Varispeed L7

INSTRUCTION MANUAL

INVERTERS FOR ELEVATOR DRIVES

MODEL: CIMR-L7B

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

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

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

YASKAWA

MANUAL NO. TOEP C710676 08B

Preface

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

General Precautions

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

Safety Information

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

WARNING

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

CAUTION

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

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

IMPORTANT

Indicates important information that should be memorized.

Safety Precautions

■Motor Selection

⚠ WARNING

- Use only a Yaskawa permanent magnet motor in combination with this Inverter, specifically SSE4□-F□21. Running any other permanent magnet motor with this Inverter may cause the Inverter to operate abnormally. Consult with Yaskawa before attempting to use a motor other than the model specified.

■Confirmations upon Delivery

⚠ CAUTION

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

■Installation

⚠ CAUTION

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

■Wiring

⚠ WARNING

- Always turn OFF the input power supply before wiring terminals.
  Otherwise, an electric shock or fire can occur.
- Wiring must be performed by an authorized person qualified in electrical work.
  Otherwise, an electric shock or fire can occur.
- Be sure to ground the ground terminal. (200 V Class: Ground to 100 Ω or less, 400 V Class: Ground to 10 Ω or less)
  Otherwise, an electric shock or fire can occur.
- Always check the operation of any fast stop circuits after they are wired.
  Otherwise, there is the possibility of injury. (Wiring is the responsibility of the user.)
- Never touch the output terminals directly with your hands or allow the output lines to come into contact with the Inverter case. Never short the output circuits.
  Otherwise, an electric shock or ground short can occur.
- Do not use the Inverter for any load other than a three-phase AC motor.
- A permanent magnet motor is a type of permanent magnet motor with a rotor in which a magnet is integrated. Unlike an induction motor, the permanent magnet motor terminal generates high voltage when the motor is running, even when the Inverter power is shut off. Be sure to completely stop the motor before wiring, maintenance and inspection.
  Failure to do so may result in electric shock.

WARNING

- Wire the Inverter so that the Run command switches off when a Stop command (or Fast stop command) is input to terminal BB or terminal BB1.
  If the Run command is not removed, then the motor will begin running as soon as the Stop command (or Fast stop command) is cleared.
  This can result in personal injury.

CAUTION

- Check to be sure that the voltage of the main AC power supply satisfies the rated voltage of the Inverter.
  Injury or fire can occur if the voltage is not correct.
- Do not perform voltage withstand tests on the Inverter.
  Otherwise, semiconductor elements and other devices can be damaged.
- Connect braking resistors, Braking Resistor Units, and Braking Units as shown in the I/O wiring examples.
  Otherwise, a fire can occur and the Inverter, braking resistors, Braking Resistor Units, and Braking Units can be damaged.
- Tighten all terminal screws to the specified tightening torque.
  Otherwise, a fire may occur.
- Do not connect AC power to output terminals U, V, and W.
  The interior parts of the Inverter will be damaged if voltage is applied to the output terminals.
- Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits.
  The Inverter can be damaged or interior parts burnt if these devices are connected.
- When a magnetic contactor is connected to the output circuits, do not switch it ON and OFF while the Inverter is running.
  Surge current will cause the overcurrent protection circuit inside the Inverter to operate.
- This Inverter can drive an induction motor or a permanent magnet motor. Select a suitable control method (parameter A1-02) for the motor you drive.
  Failure to do so will cause damage to the motor.

■Setting User Parameters

WARNING

- Do not change the factory setting (0) in b1-03 (Run Command source selection).
  Doing so can cause the elevator to drop.
- Do not change the factory setting (1) in L8-05 (Input open-phase protection selection).
  You can change it to 0, but only after confirming that there are no factors that cause input open phase.
  Doing so may damage the Inverter main circuits.

⚠ CAUTION

- Disconnect the load (machine, device) from the motor before performing rotational autotuning or pole tuning.
  The motor may turn, possibly resulting in injury or damage to equipment. Also, motor parameters cannot be correctly set with the motor attached to a load.
- Stay clear of the motor until rotational autotuning or pole tuning has been successfully completed.
  The motor could stop and then start again unexpectedly and this could result in injury.
- Always confirm the following before rotational autotuning or pole tuning:
  • The lock key has been removed from the motor shaft.
  • There are neither people nor objects around the motor shaft.
  • The motor is at a complete stop.
  Failure to do so may result in injury.
- Be careful when handling the shaft and coupling.
  Failure to do so may result in injury.
- Be careful not to injure yourself with the key groove when turning the motor shaft by hand.
  Failure to do so may result in injury.
- When operating a permanent magnet motor for the first time, or after exchanging a permanent magnet motor or an Inverter, set a correct motor parameter to the Inverter before the operation, and be sure to check the motor speed detection.
  Shortage of torque may be the cause when the motor is pulled in the load direction or when the motor does not run as directed, such as reverses, doesn't work, or over-accelerates.
  Refer to *Chapter 4 Trial Operation* for details.
- Do not change the parameter settings unnecessarily.
  Doing so may impede motor operation.
- When running a permanent magnet motor, be sure to set the following parameters.
  • Motor related parameters (E1-□□, E5-□□)
  • Parameters for PG open-circuit detection function (F1-□□)
  • Parameters for excessive speed deviation detection function (F1-□□)
  • Parameters for over-acceleration detection function (S3-□□)
  Failure to do so will cause damage to the equipment.
- If running a permanent magnet motor with any option cards other than the PG-F2 card, and not using the braking sequence recommended by this Inverter, set the following braking sequences externally.
  • After inputting the operational order, or closing the pole detection complete signal, release the braking.
  A basket will be pulled by a counter weight. Be careful of this, as it can cause injury.
- If running a permanent magnet motor with any option cards other than the PG-F2 card, note that the Inverter has not been adapted for use with batteries. If so, do not select the battery as the power source for an operation.
  Shortage of torque may be the cause when the motor is pulled in the load direction or when the motor does not run as directed, such as reverses, doesn't work, or over-accelerates.

■Trial Operation

⚠ WARNING

- Check to be sure that the front cover is attached before turning ON the power supply.
  An electric shock may occur.
- Provide a separate fast stop switch; the Digital Operator STOP Key is valid only when its function is set.
  Injury may occur.
- Reset alarms only after confirming that the RUN signal is OFF.
  Injury may occur.

⚠ CAUTION

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

■Maintenance and Inspection

⚠ WARNING

- Do not touch the Inverter terminals. Some of the terminals carry high voltages and are extremely dangerous.
  Doing so can result in electric shock.
- Always have the protective cover in place when power is being supplied to the Inverter. When attaching the cover, always turn OFF power to the Inverter through the MCCB.
  Doing so can result in electric shock.
- After turning OFF the main circuit power supply, wait for the time indicated on the front cover, and make sure the CHARGE indicator light has gone out, and then perform maintenance and inspection.
  The capacitor will remain charged and is dangerous.
- Maintenance, inspection, and replacement of parts must be performed only by authorized personnel.
  Remove all metal objects, such as watches and rings, before starting work. Always use grounded tools.
  Failure to heed these warning can result in electric shock.
- Be sure to completely stop the permanent magnet motor before maintenance and inspection.
  Failure to do so may result in electric shock.

⚠ CAUTION

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

■Other

⚠ WARNING

- Do not attempt to modify or alter the Inverter.

  Doing so can result in electrical shock or injury.

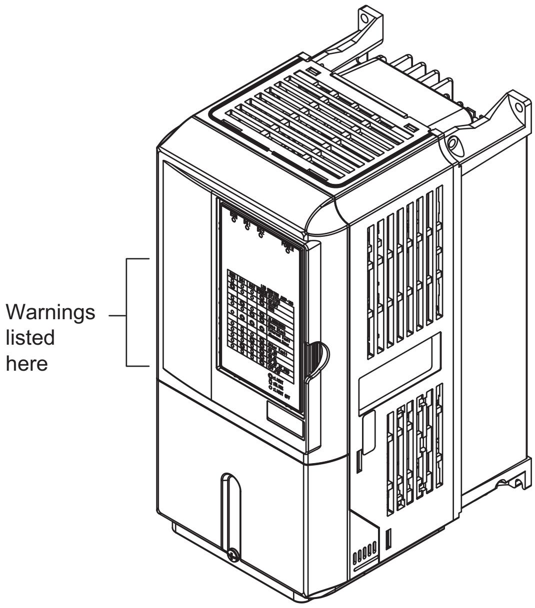
⚠ CAUTION

- Do not subject the Inverter to halogen gases, such as fluorine, chlorine, bromine, and iodine, at any time even during transportation or installation.

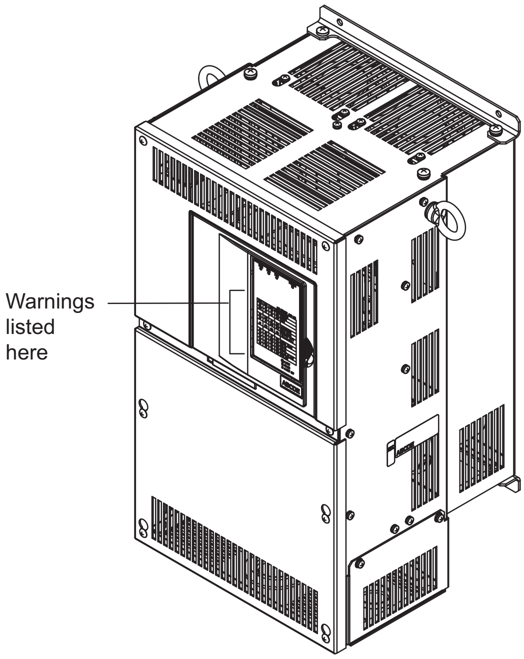
  Otherwise, the Inverter can be damaged or interior parts burnt.

Warning Labels on the Inverter

Be sure to read and follow all warning labels on the Inverter before installation.



CIMR-L7B23P7 (example)



CIMR-L7B2022 (example)

Text on Warning Labels

⚠WARNING

Risk of electric shock.

- Read manual before installing.
- Wait 5 minutes for capacitor discharge after disconnecting power supply.
- After opening the manual switch between the drive and motor, please wait 5 minutes before inspecting, performing maintenance or wiring the drive.

⚠AVERTISSEMENT

Risque de décharge électrique.

- Lire le manuel avant l' installation.
- Attendre 5 minutes aprés la coupure de l' allmentation. Pour permettre la décharge des condensateurs.
- Après avoir déconnécte la protection entra le drive et le moteur, veuillez patienter 5 minutes avant d' inspecter, d' effectuer une opération de montage ou de câblage du variateur.

⚠危険

けが・感電のおそれがあります。

- 据え付け・運転の前には必ず取扱説明書をお読み下さい。
- 通電中及び電源遮断後5分以内はタミナルカバーを外さないで下さい。
- 保守・点検，配線を行う場合は，出力側手動開閉器を遮断後，5分待って実施して下さい。

Warranty Information

■Free Warranty Period and Scope

Warranty Period

This product is warranted for twelve months after being delivered to Yaskawa’s customer or if applicable eighteen months from the date of shipment from Yaskawa’s factory whichever comes first.

Scope of Warranty

Inspections

Periodic inspections must be conducted by the customer. However, upon request, Yaskawa or one of Yaskawa’s Service Centers can inspect the product for a fee. In this case, if after conferring with the customer, a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, then this fee will be waived and the problem remedied free of charge.

Repairs

If a Yaskawa product is found to be defective due to Yaskawa workmanship or materials and the defect occurs during the warranty period, Yaskawa will provide a replacement, repair the defective product, and provide shipping to and from the site free of charge.

However, if the Yaskawa Authorized Service Center determines that the problem with a Yaskawa product is not due to defects in Yaskawa’s workmanship or materials, then the customer will be responsible for the cost of any necessary repairs. Some problems that are outside the scope of this warranty are:

- Problems due to improper maintenance or handling, carelessness, or other reasons where the customer is determined to be responsible.
- Problems due to additions or modifications made to a Yaskawa product without Yaskawa’s understanding.
- Problems due to the use of a Yaskawa product under conditions that do not meet the recommended specifications.
- Problems caused by natural disaster or fire.
- Or other problems not due to defects in Yaskawa workmanship or materials.

Warranty service is only applicable within Japan.

However, after-sales service is available for customers outside of Japan for a reasonable fee. Contact your local Yaskawa representative for more information.

■Exceptions

Any inconvenience to the customer or damage to non-Yaskawa products due to Yaskawa's defective products whether within or outside the warranty period are NOT covered by this warranty.

- This Inverter does not guarantee performance of the entire elevator system.
- Proper safety measure must be taken on the upper controller side of the hoist application.
- The swing suppression and noise preventative features in this Inverter do not guarantee passenger comfort.

■Restrictions

- The Varispeed L7 was not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.
- Customers who intend to use the product described in this manual for devices or systems relating to transportation, health care, space aviation, atomic or electric power, or underwater use must contact their Yaskawa representatives or the nearest Yaskawa sales office beforehand.
- This product has been manufactured under strict quality-control guidelines. However, if this product is to be installed in any location where failure of this product could involve or result in a life-and-death situation or loss of human life or in a facility where failure may cause a serious accident or physical injury, safety devices must be installed to minimize the likelihood of any accident.

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 STEGMANN Incorporated.

Contents

1

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	Open Chassis (IEC IP00) CIMR-L7B	Enclosed Wall-mounted (NEMA 1) CIMR-L7B	Enclosed Wall-mounted (IEC IP20) CIMR-L7B
200 V class	3.7	7	CIMR-L7B23P7	Remove the top and bottom covers from the Enclosed Wall-mounted model.	23P71□	23P77□
	5.5	10	CIMR-L7B25P5		25P51□	25P57□
	7.5	14	CIMR-L7B27P5		27P51□	27P57□
	11	20	CIMR-L7B2011		20111□	20117□
	15	27	CIMR-L7B2015		20151□	20157□
	18.5	33	CIMR-L7B2018		20181□	20187□
	22	40	CIMR-L7B2022	20220□	20221□	20227□
	30	54	CIMR-L7B2030	20300□	20301□	20307□
	37	67	CIMR-L7B2037	20370□	20371□	20377□
	45	76	CIMR-L7B2045	20450□	20451□	20457□
	55	93	CIMR-L7B2055	20550□	20551□	20557□
400 V class	3.7	7	CIMR-L7B43P7	Remove the top and bottom covers from the Enclosed Wall-mount model.	43P71□	43P77□
	4.0	9	CIMR-L7B44P0		44P01□	43P77□
	5.5	12	CIMR-L7B45P5		45P51□	45P57□
	7.5	15	CIMR-L7B47P5		47P51□	47P57□
	11	22	CIMR-L7B4011		40111□	40117□
	15	28	CIMR-L7B4015		40151□	40157□
	18.5	34	CIMR-L7B4018		40181□	40187□
	22	40	CIMR-L7B4022	40220□	40221□	40227□
	30	54	CIMR-L7B4030	40300□	40301□	40307□
	37	67	CIMR-L7B4037	40370□	40371□	40377□
	45	80	CIMR-L7B4045	40450□	40451□	40457□
	55	106	CIMR-L7B4055	40550□	40551□	40557□

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

Permanent magnet motor Application Example

◆ Permanent magnet motor Application Example

The table below lists which models of Yaskawa's standard SPM motors correspond with which models of EnDat encoders.

Application Examples: Yaskawa SPM Motors and EnDat Encoders

Load Capacity kg	Elevator Speed m/min	Motor Output *1 kW	Revolutions per Minute *2 min^{-1}	Motor Model SSE4-□-F□21	Inverter Model CIMR-L7B□
200 V Class					
450	45	2.1	72	22P1072	25P5
	60	2.8	96	22P8096	
	90	4.2	144	24P2144	27P5
600	45	2.8	72	22P8072	
	60	3.7	96	23P7096	
	90	5.6	144	25P6144	2011
	105	6.5	168	26P5168	
750	45	3.5	72	23P5072	27P5
	60	4.6	96	24P6096	
	90	6.9	144	26P9144	2015
	105	8.1	168	28P1168	
900	45	4.2	72	24P2072	2011
	60	5.6	96	25P6096	
	90	8.3	144	28P3144	2015
	105	9.7	168	29P7168	
1000	45	4.6	72	24P6072	2011
	60	6.2	96	26P2096	
	90	9.2	144	29P2144	2018
	105	11	168	2011168	
400 V Class					
450	45	2.1	72	42P1072	45P5
	60	2.8	96	42P8096	
	90	4.2	144	44P2144	47P5
600	45	2.8	72	42P8072	45P5
	60	3.7	96	43P7096	
	90	5.6	144	45P6144	4011
	105	6.5	168	46P5168	
750	45	3.5	72	43P5072	47P5
	60	4.6	96	44P6096	
	90	6.9	144	46P9144	4011
	105	8.1	168	48P1168	
900	45	4.2	72	44P2072	
	60	5.6	96	45P6096	
	90	8.3	144	48P3144	4015
	105	9.7	168	49P7168	
1000	45	4.6	72	44P6072	4011
	60	6.2	96	46P2096	
	90	9.2	144	49P2144	4015
	105	11	168	4011168	

* 1. 105 m/min up to 1000 kg.
* 2. Sheave diameter of 400 m with a roping ratio of 2:1.

Confirmations upon Delivery

◆ Checks

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

Table 1.2 Checks

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

If you find any irregularities in the above items, contact the agency from which you purchased the Inverter.

◆ Nameplate Information

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

■ Example Nameplate

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

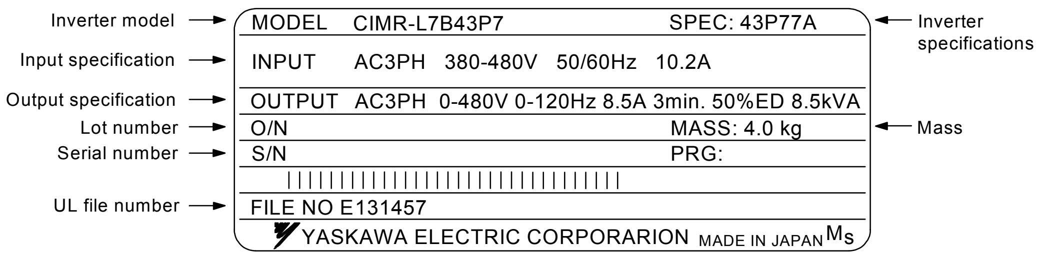


Fig 1.1 Nameplate

■Inverter Model Numbers

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

CIMR – L7 B 2 3P7

Inverter — CIMR

Varispeed L7 — L7

No.	Specification
B	IM Motor (PG optional)

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

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

“P” Indicates the decimal point.

Fig 1.2 Inverter Model Numbers

■Inverter Specifications

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

2 3P7 1

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

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

“P” Indicates the decimal point

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

Fig 1.3 Inverter Specifications

◆ Component Names

■ Inverters of 18.5 kW or Less

The external appearance and component names of the Inverter are shown in *Fig 1.4*. The Inverter with the terminal cover removed is shown in *Fig 1.5*.

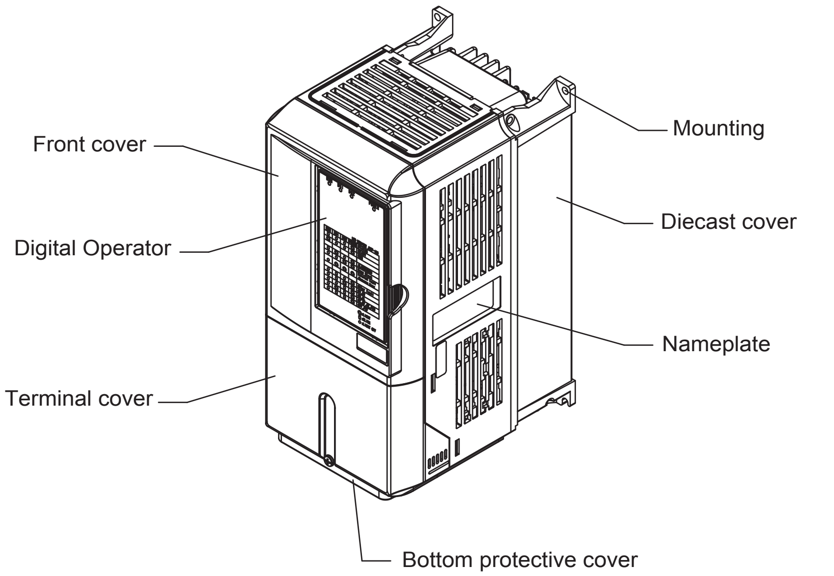


Fig 1.4 Inverter Appearance (18.5 kW or Less)

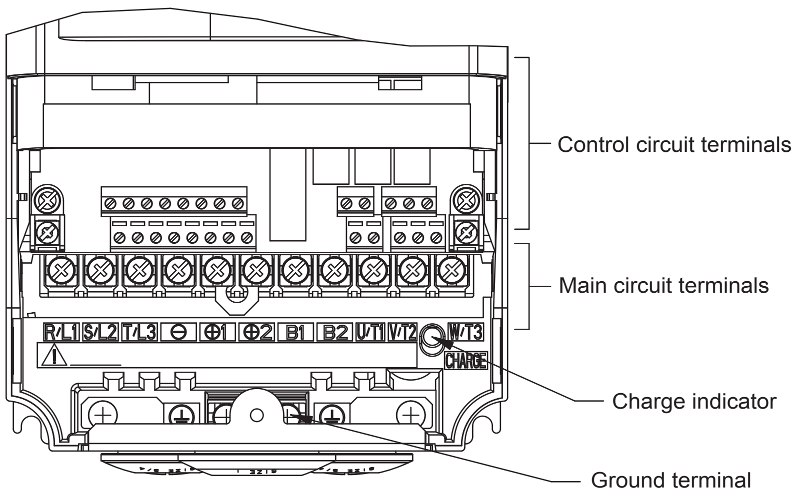


Fig 1.5 Terminal Arrangement (18.5 kW or Less)

■ Inverters of 22 kW or More

The external appearance and component names of the Inverter are shown in *Fig 1.6*. The Inverter with the terminal cover removed is shown in *Fig 1.7*.

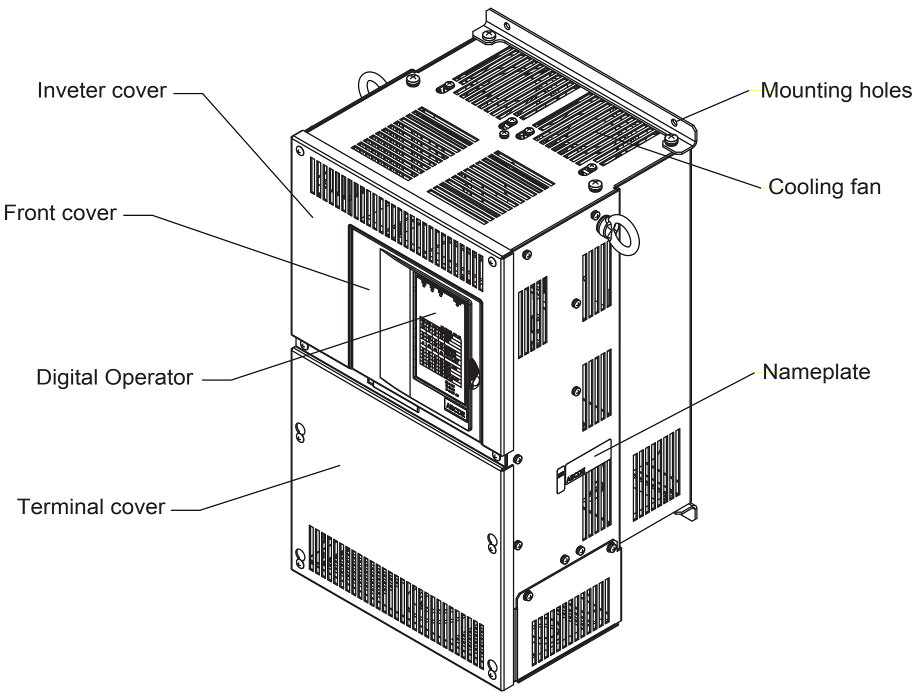


Fig 1.6 Inverter Appearance (22 kW or More)

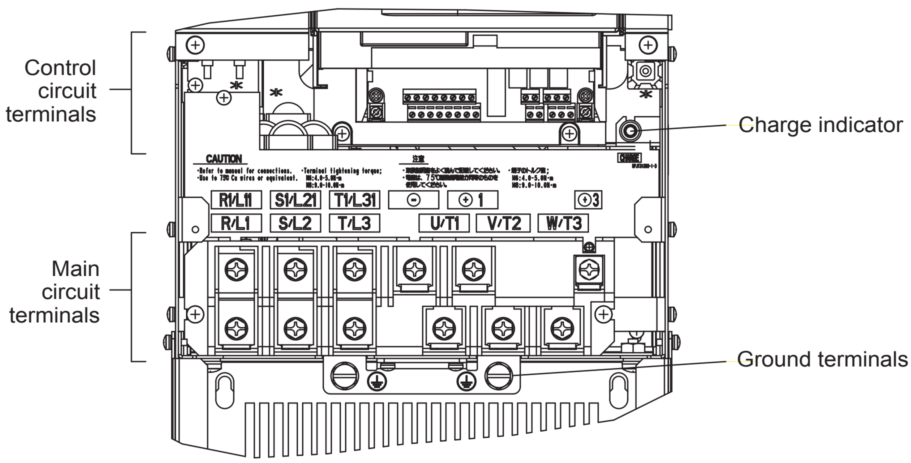
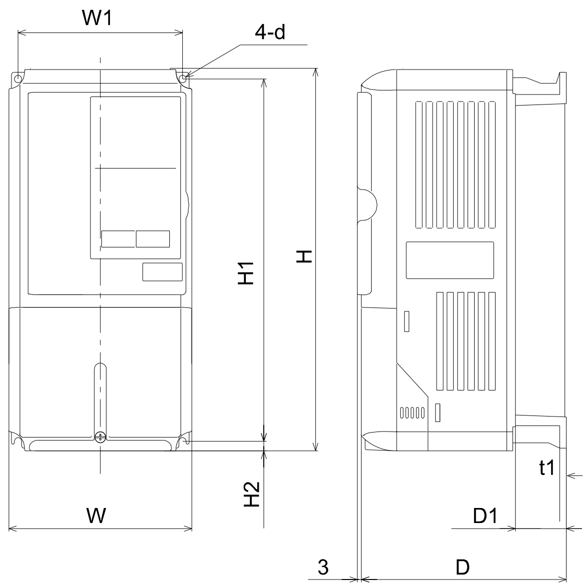


Fig 1.7 Terminal Arrangement (22 kW or More)

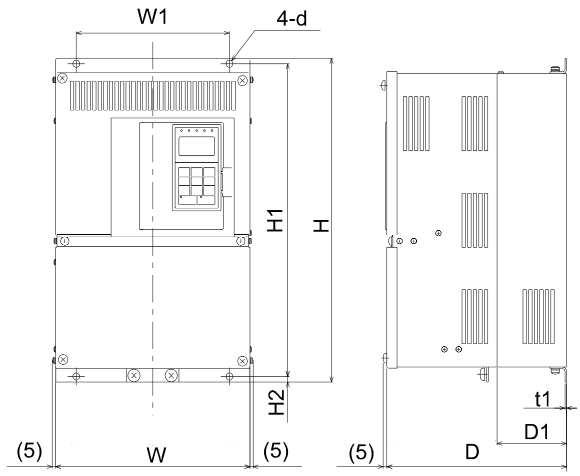
Exterior and Mounting Dimensions

◆ Open Chassis Inverters (IP00)

Exterior diagrams of the Open Chassis Inverters are shown below.



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

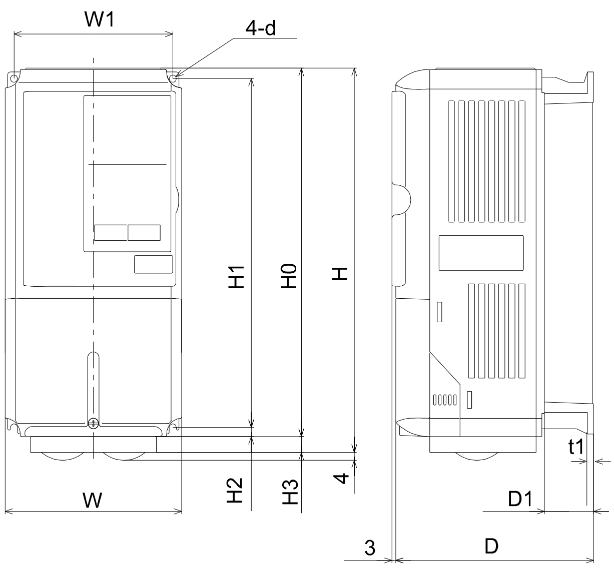


200 V Class Inverters of 22 or 55 kW
400 V Class Inverters of 22 to 55 kW

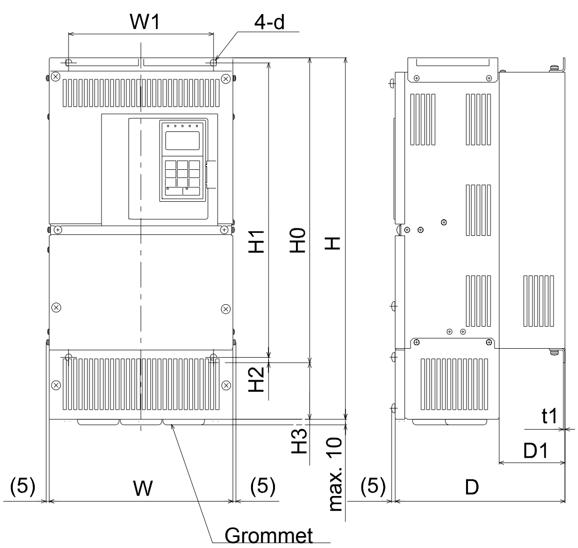
Fig 1.8 Exterior Diagrams of Open Chassis Inverters

◆ Enclosed Wall-mounted Inverters (NEMA1 / IP20)

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



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



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

Fig 1.9 Exterior Diagrams of Enclosed Wall-mounted Inverters

Voltage Class	Max. Applicable Motor Output [kW]	Dimensions (mm)																																	Caloric Value (W)			Cooling Method
		Open Chassis (IP00)									Enclosed Wall-mounted (NEMA1)											Enclosed Wall-mounted (IP20)											Mounting Holes d*	External	Internal	Total Heat Generation	
		W	H	D	W1	H1	H2	D1	t1	Approx. Mass	W	H	D	W1	H0	H1	H2	H3	D1	t1	Approx. Mass	W	H	D	W1	H0	H1	H2	H3	D1	t1	Approx. Mass					
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	7.5	65.5	2.3	6	200	300	197	186	300	285	8		65.5	2.3	6	200	300	197	186	300	285	8		65.5	2.3	6	M6	219	113	332	
	11									7		310						10			7		310						10			7		374	170	544	
	15	240	350	207	216	335		78		11	240	350	207	216	350	335	7.5	0	78		11	240	350	207	216	350	335	7.5	0	78		11		429	183	612	
	18.5											380						30					380						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	12.5	100	3.2	52	380	809	298	250	600	575	12.5	209	100	3.2	57													1015	411	1426	
	45			328				130		57			328						130		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	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	80	68	148	Fan
	4.0																																	91	70	161	
	5.5																																	127	82	209	
	7.5	200	300	197	186	285	8	65.5	2.3	6	200	300	197	186	300	285	8		65.5	2.3	6	200	300	197	186	300	285	8		65.5	2.3	6	M6	193	114	307	
	11																																	252	158	410	
	15	240	350	207	216	335	7.5	78		10	240	350	207	216	350	335	7.5		78		10	240	350	207	216	350	335	7.5		78		10		326	172	498	
	18.5																																	426	208	634	
	22	275	450	258	220	435		100		17	279	535	258	220	450	435		85	100		20	279	514.5	258	220	450	435		64	100		19		466	259	725	
	30																																	678	317	995	
	37	325	550	283	260	535		105		31	329	635	283	260	550	535			105		35	329	614	283	260	550	535			105		34		784	360	1144	
	45									30		715						165			34		629.5						79.5					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

1

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

Table 1.4 Installation Site

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

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

Observe the following precautions when mounting the Inverter.

- Install the Inverter in a clean location which is free from oil mist and dust. It can be installed in a totally enclosed panel that is completely shielded from floating dust.
- When installing or operating the Inverter, always take special care so that metal powder, oil, water, or other foreign matter does not get into the Inverter.
- Do not install the Inverter on combustible material, such as wood.
- Install the Inverter in a location free from radioactive materials and combustible materials.
- Install the Inverter in a location free from harmful gasses and liquids.
- Install the Inverter in a location without excessive oscillation.
- Install the Inverter in a location free from chlorides.
- Install the Inverter in a location not in direct sunlight.

◆ Controlling the Ambient Temperature

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

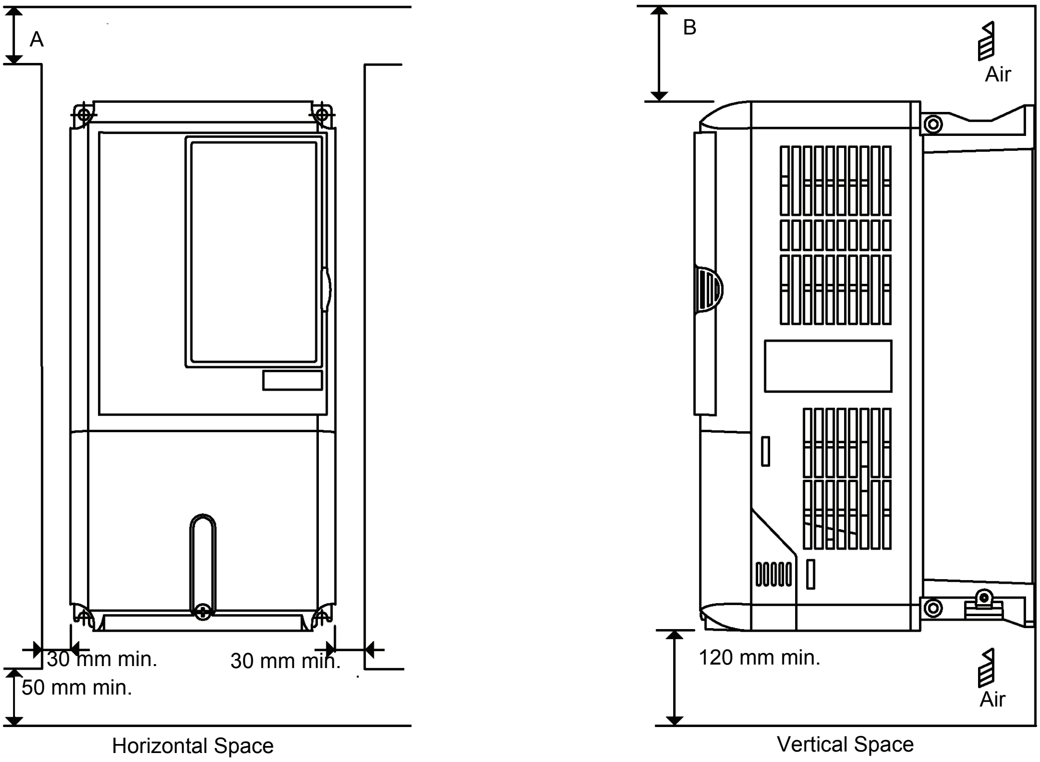
◆ Protecting the Inverter from Foreign Matter

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
200 V Class Inverter, 3.7 to 55 kW 400 V Class Inverter, 3.7 to 55 kW	50 mm	120 mm

Fig 1.10 Inverter Installation Orientation and Space

IMPORTANT

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

Removing and Attaching the Terminal Cover

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

◆ Removing the Terminal Cover

■ Inverters of 18.5 kW or Less

Loosen the screw at the bottom of the terminal cover, press in on the sides of the terminal cover in the directions of arrows 1, and then lift up on the terminal in the direction of arrow 2.

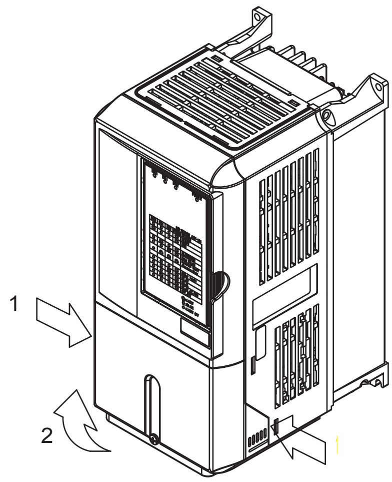


Fig 1.11 Removing the Terminal Cover (Model CIMR-L7B43P7 Shown Above)

■ 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.

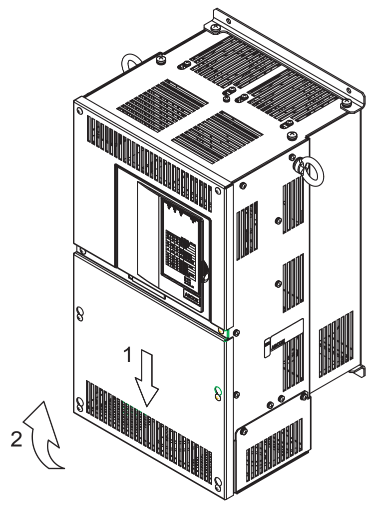


Fig 1.12 Removing the Terminal Cover (Model CIMR-L7B4022 Shown Above)

◆ 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 boards or change the control circuit terminal board 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.

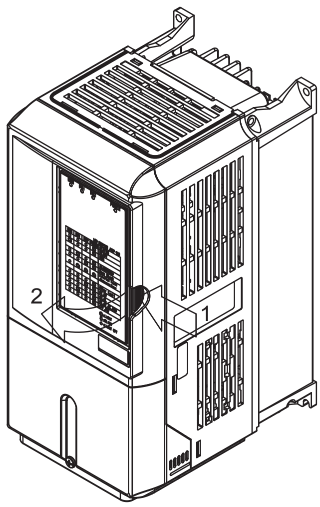


Fig 1.13 Removing the Digital Operator/LED Monitor (Model CIMR-L7B43P7 Shown Above)

■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.

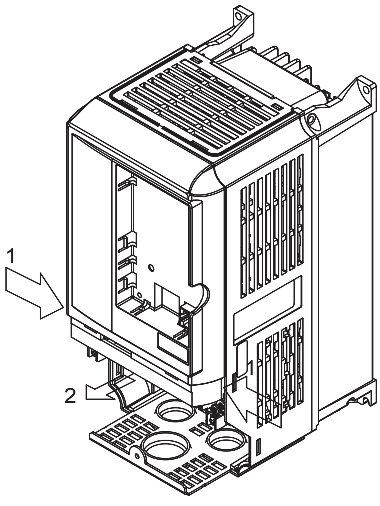


Fig 1.14 Removing the Front Cover (Model CIMR-L7B43P7 Shown Above)

■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).

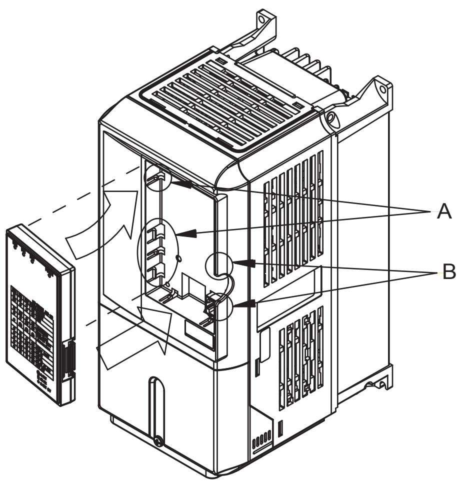


Fig 1.15 Mounting the Digital Operator/LED Monitor

IMPORTANT

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.

◆ 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 board in the direction of arrow 2.

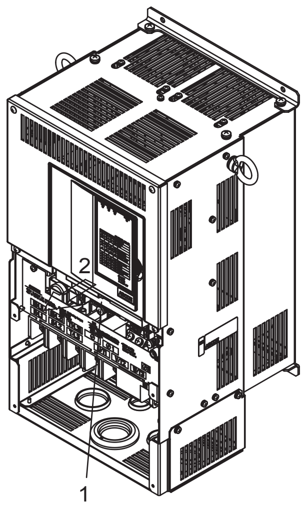


Fig 1.16 Removing the Front Cover (Model CIMR-L7B4022 Shown Above)

■ Attaching the Front Cover

After completing the required work, such as mounting an optional board or setting the control circuit terminal board, 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.

2

Wiring

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

Connections to Peripheral Devices

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

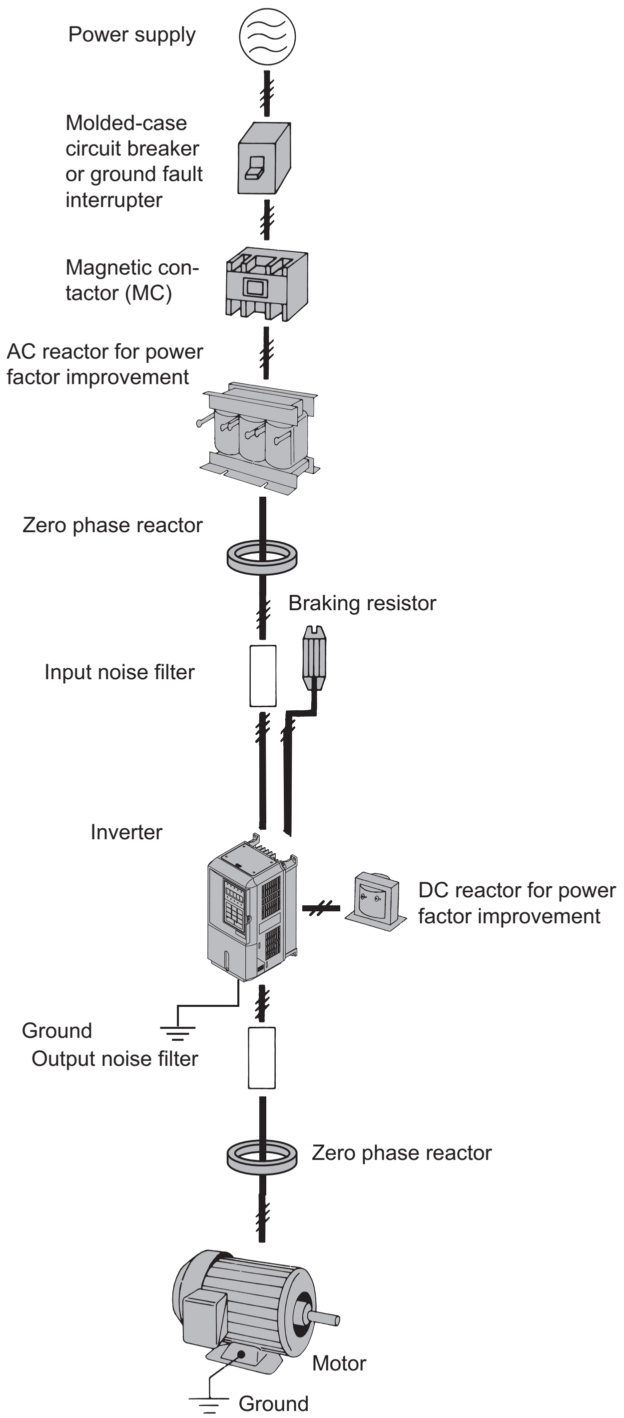


Fig 2.1 Example Connections to Peripheral Devices

Connection Diagram

Example: 400 V 3.7 kW (CIMR-L7B43P7)

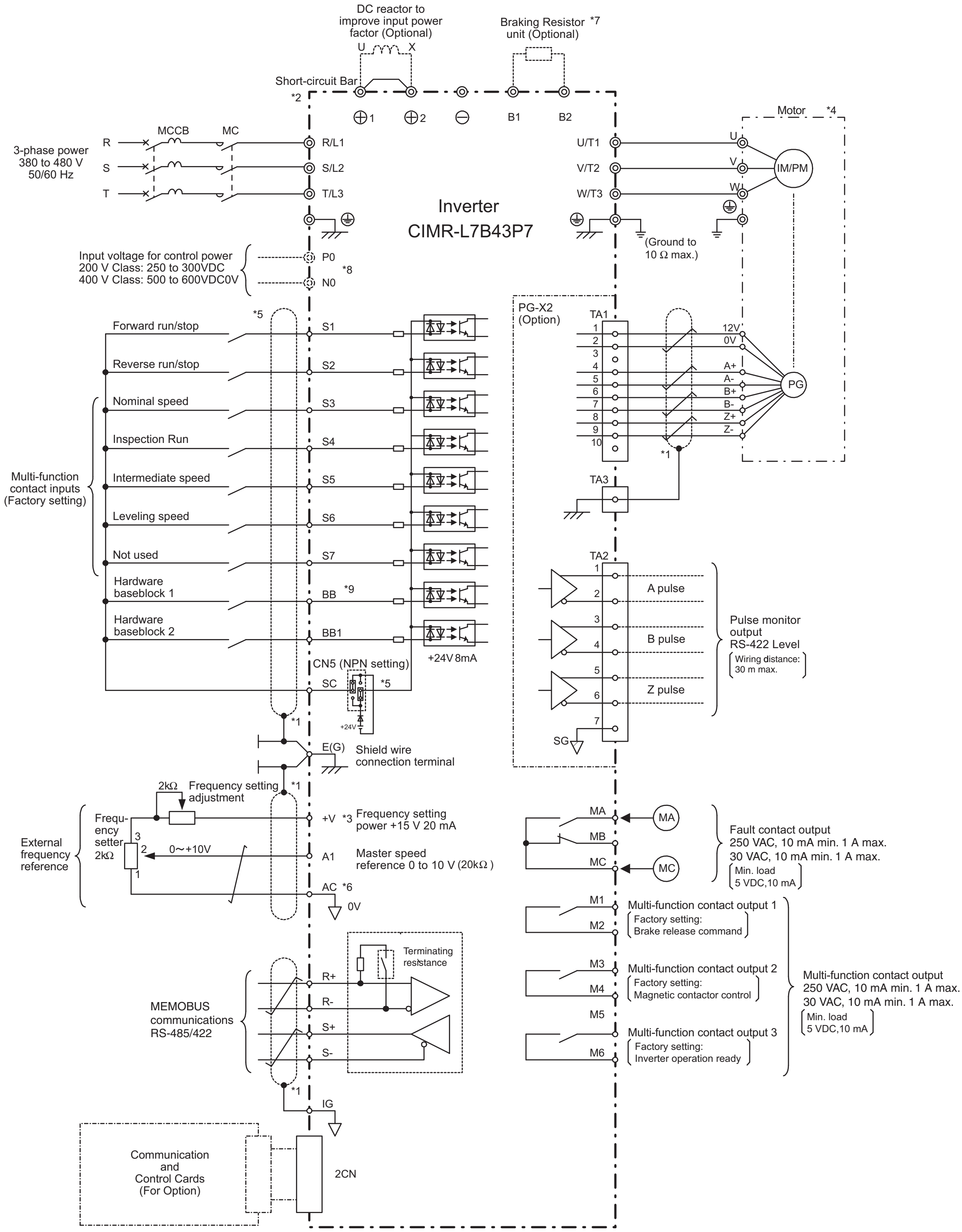


Fig 2.2 Connection Diagram (Model CIMR-L7B43P7 Shown Above)

* 1. indicates shield wire and indicates twisted-pair shield wire.

* 2. Main circuit terminals are indicated with double circles and control circuit terminals are indicated with single circle.

* 3. The output current capacity of the +V and −V terminals is 20 mA. Do not short-circuit between the +V and AC terminals. Doing so may result in a malfunction or a breakdown of the Inverter.

* 4. The wiring for a motor with a cooling fan is not required for self-cooling motors.

* 5. Sequence input signals S1 to S7, BB, and BB1 are labeled for sequence connections (0 V common and sinking mode) for no-voltage contacts or NPN transistors. These are the factory settings.
For PNP transistor sequence connections (+24V common and sourcing mode) or to provide a 24-V external power supply, refer to *page 2-22*.

2

* 6. Do not ground nor connect the AC terminal on the control circuit to the unit. Doing so may result in a malfunction or a breakdown of the Inverter.
* 7. Disable the stall prevention during deceleration (set parameter L3-04 to 0) when using a Braking Resistor Unit or a Braking Unit. If this user parameter is not changed to disable stall prevention, the system may not stop during deceleration.
* 8. During battery operation, input voltage for control power from the PO and NO terminals. The PO and NO terminals are set to the B1 (or ⊕3) and ⊖ terminals when shipping.
* 9. To enable the Inverter, the BB and BB1 terminals must be closed. If one of the terminals is closed, "BB" will be displayed on the Digital Operator and the Inverter will not start.

IMPORTANT

1. Control circuit terminals are arranged as shown below.

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

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 multi-function contact inputs S1 to S7, BB, and BB1 are shown for the connection of contacts or NPN transistors (0V common and sinking mode). This is the factory setting.
5. A DC reactor is an option only for Inverters of 18.5 kW or less. Remove the short circuit bar when connecting a DC reactor.
6. The minimum permissible load of a multi-function contact output and an error contact output is 10 mA.
7. The master frequency reference is set to a voltage input reference as the factory setting.

Terminal Block Configuration

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

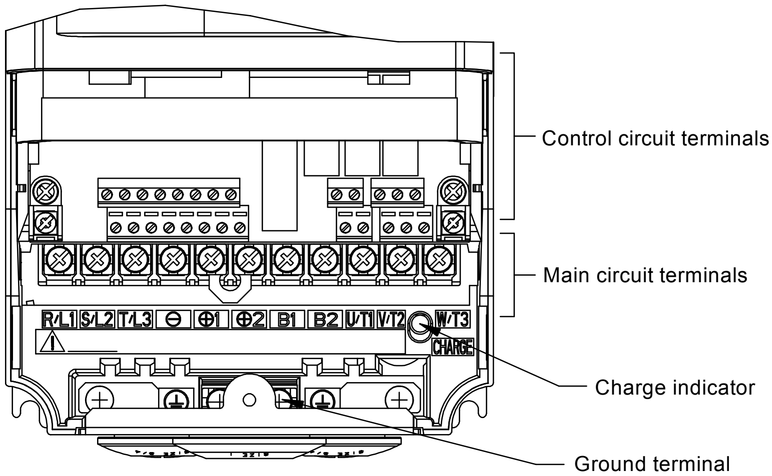


Fig 2.3 Terminal Arrangement (200 V/400 V Class Inverter of 3.7 kW)

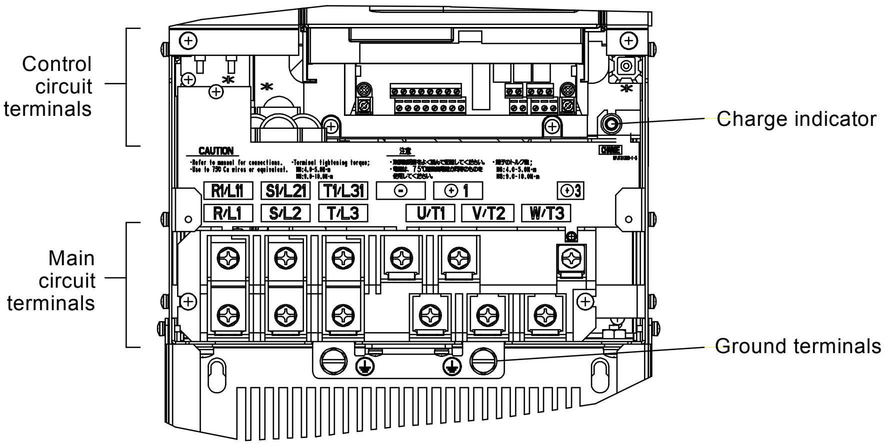


Fig 2.4 Terminal Arrangement (200 V/400 V Class Inverter of 22 kW or more)

2

Wiring Main Circuit Terminals

◆ Applicable Wire Sizes and Closed-loop Connectors

Select the appropriate wires and crimp terminals from *Table 2.1* to *Table 2.3*. Refer to instruction manual TOBPC72060000 for wire sizes for Braking Resistor Units and Braking Units.

Table 2.1 200 V Class Wire Sizes

Inverter Model CIMR-☐	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2(AWG)	Recommended Wire Size mm^2 (AWG)	Wire Type
L7B23P7	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
	⏚					
L7B25P5	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)	
	⏚					
L7B27P5	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)	
	⏚					
L7B2011	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)	
	⏚					
L7B2015	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)	
L7B2018	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)	
L7B2022	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)	
L7B2030	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)	
L7B2037	R/L1, S/L2, T/L3, ⊖, ⊕1 U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M10	17.6 to 22.5	70 to 95 (2/0 to 4/0)	70 (2/0)	
	⊕3, PO	M8	8.8 to 10.8	6 to 16 (10 to 4)	–	
	⏚	M10	17.6 to 22.5	35 to 70 (2 to 2/0)	35 (2)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 4 (20 to 10)	1.5 (16)	

Table 2.1 200 V Class Wire Sizes (Continued)

Inverter Model CIMR-☐	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2(AWG)	Recommended Wire Size mm^2 (AWG)	Wire Type
L7B2045	R/L1, S/L2, T/L3, ⊖, ⊕1 U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M10	17.6 to 22.5	95 (3/0 to 4/0)	95 (3/0)	Power cables, e.g., 600 V vinyl power cables
	⊕3, PO	M8	8.8 to 10.8	6 to 16 (10 to 4)	–	
	⏚	M10	17.6 to 22.5	50 to 70 (1 to 2/0)	50 (1)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 4 (20 to 10)	1.5 (16)	
L7B2055	R/L1, S/L2, T/L3, ⊖, ⊕1, NO	M12	31.4 to 39.2	50 to 95 (1/0 to 4/0)	50 × 2P (1/0 × 2P)	
	U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31	M10	17.6 to 22.5	90 (4/0)	90 (4/0)	
	⊕3, PO	M8	8.8 to 10.8	6 to 70 (10 to 2/0)	–	
	⏚	M10	17.6 to 22.5	35 to 95 (3 to 4/0)	50 (1/0)	
	r/l1, Δ/l2	M4	1.3 to 1.4	0.5 to 4 (20 to 10)	1.5 (16)	

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

Table 2.2 400 V Class Wire Sizes

Inverter Model CIMR-☐	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2 (AWG)	Recommended Wire Size mm^2 (AWG)	Wire Type
L7B43P7	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)	
L7B44P0	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)	
L7B45P5	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)	
L7B47P5	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M4	1.2 to 1.5	4 (10)	4 (10)	
	⏚			4 (12 to 10)	4 (12)	
L7B4011	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)	
L7B4015	R/L1, S/L2, T/L3, ⊖, ⊕1, ⊕2, B1, B2, U/T1, V/T2, W/T3, NO, PO	M5	2.5	10 (8 to 6)	10 (8)	
	⏚	M5 (M6)	2.5 (4.0 to 5.0)	6 to 10 (10 to 6)	6 (10)	

Table 2.2 400 V Class Wire Sizes (Continued)

Inverter Model CIMR-☐	Terminal Symbol	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2 (AWG)	Recommended Wire Size mm^2 (AWG)	Wire Type
L7B4018	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)	Power cables, e.g., 600 V vinyl power cables
	B1, B2, PO	M5	2.5	10 (8)	10 (8)	
	⏚	M6	4.0 to 5.0	10 to 25 (8 to 4)	10 (8)	
L7B4022	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)	
L7B4030	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)	
L7B4037	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)	
L7B4045	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)	
L7B4055	R/L1, S/L2, T/L3, ⊖, ⊕1, U/T1, V/T2, W/T3, R1/L11, S1/L21, T1/L31, NO	M8	9.0 to 10.0	50 (1 to 1/0)	50 (1)	
	⊕3, PO	M6	4.0 to 5.0	10 to 16 (8 to 4)	-	
	⏚	M8	9.0 to 10.0	25 to 35 (4 to 2)	25 (4)	

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

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

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

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

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

IMPORTANT

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

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

2

◆ Main Circuit Terminal Functions

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

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

Purpose	Terminal Symbol	Model: CIMR-L7∗☐	
		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 power input	⊕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 for battery operation *	P0, N0	23P7 to 2055	43P7 to 4055

* When running a permanent magnet motor using an option card other than the PG-F2 card, do not use the P0 and N0 terminals, as they do not correspond to the battery operation.

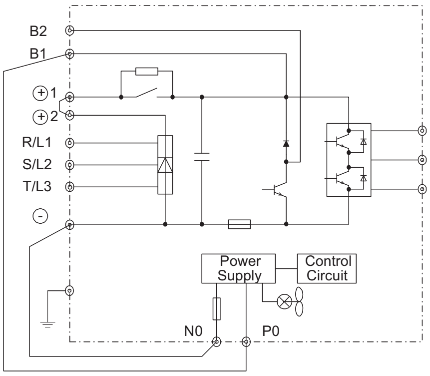
Note: The ⊕1 and ⊖ input terminals for the DC power do not conform to UL/cUL standards.

◆ Main Circuit Configurations

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

Table 2.5 Inverter Main Circuit Configurations

<table>
<tr><th>200 V Class</th><th>400 V Class</th></tr>
<tr><td>
CIMR - L7B23P7 to 2018



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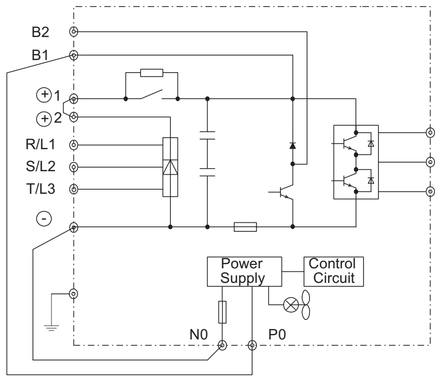
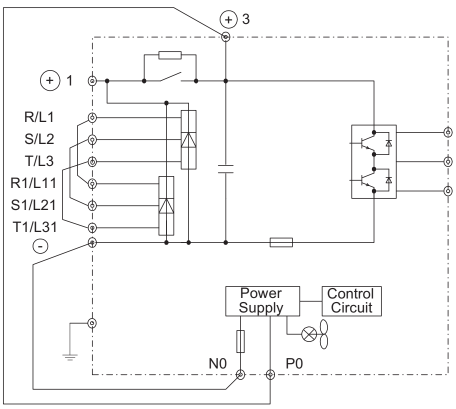
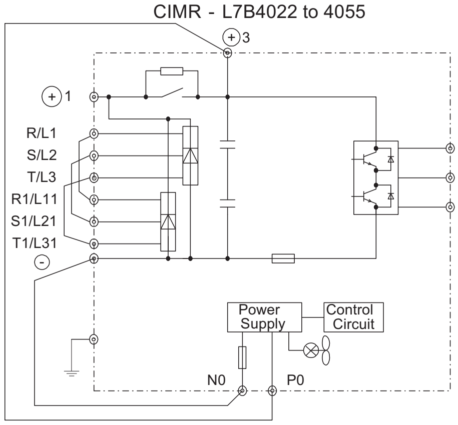
CIMR - L7B43P7 to 4018



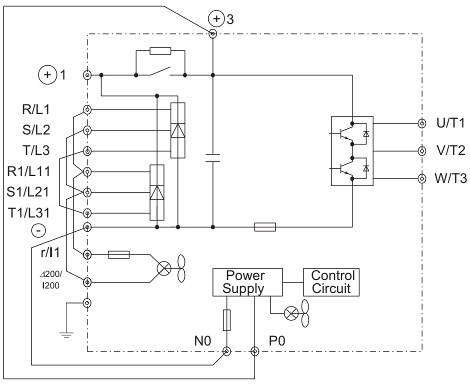
</td></tr>
<tr><td>
CIMR - L7B2022,2030



</td><td>
CIMR - L7B4022 to 4055



</td></tr>
<tr><td>
CIMR - L7B2037 to 2055



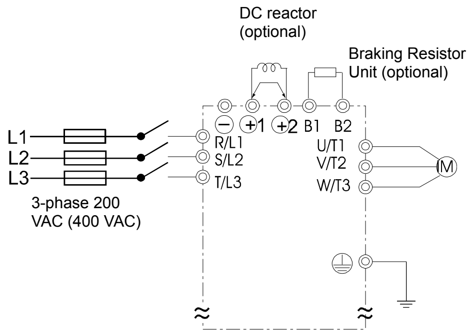
</td><td></td></tr>
</table>

Note: Consult your supplier for using 12-phase rectification.

◆ Standard Connection Diagrams

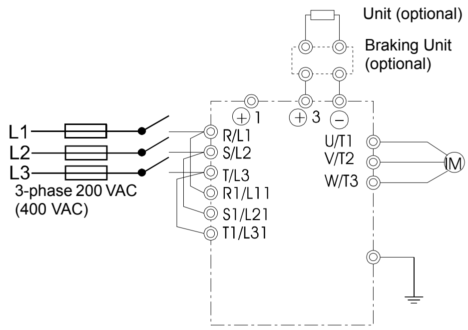
Standard Inverter connection diagrams are shown in *Fig 2.5*. These are the same for both 200 V Class and 400 V Class Inverters. The connections depend on the Inverter capacity.

■CIMR-L7B3P7 to 2018 and 43P7 to 4018



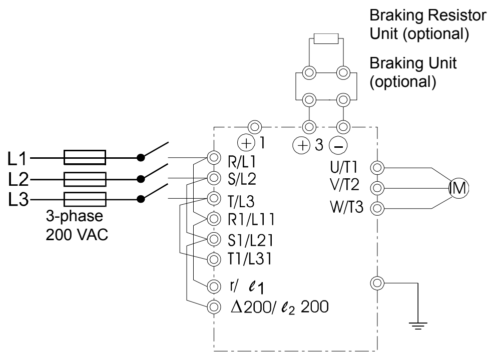
Be sure to remove the short-circuit bar before connecting the DC reactor.

■CIMR-L7B2022, 2030, and 4022 to 4055



The DC reactor is built in.

■CIMR-L7B2037 to 2055



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

Fig 2.5 Main Circuit Terminal Connections

◆ Wiring the Main Circuits

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

■Wiring Main Circuit Inputs

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

Installing Fuses

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

Table 2.6 Input Fuses

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

Installing a Moulded-case Circuit Breaker

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

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

Installing an Earth Leakage Breaker

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

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

Installing a Magnetic Contactor at the Input

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

The following things should be considered:

- The Inverter can be started and stopped by opening and closing the magnetic contactor on the primary side. Frequently opening and closing the magnetic contactor, however, may cause the Inverter to break down. Do not exceed one power up per hour.
- When the Inverter is operated 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 may flow through the input power circuit, causing the Inverter to break down.

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

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

Installing a Surge Absorber

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

■Wiring the Output Side of the Main Circuit

Observe the following precautions when wiring the main output circuits.

Connecting the Inverter and Motor

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

Check that the motor rotates forward with the Forward Run Command. Switch over two of the motor cable wires and reconnect if the motor rotates in reverse with the Forward Run Command.

Never Connect a Power Supply to Output Terminals

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

Never Short or Ground Output Terminals

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

Do Not Use a Phase Advancing Capacitor

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

Using a Magnetic Contactor

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

■Ground Wiring

Observe the following precautions when wiring the ground line.

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

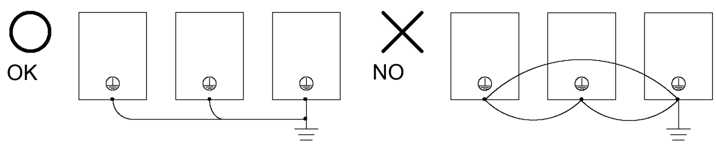


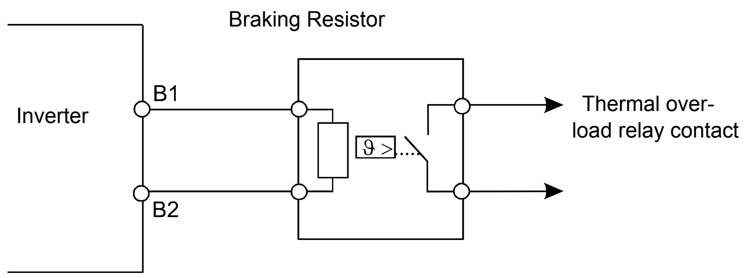
Fig 2.6 Ground Wiring

■Connecting a Braking Resistor and Braking Unit (CDBR)

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

To prevent overheating of the braking unit/braking resistor, design the control circuit to stop the Inverter operation 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

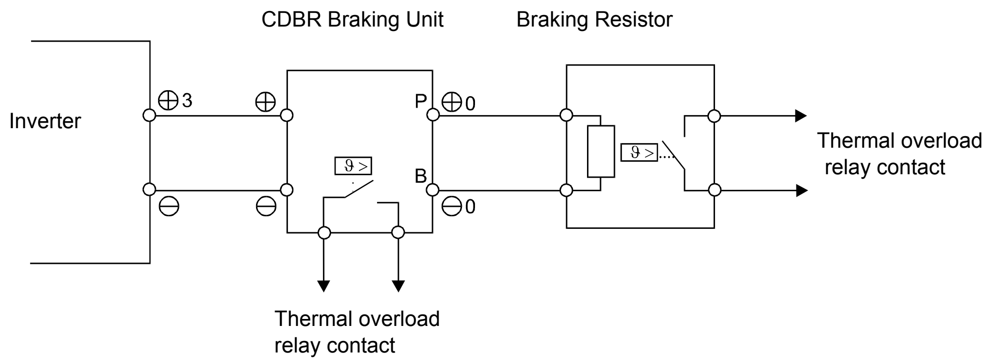


Fig 2.7 Connecting the Braking Resistor and Braking Unit

Connecting Braking Units in Parallel

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

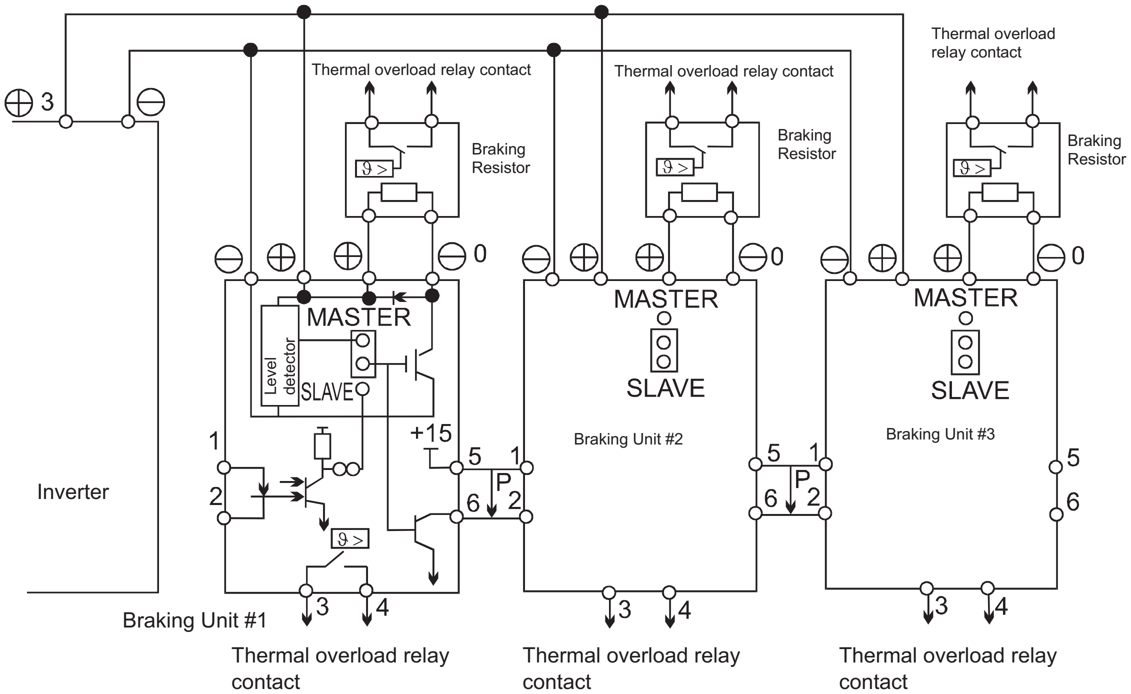


Fig 2.8 Connecting Braking Units in Parallel

■Control Power Supply Connection

The control board of the Inverter can be supplied by an external voltage source during emergency operation using the twisted wires marked with P0 and N0. Upon shipment the wires are connected to the main circuit terminals B1/+3 and -.

Refer to *page 6-101, Emergency Operation* for details about emergency operation.

Follow the example shown in *Fig 2.9* when connect a backup power supply battery for the system.

Table 2.7

L2-11 (Battery voltage)	Sets the voltage supplied by the backup battery.
H1-05 (Terminal S7 function selection)	Sets the battery run command 85.

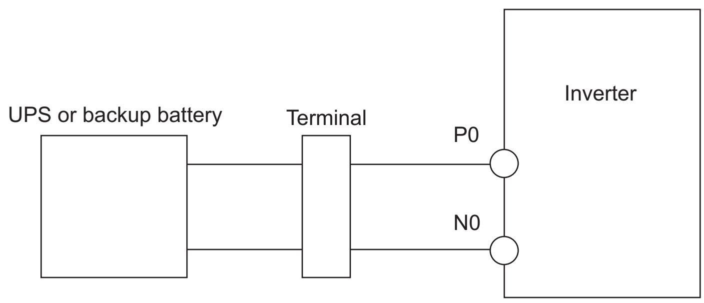


Fig 2.9 Connecting a Backup Battery

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. Separate the lines from main power lines or other control circuits in order to reduce induction from peripheral devices.

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

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

2

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

Terminals	Terminal Screws	Tightening Torque (N•m)	Possible Wire Sizes mm^2(AWG)	Recom-mended Wire Size mm^2(AWG)	Wire Type
AC, SC, A1, +V, S1, S2, S3, S4, S5, S6, S7, MA, MB, MC, M1, M2, M3, M4, M5, M6, BB, BB1, R+, R-, S+, S-, IG	Phoenix type	0.5 to 0.6	Single wire*2: 0.14 to 2.5 Stranded wire: 0.14 to 1.5 (26 to 14)	0.75 (18)	• Shielded, twisted-pair wire*1 • Shielded, polyethylene-covered, viny1 sheath cable (KPEV-S by Hitachi Electrical Wire or equiva-lent)
E (G)	M3.5	0.8 to 1.0	0.5 to 2 (20 to 14)	1.25 (12)	

* 1. Use shielded twisted-pair cables to input an external frequency reference.
* 2. We recommend using straight solderless terminal on signal lines to simplify wiring and improve reliability.

■ Straight Solderless Terminals for Signal Lines

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

Table 2.9 Straight Solderless Terminal Sizes

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

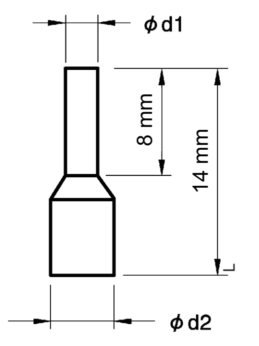


Fig 2.10 Straight Solderless Terminal Sizes

■Wiring Method

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

1. Loosen the terminal screws with a thin-slot screwdriver.
2. Insert the wires from underneath the terminal block.
3. Tighten the terminal screws firmly.

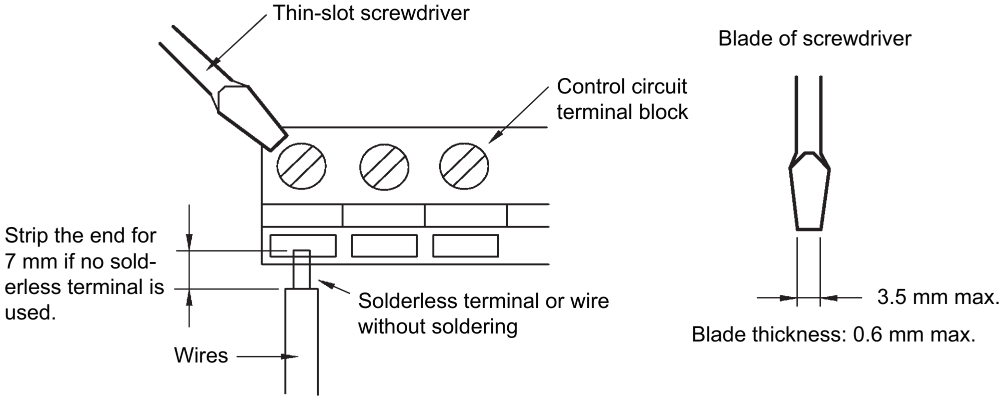


Fig 2.11 Connecting Wires to Terminal Block

◆ Control Circuit Terminal Functions

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

Table 2.10 Control Circuit Terminals

Type	No.	Signal Name	Function		Signal Level
Multi-function contact input signals	S1	Forward Run/Stop Command	Forward run when ON; stopped when OFF.		24 VDC, 8 mA Photocoupler
	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*	Hardware baseblock 1	–		
	SC	Multi-function contact input common	–		
Analog input signals	+V	15 V power output	15 V power supply for analog references		15 V (Max. current: 20 mA)
	A1	Frequency reference	0 to +10 V/100%		0 to +10 V(20 kΩ)
	AC	Analog reference neutral	0 V		–
Multi-function contact output signals	M1	Brake command (1NO contact)	Brake command when ON.	Multi-function contact outputs	Relay contacts Contact capacity: 10 mA min. 1 A max. at 250 VAC 10 mA min. 1 A max. at 30 VDC
	M2				
	M3	Magnetic Contactor Control (1NO contact)	Magnetic Contactor Control when ON		
	M4				
	M5	Inverter Ready (1NO contact)	Inverter Ready when ON.		
	M6				
	MA	Fault output signal (SPDT) (1 Change over contact)	Fault when CLOSED across MA and MC Fault when OPEN across MB and MC		
	MB				
	MC				
RS-422/485 MEMOBUS Communication	R+	MEMOBUS communication input	When using two RS-485 wires, short-circuit between R+ and S+, R- and S-		Differential input Photocoupler isolation
	R-				
	S+	MEMOBUS communication output			Differential output Photocoupler isolation
	S-				
	IG	Shielded wire for communication	–		–

* This terminal is available on Inverters with hardware SPEC: B only.
Note 1. Do not use this power supply for supplying any external equipment.
Note 2. When driving a reactive load, such as a relay coil with DC power supply, always insert a flywheel diode as shown in Fig 2.12.

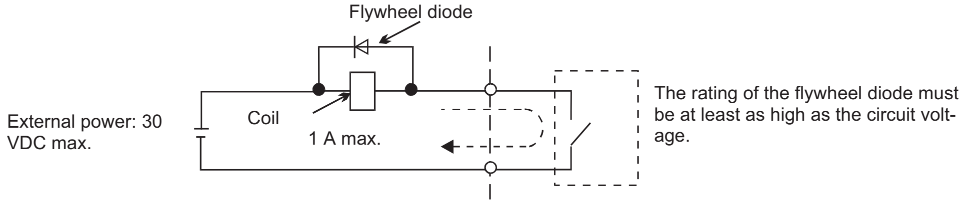


Fig 2.12 Flywheel Diode Connection

■Shunt Connector CN15 and DIP Switch S1

The shunt connector CN5 and DIP switch S1 are shown below.

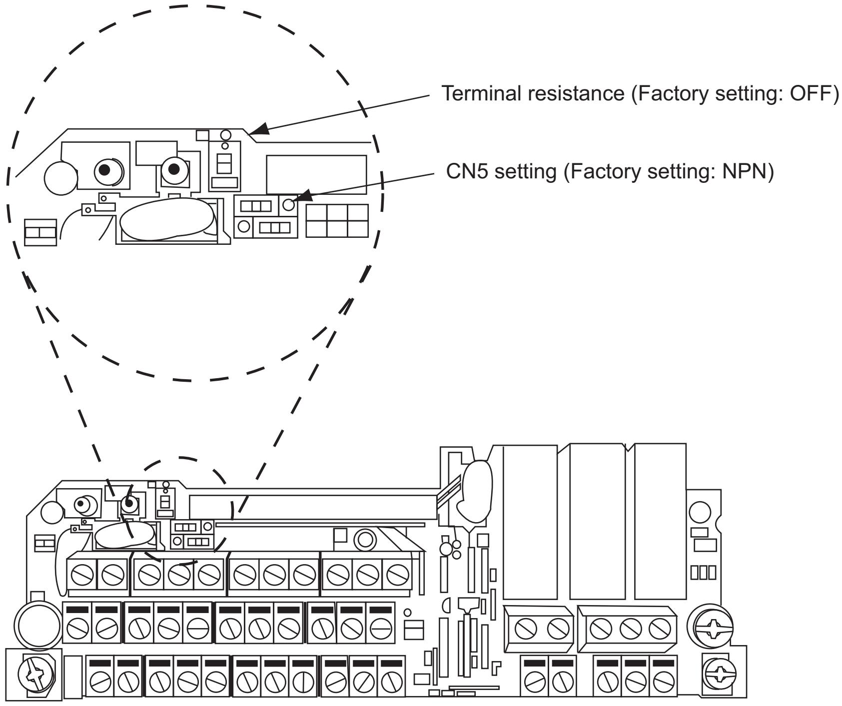
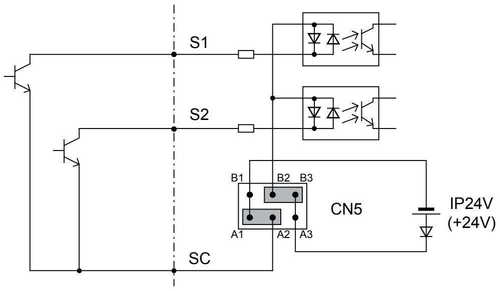
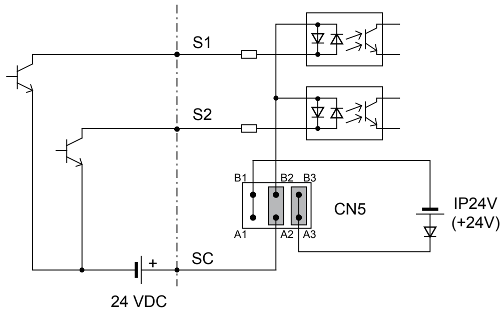
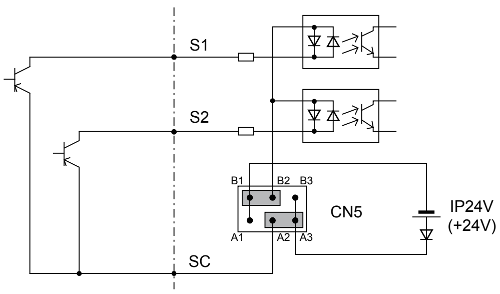
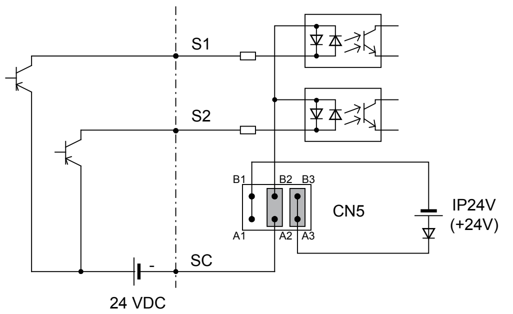


Fig 2.13 Shunt Connector CN5 and DIP Switch S1

■ 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 2.11 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)**
	

◆ Control Circuit Terminal Connections

Connections to Inverter control circuit terminals are shown in *Fig 2.14*.

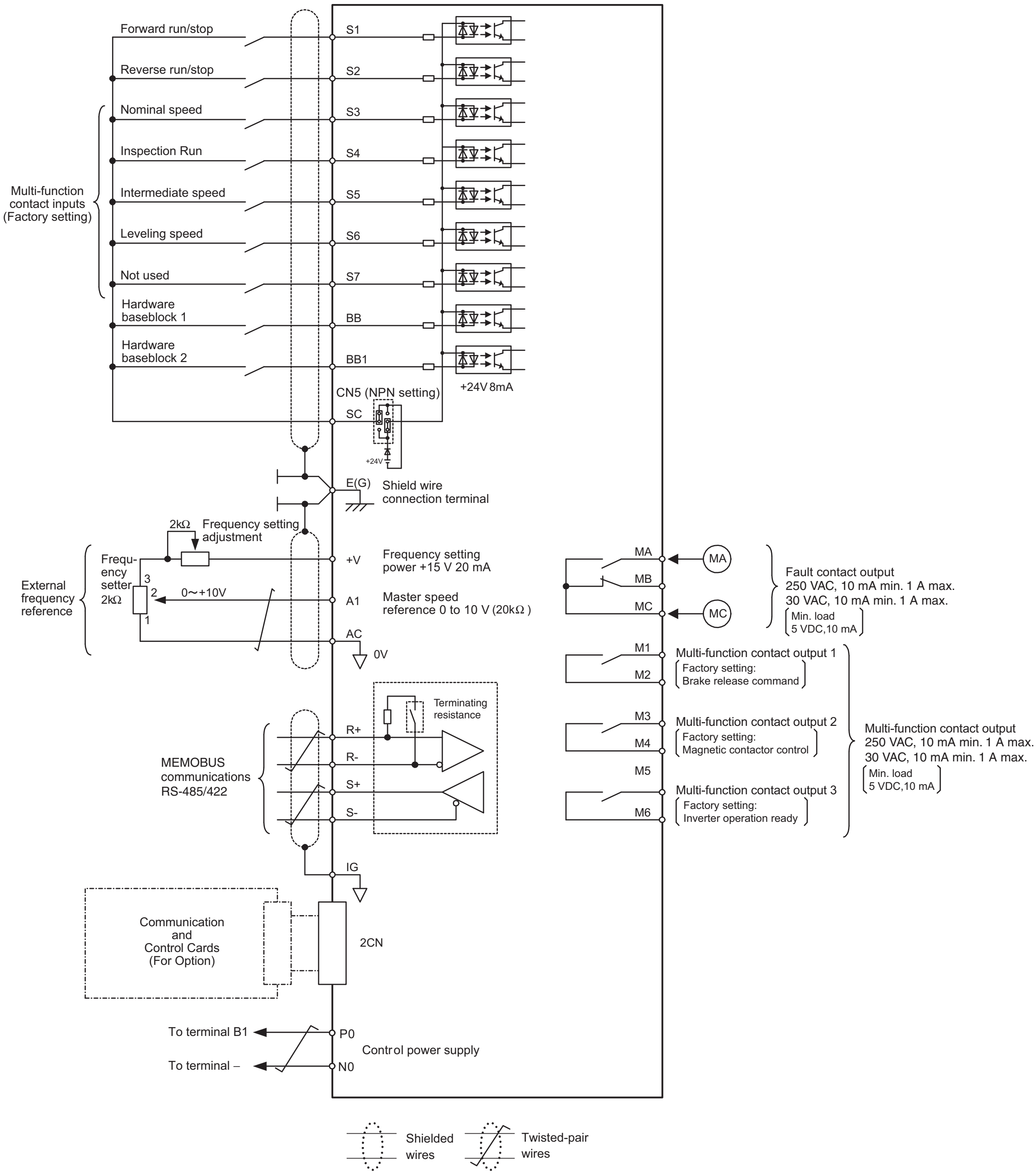


Fig 2.14 Control Circuit Terminal Connections

◆ Control Circuit Wiring Precautions

Observe the following precautions for wiring the control circuits.

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

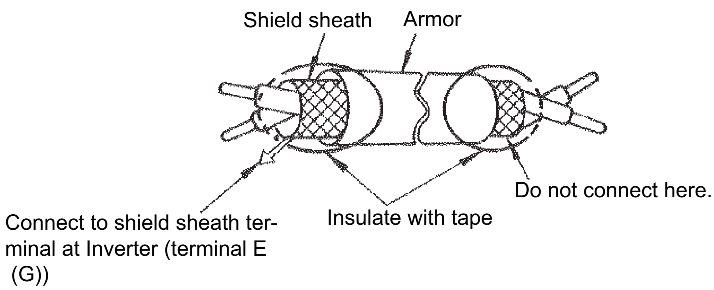


Fig 2.15 Processing the Ends of Shielded Twisted-pair Cables

Wiring Check

◆ Checks

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

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

Installing and Wiring Option Cards

◆ Option Card Models and Specifications

Three option cards can be mounted in the Inverter. One card can be mounted on each of the three places on the control board (A, C and D) shown in *Fig 2.16*.

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

Table 2.12 Option Card Specifications

Board	Model	Specifications	Mounting Location
PG Speed control boards	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	EnDat/HIPERFACE®	A
DeviceNet communications board*	SI-N1	Option card for DeviceNet fieldbus	C
Profibus-DP communications board*	SI-P1	Option card for Profibus-DP fieldbus	C
CANOpen communications board*	SI-S1	Option card for CANOpen fieldbus	C
Analog input board	AI-14B	3 Channel analog input board Signal level: -10 to 10 V or 0 to 10V Resolution: 13 Bit + sign	C
Analog output boards	AO-08	2 channel analog output board Signal level: 0 to 10 V Resolution: 8 Bit	D
	AO-12	2 channel high resolution analog output board Signal level: -10 to +10 V Resolution: 11 Bit + sign	D
Digital output boards	DO-08	6 channel multi-function contact output board for monitoring the Inverter status (fault, zero-speed, running, etc.)	D
	DO-02C	2 channel relay contact output	D

* Under development

◆ Installation

Before mounting an option card, remove the terminal cover and be sure that the charge indicator inside the Inverter does not glow anymore. After that remove the Digital Operator/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.

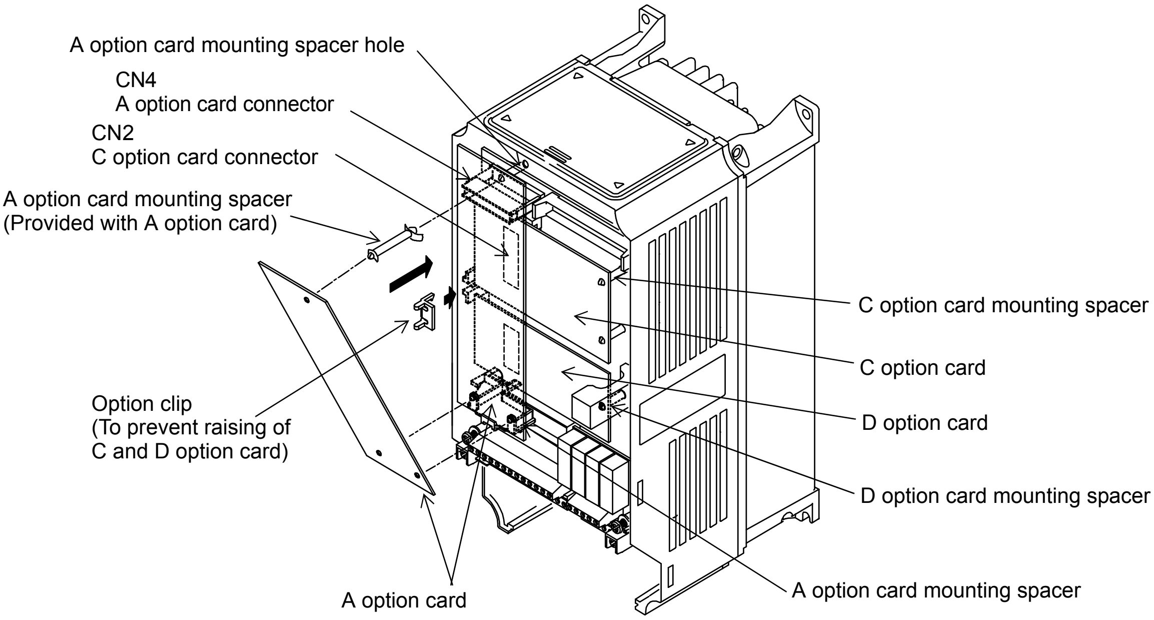


Fig 2.16 Mounting Option Cards

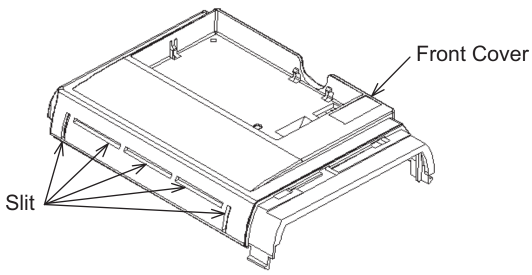


Fig 2.17 Cutting the Front Cover

Cut out the slits on the front cover with nippers. Be careful to avoid injury.

◆ PG Speed Control Board Terminals and Specifications

■PG-B2

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

Table 2.13 PG-B2 Terminal Specifications

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

■PG-X2

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

Table 2.14 PG-X2 Terminal Specifications

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

■PG-F2 Option Card

Supported Encoders

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

- HIPERFACE®: SRS50/60 manufactured by STEGMANN.
- EnDat: ECN113 (EnDat01), ECN413 (EnDat01), ECN1313 (EnDat01) manufactured by HEIDEN HAIN

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

Input/Output Specifications

Table 2.15 PG-F2 I/O Specifications

Terminal	No.	Contents		Specifications
		HIPERFACE®	EnDat	
TB1	1	Us		EnDat: 5 VDC ±5%, (250 mA max.) HIPERFACE®: 8 VDC (150 mA max.)
	2	GND		0 V
	3	REFSIN	B-	Differential Input
	4	+SIN	B+	
	5	REFCOS	A-	
	6	+COS	A+	
	7	DATA+		RS-485 Data Communications Terminal Resistance: 130Ω
	8	DATA-		
TB2	1	–	CLOCK	Differential Output, Clock Frequency: 100 kHz
	2	–	/CLOCK	
TB3	1	COS Pulse	A Pulse	Open Collector Output 24 VDC, 30 mA max.
	2	GND		
	3	SIN Pulse	B Pulse	
	4	GND		
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 option 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 to 5.25V upon shipment.

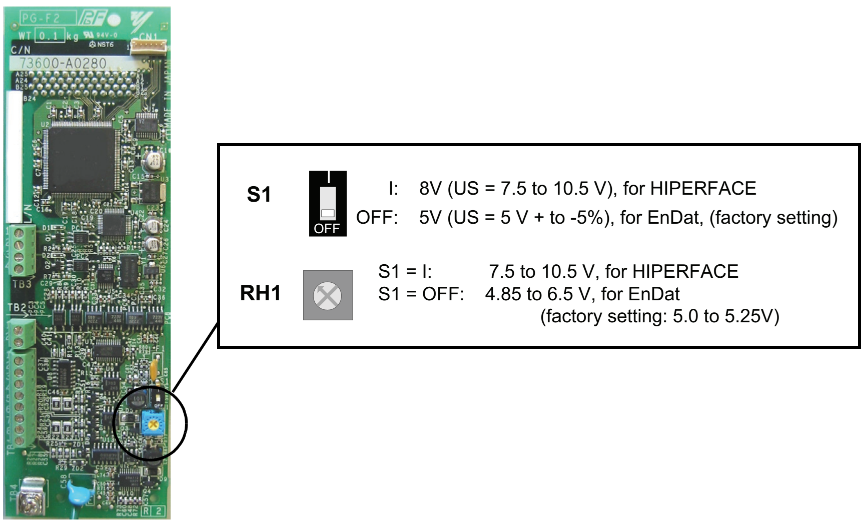


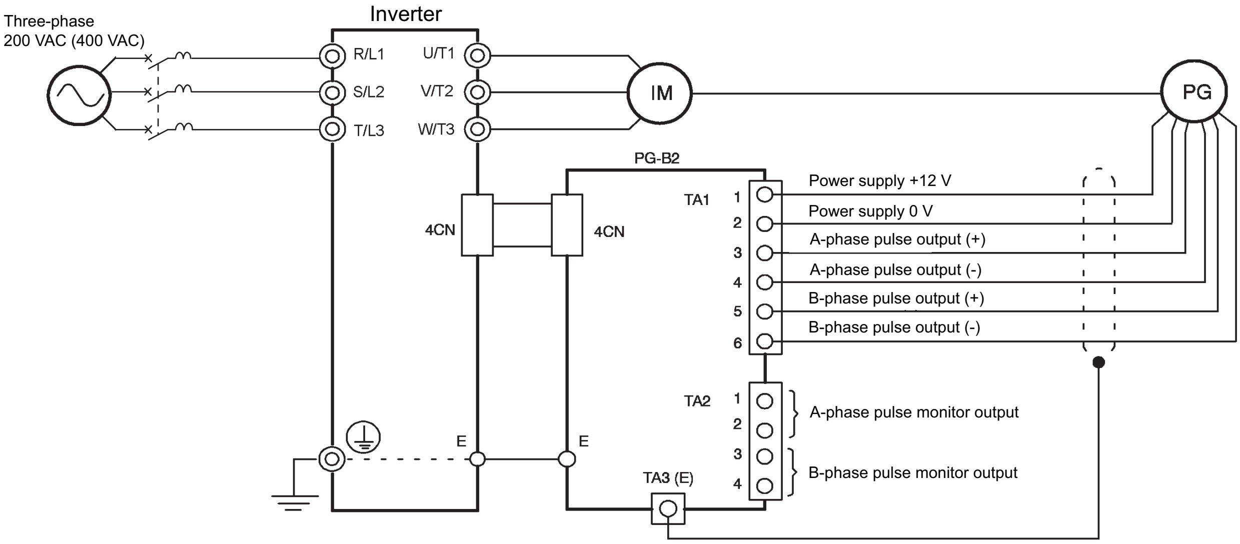
Fig 2.18 PG-F2 Encoder Power Supply Voltage Selection

◆ Wiring

The following illustrations show wiring examples for the option card.

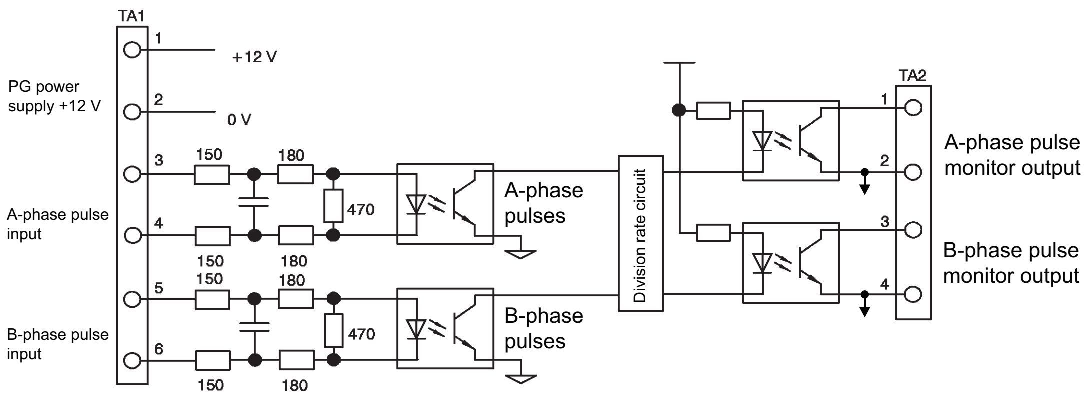
■ Wiring the PG-B2

Wiring examples are provided in the following illustrations for the PG-B2.

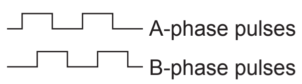


- Shielded twisted-pair wires must be used for signal lines.
- Do not use the pulse generator's power supply for anything other than the pulse generator (encoder). Using it for another purpose can cause malfunctions due to noise.
- The length of the pulse generator's wiring must not be more than 100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

Fig 2.19 PG-B2 Wiring



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

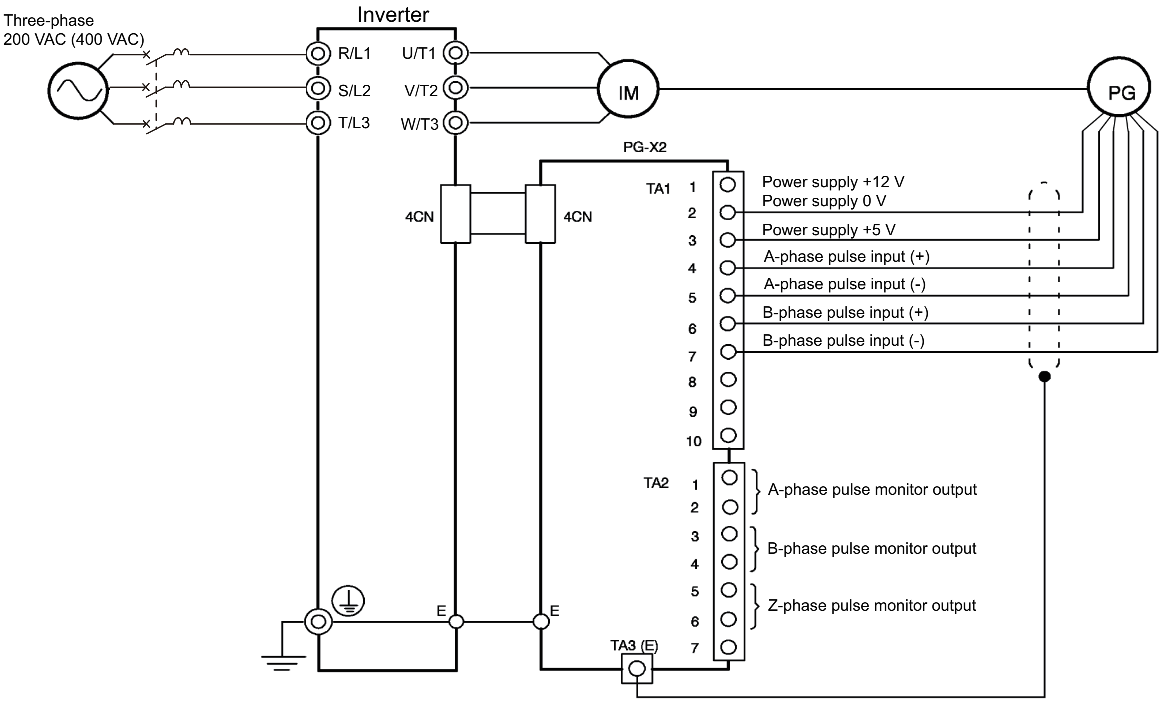


•The pulse monitor emitter is connected to common inside the PG-B2. The emitter common must be used for external circuits.

Fig 2.20 I/O Circuit Configuration of the PG-B2

■Wiring the PG-X2

Wiring examples are provided in the following illustrations for the PG-X2.



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

Fig 2.21 PG-X2 Wiring

■PG-F2

Wiring the PG-F2 Option Card

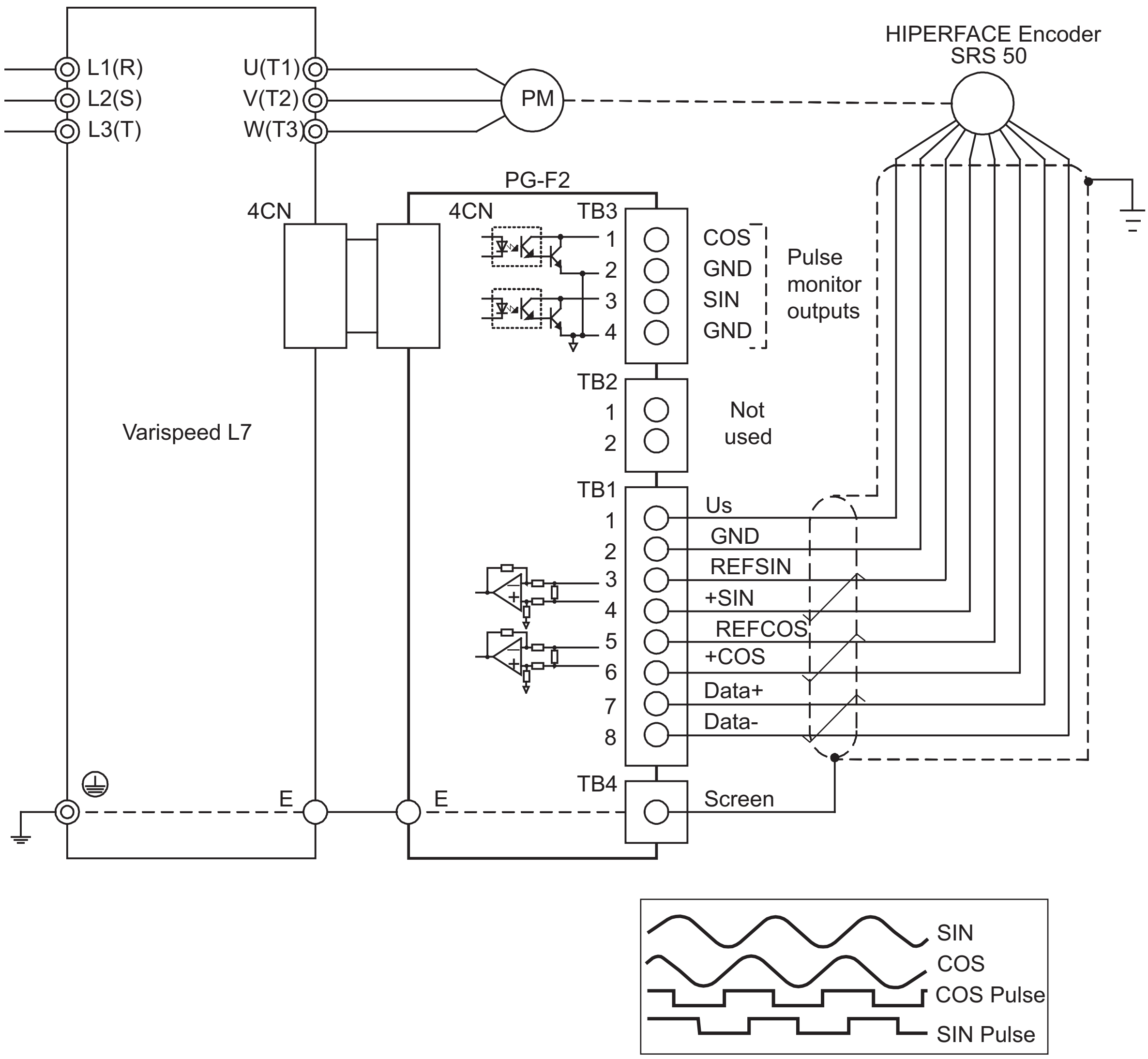
Wiring for the PG-F2 option card along with HIPERFACE® or EnDat is shown in the illustration below.

Use a shielded twisted pair cable for connecting the encoder.

Shielded line should be used to connect terminal TB4 to motor ground terminal. (HIPERFACE®)

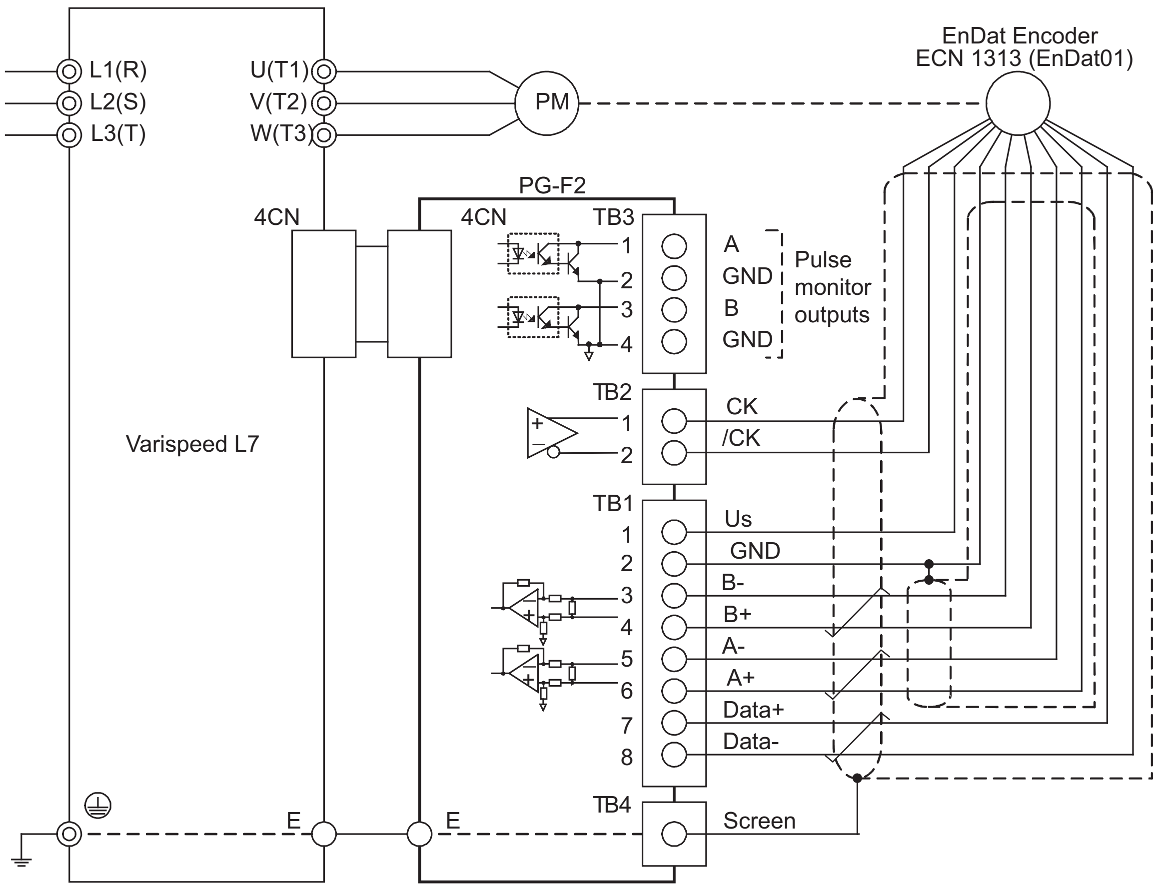
Connect a shielded cable to terminal TB4. (EnDat)

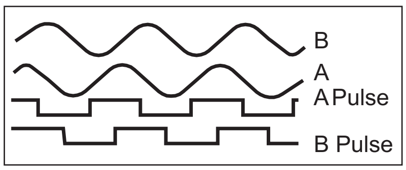
[HIPERFACE®]



Note: TB1-2, TB3-2, and TB3-4 are GNDs for the PG-F2 option card.

[EnDat]





Note: TB1-2, TB3-2, and TB3-4 are GNDs for the PG-F2 option card.

IMPORTANT

- The length of the PG wiring must not be more than 50 m for the signal lines and 30 m 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 signal voltage levels must be within the following limits:
  REFSIN (B-), REFCOS (A-) offset: 2.2 to 2.8 V
  +SIN (B+), +COS (A+) peak-to-peak voltage (Vp-p) 0.9 to 1.1 V

2

◆ Wiring the Terminal Blocks

Use not more than 50 meters of wiring for PG (encoder) signal lines and keep them separate from power lines.

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

■Wire Sizes (Same for All Models)

Terminal wire sizes are shown in *Table 2.16*.

Table 2.16 Wire Sizes

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

■Straight Solderless Terminals

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

Refer to *Table 2.9* for specifications.

■Cable Lug Connector Sizes and Tightening Torque

The lug sizes and tightening torques for various wire sizes are shown in *Table 2.17*.

Table 2.17 Cable Lugs and Tightening Torques

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

■Wiring Method and Precautions

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

- Separate the control signal lines for the PG Speed Control Board from main circuit lines and power lines.
- Connect the shield when connecting to a PG. The shield must be connected to prevent operational errors caused by noise. Also, do not use any lines that are more than 100 m long.
- Connect the shield to the shield terminal (E).
- Do not solder the ends of wires. Doing so may cause contact faults.
- When not using straight solderless terminals, strip the wires to a length of approximately 5.5 mm.

◆ Selecting the Number of PG (Encoder) Pulses

The setting for the number of PG pulses depends on the model of PG Speed Control Board being used. Set the correct number for your model.

■PG-B2

The maximum response frequency is 32,767 Hz.

Use a PG that outputs a maximum frequency of approximately 20 kHz for the rotational speed of the motor.

$$\frac{\text{Motor speed at maximum frequency output (min}^{-1}\text{)}}{60} \times \text{PG rating (p/rev)} = 20{,}000 \text{ Hz}$$

Some examples of PG output frequency (number of pulses) for the maximum frequency output are shown in *Table 2.18*.

Table 2.18 PG Pulse Selection Examples

Motor's Maximum Speed (min^{-1})	PG Rating (p/rev)	PG Output Frequency for Maximum Frequency Output (Hz)
1800	600	18,000
1500	600	15,000
1200	900	18,000
900	1200	18,000

Note 1.The motor speed at maximum frequency output is expressed as the sync rotation speed.
Note 2.The PG power supply is 12 V.
Note 3.A separate power supply is required if the PG power supply capacity is greater than 200 mA. (If momentary power loss must be handled, use a backup capacitor or other method.)

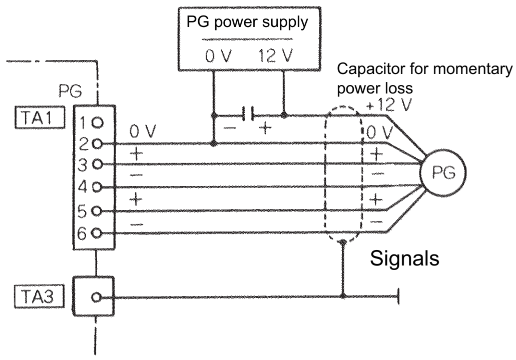


Fig 2.22 PG-B2 Connection Example

■PG-X2

There are 5 V and 12 V PG power supplies.
Check the PG power supply specifications before connecting.

The maximum response frequency is 300 kHz.

Use the following equation to computer the output frequency of the PG (f_{PG}).

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

2

A separate power supply is required if the PG power supply capacity is greater than 200 mA. (If momentary power loss must be handled, use a backup capacitor or other method.)

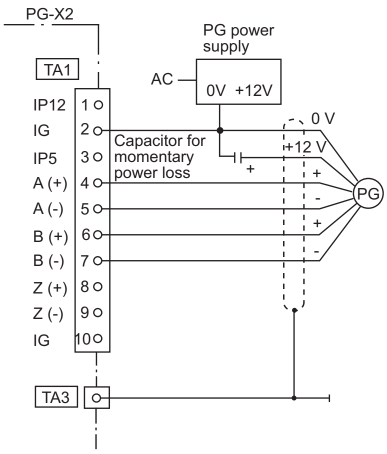


Fig 2.23 PG-X2 Connection Example (for 12 V PG power supply)

3

LED Monitor/Digital Operator and Modes

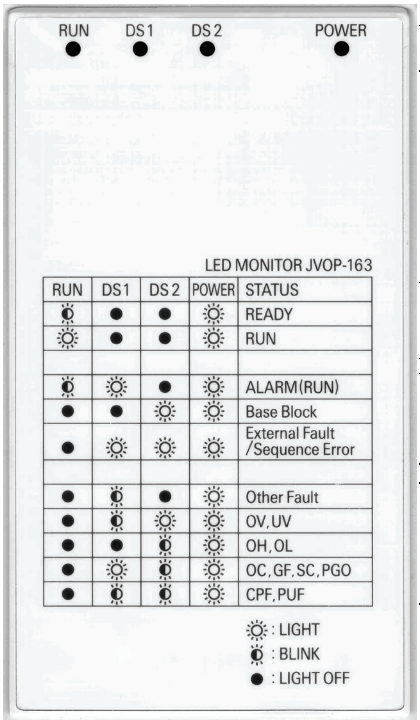
The Varispeed L7 is equipped with the LED Monitor JVOP-163 which shows the inverter status. The optional Digital Operator JVOP-160 can be used to adjust parameters as required.
This chapter describes Digital Operator displays and functions, and provides an overview of operating modes and switching between 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: Inverter Status 1
DS2: Inverter Status 2
The combination of the three LEDs Run, DS1 and DS2 indicates the inverter status.

Inverter Status Indications

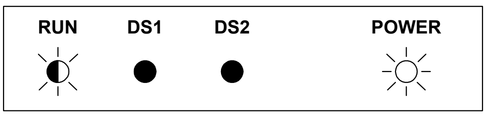
Alarm Indications

Fault Indications

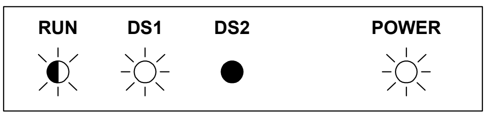
Fig 3.1 Digital Operator Component Names and Functions

◆ LED Display Examples

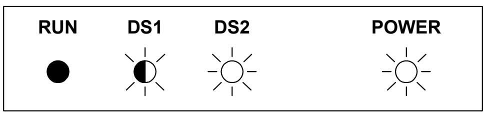
Normal operation: The figure below shows the LED display when the inverter is ready and no FWD/REV signal is active



Alarm: The figure below shows an example of the LED display when a minor fault occurs.
Refer to *Chapter 7 Troubleshooting* and take appropriate countermeasures.



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



Digital Operator JVOP-160

◆ Digital Operator Display

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

Inverter 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 Inverter 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

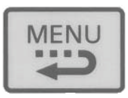
Execute operations such as setting parameters, monitoring, jogging, and autotuning.

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

Table 3.1 Key Functions (Continued)

Key	Name	Function
FWD/REV	FWD/REV Key	Selects the rotation direction of the motor when the Inverter is 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*.

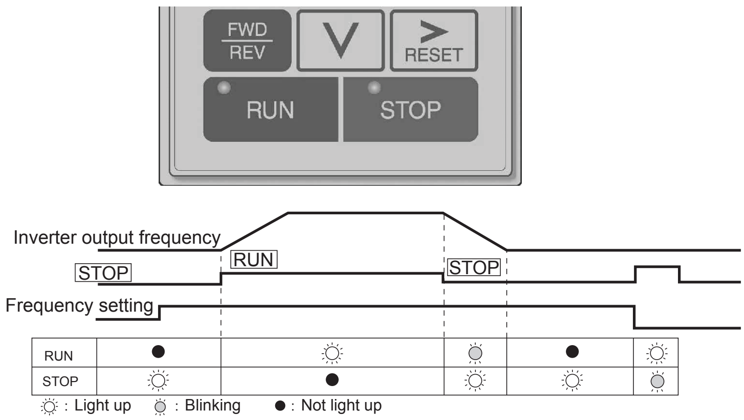


Fig 3.3 RUN and STOP Indicators

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

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

Table 3.2 Relation of Inverter to RUN and STOP Indicators

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

Note ☼: Light up ◍: Blinking ●: Not light up

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

3

◆ 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 3.3*.

Table 3.3 Modes

Mode	Primary function(s)
Drive mode	Use this mode to start/stop the Inverter, to monitor values such as the frequency 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*	Use this mode when using a motor with unknown motor data in the vector control methods. The motor data are measured/calculated and set automatically. This mode can also be used to measure the motor line-to-line resistance only.

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

◆ 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.

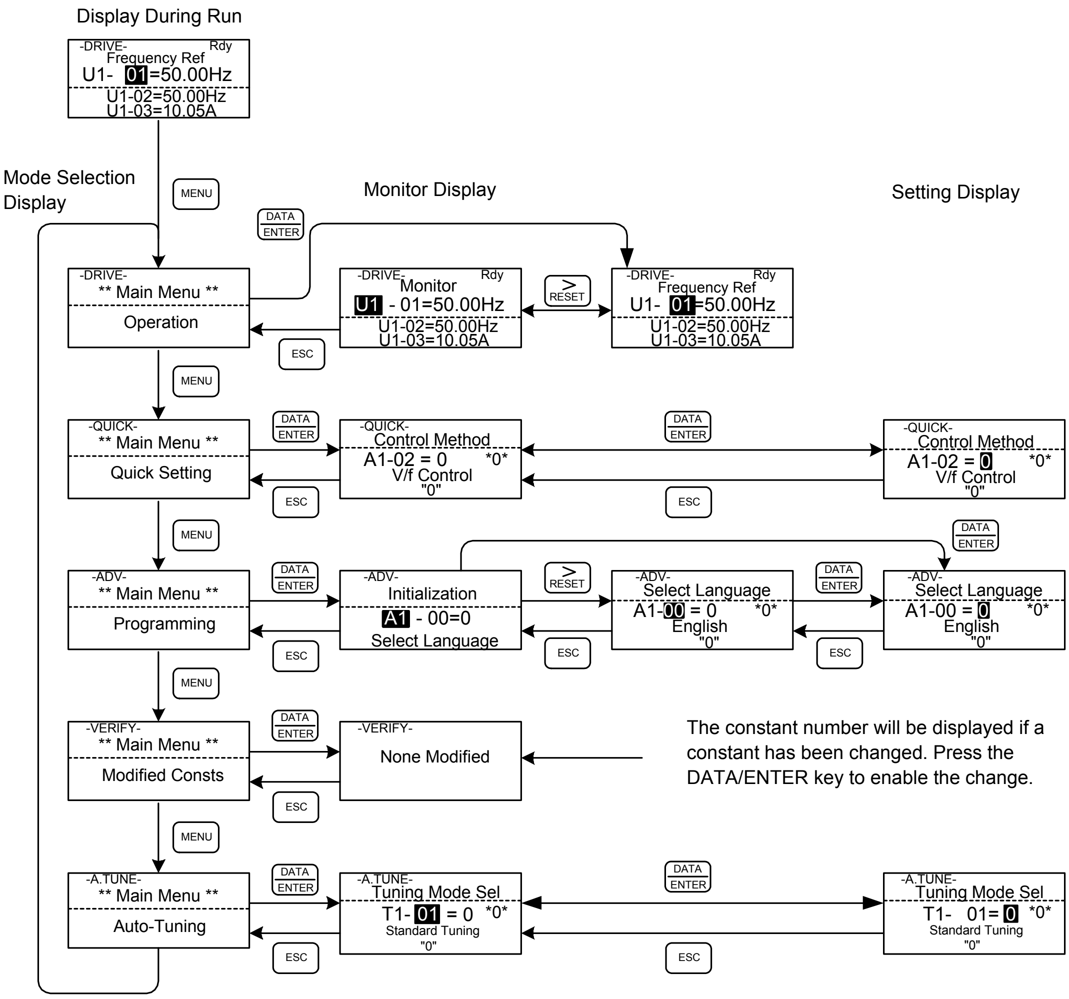


Fig 3.4 Mode Transitions

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 inverter 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.

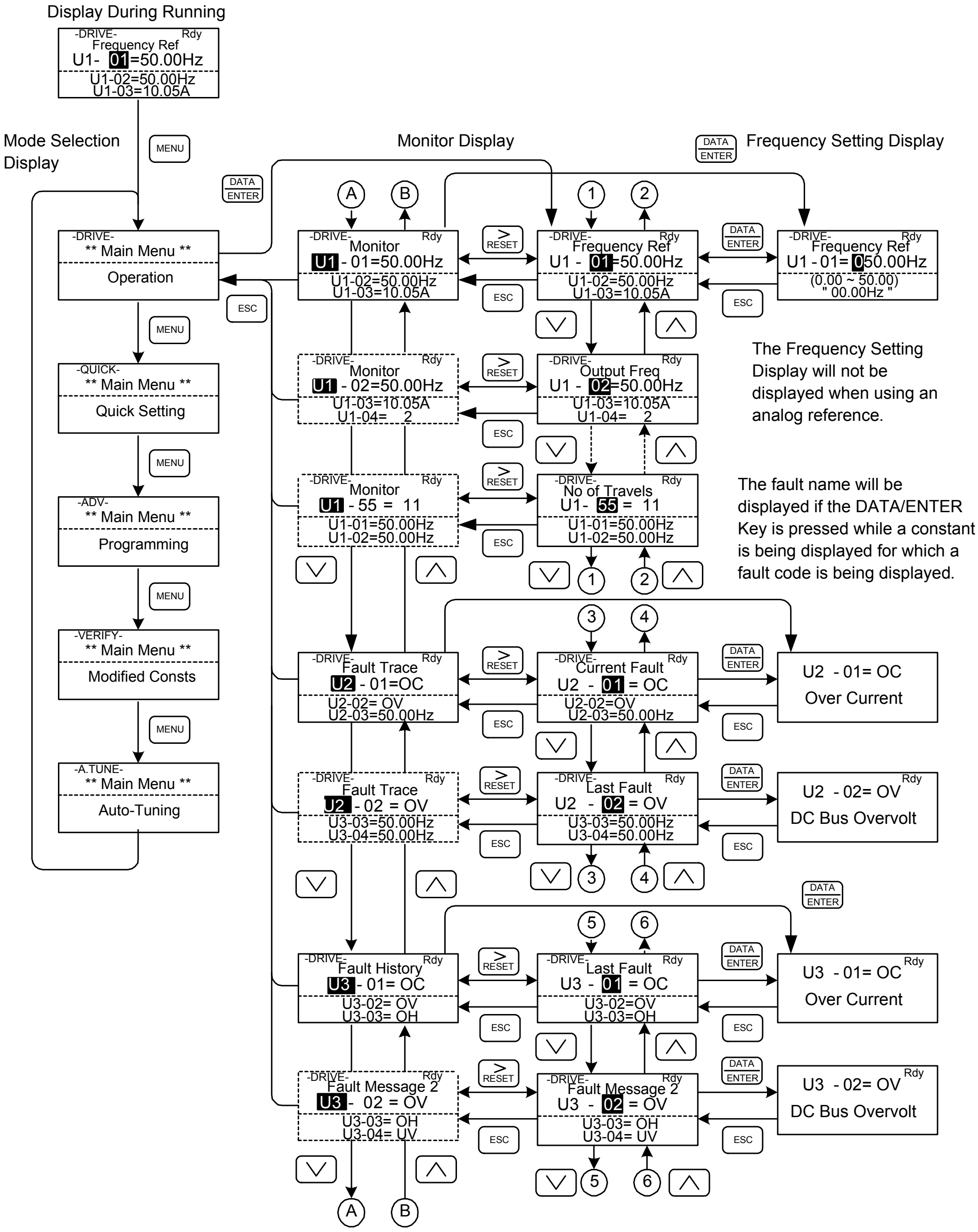


Fig 3.5 Operations in Drive Mode

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, Parameters Available in Quick Programming Mode* for details.

■Example Operations

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

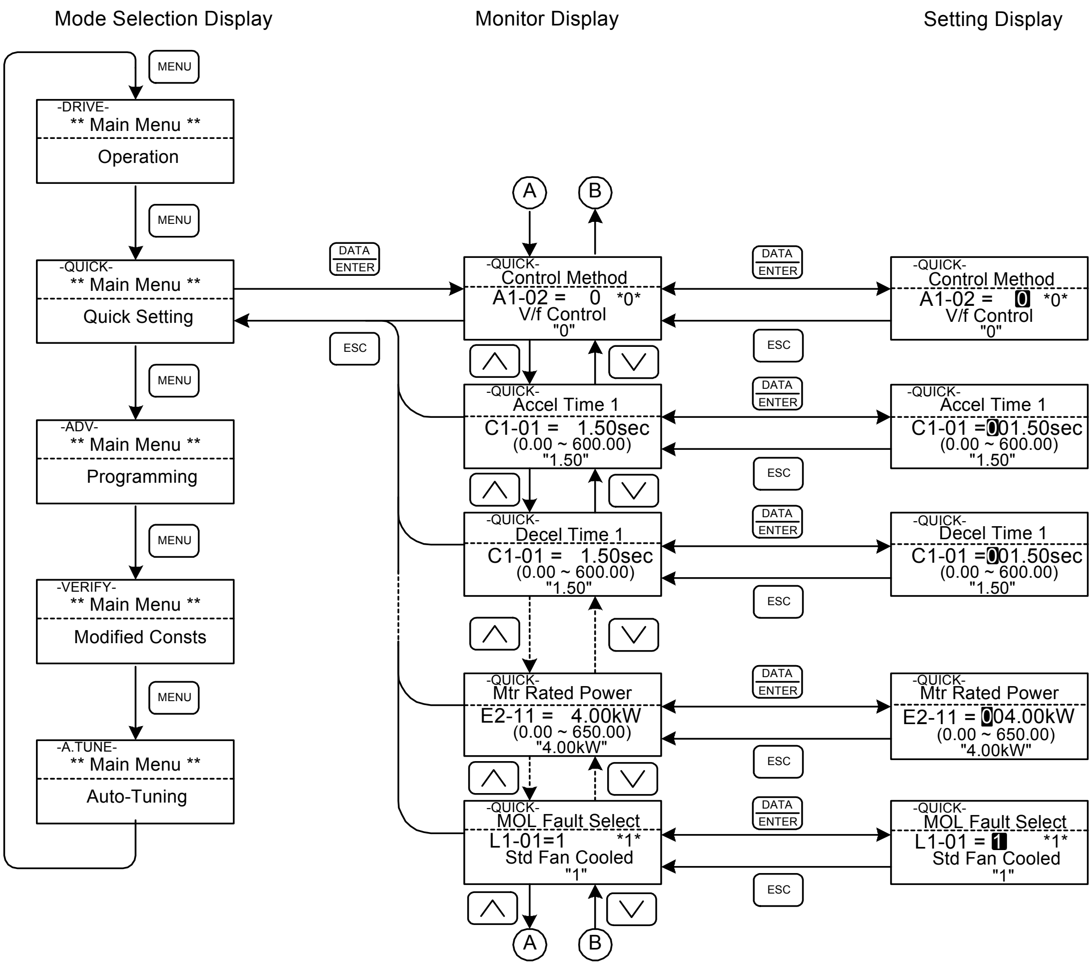


Fig 3.6 Operations in Quick Programming Mode

◆ **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 *Chapter 5 Parameters* for details about the parameters.

◆ Example Operations

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

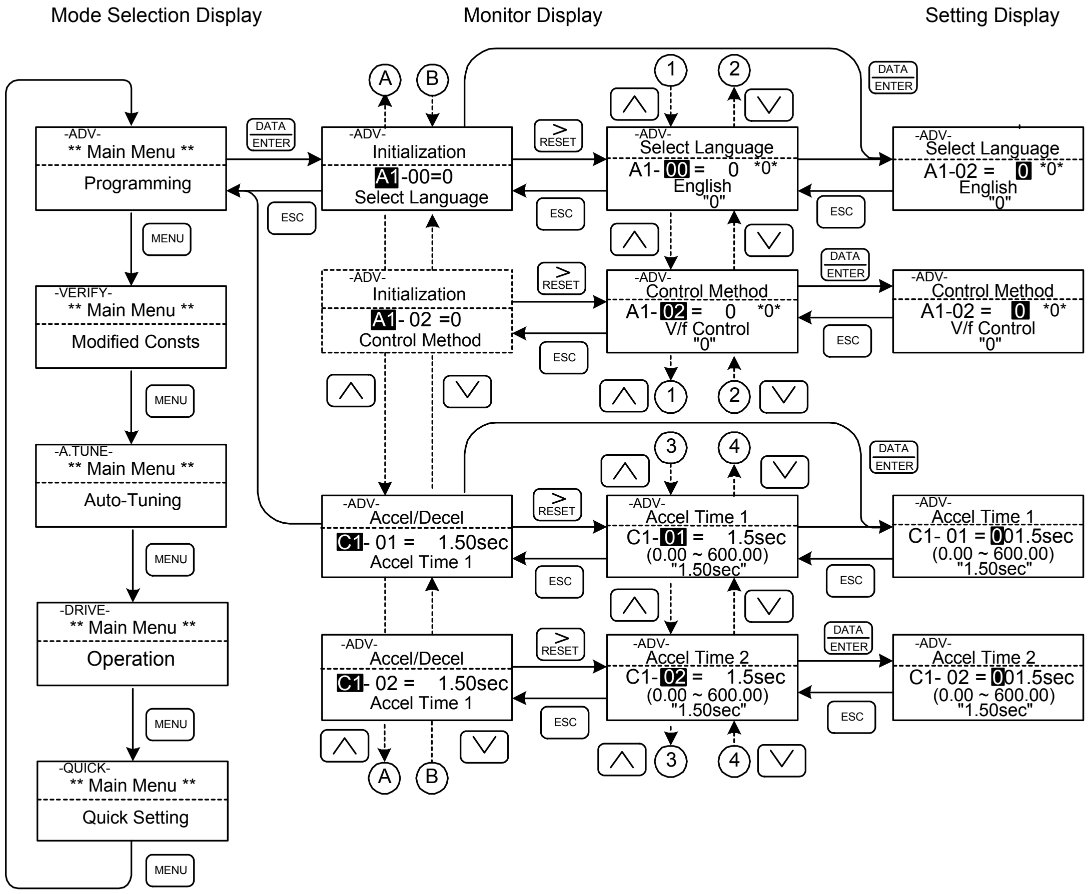


Fig 3.7 Operations in Advanced Programming Mode

■Setting Parameters

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

Table 3.4 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 C1-00 = 1.50sec Accel Time 1	Press the Increment or Decrement key to display the parameter C1-01 (Acceleration Time 1).
7	-ADV- Accel Time 1 C1-01 = 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.

3

◆ Verify Mode

The Verify mode is used to display the parameters that have been changed from their factory 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 parameter list if it has been changed before. The other parameters will not be displayed, even if they are different from the factory 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 factory settings:

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

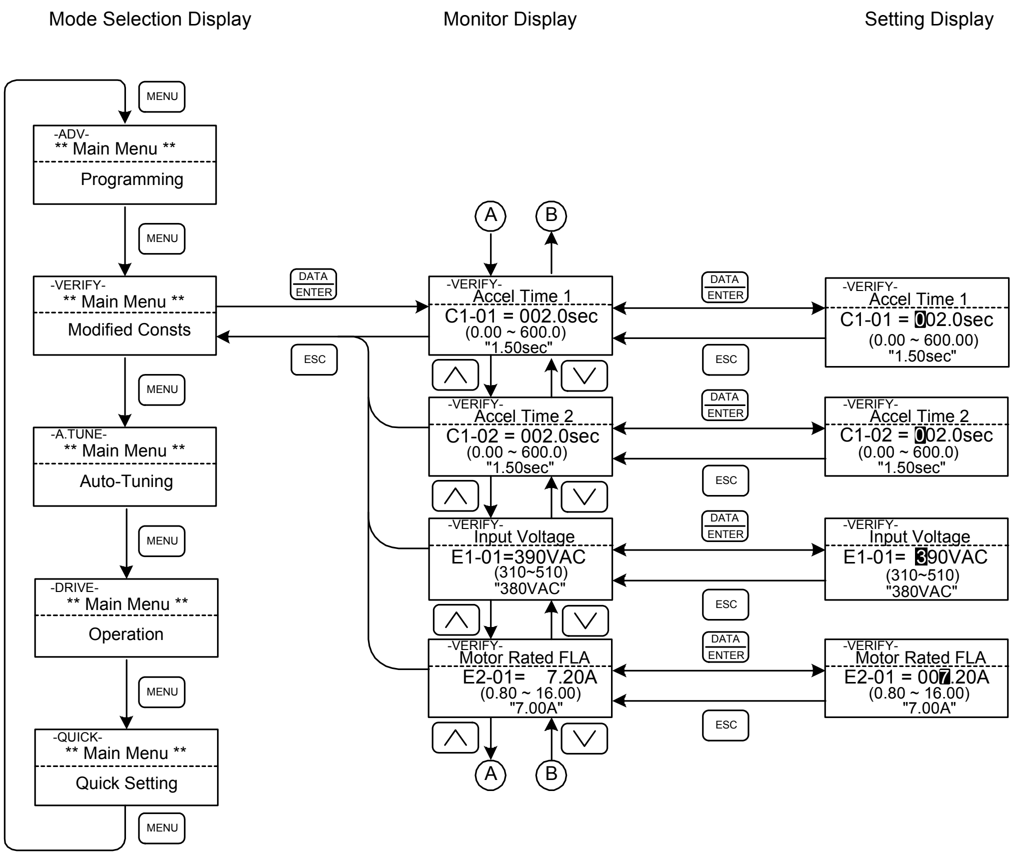


Fig 3.8 Operations in Verify Mode

◆ Autotuning Mode

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

When V/f control has been selected, 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.

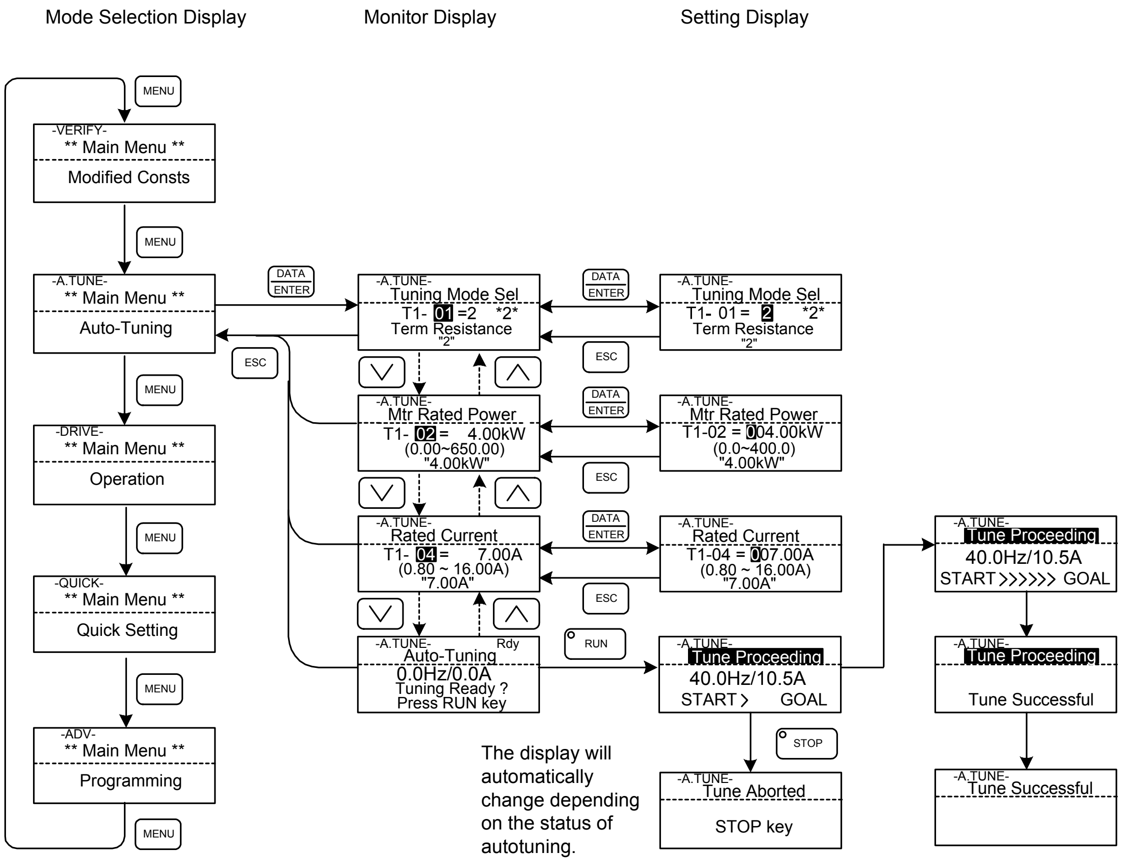


Fig 3.9 Operation in Autotuning Mode

If a fault occurs during autotuning, refer to *page 7-13, Autotuning Faults.*

4

Trial Operation

This chapter describes the procedures for trial operation of the Inverter and provides an example of trial operation.

Overview of Trial Operation Procedure

Perform trial operation according to the following flowchart.

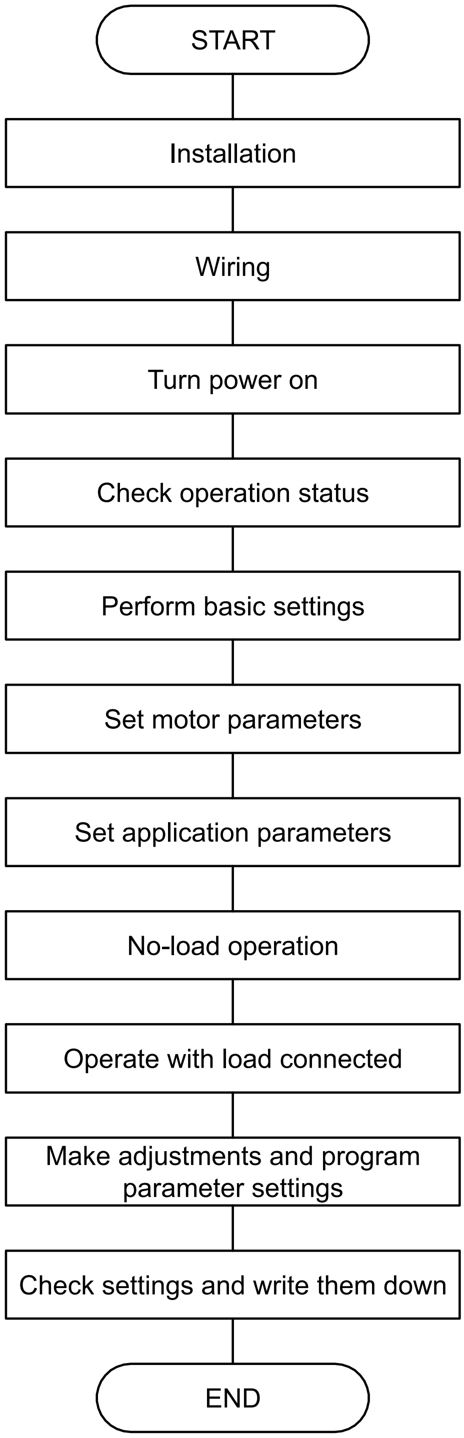


Fig 4.1 Trial Operation Flowchart

Performing a Trial Operation

This section lists the procedure for performing a trial operation.

Use the JVOP-160 Digital Operator when performing a trial operation.

◆ Turning on the Power

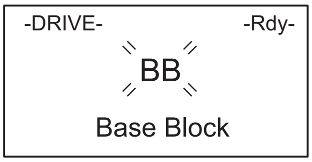
Confirm all of the following items and then turn ON the power supply.

- Check that the power supply is of the correct voltage.
  200 V Class: 3-phase 200 to 240 VAC 50/60 Hz
  400 V Class: 3-phase 380 to 480 VAC 50/60 Hz
  For an Inverter of 200 V, 37 kW or more, use one of the following power supplies for the cooling fan.
  3-phase 200/208/200 VAC 50 Hz or 3-phase 200/208/220/230 VAC 60 Hz
- Make sure that the motor output terminals (U, V, W) and the motor are connected correctly.
- Make sure that the Inverter control circuit terminal and the control device are wired correctly.
- Set all Inverter control circuit terminals to turn OFF.
- When using a PG speed control board, make sure that it is wired correctly.
- Make sure that the motor is not connected to the mechanical system. (No-load condition)

◆ Display at Power Up

After the Inverter is powered up without any problems, the operator display will show the following messages:

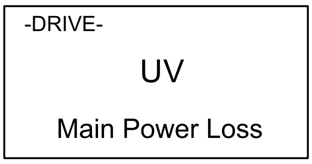
Display at power up



"BB Base Block" flashes on the Digital Operator screen.

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 will appear on the display screen. The example shown here is for a low voltage alarm.

◆ Basic Settings

When using a permanent magnet motor, set the control mode to Closed-loop vector control (PM) (A1-02 = 6).

For more information on how the Digital Operator works, see *Chapter 3*. For more information on parameters and their settings, refer to *Chapter 5* and *Chapter 6*.

IMPORTANT For permanent magnet motors do not use any other control mode than closed-loop vector control (PM) (A1-02 = 6). Using any other control mode can cause damage to the equipment or cause the machinery to behave erratically.

Table 4.1 Basic Parameter Settings

◎: indicates parameter must be set, ○: indicates parameter should be set as needed

Setting Required	Parameter No.	Parameter Name	Description	Setting Range	Default	Remarks
◎	A1-02	Control method selection	Selects the control method of the Inverter. 0: V/f Control 2: Open-loop vector 1 control 3: Closed-loop vector control 6: Closed-loop vector control (PM) This parameter is not changed by the initialize operation.	0, 2, 3, 6	0	
◎	b1-01	Reference source selection	Sets the frequency reference input method. 0: Digital Operator 1: Control circuit terminal (analog input)*1 2: MEMOBUS communications 3: Option card*2	0 to 3	0	
◎	b1-02	Run command source selection	Sets the Run Command input method. 0: Digital Operator 1: Control circuit terminal (sequence input) 2: MEMOBUS communications 3: Option card	0 to 3	1	
◎	C1-01	Acceleration time 1	Sets the time to accelerate from zero to maximum frequency.	0.00 to 600.00	3.00 s	
◎	C1-02	Deceleration time 1	Sets the time to decelerate to zero.	0.00 to 600.00	3.00 s	
○	d1-01to 04, 17	Frequency reference 1-4, Jog frequency reference	These parameters must be set individually in order to use the multi-step speed and Jog reference functions.	0.00 to 120.00	d1-01 to 04: 0.00% d1-17: 8.00%	

Table 4.1 Basic Parameter Settings (cont'd)

◎: indicates parameter must be set, ○: indicates parameter should be set as needed

Setting Required	Parameter No.	Parameter Name	Description	Setting Range	Default	Remarks
◎	F1-01	PG parameter	Sets the number of pulses per revolution (PPM) of the encoder (PG). Should be set to a value that isn't significantly less than the pulse count for motor 1	0 to 8192 (PM)	8192 (PM)	
◎	F1-05	PG rotation	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.)	0,1	1 (PM)	
○	F1-21	Absolute encoder resolution	Sets the serial line resolution for absolute encoders (HIPERFACE® or EnDat). 0: 16384 1: 32768 2: 8192	0 to 2	2	
◎	N8-35	Magnet position detection selection	Sets the magnet position detection method. 0: Magnet position detection method 1 2: Magnet position detection method 2 4: HIPERFACE® method 5: EnDat method	0, 2, 4, 5	2	
◎	S3-13	Traction sheave diameter	Sets the diameter of the traction sheave.	100 to 2000	400 mm	
◎	S3-14	Roping	Sets the roping ratio for the elevator. 1: [1:1] 2: [1:2]	1, 2	2	
◎	S3-16	Over acceleration detection level	Sets the maximum car acceleration value. If the acceleration rate is higher than this value, the Inverter trips with an over acceleration fault (DV6).	0.0 to 50.0	1.5 *3	

* 1. If d1-18 is set to 1 or 2, an analog reference will have priority over a frequency reference from a multi-function contact input.

* 2. If d1-18 is set to 1 or 2, a frequency reference from a multi-function contact input will be valid even if b1-01 is set to 2 or 3.

* 3. Set parameter S3-16 to 0.0/ms^2 whenever a DV6 fault occurs during a trial operation. When performing a trial operation with the machine connected to the motor, set the appropriate value after reviewing *Chapter 6 Parameter Settings by Function*.

◆ Setting Motor Related Parameters

Motor related parameters must to be set to the proper values when using a permanent magnet motor.

Procedures for setting these values will differ depending on the motor being used, so be sure to follow the directions in the table below that correspond to the type of permanent magnet motor set up.

Table 4.2 Setting Procedure According to Motor Set-up

Motor Set-up	Setting Procedure	PG Option Card[*1]	N8-35 Setting Value[*2]	PG Setting Parameter[*3]
Permanent magnet motor with an incremental encoder	Setting Procedure 1 *See pages 4-7 through 4-13.*	PG-X2	2	F1-01
Yaskawa motor with an incremental encoder (SSE4 □ -F11)			0	
Permanent magnet motor with HIPERFACE® encoder	Setting Procedure 2 See pages *4-14* through *4-20*.	PG-F2	4	F1-01, F1-21
Permanent magnet motor with EnDat encoder			5	

4

* 1. Use the PG option card appropriate for the combination of motor and encoder as listed in Table 4.2.
* 2. Parameter N8-35 should be set according to the combination of motor and encoder as indicated in Table 4.2.
* 3. Set the parameters listed in Table 4.2 according to the combination of motor and encoder used.

Setting Motor Parameters: Procedure 1

Set motor parameters as described below when using an incremental encoder with a permanent magnet motor, or when using a Yaskawa permanent magnet motor.

(1) Setting and verification prior to operation

Follow the procedure in the flowchart below whenever

- using Varispeed L7 (L7B) for the first time.
- changing motors or Inverters.
- replacing the PG.
- replacing wires running between the motor and Inverter.

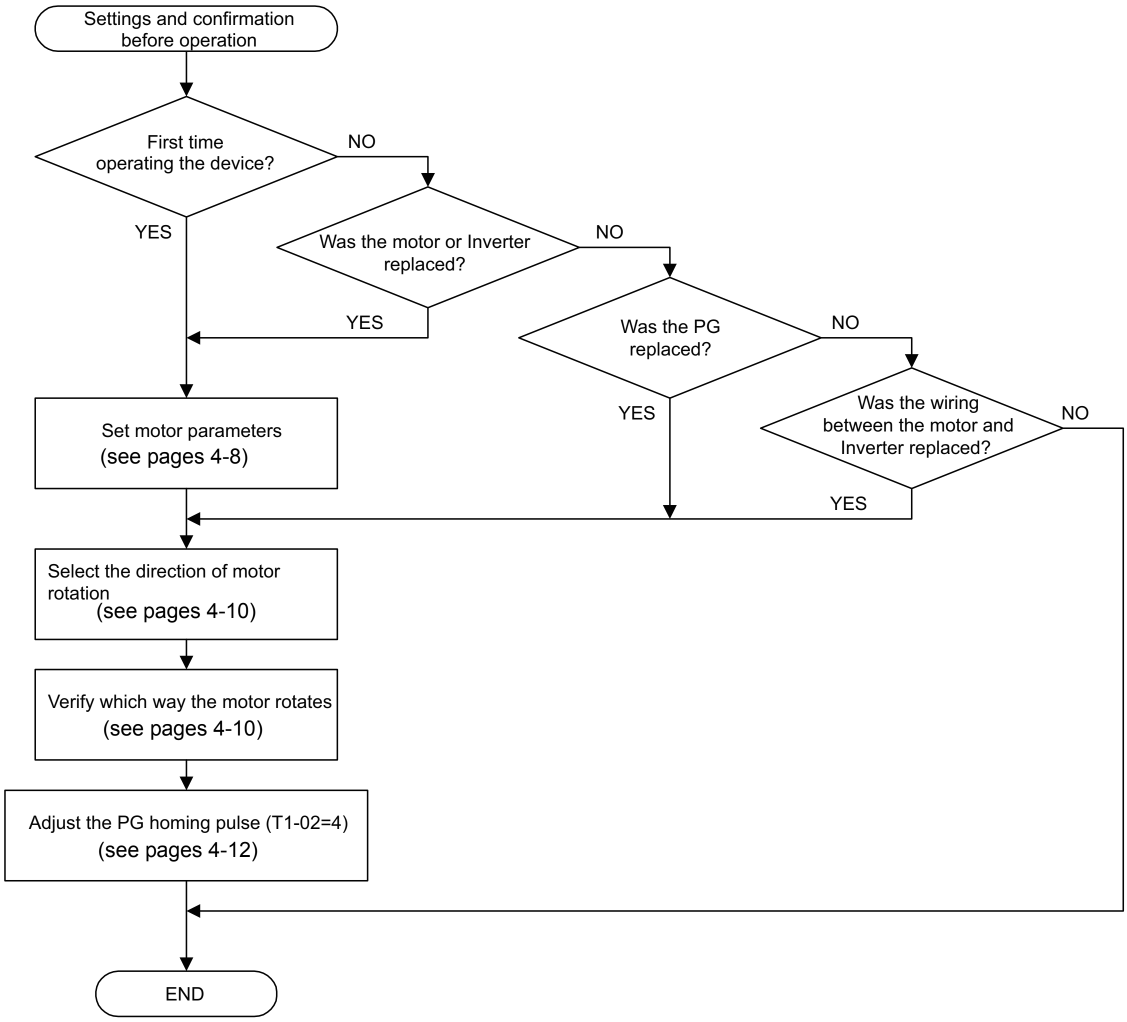


Fig 4.2 Settings and Data Verification Before Operating the Inverter

(2) Setting Motor Parameters

- Using a permanent magnet motor with an incremental encoder
  Refer to the motor parameter setting table provided by Yaskawa and enter the appropriate value into the Inverter. Verify the data entered after setting all motor parameters as indicated in the table.

IMPORTANT

Contact Yaskawa when using a motor type that is not listed in the motor parameter setting table.

Table 4.3 Motor Parameter Setting Table (Example)

Motor Type: XXXXXXXX

No.	Parameter Name	Setting Units	Setting Value	Notes
E1-04	Maximum output frequency	min^{-1}		
E1-06	Base frequency	min^{-1}		
E1-13	Base voltage	VAC		
E5-02	Motor rated power	kW		
E5-03	Motor rated current	A		
E5-04	Number of motor poles	POLES		
E5-05	Motor line to line resistance	W		
E5-06	Motor d-axis inductance	mH		
E5-07	Motor q-axis inductance	mH		
E5-09	Motor voltage parameter	mv·s/rad		
N8-36	Magnet position detection method 2 frequency	Hz		
N8-37	Magnet position detection method 2 current level	%		
N8-39	Low pass filter cut-off frequency for magnet position detection method 2	Hz		

- When using an incremental encoder with a Yaskawa permanent magnet motor

  Refer to the motor nameplate to find the parameter setting values that should be entered to the Inverter.

  Verify all data after entering the appropriate values as indicated.

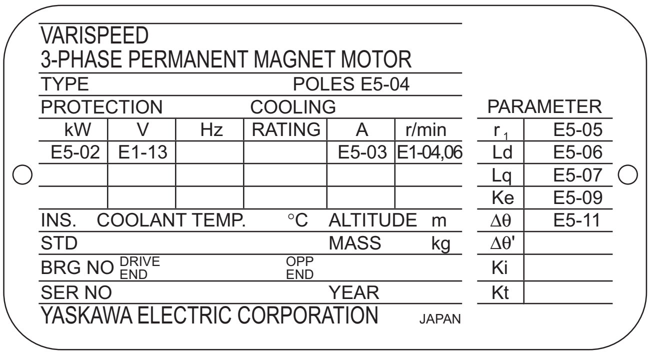


Fig 4.3 Nameplate Example for a Yaskawa permanent magnet motor

Table 4.4 List of Motor Parameter Settings

No.	Parameter Name	Setting Units	Value Displayed	Check	Motor Nameplate
E1-04	Maximum output frequency	min^{-1}			(r/min) or (min^{-1})
E1-06	Base frequency	min^{-1}			(r/min) or (min^{-1})
E1-13	Base voltage	VAC			(V)
E5-02	Motor rated power	kW			(KW)
E5-03	Motor rated current	A			(A)
E5-04	Number of motor poles	POLES			(POLES)
E5-05	Motor line to line resistance	W			(r1)
E5-06	Motor d-axis inductance	mH			(Ld)
E5-07	Motor q-axis inductance	mH			(Lq)
E5-09	Motor voltage parameter	mv·s/rad			(Ke)
E5-11	PG home position offset				(Δθ)

4

(3) Selecting which way the motor should rotate

IMPORTANT

- The motor should be set so that when it rotates in the forward direction the elevator car goes up.
- Torque compensation at start uses a 0 to +10 V analog signal fixed in the forward direction. The elevator also requires positive torque compensation when ascending. The direction of the motor must be set so that the elevator goes up when the motor is rotating forwards.

The factory setting for the PG rotation is Phase B leads with a Forward Run Command (F1-05 = 1).

The motor is considered to be moving forwards if the shaft rotates counter-clockwise when looking from the load side.

The motor wiring should be connected so that the elevator car goes up when the motor is rotating counter-clockwise (i.e., in the forward direction). Wiring should be corrected if this is not the case.

Note: Follow the procedure below to change the direction of the motor so that it rotates clockwise looking from the load side of the shaft as the elevator car goes up.
Step 1: Change the wiring between the motor and Inverter
Reconnect the wires so that the lines that ran to U, V, and W now run to U, W, and V.
Step 2: Change the following parameters.
• PG rotation (F1-05)
Change the setting value from 1 (Phase B leads with a Forward Run Command) to 0 (Phase A leads with a Forward Run Command).
• PG home position offset (E5-11)
Set the value to its additive inverse.
For example, when adjustments to the PG home position have already been made, multiply the PG home position value by negative one and set that value.

4

(4) Verify the direction of motor rotation

Follow the procedure described below and have the speed detection value displayed on the Digital Operator keypad screen. Be sure to verify the data provided in the table.

- Rotate the motor shaft by hand to verify that the direction of rotation coincides with the polarity on the Digital Operator screen.
- Make sure the speed is properly displayed.

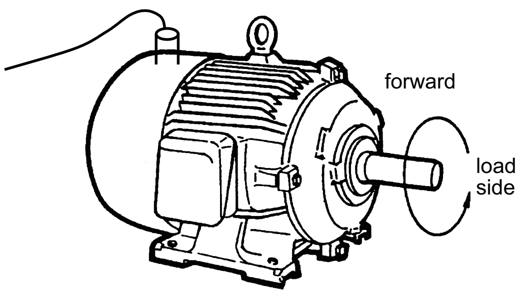


Fig 4.4 Direction of Motor Rotation

Table 4.5 Verifying Motor Rotation

Procedure	Objective	Digital Operator Display	Points to Verify
①	Turn the power on and set the Digital Operator screen to display the motor speed (U1-05).		
②	To have the forward direction be counter-clockwise: Rotation moves counter-clockwise when looking down the motor shaft from the load side.	*Example:* Change U1-05 from 0.00% to 3.00%	Confirm that motor speed is displayed as a *positive* value, and that it corresponds to the rotational speed.
	To have the forward direction be clockwise: Rotation moves clockwise when looking down the motor shaft from the load side.		
③	To have the forward direction be counter-clockwise: Rotation moves clockwise when looking down the motor shaft from the load side.	*Example:* Change U1-05 from 0.00% to -3.00%	Confirm that motor speed is displayed as a *negative* value, and that it corresponds to the rotational speed.
	To have the forward direction be clockwise: Rotation moves counter-clockwise when looking down the motor shaft from the load side.		

Corrective action for problems that may occur while verifying the direction of motor rotation:

Description of Problem	Corrective Action
Motor speed is displayed with the polarity reversed.	Double check the motor wiring, PG cable wiring, and PG rotation (F1-05).
Motor speed is zero or is clearly wrong.	Refer to *Chapter 2 Wiring* to verify that the PG has been wired correctly.

IMPORTANT

- Verify that the STOP LED on the Digital Operator is flashing, then check the direction of motor rotation.
- Make sure that nothing gets wrapped up on the motor shaft or coupling.
- Take caution of the key slot when rotating the motor shaft by hand to avoid injury.

(5) PG Encoder Home Position Pulse Adjustment

• Procedure

When performing autotuning, select Magnet position autotuning (T1-01 = 4) and press the RUN key.

The Inverter will automatically begin assessing the amount of offset for the PG home position.

- After tuning is complete the Inverter will automatically save the offset value for the PG home position to parameter E5-11.
- If tuning is interrupted or stopped before completion
  The Inverter will abort the autotuning process if a fault occurs during autotuning, and no value will be saved to parameter E5-11 (PG home position offset).
  If a fault occurs during autotuning, refer to *Chapter 7 Troubleshooting* in order to solve the problem. After taking the necessary corrective action, perform autotuning again to calculate the proper PG home position offset.

• Notes Prior to Performing Autotuning

Be sure to verify the following points prior to performing autotuning.

- Autotuning automatically checks motor parameter settings.
- This is the major difference when compared with the autotuning process used for a servo system (a servo system checks the size of the load).
- If the load is coupled with the motor when autotuning is performed (i.e., the rope is connected), motor parameters may not be set properly, which can lead to erratic and potentially dangerous behavior of the machine. Be absolutely sure to disconnect the load from the motor when performing autotuning.
- Autotuning measures takes various measurements while rotating the motor and saves that data.
- For this reason, the brake must be released prior to autotuning to allow the Inverter to rotate the motor. Be sure that any contact switches are closed before attempting autotuning.
- BB or BB1 signals (BB-SC) on the control terminal block that trigger baseblock should be closed so that baseblock is released when autotuning the Inverter and motor.

• Related Parameters

No.	Parameter Name	Description	Setting Range	Default
T1-01	Autotuning mode selection	Sets the autotuning mode. 0: Rotational autotuning 1: Stationary autotuning 2: Stationary autotuning for line to line resistance only 4: Encoder offset tuning	0 to 4 (PM)	4 (PM)

For more information on the Digital Operator and display screens when autotuning the Inverter and motor, see *Chapter 3 LED Monitor/Digital Operator and Modes*.

• Adjusting the PG Home Location Pulse Offset, Pattern of Operation

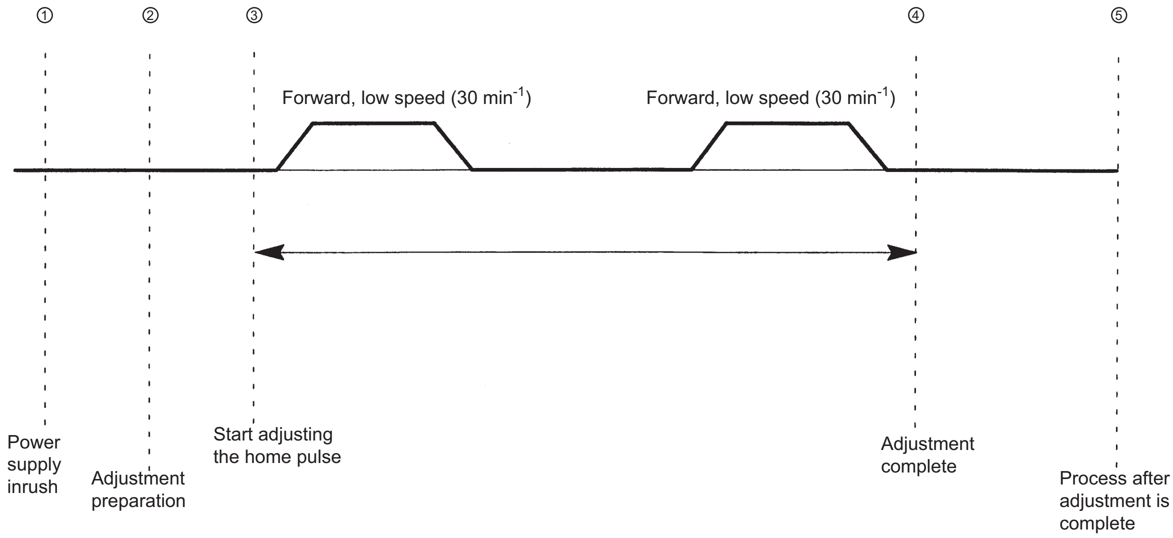


Fig 4.5 Adjusting the PG Home Location Pulse Offset, Pattern of Operation

Setting Motor Parameters: Procedure 2

Follow the procedure below to set motor parameters when using a permanent magnet motor with a HIPERFACE® or EnDat encoder.

(1) Setting and verification prior to operation

Follow the procedure in the flowchart below whenever

- using Varispeed L7 (L7B) for the first time.
- changing motors or Inverters.
- replacing the PG.
- replacing wires running between the motor and Inverter.

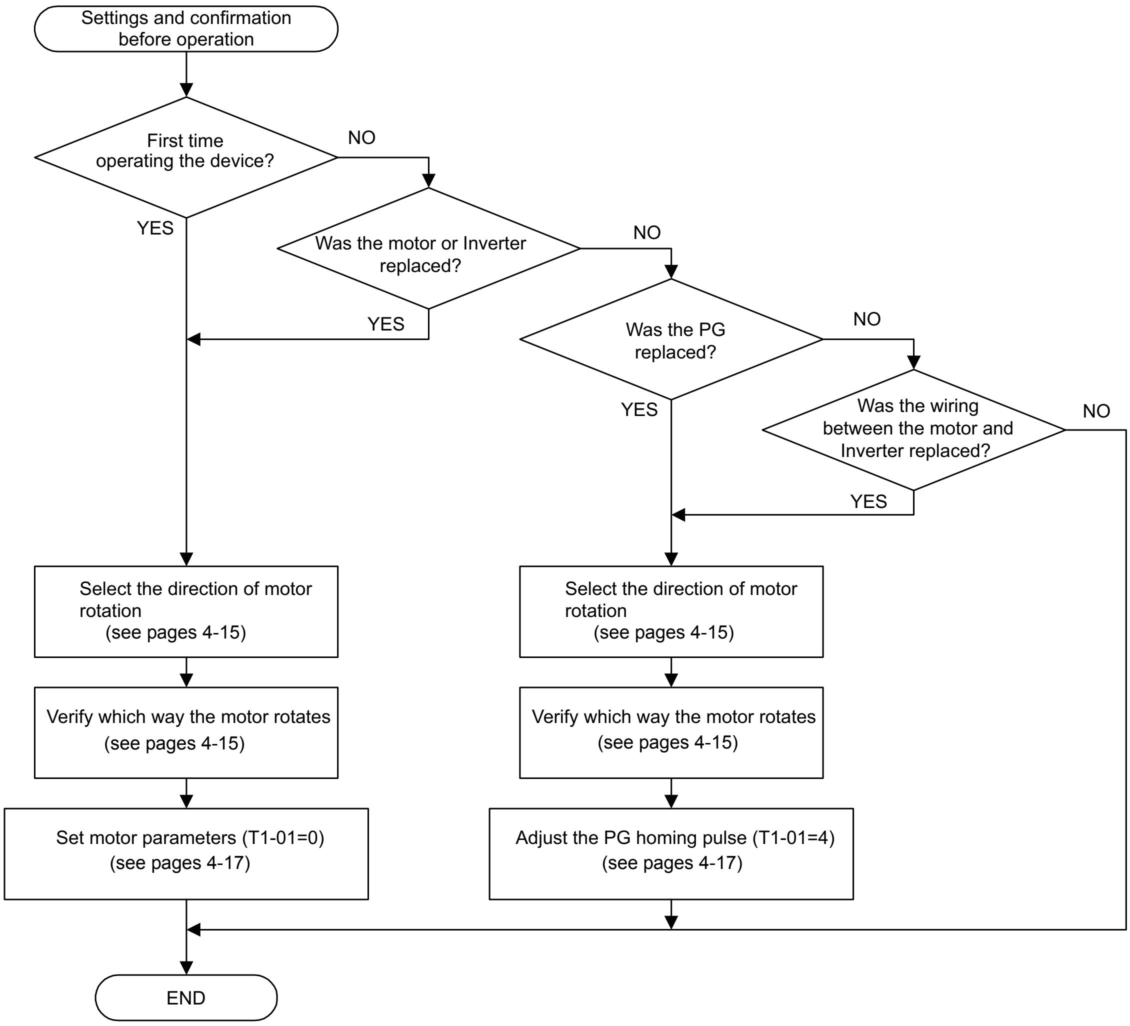


Fig 4.6 Settings and Data Verification Before Operating the Inverter

(2) Selecting which way the motor should rotate

IMPORTANT

- The motor should be set so that when it rotates in the forward direction the elevator car goes up.
- Torque compensation at start uses a 0 to +10 V analog signal fixed in the forward direction. The elevator also requires positive torque compensation when ascending. The direction of the motor must be set so that the elevator goes up when the motor is rotating forwards.

The factory setting for the PG rotation is Phase B leads with a Forward Run Command (F1-05 = 1).

The motor is considered to be moving forwards if the shaft rotates counter-clockwise when looking from the load side.

The motor wiring should be connected so that the elevator car goes up when the motor is rotating counter-clockwise (i.e., in the forward direction). Wiring should be corrected if this is not the case.

Note:Follow the procedure below to change the direction of the motor so that it rotates clockwise looking from the load side of the shaft as the elevator car goes up.
Step 1: Change the wiring between the motor and Inverter
Reconnect the wires so that the lines that ran to U, V, and W now run to U, W, and V.
Step 2: Change the following parameters.
• PG rotation (F1-05)
Change the setting value from 1 (Phase B leads with a Forward Run Command) to 0 (Phase A leads with a Forward Run Command).
• PG home position pulse offset (E5-11)
Set the value to its additive inverse.
For example, when adjustments to the PG home position have already been made, multiply the PG home position value by negative one and set that value.

(3) Verify the direction of motor rotation

Follow the procedure described below and have the speed detection value displayed on the Digital Operator keypad screen. Be sure to verify the data provided in the table.

- Rotate the motor shaft by hand to verify that the direction of rotation coincides with the polarity on the Digital Operator screen.
- Make sure the speed is properly displayed.

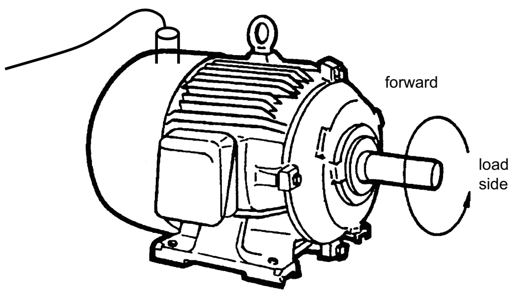


Fig 4.7 Direction of Motor Rotation

Table 4.6 Verifying Motor Rotation

Procedure	Objective	Digital Operator Display	Points to Verify
①	Turn the power on and set the Digital Operator screen to display the motor speed (U1-05).		
②	To have the forward direction be counter-clockwise: Rotation moves counter-clockwise when looking down the motor shaft from the load side.	*Example:* Change U1-05 from 0.00% to 3.00%	Confirm that motor speed is displayed as a *positive* value, and that it corresponds to the rotational speed.
	To have the forward direction be clockwise: Rotation moves clockwise when looking down the motor shaft from the load side.		
③	To have the forward direction be counter-clockwise: Rotation moves clockwise when looking down the motor shaft from the load side.	*Example:* Change U1-05 from 0.00% to -3.00%	Confirm that motor speed is displayed as a *negative* value, and that it corresponds to the rotational speed.
	To have the forward direction be clockwise: Rotation moves counter-clockwise when looking down the motor shaft from the load side.		

Corrective action for problems that may occur while verifying the direction of motor rotation:

Description of Problem	Corrective Action
Motor speed is displayed with the polarity reversed.	Double check the motor wiring, PG cable wiring, and PG rotation (F1-05).
Motor speed is zero or is clearly wrong.	Refer to *Chapter 2 Wiring* to verify that the PG has been wired correctly.

IMPORTANT

- Verify that the STOP LED on the Digital Operator is flashing, then check the direction of motor rotation.
- Make sure that nothing gets wrapped up on the motor shaft or coupling.
- Watch out for the key slot when rotating the motor shaft by hand to avoid injury.

(4) Setting Motor Parameters

• Procedure

1. When performing autotuning, select Rotational autotuning (T1-01 = 0).
2. Enter the information as requested from either the motor nameplate or Test Report provided.
   The Digital Operator will ask for the motor rated capacity, the base revolutions per minute (min^{-1}), rated voltage, rated current, number of motor poles, the d-axis inductance, induction voltage parameter, and number of PG pulses per motor rotation.
   If the Motor voltage parameter calculation selection is set to Automatic calculation (T2-10 = 1) then the Inverter will set these values automatically, so there is no need to enter them yourself.
3. Press the RUN key once all data has been entered. All remaining motor data will be automatically calculated by the Inverter.
   - If autotuning completes without any trouble, the Inverter will automatically set the motor parameters (E5-xx). Refer to related parameters.
   - If tuning is interrupted or stopped before completion
     The Inverter will abort the autotuning process if a fault occurs during autotuning, and no values will be saved to the motor parameters E5-xx.
     If a fault occurs during autotuning, refer to *Chapter 7 Troubleshooting* in order to solve the problem. After taking the necessary corrective action, perform rotational autotuning again to calculate the proper motor parameters.

• Notes Prior to Performing Autotuning

Be sure to verify the following points prior to performing autotuning.

- Autotuning automatically checks motor parameter settings.
  This is the major difference when compared with the autotuning process used for a servo system (a servo system checks the size of the load).
- If the load is coupled with the motor when autotuning is performed (i.e., the rope is connected), motor parameters may not be set properly, which can lead to erratic and potentially dangerous behavior of the machine. Be absolutely sure to disconnect the load from the motor when performing autotuning.
- Autotuning measures takes various measurements while rotating the motor and saves that data.
  For this reason, the brake must be released prior to autotuning to allow the Inverter to rotate the motor. Be sure that any contact switches are closed before attempting autotuning.
- BB or BB1 signals (BB-SC) on the control terminal block that trigger baseblock should be closed so that baseblock is released when autotuning the Inverter and motor.

• Related Parameters

Parameter No	Name	Description	Setting Range	Factory Setting
T1-01	Autotuning mode selection	Sets the autotuning mode. 0: Rotational autotuning 1: Stationary autotuning 2: Stationary autotuning for line-to-line resistance only 4:Encoder offset tuning	0 to 4 (PM)	4 (PM)
T2-01	Motor output power	Sets the output power of the motor in kW.	0.00 to 300.00 *4	3.70 kW *2
T2-02	Motor base frequency	Sets the motor base frequency.	0 to 3600	96 min^{-1} *2
T2-03	Motor rated voltage	Sets the rated voltage of the motor.	0.0 to 255.0 *1	200.0 VAC *1
T2-04	Motor rated current	Sets the rated current of the motor.	0.00 to 200.0 *3	7.00 A *2
T2-05	Number of motor poles	Sets the number of motor poles.	4 to 48	32 Pole
T2-06	Motor d-axis inductance	Automatically sets parameter E5-06 after tuning the d-axis inductance setting from the value indicated on the motor nameplate.	0.00 to 300.00	30.20 mH *2
T2-08	Motor voltage parameter k_e	Sets the motor voltage parameter before autotuning.	50.0 to 2000.0	1251 mV s/rad *2
T2-09	Number of PG pulses	Sets the number of PG pulses per revolution.	0 to 8192	8192 PPR
T2-10	Motor voltage parameter calculation selection	Selects if the voltage parameter is calculated during autotuning or if it has to input manually. 0: Manual input in parameter T2-08 1: Automatic calculation	0,1	1

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

Refer to *Chapter 3 LED Monitor/Digital Operator and Modes* for the operations and descriptions during autotuning.

(5) PG Encoder Home Position Pulse Adjustment

• Procedure

When performing Autotuning, select Magnet position autotuning (T1-01 = 4) and press the RUN key.

The Inverter will automatically begin assessing the amount of offset for the PG home position.

- After tuning is complete the Inverter will automatically save the offset value for the PG home position to parameter E5-11.
- If tuning is interrupted or stopped before completion
  The Inverter will abort the autotuning process if a fault occurs during autotuning, and no value will be saved to parameter E5-11 (PG Home Position Offset).
  If a fault occurs during autotuning, refer to *Chapter 7 Troubleshooting* in order to solve the problem. After taking the necessary corrective action, perform autotuning again to calculate the proper PG home position offset.

• Notes Prior to Performing Autotuning

Be sure to verify the following points prior to performing autotuning.

- Autotuning automatically checks motor parameter settings.
- This is the major difference when compared with the autotuning process used for a servo system (a servo system checks the size of the load).
- If the load is coupled with the motor when autotuning is performed (i.e., the rope is connected), motor parameters may not be set properly, which can lead to erratic and potentially dangerous behavior of the machine. Be absolutely sure to disconnect the load from the motor when performing autotuning.
- Autotuning measures takes various measurements while rotating the motor and saves that data.
- For this reason, the brake must be released prior to autotuning to allow the Inverter to rotate the motor. Be sure that any contact switches are closed before attempting autotuning.
- BB or BB1 signals (BB-SC) on the control terminal block that trigger baseblock should be closed so that baseblock is released when autotuning the Inverter and motor.

• Related Parameters

No.	Parameter Name	Description	Setting Range	Default
T1-01	Autotuning mode selection	Sets the autotuning mode. 0: Rotational autotuning 1: Stationary autotuning 2: Stationary autotuning for line to line resistance only 4: Encoder offset tuning	0 to 4 (PM)	4 (PM)

For more information on the Digital Operator and display screens when autotuning the Inverter and motor, see *Chapter 3 LED Monitor/Digital Operator and Modes*.

• Adjusting the PG Home Location Pulse Offset, Pattern of Operation

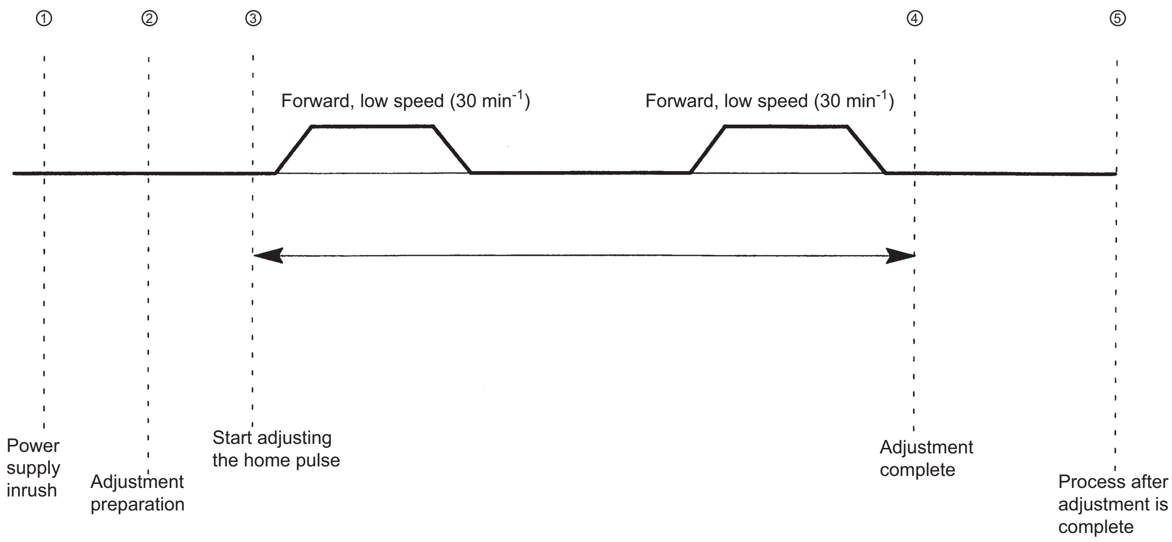


Fig 4.8 Adjusting the PG Home Location Pulse Offset, Pattern of Operation

◆ Application Settings

User parameters are set as required in advanced programming mode (i.e., with the ADV indicator lit on the Digital Operator). All the parameters that can be set in quick programming mode can also be displayed and set in advanced programming mode.

Setting Examples

The following are examples of settings for applications.

- When using an Inverter-mounted braking resistor (ERF), set L8-01 to 1 to enable ERF braking resistor overheating protection.
- To use a 0 to 10-V analog signal for a 500min^{-1} motor for variable-speed operation between 0 to 450 min^{-1} (0% to 90% speed deduction), set H3-02 to 90.0%.
- To control speed between 20% and 80% to ensure smooth gear operation and limit the maximum speed of the machine, set d2-01 to 80.0% and set d2-02 to 20.0%.

◆ No-load Operation

To being no-load operation (without connecting the machine and the motor), press the LOCAL/REMOTE Key on the Digital Operator to change to Local mode (the SEQ and REF indicators on the Digital Operator should be OFF).

Always confirm safety around the motor and machine before starting Inverter operation from the Digital Operator. Confirm that the motor works normally and that no errors are displayed at the Inverter.

Jog Frequency Reference (d1-17, default: 8.00 Hz) can be started and stopped by pressing and releasing the JOG Key on the Digital Operator. If the external sequence prevent operation from the Digital Operator, confirm that fast stop circuits and machine safety mechanisms are functioning, and then start operation in Remote mode (i.e., with a signal from the control signal terminals). The safety precautions must always be taken before starting the Inverter with the motor connected to the machine.

IMPORTANT

Both a Run Command (forward or reverse) and a frequency reference (or multi-step speed reference) must be provided to start Inverter operation.

Input these commands and reference regardless of the operation method (i.e., LOCAL of REMOTE).

◆ Loaded Operation

Connect the machine to the motor and then start operation as described for no-load operation (i.e., from the Digital Operator or by using control circuit terminal signals).

Connecting the Load

- After confirming that the motor has stopped completely, connect the mechanical system.
- Be sure to tighten all the screws when securing the motor shaft to the mechanical system.

Operation using the Digital Operator

- Use the Digital Operator to start operation in Local mode in the same way as in no-load operation.
- If fault occurs during operation, make sure the STOP Key on the Digital Operator is easily accessible.
- At first, set the frequency reference to a low speed of one tenth the normal operating speed.

Checking Operating Status

- Having checked that the operating direction is correct and that the machine is operating smoothly at slow speed, increase the frequency reference.
- After changing the frequency reference or the rotation direction, check that there is no oscillation or abnormal sound from the motor. Check the monitor display to ensure that U1-03 (Output Current) is not too high.
- Refer to *page 4-23, Performance Optimization* if hunting, vibration, or other problems originating in the control system occur.

◆ Check and Recording User Parameters

Use verify mode (i.e., when the VERIFY indicator on the Digital Operator is lit) to check user parameters that have been changed for trial operation and record them in a user parameter table.

Any user parameters that have been change by autotuning will also be displayed in verify mode.

If required, the copy function in parameters o3-01 and o3-02 displayed in advanced programming mode can be used to copy the changed settings from the Inverter to a recording area in the Digital Operator. If changed settings are saved in the Digital Operator, they can be easily copied back to the Inverter to speed up system recovery if for any reason the Inverter has to be replaced.

The following functions can also be used to manage user parameters.

- Recording user parameters
- Setting access levels for user parameters
- Setting a password

Recording User Parameters (o2-03)

If o2-03 is set to 1 after completing trial operation, the settings of user parameters will be saved in a separate memory area in the Inverter. Later, after Inverter settings have been changed, the user parameters can be initialized to the settings saved in the separate memory area when o2-03 was set to 1 by setting A1-03 (Initialize) to 1110.

User Parameter Access Levels (A1-01)

A1-01 can be set to 0 (monitoring-only) to prevent user parameters from being changed. A1-01 can also be set to 1 (User-specified Parameters) and used along with A2 parameters to display only parameters required by the machine or application in a programming mode.

Password (A1-04 and A1-05)

When the access level is set to monitoring-only (A1-01 = 0), a password can be set so that user parameters will be displayed only when the correct password is input.

Performance Optimization

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

Table 4.7 Performance Optimization

Problem	Possible Reason	Countermeasure
Rollback at start	Too slow ASR response when the brake opens.	• Increase the ASR proportional (P) gain 2 at start (C5-03) and decrease the ASR integral (I) time 2 at start (C5-04). If vibration occurs set the values back in small steps. • Increase the zero-servo gain in parameter S1-20. If vibration occurs set the values back in small steps.
	Motor torque is not fully established when the brake opens.	• Lengthen the brake release delay time (S1-06) and the DC injection braking/zero-speed time at start (S1-04).
Jerk at start	Motor starts turning when the brake is not completely opened or runs against the brake.	• Increase the DC injection braking/zero-speed time at start (S1-04).
	Too fast acceleration rate change.	• Increase the S-curve characteristic time at acceleration start (C2-01).
Vibrations during acceleration/deceleration	Too high ASR settings.	• Decrease C5-01/C5-03 and increase C5-02/C5-04.
Jerk caused by overshooting when the top speed is reached	Too soft or too hard ASR controller settings.	Readjust the ASR proportional (P) gain 1 (C5-01) and the ASR integral (I) time 1 (C5-02).
	Too fast acceleration rate change.	Increase the S-curve characteristic time at acceleration end (C2-02).
	Slow response to the speed reference.	Enable Feed forward control selection (N5-01=1). To adjust how feed forward operates, refer to *Chapter 6 Parameter Settings by Function*.
Motor stops shortly when the leveling speed is reached (undershooting)	Too slow ASR controller.	Increase the ASR proportional (P) gain 3 (C5-09) and decrease the ASR integral (I) time 3 (C5-10).
	Too fast deceleration rate change.	Increase the S-curve characteristic time at deceleration end (C2-04).
	Slow response to the speed reference.	Enable Feed forward control selection (N5-01=1). To adjust how feed forward operates, refer to *Chapter 6 Parameter Settings by Function*.
Jerk at stop	Brake closed too early causing the motor to run against the brake.	Increase the brake close delay time (S1-07) and if necessary the DC injection braking/zero-speed time at stop (S1-05).
High frequency motor noise	The carrier frequency is too low.	Increase the carrier frequency in parameter C6-11. If the carrier frequency increased higher than the factory setting, a current derating must be considered. Refer to *Chapter 6 Parameter Settings by Function*.

5

Parameters

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

Parameter Descriptions

This section describes the contents of the parameter tables.

◆ Description of Parameter Tables

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

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

• Parameter Number:	The number of the parameter.
• Name:	The name of the parameter.
• Display	The display shown in the Digital Operator JVOP-160
• Description:	Details on the function or settings of the parameter.
• Setting Range:	The setting range for the parameter.
• Factory Setting:	The factory setting (each control method has its own factory setting. Therefore the factory setting changes when the control method is changed.) Refer to page *page 5-66, Factory Settings that Change with the Control Method (A1-02)* for factory settings that are changed by setting the control method.
• Change during Operation:	Indicates whether the parameter can be changed or not while the Inverter is in operation. Yes: Changes are possible during operation. No: Changes are not possible during operation.
• Control Methods:	Indicates the control methods in which the parameter can be monitored or set. Q: The item can be monitored and set as well in quick programming mode as in advanced programming mode. A: The item can be monitored and set in advanced programming mode only. No: The item cannot be monitored or set in this control method.
• MEMOBUS Register:	The register number used for MEMOBUS communications.
• Page:	Reference page for more detailed information about the parameter.

Digital Operation Display Functions and Levels

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

MENU

Inverter 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 factory 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	Display	Page
U1	Status Monitor Parameters	Monitor	5-58
U2	Fault Trace	Fault Trace	5-63
U3	Fault History	Fault History	5-65
A1	Initialize Mode	Initialization	5-10
A2	User-set Parameters	User Parameter	5-11
b1	Operation Mode Selections	Sequence	5-12
b2	DC Injection Braking	DC Braking	5-13
b4	Timer Function	Delay Timers	5-13
b6	Dwell Functions	Reference Hold	5-13
b7	Droop Control	Droop Control	5-14
b8	Energy Saving	Energy Saving	5-14
C1	Acceleration/Deceleration	Accel/Decel	5-15
C2	S-curve Acceleration/Deceleration	S-Curve Acc/Dcc	5-16
C3	Motor Slip Compensation	Motor-Slip Comp	5-17
C4	Torque Compensation	Torque Comp	5-18
C5	Speed Control (ASR)	ASR Tuning	5-19
C6	Carrier Frequency	Carrier Freq	5-20
d1	Preset References	Preset Reference	5-21
d6	Field Forcing	Field-weakening	5-22
E1	V/f Pattern	V/f Pattern	5-23
E2	Motor Setup	Motor Setup	5-24
E5	Permanent Magnet Motor Parameter Parameter	Motor Setup	5-25
F1	PG Option Setup	PG Option Setup	5-26
F4	Analog Monitor Boards	AO-08, 12 Setup	5-28
F5	Digital Output Boards	DO-02C, 08 Setup	5-29
F6	Serial Communications Settings	ComOPT Setup	5-30
H1	Multi-function Contact Inputs	Digital Inputs	5-31
H2	Multi-function Contact Outputs	Digital Outputs	5-33
H3	Analog Inputs	Analog Inputs	5-35
H5	MEMOBUS Communications	Serial Com Setup	5-37
L1	Motor Overload	Motor Overload	5-38
L2	Power Loss Ridethrough	PwrLoss Ridethru	5-38
L3	Stall Prevention	Stall Prevention	5-39
L4	Reference Detection	Ref Detection	5-40
L5	Fault Restart	Fault Restart	5-41
L6	Torque Detection	Torque Detection	5-42
L7	Torque Limits	Torque Limit	5-43
L8	Hardware Protection	Hdwe Protection	5-43
N2	Automatic Frequency Regulator	AFR	5-45
N5	Feed Forward	Feedfoward Cont	5-45
N8	Startup Current	PM Adjustments	5-46
N9	Factory-set Parameter	Factory Tuning	5-47
o1	Monitor Selections	Monitor Select	5-47
o2	Digital Operator/LED Monitor Functions	Key Selections	5-48
o3	Copy Function	COPY Function	5-50
S1	Brake Sequence	BrakeSequence	5-51
S2	Slip Compensation	Elevator Slip	5-54
S3	Special Sequence Functions	Elevator Sequence	5-55
T1	Motor Autotuning	Autotuning	5-56
T2	Permanent Magnet Motor Autotuning	-	5-57

5

◆ Parameters Available in Quick Programming Mode

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

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS 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 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
A1-02	Control method selection Control Method	Sets the control method for the Inverter. 0: V/f control 1: Open-loop vector 1 control 2: Closed-loop vector control 6: Closed-loop vector control (PM) This parameter is not changed by the initialize operation.	0, 2, 3, 6	0	No	Q	Q	Q	Q	102H
b8-16	Energy savings control parameter Ki EnergySave Ki	This coefficient maintains torque linearity. Manually enter the value for Ki as indicated by the motor nameplate.	0.00 to 2.00	0.10	No	No	No	No	Q	1F8H
b8-17	Energy savings control parameter Kt EnergySave Kt	This coefficient maintains torque linearity. Manually enter the value for Kt as indicated by the motor nameplate.	0.00 to 2.00	1.00	No	No	No	No	Q	1F9H
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	3.00 s	Yes	Q	Q	Q	Q	200H
C1-02	Deceleration time 1 Decel Time 1	Sets the deceleration time to decelerate from the maximum output frequency to 0 Hz.								201H

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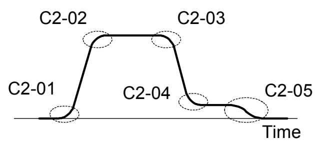
(Continued)

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register
C2-01	S-curve characteristic time at acceleration start S-Crv Acc @ Start	Set the S-curve time to smooth out any sudden changes in motor speed. The S-curve can be used at start and stop, as well as during acceleration and deceleration.  $T_{accel} = \frac{C2\text{-}01}{2} + C1\text{-}01 + \frac{C2\text{-}02}{2}$ $T_{decel} = \frac{C2\text{-}03}{2} + C1\text{-}02 + \frac{C2\text{-}04}{2}$ 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
C2-02	S-curve characteristic time at acceleration end S-Crv Acc @ End					Q	Q	Q	Q	20CH
C2-03	S-curve characteristic time at deceleration start S-Crv Dec @ Start					Q	Q	Q	Q	20DH
C2-04	S-curve characteristic time at deceleration end S-Crv Dec @ End					Q	Q	Q	Q	20EH
C2-05	S-curve characteristic time below leveling speed Scurve @ leveling					Q	Q	Q	Q	232H
C5-01	ASR proportional (P) gain 1 ASR P Gain 1	Set the proportional gain 1 and the integral time 1 of the speed control loop (ASR) for the minimum frequency. The settings become active for acceleration only.	0.00 to 300.00	40.00 3.00 (PM)	Yes	No	No	Q	Q	21BH
C5-02	ASR integral (I) time 1 ASR I Time 1		0.000 to 10.000	0.500 s 0.300 s (PM)	Yes	No	No	Q	Q	21CH
C5-03	ASR proportional (P) gain 2 ASR P Gain 2	Set the proportional gain 2 and the integral time 2 of the speed control loop (ASR) for the maximum frequency. The settings become active for acceleration only.	0.00 to 300.00	20.00 3.00 (PM)	Yes	No	No	Q	Q	21DH
C5-04	ASR integral (I) time 2 ASR I Time 2		0.000 to 10.000	0.500 s	Yes	No	No	Q	Q	21EH
C5-06	ASR primary delay time ASR Gain SW Freq	Sets the filter time parameter for outputting torque references from the speed control loop (ASR). It is set in 1-second units. Usually setting is not necessary.	0.000 to 0.500	0.004 s 0.020 s (PM)	No	No	No	Q	Q	220H

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(Continued)

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
C5-07	ASR switching frequency	ASR Gain SW Freq	Sets the frequency for switching between Proportion Gain 1, 2,3 and Integral Time 1, 2, 3. Multi-function input speed control (ASR) proportion gain switching has priority.	0.0 to 120.0 0.0 to 100.0 (PM)	0.0 Hz 2.0% (PM)	No	No	No	Q	Q	221H
C5-09	ASR proportional (P) gain 3	ASR P Gain 3	Set the proportional gain 3 and the integral time 3 of the speed control loop (ASR) for the minimum frequency. The settings become active for deceleration only.	0.00 to 300.00	40.00 3.00 (PM)	Yes	No	No	Q	Q	22EH
C5-10	ASR integral (I) time 3	ASR I Time 3		0.000 to 10.000	0.500 s 0.300 s (PM)	Yes	No	No	Q	Q	231H
d1-09	Nominal speed reference	Nomin Speed vn	Sets the frequency reference when the nominal speed is selected by a multi-function contact input.*10	0 to 120.00 *2 *3 *11	50.00 Hz 100.00 % (PM)	Yes	Q*16	Q*16	Q*16	Q*16	288H
d1-14	Inspection speed reference	Inspect Speed vi	Sets the frequency reference when the inspection speed is selected by a multi-function contact input*18		25.00 Hz 50.00 % (PM)	Yes	Q	Q	Q	Q	28FH
d1-17 *12	Leveling speed reference	Level Speed vl	Sets the frequency reference when the leveling speed is selected by a multi-function contact input*10		4.00 Hz 8.00% (PM)	Yes	Q	Q	Q	Q	292H
E1-01	Input voltage setting	Input Voltage	Sets the Inverter input voltage. This setting is used as a reference value for protection functions.	155 to 255 *4	200 VAC *4 *13	No	Q	Q	Q	Q	300H

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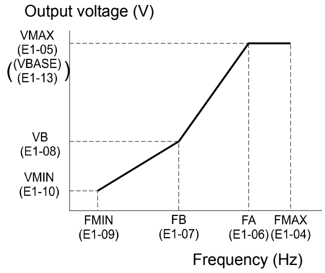

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
E1-04	Max. output frequency (FMAX) Max Frequency		0.0 to 120.0 20 to 3600 (PM)	60.0 Hz *13 96 min-1 (PM) *7	No	Q	Q	Q	Q	303H
E1-05	Max. voltage (VMAX) Max Voltage		0.0 to 255.0 *4	200.0 VAC *4 *13	No	Q	Q	Q	No	304H
E1-06	Base frequency (FA) Base Frequency		0.0 to 120.0 20 to 3600 (PM)	60.0 Hz *13 96 min-1 (PM) *7	No	Q	Q	Q	Q	305H
E1-08	Mid. output frequency voltage (VB) Mid voltage A	To set V/f characteristics in a straight line, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Always ensure that the four frequencies are set in the following manner: E1-04 (FMAX) ≥ E1-06 (FA) > E1-07 (FB) ≥ E1-09 (FMIN)	0.0 to 255.0 *4	14.0 VAC *13 *14 *15	No	Q	Q	No	No	307H
E1-09	Min. output frequency (FMIN) Min Frequency		0.0 to 120.0 0 to 3600 (PM)	1.5 Hz *5 *13 0 min^{-1} (PM)	No	Q	Q	A	A	308H
E1-10	Min. output frequency voltage (VMIN) Min Voltage		0.0 to 255.0 *4	7.0 VAC *13 *14 *15	No	Q	Q	No	No	309H
E1-13	Base voltage (VBASE) Base Voltage	Sets the output voltage of the base frequency (E1-06).	0.0 to 255.0 *14	0.0VAC *17 200.0 VAC (PM)	No	A	No	No	Q	30CH
E2-01	Motor rated current Motor Rated FLA	Sets the motor rated current in Amps. This set value will become the base value for motor protection and torque limits. This parameter is an input data for autotuning.	1.75 to 35.00 *6	14.00 A *7	No	Q	Q	Q	No	30EH
E2-02	Motor rated slip Motor Rated Slip	Sets the motor rated slip. This set value will become the reference value for the slip compensation. This parameter is automatically set during autotuning.	0.00 to 20.00	2.73 Hz *7	No	Q	Q	Q	No	30FH
E2-03	Motor no-load current No-Load Current	Sets the motor no-load current. This parameter is automatically set during autotuning.	0.00 to 13.99 *8	4.50 A *7	No	Q	Q	Q	No	310H
E2-04	Number of motor poles Number of Poles	Sets the number of motor poles. This value is an input data for autotuning.	2 to 48	4	No	No	No	Q	No	311H

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(Continued)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
E2-05	Motor line-to-line resistance Term Resistance	Sets the motor phase-to-phase resistance. This parameter is automatically set during autotuning.	0.000 to 65.000	0.771 Ω *7	No	Q	Q	Q	No	312H
E2-11	Motor rated output power Mtr Rated Power	Sets the rated output power of the motor. This parameter is an input data for autotuning.	0.00 to 650.00	3.70 kW *7	No	Q	Q	Q	No	318H
E5-02	Motor rated power Rated power	Sets the motor rated power (capacity).	0.00 to 300.00	3.70 kW *7	No	No	No	No	Q	32AH
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.	0.0 to 200.0	7.0 A *7	No	No	No	No	Q	32BH
E5-04	Number of motor poles Number of poles	Sets the number of motor poles.	4 to 48	32 pole *7	No	No	No	No	Q	32CH
E5-05	Motor line-to-line resistance Term resistance	Sets the motor line-to-line resistance.	0.000 to 65.000	3.860Ω *7	No	No	No	No	Q	32DH
E5-06	d-axis inductance d-ax inductance	Sets the motors d-axis inductance.	0.00 to 300.00	30.20 mH *7	No	No	No	No	Q	32EH
E5-07	q-axis inductance q-ax inductance	Sets the motors q-axis inductance.	0.00 to 600.00	36.00 mH *7	No	No	No	No	Q	32FH
E5-09	Motor voltage parameter Voltage Parameter	Sets the motor voltage parameter.	50.0 to 4000.0	1251.0 mV s/rad *7	No	No	No	No	Q	331H
E5-11	PG home position offset Zpuls-Mag Offset	Sets the amount of pulses to align the home position in units of 0.1 degrees.	-180.0 to 180.0	0.0 deg	No	No	No	No	Q	333H
F1-01	PG parameter PG Pulses/ Rev	Sets the number of PG pulses per revolution	0 to 60000 0 to 8192 (PM)	600 *9 8192 (PM)	No	No	No	Q	Q	380H
F1-05	PG rotation PG Rotation Sel	0: Phase A leads with Forward Run Command. (Phase B leads with Reverse Run Command) 1: Phase B leads with Forward Run Command. (Phase A leads with Reverse Run Command)	0, 1	0 1 (PM)	No	No	No	Q	Q	384H

(Continued)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
						Control Methods				
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	0 to 2	2	No	No	No	No	Q	3B0H
L1-01	Motor protection selection MOL Fault Select	Sets whether the motor thermal overload protection function is enabled or disabled. 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 parameter torque motor protection	0 to 3 0.5 (PM)	1 5 (PM)	No	Q	Q	Q	A	480H
N8-01	Initial magnetic polarity estimation current MagPos Srch Curr	Determines the current for estimating the initial magnetic polarity. Set as a percentage of the motor rated torque (E5-03). Usually setting is not necessary. If the motor nameplate includes a value for Si, then that value should be entered to this parameter.	0 to 100	75%	No	No	No	No	Q	540H
N8-35	Magnet position detection method Mag det sel	Sets the magnet position detection method. 0: Magnet position detection method 1 2: Magnet position detection method 2 4: HIPERFACE® method 5: EnDat method	0,2,4,5	2	No	No	No	No	Q	562H

*1. The setting ranges for acceleration/deceleration times depend on the setting of C1-10 (Accel/decel time setting unit). If C1-10 is set to 1, the setting range is 0.0 to 6000.0 (s).
*2. The unit is set in o1-03 (frequency units of reference setting and monitor, default: 0.01 Hz). If the display unit is changed, the setting range values also change.
*3. The maximum setting value depends on the setting of the maximum output frequency (E1-04).
*4. The values will change according to parameter o2-09. The values provided are for a 200 V class Inverter and for when o2-09 is set to 0 (Japanese specification). Values for a 400 V class Inverter are double.
*5. The factory settings will change when the control method is changed. Open-loop vector 1 control factory settings are given.
*6. The setting range is from 10% to 200% of the Inverter rated output current. The value for a 200 V class Inverter for 3.7 kW is given.
*7. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.
*8. The setting ranges depend on the Inverter capacity. The values for a 200 V class Inverter of 3.7 kW are given
*9. The values will change according to parameter o2-09. The values provided are for when o2-09 is set to 0 (Japanese specification). The value will be 1024 when o2-09 is set to 1 or 2.
*10. Enabled by the combined selection of the nominal speed command, the intermediate speed command, and the releveling speed command.
*11. The setting range becomes 0.00 to 100.00 when using closed-loop vector control (PM).
*12. Becomes the jog frequency reference when d1-18 is set to 0.
*13. The factory settings will change according to parameter o2-09. Values shown here are for when o2-09 is set to 0.
*14. These are values for a 200 V class Inverter. Values for a 400 V class Inverter are double.
*15. The factory settings will change when the control method is changed. (The V/f control factory settings are given.)
*16. d1-19 to d1-13 are not displayed if d1-18 is set to 0. These are changed to H1-01 (24), H1-02 (14), H1-03 (3), H1-04 (4), and H1-05 (6).
*17. After autotuning, E1-13 will contain the same value as E1-05.
*18. Enabled if the Inspection Run Command is set for a multi-function contact input.

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Parameter Tables

◆ A: Setup Settings

■ Initialize Mode: A1

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
						Control Methods					
A1-00	Language selection for Digital Operator display Select Language	Used to select the language displayed on the Digital Operator (JVOP-160 only). 0: English 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese This parameter is not changed by the initialize operation.	0 to 6	0	Yes	A	A	A	A	100H	-
A1-01	Parameter access level Access Level	Used to set the parameter access level (set/read.) 0: Monitoring only (Monitoring drive mode and setting A1-01 and A1-04.) 1: Used to select parameters (Only parameters set in A2-01 to A2-32 can be read and set.) 2: Advanced (Parameters can be read and set in both, quick programming mode (Q) and advanced programming mode (A).)	0 to 2	2	Yes	Q	Q	Q	Q	101H	6-93 6-94
A1-02	Control method selection Control Method	Used to select the control method for the Inverter 0: V/f control 2: Open-loop vector 1 control 3: Closed-loop vector control 6: Closed-loop vector control (PM) This parameter is not changed by the initialize operation.	0, 2, 3, 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 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.) Zero is always displayed when o2-09 is set to 1 or 2.	0 to 9999	0	No	A	A	A	A	104H	6-94

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(Continued)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS 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	No	A	A	A	A	105H	6-94

■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 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
A2-01 to A2-32	User specified parameters User Param 1 to 32	Used to select the function for each of the user specified parameters. Parameters are the only accessible parameters if Parameter Access Level is set to parameters (A1-01=1)	–	–	No	A	A	A	A	106H to 125H	6-95

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◆ Application Parameters: b

■Operation Mode Selections: b1

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register	Page
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
b1-01	Reference source selection Reference Source	Sets the frequency reference input method. 0: Digital Operator 1: Control circuit terminal (analog input)*1 2: MEMOBUS communications 3: Option card*2	0 to 3	0	No	A	A	A	A	180H	6-7 6-109
b1-02	Run Command source selection Run Source	Sets the Run Command input method. 0: Digital Operator 1: Control circuit terminal (sequence input) 2: MEMOBUS communications 3: Option card	0 to 3	1	No	A	A	A	A	181H	6-6 6-109
b1-03	Stopping method selection Stopping Method	Selects the stopping method when the run command is removed. 0: Deceleration to stop 1: Coast to stop	0, 1	0	No	A	A	A	A	182H	-
b1-06	Control input scan Cntl Input Scans	Used to set the responsiveness of the control inputs (forward/reverse and multi-function inputs.) 0: Fast reading 1: Normal reading (Can be used for possible malfunction due to noise.)	0, 1	1	No	A	A	A	A	185H	-
b1-07	Operation selection after switching to remote mode LOC/REM RUN Sel	Used to set the operation mode by switching to the Remote mode using the LOCAL/REMOTE Key. 0: Run signals that are input during mode switching are disregarded. (Input Run signals after switching the mode.) 1: Run signals become effective immediately after switching to the Remote mode.	0,1	0	No	A	A	A	A	186H	-
b1-08	Run Command selection in programming modes RUN CMD at PRG	Used to set an operation prohibition in programming modes. 0: Operation prohibited. 1: Operation permitted [(Disabled when Digital Operator is the selected Run Command source (b1-02 = 0)]. 2: Operation prohibited (the Digital Operator will not enter the programming mode.	0 to 2	0	No	A	A	A	A	187H	-

* 1. If d1-18 is set to 1 or 2, an analog reference will have priority over a frequency reference from a multi-function contact input.
* 2. If d1-18 is set to 1 or 2, a frequency reference from a multi-function contact input will be valid even if b1-01 is set to 2 or 3.

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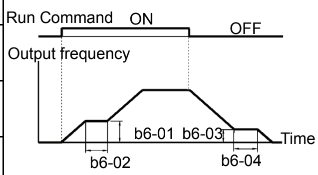
■DC Injection Braking: b2

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	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	No	A	No	No	190H	-

■Timer Function: b4

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	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 3000.0	0.0 s	No	A	A	A	A	1A3H	6-71
b4-02	Timer function OFF-delay time Delay-OFF Timer	Sets the timer function output OFF-delay time (dead band) for the timer function input, in 1-second units. Enabled when a timer function is set in H1-☐☐ or H2-☐☐.	0.0 to 3000.0	0.0 s	No	A	A	A	A	1A4H	6-71

■Dwell Functions: b6

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	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 to 100.0 (PM)	0.0 Hz 0.0% (PM)	No	A	A	A	A	1B6H	6-27
b6-02	Dwell time at start Dwell Time @ Start		0.0 to 10.0	0.0 s	No	A	A	A	A	1B7H	6-27
b6-03	Dwell frequency at stop Dwell Ref @ Stop		0.0 to 120.0 0.0 to 100.0 (PM)	0.0 Hz 0.0% (PM)	No	A	A	A	A	1B8H	6-27
b6-04	Dwell time at stop Dwell Time @ Stop		0.0 to 10.0	0.0 s	No	A	A	A	A	1B9H	6-27

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■Droop Control: b7

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register	Page
b7-01	Droop control gain Droop Quantity	Sets the slip as a percentage of maximum frequency when the maximum output frequency is specified and the rated torque occurs. Droop control is not performed when the setting is 0.0.	0.0 to 100.0	0.0 %	Yes	No	No	No	A	1CAH	6-35
b7-02	Droop control delay time Droop Delay Time	Droop control responsiveness parameter. When hunting or oscillation occurs, increase the value.	0.03 to 2.00	0.05 s	Yes	No	No	No	A	1CBH	6-35

■Energy Saving: b8

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register	Page
b8-01	Energy-saving mode selection Energy Save Sel	Select whether to enable or disable energy-saving control. 0: Disabled 1: Enabled	0,1	0	No	No	No	No	A	1CCH	-
b8-16	Energy savings control parameter Ki EnergySave Ki	This coefficient maintains torque linearity. Manually enter the value for Ki as indicated by the motor nameplate.	0.00 to 2.00	0.10	No	No	No	No	Q	1F8H	-
b8-17	Energy savings control parameter Kt EnergySave Kt	This coefficient maintains torque linearity. Manually enter the value for Kt as indicated by the motor nameplate.	0.00 to 2.00	1.00	No	No	No	No	Q	1F9H	-

◆ Tuning Parameters: C

■Acceleration/Deceleration: C1

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register	Page
C1-01	Acceleration time 1	Accel Time 1	Sets the acceleration time to accelerate from 0 Hz to the maximum output frequency.	0.00 to 600.00 *	3.00 s	Yes	Q	Q	Q	Q	200H	6-23 6-25
C1-02	Deceleration time 1	Decel Time 1	Sets the deceleration time to decelerate from the maximum output frequency to 0 Hz.	0.00 to 600.00 *	3.00 s	Yes	Q	Q	Q	Q	201H	6-23 6-25
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.	0.00 to 600.00 *	3.00 s	Yes	A	A	A	A	202H	6-23 6-25
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.	0.00 to 600.00 *	3.00 s	Yes	A	A	A	A	203H	6-23 6-25
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 *	3.00 s	No	A	A	A	A	204H	6-23 6-25
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.	0.00 to 600.00 *	3.00 s	No	A	A	A	A	205H	6-23
C1-07	Acceleration time 4	Accel Time 4	Sets the acceleration time when the frequency reference is below the value set in C1-11.	0.00 to 600.00 *	3.00 s	No	A	A	A	A	206H	6-23 6-25
C1-08	Deceleration time 4	Decel Time 4	Sets the deceleration time when the frequency reference is below the value set in C1-11.	0.00 to 600.00 *	3.00 s	No	A	A	A	A	207H	6-23 6-25
C1-09	Fast stop time	Fast Stop Time	Sets the deceleration time when the frequency reference is below the value set in C1-11.	0.00 to 600.00 *	3.00 s	No	A	A	A	A	208H	6-13
C1-10	Accel/decel time setting unit	Acc/Dec Units	0: 0.01-second units 1: 0.1-second units	0, 1	0	No	A	A	A	A	209H	6-23
C1-11	Decel time switching frequency	Acc/Dec SW Freq	Sets the frequency for automatic acceleration/deceleration switching. If the output frequency is below the set frequency: Accel/decel time 4 If the output frequency is above the set frequency: Accel/decel time 1.	0.0 to 120.0 0.0 to 100.0 (PM)	0.0 Hz 0.0% (PM)	No	A	A	A	A	20AH	6-24

* The setting ranges for acceleration/deceleration times depend on the setting of C1-10 (Accel/decel time setting unit). If C1-10 is set to 1, the setting range for acceleration/deceleration times becomes 0.0 to 6000.0 seconds.

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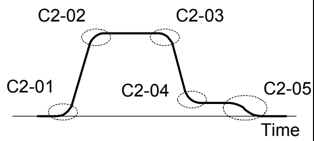
■S-curve Acceleration/Deceleration: C2

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
C2-01	S-curve characteristic time at acceleration start S-Crv Acc @ Start	Set the S-curve time to smooth out any sudden changes in motor speed. The S-curve can be used at start and stop, as well as during acceleration and deceleration.  $T_{accel} = \frac{C2\text{-}01}{2} + C1\text{-}01 + \frac{C2\text{-}02}{2}$ $T_{decel} = \frac{C2\text{-}03}{2} + C1\text{-}02 + \frac{C2\text{-}04}{2}$ 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	6-26
C2-02	S-curve characteristic time at acceleration end S-Crv Acc @ End				No	Q	Q	Q	Q	20CH	6-26
C2-03	S-curve characteristic time at deceleration start S-Crv Dec @ Start				No	Q	Q	Q	Q	20DH	6-26
C2-04	S-curve characteristic time at deceleration end S-Crv Dec @ End				No	Q	Q	Q	Q	20EH	6-26
C2-05	S-curve characteristic time below leveling speed Scurve @ leveling				No	Q	Q	Q	Q	232H	6-26

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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 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register	Page
C3-01	Slip compensation gain Slip Comp Gain	Used to improve speed accuracy when operating with a load. Usually changing this setting is not necessary. Adjust this parameter under the following circumstances. • When motor speed is lower than the frequency reference increase the set value. • When motor speed is higher than the frequency reference decrease the set value. 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	No	A	A	No	20FH	6-36
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	No	A	No	No	210H	6-37
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	No	A	No	No	211H	6-37
C3-04	Slip compensation selection during regeneration Slip Comp Regen	0: Disabled 1: Enabled When the slip compensation during regeneration function has been activated and regeneration capacity increases momentarily, it might be necessary to use a braking option (braking resistor, Braking Resistor Unit or Braking Unit.)	0, 1	1	No	No	A	No	No	212H	6-37
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, 1	1 0 (PM)	No	No	A	A	No	213H	6-37

■Torque Compensation: C4

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	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 1 control.	0.00 to 2.50	1.00	Yes	A	A	No	No	215H	6-39
C4-02	Torque compensation delay time parameter Torq Comp Time	The torque compensation delay time is set in ms units. Usually changing this setting is not necessary. Adjust it under the following circumstances: • When the motor is oscillating, increase the set values. • When the responsiveness of the motor is low, decrease the set values.	0 to 10000	200 ms *	No	A	A	No	No	216H	6-39
C4-03	Starting torque compensation (FWD) FTorqCmp @ Start	Sets the torque compensation value at start in FWD direction	0.0 to 200.0%	0.0%	No	No	A	No	No	217H	6-39
C4-04	Starting torque compensation (REV) RTorqCmp @ Start	Sets the torque compensation value at start in REV direction	-200.0% to 0.0	0.0%	No	No	A	No	No	218H	6-40
C4-05	Starting torque compensation time parameter TorqCmpDelayT	Sets starting torque start-up time. When 0 to 4 ms is set, it is operated without filter.	0 to 200	10 ms	No	No	A	No	No	219H	6-40
C4-06	Torque compensation primary delay time 2 Start Torq Time	Increase settings when acceleration is complete, or if an OV fault or error occurs with sudden changes in the load. Usually setting is not necessary.	0 to 10000	150 ms	No	No	A	No	No	21AH	-

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

■Speed Control (ASR): C5

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Remarks
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 maximum frequency.	0.00 to 300.00	40.00 3.00 (PM)	Yes	No	No	Q	Q	21BH	6-41
C5-02	ASR integral (I) time 1	ASR I Time 1		0.000 to 10.000	0.500 s 0.300 s (PM)	Yes	No	No	Q	Q	21CH	6-41
C5-03	ASR proportional (P) gain 2	ASR P Gain 2	Set the proportional gain 2 and the integral time 2 of the speed control loop (ASR) for the minimum frequency. The settings become active for acceleration only.	0.00 to 300.00	20.00 3.00 (PM)	Yes	No	No	Q	Q	21DH	6-42
C5-04	ASR integral (I) time 2	ASR I Time 2		0.000 to 10.000	0.500 s	Yes	No	No	Q	Q	21EH	6-42
C5-06	ASR primary delay time	ASR Gain SW Freq	Sets the filter time parameter for outputting torque references from the speed control loop (ASR). It is set in 1-second units. Usually setting is not necessary.	0.000 to 0.500	0.004 s 0.020 s	No	No	No	Q	Q	220H	6-42
C5-07	ASR switching frequency	ASR Gain SW Freq	Sets the frequency for switching between Proportion Gain 1, 2,3 and Integral Time 1, 2, 3. Multi-function input speed control (ASR) proportion gain switching has priority.	0.0 to 120.0 0.0 to 100.0 (PM)	0.0 Hz 2.0% (PM)	No	No	No	Q	Q	221H	6-42
C5-08	ASR integral (I) limit	ASR I Limit	Set the parameter to a small value to prevent any radical load change. A setting of 100% is equal to the maximum output frequency.	0 to 400	400%	No	No	No	A	A	222H	6-42
C5-09	ASR proportional (P) gain 3	ASR P Gain 3	Set the proportional gain 3 and the integral time 3 of the speed control loop (ASR) for the minimum frequency. The settings become active for acceleration only.	1.00 to 300.00	40.00 3.00 (PM)	Yes	No	No	Q	Q	22EH	6-42
C5-10	ASR integral (I) time 3	ASR I Time 3		0.000 to 10.000	0.500 s 0.300 s (PM)	Yes	No	No	Q	Q	231H	6-42
C5-15	ASR gain for encoder offset tuning	Pullin ASR Pgain	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	No	No	No	A	238H	-

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■Carrier Frequency: C6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
C6-02	Carrier frequency selection CarrierFreq Sel	Selects the carrier frequency. 1: 2 kHz 2: 5 kHz 3: 8 kHz 4: 10 kHz 5: 12.5 kHz 6: 15 kHz	1 to 6	3 *3	No	A	A	A	No	224H	6-2
C6-03	Carrier frequency upper limit CarrierFreq Max	Set the carrier frequency upper limit and lower limit in kHz units. With the vector control method, the upper limit of the carrier frequency is fixed in C6-03.	2.0 to 15.0 *1 *2	8.0 kHz *3	No	A	A	A	No	225H	6-2
C6-09	Carrier during rotational autotuning Carrier in tune	Selects the carrier frequency during rotational autotuning (no-load current, rated motor slip, and iron-core saturation coefficients 1 and 2). 0: 5kHz 1: Setting value for C6-03.	0,1	0	No	No	A	A	No	22BH	-
C6-10	Carrier during stationary autotuning Fc Static Tuning	Selects the carrier frequency during stationary autotuning. 0: 0.5 kHz 1: 1.0 kHz 2: 1.5 kHz 3: 2.0 kHz	0 to 3	1	No	No	A	A	No	22CH	-
C6-11	Carrier frequency selection 2 CarrierFreq Sel	1: 2 kHz 2: 4 kHz 3: 6 kHz 4: 8 kHz 5: 12 kHz 6: 15 kHz	1 to 6	4 *3	No	No	No	No	A	22DH	6-2

* 1. The setting ranges depend on the Inverter capacity.
* 2. Can only be set when parameter C6-02 is set to 0F.
* 3. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

◆ Reference Parameters: d

■Preset Reference: d1

Param-eter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Regis-ter	Page
d1-01	Frequency reference 1	Reference 1	Sets the frequency reference.			Yes	A *4	A *4	A *4	A *4	280H	6-8
d1-02	Frequency reference 2	Reference 2	Sets the frequency reference when multi-step speed command 1 is ON for a multi-function input.			Yes	A *4	A *4	A *4	A *4	281H	6-8
d1-03	Frequency reference 3	Reference 3	Sets the frequency reference when multi-step speed command 2 is ON for a multi-function input.			Yes	A *4	A *4	A *4	A *4	282H	6-8
d1-04	Frequency reference 4	Reference 4	Sets the frequency reference when multi-step speed commands 1 and 2 are ON for multi-function inputs.			Yes	A *4	A *4	A *4	A *4	283H	6-8
d1-05	Frequency reference 5	Reference 5	Sets the frequency when multi-step speed command 3 is ON for a multi-function input.		0.00 Hz *3	Yes	A *4	A *4	A *4	A *4	284H	6-8
d1-06	Frequency reference 6	Reference 6	Sets the frequency reference when multi-step speed commands 1 and 3 are ON for multi-function inputs.			Yes	A *4	A *4	A *4	A *4	285H	6-8
d1-07	Frequency reference 7	Reference 7	Sets the frequency reference when multi-step speed commands 2 and 3 are ON for multi-function inputs.			Yes	A *4	A *4	A *4	A *4	286H	6-8
d1-08	Frequency reference 8	Reference 8	Sets the frequency reference when multi-step speed commands 1, 2, and 3 are ON for multi-function inputs.	0 to 120.00 *1 *2		Yes	A *4	A *4	A *4	A *4	287H	6-8
d1-09	Nominal speed reference	Nomin Speed vn	Sets the frequency reference when the nominal speed is selected by a multi-function contact input.*7		50.00 Hz 100.00% (PM)	Yes	Q *5	Q *5	Q *5	Q *5	288H	6-10 6-12
d1-10	Intermediate speed 1 reference	Interm Speed v1	Sets the frequency reference when the intermediate speed 1 is selected by a multi-function contact input.*7			Yes	A *5	A *5	A *5	A *5	28BH	6-10 6-12
d1-11	Intermediate speed 2 reference	Interm Speed v2	Sets the frequency reference when the intermediate speed 2 is selected by a multi-function contact input.*7		0.00 Hz *3	Yes	A *5	A *5	A *5	A *5	28CH	6-10 6-12
d1-12	Intermediate speed 3 reference	Interm Speed v3	Sets the frequency reference when the intermediate speed 3 is selected by a multi-function contact input.*7			Yes	A *5	A *5	A *5	A *5	28DH	6-10 6-12
d1-13	Releveling speed reference	Relevel Speed vr	Sets the frequency reference when the releveling speed is selected by a multi-function contact input.*7			Yes	A *5	A *5	A *5	A *5	28EH	6-10 6-12

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(Continued)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
d1-14	Inspection speed reference Inspect Speed vi	Sets the frequency reference when the inspection speed is selected by a multi-function contact input.*8	0 to 120.00 *1*2	25.00 Hz 50.00% (PM)	Yes	Q	Q	Q	Q	28FH	6-14
d1-17 *6	Leveling speed reference Level Speed vl	Sets the frequency reference when the leveling speed is selected by a multi-function contact input.*7	0 to 120.00 *1*2	4.00 Hz 8.00% (PM)	Yes	Q	Q	Q	Q	292H	6-10 6-12
d1-18	Speed priority selection SpeedPrioritySel	Speed reference priority selection 0: Use multi-speed reference (d1-01 to d1-08) 1: High speed reference has priority. 2: Leveling speed reference has priority.	0 to 2	0	No	A	A	A	A	2A7H	6-8 6-10 6-12

* 1. The maximum setting value depends on the setting of the maximum output frequency (E1-04).
* 2. The setting range becomes 0.00 to 100.00 when using closed-loop vector control (PM).
* 3. The factory setting changes to 0.00% when using closed-loop vector control (PM).
* 4. d1-01 to d1-08 are not displayed if d1-18 is set to 1 or 2. These are changed to H1-01 (80), H1-02 (84), H1-03 (81), H1-04 (83), and H1-05 (F).
* 5. d1-09 to d1-13 are not displayed if d1-18 is set to 0. These are changed to H1-01 (24), H1-02 (14), H1-03 (3), H1-04 (4), and H1-05 (6).
* 6. Becomes the jog frequency reference when d1-18 is set to 0.
* 7. Enabled by the combined selection of the nominal speed command, the intermediate speed command, and the releveling speed command.
* 8. Enabled if the Inspection Run Command is set for a multi-function contact input.

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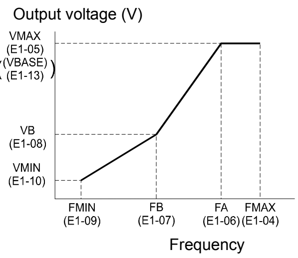
■Field Forcing: d6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	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, 1	0	No	No	A	A	No	2A2H	6-49
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	No	A	A	No	2A5H	6-49

◆ Motor Parameters: E

■V/f Pattern: E1

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	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.	155 to 255 *1	200 VAC *1 *4	No	Q	Q	Q	Q	300H	6-83
E1-03	V/f pattern selection	V/F Selection	0 to D: Select from the 15 preset patterns. F: Custom user-set patterns (Applicable for settings E1-04 to E1- 10.) FF: No internal voltage limit	0 to FF	F	No	A	No	No	No	302H	-
E1-04	Max. output frequency (FMAX)	Max Frequency	 To set V/f characteristics in a straight line, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Always ensure that the four frequencies are set in the following manner: E1-04 (FMAX) ≥ E1-06 (FA) > E1-07 (FB) ≥ E1-09 (FMIN)	0.0 to 120.0 20 to 3600 (PM)	60.0 Hz *4 96 min^{-1} (PM)*5	No	Q	Q	Q	Q	303H	6-83
E1-05	Max. output voltage (VMAX)	Max Voltage		0.0 to 255.0 *1	200.0 VAC *1 *4	No	Q	Q	Q	No	304H	6-83
E1-06	Base frequency (FA)	Base Frequency		0.0 to 120.0 20 to 3600 (PM)	60.0 Hz *4 96 min^{-1} (PM)*5	No	Q	Q	Q	Q	305H	6-83
E1-07	Mid. output frequency (FB)	Mid Frequency A		0.0 to 120.0	3.0 Hz *2 *4	No	A	A	No	No	306H	6-83
E1-08	Mid. output frequency voltage (VB)	Mid Voltage A		0.0 to 255.0 *1	14.0 VAC *1 *2*4	No	Q	Q	No	No	307H	6-83
E1-09	Min. output frequency (FMIN)	Min Frequency		0.0 to 120.0 0 to 3600 (PM)	1.5 Hz *2 *4 0 min^{-1} (PM)	No	Q	Q	A	A	308H	6-83
E1-10	Min. output frequency voltage (VMIN)	Min Voltage		0.0 to 255.0 *1	7.0 VAC *1*2 *4	No	Q	Q	No	No	309H	6-83
E1-13	Base voltage (VBASE)		Sets the output voltage of the base frequency (E1-06).	0.0 to 255.0 *1	0.0 VAC *3	No	A	No	No	Q	30CH	6-83

* 1. These are values for a 200 V class Inverter. Values for a 400 V class Inverter are double.
* 2. The factory settings will change when the control method is changed. (The V/f control factory settings are given.)
* 3. After autotuning, E1-13 will contain the same value as E1-05.
* 4. The factory settings will change according to parameter o2-09. Values shown here are for when o2-09 is set to 0.
* 5. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7kW are given.

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■ Motor Setup: E2

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register	Page
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
E2-01	Motor rated current Motor Rated FLA	Sets the motor rated current in Amps. This set value will become the reference value for motor protection and torque limits. This parameter is an input data for autotuning.	1.75 to 35.00 *1	14.00 A *2	No	Q	Q	Q	No	30EH	6-60 6-77
E2-02	Motor rated slip Motor Rated Slip	Sets the motor rated slip. This set value will become the reference value for the slip compensation. This parameter is automatically set during autotuning.	0.00 to 20.00	2.73 Hz *2	No	Q	Q	Q	No	30FH	6-77
E2-03	Motor no-load current No-Load Current	Sets the motor no-load current. This parameter is automatically set during autotuning.	0.00 to 13.99 *3	4.50 A *2	No	Q	Q	Q	No	310H	6-77
E2-04	Number of motor poles Number of Poles	Sets the number of motor poles. This value is an input data for autotuning.	2 to 48	4 poles	No	No	No	Q	No	311H	6-77
E2-05	Motor line-to-line resistance Term Resistance	Sets the motor phase-to-phase resistance. This parameter is automatically set during autotuning.	0.000 to 65.000	0.771 Ω *2	No	Q	Q	Q	No	312H	6-77
E2-06	Motor leak inductance Leak Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of the motor rated voltage. This parameter is automatically set during autotuning.	0.0 to 40.0	19.6% *2	No	No	A	A	No	313H	6-77
E2-07	Motor iron saturation coefficient 1 Saturation Comp1	Sets the motor iron saturation coefficient at 50% of magnetic flux. This parameter is automatically set during rotating autotuning.	0.00 to 0.50	0.50	No	No	A	A	No	314H	6-77
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.	E2-07 to 0.75	0.75	No	No	A	A	No	315H	6-77
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	No	A	A	No	316H	6-77
E2-10	Motor iron loss for torque compensation Tcomp Iron Loss	Sets motor iron losses.	0 to 65535	112 W *2	No	No	No	No	No	317H	6-78
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 *2	No	Q	Q	Q	No	318H	6-78

(Continued)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
E2-12	Motor iron saturation coefficient 3 Saturation Comp3	This parameter is automatically set during rotating autotuning.	1.30 to 1.60	1.30	No	No	A	A	No	328H	6-78

* 1. The setting range is from 10% to 200% of the Inverter rated output current. The value for a 200 V class Inverter for 3.7 kW is given.
* 2. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.
* 3. The setting ranges depend on the Inverter capacity. The values for a 200 V class Inverter of 3.7 kW are given.

■Permanent magnet motor parameter: E5

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
E5-02	Motor rated power Rated power	Sets the motor rated power (capacity).	0.00 to 300.00	3.70 kW *	No	No	No	No	Q	32AH	-
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.	0.0 to 200.0	7.0 A *	No	No	No	No	Q	32BH	-
E5-04	Number of motor poles Number of poles	Sets the number of motor poles.	4 to 48	32 pole *	No	No	No	No	Q	32CH	-
E5-05	Motor line-to-line resistance Term resistance	Sets the motor line-to-line resistance.	0.000 to 65.000	3.860Ω *	No	No	No	No	Q	32DH	-
E5-06	d-axis inductance d-ax inductance	Sets the motors d-axis inductance.	0.00 to 300.00	30.20 mH *	No	No	No	No	Q	32EH	-
E5-07	q-axis inductance q-ax inductance	Sets the motors q-axis inductance.	0.00 to 600.00	36.00 mH *	No	No	No	No	Q	32FH	-
E5-09	Motor voltage parameter Voltage Parameter	Sets the motor voltage parameter.	50.0 to 4000.0	1251.0 mV s/rad *	No	No	No	No	Q	331H	-
E5-11	PG home position offset Zpuls-Mag Offset	Sets the amount of pulses to align the home position in units of 0.1 degrees.	-180.0 to 180.0	0.0 deg	No	No	No	No	Q	333H	-

* The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

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◆ 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 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register	Page
F1-01	PG parameter PG Pulses/ Rev	Sets the number of PG pulses per revolution	0 to 60000 0 to 8192 (PM)	600*1 8192 (PM)	No	No	No	Q	Q	380H	6-97
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 (Fast stop using the deceleration time in C1-09.) 3: Continue operation (To protect the motor or machinery, avoid to use this setting.)	0 to 3	1	No	No	No	A	A	381H	6-97
F1-03	Operation selection at overspeed (OS) PG Over-speed 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 (Fast stop using the deceleration time in C1-09.) 3: Continue operation (To protect the motor or machinery, avoid to use this setting.)	0 to 3	1	No	No	No	A	A	382H	6-97
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 (Fast stop using the deceleration time in C1-09.) 3: Continue operation (DEV is displayed and operation continued.)	0 to 3	3 1 (PM)	No	No	No	A	A	383H	6-97
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, 1	0 1 (PM)	No	No	No	Q	Q	384H	6-51 6-97
F1-06	PG division rate (PG pulse monitor) PG Output Ratio	Sets the division ratio for the PG speed control board pulse output. Division ratio = (1+ n) /m (n=0 or 1 m=1 to 32) The first digit of the value of F1-06 stands for n, the second and the third stands for m. This parameter is effective only when a PG-B2 is used. The possible division ratio settings are: 1/32 ≤ F1-06 ≤ 1.	1 to 132	1	No	No	No	A	A	385H	6-97

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(Continued)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: 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	No	No	A	A	387H	6-98
F1-09	Overspeed detection delay time / PG Overspd Time		0.0 to 2.0	0.0 s	No	No	No	A	A	388H	6-98
F1-10	Excessive speed deviation detection level / PG Deviate Level	Sets the speed deviation detection method. Any speed deviation above the F1-10 set level (set as a percentage of the maximum output frequency) that continues for the time set in F1-11 is detected as a speed deviation. The speed deviation is the difference between actual motor speed and the speed reference command.	0 to 50	10%	No	No	No	A	A	389H	6-98
F1-11	Excessive speed deviation detection delay time / PG Deviate Time		0.0 to 10.0	0.5 s	No	No	No	A	A	38AH	6-98
F1-14	PG open-circuit detection delay time / PGO Detect Time	Used to set the PG disconnection detection time. PGO will be detected if the detection time exceeds the set time.	0.0 to 10.0	1.0 s	No	No	No	A	A	38DH	6-98
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 × 5ms.	0 to 5	1	No	No	No	No	A	3ADH	-
F1-19	DV4 fault detection selection / DV4 detect pulse	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	No	No	A	3AEH	-
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	0 to 2	2	No	No	No	No	Q	3B0H	-
F1-22	Magnet position offset / PG-F2 Mag θComp	Sets the Offset between the rotor magnet and encoder zero position.	0 to 360	60deg	No	No	No	No	A	3B1H	-
F1-25	Encoder copy selection / ENC Copy Sel	Used to memorize encoder and motor data in the encoder memory (for HIPERFACE® and EnDat encoders)*2 0: Normal operation 1: WRITE (Inverter to encoder) 2: COPY (Encoder to Inverter) 3: VERIFY	0 to 3	0	No	No	No	No	A	3B4H	6-95

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(Continued)

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register	Page
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	0,1	0	No	No	No	No	A	3B5H	6-95

* 1. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

* 2. Parameter F1-25 can only be set using the Digital Operator.
Once F1-25 has been set to 1, 2, or 3, the copy function will be executed. Afterwards, “Copy complete” will appear on the Digital Operator screen, and F1-25 will be reset to zero.
If F1-26 = 0, then “Encoder write protected” will still appear even when F1-25 is set to 1.

■Analog Monitor Boards: F4

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register	Page
F4-01	Channel 1 monitor selection AO Ch1 Select	Using an AO-08 option card the possible outputs signal is 0 to +10V only. The setting of F4-07 and F4-08 has no effect. Sets the channel 1 item bias to 100%/10 V when the analog monitor board is used. This function is enabled when the analog monitor board 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 99	2 5 (PM)	No	A	A	A	A	391H	-
F4-02	Channel 1 gain AO Ch1 Gain		0.0 to 1000.0	100.0%	Yes	A	A	A	A	392H	-
F4-03	Channel 2 monitor selection AO Ch2 Select		1 to 99	3	No	A	A	A	A	393H	-
F4-04	Channel 2 gain AO Ch2 Gain		0.0 to 1000.0	50.0%	Yes	A	A	A	A	394H	-
F4-05	Channel 1 output monitor bias AO Ch1 Bias		-110.0 to 110.0	0.0%	Yes	A	A	A	A	395H	-
F4-06	Channel 2 output monitor bias AO Ch2 Bias		-110.0 to 110.0	0.0%	Yes	A	A	A	A	396H	-
F4-07	Analog output signal level for channel 1 AO Opt Level Sel	Selects the analog output signal level for channel 1 (effective for the AO-12 option card only). 0: 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, 1	0	No	A	A	A	A	397H	-
F4-08	Analog output signal level for channel 2 AO Opt Level Sel		0, 1	0	No	A	A	A	A	398H	-

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

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register	Page
F5-01	Channel 1 output selection DO Ch1 Select	Effective when a digital output boards (DO-02C 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 boards (DO-02C 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 boards 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 boards 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 boards 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 boards 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 boards 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 boards 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	Effective when a DO-08 digital output boards 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				MEMOBUS Register	Page
						V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
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: Fast 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, 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: Fast 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 from communications option card 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, 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, 1	1	No	No	No	A	A	3A7H	-

◆ Terminal Function Parameters: H

■Multi-function Contact Inputs: H1

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register	Page
H1-01	Terminal S3 function selection Terminal S3 Sel	Multi-function input 1	0 to 88	24 (80) *	No	A	A	A	A	400H	6-69
H1-02	Terminal S4 function selection Terminal S3 Sel	Multi-function input 2		14 (84) *	No	A	A	A	A	401H	6-69
H1-03	Terminal S5 function selection Terminal S3 Sel	Multi-function input 3		3 (81) *	No	A	A	A	A	402H	6-69
H1-04	Terminal S6 function selection Terminal S3 Sel	Multi-function input 4		4 (83) *	No	A	A	A	A	403H	6-69
H1-05	Terminal S7 function selection Terminal S3 Sel	Multi-function input 5		6 (F) *	No	A	A	A	A	404H	6-69

* Value will change to number in parenthesis when parameter d1-18 equals 1 or 2.

Multi-function Contact Input Functions

Setting Value	Function	Control Methods				Page
		V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
3	Multi-step speed reference 1	Yes	Yes	Yes	Yes	6-8
4	Multi-step speed reference 2	Yes	Yes	Yes	Yes	6-8
5	Multi-step speed reference 3	Yes	Yes	Yes	Yes	6-8
6	Jog frequency command (higher priority than multi-step speed reference)	Yes	Yes	Yes	Yes	-
7	Accel/decel time switch over 1	Yes	Yes	Yes	Yes	6-24
8	External baseblock NO (NO contact: Baseblock at ON)	Yes	Yes	Yes	Yes	6-70
9	External baseblock NC (NC contact: Baseblock at OFF)	Yes	Yes	Yes	Yes	6-70
F	Not used (Set when a terminal is not used)	-	-	-	-	-
14	Fault reset (Reset when turned ON)	Yes	Yes	Yes	Yes	-
15	Fast stop. (NO: Deceleration to stop in deceleration time set in C1-09 when ON.)	Yes	Yes	Yes	Yes	6-14
17	Fast stop (NC: Deceleration to stop in deceleration time set in C1-09 when OFF)	Yes	Yes	Yes	Yes	6-14
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	6-71
1A	Accel/decel time switch over 2	Yes	Yes	Yes	Yes	6-24
20 to 2F	External fault; Input mode: NO contact/NC contact, Detection mode: Normal/during operation	Yes	Yes	Yes	Yes	6-70
60	DC injection braking command (ON: Performs DC injection braking) Can be set when o2-09 is set to 1 (American specification). The brake sequence is disabled.	Yes	Yes	Yes	No	-
67	Communications test mode (“Pass” is displayed when the communications test is passed.)	Yes	Yes	Yes	Yes	-
80	Nominal Speed Command (d1-09) *1	Yes	Yes	Yes	Yes	6-18
81	Intermediate Speed Command (d1-10) *1	Yes	Yes	Yes	Yes	6-18
82	Releveling Speed Command (d1-13)*1	Yes	Yes	Yes	Yes	6-18
83	Leveling Speed Command (d1-17)*1	Yes	Yes	Yes	Yes	6-18
84	Inspection Run Command (d1-14)	Yes	Yes	Yes	Yes	6-14
85	Battery Operation Command *2	Yes	Yes	Yes	Yes	6-101
86	Magnetic Contactor Answer Back Signal	Yes	Yes	Yes	Yes	6-18 6-72
87	High Speed Limit Switch (UP)	Yes	Yes	Yes	Yes	6-34
88	High Speed Limit Switch (Down)	Yes	Yes	Yes	Yes	6-34

* 1. Selection not possible when d1-18 = 0.
* 2. Battery-powered operation is not available if using a permanent magnet motor with an option card other than a PG-F2 option card.

■ Multi-function Contact Outputs: H2

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register	Page
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	40BH	6-73
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	40CH	6-73
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	40DH	6-73

Multi-function Contact Output Functions

Setting Value	Function	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	Page
0	During run 1 (ON: Run Command is ON or voltage is being output)	Yes	Yes	Yes	Yes	6-73
1	Zero-speed	Yes	Yes	Yes	Yes	6-74
2	f_{ref}/f_{out} agree 1 (detection width L4-02 is used.)	Yes	Yes	Yes	Yes	6-32
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	6-32
4	Frequency detection 1 (ON: +L4-01 ≥ output frequency ≥ -L4-01, with detection width L4-02 used)	Yes	Yes	Yes	Yes	6-32
5	Frequency detection 2 (ON: Output frequency ≥ +L4-01 or output frequency ≤ -L4-01, with detection width L4-02 used)	Yes	Yes	Yes	Yes	6-32
6	Inverter operation ready; READY: After initialization or no faults	Yes	Yes	Yes	Yes	6-74
7	During DC bus undervoltage (UV) detection	Yes	Yes	Yes	Yes	6-74
8	During baseblock (NO contact, ON: during baseblock)	Yes	Yes	Yes	Yes	6-74
9	Frequency reference source selection (ON: Frequency reference from Operator)	Yes	Yes	Yes	Yes	6-74
A	Run Command source selection status (ON: Run Command from Operator)	Yes	Yes	Yes	Yes	6-74
B	Car stuck/undertorque detection 1 NO (NO contact, ON: Overtorque/undertorque detection)	Yes	Yes	Yes	Yes	6-55
C	Loss of frequency reference (Effective when 1 is set for L4-05)	Yes	Yes	Yes	Yes	6-53
D	Braking transistor fault	Yes	Yes	Yes	Yes	-
E	Fault (ON: Digital Operator/Monitor communications error or fault other than CPF00 and CPF01 has occurred.)	Yes	Yes	Yes	Yes	6-74
F	Not used. (Set when the terminal is not used.)	-	-	-	-	-
10	Minor fault (ON: Alarm displayed)	Yes	Yes	Yes	Yes	6-74
11	Fault reset command active	Yes	Yes	Yes	Yes	6-74
12	Timer function output	Yes	Yes	Yes	Yes	6-71
13	f_{ref}/f_{set} agree 2 (detection width L4-04 is used)	Yes	Yes	Yes	Yes	6-32
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	6-32

(Continued)

Setting Value	Function	Control Methods				Page
		V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
15	Frequency detection 3 (ON: Output frequency ≤ -L4-03, detection width L4-04 is used)	Yes	Yes	Yes	Yes	6-32
16	Frequency detection 4 (ON: Output frequency ≥ -L4-03, detection width L4-04 is used)	Yes	Yes	Yes	Yes	6-32
17	Car stuck/undertorque detection 1 NC (NC Contact, OFF: Torque detection)	Yes	Yes	Yes	Yes	6-55
18	Car stuck/undertorque detection 2 NO (NO Contact, ON: Torque detection)	Yes	Yes	Yes	Yes	6-55
19	Car stuck/undertorque detection 2 NC (NC Contact, OFF: Torque detection)	Yes	Yes	Yes	Yes	6-55
1A	During reverse run (ON: During reverse run)	Yes	Yes	Yes	Yes	6-75
1B	During baseblock 2 (OFF: During baseblock)	Yes	Yes	Yes	Yes	6-75
1D	During regenerative operation	No	No	Yes	Yes	6-75
1E	Restart enabled (ON: Automatic fault restart enabled)	Yes	Yes	Yes	Yes	-
1F	Motor overload (OL1, including OH3) pre-alarm (ON: 90% or more of the detection level)	Yes	Yes	Yes	Yes	6-61
20	Inverter overheat (OH) pre-alarm (ON: Temperature exceeds L8-02 setting)	Yes	Yes	Yes	Yes	6-64
30	During torque limit (current limit) (ON: During torque limit)	No	Yes	Yes	Yes	6-57
33	Zero-servo end (ON: Zero-Servo completed)	No	No	Yes	Yes	-
37	During run 2 (ON: Frequency output, OFF: Baseblock, DC injection braking, initial excitation, operation stop)	Yes	Yes	Yes	Yes	6-73
38	During cooling fan operation	Yes	Yes	Yes	Yes	-
3C	Magnet Position Detection Complete	No	No	No	Yes	-
3D	Internal Cooling Fan Fault	Yes	Yes	Yes	Yes	6-59
40	Brake Release Command	Yes	Yes	Yes	Yes	6-18
41	Magnetic Contactor Close Command	Yes	Yes	Yes	Yes	6-18
42	Speed detection at deceleration (Door zone)	Yes	Yes	Yes	Yes	6-75
43	Not zero-speed	Yes	Yes	Yes	Yes	6-75
46	Hardware Baseblock 1 ON: Hardware baseblock is not being executed (terminals BB and BB1 are both closed).	Yes	Yes	Yes	Yes	6-5 6-75
47	Hardware Baseblock 2 ON: Hardware baseblock is currently being executed (terminals BB and BB1 are both open).	Yes	Yes	Yes	Yes	6-5 6-75

■Analog Inputs: H3

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
H3-01	AI-14B Channel 1 signal level selection AI-14 CH1 LvlSel	Selects the input signal level of Channel 1 if an AI-14B option card is installed. 0: 0 to +10V 1: -10 to +10V	0 or 1	0	No	A	A	A	A	410H	6-30
H3-02	AI-14B Channel 1 gain AI-14 CH1 Gain	Sets the frequency reference value when 10 V is input as a percentage of the maximum output frequency set in E1-04.	0.0 to 1000.0	100.0%	Yes	A	A	A	A	411H	6-30
H3-03	AI-14B Channel 1 bias AI-14 CH1 Bias	Sets the frequency reference value when 0 V is input as a percentage of the maximum output frequency set in E1-04.	-100.0 to +100.0	0.0%	Yes	A	A	A	A	412H	6-30
H3-04	AI-14B Channel 3 signal level selection AI-14 CH3 LvlSel	Selects the input signal level of Channel 3 if an AI-14B option card is installed. 0: 0 to 10V 1: -10 to +10V	0 or 1	0	No	A	A	A	A	413H	6-30
H3-05	AI-14B Channel 3 function selection AI-14 CH3FuncSel	Selects the function for the channel 3 input if an AI-14B option card is installed. See the table below for the available functions.	2,3,14	2	No	A	A	A	A	414H	6-30
H3-06	AI-14B Channel3 gain AI-14 CH3 Gain	Sets the input level according to the 100% value of the function set in parameter H3-05 when the voltage at channel 3 of the AI-14B option card is 10 V.	0.0 to 1000.0	100.0%	Yes	A	A	A	A	415H	6-30
H3-07	AI-14B Channel 3 Bias AI-14 CH3 Bias	Sets the input level according to the 0% value of the function set in parameter H3-05 when the voltage at channel 3 of the AI-14B option card is 0 V.	-100.0 to +100.0	0.0%	Yes	A	A	A	A	416H	6-30
H3-08	AI-14B Channel 2 signal level selection AI-14 CH2 LvlSel	Selects the input signal level of Channel 2 if an AI-14B option card is installed. 0: 0 to 10V 1: -10 to +10V 2: 4 to 20 mA. If current input is selected, channel 2 must be set to current input by hardware as well. Refer to the AI-14B manual.	0 to 2	0	No	A	A	A	A	417H	6-30
H3-09	AI-14B Channel 2 function selection AI-14 CH2FuncSel	Selects the function for the channel 2 input if an AI-14B option card is installed. See the table below for the available functions.	0 to 1F	3	No	A	A	A	A	418H	6-30
H3-10	AI-14B Channel 2 Gain AI-14 CH2 Gain	Sets the input level according to the 100% value of the function set in parameter H3-09 when the voltage/current at channel 2 of the AI-14B option card is 10V/20mA.	0.0 to 1000.0	100.0%	Yes	A	A	A	A	419H	6-31
H3-11	AI-14B Channel 2 Bias AI-14 CH2 Bias	Sets the input level according to the 0% value of the function set in parameter H3-09 when the voltage/current at channel 2 of the AI-14B option card is 0V/0mA.	-100.0 to +100.0	0.0%	Yes	A	A	A	A	41AH	6-31

5

(Continued)

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register	Page
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
H3-12	Analog input filter time parameter CH1-3 Filter-Time	Sets delay filter time parameter 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	6-31
H3-15	Terminal A1 function selection Terminal A1 Func	Sets the multi-function analog input function for terminal A1. Frequency Reference Torque compensation	0, 1	0	No	No	No	A	A	434H	6-31
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	6-31
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	6-31

Note: H3-01 to H3-11 are displayed if using an A1-14B option card.

H3-05,H3-09 Settings

Setting Value	Function	Contents (100%)	Control Methods				Page
			V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
1F	Analog input not used.	-	Yes	Yes	Yes	Yes	6-61
2	Auxiliary frequency reference (is used as multi speed reference 2)	Maximum output frequency (AI-14B use only)	Yes	Yes	Yes	Yes	6-32
3	Auxiliary frequency reference (is used as multi speed reference 3)	Maximum output frequency (AI-14B use only)	Yes	Yes	Yes	Yes	6-32
14	Torque compensation	Motor’s rated torque	No	No	Yes	Yes	6-32

Note: Can be set only when using an A1-14B option card.

■MEMOBUS Communications: H5

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
H5-01	Slave address Serial Comm Adr	Set the Inverter's slave address.	0 to 20 *	1F	No	A	A	A	A	425H	6-109
H5-02	Communication speed selection Serial Baud Rate	Set the baud rate for 6CN MEMOBUS communications. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps	0 to 4	3	No	A	A	A	A	426H	6-109
H5-03	Communication parity selection Serial Com Sel	Set the parity for 6CN MEMOBUS communications. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0	No	A	A	A	A	427H	6-109
H5-04	Stopping method after communication error Serial Fault Sel	Set the stopping method for communications errors. 0: Deceleration to stop using deceleration time in C1-02 1: Coast to stop 2: Fast stop using deceleration time in C1-09 3: Continue operation	0 to 3	3	No	A	A	A	A	428H	6-109
H5-05	Communication error detection selection Serial Flt Dtct	Set whether or not a communications timeout is to be detected as a communications error. 0: Do not detect. 1: Detect	0,1	1	No	A	A	A	A	429H	6-109
H5-06	Send wait time Transmit WaitTIM	Set the time from the Inverter receiving data to when the Inverter starts to send.	5 to 65	5 ms	No	A	A	A	A	42AH	6-109
H5-07	RTS control ON/OFF RTS Control Sel	Select to enable or disable RTS control. 0: Disabled (RTS is always ON) 1: Enabled (RTS turns ON only when sending)	0,1	1	No	A	A	A	A	42BH	6-109

* If H5-01 is set to zero, then the Inverter will no longer respond to MEMOBUS communications.

5

◆ Protection Function Parameters: L

■Motor Overload: L1

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register	Page
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
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 parameter torque motor protection	0 to 3 0.5 (PM)	1 5 (PM)	No	Q	Q	Q	A	480H	6-60
L1-02	Motor protection time parameter 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	6-61

* Values will change according to parameter o2-09. Values shown here are for when o2-09 is set to 0.

■Power Loss Ridethrough: L2

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register	Page
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
L2-05	Undervoltage detection level PUV Det Level	Sets the DC bus undervoltage (UV) detection level (DC bus voltage).	150 to 210 *	190 VDC *	No	A	A	A	A	489H	-
L2-11	Battery Voltage Volt@batterydr	Sets the battery voltage.	0 to 400 *	0 *	No	A	A	A	A	4CBH	6-101

* These are values for a 200 V class Inverter. Values for a 400 V class Inverter are the double.

■Stall Prevention: L3

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS 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	No	No	48FH	6-28
L3-02	Stall prevention level during accel StallP Accel Lvl	Sets the stall prevention during acceleration operation current level as a percentage of Inverter rated current. Effective when L3-01 is set to 1 or 2. Usually changing this setting is not necessary. Reduce the setting when the motor stalls.	0 to 200	150%	No	A	A	No	No	490H	6-28
L3-03	Stall prevention limit during accel StallP CHP Lvl	Sets the lower limit for stall prevention during acceleration, as a percentage of the Inverter rated current, when operation is in the frequency range above E1-06. Usually setting is not necessary.	0 to 100	50%	No	A	A	No	No	491H	-
L3-04	Stall prevention selection during decel StallP Decel Sel	0: Disabled (Deceleration as set. If deceleration time is too short, a main circuit overvoltage may result.) 1: Enabled (Deceleration is stopped when the main circuit voltage exceeds the overvoltage level. Deceleration restarts when voltage is returned.) 2: Intelligent deceleration mode (Deceleration rate is automatically adjusted so that the Inverter can decelerate in the shortest possible time. Set deceleration time is disregarded.) 3: Enabled (with Braking Resistor Unit) When a braking option (braking resistor, Braking Resistor Unit, Braking Unit) is used, always set to 0 or 3.	0 to 3 *	0	No	A	A	A	No	492H	-
L3-05	Stall prevention selection during running StallP Run Sel	Selects the stall prevention during running. 0: Disabled (Runs as set. With a heavy load, the motor may stall.) 1: Deceleration using deceleration time 1 (C1-02.) 2: Deceleration using deceleration time 2 (C1-04.)	0 to 2	1	No	A	No	No	No	493H	6-52

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Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
L3-06	Stall prevention level during running StallP Run Level	Set the stall prevention during running operation current level as a percentage of the Inverter rated current. Effective when L3-05 is 1 or 2. Usually changing this setting is not necessary. Reduce the setting when the motor stalls.	30 to 200	150%	No	A	No	No	No	494H	6-52

* Setting range changes to 0, 1, and 2 when operating in closed-loop vector control.

■Reference Detection: L4

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	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 0.0 to 100.0 (PM)	0.0 Hz 0.0% (PM)	No	A	A	A	A	499H	6-32
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 0.0 to 40.0 (PM)	2.0 Hz 4.0% (PM)	No	A	A	A	A	49AH	6-32
L4-03	Speed agreement detection level (+/-) Spd Agree Lvl+-	Effective when "f_{out}/f_{set} agree 2", "Frequency detection 3" or "Frequency detection 4" is set for a multi-function output.	-120.0 to +120.0 -100.0 to 100.0 (PM)	0.0 Hz 0.0% (PM)	No	A	A	A	A	49BH	6-32
L4-04	Speed agreement detection width (+/-) Spd Agree Wdth+-	Effective when "f_{ref}/f_{out} agree 2" "f_{out}/f_{set} agree 2", "Frequency detection 3" or "Frequency detection 4" is set for a multi-function output.	0.0 to 20.0 0.0 to 40.0 (PM)	2.0 Hz 4.0% (PM)	No	A	A	A	A	49CH	6-32
L4-05	Operation when frequency reference is missing Ref Loss Sel	0: Stop (Operation follows the frequency reference.) 1: Operation at 80% speed continues. (At 80% of speed before the frequency reference was lost) Frequency reference is lost: Frequency reference dropped over 90% in 400 ms.	0,1	0	No	A	A	A	A	49DH	6-53
L4-06	Frequency reference at frequency reference loss Fref at Floss	If the frequency reference loss function is enabled (L4-05=1) when the frequency reference gets lost, the Inverter will run at a reduced frequency reference determined by the following formula: Fref = Fref at time of loss × L4-06.	0.0 to 100.0%	80.0%	No	A	A	A	A	4C2H	6-53

5

■Fault Restart: L5

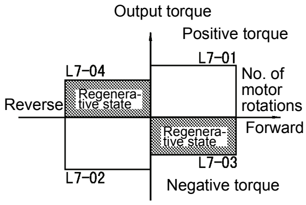
Param-eter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Regis-ter	Page
L5-01	Number of auto restart attempts Num of Restarts	Sets the number of auto restart attempts. Automatically restarts after a fault The retry fault code are the followings OV, GF, OC, OL2, OL3, OL4, UL3, UL4, PF, LF, SE1, SE2, SE3	0 to 10	2	No	A	A	A	A	49EH	6-105
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, 1	1	No	A	A	A	A	49FH	6-105
L5-03	Fault restart interval time Retry time	Sets the interval time between fault restarts.	0.5 to 180.0	2.0 s	No	A	A	A	A	4AOH	6-105
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	0,1	0	No	A	A	A	A	4CCH	6-106

5

■Torque Detection: L6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	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	6-54
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	6-54
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	6-54
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	6-54
L6-05	Torque detection level 2 Torq Det 2 Lvl		0 to 300	150%	No	A	A	A	A	4A5H	6-54
L6-06	Torque detection time 2 Torq Det 2 Time		0.0 to 10.0	0.1 s	No	A	A	A	A	4A6H	6-54

■Torque Limits: L7

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
L7-01	Forward drive torque limit	Torq Limit Fwd	Sets the torque limit value as a percentage of the motor rated torque. Four individual regions can be set. 	0 to 300	200%	No	No	A	A	A	4A7H	6-57
L7-02	Reverse drive torque limit	Torq Limit Rev				No	No	A	A	A	4A8H	6-57
L7-03	Forward regenerative torque limit	Torq Lmt Fwd Rgn				No	No	A	A	A	4A9H	6-57
L7-04	Reverse regenerative torque limit	Torq Lmt Rev Rgn				No	No	A	A	A	4AAH	6-57
L7-06	Torque limit time parameter	Torque Limit Time	Sets the torque limit integration time parameter	5 to 10000	200 ms	No	No	A	No	A	4ACH	6-57
L7-07	Torque Limit Operation during accel/decel	Torque Limit Sel	Sets the torque limit operation during acceleration and deceleration. 0: P-control (I control is added at parameter 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, 1	0	No	No	A	No	A	4C9H	6-57

■Hardware Protection: L8

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	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 heatsink temperature reaches the set value.	50 to 130	75°C*1	No	A	A	A	A	4AEH	6-64

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(Continued)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
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	6-64
L8-05 *2	Input open-phase protection selection Ph Loss In Sel	0: Disabled 1: Enabled (Detects if input current open-phase, power supply voltage imbalance or main circuit electrostatic capacitor deterioration occurs.)	0 or 1	1	No	A	A	A	A	4B1H	-
L8-07	Output open-phase protection 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	6-65
L8-09	Ground fault detection selection Ground Fault Sel	0: Disabled 1: Enabled	0, 1	1	No	A	A	A	A	4B5H	6-65
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, 1	0	No	A	A	A	A	4B6H	6-66
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	6-66
L8-12	Ambient temperature Ambient Temp	Sets the ambient temperature.	45 to 60	45 °C	No	A	A	A	A	4B8H	6-67
L8-18	Soft CLA selection Soft CLA Sel	0: Disabled 1: Enabled	0, 1	1	No	A	A	A	A	4BEH	-
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	0.2 s	No	A	A	A	A	4C0H	6-65

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(Continued)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
L8-32	OH1 detection during cooling fan failure / OH1 Detect Sel	0: Alarm triggered if the internal cooling fan fails. 1: Fault situation detected if the cooling fan fails.	0,1	1	No	A	A	A	A	4E2H	6-58

* 1. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter of 3.7 kW are given.
* 2. Applicable for L7-Series Inverters with software versions PRG: 2012 or later.

◆ N: Special Adjustments

■Automatic Frequency Regulator: N2

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	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	No	A	No	No	584H	6-46
N2-02	Speed feedback detection control (AFR) time parameter / AFR Time	This parameter determines the rate of change for speed feedback detection.	0 to 2000	50 ms	No	No	A	No	No	585H	6-46
N2-03	Speed feedback detection control (AFR) time parameter 2 / AFR Time 2	Increase the setting if overvoltage (OV) failures occur at the completion of acceleration or when the load changes radically.	0 to 2000	750 ms	No	No	A	No	No	586H	6-46

■Feed Forward: N5

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
N5-01	Feed forward control selection / Feedfoward Sel	Enables or disables the feed forward control. 0: Disabled 1: Enabled	0, 1	0	No	No	No	A	A	5B0H	6-47

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Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
N5-02	Motor acceleration time Motor Accel Time	Set the time required to accelerate the motor at the rated torque (T_{100}) to the rated speed (Nr). J: $GD^2/4$, P: Motor rated output $t_a = \frac{2\pi \cdot J\,[kgm^2]\,N_r \cdot [min^{-1}]}{60 \cdot T_{100}\,[Nm]}$ However, $t_{100} = \frac{60}{2\pi} \cdot \frac{P\,[kW]}{Nr\,[min^{-1}]} \cdot 10^3\,[Nm]$	0.001 to 60.000	0.154 s *	No	No	No	A	A	5B1H	6-47
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	No	No	A	A	5B2H	6-47

* The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

■Startup Current: N8

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
N8-01	Initial magnetic polarity estimation current MagPos Srch Curr	Determines the current for estimating the initial magnetic polarity. Set as a percentage of the motor rated torque (E5-03). Usually setting is not necessary. If the motor nameplate includes a value for Si, then that value should be entered to this parameter.	0 to 100	75%	No	No	No	No	Q	540H	-
N8-35	Magnet position detection method Mag det sel	Sets the magnet position detection method. 0: Magnet position detection method 1 2: Magnet position detection method 2 4: HIPERFACE® method 5: EnDat method	0,2,4,5	2	No	No	No	No	Q	562H	-
N8-36	Magnet position detection method 2 frequency Inj freq	Sets the frequency for magnet position detection method 2.	0 to 1000	500 Hz	No	No	No	No	A	563H	-
N8-37	Magnet position detection method 2 current level Inj cur lvl	Sets the amount of current for magnet position detection method 2 as a percentage of the motor rated current.	0.1 to 99.9	30.0%	No	No	No	No	A	564H	-
N8-39	Low pass filter cut-off frequency for magnet position detection method 2 LPF cutoff freq	Sets the low pass filter cut-off frequency for magnet position detection method 2.	0 to 999	50 Hz	No	No	No	No	A	566H	-

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
N8-46	Inductance measurement current level Induct Meas Lev	Sets the current which is used for the inductance measurement during stationary autotuning. The value is set in % of the motor rated current.	0.0 to 99.9	10.0%	No	No	No	No	A	56DH	-

■Factory-set Parameter: N9

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	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	0.0 µs	No	No	No	No	A	64DH	6-43
N9-74 *	Leakage current reduction selection Leak Cur Dec Sel	Selects whether to reduce the leakage current. If some carrier frequencies cause vibration due to leakage current, enable this function. 0: Disabled 1: Enabled	0 or 1	0	No	No	No	No	A	65BH	-

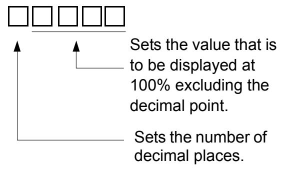
* Applicable for L7-Series Inverters with software versions PRG: 2012 or later.

5

◆ Digital Operator/LED Monitor Parameters: o

■Monitor Selections: o1

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
o1-01	Monitor selection User Monitor Sel	Selects which monitor will be displayed in the operation menu upon power-up when o1-02 is set to 4.	4 to 99	6	Yes	A	A	A	A	500H	6-85
o1-02	Monitor selection after power up Power-On Monitor	Sets the monitor item to be displayed when the power is turned on. 0: Frequency reference 1: Output frequency 2: Output current 3: The monitor item set for o1-01	1 to 4	1	Yes	A	A	A	A	501H	6-85

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register	Page
o1-03	Frequency units of reference setting and monitor	Display Scaling	Sets the units that will be set and displayed for the frequency reference and frequency monitor. 0: 0.01 Hz units 1: 0.01% units (Maximum output frequency is 100%) 2 to 39: min^{-1} units (Set the motor poles.) 40 to 39999: User desired display Set the desired values for setting and display for the max. output frequency.  Example: When the max. output frequency value is 200.0, set 12000	0 to 39999	0 1 (PM)	No	A	A	A	A	502H	6-85
o1-04	Setting unit for frequency parameters related to V/f characteristics	Display Units	Set the setting unit for frequency reference-related parameters. 0: Hz 1: min^{-1}	0, 1	0 1 (PM)	No	No	No	A	A	503H	6-85
o1-05	LCD Display contrast adjustment	LCD Contrast	Sets the contrast on the optional LCD operator (JVOP-160). 0: light 2: 3:normal 4: 5:dark	0 to 5	3	Yes	A	A	A	A	504H	6-85

■Digital Operator/LED Monitor Functions: o2

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	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, 1	0	No	A	A	A	A	505H	6-87
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, 1	0	No	A	A	A	A	506H	6-86

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(Continued)

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register	Page
o2-03	Parameter initial value / User Defaults	Clears or stores user initial values. 0: Stores/not set 1: Begins storing (Records the set parameters as user initial values.) 2: All clear (Clears all recorded user initial values) When the set parameters are recorded as user initial values, 1110 will be set in A1-03.	0 to 2	0	No	A	A	A	A	507H	6-86
o2-04	kVA selection / Inverter Model #	(Do not set this parameter.)	0 to FF	4*	No	A	A	A	A	508H	6-86
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, 1	0	No	A	A	A	A	509H	6-86
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, 1	0	No	A	A	A	A	50AH	6-86
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	6-86
o2-08	Cumulative operation time selection / Elapsed Time Run	0: Accumulated Inverter power on time. 1: Accumulated Inverter run time.	0, 1	1	No	A	A	A	A	50CH	6-86
o2-09	Initialize Mode / InitModeSet	0: Japanese specification 1: American specification 2: European specification	0 to 2	0	No	A	A	A	A	50DH	6-86
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	6-86
o2-12	Fault trace initialize / Fault Trace Init	0: No initialisation 0: Initialize (= zero clear) after setting “1” o2-12 will be returned to “0”	0, 1	0	No	A	A	A	A	510H	6-86
o2-15	Number of Travels counter initialize / Initialize Sel	Operation counter initialize. 0: Number of travels counter is kept 1: Number of travels counter monitor clear	0, 1	0	No	A	A	A	A	513H	6-87

* The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

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■ Copy Function: o3

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS 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	6-89
o3-02	Read permission selection / Read Allowable	0: READ prohibited 1: READ permitted	0, 1	0	No	A	A	A	A	516H	6-89

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◆ Elevator Function Parameters: S

■Brake Sequence: S1

Param-eter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Regis-ter	Page
S1-01	Zero speed level at stop ZeroSpeed@stop	Sets the speed level at which the DC injection/zero speed operation starts during stop. If S1-01 < E1-09, the DC injection/zero speed operation starts from E1-09. For closed-loop vector control, the zero-servo starts from S1-01.	0.0 to 10.0	1.2 Hz *1	No	A	A	A	A	680H	6-15
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. DC excitation current in closed-loop vector control changes according to E2-03 setting.	0 to 100	50%	No	A	A	No	No	681H	6-15
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. DC excitation current in closed-loop vector control changes according to E2-03 setting.	0 to 100	50%	No	A	A	No	No	682H	6-15
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 *1	No	A	A	A	A	683H	6-15
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	6-16
S1-06	Brake release delay time Brake open delay	Sets the time delay from the brake release 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	6-16
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	6-16
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)	200 ms	No	A	A	A	No	68DH	6-16 6-62

(Continued)

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
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	200 ms	No	A	A	A	No	68EH	6-16 6-62
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	0.10 s	No	A	A	A	A	68FH	6-16
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	No	A	No	No	690H	6-16
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	No	A	No	No	691H	6-16
S1-19	Magnetic contactor open delay time Cont open delay	Sets the magnetic contactor control output delay time after stop.	0.00 to 1.00	0.10 s	No	A	A	A	A	692H	6-16
S1-20	Zero-servo gain Zero-servo Gain	Adjust the strength of the zero-servo lock. When closed-loop vector control is selected, a position control loop is created at start and stop. Increasing the zero-servo gain increases the strength of the lock. Increasing this too much may induce oscillation.	0 to 100	5	No	No	No	A	A	693H	6-17
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	No	No	A	A	694H	6-17
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. Enabled when Torque compensation is assigned for one of the multi-function analog inputs.	0 to 5000	500 ms	No	No	No	A	A	695H	6-17

(Continued)

Param-eter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Regis-ter	Page
S1-23	Torque compensation gain during lowering / TorqComp-gain@low	Sets the torque compensation gain at lowering in 0.001 seconds units when the torque compensation at start function is used.	0.500 to 10.000	1.000	No	No	No	A	A	696H	6-17
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	No	No	A	A	697H	6-17
S1-25	Torque compensation bias during lowering / TorqComp-Bias@red	Sets the torque compensation bias at lowering as a percentage when the torque compensation at start function is used.	-200.0 to +200.0	0.0%	No	No	No	A	A	698H	6-17
S1-26	Dwell speed reference / DWELL speed	Hold speed reference when the load is heavy.The frequency reference follows the C1-07 acceleration 4 setting time. Acceleration time will be changed when the motor speed exceeds the C1-11 setting frequency.	0.0 to 120.0	0.0 Hz	No	A	A	A	A	699H	6-17 6-24
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 multi-function output is set for the “Door zone” signal (H2-☐☐=42), this output will be closed.	0.0 to 120.0	0.0 Hz	No	A	A	A	A	69AH	6-17
S1-28	SE1 Selection / SE1 Selection	0: SE1 can be reset when stopped. 1: SE1 is automatically reset when stopped. 2: SE1 is not detected at any time.	0 to 2	0	No	A	A	A	A	69BH	6-18
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 to 1000	0 ms	No	No	No	No	A	69EH	6-18
S1-33 *2	Zero-servo gain 2 / ZeroSrvGain2	Adjust the strength of the position control loop at start. Increasing zero-servo gain 2 increases the strength of the lock. Increasing this too much may induce oscillation. When 0.00 is set or the starting torque compensation is enabled, this function is disabled.	0.00 to 30.00	0.00	No	No	No	No	A	6A0H	6-18

* 1. The factory settings will change when the control method is changed. V/f control factory settings are given.
* 2. Applicable for L7-Series Inverters with software versions PRG: 2013 or later.

5

■Slip Compensation: S2

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register	Page
S2-01	Motor rated speed Rated min^{-1}	Sets the motor rated speed.	300 to 1800	1380 min^{-1}	No	A	No	No	No	6AEH	6-48
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.	0.00 to 5.00	0.70	Yes	A	A	No	No	6AFH	6-48
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.	0.00 to 5.00	1.00	Yes	A	A	No	No	6B0H	6-48
S2-07	Slip compensation delay time SlipCompDelay T	Sets the Slip compensation delay time.	0 to 10000	200 ms	No	No	A	No	No	6B4H	6-49
S2-15	Slip compensation selection during regeneration slip comp @gene	0: Disabled. 1: Enabled. When the slip compensation during regeneration function has been activated, as regeneration capacity increases momentarily, it may be necessary to use a braking option (braking resistor, Braking Resistor Unit or Braking Unit.)	0,1	1	No	A	A	No	No	6BCH	-

5

■Special Sequence Functions: S3

Param-eter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Regis-ter	Page
S3-01	Short-floor function selection Short floor sel	Enables or disables the short floor operation function 0: disabled 1: enabled	0, 1	0	No	A	A	A	A	6BDH	6-21
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	0,1	0	No	No	No	No	A	6C4H	6-51
S3-09	Frequency reference loss fault detection FRL selection	Enables or disables the frequency reference loss fault detection. 0: disabled 1: enabled	0, 1	0	No	A	A	A	A	6C5H	-
S3-13	Traction sheave diame-ter Sheave diam-eter	Sets the diameter of the traction sheave.	100 to 2000	400 mm	No	A	A	A	A	6C9H	-
S3-14	Roping Roping ratio	Sets the roping ratio of the elevator. 1: [1: 1] 2: [1: 2]	1,2	2	No	A	A	A	A	6CAH	-
S3-16	Over acceler-ation detec-tion level Over Acc Det Lvl	Sets the maximum car acceleration value. If the acceleration rate is higher than this value, the Inverter trips with an over acceleration fault (DV6).	0.0 to 50.0	1.5	No	No	No	No	A	6CCH	6-67
S3-17	Over acceler-ation deceler-ation time parameter 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	0.050 s	No	No	No	No	A	6CDH	6-67
S3-18	Over acceler-ation detec-tion 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	0,1	0	No	No	No	No	A	6CEH	6-68
S3-23	Distance cal-culation deceleration time gain DEV Det Cond Sel	Sets the conditions for detecting overspeed. 0: Begin watching for overspeed deviation once the speed reference, soft start output (calculated automatically by the Inverter), and motor speed are all the same. 1: Begin watching for overspeed deviation as soon as the speed reference and soft start output agree. 2: Always check to see if an overspeed deviation situation is present.	0 to 2	0 2 (PM)	No	No	No	No	A	6D3H	-
S3-25 *	Factory-set parameter 1 Factory ADJ 1	Factory-set parameter Do not change this setting.	0 or 1	0	No	No	No	A	A	6d5H	-
S3-26 *	Factory-set parameter 2 Factory ADJ 2	Factory-set parameter Do not change this setting.	0 to 9999	0	No	No	No	A	A	6d6H	-

* Applicable for L7-Series Inverters with software versions PRG: 2013 or later.

■Motor Autotuning: T1

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register	Page
T1-01	Autotuning mode selection Tuning Mode Sel	Sets the autotuning mode. 0: Rotational autotuning 1: Stationary autotuning 2: Stationary autotuning for line-to-line resistance only 4: Encoder offset tuning	0 to 2 0.4 (PM)	1* 4 (PM)	No	Yes	Yes	Yes	Yes	701H	6-82
T1-02	Motor output power Mtr Rated Power	Sets the output power of the motor in kilowatts.	0.00 to 650.00	3.70 kW *2	No	Yes	Yes	Yes	No	702H	6-82
T1-03	Motor rated voltage Rated Voltage	Sets the base voltage of the motor.	0 to 255.0 *3	190.0 V *3	No	No	Yes	Yes	No	703H	6-82
T1-04	Motor rated current Rated Current	Sets the base current of the motor.	1.75 to 35.00 *4	14.00 A *2	No	Yes	Yes	Yes	No	704H	6-82
T1-05	Motor rated frequency Rated Frequency	Sets the rated frequency of the motor.	0 to 120.0 *5	60.0 Hz	No	No	Yes	Yes	No	705H	6-82
T1-06	Number of motor poles Number of Poles	Sets the number of motor poles.	2 to 48 poles	4 poles	No	No	Yes	Yes	No	706H	6-82
T1-07	Motor base speed Rated Speed	Sets the base speed of the motor.	0 to 24000	1450 min^{-1}	No	No	Yes	Yes	No	707H	6-82
T1-08	Number of PG pulses PG Pulses/Rev	Sets the number of PG pulses per revolution.	0 to 60000	600 PPR *2	No	No	No	Yes	No	708H	6-82
T1-09	No load current No load current	Sets the no load current of motor.	0.0 to 35.00 *5	4.05 (E2-03)	No	No	Yes	Yes	No	709H	6-82

* 1. Set T1-02 and T1-04 when 2 is set for T1-01. For V/f control a set value 2 is possible only.
* 2. The factory settings depend on the Inverter capacity. The values provided are for a 200 V class Inverter for 3.7 kW and when o2-09 is set to 0.
* 3. These are values for a 200 V class Inverter. Values for a 400 V class Inverter are double.
* 4. The setting range is from 10% to 200% of the Inverter rated output current. The value for a 200 V class Inverter for 0.4 kW is given.
* 5. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

■Permanent magnet motor Autotuning: T2

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register	Page
T2-01	Motor output power Rated power	Sets the output power of the motor in kW.	0.00 to 300.00 *1	3.70 kW *2	No	No	No	No	Yes	730H	-
T2-02	Motor base frequency Base Frequency	Sets the motor base frequency.	0 to 3600	96 min^{-1} *2	No	No	No	No	Yes	731H	-
T2-03	Motor rated voltage Rated Voltage	Sets the rated voltage of the motor.	0.0 to 255.0 *3	200.0 VAC *3	No	No	No	No	Yes	732H	-
T2-04	Motor rated current Rated Current	Sets the rated current of the motor.	0.00 to 200.0 *4	7.00 A *2	No	No	No	No	Yes	733H	-
T2-05	Number of motor poles Number of Poles	Sets the number of motor poles.	4 to 48	32 Pole	No	No	No	No	Yes	734H	-
T2-06	Motor d-axis inductance d-ax inductance	Automatically sets parameter E5-06 after tuning the d-axis inductance setting from the value indicated on the motor nameplate.	0.00 to 300.00	30.20 mH *2	No	No	No	No	Yes	735H	-
T2-08	Motor voltage parameter k_e Voltage parameter	Sets the motor voltage parameter before autotuning.	50.0 to 2000.0	1251 mV s/rad *2	No	No	No	No	Yes	737H	-
T2-09	Number of PG pulses PG Pulses/Rev	Sets the number of PG pulses per revolution.	0 to 8192	8192 PPR	No	No	No	No	Yes	738H	-
T2-10	Motor voltage parameter calculation selection VoltConst-CalcSel	Selects if the voltage parameter is calculated during autotuning or if it has to input manually. 0: Manual input in parameter T2-08 1: Automatic calculation	0,1	1	No	No	No	No	Yes	72FH	-

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

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◆ U: Monitor Parameters

■ 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	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
U1-01	Frequency reference	Frequency Ref	Monitors/sets the frequency reference value.*	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	A	A	A	A	40H
U1-02	Output frequency	Output Freq	Monitors the output frequency.*	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	A	A	A	A	41H
U1-03	Output current	Output Current	Monitors the output current.	10 V: Inverter rated output current (0 to +10 V, absolute value output)	0.1 A	A	A	A	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.*	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	No	A	A	A	44H
U1-06	Output voltage	Output Voltage	Monitors the output voltage reference value.	10 V: 200 VAC (400 VAC) (0 to +10 V output)	0.1 VAC	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 VDC	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

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

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 1	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=0000000 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
U1-11	Output terminal status Output Term Sts	Shows output ON/OFF status. U1-11=000000000 1: Multi-function contact output 1 (M1-M2) is ON 1: Multi-function contact output 2 (M3-M4) is ON 1: Multi-function contact output 3 (M5-M6) is ON (Always 0) 1: Error output (MA/MB-MC) is ON	(Cannot be output.)	-	A	A	A	A	4AH
U1-12	Operation status Int Ctl Sts 1	Inverter operating status. U1-12=00000000 Run 1:Zero-speed 1: Reverse 1: Reset signal input 1: Speed agree 1: Inverter ready 1: Minor fault 1: Major fault	(Cannot be output.)	-	A	A	A	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

(Continued)

Parameter Number	Name: Display	Description	Output Signal Level at Multi-Function Analog Output (AO-option card)	Min. Unit	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
U1-15	Terminal A1 or A1-14B channel 1 input voltage level Term A1 Level	Monitors the input voltage level of the multi-function analog input A1. A value of 100% corresponds to 10V input.*1	10 V: 100% (0 to ± 10 V possible)	0.1%	A	A	A	A	4EH
U1-16	AI-14B channel 2 input voltage level AI-14 Ch2 IptLv1	Monitors the input voltage level of the multi-function analog input AI-14B channel 1. A value of 100% corresponds to 10V/20mA input.*2	10 V/20 mA: 100% (0 to ±10 V possible)	0.1%	A	A	A	A	4FH
U1-17	AI-14B channel 3 input voltage level AI-14 Ch3 IptLv1	Monitors the input voltage level of the multi-function analog input AI-14B channel 3. An input of 10 V corresponds to 100%.*2	10 V: 100% (10 V) (-10 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%	No	A	A	A	52H
U1-20	Frequency reference after soft-starter SFS Output	Monitors the frequency reference after the soft starter. This frequency value does not include compensations, such as slip compensation. The unit is set in o1-03.	10 V: Max. frequency (0 to ± 10 V possible)	0.01 Hz	A	A	A	A	53H
U1-21	ASR input ASR Input	Monitors the input to the speed control loop. The maximum frequency corresponds to 100%.	10 V: Max. frequency (0 to ± 10 V possible)	0.01%	No	No	A	A	54H
U1-22	ASR output ASR output	Monitors the output from the speed control loop. The motor rated secondary current corresponds to 100%.	10 V: Motor rated secondary current (0 to ± 10 V possible)	0.01%	No	No	A	A	55H
U1-25	DI-16H2 input status DI-16 Reference	Monitors the reference value from a DI-16H2 Digital Reference Board. The value will be displayed in binary or BCD depending on user parameter 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 VAC	No	A	A	A	59H

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(Continued)

Parameter Number	Name	Display	Description	Output Signal Level at Multi-Function Analog Output (AO-option card)	Min. Unit	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
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 VAC	No	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 %	No	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 %	No	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.)	-	No	No	A	A	62H
U1-39	MEMOBUS communications error code	Transmit Err	Shows MEMOBUS errors. U1-39=00000000 1: CRC error 1: Data length error Not used 1: Parity error 1: Overrun error 1: Framing error 1: Time out Not used	(Cannot be output.)	-	A	A	A	A	66H
U1-40	Cooling fan operating time	FAN Elapsed Time	Monitors the total operating time of the cooling fan. The time can be set in 02-10.	(Cannot be output.)	1 hr.	A	A	A	A	67H
U1-41	Heatsink Temperature	Actual Fin Temp	Monitors the Inverter heatsink temperature.	10/100°C	1°C	A	A	A	A	68H
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 to 10 V)	0.01%	No	No	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 to 10 V)	0.01%	No	No	A	A	6CH

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(Continued)

Parameter Number	Name / Display	Description	Output Signal Level at Multi-Function Analog Output (AO-option card)	Min. Unit	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register
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 to 10 V)	0.01%	A	A	A	No	71H
U1-51	Max Current during acceleration Max Amp at accel	Monitors the maximum current during acceleration.	10 V: Rated current of motor (0 to +10 V, absolute value output)	0.1 A	A	A	A	A	72H
U1-52	Max Current during deceleration Max Amp at decel	Monitors the maximum current during deceleration.	10 V: Rated current of motor (0 to +10 V, absolute value output)	0.1 A	A	A	A	A	73H
U1-53	Max Current during Top speed Max Amp at top speed	Monitors the maximum current at top speed.	10 V: Rated current of motor (0 to +10 V, absolute value output)	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 to +10 V, absolute value output)	0.1 A	A	A	A	A	75H
U1-55	Operation counter Operation Cnt	Monitors the elevator operation counter. o2-15 can clear this counter.	(Cannot be output.)	times	A	A	A	A	76H
U1-56	AI-14B channel 1 input voltage level AI-14 Ch1 1ptLv1	Monitors the input voltage level of the multi-function analog input AI-14B channel 1. An input of 10 V corresponds to 100%.*2	10 V: 100% (10 V) (-10 to 10 V possible)	0.1%	A	A	A	A	4FH
U1-57	Car acceleration rate Cage accel	Shows the elevator car acceleration rate value. Set the diameter of the traction sheave (S3-13) and the roping ratio (S3-14) correctly.	10V: 9.8 m/s^2 (-10 to 10 V)	0.1	No	No	No	A	78H
U1-74	q-axis motor current reference Iq Reference	Monitors the q-axis current reference.	10 V: Motor rated current	0.1%	No	No	No	A	7C6H
U1-75	d-axis motor current reference Id Reference	Monitors the d-axis current reference.	10 V: Motor rated current	0.1%	No	No	No	A	7C7H
U1-90 *3	Monitor for factory setting Factory ADJ Mon	Monitor for factory setting.	(Cannot be output.)	-	No	No	A	A	720H

* 1. U1-15 is not displayed if an AI-14B option card is mounted.
* 2. U1-16, U1-17, and U1-56 are displayed if an AI-14B option card is mounted.
* 3. Applicable for L7-Series Inverters with software versions PRG: 2013 or later.

■ Fault Trace: U2

Parameter Number	Name / Display	Description	Output Signal Level at Multi-Function Analog Output (AO-option card)	Min. Unit	V/f	Open-loop Vector 1	Closed-loop Vector	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	No	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 VAC	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%	No	No	A	A	89H
U2-11	Input terminal status at fault Input Term Sts	The input terminal status when the last fault occurred. The format is the same as for U1-10.		-	A	A	A	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

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(Continued)

Parameter Number	Name: Display	Description	Output Signal Level at Multi-Function Analog Output (AO-option card)	Min. Unit	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
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
U2-15	Soft Starter Speed Reference at Fault SFS Output	Shows the soft start speed reference when the most recent fault occurred. Setting units depend on parameter o1-03. Displayed in the same way as U1-20.	No output available.	0.01 Hz	No	No	No	A	7E0H
U2-16	q-Axis Current at Fault q-axis Current	Shows the q-axis current when the most recent fault occurred. Setting units depend on parameter o1-03. Displayed in the same way as U1-18.	No output available.	0.10%	No	No	No	A	7E1H
U2-17	d-Axis Current at Fault d-axis Current	Shows the d-axis current when the most recent fault occurred. Setting units depend on parameter o1-03. Displayed in the same way as U1-19.	No output available.	0.10%	No	No	No	A	7E2H

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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 at Multi-Function Analog Output (AO-option card)	Min. Unit	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register
U3-01	Last fault Last Fault	The error content of 1st last fault.		-	A	A	A	A	90H (800H)
U3-02	Second last fault Fault Message 2	The error content of 2nd last fault.		-	A	A	A	A	91H (801H)
U3-03	Third last fault Fault Message 3	The error content of 3rd last fault.		-	A	A	A	A	92H (802H)
U3-04	Fourth last fault Fault Message 4	The error content of 4th last fault.		-	A	A	A	A	93H (803H)
U3-05	Cumulative operation time at fault Elapsed Time 1	The total operating time when the 1st previous fault occurred.		1 hr.	A	A	A	A	94H (80AH)
U3-06	Accumulated time of second fault Elapsed Time 2	The total operating time when the 2nd previous fault occurred.	(Cannot be output.)	1 hr.	A	A	A	A	95H (80BH)
U3-07	Accumulated time of third fault Elapsed Time 3	The total operating time when the 3rd previous fault occurred.		1 hr.	A	A	A	A	96H (80CH)
U3-08	Accumulated time of fourth/oldest fault Elapsed Time 4	The total operating time when the 4th previous fault occurred.		1 hr.	A	A	A	A	97H (80DH)
U3-09 to U3-14	Fifth last to tenth last fault Fault Message 5 to 10	The error content of the 5th to 10th last fault		–	A	A	A	A	804H 805H 806H 807H 808H 809H
U3-15 to U3-20	Accumulated time of fifth to tenth fault Elapsed Time 5 to 10	Total generating time when 5th... 10th previous fault occurred		1hr	A	A	A	A	806H 80FH 810H 811H 812H 813H

IMPORTANT

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

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

Parameter Number	Name / Display	Setting Range	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	Remarks
C3-05	Output voltage limit operation selection Output V limit Sel	0, 1	-	1	1	-	
C4-02	Torque compensation delay time parameter Torq Comp Time	0 to 10000	200 ms	50 ms	-	-	
C5-01	ASR proportional (P) gain 1 ASR P Gain 1	0.00 to 300.00	-	-	40.00	3.00	
C5-02	ASR integral (I) time 1 ASR I Time 1	0.000 to 10.000	-	-	0.500 s	0.300 s	
C5-03	ASR proportional (P) gain 2 ASR P Gain 2	0.00 to 300.00	-	-	20.00	3.00	
C5-06	ASR primary delay time ASR Gain SW Freq	0.000 to 0.500	-	-	0.004	0.020	
C5-07	ASR switching frequency	0.0 to 120.0	-	-	0.0%	2.0%	
	ASR Gain SW Freq	0.0 to 100.0					
C5-09	ASR proportional (P) gain 3 ASR P Gain 3	0.00 to 300.00	-	-	40.00	3.00	
C5-10	ASR integral (I) time 3 ASR I Time 3	0.000 to 10.000	-	-	0.500	0.300	
d1-09	Nominal speed	0.00 to 120.00	50.00 Hz	50.00 Hz	50.00 Hz	-	
	Nomin Speed vn	0.00 to 100.00	-	-	-	100.00%	
d1-14	Inspection speed	0.00 to 120.00	25.00 Hz	25.00 Hz	25.00 Hz	-	
	Inspect Speed vi	0.00 to 100.00	-	-	-	50.00%	
d1-17	Leveling speed	0.00 to 120.00	4.00 Hz	4.00 Hz	4.00 Hz	-	
	Level Speed vl	0.00 to 100.00	-	-	-	8.00%	
E1-04	Max. output frequency (FMAX) Max Frequency	0.0 to 120.0	60.0 Hz *2	60.0 Hz *3	60.0 Hz *3	96 PRM *4	
E1-05	Max. output voltage (VMAX)*1 Max Voltage	0.0 to 255.0 (0.0 to 510.0)	200.0 V *2	200.0 V *3	200.0 V *3	-	
E1-06	Base frequency (FA) Base Frequency	0.0 to 400.0	60.0 Hz *2	60.0 Hz *3	60.0 Hz *3	96 PRM *4	
E1-07	Mid. output frequency (FB) Mid Frequency A	0.0 to 400.0	3.0 Hz *2	3.0 Hz *3	-	-	
E1-08	Mid. output frequency voltage (VC)*1 Mid voltage A	0.0 to 255.0 (0.0 to 510.0)	14.0 V *2	11.0 V *3	-	-	
E1-09	Min. output frequency (FMIN) Min Frequency	0.0 to 400.0	1.5 Hz *2	0.5 Hz *3	0.0 Hz	0 RPM	
E1-10	Min. output frequency voltage (VMIN)*1 Min Voltage	0.0 to 255.0 (0.0 to 510.0)	7.0 V *2	2.0 V *3	-	-	
E1-13	Base voltage (VBASE) Base Voltage	0.0 to 255.0 (0.0 to 510.0)	0.0 V	-	-	200.0 V	

5

(Continued)

Parameter Number	Name / Display	Setting Range	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	Remarks
F1-01	PG parameter	0 to 60000	-	-	600	-	
	PG Pulses/Rev	0 to 8192	-	-	-	8192	
F1-04	Operation selection at speed deviation	0 to 3	-	-	3	1	
	PG Deviation Sel						
F1-05	PG rotation	0, 1	-	-	0	1	
	PG Rotation Sel						
F4-01	Channel 1 monitor selection	1 to 99	2	2	2	5	
	AO Ch1 Select						
L1-01	Motor protection selection	0 to 3	1	1	1	-	
	MOL Fault Select	0, 5	-	-	-	5	
L4-02	Speed agreement detection width	0.0 to 20.0	2.0 Hz	2.0 Hz	2.0 Hz	-	
	Spd Agree Width	0.0 to 40.0	-	-	-	4.0%	
L4-04	Speed agreement detection width (+/-)	0.0 to 20.0	2.0 Hz	2.0 Hz	2.0 Hz	-	
	Spd Agree Wdth+-	0.0 to 40.0	-	-	-	4.0%	
o1-03	Frequency units of reference setting and monitor	0 to 39999	0	0	0	1	
	Display Scaling						
o1-04	Setting unit for frequency parameters related to V/f characteristics	0, 1	-	-	0	1	
	Display Units						
S1-01	Zero speed level at stop	0.0 to 10.0	1.2 Hz	0.5 Hz	0.1 Hz	0.5 Hz	
	ZeroSpeed@stop						

* 1. These are values for a 200 V class Inverter. Values for a 400 V class Inverter are double. (Setting ranges, factory settings)

* 2. These values will change depending on o2-09, Inverter capacity, and the V/f pattern (E1-03). The values provided here are for a 200 V class, 3.7 kW Inverter when o2-09 is set to zero (factory setting), and E1-03 is set to F (factory setting). Refer to *page 5-68, Parameters that change with V/f patterns*.

* 3. The setting values will change depending on o2-09. The values provided are for when o2-09 is set to 0 (factory setting.) Refer to *page 5-68, Parameters that change with V/f patterns*.

* 4. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

◆ Parameters that change with V/f patterns

■For Japanese (o2-09 = 0)

Inverter capacity: 200 V 3.7 to 45 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	60.0	60.0	60.0
E1-05	Max. output voltage (VMAX)	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0
E1-06	Base frequency (FA)	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	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	11.0	0.0
E1-09	Min. output frequency (FMIN)	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	0.0
E1-10	Min. output frequency voltage (VMIN)	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	2.0	0.0

5

Inverter capacity: 200 V 55 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	60.0	60.0	60.0
E1-05	Max. output voltage (VMAX)	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0
E1-06	Base frequency (FA)	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	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	11.0	0.0
E1-09	Min. output frequency (FMIN)	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	0.0
E1-10	Min. output frequency voltage (VMIN)	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	2.0	0.0

Inverter capacity: 400 V 3.7 to 45 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	60.0	60.0	60.0
E1-05	Max. output voltage (VMAX)	V	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
E1-06	Base frequency (FA)	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	V	28.0	28.0	28.0	28.0	70.0	100.0	70.0	100.0	36.0	46.0	36.0	46.0	28.0	28.0	28.0	22.0	0.0
E1-09	Min. output frequency (FMIN)	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	0.0
E1-10	Min. output frequency voltage (VMIN)	V	14.0	14.0	14.0	14.0	12.0	14.0	12.0	14.0	18.0	22.0	18.0	26.0	14.0	14.0	14.0	4.0	0.0

Inverter capacity: 400 V 55 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	60.0	60.0	60.0
E1-05	Max. output voltage (VMAX)	V	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
E1-06	Base frequency (FA)	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	V	24.0	24.0	24.0	24.0	70.0	100.0	70.0	100.0	30.0	40.0	30.0	40.0	24.0	24.0	24.0	22.0	0.0
E1-09	Min. output frequency (FMIN)	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	0.0
E1-10	Min. output frequency voltage (VMIN)	V	12.0	12.0	12.0	12.0	10.0	12.0	10.0	12.0	14.0	18.0	14.0	22.0	12.0	12.0	12.0	4.0	0.0

■For America (o2-09 = 1)

Inverter capacity: 200 V 3.7 to 45 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	60.0	60.0	60.0
E1-05	Max. output voltage (VMAX)	V	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0
E1-06	Base frequency (FA)	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	V	16.1	16.1	16.1	16.1	40.2	57.5	40.2	57.5	20.7	26.4	20.7	26.4	16.1	16.1	16.1	12.6	0.0
E1-09	Min. output frequency (FMIN)	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	0.0
E1-10	Min. output frequency voltage (VMIN)	V	8.0	8.0	8.0	8.0	6.9	8.0	6.9	8.0	10.3	12.6	10.3	14.9	8.0	8.0	8.0	2.3	0.0

Inverter capacity: 200 V 55 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	60.0	60.0	60.0
E1-05	Max. output voltage (VMAX)	V	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0	230.0
E1-06	Base frequency (FA)	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	V	13.8	13.8	13.8	13.8	40.2	57.5	40.2	57.5	17.2	23.0	17.2	23.0	13.8	13.8	13.8	12.6	0.0
E1-09	Min. output frequency (FMIN)	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	0.0
E1-10	Min. output frequency voltage (VMIN)	V	6.9	6.9	6.9	6.9	5.7	6.9	5.7	6.9	8.0	10.3	8.0	12.6	6.9	6.9	6.9	2.3	0.0

Inverter capacity: 400 V 3.7 to 45 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	60.0	60.0	60.0
E1-05	Max. output voltage (VMAX)	V	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0
E1-06	Base frequency (FA)	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	V	32.2	32.2	32.2	32.2	80.5	115.0	80.5	115.0	41.4	52.9	41.4	52.9	32.2	32.2	32.2	25.3	0.0
E1-09	Min. output frequency (FMIN)	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	0.0
E1-10	Min. output frequency voltage (VMIN)	V	16.1	16.1	16.1	16.1	13.8	16.1	13.8	16.1	20.7	25.3	20.7	29.9	16.1	16.1	16.1	4.6	0.0

Inverter capacity: 400 V 55 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	60.0	60.0	60.0
E1-05	Max. output voltage (VMAX)	V	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0	460.0
E1-06	Base frequency (FA)	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	V	27.6	27.6	27.6	27.6	80.5	115.0	80.5	115.0	34.5	46.0	34.5	46.0	27.6	27.6	27.6	25.3	0.0
E1-09	Min. output frequency (FMIN)	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	0.0
E1-10	Min. output frequency voltage (VMIN)	V	13.8	13.8	13.8	13.8	11.5	13.8	11.5	13.8	16.1	20.7	16.1	25.3	13.8	13.8	13.8	4.6	0.0

■For Europe (o2-09 = 2)

Inverter capacity: 200 V 3.7 to 45 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	50.0	50.0	50.0
E1-05	Max. output voltage (VMAX)	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	190.0	190.0	190.0
E1-06	Base frequency (FA)	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	50.0	50.0	50.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	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	18.6	12.5	0.0
E1-09	Min. output frequency (FMIN)	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	0.5	0.3	0.0
E1-10	Min. output frequency voltage (VMIN)	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	9.7	2.5	0.0

Inverter capacity: 200 V 55 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	50.0	50.0	50.0
E1-05	Max. output voltage (VMAX)	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	190.0	190.0	190.0
E1-06	Base frequency (FA)	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	50.0	50.0	50.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	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	16.0	12.5	0.0
E1-09	Min. output frequency (FMIN)	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	0.5	0.3	0.0
E1-10	Min. output frequency voltage (VMIN)	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	8.3	2.5	0.0

Inverter capacity: 400 V 3.7 to 45 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	50.0	50.0	50.0
E1-05	Max. output voltage (VMAX)	V	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	380.0	380.0	380.0
E1-06	Base frequency (FA)	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	50.0	50.0	50.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	V	28.0	28.0	28.0	28.0	70.0	100.0	70.0	100.0	36.0	46.0	36.0	46.0	28.0	28.0	37.3	25.0	0.0
E1-09	Min. output frequency (FMIN)	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	0.5	0.3	0.0
E1-10	Min. output frequency voltage (VMIN)	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	8.3	2.5	0.0

Inverter capacity: 400 V 55 kW

Parameter Number	Name	Unit	Factory Setting															Open-loop Vector 1 Control	Closed-loop Vector Control
E1-03	V/f pattern selection	Hz	0	1	2	3	4	5	6	7	8	9	A	B	C	D	F		
E1-04	Max. output frequency (FMAX)	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	50.0	50.0	50.0
E1-05	Max. output voltage (VMAX)	V	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0	380.0	380.0	380.0
E1-06	Base frequency (FA)	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	50.0	50.0	50.0
E1-07	Mid. output frequency (FB)	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	0.0
E1-08	Mid. output frequency voltage (VB)	V	24.0	24.0	24.0	24.0	70.0	100.0	70.0	100.0	30.0	40.0	30.0	40.0	24.0	24.0	32.0	25.0	0.0
E1-09	Min. output frequency (FMIN)	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	0.5	0.3	0.0
E1-10	Min. output frequency voltage (VMIN)	V	12.0	12.0	12.0	12.0	10.0	12.0	10.0	12.0	14.0	18.0	14.0	22.0	12.0	12.0	16.6	5.0	0.0

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

■200 V Class Inverters

Parameter Number	Name	Unit	Factory Setting				
-	Inverter Capacity	kW	3.7	5.5	7.5	11	15
o2-04	kVA selection	-	4	5	6	7	8
C6-02	Carrier frequency selection	-	3	3	3	3	3
E1-04	Max. output frequency (FMAX)	min^{-1}	96	96	168	168	168
E1-06	Base frequency (FA)	min^{-1}	96	96	168	168	168
E2-01	Motor rated current	A	14.00	19.60	26.60	39.7	53.0
E2-02	Motor rated slip	Hz	2.73	1.50	1.30	1.70	1.60
E2-03	Motor no-load current	A	4.50	5.10	8.00	11.2	15.2
E2-05	Motor line-to-line resistance	W	0.771	0.399	0.288	0.230	0.138
E2-06	Motor leak inductance	%	19.6	18.2	15.5	19.5	17.2
E2-10	Motor iron loss for torque compensation	W	112	172	262	245	272
E5-03	Motor rated current	A	7.00	11.00	14.50	21.0	24.0
E5-05	Motor line-to-line resistance	W	3.86	1.47	1.56	0.63	0.63
E5-06	D-axis inductance	mH	30.2	17.1	12.0	7.0	7.0
E5-07	Q-axis inductance	MH	36.0	24.5	14.6	9.9	9.9
E5-09	Motor voltage parameter	mV s/red	1251	1305	797	835	835
L8-02	Overheat pre-alarm level	°C	75	73	75	80	65
N5-02	Motor acceleration time	s	0.121	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	-	9	A	B	C	D	E
C6-02	Carrier frequency selection	-	3	3	3	2	2	2
E1-04	Max. output frequency (FMAX)	min^{-1}	168	168	168	168	168	168
E1-06	Base frequency (FA)	min^{-1}	168	168	168	168	168	168
E2-01	Motor rated current	A	65.8	77.2	105.0	131.0	160.0	190.0
E2-02	Motor rated slip	Hz	1.67	1.70	1.80	1.33	1.60	1.43
E2-03	Motor no-load current	A	15.7	18.5	21.9	38.2	44.0	45.6
E2-05	Motor line-to-line resistance	W	0.101	0.079	0.064	0.039	0.030	0.022
E2-06	Motor leak inductance	%	20.1	19.5	20.8	18.8	20.2	20.5
E2-10	Motor iron loss for torque compensation	W	505	538	699	823	852	960
E5-03	Motor rated current	A	29.6	35.2	48.0	59.2	72.0	88.0
E5-05	Motor line-to-line resistance	W	0.46	0.36	0.27	0.18	0.15	0.11
E5-06	D-axis inductance	mH	5.67	4.84	3.68	2.59	2.57	2.05
E5-07	Q-axis inductance	MH	8.0	6.83	5.36	3.78	3.73	2.97
E5-09	Motor voltage parameter	mV s/red	835	835	835	835	835	835
L8-02	Overheat pre-alarm level	°C	75	75	70	85	90	80
N5-02	Motor acceleration time	s	0.098	0.096	0.126	0.124	0.188	0.186

■400 V Class Inverters

Parameter Number	Name	Unit	Factory Setting				
-	Inverter Capacity	kW	18.5	22	30	37	45
o2-04	kVA selection	-	9	A	B	C	D
E1-04	Carrier frequency selection	min^{-1}	96	96	168	168	168
E1-06	Max. output frequency (FMAX)	min^{-1}	96	96	168	168	168
E2-02	Base frequency (FA)	Hz	2.70	2.70	1.50	1.30	1.70
E2-03	Motor rated current	A	2.30	2.30	2.60	4.00	5.6
E2-05	Motor rated slip	W	3.333	3.333	1.595	1.152	0.922
E2-06	Motor no-load current	%	19.3	19.3	18.2	15.5	19.6
E2-10	Motor line-to-line resistance	W	130	130	193	263	385
E5-03	Motor leak inductance	A	3.50	3.50	5.50	7.25	10.5
E5-05	Motor iron loss for torque compensation	W	15.44	15.44	5.88	6.24	2.52
E5-06	Motor rated current	mH	120.8	120.8	68.4	48.0	28.0
E5-07	Motor line-to-line resistance	MH	144	144	98	58.4	39.6
E5-09	D-axis inductance	mV s/red	2502	2502	2610	1594	1670
L8-02	Q-axis inductance	°C	90	90	85	90	73
N5-02	Motor voltage parameter	s	0.121	0.081	0.081	0.075	0.082

Parameter Number	Name	Unit	Factory Setting					
-	Inverter Capacity	kW	18.5	22	30	37	45	55
o2-04	kVA selection	-	9	A	B	C	D	E
C6-02	Carrier frequency selection	-	3	3	3	2	2	2
E1-04	Max. output frequency (FMAX)	min^{-1}	168	168	168	168	168	
E1-06	Base frequency (FA)	min^{-1}	168	168	168	168	168	
E2-01	Motor rated current	A	32.9	38.6	52.3	65.6	79.7	95.0
E2-02	Motor rated slip	Hz	1.67	1.70	1.80	1.33	1.60	1.46
E2-03	Motor no-load current	A	7.8	9.2	10.9	19.1	22.0	24.0
E2-05	Motor line-to-line resistance	W	0.403	0.316	0.269	0.155	0.122	0.088
E2-06	Motor leak inductance	%	20.1	23.5	20.7	18.8	19.9	20.0
E2-10	Motor iron loss for torque compensation	W	508	586	750	925	1125	1260
E5-03	Motor rated current	A	14.8	17.6	24.0	29.6	36.0	44.0
E5-05	Motor line-to-line resistance	W	1.84	1.44	1.08	0.72	0.60	0.44
E5-06	D-axis inductance	mH	22.7	19.4	14.7	10.4	10.3	8.2
E5-07	Q-axis inductance	MH	32	27.3	21.4	15.1	14.9	11.9
E5-09	Motor voltage parameter	mV s/red	1670	1670	1670	1670	1670	1670
L8-02	Overheat pre-alarm level	°C	80	80	72	80	82	73
N5-02	Motor acceleration time	s	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 Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register
C6-02	Carrier frequency selection CarrierFreq Sel	Selects the carrier frequency. 1: 2 kHz 2: 5 kHz 3: 8 kHz 4: 10 kHz 5: 12.5 kHz 6: 15 kHz	1 to 6	3 *3	No	A	A	A	No	224H
C6-03	Carrier frequency upper limit CarrierFreq Max	Set the carrier frequency upper limit and lower limit in kHz units. With the vector control method, the upper limit of the carrier frequency is fixed in C6-03.	2.0 to 15.0 *1 *2	8.0 kHz *3	No	A	A	A	No	225H
C6-11	Carrier frequency selection 2 CarrierFreq Sel	1: 2 kHz 2: 4 kHz 3: 6 kHz 4: 8 kHz 5: 12 kHz 6: 15 kHz	1 to 6	4 *3	No	No	No	No	A	22DH

* 1. The setting ranges depend on the Inverter capacity.
* 2. Can only be set when parameter C6-02 is set to 0F.
* 3. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

■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

The Inverter current rating depends on the carrier frequency setting. If the carrier frequency is increased the rated current is decreased and vice versa like shown in *Fig 6.1*.

The overload capability is always 150% of the de- or updated Inverter current for 30 sec. If this over load limit is exceeded the Inverter trips with an Inverter overload fault (OL2).

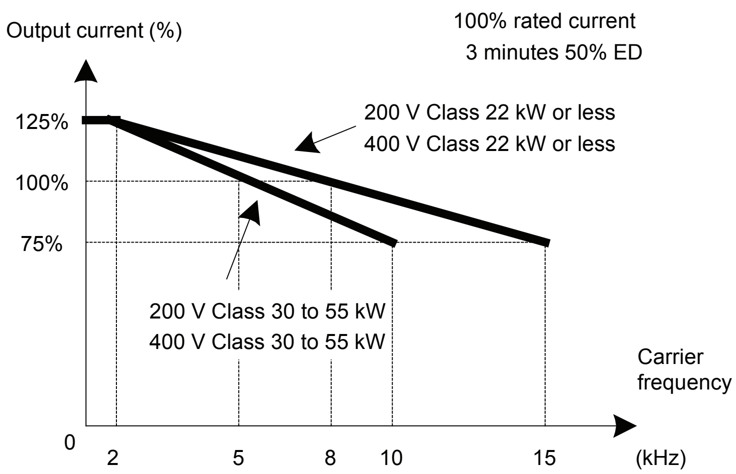


Fig 6.1 Current Rating Depending on the Carrier Frequency

◆ 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.

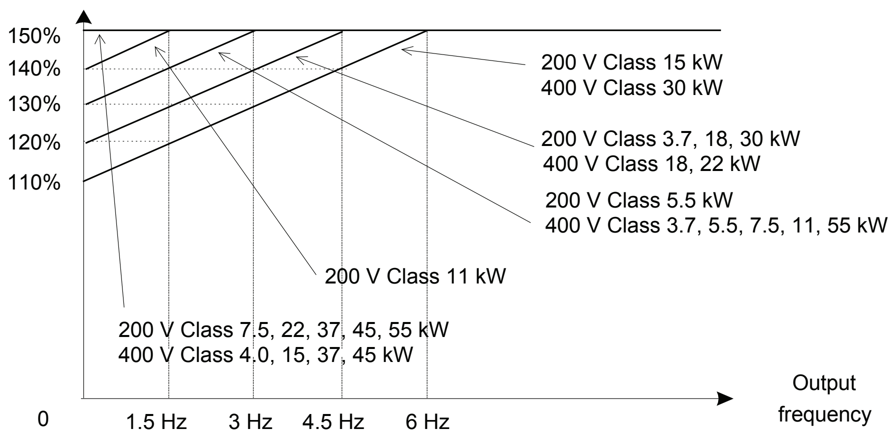


Fig 6.2 Low Frequency Current Limitation

IMPORTANT

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

EN81-1 Compliance

■EN81-1 Conform Wiring with One Motor Magnetic Contactor

In order to use the L7B with one motor magnetic contactor instead of two while keeping compliance to the EN81-1:1998, the following rules have to be followed:

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

Fig 6.3 shows an EN81-1:1998 wiring example.

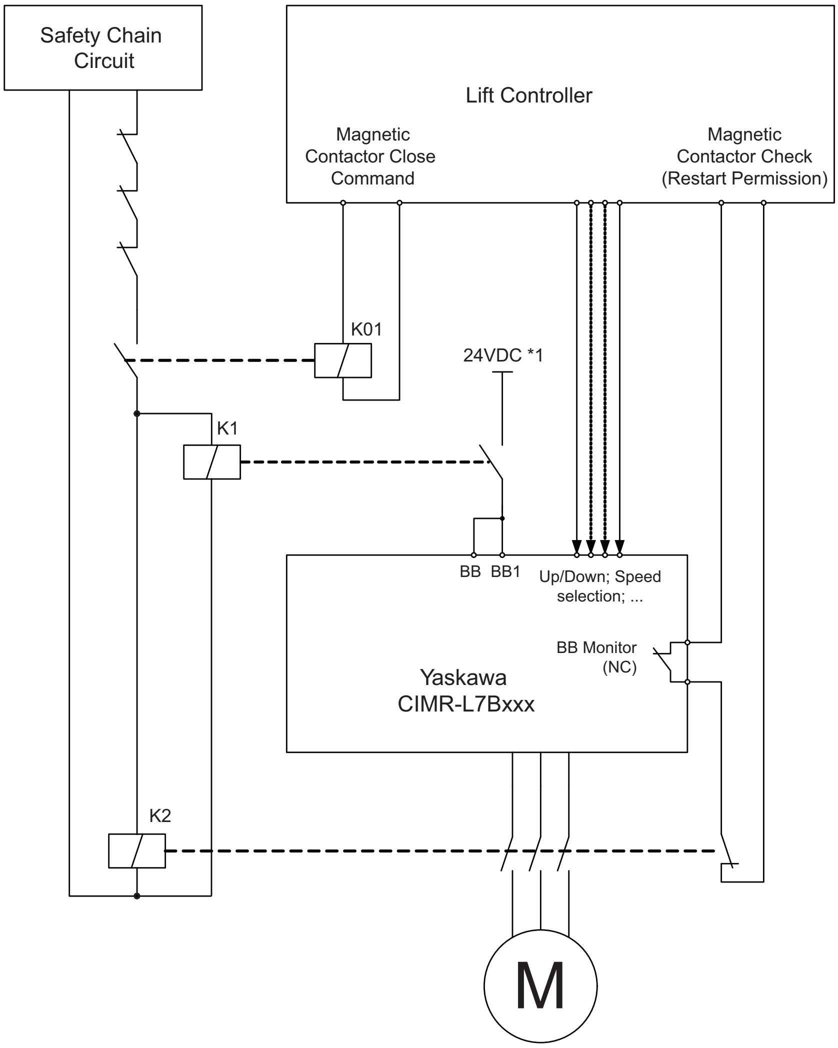


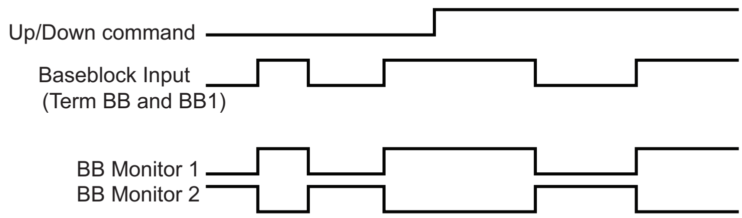
Fig 6.3 EN81-1 Conform Wiring with One Motor Magnetic Contactor (Example)

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

■Baseblock Monitor 1 and 2 (Setting: 46/47)

Setting Value	Function	Control Methods			
		V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
46	Hardware baseblock monitor 1 (ON: terminal BB and BB1 closed)	Yes	Yes	Yes	Yes
47	Hardware baseblock monitor 2 (ON: terminal BB or BB1 off)	Yes	Yes	Yes	Yes

If a multi-function output is programmed for this function, the output is switched if both baseblock inputs (BB and BB1) are enabled.



6

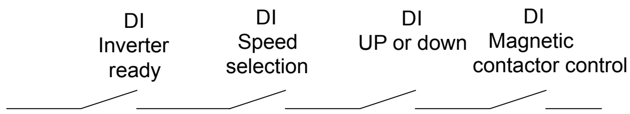
◆ Up and Down Commands

■Travel start in Up or Down direction

UP and Down commands are the travel direction information.

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

- At least one speed reference must be selected.
- The hardware baseblock signal must be set (not baseblock condition).
- When a multi-function contact input is set as magnetic contactor confirmation input, the magnetic 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 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
b1-02	Run Command source selection	Sets the Run Command input method. 0: Digital Operator 1: Control circuit terminal (sequence input) 2: MEMOBUS communications 3: Option card	0 to 3	1	No	A	A	A	A	181H
	Run Source									

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 *Chapter 3 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 Memobus Communications (b1-02=2)

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

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

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

◆ Speed Reference Source Selection

■Speed Reference Source Selection

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

Related Parameters

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

* 1. If d1-18 is set to 1 or 2, an analog reference will have priority over a frequency reference from a multi-function contact input.
* 2. If d1-18 is set to 1 or 2, a frequency reference from a multi-function contact input will be valid even if b1-01 is set to 2 or 3.

Input the Speed Reference from the Multi-function Contact Inputs (b1-01=0)

When b1-01 is set to 0 the speed reference can be selected from preset speeds using the multi-function contact inputs of the Inverter. Refer to *page 6-8, Speed Selection Sequence Using Multi-function Contact Inputs* for details.

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

When b1-01 is set to 1 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 board.
The analog reference signal can also be used as 1st speed if multispeed operation is selected (d1-18=0, refer to *page 6-8, Speed Selection Sequence Using Multi-function Contact 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 multi-function contact inputs except the service speed.

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

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

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

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

◆ Speed Selection Sequence Using Multi-function Contact Inputs

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

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register
d1-18	Speed priority selection SpeedPrioritySel	Speed reference priority selection 0: Use multi-speed reference (d1-01 to d1-08) 1: High speed reference has priority. 2: Leveling speed reference has priority.	0 to 2	0	No	A	A	A	A	2A7H

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

Maximum 8 preset speed steps can be selected using 3 binary coded multi-function contact inputs. The Inverter is started using the Up/Down command. It stops when the Up/Down command is removed.

Related Parameters

Parameter No.	Name	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register
d1-01 to d1-08	Sets the frequency reference	0 to 120.00 *1 *2	0.00 Hz *3	Yes	A *4	A *4	A *4	A *4	280H to 287H

* 1. The maximum setting value depends on the setting of the maximum output frequency (E1-04).
* 2. The setting range becomes 0.00 to 100.00 when using closed-loop vector control (PM).
* 3. The factory setting changes to 0.00% when using closed-loop vector control (PM).
* 4. d1-01 to d1-08 are not displayed if d1-18 is set to 1 or 2. These are changed to H1-01 (80), H1-02 (84), H1-03 (81), H1-04 (83), and H1-05 (F).

6

Multi-function Contact 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

Setting Notes

To set up a 3 step speed sequence using the analog input terminals, follow the directions below.

Speed Step 1

If using analog input terminal A1 to enter the first speed in the sequence, set b1-01 to 1. If using d1-01 (Frequency reference 1) to supply the first speed in the sequence, set b1-01 to 0.

Speed Step 2

Enter the second speed in the sequence to analog input terminal A1-14B CH2 by setting H3-09 to 2 (Auxiliary frequency reference 1).

Speed Step 3

Enter the third speed in the sequence to analog input terminal A1-14B CH3 by setting H3-05 to 3 (Auxiliary frequency reference 2).

Speed Selection Table

The following table shows the combinations of the multi-function contact input and the according speed.

If b1-02 is set to “1”, speed 1 is input as analog reference at terminal A1 or Channel CH1 of an analog input option 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
1	OFF	OFF	OFF	Frequency reference 1 d1-01 or A1/AI-14B CH1
2	ON	OFF	OFF	Frequency reference 2 d1-02 or AI-14B CH2
3	OFF	ON	OFF	Frequency reference 3 d1-03 or AI-14B CH3
4	ON	ON	OFF	Frequency reference 4 d1-04
5	OFF	OFF	ON	Frequency reference 5 d1-05
6	ON	OFF	ON	Frequency reference 6 d1-06
7	OFF	ON	ON	Frequency reference 7 d1-07
8	ON	ON	ON	Frequency reference 8 d1-08

■Multi-Step Speed Operation 2, (Binary Input) (d1-18=3)

Maximum 7 preset speed steps can be selected using 3 binary coded multi-function contact inputs. The Inverter is started using the Up/Down command. It is stopped when the Up/Down command is removed or when all speed selection inputs are removed.

6

Related Parameters

Parame-ter No.	Name	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMO-BUS Register
					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
d1-02 to d1-08	Multi-Step speed 2 to 8 reference value	0 to 120.00 *1 *2	0.00 Hz *3	Yes	A *4	A *4	A *4	A *4	281H to 287H

* 1. The maximum setting value depends on the setting of the maximum output frequency (E1-04).
* 2. The setting range becomes 0.00 to 100.00 when using closed-loop vector control (PM).
* 3. The factory setting changes to 0.00% when using closed-loop vector control (PM).
* 4. d1-01 to d1-08 are not displayed if d1-18 is set to 1 or 2. These are changed to H1-01 (80), H1-02 (84), H1-03 (81), H1-04 (83), and H1-05 (F).

Multi-function Contact 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 multi-function contact input and the according speed.

Analog input A1 or Channel CH1 of an analog input option card AI-14B can not be used as reference input.

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

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

With this setting 6 different speeds can be set and selected using four multi-function contact inputs.

Related Parameters

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register
d1-09	Nominal speed reference	Nomin Speed vn	Sets the frequency reference when the nominal speed is selected by a multi-function contact input.*6	0 to 120.00 *1 *2	50.00 Hz 100.00% (PM)	Yes	Q *4	Q *4	Q *4	Q *4	288H
d1-10	Intermediate speed 1 reference	Interm Speed v1	Sets the frequency reference when the intermediate speed 1 is selected by a multi-function contact input.*6		0.00 Hz *3	Yes	A *4	A *4	A *4	A *4	28BH
d1-11	Intermediate speed 2 reference	Interm Speed v2	Sets the frequency reference when the intermediate speed 2 is selected by a multi-function contact input.*6			Yes	A *4	A *4	A *4	A *4	28CH
d1-12	Intermediate speed 3 reference	Interm Speed v3	Sets the frequency reference when the intermediate speed 3 is selected by a multi-function contact input.*6			Yes	A *4	A *4	A *4	A *4	28DH
d1-13	Releveling speed reference	Relevel Speed vr	Sets the frequency reference when the releveling speed is selected by a multi-function contact input.*6			Yes	A *4	A *4	A *4	A *4	28EH
d1-17 *5	Leveling speed reference	Level Speed vl	Sets the frequency reference when the leveling speed is selected by a multi-function contact input.*6		4.00 Hz 8.00% (PM)	Yes	Q	Q	Q	Q	292H

* 1. The maximum setting value depends on the setting of the maximum output frequency (E1-04).
* 2. The setting range becomes 0.00 to 100.00 when using closed-loop vector control (PM).
* 3. The factory setting changes to 0.00% when using closed-loop vector control (PM).
* 4. d1-09 to d1-13 are not displayed if d1-18 is set to 0. These are changed to H1-01 (24), H1-02 (14), H1-03 (3), H1-04 (4), and H1-05 (6).
* 5. Becomes the jog frequency reference when d1-18 is set to 0.
* 6. Enabled by the combined selection of the nominal speed command, the intermediate speed command, and the releveling speed command.

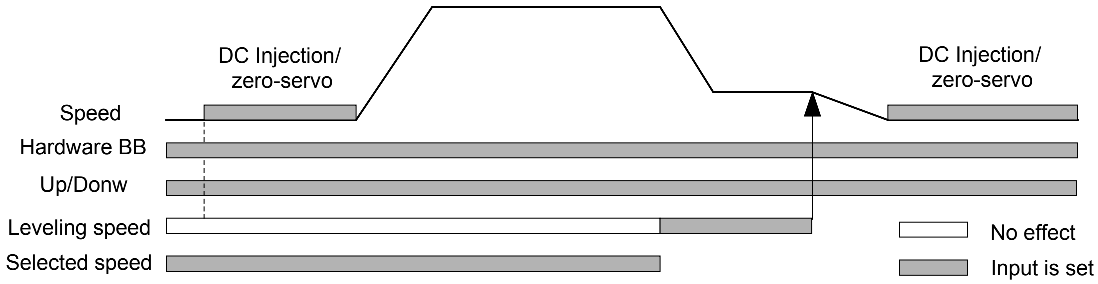
Multi-function Contact Input Factory Settings

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 contact 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. The selected travel speed must be different from leveling speed and inspection speed. The higher speed has priority over the leveling speed, i.e. as long as a higher speed is selected, the leveling signal is disregarded (see the fig. below)

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



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

Terminal function	Nominal Speed d1-09	Intermed. Speed 1 d1-10	Intermed. Speed 2 d1-11	Intermed. Speed 3 d1-12	Relevel. Speed d1-13	Leveling Speed d1-17	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

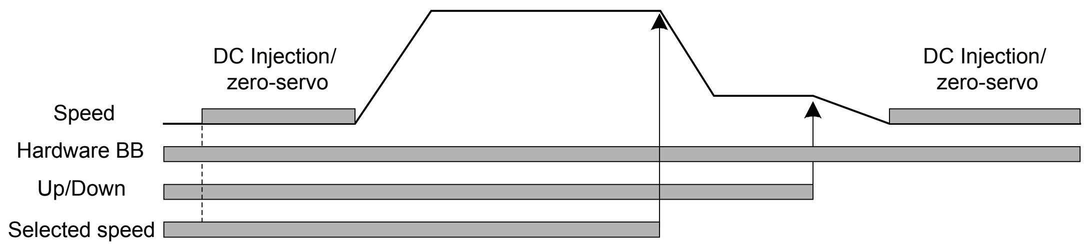
* 0 = disabled, 1 = enabled, X = no meaning

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

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

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

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



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

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

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

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

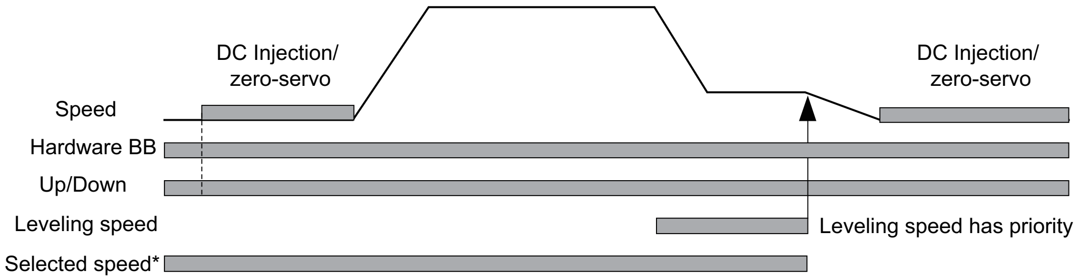
■Separate Speed Selection Inputs, Leveling Speed Has Priority (d1-18=2)

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

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

If d1-18 is set to “2” and one multi-function contact input is set 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 leveling speed and inspection speed.

The Inverter stops when the leveling speed command is removed.



* Indicates the speed selected from the Nominal speed reference, Intermediate speed reference, and the Releveling speed reference.

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

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

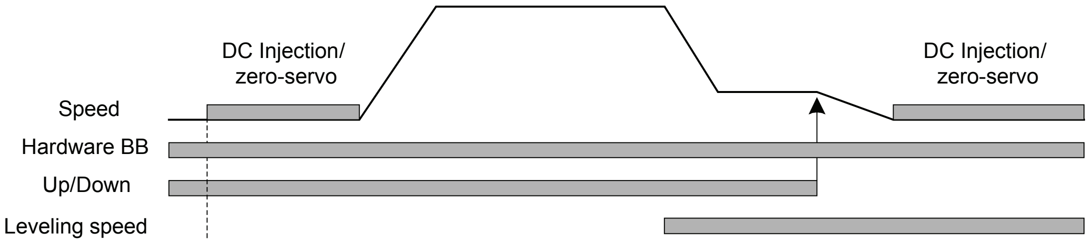
* 0 = disabled, 1 = enabled, X = no meaning

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

If d1-18 is set to “2” and no multi-function contact 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 multi-function contact inputs.

Terminal function	Nominal Speed d1-09	Intermed. Speed 1 d1-10	Intermed. Speed 2 d1-11	Intermed. Speed 3 d1-12	Relevel. Speed d1-13	Leveling Speed d1-17
Nominal Speed command (H1-☐☐=80)	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.

6

◆ Fast Stop

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

After the Fast Stop Command has been input, the operation cannot be restarted until the Inverter has stopped. To cancel the Fast stop, turn OFF the Run Command and Fast Stop Command.

■Related parameters

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
C1-09	Fast stop time Fast Stop Time	Sets the deceleration time when the frequency reference is below the value set in C1-11.	0.00 to 600.00 *	3.00 s	No	A	A	A	A	208H

* The setting ranges for acceleration/deceleration times depend on the setting of C1-10 (Accel/decel time setting unit). If C1-10 is set to 1, the setting range for acceleration/deceleration times becomes 0.0 to 6000.0 seconds.

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

Setting Value	Function	Control Methods			
		V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
15	Fast Stop, NO contact	Yes	Yes	Yes	Yes
17	Fast Stop, NC contact	Yes	Yes	Yes	Yes

◆ Inspection RUN

A multi-function contact input can be used to activate the inspection run. Therefore a inspection speed must be set and any of the multi-function contact inputs must be set to “Inspection Run Selection” (H1-☐☐=84).

■Related parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
d1-14	Inspection speed reference Inspect Speed vi	Sets the frequency reference when the inspection speed is selected by a multi-function contact input.*3	0 to 120.00 *1 *2	25.00 Hz 50.00% (PM)	Yes	Q	Q	Q	Q	28FH

* 1. The maximum setting value depends on the setting of the maximum output frequency (E1-04).
* 2. The setting range becomes 0.00 to 100.00 when using closed-loop vector control (PM).
* 3. Enabled if the Inspection Run Command is set for a multi-function contact input.

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

Setting Value	Function	Control Methods			
		V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
84	Inspection Run Command	Yes	Yes	Yes	Yes

The inspection Run Command 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).

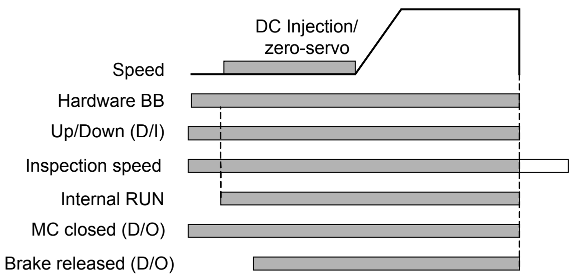
Stop without deceleration ramp

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

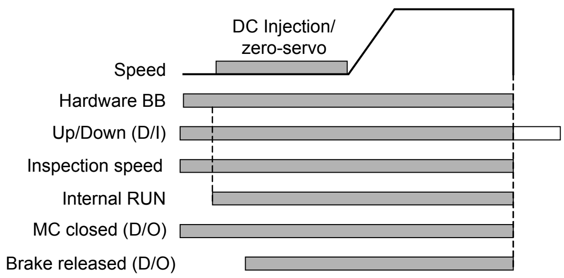
- The Inverter output is cut by baseblock immediately
- The brake open signal is removed immediately
- The magnetic contactor control output is removed immediately

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

Inspection RUN
(Stop by Up/Down signal removal)



Inspection RUN
(Stop by Inspection Speed signal removal)



◆ Brake Sequence

The Inverter 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 Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
							V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
H3-15	Terminal A1 function selection	Terminal A1 Func	Sets the multi-function analog input function for terminal A1. Frequency Reference Torque compensation	0, 1	0	No	No	No	A	A	434H
S1-01	Zero speed level at stop	ZeroSpeed@stop	Sets the speed level at which the DC injection/zero speed operation starts during stop. If S1-01 < E1-09, the DC injection/zero speed operation starts from E1-09. For closed-loop vector control, the zero-servo starts from S1-01.	0.0 to 10.0	1.2 Hz *1	No	A	A	A	A	680H
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. DC excitation current in closed-loop vector control changes according to E2-03 setting.	0 to 100	50%	No	A	A	No	No	681H
S1-03	DC injection braking current at stop	DC Inj I @stop	Sets the DC injection braking current as a percentage of the Inverter rated current. DC excitation current in closed-loop vector control changes according to E2-03 setting.	0 to 100	50%	No	A	A	No	No	682H
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 *1	No	A	A	A	A	683H

6

Parameter Number	Name		Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
	Name	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
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
S1-06	Brake release delay time	Brake open delay	Sets the time delay from the brake release 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
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
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)	200 ms	No	A	A	A	No	68DH
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	200 ms	No	A	A	A	No	68EH
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	0.10 s	No	A	A	A	A	68FH
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	No	A	No	No	690H
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	No	A	No	No	691H
S1-19	Magnetic contactor open delay time	Cont open delay	Sets the magnetic contactor control output delay time after stop.	0.00 to 1.00	0.10 s	No	A	A	A	A	692H

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
S1-20	Zero-servo gain Zero-servo Gain	Adjust the strength of the zero-servo lock. When closed-loop vector control is selected, a position control loop is created at start and stop. Increasing the zero-servo gain increases the strength of the lock. Increasing this too much may induce oscillation.	0 to 100	5	No	No	No	A	A	693H
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	No	No	A	A	694H
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. Enabled when Torque compensation is assigned for one of the multi-function analog inputs.	0 to 5000	500 ms	No	No	No	A	A	695H
S1-23	Torque compensation gain during lowering TorqComp-gain@low	Sets the torque compensation gain at lowering in 0.001 seconds units when the torque compensation at start function is used.	0.500 to 10.000	1.000	No	No	No	A	A	696H
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	No	No	A	A	697H
S1-25	Torque compensation bias during lowering TorqComp-Bias@red	Sets the torque compensation bias at lowering as a percentage when the torque compensation at start function is used.	-200.0 to +200.0	0.0%	No	No	No	A	A	698H
S1-26	Dwell speed reference DWELL speed	Hold speed reference when the load is heavy.The frequency reference follows the C1-07 acceleration 4 setting time. Acceleration time will be changed when the motor speed exceeds the C1-11 setting frequency.	0.0 to 120.0	0.0 Hz	No	A	A	A	A	699H
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 multi-function output is set for the “Door zone” signal (H2-☐☐=42), this output will be closed.	0.0 to 120.0	0.0 Hz	No	A	A	A	A	69AH

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
S1-28	SE1 Selection SE1 Selection	0: SE1 can be reset when stopped. 1: SE1 is automatically reset when stopped. 2: SE1 is not detected at any time.	0 to 2	0	No	A	A	A	A	69BH
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 to 1000	0 ms	No	No	No	No	A	69EH
S1-33 *2	Zero-servo gain 2 ZeroSrvGain2	Adjust the strength of the position control loop at start. Increasing zero-servo gain 2 increases the strength of the lock. Increasing this too much may induce oscillation. When 0.00 is set or the starting torque compensation is enabled, this function is disabled.	0.00 to 30.00	0.00	No	No	No	No	A	6A0H

* 1. The factory settings will change when the control method is changed. V/f control factory settings are given.
* 2. Applicable for L7-Series Inverters with software versions PRG: 2013 or later.

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

Setting Value	Function	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
80 to 83	Speed selection inputs (refer to *page 6-8, Speed Selection Sequence Using Multi-function Contact Inputs*)*	Yes	Yes	Yes	Yes
86	Magnetic contactor answer back signal	Yes	Yes	Yes	Yes

* Selection not possible when d1-18 = 0.

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

Setting Value	Function	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector 1	Closed-loop Vector (PM)
40	Brake release command	Yes	Yes	Yes	Yes
41	Magnetic 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.

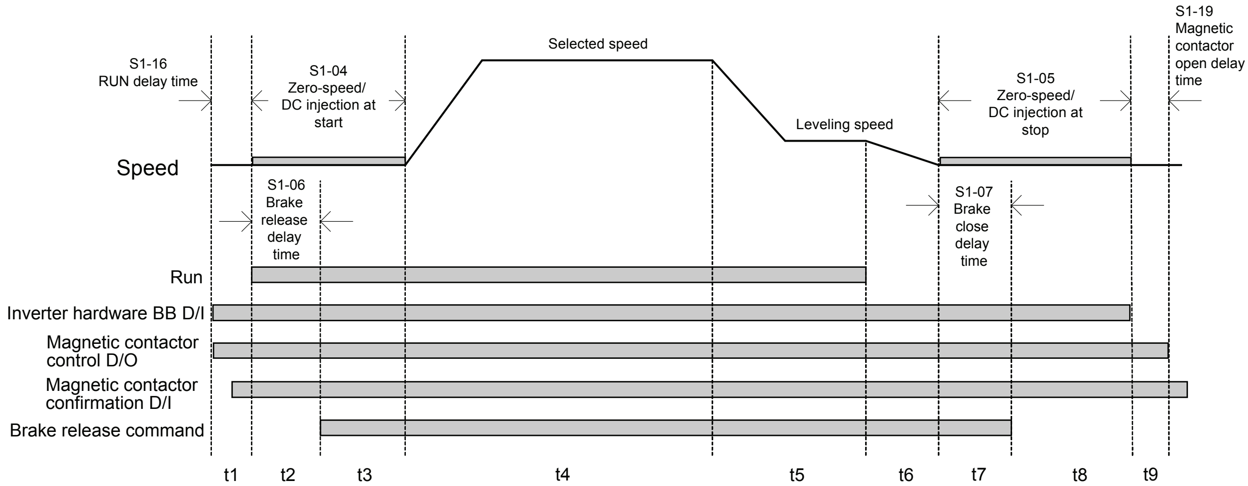


Fig 6.4 Timing Chart of Brake Sequence Without Torque Compensation at Start

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

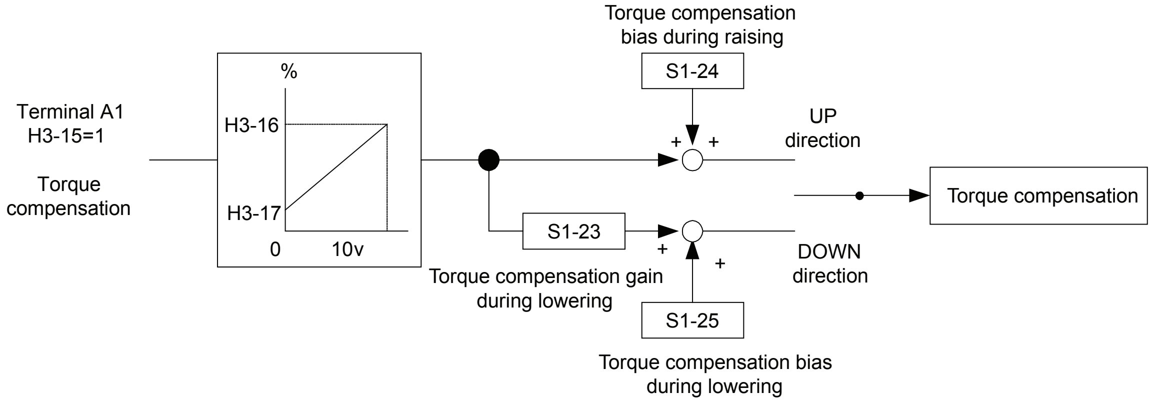
Timing	Description
t1	The Inverter gets the direction signal (UP/DOWN) The Inverter gets the hardware baseblock disable signal (Not BB condition). The Inverter receives the speed reference signal. The Inverter sets the magnetic contactor closed signal. The Inverter waits for the magnetic contactor confirmation signal. If no multi-function contact input is set to magnetic 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-speed operation (Closed Loop) is started. When the brake open delay time (S1-06) has elapsed, the Inverter sets the brake release 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 avoid this setting since the motor could be driven against the brake)
t4	The speed is increased to the selected speed and is kept parameter until the leveling speed is selected.
t5	The speed is decreased to the leveling speed and is kept parameter 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 6-8, Speed Selection Sequence Using Multi-function Contact Inputs*)
6	The speed is decreased to the zero-speed level.
t7	When the zero-speed level is reached, the DC injection (Open Loop) or zero-speed operation (Closed Loop) is applied for the time set in S1-05. When the brake close delay time (S1-07) has elapsed, the brake release 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 baseblock signal must be set.
t9	After the magnetic contactor open delay time (S1-19) has elapsed, the magnetic contactor close signal is removed.

6

■Brake Sequence with torque compensation at start (closed-loop vector control required)

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.
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 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.

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

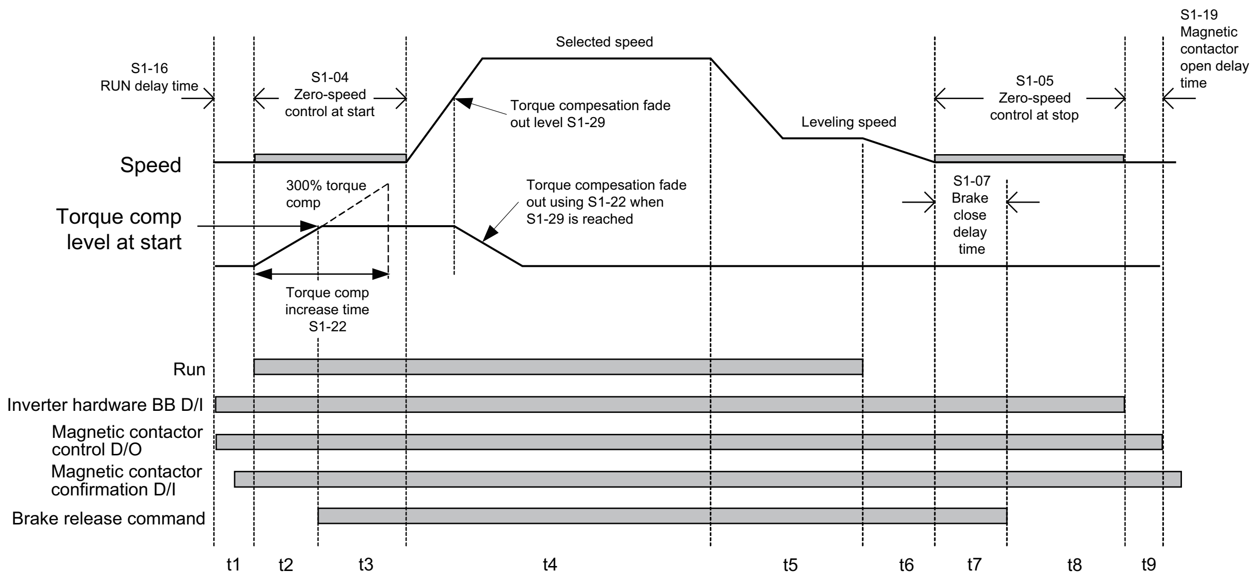


Fig 6.5 Timing Chart of Brake Sequence With Torque Compensation at Start

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

Timing	Description
t1	The Inverter gets the direction signal (UP/DOWN)
	The Inverter gets the hardware baseblock signal disable signal (Not BB condition).
	The Inverter receives the speed reference signal.
	The Inverter sets the magnetic contactor close signal.
	The Inverter waits for the magnetic contactor confirmation signal. If no multi-function contact input is set to magnetic 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 parameter set in parameter S1-22. After reaching the torque compensation level at start, the Inverter sets the brake release command.
t3	The brake opens and the zero-speed operation is continued until S1-04 has elapsed.
t4	The speed is increased to the selected speed and is kept parameter 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 parameter set in S1-22.
t5	The speed is decreased to the leveling speed and is kept parameter 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 6-8, Speed Selection Sequence Using Multi-function Contact Inputs*).
t6	The speed is decreased to the zero-speed level.
t7	When the zero-speed Level is reached, zero-speed operation is applied for the time set in S1-05. When the brake close delay time (S1-07) has elapsed, the brake release 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 baseblock signal must be set.
t9	After the magnetic contactor open delay time (S1-19) has elapsed, the magnetic contactor close signal is removed.

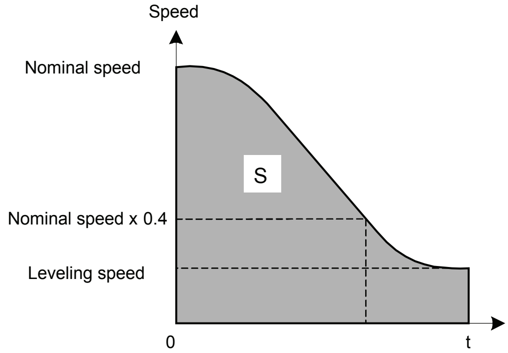
◆ Short Floor Operation

■Related parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods					MEMOBUS Register
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
S3-01	Short-floor function selection Short floor sel	Enables or disables the short floor operation function 0: disabled 1: enabled	0, 1	0	No	A	A	A	A		6BDH

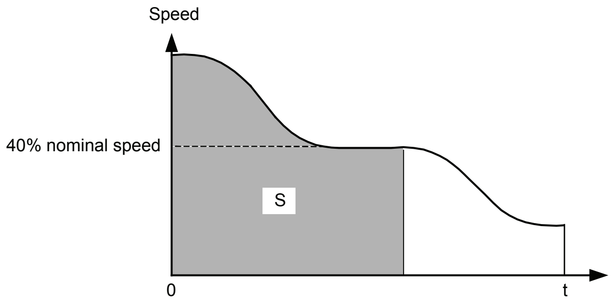
■Principle

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



There are two ways of operation:

- If the leveling speed signal is set when minimal 40% of the nominal speed have been reached, the Inverter keeps the reached speed for the distance equal to the area S. After that it decelerates to the leveling speed.
- If the leveling signal is set before 40% of the nominal speed have been reached, the Inverter accelerates to 40% of the nominal speed and keeps it for the distance equal to the area S. After that it decelerates to leveling speed.



■Parameter Setup

The short floor function can be activated by setting parameter S3-01 to 1.

When parameter d1-18 is set to 1 or 2 (dedicated speed inputs), the value of parameter d1-09 is taken as nominal speed.

Acceleration and Deceleration Characteristics

◆ Setting Acceleration and Deceleration Times

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

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

- multi-function contact 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 0.00sec.

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register
C1-01	Acceleration time 1 Accel Time 1	Sets the acceleration time to accelerate from 0 Hz to the maximum output frequency.	0.00 to 600.00 *	3.00 s	Yes	Q	Q	Q	Q	200H
C1-02	Deceleration time 1 Decel Time 1	Sets the deceleration time to decelerate from the maximum output frequency to 0 Hz.			Yes	Q	Q	Q	Q	201H
C1-03	Acceleration time 2 Accel Time 2	Sets the acceleration time when the multi-function input “accel/decel time 1” is set to ON.			Yes	A	A	A	A	202H
C1-04	Deceleration time 2 Decel Time 2	Sets the deceleration time when the multi-function input “accel/decel time 1” is set to ON.			Yes	A	A	A	A	203H
C1-05	Acceleration time 3 Accel Time 3	Sets the acceleration time when the multi-function input “accel/decel time 2” is set to ON.			No	A	A	A	A	204H
C1-06	Deceleration time 3 Decel Time 3	Sets the deceleration time when the multi-function input “accel/decel time 2” is set to ON.			No	A	A	A	A	205H
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
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
C1-10	Accel/decel time setting unit Acc/Dec Units	0: 0.01-second units 1: 0.1-second units	0, 1	0	No	A	A	A	A	209H

6

Parameter Number	Name		Description	Setting Range	Factory Setting	Change during Operation	Control Methods					MEMOBUS Register
	Display						V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
C1-11	Decel time switching frequency	Acc/Dec SW Freq	Sets the frequency for automatic acceleration/deceleration switching. If the output frequency is below the set frequency: Accel/decel time 4 If the output frequency is above the set frequency: Accel/decel time 1.	0.0 to 120.0 / 0.0 to 100.0 (PM)	0.0 Hz / 0.0% (PM)	No	A	A	A	A		20AH
S1-26	Dwell speed reference	DWELL speed	Hold speed reference when the load is heavy.The frequency reference follows the C1-07 acceleration 4 setting time. Acceleration time will be changed when the motor speed exceeds the C1-11 setting frequency.	0.0 to 120.0	0.0 Hz	No	A	A	A	A		699H

* The setting ranges for acceleration/deceleration times depend on the setting of C1-10 (Accel/decel time setting unit). If C1-10 is set to 1, the setting range for acceleration/deceleration times becomes 0.0 to 6000.0 seconds.

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

Setting Value	Function	Control Methods			
		V/f	Open-loop Vector 1	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 units using C1-10. The factory setting is 1.

Setting 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.

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

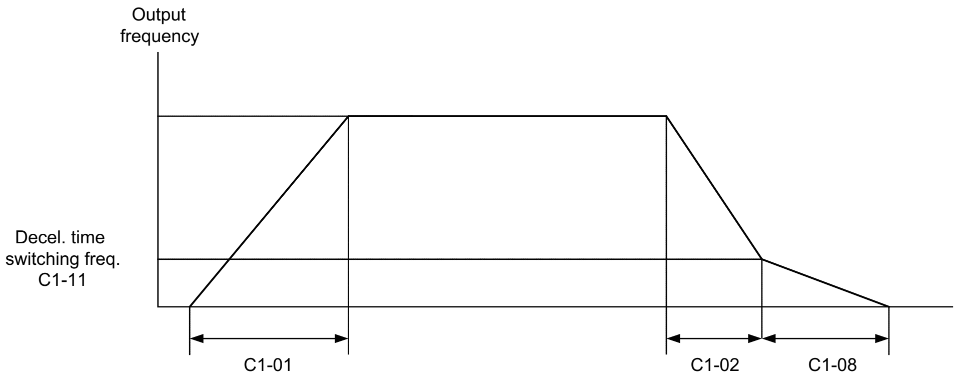
When two multi-function contact input terminals are set to “Accel./Decel. time switch over 1 and 2” (H1-□□=7 and 1A), the acceleration/deceleration times can be switched over even during operation by a binary combination of the inputs. The following table shows the acceleration/deceleration time switching 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 6.6* 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 6.6 Acceleration/deceleration Time Switching Frequency

■Dwell at Start Function (Closed-loop vector only)

The dwell function can be used to improve the start behavior when the static friction is high.

After the start command has been set, the output speed is increased up to the Dwell speed set in parameter S1-26 using the acceleration time C1-07. As soon as the motor speed (PG feedback) reaches the acceleration time switching level C1-11, the acceleration is continued using the selected acceleration time.

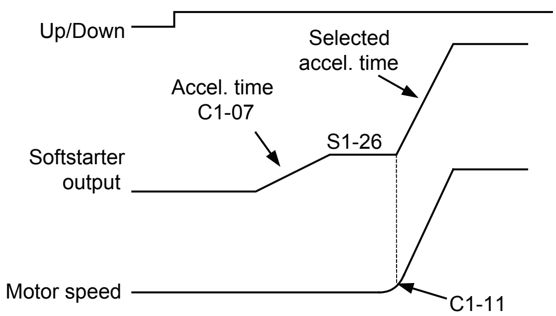


Fig 6.7 Dwell at start function

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

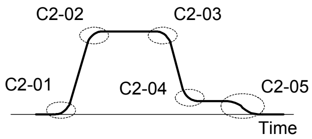
Parameter Number	Name		Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
	Name	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
C2-01	S-curve characteristic time at acceleration start	S-Crv Acc @ Start	Set the S-curve time to smooth out any sudden changes in motor speed. The S-curve can be used at start and stop, as well as during acceleration and deceleration.  $T_{accel} = \frac{C2\text{-}01}{2} + C1\text{-}01 + \frac{C2\text{-}02}{2}$ $T_{decel} = \frac{C2\text{-}03}{2} + C1\text{-}02 + \frac{C2\text{-}04}{2}$ 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
C2-02	S-curve characteristic time at acceleration end	S-Crv Acc @ End					Q	Q	Q	Q	20CH
C2-03	S-curve characteristic time at deceleration start	S-Crv Dec @ Start					Q	Q	Q	Q	20DH
C2-04	S-curve characteristic time at deceleration end	S-Crv Dec @ End					Q	Q	Q	Q	20EH
C2-05	S-curve characteristic time below leveling speed	Scurve @ leveling					Q	Q	Q	Q	232H

Fig 6.8 shows the influence of the different S-curve times.

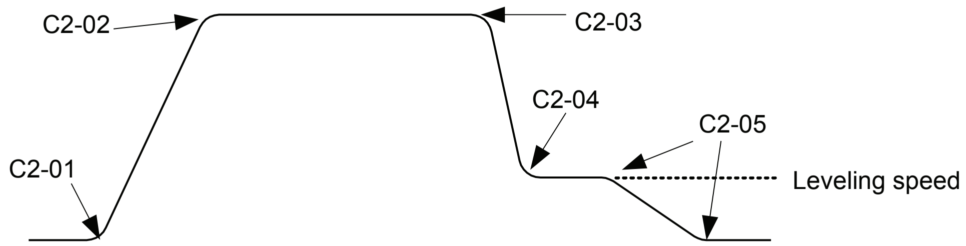
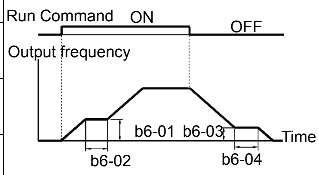


Fig 6.8 S-curve Settings

◆ Output Speed Hold (Dwell Function)

The dwell function holds the speed temporarily.

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
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 to 100.0 (PM)	0.0 Hz 0.0% (PM)	No	A	A	A	A	1B6H
b6-02	Dwell time at start Dwell Time @ Start		0.0 to 10.0	0.0 s	No	A	A	A	A	1B7H
b6-03	Dwell frequency at stop Dwell Ref @ Stop		0.0 to 120.0 0.0 to 100.0 (PM)	0.0 Hz 0.0% (PM)	No	A	A	A	A	1B8H
b6-04	Dwell time at stop Dwell Time @ Stop		0.0 to 10.0	0.0 s	No	A	A	A	A	1B9H

■Applying an Output Speed Dwell

The dwell function at start is applied when the speed level set in parameter b6-01 is reached. 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 6.9*.

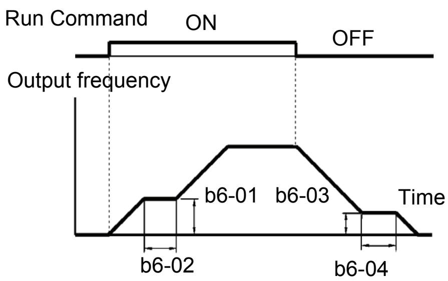


Fig 6.9 Output Frequency Dwell Settings

◆ 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.

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
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	No	No	48FH
L3-02	Stall prevention level during accel StallP Accel Lvl	Sets the stall prevention during acceleration operation current level as a percentage of Inverter rated current. Effective when L3-01 is set to 1 or 2. Usually changing this setting is not necessary. Reduce the setting when the motor stalls.	0 to 200	150%	No	A	A	No	No	490H

■Time Chart

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

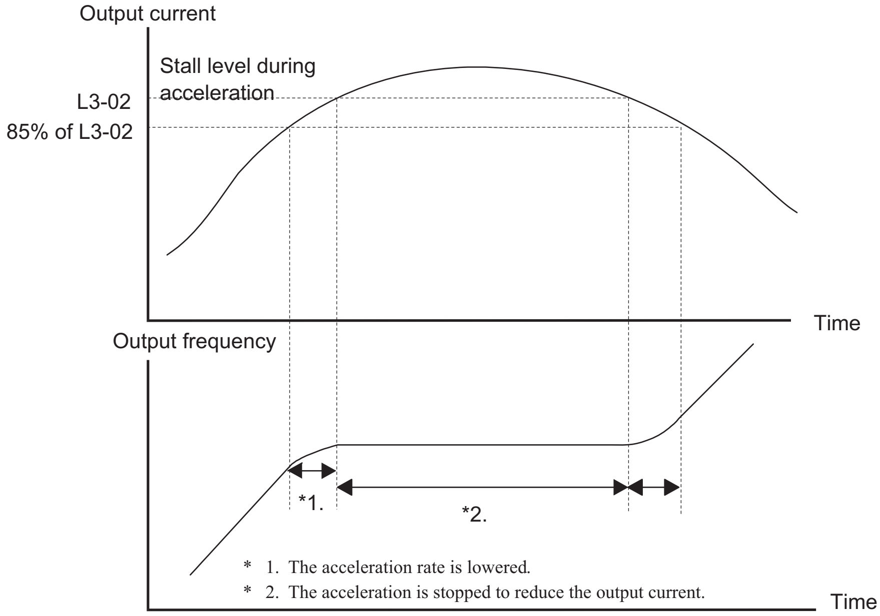


Fig 6.10 Time Chart for Stall Prevention During Acceleration

■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.

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 board AI-14B can be adjusted.

■Related Parameters

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

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
H3-10	AI-14B Channel 2 Gain AI-14 CH2 Gain	Sets the input level according to the 100% value of the function set in parameter H3-09 when the voltage/ current at channel 2 of the AI-14B option card is 10V/20mA.	0.0 to 1000.0	100.0%	Yes	A	A	A	A	419H
H3-11	AI-14B Channel 2 Bias AI-14 CH2 Bias	Sets the input level according to the 0% value of the function set in parameter H3-09 when the voltage/ current at channel 2 of the AI-14B option card is 0V/0mA.	-100.0 to +100.0	0.0%	Yes	A	A	A	A	41AH
H3-12	Analog input filter time parameter CH1-3 Filter-Time	Sets delay filter time parameter 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
H3-15	Terminal A1 function selection Terminal A1 Func	Sets the multi-function analog input function for terminal A1. Frequency Reference Torque compensation	0, 1	0	No	No	No	A	A	434H
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
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

Note:H3-01 to H3-11 are displayed if using an A1-14B option card.

■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 multi-function contact 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 Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
L4-01	Speed agreement detection level Spd Agree Level	Effective when "f_{out}/f_{set} agree 1", "Frequency detection 1" or "Frequency detection 2" is set for a multi-function output.	0.0 to 120.0 0.0 to 100.0 (PM)	0.0 Hz 0.0% (PM)	No	A	A	A	A	499H
L4-02	Speed agreement detection width Spd Agree Width	Effective when "f_{ref}/f_{out} agree 1", "f_{out}/f_{set} agree 1" or "Frequency detection 1" or "Frequency detection 2" is set for a multi-function output.	0.0 to 20.0 0.0 to 40.0 (PM)	2.0 Hz 4.0% (PM)	No	A	A	A	A	49AH
L4-03	Speed agreement detection level (+/-) Spd Agree Lvl+-	Effective when "f_{out}/f_{set} agree 2", "Frequency detection 3" or "Frequency detection 4" is set for a multi-function output.	-120.0 to +120.0 -100.0 to 100.0 (PM)	0.0 Hz 0.0% (PM)	No	A	A	A	A	49BH
L4-04	Speed agreement detection width (+/-) Spd Agree Wdth+-	Effective when "f_{ref}/f_{out} agree 2" "f_{out}/f_{set} agree 2", "Frequency detection 3" or "Frequency detection 4" is set for a multi-function output.	0.0 to 20.0 0.0 to 40.0 (PM)	2.0 Hz 4.0% (PM)	No	A	A	A	A	49CH

■Multi-function 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.

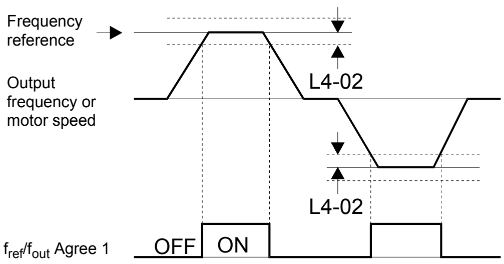
Function	Setting
f_{ref}/f_{out} Agree 1	2
f_{out}/f_{set} Agree 1	3
Frequency detection 1	4
Frequency detection 2	5
f_{ref}/f_{out} Agree 2	13
f_{out}/f_{set} Agree 2	14
Frequency detection 3	15
Frequency detection 4	16

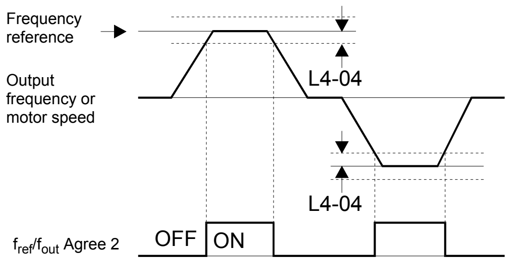
■Setting Precautions

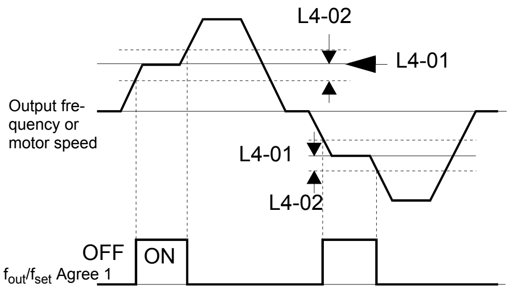
- With L4-01 an absolute speed agreement level is set, i.e. a speed agreement is detected in both directions (Up and Down).
- With L4-03 a signed speed agreement level is set, i.e. a speed agreement is detected only in the set direction (positive level → Up direction, negative level → Down direction).

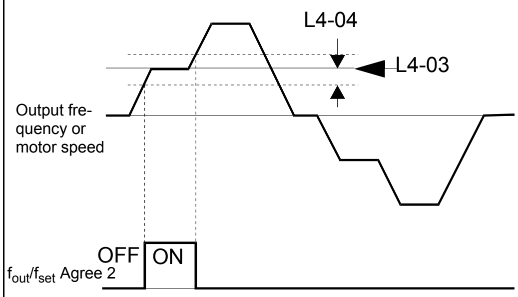
■Time Charts

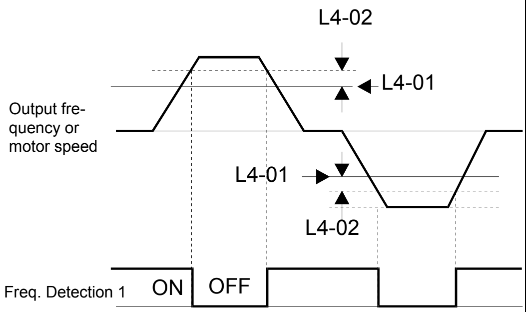
The following table shows the time charts for each of the speed agreement functions.

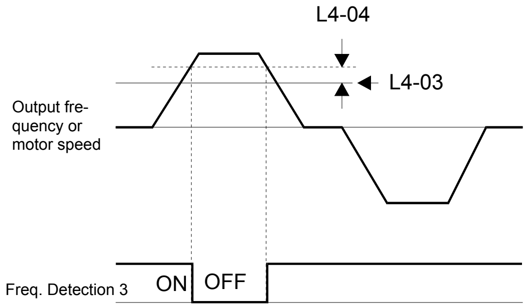
<table>
<tr><th>Related parameter</th><th>L4-01: Speed Agree Level
L4-02: Speed Agree Width</th><th>L4-03: Speed Agree Level +/–
L4-04: Speed Agree Width</th></tr>
<tr><td>f_{ref}/f_{out} Agree</td><td>f_{ref}/f_{out} Agree 1


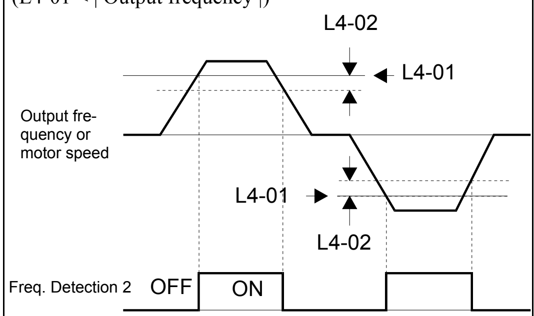
(Multi-function output setting = 2)</td><td>f_{ref}/f_{out} Agree 2


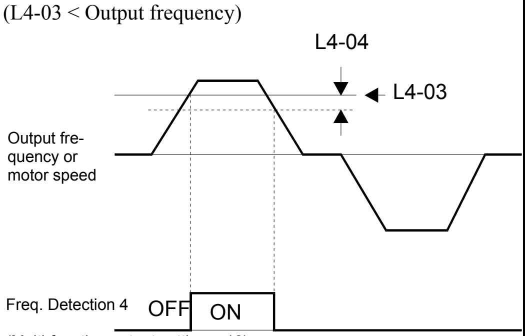
(Multi-function output setting = 13)</td></tr>
<tr><td>f_{out}/f_{set} Agree</td><td>f_{out}/f_{set} Agree 1
(ON at the following conditions during frequency agree)


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


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


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


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


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


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

◆ Limiting the Elevator Speed

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

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

Setting Value	Function	Control Methods			
		V/f	Open-loop Vector 1	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

◆ Droop Control Function

Droop control is a function that allows the user to set the amount of motor slip.
When a single load is operated with two motors (such as in a crane conveyor), a high-resistance motor is normally used. This is to use torque characteristics that exhibit proportion movements due to changes in the secondary resistor to maintain torque balance with the load and overall speed balance with the load.
If droop control is used, a high-resistance motor characteristics can be set for a general-purpose motor.

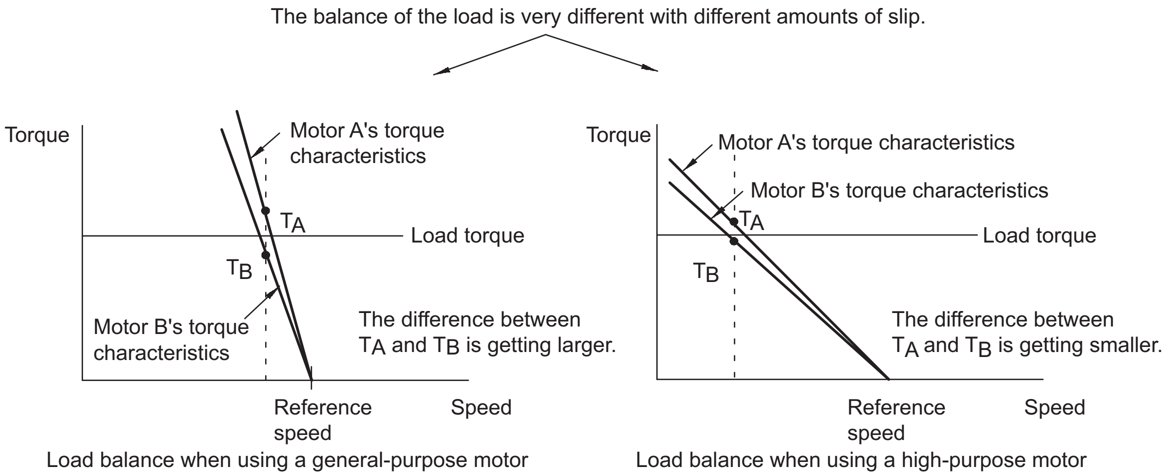


Fig 6.11 Droop Control Function

■Related Parameters

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
b7-01	Droop control gain Droop Quantity	Sets the slip as a percentage of maximum frequency when the maximum output frequency is specified and the rated torque occurs. Droop control is not performed when the setting is 0.0.	0.0 to 100.0	0.0 %	Yes	No	No	No	A	1CAH
b7-02	Droop control delay time Droop Delay Time	Droop control responsiveness parameter. When hunting or oscillation occurs, increase the value.	0.03 to 2.00	0.05 s	Yes	No	No	No	A	1CBH

■Setting Precautions

- Droop control is disabled if b7-01 is set to 0.0.
- Set b7-01 to the amount of slip as the percentage of slip when the maximum output frequency is input and the rated torque is generated.
- Parameter b7-02 is used to adjust the responsiveness of droop control. Increase this setting if oscillation or hunting occur.
- Disable the feed forward control (N5-01 = 0) when using the droop control function.

■Setting the Droop Control Gain

Set the droop control gain as the speed reduction at a 100% motor torque, as a percentage of the maximum output frequency.

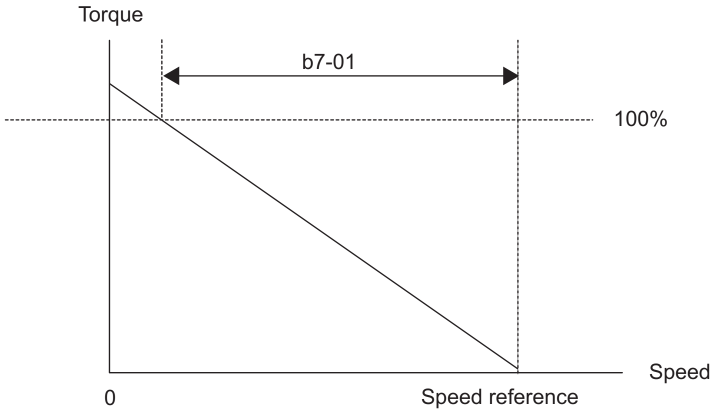


Fig 6.12 Droop Control Gain

◆ 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 parameter, 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.

6

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register
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	No	A	A	No	20FH

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
						V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
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	No	A	No	No	210H
C3-03	Slip compensation limit Slip Comp Limit	Sets the slip compensation limit as a percentage of motor rated slip.	0 to 250	200%	No	No	A	No	No	211H
C3-04	Slip compensation selection during regeneration Slip Comp Regen	0: Disabled 1: Enabled When the slip compensation during regeneration function has been activated and regeneration capacity increases momentarily, it might be necessary to use a braking option (braking resistor, Braking Resistor Unit or Braking Unit.)	0, 1	1	No	No	A	No	No	212H
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, 1	1 0 (PM)	No	No	A	A	No	213H

6

■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:

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

   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 parameter 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 Parameter (C3-02)

The slip compensation delay time parameter 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 parameter torque range and fixed output range.

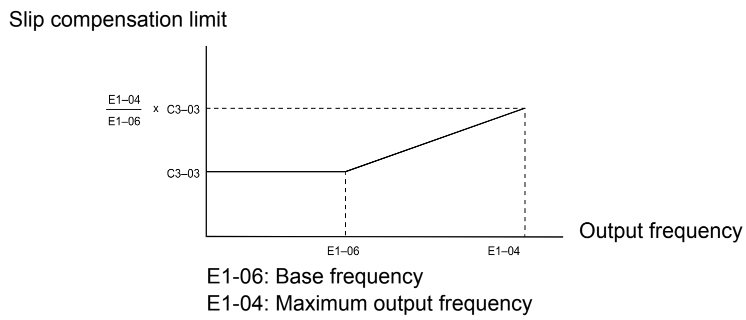


Fig 6.13 Slip Compensation Limit

■Selecting 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 Saturated (C3-05)

6

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.

■Related Parameters

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
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 1 control.	0.00 to 2.50	1.00	Yes	A	A	No	No	215H
C4-02	Torque compensation delay time parameter Torq Comp Time	The torque compensation delay time is set in ms units. Usually changing this setting is not necessary. Adjust it under the following circumstances: • When the motor is oscillating, increase the set values. • When the responsiveness of the motor is low, decrease the set values.	0 to 10000	200 ms *	No	A	A	No	No	216H
C4-03	Starting torque compensation (FWD) FTorqCmp @ Start	Sets the torque compensation value at start in FWD direction	0.0 to 200.0%	0.0%	No	No	A	No	No	217H

6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
C4-04	Starting torque compensation (REV) RTorqCmp @ Start	Sets the torque compensation value at start in REV direction	-200.0% to 0.0	0.0%	No	No	A	No	No	218H
C4-05	Starting torque compensation time parameter TorqCmpDelayT	Sets starting torque start-up time. When 0 to 4 ms is set, it is operated without filter.	0 to 200	10 ms	No	No	A	No	No	219H

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

■Adjusting Torque Compensation Gain (C4-01)

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

Open-loop vector control

- If the torque response is slow increase the 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 Parameter (C4-02)

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

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

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

- If the motor 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.

It works like shown in the following diagram.

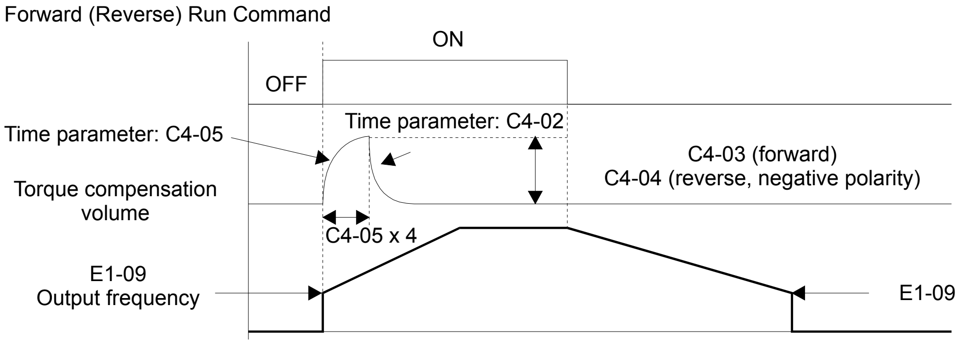


Fig 6.14 Time Chart for Starting Torque Frequency

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 parameter (C4-05)

◆ Automatic Speed Regulator (ASR) (Closed-loop Vector only)

In closed-loop vector control the automatic speed regulator (ASR) adjusts the *torque reference* in order to eliminate the deviation between the speed reference and the measured speed (PG feedback). The ASR settings determine the motor speed accuracy and stability. *Fig 6.15* shows the ASR structure.

6

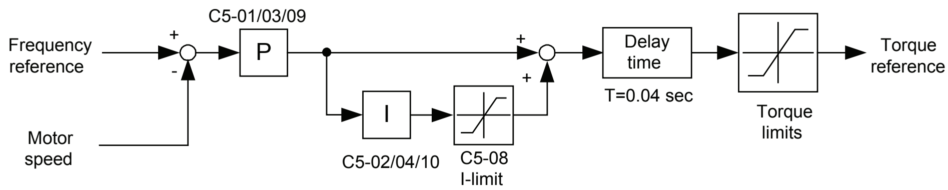


Fig 6.15 ASR Block Diagram

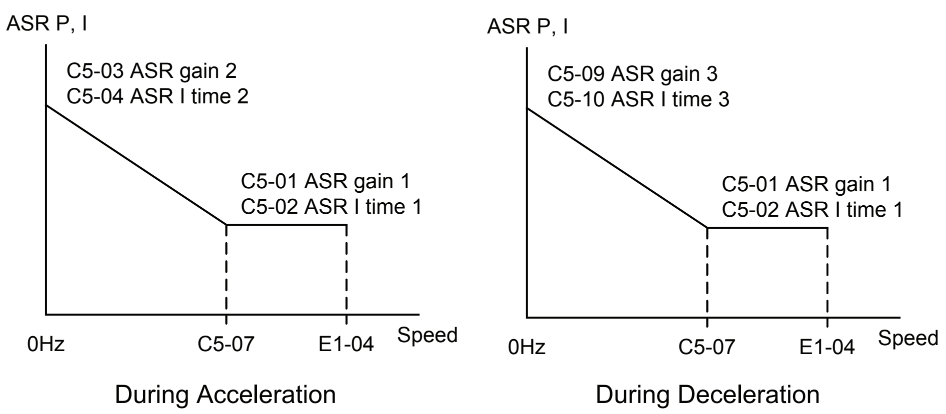
■Related Parameters

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
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 maximum frequency.	0.00 to 300.00	40.00 3.00 (PM)	Yes	No	No	Q	Q	21BH
C5-02	ASR integral (I) time 1 ASR I Time 1		0.000 to 10.000	0.500 s 0.300 s (PM)	Yes	No	No	Q	Q	21CH

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
C5-03	ASR proportional (P) gain 2	ASR P Gain 2	Set the proportional gain 2 and the integral time 2 of the speed control loop (ASR) for the minimum frequency. The settings become active for acceleration only.	0.00 to 300.00	20.00 3.00 (PM)	Yes	No	No	Q	Q	21DH
C5-04	ASR integral (I) time 2	ASR I Time 2		0.000 to 10.000	0.500 s	Yes	No	No	Q	Q	21EH
C5-06	ASR primary delay time	ASR Gain SW Freq	Sets the filter time parameter for outputting torque references from the speed control loop (ASR). It is set in 1-second units. Usually setting is not necessary.	0.000 to 0.500	0.004 s 0.020 s	No	No	No	Q	Q	220H
C5-07	ASR switching frequency	ASR Gain SW Freq	Sets the frequency for switching between Proportion Gain 1, 2,3 and Integral Time 1, 2, 3. Multi-function input speed control (ASR) proportion gain switching has priority.	0.0 to 120.0 0.0 to 100.0 (PM)	0.0 Hz 2.0% (PM)	No	No	No	Q	Q	221H
C5-08	ASR integral (I) limit	ASR I Limit	Set the parameter to a small value to prevent any radical load change. A setting of 100% is equal to the maximum output frequency.	0 to 400	400%	No	No	No	A	A	222H
C5-09	ASR proportional (P) gain 3	ASR P Gain 3	Set the proportional gain 3 and the integral time 3 of the speed control loop (ASR) for the minimum frequency. The settings become active for acceleration only.	1.00 to 300.00	40.00 3.00 (PM)	Yes	No	No	Q	Q	22EH
C5-10	ASR integral (I) time 3	ASR I Time 3		0.000 to 10.000	0.500 s 0.300 s (PM)	Yes	No	No	Q	Q	231H

■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).



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

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

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 or if undershooting occurs at leveling speed. If vibrations occur in the low speed area during deceleration increase the value.

◆ A/D Conversion Delay Time Tuning

6

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

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
N9-60	A/D conversion start delay timer AD DelayT@Start	Sets the A/D conversion delay time.	0.0 to 40.0	0.0 μs	No	No	No	No	A	64DH

■Adjustments

Normally no adjustment is needed for this value. However, if cyclic oscillations as shown in *Fig. 6.16* while operating at a parameter speed, the A/D conversion delay can be increased in order to eliminate the vibrations.

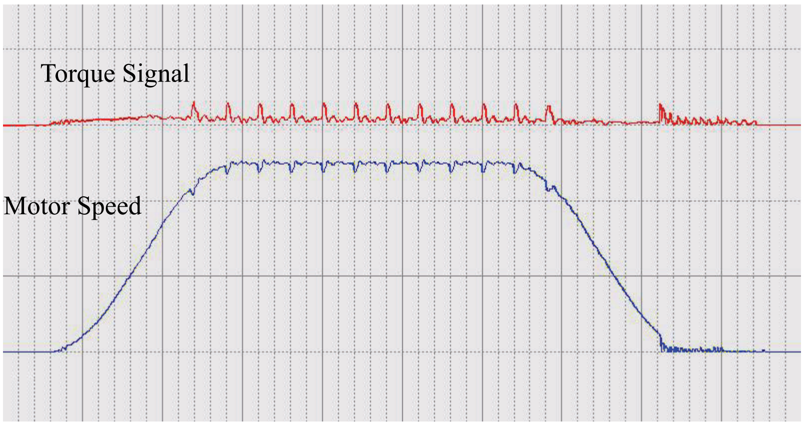


Fig 6.16 Oscillations Caused by Bad A/D Conversion Adjustment

◆ Torque Compensation Reduction at Stop

Reduces the amount of torque compensation used to get a stopped elevator moving again by dividing the value of parameter S1-31 into 300% (300%/S1-31). The following timechart shows the braking sequence for the start-up torque compensation.

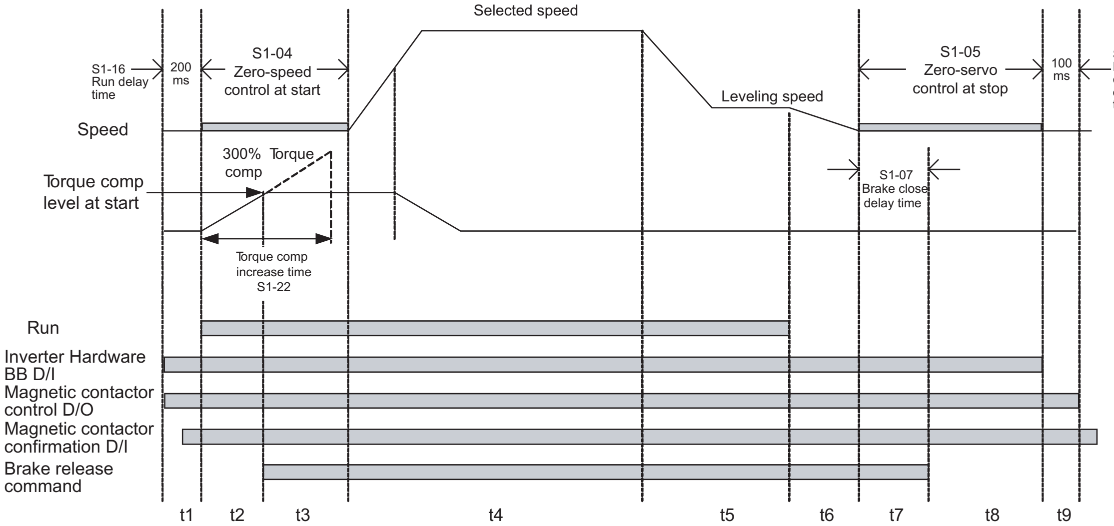


Fig 6.17 Timing Chart of Brake Sequence With Torque Compensation at Start

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

Timing	Description
t0-t1	The Inverter receives a direction signal indicating up or down.
	The Inverter receives a signal to disable hardware baseblock (i.e., a signal indicating there is no baseblock condition).
	The Inverter receives the speed reference.
	The Inverter receives a signal to close the magnetic contactor.
	The Inverter waits for verification that the magnetic contactor has closed. If no multi-function input has been programmed to issue a command verifying that the magnetic contactor has closed, then the Inverter will proceed to the next step once the time set to S1-16 has passed (Run delay time).
t1-t2	Zero-servo operation begins. Analog torque compensation value is maintained and the Inverter begins generating torque compensation based on S1-22 (Starting torque compensation increase time).
	Once the torque compensation reaches the specified level at start, the Inverter then releases the brake and maintains the torque compensation value until it stops.
t2-t3	After the time set to S1-04 has expired (DC braking at start, or DC excitation), the Inverter begins to accelerate the motor. The Dwell function can be enabled at start.
t3-t4	Inverter begins to accelerate.
t4-t5	The Inverter speed reaches the specified speed reference.
t5-t6	The Inverter begins to accelerate.
t6-t7	Zero-speed is selected.
t7-t8	The Inverter reaches the zero-speed level. The Inverter continues using zero-speed control. After the time set to S1-07 passes (Brake close delay time), the Inverter issues a command to close the brake.
	After the time set to S1-07 passes (Brake close delay time), the Inverter issues a command to close the brake.
t8-t9	The Inverter continues operating with zero-speed until the time set to parameters S1-05 and S1-07 have passed. The signal indicating direction is disabled. Torque is reduced by the specified bias level: (300%) / (S1-31) The Inverter halts output once the torque compensation level drops to zero. The hardware baseblock signal is switched on.
t9-t10	Once the time set to S1-19 passes (Magnetic contactor open delay time), the Inverter will shut off the magnetic contactor control signal.

◆ 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.

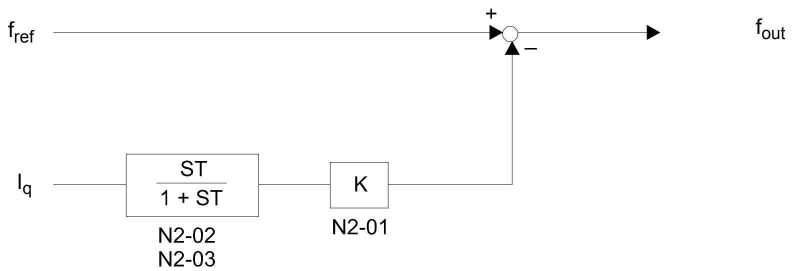


Fig 6.18 AFR Control Loop

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register
N2-01	Speed feedback detection control (AFR) gain AFR Gain	Sets the internal speed feedback detection control gain. Normally, there is no need to change this setting. • If necessary, adjust this parameter as follows: • If hunting occurs, increase the set value. If response is low, decrease the set value. Adjust the setting by 0.05 at a time, while checking the response.	0.00 to 10.00	1.00	No	No	A	No	No	584H
N2-02	Speed feedback detection control (AFR) time parameter AFR Time	This parameter determines the rate of change for speed feedback detection.	0 to 2000	50 ms	No	No	A	No	No	585H
N2-03	Speed feedback detection control (AFR) time parameter 2 AFR Time 2	Increase the setting if overvoltage (OV) failures occur at the completion of acceleration or when the load changes radically.	0 to 2000	750 ms	No	No	A	No	No	586H

■Setting the AFR Gain (N2-01)

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

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

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

◆ Inertia Compensation (Closed-loop Vector only)

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

Param-eter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Regis-ter
N5-01	Feed forward control selection Feedfoward Sel	Enables or disables the feed forward control. 0: Disabled 1: Enabled	0, 1	0	No	No	No	A	A	5B0H
N5-02	Motor accel-eration time Motor Accel Time	Set the time required to accelerate the motor at the rated torque (T_{100}) to the rated speed (Nr). J: $GD^2/4$, P: Motor rated output $t_a = \frac{2\pi \cdot J\,[kgm^2]\,N_r \cdot [min^{-1}]}{60 \cdot T_{100}\,[Nm]}$ However, $t_{100} = \frac{60}{2\pi} \cdot \frac{P\,[kW]}{Nr\,[min^{-1}]} \cdot 10^3\,[Nm]$	0.001 to 60.000	0.154 s *	No	No	No	A	A	5B1H
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	No	No	A	A	5B2H

* The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

■Adjustments

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 time to improve the responsiveness to the speed reference
- Decrease the time if vibrations occur

◆ Improving the Leveling Accuracy by Slip Compensation

This function can be used in V/f and open-loop vector control to improve the leveling accuracy by compensating the motor slip influence at low speed.

The Inverter measures the current level or torque reference 1.0 s after the speed-agree condition (acceleration finished) for 0.5 s 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 6.19*).

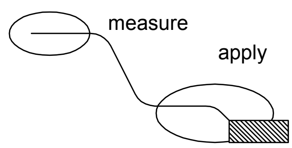


Fig 6.19 Slip Compensation Working Principle

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
S2-01	Motor rated speed Rated min^{-1}	Sets the motor rated speed.	300 to 1800	1380 min^{-1}	No	A	No	No	No	6AEH
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.	0.00 to 5.00	0.70	Yes	A	A	No	No	6AFH
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.	0.00 to 5.00	1.00	Yes	A	A	No	No	6B0H

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
S2-07	Slip compensation delay time SlipCompDelay T	Sets the Slip compensation delay time.	0 to 10000	200 ms	No	No	A	No	No	6B4H

■Adjustments

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

- Set the motor speed in S2-01 if V/f control is used.
- Try to measure the actual motor speed during leveling.
- If the motor speed is lower than the leveling speed reference increase S2-02 in motoring mode or decrease S2-03 in regenerative mode.
- If the motor speed is higher than the leveling speed reference decrease S2-02 in motoring mode or increase S2-03 in regenerative mode.

◆ Field Forcing

The field forcing function controls the motor flux and compensates the flux establishment delay of the motor. Thereby it improves the motor responsiveness 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.

6

■Related Parameters

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
d6-03	Field forcing function selection Field Force Sel	Enables or disables field forcing function. 0: Disabled 1: Enabled	0, 1	0	No	No	A	A	No	2A2H
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	No	A	A	No	2A5H

◆ 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 Number	Name: Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
S1-02	DC injection braking current at start DC Inj I @start	Sets the DC injection braking current as a percentage of the Inverter rated current. DC excitation current in closed-loop vector control changes according to E2-03 setting.	0 to 100	50%	No	A	A	No	No	681H
S1-03	DC injection braking current at stop DC Inj I @stop	Sets the DC injection braking current as a percentage of the Inverter rated current. DC excitation current in closed-loop vector control changes according to E2-03 setting.	0 to 100	50%	No	A	A	No	No	682H
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	No	A	No	No	690H
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	No	A	No	No	691H

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.

◆ 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.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
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, 1	0 1 (PM)	No	No	No	Q	Q	384H
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	0,1	0	No	No	No	No	A	6C4H

■Change Motor Direction in V/f or Open-loop Vector 1 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 induction motors or permanent magnet motors 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 permanent magnet motors is used, always perform an encoder offset tuning after parameter S3-08 and F1-05 has been changed. Refer to *Chapter 4 Trial Operation.*

6

◆ 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 parameter speed.

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

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

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods					MEMOBUS Register
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
L3-05	Stall prevention selection during running StallP Run Sel	Selects the stall prevention during running. 0: Disabled (Runs as set. With a heavy load, the motor may stall.) 1: Deceleration using deceleration time 1 (C1-02.) 2: Deceleration using deceleration time 2 (C1-04.)	0 to 2	1	No	A	No	No	No		493H
L3-06	Stall prevention level during running StallP Run Level	Set the stall prevention during running operation current level as a percentage of the Inverter rated current. Effective when L3-05 is 1 or 2. Usually changing this setting is not necessary. Reduce the setting when the motor stalls.	30 to 200	150%	No	A	No	No	No		494H

■Precautions

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

■Setting Precautions

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

6

◆ Operation Selection at Frequency Reference Loss

The frequency reference loss detection function continues operation using speed of the frequency reference before loss × L4-06 (%) when the frequency reference using an analog input is reduced 90% or more in 400 ms.

When the error signal during frequency reference loss is output externally, set H2-01 to H2-03 (multi-function contact output terminal M1-M2, P1-PC, and P2-PC function selection) to C (frequency reference lost).

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
L4-05	Operation when frequency reference is missing Ref Loss Sel	0: Stop (Operation follows the frequency reference.) 1: Operation at 80% speed continues. (At 80% of speed before the frequency reference was lost) Frequency reference is lost: Frequency reference dropped over 90% in 400 ms.	0,1	0	No	A	A	A	A	49DH
L4-06	Frequency reference at frequency reference loss Fref at Floss	If the frequency reference loss function is enabled (L4-05=1) when the frequency reference gets lost, the Inverter will run at a reduced frequency reference determined by the following formula: Fref = Fref at time of loss × L4-06.	0.0 to 100.0%	80.0%	No	A	A	A	A	4C2H

■Setting Value (Multi-function Contact Output)

Setting Value	Function	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
C	Loss of frequency reference (Effective when 1 is set for L4-05)	Yes	Yes	Yes	Yes

◆ 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 multi-function contact output terminals M1-M2, M3-M4, or M5-M6.

To use the overtorque/undertorque detection function, set B, 17, 18, 19 (overtorque/undertorque detection NO/NC) in one of the parameter H2-01 to H2-03 (multi-function contact output terminals M1 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 Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
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
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
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
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
L6-05	Torque detection level 2 Torq Det 2 Lvl		0 to 300	150%	No	A	A	A	A	4A5H
L6-06	Torque detection time 2 Torq Det 2 Time		0.0 to 10.0	0.1 s	No	A	A	A	A	4A6H

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

Set Value	Function	Control Methods			
		V/f	Open-loop Vector 1	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

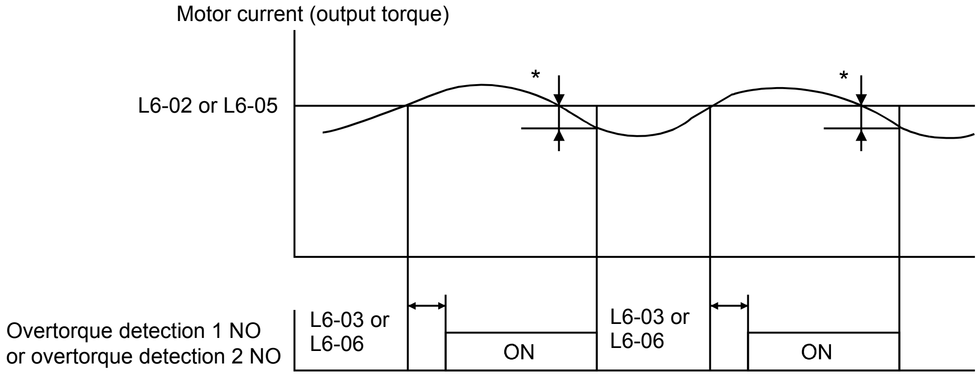
■L6-01 and L6-04 Set Values and Operator Display (JVOP-160 only)

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

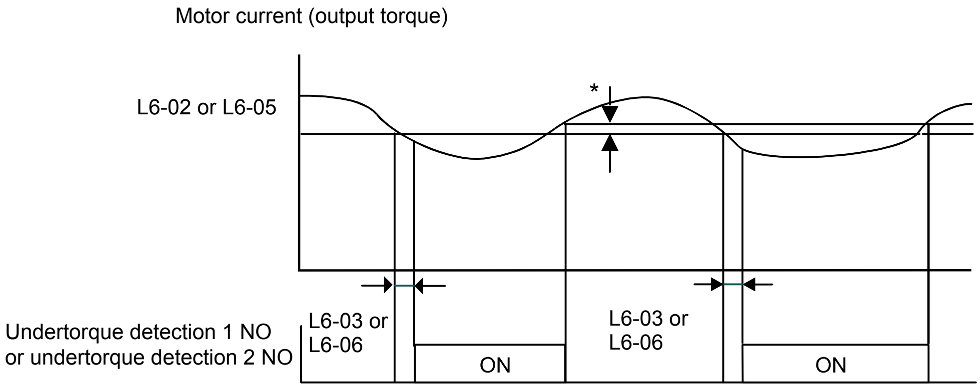
■Timing Charts

Fig 6.20 and *Fig 6.21* show the timing charts for overtorque and undertorque detection.



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

Fig 6.20 Overtorque Detection



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

Fig 6.21 Undertorque Detection

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

The Overtorque detection function can be used to detect a stuck car. The torque detection function 1 can be used for this. Therefore a multi-function contact output has to be set to “Overtorque 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 6.22*)

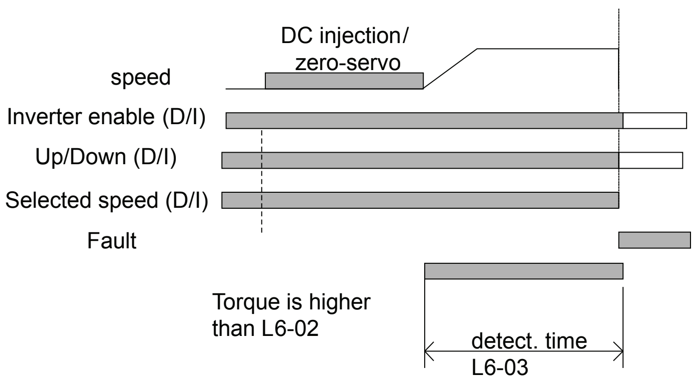
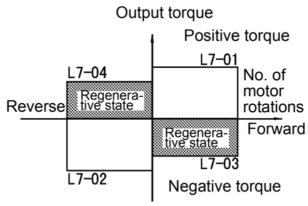


Fig 6.22 Car Stuck Fault Detection

◆ 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 Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMO-BUS Register
L7-01	Forward drive torque limit	Torq Limit Fwd	Sets the torque limit value as a percentage of the motor rated torque. Four individual regions can be set. 	0 to 300	200%	No	No	A	A	A	4A7H
L7-02	Reverse drive torque limit	Torq Limit Rev				No	No	A	A	A	4A8H
L7-03	Forward regenerative torque limit	Torq Lmt Fwd Rgn				No	No	A	A	A	4A9H
L7-04	Reverse regenerative torque limit	Torq Lmt Rev Rgn				No	No	A	A	A	4AAH
L7-06	Torque limit time parameter	Torque Limit Time	Sets the torque limit integration time parameter	5 to 10000	200 ms	No	No	A	No	A	4ACH
L7-07	Torque Limit Operation during accel/decel	Torque Limit Sel	Sets the torque limit operation during acceleration and deceleration. 0: P-control (I control is added at parameter 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, 1	0	No	No	A	No	A	4C9H

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

Setting Value	Function	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)
30	During torque limit	No	Yes	Yes	Yes

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■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 inverter, forward regenerative and reverse regenerative (see *Fig 6.23*)

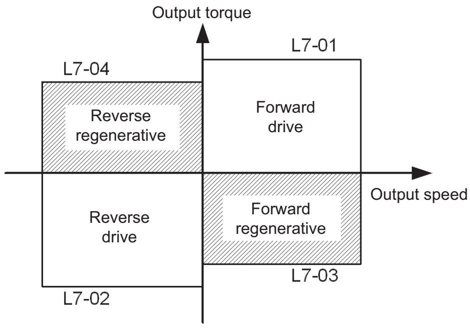


Fig 6.23 Torque Limit Parameters

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

If a multi-function 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.

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

In open-loop vector control an integral operation can be applied to the torque limit function (P-control is standard). This improves the torque limit responsiveness and smooths the torque limit operation. To enable the integral operation set parameter L7-07 to 1. The integral time parameter can be set in parameter L7-06.

■Setting Precautions

6

- 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.

◆ Internal Cooling Fan Failure OH1 Detection

Use the parameter setting to select the operation of the motor after a cooling fan fault occurs. This function can be used for times when a motor should not be stopped quickly (with an fast stop.)

Cooling fans are installed in 200 V Class Inverter models of 11 kW, 18.5 kW, and 37 kW to 55 kW, and in 400 V Class Inverter models of 11 kW and 18.5 kW.

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
L8-32	OH1 detection during cooling fan failure OH1 Detect Sel	0: Alarm triggered if the internal cooling fan fails. 1: Fault situation detected if the cooling fan fails.	0,1	1	No	A	A	A	A	4E2H

The following table describes the operation of the motor and the display of the Digital Operator in accordance with the settings of the L8-32 if a cooling fan fault occurred.

Setting Value	Fault	Digital Operator	Motor Operation	Multi-function Contact Output
0	Cooling Fin Overheating	OH1 (lit)	Coast to a stop	Fault
	Inverter's Cooling Fan Fault	FAN (blink)	Continue operation	Minor fault
1	Cooling Fin Overheating	OH (lit)	Coast to a stop	Fault
	Inverter's Cooling Fan Fault	OH1 (lit)	Coast to a stop	Fault

■Setting Values (Multi-function Contact Output)

Contact output is possible during a cooling fan fault by setting one of the multi-function contact outputs (H2-□□) to “3D”.

Setting Value	Function	Control Method			
		V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
3D	Inverter's Cooling Fan Fault	Yes	Yes	Yes	Yes

Refer to *Multi-function Contact Outputs: H2* in *Chapter 5, Parameters* for more details on multi-function contact output.

IMPORTANT

If L8-32 is set to 0, be sure to set H2-01 to H2-03 multi-function contact outputs to 10 (minor fault) or to 3D (Inverter's cooling fan fault.) If a cooling fan fault occurs, stop the Inverter immediately and replace the cooling fan. If the Inverter continues to run while a cooling fan fault occurs, the Inverter's cooling ability will be affected and the Inverter's internal temperature will increase and shorten the Inverter's life.
During a cooling fan fault, the cooling fan stops for about 3 seconds every minute (interval operation.)

■Fault Detection

Display	Meaning	Probable Causes	Corrective Actions
OH (OH1) Heatsnk Overtemp (Heatsnk MAX Temp)	Cooling Fin Overheating The temperature of the Inverter's cooling fins exceeded the setting in L8-02 or the overheat protection level. OH: The temperature exceeded the setting in L8-02 (Stopping method can be changed by L8-03.). OH1: The temperature exceeded 100°C (Stopping method: Coast to stop).	The ambient temperature is too high.	Install a cooling unit.
		There is a heat source nearby.	Remove the heat source.
		The Inverter's cooling fan has stopped.	Replace the cooling fan. (Contact our sales representative.)
		• A short-circuit between +V, –V, and AC terminals occurred. • Overload in the control circuit terminal.	• Make sure that incorrect wiring has not been done. • Check the resistance and wiring for the frequency setting potentiometer, etc. (Check that the current for terminals +V and –V is 20 mA or less.)
	Inverter's Cooling Fan Fault (11 kW or more) This fault is detected when L8-32 is set to 1.	• The Inverter's cooling fan has stopped. • The heatsink is clogged.	• Replace the cooling fan. (Contact our sales representative.) • Clean the heatsink.

■Alarm Detection

Display	Meaning	Probable causes	Corrective Actions
FAN (blinking) Cooling FAN Err	Inverter's Cooling Fan Fault An Inverter's cooling fan fault was detected. This fault is detected when L8-32 is set to 0.	The Inverter's cooling fan has stopped.	Replace the cooling fan. (Contact our sales representative.)

◆ Motor Overload Protection

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

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMO-BUS Register
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
E2-01	Motor rated current Motor Rated FLA	Sets the motor rated current in Amps. This set value will become the reference value for motor protection and torque limits. This parameter is an input data for autotuning.	1.75 to 35.00 *1	14.00 A *2	No	Q	Q	Q	No	30EH
L1-01	Motor protection selection MOL Fault Select	Sets whether the motor thermal overload protection function is enabled or disabled. 0: Disabled 1: General-purpose motor protection (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 parameter torque motor protection	0 to 3 0.5 (PM)	1 5 (PM)	No	Q	Q	Q	A	480H

6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
L1-02	Motor protection time parameter MOL Time Const	Sets the electric thermal detection time in seconds units. Usually changing this setting is not necessary. The factory setting is 150% overload for one minute. When the motor's overload capability is known, also set the overload resistance protection time for when the motor is hot started.	0.1 to 5.0 *3	1.0 min *3	No	A	A	A	A	481H

* 1. The setting range is from 10% to 200% of the Inverter rated output current. The value for a 200 V class Inverter for 3.7 kW is given.
* 2. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.
* 3. Values will change according to parameter o2-09. Values shown here are for when o2-09 is set to 0.

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

Setting Value	Function	Control Methods: V/f	Open-loop Vector 1	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)

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

■Setting Motor Overload Protection Characteristics (L1-01)

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

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

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

■Setting Motor Protection Operation Time (L1-02)

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

Fig 6.24 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)

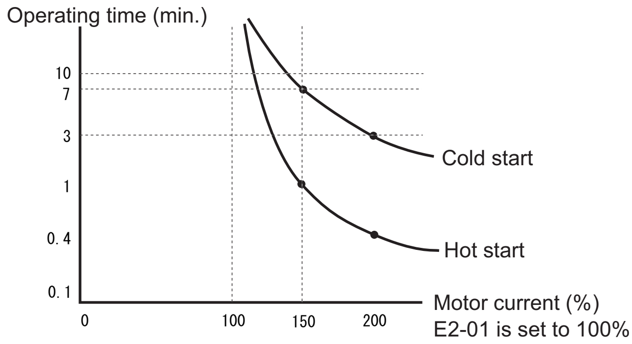


Fig 6.24 Motor Protection Operation Time

■Setting a Motor Overload Pre-Alarm

If the motor overload protection function is enabled (i.e., L1-01 is set to a value different from 0) and H2-01 is set to H2-03 (output terminals M1-M2, M3-M4, and M5-M6 function selection) to 1F (motor overload OL1 pre-alarm), the motor overload pre-alarm will be output at 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.

6

◆ Output Current Observation

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

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
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)	200 ms	No	A	A	A	No	68DH
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	200 ms	No	A	A	A	No	68EH

SE2 fault (SE2, Current observation at start)

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

SE3 fault (SE3, Current observation during Run)

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

Inverter Protection

◆ Inverter Overheat Protection

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

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

To prevent a 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 multi-function 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 Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
L8-02	Overheat pre-alarm level OH Pre-Alarm Lvl	Sets the detection temperature for the Inverter overheat detection pre-alarm in °C. The pre-alarm detects when the heatsink temperature reaches the set value.	50 to 130	75°C*	No	A	A	A	A	4AEH
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

* The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter of 3.7 kW are given.

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

Setting Value	Function	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
20	Inverter overheat (OH)	Yes	Yes	Yes	Yes

◆ Output Open Phase Protection

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 Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register
L8-07	Output open-phase protection 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
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	0.2 s	No	A	A	A	A	4C0H

◆ Ground Fault Protection

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

■Related Parameters

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register
L8-09	Ground fault detection selection Ground Fault Sel	0: Disabled 1: Enabled	0, 1	1	No	A	A	A	A	4B5H

■Precautions

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

◆ Cooling Fan Control

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

■Related Parameters

Param-eter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Regis-ter
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, 1	0	No	A	A	A	A	4B6H
L8-11	Cooling fan control delay time Fan Delay Time	Set the time in seconds to delay turning OFF the cooling fan after the Inverter Stop Command is given. (Valid only if L8-10 = 0)	0 to 300	60 s	No	A	A	A	A	4B7H

■Selecting the Cooling Fan Control

Using parameter L8-10 two modes can be selected:

0: The fan is ON only when the Inverter output is ON, i.e. a voltage is output. This is the factory setting. The 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.

■Cooling Fan Control Delay Time

6

If the elevator is to operate for longer than 60 seconds in a single run, parameter L8-11 should be set to an appropriate level.

◆ Setting the Ambient Temperature

■Related Parameters

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
L8-12	Ambient temperature Ambient Temp	Sets the ambient temperature.	45 to 60	45 °C	No	A	A	A	A	4B8H

At high ambient temperatures an output current derating has to be considered. The derating depends on the ambient temperature. The derating curve is shown in *Fig 6.25*. To ensure a safe Inverter protection at high ambient temperatures, always set parameter L8-15 to the actual ambient temperature.

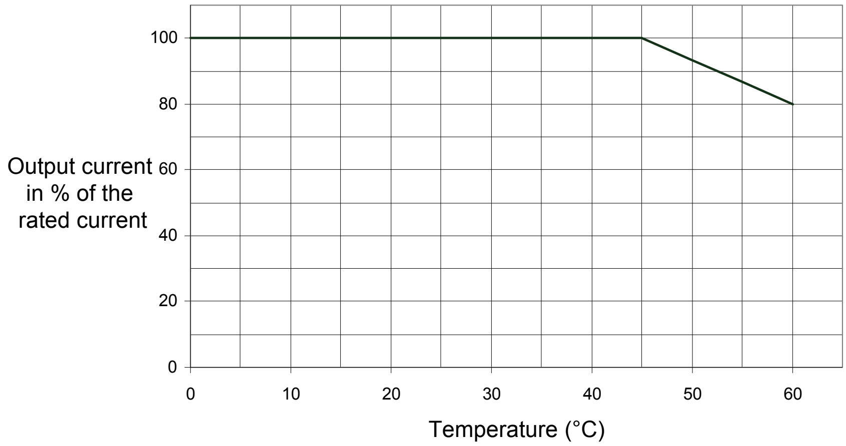


Fig 6.25 Ambient Temperature Derating Curve

6

◆ 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 control (PM) only (A1-02 = 6). If an over acceleration is detected, the Inverter coasts to stop and a DV6 fault is displayed.

■Related Parameters

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
S3-16	Over acceleration detection level Over Acc Det Lvl	Sets the maximum car acceleration value. If the acceleration rate is higher than this value, the Inverter trips with an over acceleration fault (DV6).	0.0 to 50.0	1.5	No	No	No	No	A	6CCH
S3-17	Over acceleration deceleration time parameter 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	0.050 s	No	No	No	No	A	6CDH

Parameter Number	Name		Description	Setting Range	Factory Setting	Change during Operation	Control Methods					MEMOBUS Register
	Display						V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)		
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	0,1	0	No	No	No	No	A		6CEH

■Adjusting the Over Acceleration Detection

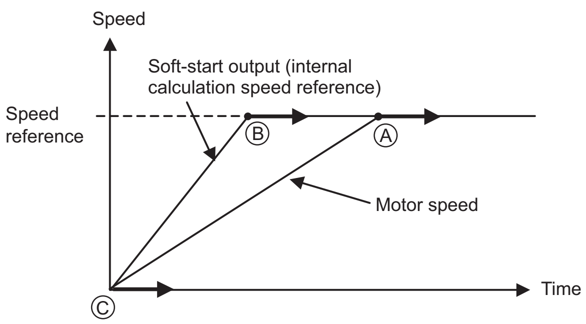
Over acceleration is detected when the acceleration of the car exceeds the value set in S3-16 for longer than the time set in S3-17. The setting of parameter S3-18 decides whether the over acceleration detection is always on when the power supply is on (S3-18 = 0) or only during operation (S3-18 = 1).

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 (Traction sheave diameter) and S3-14 (Roping) in order to make this function working properly.

◆ Selection of Conditions for Detection of Excessive Speed Deviation

Selects the conditions for detection of excessive speed deviation.



Set Value	Description
0	Monitors the excessive speed deviation after speed reference, soft-start output (Inverter internal calculation speed reference), and motor speed coincide with each other*. (A)
1	Monitors the excessive speed deviation after speed reference and soft-start output coincide with each other*. (B)
2	Always monitors the excessive speed deviation during operation. (C)

* Speed agree detection width can be set by L4-02.

6

Input Terminal Functions

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

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
H1-01	Terminal S3 function selection / Terminal S3 Sel	Multi-function input 1	0 to 88	24 (80) *	No	A	A	A	A	400H
H1-02	Terminal S4 function selection / Terminal S3 Sel	Multi-function input 2		14 (84) *	No	A	A	A	A	401H
H1-03	Terminal S5 function selection / Terminal S3 Sel	Multi-function input 3		3 (81) *	No	A	A	A	A	402H
H1-04	Terminal S6 function selection / Terminal S3 Sel	Multi-function input 4		4 (83) *	No	A	A	A	A	403H
H1-05	Terminal S7 function selection / Terminal S3 Sel	Multi-function input 5		6 (F) *	No	A	A	A	A	404H

* Value will change to number in parenthesis when parameter d1-18 equals 1 or 2.

◆ Closing 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.

Hardware Baseblock

When hardware baseblock is activated, the power supply of the IGBT driver circuit is cut off and the motor starts to coast. If the baseblock command is cleared, the Inverter output operation is resumed.
To use this baseblock function the multi-function contact input S8 must be used. The input is a NC input, i.e. if terminal S8 is open, the Inverter is baseblocked.

Software Baseblock

When software baseblock is used, the Inverter output is cut by a software function. If the baseblock command is cleared, the Inverter output operation is resumed.
To use this baseblock function one of the multi-function contact inputs must be set to baseblock, i.e. one of the parameters H1-01 to H1-05 (multi-function contact 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.

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

Set Value	Function	Control Methods			
		V/f	Open-loop Vector 1	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

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

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 (multi-function contact 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 *1		Error Detection Method *2		Operation During Error Detection			
	NO Contact	NC Contact	Parameter Detection	Detection During Operation	Decelerate to Stop (Error)	Coast to Stop (Error)	Fast Stop (Error)	Continue Operation (Warning)
20	Yes		Yes		Yes			
21		Yes	Yes		Yes			
22	Yes			Yes	Yes			
23		Yes		Yes	Yes			
24	Yes		Yes			Yes		
25		Yes	Yes			Yes		
26	Yes			Yes		Yes		
27		Yes		Yes		Yes		
28	Yes		Yes				Yes	
29		Yes	Yes				Yes	
2A	Yes			Yes			Yes	
2B		Yes		Yes			Yes	
2C	Yes		Yes					Yes
2D		Yes	Yes					Yes
2E	Yes			Yes				Yes
2F		Yes		Yes				Yes

* 1. Sets the input level at which errors are detected. (NO contact: External error when ON; NC contact: External error when OFF).

* 2. Set the detection method to detect errors using either parameter detection or detection during operation.
Parameter detection: Detects while power is supplied to the Inverter.
Detection during operation: Detects only during Inverter operation.

◆ Using the Timer Function

The multi-function contact input terminals S3 to S7 can be used as 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. By setting the delay time, you can prevent chattering of the sensors and switches.

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

■Related Parameters

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

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

Setting Value	Function	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
18	Timer function input	Yes	Yes	Yes	Yes

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

Setting Value	Function	Control Methods: V/f	Open-loop Vector 1	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.

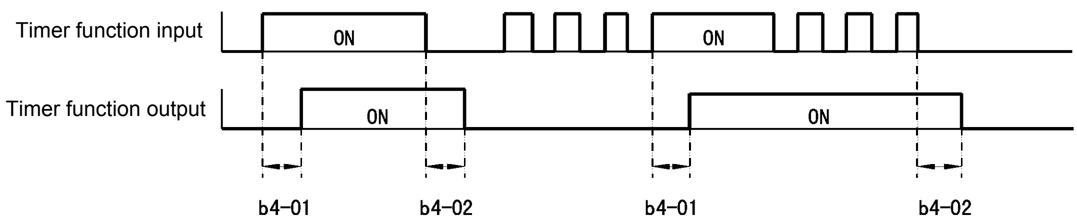


Fig 6.26 Timer Function Operation Example

◆ Magnetic Contactor Answer Back Detection

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

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

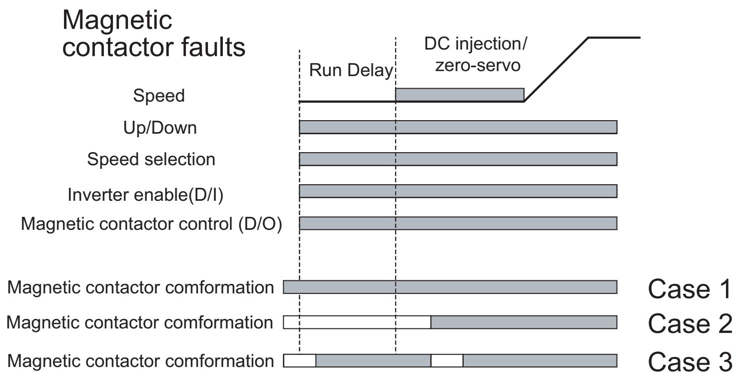
Setting Value	Function	Control Methods			
		V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
86	Magnetic contactor answer back	Yes	Yes	Yes	Yes

SE1 (Sequence Error) Detection Conditions

The following conditions will trigger an SE1 fault situation:

1. The answer back magnetic contactor failed to close within the Run delay time (S1-16).
2. The answer back magnetic contactor remained closed for longer than 1 second even though no close command was output.
3. The answer back magnetic contactor opened during run.

Inverters with SPEC: A recognize only detection conditions 2 and 3.



Output Terminal Functions

The multi-function contact 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 Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
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	40BH
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	40CH
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	40DH

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

During Run (Setting: 0)

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

During Run 2 (Setting: 37)

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

These outputs can be used to indicate the Inverter’s operating status.

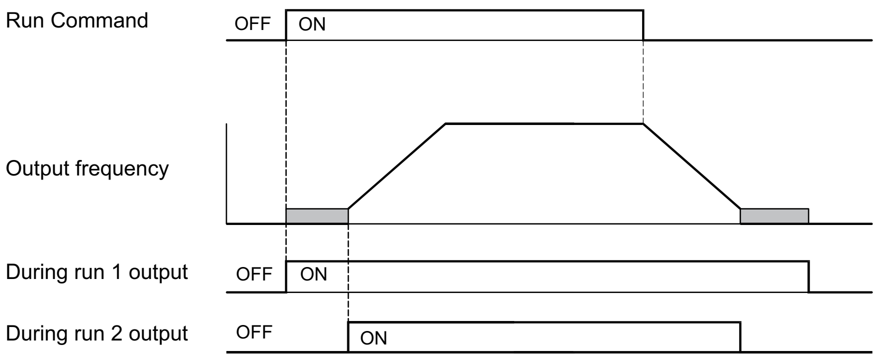


Fig 6.27 Timing Chart for “During RUN” Output

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■Zero-speed (Setting: 1)

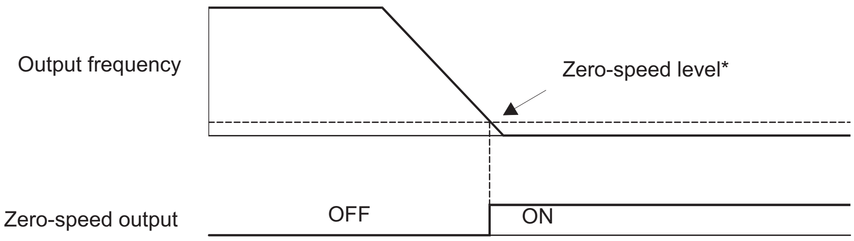


Fig 6.28 Timing Chart for Zero-speed

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 method. It is 0.1 Hz for closed-loop vector, 0.5 Hz for open-loop vector and 1.2 Hz for V/f control.

■Inverter Operation Ready (Setting: 6)

If a multi-function output is set to this function, the output is switched ON when the initialization of the Inverter at startup has been finished without any faults.

■During DC Bus Undervoltage (Setting: 7)

If a multi-function 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 multi-function output is set to this function, the output is switched ON as long as the Inverter output is baseblocked.

■Frequency Reference Source Selection (Setting: 9)

If a multi-function 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 multi-function 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 multi-function 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 *Fault Detection* in *Chapter 7* for a fault list).

■Minor Fault Output (Setting: 10)

If a multi-function output is set to this function, the output is switched ON when a minor fault occurs (refer to *Alarm Detection* in *Chapter 7* for an alarm list).

■Fault Reset Command Active (Setting: 11)

If a multi-function output is set to this function, the output is switched ON as long as a fault reset command is input at one of the multi-function contact inputs.

■During Reverse Run (Setting: 1A)

If a multi-function output is set to this function, the output is switched ON whenever a Run Command in reverse direction is active. The contact is also ON during DC injection braking and baseblock. It is OFF when a Forward Run Command is input.

■During Baseblock 2 (Setting: 1B)

If a multi-function output is set to this function, the output is switched OFF as long as a Baseblock command is input.

■During Regenerative Operation (Setting: 1D)

If a multi-function 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.

■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)

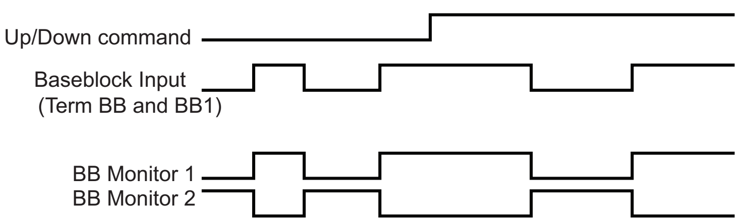
This function can be used for indicating the inverse condition of the zero-speed status.

OFF	The output frequency is lower than the zero-speed level.
ON	The output frequency is higher than the zero-speed level.

■Baseblock Monitor 1 and 2 (Setting: 46/47)

If a multi-function output is programmed for this function, the output is switched if both baseblock inputs (BB and BB1) are enabled.

Setting Value	Function	Control Methods			
		V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
46	Hardware baseblock monitor 1 (ON: terminal BB and BB1 closed)	Yes	Yes	Yes	Yes
47	Hardware baseblock monitor 2 (ON: terminal BB or BB1 off)	Yes	Yes	Yes	Yes



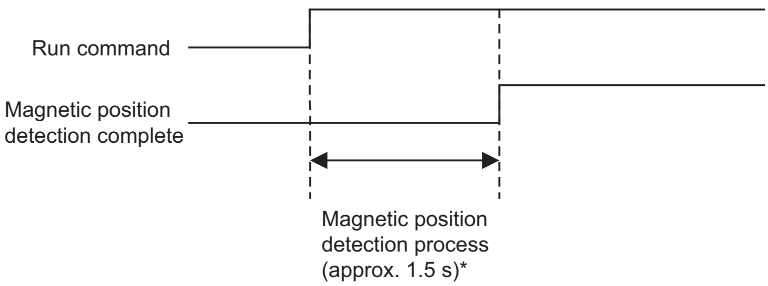
◆ Magnetic Position Detection Status Signal

When running a permanent magnet motor without a PG-F2 option card, an external braking sequence needs to be set up if not using the recommended braking sequence. This will ensure that the brake does not get released when the magnetic position detection status signal opens.

The magnetic pole detection status switch is open when the unit is powered up. The three types of conditions that will trigger the magnetic position detection process are provided below.

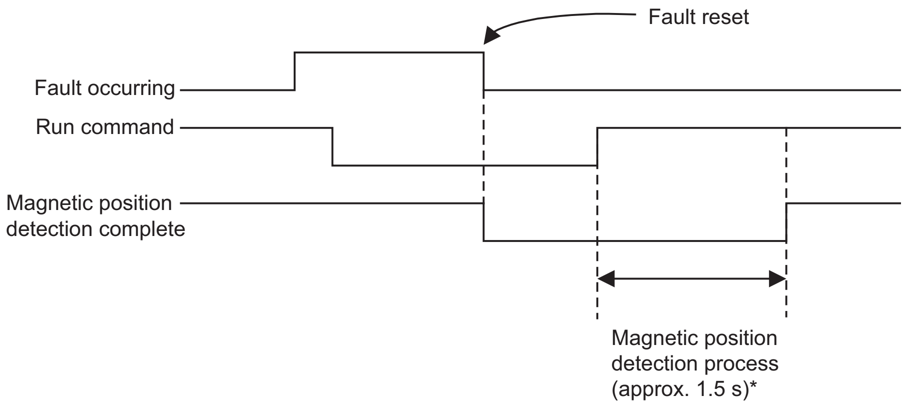
The magnetic position detection signal will close once the process is complete.

Condition 1: First time operating the Inverter after the power is switched on.



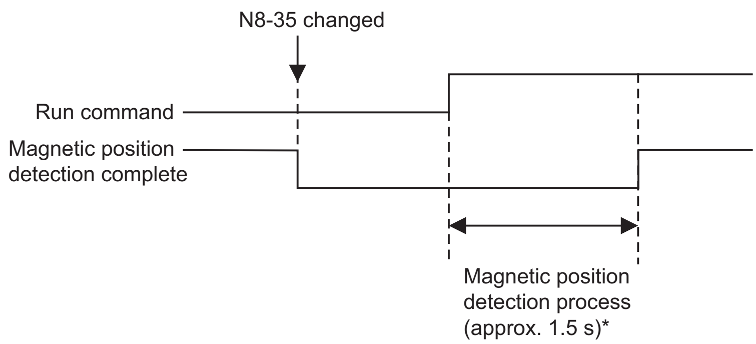
* 200 ms when N8-35 equals zero.

Condition 2: Operation following a PGO fault or a DV fault (DV1 through DV4).



* 200 ms when N8-35 equals zero.

Condition 3: Operation after the setting value of parameter N8-35 has been changed.



* 200 ms when N8-35 equals zero.

Motor and V/f Pattern Setup

◆ Setting Motor Parameters

In the vector control methods the motor parameters can be set automatically by the autotuning function (refer to *page 6-79, Autotuning*). However, if autotuning does not complete normally, the parameters must be set manually like described below.

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register
E2-01	Motor rated current / Motor Rated FLA	Sets the motor rated current in Amps. This set value will become the reference value for motor protection and torque limits. This parameter is an input data for autotuning.	1.75 to 35.00 *1	14.00 A *2	No	Q	Q	Q	No	30EH
E2-02	Motor rated slip / Motor Rated Slip	Sets the motor rated slip. This set value will become the reference value for the slip compensation. This parameter is automatically set during autotuning.	0.00 to 20.00	2.73 Hz *2	No	Q	Q	Q	No	30FH
E2-03	Motor no-load current / No-Load Current	Sets the motor no-load current. This parameter is automatically set during autotuning.	0.00 to 13.99 *3	4.50 A *2	No	Q	Q	Q	No	310H
E2-04	Number of motor poles / Number of Poles	Sets the number of motor poles. This value is an input data for autotuning.	2 to 48	4 poles	No	No	No	Q	No	311H
E2-05	Motor line-to-line resistance / Term Resistance	Sets the motor phase-to-phase resistance. This parameter is automatically set during autotuning.	0.000 to 65.000	0.771 Ω *2	No	Q	Q	Q	No	312H
E2-06	Motor leak inductance / Leak Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of the motor rated voltage. This parameter is automatically set during autotuning.	0.0 to 40.0	19.6% *2	No	No	A	A	No	313H
E2-07	Motor iron saturation coefficient 1 / Saturation Comp1	Sets the motor iron saturation coefficient at 50% of magnetic flux. This parameter is automatically set during rotating autotuning.	0.00 to 0.50	0.50	No	No	A	A	No	314H
E2-08	Motor iron saturation coefficient 2 / Saturation Comp2	Sets the motor iron saturation coefficient at 75% of magnetic flux. This parameter is automatically set during rotating autotuning.	E2-07 to 0.75	0.75	No	No	A	A	No	315H

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
E2-10	Motor iron loss for torque compensation Tcomp Iron Loss	Sets motor iron losses.	0 to 65535	112 W *2	No	No	No	No	No	317H
E2-11	Motor rated output power Mtr Rated Power	Sets the rated output power of the motor. This parameter is an input data for autotuning.	0.00 to 650.00	3.70 kW *2	No	Q	Q	Q	No	318H
E2-12	Motor iron saturation coefficient 3 Saturation Comp3	This parameter is automatically set during rotating autotuning.	1.30 to 1.60	1.30	No	No	A	A	No	328H

* 1. The setting range is from 10% to 200% of the Inverter rated output current. The value for a 200 V class Inverter for 3.7 kW is given.
* 2. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.
* 3. The setting ranges depend on the Inverter capacity. The values for a 200 V class Inverter of 3.7 kW are given.

■Manual Setting of the Motor Parameters

Motor Rated Current Setting (E2-01)

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

Motor Rated Slip Setting (E2-02)

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

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

6

Motor No-Load Current Setting (E2-03)

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

Number of Motor Poles Setting (E2-04)

E2-04 is displayed only when closed-loop vector control method is selected. Set the number of motor poles as written on the motor nameplate.

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

E2-05 is set automatically when performing motor line-to-line resistance autotuning. When you cannot perform tuning, consult the motor manufacturer for the line-to-line resistance value. Calculate the resistance from the line-to-line resistance value in the motor test report using the following formula, and then make the setting accordingly.

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

Motor Leak Inductance Setting (E2-06)

Set the amount of voltage drop due to motor leakage inductance in E2-06 as 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, E2-08)

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. The motor iron loss has to be set in kW.

◆ Autotuning

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

IMPORTANT

1. If the magnetic contactors are controlled by the Inverter, they will be closed during autotuning. If the magnetic contactors are controlled by an external controller, make sure to close the contacts during autotuning.
2. Make sure to close the baseblock contact during autotuning. Otherwise the autotuning can not be started and will terminate with a minor fault.
3. For rotating autotuning make sure that the brake is open during autotuning.
4. Never do rotating autotuning with the ropes installed.

■ Setting the Autotuning Mode

One of the following three autotuning modes can be set.

- Rotating autotuning
- Non-rotating autotuning
- Non-rotating autotuning for line-to-line resistance only

Rotating Autotuning (T1-01 = 0)

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

IMPORTANT

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

Stationary Autotuning (T1-01 = 1)

Stationary autotuning is used for open-loop vector control and closed-loop vector control. Set T1-04 to 4, and Motor no-load current (T1-09) will be added as a setting item. Input the data from the nameplate. Be sure to input the value or motor no-load current (motor exciting current) from motor examination results to T1-09. After autotuning, the value of T1-09 will be written in E2-03. When not setting T1-09, the value of Yaskawa standard motor’s no-load current will be written in E2-03.

IMPORTANT

1. Power will be supplied to the motor when stationary autotuning is performed even though the motor will not turn. Do not touch the motor until autotuning has been completed.
2. When performing stationary autotuning connected to a conveyor or other machine, ensure that the holding brake is not activated during autotuning.

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

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

To perform autotuning in V/f control, set T1-02 (Motor rated power) and T1-04 (Motor rated current) and then press the RUN key on the Digital Operator. The Inverter 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 autotuning.

IMPORTANT

1. Power will be supplied to the motor when stationary autotuning 1 is performed even though the motor will not turn. Do not touch the motor until autotuning has been completed.
2. When performing stationary autotuning 1 connected to a conveyor or other machine, ensure that the holding brake is not activated during autotuning.

■ Precautions Before Using Autotuning

Read the following precautions before using autotuning.

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

■Precautions for Rotating and Non-rotating Autotuning

If the motor rated voltage is higher than the power supply voltage, lower the base voltage value like shown in *Fig 6.29* 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.

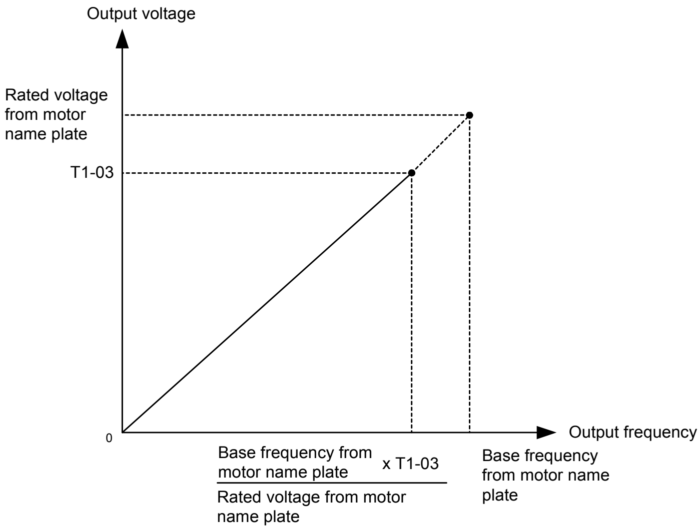


Fig 6.29 Motor Base Frequency and Inverter Input Voltage Setting

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

■Precautions after Rotating and Non-rotating Autotuning

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

■Parameter Settings for Autotuning

The following parameters must be set for autotuning.

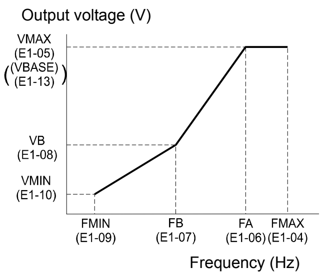
Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
T1-01	Autotuning mode selection / Tuning Mode Sel	Sets the autotuning mode. 0: Rotational autotuning 1: Stationary autotuning 2: Stationary autotuning for line-to-line resistance only 4:Encoder offset tuning	0 to 2 0.4 (PM)	1* 4 (PM)	No	Yes	Yes	Yes	Yes	701H
T1-02	Motor output power / Mtr Rated Power	Sets the output power of the motor in kilowatts.	0.00 to 650.00	3.70 kW *2	No	Yes	Yes	Yes	No	702H
T1-03	Motor rated voltage / Rated Voltage	Sets the base voltage of the motor.	0 to 255.0 *3	190.0 V *3	No	No	Yes	Yes	No	703H
T1-04	Motor rated current / Rated Current	Sets the base current of the motor.	1.75 to 35.00 *4	14.00 A *2	No	Yes	Yes	Yes	No	704H
T1-05	Motor rated frequency / Rated Frequency	Sets the rated frequency of the motor.	0 to 120.0 *5	60.0 Hz	No	No	Yes	Yes	No	705H
T1-06	Number of motor poles / Number of Poles	Sets the number of motor poles.	2 to 48 poles	4 poles	No	No	Yes	Yes	No	706H
T1-07	Motor base speed / Rated Speed	Sets the base speed of the motor.	0 to 24000	1450 min^{-1}	No	No	Yes	Yes	No	707H
T1-08	Number of PG pulses / PG Pulses/Rev	Sets the number of PG pulses per revolution.	0 to 60000	600 PPR *2	No	No	No	Yes	No	708H
T1-09	No load current / No load current	Sets the no load current of motor.	0.0 to 35.00 *5	4.05 (E2-03)	No	No	Yes	Yes	No	709H

* 1. Set T1-02 and T1-04 when 2 is set for T1-01. For V/f control a set value 2 is possible only.
* 2. The factory settings depend on the Inverter capacity. The values provided are for a 200 V class Inverter for 3.7 kW and when o2-09 is set to 0.
* 3. These are values for a 200 V class Inverter. Values for a 400 V class Inverter are double.
* 4. The setting range is from 10% to 200% of the Inverter rated output current. The value for a 200 V class Inverter for 0.4 kW is given.
* 5. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

◆ Setting the V/f Pattern

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

■Related Parameters

Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
E1-01	Input voltage setting Input Voltage	Sets the Inverter input voltage. This setting is used as a reference value for protection functions.	155 to 255 *1	200 VAC *1 *4	No	Q	Q	Q	Q	300H
E1-04	Max. output frequency (FMAX) Max Frequency	 To set V/f characteristics in a straight line, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Always ensure that the four frequencies are set in the following manner: E1-04 (FMAX) ≥ E1-06 (FA) > E1-07 (FB) ≥ E1-09 (FMIN)	0.0 to 120.0 20 to 3600 (PM)	60.0 Hz *4 96 min^{-1} (PM) *5	No	Q	Q	Q	Q	303H
E1-05	Max. voltage (VMAX) Max Voltage		0.0 to 255.0 *1	200.0 VAC *1 *4	No	Q	Q	Q	No	304H
E1-06	Base frequency (FA) Base Frequency		0.0 to 120.0 20 to 3600 (PM)	60.0 Hz *4 96 min^{-1} (PM) *5	No	Q	Q	Q	Q	305H
E1-07	Mid. output frequency (FB) Mid Frequency A		0.0 to 120.0	3.0 Hz *2 *4	No	A	A	No	No	306H
E1-08	Mid. output frequency voltage (VB) Mid voltage A		0.0 to 255.0 *1	14.0 VAC *1 *2 *4	No	Q	Q	No	No	307H
E1-09	Min. output frequency (FMIN) Min Frequency		0.0 to 120.0 0 to 3600 (PM)	1.5 Hz *2 *4 0 min^{-1} (PM)	No	Q	Q	A	A	308H
E1-10	Min. output frequency voltage (VMIN) Min Voltage		0.0 to 255.0 *1	7.0 VAC *1 *2 *4	No	Q	Q	No	No	309H
E1-13	Base voltage (VBASE) Base Voltage	Sets the output voltage of the base frequency (E1-06).	0.0 to 255.0 *1	0.0 VAC *3 200.0 VAC (PM)	No	A	No	No	Q	30CH

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

6

* 4. The factory settings will change according to parameter o2-09. Values shown here are for when o2-09 is set to 0.
* 5. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7kW are given.

■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 6.30*).

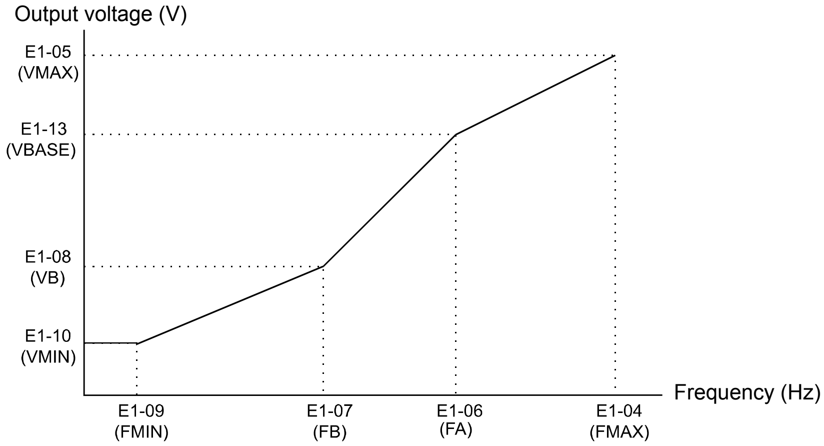


Fig 6.30 V/f pattern setting

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.

6

■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)

Digital Operator/LED Monitor Functions

◆ Setting Digital Operator/LED Monitor Functions

■Related Parameters

Parameter Number	Name	Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register
o1-01	Monitor selection	User Monitor Sel	Selects which monitor will be displayed in the operation menu upon power-up when o1-02 is set to 4.	4 to 99	6	Yes	A	A	A	A	500H
o1-02	Monitor selection after power up	Power-On Monitor	Sets the monitor item to be displayed when the power is turned on. 0: Frequency reference 1: Output frequency 2: Output current 3: The monitor item set for o1-01	1 to 4	1	Yes	A	A	A	A	501H
o1-03	Frequency units of reference setting and monitor	Display Scaling	Sets the units that will be set and displayed for the frequency reference and frequency monitor. 0: 0.01 Hz units 1: 0.01% units (Maximum output frequency is 100%) 2 to 39: min^{-1} units (Set the motor poles.) 40 to 39999: User desired display Set the desired values for setting and display for the max. output frequency. □□□□□ Sets the value that is to be displayed at 100% excluding the decimal point. Sets the number of decimal places. Example: When the max. output frequency value is 200.0, set 12000	0 to 39999	0 1 (PM)	No	A	A	A	A	502H
o1-04	Setting unit for frequency parameters related to V/f characteristics	Display Units	Set the setting unit for frequency reference-related parameters. 0: Hz 1: min^{-1}	0, 1	0 1 (PM)	No	No	No	A	A	503H
o1-05	LCD Display contrast adjustment	LCD Contrast	Sets the contrast on the optional LCD operator (JVOP-160). 0: light 2: 3: normal 4: 5: dark	0 to 5	3	Yes	A	A	A	A	504H

6

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Register
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, 1	0	No	A	A	A	A	506H
o2-03	Parameter initial value User Defaults	Clears or stores user initial values. 0: Stores/not set 1: Begins storing (Records the set parameters as user initial values.) 2: All clear (Clears all recorded user initial values) When the set parameters are recorded as user initial values, 1110 will be set in A1-03.	0 to 2	0	No	A	A	A	A	507H
o2-04	kVA selection Inverter Model #	(Do not set this parameter.)	0 to FF	4*	No	A	A	A	A	508H
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, 1	0	No	A	A	A	A	509H
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, 1	0	No	A	A	A	A	50AH
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
o2-08	Cumulative operation time selection Elapsed Time Run	0: Accumulated Inverter power on time. 1: Accumulated Inverter run time.	0, 1	1	No	A	A	A	A	50CH
o2-09	Initialize Mode InitModeSet	0: Japanese specification 1: American specification 2: European specification	0 to 2	0	No	A	A	A	A	50DH
o2-10	Fan operation time setting Fan ON Time Set	Sets the initial value of the fan operation time. The operation time is accumulated starting from this set value.	0 to 65535	0 hr.	No	A	A	A	A	50EH
o2-12	Fault trace initialize Fault Trace Init	0: No initialisation 0: Initialize (= zero clear) after setting “1” o2-12 will be returned to “0”	0, 1	0	No	A	A	A	A	510H

6

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
o2-15	Number of Travels counter initialize Initialize Sel	Operation counter initialize. 0: Number of travels counter is kept 1: Number of travels counter monitor clear	0, 1	0	No	A	A	A	A	513H

* The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

■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).

■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)

■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 “min^{-1}”. 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 $\neq$ 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 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 5-66, Factory Settings that Change with the Control Method (A1-02)* to see parameters that depend on this setting.

Normally it is not necessary to change this setting, unless the control board 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 is Disconnected (o2-06)

This function selects the operation when the digital operator gets disconnected when a Run Command is active.

If o2-06 is set to 0 the operation is continued.
If o2-06 is set to 1 the output is switched off and the motor coasts to stop. The fault contact is operated. When the operator is reconnected an OPR (Operator disconnected) is shown.

■Cumulative Operation Time (o2-07 and o2-08)

The Inverter has a function that counts the operation time of the Inverter cumulatively.

Using parameter o2-07 the 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 elevator operation counter monitor (U1-55) can be initialized.

◆ Copying Parameters (JVOP-160 only)

The Digital Operator can perform the following three functions using a built-in EEPROM (non-volatile memory).

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

The data saved in the 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 Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
o3-01	Copy function selection Copy Func-tion 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
o3-02	Read permission selection Read Allowable	0: READ prohibited 1: READ permitted	0, 1	0	No	A	A	A	A	516H

6

■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 parameters 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 7-15, Digital Operator Copy Function Faults* for corrective actions.

6

■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
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 parameters 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 7-15, 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 7-15, 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

6

◆ Prohibiting Overwriting of Parameters

If A1-01 is set to 0, all parameters except A1-01 and A1-04 are write protected, U1-☐☐, U2-☐☐ and U3-☐☐ will be displayed. If A1-01 is set to 1, only the parameters A1-01, A1-04 and A2-☐☐ can be read or written, U1-☐☐, U2-☐☐ and U3-☐☐ will be displayed. All other parameters will not be displayed.

If you set one of the parameters H1-01 to H1-05 (multi-function contact input terminal S3 to S7 function selection) to 1B (write parameters permitted), parameters can be written from the digital operator when the terminal that has been set is ON. When the set terminal is OFF, writing parameters other than the frequency reference is prohibited. However, the parameters can be read.

■Related Parameters

Parameter Number	Name	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
	Display					V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
A1-01	Parameter access level Access Level	Used to set the parameter access level (set/read.) 0: Monitoring only (Monitoring drive mode and setting A1-01 and A1-04.) 1: Used to select parameters (Only parameters set in A2-01 to A2-32 can be read and set.) 2: Advanced (Parameters can be read and set in both, quick programming mode (Q) and advanced programming mode (A).)	0 to 2	2	Yes	Q	Q	Q	Q	101H

6

◆ 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 Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	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 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
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.) Zero is always displayed when o2-09 is set to 1 or 2.	0 to 9999	0	No	A	A	A	A	104H
A1-05	Password setting Select Password	Used to set a four digit number as the password. Usually this parameter is not displayed. When the Password (A1-04) is displayed, hold down the RESET key and press the Menu key. The password will be displayed.	–	0	No	A	A	A	A	105H

■Setting a Password

The password can be set in parameter A1-05. Normally A1-05 is not displayed. To display and modify A1-05 the MENU and Reset key must be pressed together in the A1-04 display.

6

◆ Displaying User-set Parameters Only

The A2 parameters (user-set parameters) and A1-01 (parameter access level) can be used to establish a parameter set that contains only the most important parameters.

Set the number of the parameter to which you want to refer in A2-01 to A2-32, and then set A1-01 to 1. Using the advanced programming mode you can read and modify A1-01 to A1-03 and the parameters set in A2-01 to A2-32 only.

■Related Parameters

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

◆ 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 Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register
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	No	No	No	A	3B4H
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	0,1	0	No	No	No	No	A	3B5H

* Parameter F1-25 can only be set using the digital operator.
Once F1-25 has been set to 1, 2, or 3, the copy function will be executed. Afterwards, "Copy complete" will appear on the Digital Operator screen, and F1-25 will be reset to zero.
If F1-26 = 0, then "Encoder write protected" will still appear even when F1-25 is set to 1.

6

■Saved Parameters

The following parameters are saved in the encoder memory:

- E1-04 Max. output frequency
- E1-06 Base frequency
- E1-13 Base voltage
- E5-02 Motor rated power
- E5-03 Motor rated current
- E5-04 Number of motor poles
- E5-05 Motor line-to-line resistance
- E5-06 D-axis inductance
- E5-07 Q-axis inductance
- E5-09 Motor voltage parameter
- F1-01 PG parameter
- F1-05 PG rotation
- F1-21 Absolute encoder resolution
- 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 *Chapter 7 Troubleshooting*).

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 COPYING” 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 *Chapter 7 Troubleshooting*).

■Verify Saved Parameters

To compare the parameters stored in the Inverter and encoder the parameter F1-25 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 Inverter 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/CPF24 must not be active.

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. Two different PG boards can be used, the PG-B2 and the PG-X2 board. Refer to *page 2-26, Option Card Models and Specifications* to see details.

■Related Parameters

Param-eter Number	Name Display	Description	Setting Range	Factory Setting	Change during Opera-tion	Control Methods V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMO-BUS Regis-ter
F1-01	PG parameter PG Pulses/ Rev	Sets the number of PG pulses per revolution	0 to 60000 0 to 8192 (PM)	600*1 8192 (PM)	No	No	No	Q	Q	380H
F1-02	Operation selection at PG open circuit (PGO) PG Fdbk Loss Sel	Sets the PG disconnection stopping method. 0: Ramp to stop (Deceleration to stop using the deceleration time 1, C1-02.) 1: Coast to stop 2: Fast stop (Fast stop using the deceleration time in C1-09.) 3: Continue operation (To protect the motor or machinery, avoid to use this setting.)	0 to 3	1	No	No	No	A	A	381H
F1-03	Operation selection at overspeed (OS) PG Over-speed 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 (Fast stop using the deceleration time in C1-09.) 3: Continue operation (To protect the motor or machinery, avoid to use this setting.)	0 to 3	1	No	No	No	A	A	382H
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 (Fast stop using the deceleration time in C1-09.) 3: Continue operation (DEV is displayed and operation continued.)	0 to 3	3 1 (PM)	No	No	No	A	A	383H
F1-05	PG rotation PG Rotation Sel	0: Phase A leads with Forward Run Command. (Phase B leads with Reverse Run Command) 1: Phase B leads with Forward Run Command. (Phase A leads with Reverse Run Command)	0, 1	0 1 (PM)	No	No	No	Q	Q	384H
F1-06	PG division rate (PG pulse monitor) PG Output Ratio	Sets the division ratio for the PG speed control board pulse output. Division ratio = (1+ n) /m (n=0 or 1 m=1 to 32) The first digit of the value of F1-06 stands for n, the second and the third stands for m. This parameter is effective only when a PG-B2 is used. The possible division ratio settings are: $1/32 \leq$ F1-06 ≤ 1.	1 to 132	1	No	No	No	A	A	385H

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Parameter Number	Name Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods				MEMOBUS Register
						V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	
F1-08	Overspeed detection level PG Overspd Level	Sets the overspeed detection method. Motor speeds that continue to exceed the value set in F1-08 (set as a percentage of the maximum output frequency) for the time set in F1-09 are detected as overspeed faults.	0 to 120	115%	No	No	No	A	A	387H
F1-09	Overspeed detection delay time PG Overspd Time		0.0 to 2.0	0.0 s	No	No	No	A	A	388H
F1-10	Excessive speed deviation detection level PG Deviate Level	Sets the speed deviation detection method. Any speed deviation above the F1-10 set level (set as a percentage of the maximum output frequency) that continues for the time set in F1-11 is detected as a speed deviation. The speed deviation is the difference between actual motor speed and the speed reference command.	0 to 50	10%	No	No	No	A	A	389H
F1-11	Excessive speed deviation detection delay time PG Deviate Time		0.0 to 10.0	0.5 s	No	No	No	A	A	38AH
F1-14	PG open-circuit detection delay time PGO Detect Time	Used to set the PG disconnection detection time. PGO will be detected if the detection time exceeds the set time.	0.0 to 10.0	1.0 s	No	No	No	A	A	38DH

* The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.

6

■Using PG Speed Control Board

There are two types of PG Speed control board that can be used in closed-loop vector control:

- PG-B2: A/B-phase pulse input, compatible with complimentary outputs.
- PG-X2: A/B/Z-phase pulse input, compatible with line drivers (RS-422).
- PG-F2: EnDat I/f, HIPERFACE® I/f.

For the mounting instructions, specifications and connection diagrams refer to *page 2-26, Installing and Wiring Option Cards*.

IMPORTANT

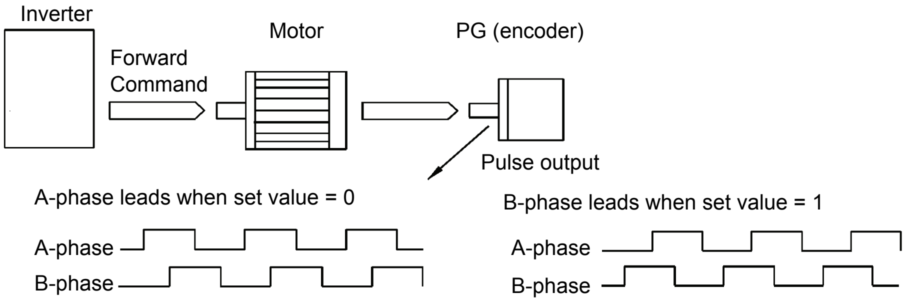
If open-loop vector control is used and a PG board is installed, the speed detected by the PG board is displayed in the monitor parameter U1-05. Therefore the PG parameter has to be set in parameter F1-01. The direction of the speed detection can be changed by parameter F1-05.
To change the U1-05 value to the internally calculated value remove the PG board.

■Setting Number of PG Pulses (F1-01)

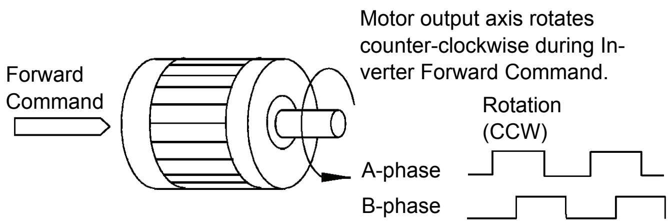
Set the number of PG (Pulse Generator/Encoder) pulses in pulses per revolution.

■Suit the PG Rotation Direction and Motor Rotation Direction (F1-05)

Parameter F1-05 suits the PG rotation direction to the motor rotation direction. If the motor is rotating forwards, set whether it is A-phase leads or B-phase leads.



Example: Forward rotation of standard motor (PG)



With the used PG the A-phase leads (CCW) when motor rotation is forward.

Generally, the A-phase leads when the rotation direction is counter-clockwise (CCW) seen from the shaft side (FWD command is input).

■Setting PG Pulse Monitor Output Division Ratio (F1-06)

This function is enabled only when using PG speed control board PG-B2. Set the division ratio for the PG pulse monitor output. The set value is expressed as n for the higher place digit, and m for the two lower place digits. The dividing ratio is calculated as follows:

Dividing ratio = (1 + n)/m (Setting range) n: 0 or 1, m: 1 to 32

$$\text{F1-06} = \underbrace{\square}_{n}\ \underbrace{\square\square}_{m}$$

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.

■Detecting PG Open Circuit (F1-02 and F1-14)

Parameter F1-02 selects the stopping method when a PG disconnection is detected.

PG open (PGO) is 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.

◆ 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)

6

Emergency Operation

Using emergency 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 emergency operation must be enabled by a multi-function contact input (H1-□□ = 85). The battery voltage 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.

Emergency operation powered by a backup battery requires the use of the PG-F2 option card. The Inverter cannot run a Permanent magnet motor with the backup battery if any other option card is used.

■Related Parameters.

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
L2-11	Battery Voltage Volt@batterydr	Sets the battery voltage.	0 to 400 *	0 *	No	A	A	A	A	4CBH

* These are values for a 200 V class Inverter. Values for a 400 V class Inverter are the double.

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

Setting Value	Function mane	V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)
85	Battery operation command*	Yes	Yes	Yes	Yes

* Battery-powered operation is not available if using a permanent magnet motor with an option card other than a PG-F2 option card.

■Emergency Operation Power Supply Ratings

The power supply to the DC bus and to the control board during battery operation must meet the following requirements:

Voltage class	Control Power Supply	DC Bus Power Supply
200 V	280 to 300 VDC	48 to 300 VDC
400 V	500 to 600 VDC	96 to 600 VDC

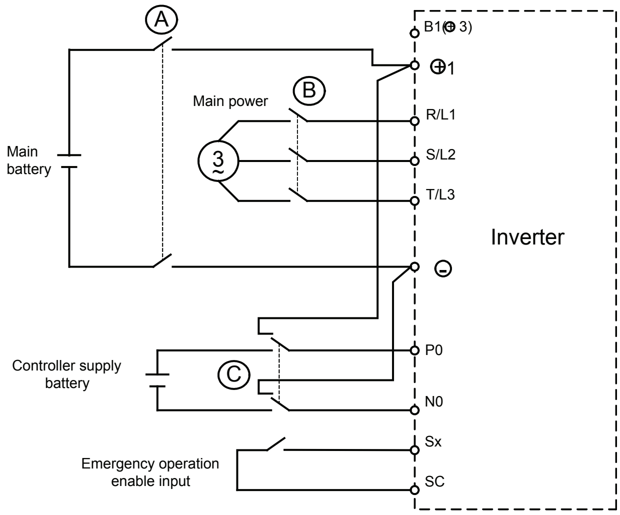
- Note: When an AC power supply (e.g. a single phase UPS like example 3 below) is used, make sure that the rectified voltage meets the voltage range above.

■Battery operation wiring examples

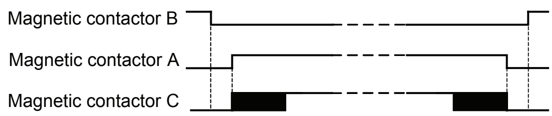
The following diagrams show some wirings examples for emergency operation

Example 1: Two Batteries, Main battery voltage lower than 280 VDC.

Wiring



Magnetic contactor sequence

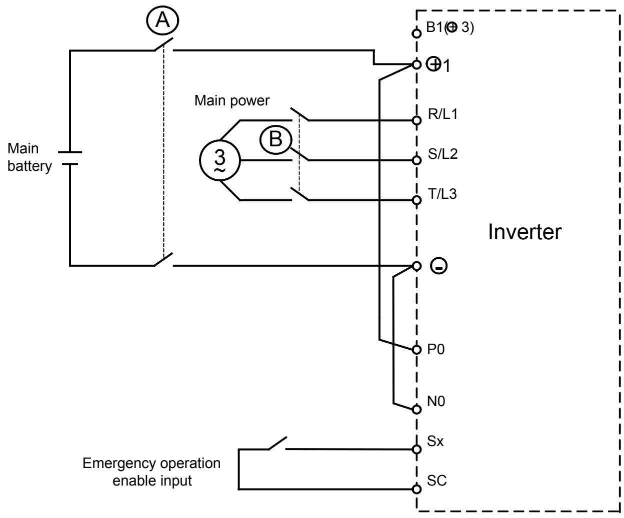


The magnetic contactors must be operated, so that magnetic contactor B is always opened, before A and C are closed. Magnetic contactor C can be closed after A but not before. When battery operation is disabled, the magnetic contactors A and C must be opened, before B is closed.

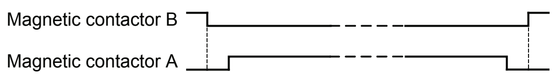
Example 2: Main battery voltage higher than 280 VDC.

6

Wiring



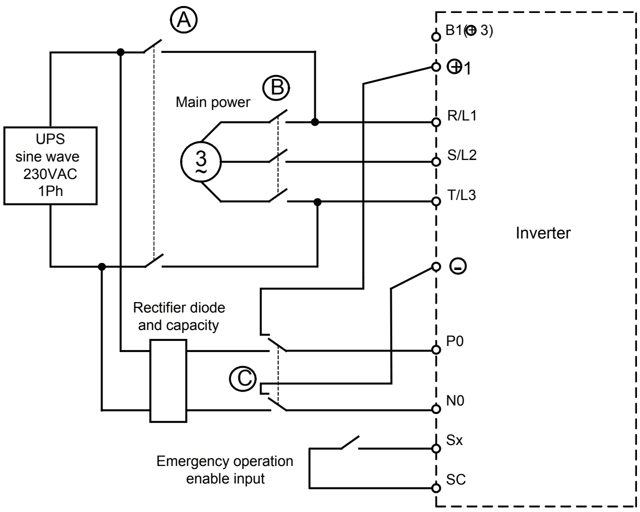
Magnetic contactor sequence



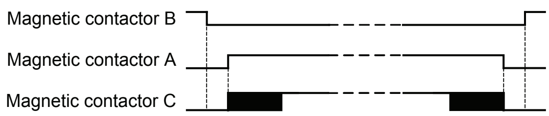
The magnetic contactors must be operated, so that magnetic contactor B is always opened, before A is closed. When the battery operation is disabled, the magnetic contactor A must be opened, before B is closed.

Example 3: 1 Phase, 230 V UPS Power Supply

Wiring



Magnetic contactor sequence



The magnetic contactors must be operated, so that magnetic contactor B is always opened, before A and C are closed. Magnetic contactor C can be closed after A but not before. When battery operation is disabled, the magnetic contactors A and C must be opened, before B is closed.

■Emergency Operation Speed

During emergency operation the speed is limited by the battery voltage using the following formula:

- for the 200 V class: $$\text{Emergency Operation Speed Limit} = \frac{\text{Battery Voltage L2-11} \times \text{Base frequency E1-04}}{300\ \text{V} \times 2}$$

- for the 400 V class: $$\text{Emergency Operation Speed Limit} = \frac{\text{Battery Voltage L2-11} \times \text{Base frequency E1-04}}{600\ \text{V} \times 2}$$

If the emergency speed reference (d1-15) is higher than the emergency operation speed limit, the output frequency is automatically limited to the calculated limit. It prevents a voltage saturation and a possible motor stalling.

■Precautions

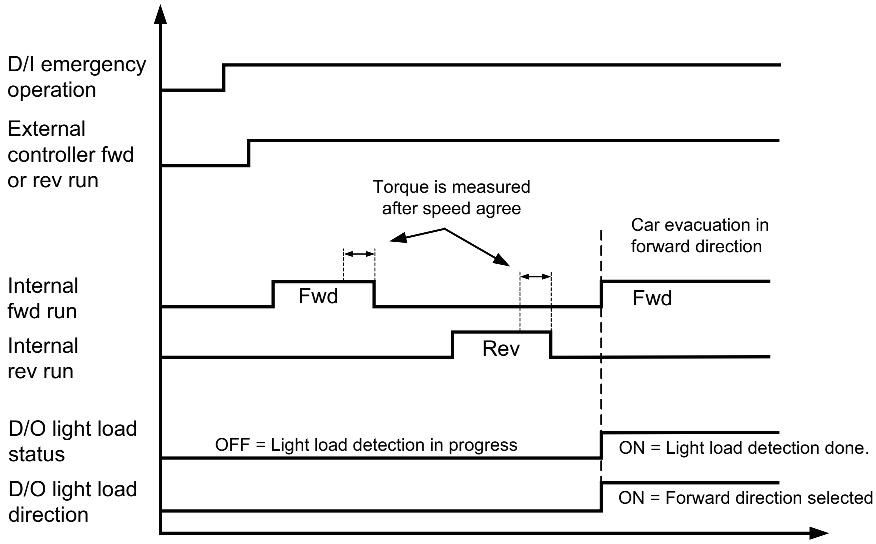
Because of the possibly low DC bus voltage during battery operation, the heatsink cooling fans may not work. A continuous operation under this condition can result in over heat faults and Inverter damage.

6

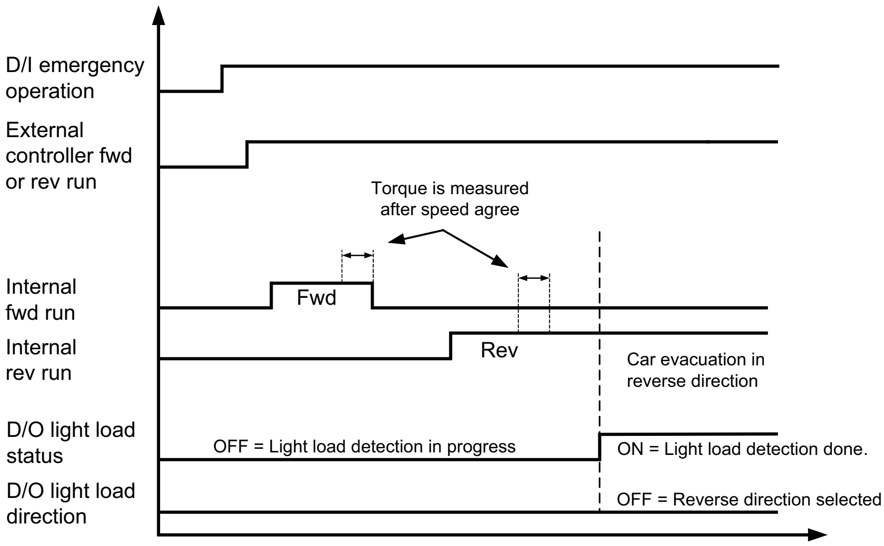
■Light Load Direction Detection

The Inverter can detect the light load direction for emergency operation. Therefore, if the light load direction search is enabled (S3-06 is set to 1), the elevator is driven with the emergency speed in forward direction first and in reverse direction afterwards. The current/torque is measured in both directions and compared to each other.

- If the detected light direction is forward, the Inverter stops and restarts in the forward direction with the set emergency operation speed. At the restart the light load detection status output (H2-☐☐=45) and the light load direction output (H1-☐☐=44) are set.



- If the detected light load direction is reverse, the Inverter continues the operation with the set emergency operation speed. The light load detection status output (H1-☐☐=45) is set, the direction output is not changed.



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

■Auto Restart External Outputs

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

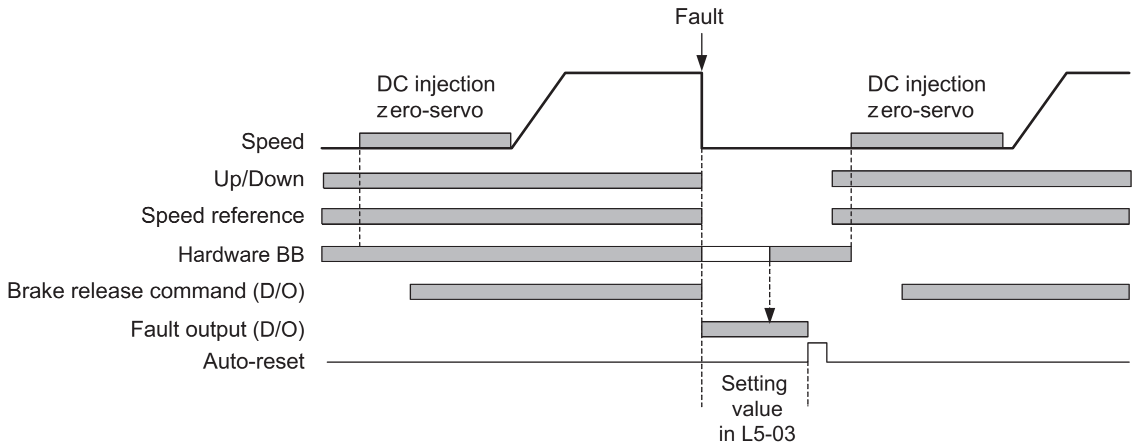
■Related Parameters.

Parameter Number	Name (Display)	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
L5-01	Number of auto restart attempts Num of Restarts	Sets the number of auto restart attempts. Automatically restarts after a fault The retry fault code are the followings OV, GF, OC, OL2, OL3, OL4, UL3, UL4, PF, LF, SE1, SE2, SE3	0 to 10	2	No	A	A	A	A	49EH
L5-02	Auto restart operation selection Restart Sel	Sets whether a fault contact output is activated during fault restart. 0: No output (Fault contact is not activated.) 1: Output (Fault contact is activated.)	0, 1	1	No	A	A	A	A	49FH
L5-03	Fault restart interval time Retry time	Sets the interval time between fault restarts.	0.5 to 180.0	2.0 s	No	A	A	A	A	4AOH

■Fault Reset Interval Time Setting

The Inverter allows the user to set the wait time required between fault resets.

The time between fault resets in SPEC: A is fixed at 2 seconds.



After receiving the hardware baseblock signal, the auto-reset signal can be received.

■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.

◆ UV1 Fault Reset Operation Selection Function

■Related Parameters

Parameter Number	Name / Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Control Methods: Open-loop Vector 1	Control Methods: Closed-loop Vector	Control Methods: Closed-loop Vector (PM)	MEMOBUS Register
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	0,1	0	No	A	A	A	A	4CCH

■Functions

- When L5-05 is set its default value of 0, the Inverter will restart itself after a fault occurs as has traditionally done.
- If L5-05 is set to 1, then the Inverter will always attempt to restart itself after a UV1 fault, regardless of the value saved to parameter L5-01.
- When a fault restart is executed, then fault relays MA-MC and MB-MC will be closed (factory setting). If the fault restart relay is disabled, then be sure that L5-02 is set to 0 (Auto restart operation selection).
- Even when L5-05=1, the Inverter will follow the setting value saved to L5-01, counting faults other than UV1* and registering that number in the fault restart history. If UV1 and other faults occur intermittently, all faults other than UV1 will be included in the number of fault restart attempts.

  * The Inverter will attempt to restart itself after the following faults occur: OV, GF, OC, OL2, OL3, OL4, UL3, UL4, PF, LF, SE1, SE2, and SE3
- Parameter L5-03 (Fault restart interval time) will also function exactly as it has in the past (factory setting = 2.0 s).

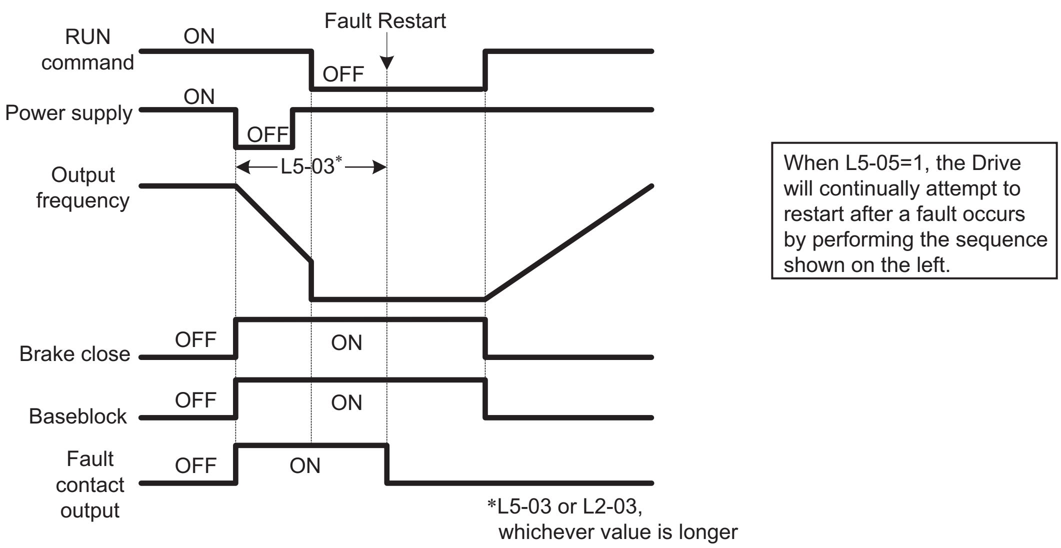


Fig 6.31 UV1 Fault Restart Sequence

6

MEMOBUS Communications

◆ RS-422/485 Interface

You can perform serial communications with MEMOCON-series Programmable Controllers (PLCs) or similar devices using the MEMOBUS protocol.

■MEMOBUS Communications Configuration

MEMOBUS communications are configured using 1 master (PLC) and a maximum of 31 slaves. Serial communications between master and slave are normally started by the master, and the slave responds.

The master performs signal communications with one slave at a time. Consequently, you must set the address of each slave beforehand, so the master can perform signal communications using that address. Slaves receiving commands from the master perform the specified function, and send a response to the master.

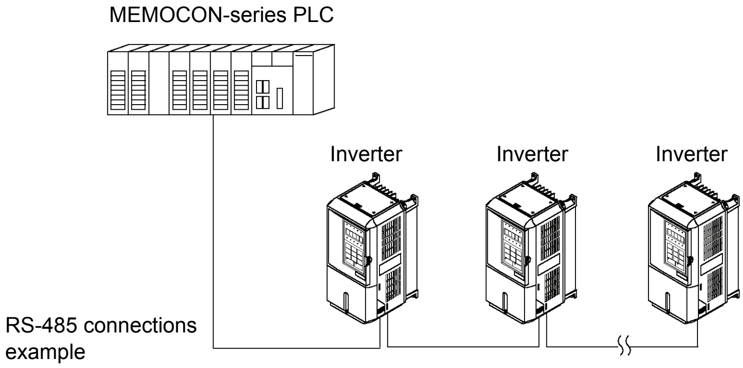


Fig 6.32 Example of Connections between PLC and Inverter

■Communications Specifications

The MEMOBUS communications specifications are shown in the following table.

Item	Specifications
Interface	RS-422, RS-485
Communications Cycle	Asynchronous (Start-stop synchronization)
Communications Parameters	Baud rate: Select from 1,200, 2,400, 4,800, 9,600, and 19,200 bps. Data length: 8 bits fixed Parity: Select from even, odd, or none. Stop bits: 1 bit fixed
Communications Protocol	MEMOBUS (RTU mode only)
Number of Connectable Units	31 units max. (when using RS-485)

■Communications Connection Terminal

MEMOBUS communications use the following terminals: S+, S-, R+, and R-. Set the terminating resistance by turning ON pin 1 of switch S1 for the last Inverter only, as seen from the PLC.

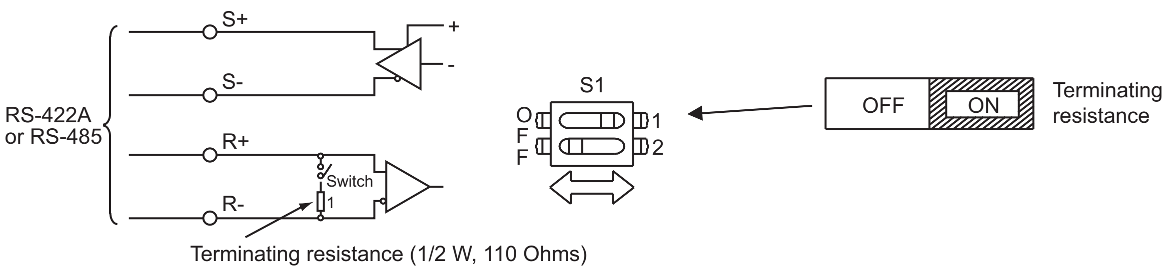
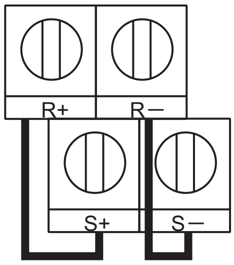


Fig 6.33 Communications Connection Terminal

IMPORTANT

1. Separate the communication cables from the main circuit cables and other wiring and power cables.
2. Use shielded cables for the communication cables, connect the shield cover to the Inverter earth terminal, and arrange the terminals so that the other end is not connected to prevent operating errors due to noise.
3. When using RS-485 communications, connect S+ to R+, and S- to R-, on the Inverter exterior.



■Procedure for Communicating with the PLC

Use the following procedure to perform communications with the PLC.

1. Turn OFF the power supply turned and connect the communication cable between the PLC and the Inverter.
2. Turn ON the power supply.
3. Set the required communications parameters (H5-01 to H5-07) using the Digital Operator.
4. Turn OFF the power supply, and check that the Digital Operator display has completely disappeared.
5. Turn ON the power supply once again.
6. Perform communications with the PLC.

INFO

Set the timer on the master to monitor response time from the slave. Set the master so that if the slave does not respond to the master within the set time, the same command message will be sent from the master again.

■Related Parameters

Parameter Number	Name: Display	Description	Setting Range	Factory Setting	Change during Operation	Control Methods: V/f	Open-loop Vector 1	Closed-loop Vector	Closed-loop Vector (PM)	MEMOBUS Register
b1-01	Reference source selection Reference Source	Sets the frequency reference input method. 0: Digital Operator 1: Control circuit terminal (analog input)*1 2: MEMOBUS communications 3: Option card*2	0 to 3	0	No	A	A	A	A	180H
b1-02	Run Command source selection Run Source	Sets the Run Command input method. 0: Digital Operator 1: Control circuit terminal (sequence input) 2: MEMOBUS communications 3: Option card	0 to 3	1	No	A	A	A	A	181H
H5-01	Slave address Serial Comm Adr	Set the Inverter's slave address.	0 to 20 *3	1F	No	A	A	A	A	425H
H5-02	Communication speed selection Serial Baud Rate	Set the baud rate for 6CN MEMOBUS communications. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps	0 to 4	3	No	A	A	A	A	426H
H5-03	Communication parity selection Serial Com Sel	Set the parity for 6CN MEMOBUS communications. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0	No	A	A	A	A	427H
H5-04	Stopping method after communication error Serial Fault Sel	Set the stopping method for communications errors. 0: Deceleration to stop using deceleration time in C1-02 1: Coast to stop 2: Fast stop using deceleration time in C1-09 3: Continue operation	0 to 3	3	No	A	A	A	A	428H
H5-05	Communication error detection selection Serial Flt Dtct	Set whether or not a communications timeout is to be detected as a communications error. 0: Do not detect. 1: Detect	0,1	1	No	A	A	A	A	429H
H5-06	Send wait time Transmit WaitTIM	Set the time from the Inverter receiving data to when the Inverter starts to send.	5 to 65	5 ms	No	A	A	A	A	42AH
H5-07	RTS control ON/OFF RTS Control Sel	Select to enable or disable RTS control. 0: Disabled (RTS is always ON) 1: Enabled (RTS turns ON only when sending)	0,1	1	No	A	A	A	A	42BH

* 1. If d1-18 is set to 1 or 2, an analog reference will have priority over a frequency reference from a multi-function contact input.
* 2. If d1-18 is set to 1 or 2, a frequency reference from a multi-function contact input will be valid even if b1-01 is set to 2 or 3.
* 3. If H5-01 is set to zero, then the Inverter will no longer respond to MEMOBUS communications.

6

MEMOBUS communications can perform the following operations regardless of the settings in b1-01 and b1-02.

- Monitoring operation status from the PLC
- Setting and reading parameters
- Resetting errors
- Inputting multi-function commands

An OR operation is performed between the multi-function commands input from the PLC and commands input from multi-function contact input terminals S3 to S7.

■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 is changed by the command (function) contents.

Slave address
Function code
Data
Error check

The space between messages must support the following.

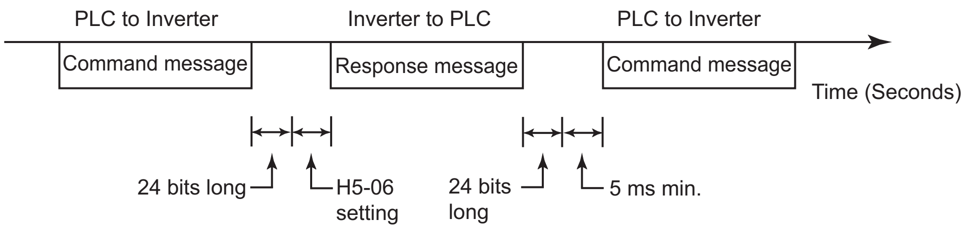


Fig 6.34 Message Spacing

Slave Address

Set the Inverter address from 0 to 20 Hex. If you set 0, commands from the master will be broadcast (i.e., the Inverter will not return responses).

Function Code

The function code specifies commands. There are three function codes, as shown below.

Function Code (Hexadecimal)	Function	Command Message		Response Message	
		Min. (Bytes)	Max. (Bytes)	Min. (Bytes)	Max. (Bytes)
03H	Read storage register contents	8	8	7	37
08H	Loopback test	8	8	8	8
10H	Write multiple storage registers	11	41	8	8

Data

Configure consecutive data by combining the storage register address (test code for a loopback address) and the data the register contains. The data length changes depending on the command details.

Error Check

Errors are detected during communications using CRC-16. Perform calculations using the following method.

1. The factory setting for CRC-16 communications is usually 0, but when using the MEMOBUS system, set the factory setting to 1 (i.e., set all 16 bits to 1).
2. Calculate CRC-16 using MSB as slave address LSB, and LSB as the MSB of the final data.
3. Also calculate CRC-16 for response messages from the slaves, and compare them to the CRC-16 in the response messages.

■MEMOBUS Message Example

An example of MEMOBUS command/response messages is given below.

Reading Storage Register Contents

Read the contents of the storage register only for specified quantities whose addresses are consecutive, starting from a specified address. The contents of the storage register are separated into higher place 8 bits and lower place 8 bits, and comprise the data within response messages in address order.

The following table shows 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 place	00H
	Lower place	20H
Quantity	Higher place	00H
	Lower place	04H
CRC-16	Higher place	45H
	Lower place	F0H

Response Message (During Normal Operation)

Slave Address		02H
Function Code		03H
Data quantity		08H
Lead storage register	Higher place	00H
	Lower place	65H
Next storage register	Higher place	00H
	Lower place	00H
Next storage register	Higher place	00H
	Lower place	00H
Next storage register	Higher place	01H
	Lower place	F4H
CRC-16	Higher place	AFH
	Lower place	82H

Response Message (During Error)

Slave Address		02H
Function Code		83H
Error code		03H
CRC-16	Higher place	F1H
	Lower place	31H

6

Loopback Test

The loopback test returns command messages directly as response messages without changing the contents to check the communications between the master and slave. You can set user-defined test code and data values.

The following table shows a message example when performing a loopback test with the slave 1 Inverter.

Command Message

Slave address		01H
Function code		08H
Test Code	Higher place	00H
	Lower place	00H
Data	Higher place	A5H
	Lower place	37H
CRC-16	Higher place	DAH
	Lower place	8DH

Response Message (During Normal Operation)

Slave address		01H
Function code		08H
Test Code	Higher place	00H
	Lower place	00H
Data	Higher place	A5H
	Lower place	37H
CRC-16	Higher place	DAH
	Lower place	8DH

Response Message (During Error)

Slave address		01H
Function code		89H
Error Code		01H
CRC-16	Higher place	86H
	Lower place	50H

Writing to Multiple Storage Registers

Write the specified data to each specified storage register from the specified addresses. The written data must be in the following order in the command message: Higher place 8 bits, then lower place 8 bits, in storage register address order.
The following table shows an example of a message when forward operation has been set at a frequency reference of 60.0 Hz in the slave 1 Inverter by the PLC.

Command Message

Slave Address		01H
Function Code		10H
Start Address	Higher place	00H
	Lower place	01H
Quantity	Higher place	00H
	Lower place	02H
No. of data		04H
Lead data	Higher place	00H
	Lower place	01H
Next data	Higher place	02H
	Lower place	58H
CRC-16	Higher place	63H
	Lower place	39H

Response Message (During Normal Operation)

Slave Address		01H
Function Code		10H
Start Address	Higher place	00H
	Lower place	01H
Quantity	Higher place	00H
	Lower place	02H
CRC-16	Higher place	10H
	Lower place	08H

Response Message (During Error)

Slave Address		01H
Function Code		90H
Error code		02H
CRC-16	Higher place	CDH
	Lower place	C1H

INFO

Set the number of data specified using command messages as quantity of specified messages x 2. Handle response messages in the same way.

■Data Tables

The data tables are shown below. The types of data are as follows: Reference data, monitor data, and broadcast data.

Reference Data

The reference data table is shown below. You can both read and write reference data.

Register No.	Contents	
0000H	Not used	
0001H	Frequency reference	
	Bit 0	Forward Run/Stop Command 1: Forward run 0: Stop
	Bit 1	Reverse Run/Stop Command 1: Reverse run 0: Stop
	Bit 2	External fault1: Error (EFO)
	Bit 3	Fault reset1: Reset command
	Bit 4	ComNet
	Bit 5	ComCtrl
	Bit 6	Multi-function input command 3
	Bit 7	Multi-function input command 4
	Bit 8	Multi-function input command 5
	Bit 9	Multi-function input command 6
	Bit A	Multi-function input command 7
	Bit B to F	Not used
0002H	Frequency reference (Set units using parameter o1-03)	
0003H	Not used	
0004H	Not used	
0005H	Not used	
0006H	Not used	
0007H	Analog output 1 setting (-11 V/-1540 to 11 V/1540)	
0008H	Analog output 2 setting (-11 V/-1540 to 11 V/1540)	
0009H	Multi-function contact output setting	
	Bit 0	Multi-function contact output (Terminal M1-M2) 1: ON 0: OFF
	Bit 1	Multi-function contact output (Terminal M3-M4) 1: ON 0: OFF
	Bit 2	Multi-function contact output (Terminal M5-M6) 1: ON 0: OFF
	Bit 3 to 5	Not used
	Bit 6	Set error contact (terminal MA-MC) output using bit 7.1: ON 0: OFF
	Bit 7	Error contact (terminal MA-MC) 1: ON 0: OFF
	Bits 8 to F	Not used
000AH to 000EH	Not used	

6

Register No.	Contents	
000FH	Reference selection settings	
	Bits 0 to B	Not used
	C	Broadcast data terminal S5 input 1: Enabled 0: Disabled
	D	Broadcast data terminal S6 input 1: Enabled 0: Disabled
	E	Broadcast data terminal S7 input 1: Enabled 0: Disabled

Note: Write 0 to all unused bits. Also, do not write data to reserved registers.

Monitor Data

The following table shows the monitor data. Monitor data can only be read.

Register No.	Contents	
0020H	Inverter status	
	Bit 0	Operation 1: Operating 0: Stopped
	Bit 1	Reverse operation 1: Reverse operation 0: Forward operation
	Bit 2	Inverter startup complete 1: Completed 2: Not completed
	Bit 3	Error 1: Error
	Bit 4	Data setting error 1: Error
	Bit 5	Multi-function contact output (terminal M1 - M2) 1: ON 0: OFF
	Bit 6	Multi-function contact output 1 (terminal M3 - M4) 1: ON 0: OFF
	Bit 7	Multi-function contact output 2 (terminal M5 - M6) 1: ON 0: OFF
	Bits 8 to B	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	Injection brake transistor resistance overheat (rr, rH)
	Bit 5	Fuse blown (PUF)
	Bit 6	PID feedback reference lost (FbL)
	Bit 7	External fault (EF, EFO)
	Bit 8	Hardware error (CPF)
	Bit 9	Motor overload (OL1), overtorque 1 (OL3) detected, or overtorque 2 (OL4) 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	Main Circuit Voltage Fault (PF), Output Open-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

Register No.	Contents	
0023H	Frequency reference (U1-01)	
0024H	Output frequency (U1-02)	
0025H	Output voltage reference (U1-06)	
0026H	Output current (U1-03) (Unit: 1/0.1A)	
0027H	Output power (U1-08)	
0028H	Torque reference (U1-09)	
0029H	Not used	
002AH	Not used	
002BH	Sequence input status	
	Bit 0	Multi-function contact input terminal S1 1: ON, 0: OFF
	Bit 1	Multi-function contact input terminal S2 1: ON, 0: OFF
	Bit 2	Multi-function contact input terminal S3 1: ON, 0: OFF
	Bit 3	Multi-function contact input terminal S4 1: ON, 0: OFF
	Bit 4	Multi-function contact input terminal S5 1: ON, 0: OFF
	Bit 5	Multi-function contact input terminal S6 1: ON, 0: OFF
	Bit 6	Multi-function contact input terminal S7 1: ON, 0: OFF
	Bits 7 to F	Not used
002CH	Inverter status	
	Bit 0	Operation 1: Operating
	Bit 1	Zero-speed 1: Zero-speed
	Bit 2	Frequency matching 1: Matched
	Bit 3	User-defined speed matching 1: Matched
	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	Low voltage detection 1: Detected
	Bit 8	Baseblock 1: Inverter output baseblock
	Bit 9	Frequency reference mode 1: Not communications 0: Communications
	Bit A	Run Command mode 1: Not communications 0: Communications
	Bit B	Overtorque detection 1: Detected
	Bit C	Frequency reference lost 1: Lost
	Bit D	Retrying error 1: Retrying
	Bit E	Error (including MEMOBUS communications time-out) 1:Error occurred
	Bit F	MEMOBUS communications time-out 1: Timed out
002DH	Multi-function contact output status	
	Bit 0	Multi-function contact output (terminal M1-M2)1: ON0: OFF
	Bit 1	Multi-function contact output (terminal M3-M4)1: ON0: OFF
	Bit 2	Multi-function contact output (terminal M5-M6)1: ON0: OFF
	Bits 3 to F	Not used
002EH - 0030H	Not used	
0031H	Main circuit DC voltage	
0032H	Torque monitor (Unit: 1/0.1%)	
0033H	Output power (U1-08)	
0034H - 003AH	Not used	
003BH	CPU software number	
003CH	Flash software number	

Register No.	Contents	
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 fault reset is input (you can also reset while the Unit is operating).

Broadcast Data

The following table shows the broadcast data. You can also write this data.

Register Address	Contents	
0001H	Operation signal	
	Bit 0	Run Command 1: Operating 0: Stopped
	Bit 1	Reverse operation command 1: Reverse 0: Forward
	Bits 2 and 3	Not used
	Bit 4	External fault 1: Error (set using H1-01)
	Bit 5	Fault reset 1: Reset command (set using H1-02)
	Bits 6 to B	Not used
	Bit C	Multi-function contact input terminal S5 input
	Bit D	Multi-function contact input terminal S6 input
	Bit E	Multi-function contact input terminal S7 input
	Bit F	Multi-function contact input terminal S8 input
0002H	Frequency reference	30000/100%

Note: Bit signals not defined in the broadcast operation signals use local node data signals continuously.

■ENTER Command

When writing parameters to the Inverter from the PLC using MEMOBUS communications, the parameters are temporarily stored in the parameter data area in the Inverter. To enable these parameters in the parameter data area, use the ENTER command.

There are two types of ENTER commands: ENTER commands that enable parameter data in RAM, and ENTER commands that write data to EEPROM (non-volatile memory) in the Inverter at the same time as enabling data in RAM.

The following table shows the ENTER command data. ENTER command data can only be written.

The ENTER command is enabled by writing 0 to register number 0900H or 0901H.

Register No.	Contents
0900H	Write parameter data to EEPROM
0910H	Parameter data is not written to EEPROM, but refreshed in RAM only.

INFO

The maximum number of times you can write to EEPROM using the Inverter is 100 thousand. Do not frequently execute ENTER commands (0900H) written to EEPROM.
The ENTER command registers are write-only. Consequently, if reading these registers, the register address will become invalid (Error code: 02H).

■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 register address you are attempting to access is not recorded anywhere. • With broadcast sending, a start address other than 0000H, 0001H, or 0002H has been set.
03H	Invalid quantity error • The number of data packets being read or written is outside the range 1 to 16. • In write mode, the number of data packets 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 from the PLC during operation. • Attempting to write via ENTER commands from the PLC 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 main circuit undervoltage (UV) error • Writing parameters from the PLC during UV (main circuit undervoltage) alarm. • Writing via ENTER commands from the PLC during UV (main circuit undervoltage) alarm.
24H	Writing error during parameters processing Attempting to write parameters from the PLC while processing parameters in the Inverter.

■Slave Not Responding

In the following cases, the slave will ignore the write function. If the slave address specified in the command message is 0, all slaves execute the write function, but do not return response messages to the master.

- When a communications error (overrun, framing, parity, or CRC-16) is detected in the command message.
- When the slave address in the command message and the slave address in the Inverter do not agree.
- When the data that configures the message and the data time length exceeds 24 bits.
- When the command message data length is invalid.

■Application Precautions

Set a timer in the master to monitor response time from the slaves. Make the setting so that if no response is sent to the master from the slave within the set time, the same command message is sent again from the master.

■Self-Diagnosis

The Inverter has a built-in function for self-diagnosing the operations of serial communications interface circuits. This function is called the self-diagnosis function. The self-diagnosis function connects the communications parts of the send and receive terminals, receives the data sent by the Inverter, and checks if communications are being performed normally.

Perform the self-diagnosis function using the following procedure.

1. Turn ON the power supply to the Inverter, and set 67 (communications test mode) in parameter H1-05 (Terminal S7 Function Selection).
2. Turn OFF the power supply to the Inverter.
3. Perform wiring according to the following diagram while the power supply is turned OFF.
4. Turn ON the terminating resistance. (Turn ON pin 1 on DIP switch 1.)
5. Turn ON the power supply to the Inverter again.

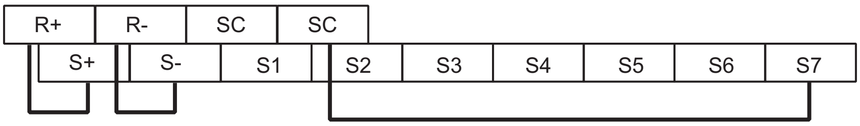


Fig 6.35 Details of Communications Terminals

“Pass” will be displayed if self-diagnosis is completed without an error occurring.

If an error occurs, a CE (MEMOBUS communications error) alarm will be displayed on the Digital Operator, the error contact output will be turned ON, and the Inverter operation ready signal will be turned OFF.

6

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 magnetic 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 magnetic 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, magnetic contactor on the Inverter output has opened or closed, a special motor or a motor with a rated current larger than the Inverter's output current is used.	Remove the motor and run the Inverter without the motor. Check the motor for a phase-to-phase short. Verify the accel/decel times (C1-□□). Check the Inverter for a phase-to-phase short at the output.
PUF DC Bus Fuse Open	DC Bus Fuse 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 (Continued)

Display	Meaning	Probable Causes	Corrective Actions
OV DC Bus Overvolt	DC Bus Overvoltage The DC bus voltage has exceeded the overvoltage detection level. Default detection levels are: 200 V class: 410 VDC 400 V class: 820 VDC	The deceleration time is set too short and the regenerative energy from the motor is too large.	Increase the deceleration time (C1-02/04/06/08) or connect a braking option.
		The power supply voltage is too high.	Check the power supply and decrease the voltage to meet the Inverter's specifications.
		The braking chopper / braking resistor is not working.	Check the braking chopper / resistor.
UV1 DC Bus Undervolt	DC Bus Undervoltage The DC bus voltage is below the Undervoltage Detection Level (L2-05). The factory settings are: 200V class: 190 VDC 400 V class: 380 VDC	The voltage fluctuations of the power supply are too high.	Check the input voltage.
		A momentary power loss occurred.	
		The terminal screws of the input power supply are loose.	Check the wiring of the input terminals.
		An open-phase error occurred at the input terminals.	Check the input voltage and the wiring of the input terminals.
		The acceleration time is set too short.	Extend the settings in C1-01/03/05/07
	Main Circuit MC Operation Failure The MC stopped responding during Inverter operation.	An error occurred in the inrush current prevention circuit while the Inverter was running.	Replace the Inverter.
UV2 CTL PS Undervolt	Control Power Supply Undervoltage Undervoltage of the control circuit while the Inverter was running.	External load was pulling down the Inverter's power supplies or there was an internal short in the power/gate drive board.	Remove all connection to the control terminals and cycle the power to the Inverter.
			Replace the Inverter.
UV3 MC Answerback	Inrush Current Prevention Circuit Fault An overheating of the charging resistor for the DC bus capacitors occurred. The MC of the charging circuit did not respond 10 sec. after the MC ON signal has been output. (Applicable Inverter Capacities 200 V class: 37 to 55 kW)	The magnetic contactor of the inrush current prevention circuit is defective.	Cycle the power to the Inverter.
			Replace the Inverter if the fault continues to occur.
PF Input Phase Loss	Main Circuit Voltage Fault An unusual big ripple on the DC bus voltage has been detected. Only detected when L8-05=1 (enabled)	The wiring terminals for the input power supply are loose.	Tighten the input terminal screws
		A phase loss occurred in the input power supply.	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.	

7

Table 7.1 Resetable Faults (Continued)

Display	Meaning	Probable Causes	Corrective Actions
LF Output Phase Loss	Output Open-phase An open-phase occurred at the Inverter output. The fault is detected when the output current falls below 5% of the Inverter rated current and L8-07=1 (enabled)	There is a broken wire in the output cable. 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.
OH Heatsink Overtemp	Heatsink Overheat The temperature of the Inverter's heatsink exceeded the setting in L8-02 and L8-03 is set to 0,1 or 2.	The ambient temperature is too high.	Check for dirt build-up on the fans or heatsink.
		There is a heat source nearby.	Reduce the ambient temperature around the inverter.
		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 inverter.
		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 Parameter)	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.

Table 7.1 Resetable Faults (Continued)

Display	Meaning	Probable Causes	Corrective Actions
UL3 Undertorq Det 1	Undertorque Detection 1 The Inverter's output current (V/f control) or the output torque (Vector control) fell below L6-02 for longer than the time set in L6-03 and L6-04 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.
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 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 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.
DV1	Z-Phase Pulse Missing Detection enabled whenever the Inverter is ON. No Z-phase pulse was detected for an entire motor rotation.	• PG cable is not wired properly. • PG cable is not connected. • Encoder on the motor side is damaged.	• Correct the wiring. • Reconnect the encoder. • If a DV1 fault still occurs after taking other corrective action, replace the PG card or the encoder itself (contact your Yaskawa representative).
DV2	Z-Phase Noise Fault Detection	• Noise is disrupting the Z-phase signal. • PG cable is not wired properly. • PG option card is damaged. • Encoder on the motor side is damaged.	• Make sure the cables feeding the encoder are at least 30cm from the noise source (the Inverter output lines). • Correct the wiring. • Reconnect the encoder. • If a DV2 fault still occurs after taking other corrective action, replace the PG option card or the encoder itself (contact your Yaskawa representative).

7

Table 7.1 Resetable Faults (Continued)

Display	Meaning	Probable Causes	Corrective Actions
DV3	Reverse Detection Detection only during run. The difference between the speed reference and the motor speed exceeded 30% during reverse (or forward) acceleration with a torque reference in the opposite direction.	• The amount of compensation for the home position is set improperly (E5-11). • Noise along the encoder's A- or B-phase lines. • PG cable is not wired properly. • PG cable is not connected. • PG option card is damaged. • Encoder on the motor side is damaged. • The Inverter has been programmed to operate in such a way that the conditions trigger DV3. • Rotational direction of the encoder (F1-05) is in reverse phase relative to the main motor cables.	• Set the home position pulse compensation (E5-11) in accordance with $\Delta\theta$ written on the motor nameplate. When replacing the encoder or changing the direction of the motor, be sure to adjust the pulses to the home position. • Check the direction of motor rotation. • Correct the wiring. • Make sure there are no loose wire connections. • Check the operating conditions to make sure there aren't any problems on the load side that would create the fault situation described. • Reconnect the encoder. • Make sure the U, V, and W phases from the motor are all wired properly.
DV4	Reverse Detection 2 Detection only during run. The speed reference is rotating in the opposite direction from the encoder for the number of pulses set to F1-19.	• The amount of compensation for the home position is set improperly (E5-11). • Noise along the encoder's A- or B-phase lines. • PG cable is not wired properly. • PG cable is not connected. • PG option card is damaged. • Encoder on the motor side is damaged. • The encoder is rotating in the opposite direction of the speed reference and creating the fault conditions described for DV4.	• Set the home position pulse compensation (E5-11) in accordance with $\Delta\theta$ written on the motor nameplate. When replacing the encoder or changing the direction of the motor, be sure to adjust the pulses to the home position. • Check the direction of motor rotation. • Correct the wiring. • Make sure there are no loose wire connections. • Check the operating conditions to make sure there aren't any problems on the load side that would create the fault situation described. • Reconnect the encoder. • Make sure the U, V, and W phases from the motor are all wired properly. • Disable DV4 fault detection in applications where the speed reference is given to operate in the opposite direction of the load side. To do so, set F1-19 to 0.
DV6 OverAcceleration	The elevator car has exceeded the acceleration rate set to S3-16. When DV6 is detected, the Inverter will coast to stop, regardless of other settings.	• The amount of compensation for the home position is set improperly (E5-11). • Noise along the encoder's A- or B-phase lines. • PG cable is not wired properly. • PG cable is not connected. • PG option card is damaged. • Encoder on the motor side is damaged. • Phase loss has occurred in the wires running from the output side of the Inverter. • Motor parameters (E5-xx) are set to the wrong values.	• Set the home position pulse compensation (E5-11) in accordance with $\Delta\theta$ written on the motor nameplate. When replacing the encoder or changing the direction of the motor, be sure to adjust the pulses to the home position. • Correct the wiring. • Reconnect the encoder. • Make sure motor parameters (E5 parameters) are set correctly.

7

Table 7.1 Resetable Faults (Continued)

Display	Meaning	Probable Causes	Corrective Actions
SVE Zero-servo Fault	Zero-servo Fault The motor position moved during Zero-servo Operation.	The torque limit is too small.	Increase the torque limit.
		The load torque is too large.	Decrease the load torque.
		-	Check for signal noise.
CF Out of Control	Control Fault A torque limit was reached continuously for 3 seconds or longer during a deceleration stop in open-loop vector control.	Motor parameters were not set properly.	Check the motor parameters.
FRL Ref Missing	Reference Fault at Start When d1-18=1 and the Leveling Speed Selection (83) is not set in multi-function contact inputs, the Leveling Speed reference was input.	Parameters for reference were not set properly.	• Set the Leveling Speed Selection (83) in multi-function contact inputs. • If the Leveling Speed Selection (83) is not set in multi-function contact inputs, do not input the Leveling Speed reference.
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		
OPR Oper Disconnect	Digital Operator Connection Fault Detected when the Digital Operator is removed and the Inverter receives its Run Command through the Digital Operator. (b1-02=0)	The Digital Operator was removed during running or the Digital Operator cable is broken.	Check the connection of the Digital Operator.
CE Memobus Com Err	MEMOBUS Communication Error Detected when control data was not received correctly for two seconds, 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 magnetic contactor answer back for S1-16 time setting.	The magnetic contactor or auxiliary switch has a malfunction.	Check the magnetic contactor.
SE2 Sequence Error 2	The output current at start was below 25% of no-load current.	The magnetic contactor was not closed at start.	Check the magnetic contactor.
SE3 Sequence Error 3	The output current during run was below 25% of no-load current.	The magnetic contactor was opened during run.	Check the magnetic contactor.

7

Table 7.2 Not Resetable Faults

Display	Meaning	Probable Causes	Corrective Actions
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.
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.

Table 7.2 Not Resetable Faults (Continued)

Display	Meaning	Probable Causes	Corrective Actions
CPF20 Option A/D Error	Communication option card A/D Converter Error	Option card connection is not correct.	Turn off the power and re-install the option card again
			Remove all inputs to the option card
		Option card A/D converter is faulty.	Perform an initialization to factory defaults.
			Cycle the Inverter power supply.
			Replace the option card
			Replace the Inverter
CPF21 Option CPU Down	Self-diagnosis Fault of Option Card	Noise or spike was on the communication line and/or defective option card.	Perform an initialization to factory defaults.
			Cycle the Inverter power supply.
			Replace the option card
			Replace the Inverter
CPF22 Option Type Err	Option Card Code Number Fault	An unrecognizable option card is connected to the control board.	Remove any option cards
			Perform an initialization to factory defaults
			Cycle the Inverter power supply.
			Replace the option card
			Replace the Inverter
CPF23 Option DPRAM Err	Option Card Interconnection Fault	An option card was not correctly connected to the control board, or an option card which is not made for the Inverter has been attached to the control board.	Turn off the power and reinstall the option card again
			Perform an initialization to factory defaults
			Cycle the Inverter power supply.
			Replace the option card
			Replace the Inverter
CPF24 PG-F2 Comm Err	PG-F2 Option Card Communication Error	The option card is defective.	Replace the option card.

◆ Alarm Detection

Alarms are Inverter protection functions that indicate unusual conditions without switching off the inverter 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.

Table 7.3 Alarm Detection (Continued)

Display	Meaning	Probable causes	Corrective Actions
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 inverter 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 inverter 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 heatsink 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).
OH2 Over Heat 2 (flashing)	Overheat Alarm An OH2 alarm signal is input from a multi-function contact input terminal (S3 to S7) that is programmed to OH2 Alarm Signal Input.	An external overheat occurred.	Clear the multi-function input terminal's overheating alarm input.
OL3 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.
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.

Table 7.3 Alarm Detection (Continued)

Display	Meaning	Probable causes	Corrective Actions
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.
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
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		
CE MEMOBUS Com Err (flashing)	MEMOBUS Communications Alarm Detected when control data was not received correctly for two seconds, H5-04 is set to 3 and H5-05 is set to 1.	Connection is broken and/or the master has stopped the communication.	Check the connections and all user-side software configurations.
BUS Option Com Err (flashing)	Option Communications Alarm After initial communication was established, the connection was lost.	Connection is broken and/or the master has stopped the communication.	Check the connections and all user-side software configurations.
RUNC (flashing)	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 multi-function contact input or by the RESET button on the digital operator.	Remove the RUN signal first and reset the error.
CALL ComCall (flashing)	Communications on Standby Communication has not yet been established.	Connection was not made properly or user software was not configured to the correct baud rate or configuration (e.g. Parity).	Check the connections and all PLC-side software configurations.

◆ 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 5-73, Factory Settings that Change with the Inverter Capacity (o2-04)*
OPE02 Limit	Parameter Setting Out of Range	Parameter setting was outside of the allowable range.	Verify the parameter settings.
OPE03 Terminal	Multi-function Input Selection Error	One of the following errors has been made in the multi-function input (H1-01 to H1-05) settings: • Functions were selected duplicative. • External Baseblock NO (8) and External Baseblock NC (9) were selected at the same time. • The Fast Stop Command NO (15) and NC(17) are set simultaneously.	Verify the parameter settings in H1-□□
OPE05 Sequence Select	RUN/Reference Command Selection Error The Reference Source Selection b1-01 and/or the RUN Source Selection parameter b1-02 are set to 3 (option card) but no option card is installed.	Option card is not installed or is installed incorrectly	Verify that the board is installed. Remove the power supply and re-install the option card again Recheck the setting of b1-01 and b1-02.
OPE06 PG Opt Missing 6	Control method selection error	One of the control methods needing a PG feedback was selected (A1-02 =3 or 6), but a PG option card is not installed. Problem also may be due to a setting mismatch between parameter N8-35 and the PG speed control card that is connected.	Recheck the setting of A1-02. Confirm if the PG Speed control card is attached.
OPE07 Analog Selection	Multi-function Analog Input Error	Reference source selection (b1-01) is set to Control circuit terminal (analog input) (1) when Multi-function analog input (H3-05) is set to Torque compensation (14).	Check the parameters b1-01, H3-09 and H6-01.
OPE08 Parameter 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.
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.

Table 7.4 Operator Programming Errors (Continued)

Display	Meaning	Probable Causes	Corrective Actions
OPE11 CarrFrq/On-Delay	Carrier Frequency Parameter Setting Error	One of the following parameter setting errors exists. • Carrier frequency Gain C6-05 > 6 and C6-03 (Carrier frequency upper limit) < C6-04 (Carrier frequency lower limit) • Upper/lower limit error in C6-03 and 04. • C6-01 = 0 and C6-02 = 2 to 6. • C6-01 = 1 and C6-02 = 7 to E.	Check the parameter settings.
OPE13 KiKt Setting Err	Energy-saving Control Parameter Setting Error	The calculations for Energy-saving parameters Ki and Kt have yielded values outside the permissible setting range.	Make sure the information written on the motor nameplate was entered properly, and that the Ex-xx parameters are set correctly.
ERR EEPROM R/W Err	EEPROM write error The NV-RAM data does not match the EEPROM data.	A verification error occurred when writing EEPROM.	Cycle power to the Inverter.
			Do a factory initialization (A1-03).

◆ Autotuning Faults

Autotuning faults are shown below. When the following faults are detected, the fault is displayed on the digital operator and the motor coasts to stop. No fault or alarm outputs will be operated.

Table 7.5 Autotuning Faults

Display	Meaning	Probable causes	Corrective Actions
Er - 01 Fault	Motor data fault	There is an error in the data input for autotuning.	Check the input data.
		There is an error in the relationship between the motor output and the motor rated current.	Check the Inverter and motor capacity.
		There is an error between the no-load current setting and the input motor rated current (when autotuning for line-to-line resistance is performed for vector control)	Check the motor rated current and no-load current.
Er - 02 Minor Fault	Alarm	An alarm is detected during autotuning.	Check the input data.
			Check wiring and the machine.
			Check the load.
Er - 03 STOP key	STOP key input	The STOP key was pressed to cancel autotuning.	-
Er - 04 Resistance	Line-to-Line Resistance Fault	Autotuning was not completed in the specified time. The autotuning result is outside the parameter setting range.	• Check the input data. • Check 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.
Er - 05 No-Load Current	No-Load Current Fault		
Er - 08 Rated slip	Rated Slip Fault		

Table 7.5 Autotuning Faults (Continued)

Display	Meaning	Probable causes	Corrective Actions
Er - 09 Accelerate	Acceleration Fault Detected only for rotating autotuning	The motor did not accelerate in the specified time	• Increase C1-01 (Acceleration Time 1). • Increase L7-01 and L7-02 (Torque Limits) if they are low. • If the motor is connected to the machine, disconnect it.
Er - 11 Motor Speed	Motor Speed Fault Detected only for rotating autotuning	The torque reference exceeded 100% during acceleration. Detected only when A1-02 is set to 2 or 3 (Vector control).	• If the motor is connected to the machine, disconnect it. • Increase C1-01 (Acceleration Time 1). • Check the input data (particularly the number of PG pulses and the number of motor poles).
Er - 12 I-det. Circuit	Current Detection Fault	The current exceeded the motor rated current.	Check wiring of the Inverter and the mounting.
		Any of U/T1, V/T2 and W/T3 has open-phase	
Er - 13 Leakage Inductance Fault	The leakage inductance measurement caused an error.	Autotuning was not completed in the specified time.	Check the motor wiring.
		Autotuning result is outside the parameter setting range.	
End - 1 V/f Over Setting	V/f Settings Alarm Displayed after autotuning is complete	The torque reference exceeded 100% and the no-load current exceeded 70% during autotuning.	Check and correct the motor settings
			If the motor and the machine are connected, disconnect the motor from the machine.
End - 2 Saturation	Motor Core Saturation Fault Displayed after autotuning is complete. Detected only for rotating autotuning	During autotuning, 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 autotuning is complete	During autotuning, the measured value of motor rated current (E2-01) was higher than the set value.	Check the motor rated current value.
Z_SRCH_ERR (permanent magnet motor tuning only)	All encoders	The motor speed exceeded 20 min^{-1} at the autotuning start. The encoder offset tuning could not be performed in the specified time.	• Remove the ropes and repeat the autotuning. • 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.	
		A encoder serial communication error has occurred during autotuning	• Check the encoder wiring (order, shield etc.) • Check the encoder power supply. • Replace the encoder.
LD_ERR (permanent magnet motor tuning only)	Inductance error	The inductance could not be measured in the specified time during the motor rotation.	Check the motor wiring.

Table 7.5 Autotuning Faults (Continued)

Display	Meaning	Probable causes	Corrective Actions
RS_ERR (permanent magnet 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 (permanent magnet motor tuning only)	Voltage parameter error	The voltage parameter could not be measured in the specified time during the motor rotation.	Check the motor wiring.
Slip Accel/Decel Limit	Lower Limit of Slip Tuning Value	The results from stationary autotuning 1 indicate that the slip value has fallen below 0.2 Hz.	• Check the data entered for autotuning. • Perform rotational autotuning if possible. If stationary autotuning is necessary and the error continues, use stationary autotuning 2.

◆ 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 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)

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 Inverter is in UV (under voltage) status.	Make sure that no fault and no alarm is active and retry.
COPY from Encoder to Inverter	EDE WRITE IMPOSSIBLE	A write to encoder command could not be performed since F1-26 is set to 0 (write prohibited) or in CPF 24 (PG-F2 Option Card Communication Error) status.	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 Inverter is in UV (under voltage) status.	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 L7B data format.	Retry the Write command.
	ECS SUM CHECK ERROR	The check sum of the data, which were written into the Inverter is wrong.	-
VERFIY	EVE VERIFY ERROR	The data in the encoder and Inverter data do not match.	-

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 you cannot remember the password, 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 multi-function contact inputs. Check the input signals and the frequency reference settings.
Also make sure to set the Baseblock signal. The Inverter does not accept any input if it is baseblocked.

■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.

■Autotuning has not been performed for vector control

Vector control does not work properly, if autotuning has not been performed. Perform autotuning, 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 overvoltage fault, then the motor's power may be insufficient. Consider increasing the motor and Inverter capacity.

The torque limit has been reached.

When a torque limit is reached (L7-01 to L7-04), the motor torque will be limited. This can 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.

■Autotuning has not been performed for vector control

The Vector control performance may not be optimal, if autotuning has not been performed. Perform autotuning, or set the motor parameters manually. Alternatively, change the Control Method Selection (A1-02) to V/f Control (0 or 1).

◆ If Peripheral Devices are Influenced by the Starting or Running Inverter

The following solutions are possible:

- Change the Inverter's Carrier Frequency Selection (C6-02) to lower the carrier frequency. This will help to reduce the amount of transistor switching noise.
- Install an Input Noise Filter at the Inverter's input power terminals.
- Install an Output Noise Filter at the Inverter's motor terminals.
- Use shielded motor cables or a conduit. Metal shields electrical noise.
- Check the grounding of the Inverter and motor.
- Separate main circuit 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

7

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 autotuning has not been performed, proper performance may not be achieved for Vector Control. Perform autotuning or set the motor parameters manually.

■Oscillation and hunting occur with closed-loop vector control

The gain adjustment may be insufficient. Adjust the speed control loop (Automatic Speed Regulator, ASR) by changing 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 autotuning has not been performed, proper performance may not be achieved for closed-loop vector control. Perform autotuning or set the motor parameters manually.

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.
Heatsinks	Are the fins dirty or dusty?	Clean off any dirt and dust with an air gun using dry air at a pressure of 4 x 10^5 to 6 x 10^5 Pa (4 to 6 bar, 55 to 85 psi).
All PCBs	Is there any conductive dirt or oil mist on the PCBs?	Clean off any dirt and dust with an air gun using dry air at a pressure of 4 x 10^5 to 6 x 10^5 Pa (4 to 6 bar, 55 to 85 psi). Replace the boards if they cannot be made clean.
Input Diodes Output Transistors Power Modules	Is there any conductive dirt or oil mist on the modules or components?	Clean off any dirt and dust with an air gun using dry air at a pressure of 4 x 10^5 to 6 x 10^5 Pa (4 to 6 bar, 55 to 85 psi).
DC bus capacitors	Are there any irregularities, such as discoloration or odor?	Replace the capacitor or Inverter.
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 magnetic contactor	–	Determine need by inspection.
DC bus fuse Control power fuse	10 years	Replace with new part.
PCB capacitors	5 years	Replace with new board. (Determine need by inspection.)

Note: The standard replacement period is based on the following usage conditions:
Ambient temperature:Yearly average of 30°C/86°F
Load factor: 80%
Operating rate: 12 hours per day

◆ Types and Number of Cooling Fans Used in the Inverter

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

Table 8.2 shows the number of cooling fans used in the Inverter. For more information on models and specifications of cooling fans, contact your Yaskawa representative or YASKAWA ELECTRIC ENGINEERING CORPORATION.

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

Table 8.2 Number of cooling Fans to be Used

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

* No models

8

◆ Cooling Fan Replacement Outline

■200 V and 400 V Class Inverters of 18.5 kW or Less

A cooling fan is attached to the bottom of the Inverter.

If the Inverter is installed using the mounting holes on the back of the Inverter, the cooling fan can be replaced without removing the Inverter from the installation panel.

Removing the Cooling Fan

1. Press in on the right and left sides of the fan cover in the direction of arrows 1 and pull the fan out in the direction of arrow 2.
2. Pull out the cable connected to the fan from the fan cover and disconnect the relay connector.
3. Open the fan cover on the left and right sides and remove the fan cover from the fan.

Mounting the Cooling Fan

1. Attach the fan cover to the cooling fan. Be sure that the airflow direction indicated by the arrows above faces into the Inverter.
2. Connect the relay connector securely and place the relay 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.

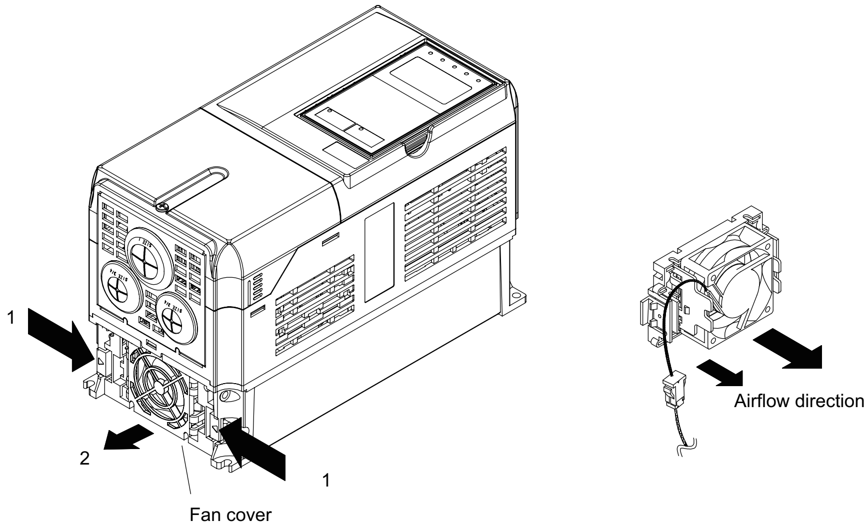


Fig 8.1 Cooling Fan Replacement (200 V Class Inverters of 5.5 kW)

■200 V and 400 V Class Inverters of 22 kW or More

A cooling fan is attached to the top panel inside the Inverter.

The cooling fan can be replaced without removing the Inverter from the installation panel.

200 V Class Inverters of 22 kW, 30kW and 400 V Class Inverters of 22 kW to 55 kW

Removing the Cooling Fan

1. Remove the terminal cover, Inverter cover, Digital Operator, and front cover from the front of the Inverter.
2. Remove the control board bracket to which the boards are mounted. Remove all cables connected to the control board. The cables connected to the control circuit terminals can be removed at the same time by removing them together with the control circuit terminal board. This procedure is not required for 400 V Class Inverters of 37 kW, 45 kW, and 55 kW. (Refer to page 8-12.)
3. Remove the cooling fan power cable connector (CN26 and CN27) from the gate inverter board positioned at the back of the controller.
4. Remove the fan cover screws and pull out the fan cover from the Inverter.
5. Remove the cooling fan from the fan cover and replace it with a new one.

Mounting the Cooling Fan

After attaching a new cooling fan, reverse the above procedure to attach all of the components. Refer to the next page for attaching the fan cover.
When attaching the cooling fan to the mounting bracket, be sure that the airflow faces the top of the Inverter.

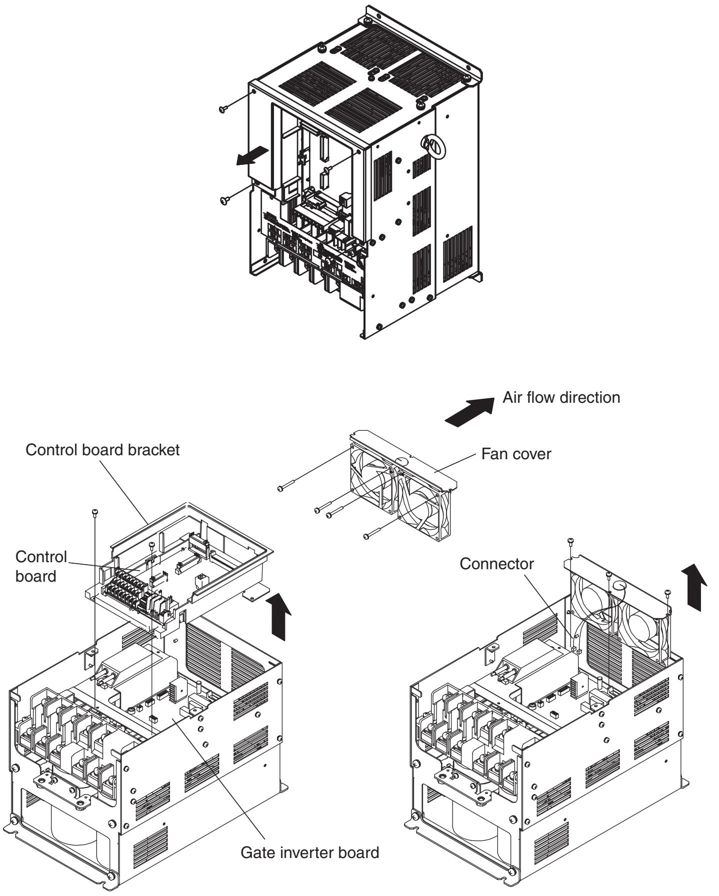


Fig 8.2 Cooling Fan Replacement (200 V Class Inverters of 22 kW)

Attaching the Fan Cover

1. Tilt the fan cover toward the bottom of the Inverter as shown in Fig 8.3 and insert it to the mounting hole until it meets with A.

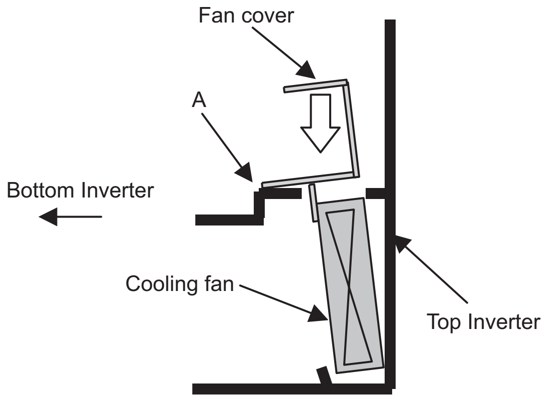


Fig 8.3

2. Push the fan cover toward the top of the Inverter.

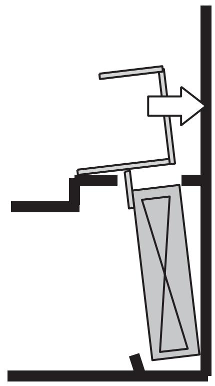


Fig 8.4

3. Make sure that there is no gap between the fan cover and A. Then screw it in place with the three screws.

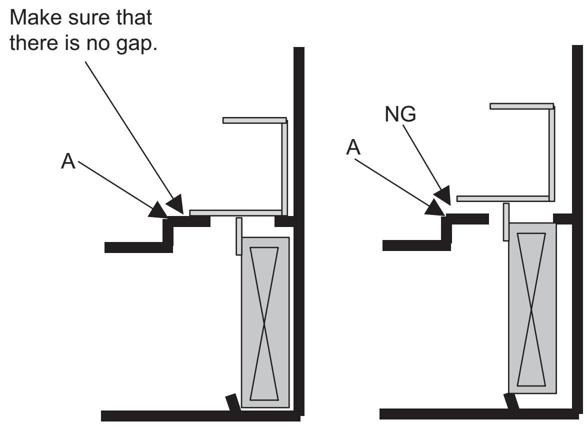


Fig 8.5

8

200 V Class Inverters of 55 kW

Removing the Cooling Fan

1. Remove the terminal cover, Inverter cover, Digital Operator, and front cover from the front of the Inverter.
2. Pull the cooling fan power cable connector that extends from the fan cover cable hole out of the cooling fan power relay board.
3. Only for 400 V Class Inverters of 75 kW and 90 kW, loosen the resistor unit mounting screws and slide the resistor unit to remove it. Take care as the resistor unit is hot.
4. Remove the fan cover screws and pull out the fan cover from the Inverter.
5. Remove the cooling fan from the fan cover and replace it with a new one.

Mounting the Cooling Fan

After attaching a new cooling fan, reverse the above procedure to attach all of the components.
When attaching the cooling fan to the mounting bracket, be sure that the airflow faces the top of the Inverter.

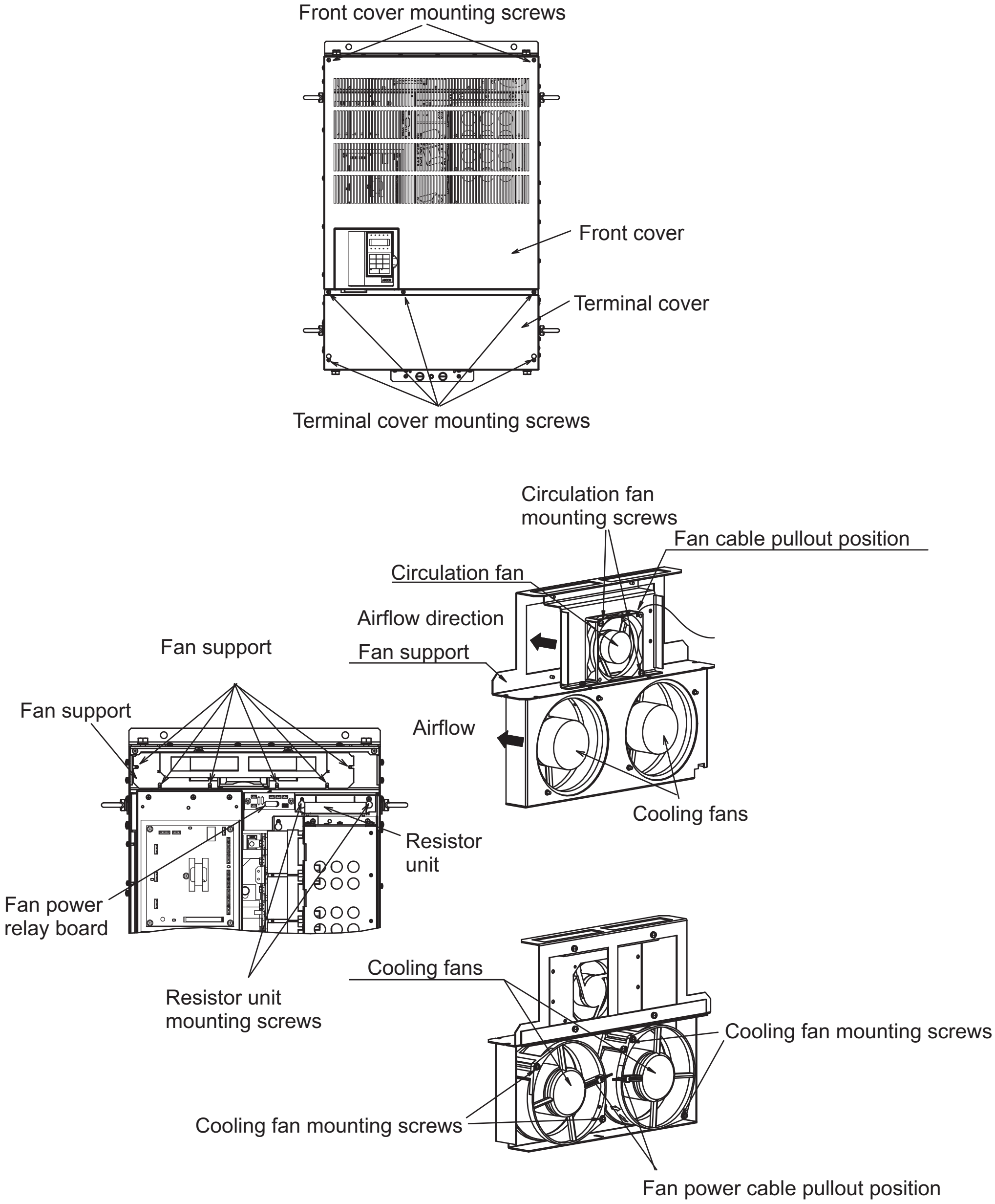


Fig 8.6 Cooling Fan Replacement (400 V Class Inverters of 75 kW and 90 kW)

8

200 V Class Inverters of 37 kW and 45 kW

Removing the Cooling Fan

1. Remove the terminal cover, Inverter cover, Digital Operator, and front cover from the front of the Inverter.
2. Remove the panel to which the control board, the gate inverter board, and the cooling fan power relay board are mounted. Remove any cables that are connected to the control board, the gate inverter board, and the cooling fan power relay board. The cable that is connected to the control circuit terminals can be removed together with the control circuit terminal board. (Refer to page 8-12.)
3. Remove the fan cover screws and pull out the fan cover from the Inverter.
4. Remove the cooling fan from the fan cover and replace it with a new one.

Mounting the Cooling Fan

After attaching a new cooling fan, reverse the above procedure to attach all of the components.
When attaching the cooling fan to the mounting bracket, be sure that the airflow faces the top of the Inverter.

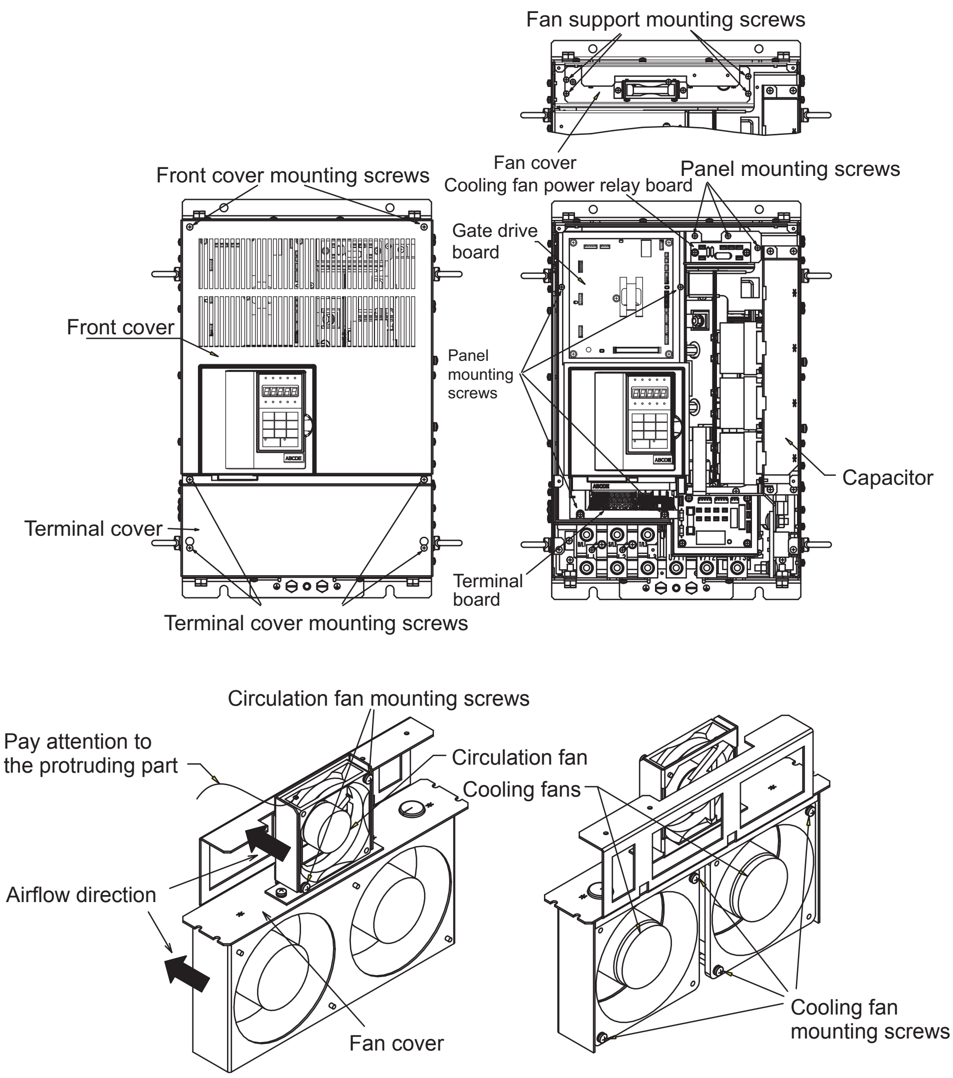


Fig 8.7 Cooling Fan Replacement (200 V Class Inverters of 37 kW and 45 kW)

◆ Circulation Fan Replacement Outline

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

■200 V and 400 V Class Inverters of 11 kW

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

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

Removing the Circulation Fan

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

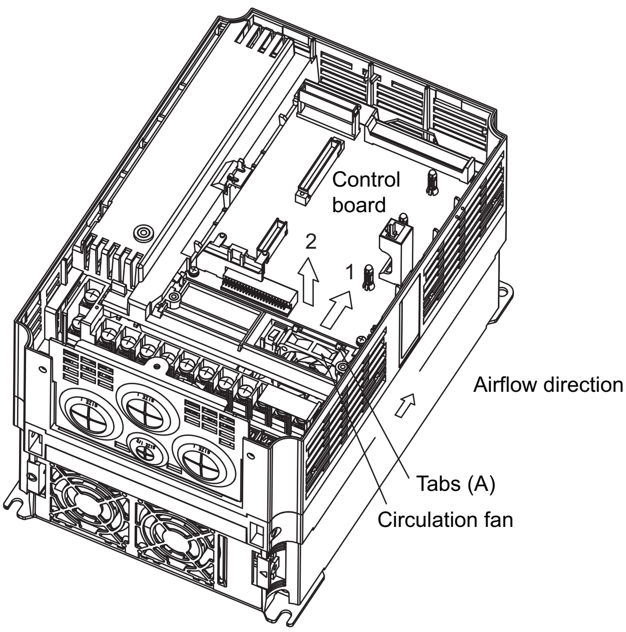
Mounting the Circulation Fan

Reverse the above procedure to mount the fan.

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

Mount the fan securely using the tabs (A).

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



Inverter with Control Circuit Terminal Board Removed

Fig 8.8   Circulation Fan Replacement (200 V and 400 V Class Inverters of 11 kW)

■200 V and 400 V Class Inverters of 18.5 kW

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

Removing the Circulation Fan

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

Mounting the Circulation Fan

Reverse the above procedure to mount the fan.

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

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

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

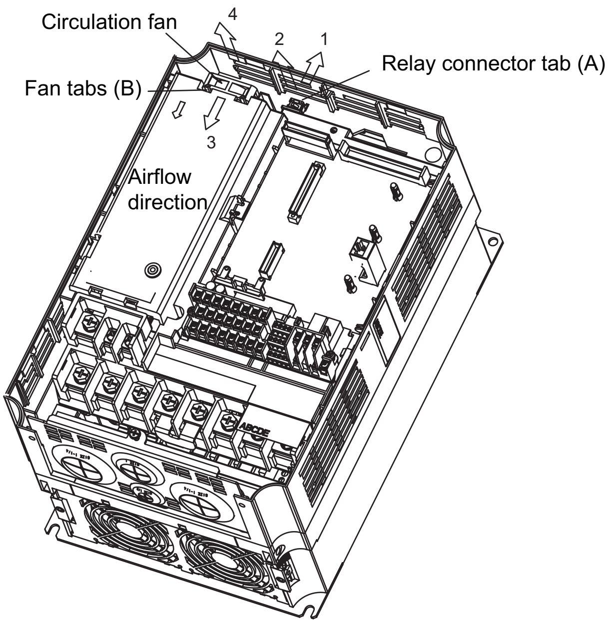


Fig 8.9 Circulation Fan Replacement (200 V and 400 V Class Inverters of 18.5 kW)

■200 V Class Inverters of 37 kW or More

The circulation fan is installed in front of the fan cover inside the Inverter. Remove the circulation fan using the procedure for replacing the cooling fan and replace it with the new fan. (The installation position for 200 V Class Inverters of 75 kW is different.)

◆ Removing and Mounting the Control Circuit Terminal Board

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

■Removing the Control Circuit Terminal Board

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

■Mounting the Control Circuit Terminal Board

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

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

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

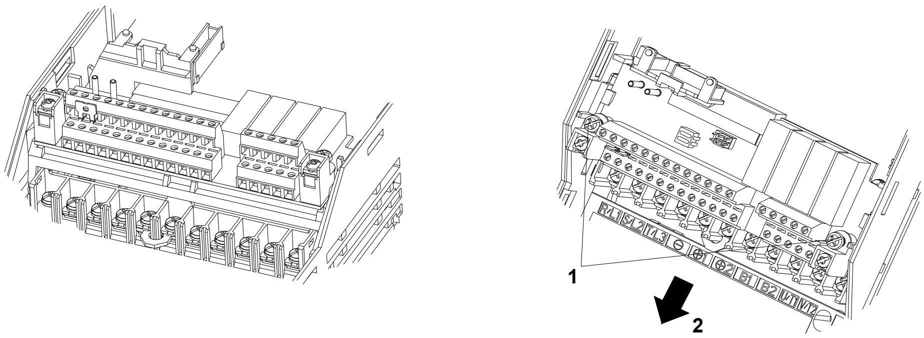


Fig 8.10 Removing the Control Circuit Terminal Board

IMPORTANT

Always confirm that the input power is removed and the Charge LED is off before removing or mounting the control circuit terminal board.

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.

■200 V Class

Table 9.1 200 V Class Inverters

Model Number CIMR-L7B □			23P7	25P5	27P5	2011	2015	2018	2022	2030	2037	2045	2055
Max. applicable motor output (kW)*1			3.7	5.5	7.5	11	15	18.5	22	30	37	45	55
Output Rating	Rated output capacity (kVA)		7	10	14	20	27	33	40	54	67	76	93
	Rated output current (A)		17.5	25	33	49	64	80	96	130	160	183	224
	Max. output voltage (V)		3-phase; 200, 208, 220, 230, or 240 VAC (Proportional to input voltage.)										
	Max. output frequency (Hz)		Up to 120Hz available by programing.										
Power supply characteristics	Rated voltage (V) Rated frequency (Hz)		3-phase, 200/208/220/230/240 VAC, 50/60 Hz										
	Rated input current (A)		21	25	40	52	68	96	115	156	176	220	269
	Allowable voltage fluctuation		+ 10%, - 15%										
	Allowable frequency fluctuation		±5%										
	Measures for power supply	DC reactor	Optional						-				
		12-pulse rectification	Not 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.

9

■400 V Class

Table 9.2 400 V Class Inverters

Model Number CIMR-L7B □			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							-				
		12-phase rectification	Not 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-L7B ☐		Specification
Control Characteristics	Control method	Sine wave PWM Closed-loop vector control, open-loop vector 1 control, V/f control
	Carrier Frequency	8 kHz higher carrier frequency possible with current derating.
	Speed control range	1:40 (V/f control) 1:100 (open-loop vector 1 control) 1:1000 (closed-loop vector control)
	Speed control accuracy	± 3% (V/f control) ± 0.2% (open-loop vector 1 control) ± 0.02% (closed-loop vector control) (25°C ± 10°C)
	Speed control response	5 Hz (open-loop vector 1 control) 30 Hz (closed-loop vector control)
	Torque limits	Provided (4 quadrant steps can be changed by parameter settings.) (Vector control)
	Torque accuracy	± 5%
	Frequency range	0.01 to 120 Hz
	Frequency accuracy (temperature characteristics)	Digital references: ± 0.01% (-10°C to +40°C)
		Analog references: ± 0.1% (25°C ±10°C)
	Frequency setting resolution	Digital references: 0.01 Hz
		Analog references: 0.025/50 Hz (11 bits plus sign)
	Output frequency resolution	0.01 Hz
	Overload capacity and maximum current	150% of rated output current for 30 s.
	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	Hardware Baseblock meets EN954-3 safety category 3, stop category 0, Overtorque/undertorque detection, torque limits, 8-speed control (maximum), 4 acceleration and deceleration times, S-curve acceleration/deceleration, autotuning (rotational or stationary), dwell function, cooling fan ON/OFF control, slip compensation, torque compensation, auto-restart after fault, DC braking for starting and stopping, automatic fault reset and parameter copy function, special Elevator functions and sequences, short floor, hardware baseblock

Table 9.3 Common Specifications (Continued)

Model Number CIMR-L7B ☐		Specification
Protective Functions	Motor protection	Protection by electronic thermal overload relay. This does not protect the internal magnets of a permanent magnet motor from demagnetization.
	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 s.
	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.
	Heatsink overheating	Protection by thermistor.
	Stall prevention	Stall prevention during acceleration, deceleration and running independently.
	Grounding protection	Protection by electronic circuits.
	Charge indicator	Glows when the main circuit DC voltage is approximately 10 VDC or more.
	Protective structure	Enclosed wall-mounted type (IP20): All models Enclosed wall-mounted type (NEMA 1): 18.5 kW or less (same for 200 V and 400 V class Inverters) Open chassis type (IP00): 22 kW or more (same for 200 V and 400 V class Inverters)
Environment	Ambient operating temperature	-10°C to 45°C
	Ambient operating humidity	95% max. (with no condensation)
	Storage temperature	- 20°C to + 60°C (short-term temperature during transportation)
	Application site	Indoor (no corrosive gas, dust, etc.)
	Altitude	1000 m max.
	Vibration	10 to 20 Hz, 9.8 m/s^2 max.; 20 to 50 Hz, 2 m/s^2 max

10

Appendix

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

Inverter Application Precautions

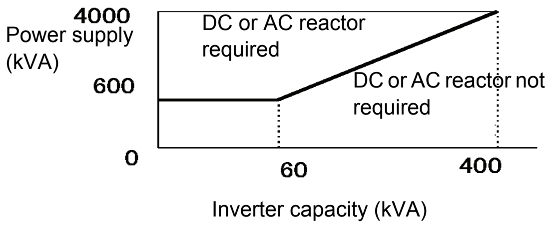
◆ Selection

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 inverter, 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.

10

■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 parameter 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.

■Gearmotor

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

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

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

EMC Compatibility

■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.

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

■Measures to Ensure Conformity of Yaskawa 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. inverter) 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.

■Laying Cables

Measures Against Line-Borne Interference:

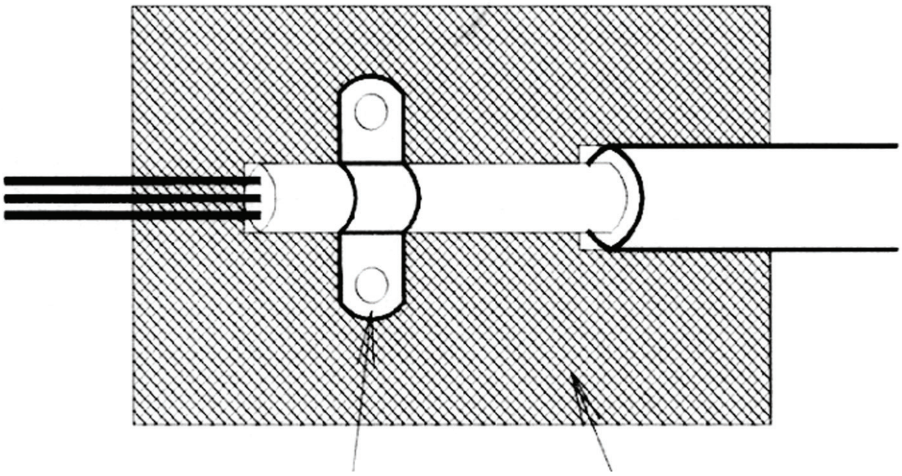
Line filter and frequency Inverter must be mounted on the same metal plate. Mount the two components as close to each other as possible, with cables kept as short as possible.

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.

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-L7B23P77	FS 5973-35-07	35	1.4	141 x 46 x 330
CIMR-L7B25P57				
CIMR-L7B27P57	FS 5973-60-07	60	3	206 x 60 x 355
CIMR-L7B20117				
CIMR-L7B20157	FS 5973-100-07	100	4.9	236 x 80 x 408
CIMR-L7B20187				
CIMR-L7B20227	FS 5973-130-35	130	4.3	90 x 180 x 370
CIMR-L7B20307				
CIMR-L7B20377	FS 5973-160-40	160	6	120 x 170 x 451
CIMR-L7B20457	FS 5973-240-37	240	11	130 x 240 x 610
CIMR-L7B20557				

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

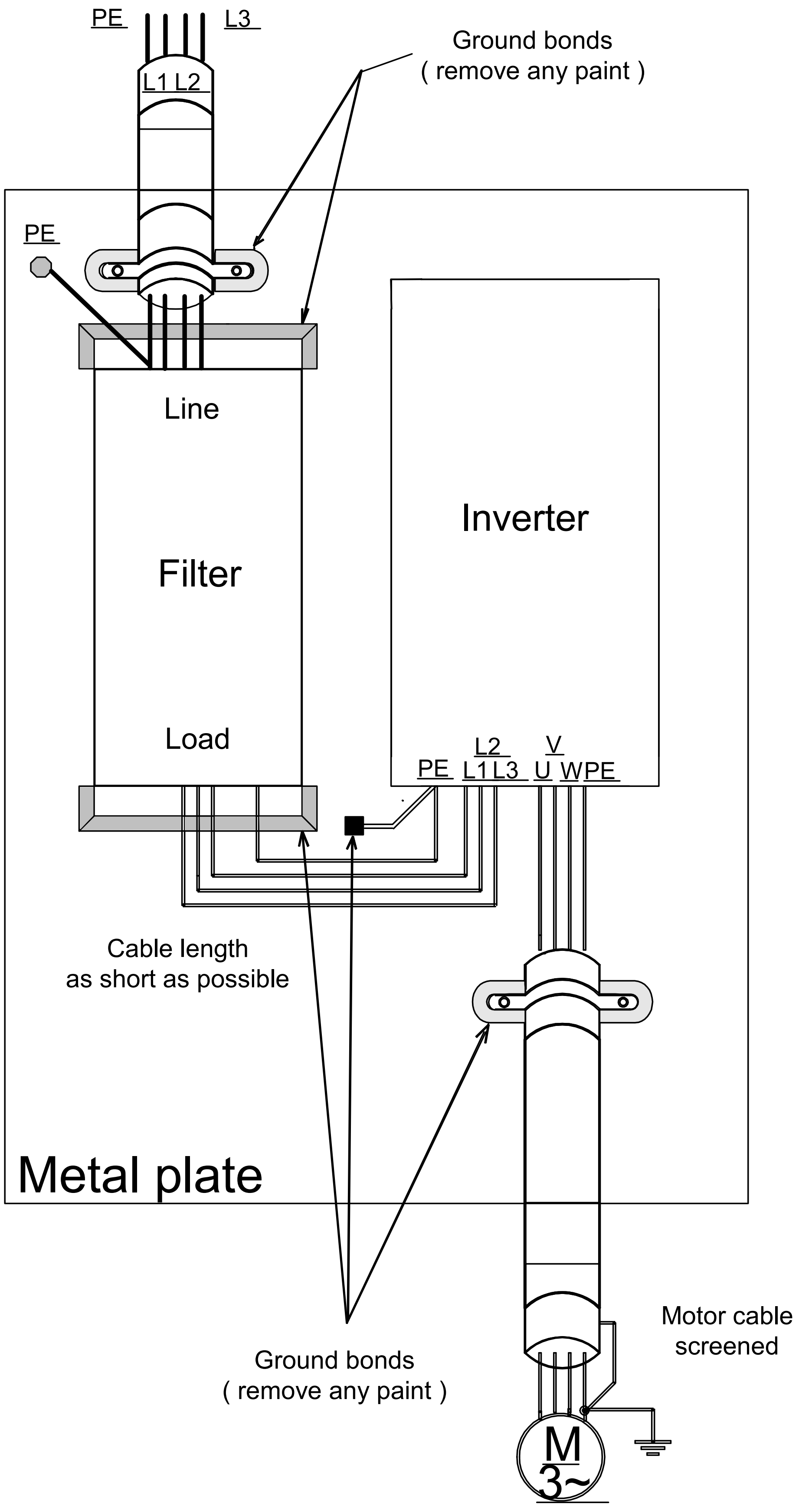
Inverter Model	Line Filter			
Varispeed L7	Model	Current (A)	Weight (kg)	Dimensions W x D x H
CIMR-L7B43P77	FS5972-10-07	10	1.2	141 x 46 x 330
CIMR-L7B44P07	FS 5972-18-07	18	1.3	141 x 46 x 330
CIMR-L7B45P57				
CIMR-L7B47P57	FS 5972-21-07	21	1.8	206 x 50 x 355
CIMR-L7B40117	FS 5972-35-07	35	2.1	206 x 50 x 355
CIMR-L7B40157	FS 5972-60-07	60	4.0	236 x 65 x 408
CIMR-L7B40187				
CIMR-L7B40227	FS 5972-70-52	70	3.4	80 x 185 x 329
CIMR-L7B40307				
CIMR-L7B40377	FS 5972-100-35	100	4.5	90 x 150 x 330
CIMR-L7B40457				
CIMR-L7B40557	FS 5972-130-35	130	4.7	90 x 180 x 370

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

IMPORTANT

1. max. motor cable length: 10 m Class B, 50 m Class A
2. Permissible emission of power inverter systems for commercial and light environment (EN61800-3, A11) (general availability, 1st environment)

■Installation Inverters and EMC filters



User Parameters

The factory settings of each parameter are given in the following table.

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	
b1-03	Stopping method selection	0	
b1-06	Control input scan	1	
b1-07	Operation selection after switching to remote mode	0	
b1-08	Run Command selection in programming modes	0	
b2-08	Magnetic flux compensation volume	0%	
b4-01	Timer function ON-delay time	0.0 s	
b4-02	Timer function OFF-delay time	0.0 s	
b6-01	Dwell frequency at start	0.0 Hz 0.0% (PM)	
b6-02	Dwell time at start	0.0 s	
b6-03	Dwell frequency at stop	0.0 Hz 0.0% (PM)	
b6-04	Dwell time at stop	0.0 s	
b7-01	Droop control gain	0.0 %	
b7-02	Droop control delay time	0.05 s	
b8-01	Energy-saving mode selection	0	
b8-16	Energy savings control parameter Ki	0.10	
b8-17	Energy savings control parameter Kt	1.00	
C1-01	Acceleration time 1	3.00 s	
C1-02	Deceleration time 1	3.00 s	
C1-03	Acceleration time 2	3.00 s	
C1-04	Deceleration time 2	3.00 s	
C1-05	Acceleration time 3	3.00 s	
C1-06	Deceleration time 3	3.00 s	
C1-07	Acceleration time 4	3.00 s	
C1-08	Deceleration time 4	3.00 s	
C1-09	Fast stop time	3.00 s	
C1-10	Accel/decel time setting unit	0	
C1-11	Accel/decel time switching frequency	0.0 Hz 0.0% (PM)	
C2-01	S-curve characteristic time at acceleration start	0.50 s	
C2-02	S-curve characteristic time at acceleration end	0.50 s	
C2-03	S-curve characteristic time at deceleration start	0.50 s	
C2-04	S-curve characteristic time at deceleration end	0.50 s	
C2-05	S-curve characteristic time below leveling speed	0.50 s	
C3-01	Slip compensation gain	1.0	

(Continued)

No.	Name	Factory Setting	Setting
C3-02	Slip compensation delay time	2000 ms	
C3-03	Slip compensation limit	200%	
C3-04	Slip compensation selection during regeneration	1	
C3-05	Output voltage limit operation selection	1 0 (PM)	
C4-01	Torque compensation gain	1.00	
C4-02	Torque compensation delay time parameter	200 ms *1	
C4-03	Starting torque compensation (FWD)	0.0%	
C4-04	Starting torque compensation (REV)	0.0%	
C4-05	Starting torque compensation time parameter	10 ms	
C4-06	Torque compensation primary delay time 2	150 ms	
C5-01	ASR proportional (P) gain 1	40.00 3.00 (PM)	
C5-02	ASR integral (I) time 1	0.500 s 0.300 s (PM)	
C5-03	ASR proportional (P) gain 2	20.00 3.00 (PM)	
C5-04	ASR integral (I) time 2	0.500 s	
C5-06	ASR primary delay time	0.004 s 0.020 s	
C5-07	ASR switching frequency	0.0 Hz 2.0% (PM)	
C5-08	ASR integral (I) limit	400%	
C5-09	ASR proportional (P) gain 3	40.00 3.00 (PM)	
C5-10	ASR integral (I) time 3	0.500 s 0.300 s (PM)	
C5-15	ASR gain for encoder offset tuning	5.00	
C6-02	Carrier frequency selection	3*2	
C6-03	Carrier frequency upper limit	8.0 kHz *2	
C6-09	Carrier during rotational autotuning	0	
C6-10	Carrier during stationary autotuning	1	
C6-11	Carrier frequency selection 2	4*2	
d1-01	Frequency reference 1	0.00 Hz*3	
d1-02	Frequency reference 2	0.00 Hz*3	
d1-03	Frequency reference 3	0.00 Hz*3	
d1-04	Frequency reference 4	0.00 Hz*3	
d1-05	Frequency reference 5	0.00 Hz*3	
d1-06	Frequency reference 6	0.00 Hz*3	
d1-07	Frequency reference 7	0.00 Hz*3	
d1-08	Frequency reference 8	0.00 Hz*3	
d1-09	Nominal speed reference	50.00 Hz 100.00% (PM)	
d1-10	Intermediate speed 1 reference	0.00 Hz*3	

(Continued)

No.	Name	Factory Setting	Setting
d1-11	Intermediate speed 2 reference	0.00 Hz*3	
d1-12	Intermediate speed 3 reference	0.00 Hz*3	
d1-13	Reveling speed reference	0.00 Hz*3	
d1-14	Inspection speed reference	25.00 Hz 50.00% (PM)	
d1-17	Leveling speed reference	4.00 Hz 8.00% (PM)	
d1-18	Speed priority selection	0	
d6-03	Field forcing function selection	0	
d6-06	Field forcing function Limit	400%	
E1-01	Input voltage setting	200 VAC*4*5	
E1-03	V/f pattern selection	F	
E1-04	Max. output frequency (FMAX)	60.0 Hz*5 96 min^{-1} (PM)*2	
E1-05	Max. output voltage (VMAX)	200 VAC*4*5	
E1-06	Base frequency (FA)	60.0 Hz*5 96 min^{-1} (PM)*2	
E1-07	Mid. output frequency (FB)	3.0 Hz*1*5	
E1-08	Mid. output frequency voltage (VB)	14.0 VAC*1*4*5	
E1-09	Min. output frequency (FMIN)	1.5 Hz*1*5	
E1-10	Min. output frequency voltage (VMIN)	7.0 VAC*1*4*5	
E1-13	Base voltage (VBASE)	0.0 VAC*6	
E2-01	Motor rated current	14.00 A*2	
E2-02	Motor rated slip	2.73 Hz*2	
E2-03	Motor no-load current	4.50 A*2	
E2-04	Number of motor poles	4 poles	
E2-05	Motor line-to-line resistance	0.771 Ω*2	
E2-06	Motor leak inductance	19.6%*2	
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	112 W*2	
E2-11	Motor rated output power	3.70 kW*2	
E2-12	Motor iron saturation coefficient 3	1.30	
E5-02	Motor rated power	3.70 kW*2	
E5-03	Motor rated current	7.0 A*2	
E5-04	Number of motor poles	32 pole*2	
E5-05	Motor line-to-line resistance	3.860Ω*2	
E5-06	d-axis inductance	30.20 mH*2	
E5-07	q-axis inductance	36.00 mH*2	
E5-09	Motor voltage parameter	1251.0 mV s/rad*2	
E5-11	PG home position offset	0.0 deg	

(Continued)

No.	Name	Factory Setting	Setting
F1-01	PG parameter	600*2	
		8192 (PM)	
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	
		1 (PM)	
F1-05	PG rotation	0	
		1 (PM)	
F1-06	PG division rate (PG pulse monitor)	1	
F1-08	Overspeed detection level	115%	
F1-09	Overspeed detection delay time	0.0 s	
F1-10	Excessive speed deviation detection level	10%	
F1-11	Excessive speed deviation detection delay time	0.5 s	
F1-14	PG open-circuit detection delay time	1.0 s	
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	60deg	
F1-25	Encoder copy selection	0	
F1-26	Encoder copy write permission selection	0	
F4-01	Channel 1 monitor selection	2	
		5 (PM)	
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	1	
H1-01	Terminal S3 function selection	24 (80)*7	
H1-02	Terminal S4 function selection	14 (84)*7	
H1-03	Terminal S5 function selection	3 (81)*7	

(Continued)

No.	Name	Factory Setting	Setting
H1-04	Terminal S6 function selection	4 (83)[*7]	
H1-05	Terminal S7 function selection	6 (F)[*7]	
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 parameter for the AI-14B	0.03 s	
H3-15	Terminal A1 function selection	0	
H3-16	Terminal A1 input gain	100.0%	
H3-17	Terminal A1 input bias	0.0%	
H5-01	Slave address	1F	
H5-02	Communication speed selection	3	
H5-03	Communication parity selection	0	
H5-04	Stopping method after communication error	3	
H5-05	Communication error detection selection	1	
H5-06	Send wait time	5 ms	
H5-07	RTS control ON/OFF	1	
L1-01	Motor protection selection	1 5 (PM)	
L1-02	Motor protection time parameter	1.0 min[*5]	
L2-05	Undervoltage detection level	190 VDC[*4]	
L2-11	Battery Voltage	0 VDC[*4]	
L3-01	Stall prevention selection during accel	1	
L3-02	Stall prevention level during accel	150%	
L3-03	Stall prevention limit during accel	50%	
L3-04	Stall prevention selection during decel	0	
L3-05	Stall prevention selection during running	1	
L3-06	Stall prevention level during running	150%	
L4-01	Speed agreement detection level	0.0 Hz 0.0% (PM)	
L4-02	Speed agreement detection width	2.0 Hz 4.0% (PM)	
L4-03	Speed agreement detection level (+/-)	0.0 Hz 0.0% (PM)	
L4-04	Speed agreement detection width (+/-)	2.0 Hz 4.0% (PM)	
L4-05	Operation when frequency reference is missing	0	

(Continued)

No.	Name	Factory Setting	Setting
L4-06	Frequency reference at frequency reference loss	80.0%	
L5-01	Number of auto restart attempts	2	
L5-02	Auto restart operation selection	1	
L5-03	Fault restart interval time	2.0 s	
L5-05	Under voltage fault restart selection	0	
L6-01	Torque detection selection 1	4	
L6-02	Torque detection level 1	150%	
L6-03	Torque detection time 1	10.0 s	
L6-04	Torque detection selection 2	0	
L6-05	Torque detection level 2	150%	
L6-06	Torque detection time 2	0.1 s	
L7-01	Forward inverter torque limit	200%	
L7-02	Reverse inverter torque limit	200%	
L7-03	Forward regenerative torque limit	200%	
L7-04	Reverse regenerative torque limit	200%	
L7-06	Torque limit time parameter	200 ms	
L7-07	Torque Limit Operation during accel/decel	0	
L8-02	Overheat pre-alarm level	75 °C[*2]	
L8-03	Operation selection after overheat pre-alarm	3	
L8-05[*8]	Input open-phase protection selection	1	
L8-07	Output open-phase protection selection	2	
L8-09	Ground protection selection	1	
L8-10	Cooling fan control selection	0	
L8-11	Cooling fan control delay time	60 s	
L8-12	Ambient temperature	45 °C	
L8-18	Soft CLA selection	1	
L8-20	LF detection time	0.2 s	
L8-32	OH1 detection during cooling fan failure	1	
N2-01	Speed feedback detection control (AFR) gain	1.00	
N2-02	Speed feedback detection control (AFR) time parameter	50 ms	
N2-03	Speed feedback detection control (AFR) time parameter 2	750 ms	
N5-01	Feed forward control selection	0	
N5-02	Motor Accel Time	0.154 s [*2]	
N5-03	Feed forward proportional gain	1.00	
N8-01	Initial magnetic polarity estimation current	75%	
N8-35	Magnet position detection method	2	
N8-36	Magnet position detection method 2 frequency	500 Hz	
N8-37	Magnet position detection method 2 current level	30.0%	
N8-39	Low pass filter cut-off frequency for magnet position detection method 2	50 Hz	
N8-46	Inductance measurement current level	10.0%	
N9-60	A/D conversion start delay timer	0.0 µs	
N9-74[*8]	Leakage current reduction selection	0	
o1-01	Monitor selection	6	
o1-02	Monitor selection after power up	1	
o1-03	Frequency units of reference setting and monitor	0	
		1 (PM)	

(Continued)

No.	Name	Factory Setting	Setting
o1-04	Setting unit for frequency parameters related to V/f characteristics	0 1 (PM)	
o1-05	LCD Display contrast adjustment	3	
o2-01	LOCAL/REMOTE key enable/disable	0	
o2-02	STOP key during control circuit terminal operation	0	
o2-03	Parameter initial value	0	
o2-04	kVA selection	4*2	
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	1	
o2-09	Initialize Mode	0	
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	1.2 Hz*1	
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 s*1	
S1-05	DC injection braking time at stop	0.60 s	
S1-06	Brake release delay time	0.20	
S1-07	Brake close delay time	0.10	
S1-14	SE2 detection delay time	200 ms	
S1-15	SE3 detection delay time	200 ms	
S1-16	Run delay time	0.10 s	
S1-17	DC injection current gain at regenerative operation	100%	
S1-18	DC injection current gain at motoring operation	20%	
S1-19	Magnetic contactor open delay time	0.10 s	
S1-20	Zero-servo gain	5	
S1-21	Zero-servo completion width	10	
S1-22	Starting torque compensation increase time	500 ms	
S1-23	Torque compensation gain during lowering	1.000	
S1-24	Torque compensation bias during raising	0.0%	
S1-25	Torque compensation bias during lowering	0.0%	
S1-26	Dwell speed at start reference	0.0 Hz	
S1-27	Door zone speed level	0.0 Hz	
S1-28	SE1 selection	0	
S1-31	Torque limit time at stop	0 ms	
S1-33 *11	Zero-servo gain 2	0.00	
S2-01	Motor rated speed	1380 min^{-1}	
S2-02	Slip compensation gain in motoring mode	0.70	
S2-03	Slip compensation gain in regenerative mode	1.00	
S2-07	Slip compensation delay time	200 ms	
S2-15	Slip compensation selection during regeneration	1	

(Continued)

No.	Name	Factory Setting	Setting
S3-01	Short-floor function selection	0	
S3-08	Output phase order	0	
S3-09	Frequency reference loss fault detection	0	
S3-13	Traction sheave diameter	400 mm	
S3-14	Roping	2	
S3-16	Over acceleration detection level	1.5	
S3-17	Over acceleration deceleration time parameter	0.050 s	
S3-18	Over acceleration detection method selection	0	
S3-23	Distance calculation deceleration time gain	0 2 (PM)	
S3-25 *11	Factory-set parameter 1	0	
S3-26 *11	Factory-set parameter 2	0	
T1-01	Autotuning mode selection	1*9 4 (PM)	
T1-02	Motor output power	3.70 kW*10	
T1-03	Motor rated voltage	190.0 V*4	
T1-04	Motor rated current	14.00 A*10	
T1-05	Motor base frequency	60.0 Hz	
T1-06	Number of motor poles	4 poles	
T1-07	Motor base speed	1450 min^{-1}	
T1-08	Number of PG pulses	600 PPR*10	
T1-09	Motor no-load current	4.05 (E2-03)	
T2-01	Motor output power	3.70 kW*2	
T2-02	Motor base frequency	96 min^{-1}*2	
T2-03	Motor rated voltage	200.0 VAC*4	
T2-04	Motor rated current	7.00 A*2	
T2-05	Number of motor poles	32 Pole	
T2-06	Motor d-axis inductance	30.20 mH*2	
T2-08	Motor voltage parameter k_e	1251 mVs/rad *2	
T2-09	Number of PG pulses	8192 PPR	
T2-10	Motor voltage parameter calculation selection	1	

* 1. The factory settings will change when the control method is changed. (V/f control factory settings are given.)
* 2. The factory settings depend on the Inverter capacity. The values for a 200 V class Inverter for 3.7 kW are given.
* 3. The factory setting changes to 0.00% when using closed-loop vector control (PM).
* 4. These are values for a 200 V class Inverter. Values for a 400 V class Inverter are double.
* 5. The factory settings will change according to parameter o2-09. Values shown here are for when o2-09 is set to 0.
* 6. After autotuning, E1-13 will contain the same value as E1-05.
* 7. Value will change to number in parenthesis when parameter d1-18 equals 1 or 2.
* 8. Applicable for L7-Series Inverters with software versions PRG: 2012 or later.
* 9. Set T1-02 and T1-04 when 2 is set for T1-01. For V/f control a set value 2 is possible only.
* 10.The factory settings depend on the Inverter capacity. The values provided are for a 200 V class Inverter for 3.7 kW and when o2-09 is set to 0.
* 11.Applicable for L7-Series Inverters with software versions PRG: 2013 or later.

Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

MANUAL NO. TOEP C710676 08B

Published in Japan June 2008 08-1 ◇1

June 2008 — Date of publication

08-1 — Date of original publication

◇1 — Revision number

Date of Publication	Rev. No.	Section	Revised Content
January 2008	–		First edition
June 2008	◇2	Chapter 5, Chapter 6	Addition: Parameters S1-33, S3-25, S3-26, and U1-90
		Back cover	Revision: Address

Varispeed L7

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MANUAL NO. TOEP C710676 08B

Published in Japan June 2008 08-1 ①
08-5-10