Error)

Slave Address		02H
Function Code		83H
Error code		03H
CRC-16	Higher	F1H
	Lower	31H

6

Loop back Test

The loop back test returns command messages directly as response messages without changing the contents to check the communications between the master and slave.

The following table shows a message example for performing a loop back test with the slave no. 1.

Command Message

Slave address		01H
Function code		08H
Test Code	Higher	00H
	Lower	00H
Data	Higher	A5H
	Lower	37H
CRC-16	Higher	DAH
	Lower	8DH

Response Message
(During Normal Operation)

Slave address		01H
Function code		08H
Test Code	Higher	00H
	Lower	00H
Data	Higher	A5H
	Lower	37H
CRC-16	Higher	DAH
	Lower	8DH

Response Message
(During Error)

Slave address		01H
Function code		89H
Error Code		01H
CRC-16	Higher	86H
	Lower	50H

Writing to Multiple Inverter Memory Registers

The writing of inverter memory registers works similar to the reading process, i.e. the address of the first register that has to be written and the number of registers must be set in the command message.

The data registers which shall be written must be consecutive, starting from the specified address in the command message. The data order must be higher 8 bits, then lower 8 bits. The data must be in memory register address order.

The following table shows an example of a message where a forward operation has been set with a frequency reference of 60.0 Hz for the inverter with the slave address 01H.

Command Message

Slave Address		01H
Function Code		10H
Start Address	Higher	00H
	Lower	01H
Quantity	Higher	00H
	Lower	02H
No. of data		04H
Lead data	Higher	00H
	Lower	01H
Next data	Higher	02H
	Lower	58H
CRC-16	Higher	63H
	Lower	39H

Response Message
(During Normal Operation)

Slave Address		01H
Function Code		10H
Start Address	Higher	00H
	Lower	01H
Quantity	Higher	00H
	Lower	02H
CRC-16	Higher	10H
	Lower	08H

Response Message
(During Error)

Slave Address		01H
Function Code		90H
Error code		02H
CRC-16	Higher	CDH
	Lower	C1H

* No. of data = 2 x (quantity)

IMPORTANT

For the number of data value in the command message the double value of the data quantity must be

■Monitor Data

The following table shows the monitor data. Monitor data can only be read.

Register Address.	Contents	
0010H	Inverter status signal	
	Bit 0	During run
	Bit 1	Zero speed
	Bit 2	During reverse operation
	Bit 3	Reset signal active
	Bit 4	During speed agree
	Bit 5	Inverter ready
	Bit 6	Minor fault
	Bit 7	Major fault
	Bits 8 to D	Not used
	Bit E	ComRef status
	Bit F	ComCtrl status
0011H	Operator status	
	Bit 0	During OPE alarm
	Bit 1	During fault
	Bit 2	Operator in programming mode
	Bit 3	0: Digital operator attached 1: PC connected
	Bit 4 to F	Not used
0012H	OPE Fault Number	
0013H	Not used	
0014H	Fault Content 1	
	Bit 0	PUF, DC bus fuse blown
	Bit 1	UV1
	Bit 2	UV2
	Bit 3	UV3
	Bit 4	Not used
	Bit 5	GF, Ground fault
	Bit 6	OC, Over current
	Bit 7	OV, DC bus over voltage
	Bit 8	OH, Inverter heatsink overheat pre-alarm
	Bit 9	OH1, Inverter heatsink overheat
	Bit A	OL1, Motor overload
	Bit B	OL2, Inverter overload
	Bit C	OL3, Overtorque detection 1
	Bit D	OL4, Overtorque detection 2
	Bit E	RR, Internal braking transistor fault
	Bit F	RH, Inverter mounted braking resistor overheat
0015H	Fault Content 2	
	Bit 0	EF3, External fault set on terminal S3
	Bit 1	EF4, External fault set on terminal S4
	Bit 2	EF5, External fault set on terminal S5
	Bit 3	EF6, External fault set on terminal S6
	Bit 4	EF7, External fault set on terminal S7
	Bit 5	Not used
	Bit 6	Not used
	Bit 7	OS, Overspeed detected
	Bit 8	DEV, Speed deviation detected
	Bit 9	PGO, PG disconnected
	Bit A	PF, Input phase loss
	Bit B	LF, Output open phase
	Bit C	OH3, Motor overheat pre-alarm (PTC analog input)
	Bit D	OPR, Digital operator disconnected
	Bit E	ERR, EPROM error
	Bit F	Not used

Register Address.	Contents	
0016H	Fault Content 3	
	Bit 0	CE, Memobus communications error
	Bit 1	BUS, Bus option communications error
	Bit 2/3	Not used
	Bit 4	CF, Control fault
	Bit 5	SVE, Zero servo fault
	Bit 6	EF0, External fault from optional input card
	Bit 7	Not used
	Bit 8	UL3, Undertorque detection 1
	Bit 9	UL4, Undertorque detection 2
	Bit A to F	Not used
0017H	CPF Fault Content 1	
	Bit 0/1	Not used
	Bit 2	CPF02
	Bit 3	CPF03
	Bit 4	Not used
	Bit 5	CPF05
	Bit 6	CPF06
	Bit 7 to F	Not used
0018H	CPF Fault Content 2	
	Bit 0	CPF20
	Bit 1	CPF21
	Bit 2	CPF22
	Bit 3	CPF23
	Bit 4 to F	Not used
0019H	Alarm Content 1	
	Bit 0	UV, DC bus undervoltage
	Bit 1	OV, DC bus overvoltage
	Bit 2	OH, Inverter heatsink overheat pre-alarm
	Bit 3	OH2, Inverter overheat alarm input by a digital input
	Bit 4	OL3, Overtorque detection 1
	Bit 5	OL4, Overtorque detection 2
	Bit 6	EF, Forward/Reverse input set at the same time
	Bit 7	BB, Baseblock active
	Bit 8	EF3, External alarm set on terminal S3
	Bit 9	EF4, External alarm set on terminal S4
	Bit A	EF5, External alarm set on terminal S5
	Bit B	EF6, External alarm set on terminal S6
	Bit C	EF7, External alarm set on terminal S7
	Bit D/E	Not used
	Bit F	OS, Overspeed alarm
001AH	Alarm Content 2	
	Bit 0	DEV, Speed deviation
	Bit 1	PGO, PG disconnected
	Bit 2	OPR, Digital operator disconnected
	Bit 3	CE, Memobus communications error
	Bit 4	BUS, Communications error
	Bit 5	CALL, Memobus communications on standby
	Bit 6	OL1, Motor overload
	Bit 7	OL2, Inverter overload
	Bit 8 to B	Not used
	Bit C	CALL, Communications on standby
	Bit D	UL3, Undertorque detection 1
	Bit E	UL4, Undertorque detection 2
	Bit F	Not used
001BH	Not used	

Register Address.	Contents	
0020H	Inverter status	
	Bit 0	Forward operation
	Bit 1	Reverse operation
	Bit 2	Inverter startup complete 1: Completed 2: Not completed
	Bit 3	Error
	Bit 4	Data setting error
	Bit 5	Multi-function contact output 1 (terminal M1 - M2) 1: ON 0: OFF
	Bit 6	Multi-function contact output 2 (terminal M3 - M4) 1: ON 0: OFF
	Bit 7	Multi-function contact output 3 (terminal M5 - M6) 1: ON 0: OFF
	Bits 8 to F	Not used
0021H	Error details	
	Bit 0	Overcurrent (OC), Ground fault (GF)
	Bit 1	Main circuit overvoltage (OV)
	Bit 2	Inverter overload (OL2)
	Bit 3	Inverter overheat (OH1, OH2)
	Bit 4	Braking transistor/resistance overheat (rr, rH)
	Bit 5	Fuse blown (PUF)
	Bit 6	Not used
	Bit 7	External error (EF, EFO)
	Bit 8	Control board error (CPF)
	Bit 9	Motor overload (OL1) or overtorque 1 (OL3) detected
	Bit A	PG broken wire detected (PGO), Overspeed (OS), Speed deviation (DEV)
	Bit B	Main circuit undervoltage (UV) detected
	Bit C	Main circuit undervoltage (UV1), control power supply error (UV2), inrush prevention circuit error (UV3), power loss
	Bit D	Missing output phase (LF)
	Bit E	MEMOBUS communications error (CE)
	Bit F	Operator disconnected (OPR)
0022H	Data link status	
	Bit 0	Writing data
	Bit 1	Not used
	Bit 2	Not used
	Bit 3	Upper and lower limit errors
	Bit 4	Data integrity error
	Bits 5 to F	Not used
0023H	Frequency reference	Monitors U1-01
0024H	Output frequency	Monitors U1-02
0025H	Output voltage	Monitors U1-06
0026H	Output current	Monitors U1-03
0027H	Output power	Monitors U1-08
0028H	Torque reference	Monitors U1-09
0029H	Not used	
002AH	Not used	
002BH	Control terminals input status	
	Bit 0	Input terminal S1 1: ON 0: OFF
	Bit 1	Input terminal S2 1: ON 0: OFF
	Bit 2	Multi-function input terminal S3 1: ON 0: OFF
	Bit 3	Multi-function input terminal S4 1: ON 0: OFF
	Bit 4	Multi-function input terminal S5 1: ON 0: OFF
	Bit 5	Multi-function input terminal S6 1: ON 0: OFF
	Bit 6	Multi-function input terminal S7 1: ON 0: OFF
	Bits 7 to F	Not used

Register Address.	Contents		
002CH	Inverter status		
	Bit 0	Operation	1: Operating
	Bit 1	Zero speed	1: Zero speed
	Bit 2	Frequency agree	1: Agreement
	Bit 3	User-defined speed agree	1: Agreement
	Bit 4	Frequency detection 1:	1: Output frequency ≤ L4-01
	Bit 5	Frequency detection 2:	1: Output frequency ≥ L4-01
	Bit 6	Inverter startup completed	1: Startup completed
	Bit 7	Undervoltage detection	1: Detected
	Bit 8	Baseblock	1: Inverter output baseblock
	Bit 9	Frequency reference mode	1: Not communication 0: Communication option
	Bit A	Run command mode	1: Not communication 0: Communication option
	Bit B	Overtorque detection	1: Detected
	Bit C	Frequency reference lost	1: Lost
	Bit D	Restart enabled	1: Restarting
	Bit E	Error (including MEMOBUS communications time-out) 1:Error occurred	
	Bit F	MEMOBUS communications time-out1: Timed out	
002DH	Multi-function contact output status		
	Bit 0	Multi-function contact output 1 (terminal M1-M2) 1: ON 0: OFF	
	Bit 1	Multi-function contact output 2 (terminal M3-M4) 1: ON 0: OFF	
	Bit 2	Multi-function contact output 3 (terminal M5-M6) 1: ON 0: OFF	
	Bits 3 to F	Not used	
002EH - 0030H	Not used		
0031H	Main circuit DC voltage		
0032H	Torque Monitor U1-09		
0033H	Power Monitor U1-08		
0034H - 003AH	Not used		
003BH	CPU software number		
003CH	Flash software number		
003DH	Communications error details		
	Bit 0	CRC error	
	Bit 1	Invalid data length	
	Bit 2	Not used	
	Bit 3	Parity error	
	Bit 4	Overrun error	
	Bit 5	Framing error	
	Bit 6	Time-out	
	Bits 7 to F	Not used	
003EH	kVA setting		
003FH	Control method		

Note: Communications error details are stored until an error reset is input.

◆ Inverter Error Codes

The content of a current fault and faults that have occurred earlier can be read out by Memobus using the Fault Trace (U2-☐☐) and the Fault History (U3-☐☐) parameters. The fault codes are shown in the table below.

Fault Code	Fault Description	Fault Code	Fault Description	Fault Code	Fault Description
01H	PUF	14H	EF6	37H	SE1
02H	UV1	15H	EF7	38H	SE2
03H	UV2	18H	OS	39H	SE3
04H	UV3	19H	DEV	83H	CPF02
06H	GF	1AH	PGO	84H	CPF03
07H	OC	1BH	PF	85H	CPF04
08H	OV	1CH	LF	86H	CPF05
09H	OH	1DH	OH3	87H	CPF06
0AH	OH1	1EH	OPR	88H	CPF07
0BH	OL1	1FH	ERR	89H	CPF08
0CH	OL2	21H	CE	8AH	CPF09
0DH	OL3	22H	BUS	8BH	CPF10
0EH	OL4	25H	CF	91H	CPF20
0FH	RR	26H	SVE	92H	CPF21
10H	RH	27H	EF0	93H	CPF22
11H	EF3	28H	FBL	94H	CPF23
12H	EF4	29H	UL3		
13H	EF5	2AH	UL4		

◆ ENTER Command

When parameters are written in the Inverter from a PC/PLC using MEMOBUS communications, the parameters are temporarily stored in the parameter data area of the Inverter. To enable these parameters in the parameter data area, an ENTER command must be used.

There are two types of ENTER commands:

- ENTER commands that enable parameter data in RAM only (changes will be lost after power loss)
- ENTER commands that write data into the EEPROM (non-volatile memory) of the Inverter and enable the data in RAM at the same time.

Register Address.	Contents
0900H	Write parameter data to EEPROM, RAM is refreshed
0910H	Parameter data are not written to EEPROM, but refreshed in RAM only.

An ENTER command is performed by writing 0 to register number 0900H or 0910H.

IMPORTANT

- The EEPROM can be written up to 100,000 times only. Do not frequently execute ENTER commands (0900H) which write into the EEPROM.
- The ENTER command registers are write-only registers. Consequently, if these registers are read out, error code 02H is returned.
- An ENTER command is not required if reference or broadcast data are sent to the inverter.

◆ Communication Error Codes

The following table shows MEMOBUS communications error codes.

Error Code	Contents
01H	Function code error A function code other than 03H, 08H, or 10H has been set by the PLC.
02H	Invalid register number error • The specified register address does not exist. • With broadcast sending, a start address other than 0001H, or 0002H has been set.
03H	Invalid quantity error • The number of data packets (register content) being read or written is outside the range of 1 to 16. • In write mode, the number of data bytes in the message is not No. of packets x 2.
21H	Data setting error • A simple upper limit or lower limit error has occurred in the control data or when writing parameters. • When writing parameters, the parameter setting is invalid.
22H	Write mode error • Attempting to write parameters to the inverter during operation. • Attempting to write via ENTER commands during operation. • Attempting to write parameters other than A1-00 to A1-05, E1-03, or 02-04 when warning alarm CPF03 (defective EEPROM) has occurred. • Attempting to write read-only data.
23H	Writing during DC bus undervoltage (UV) error • Writing parameters to the inverter during UV (DC bus undervoltage) alarm. • Writing via ENTER commands during UV (DC bus undervoltage) alarm.
24H	Writing error during parameters processing Attempting to write parameters while processing parameters in the Inverter.

■Slave Not Responding

In the following cases, the slave ignores the write function.

- When a communications error (overrun, framing, parity, or CRC-16) is detected in the command message.
- When the gap between two blocks (8 bit) of a message exceeds 24 bits.
- When the command message data length is invalid.

7

Troubleshooting

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

Protective and Diagnostic Functions

This section describes the fault and alarm functions of the Inverter. These functions include fault detection, alarm detection, programming error detection and auto-tuning error detection.

◆ Fault Detection

When the Inverter detects a fault, the fault contact output is operated and the Inverter output is switched OFF and the motor coasts to stop. (The stopping method can be selected for some faults.) A fault code is displayed on the Digital Operator/LED Monitor.

The faults can be categorized in two groups:

- Faults that can be reset without cycling the power using an input or the reset key at the Digital Operator (resetable faults)
- Faults that require to cycle the power (non-resetable faults)

When a fault has occurred refer to the following to identify the fault and to correct the causes.
To reset a fault it is necessary to remove the RUN signal and correct the fault reason. Otherwise a Reset is not accepted or the Inverter trips with the same fault again.

The following tables shows a list of faults and corrective actions.

Table 7.1 Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
GF Ground Fault	Ground Fault The ground current at the Inverter output exceeded 50% of the Inverter rated output current and L8-09=1 (Enabled).	One Inverter output was shorted to ground or a DCCT is defective. The output contactor was opened when the inverter output was still active.	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. Check the control sequence for wrong motor contactor signals.
OC Over Current	Overcurrent The Inverter's output current exceeded the overcurrent detection level.	Shorted Inverter output phase-to-phase, shorted motor, locked rotor, too heavy load, accel/decel time too short, contactor on the Inverter output has opened or closed, a special motor or a motor with a rated current larger than the Inverter's output current is used.	Remove the motor and run the Inverter without the motor. Check the motor for a phase-to-phase short. Verify the accel/decel times (C1-□□). Check the Inverter for a phase-to-phase short at the output.
PUF DC Bus Fuse Open	DC Bus Fuse blown. The fuse in the main circuit is open. Warning: Never run the Inverter after replacing the DC bus fuse without checking for shorted components.	Shorted output transistor(s) or terminals.	Check the motor and the motor cables for short circuits or insulation failures (phase-to-phase). Replace the inverter after correcting the fault.

Table 7.1 Resetable Faults

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.
		The braking chopper / braking resistor is not working.	Check the braking chopper / resis-tor.
UV1 DC Bus Undervolt	DC Bus Undervoltage The DC bus voltage is below the Und-ervoltage Detection Level (L2-05). The default settings are: 200V class: 190 VDC 400 V class: 380 VDC	The voltage fluctuations of the power supply are too high.	Check the input voltage.
		A momentary power loss occurred.	
		The terminal screws of the input power supply are loose.	Check the wiring of the input termi-nals.
		An open-phase error occurred at the input terminals.	Check the input voltage and the wiring of the input terminals.
		The acceleration time is set too short.	Extend the settings in C1-01/03/05/07
	Main Circuit MC Operation Failure The MC stopped responding during Inverter operation.	An error occurred in the inrush current prevention circuit while the Inverter was running.	Replace the Inverter.
UV2 CTL PS Undervolt	Control Power Supply Undervoltage Undervoltage of the control circuit while the Inverter was running.	External load was pulling down the Inverter's power supplies or there was an internal short in the power/gate drive board.	Remove all connection to the con-trol terminals and cycle the power to the Inverter.
			Replace the Inverter.
UV3 MC Answerback	Inrush Current Prevention Circuit Fault An overheating of the charging resistor for the DC bus capacitors occurred. The MC of the charging circuit did not respond 10 sec. after the MC ON signal has been output. (Applicable Inverter Capacities 200 V class: 37 to 55 kW)	The contactor of the inrush current pre-vention circuit is defective.	Cycle the power to the Inverter.
			Replace the Inverter if the fault continues to occur.
PF Input Phase Loss	Main Circuit Voltage Fault An unusual big ripple on the DC bus voltage has been detected. Only detected when L8-05=1 (enabled)	The wiring terminals for the input power supply are loose.	Tighten the input terminal screws
		A phase loss occurred in the input power supply.	Check the power supply voltage
		A momentary power loss occurred	
		The voltage fluctuation of the input power supply is too high.	
		The voltage balance between the input phases is bad.	
LF Output Phase Loss	Output Open-phase An open-phase occurred at the Inverter output. The fault is detected when the output current falls below 5% of the inverter rated current and L8-07=1 (enabled)	There is a broken wire in the output cable. The motor winding is broken. The output terminals are loose.	Reset the fault after correcting its cause.
		The motor has a capacity less than 5% of the Inverter's maximum motor capacity.	Check the motor and Inverter capacity.

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Table 7.1 Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
OH Heatsink Overtemp	Heatsink Overheat The temperature of the Inverter's cooling fin exceeded the setting in L8-02 and L8-03 is set to 0,1 or 2.	The 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) is/are broken.	Replace the cooling fan(s).
	Inverter's Cooling Fan Stopped	The Inverter's internal cooling fan is broken (18.5 kW and larger).	
OH1 Heatsink Max Temp	Heatsink Overheat The temperature of the Inverter's heatsink exceeded 105 °C.	The ambient temperature is too high.	Check for dirt build-up on the fans or heatsink.
		There is a heat source nearby.	Reduce the ambient temperature around the drive.
		The Inverter's cooling fan(s) is/are broken.	Replace the cooling fan(s).
	Inverter's Cooling Fan Stopped	The Inverter's internal cooling fan is broken (18.5 kW and larger).	
RR DynBrk Transistr	Dynamic Braking Transistor The built-in dynamic braking transistor failed.	Defective or failed dynamic braking resistor caused braking transistor damage.	Cycle power to the Inverter.
			Replace the Inverter.
OL1 Motor Overload	Motor Overload Detected when L1-01 is set to 1,2 or 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.	Check the V/f characteristics (E1-☐☐).
		The setting of Motor Rated Current (E2-01) is incorrect.	Check the setting of Motor Rated Current Setting (E2-01).
OL2 Inv Overload	Inverter Overload The Inverter output current exceeded the Inverter's overload capability.	The load is too large. The acceleration time or deceleration times are too short.	Recheck the cycle time and the size of the load as well as the accel/ decel times (C1-☐☐).
		The voltage settings of the V/f pattern is incorrect.	Check the V/f characteristics (E1-☐☐).
		The size of the Inverter is too small.	Check the setting of Motor Rated Current Setting (E2-01).
OL3 Car Stuck	Overtorque/Car Stuck Detection 1 The Inverter's output current (V/f control) or the output torque (Vector Control) exceeded L6-02 for longer than the time set in L6-03 and L6-01 is set to 3 or 4.	Motor was overloaded.	Ensure the values in L6-02 and L6-03 are appropriate.
			Check application/machine status to eliminate fault.
OL4 Car Stuck	Overtorque/Car Stuck Detection 2 The Inverter's output current (V/f control) or the output torque (Vector Control) exceeded L6-05 for longer than the time set in L6-06 and L6-04 is set to 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 than the time set in L6-03 and L6-01 is set to 7 or 8.	Motor was underloaded.	Ensure the values in L6-02 and L6-03 are appropriate.
			Check application/machine status to eliminate fault.

Table 7.1 Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
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 than the time set in L6-06 and L6-04 is set to 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 is set to 0, 1 or 2 and A1-02 is set to 3. The motor speed feedback (U1-05) exceeded the setting in F1-08 for a time longer than the setting of F1-09.	Overshooting/Undershooting occurs.	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 is set to 0, 1 or 2 and A1-02 is set to 3 or 6 Detected when no PG (encoder) pulses are received for a time longer than the setting of F1-14.	The PG wiring is broken.	Fix the broken/disconnected wiring.
		The PG is wired incorrectly.	Fix the wiring.
		Power is not supplied to the PG.	Supply power to the PG properly.
		Wrong brake control sequence. The motor runs against the closed brake.	Check the sequence and if the brake is opened when the inverter starts to increase the speed.
DEV Speed Deviation	Excessive Speed Deviation Detected when F1-04 is set to 0, 1 or 2 and A1-02 is set to 3 or 6 The speed deviation is higher than the setting of F1-10 for a time longer than the setting of 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 of F1-10 and F1-11 are not appropriate.	Check the settings of F1-10 and F1-11.
		Wrong brake control sequence. The motor runs against the closed brake.	Check the sequence and if the brake is opened when the inverter starts to increase the speed.
DV3	Wrong rotation direction Detected when the speed deviation is higher than 30% and the torque reference and acceleration have opposite signs.	PG wire broken	Check the PG wiring
		Incorrect PG wiring	Correct the wiring
		Wrong magnet position compensation value (F1-22)	Verify the PG direction and execute an encoder offset auto tuning
		The load is too large	Reduce the load and check the brake
DV4	Wrong rotation direction Detected when F1-19 is not 0, the speed reference and motor speed have opposite signs and the detection threshold set in F1-19 is exceeded.	The magnet position offset setting in F1-22 is wrong	Verify the PG direction and execute an encoder offset auto tuning
		The load is too large	Reduce the load and check the brake
DV6 Over Acceleration	An over acceleration of the car was detected (A1-02 = 6 only)	The load is too large	Reduce the load
		Magnet position offset is wrong	Check the PG direction, check F1-22 and perform an encoder offset tuning.
		Sheave diameter, gear ratio or roping setting incorrect	Verify the settings of S3-13, S3-14 and S3-15.
		Too short acceleration or deceleration time.	Adjust the acceleration and deceleration times.
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.

Table 7.1 Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
CF Out of Control	Control Fault A torque limit was reached continuously for 3 seconds or longer during a deceleration stop in Open Loop Vector control.	Motor parameters were not set properly.	Check the motor parameters.
EF0 Opt External Flt	External fault input from Communications Option Card	An external fault condition was present, input from a communication option card.	Check for an external fault condition. Verify the parameters. Verify communication signals
EF3 Ext Fault S3	External fault at terminal S3	An “external fault” was input from a multi-function input terminal (S3 to S7).	Eliminate the cause of the external fault condition.
EF4 Ext Fault S4	External fault at terminal S4		
EF5 Ext Fault S5	External fault at terminal S5		
EF6 Ext Fault S6	External fault at terminal S6		
EF 7 Ext Fault S7	External fault at terminal S7		
CE Memobus Com Err	MEMOBUS Communication Error Detected when control data was not received correctly for two seconds, H5-04 is set to 0,1 or 2 and H5-05 is set to 1.	Connection is broken and/or the master has stopped the communication.	Check the connections and all PLC-side software configurations.
BUS Option Com Err	Option Communication Error After initial communication has been established, the connection got lost.	Connection is broken and/or the master has stopped the communication.	Check the connections and all PLC-side software configurations.
SE1 Sequence Error 1	Detected no output contactor answer back for S1-16 time setting.	The output contactor or auxiliary switch has a malfunction.	Check the output contactor.
SE2 Sequence Error 2	The output current at start was below 25% of no-load current.	The output contactor was not closed at start.	Check the output contactor.
SE3 Sequence Error 3	The output current during run was below 25% of no-load current.	The output contactor was opened during run.	Check the output contactor.
SE4 Brake Answer Fault	The Brake Release Command and the Brake Release Check signals do not match.	The feedback signal from the brake is not switched ON while the Brake Relase command is switched ON.	Check the brake sequence.
Ref Missing FRL	No speed was selected before the inverter start.	A start signal was given and no speed was selected when d1-18 = 1 and H1-□□≠83.	Check the speed selection/start sequence.

Table 7.2 Not Resetable Faults

CPF00 COM-ERR(OP&INV)	Digital Operator/LED Monitor Communication Fault 1 Communication with the digital operator could not be established within 5 seconds after the power was supplied to the Inverter.	Digital operator cable was not securely connected or digital operator is defective and/or control board is defective	Disconnect the Digital Operator/LED Monitor and then connect it again. Replace the Inverter.
	CPU External RAM Fault	The control board is damaged.	Cycle the Inverter power supply. Replace the Inverter.

Table 7.2 Not Resetable Faults

CPF01 COM-ERR(OP&INV)	Digital Operator/LED Monitor Communication Fault 2 After communications with the digital operator was established, the communication stopped for 2 seconds or more.	Digital operator cable is not properly connected or the digital operator is defective	Disconnect the Digital Operator/ LED Monitor and then connect it again.
		The control board is damaged.	Cycle the Inverter power supply.
			Replace the Inverter.
CPF02 BB Circuit Err	Baseblock circuit error A baseblock circuit error occurred at power-up.	Gate array hardware failure at power-up.	Perform an initialization to factory defaults.
			Cycle the Inverter power supply.
			Replace the Inverter.
CPF03 EEPROM Error	EEPROM error Check sum is not valid	Noise or spike was on the control circuit input terminals or the control board is damaged.	Perform an initialization to factory defaults.
			Cycle the Inverter power supply.
			Replace the Inverter.
CPF04 Internal A/D Err	CPU Internal A/D Converter Fault	Noise or spike was on the control circuit input terminals or the control board is damaged.	Perform an initialization to factory defaults.
			Cycle the Inverter power supply.
			Replace the Inverter.
CPF05 External A/D Err	CPU External A/D Converter Fault	Noise or spike was on the control circuit input terminals or the control board is damaged.	Perform an initialization to factory defaults.
			Cycle the Inverter power supply.
			Replace the Inverter.
CPF06 Option Error	Option Card Connection Fault	The Option Card is not connected properly.	Turn off the power and re-install the Option Card again.
		The Inverter or Option Card is damaged.	Replace the Option Card or the Inverter.
CPF07 RAM-Err	ASIC Internal RAM fault	-	Cycle the Inverter power supply.
		The control circuit is damaged.	Replace the Inverter.
CPF08 WAT-Err	Watchdog Timer Fault	-	Cycle the Inverter power supply.
		The control circuit is damaged.	Replace the Inverter.
CPF09 CPU-Err	CPU-ASIC Mutual Diagnosis Fault	-	Cycle the Inverter power supply.
		The control circuit is damaged.	Replace the Inverter.
CPF10 ASIC-Err	ASIC version fault	The control circuit is damaged.	Replace the Inverter.
CPF20 Option A/D Error	Communication Option Card A/D Converter Error	Option board connection is not correct.	Turn off the power and re-install the option board again
			Remove all inputs to the option board
		Option card A/D converter is faulty.	Perform an initialization to factory defaults.
			Cycle the Inverter power supply.
			Replace the option board
			Replace the inverter
CPF21 Option CPU Down	Self-diagnosis Fault of Option Board	Noise or spike was on the communication line and/or defective option board.	Perform an initialization to factory defaults.
			Cycle the Inverter power supply.
			Replace the option board
			Replace the Inverter

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Table 7.2 Not Resetable Faults

CPF22 Option Type Err	Option Board Code Number Fault	An unrecognizable option board is connected to the control board.	Remove any option boards
			Perform an initialization to factory defaults
			Cycle the Inverter power supply.
			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 which is not made for the Inverter has been attached to the control board.	Turn off the power and reinstall the option board again
			Perform an initialization to factory defaults
			Cycle the Inverter power supply.
			Replace the option board
			Replace the Inverter
CPF24 Option Comm Err	PG-F2 (Hiperface®/ EnDat) serial communication error Detected when no data were received from the encoder for 200 msec	Encoder connection wiring broken or encoder broken	Check the encoder connection or replace the encoder if necessary

◆ Alarm Detection

Alarms are Inverter protection functions that indicate unusual conditions without switching off the drive and operating the fault output contact. The alarm automatically disappears when its cause is eliminated.

During an alarm condition, the Digital Operator/LED Monitor alarm display flashes and an alarm output is generated at the multi-function outputs (H2-01 to H2-03) if programmed.

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

Table 7.3 Alarm Detection

Display	Meaning	Probable causes	Corrective Actions
EF External Fault (flashing)	Forward/Reverse Run Commands Input Together Both the forward and the reverse run commands are input simultaneously for 500ms or more. This alarm stops the motor.	Control sequence is faulty.	Check external sequence logic, so that only one input is received at a time.
UV DC Bus Undervolt (flashing)	DC Bus Undervoltage The following conditions occurred • The DC bus voltage was below the Undervoltage Detection Level Setting (L2-05). • The MC of the inrush current prevention circuit was opened. • The control power supply voltage was below the CUV level. UV Alarm is detected only, when the drive is in stop condition	For the probable reasons please have a look at UV1, UV2 and UV3 in table 7.1.	For the corrective actions please have a look at UV1, UV2 and UV3 in table 7.1
OV DC Bus Overvolt (flashing)	DC Bus Overvoltage The DC bus voltage exceeded the overvoltage detection level. 200 V class: 410 VDC 400 V class: 820 VDC An OV Alarm is detected only, when the drive is in stop condition.	The power supply voltage is too high.	Check the power supply and decrease the voltage to meet the Inverter’s specifications
OH Heatsnk Overtmp (flashing)	Heatsink Overheat The temperature of the Inverter's cooling fin exceeded the temperature programmed in L8-02. Enabled when L8-03 = 3.	The ambient temperature is too high.	Check for dirt build-up on the fans or heatsink.
		There is a heat source nearby.	Reduce the ambient temperature around the Inverter
		The Inverter cooling fan(s) has stopped.	Replace the cooling fan(s).
OL3 Car Stuck (flashing)	Overtorque Detection 1 The Inverter’s output current (V/f control) or the output torque (Vector control) exceeded L6-02 for longer than the time set in L6-03 and L6-01is set to 1 or 2.	Motor was overloaded	Ensure the values in L6-02 and L6-03 are appropriate.
			Check application/machine status to eliminate fault.
OL4 Car Stuck (flashing)	Overtorque Detection 1 The Inverter’s output current (V/f control) or the output torque (Vector control) exceeded L6-02 for longer than the time set in L6-03 and L6-01 is set to 1 or 2.	Motor was overloaded	Ensure the values in L6-05 and L6-06 are appropriate.
			Check application/machine status to eliminate fault.

Table 7.3 Alarm Detection

Display	Meaning	Probable causes	Corrective Actions
UL3 Undertorque Det 1 (flashing)	Undertorque Detection 1 The Inverter's output current (V/f control) or the output torque (Vector control) fell below L6-02 for longer than the time set in L6-03 and L6-01 is set to 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 than the time set in L6-06 and L6-04 is set to 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 is set to 1 or 3 and F1-03 is set to 3. The motor speed feedback (U1-05) exceeded the value set in F1-08 for a time longer than the setting of F1-09.	Overshooting/undershooting occurs.	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 is set to 3 and A1-02 is set to 1 or 3. Detected when no PG (encoder) pulses are received for a time longer than the setting of F1-14	The PG wiring is broken.	Fix the broken/disconnected wiring.
		The PG is wired incorrectly.	Check the wiring
		Power is not supplied to the PG.	Supply the correct power to the PG.
DEV Speed Deviation (flashing)	Excessive Speed Deviation Detected when F1-04 is set to 3 and A1-02 is set to 1 or 3. The speed deviation is higher than the setting of F1-10 for longer than the setting of 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.
	An over acceleration of the car was detected (A1-02 = 6 only)	The load is too large	Reduce the load
		Magnet position offset is wrong	Check the PG direction, check F1-22 and perform an encoder offset tuning.
		Sheave diameter, gear ratio or roping setting incorrect	Verify the settings of S3-13, S3-14 and S3-15.
		Too short acceleration or deceleration time.	Adjust the acceleration and deceleration times.
EF0 Opt External Flt (flashing)	Communication Option Card External Fault	An external fault condition was input from by communication option card.	Check for an external fault condition.
			Verify the parameters.
			Verify communication signals

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Table 7.3 Alarm Detection

Display	Meaning	Probable causes	Corrective Actions
EF3 Ext Fault S3 (flashing)	External fault at terminal S3	An external fault was input by a multi-function input terminal (S3 to S7) which is programmed for the external fault function alarm output.	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		
BUS Option Com Err (flashing)	Option Communications Alarm After initial communication was established, the connection was lost.	Connection is broken and/or the master has stopped the communication.	Check the connections and all user-side software configurations.
Ext Run Active Cannot Reset	Detected after a fault when a RESET command is input while the RUN command is still active	The RUN command has not been removed and a RESET command is input by digital input or by the RESET button on the digital operator.	Remove the RUN signal first and reset the error.
Ext Run Active Cannot Reset	An inverter fault can’t be reset.	The fault was tried to be reset when a direction signal (Up/Down) was still active.	Remove the direction signal and retry to reset the fault. If the fault reset is handled by a PLC, check the sequence.
FF_CAL	Feed forward motor acceleration time active	Motor acceleration time calculation was activated by setting n5-05 = 1 and enabling the inspection input	• Perform the complete tuning procedure • Abort the tuning by setting n5-05 = 0.

◆ Operator Programming Errors

An Operator Programming Error (OPE) occurs when two or more parameter related to each other are set inappropriate or an individual parameter setting is incorrect. The Inverter does not operate until the parameter setting is set correctly; however, no other alarm or fault outputs will occur. If an OPE occurs, change the related parameter by checking the cause shown in *Table 7.4*. When an OPE error is displayed, press the ENTER key to see U1-34 (OPE Detected). This monitor displays the parameter that is causing the OPE error.

Table 7.4 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 incorrect.	Enter the correct kVA setting by referring to *page 5-67, Factory Settings Changing with Inverter Capacity (o2-04)*
		A not suitable software has beenn installed on the inverter.	Compare U1-14 and the software number in the nameplate. Replace the software if necessary.
OPE02 Limit	Parameter Setting is out of range	Parameter setting was outside of the allowable range.	Verify the parameter settings.
	Hiperface® selected (n8-35=4) and: • F1-01 is different from 512 or 1024 • F1-21 is set to 2		
	EnDat selected (n8-35=5) and: • F1-01 is different from 512 or 2048 • F1-21 is set to 0 or 1		
	S3-01 = 2 (Advanced short floor) and: • E1-04 > 100Hz or • E1-04 < 6Hz or • d1-09 > 100Hz or • d1-09 < 4.8Hz or • C1-01 to C1-08 > 50sec or • C1-01 to C1-08 < 0.1 sec.		
OPE03 Terminal	Multi-function Input Selection Error	One of the following errors has been made in the multi-function input (H1-01 to H1-05) settings: • Functions were selected duplicative. • 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 Selection	RUN/Reference Command Selection Error The Reference Source Selection b1-01 and/or the RUN Source Selection parameter b1-02 are set to 3 (option board) but no option board is installed.	Option board is not installed or is installed incorrectly	Verify that the board is installed. Remove the power supply and re-install the option board again
			Recheck the setting of b1-01 and b1-02.
OPE06 PG Opt Missing	Control method selection error	One of the control methods needing a PG feedback was selected (A1-02 =3/6), but a PG option board is not installed.	Verify the control method selection in parameter A1-02 and/or the installation of the PG option board.
OPE08 Constant Selection	Function Selection Error	A setting has been made, which 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.

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Table 7.4 Operator Programming Errors

Display	Meaning	Probable Causes	Corrective Actions
OPE10 V/f Ptrn Setting	V/f Parameter Setting Error	V/f parameter settings were out of range.	Check parameters (E1-□□). A frequency/voltage value may be set higher than the maximum frequency/voltage.
ERR EEPROM R/W Err	EEPROM write error The NV-RAM data does not match the EEPROM data.	A verification error occurred when writing EEPROM.	Cycle power to the Inverter.
			Do a factory initialization (A1-03)

◆ Auto-tuning Faults

Auto-tuning faults are shown below. When the following faults are detected, the fault is displayed on the digital operator and the motor coasts to stop. No fault or alarm outputs will be operated.

Table 7.5 Auto-tuning Faults

Display	Meaning	Probable causes	Corrective Actions
Fault	Motor data fault	There is an error in the data input for autotuning.	Check the input data.
		There is an error in the relationship between the motor output and the motor rated current.	Check the Inverter and motor capacity.
		There is an error between the no-load current setting and the input motor rated current (when auto-tuning for line-to-line resistance is performed for vector control)	Check the motor rated current and no-load current.
Minor Fault	Alarm	An alarm is detected during auto-tuning.	Check the input data.
			Check wiring and the machine.
			Check the load.
STOP key	STOP key input	The STOP key was pressed to cancel autotuning.	-
Resistance	Line-to-Line Resistance Fault	Autotuning was not completed in the specified time. The auto-tuning result is outside the parameter setting range.	• Check the input data. • Check the motor wiring. • If the motor is connected to the machine, disconnect it. • If the setting of T1-03 is higher than the Inverter input power supply voltage (E1-01), change the input data.
No-Load Current	No-Load Current Fault		
Rated slip	Rated Slip Fault		
Accelerate	Acceleration error (detected during rotating autotuning only)	The motor did not accelerate in the specified time. Rotating autotuning was performed with a high load connected.	• Increase C1-01 (Acceleration Time 1). • Increase L7-01 and L7-02 (Torque Limits) if they are low. • Remove the ropes and repeat the tuning.
Motor Speed	Motor Speed Fault Detected only for rotating autotuning	The torque reference exceeded 100% during acceleration. Detected only when A1-02 is set to 2 (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). • Perform not rotating auto tuning
I-det. Circuit	Current Detection Fault	The current exceeded the motor rated current.	Check wiring of the Inverter and the mounting.
		Any of U/T1, V/T2 and W/T3 has open-phase	

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Table 7.5 Auto-tuning Faults

Display	Meaning	Probable causes	Corrective Actions
Leakage Inductance Fault	The leakage inductance measurement caused an error.	Auto-tuning was not completed in the specified time.	• Check the motor wiring. • Check the motor rated current input value
		Auto-tuning result is outside the parameter setting range.	
		The leakage inductance tuning current was too high or too low (Closed Loop Vector for PM only)	Reduce or increase the current level for leakage inductance tuning by changing parameter n8-46.
Z_SRCH_ERR (PM motor tuning only)	All encoders	The motor speed exceeded 20 rpm at the auto tuning start. The magnetic pole position tuning could not be performed in the specified time.	• Remove the ropes and repeat the tuning • Check the encoder rotation direction and if necessary change F1-05.
	Encoder with Z-pulse	The difference between two measurements of the magnet pole position was higher than 3°.	
	Serial encoders	The difference between two measurements of the magnet pole position was higher than 5°.	
		An encoder serial communication error has occurred during the tuning.	• Check the encoder wiring (order, shield etc.) • Check the encoder power supply. • Replace the encoder.
LD_ERR (PM motor tuning only)	Inductance error	The inductance could not be measured in the specified time during the motor rotation.	Check the motor wiring
RS_ERR (PM motor tuning only)	Line-to-line resistance error	The resistance could not be measured in the specified time during the motor rotation or the calculated value was out of range.	• Check the motor wiring • Check the motor input data
KE_ERR (PM motor tuning only)	Voltage constant error	The voltage constant could not be measured in the specified time during the motor rotation.	Check the motor wiring
End - 1 V/f Over Setting	V/f Settings Alarm Displayed after auto-tuning is complete	The torque reference exceeded 100% and the no-load current exceeded 70% during auto-tuning.	Check and correct the motor settings
			If the motor and the machine are connected, disconnect the motor from the machine.
End - 2 Saturation	Motor Core Saturation Fault Displayed after auto-tuning is complete. Detected only for rotating autotuning	During auto-tuning, the measured values of motor iron-core saturation coefficient 1 and 2 (E2-07 and E2-08) exceeded its setting range.	Check the input data.
			Check the motor wiring.
			If the motor and the machine are connected, disconnect the motor from the machine.
End - 3 Rated FLA Alm	Rated Current Setting Alarm Displayed after auto-tuning is complete	During auto-tuning, the measured value of motor rated current (E2-01) was higher 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 operator. The fault or alarm contact output is not operated.

Table 7.6 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 Operator was write-protected (o3-02 = 0).	Set o3-02 to enable writing parameters into the 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 SUM CHECK ERROR	Upon completion of the COPY function, the Inverter's data checksum was different to the digital operator's data checksum.	Retry the COPY function (o3-01 = 2)
Verify Function	VYE VERIFY ERROR	The set value of the digital operator and the Inverter do not match	Retry the Verify function (o3-01 = 3)

◆ Machine Data Copy Function Faults

These faults can occur during the machine data (encoder) COPY function. When a fault occurs, the fault content is displayed on the operator. The fault or alarm contact output is not operated.

Table 7.7 Machine Data Copy Function Faults

Function	Digital Operator Display	Probable Causes	Corrective Actions
WRITE from inverter to encoder	ERE DATA ERROR	A write to encoder command could not be performed since the drive is in UV (under voltage) condition.	Make sure that no fault and no alarm is active and retry.
COPY from Encoder to Inverter	EDE WRITE IMPOSSIBLE	The write to encoder command is prohibited.	Set parameter F1-26 to 1 to permit a write to encoder command.
	EIF WRITE DATA ERROR	A communication error occurred during the write to encoder process.	Retry the write to encoder command.
	ECE COPY ERROR	A read to encoder command could not be performed since the drive is in UV (under voltage) condition.	Make sure that no fault and no alarm is active and retry.
	EPE ID MISMATCH	The data in the encoder do not fit to the L7X data format.	-
	ECS SUM CHECK ERROR	The check sum of the data, which were written into the inverter is wrong.	Retry the COPY command.
VERFIY	EVE VERIFY ERROR	The data in the encoder and inverter data do not match.	-

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Troubleshooting

Due to parameter setting errors, faulty wiring etc., 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 a fault code is displayed, refer to *page 7-2, 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 the password got lost, check parameter A1-05 (Password Setting) by pressing the Shift/RESET key and the MENU key simultaneously in the A1-04 display. Read the password and set it in parameter A1-04.

■OPE01 through OPE11 is displayed.

The set value for the parameter is wrong. Refer to *Table 7.4* in this chapter and correct the settings.

■CPF00 or CPF01 is displayed.

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

◆ If the Motor Does Not Operate Properly

The following causes are possible:

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

The frequency reference is 0.00 Hz or a no speed is selected by the digital inputs. Check the input signals and the frequency reference settings.
Also make sure to set the Baseblock signal. The inverter does not accept any input if it is base blocked.

■The load is too heavy

Check the motor current. If it is at the limit of the inverter rated current the load might be too high. Check the inverter size and the mechanical system. Check also if the brake is working or not to make sure, that the motor is not running against the closed brake.

◆ If the Direction of the Motor Rotation is Reversed

If the motor rotates in the wrong direction, the motor output wiring may be incorrect.

The direction of the motor rotation can be reversed by switching two wires among U, V, and W. If an encoder is used, the polarity has to be switched over as well. If the Inverter is operated in V/f mode parameter b1-04 can be used to change the rotation direction.

◆ If the Motor Stalls or Acceleration is Slow

■The torque limit has been reached.

When a torque limit has been set in parameters L7-01 to L7-04, the output torque will be limited according to 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 in 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 in L3-06 (Stall Prevention Level during Running) is too low, the motor speed and torque will be limited. Check that the set value is suitable and that the load is not too large for the motor.

■Auto-tuning has not been performed for vector control

Vector control does not work properly, if auto-tuning has not been performed. Perform auto-tuning, or set the motor parameters manually.

◆ 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 fault but the torque is 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 lengthen the deceleration time. Check the L7-☐☐ parameters to be sure that the torque limit values are 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. Either reduce the load or increase 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 an acceptable value.

■Auto-tuning has not been performed for vector control

The Vector control performance may not be optimal, if auto-tuning has not been performed. Perform auto-tuning, or set the motor parameters manually.
For induction motors alternatively the V/f control mode can be used.

◆ 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 wires from control circuit wires.

◆ If the Earth Leakage Breaker Operates When the Inverter is Running

The Inverter’s output is pulse modulated, i.e. the output voltage consists of high frequency pulses (PWM). This high frequency signal causes a certain amount of leakage current which may cause the earth leakage breaker to operate and cut off the power supply. Change to a ground fault interrupter with a high leakage detection level (i.e., a sensitivity current of 200 mA or higher, with an operating time of 0.1 s or more), and one, which incorporates high frequencies countermeasures (i.e., one designed for use with Inverters). Lowering the Inverter's Carrier Frequency Selection (C6-02) can also help, since the leakage current increases with the cable length.

◆ If There is Mechanical Oscillation

Use the following information when there is mechanical vibration:

■Oscillation and hunting occur with V/f control

The torque compensation parameter settings may be incorrect for the machine. Adjust parameters C4-01 (Torque Compensation Gain) and C4-02 (Torque Compensation Delay Time). Decrease C4-01 carefully in steps of 0.05 and/or increase C4-02.

Furthermore the Slip Compensation Delay Time (C3-02) can be increased or decreased.

■Oscillation and hunting occur with Open Loop Vector control.

The torque compensation parameter settings may be incorrect for the machine. Adjust parameters C4-01 (Torque Compensation Gain), C4-02 (Torque Compensation Delay Time Parameter) and C3-02 (Slip Compensation Delay Time) in order. Lower the gain parameters and raise the delay time parameters.

If auto-tuning has not been performed, proper performance may not be achieved for Vector Control. Perform auto-tuning or set the motor parameters manually.

■Oscillation and hunting occur with Closed Loop Vector control for IM and PM

The gain adjustment may be insufficient. Adjust the speed control loop (Automatic Speed Regulator, ASR) by changing the C5-☐☐ parameters. If the oscillation points overlap with those of the machine and cannot be eliminated, increase the ASR Delay Time, and then readjust the ASR gains.

If auto-tuning has not been performed, proper performance may not be achieved for Closed Loop Vector Control. Perform auto-tuning or set the motor parameters manually.

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8

Maintenance and Inspection

This chapter describes basic maintenance and inspection for the Inverter

Maintenance and Inspection

◆ Periodic Inspection

Check the following items during periodic maintenance.

- The motor should not vibrate or make unusual noises.
- There should be no abnormal heat generation from the Inverter or motor.
- The ambient temperature should be within the Inverter's specifications.
- The output current value shown in U1-03 should not be higher than the motor or the Inverter rated current for extended period of time.
- The cooling fan in the Inverter should be operating normally.

Before attempting any maintenance checks, make sure that the three-phase power is disconnected. With power removed from the unit, the DC bus capacitors will stay charged for several minutes. The charge LED in the Inverter will light red until the DC bus voltage is below 10VDC. To ensure that the DC bus is completely discharged, measure between the positive and negative bus with a DC voltmeter. Be sure not to touch terminals immediately after the power has been turned off. Doing so can result in electric shock.

Table 8.1 Periodic Inspections

Item	Inspection	Corrective Procedure
External terminals Mounting bolts connectors	Are all screws and bolts tight?	Tighten loose screws and bolts firmly.
	Are connectors tight?	Reconnect the loose connectors.
Cooling fins	Are the fins dirty or dusty?	Clean off any dirt and dust with an air gun using dry air at a pressure of 4×10^5 to 6×10^5 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 4×10^5 to 6×10^5 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 4×10^5 to 6×10^5 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.
Cooling Fan(s)	Is there any abnormal noise or vibration, or has the total operating time exceeded 20,000 hours. Check U1-40 for the elapsed cooling operation time.	Replace Cooling Fan

◆ Periodic Maintenance of Parts

In order to keep the Inverter operating normally over a long 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 8.2 Part Replacement Guidelines

Part	Standard Replacement Period	Replacement Method
Cooling fan(s)	2 to 3 years (20,000 hours)	Replace with new part.
DC bus capacitor	5 years	Replace with new part. (Determine need by inspection.)
Soft charge contactor	–	Determine need by inspection.
DC bus fuse Control power fuse	10 years	Replace with new part.
PCB capacitors	5 years	Replace with new board. (Determine need by inspection.)

Note: The standard replacement period is based on the following usage conditions:
Ambient temperature:Yearly average of 30°C/86°F
Load factor: 80%
Operating rate: 12 hours per day

◆ Cooling Fan Replacement

■200 V and 400 V Class Inverters of 18.5 kW or Less

A cooling fan is attached to the bottom of the Inverter.

If the Inverter is installed using the mounting holes on the back of the Inverter, the cooling fan can be replaced without removing the nverter from the installation panel.

If the Inverter is mounted with the heatsink external to the enclosure, the cooling fan can only be replaced by removing the Inverter from the enclosure.

Removing the Cooling Fan

1. Always turn OFF the input power before removing and installing the heatsink cooling fan.
2. Press in on the right and left sides of the fan cover in the direction of arrows “1“ and when pull the fan out in the direction of arrow “2“.
3. Pull out the cable connected to the fan from the fan cover and disconnect the power connector.
4. Open the fan cover on the left and right sides in direction of arrows “3“ and remove the fan cover from the fan.

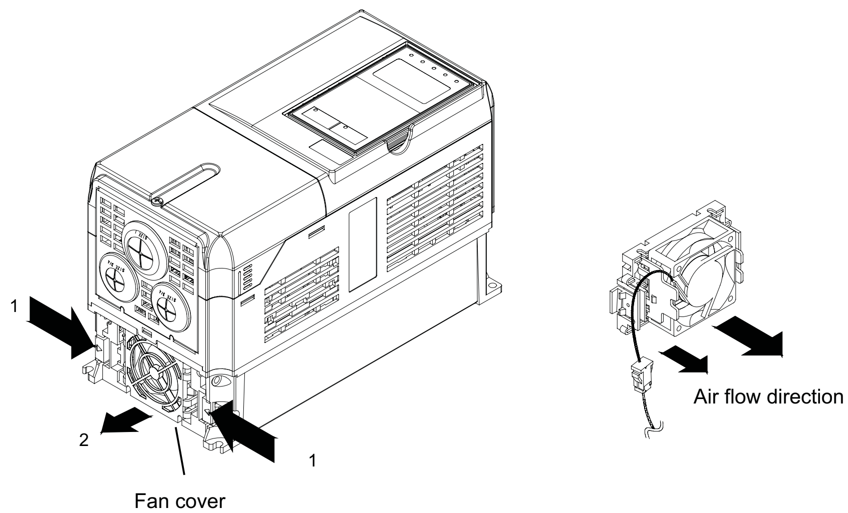


Fig 8.1 Cooling Fan Replacement (Inverters of 18.5 kW or Less)

Mounting the Cooling Fan

1. Attach the fan cover to the cooling fan. Be sure that the air flow direction is correct (see figure above).
2. Connect the cables securely and place the connector and cable into the fan cover.
3. Mount the fan cover on the Inverter. Be sure that the tabs on the sides of the fan cover click into place on the Inverter heatsink.

■200 V and 400 V Class Inverters of 22 kW or More

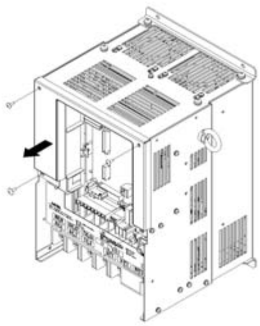
The heatsink cooling fan is attached to the top of the heatsink inside the Inverter. The cooling fan(s) can be replaced without removing the Inverter from the installation panel.

Removing the Cooling Fan

1. Always turn OFF the input power before removing and installing the heatsink cooling fan assembly.
2. Remove the terminal cover, Inverter cover, Digital Operator/LED Monitor, and front cover from the Inverter.
3. Remove the control PCB (if necessary) bracket to which the cards are mounted. Remove all cables connected to the control PCB and remove the cooling fan power connector from the fan board positioned near the top of the Inverter.
4. Remove the cooling fan power connectors from the gate drive board positioned at the back of the Inverter.
5. Remove the fan assembly screws and pull out the fan assembly from the Inverter.
6. Remove the cooling fan(s) from the fan assembly.

Mounting the Cooling Fan

After attaching the new cooling fan(s), reverse the above procedure to attach all of the components.
When attaching the cooling fan to the mounting bracket, be sure that the air flow direction faces the top of the Inverter.



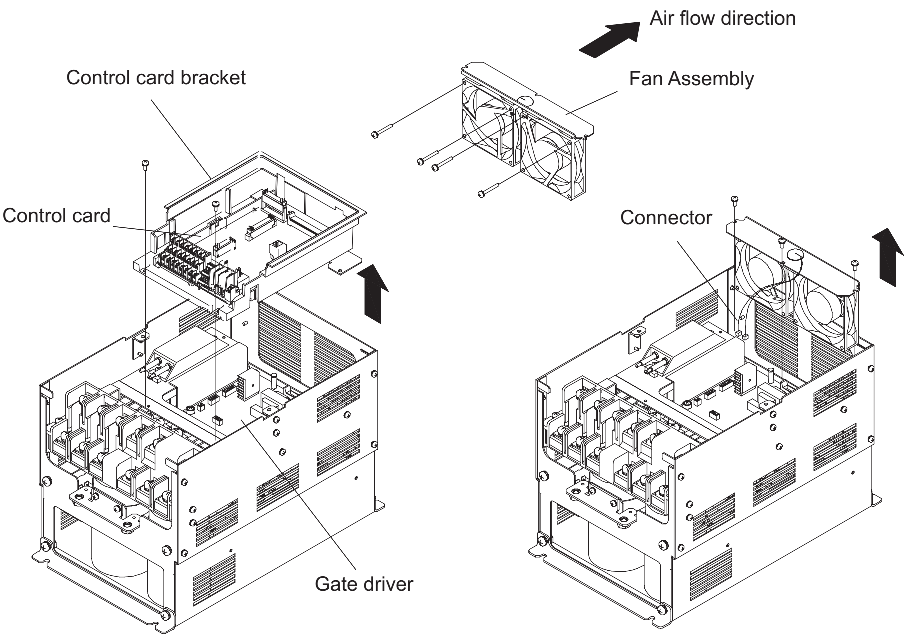


Fig 8.2 Cooling Fan Replacement (Inverters of 22 kW or More)

◆ Removing and Mounting the Terminal Card

The Terminal Card can be removed and mounted without disconnecting the control wiring.

■Removing the Terminal Card

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

■Mounting the Terminal Card

Reverse the removal procedure to mount the terminal card.

Confirm that the terminal card and the control PCB properly meet at connector CN8 before insertion.

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

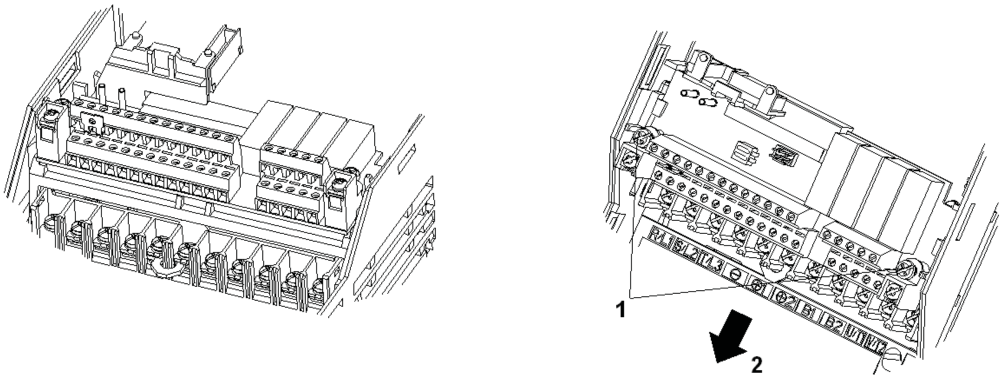


Fig 8.3 Removing the Control Circuit Terminal Card

8

IMPORTANT

Always confirm that the input power is removed and the Charge LED is off before removing or mounting the terminal card.

9

Specifications

This chapter describes the basic specifications of the Inverter.

Inverter Specifications

The Inverter specifications are listed in the following tables.

◆ Specifications by Model

Specifications are given by model in the following tables.

■200V Class

Table 9.1 200 V Class Inverters

<table>
<tr><th colspan="3">Model Number CIMR-L7X □</th><th>23P7</th><th>25P5</th><th>27P5</th><th>2011</th><th>2015</th><th>2018</th><th>2022</th><th>2030</th><th>2037</th><th>2045</th><th>2055</th></tr>
<tr><td colspan="3">Max. applicable motor output (kW)*1</td><td>3.7</td><td>5.5</td><td>7.5</td><td>11</td><td>15</td><td>18.5</td><td>22</td><td>30</td><td>37</td><td>45</td><td>55</td></tr>
<tr><td rowspan="4">Output Rating</td><td colspan="2">Rated output capacity (kVA)</td><td>7</td><td>10</td><td>14</td><td>20</td><td>27</td><td>33</td><td>40</td><td>54</td><td>67</td><td>76</td><td>93</td></tr>
<tr><td colspan="2">Rated output current (A)</td><td>17.5</td><td>25</td><td>33</td><td>49</td><td>64</td><td>80</td><td>96</td><td>130</td><td>160</td><td>183</td><td>224</td></tr>
<tr><td colspan="2">Max. output voltage (V)</td><td colspan="11">3-phase; 200, 208, 220, 230, or 240 VAC
(Proportional to input voltage.)</td></tr>
<tr><td colspan="2">Max. output frequency (Hz)</td><td colspan="11">Up to 120Hz available by programing.</td></tr>
<tr><td rowspan="6">Power supply characteristics</td><td colspan="2">Rated voltage (V)
Rated frequency (Hz)</td><td colspan="11">3-phase, 200/208/220/230/240 VAC, 50/60 Hz</td></tr>
<tr><td colspan="2">Rated input current (A)</td><td>21</td><td>25</td><td>40</td><td>52</td><td>68</td><td>96</td><td>115</td><td>156</td><td>176</td><td>220</td><td>269</td></tr>
<tr><td colspan="2">Allowable voltage fluctuation</td><td colspan="11">+ 10%, - 15%</td></tr>
<tr><td colspan="2">Allowable frequency fluctuation</td><td colspan="11">±5%</td></tr>
<tr><td rowspan="2">Measures for power supply</td><td>DC reactor</td><td colspan="6">Optional</td><td colspan="5">Built In</td></tr>
<tr><td>12-pulse rectification</td><td colspan="6">Not possible</td><td colspan="5">Possible</td></tr>
</table>

* 1. The maximum applicable motor output is given for a standard 4-pole Yaskawa standard motor. When selecting the actual motor and Inverter, be sure that the Inverter's rated current is higher than the motor's rated current.

* 2. A transformer with dual star-delta secondary is required on the power supply for 12-pulse-rectification.

■400 V Class

Table 9.2 400 V Class Inverters

Model Number CIMR-L7X ☐			43P7	44P0	45P5	47P5	4011	4015	4018	4022	4030	4037	4045	4055
Max. applicable motor output (kW) *1			3.7	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55
Output Rating	Rated output capacity (kVA)		7	9	12	15	22	28	34	40	54	67	80	106
	Rated output current (A)		8.5	11	14	18	27	34	41	48	65	80	96	128
	Max. output voltage (V)		3-phase; 380, 400, 415, 440, 460, or 480 VAC (Proportional to input voltage.)											
	Max. output frequency (Hz)		120 Hz max.											
Power supply characteristics	Rated voltage (V) Rated frequency (Hz)		3-phase, 380, 400, 415, 440, 460 or 480 VAC, 50/60 Hz											
	Rated input current (A)		10.2	13.2	17	22	32	41	49	58	78	96	115	154
	Allowable voltage fluctuation		+ 10%, - 15%											
	Allowable frequency fluctuation		±5%											
	Measures for power supply	DC reactor	Optional							Built In				
		12-phase rectification	Not possible							Possible				

* 1. The maximum applicable motor output is given for a standard 4-pole Yaskawa standard motor. When selecting the actual motor and Inverter, be sure that the Inverter's rated current is higher than the motor's rated current.

* 2. A transformer with dual star-delta secondary is required on the power supply for 12-pulse-rectification.

◆ Common Specifications

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

Table 9.3 Common Specifications

	Model Number CIMR-L7X ☐	Specification
Control Characteristics	Control method	Sine wave PWM Closed Loop Vector control for IM and PM motors, Open Loop Vector control, V/f control
	Carrier Frequency	8 kHz higher carrier frequency possible with current derating (refer to *page 9-6, Carrier Frequency Derating*)
	Speed control range	1:40 (V/f control) 1:100 (Open Loop Vector control) 1:1000 (Closed Loop Vector control)
	Speed control accuracy	± 3% (V/f control) ± 0.2% (Open Loop Vector control) ± 0.02% (Closed Loop Vector control) (25°C ± 10°C)
	Speed control response	5 Hz (control without PG) 30 Hz (control with PG)
	Torque limits	Provided (4 quadrant steps can be changed by constant settings.) (Vector control)
	Torque accuracy	± 5%
	Frequency range	0.01 to 120 Hz
	Frequency accuracy (temperature characteristics)	Digital references: ± 0.01% (-10°C to +40°C)
		Analog references: ± 0.1% (25°C ±10°C)
	Frequency setting resolution	Digital references: 0.01 Hz
		Analog references: 0.025/50 Hz (11 bits plus sign)
	Output frequency resolution	0.01 Hz
	Overload capacity and maximum current	150% of rated output current for 30 sec.
	Frequency setting signal	0 to +10V
	Acceleration/Deceleration time	0.01 to 600.00 s (4 selectable combinations of independent acceleration and deceleration time settings)
	Main control functions	Over torque/under torque detection, torque limits, 8-speed control (maximum), 4 acceleration and deceleration times, S-curve acceleration/deceleration, auto-tuning (rotational or stationary), dwell function, cooling fan ON/OFF control, slip compensation, torque compensation, auto-restart after fault, DC braking for starting and stopping, automatic fault reset and parameter copy function, special Lift functions and sequences, short floor operation, rescue operation with light load direction search, machine data copy function (save in encoder memory)
Protective Functions	Motor protection	Protection by electronic thermal overload relay.
	Instantaneous overcurrent protection	Stops at approximately 200% of rated output current.
	Fuse blown protection	Stops for fuse blown.
	Overload protection	OL2 fault at 150% of rated output current for 30 sec
	Overvoltage protection	200 Class Inverter: Stops when main-circuit DC voltage is above 410 V. 400 Class Inverter: Stops when main-circuit DC voltage is above 820 V.
	Undervoltage protection	200 Class Inverter: Stops when main-circuit DC voltage is below 190 V. 400 Class Inverter: Stops when main-circuit DC voltage is below 380 V.
	Cooling fin overheating	Protection by thermistor.
	Stall prevention	Stall prevention during acceleration, deceleration and running independently.
	Grounding protection	Protection by electronic circuits.
	Charge indicator	Glows when the main circuit DC voltage is approximately 10 VDC or more.

Table 9.3 Common Specifications

Model Number CIMR-L7X ☐		Specification
Protective structure		Enclosed wall-mounted type (IP20): All models Enclosed wall-mounted type (NEMA 1): 18.5 kW or less (same for 200 V and 400 V class Inverters) Open chassis type (IP00): 22 kW or more (same for 200 V and 400 V class Inverters)
Environment	Ambient operating temperature	–10°C to 45°C, max. 60°C with derating (refer to *page 9-6, Ambient Temperature Derating*)
	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. 3000 m with derating (refer to *page 9-7, Altitude Derating*).
	Vibration	10 to 20 Hz, 9.8 m/s^2 max.; 20 to 50 Hz, 2 m/s^2 max
Regulations	Safe Disable	Hardware Baseblock meets EN954-1 safety category 3, stop category 0 EN81-1 conform one motor contactor solution possible
	Harmonics	EN 12015 can be fulfilled with optiona AC reactor

Derating

◆ Ambient Temperature Derating

If the inverter ambient temperature is higher than 45°C, an output current derating like shown in *Fig 9.1* must be considered.

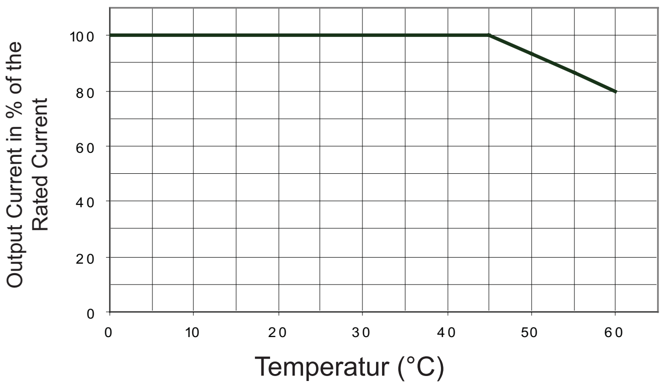


Fig 9.1 Ambient Temperature Derating

◆ Carrier Frequency Derating

If the carrier frequency is set higher than the factory default value, an output current derating like shown in *Fig 9.2* must be considered

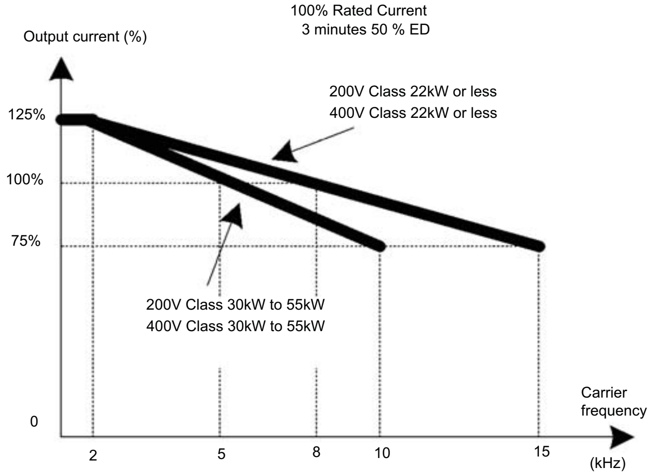


Fig 9.2 Carrier Frequency Derating

9

◆ Altitude Derating

The standard inverter specification is valid for altitudes up to 1000m above sea level. If the inverter is used in regions with higher altitude, the allowable input voltage, output current and ambient temperature are derated as shown below.

Table 9.4 Altitude derating

Altitude	Input Voltage	Output Current	Max. Ambient Temperature
1000 m or less	100%	100%	100%
1000 to 2000 m	90% of standard spec.	90% of standard spec.	95% of standard spec.
2000 to 3000 m	80% of standard spec.	80% of standard spec.	90% of standard spec.

IMPORTANT

The maximum altitude is 3000m above sea level.

■Example

The following example shows the derating of a 400V, 7.5 kW, inverter (L7X47P5)

Table 9.5 Altitude derating example

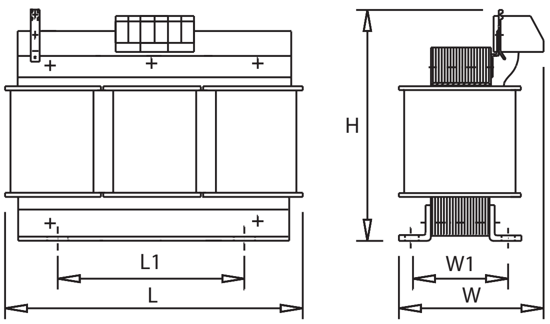
Altitude	Input Voltage	Output Current	Ambient Temperature
1000 m or less	480 VAC or less	18 A or less	-10 to 45 °C
1000 to 2000 m	432 VAC or less	16.2 A or less	-10 to 43 °C
2000 to 3000 m	384 VAC or less	14.4 A or less	-10 to 41 °C

AC Reactors for EN 12015 Compatibility

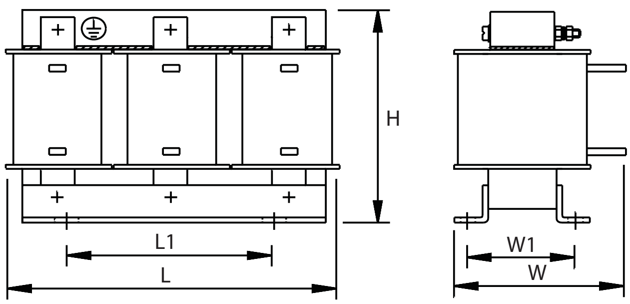
The following table shows the AC reactors which have to be applied in order to fulfill the requirements of the EN 12015.

Table 9.6 AC Chokes

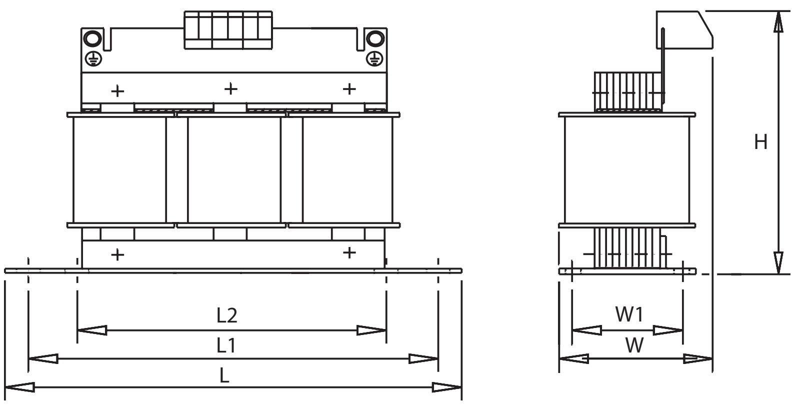
Inverter Model No	AC Reactor-Model No	Drawing	L	W	H	L1	L2	W1	Mount-ing holes	Weight
L7X44P0	B 0604062	A	219	105	190	201	136	71	8 x M6	11 kg
L7X45P5										
L7X47P5	B 0607074	C	210	120	215	175	-	95	4 x M6	14 kg
L7X4011	B 0604063	C	210	120	215	175	-	95	4 x M6	14.5 kg
L7X4015	B 0604064	C	264	128	260	215	-	114	4 x M8	25 kg
L7X4018										
L7X4022	B 0607075	B	300	200	270	240	-	145	4 x M8	43.5 kg
L7X4030	B 0604066	B	300	226	270	240	-	171	4 x M8	52.5 kg
L7X4037										
L7X4045	B 0608006	B	420	200	375	370	-	151	4 x M10	88.5 kg
L7X4055										



Drawing A



Drawing B



Drawing C

9

EN 954-1 / EN81-1 Certificates

Product Service

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

CERTIFICATE

No. Z10 06 06 22733 006

Holder of Certificate: Yaskawa Electric Corporation
Inverter Plant
2-13-1 Nishimiyaichi
Yukuhashi, Fukuoka
824 JAPAN

Factory(ies): 22733

Certification Mark:

Product: Static power converter
AC Inverter

Model(s): CIMR-L7Z/B**** AC Inverter
with risk category 3 stop circuit
For nomenclature see attachment

Parameters:

Rated voltage:	200 to 230V3ac, 200 to 240V3ac and 380 to 480V3ac
Rated current:	200V3ac: 269A 400V3ac: 154A
Rated frequency:	50 / 60 Hz
Protection class:	I
Over voltage category:	III

Remark:
When installing/inserting the equipment all requirements of the mentioned test standards must be fulfilled.

Tested according to: EN 954-1:1996
EN 50178:1997

The listed product was tested on a voluntary basis and complies with the relating standards or directives. The certification mark shown above can be affixed on the product. See also notes overleaf.

Test report no.: 717500786

Date, 2006-06-19

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161780

TÜV SÜD Product Service GmbH · Zertifizierstelle · Ridlerstrasse 65 · 80339 München · Germany

Product Service

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Attachment to certificate Z10 06 06 22733 006

Nomenclature of Product type

CIMR-	L7	*	*	***	*
A	B	C	D	E	F

A. CIMR Inverter

B. L7: Series name

C. Customer code
- Z: for OYMC product (OMRON Yaskawa motion control BV)
- B: For Yaskawa product

D. Rated voltage
- 2 200V3ac
- 4 400V3ac

E. Applicable motor output

3P7:	3,7KW	4P0:	4,0KW	5P5:	5,5KW
7P5:	7,5KW	011:	11KW	015:	15KW
018:	18,5KW	022:	22KW	030:	30KW
037:	37KW	045:	45KW	055:	55KW

F. IP rating
- 0: IP00
- 1: IP20

Page 2 of 3

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9

TÜV SÜD Rail

Assessment Report

of the Satety Testing
of

Static power converter
CIMR-L7Z** / CIMR-L7B**** AC Inverter**
for the
Shut down of a power unit according EN81-1

Manufacturer:

Yaskawa Electric Europe GmbH
Am Kronberger Hang 2
D-65824 Schwalbach

Report No.: 717500451
Revision 1.0 dated 26. July 2006

Test Centre:

TÜV SÜD Rail GmbH
Automation, Software and Electronics - IQSE
Ridlerstraße 65
D-80339 München

ZERTIFIKAT ◆ CERTIFICATE ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

TÜV SÜD Product Service

Electrical Rating

Name of a product	Rated input voltage and frequency	Output power (KW)	Rated input current (A)	Output Voltage and Frequ. and current (A) 75%ED/3min.
CIMR-L7*23P7*	200 to 240V3ac, 50/60Hz	3,7	15,7/21,0	0 to 240V, 0 to 120Hz, 13,1/17,5
CIMR-L7*25P5	200 to 240V3ac, 50/60Hz	5,5	23,0/25,0	0 to 240V, 0 to 120Hz, 18,8/23,0
CIMR-L7*27P5	200 to 240V3ac, 50/60Hz	7,5	30,0/40,0	0 to 240V, 0 to 120Hz, 24,8/33,0
CIMR-L7*2011	200 to 230V3ac, 50/60Hz	11,0	44,0/52,0	0 to 240V, 0 to 120Hz, 36,8/49,0
CIMR-L7*2015	200 to 240V3ac, 50/60Hz	15,0	58,0/68,0	0 to 240V, 0 to 120Hz, 48,0/64,0
CIMR-L7*2018	200 to 240V3ac, 50/60Hz	18,5	72,0/96,0	0 to 240V, 0 to 120Hz, 60,0/80,0
CIMR-L7*2022	200 to 240V3ac, 50/60Hz	22,0	86,0/115,0	0 to 240V, 0 to 120Hz, 72,0/96,0
CIMR-L7*2030	200 to 240V3ac, 50/60Hz	30,0	117,0/156,0	0 to 240V, 0 to 120Hz, 97,5/130,0
CIMR-L7*2037	200 to 220V3ac, 50Hz 200 to 230V3ac, 60Hz	37,0	144,0/176,0	0 to 230V, 0 to 120Hz, 120,0/160,0
CIMR-L7*2045	200 to 220V3ac, 50Hz 200 to 230V3ac, 60Hz	45,0	165,0/220,0	0 to 230V, 0 to 120Hz, 137,3/183,0
CIMR-L7*2055	200 to 220V3ac, 50Hz 200 to 230V3ac, 60Hz	55,0	202,0/269,0	0 to 230V, 0 to 120Hz, 168,0/224,0
CIMR-L7*43P7*	380 to 480V3ac, 50/60Hz	3,7	7,7/10,2	0 to 480V3ac, 0 to 120Hz, 6,4/8,5
CIMR-L7*44P0	380 to 480V3ac, 50/60Hz	4,0	10,0/13,2	0 to 480V3ac, 0 to 120Hz, 8,3/11,0
CIMR-L7*45P5	380 to 480V3ac, 50/60Hz	5,5	12,6/17,0	0 to 480V3ac, 0 to 120Hz, 10,5/14,0
CIMR-L7*47P5	380 to 480V3ac, 50/60Hz	7,5	16,0/22,0	0 to 480V3ac, 0 to 120Hz, 13,5/18,0
CIMR-L7*4011	380 to 480V3ac, 50/60Hz	11,0	24,0/32,0	0 to 480V3ac, 0 to 120Hz, 20,3/27,0
CIMR-L7*4015	380 to 480V3ac, 50/60Hz	15,0	31,0/41,0	0 to 480V3ac, 0 to 120Hz, 25,5/34,0
CIMR-L7*4018	380 to 480V3ac, 50/60Hz	18,5	37,0/49,0	0 to 480V3ac, 0 to 120Hz, 30,8/41,0
CIMR-L7*4022	380 to 480V3ac, 50/60Hz	22,0	43,0/58,0	0 to 480V3ac, 0 to 120Hz, 36,0/48,0
CIMR-L7*4030	380 to 480V3ac, 50/60Hz	30,0	59,0/78,0	0 to 480V3ac, 0 to 120Hz, 48,8/65,0
CIMR-L7*4037	380 to 480V3ac, 50/60Hz	37,0	72,0/96,0	0 to 480V3ac, 0 to 120Hz, 60,0/80,0
CIMR-L7*4045	380 to 480V3ac, 50/60Hz	45,0	86,0/115,0	0 to 480V3ac, 0 to 120Hz, 72,0/96
CIMR-L7*4055	380 to 480V3ac, 50/60Hz	55,0	115,0/154,0	0 to 480V3ac, 0 to 120Hz, 96,0/128

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Inhalt

Assessment Report of the Safety Testing of Static power converter CIMR-L7Z**** and CIMR-L7B**** AC Inverter for the shut down of a power unit according EN81-1

1 General

Yaskawa Europe GmbH, Am Kronberger Hang 2, D-65824 commissioned TÜV SÜD Rail GmbH with the functional safety testing of the Static power converter CIMR-L7Z**** and CIMR-L7B****.
The report on hand represents the execution and the individual results of the safety technical examination.

2 Scope of Testing

With the examination it has to be checked, whether the Static power converters CIMR-L7Z**** and CIMR-L7B**** are suitable for the shut down of a power unit according EN 81-1, chapter 12.7.

3 Test Documents

Titel	Version	Date
L7Z Step3 Manual	Draft	01.06.2006
Zertifikat No. Z10 06 06 22733 006		19.06.2006

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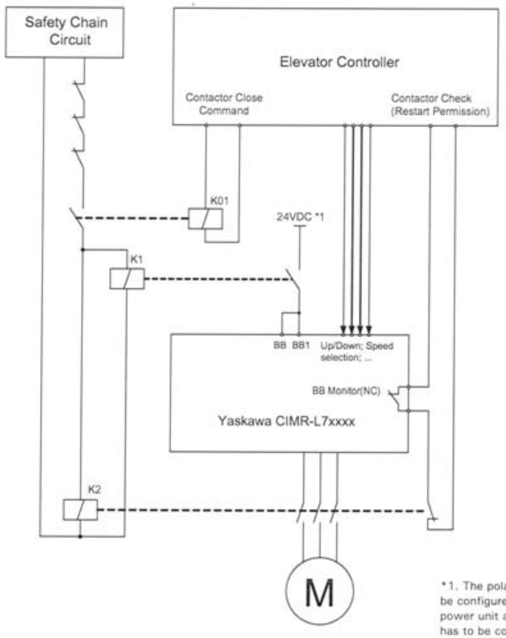
4 Description of the System



*1. The polarity of the 24VDC signal can be configured. For the shut down of the power unit according EN81-1 the input has to be configured to +24 VDC.

The shut down of the power unit is made both by an independent contactor (K2) and by the static power converter CIMR-L7Z**** resp. CIMR-L7B****. The static power converter has been examined by TÜV SÜD and fulfils the safety requirements according EN 954-1, category 3 (see certificate No. Z10 06 06 22733 006) dated 19.06.1006)

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The base block inputs BB and BB1 of the L7 drive must be used to enable/disable the power unit. If the safety chain is deenergized, the normally open contact of the auxiliary relay must be open (K1 release).

The BB Monitor function of the static power converter must be programmed to one of the multifunction digital outputs. This BB monitor contact is checked by the Elevator Controller. In the case of a malfunction of K1 or K2 the Elevator Controller can prevent movement of the power unit over the auxiliary relay K01.

5 Testing Principles

The examination was carried out on the assumption that, according EN81-1:1998, Chapter 14.1.1, no single faults may occur which have an unfavourable effect for the safe shut down of the power unit.

Furthermore the requirements of the EN81.1:1998, Chapter 12.7 „Shut down of power unit and monitoring" (esp. 12.7.3 b) have been taken into account.

6 Performance of examination

The reaction of the system in case of faults was analysed by Failure mode and effect analysis (FMEA), i.e. all faults on the components have been evaluated with regard to its effect on the safe shut down of the power unit.

Faults in the components of the static power converter were not observed because this has already been examined by TÜV SÜD and fulfils therefore the safety requirements according EN 954-1, category 3.

7 Result

The examination of the Static power converters CIMR-L7Z**** and. CIMR-L7B**** for shut down of a power unit according EN 81-1, chapter 12.7 (esp. 12.7.3 b) did not result in any technical safety objections.

The Static power converters CIMR-L7Z**** and CIMR-L7B**** meet the requirements listed in chapter 5 of this report under the observance of following conditions.

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8 Conditions

The base block inputs BB and BB1 must be programmed that the power-off condition is the safe state (shut down of the power unit).

The auxiliary relays must meet the requirements of EN81-1:1998, chapter 13.2.

The interconnection has to be carried out according to chapter 4 of this report.

The BB Monitor function of the static power converter must be programmed to one of the multifunction digital outputs. This BB monitor contact has to be checked by the Elevator Controller. In the case of a malfunction of K1 or K2 the Elevator Controller must prevent movement of the power unit over the auxiliary relay K01.

The wiring has to be carried out according the corresponding requirements of EN81-1.

Only the types of Static power converter listed in the attachment of the certificate from TÜV SÜD may be used (see attachment to certificate Z10 06 06 22733 006).

TÜV SÜD Rail GmbH

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Appendix

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

Inverter Application Precautions

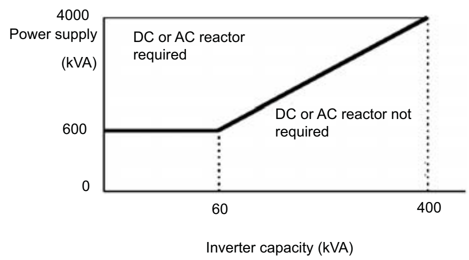
◆ Selection

Observe the following precautions when selecting an Inverter.

■Installing Reactors

A large peak current can 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 shifting 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 converter, 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.



◆ Installation

Observe the following precautions when installing an Inverter.

■Installation in Enclosures

Install the Inverter in a clean location where it is not subjected to oil mist, dust, and other contaminants, or install the Inverter in a completely enclosed panel. Provide cooling measures and sufficient panel space so that the temperature surrounding the Inverter does not exceed the allowable temperature. Do not install the Inverter on wood or other combustible materials.

■Installation Direction

Mount the Inverter vertically to a wall or other vertical surface.

◆ Settings

Observe the following precautions when making settings for an Inverter.

■Upper Limits

The maximum output frequency can be set up to 120Hz. Setting the output frequency too high can damage the machine. So pay attention to the mechanical system and observe required limits for the output frequency.

■DC Injection Braking

If the DC Injection Braking Current or the Braking Time are set too high the motor can overheat what can damage the motor

■Acceleration/Deceleration Times

The motor's acceleration and deceleration times are determined by the torque generated by the motor, the load torque, and the load's inertial moment ($GD^2/4$). If the stall prevention functions are activated during acceleration or deceleration, it might be necessary to increase the acceleration or deceleration time.

To reduce the acceleration or deceleration times, increase the capacity of the motor and Inverter.

◆ Handling

Observe the following precautions during wiring or maintenance of an Inverter.

■Wiring Check

The Inverter will be internally damaged if the power supply voltage is applied to output terminal U, V, or W. Check wiring for any mistakes before supplying power. Check all wiring and control sequences carefully.

■Magnetic Contactor Installation

If a magnetic contactor is installed in the power supply line, do not exceed one start per hour. Switching more often can damage the inrush current prevention circuit.

■Maintenance and Inspections

After turning OFF the main circuit power supply it can take several minutes before the DC bus is discharged completely. The CHARGE LED, indicating if the DC bus is charged, glows above a voltage of 10VDC.

Motor Application Precautions

◆ Using the Inverter for an Existing Standard Motor

Observe the following precautions when using an Inverter for an existing standard motor.

■Low Speed Ranges

If a standard cooled motor is used at low speed the cooling effects are diminished. If the motor is used in constant torque applications in low speed area the motor may overheat. If full torque is required at low speed continuously an externally cooled motor must be used.

■Installation Withstand Voltage

If the inverter is used with an input voltage of 440 V or higher and long motor cables, voltage spikes at the motor terminals may occur which can damage the motor windings. Please ensure that the motor insulation class is sufficient.

■Noise

The noise generated in the motor depends on the carrier frequency. The higher the setting, the less is the generated noise.

◆ Using the Inverter for Special Motors

Observe the following precautions when using a special motor.

■Pole-changing Motor

The rated input current of pole-changing motors differs from that of standard motors. Select an appropriate Inverter according to the maximum current of the motor.

■Single-phase Motor

Do not use an Inverter for a single-phase motor. These motors are often equipped with capacitors Any capacitor directly connected to the inverter output may damage the Inverter.

User Constants

The factory settings of each parameter are given in the following table. They are for a 200 V Class Inverter with 3.7 kW.

No.	Name	Factory Setting	Setting
A1-00	Language selection for Digital Operator display	0	
A1-01	Parameter access level	2	
A1-02	Control method selection	0	
A1-03	Initialize	0	
A1-04	Password	0	
A1-05	Password setting	0	
A2-01 to A2-32	User specified parameters	–	
b1-01	Reference source selection	0	
b1-02	RUN command source selection	1	
b1-06	Control input scan	1	
b1-08	Run command selection in programming modes	1	
b2-08	Magnetic flux compensation volume	0%	
b4-01	Timer function ON-delay time	0.0 sec.	
b4-02	Timer function OFF-delay time	0.0 sec.	
b6-01	Dwell frequency at start	0.0 Hz	
b6-02	Dwell time at start	0.0 sec.	
b6-03	Dwell frequency at stop	0.0 Hz	
b6-04	Dwell time at stop	0.0 sec.	
C1-01	Acceleration time 1	10.0 sec.	
C1-02	Deceleration time 1	1.5 s	
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	1	
C1-11	Accel/decel time switching frequency	0.0 Hz	
C2-01	S-curve characteristic time at acceleration start	0.5 sec.	
C2-02	S-curve characteristic time at acceleration end	0.5 sec.	
C2-03	S-curve characteristic time at deceleration start	0.5 sec.	
C2-04	S-curve characteristic time at deceleration end	0.5 sec.	
C2-05	S-curve Characteristic time below leveling speed	0.50 sec.	
C3-01	Slip compensation gain	1.0	
C3-02	Slip compensation delay time	2000 msec	
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 msec *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 msec	

No.	Name	Factory Setting	Setting
C5-01	ASR proportional (P) gain 1	40 *1	
C5-02	ASR integral (I) time 1	0.5 *1	
C5-03	ASR proportional (P) gain 2	20 *1	
C5-04	ASR integral (I) time 2	0.5 *1	
C5-06	ASR delay time	0.004 msec	
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 sec.	
C5-15	ASR gain (P) during encoder offset tuning	5.00	
C6-02	Carrier frequency selection	1	
C6-06	PWM method selection	0	
C6-11	Carrier frequency for PM motor control	4	
d1-01	Frequency reference 1	0.00 Hz	
d1-02	Frequency reference 2	0.00 Hz	
d1-03	Frequency reference 3	0.00 Hz	
d1-04	Frequency reference 4	0.00 Hz	
d1-05	Frequency reference 5	0.00 Hz	
d1-06	Frequency reference 6	0.00 Hz	
d1-07	Frequency reference 7	0.00 Hz	
d1-08	Frequency reference 8	0.00 Hz	
d1-09	Frequency reference 9 Vn	50.00 Hz	
d1-10	Frequency reference 10 V_1	0.00 Hz	
d1-11	Frequency reference 11 V_2	0.00 Hz	
d1-12	Frequency reference 12 V_3	0.00 Hz	
d1-13	Frequency reference 13 V_r	0.00 Hz	
d1-14	Frequency reference 14 Inspection	25 Hz	
d1-17	Jog frequency reference / Leveling speed	4.00 Hz	
d1-18	Speed priority selection	1	
d1-19	Second motor speed	0.00 Hz	
d6-03	Field forcing function selection	0	
d6-06	Field forcing function Limit	400%	
E1-01	Input voltage setting	*1	
E1-04	Max. output frequency (FMAX)	50.0 Hz	
E1-05	Max. output voltage (VMAX)	*1	
E1-06	Base frequency (FA)	50.0 Hz	
E1-07	Mid. output frequency (FB)	*1	
E1-08	Mid. output frequency voltage (VB)	*1	
E1-09	Min. output frequency (FMIN)	*1	
E1-10	Min. output frequency voltage (VMIN)	*1	
E1-13	Base voltage (VBASE)	0.0 V	
E2-01	Motor rated current	*1	
E2-02	Motor rated slip	*1	
E2-03	Motor no-load current	*1	
E2-04	Number of motor poles	4 poles	
E2-05	Motor line-to-line resistance	*1	
E2-06	Motor leak inductance	*1	

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No.	Name	Factory Setting	Setting
E2-07	Motor iron saturation coefficient 1	0.50	
E2-08	Motor iron saturation coefficient 2	0.75	
E2-09	Monitor mechanical losses	0.0%	
E2-10	Motor iron loss for torque compensation	*1	
E2-11	Motor rated output power	*1	
E2-12	Motor iron saturation coefficient 3	1.30	
E3-01	Motor 2 control mode selection	0	
E3-02	Motor 2 Max. output frequency (FMAX)	50.00 Hz	
E3-03	Motor 2 Max. output voltage (VMAX)	400.0 V	
E3-04	Motor 2 Base frequency (FA)	50.00 Hz	
E3-05	Motor 2 Mid. output frequency (FB)	*1	
E3-06	Motor 2 Mid. output frequency voltage (VB)	*1	
E3-07	Motor 2 Min. output frequency (FMIN)	*1	
E3-08	Min. output frequency voltage (VMIN)	*1	
E4-01	Motor 2 rated current	*1	
E4-02	Motor 2 rated slip	*1	
E4-03	Motor 2 no-load current	*1	
E2-04	Motor 2 number of motor poles	4	
E4-05	Motor 2 line-to-line resistance	*1	
E4-06	Motor 2 leak inductance	*1	
E4-07	Motor 2 iron saturation coefficient 1	*1	
E5-02	PM motor rated power	*1	
E5-03	PM motor rated current	*1	
E5-04	PM motor number of poles	4 poles	
E5-06	PM motor d-axis inductance	*1	
E5-07	PM motor q-axis inductance	*1	
E5-09	PM Motor voltage constant	*1	
F1-01	PG constant	1024	
F1-02	Operation selection at PG open circuit (PGO)	1	
F1-03	Operation selection at overspeed (OS)	1	
F1-04	Operation selection at deviation	3	
F1-05	PG rotation	0	
F1-06	PG division rate (PG pulse monitor)	1	
F1-08	Overspeed detection level	115%	
F1-09	Overspeed detection delay time	0.0 sec.	
F1-10	Excessive speed deviation detection level	10%	
F1-11	Excessive speed deviation detection delay time	0.5 sec.	
F1-12	Number of PG teeth 1	0	
F1-13	Number of PG teeth 2	0	
F1-14	PG open-circuit detection delay time	1.0 sec.	
F1-18	DV3 fault detection selection	1	
F1-19	DV4 fault detection selection	1024	
F1-21	Absolute encoder resolution	2	
F1-22	Magnet position offset	60 deg	
F1-24	PGO Detection level at stop	20%	
F1-25	Encoder copy function selection	0	

No.	Name	Factory Setting	Setting
F1-26	Encoder copy write permission	0	
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 Card	0	
F6-03	Stopping method for external error from Communications Option Card	1	
F6-04	Trace sampling from Communications Option Card	0	
F6-05	Current monitor unit selection	0	
F6-06	Torque reference/torque limit selection from communications option card	0	
H1-01	Terminal S3 function selection	80	
H1-02	Terminal S4 function selection	84	
H1-03	Terminal S5 function selection	81	
H1-04	Terminal S6 function selection	83	
H1-05	Terminal S7 function selection	F	
H2-01	Terminal M1-M2 function selection	40	
H2-02	Terminal M3-M4 function selection	41	
H2-03	Terminal M5-M6 function selection	6	
H3-01	Frequency reference AI-14B CH1signal level selection	0	
H3-02	Frequency reference AI-14B CH1 input gain	100.0%	
H3-03	Frequency referenceAI-14B CH1 input bias	0.0%	
H3-04	AI-14B CH3 signal level selection	0	
H3-05	AI-14B CH3 function selection	2	
H3-06	AI-14B CH3 input gain	100.0%	
H3-07	AI-14B CH3 input bias	0.0%	
H3-08	AI-14B CH2 signal level selection	0	
H3-09	AI-14B CH2 function selection	3	
H3-10	AI-14B CH2 input gain	100.0%	
H3-11	AI-14B CH2 input bias	0.0%	
H3-12	Analog input filter time constant for the AI-14B	0.03 sec.	
H3-15	Terminal A1 function selection	0	
H3-16	Terminal A1 input gain	100.0%	
H3-17	Terminal A1 input bias	0.0%	
L1-01	Motor protection selection	1	

No.	Name	Factory Setting	Setting
L1-02	Motor protection time constant	1.0 min	
L2-05	Undervoltage detection level	190 V	
L2-11	Battery Voltage	0V	
L3-01	Stall prevention selection during accel	1	
L3-02	Stall prevention level during accel	150%	
L3-05	Stall prevention selection during running	1	
L3-06	Stall prevention level during running	150%	
L4-01	Speed agreement detection level	0.0 Hz	
L4-02	Speed agreement detection width	2.0 Hz	
L4-03	Speed agreement detection level (+/-)	0.0 Hz	
L4-04	Speed agreement detection width (+/-)	2.0 Hz	
L5-01	Number of auto restart attempts	2	
L5-02	Auto restart operation selection	0	
L5-05	Under voltage fault (UV1) restart selection	1	
L6-01	Torque detection selection 1	0	
L6-02	Torque detection level 1	150%	
L6-03	Torque detection time 1	0.1 sec.	
L6-04	Torque detection selection 2	0	
L6-05	Torque detection level 2	150%	
L6-06	Torque detection time 2	0.1 sec.	
L7-01	Forward drive torque limit	300%	
L7-02	Reverse drive torque limit	300%	
L7-03	Forward regenerative torque limit	300%	
L7-04	Reverse regenerative torque limit	300%	
L7-06	Torque limit time constant	200 ms	
L7-07	Torque Limit Operation during accel/decel	0	
L8-02	Overheat pre-alarm level	75 °C[*1]	
L8-03	Operation selection after overheat pre-alarm	3	
L8-07	Output open-phase selection	2	
L8-09	Ground protection selection	1	
L8-10	Cooling fan control selection	0	
L8-11	Cooling fan control delay time	60 sec.	
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	50 msec	
n5-01	Feed forward control selection	1	
n5-02	Motor Accel Time	0.178 sec.	
n5-03	Feed forward proportional gain	1.00	
n5-05	Motor acceleration time tuning	0	
n8-29	Current regulator q-axis P gain	1000 rad/sec.	
n8-30	Current regulator q-axis I time	10.0 ms	
n8-32	Current regulator d-axis P gain	1000 rad/sec.	
n8-33	Current regulator d-axis I gain	10.0 ms	
n8-35	Magnet position detection method	5	
n8-46	Inductance measurement current level	10.0%	
n9-60	A/D converter start delay time	0.0 µsec.	

No.	Name	Factory Setting	Setting
o1-01	Monitor selection	6	
o1-02	Monitor selection after power up	1	
o1-03	Frequency units of reference setting and monitor	0	
o1-04	Setting unit for frequency parameters related to V/f characteristics	0	
o1-05	LCD Display contrast adjustment	3	
o2-01	LOCAL / REMOTE key enable/disable	0	
o2-02	STOP key during control circuit terminal operation	0	
o2-03	User parameter initial value	0	
o2-04	kVA selection	0	
o2-05	Frequency reference setting method selection	0	
o2-06	Operation selection when digital operator / LED monitor is disconnected	0	
o2-07	Cumulative operation time setting	0 hr.	
o2-08	Cumulative operation time selection	0	
o2-09	Initialize Mode	2	
o2-10	Fan operation time setting	0 hr.	
o2-12	Fault trace initialize	0	
o2-15	"No of Travels" monitor initialize	0	
o3-01	Copy function selection	0	
o3-02	Read permission selection	0	
S1-01	Zero speed level at stop	0.5 Hz	
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	0.40 sec	
S1-05	DC injection braking time at stop	0.60	
S1-06	Brake release delay time	0.20	
S1-07	Brake close delay time	0.10	
S1-14	SE2 detection delay time	200 msec	
S1-15	SE3 detection delay time	200 msec	
S1-16	Run delay time	0.10 sec.	
S1-17	DC injection current gain at regenerative operation	100%	
S1-18	DC injection current gain at motoring operation	20%	
S1-19	Output contactor open delay time	0.10 sec.	
S1-20	Zero servo gain	5	
S1-21	Zero servo completion width	10	
S1-22	Starting torque compensation increase time	500 msec	
S1-23	Torque compensation gain during lowering	1.000	
S1-24	Torque compensation bias during raising	0.0%	
S1-25	Torque compensation bias during lowering	0.0%	
S1-26	Dwell speed at start reference	0.0 Hz	
S1-27	Door zone speed level	0.0 Hz	
S1-28	SE1 detection selection	0	
S1-29	Torque compensation fade out level	0.0 Hz	
S1-30	Torque compensation fade out time	1000 msec	
S1-31	Torque limit time at stop	0 msec	
S2-01	Motor rated speed	1380 rpm	
S2-02	Slip compensation gain in motoring mode	0.7	
S2-03	Slip compensation gain in regenerative mode	1.0	
S2-05	Slip compensation torque detection delay time	1.0 sec.	

No.	Name	Factory Setting	Setting
S2-06	Slip compensation torque detection time	0.5 sec.	
S2-07	Slip compensation delay time	200 msec	
S3-01	Short floor operation selection	0	
S3-03	Inspection deceleration ramp time	0.0 sec.	
S3-04	Nominal/Leveling speed detection level	0.0 Hz	
S3-05	Nominal speed for short floor calculation	0.0 Hz	
S3-06	Light load direction search for rescue operation	0	
S3-07	Light load search time	1.0 sec.	
S3-08	Output phase order	0	
S3-09	Frequency reference missing (FRL) fault detection	1	
S3-10	Light load search frequency	3.00 Hz	
S3-11	Rescue operation torque limit	100%	
S3-12	Base block restart selection	0	
S3-13	Traction sheave diameter	400 mm	
S3-14	Roping	2	
S3-15	Gear Ratio	1.000	
S3-16	Over acceleration detection level	1.5 m/s^2	
S3-17	Over acceleration deceleration time constant	0.05 sec.	
S3-18	Over acceleration detection method selection	0	
S3-19	Inspection speed upper limit	25.0 Hz	
S3-20	Short floor minimum constant speed time	0.0 sec.	
S3-21	Distance calculation acceleration time gain	150.0%	
S3-22	Distance calculation deceleration time gain	150.0%	
S3-24	Light load direction search method	0	
T1-01	Autotuning mode selection	0	
T1-02	Motor output power	*1	
T1-03	Motor rated voltage	*1	
T1-04	Motor rated current	*1	
T1-05	Motor base frequency	60.0 Hz	
T1-06	Number of motor poles	4 poles	
T1-07	Motor base speed	1450 r/min	
T1-08	Number of PG pulses	1024	
T1-09	Motor no-load current	E2-03 value	
T2-01	Motor output power	*1	
T2-02	Motor base frequency	1750 rpm	
T2-03	Motor rated voltage	*1	
T2-04	Motor rated current	*1	
T2-05	Motor pole number	4	
T2-08	Motor voltage constant	*1	
T2-09	Number of PG pulses	2048	
T2-10	Motor voltage constant calculation selection	1	

*1. The factory setting depends on the inverter model and the control method.

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