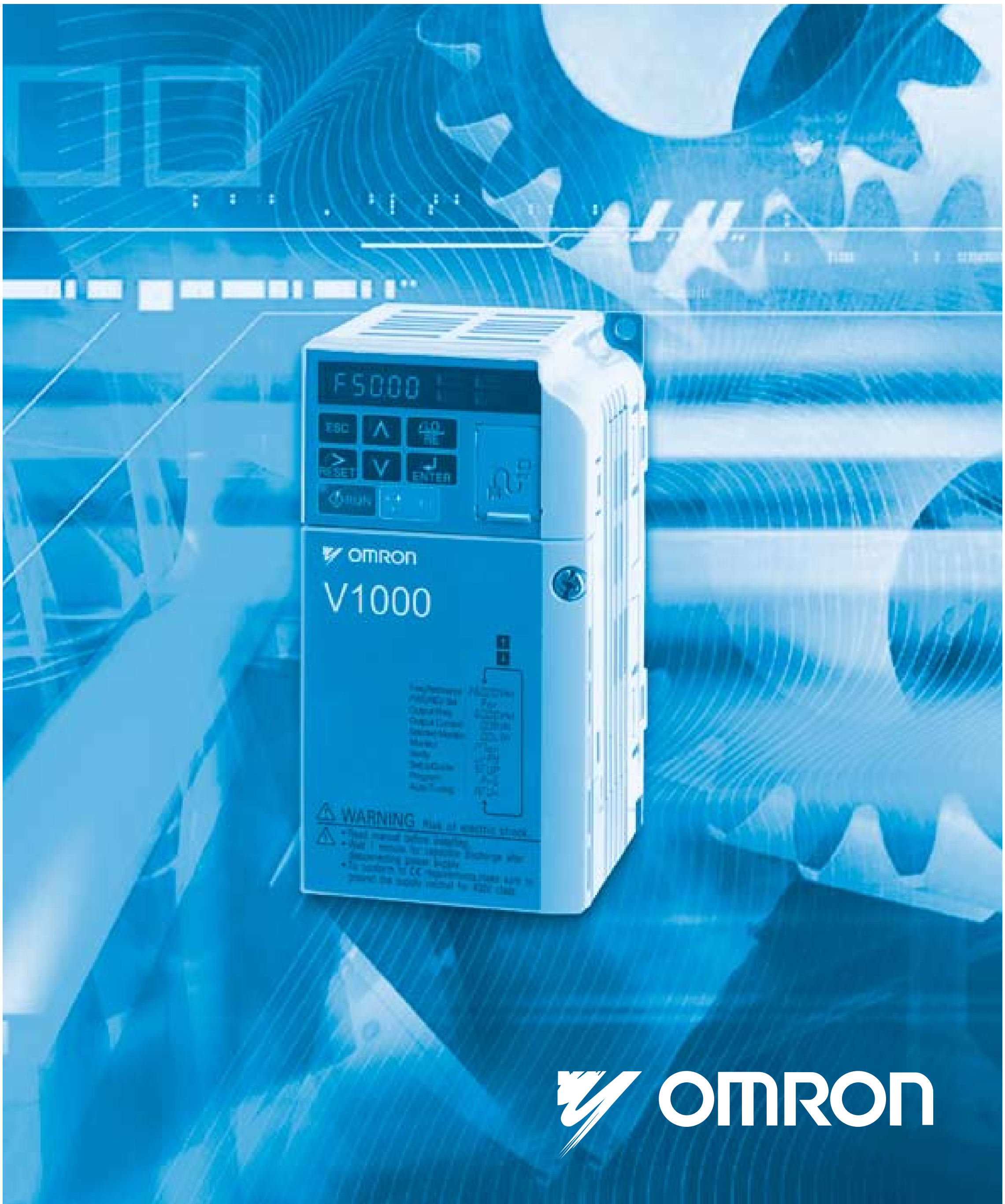
Manual No.
TOEPC71060622-01-OY

V1000

Compact Vector Control Drive
Model: VZA
200 V Class Three-Phase Input 0.1 to 15 kW
200 V Class Single-Phase Input 0.1 to 4.0 kW
400 V Class Three-Phase Input 0.2 to 15 kW

USER'S MANUAL



YASKAWA

OYMC AC Drive - V1000

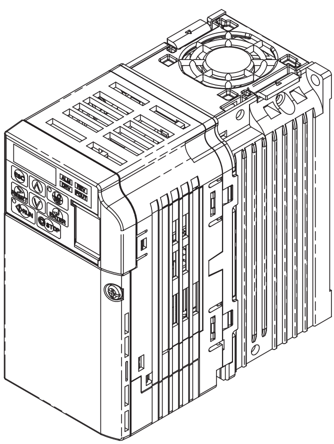
Compact Vector Control Drive

User Manual

Type: VZA□□□□□□□□

Model: 200 V Class, Three-Phase Input: 0.1 to 15 kW
200 V Class, Single-Phase Input: 0.1 to 4.0 kW
400 V Class, Three-Phase Input: 0.2 to 15 kW

To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.



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Preface & General Safety

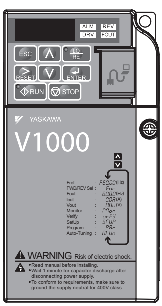
This section provides safety messages pertinent to this product, that, if not heeded, may result in fatality, personal injury, or equipment damage. OYMC is not responsible for the consequences of ignoring these instructions.

i.1 Preface

OYMC distributes products used as components in a wide variety of industrial systems and equipment. The selection and application of OYMC products remain the responsibility of the equipment manufacturer or end user. OYMC accepts no responsibility for the way its products are incorporated into the final system design. Under no circumstances should any OYMC product be incorporated into any product or design as the exclusive or sole safety control. Without exception, all controls should be designed to detect faults dynamically and fail safely under all circumstances. All systems or equipment designed to incorporate a product distributed by OYMC must be supplied to the end user with appropriate warnings and instructions as to the safe use and operation of that part. Any warnings provided by OYMC must be promptly provided to the end user. OYMC offers an express warranty only as to the quality of its products in conforming to standards and specifications published in the OYMC manual. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS OFFERED. OYMC assumes no liability for any personal injury, property damage, losses, or claims arising from misapplication of its products.

◆ Applicable Documentation

The following manuals are available for V1000 series drives:

<table>
<tr><td rowspan="4">
</td><td>V1000 Series AC Drive User Manual</td></tr>
<tr><td>Read this manual first.
This manual describes installation, wiring, operation procedures, functions, troubleshooting, maintenance, and inspections to perform before operation.</td></tr>
<tr><td>V1000 Series AC Drive Quick Start Guide</td></tr>
<tr><td>This guide is packaged together with the product. It contains basic information required to install and wire the drive. This guide provides basic programming and simple set-up and adjustment. Refer to the V1000 User Manual for complete descriptions of drive features and functions.</td></tr>
</table>

◆ Symbols

NOTE: indicates a supplement or precaution that does not cause drive damage.

TERMS **Indicates a term or definition used in this manual.**

◆ Terms and Abbreviations

TERMS

Drive: V1000 Series Drive
PM motor: Synchronous motor (an abbreviation for IPM motor or SPM motor)
IPM motor: SSR1 Series
OYMC: Omron Yaskawa Motion Control B.V.
SPM motor: Pico motor (SMRA Series)

i.2 General Safety

◆ Supplemental Safety Information

General Precautions
• The diagrams in this manual may be indicated without covers or safety shields to show details. Restore covers or shields before operating the drive and run the drive 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 OYMC representative or the nearest OYMC sales office and provide the manual number shown on the front cover. • If nameplate becomes worn or damaged, order a replacement from your OYMC representative or the nearest OYMC sales office.

WARNING
Read and understand this manual before installing, operating or servicing this drive. The drive must be installed according to this manual and local codes. The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

DANGER
Indicates a hazardous situation, which, if not avoided, will result in death or serious injury.

WARNING
Indicates a hazardous situation, which, if not avoided, could result in death or serious injury.

WARNING! *will also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

CAUTION
Indicates a hazardous situation, which, if not avoided, could result in minor or moderate injury.

CAUTION! *will also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

NOTICE
Indicates a property damage message.

NOTICE: *will also be indicated by a bold key word embedded in the text followed by an italicized safety message.*

◆ Safety Messages

⚠ DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

The operating company is responsible for any injuries or equipment damage resulting from failure to heed the warnings in this manual.

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure the DC bus voltage level to confirm safe level.

⚠ WARNING

Sudden Movement Hazard

System may start unexpectedly upon application of power, resulting in death or serious injury.

Clear all personnel from the drive, motor and machine area before applying power. Secure covers, couplings, shaft keys and machine loads before applying power to the drive.

When using FBD's to create custom programming, the drive I/O terminal functions change from factory settings and the drive will not perform as outlined in this manual.

Unpredictable equipment operation may result in death or serious injury.

Take special note of custom I/O programming in the drive before attempting to operate equipment.

⚠ WARNING

Electrical Shock Hazard

Do not attempt to modify or alter the drive in any way not explained in this manual.

Failure to comply could result in death or serious injury.

OYMC is not responsible for any modification of the product made by the user. This product must not be modified.

Do not allow unqualified personnel to use equipment.

Failure to comply could result in death or serious injury.

Maintenance, inspection, and replacement of parts must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

Fire Hazard

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

⚠ CAUTION

Crush Hazard

Do not carry the drive by the front cover.

Failure to comply may result in minor or moderate injury from the main body of the drive falling.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not perform a withstand voltage test on any part of the drive.

Failure to comply could result in damage to the sensitive devices within the drive.

Do not operate damaged equipment.

Failure to comply could result in further damage to the equipment.

Do not connect or operate any equipment with visible damage or missing parts.

Install adequate branch circuit short circuit protection per applicable codes.

Failure to comply could result in damage to the drive.

The drive is suitable for circuits capable of delivering not more than 30,000 RMS symmetrical Amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400 V Class).

Do not expose the drive to halogen group disinfectants.

Failure to comply may cause damage to the electrical components in the drive.

Do not pack the drive in wooden materials that have been fumigated or sterilized.

Do not sterilize the entire package after the product is packed.

◆ Drive Label Warnings

Always heed the warning information listed in *Figure i.1* in the position shown in *Figure i.2*.

WARNING Risk of electric shock.

- Read manual before installing.
- Wait 5 minutes for capacitor discharge after disconnecting power supply.
- To conform to CE requirements, make sure to ground the supply neutral for 400V class.

Figure i.1 Warning Information

Figure i.2 Warning Information Position

◆ Warranty Information

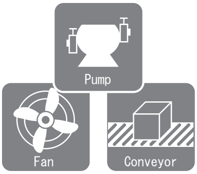
■ Restrictions

The V1000 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 power, electric power, or in underwater applications must first contact their OYMC representatives or the nearest OYMC sales office.

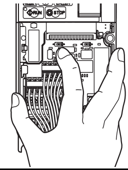
This product has been manufactured under strict quality-control guidelines. However, if this product is to be installed in any location where failure of this product could involve or result in a life-and-death situation or loss of human life or in a facility where failure may cause a serious accident or physical injury, safety devices must be installed to minimize the likelihood of any accident.

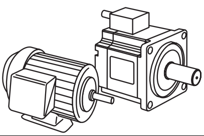
◆ Quick Reference

Easily Set Application-Specific Parameters	
Preset parameter defaults are available for many applications. ***Refer to Application Presets on page 107***	

Run a Motor of One-Frame Larger Capacity
When using this drive for variable torque loads such as fans and pumps, a motor one frame size larger can be used. ***Refer to Drive Duty Mode Selection: C6-01 on page 130***

Know the Details of Safety Measures
The functions listed below affect the safe operation of the drive. Ensure that the settings fit the application requirements prior to operation.
Operation of digital outputs during Auto-tuning. Rotational Auto-tuning allows for normal digital output operation, while non-rotational Auto-tuning does not allow for normal digital output operation.
Safe operations. Run by power on. Parameter setting b1-17.
LOCAL/REMOTE key effective during stop in drive mode. Parameter o2-01.
LED operator stop key priority selection. Parameter o2-02.
Enter press required after changing the keypad frequency reference. Parameter o2-05.
Operation interlock when program mode is selected. Parameter b1-08.

Replace the Drive	
The removable terminal block with parameter backup function allows the transfer of parameter settings after drive replacement. ***Refer to Replacing the drive on page 255***	

Drive a Synchronous PM Motor	
The V1000 drive can operate synchronous PM motors. ***Refer to Subchart A3: Operation with Permanent Magnet Motors on page 106***.	

Perform Auto-tuning
Automatic tuning sets motor parameters. ***Refer to Auto-Tuning on page 149***

Check the Maintenance Period Using Drive Monitors
The maintenance period of fans and capacitors can be checked drive monitors. ***Refer to Performance Life Monitors on page 248***.

Drive or Motor Faults are Displayed on a Digital Operator
Refer to Fault Displays, Causes, and Possible Solutions on page 183 and ***Refer to Alarm Codes, Causes, and Possible Solutions on page 202***.

Standards Compliance	
Refer to CE Low Voltage Directive Compliance on page 401 and ***Refer to UL Standards Compliance on page 410***.	C US LISTED

1

Receiving

This chapter describes the proper inspections to perform after receiving the drive and illustrates the different enclosure types and components.

1.1 Section Safety

CAUTION

Do not carry the drive by the front cover.

Failure to comply may cause the main body of the drive to fall, resulting in minor or moderate injury.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

A motor connected to a PWM drive may operate at a higher temperature than a utility-fed motor and the operating speed range may reduce motor cooling capacity.

Ensure that the motor is suitable for inverter duty and/or the motor service factor is adequate to accommodate the additional heating with the intended operating conditions.

1.2 Model Number and Nameplate Check

Please perform the following tasks after receiving the drive:

- Inspect the drive for damage.
  If the drive appears damaged upon receipt, contact the shipper immediately.
- Verify receipt of the correct model by checking the information on the nameplate.
- If you have received the wrong model or the drive does not function properly, contact your supplier.

◆ Nameplate

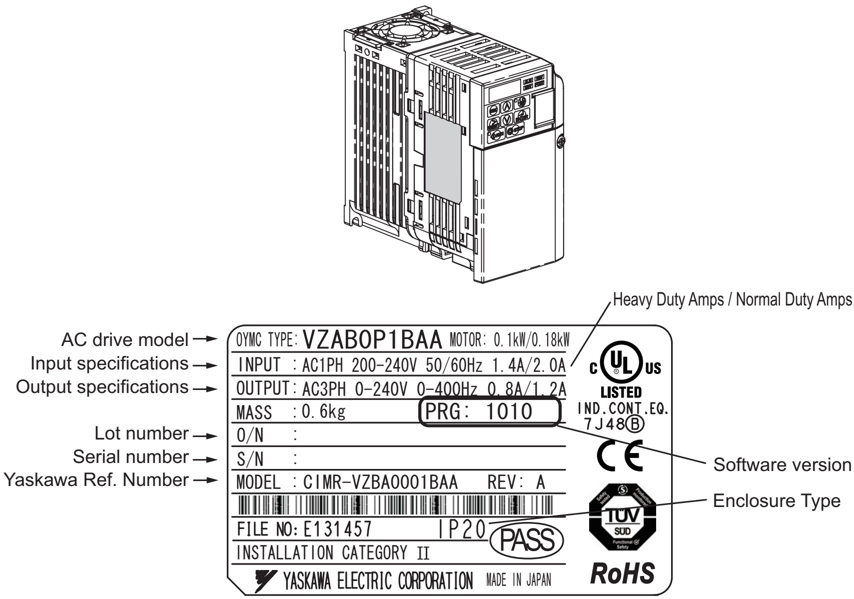
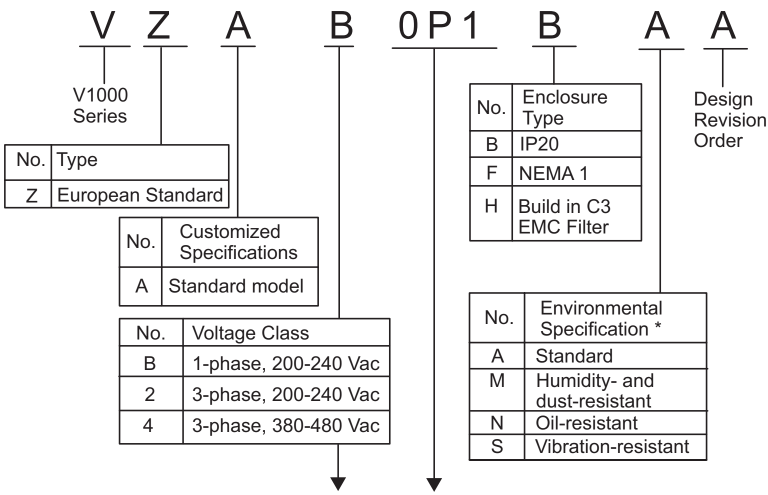


Figure 1.1 Nameplate Information

1.2 Model Number and Nameplate Check



Single-Phase 200 V

No.	Heavy Duty		Normal Duty	
	Max. Motor Capacity kW	**Rated Output Current A**	**Max. Motor Capacity kW**	**Rated Output Current A**
B0P1	0.1	0.8	0.2	1.2
B0P2	0.2	1.6	0.4	1.9
B0P4	0.4	3	0.75	3.3
B0P7	0.75	5	1.1	6
B1P5	1.5	8	2.2	9.6
B2P2	2.2	11	3.0	12
B4P0	4.0	17.5	-	-

Three-Phase 200 V

No.	Heavy Duty		Normal Duty	
	Max. Motor Capacity kW	**Rated Output Current A**	**Max. Motor Capacity kW**	**Rated Output Current A**
20P1	0.1	0.8	0.2	1.2
20P2	0.2	1.6	0.4	1.9
20P4	0.4	3	0.75	3.5

No.	Heavy Duty		Normal Duty	
	Max. Motor Capacity kW	Rated Output Current A	Max. Motor Capacity kW	Rated Output Current A
20P7	0.75	5	1.1	6
21P5	1.5	8	2.2	9.6
22P2	2.2	11	3.0	12
24P0	4.0	17.5	5.5	19.6
25P5	5.5	25	7.5	30
27P5	7.5	33	11	40
2011	11	47	15	56
2015	15	60	18.5	69

Three-Phase 400 V

No.	Heavy Duty		Normal Duty	
	Max. Motor Capacity kW	Rated Output Current A	Max. Motor Capacity kW	Rated Output Current A
40P2	0.2	1.2	0.4	1.2
40P4	0.4	1.8	0.75	2.1
40P7	0.75	3.4	1.5	4.1
41P5	1.5	4.8	2.2	5.4
42P2	2.2	5.5	3.0	6.9
43P0	3.0	7.2	4.0	8.8
44P0	4.0	9.2	5.5	11.1
45P5	5.5	14.8	7.5	17.5
47P5	7.5	18	11	23
4011	11	24	15	31
4015	15	31	18.5	38

* Drives with these specifications do not guarantee complete protection for the specified environmental condition.

Note: *Refer to Component Names on page 30* for differences regarding enclosure protection types and component descriptions.

1.3 Drive Models and Enclosure Types

The following table describes drive enclosures and models.

Table 1.1 Drive Models and Enclosure Types

Voltage Class	Enclosure Type	
	IP20/Open-Chassis VZA	IP20/ NEMA Type1) VZA
Single-Phase 200 V Class	B0P1B	-
	B0P2B	-
	B0P4B	-
	B0P7B	-
	B1P1B	-
	B2P2B	-
	B4P0B	-
Three-Phase 200 V Class	20P1B	-
	20P2B	-
	20P4B	-
	20P7B	-
	21P5B	-
	22P2B	-
	24P0B	-
	-	25P5F
	-	27P5F
	-	2011F
	-	2015F
Three-Phase 400 V Class	40P2B	-
	40P4B	-
	40P7B	-
	41P5B	-
	42P2B	-
	43P0B	-
	44P0B	-
	-	45P5F
	-	47P5F
	-	4011F
	-	4015F

TERMS

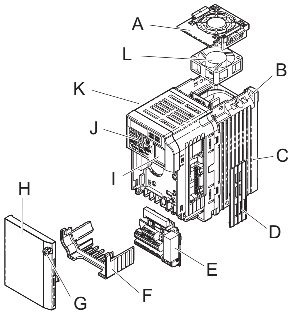
- Two types of enclosures are offered for V1000 drives.
- IP20/Open-Chassis models are often placed inside a large enclosure panel where the front of the drive is covered to prevent someone from accidentally touching charged components.
- IP20/NEMA Type 1 models mount to an indoor wall and not inside a large enclosure panel.

1.4 Component Names

This section illustrates the drive components as they are mentioned in this manual.

◆ IP20/Open-Chassis

■ Single-phase AC200 V VZAB0P1B ~ VZAB0P4B Three-phase AC200 V VZA20P1B ~ VZA20P7B



A – Cooling fan cover *<1>*

B – Mounting hole

C – Heatsink

D – Optional 24 V DC power supply connector cover

E – Terminal board
Refer to ***Table 3.6*** **on page** ***66***

F – Terminal cover

G – Front cover screw

H – Front cover

I – Comm port
Refer to Network Communications on page 389

J – LED operator
Refer to Using the Digital LED Operator on page 87

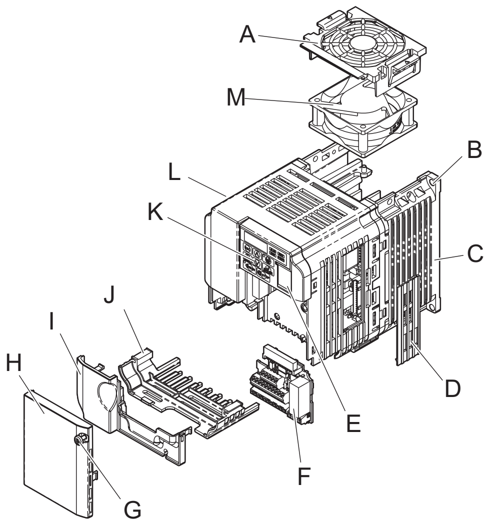
K – Drive case

L – Cooling fan *<1>*

<1> The drives VZAB0P1B ~ VZAB0P4B and VZA20P1B ~ VZA20P4B have no cooling fan and cooling fan cover

Figure 1.2 Exploded View of IP20/Open-Chassis Type Components Three-Phase AC200 V VZA20P7B

■ Single-Phase AC200 V VZAB0P7B ~ VZAB4P0B
Three-Phase AC200 V VZA21P5B ~ VZA24P0B
Three-Phase AC400 V VZA40P2B ~ VZA44P0B



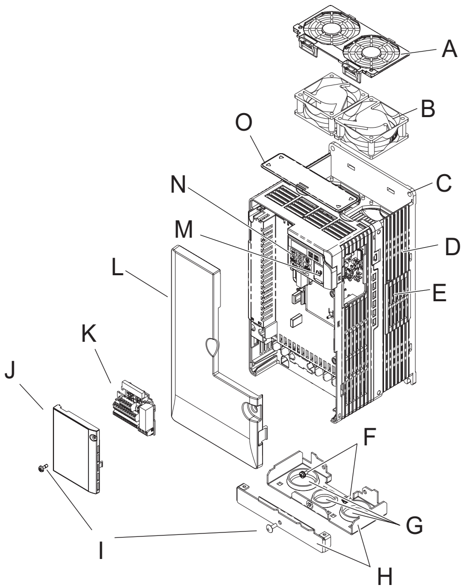
A – Fan cover <1>
B – Mounting hole
C – Heatsink
D – Optional 24 V DC power supply connector cover
E – Comm port *Refer to Network Communications on page 389*
F – Terminal board Refer to *Table 3.6* on page *66*
G – Front cover screw
H – Front cover
I – Terminal cover
J – Bottom cover
K – LED operator *Refer to Using the Digital LED Operator on page 87*
L – Case
M – Cooling fan <1>

<1> The drives VZAB0P7B and VZA40P2B ~ VZA40P7B have no cooling fan and cooling fan cover. The drive VZAB4P0B has 2 cooling fans.

Figure 1.3 Exploded view of IP20/Open-Chassis Type Components Three-Phase AC200 V VZA22P2B

◆ IP20/NEMA Type 1 Enclosure

■ Three-phase AC200 V VZA25P5F ~ VZA2015F
Three-phase AC400 V VZA45P5F ~ VZA4015F

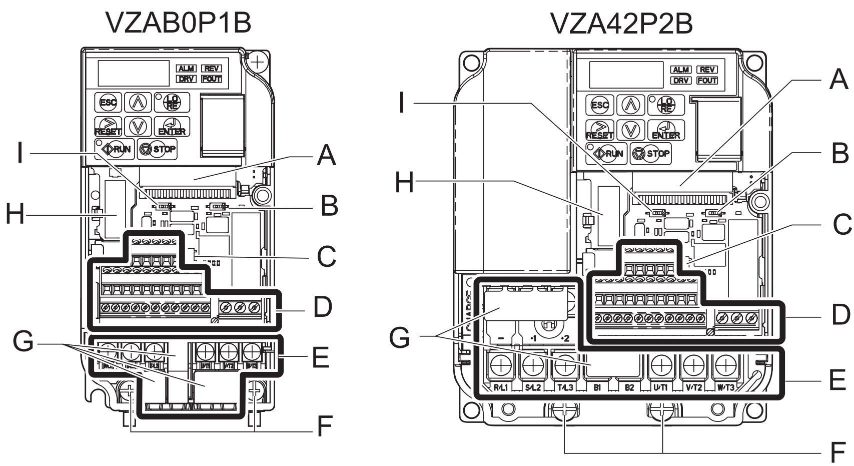


- **A – Fan cover**
- **B – Cooling fan**
- **C – Mounting Hole**
- **D – Case and Heatsink**
- **E – Optional 24 V DC power supply connector cover**
- **F – Cover screws**
- **G – Rubber bushing**
- **H – Bottom cover**
- **I – Front cover screws**
- **J – Terminal cover**
- **K – Terminal board**
  Refer to *Table 3.6* on page *66*
- **L – Front cover**
- **M – Comm port**
  Refer to Network Communications on page 389
- **N – LED operator**
  Refer to Using the Digital LED Operator on page 87
- **O – Top cover**

Figure 1.4 Exploded view of IP20/NEMA Type 1 Components

Three-phase AC400 V VZA45P5F

◆ Front Views



A – Terminal board connector

B – DIP switch S1
Refer to Terminal A2 Switch on page 75

C – DIP switch S3
Refer to Sinking/Sourcing Mode Switch on page 73

D – Control circuit terminal
Refer to Control Circuit Wiring on page 65

E – Main circuit terminal
Refer to Wiring the Main Circuit Terminal on page 64

F – Ground terminal

G – Terminal cover

H – Option card connector
Refer to Connecting the Option Card on page 275

I – DIP switch S2
Refer to MEMOBUS/Modbus Termination on page 77

Figure 1.5 Front Views of Drives

1.4 Component Names

2

Mechanical Installation

This chapter explains how to properly mount and install the drive.

2.1 Section Safety

⚠ WARNING

Fire Hazard

Provide sufficient cooling when installing the drive inside an enclosed panel or cabinet.

Failure to comply could result in overheating and fire.

When multiple drives are placed inside the same enclosure panel, install proper cooling to ensure air entering the enclosure does not exceed 40 °C.

⚠ CAUTION

Crush Hazard

Do not carry the drive by the front cover.

Failure to comply may result in minor or moderate injury from the main body of the drive falling.

NOTICE

Observe proper electrostatic discharge (ESD) procedures when handling the drive.

Failure to comply could result in ESD damage to the drive circuitry.

It may be difficult to perform maintenance on the cooling fans of drives installed in a vertical row inside an enclosure.

Ensure adequate spacing at the top of the drive to perform cooling fan replacement when required.

NOTICE

Operating the motor in the low-speed range diminishes the cooling effects, increases motor temperature, and may lead to motor damage by overheating.

Reduce the motor torque in the low-speed range whenever using standard blower cooled motor. If 100% torque is required continuously at low speed, consider using a special drive or vector motor. Select a motor that is compatible with the required load torque and operating speed range.

Do not operate motors above the maximum rated RPM.

Failure to comply may lead to bearing or other mechanical motor failures.

The speed range for continuous operation differs according to the lubrication method and motor manufacturer.

If the motor is to be operated at a speed higher than 60 Hz, consult with the manufacturer.

Continuously operating an oil-lubricated motor in the low-speed range may result in burning.

When the input voltage is 480 V or higher or the wiring distance is greater than 100 meters, pay special attention to the motor insulation voltage or use a drive-rated motor.

Failure to comply could lead to motor winding failure.

Motor vibration may increase when operating a machine in variable-speed mode, if that machine previously operated at a constant speed.

Install vibration-proof rubber on the motor base or use the frequency jump function to skip a frequency resonating the machine.

The motor may require more acceleration torque with drive operation than with a commercial power supply.

Set a proper V/f pattern by checking the load torque characteristics of the machine to be used with the motor.

NOTICE

The rated input current of submersible motors is higher than the rated input current of standard motors.

Select an appropriate drive according to its rated output current. When the distance between the motor and drive is long, use a cable thick enough to connect the motor to the drive to prevent motor torque reduction.

When an using an explosion-proof motor, it must be subject to an explosion-proof test in conjunction with the drive.

This is also applicable when an existing explosion-proof motor is to be operated with the drive. Since the drive itself is not explosion-proof, always install it in a safe place.

Do not use a drive for a single phase motor.

Replace the motor with a three phase motor.

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 60 Hz.

2.2 Mechanical Installation

This section outlines specifications, procedures, and environment for proper mechanical installation of the drive.

◆ Installation Environment

To help prolong the optimum performance life of the drive, install the drive in the proper environment. The table below provides description of the appropriate environment for the drive.

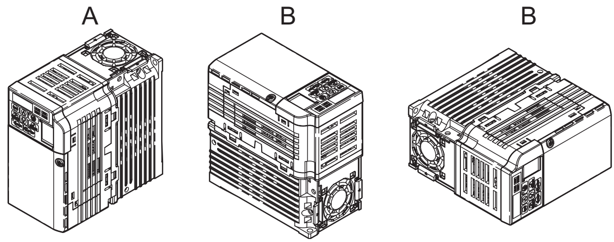
Table 2.1 Installation Environment

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	-10 °C to +40 °C (IP20/NEMA Type 1) -10 °C to +50 °C (IP20/Open-Chassis) Drive reliability improves in environments without wide temperature fluctuations. When using an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the drive.
Humidity	95% RH or less and free of condensation
Storage Temperature	-20 °C to +60 °C
Surrounding Area	Install the drive in an area free from: • oil mist and dust • metal shavings, oil, water or other foreign materials • radioactive materials • combustible materials (e.g., wood) • harmful gases and liquids • excessive vibration • chlorides • direct sunlight.
Altitude	1000 m or lower
Vibration	10 to 20 Hz at 9.8 m/s^2 20 to 55 Hz at 5.9 m/s^2
Orientation	Install the drive vertically to maintain maximum cooling effects.

NOTICE: *Prevent foreign matter such as metal shavings or wire clippings from falling into the drive during installation and project construction. Failure to comply could result in damage to the drive. Place a temporary cover over the top of the drive during installation. Remove the temporary cover before start-up, as the cover will reduce ventilation and cause the drive to overheat.*

◆ Installation Orientation and Spacing

Install the drive upright as illustrated in *Figure 2.1* to maintain proper cooling.

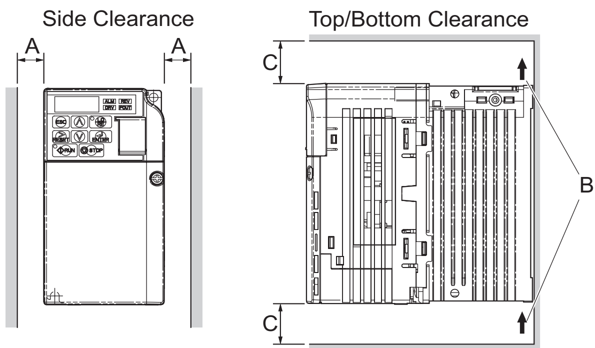


A – Correct **B – Incorrect**

Figure 2.1 Correct Installation Orientation

■ Single Drive Installation

To maintain sufficient space for airflow and wiring, refer to *Figure 2.2*. Install the heatsink against a closed surface to avoid diverting cooling air around the heatsink.



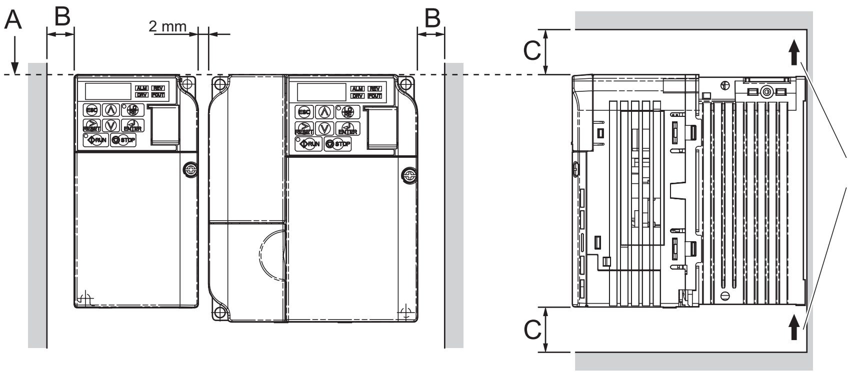
A – 30 mm minimum
B – Airflow direction
C – 100 mm minimum

Figure 2.2 Correct Installation Spacing

Note: IP20/NEMA Type 1 and IP20/Open-Chassis models require the same amount of space above and below the drive for installation.

Multiple Drive Installation

When installing multiple drives into the same enclosure panel, mount the drives according to *Figure 2.2*. When mounting drives with a minimum side-by-side clearance of 2 mm according to *Figure 2.3*, derating must be considered and parameter L8-35 must be set. *Refer to Parameter List on page 293*.



A – Line up the tops of the drives.
B – 30 mm minimum
C – 100 mm minimum
D – Airflow direction

Figure 2.3 Space Between Drives (Side-by-Side Mounting)

Note: When installing drives of different sizes into the same enclosure panel, the tops of the drives should line up. Leave space between the top and bottom of stacked drives for cooling fan replacement if required. Using this method, it is possible to replace the cooling fans later.

NOTICE: *When drives with IP20/NEMA Type 1 enclosures are mounted side-by-side, the top covers of all drives must be removed as shown in the figure below.*

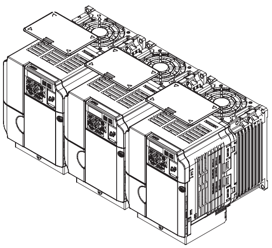


Figure 2.4 IP20/NEMA 1 Side-by-Side Mounting in Enclosure

◆ Removing and Attaching the Protective Covers

Refer to Electrical Installation on page 47, for information regarding the removal and reattachment of protective covers.

◆ Exterior and Mounting Dimensions

The table below matches each drive model with its appropriate drawing.

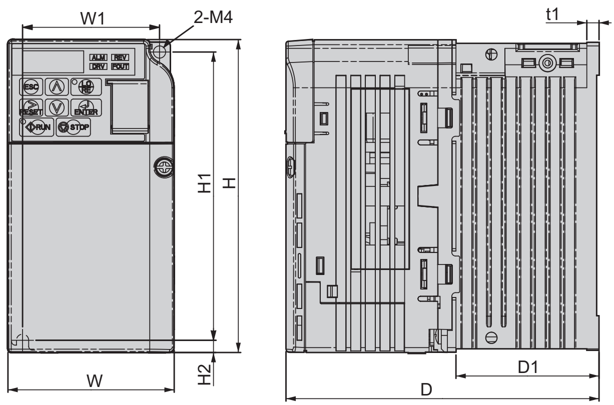
Table 2.2 Drive Models and Types

Protective Design	Drive Model VZA			Page
	Single-Phase 200 V Class	Three-Phase 200 V Class	Three-Phase 400 V Class	
IP20/Open-Chassis	B0P1B B0P2B B0P4B	20P1B 20P2B 20P4B 20P7B	–	43
IP20/Open-Chassis	B0P7B B1P5B B2P2B B4P0B	21P5B 22P2B 24P0B	40P2B 40P4B 40P7B 41P5B 42P2B 43P0B 44P0B	44
IP20/NEMA Type 1	–	25P5F 27P5F 2011F 2015F	45P5F 47P5F 4011F 4015F	45

Note: For information on the amount of heat generated by the drive and appropriate cooling methods, refer to *Specifications on page 279*.

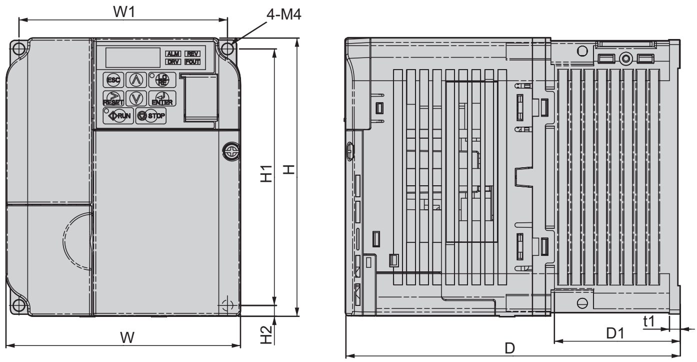
■ IP20/Open-Chassis Drives

Table 2.3 IP20/Open-Chassis (without an EMC filter)



Voltage Class	Drive Model VZA	Dimensions (mm)								
		W1	H1	W	H	D	t1	H2	D1	Weight (kg)
Single-Phase 200 V Class	B0P1B	56	118	68	128	76	3	5	6.5	0.6
	B0P2B	56	118	68	128	76	3	5	6.5	0.6
	B0P4B	56	118	68	128	118	5	5	38.5	1.0
Three-Phase 200 V Class	20P1B	56	118	68	128	76	3	5	6.5	0.6
	20P2B	56	118	68	128	76	3	5	6.5	0.6
	20P4B	56	118	68	128	108	5	5	38.5	0.9
	20P7B	56	118	68	128	128	5	5	58.5	1.1

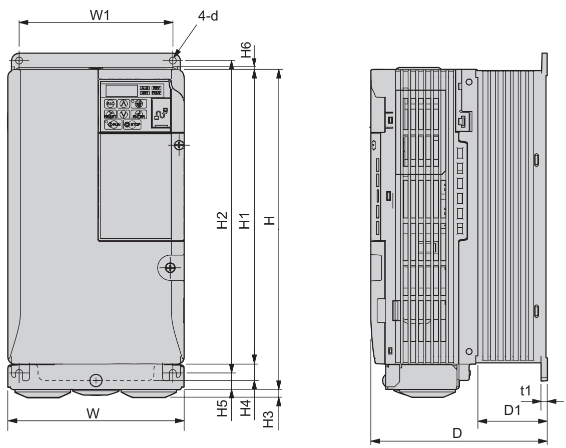
Table 2.4 IP20/Open-Chassis (without an EMC filter)



Voltage Class	Drive Model VZA	Dimensions (mm)								
		W1	H1	W	H	D	t1	H2	D1	Weight (kg)
Single-Phase 200 V Class	B0P7B	96	118	108	128	137.5	5	5	58	1.7
	B1P5B	96	118	108	128	154	5	5	58	1.8
	B2P2B	128	118	140	128	163	5	5	65	2.4
	B4P0B	158	118	170	128	180	5	5	65	3.0
Three-Phase 200 V Class	21P5B	96	118	108	128	129	5	5	58	1.7
	22P2B	96	118	108	128	137.5	5	5	58	1.7
	24P0B	128	118	140	128	143	5	5	65	2.4
Three-Phase 400 V Class	40P2B	96	118	108	128	81	5	5	10	1.0
	40P4B	96	118	108	128	99	5	5	28	1.2
	40P7B	96	118	108	128	137.5	5	5	58	1.7
	41P5B	96	118	108	128	154	5	5	58	1.7
	42P2B	96	118	108	128	154	5	5	58	1.7
	43P0B	96	118	108	128	154	5	5	58	1.7
	44P0B	128	118	140	128	143	5	5	65	2.4

■ IP20/NEMA Type 1 Drives

Table 2.5 IP20/NEMA Type 1 (without an EMC filter)



Voltage Class	Drive Model VZA	Dimensions (mm)													
		W1	H2	W	H1	D	t1	H5	D1	H	H4	H3	H6	d	Weight (kg)
Three-Phase 200 V Class	25P5F	122	248	140	248	140	5	13	55	254	13	6	1.5	M5	3.8
	27P5F	122	248	140	248	140	5	13	55	254	13	6	1.5	M5	3.8
	2011F	160	284	180	284	163	5	13	75	290	15	6	1.5	M5	5.5
	2015F	192	336	220	336	187	5	22	78	350	15	7	1.5	M6	9.2
Three-Phase 400 V Class	45P5F	122	248	140	248	140	5	13	55	254	13	6	1.5	M5	3.8
	47P5F	122	248	140	248	140	5	13	55	254	13	6	1.5	M5	3.8
	4011F	160	284	180	284	143	5	13	55	290	15	6	1.5	M5	5.2
	4015F	160	284	180	284	163	5	13	75	290	13	6	1.5	M5	5.5

3

Electrical Installation

This chapter explains proper procedures for wiring the control circuit terminals, motor and power supply.

3.1 Section Safety

DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

⚠ WARNING

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection, and servicing must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of AC drives.

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire.

Attach the drive to metal or other noncombustible material.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive.

Check all the wiring to ensure that all connections are correct after installing the drive and connecting any other devices.

Failure to comply could result in damage to the drive

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

OYMC is not responsible for any modification of the product made by the user. This product must not be modified.

3.2 Standard Connection Diagram

Connect the drive and peripheral devices as shown in ***Figure 3.1***. It is possible to run the drive via the digital operator without connecting digital I/O wiring. This section does not discuss drive operation; ***Refer to Start-Up Programming & Operation on page 83*** for instructions on operating the drive.

NOTICE: *Inadequate branch short circuit protection could result in damage to the drive. Install adequate branch circuit short circuit protection per applicable codes. The drive is suitable for circuits capable of delivering not more than 18,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400 V Class).*

NOTICE: *When the input voltage is 480 V or higher or the wiring distance is greater than 100 meters, pay special attention to the motor insulation voltage or use an inverter duty motor. Failure to comply could lead to motor insulation breakdown.*

NOTICE: *Do not connect the AC control circuit ground to the drive enclosure. Improper drive grounding can cause the control circuit to malfunction.*

NOTICE: *The minimum load for the multi-function relay output MA-MB-MC is 10 mA. If a circuit requires less than 10 mA, connect it to a photocoupler output (P1, P2, PC). Improper application of peripheral devices could result in damage to the photocoupler output of the drive.*

3.2 Standard Connection Diagram

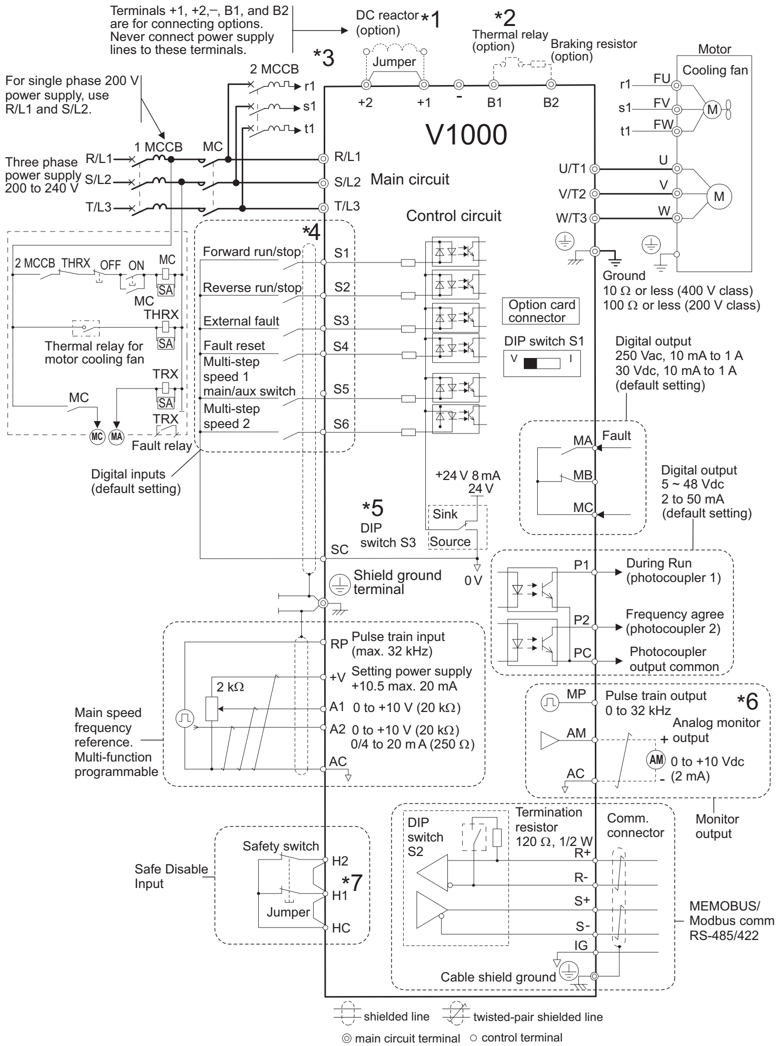


Figure 3.1 Drive Standard Connection Diagram

* 1. Remove the jumper when installing an optional DC reactor.
* 2. The MC on the input side of the main circuit should open when the thermal relay is triggered.
* 3. Self-cooled motors do not require separate cooling fan motor wiring.
* 4. Connected using sequence input signal (S1 to S6) from NPN transistor; Default: sink mode (0 V com)
* 5. Use only a +24 V internal power supply in sinking mode; the source mode requires an external power supply. ***Refer to I/O Connections on page 73***.
* 6. Monitor outputs work with devices such as analog frequency meters, ammeters, voltmeters and wattmeters; they are intended for use as a feedback-type of signal.
* 7. Disconnect the wire jumper between HC, H1 and H2 when utilizing the safety input. ***Refer to Wiring Procedure on page 69*** for details on how to remove the jumper. The wire length for the for the Safe Disable input should not be longer than 30 m.

WARNING! *Sudden Movement Hazard. Do not close the wiring for the control circuit unless the multifunction input terminal parameter is properly set (S5 for 3-wire; H1-05 = "0"). Improper sequencing of run/stop circuitry could result in death or serious injury from moving equipment.*

WARNING! *Sudden Movement Hazard. Ensure start/stop and safety circuits are wired properly and in the correct state before energizing the drive. Failure to comply could result in death or serious injury from moving equipment. When programmed for 3-wire control, a momentary closure on terminal S1 may cause the drive to start.*

WARNING! *When 3-Wire sequence is used, set the drive to 3-Wire sequence before wiring the control terminals and ensure parameter b1-17 is set to 0 (drive does not accept a run command at power up (default)). If the drive is wired for 3-Wire sequence but set up for 2-Wire sequence (default) and if parameter b1-17 is set to 1 (drive accepts a Run command at power up), the motor will rotate in reverse direction at power up of the drive and may cause injury.*

WARNING! *When the application preset function is executed (or A1-06 is set to any value other than 0) the drive I/O terminal functions change. This may cause unexpected operation and potential damage to equipment or injury.*

Figure 3.2 illustrates an example of a 3-wire sequence.

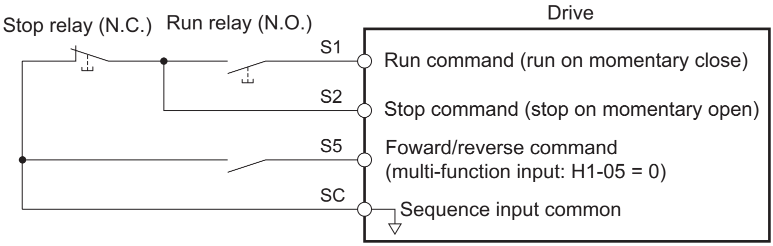


Figure 3.2 3-Wire Sequence

Electrical Installation
3

3.3 Main Circuit Connection Diagram

Refer to *Figure 3.3* and *Figure 3.4* for standard drive connection diagrams. Connections may vary based on drive capacity. The main circuit DC power supply powers the control circuit.

NOTICE: *Do not use the negative DC bus terminal "-" as a ground terminal. This terminal is at high voltage DC potential. Improper wiring connections could result in damage to the drive.*

◆ Single-Phase 200 V Class (VZAB0P1 ~ B4P0)

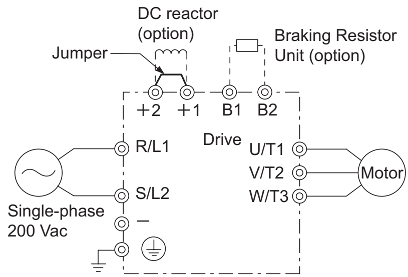


Figure 3.3 Connecting Main Circuit Terminals

NOTICE: *Do not connect T/L3 terminal when using single-phase power supply input. Incorrect wiring may damage the drive.*

◆ Three-Phase 200 V Class (VZA20P1 ~ 2015) Three-Phase 400 V Class (VZA40P2 ~ 4015)

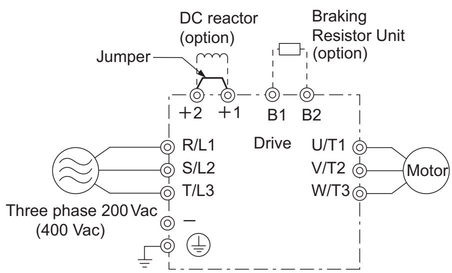


Figure 3.4 Connecting Main Circuit Terminals

3.4 Terminal Block Configuration

The figures in this section provide main circuit terminal block illustrations of the different drive sizes.

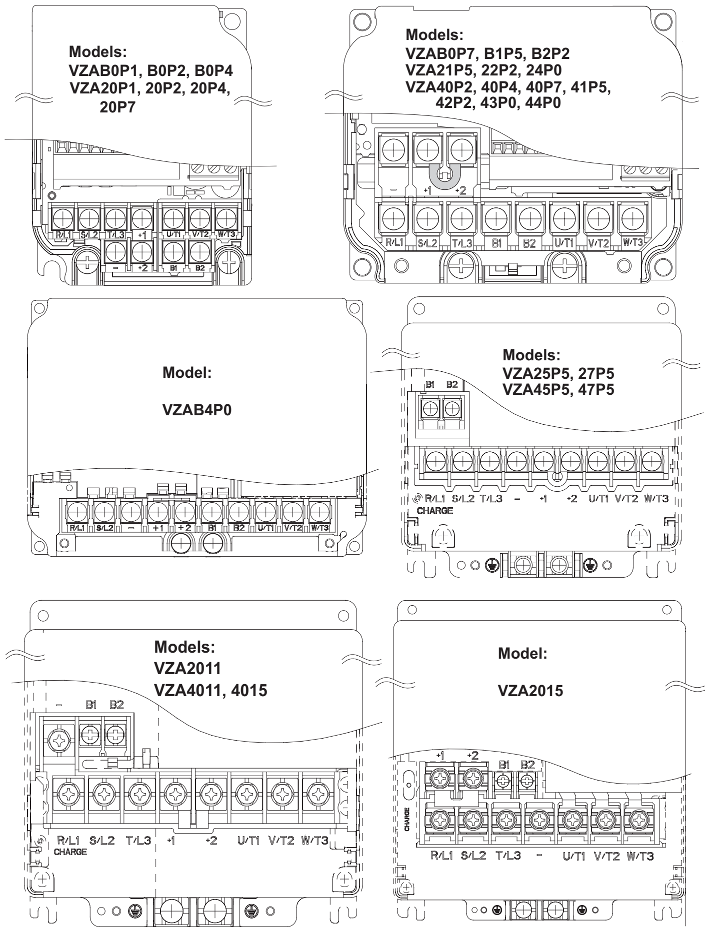


Figure 3.5 Main Circuit Terminal Block Configurations

3.5 Protective Covers

Follow the procedure below to remove the protective covers before wiring the drive and to reattach the covers after wiring is complete.

◆ IP20/Open-Chassis

■ Removing the Protective Covers

1. Loosen the screw that locks the front cover in place to remove.

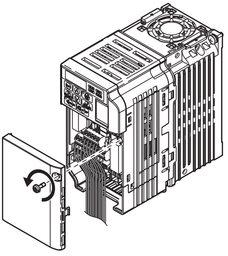


Figure 3.6 Remove the Front Cover on an IP20/Open-Chassis Drive

2. Apply pressure to the tabs on each side of the terminal cover. Pull the terminal cover away from the drive while pushing in on the tabs to pull the cover free.

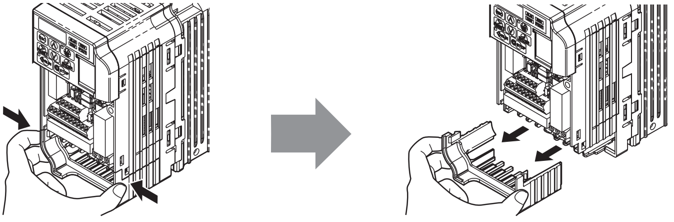


Figure 3.7 Remove the Terminal Cover on an IP20/Open-Chassis Drive

■ Reattaching the Protective Covers

Properly connect all wiring and route power wiring away from control signal wiring. Reattach all protective covers when wiring is complete. Apply only a small amount of pressure to lock the cover back into place.

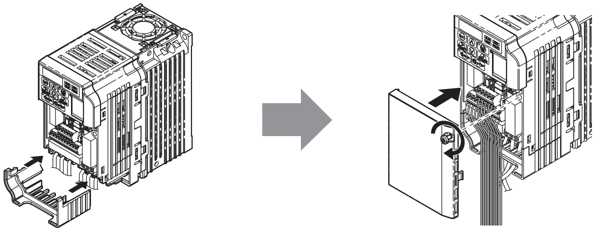


Figure 3.8 Reattach the Protective Covers on an IP20/Open-Chassis Drive

◆ IP20/NEMA Type 1

■ Removing the Protective Covers on an IP20/NEMA Type 1 design

1. Loosen the screw on the front cover to remove the front cover.

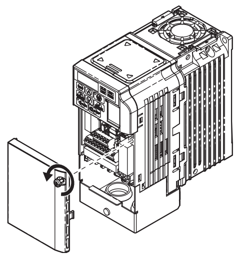


Figure 3.9 Remove the Front Cover on an IP20/NEMA Type 1 Drive

2. Loosen the screw on the terminal cover (*Figure 3.10*, **B**) to remove the terminal cover and expose the conduit bracket (*Figure 3.10*, **A**).

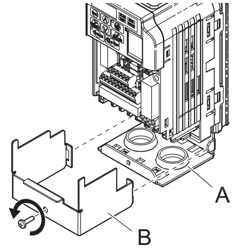


Figure 3.10 Remove the Terminal Cover on an IP20/NEMA Type 1 Drive

3. Loosen two screws attaching the conduit bracket (***Figure 3.11***, ***A***) to remove.

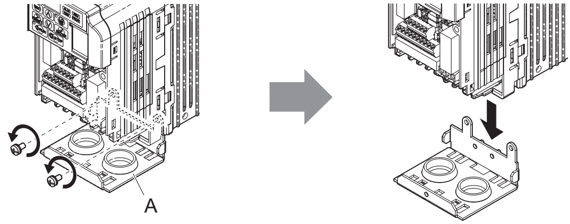
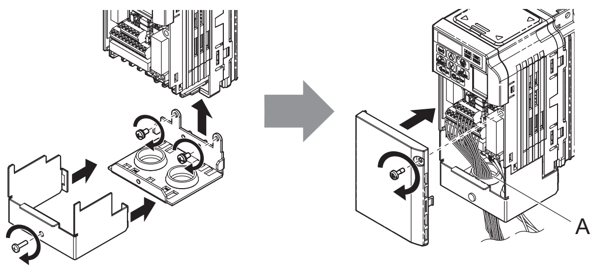


Figure 3.11 Remove the Conduit Bracket on an IP20/Open-Chassis Drive

■ Reattaching the Protective Covers

Pass power wiring and control signal wiring through the exit holes on the bottom of the conduit bracket of the drive. Place power wiring and control signal wiring in separate conduits. Properly connect all wiring after installing the drive and connecting other devices. Reattach all protective covers when wiring is complete.



A – Pass power wiring and control signal wiring through different exit holes at the bottom of the drive.

Figure 3.12 Reattach the Protective Covers and Conduit Bracket on an IP20/NEMA Type 1 Drive

3.6 Main Circuit Wiring

This section describes the functions, specifications, and procedures required to safely and properly wire the main circuit of the drive.

NOTICE: *Do not solder the ends of wire connections to the drive. Soldered wiring connections can loosen over time. Improper wiring practices could result in drive malfunction due to loose terminal connections.*

◆ Main Circuit Terminal Functions

Table 3.1 Main Circuit Terminal Functions

Terminal	Type	Function	Reference
R/L1	Main circuit power supply input	Connects line power to the drive. Drives with single phase 200 V input power use terminals R/L1 and S/L2 only (T/L3 must not be used).	*54*
S/L2			
T/L3			
U/T1	Drive output	Connects to the motor.	*63*
V/T2			
W/T3			
B1	Braking resistor	Available for connecting a braking resistor or the braking resistor unit option.	*78*
B2			
+1	DC reactor connection	These terminals are shorted at shipment. Remove the shorting bar between +1 and +2 when connecting to this terminal.	*267*
+2			
+1	DC power supply input	For connecting a DC power supply.	-
–			
⏚ (2 terminals)	Ground	Grounding Terminal For 200 V class: 100 Ω or less For 400 V class: 10 Ω or less	*63*

◆ Wire Gauges and Tightening Torque

Select the appropriate wires and crimp terminals from *Table 3.2*through *Table 3.4*.

Note: **1.** Wire gauge recommendations based on drive continuous current ratings using 75°C 600 Vac vinyl-sheathed wire assuming ambient temperature within 30°C and wiring distance less than 100 m.
2. Terminals +1, +2, –, B1 and B2 are for connecting optional devices such as a DC reactor or braking resistor. Do not connect other non-specified devices to these terminals.

- Consider the amount of voltage drop when selecting wire gauges.
Increase the wire gauge when the voltage drop is greater than 2% of motor rated voltage. Ensure the wire gauge is suitable for the terminal block. Use the following formula to calculate the amount of voltage drop:
- Line drop voltage (V) = $\sqrt{3}$ x wire resistance (Ω/km) x wire length (m) x current (A) x10^{-3}

- Refer to instruction manual TOBPC72060000 for braking unit or braking resistor unit wire gauges.
- *Refer to Standards Compliance on page 397* for information on UL compliance.

■ Single-Phase 200 V Class

Table 3.2 Wire Gauge and Torque Specifications

Model VZA	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm^2 (AWG)	Recommended Gauge mm^2 (AWG)	Line Type
B0P1 B0P2 B0P4	R/L1, S/L2, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M3.5	0.8 to 1.0 (7.1 to 8.9)	0.75 to 2.5 (18 to 14)	2.5 (14)	*Note: 1.*
B0P7	R/L1, S/L2, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	2.5 (14)	*Note: 1.*
B1P5	R/L1, S/L2, U/T1, V/T2, W/T3, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	4 (12)	*Note: 1.*
	–, +1, +2, B1, B2,	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	6 (10)	*Note: 1.*
B2P2	R/L1, S/L2, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	6 (10)	*Note: 1.*
B4P0	R/L1, S/L2, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M5	2.0 to 2.5 (17.7 to 22.1)	4 to 10 (12 to 8)	10 (8)	*Note: 1.*

■ Three-Phase 200 V Class

Table 3.3 Wire Gauge and Torque Specifications

Model VZA	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm^2 (AWG)	Recommended Gauge mm^2 (AWG)	Line Type
20P1 20P2 20P4 20P7	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M3.5	0.8 to 1.0 (7.1 to 8.9)	0.75 to 2.5 (18 to 14)	2.5 (14)	*Note: 1.*
21P5	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	2.5 (14)	*Note: 1.*
	⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	4 (12)	*Note: 1.*
22P2	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	4 (12)	*Note: 1.*
24P0	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	6 (10)	*Note: 1.*

Model VZA	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)	Line Type
25P5	R/L1,S/L2,T/L3,U/T1,V/T2,W/T3,-,+1,+2	M4	1.2 to 1.5 (10.6 to 13.3)	6 to 16 (10 to 6)	10 (8)	*Note: 1.*
	B1,B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	6 (10)	*Note: 1.*
	⏚	M5	2 to 2.5 (17.7 to 22.1)	6 to 16 (10 to 6)	10 (8)	*Note: 1.*
27P5	R/L1,S/L2,T/L3,U/T1,V/T2,W/T3,-,+1,+2	M4	1.2 to 1.5 (10.6 to 13.3)	6 to 16 (10 to 6)	16 (6)	*Note: 1.*
	B1,B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	6 (10)	*Note: 1.*
	⏚	M5	2 to 2.5 (17.7 to 22.1)	6 to 16 (10 to 6)	10 (8)	*Note: 1.*
2011	R/L1,S/L2,T/L3,U/T1,V/T2,W/T3,-,+1,+2	M6	4 to 6 (35.4 to 53.1)	16 to 25 (6 to 4)	25 (4)	*Note: 1.*
	B1,B2	M5	2 to 2.5 (17.7 to 22.1)	6 to 10 (10 to 8)	10 (8)	*Note: 1.*
	⏚	M6	4 to 6 (35.4 to 53.1)	16 to 25 (6 to 4)	25 (4)	*Note: 1.*
2015	R/L1,S/L2,T/L3,U/T1,V/T2,W/T3,-,+1,+2	M8	9 to 11 (79.7 to 11.0)	10 to 35 (8 to 2)	35 (2)	*Note: 1.*
	B1,B2	M5	2 to 2.5 (17.7 to 22.1)	10 to 16 (8 to 6)	16 (6)	*Note: 1.*
	⏚	M6	4 to 6 (35.4 to 53.1)	10 to 25 (8 to 4)	25 (4)	*Note: 1.*

■ Three-Phase 400 V Class

Table 3.4 Wire Gauge and Torque Specifications

Model VZA	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)	Line Type
40P2 40P4 40P7 41P5 42P2	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2, ⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	2.5 (14)	*Note: 1.*
43P0	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	2.5 (14)	*Note: 1.*
	⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	4 (12)	*Note: 1.*

Model VZA	Terminal	Screw Size	Tightening Torque N•m (lb.in.)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)	Line Type
44P0	R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, –, +1, +2, B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	2.5 (14)	*Note: 1.*
	⏚	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	4 (12)	*Note: 1.*
45P5	R/L1,S/L2,T/L3,U/T1,V/T2,W/T3,-,+1,+2, B1, B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	6 (10)	*Note: 1.*
	⏚	M5	2 to 2.5 (17.7 to 22.1)	6 to 16 (10 to 6)	6 (10)	*Note: 1.*
47P5	R/L1,S/L2,T/L3,U/T1,V/T2,W/T3,-,+1,+2	M4	1.2 to 1.5 (10.6 to 13.3)	6 to 16 (10 to 6)	10 (8)	*Note: 1.*
	B1,B2	M4	1.2 to 1.5 (10.6 to 13.3)	2.5 to 6 (14 to 10)	6 (10)	*Note: 1.*
	⏚	M5	2 to 2.5 (17.7 to 22.1)	6 to 16 (10 to 6)	6 (10)	*Note: 1.*
4011	R/L1,S/L2,T/L3,U/T1,V/T2,W/T3,-,+1,+2	M5	2 to 2.5 (17.7 to 22.1)	6 to 16 (10 to 6)	10 (8)	*Note: 1.*
	B1,B2	M5	2 to 2.5 (17.7 to 22.1)	6 to 10 (10 to 8)	10 (8)	*Note: 1.*
	⏚	M6	4 to 6 (35.4 to 53.1)	6 to 16 (10 to 6)	10 (8)	*Note: 1.*
4015	R/L1,S/L2,T/L3,U/T1,V/T2,W/T3,-,+1,+2	M5	2 to 2.5 (17.7 to 22.1)	6 to 16 (10 to 6)	10 (8)	*Note: 1.*
	B1,B2	M5	2 to 2.5 (17.7 to 22.1)	6 to 10 (10 to 8)	10 (8)	*Note: 1.*
	⏚	M6	4 to 6 (35.4 to 53.1)	6 to 16 (10 to 6)	10 (8)	*Note: 1.*

◆ Main Circuit Terminal Power Supply and Motor Wiring

This section outlines the various steps, precautions, and checkpoints for wiring the main circuit terminals and motor terminals.

NOTICE: *When connecting the motor to the drive output terminals U/T1, V/T2, and W/T3, the phase order for the drive and motor should match. Failure to comply with proper wiring practices may cause the motor to run in reverse if the phase order is backward.*

NOTICE: *Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. Improper application of noise filters could result in damage to the drive.*

NOTICE: *Do not connect the AC power line to the output motor terminals of the drive. Failure to comply could result in death or serious injury by fire as a result of drive damage from line voltage application to output terminals.*

■ Cable Length Between Drive and Motor

When the cable length between the drive and the motor is too long (especially at low frequency output), note that the cable voltage drop may cause reduced motor torque. Drive output current will increase as the leakage current from the cable increases. An increase in leakage current may trigger an overcurrent situation and weaken the accuracy of the current detection.

Adjust the drive carrier frequency according to the following table. If the motor wiring distance exceeds 100 m because of the system configuration, reduce the ground currents. ***Refer to Carrier Frequency Selection: C6-02 on page 131***.

Refer to ***Table 3.5*** to set the carrier frequency to an appropriate level.

Table 3.5 Cable Length Between Drive and Motor

Cable Length	50 m or less	100 m or less	Greater than 100 m
Carrier Frequency	15 kHz or less	5 kHz or less	2 kHz or less

Note: When setting carrier frequency, calculate the cable length as the total distance of wiring to all connected motors when running multiple motors from a single drive.

■ Ground Wiring

Follow the precautions to wire the ground for one drive or a series of drives.

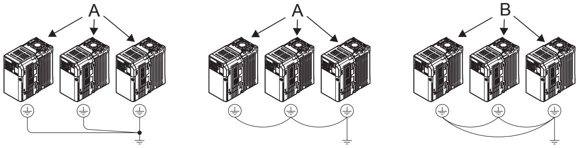
WARNING! *Electrical Shock Hazard. Always use a ground wire that complies with technical standards on electrical equipment and minimize the length of the ground wire. Improper equipment grounding may cause dangerous electrical potentials on equipment chassis, which could result in death or serious injury.*

WARNING! *Electrical Shock Hazard. Be sure to ground the drive ground terminal. (200 V Class: Ground to 100 Ω or less, 400 V Class: Ground to 10 Ω or less). Improper equipment grounding could result in death or serious injury by contacting ungrounded electrical equipment.*

NOTICE: *Do not share the ground wire with other devices such as welding machines or large-current electrical equipment. Improper equipment grounding could result in drive or equipment malfunction due to electrical interference.*

NOTICE: *When using more than one drive, ground multiple drives according to instructions. Improper equipment grounding could result in abnormal operation of drive or equipment.*

Refer to ***Figure 3.13*** when using multiple drives. Do not loop the ground wire.



A – Correct **B – Incorrect**

Figure 3.13 Multiple Drive Wiring

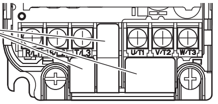
Electrical Installation 3

3.6 Main Circuit Wiring

■ Wiring the Main Circuit Terminal

WARNING! *Electrical Shock Hazard. Shut off the power supply to the drive before wiring the main circuit terminals. Failure to comply may result in death or serious injury.*

Note: **1.** A cover placed over the DC Bus and braking circuit terminals prior to shipment helps prevent miswiring. Cut away covers as needed for terminals with a needle-nose pliers.



A – Protective Cover to Prevent Miswiring

2. The ground terminal screw on IP20/NEMA Type 1 holds the protective cover in place.

Main Circuit Connection Diagram

For drive main power circuit connections, refer to ***Figure 3.3*** and ***Figure 3.4*** on page ***54***.

WARNING! *Fire Hazard. The braking resistor connection terminals are B1 and B2. Do not connect braking resistors to any other terminals. Improper wiring connections could cause the braking resistor to overheat and cause death or serious injury by fire. Failure to comply may result in damage to the braking circuit or drive.*

3.7 Control Circuit Wiring

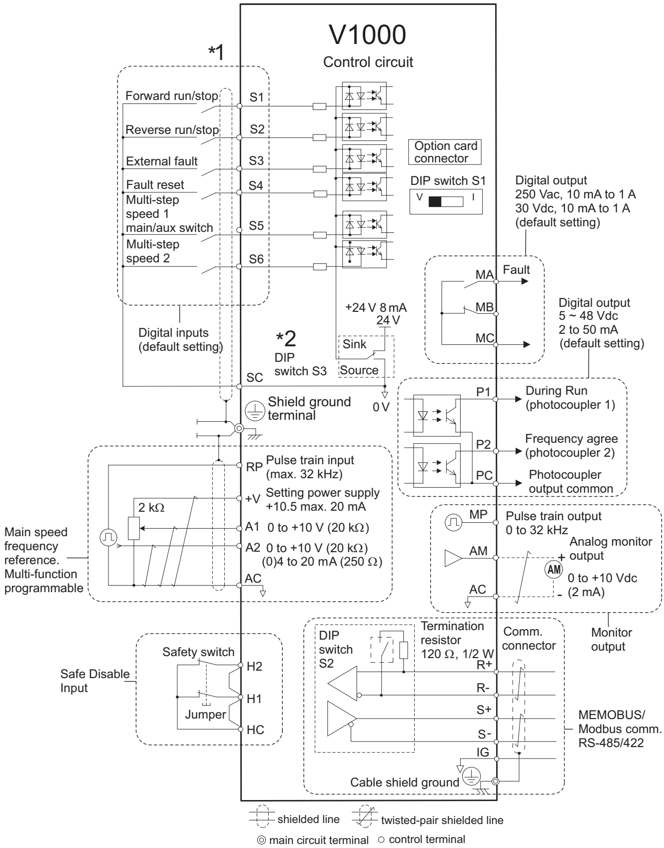


Figure 3.14 Control Circuit Connection Diagram

* 1. Connected using sequence input signal (S1 to S6) from NPN transistor;Default:sink mode (0 V com)
* 2. Use only the +24 V internal power supply in sinking mode; the source mode requires an external power supply. ***Refer to I/O Connections on page 73***.

NOTICE: *Do not solder the ends of wire connections to the drive. Soldered wire connections can loosen over time. Improper wiring practices could result in drive malfunction due to loose terminal connections.*

◆ Control Circuit Terminal Block Functions

Drive parameters determine which functions apply to the multi-function digital inputs (S1 to S6), multi-function digital outputs (MA, MB), multi-function pulse inputs and outputs (RP, MP) and multi-function photocoupler outputs (P1, P2). The default is called out next to each terminal. Refer to *Figure 3.14 on page 65*

WARNING! *Sudden Movement Hazard. Always check the operation and wiring of control circuits after being wired. Operating a drive with untested control circuits could result in death or serious injury.*

WARNING! *Confirm the drive I/O signals and external sequence before starting test run. Setting parameter A1-06 may change the I/O terminal function automatically from the factory setting.* ***Refer to Application Presets on page 107****. Failure to comply may result in death or serious injury.*

NOTICE: *Do not switch an input contactor more often than once every 30 minutes. Improper equipment sequencing could shorten useful life of the drive electrolytic capacitors and circuit relays. Normally the drive I/O should be used to stop and start the motor.*

■ Input Terminals

Table 3.6 Control Circuit Input Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Multi-Function Digital Inputs	S1	Multi-function input 1 (Closed: Forward run, Open: Stop)	Photocoupler 24 Vdc, 8 mA **Note:** Drive preset to sinking mode. When using source mode, set DIP switch S3 to allow for a 24 Vdc (±10%) external power supply. Refer to page *73*.
	S2	Multi-function input 2 (Closed: Reverse run, Open: Stop)	
	S3	Multi-function input 3 (External fault (N.O.))	
	S4	Multi-function input 4 (Fault reset)	
	S5	Multi-function input 5 (Multi-step speed reference 1)	
	S6	Multi-function input 6 (Multi-step speed reference 2)	
	SC	Multi-function input common (Control common)	Sequence common
Safe Disable Input	HC	Power supply for safe disable inputs	+24 Vdc (max 10 mA allowed)
	H1	Safe disable input 1	One or Both Open: Output disabled (always use both inputs) Closed: Normal operation **Note:** Disconnect wire jumper between HC, H1 and H2 when using safe disable input. The wire length should not exceed 30 m.
	H2	Safe disable input 2	

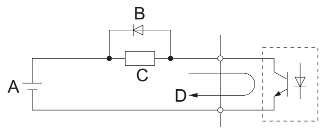
Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Main Frequency Reference Input	RP	Multi-function pulse train input (frequency reference)	Response frequency: 0.5 to 32 kHz (Duty Cycle: 30 to 70%) (High level voltage: 3.5 to 13.2 Vdc) (Low level voltage: 0.0 to 0.8 Vdc) (input impedance: 3 kΩ)
	+V	Analog input power supply	+10.5 Vdc (max allowable current 20 mA)
	A1	Multi-function analog input 1 (frequency reference)	Input voltage 0 to +10 Vdc (20 kΩ) resolution 1/1000
	A2	Multi-function analog input 2 (frequency reference)	Voltage or current input (Selected by DIP switch S1) 0 to +10 Vdc (20 kΩ) resolution: 1/1000 4 to 20 mA (250 Ω) or 0 to 20 mA (250 Ω) resolution: 1/500
	AC	Frequency reference common	0 Vdc

■ Output Terminals

Table 3.7 Control Circuit Output Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Multi-Function Digital Output	MA	N.O. (fault)	Digital output 30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A
	MB	N.C. output (fault)	
	MC	Digital output common	
Multi-Function Photocoupler Output	P1	Photocoupler output 1 (During run)	Photocoupler output 48 Vdc, 2 to 50 mA
	P2	Photocoupler output 2 (Frequency agree)	
	PC	Photocoupler output common	
Monitor Output	MP	Pulse train output (Output frequency)	32 kHz (max)
	AM	Analog monitor output	0 to 10 Vdc (2 mA or less) Resolution: 1/1000
	AC	Monitor common	0 V

Connect a suppression diode as shown in ***Figure 3.15*** when driving a reactive load such as a relay coil. Ensure the diode rating is greater than the circuit voltage.



A – External power, 48 V max.
B – Suppression diode
C – Coil
D – 50 mA or less

Figure 3.15 Connecting a Suppression Diode

■ Serial Communication Terminals

Table 3.8 Control Circuit Terminals: Serial Communications

Type	No.	Signal Name	Function (Signal Level)	
MEMOBUS/ Modbus Communication	R+	Communications input (+)	MEMOBUS/Modbus communication: Use a RS-485 or RS-422 cable to connect the drive.	RS-485/422 MEMOBUS/ Modbus communication protocol 115.2 kbps (max.)
	R-	Communications input (-)		
	S+	Communications output (+)		
	S-	Communications output (-)		
	IG	Shield ground	0 V	

◆ Removable Terminal Block Configuration

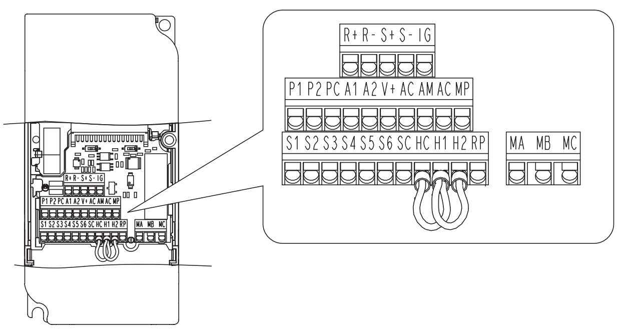


Figure 3.16 Removable Control Circuit Terminal Block

■ Wire Size

Select the appropriate wires and crimp terminals from *Table 3.9*. Crimp a ferrule to signal wiring to improve wiring simplicity and reliability.

Table 3.9 Wire Size Specifications (Same for All Models)

Terminal	Bare Wire Terminal		Ferrule-Type Terminal		Wire Type
	Applicable wire size mm² (AWG)	Recommended wire size mm² (AWG)	Applicable wire size mm² (AWG)	Recommended wire size mm² (AWG)	
S1-S6, SC, RP, +V, A1, A2, AC, HC, H1, H2, P1, P2, PC, MP, AM, AC, S+, S-, R+, R-, IG, MA, MB, MC	Stranded wire: 0.2 to 1.0 (24 to 16) Solid wire: 0.2 to 1.5 (24 to 16)	0.75 (18)	0.25 to 0.5 (24 to 20)	0.5 (20)	Shielded line, etc.

■ Ferrule-Type Wire Terminations

Crimp a ferrule to signal wiring to improve wiring simplicity and reliability. Use CRIMPFOX ZA-3, a crimping tool manufactured by PHOENIX CONTACT.

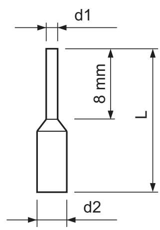


Figure 3.17 Ferrule Dimensions

Table 3.10 Ferrule Terminal Types and Sizes

Size mm² (AWG)	Type	L (mm)	d1 (mm)	d2 (mm)	Manufacturer
0.25 (24)	AI 0.25-8YE	12.5	0.8	1.8	PHOENIX CONTACT
0.34 (22)	AI 0.34-8TQ	10.5	0.8	1.8	
0.5 (20)	AI 0.5-8WH or AI 0.5-8OG	14	1.1	2.5	

◆ Wiring Procedure

This section describes the proper procedures and preparations for wiring the terminal board.

WARNING! *Electrical Shock Hazard. Do not remove covers or touch the circuit boards while the power is on. Failure to comply could result in death or serious injury.*

NOTICE: *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 other high-power lines. Improper wiring practices could result in drive malfunction due to electrical interference.*

3.7 Control Circuit Wiring

NOTICE: *Separate wiring for digital output terminals MA, MB and MC from wiring to other control circuit lines. Improper wiring practices could result in drive or equipment malfunction or nuisance trips.*

NOTICE: *Use a class 2 power supply (UL standard) when connecting to the control terminals. Improper application of peripheral devices could result in drive performance degradation due to improper power supply.*

NOTICE: *Insulate shields with tape or shrink tubing to prevent contact with other signal lines and equipment. Improper wiring practices could result in drive or equipment malfunction due to short circuit.*

NOTICE: *Connect the shield of shielded cable to the appropriate ground terminal. Improper equipment grounding could result in drive or equipment malfunction or nuisance trips.*

Prepare the wire ends for connecting them to the terminal board like shown in ***Figure 3.20***. Use ferrules like specified above or solid wires. The stripping length for solid wires is 8 mm.

NOTICE: *Use shielded twisted-pair cables as indicated to prevent operating faults. Improper wiring practices could result in drive or equipment malfunction due to electrical interference.*

Connect control wires like shown in ***Figure 3.18***.

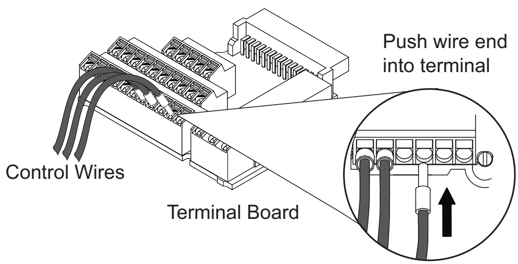


Figure 3.18 Connecting Wires to the Control Terminals

To disconnect control wires from the terminals use the procedure described in ***Figure 3.19***. Grasp the wire where it enters the terminal with a pair of pliers, then use a straight-edge screw driver to release the terminal and pull the wire out. If it fits tightly, e.g. if ferrules are used, turn the wire for about 45° and then pull it gently out. Use this procedure to remove the wire jumper between terminals HC, H1 and H2 that is preinstalled at shipping.

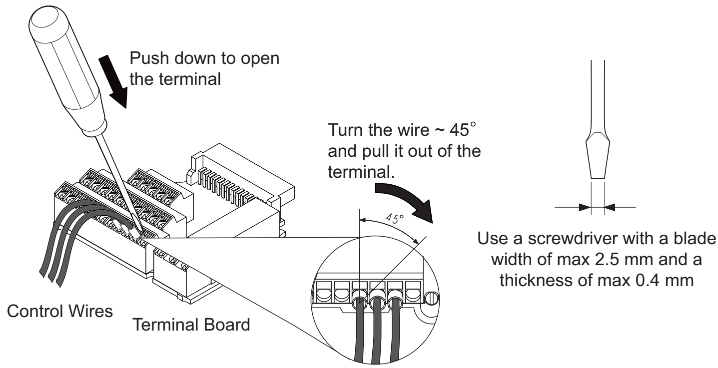
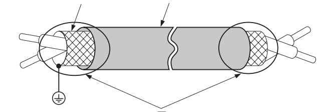


Figure 3.19 Removing Wires from the Terminal Board

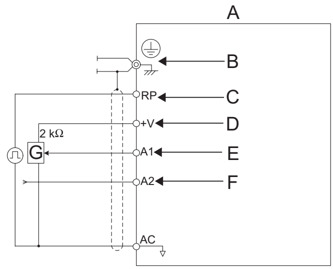


A	**– Drive side**	**D**	**– Control device side**
B	**– Connect shield to ground terminal of drive.**	**E**	**– Shield sheath (Insulate with tape)**
C	**– Insulation**	**F**	**– Shield**

Figure 3.20 Preparing the Ends of Shielded Cables

When setting the frequency by analog reference from an external potentiometer, use shielded twisted-pair wires and ground the shield of twisted-pair wires to the ground terminal of the drive.

NOTICE: *The analog signal lines between the drive and the operator station or peripheral equipment should not exceed 50 meters when using an analog signal from a remote source to supply the frequency reference. Failure to comply could result in poor system performance.*



A – Drive

B – Ground terminal (shield connection)

C – (RP) Pulse train (maximum 32 kHz)

D – (+V) Frequency setting power source +10.5 Vdc maximum 20 mA

E – (A1) Main speed frequency reference 0 to +10 Vdc (20 kΩ)

F – (A2) Multi-function analog input 0 to +10 Vdc (20 kΩ) or 4 to 20 mA (250 Ω)/ 0 to 20 mA (250 Ω)

G – Frequency setting potentiometer

Figure 3.21 Wiring the Frequency Reference to the Control Circuit Terminals (External Reference)

3.8 I/O Connections

◆ Sinking/Sourcing Mode Switch

Set the DIP switch S3 on the front of the drive to switch the digital input terminal logic between sinking mode and sourcing mode; the drive is preset to sinking mode.

Table 3.11 Sinking/Sourcing Mode Setting

Set Value	Details
SINK	Sinking Mode (0 V common): factory setting
SOURCE	Sourcing Mode (+24 V common)

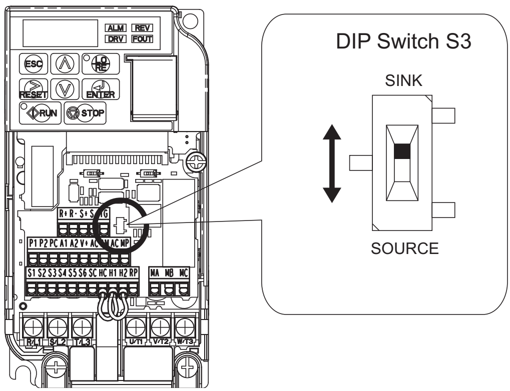


Figure 3.22 DIP Switch S3

■ Transistor Input Signal Using 0 V Common/Sink Mode

When controlling the digital inputs by NPN transistors (0 V common / sinking mode), set the DIP switch S3 to SINK and use the internal 24 V power supply.

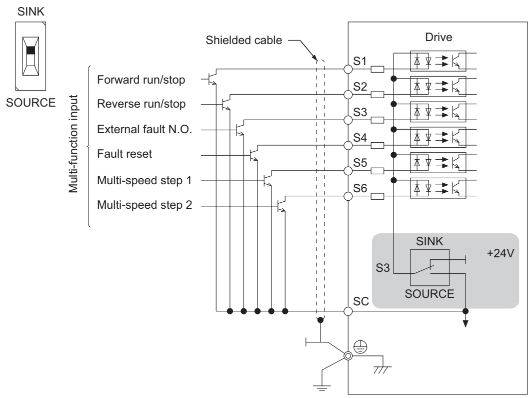


Figure 3.23 Sinking Mode: Sequence from NPN Transistor (0 V Common)

■ Transistor Input Signal Using +24 V Common/Source Mode

When controlling digital inputs by PNP transistors (+24 V common / sourcing mode), set the DIP switch S3 to SOURCE and use an external 24 V power supply.

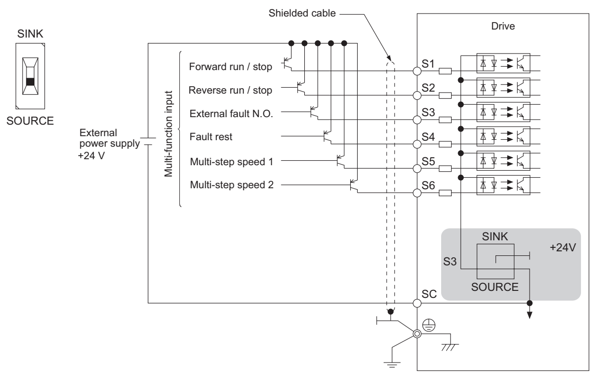


Figure 3.24 Source Mode: Sequence from PNP Transistor (+24 V Common)

3.9 Main Frequency Reference

◆ Terminal A2 Switch

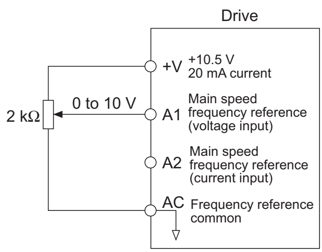
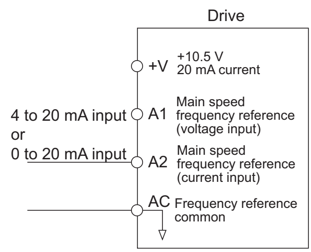
The main frequency reference can either be a voltage or current signal input. For voltage signals both analog inputs, A1 and A2, can be used, for current signals A2 must be used.

To use current input at terminal A2, set the DIP switch S1 to "I" (factory setting) and set parameter H3-09 = “2” or “3” (4-20 mA or 0-20 mA). Set parameter H3-10 = “0” (frequency reference).

Note: If Terminals A1 and A2 are both set for frequency reference (H3-02 = 0 and H3-10 = 0), the addition of both input values builds the frequency reference.

When using input A2 as voltage input, set the DIP switch S1 to “V” (left position) and program parameter H3-09 to “0” (0 to +10 Vdc with lower limit) or “1” (0 to +10 Vdc without lower limit).

Table 3.12 Frequency Reference Configurations

Voltage Input	Current Input
	

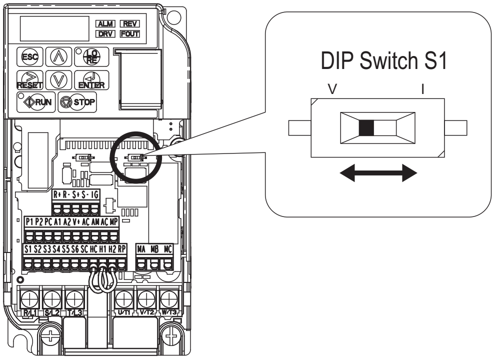


Figure 3.25 DIP Switch S1

Table 3.13 DIP Switch S1 Settings

Setting Value	Description
V (left position)	Voltage input (0 to 10 V)
I (right position)	Current input (4 to 20 mA or 0 to 20 mA): factory setting

Table 3.14 Parameter H3-09 Details

No.	Parameter Name	Description	Setting Range	Default Setting
H3-09	Frequency ref. (current) terminal A2 signal level selection	Selects the signal level for terminal A2. 0: 0 to +10 V, unipolar input (negative frequency reference values are zeroed) 1: 0 to +10 V, bipolar input (negative frequency reference changes the direction) 2: 4 to 20 mA 3: 0 to 20 mA	0 to 3	2

3.10 MEMOBUS/Modbus Termination

DIP switch S2 controls the terminal resistance as shown in the *Figure 3.26*. The OFF position is the default of the terminating resistor switch for MEMOBUS/Modbus communications. Turn the terminal resistor switch ON when the drive is the last drive in a series of slave drives.

Table 3.15 MEMOBUS/Modbus Switch Settings

S2 Position	Description
ON	Internal terminal resistance ON
OFF	Internal terminal resistance OFF (no terminal resistance); default setting

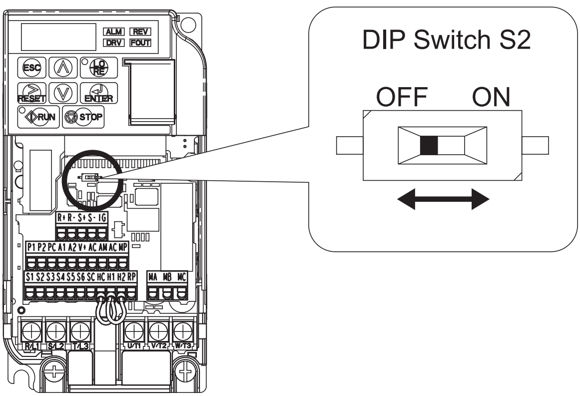


Figure 3.26 DIP Switch S2

Note: Refer to the MEMOBUS/Modbus communications manual for details on MEMOBUS/Modbus.

3.11 Braking Resistor

Dynamic braking (DB) helps bring the motor to a smooth and rapid stop when working with high inertia loads. As the drive lowers the frequency of a motor with high inertia connected, regeneration occurs. This can cause an overvoltage situation when the regenerative energy flows back into the DC bus capacitors. A braking resistor prevents these overvoltage faults.

NOTICE: *Do not allow unqualified personnel to use the product. Failure to comply could result in damage to the drive or braking circuit. Carefully review the braking resistor instruction manual when connecting a braking option to the drive.*

Note: The braking circuit must be sized properly in order to dissipate the power required to decelerate the load in the desired time. Ensure that the braking circuit can dissipate the energy for the set deceleration time prior to running the drive.

Use a thermal overload relay or an over-temperature contact to interrupt input power to the drive in the event the braking resistor overheats.

In the event of a possible thermal overload, the relay will trigger the input contactor and prevent the braking resistor from burning up.

◆ Installation

WARNING! *Fire Hazard. The braking resistor connection terminals are B1 and B2. Do not connect a braking resistor directly to any other terminals. Improper wiring connections could result in death or serious injury by fire. Failure to comply may result in damage to the braking circuit or drive.*

NOTICE: *Connect braking resistors to the drive as shown in the I/O wiring examples. Improperly wiring braking circuits could result in damage to the drive or equipment.*

■ Installation Procedure

1. Disconnect all electrical power to the drive and wait at least five minutes before servicing the drive and any connected components.
2. Remove drive front cover.
3. Use a voltmeter to verify that voltage is disconnected from incoming power terminals and that the DC bus no longer holds a charge.

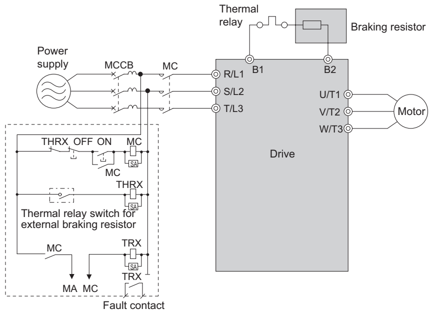


Figure 3.27 Connecting a Braking Resistor

4. Follow manufacturer instructions to connect the resistor unit to the drive using proper wire gauge according to local electrical codes.
   Power leads for the remote mount resistors generate high levels of electrical noise; group these signal leads separately.
5. Mount the resistor unit on a noncombustible surface. Maintain minimum side and top clearances according to resistor manufacturer instructions.

WARNING! *Fire Hazard. Do not use improper combustible materials. Failure to comply could result in death or serious injury by fire. Attach the drive or braking resistors to metal or other noncombustible material.*

6. Reinstall drive covers and resistor covers, if provided.

■ Adjustments

7. Set parameter L3-04 = “0” or “3” to disable stall prevention during deceleration.
   Set parameter L8-01= “1” to enable overheat protection when using Yaskawa heatsink mounted braking resistor. Set L8-01 = “0” for other braking resistor types.
   Set parameter L3-04 = “3” to generate the shortest possible deceleration time.

Table 3.16 Braking Resistor Settings

Parameter	Settings
L8-01: Internal Dynamic Braking Resistor Protection selection	0: Disabled. The drive will not provide overheat protection. Supply separate means of overheat protection. 1: Enabled. Braking Resistor is protected from overheat.
L3-04: Stall Prevention During Deceleration *<1>*	0: Stall prevention disabled.
	3: Stall prevention enabled with a braking resistor. *<2>*

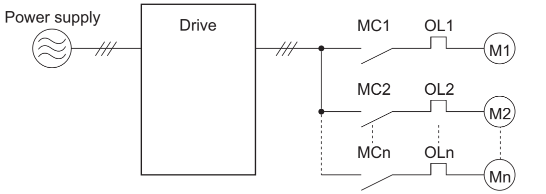
<1> Select either 0 or 3.
<2> This setting cannot be used in OLV control for PM motor.

■ Operation Check

8. Operate the system and verify the required deceleration rate is obtained during dynamic braking or stopping.

3.12 Wiring Checklist

☑	No.	Item	Page
		Drive, peripherals, option cards	
☐	1	Check drive model number to ensure receipt of correct model.	*25*
☐	2	Check for correct braking resistors, DC reactors, noise filters, and other peripheral devices.	*78*
☐	3	Check for correct option card model.	*274*
		Installation area and physical setup	
☐	4	Ensure area surrounding the drive complies with specifications.	*39*
		Power supply voltage, output voltage	
☐	5	The voltage from the power supply should fall within the input voltage specification range of the drive.	*133*
☐	6	The voltage rating for the motor should match the drive output specifications.	*25* *118*
		Main circuit wiring	
☐	7	Confirm proper branch circuit protection exists per National and Local codes.	*51*
☐	8	Properly wire the power supply to drive terminals R/L1, S/L2 and T/L3.	*54*
☐	9	Properly wire the drive and motor together. The motor lines and drive output terminals R/T1, V/T2 and W/T3 should match in order to produce the desired phase order. If the phase order is incorrect, the drive will rotate in the opposite direction.	*62*
☐	10	Use 600 Vac vinyl-sheathed wire for the power supply and motor lines.	*59*
☐	11	Use the correct wire gauges for the main circuit. Refer to ***Table 3.2***, ***Table 3.3***, or ***Table 3.4***.	*59*
		• When using comparatively long motor cable, calculate the amount of voltage drop. Motor rated voltage (V) x 0.02 ≥ 3 x voltage resistance (Ω/km) x cable length (m) x motor rated current (A) x 10^{-3}	*59*
		• If the cable between the drive and motor exceeds 100 m, adjust the carrier frequency (C6-02) accordingly.	*63* *131*
☐	12	Properly ground the drive. Review page ***63***.	*63*
☐	13	Tightly fasten all terminal screws (control circuit terminals, grounding terminals). Refer to ***Table 3.2***, ***Table 3.3*** or ***Table 3.4***.	*59*

☑	No.	Item	Page
☐	14	Set up overload protection circuits when running multiple motors from a single drive.  MC1 - MCn ... magnetic contactor OL1 - OLn ... thermal relay **Note:** Close MC1 through MCn before operating the drive.	
☐	15	If using a braking resistor or dynamic braking resistor unit, install a magnetic contactor. Properly install the resistor, and ensure that overload protection shuts off the power supply.	*78*
☐	16	Verify phase advancing capacitors are NOT installed on the output side of the drive.	
		Control circuit wiring	
☐	17	Use twisted-pair cables for all drive control circuit wiring.	*65*
☐	18	Ground the shields of shielded wiring to the GND ⏚ terminal.	*74*
☐	19	If using a 3-wire sequence, properly set parameters for multi-function contact input terminals S1 through S6, and properly wire control circuits.	*53*
☐	20	Properly wire any option cards.	*275*
☐	21	Check for any other wiring mistakes. Only use a multimeter to check wiring.	-
☐	22	Properly fasten the control circuit terminal screws in the drive. Refer to *Table 3.2*, *Table 3.3* or *Table 3.4*.	*59*
☐	23	Pick up all wire clippings.	
☐	24	Ensure that no frayed wires on the terminal block are touching other terminals or connections.	
☐	25	Properly separate control circuit wiring and main circuit wiring.	
☐	26	All signal line wiring should not exceed 50 m.	
☐	27	Safe Disable input wiring should not exceed 30 m.	

3.12 Wiring Checklist

4

Start-Up Programming & Operation

This chapter explains the functions of the LED operator and how to program the drive for initial operation.

4.1 Section Safety

⚠ DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

⚠ WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may include drives without covers or safety shields to illustrate details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

WARNING

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection, and servicing must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire.

Attach the drive to metal or other noncombustible material.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

Do not allow unqualified personnel to use the product.

Failure to comply could result in damage to the drive or braking circuit.

Carefully review instruction manual TOBPC72060000 when connecting a braking option to the drive.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

OYMC is not responsible for any modification of the product made by the user. This product must not be modified.

Check all the wiring to ensure that all connections are correct after installing the drive and connecting any other devices.

Failure to comply could result in damage to the drive.

4.2 Using the Digital LED Operator

Use the LED operator to enter run and stop commands, display data, edit parameters, as well as display fault and alarm information.

◆ Keys, Displays, and LEDs

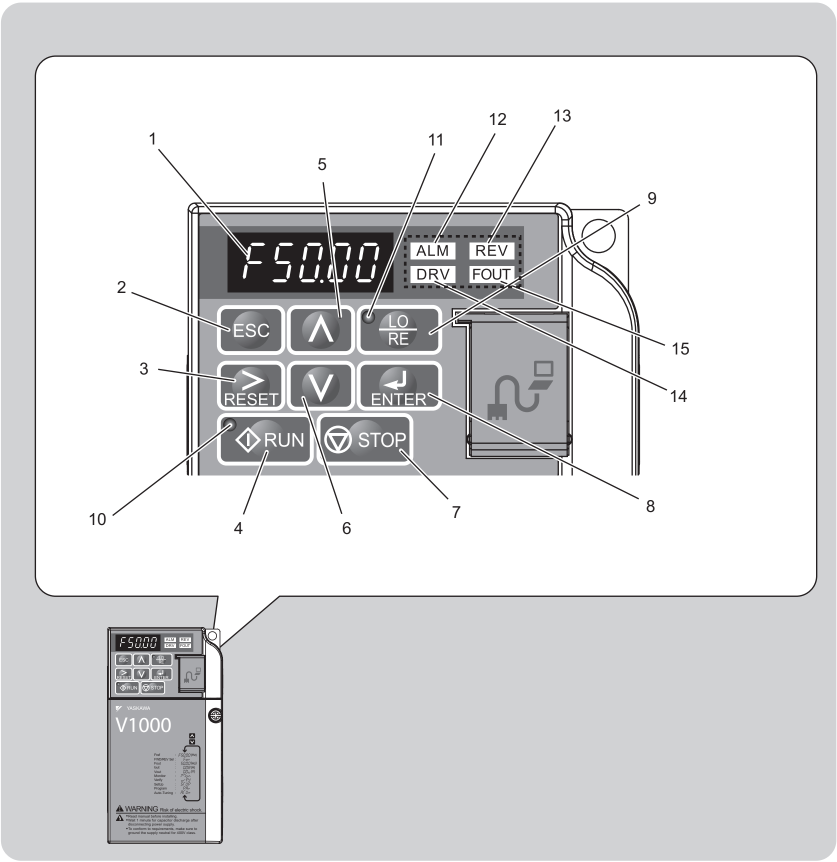


Table 4.1 Keys and Displays on the LED Operator

No.	Display	Name	Function
1	F50.00	Data Display Area	Displays the frequency reference, parameter number, etc.
2	ESC	ESC Key	Returns to the previous menu.
3	> RESET	RESET Key	Moves the cursor to the right. Resets the drive to clear a fault situation.
4	RUN	RUN Key	Starts the drive.
5	∧	Up Arrow Key	Scrolls up to select parameter numbers, setting values, etc.
6	∨	Down Arrow Key	Scrolls down to select parameter numbers, setting values, etc.
7	STOP	STOP Key	Stops the drive. **Note:** Stop priority circuit. A fast-stop is available by pressing the STOP key when the drive detects a danger even if the drive is running by a signal from the multi-function contact input terminal (REMOTE is set). To avoid stoppage by using the STOP key, set o2-02 (STOP Key Function Selection) to 0 (Disabled).
8	ENTER	ENTER Key	Selects all modes, parameters, settings, etc. Selects a menu item to move from one display screen to the next.
9	LO/RE	LO/RE Selection Key	Switches drive control between the operator (LOCAL) and the control circuit terminals (REMOTE). **Note:** LOCAL/REMOTE key effective during stop in drive mode. If the digital operator could change from REMOTE to LOCAL by incorrect operation, set o2-01 (LOCAL/REMOTE Key Function Selection) to “0” (disabled) to disable LOCAL/REMOTE key.
10	RUN	RUN Light	Lit while the drive is operating the motor.
11	LO/RE	LO/RE Light	Lit while the operator (LOCAL) is selected to run the drive.

No.	Display	Name	Function
12	ALM	ALM LED Light	*Refer to LED Screen Displays on page 90*.
13	REV	REV LED Light	
14	DRV	DRV LED Light	
15	FOUT	FOUT LED Light	

◆ Digital Text Display

Text appears on the LED Operator as shown below. This section explains the meaning of text as it appears on the display screen.

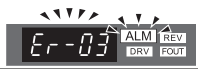
Lit	Flashing
	

Table 4.2 Digital Text Display

Text	LED	Text	LED	Text	LED	Text	LED
0		9		I		R	
1		A		J		S	
2		B		K		T	
3		C		L		U	
4		D		M	<1>	V	
5		E		N		W	<1>
6		F		O		X	none
7		G		P		Y	
8		H		Q		Z	none

<1> Displayed in two digits.

◆ LED Screen Displays

Display	Lit	Flashing	Off
ALM	When the drive detects a alarm or error	• When an alarm occurs • OPE detected • When a fault or error occurs during Auto-Tuning	Normal state (no fault or alarm)
REV	Motor is rotating in reverse	—	Motor is rotating forward
DRV	Drive Mode Auto-Tuning	When FBD’s are used *<1>*	Programming Mode
FOUT	Displays output frequency (Hz)	—	—
As illustrated in this manual			

<1> Refer to the FDB’s instruction manual for further information.

◆ LO/RE LED and RUN LED Indications

LED	Lit	Flashing	Flashing Quickly	Off
LO RE	When run command is selected from LED operator (LOCAL)	—	—	Run command is selected from device other than LED operator (REMOTE)
RUN	During run	• During deceleration to stop • When a run command is input and frequency reference is 0	• During deceleration at a fast-stop. • During deceleration • During stop by interlock operation.	During stop
As shown				

<1> For the difference between “flashing” and “flashing in short intervals” of the RUN LED, refer to Figure 4.2, RUN LED and Drive Operation.

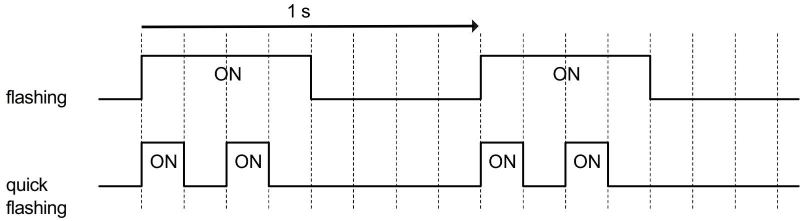


Figure 4.1 RUN LED Status and Meaning

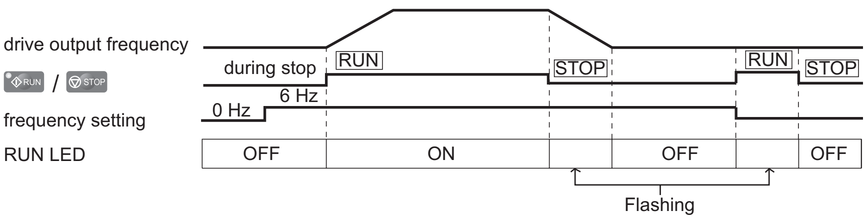


Figure 4.2 RUN LED and Drive Operation

◆ Menu Structure for Digital LED Operator

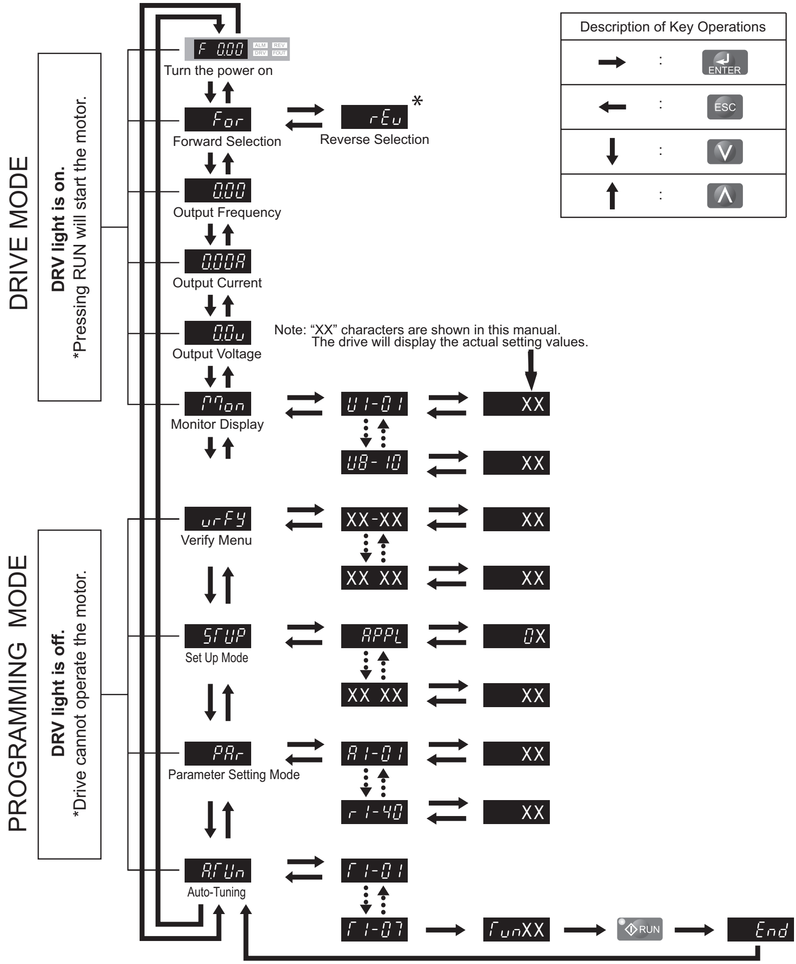


Figure 4.3 Digital LED Operator Screen Structure

* Reverse can only be selected while LOCAL is set.

4.3 The Drive and Programming Mode

The drive functions are divided into two main groups accessible via the Digital LED Operator:

Drive Mode: The Drive mode allows motor operation and parameter monitoring. Parameter settings cannot be changed when accessing functions in the Drive Mode (*Table 4.3*).

Programming Mode: The Programming Mode allows access to setup/adjust, verify parameters and Auto-Tuning. The drive prohibits changes in motor operation such as start/stop when the Digital LED Operator is accessing a function in the Programming Mode.

Table 4.3 illustrates the different functions visible as the "Up arrow" is scrolled immediately after powering up the drive.

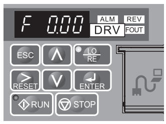
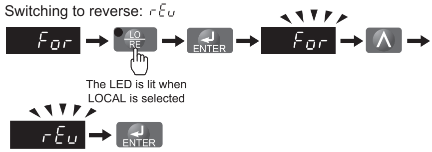
Note: When b1-08 (Run Command Selection while in Programming Mode) is set to 1 (enabled), the drive can run even if the mode is switched to the programming mode. When setting b1-08 to 0 (disabled), the mode cannot be switched to the programming mode while the drive is running.

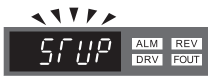
Table 4.3 Summary of Modes

Mode Group	Description	Key Press	LED Digital Operator Display
Drive Mode Functions (Motor operation and monitoring)	Frequency Reference Display (Initial power-up state)	∧	F 0.00 (ALM REV DRV FOUT)
	Forward/Reverse	∧	For (ALM REV DRV FOUT)
	Output Frequency Display	∧	0.00 (ALM REV DRV FOUT)
	Output Current Display	∧	0.00A (ALM REV DRV FOUT)
	Output Voltage Reference	∧	0.0u (ALM REV DRV FOUT)
	Monitor Display	∧	Mon (ALM REV DRV FOUT)
Programming Mode Functions (Changing parameters)	Verify Function	∧	urFy (ALM REV DRV FOUT)
	Setup Group Parameters	∧	STUP (ALM REV DRV FOUT)
	All Parameters	∧	PAr (ALM REV DRV FOUT)
	Auto-Tuning	∧	ATUn (ALM REV DRV FOUT)

◆ Navigating the Drive and Programming Modes

The drive is set to operate in Drive Mode when it is first powered up. Switch between display screens by using the ∧ and ∨ keys.

Power Up	Frequency Reference  Default Setting	This display screen allows the user to monitor and set the frequency reference while the drive is running. ***Refer to The Drive and Programming Mode on page 93***. **Note:** The user can select items to display when the drive is first powered up by setting parameter o1-02.
Drive Mode	∧ ↓↑ ∨	
	Forward/Reverse 	For : Motor rotates forward. rEu : Motor rotates in reverse. **Note:** For applications that should not run in reverse (fans, pumps, etc.), set parameter b1-04 = ”1” to prohibit the motor from rotating in reverse. This sequence also puts the drive in LOCAL mode. Switching to reverse: rEu 
	∧ ↓↑ ∨	
	Output Frequency Display 	Monitors the frequency output by the drive.
	∧ ↓↑ ∨	
	Output Current Display 	Monitors the output current of the drive.
	∧ ↓↑ ∨	

Drive Mode	Output Voltage Reference (Default setting) 	Scroll through o1-01 (User Monitor Selection) until the desired contents appear. ➡ *Refer to Parameter List on page 293*
	∧ ↓↑ ∨	
	Monitor Display 	Monitor parameters (U-parameters) are displayed. ➡ *Refer to Drive Status Monitors: U1-01 to U6-19 on page 146*.
Programming Mode	∧ ↓↑ ∨	
	Verify Function 	Lists all parameters that have been edited or changed from default settings. ➡ *Refer to Verifying Parameter Changes: Verify Menu on page 98*.
	∧ ↓↑ ∨	
	Setup 	A select list of parameters necessary to get the drive operational quickly. ➡ *Refer to The Setup Group within the Programming Mode on page 97*. **Note:** Parameters to be displayed differ depending on the setting of A1-06 (Application Preset). *Refer to Application Presets on page 107*.
	∧ ↓↑ ∨	
	Parameter Setting 	Allows the user to access and edit all parameter settings. ➡ *Refer to Parameter List on page 293*.
	∧ ↓↑ ∨	
	Auto-Tuning 	Motor parameters are calculated and set automatically. ➡ *Refer to Auto-Tuning on page 149*.
	∧ ↓↑ ∨	

Start-Up Programming & Operation

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Drive Mode	Frequency Reference 	Returns to the frequency reference display screen.

■ Drive Mode Details

The following actions are possible in the Drive Mode:

- Run and stop the drive.
- Monitor the operation status of the drive (frequency reference, output frequency, output current, output voltage, etc.).
- View information on an alarm.
- View a history of alarms that have occurred.

Note: Select "Drive Mode" when running. The mode can be switched to any mode (program mode, etc.) other than drive mode while the drive is stopped. However, the drive cannot be operated in other modes. Return the mode to "Drive Mode" after completing periodic inspection.

Figure 4.4 illustrates changing the default frequency reference of F 0.00 (0 Hz) to F 6.00 (6 Hz) while in Drive Mode. This example assumes the drive is set to LOCAL.

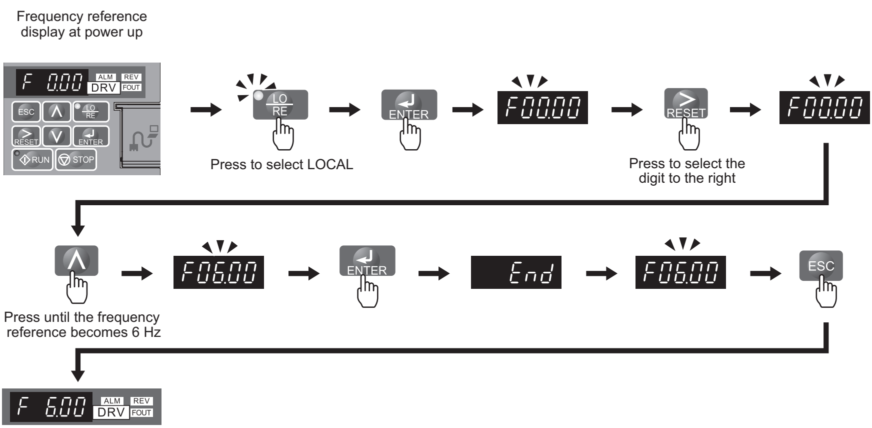


Figure 4.4 Setting the Frequency Reference while in Drive Mode

Note: The drive will not accept a frequency reference set value unless the ENTER key is pressed after the frequency reference is entered. This feature prevents accidental setting of the frequency reference. By setting o2-05 (Frequency Reference Setting Method Selection) to 1 (Enabled), the drive will accept the frequency reference while it is being adjusted on the digital operator.

■ Programming Mode Details

The following actions are possible in the programming mode:

- **Verify Function:** Verify parameter setting changes from original default values.
- **Setup Group:** Access a list of commonly used parameters to simplify setup.
- **Parameter Setting Mode:** Access and edit all parameter settings.
- **Auto-Tuning:** Automatically calculates and sets motor parameters for Open Loop or PM Vector control to optimize the drive for the motor characteristics.

The Setup Group within the Programming Mode

In Setup Group, the user can access the minimum group of parameters required to operate the application.

Note: Setup Group parameters are listed in Appendix B, and indicated with the letter "S" in the Access Level column.

Note: Pressing ***ENTER*** from ***APPL*** navigates to the Application Preset setting display. When the set value is changed, the parameter is changed to the optimum value for each application. It is set to 0 (General-purpose) prior to shipment. *Refer to Application Presets on page 107*.

Figure 4.5 illustrates the keys to press to enter the Setup Group.

In this example, the source of the frequency reference is changed from the control circuit terminals to the LED Operator (i.e., b1-01 is changed from 1 to 0).

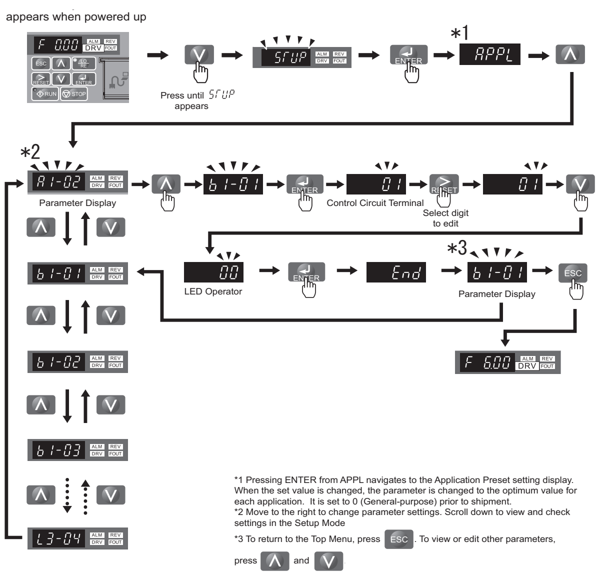


Figure 4.5 Setup Group Example

◆ Changing Parameter Settings or Values

This example explains changing C1-01 (Acceleration Time 1) from 10.0 seconds (default) to 20.0 seconds.

Step		Display/Result
1. Turn on the power to the drive. The initial display appears.	⇒	F 0.00 ALM REV DRV OUT
2. Press the ∧ key until the Setup Mode Screen appears.	⇒	STUP
3. Press the ENTER key to view the parameter setting display.	⇒	A1-02
4. Scroll through parameters by pressing the ∧ key until C1-01 appears.	⇒	C1-01
5. Press ENTER to view the current setting value (10.0 seconds). (Number farthest to the left flashes)	⇒	0010.0
6. Press > RESET until the desired number is selected. ("1" flashes)	⇒	0010.0
7. Press the ∧ key and enter 0020.0.	⇒	0020.0
8. Press ENTER and the drive will confirm the change.	⇒	End
9. The display automatically returns to the screen shown in Step 4.	⇒	C1-01
10. Press the ESC key until back at the initial display.	⇒	F 0.00 ALM REV DRV OUT

◆ Verifying Parameter Changes: Verify Menu

The Verify Menu lists edited parameters from the Programming Mode or as a result of Auto-Tuning. The Verify Menu helps determine which settings have been changed, and is particularly useful when replacing a drive. If no settings have been changed the Verify Menu will read nonE. The Verify menu also allows users to access and re-edit edited parameters.

Note: The Verify Menu will not display parameters from the A1 group (except for A1-02) even if those parameters have been changed from default settings.

The example below is continued from page 98. Here, parameter C1-01 is accessed using the Verify Menu and is changed again to 20.0 s.

To check the list of edited parameters:

Step		Display/Result
1. Turn on the power to the drive. The initial display appears.	⇒	F 0.00 DRV ALM REV OUT
2. Press ∧ until the display reads, “Verify.”	⇒	urFy
3. Press ENTER to enter the list of parameters that have been edited from their original default settings. Scroll through the list by pressing the ∧ key.	⇒	A2-02
4. Press the ∧ key until C1-01 appears.	⇒	C1-01
5. Press the ENTER key to access the setting value.(number farthest to the left flashes)	⇒	0020.0

◆ Switching Between LOCAL and REMOTE

Entering the run command using the LED operator is referred to as LOCAL, while entering the run command from an external device via the control circuit terminals or network option card is referred to as Remote.

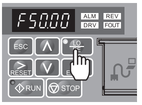
WARNING! *Sudden Movement Hazard. The drive may start unexpectedly if the Run command is already applied when switching from LOCAL mode to REMOTE mode when b1-07 = 1, resulting in death or serious injury. Be sure all personnel are clear of rotating machinery and electrical connections prior to switching between LOCAL mode and REMOTE mode.*

There are three ways to switch between LOCAL and REMOTE.

Note: **1.** After selecting LOCAL, LO/RE will remain lit.
2. The drive will not allow the user to switch between LOCAL and REMOTE during run.

■ Using the LO/RE Key on the LED Operator

Step		Display/Result
1. Turn on the power to the drive. The initial display appears.	⇒	F 0.00 DRV ALM REV OUT

Step		Display/Result
2. Press LO RE. LO/RE will light up. The drive is now in Local. To set the drive for REMOTE operation, press the LO RE key again.	⇒	 

■ Using Input Terminals S1 through S6 to Switch between LO/RE

Switch between LOCAL and REMOTE using one of the digital input terminals S6 (set the corresponding parameter H1-01 through H1-06 to “1”).

Follow the example below to set the digital input terminals.

Note: 1. For a list of digital input selections, *Refer to Parameter List on page 293*.
2. Setting a multi-function input terminal to a value of 1 disables the LO/RE key on the LED operator.

◆ Parameters Available in the Setup Group

■ Setup Mode (StUP)

Parameters used for this drive are classified into A to U. To simplify the drive setup, frequently used parameters are selected and input into Setup Mode.

1. To set a parameter, the Setup Mode must be displayed first. Press the Up/Down key until StUP is displayed.
2. Select the parameter and change the setting. *Table 4.4* lists parameters available in the Setup group. If the desired parameter can not be set in the Setup mode, use the Parameter Setting Mode.

Note: When parameter A1-02 (Control Method Selection) is changed, some parameter set values are also changed automatically.
Note: This manual also explains other parameters not visible in the Setup Group (A1-06 = 0). Use the “Par” menu in the Programming mode to access parameters not listed in the Setup Group.
Note: Display parameters depend on A1-06. *Refer to Application Presets on page 107*.

Table 4.4 Setup Group Parameters

Parameter	Name
A1-02	Control Method Selection
b1-01	Frequency Reference Selection 1
b1-02	Run Command Selection 1
b1-03	Stop Method Selection

Parameter	Name
E1-01	Input Voltage Reference
E1-03	V/f Pattern Selection
E1-04	Maximum Output Frequency (FMAX)
E1-05	Maximum Voltage (VMAX)

Parameter	Name
C1-01	Acceleration Time 1
C1-02	Deceleration Time 1
C6-01	Duty Selection
C6-02	Carrier Frequency Selection
d1-01	Frequency Reference 1
d1-02	Frequency Reference 2
d1-03	Frequency Reference 3
d1-04	Frequency Reference 4
d1-17	Jog Frequency Reference

Parameter	Name
E1-06	Base Frequency (FA)
E1-09	Minimum Output Frequency (FMIN)
E1-13	Base Voltage (VBASE)
E2-01	Motor Rated Current
E2-04	Number of Motor Poles
E2-11	Motor Rate Capacity
H4-02	Terminal FM Gain Setting
L1-01	Motor Protection Function Selection
L3-04	Stall Prevention Selection during Deceleration

4.4 Start-up Flowcharts

The flowcharts in this section summarize basic steps required to start-up the drive. Use the flowcharts to determine the most appropriate start-up method for a given application. The charts are intended as a quick reference to help familiarize the user with start-up procedures. ***Refer to Basic Drive Setup Adjustments on page 118*** and perform all checks to ensure a proper drive start-up.

Flowchart	Subchart	Objective	Page
A		Basic start-up procedure and motor tuning.	***103***
	A-1	Simple motor set-up with Energy Savings or Speed Search using V/f mode.	***104***
	A-2	High-performance operation using Open Loop Vector (OLV) motor control.	***105***
	A-3	Operation with Permanent Magnet (PM) motors.	***106***
	-	Set-up of drive using application specific selections. ***Refer to Application Presets on page 107***	-

◆ Flowchart A: Basic Start-Up and Motor Tuning

Figure 4.6, Flowchart A, describes basic start-up sequence for the drive and motor system. This sequence varies slightly depending on application. Use drive default parameter settings in simple applications that do not require high precision.

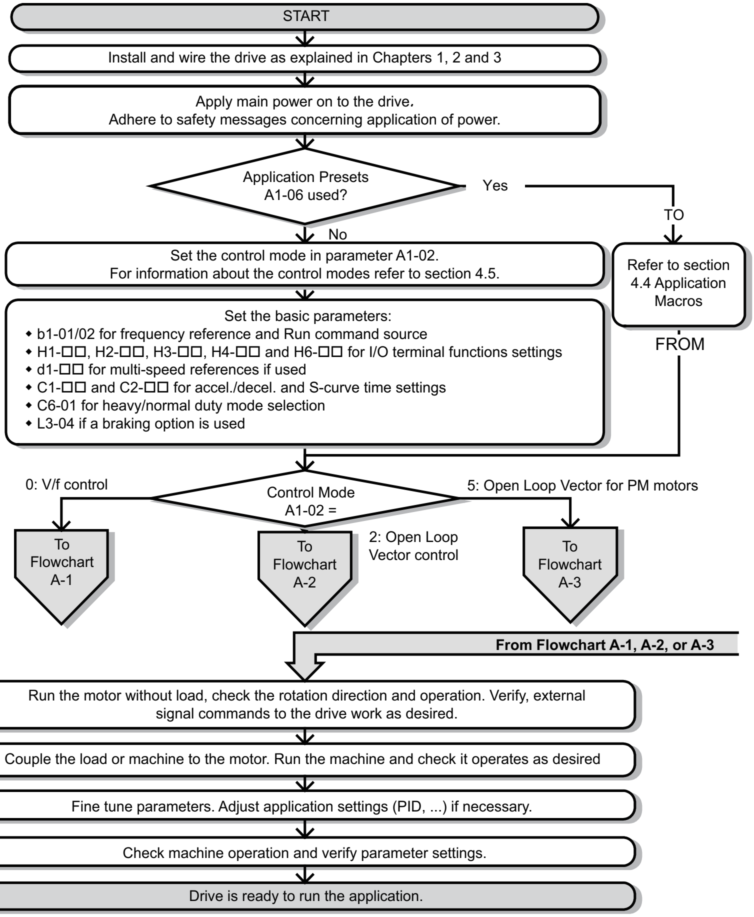


Figure 4.6 Basic Start-Up and Motor Tuning

◆ Subchart A1: Simple Motor Set-Up with Energy Savings or Speed Search using V/f Mode

Figure 4.7, Flowchart A1, describes simple motor set-up for V/f control. V/f Motor Control is suited for the most basic applications such as fans or pumps. This procedure illustrates using Energy Savings and Speed Estimation Speed Search. V/f control can be used where rotational auto-tuning cannot be performed.

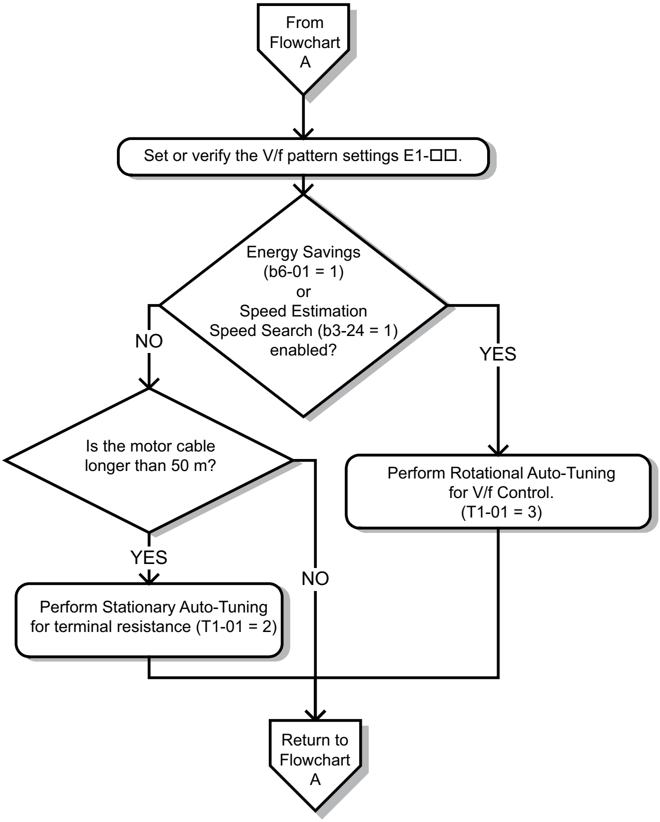


Figure 4.7 Simple Motor Set-Up with Energy Savings or Speed Search Using V/f Mode

◆ Subchart A2: High Performance Operation Using Open Loop Vector Motor Control

Figure 4.8, Flowchart A2, uses Open Loop Vector Control for high-performance motor operation. This is appropriate for applications requiring high starting torque, torque limits, and improved speed regulation.

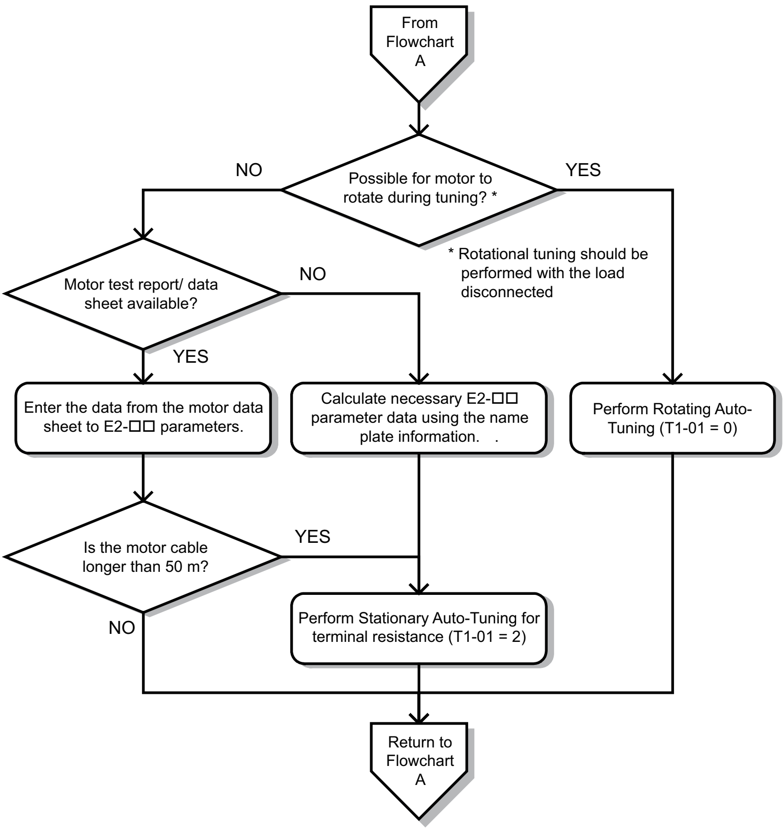


Figure 4.8 Flowchart A2: High Performance Operation Using Open Loop Vector Motor Control

◆ Subchart A3: Operation with Permanent Magnet Motors

Figure 4.9, Flowchart A3, illustrates tuning for PM motors in Open Loop Vector Control. PM motors can be used for energy savings in reduced or variable torque applications.

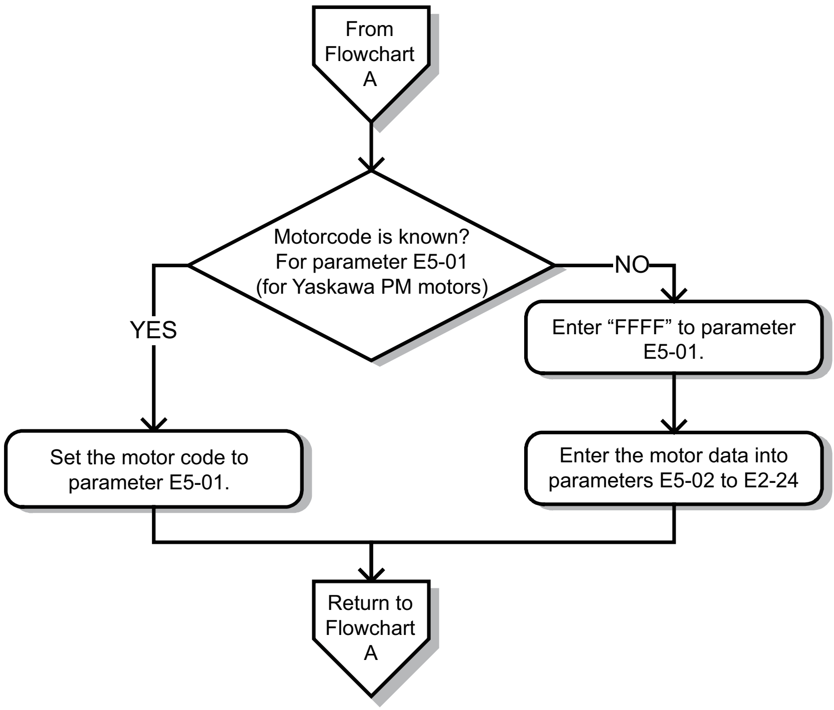


Figure 4.9 Operation with Permanent Magnet Motors

4.5 Application Presets

◆ Application Preset Function (APPL)

APPL

This drive incorporates a function to set the parameters automatically for the applications that are frequently used. Using this Application Preset Function can set or run the drive easily.

1: Water supply pump	2: Conveyor	3: Air supply/exhaust fan
4: AHU (HVAC) fan	5: Compressor	6: Hoist
7: Traveling application		

◆ Application Presets: A1-06

The drive features application presets to facilitate the set up of commonly used applications such as a water supply pump, conveyor, exhaust fan, HVAC fan, compressor, hoist and travelling application. Selecting one of these presets automatically sets the required parameters to the optimum values and changes the appropriate I/O terminal settings for that specific application.

Verify all I/O signals and external sequences before operating the motor. ***Refer to Hoist Application Preset Specifics on page 115*** when selecting a hoist application.

Users are able to make further adjustments to these settings using the Setup Mode.

No.	Parameter Name	Setting Range	Default
A1-06	Application Presets	0: General-purpose (A2 parameters are not affected) 1: Water supply pump 2: Conveyor 3: Exhaust fan 4: HVAC fan 5: Air compressor 6: Hoist 7: Traveling	0 <1>

<1> All general-purpose parameters are accessible when A1-06 = 0.

4.5 Application Presets

WARNING! *Confirm the drive I/O signals and external sequence before starting test run. Setting parameter A1-06 may change the I/O terminal function automatically from the factory setting. Failure to comply may result in death or serious injury.*

Perform a 2-wire or 3-wire initialization (A1-03 = 2220 or 3330) on the drive before selecting one of the application presets or before switching between application presets. The initialization process should reset drive parameters before using an application preset.

Save user-edited parameters to a list by setting o2-03 to “1”. This allows for more immediate access a specific list of relevant parameters and saves time scrolling through the parameter menu items.

Set the parameter access level for Preferred Parameters (A1-01 = “1”) to display only the setup parameters.

The parameters listed in the table below are unaffected by drive initialization:

No.	Parameter Name
A1-02 <1>	Control Method Selection
C6-01	Duty Selection
E1-03	V/f Pattern Selection
E5-01	Motor Code Selection (for PM motors)
o2-04	Drive Unit Selection

<1> The control method set to A1-02 is unaffected when performing a 2-wire or 3-wire initialization, but it automatically changes according to the value set to parameter A1-06.

■ Related Parameters

No.	Parameter Name	Setting Range	Default
A1-01	Access Level Selection	0: Operation only 1: User Parameters (access to a set of parameters selected by the user) 2: Advanced Access Level	2 <1>
A1-03	Initialize Parameters	0: No Initialize 1110: User Initialize (The user must first set user parameter values and then store them using parameter o2-03) 2220: 2-Wire Initialization 3330: 3-Wire Initialization 4440: FBD’s Initialization 5550: OPE04 Error Reset	0
A2-02 to A2-32	User Parameters, 2 to 32	b1-01 to o2-08	<1>

No.	Parameter Name	Setting Range	Default
A2-33	User Parameter Automatic Selection	0: Parameters A2-01 through A2-32 are reserved for the user to create a list of User Parameters. 1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quick access.	1 <2>
o2-03	User Parameter Default Value	0: No Change 1: Set Defaults - Saves current parameter settings as user initialization. 2: Clear All - Clears the currently saved user initialization.	0

<1> Default setting value is dependent on parameter A1-06, Application Selection
<2> Default setting value is dependent on parameter A1-06. This setting value is 0 when A1-06 = 0, and 1 when A1-06 does not = 0.

■ Application Presets

Below is a list of application presets and the values automatically assigned to the parameters as a result of each preset:

A1-06 = 1 - Water Supply Pump Application

Table 4.5 Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Method Selection	0: V/f Control
b1-04	Reverse Operation Selection	1: Reverse prohibited
C1-01	Acceleration Time 1	1.0 s
C1-02	Deceleration Time 1	1.0 s
C6-01	Duty Rating	1: Normal Duty
E1-03	V/f Pattern Selection	0FH
E1-07	Mid Output Frequency	30.0
E1-08	Mid Output Frequency Voltage	50.0
L2-01	Momentary Power Loss Operation Selection	1: Enabled
L3-04	Stall Prevention Selection during Deceleration	1: Enabled

Table 4.6 Parameters Automatically Saved as Preferred (A2-01 to A2-16)

No.	Parameter Name	No.	Parameter Name
b1-01	Frequency Reference Selection	E1-08	Mid Output Frequency Voltage
b1-02	Run Command Selection	E2-01	Motor Rated Current
b1-04	Reverse Operation Selection	H1-05	Multi-Function Digital Input Terminal S5 Function Selection
C1-01	Acceleration Time 1	H1-06	Multi-Function Digital Input Terminal S6 Function Selection
C1-02	Deceleration Time 1		

No.	Parameter Name	No.	Parameter Name
E1-03	V/f Pattern Selection	L5-01	Number of Auto Restart Attempts
E1-07	Mid Output Frequency		

A1-06 = 2: Conveyor Application

Table 4.7 Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Method Selection	0: V/f Control
C1-01	Acceleration Time 1	3.0 s
C1-02	Deceleration Time 1	3.0 s
C6-01	Duty Rating	0: Heavy Duty
L3-04	Stall Prevention Selection during Deceleration	1: Enabled

Table 4.8 Parameters Automatically Saved as Preferred (A2-01 to A2-16)

No.	Parameter Name	No.	Parameter Name
A1-02	Control Method Selection	C1-02	Deceleration Time 1
b1-01	Frequency Reference Selection	E2-01	Motor Rated Current
b1-02	Run Command Selection	L3-04	Stall Prevention Selection during Deceleration
C1-01	Acceleration Time 1		

A1-06 = 3: Exhaust Fan Application

Table 4.9 Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Method Selection	0: V/f Control
b1-04	Reverse Operation Selection	1: Reverse Prohibited
C6-01	Duty Selection	1: Normal Duty
E1-03	V/f Pattern Selection	0FH
E1-07	Mid Output Frequency	30
E1-08	Mid Output Frequency Voltage	50
L2-01	Momentary Power Loss Operation Selection	1: Enabled
L3-04	Stall Prevention Selection during Deceleration	1: Enabled

Table 4.10 Parameters Automatically Saved as Preferred (A2-01 to A2-16)

No.	Parameter Name	No.	Parameter Name
b1-01	Frequency Reference Selection	E1-07	Mid Output Frequency
b1-02	Run Command Selection	E1-08	Mid Output Frequency Voltage

No.	Parameter Name	No.	Parameter Name
b1-04	Reverse Operation Selection	E2-01	Motor Rated Current
b3-01	Speed Search Selection at Start	H1-05	Multi-Function Digital Input Terminal S5 Function Selection
C1-01	Acceleration Time 1	H1-06	Multi-Function Digital Input Terminal S6 Function Selection
C1-02	Deceleration Time 1	L5-01	Number of Auto Restart Attempts
E1-03	V/f Pattern Selection		

A1-06 = 4: HVAC Fan

Table 4.11 Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Method Selection	0: V/f Control
b1-04	Reverse Operation Selection	1: Reverse prohibited
C6-01	Duty Rating	1: Normal Duty
C6-02	Carrier Frequency Selection	3: 8.0 kHz
H2-03	Terminals P2 Function Selection (open-collector)	39: Watt Hour Pulse Output
L2-01	Momentary Power Loss Operation Selection	2: CPU Power Active - Drive will restart if power returns prior to control power supply shut down.
L8-03	Overheat Pre-Alarm Operation Selection	4: Derated operation
L8-38	Carrier Frequency Reduction	2: Carrier frequency derating across entire frequency range.

Table 4.12 Parameters Automatically Saved as Preferred (A2-01 to A2-16)

No.	Parameter Name	No.	Parameter Name
b1-01	Frequency Reference Selection	E1-03	V/f Pattern Selection
b1-02	Run Command Selection	E1-04	Max Output Frequency
b1-04	Reverse Operation Selection	E2-01	Motor Rated Current
C1-01	Acceleration Time 1	H3-11	Terminal A2 Gain Setting
C1-02	Deceleration Time 1	H3-12	Frequency Reference (Current) Terminal A2 Input Bias
C6-02	Carrier Frequency Selection	L2-01	Momentary Power Loss Operation Selection
d2-01	Frequency Reference Upper Limit	L8-03	Overheat Pre-Alarm Operation Selection
d2-02	Frequency Reference Lower Limit	o4-12	kWH Monitor Initial Value Selection

A1-06 = 5: Compressor Application

Table 4.13 Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Method Selection	0: V/f Control
b1-04	Reverse Operation Selection	1: Reverse prohibited
C1-01	Acceleration Time 1	5.0 s
C1-02	Deceleration Time 1	5.0 s
C6-01	Duty Rating	0: Heavy Duty
E1-03	V/f Pattern Selection	0FH
L2-01	Momentary Power Loss Operation Selection	1: Enabled
L3-04	Stall Prevention Selection during Deceleration	1: Enabled

Table 4.14 Parameters Automatically Saved as Preferred (A2-01 to A2-16)

No.	Parameter Name	No.	Parameter Name
b1-01	Frequency Reference Selection	E1-03	V/f Pattern Selection
b1-02	Run Command Selection	E1-07	Mid Output Frequency
b1-04	Reverse Operation Selection	E1-08	Mid Output Frequency Voltage
C1-01	Acceleration Time 1	E2-01	Motor Rated Current
C1-02	Deceleration Time 1		

A1-06 = 6: Hoist Application

Table 4.15 Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Method Selection	2: Open Loop Vector Control
b1-01	Frequency Reference Selection	0: Operator
b6-01	Dwell Reference at Start	3.0 Hz
b6-02	Dwell Time at Start	0.3 s
C1-01	Acceleration Time 1	3.0 s
C1-02	Deceleration Time 1	3.0 s
C6-01	Duty Rating	0: Heavy Duty
C6-02	Carrier Frequency Selection	2: 5 kHz
d1-01	Frequency Reference 1	6.0 Hz
d1-02	Frequency Reference 2	30.0 Hz
d1-03	Frequency Reference 3	50.0 Hz
E1-03	V/f Pattern Selection	0FH
H2-02	Terminals P1 Function Selection (open-collector)	37: During frequency output

No.	Parameter Name	Optimum Setting
H2-03	Terminals P2 Function Selection (open-collector)	5: Frequency Detection 2 (FOUT)
L2-03	Momentary Power Loss Minimum Baseblock Time	0.3 s
L3-04	Momentary Power Loss Voltage Recovery Ramp Time	0: Disabled
L4-01	Speed Agreement Detection Level	2.0 Hz
L4-02	Speed Agreement Detection Width	0.0 Hz
L6-01	Torque Detection Selection 1	8: UL3 at RUN -Fault
L6-02	Torque Detection Level 1	5%
L6-03	Torque Detection Time 1	0.5 s
L8-05	Input Phase Loss Protection Selection	1: Enabled <1>
L8-07	Output Phase Loss Protection	1: Enabled
L8-38	Carrier Frequency Reduction	0: Derated when operating at 6 Hz or less
L8-41	Current Alarm Selection	1: Enabled (alarm is output)

<1> Always disabled for single phase drives.

Note: A sequence to release the brake is needed when the multi-function output photocoupler P2-PC closes. ***Refer to Hoist Application Preset Specifics on page 115*** for more information.

Note: Perform Auto-Tuning after selecting the Hoist Application Preset.

Table 4.16 Parameters Automatically Saved as Preferred (A2-01 to A2-16)

No.	Parameter Name	No.	Parameter Name
A1-02	Control Method Selection	d1-02	Frequency Reference 2
b1-01	Frequency Reference Selection	d1-03	Frequency Reference 3
b6-01	Dwell Reference at Start	E1-08	Mid Output Frequency Voltage
b6-02	Dwell Time at Start	H2-01	Terminals MA, MB, and MC Function Selection
C1-01	Acceleration Time 1	L1-01	Motor Overload Protection Selection
C1-02	Deceleration Time 1	L4-01	Speed Agreement Detection Level
C6-02	Carrier Frequency Selection	L6-02	Torque Detection Level 1
d1-01	Frequency Reference 1	L6-03	Torque Detection Time 1

Note: Read the instructions listed in ***Hoist Application Preset Specifics on page 115*** when using Hoist Application Preset.

A1-06 = 7: Travelling Application

Table 4.17 Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Mode	0: V/f Control
b1-01	Frequency Reference Selection	0: Operator

No.	Parameter Name	Optimum Setting
C1-01	Acceleration Time 1	3.0 s
C1-02	Deceleration Time 1	3.0 s
C6-01	Duty Cycle	0: Heavy Duty
C6-02	Carrier Frequency Selection	2: 5 kHz
d1-01	Frequency Reference 1	6.0 Hz
d1-02	Frequency Reference 2	30.0 Hz
d1-03	Frequency Reference 3	50.0 Hz
H1-05	Multi-Function Digital Input Terminal S5 Function	3: Multi-Step Speed 1
H1-06	Multi-Function Digital Input Terminal S6 Function	4: Multi-Step Speed 2
H2-02	Terminals P1 Function Selection (open-collector)	37: During frequency output
L3-04	Stall Prevention Selection during Decel	0: Disabled
L8-05	Input Phase Loss Protection Selection	1: Enabled *<1>*
L8-07	Output Phase Loss Protection	1: Triggered when a single phase is lost
L8-38	Carrier Frequency Reduction	1: Always derated
L8-41	Current Alarm Selection	1: Enabled (alarm output)

<1> Always disabled for single phase drives.

Table 4.18 Parameters Automatically Saved as Preferred (A2-01 to A2-16)

No.	Parameter Name	No.	Parameter Name
b1-01	Frequency Reference Selection	d1-03	Frequency Reference 3
C1-01	Acceleration Time 1	E2-01	Motor Rated Current
C1-02	Deceleration Time 1	H1-05	Multi-Function Digital Input Terminal S5 Function
C6-02	Carrier Frequency Selection	H1-06	Multi-Function Digital Input Terminal S6 Function
d1-01	Frequency Reference 1	H2-01	Terminals MA, MB, and MC Function Selection
d1-02	Frequency Reference 2	L1-01	Motor Overload Protection Selection

Note: A sequence to release the brake is needed when the multi-function output photocoupler P2-PC closes. ***Hoist Application Preset Specifics on page 115*** for more information.

■ Hoist Application Preset Specifics

This section lists some important points when using the Hoist Application Preset (A1-06 = 6).

Conditions for Opening and Closing the Holding Brake

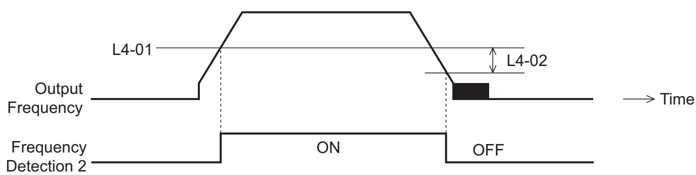
Use an output signal as described below to operate the holding brake in a hoist application.

When an external baseblock command is present, the frequency reference will be kept when a run command is entered. To avoid improper brake release make sure that frequency detection is set so that it does not operate during baseblock (L4-07 = “0” , default). To activate and release the brake using the multi-function output terminals P1-PC, program the drive as shown in the table below:

Brake Open/Close		Brake Activation Level		Control Mode		
Function	Parameter	Signal	Parameter	V/f	OLV	OLV for PM
Frequency Detection 2	L4-07 = 0 H2-02 = 5	Frequency Detection Level Frequency Detection Width	L4-01 = 1.0 to 3.0 Hz <1> L4-02 = 0.0 to 0.5 Hz <2>	O	O	-

<1> This setting range is available when using OLV Control. In V/f Control, set the level as the motor rated slip frequency pulse 0.5 Hz. Not enough motor torque will be created if this value is set too low, and the load may tend to slip. Make sure this value greater than the minimum output frequency and greater than the value of L4-02 as shown in the diagram below. If this value is set too high, there may be a jolt at start.

<2> Adjust Hysteresis for Frequency Detection 2 by changing the frequency detection width (L4-02) between 0.0 and 0.5 Hz. If the load slips during stop, make incremental changes of 0.1 Hz until the load no longer slips.



Sequence Circuit Design for Opening and Closing the Holding Brake

Design the braking sequence as follows:

The brake should release when terminal P2-PC closes in response to the run conditions on the sequence side.

When a fault signal is output, the brake should close. When an up or down command is entered, the brake should release.

Start-Up Programming & Operation 4

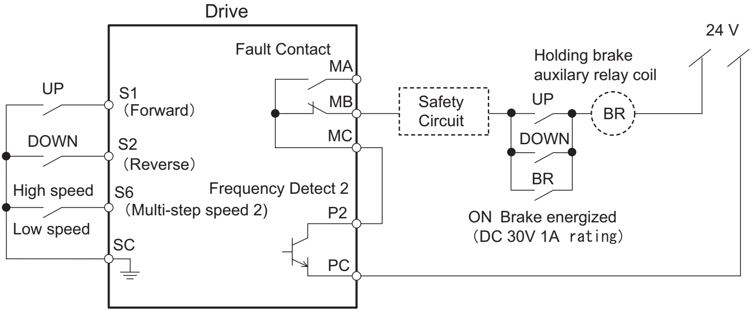


Figure 4.10 Holding Brake Circuit Design

Time chart for Opening and Closing the Holding Brake

A sequence to open and close the holding brake appears in the diagram below.

When changing the speed using an analog signal, make sure that the source of the frequency reference is assigned to the control circuit terminals (b1-01 = 1).

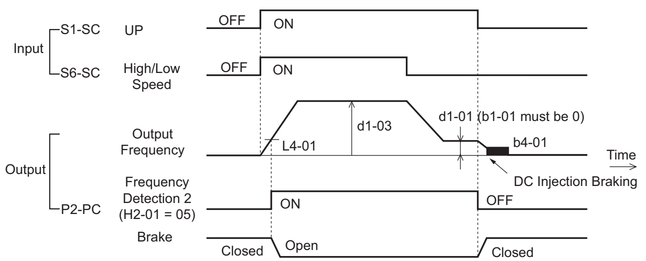


Figure 4.11 Holding Brake Time Chart

◆ User Parameters: A2-01 to A2-32

The user can select 32 parameters and set them to parameters A2-01 through A2-32 to save time scrolling through the parameter menu. The list of User Parameters can also track the most recently edited settings and save those parameters to this list.

No.	Parameter Name	Setting range	Default
A2-01 to A2-32	User Parameters, 1 to 32	b1-01 to o2-08	<1>

<1> Default setting value is dependent on parameter A1-06, Application Selection.

■ Detailed Description

To save specific parameters to A2-01 to A2-32, first set the access level to allow access to all parameters (A1-02 = “2”). After selecting the parameters to be saved to A2-01 through A2-32, set the access level to allow access only to the selected list of User Parameters. Set A1-01 to “1” to restrict access so users can only set and reference the specific parameters saved as User Parameters.

◆ User Parameter Automatic Selection: A2-33

A2-33 determines whether parameters that have been edited are saved to the User Parameters (A2-17 to A2-32) for quick, easy access.

No.	Parameter Name	Setting range	Default
A2-33	User Parameter Automatic Selection	0: Do not save history of recently viewed parameters. 1: Save history of recently viewed parameters.	0, 1

■ Detailed Description

0: Do not save history of recently viewed parameters.

To manually select the parameters listed in the Preferred Parameter group, set A2-33 to “0”.

1: Save history of recently viewed parameters.

By setting A2-33 to 1, all parameters that were recently edited will be saved to A2-17 through A2-32. A total of 16 parameters are saved in order, with the most recently edited parameter set to A2-17.

4.6 Basic Drive Setup Adjustments

This section explains the basic settings required for initial drive operation. Checking these basic parameter settings during start-up will help to ensure a successful drive start-up.

If more information is required for parameters not listed in this section, ***Refer to Parameter List on page 293*** as required for a complete listing of drive parameters.

◆ Control Mode Selection: A1-02

■ Available Control Modes

Three motor control modes are available. Select the control mode that best suits the application in which the drive will be used.

Control Mode	Parameter	Main Applications
V/f Control	A1-02 = 0 (default)	• General variable speed applications • For running multiple motors from a single drive • When replacing a drive in which motor data settings are unknown.
Open Loop Vector Control	A1-02 = 2	• General variable speed applications • Applications requiring high precision, high speed control.
PM Open Loop Vector Control	A1-02 = 5	Variable torque applications employing permanent magnet motors and energy savings.

◆ Initialize Parameter Values: A1-03

Parameter A1-03 (Initialize Parameters) resets all parameters to the original default values.

Note: Save all changed parameter settings by setting o2-03="1" before initializing the drive. Your settings will be lost if a 2-wire or 3-wire initialization using 2220, or 3330 if performed without first saving user parameters. ***Refer to Backing Up Parameter Values: o2-03 on page 160***.

■ Different Methods of Drive initialization

1110: Resets all parameters to user-defined default values

A user-initialization resets all parameters to a user-defined set of default values previously saved to the drive. Set parameter o2-03 to "2" to clear those values.

Note: Set o2-03 to "1" to save the current parameter settings and changes for a "user-initialization." After saving all parameter setting changes, parameter o2-03 automatically returns to 0. ***Refer to Verifying Parameter Settings and Backing Up Changes on page 159***.

2220: 2-Wire Initialization

Returns all parameters to factory default values for 2-wire control.

3330: 3-Wire Initialization

Returns all parameters to factory default values for 3-wire control.

1110: User Initialization

Returns all parameters to backed-up values stored at the time the user set o2-03 = 1 and pressed enter to back-up parameter settings.

5550: Uploads Parameter Data from the Removable Control Circuit Terminal Board

Replacing either the removable control circuit terminal board or the drive and applying main power may result in an oPE04 fault. If parameter setting data in the removable control circuit terminal board is correct, set A1-03 to “5550” to upload the data to the drive.

Note: *Refer to Run Command Input Selection: b1-02 on page 123*, for more information on a 2-wire and 3-wire sequence.

Note: Initializing the drive for 2-wire sequence (A1-03 = 2220) returns all drive parameters to factory settings. Back up all parameters in the event of accidental initialization. the data with 2-wire sequence returns all the set parameters to the factory settings. *Refer to Backing Up Parameter Values: o2-03 on page 160*.

◆ Application Presets: A1-06

The drive features application presets to facilitate the set up of commonly used applications such as a water supply pump, conveyor, exhaust fan, HVAC fan, compressor, hoist, and travelling application. Selecting one of these presets automatically sets the required parameters to the optimum values and changes the appropriate I/O terminal settings for that specific application. *Refer to Application Presets on page 107*

Verify all I/O signals and external sequences before operating the motor. *Refer to Hoist Application Preset Specifics on page 115* when selecting a hoist application.

Users are able to make further adjustments to these settings using the Setup Mode.

No.	Parameter Name	Setting Range	Default
A1-06	Application Presets	0: General-purpose (A2 parameters are not affected) 1: Water supply pump 2: Conveyor 3: Exhaust fan 4: HVAC fan 5: Air compressor 6: Hoist 7: Travelling application	0 <1>

<1> All general-purpose parameters are accessible when A1-06 = 0.

◆ FBD's Function Selection: A1-07

FBD' programmability can be used to customize the drive functionality or add PLC functionality by the interconnection and configuration of basic software function blocks. The drive performs the so created program in a cycle of 2 ms.

Parameter A1-07 can be used to enable or disable the FBD's program inside the drive.
Setting A1-07 to "0" disables the FBD's program in the drive.
Setting A1-07 to "1" enables the FBD's program in the drive.
If A1-07 is set to "2" a digital input (H1-□□ = "9F") can be used to enable or disable FBD's. FBD's will be enabled if the input is off.
Set A1-07 to "0" when FBD's is not used.

If FBD's assigned functions to any multi-function output terminals, those functions stay set after disabling FBD's.

No.	Parameter Name	Setting range	Default
A1-07	FBD's Function Selection	0: Disabled 1: Enabled 2: Terminal input switch (requires that H1-□□ = 9F)	0

◆ Frequency Reference Source: b1-01

This section explains how to assign the frequency reference. Parameters b1-01 and b1-02 can be used to select the source of the run command and the frequency reference independently, e.g., set the reference from the operator and set the run command from the terminals.

■ Frequency Reference from the LED Operator: b1-01 = 0

When b1-01 = 0 the frequency reference will be provided by the LED operator. ***Refer to The Drive and Programming Mode on page 93*** for information on how to set the frequency reference.

■ Frequency Reference from the Analog Input Terminal: b1-01 = 1

When b1-01 = 1, analog inputs A1 and A2 provide the frequency reference.

Note: Set H3-02 (Terminal A1 Function Selection) to "0" to configure Terminal A1 for the main analog frequency reference.

Using a Single Analog Signal (V or I) as the Frequency Reference

Control Circuit Terminal A1 (Voltage Input):

When entering the main frequency reference with a voltage signal, use the voltage input set up in control circuit terminal A1.

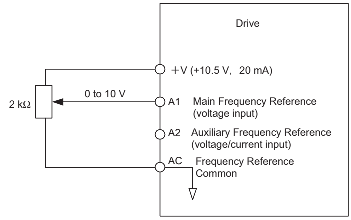


Figure 4.12 Voltage Input for the Main Frequency Reference

Control Circuit Terminal A2 (Voltage/Current Input):

Use control circuit Terminal A2 when supplying the frequency reference with a current signal between 4 to 20 mA. Use control circuit Terminal A1 for supplying a voltage reference.

- Set the signal level for analog input A2 to current input (H3-09 = “2” for 4 to 20 mA, H3-09 = “3” for 0 to 20 mA).
- Set the function for analog input A2 to frequency reference (H3-10 = “0”) to command terminal A2 to be a frequency reference.
- Set DIP switch S1 to the I position for a current signal input.

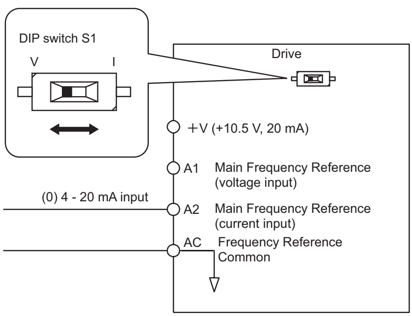


Figure 4.13 Current Input for the Main Speed Reference

Switching between Main/Auxiliary Frequency References

To configure the frequency reference to switch between analog input A1 and A2 (main/aux frequency switch), use the following setup:

1. Set the frequency reference source to terminals (b1-01 = “1”).
2. Set one of the digital inputs to auxiliary reference 1, H1-☐☐ = “3” (preset for terminal S5).
3. Set input signal type of terminal A2 using dip switch S1 and parameter H3-09.
4. Set the function of analog input A2 to Auxiliary frequency (H3-10 = “3”).

When the digital input assigned in step 2 is off, terminal A1 is the frequency reference input. If it is closed, the A2 input value becomes the frequency reference. The active acceleration / deceleration times are used for the change-over between the values

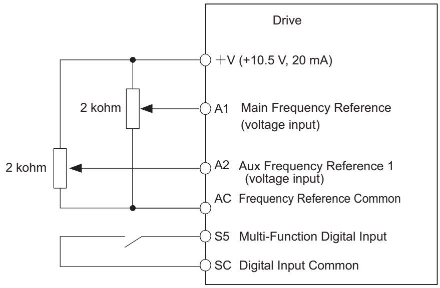


Figure 4.14 Switching between Main/Auxiliary Frequency References

■ Pulse Train Input: b1-01 = 4

Setting b1-04 to 4 programs the drive so that the frequency reference is provided by the pulse train control circuit input terminal RP.

Configuring the Drive for Pulse Train Frequency Reference Input

Setting up the Pulse Input (RP) as frequency reference input:

1. Set the reference source to pulse input (b1-01 = “4”)
2. Set the pulse train input to be the frequency reference by programming parameter H6-01 = “0” and programming the pulse train input gain to 100% (H6-03 = “100”)
3. Set the pulse input scaling (H6-02) to the input frequency value which is equal to the max. frequency reference value.
4. Apply a pulse signal to the input and check that the reference value is the desired value.
5. Readjust the pulse input gain and bias if necessary.

Note: **1.** If the frequency display reaches the maximum desired frequency before the maximum pulse reference signal is applied, increase the pulse train input scaling value (increase H6-02).
2. If the frequency display never reaches the desired maximum with the maximum pulse reference signal applied, decrease the pulse train input scaling value (reduce H6-02)

The pulse input has the following specifications. Ensure the pulse signal meets these specifications:

Pulse Train Input Specifications	
Response Frequency	0.5 to 32 kHz
Duty Cycle	30 to 70%
High Level Voltage	3.5 to 13.2 V
Low Level Voltage	0.0 to 0.8 V

Pulse Train Input Specifications	
Input Impedance	3 kΩ

◆ Run Command Input Selection: b1-02

This section explains how to assign the run command input.

Parameters b1-01 and b1-02 can be used to select the source of the run command and the frequency reference independently, e.g. set the reference from the operator and set the run command from the terminals.

WARNING! *Sudden Movement Hazard. When the run command is given by turning on the power to the drive, the motor will begin rotating as soon as the drive is powered up. Be sure to take proper precautions if using this setting. Ensure the area around the motor is safe. Failure to comply could result in death or serious injury.*

■ Run the Drive at 6 Hz using the Digital LED Operator: b1-02 = 0

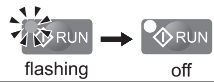
To assign the run command to the operator panel, set parameter b1-01 to “0”. This will set up the drive to acknowledge the run command through the LED operator. Initialize the run command using the Run and Stop keys. Upon power up, the drive uses parameter b1-02 to determine the run command location.

The following procedure indicates how to start and stop the drive through the LED operator after parameter b1-02 has been set to 0.

Note: When b1-02 (Run Command Selection) is not set to 0 (operator), press 

to set LOCAL.

Step		Display/Result
1. Turn on the power to the drive. The initial display appears.	⇒	
2. Set the frequency reference to F6.00 (6 Hz). **Note:** ***Refer to Drive Mode Details on page 96*** for instructions on how to set the frequency reference.	⇒	
3. Press the  key to start the motor.	⇒	

Step		Display/Result
4. The motor should accelerate up to 6 Hz while the RUN light is on.	⇒	
5. Press the STOP key to stop the motor. The RUN light will flash until the motor comes to a complete stop.	⇒	

■ Run the Drive using Digital Input Terminals: b1-02 = 1

This setting uses the digital input terminals to enter the run command. The factory setting is a 2-wire sequence.

Using a 2-Wire Sequence

Digital Input Terminals	ON	OFF
S1	Forward Run	Stop
S2	Reverse Run	Stop

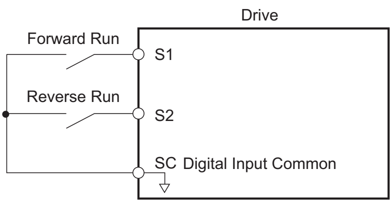


Figure 4.15 Example Wiring Diagram for 2-Wire Sequence

Using a 3-Wire Sequence

When H1-05 (Multi-Function Digital Input Terminal S5 Function Selection) = 0, the functions of terminals S1 and S2 are set to 3-wire sequence, and the multi-function input terminal becomes forward/reverse run command terminal.

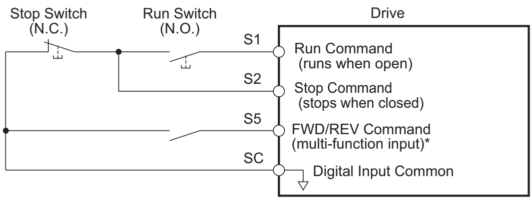


Figure 4.16 Example Wiring Diagram for 3-Wire Sequence Using Terminal S5

Note: When terminal S5 is open, the motor rotates forward. When closed, the motor rotates in reverse.

WARNING! *When 3-Wire sequence is used, set the drive to 3-Wire sequence before wiring the control terminals and ensure parameter b1-17 is set to 0 (drive does not accept a run command at power up (default)). If the drive is wired for 3-Wire sequence but set up for 2-Wire sequence (default) and if parameter b1-17 is set to 1 (drive accepts a Run command at power up), the motor will rotate in reverse direction at power up of the drive and may cause injury.*

Note: *Refer to Parameter List on page 293* for a list of digital input functions. After performing a 3-wire initialization (A1-03 = “3”), the drive will automatically assign the forward/reverse command to terminal S5.

CAUTION! *The motor will begin rotating as soon as the power is switched on. Proper precautions must be taken to ensure that the area around the motor is safe prior to powering up the drive. Failure to do so may result in minor or moderate injury.*

Note: Run by Turning on/off the Power Supply. For safety reasons, the drive is initially set up not to accept a run command at power up (b1-17 = "0"). If a run command is issued at power up, the RUN indicator LED will flash quickly. To change this and have the run command issued by the drive, change parameter b1-17 to 1

◆ Stopping Method Selection: b1-03

When a Stop command is issued, the drive stops the motor using one of four possible methods.

■ Ramp to Stop: b1-03 = 0

When b1-03 = 0, the motor will decelerate to a stop when a stop command is entered. The deceleration time is set by C1-02 (Deceleration Time 1). ***Refer to Acceleration/ Deceleration: C1-01 to C1-11 on page 128***.

When the output frequency falls below the DC Injection braking start frequency (b2-01) during deceleration, the DC Injection braking current (b2-02) will be activated for the specified DC Injection time at stop (b2-04).

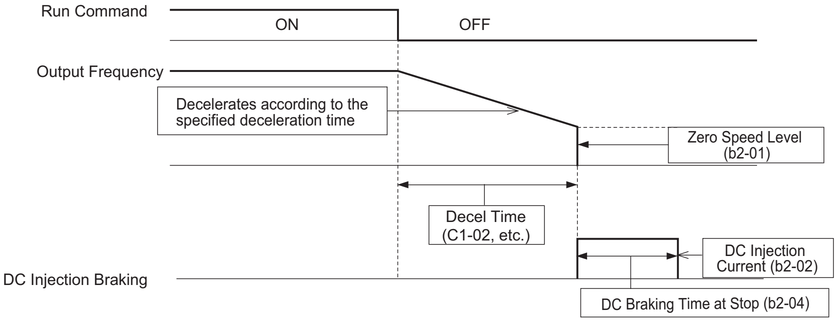


Figure 4.17 Ramp to Stop

Note: Parameter b2-04 is not available if using PM Open Loop Vector. Instead, set the Short Circuit Braking time to b2-13.

■ Coast to Stop: b1-03 = 1

When the run command is removed, the drive will shut off its output and the motor will coast (uncontrolled deceleration). The motor will coast to a stop at the rate determined by the load inertia.

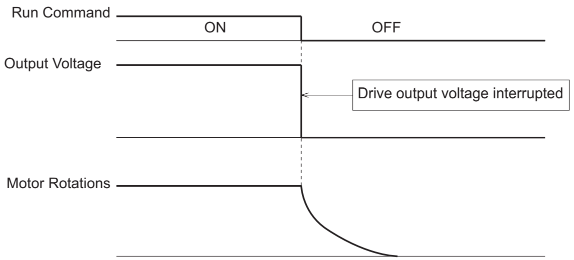


Figure 4.18 Coast to Stop

Note:
1. After entering a stop command, the drive will not accept another run command until the time set to L2-03 (Minimum Baseblock Time) passes.
2. Do not enter another run command until the motor comes to a complete stop. If a run command must be entered before the motor has fully stopped, use DC Injection or Speed Search functions to slow the motor or catch the motor before restarting.

■ DC Injection Braking to Stop: b1-03 = 2

DC Injection Braking stops a coasting motor without regenerative operation. When the run command is removed, the drive will baseblock (turn off its output) for the minimum baseblock time (L2-03). Once the minimum baseblock time has expired, the drive will inject DC current into the motor windings to lock the motor shaft. The stopping time will be reduced as compared to coast to stop. The level of DC Injection current is set by parameter b2-02 (default = 50%). The time for DC Injection Braking is determined by the value set to b2-04 and by the output frequency at the time the run command is removed.

Note: DC Injection braking cannot be selected as a stopping method in PM Open Loop Vector Control.

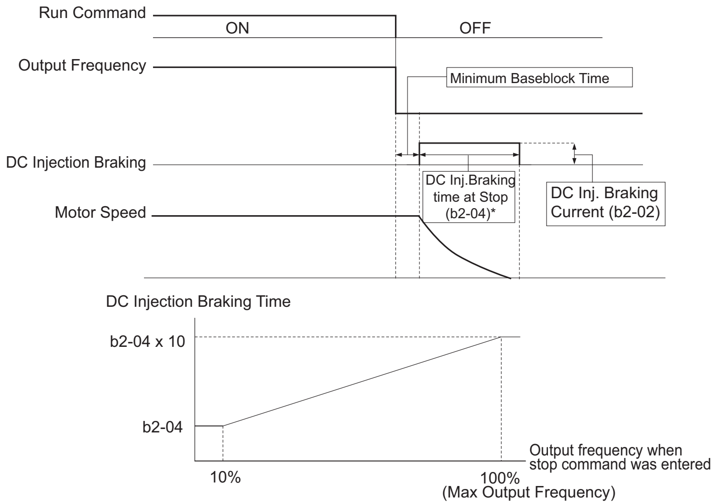


Figure 4.19 DC Injection Braking Stop

*See *Figure 4.18*

Note: Extend baseblock time (L2-03) if overcurrent (OC) occurs on stop command input.

■ Coast to Stop with Timer: Ignoring a Run Command Input within the Deceleration Time: b1-03 = 3

When b1-03 = 3, a stop command interrupts drive output and the motor coasts to stop. The drive will not accept the next run command until time “t” has passed. Time “t” is determined by the output frequency at the moment the stop command was entered and the deceleration time set to the drive according to *Figure 4.20*.

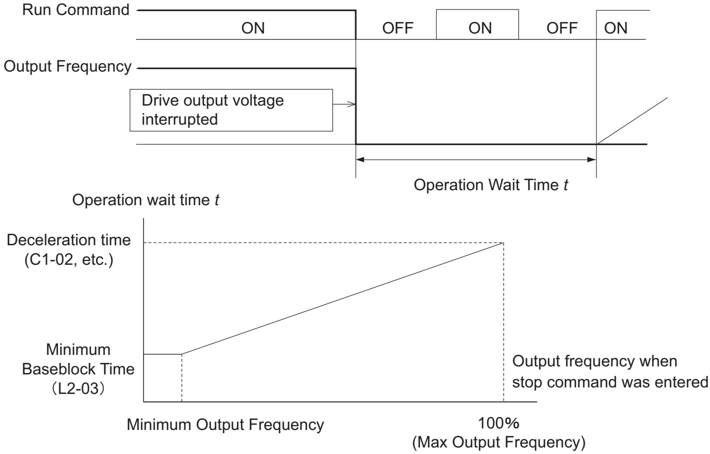


Figure 4.20 Coast to Stop with Timer

◆ Acceleration/Deceleration: C1-01 to C1-11

C1-01 (Acceleration Time 1) sets the time to accelerate from 0 to the maximum output frequency (E1-04). C1-02 (Deceleration Time 1) sets the time to decelerate from maximum output frequency to 0.

No.	Parameter Name	Description	Setting Range	Default
C1-01 <1>	Acceleration Time 1	Sets the time to accelerate from 0 to 100% (maximum output frequency).	0.0 to 6000.0	10.0 s
C1-02 <1>	Deceleration Time 1	Sets the time to decelerate from 100% (maximum output frequency) to 0%.		
C1-10	Accel/Decel Time Setting Units	Sets the setting resolution of C1-01 toC1-09. 0: 0.01 s (0.00 to 600.00 s) 1: 0.1 s (0.0 to 6000.0 s)	0, 1	1

<1> The parameter can be changed during run.

WARNING! *Sudden Movement Hazard. Rapid deceleration may cause the drive to fault on an overvoltage condition, resulting in death or serious injury due to an uncontrolled motor state. Set an acceptable deceleration time in parameter C1-09 when using the Fast-stop feature.*

■ Accel/Decel Time Setting Units

Set the units for the acceleration and deceleration times using parameter C1-10 (default = 1).

Setting	Description
0	Time is set in units of 0.01 s, making the setting range 0.00 to 600.00 seconds.
1	Time is set in units of 0.1 s, making the setting range 0.0 to 6000.0 seconds.

■ Switching Accel/Decel Times with Digital Input Terminals

Up to four different acceleration / deceleration times can be selected using any two digital input terminals S1 through S6.

Program two parameters H1-01 through H1-06 to “07” (Accel/Decel Time 1) and “1A” (Accel/Decel Time 2). The combination of these two inputs activates the acceleration/deceleration times as shown below. As the contacts of the terminals open and close, the following acceleration and deceleration time combinations are possible:

Accel/Decel Time 1 H1-□□ = 7	Accel/Decel Time 2 H1-□□ = 1A	Acceleration Time	Deceleration Time
Open (not selected)	Open (not selected)	C1-01	C1-02
Closed	Open (not selected)	C1-03	C1-04
Open (not selected)	Closed	C1-05	C1-06
Closed	Closed	C1-07	C1-08

■ Automatically Switching Acceleration/Deceleration Times

The drive can automatically switch between acceleration and deceleration times.

When the output frequency reaches the value set to C1-11, the drive will switch acceleration and deceleration times as shown in the figure below. Setting C1-11 to 0.0 Hz disables this function.

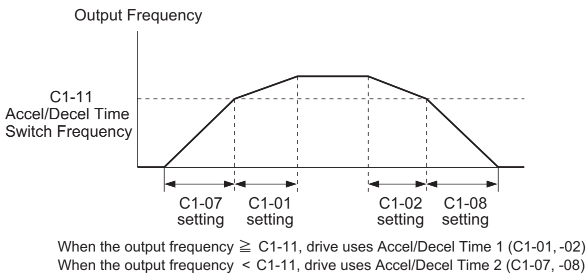


Figure 4.21 Accel/Decel Time Switching Frequency

■ Using S-Curve Characteristics during Acceleration/Deceleration

Using S-curve characteristics to smooth acceleration and deceleration minimizes abrupt shock to the load. Set S-curve characteristic time during acceleration/deceleration at start and acceleration/deceleration at stop.

Note: **1.** Setting S-curve characteristics will lengthen accel/decel times as follows:
Accel Time = Selected Accel Time + (C2-01 + C2-02)/2
Decel Time = Selected Decel Time + (C2-03 + C2-04)/2
2. Set longer S-curve times using PM Open Loop Vector Control.

Setting Example

Figure 4.22 illustrates S-curve characteristics switching between forward and reverse.

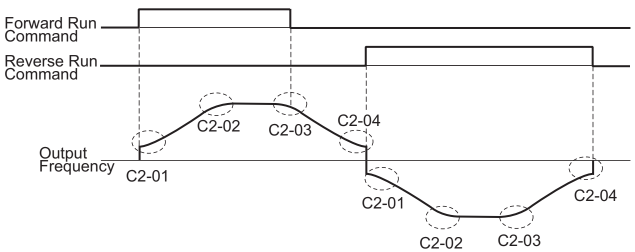


Figure 4.22 S-Curve Characteristics

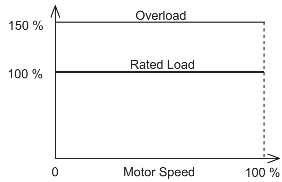
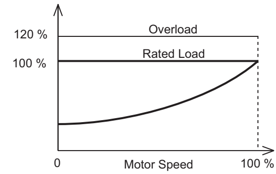
◆ Drive Duty Mode and Carrier Frequency Selection: C6-01 and C6-02

■ Drive Duty Mode Selection: C6-01

The drive has two different duty modes from which to select based on the load characteristics. The drive rated current, overload capacity, carrier frequency, and maximum output frequency will change depending upon the duty mode selection. Use parameter C6-01 (Duty Cycle) to select Heavy Duty (HD) or Normal Duty (ND) for the application. The factory setting is HD. ***Refer to Specifications on page 279*** for details about the rated current.

HD and ND Mode Selections

Mode	Heavy Duty Rating	Normal Duty Rating
C6-01	0	1

Mode	Heavy Duty Rating	Normal Duty Rating
Characteristics		
Application	Use HD Rating is designed applications requiring a high overload tolerance with constant load torque. Such applications include extruders, conveyors and cranes.	Use ND Rating for applications in which the torque requirements drop along with the speed. Examples include fans or pumps where a high overload tolerance is not required.
Overload capability (OL2)	100% continuous, 150% of drive rated current for 60 s	100% continuous, 120% of drive rated current for 60 s
L3-02 Stall Prevention during Acceleration	150%	120%
L3-06 Stall Prevention during Run	150%	120%

Note: By selecting HD/ND motor parameters E2 and E4 are changed to values for the maximum applicable motors.

■ Carrier Frequency Selection: C6-02

Fixed Carrier Frequencies

The carrier frequency can be set using parameter C6-02 as shown in table below.

Parameter	Name	Description	Setting Range	Default
C6-02	Carrier frequency	1: 2.0 kHz 2: 5.0 kHz 3: 8.0 kHz 4: 10.0 kHz 5: 12.5 kHz 6: 15.0 kHz 7: Swing PWM1 8: Swing PWM2 9: Swing PWM3 A: Swing PWM4 F: User defined (C6-03 to C6-05)	1 to F	depends on drive size

Note: Settings 7 through A for parameter C6-02 use a Swing PWM equivalent to a 2 kHz audible noise. This function turns the motor noise into a less obtrusive white noise.

Note: The upper limit for the carrier frequency is determined by drive capacity.

Precautions when setting parameter C6-02:

Symptom	Remedy
Speed and torque are unstable at low speeds.	Lower the carrier frequency.
Noise from the drive is affecting peripheral devices.	
Excessive leakage current from the drive.	
Wiring between the drive and motor is too long. *<1>*	
Motor acoustic noise is too loud.	Increase the carrier frequency or use Swing PWM.

<1> The carrier frequency may need to be lowered if the motor cable is too long. Refer to the table below.

Wiring Distance	Up to 50 m	Up to 100 m	Greater than 100 m
C6-02 (Carrier Frequency Selection)	1 to A (15 kHz)	1 to 2, 7 to A (5 kHz)	1, 7 to A (2 kHz)

Note: When using PM Open Loop Vector control with long cable lengths, set the carrier frequency to 2 kHz (C6-02 = “1”). Use V/f control if the motor cable exceeds 100 m.

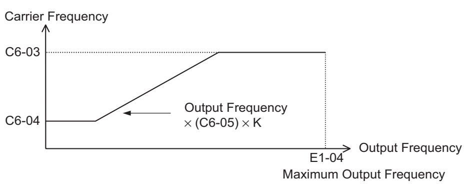
User Defined and Variable Carrier Frequency

Set parameter C6-02 to “F” to set carrier frequency values between fixed values.

In Open Loop Vector and PM motor control the desired value can be set in parameter C6-03.

In V/f control the carrier frequency can be set up to change linearly with the output frequency. In this case the upper and lower limits for the carrier frequency and the carrier frequency proportional gain (C6-03, C6-04, C6-05) have to be set up like shown ***Figure 4.23***.

Note: Set both C6-03 and C6-04 to the same value or set C6-05 to 0 to keep the carrier frequency at a constant level. C6-03 sets the Carrier frequency upper limit.



* The value of coefficient K is determined by the value of C6-03.
C6-03 ≧ 10.0 kHz : K=3
10.0 kHz > C6-03 ≧ 5.0 kHz : K=2
5.0 kHz > C6-03 : K=1

Figure 4.23 Carrier Frequency Changes Relative to Output Frequency

Note: For Open Loop Vector Mode, A1-02 = 2 and OLV for PM the carrier frequency is fixed to a value set by C6-02 or C6-03 if C6-02 is set to F (programmable).

Carrier Frequency Setting Error (oPE11)

A carrier frequency setup error (oPE11) will occur when carrier frequency gain (C6-05) is greater than 6 and C6-03 < C6-04.

Note: *Refer to Troubleshooting without Fault Display on page 224* for information on operator errors (oPE).

■ Carrier Frequency and Output Current Derating

The drives rated output current depends on the carrier frequency selection. If the carrier frequency is increased beyond the default setting, the output current is derated like explained in *Carrier Frequency Derating on page 290*. The overload capability will be 120/150 % of the derated output current for 60 s (Normal Duty/ Heavy Duty).

◆ Drive Input Voltage Setting: E1-01

Set E1-01 according to the power supply voltage. This setting serves as a base value for certain drive protective functions.

NOTICE: *Set drive input voltage (not motor voltage) in parameter E1-01 for proper function of the protective features of the drive. Failure to comply could result in improper drive operation. Set parameter E1-01 to match the input voltage of the drive.*

Parameter	Name	Description	Setting Range	Default
E1-01	Input Voltage Setting	Set to the nominal voltage of the incoming line. Sets the maximum and base voltage used by preset V/f patterns (E1-03), and adjusts the levels of drive protective features (e.g., overvoltage, braking resistor level, stall prevention, etc.).	200 V Class: 155 to 255 400 V Class: 310 to 510	200 V <1>

<1> The default depends on the voltage class and must be doubled for 400V class drives.

■ Input Voltage Setting Value: E1-01

The input voltage level determines the overvoltage detection level, the Kinetic Energy Backup operation voltage and the operation level of the braking transistor as shown in the table below.

Voltage	Setting Value of E1-01	(Approximate Values)				
		OV Detection Level	Braking Transistor Operation Level	UV Detection Level	Desired AC Voltage during KEB	Voltage Level for OV Suppression, Stall Prevention
200 V Class	all settings	410 V	394 V	190 V (single-phase=160 V)	240 V	370 V
400 V Class	setting ≥ 400 V	820 V	788 V	380 V	480 V	740 V
	setting < 400 V	740 V	708 V	350 V	440 V	660 V

Note: The braking transistor operation levels are for the drives internal braking chopper.If an external CDBR braking chopper is used refer to the instruction manual "Dynamic Braking Resistor Unit for VARISPEED-600 Series, TOBPC72060000"

◆ V/f Pattern Selection: E1-03

Parameter E1-03 is only available when using V/f Control. It allows the user to set the required V/f pattern and drive output voltage. When running a high-speed or special-purpose motor, this function fine tunes the amount of torque required for the load. Select the V/f pattern from 15 fixed V/f patterns or 1 user-programmable V/f pattern.

No.	Parameter Name	Description	Setting Range	Default
E1-03	V/f Pattern Selection	0 to E: Select from 15 preset V/f patterns. F: Custom V/f pattern (allows use of E1-04 through E1-10).	0 to F	F

■ Setting Instructions for Setting a V/f Pattern

1. Set the input voltage for the drive. ***Refer to Drive Input Voltage Setting: E1-01 on page 133***.
2. Set the V/f pattern by:
   - * choosing one of the 15 preset V/f patterns (setting = 0 through E)
   - ** select the Custom V/f pattern (setting = F, default setting)
3. In case of * the parameters listed below are automatically set. Refer to ***Selecting a Preset V/f Pattern on page 135***
   In case of **, the parameters listed below are adjustable.

No.	Parameter Name
E1-04	Maximum Output Frequency
E1-05	Maximum Voltage
E1-06	Base Frequency
E1-07	Mid Output Frequency

No.	Parameter Name
E1-08	Mid Output Frequency Voltage
E1-09	Minimum Output Frequency
E1-10	Minimum Output Frequency Voltage

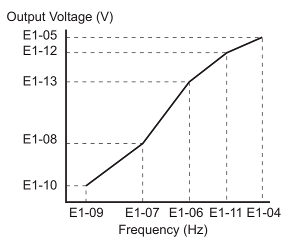


Figure 4.24 V/f Pattern

■ Selecting a Preset V/f Pattern

By setting parameter E1-03 between 0 and E, the V/f patterns below can be selected.

Table 4.19 V/f Patterns

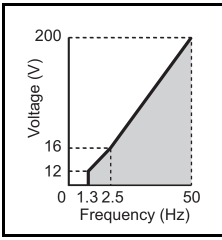
Setting	Specification	Characteristic	Application
0 (F)	50 Hz	Constant torque	For general purpose applications, torque remains constant regardless of speed changes.
1	60 Hz		
2	60 Hz (with 50 Hz base)		
3	72 Hz (with 60 Hz base)		
4	50 Hz, Heavy Duty 3	Reduced or variable torque	For applications where torque changes with the speed like fans, pumps, and others that require reduced torque relative to the load.
5	50 Hz, Heavy Duty 2		
6	60 Hz, Heavy Duty 3		
7	60 Hz, Heavy Duty 2		
8	50 Hz, mid starting torque	High starting torque	• High starting should be selected only when: • Wiring between the drive and motor exceeds 150 m • Large amount of starting torque is required • AC reactor is installed
9	50 Hz, high starting torque		
A	60 Hz, mid starting torque		
B	60 Hz, high starting torque		
C	90 Hz (with 60 Hz base)	Constant output	When operating at speeds greater than 60 Hz motor requires constant voltage. Above 60 Hz, motor operates in constant power range.
D	120 Hz (with 60 Hz base)		
E	180 Hz (with 60 Hz base)		

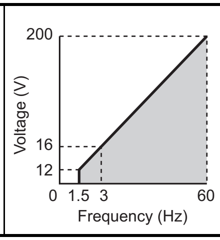
■ V/f Pattern Characteristics

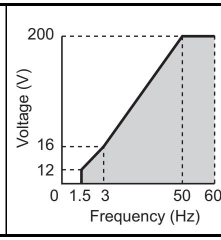
These graphs apply to 200 V class drives; double the values for 400 V class drives.

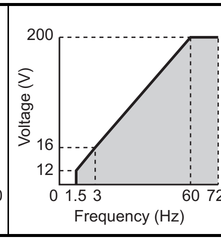
- Constant Torque Characteristics, Settings 0 through 3

Setting = 0	50 Hz	Setting = 1	60 Hz	Setting = 2	60 Hz	Setting = 3	72 Hz



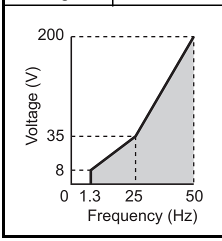


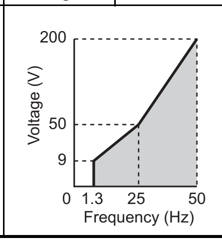


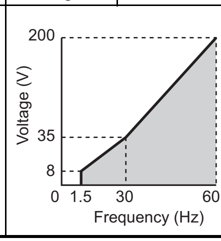


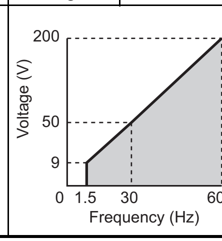
• Reduced Torque Characteristics, Settings 4 through 7

Setting = 4	50 Hz	Setting = 5	50 Hz	Setting = 6	60 Hz	Setting = 7	60 Hz

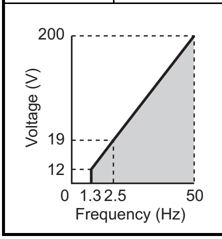
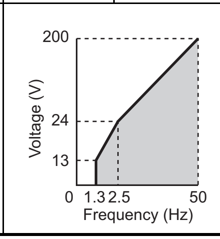
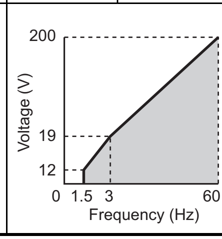
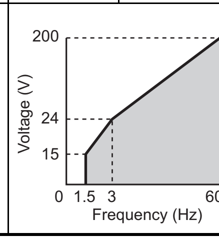




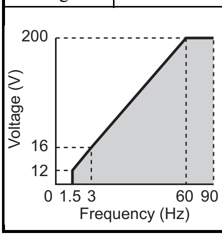
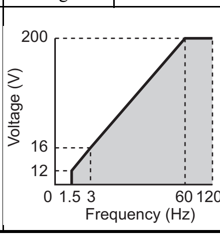
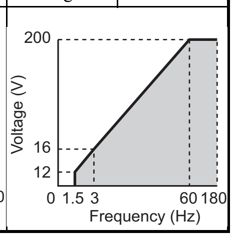




- High Starting Torque Characteristics, Settings 8 through B

Setting = 8	50 Hz	Setting = 9	50 Hz	Setting = A	60 Hz	Setting = B	60 Hz
							

- Constant Output Characteristics, Settings C through F

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz
					

Note: Setting an improper V/f pattern may result in reduced motor torque or increased current (due to over excitation).

◆ Motor Parameters: E2-01 through E2-12 (Manually Entering Parameter Settings)

In Open Loop Vector Control, motor parameters are set automatically during the Auto-Tuning process. Manually set motor parameters if Auto-Tuning cannot be performed. *Refer to Auto-Tuning on page 149* for more information. Refer to *E: Motor Parameters on page 314* for a list of motor parameters E2-01 to E2-12.

■ Setting Motor Parameters Manually

The following table provides instructions on how to set motor parameters. Refer to the motor data sheet for the correct motor data.

No.	Parameter Name	Setting Method
E2-01	Motor Rated Current	Sets the motor nameplate full load current in amperes (A).
E2-02	Motor Rated Slip	Calculate and set the motor rated slip based on the rated speed described on the motor nameplate. Motor rated slip = Motor rated frequency [Hz] - Rated speed [r/min] x No. of motor poles / 120.
E2-03	Motor No-Load Current	Set motor no-load current at rated voltage and rated frequency. Contact the motor manufacturer to get the no-load current. This information is not usually written on the motor nameplate. The default no-load current is for a Yaskawa 4-pole motor.
E2-04	Number of Motor Poles	Displayed only when OLV control mode is selected. Set the number of motor poles described on the motor nameplate.
E2-05	Motor Line-to-Line Resistance	This value is automatically set during Auto-tuning. When regular Auto-Tuning is not possible, contact the motor manufacturer to find out the line-to-line resistance. If using the Motor Test Report, calculate resistance between lines as follows: E-Type Insulation: Test Report value for line resistance at 75 °C at 0.92 ohms B-Type Insulation: Test Report value for line resistance at 75 °C at 0.92 ohms F-Type Insulation: Test Report value for line resistance at 115 °C at 0.87 ohms
E2-06	Motor Leakage Inductance	Set the amount of voltage drop due to motor leakage inductance at base frequency and motor rated current.This value should be set when using a high-speed motor or another type of motor that has a relatively small amount of inductance. Contact the motor manufacturer to get the motor leakage inductance, as this information is not usually written on the motor nameplate.
E2-07 <1>	Motor Iron-Core Saturation Coefficient 1	This value is automatically set during rotational Auto-Tuning.
E2-08 <1>	Motor Iron-Core Saturation Coefficient 2	This value is automatically set during rotational Auto-Tuning.
E2-09	Motor Mechanical Loss	Displayed only when using Open Loop Vector Control. It is not necessary to set this parameter, but it may require adjustment under the following circumstances: Large amount of torque loss relative to motor bearings Fan and pump type applications with a large amount of torque loss The amount of mechanical loss will be reflected in the amount of torque compensation.
E2-10	Motor Iron Loss for Torque Compensation	Displayed only when using V/f Control. Increase the motor iron loss in watts in order to increase the accuracy of torque compensation.
E2-11	Motor Rated Output	Sets the motor rated power in kilowatts (kW). This value is automatically set during Auto-Tuning in units of 0.01.
E2-12 <1>	Motor Iron-Core Saturation Coefficient 3	Set to the motor iron saturation coefficient at 130% of magnetic flux. This value is automatically set during rotational Auto-Tuning.

<1> Parameters E2-07 through E2-08 and E2-12 may be difficult to set manually. If Auto-Tuning is not possible, simply leave these settings at the default values.

◆ Digital Outputs H2-01 to H2-03

Parameters H2-01, H2-02 and H2-03 assign functions to digital output terminals MA, MB, MC, P1, and P2. Set these parameters as required by the application. Default values are listed below.

NOTICE: *Do not assign a function that repeats ON/OFF frequently to terminals MA and MB. Failure to comply will reduce the relay contact lifetime. The expected number of relay contact switching times is normally 200,000 times (current 1 A, resistance load).*

No.	Parameter Name	Default
H2-01	Terminal MA, MB and MC Function Selection (relay)	E: Fault
H2-02	Terminal P1 Function Selection (open-collector)	0: During Run
H2-03	Terminal P2 Function Selection (open-collector)	2: Speed Agree 1

Note: The setting range for H2-01 through H2-03 is 0 to 14D. ***Refer to Parameter List on page 293*** for more information.

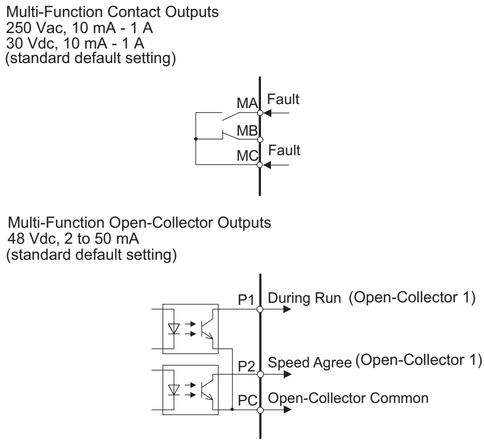


Figure 4.25 Digital Output Connection Diagram

◆ Analog Outputs: H4-01 to H4-03

Group U parameters can be used to observe the drive status (operating conditions) through the LED operator. Analog outputs corresponding to these monitors can be obtained on analog output terminal AM or Fm when programmed with parameter group H4. Some Group U monitors are not available as analog outputs.

No.	Parameter Name	Description
H4-01	Multi-Function Analog 1 (Terminal AM Monitor Selection)	Select the data to output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter “103” for U1-03. When using this terminal as a through terminal or when not using it at all, set “000” or “031”.
H4-02 *<1>*	Multi-Function Analog 1 (Terminal AM Output Gain)	Sets the output voltage level terminal AM at 100 % of the selected output value. The gain is adjustable from -999.9% to 999.9% where 100.0 % is equal to 10 V output.
H4-03 *<1>*	Multi-Function Analog 1 (Terminal AM Bias Setting)	Sets the output voltage level terminal AM at 0 % of the selected output value. The bias is adjustable from -999.9% to 999.9% where 100.0 % is equal to 10 V output.

<1> The parameter can be changed during run.

■ Changing Analog Output Settings

The following example illustrates how to program analog output terminal FM to generate a signal proportional to drive output current (monitor U1-03).

Using H4-01 to Display Monitor Contents

Step		Display/Result
1. Turn on the power to the drive. The initial display appears.	⇒	F 0.00 ALM REV DRV OUT
2. Press V until the Parameter setting menu is displayed.	⇒	PAr
3. Press ENTER to enter the Parameter setting menu.	⇒	A1-01
4. Press > RESET and Λ to select H4-01.	⇒	H4-01
5. Press ENTER to display the value currently set to H4-01.	⇒	102
6. Press > RESET and Λ to set the output current (103).	⇒	103
7. Save the setting by pressing ENTER .	⇒	End
8. The display automatically returns to the parameter setting menu.	⇒	H4-01

Step		Display/Result
9. Press the ESC key until back at the Top Screen.	⇒	F 0.00 DRV (ALM, REV, OUT)

Adjusting the Analog Output Terminal Voltage with H4-02 and H4-03

Note: This example continues from Step 3 in the previous example.

Step		Display/Result
1. Select H4-02 or H4-03 by pressing the RESET and ∧ keys.	⇒	H4-02
2. Press the ENTER key while the drive is stopped.During the display of H4-02 and H4-03 an adjustment voltage signal equal to the current bias or gain setting is output at terminal AM. Use this output signal and adjust the output gain (H4-02) and output bias (H4-03) as required.	⇒	0 100.0

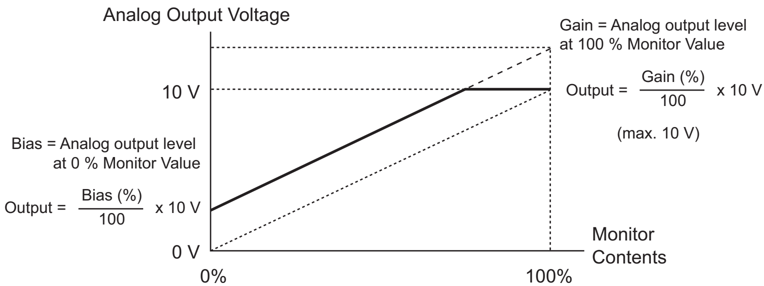


Figure 4.26 Adjusting the Monitor Output

◆ Motor Protection: L1-01 and L1-02

This section explains how to set motor overload protection.

■ Electronic Thermal Motor Protection

The drive has built-in electronic thermal overload protection to detect overload conditions. This protection meets standards set by UL and cUL for motor thermal overload protection. The protective feature is activated when the output current rises above the motor rated current for a specified time. This speed sensitive protective feature interrupts the motor current to protect the motor wiring and windings in the event of overload, eliminating the need for an external overload device. When multiple motors are used with a single drive, separate overload devices are required to properly protect the individual motor branches.

Related Parameters

<table>
<tr><th>No.</th><th>Parameter Name</th><th>Description</th><th>Setting Range</th><th>Default Setting</th></tr>
<tr><td>E2-01</td><td>Motor Rated Current</td><td>Sets the motor nameplate full load current in amperes (A). This set value becomes the reference value for motor protection, torque limit, and torque control. This value is automatically set during Auto-Tuning.</td><td>10 to 200% of drive rated current
Less than 11 kW: 2 digits below the decimal point, 11 kW or more: 1 digit below the decimal point.</td><td>Determined by o2-04 and C6-01</td></tr>
<tr><td>E4-01</td><td>Motor 2 Rated Current</td><td>Sets the motor 2 name plate full load current in amperes (A). This set value becomes the reference value for motor protection, torque limit, and torque control. This value is automatically set during Auto-Tuning.</td><td>10 to 200% of drive rated current</td><td>Determined by o2-04 and C6-01</td></tr>
<tr><td rowspan="2">L1-01</td><td rowspan="2">Motor Overload Protection Selection</td><td rowspan="2">Enables or disables motor thermal overload protection (OL1)
0: Disabled
1: Protection for general purpose motor
2: Protection for inverter motor
3: Protection for vector motor
4: Protection for PM variable torque motor</td><td>0 to 4</td><td>1</td></tr>
<tr><td colspan="2">Use L1-13 (Continuous Electrothermal Operation Selection) to select whether electronic thermal value is “held” or “not held” when the power supply is turned off.
When connecting several motors to one drive, set “0” (disabled) and install a thermal relay on each motor.</td></tr>
<tr><td>L1-02</td><td>Motor Overload Protection Time</td><td>Sets the electronic thermal overload protection detection time in the motor overload protection (OL1) function.
This setting rarely needs to be changed and should be set in accordance with the overload tolerance of the motor.</td><td>0.1 to 5.0</td><td>1.0 min</td></tr>
</table>

Note: Executing C6-01 (Duty mode) changes motor parameters E2 and E4 including motor rated current to the values of the maximum applicable motor.

Digital Outputs (H2-01 through H2-03)

Setting	Function	Description
1F	Motor Overload OL1 Alarm Warning (including OH3)	Closed = When OL1 function is at 90% of its trip point or greater.

Setting Procedure

1. Set E2-01 (Motor Rated Current) and E4-01 (Motor 2 Rated Current) to the motor rated current.

Note:
1. Values set for the current become the base current for electronic thermal overload protection.
2. These values are automatically set by performing Auto-Tuning.
3. The E4-01 setting is not needed if not using motor 2.

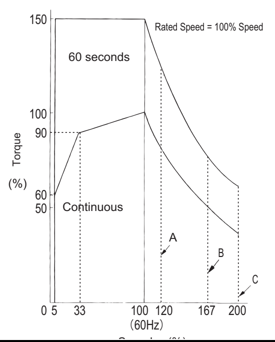
2. Set the proper motor protection level to L1-01.
The ability of the cooling fan to keep an induction motor cool varies by the speed control range. Protection characteristics of the electronic thermal overload protection should be set accordingly. Refer to ***Table 4.20*** for motor types and overload tolerances.

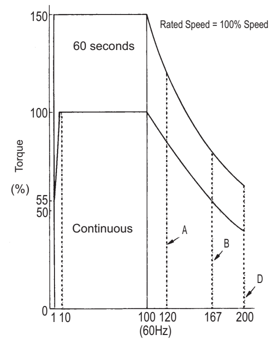
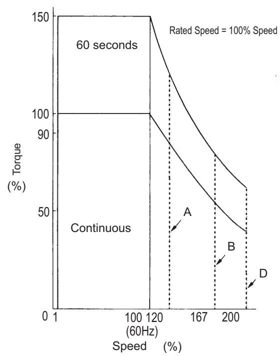
NOTICE: *When connecting multiple motors to one drive, disable the electronic overload protection of the drive (L1-01 = 0) and protect each motor with its own motor thermal overload. Failure to comply could result in improper drive operation.*

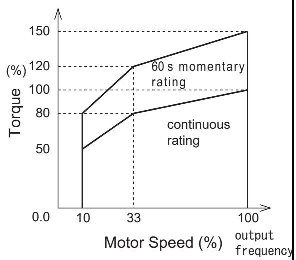
NOTICE: *Inadequate motor protection could result in damage to the motor. Configure a motor thermal overload to disconnect main power to the drive when tripped. When using a thermal relay, disable the motor protection function (L1-01 = "0").*

3. Set the motor overcurrent alarm warning level.
When H2-01, H2-02, and H2-03 (Terminal MA, MB, and MC Function selection, Terminal P1 Function Selection, and Terminal P2 Function Selection) are set to 1F motor overload (OL1 alarm warning), a motor overload alarm is enabled. If the electronic thermal value exceeds 90% of the overload detection level, the set output terminal turns on.

Table 4.20 Motor Type and Overload Tolerances

L1-01 Setting	Motor Type	Overload Tolerance	Cooling Fan Capacity	Electrothermal Protection (100% motor overload)
1	General-purpose motor (standard motor)		General purpose motors are designed to operate from line power. The most effective cooling occurs when running at line power specifications.	Operating continuously at less than line power frequency can trigger motor overload protection (OL1). A fault is then output and the motor will coast to stop.

L1-01 Setting	Motor Type	Overload Tolerance	Cooling Fan Capacity	Electrothermal Protection (100% motor overload)
2	Inverter Duty motor (1:10)		Motor designed to effectively self-cool at speeds as low as 6 Hz.	Continuous operation between 6 and 50/60 Hz.
3	Vector motor (1:100)		Motor capable of effective cooling at extremely low speeds (0.6 Hz).	Continuous operation between 0.6 and 60 Hz.

L1-01 Setting	Motor Type	Overload Tolerance	Cooling Fan Capacity	Electrothermal Protection (100% motor overload)
4	PM Derated Torque Motor		Pico motors feature a heatsink running from the flange to the enclosure. IPM motors for derated torque have the most effective cooling design.	Because this motor is designed for derated torque applications, limit the load at low speeds.

A: Typical maximum speed for Yaskawa motor frame number 200LJ and greater
B: Typical maximum speed for Yaskawa motor frame numbers 160MJ – 180LJ
C: Typical maximum speed for Yaskawa motor frame number 132MHJ or less
D: Typical maximum speed for Yaskawa motor frame number 132MJ or less

Notes on Motor Protection

- Motor protection meeting UL and cUL standards is achieved with the motor overload protection time (L1-02) set to factory default setting. Normally, L1-02 (Motor Overload Protection Time) does not require setting. If the motor overload tolerance is clear, set the overload protection time at hot start according to the motor. To detect overload earlier, decrease the setting.

  Note: *Figure 4.27* illustrates motor protection operation time characteristics.

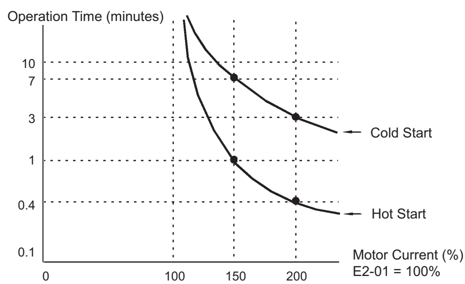


Figure 4.27 Motor Protection Operation

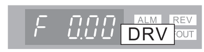
- Disable motor protection (L1-01 = 0) when running multiple motors from the same drive. Attach a thermal relay for each motor to provide overload protection.
- Use L1-13 (Continuous Electrothermal Operation Selection) to select whether the electrothermal value is “held” or “not held” when power supply is turned off. Default setting is 1 (Enabled).

- In the case of a general purpose (standard) motor, the cooling capability is reduced at a low speed. Motor overload protection (OL1) may occur in frequencies lower than motor rated speed. Use an exclusive-use or inverter-duty motor to operate the drive at rated current at low frequency.

◆ Drive Status Monitors: U1-01 to U6-19

Parameter group U displays various data regarding the operating status of the drive.

The following example demonstrates viewing output voltage reference (U1-06).

Step		Display/Result
1. Turn on the power to the drive. The initial display appears.	⇒	
2. Press  until “Monitor Display” appears.	⇒	
3. Press  to enter the Parameter Setting Screen.	⇒	
4. Press  until U1-06 appears.	⇒	
5. Press  to display the voltage reference. The Output Voltage Reference appears.	⇒	

Refer to Parameter List on page 293 for more details about Drive Status Monitors.

Table 4.21 Drive Status Monitors

No.	Parameter Name	Page
U1-01	Frequency Reference	*360*
U1-02	Output Frequency	*360*
U1-03	Output Current	*360*
U1-04	Control Mode	*360*
U1-05	Motor Speed	*361*
U1-06	Output Voltage Reference	*361*
U3-10	10th Most Recent Fault	*365*
U3-11	Cumulative Operation Time at Most Recent Fault	*365*
U3-12	Cumulative Operation Time at 2nd Most Recent Fault	*365*
U3-13	Cumulative Operation Time at 3rd Most Recent Fault	*365*
U3-14	Cumulative Operation Time at 4th Most Recent Fault	*365*
U3-15	Cumulative Operation Time at 5th Most Recent Fault	*365*

No.	Parameter Name	Page
U1-07	DC Bus Voltage	361
U1-08	Output Power	361
U1-09	Torque Reference	361
U1-10	Input Terminal Status	361
U1-11	Output Terminal Status	362
U1-12	Drive Status	362
U1-13	Terminal A1 Input Voltage	362
U1-14	Terminal A2 Input Voltage	362
U1-16	Output Frequency after SoftStart	362
U1-18	oPE Fault	363
U1-19	MEMOBUS/Modbus Error Code	363
U1-24	Input Pulse Monitor	363
U1-25	Software Number (Flash)	363
U1-26	Software Number (ROM)	363
U2-01	Current Fault	363
U2-02	Previous Fault	363
U2-03	Frequency Reference at Previous Fault	363
U2-04	Output Frequency at Previous Fault	363
U2-05	Output Current at Previous Fault	364
U2-06	Motor Speed at Previous Fault	364
U2-07	Output Voltage at Previous Fault	364
U2-08	DC Bus Voltage at Previous Fault	364
U2-09	Output Power at Previous Fault	364
U2-10	Torque Reference at Previous Fault	364
U2-11	Input Terminal Status at Previous Fault	364
U2-12	Output Terminal Status at Prev. Fault	364
U2-13	Drive Operation Status at Pre. Fault	364
U2-14	Cumulative Operation Time at Previous Fault	364
U2-15	Soft Starter Speed Reference at Previous Fault	364
U2-16	Motor q-Axis Current at Previous Fault	364

No.	Parameter Name	Page
U3-16	Cumulative Operation Time at 6th Most Recent Fault	365
U3-17	Cumulative Operation Time at 7th Most Recent Fault	366
U3-18	Cumulative Operation Time at 8th Most Recent Fault	366
U3-19	Cumulative Operation Time at 9th Most Recent Fault	366
U3-20	Cumulative Operation Time at 10th Most Recent Fault	366
U4-01	Accumulated Operation Time	366
U4-02	Number of Run Commands	366
U4-03	Cooling Fan Operation Time	366
U4-05	Capacitor Maintenance	366
U4-07	IGBT Maintenance	366
U4-09	LED Check	367
U4-10	kWH, Lower 4 Digits	367
U4-11	kWH, Upper 5 Digits	367
U4-13	Peak Hold Current	367
U4-14	Peak Hold Output Frequency	367
U4-16	Motor Overload Estimate (OL1)	367
U4-18	Frequency Reference Selection Results	367
U4-19	Freq. Ref. from MEMOBUS/Modbus Communications	367
U4-20	Option Frequency Reference	367
U4-21	Run Command Selection Results	368
U4-22	MEMOBUS/Modbus Comm. Ref.	368
U4-23	Option Card Reference	368
U5-01	PID Feedback	369
U5-02	PID Input (feedback)	369
U5-03	PID Output	369
U5-04	PID Setpoint	369
U5-05	PID Differential Feedback	369
U5-06	PID Adjusted Feedback	369
U6-01	Torque Reference (Internal)	369
U6-02	Motor Secondary Current (Iq)	369

No.	Parameter Name	Page
U2-17	Motor d-Axis Current at Previous Fault	*364*
U3-01	Most Recent Fault	*364*
U3-02	2nd Most Recent Fault	*364*
U3-03	3rd Most Recent Fault	*364*
U3-04	4th Most Recent Fault	*365*
U3-05	5th Most Recent Fault	*365*
U3-06	6th Most Recent Fault	*365*
U3-07	7th Most Recent Fault	*365*
U3-08	8th Most Recent Fault	*365*
U3-09	9th Most Recent Fault	*365*

No.	Parameter Name	Page
U6-03	Motor Excitation Current (ld)	*369*
U6-04	Output of speed control (ASR) (for Simple V/f PG)	*369*
U6-05	Output voltage reference (Vq)	*369*
U6-06	Output Voltage Reference (Vd)	*369*
U6-07	q-axis ACR Output	*369*
U6-08	d-Axis ACR Output	*369*
U6-20	Frequency Ref. Bias (Up/Down 2)	*369*
U6-21	Offset Frequency	*369*
U8-□□	Custom Monitors for FBD’s	*370*

4.7 Test Run

◆ Powering Up the Drive and Operation Status Display

■ Powering Up the Drive

Review the following checklist before turning the power on.

Item to Check	Description
Power supply voltage	Ensure the power supply voltage is correct: 200 V class: single-phase 200 to 240 Vac 50/60 Hz 200 V class: 3-phase 200 to 240 Vac 50/60 Hz 400 V class: 3-phase 380 to 480 Vac 50/60 Hz
	Properly wire the power supply input terminals (R/L1, S/L2, T/L3). (for single-phase 200 V class models, wire only R/L1 and S/L2)
	Check for proper grounding of drive and motor.
Drive output terminals and motor terminals	Properly wire drive output terminals U/T1, V/T2, and W/T3 with motor terminals U, V, and W.
Control circuit terminals	Check control circuit terminal connections.
Drive control terminal status	Open all control circuit terminals (off).
Status of the load and connected machinery	Uncouple the motor from the load.

■ Status Display

When the power supply to the drive is turned on, the LED operator lights will appear as follows:

No.	Name	Description
Normal Operation		The data display area displays the frequency reference. DRV flashes.
Fault	 Main circuit low voltage (ex)	Data displayed varies by the type of fault. ***Refer to Fault Displays, Causes, and Possible Solutions on page 183*** for more information and corrective action. ALM and DRV are lit.

◆ Auto-Tuning

Auto-Tuning automatically sets and tunes parameters required for motor operation.

■ Types of Auto-Tuning

There are three types of Auto-Tuning. ***Refer to Auto-Tuning Selection on page 151*** to select the best type of Auto-Tuning for the application.

Type	Setting	Application Conditions and Benefits	Control Mode
Rotational Auto-Tuning for V/f Control	T1-01 = 3	Assumes the motor can rotate during the Auto-Tuning process Improves torque compensation, slip compensation, energy savings, and speed search performance	V/f Control
Rotational Auto-Tuning for OLV Control	T1-01 = 0	Assumes the motor can rotate during the Auto-Tuning process Achieves high-performance motor control	Open Loop Vector Control
Stationary Auto-Tuning for V/f and OLV Control Line-to-Line Resistance Only	T1-01 = 2	For use when the motor cable exceeds 50 m The motor cable length has been modified after Auto-Tuning has been previously performed When motor capacity and drive capacity differ	V/f Control, Open Loop Vector Control

Note: Auto-Tuning cannot be performed on permanent magnet motors (IPM, SPM, etc.).

■ Auto-Tuning Selection

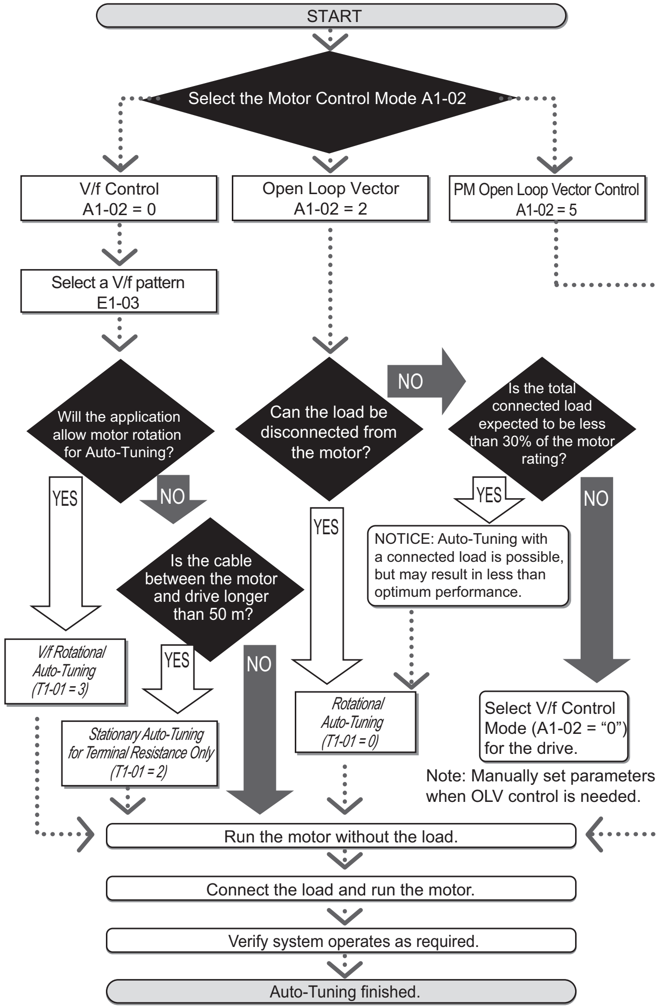


Figure 4.28

■ Before Auto-Tuning the Drive

Check the items below before Auto-Tuning the drive:

Basic Auto-Tuning Preparations

- Auto-Tuning automatically determines the electrical characteristics of the motor. This is fundamentally different from other types of Auto-Tuning features used in servo systems.
- Before auto-tuning, be sure the input supply voltage equals or exceeds the motor rated voltage. Performance can be enhanced by using a motor with a base voltage that is 20 V (40 V for 400 V class models) lower than the input supply voltage. This may be of special importance when operating the motor above 90% of base speed, where high torque precision is required.
- Auto-Tuning is not possible with permanent magnet motors.
- To cancel Auto-Tuning, press the STOP key on the LED operator.
- The next table describes digital input and output terminal status during Auto-Tuning.

Auto-Tuning Type	Digital Input	Digital Output
Auto-Tuning for Energy Savings in V/f Control	Not available	Works the same during normal operation
Rotational-Type Auto-Tuning	Not available	Works the same during normal operation
Auto-Tuning for Resistance between Lines	Not available	Maintains the status at the start of Auto-Tuning

WARNING! *When non rotarional Auto-Tuning is used in applications that utilize a mechanical brake, take special precaution to insure the brake stays applied. Auto-Tuning activates the drive multi-function outputs per the table above. Therefore, a brake may be released while the motor is uncoupled from the load, resulting in an unsafe condition. Proper precautions must therefore be taken prior to performing Auto-Tuning.*

Note: It is recommended that Rotational Auto-Tuning be performed with the load disconnected. Failure to comply could result in improper drive operation. If rotational Auto-Tuning is performed for a motor coupled to a load, the motor constants will be inaccurate and the motor may exhibit abnormal operation. Disconnect or decouple the motor from the load.

Rotational Auto-Tuning for V/f Control

- Motor rotates during Auto-Tuning.
- Sets parameters required for torque compensation, slip compensation, energy savings, and speed search.
- Available only when the drive is set for V/f Control.
- Required to perform Estimation-Type Speed Search when using V/f Control.

Rotational Auto-Tuning for Open Loop Vector Control

- Used only when in Open Loop Vector Control.
- Perform only with the motor uncoupled from the load for applications requiring high performance over a wide speed range.
- Disconnect the load before Auto-Tuning the drive and motor. Performing Rotational Auto-Tuning with the load connected will set motor parameters incorrectly, and also be dangerous because irregular motor rotation will occur.
- It is possible to perform Rotational Auto-Tuning with a connected load if the load is less than 30% of the rated load.
- Ensure a motor-mounted brake is fully released.

- Connected machinery should not produce enough power to rotate the motor.

Stationary Auto-Tuning for Terminal Resistance Only

- If the motor cable lead length has been significantly modified after Auto-Tuning has already been performed, perform Stationary Auto-Tuning with the new cables.
- Perform when using motor cables longer than 50 m with V/f Control.

WARNING! *Electrical Shock Hazard. When executing stationary Auto-Tuning for line-to-line resistance only, the motor does not rotate, however, power is applied. Do not touch the motor until Auto-Tuning is completed. Failure to comply may result in injury from electrical shock.*

Note: When auto-tuning a motor that is used on an application in conjunction with a brake, take special precaution to ensure the brake stays applied.

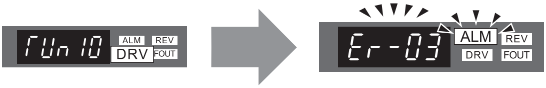
■ Auto-Tuning Fault Codes

Calculation of abnormal measurements or pressing 

before completion will interrupt Auto-Tuning.

Refer to Auto-Tuning Errors on page 182 for more information.

A B



A – Normal Auto-Tuning Display **B – Auto-Tuning Interrupted**

Figure 4.29 Auto-Tuning Interruption Display

■ Performing Auto-Tuning

The following example illustrates how to perform Rotational Auto-Tuning.

Note: The following example is shown with the drive in Open Loop Vector Control (A1-02 = 2).

Selecting the Type of Auto-Tuning

Step		Display/Result
1. Turn on the power to the drive. The initial display appears.	⇒	
2. Press the  key until the Auto-Tuning screen appears.	⇒	
3. Press  to begin setting parameters.	⇒	

Step		Display/Result
4. Press ENTER to display the value for T1-01.	⇒	02
5. Press > RESET to select the digit to edit.	⇒	02
6. Press ∧ and set the drive to perform Rotational Auto-Tuning (00).	⇒	00
7. Save the setting by pressing ENTER .	⇒	End
8. The display automatically returns to the screen shown in Step 3.	⇒	T1-01
9. Press the ESC key until back at the Top Screen.	⇒	F 0.00 ALM REV DRV OUT

Enter Data from the Motor Nameplate

After selecting the type of Auto-Tuning, enter the required data from the motor nameplate.

Note: These instructions continue from Step 7 in Selecting the Type of Auto-Tuning.

Step		Display/Result
1. Press ∧ to access the motor output power parameter T1-02.	⇒	T1-02
2. Press ENTER to view the default setting.	⇒	000.40
3. Press > RESET to select the digit to edit.	⇒	000.40
4. Press ∧ and enter “0.2.” Enter value based on motor nameplate data.	⇒	000.20
5. Press ENTER to save the setting.	⇒	End
6. The display automatically returns to the screen shown in Step 1.	⇒	T1-02

Step			Display/Result
7.	Repeat Steps 1 through 5 to set the following parameters:T1-03, Motor Rated Voltage T1-04, Motor Rated CurrentT1-05, Motor Base FrequencyT1-06, Motor Poles; T1-07, Motor Base Frequency	⇒	T1-03 ⋮ T1-07

Note: For the details of each setting, ***Refer to Motor Data for Auto-Tuning on page 156***. For stationary Auto-Tuning for line-to-line resistance only, set T1-02 and T1-04.

Starting Auto-Tuning

WARNING! *Sudden Movement Hazard. The drive and motor may start unexpectedly during Auto-Tuning, which could result in death or serious injury. Ensure the area surrounding the drive motor and load are clear before proceeding with Auto-Tuning.*

WARNING! *Electrical Shock Hazard. High voltage will be supplied to the motor when stationary Auto-Tuning is performed even with the motor stopped, which could result in death or serious injury. Do not touch the motor until Auto-Tuning has been completed.*

NOTICE: *Auto-Tuning will not function properly if a holding brake is engaged on the load. Failure to comply could result in improper operation of the drive. Ensure the motor can freely spin before beginning Auto-Tuning.*

NOTICE: *Never perform rotational Auto-Tuning for a motor connected to a load. Failure to comply could result in improper drive operation. If rotational Auto-Tuning is performed for a motor coupled to a load, the motor constants will be inaccurate and the motor may exhibit abnormal operation. Disconnect or decouple the motor from the load.*

Enter the required information from the motor nameplate. Press Λ to proceed to the Auto-Tuning start screen.

Step			Display/Result
1.	After setting T1-07 as illustrated in the previous section, press Λ and confirm the display is as follows:	⇒	TUn10
2.	Press RUN to activate Auto-Tuning. DRV flashes. **Note:** The first digit indicates which motor is undergoing Auto-Tuning (motor 1 or motor 2). The second digit indicates the type of Auto-Tuning being performed.	⇒	TUn10 ALM REV DRV FOUT
3.	Auto-Tuning finishes in approximately one to two minutes.	⇒	End

■ Motor Data for Auto-Tuning

Table 4.22 Parameters Set During Auto-Tuning

No.	Name	Description	Range	Def.	Control Mode	
					V/f	OLV
T1-00	Motor Selection 1/2	Selects which set of motor parameters are set during Auto-Tuning. If motor 2 selection (H1-□□=16) is not selected, this parameter will not be displayed. 1: Motor 1 - E1 to E2 2: Motor 2 - E3 to E4. <1> Enabled when motors 1 and 2 are switched to each other (H1-□□=16). Displayed only when either multi-function contact output H1-01 through H1-06 is set to 16.	1, 2	1	A	A
T1-01	Auto-Tuning Mode Selection	Selects the Auto-Tuning mode. 0: OLV Rotational Auto-Tuning 2: Terminal resistance only, Stationary Auto-Tuning 3: V/f Rotational Auto-Tuning. Only settings 2 and 3 are available when using V/f Control. Only setting 2 is available when using motor 2. Settings 0 and 2 are available when using OLV Control.	0, 2, 3	0 (“2” in V/f mode)	A	A
T1-02	Motor Rated Power	Sets the motor rated output power. A set value that can provide stable control in the open loop control mode ranges from 50 to 100% of the drive rating. In case of motors that operate above base speed, set the value at base speed.	0.00 to 650.00	0.40 kW	A	A
T1-03 <2>	Motor Rated Voltage	Set the motor base voltage according to the information printed on the motor nameplate. In case of motors that operate above base speed, set the value at base speed.	0.0 to 255.5	200.0 V	A	A
T1-04	Motor Rated Current	Enter the motor-rated current as specified on the motor nameplate. For best performance when using OLV select the drive so that the motor represents 50 to 100% of the drive rated current. Enter the current required at base speed for motors with extended speed ranges.	10 to 200% of drive rated current	Det. by o2-04 and C6-01	A	A
T1-05	Motor Base Frequency	Enter the motor base frequency as specified on the motor nameplate. Enter the motor base frequency for extended speed range motors.	0.0 to 400.0	60.0 Hz	A	A
T1-06	Number of Motor Poles	Enter number of motor poles indicated on motor nameplate.	2 to 48	4	A	A
T1-07	Motor Base Speed	Sets the base speed of the motor in revolutions per minute r/min (RPM). Enter the motor base speed for extended speed range motors.	0 to 24000	1750. r/min	A	A

No.	Name	Description	Range	Def.	Control Mode	
					V/f	OLV
T1-11	Motor Iron Loss	Provides iron loss for determining Energy Saving coefficient. When power is cycled, the value set to E2-10 will appear (the motor iron loss). If T1-02 is changed, an initial value for the motor capacity will appear that is close to the capacity that was changed.	0 to 65535	14W	A	–

<1> Normally not displayed.
<2> Voltage and frequency settings for vector motors and drive motors are often lower than for standard motors. Be sure to enter Auto-Tuning data according to the motor nameplate and motor data sheets. If the no-load voltage and frequency values are shown, enter those values into T1-03 and T1-05.

■ Precision Settings for Auto-Tuning

Basic motor nameplate data can be used to auto-tune a motor. However, improved performance can be achieved by using precise data for base voltage and base frequency. If the no-load base voltage and no-load base frequency (voltage and frequency that are required to operate the motor at rated speed without load) are known, enter this data when executing auto-tuning to improve performance.

Parameter	Normal Settings	Precision Tuning
T1-03	Enter the motor rated voltage	Enter the no-load base voltage when the motor is operating at its rated revolutions per minute
T1-05	Enter the motor base frequency	Enter the no-load base frequency when the motor is operating at its rated revolutions per minute

◆ No-Load Operation

This section explains how to operate the drive with the motor uncoupled from the load during a test run.

■ Before Starting the Motor

Check the following items before operation:

- Ensure the area around the motor is safe.
- Set the proper motor rated current to T1-04 to prevent overheating or other damage from motor overload.
- Ensure external emergency stop circuitry is working properly and other safety precautions have been taken.

■ During Operation

Check the following items during operation:

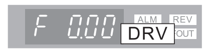
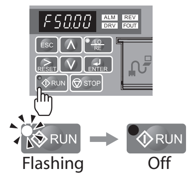
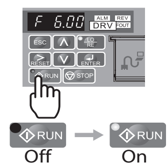
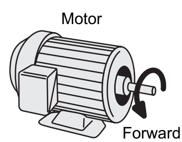
- The motor should rotate smoothly (i.e., no abnormal noise or oscillation).

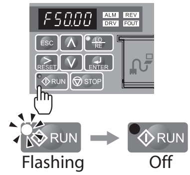
• The motor should accelerate and decelerate smoothly.

■ Operation Instructions

The following example illustrates a procedure to run the drive using the digital operator.

Note: Before starting the motor, set the frequency reference to 6 Hz. ***Refer to The Drive and Programming Mode on page 93*** for instructions.

Step		Display/Result
1. Turn on the power to the drive. The initial display appears.	⇒	
2. Press the  key to select LOCAL. The LO/RE LED will turn on.	⇒	
3. Press  to give the drive a run command. RUN will light and the motor will rotate at 6 Hz.	⇒	
4. Ensure the motor is rotating in the correct direction and no faults or alarms occur.	⇒	
5. If there is no error in step 4, press  to increase the frequency reference. Increase the frequency in 10 Hz increments verifying smooth operation results at all speeds. For each frequency monitor the drive output current (U1-03) through the LED operator to confirm the current is well below the motor rated current. Example: 6 Hz → 50 Hz/60 Hz. **Note:** ***Refer to Auto-Tuning Errors on page 182*** for help with errors that occur while Auto-Tuning the drive.		

Step		Display/Result
6. The drive should operate normally. Press STOP to stop the motor. RUN flashes until the motor comes to a complete stop.	⇒	

Note: To operate the drive, run (forward/reverse) command and frequency (or multi-step speed) reference are needed. Input these commands and references to the drive.

◆ Operating with the Load Connected

After performing a no-load test run, connect the motor and proceed to run the load.

■ Notes on Connected Machinery

- Clear the area around the motor.
- The motor should come to a complete stop without problems. Connect the machinery.
- Fasten all installation screws properly. Check that the motor and connected machinery are held in place.
- Confirm that the Fast-stop circuit or mechanical safety operate correctly.
- Prepare to press the STOP button in the case of an emergency.

■ Checklist Before Operation

- The motor should rotate in the proper direction.
- The motor should accelerate and decelerate smoothly.
- Check U1-03 to ensure there is not overcurrent.

If the application permits running the load in the reverse direction, try changing motor direction and the frequency reference and watch for abnormal motor oscillation or vibration. Correct the problem if hunting or oscillation occurs or if there are control-related problems. *Refer to Motor Hunting and Oscillation Control Parameters on page 175*.

■ Operating the Motor under Loaded Conditions

Test run the application similarly to the no-load test procedure when connecting the machinery to the motor.

◆ Verifying Parameter Settings and Backing Up Changes

Check changes to parameter settings as a result of Auto-Tuning using the Verify function. *Refer to Verifying Parameter Changes: Verify Menu on page 98*.

Save the verified parameter settings. Change the access level or set a password to the drive to prevent accidental modification of parameter settings.

■ Backing Up Parameter Values: o2-03

Performing the following procedure stores all parameters settings to drive memory where they can later be recalled if necessary. Set o2-03 to “1” to save parameter changes. This saves all parameter settings, and then returns o2-03 to 0. The drive can now “recall” the saved parameters by performing a “user-initialization” (A1-03 = 1110).

No.	Parameter Name	Description	Setting Range	Default Setting
o2-03	User Parameter Default Value	Allows storing of parameter settings as a User Initialization Selection. 0: Saved/Not set 1: Set Defaults - Saves current parameter settings as user default settings. 2: Clear All - Clears the currently saved user settings. After saving the user parameter set value, the items of 1110 (User Parameter Initialize) are displayed in A1-03 (User Parameter Default Value).	0 to 2	0
A1-03	Initialize Parameters	Selects a method to initialize the parameters. 0: No Initialize 1110: User Initialize (The user must first program and store desired settings using parameter o2-03) 2220: 2-Wire Initialization (parameter initialized prior to shipment) 3330: 3-Wire Initialization 5550: OPE4 Fault reset	0 to 5550	0

■ Parameter Access Level: A1-01

Setting the Access Level for “Operation only” (A1-01 = 0) allows the user to access parameters A1-□□ and U□-□□ only. Other parameters are not displayed.

Setting the Access Level for “User Parameters” (A1-01 = 1) allows the user to access parameters that have been previously saved as Preferred Parameters. This is helpful when displaying only the relevant parameters for a specific application.

No.	Parameter Name	Description	Setting Range	Default
A1-01	Access Level Selection	Selects which parameters are accessible via the digital operator. 0: Operation only (A1-01, -04, and -06 can be set and monitored. U parameters can be monitored) 1: User Parameters (Only those recently changed among application parameters A2-01 to -16 and A2-17 to -32 can be set and monitored) 2: Advanced Access Level (All parameters can be set and monitored)	0 to 2	2

No.	Parameter Name	Description	Setting Range	Default
A2-01 to A2-32	Preferred Parameters 1 to 32	Parameters selected by the user are stored to the User Parameter menu. This includes recently viewed parameters or parameters specifically selected for quick access. If parameter A2-33 is set to 1, recently viewed parameters will be listed between A2-17 and A2-32. Parameters A2-01 through A2-16 must be manually selected by the user. If A2-33 is set to 0, then recently viewed parameters will not be saved to the User Parameter group. The entire A2 parameter group is now available for manual programming.	b1-01 to o2-08	–
A2-33	Preferred Parameter Automatic Selection	0: Parameters A2-01 through A2-32 are reserved for the user to create a list of User Parameters. 1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quick access. The most recently changed parameter is registered in A2-17. The second most recently changed parameter is registered in A2-18.	0,1	1

■ Password Settings: A1-04, A1-05

The user can set a password to the drive to restrict access. The password is selected via parameter A1-05. The selected password must be entered in parameter A1-04 to unlock parameter access (i.e., parameter setting A1-04 must match the value programmed into A1-05). The following parameters cannot be viewed or edited until the value programmed into A1-04 correctly matches the value as programmed in parameter A1-05: A1-01, A1-02, A1-03, A1-06 and A2-01 through A2-33.

Note: Parameter A1-05 is hidden from view. To display A1-05, access parameter A1-04 and simultaneously depress the STOP key and the ∧ key.

■ Copy Function (Optional)

Using an option, the parameter setting can be copied to another drive making parameter restoration or the setup of multiple drives easy. The V1000 supports the following two options:

USB / Copy Unit

The copy unit is and external option connected to the drive to copy parameter settings from one drive to another. Furthermore it includes an USB adapter for connecting the drive to a PC.

CX-Drive

CX-Drive is a PC software tool for parameter management, monitoring and diagnosis. CX-Drive can be used to load / store / copy drive parameter settings. For details, refer to Help in the CX-Drive software.

◆ Jog Operation: FJOG/RJOG

Digital inputs programmed as Forward Jog (H1-☐☐ = 12) and Reverse Jog (H1-☐☐ = 13) will be Jog inputs that do not require a run command. Closing the terminal set for Forward Jog input will cause the drive to ramp to the Jog Frequency Reference (d1-17) in the forward direction. The Reverse Jog will cause the same action in the reverse direction. The Forward Jog and Reverse Jog can be set independently.

■ Jog Operation Parameters

No.	Name	Description	Setting Range	Default Setting
d1-17	Jog Frequency Reference	Frequency reference when: “Jog Frequency Reference” is selected via multi-function input terminals. “Jog Frequency Reference” has priority over “Multi-Step Speed Reference 1 to 16." Parameter d1-17 also sets the frequecny reference for the the multi-function input commands“Forward Jog” and “Reverse Jog.”	0.00 to 400.00	6.00 Hz

■ Selections for Digital Input Terminals S1 to S6 (H1-01 to H1-06)

Setting	Name
12	FJOG Command (ON: rotates forward at the Jog frequency set to d1-17)
13	RJOG Command (ON: rotates in reverse at the Jog frequency set to d1-17)

■ Connection Example for the Jog Function

In this example, H1-06 = 12 and d1-17 = 6.0 Hz.

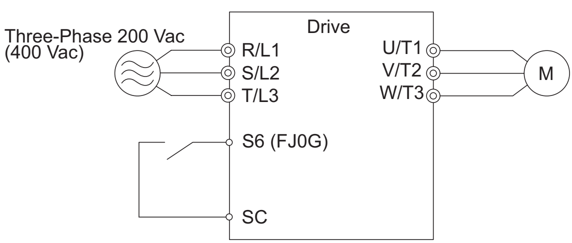


Figure 4.30 Jog Command from External Terminals

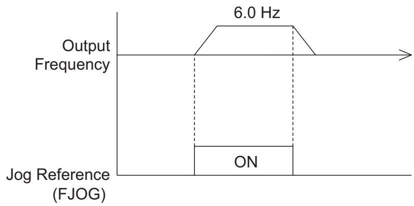


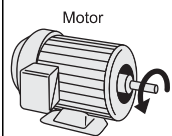
Figure 4.31 Jog Operation Pattern

■ Jog Operation Procedures

Set H1-06 (Multi-Function Contact Input Terminal S6 Function Selection) to “12” (FJOG command).

Step		Display/Result
1. Turn the power on to the drive. The initial display appears.	⇒	F 0.00 ALM REV DRV FOUT
2. Press the V key until the Parameter Setting menu appears.	⇒	PAr
3. Press ENTER to enter the Parameter Setting menu.	⇒	A1-01
4. Press Λ and > RESET until H1-06 appears.**Note:** Select a parameter between H1-01 and H1-06.	⇒	H1-06
5. Press ENTER and set the value for H1-06.	⇒	06
6. Press Λ and > RESET until “12” appears on the screen. **Note:** At jog operation in reverse run, set multi-function contact input to 13.	⇒	12
7. Press ENTER to save the setting.	⇒	End

To begin rotating the motor:

	Step		Display/Result
1.	Turn the power on to the drive. The initial display appears.**Note:** Set the drive to REMOTE.	⇒	
2.	With multi-function contact input terminal S6 closed, the motor rotates forwards at 6 Hz. **Note:** No run command is necessary when using the Jog frequency.	⇒	
3.	The drive will stop with terminal S6 open.	⇒	

◆ Multi-Step Speed Operation (4-Step Speed)

Select up to 17 preset references (including Jog reference) using five multi-function inputs S3 through S6. Four multi-step references can be selected using two multi-function inputs as illustrated in.

■ Multi-Step Speed Operation Parameters

No.	Name	Description
d1-01	Frequency Reference 1	Frequency reference. o1-03 determines the units, with Hz as the default.
d1-02	Frequency Reference 2	Frequency reference when multi-function input “Multi-Step Speed Reference 1" (H1-□□ = 3) is on. Setting unit: set by o1-03.
d1-03	Frequency Reference 3	Frequency reference when multi-function input “Multi-Step Speed Reference 2” (H1-□□ = 4) is on. Setting unit: set by o1-03.
d1-04	Frequency Reference 4	Frequency reference when multi-function input “Multi-Step Speed Reference 1, 2" (H1-□□ = 3 and 4) are both on. Setting unit: set by o1-03.

■ Digital Input

Terminal	Parameter	Setting	Contents
S5	H1-05	3	Multi-Step Speed Reference 1
S6	H1-06	4	Multi-Step Speed Reference 2

■ Wiring Example

Set up external switches SW1 and SW2.

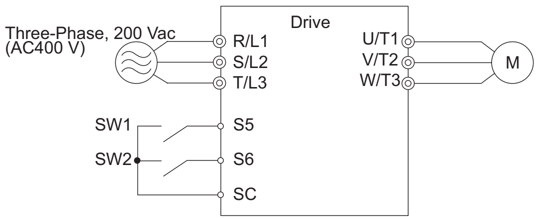


Figure 4.32 Control Terminals for 4 Multi-Step Speeds

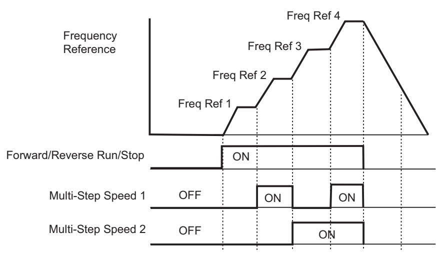
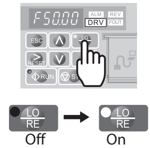
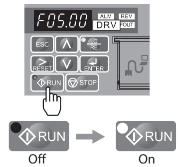
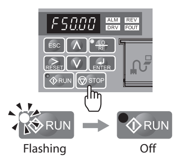


Figure 4.33 4-Step Speed Time Chart

■ Setting Procedure

Step			Display/Result
1.	Turn on the power to the drive. The initial display appears.	⇒	
2.	Set the frequencies listed below to the specified parameters: 1. d1-01 = 5 Hz: Step 1 2. d1-02 = 20 Hz: Step 2 3. d1-03 = 40 Hz: Step 3 4. d1-04 = 50 Hz: Step 4		
3.	Press the ESC key until the initial display appears.		
4.	DRV turns on.	⇒	

4.7 Test Run

Step		Display/Result
5. Press  to select LOCAL. The LO/RE light will turn on.	⇒	
6. Press  to run the motor at 5 Hz. The RUN light will turn on.	⇒	
7. With SW1closed, the drive runs the motor at Multi-Step Speed 2 (20 Hz).	⇒	
8. With SW1 open and SW2 closed, the drive runs the motor at Multi-Step 3 (40 Hz).	⇒	
9. With both SW1 and SW2 closed, the drive runs the motor at Multi-Step 4 (50 Hz).	⇒	
10. Press  to stop the drive. The RUN light will flash until the motor comes to a complete stop.	⇒	

Note: **1.** When the drive is in LOCAL mode or if the drive in REMOTE mode and the frequency reference source is set to operator keypad (b1-01/15 = 0), the value in d1-01 is used as frequency reference if speed step 1 is selected.
2. When the drive is in REMOTE mode and the frequency reference source is set to analog input (b1-01/ 15 = 1), the analog input A1 value becomes the frequency reference when speed step 1 is selected.
3. If the function "Auxiliary Frequence" is assigned to an analog input A2 (H3-10 = 2), the terminal A2 input value becomes the frequency reference when speed step 2 is selected.

4.8 Test Run Checklist

Review the checklist before performing a test run. Check each item that applies.

☑	No.	Checklist	Page
☐	1	Thoroughly read the manual before performing a test run.	
☐	2	Turn the power on.	*149*
☐	3	Set the voltage for the power supply to E1-01.	*133*

Check the items that correspond to the control mode being used.

WARNING! *Ensure start/stop and safety circuits are wired properly and in the correct state before energizing the drive. Failure to comply could result in death or serious injury from moving equipment. When programmed for 3-wire control, a momentary closure on terminal S1 may cause the drive to start.*

☑	No.	Checklist	Page
V/f Control (A1-02 = 0)			
☐	4	Select the best V/f pattern according to the application and motor characteristics. Example: If using a motor with a rated frequency of 50.0 Hz, set E1-03 to “0”.	*135*
☐	5	Perform Auto-Tuning for Energy Savings if using Energy Saving functions.	*151*
Open Loop Vector Control (A1-02 = 2)			
☐	6	Uncouple the load from the motor when performing Rotational Auto-Tuning.	*149*
☐	7	Perform Rotational Auto-Tuning.	*153*
☐	8	The following data entered during Auto-Tuning should match the information written on the motor nameplate: motor rated output power (kW) → T1-02 rated voltage (V) → T1-03 rated current (A) → T1-04 base frequency (Hz) → T1-05 number of motor poles → T1-06 motor rotations per minutes (r/min) → T1-07	*156*
PM Open Loop Vector Control (A1-02 = 5)			
☐	9	Set permanent motor parameters E5-01 through E5-24	*106*

4.8 Test Run Checklist

Proceed to the following checklist after checking items 4 through 9.

☑	No.	Checklist	Page
☐	10	The DRV should illuminate after giving a run command.	
☐	11	To give a run command and frequency reference from the LED Digital Operator, press LO/RE to set to LOCAL. The LO/RE key lights while LOCAL is displayed.	99
☐	12	If the motor rotates in the opposite direction during the test run, switch two of the drive output terminals (U/T1, V/T2, W/T3).	149
☐	13	Select the correct duty rating (C6-01) for the application.	130
☐	14	Set the correct values for the motor rated current (E2-01) and the motor protection selection (L1-01) to ensure motor thermal protection.	141
☐	15	If the run command and frequency reference are provided via the control circuit terminals, set the drive for REMOTE and be sure the LO/RE light is out.	99
☐	16	If the control circuit terminals should supply the frequency reference, select the correct voltage input signal level (0 to 10 V) or the correct current input signal level (4 to 20 mA or 0 to 20 mA).	99
☐	17	Set the proper voltage to terminal A1. (0 to 10 V)	120
☐	18	Set the proper current to terminal A2. (4 to 20 mA or 0 to 20 mA)	121
☐	19	When current input is used, set H3-09 to “2” (4 to 20 mA) or “3” (0 to 20 mA) and set H3-10 to “0”.	121
☐	20	When current input is used, switch the drive built-in DIP switch S1 from V-side (OFF) to I-side (ON).	121
☐	21	Set the minimum and maximum frequency references to the desired values. Make the following adjustments if the drive does not operate as expected: Gain adjustment: Set the maximum voltage/current signal and adjust the analog input gain (H3-03 for input A1, H3-11 for input A2) until the frequency reference value reaches the desired value. Bias adjustment: Set the minimum voltage/current signal and adjust the analog input bias (H3-04 for input A1, H3-12 for input A2) until the frequency reference value reaches the desired minimum value.	

5

Troubleshooting

This chapter provides descriptions of the drive faults, alarms, errors, related displays, and possible solutions. This chapter can also serve as a reference guide for tuning the drive during a trial run.

5.1 Section Safety

DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may illustrate drives without covers or safety shields to display details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not touch terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the drive input power is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

⚠ WARNING

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection and servicing must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Do not perform work on the drive while wearing loose clothing, jewelry, or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing and wear eye protection before beginning work on the drive.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

⚠ WARNING

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the drive matches the voltage of the incoming drive input power before applying power.

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire.

Attach the drive to metal or other noncombustible material.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

Do not allow unqualified personnel to use the product.

Failure to comply could result in damage to the drive or braking circuit.

Carefully review instruction manual TOBPC72060000 when connecting a braking option to the drive.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

OYMC is not responsible for modification of the product made by the user.

Check all the wiring after installing the drive and connecting other devices to ensure that all connections are correct.

Failure to comply could result in damage to the drive.

5.2 Motor Performance Fine Tuning

This section offers helpful information for counteracting oscillation, hunting, or other faults that occur while performing a trial run. Refer to the section below that corresponds to the motor control method used.

Note: This section describes parameters that are commonly edited. Consult OYMC or an OYMC sales representative for more information on detailed settings and fine-tuning the drive.

◆ V/f Motor Control Method Tuning

Table 5.1 Parameters for Tuning the Drive in V/f Motor Control Method

Problem	Parameter No.	Countermeasure	Default Value	Suggested Setting
• Motor hunting and oscillation at speeds between 10 and 40 Hz	Hunting Prevention Gain (n1-02)	• If insufficient motor torque relative to the size of the load causes hunting, reduce the setting. • When motor hunting and oscillation occur with a light load, increase the setting.	1.00	0.50 to 2.00
• Motor noise • Motor hunting and oscillation at speeds up to 40 Hz	Carrier Frequency Selection (C6-02)	• If the motor noise is too loud, increase the carrier frequency. • When motor hunting and oscillation occur at speeds up to 40 Hz, lower the carrier frequency. • The default setting for the carrier frequency depends on the drive capacity (o2-04) and the Drive Duty Selection (C6-01).	dep. on drive capacity	1 to A
• Poor torque or speed response • Motor hunting and oscillation	Torque Compensation Primary Delay Time (C4-02)	• If motor torque and speed response are too slow, decrease the setting. • If motor hunting and oscillation occur, increase the setting.	200 ms <1>	100 to 1000 ms
• Poor motor torque at speeds below 10 Hz • Motor hunting and oscillation	Torque Compensation Gain (C4-01)	• If motor torque is insufficient at speeds below 10 Hz, increase the setting. • If motor hunting and oscillation with a relatively light load, decrease the setting.	1.00	0.50 to 1.50
• Poor motor torque at low speeds • Motor instability at motor start	Mid Output Voltage A (E1-08) Minimum Output Voltage (E1-10)	• If torque is insufficient at speeds below 10 Hz, increase the setting. • If motor instability occurs at motor start, decrease the setting. **Note:** The recommended setting value is for 200 V class drives. Double this value when using a 400 V class drive.	E1-08: 16.0 V E1-10: 12.0 V <1>	Initial value ±5 V
• Poor speed precision	Slip Compensation Gain (C3-01)	• After setting the motor-rated current (E2-01), motor-rated slip (E2-02) and motor no-load current (E2-03), adjust the slip compensation gain (C3-01).	-	0.5 to 1.5

<1> Default settings change when the Control Method is changed (A1-02) or a different V/f pattern is selected using parameter E1-03. The default setting shown is for V/f Control.

Note: Use slip compensation to improve speed precision in V/f Control. First make sure that the proper values have been set for the motor rated current to E2-01, motor rated slip (E2-02), and motor no-load current (E2-03). Next, adjust the slip compensation gain set to C3-01 so that it is between 0.5 to 1.5.

◆ Open Loop Vector (OLV) Motor Control Method Tuning

Table 5.2 Parameters for Tuning the Drive in OLV Motor Control Method

Problem	Parameter No.	Countermeasure	Default Value	Suggested Setting
• Poor motor torque and speed response • Control motor hunting and oscillation at speeds between 10 and 40 Hz.	AFR Gain (n2-01)	• If motor torque and speed response are too slow, gradually decrease the setting by 0.05. • If motor hunting and oscillation occur, gradually increase the setting by 0.05.	1.00	0.50 to 2.00
• Poor motor torque and speed response • Control motor hunting and oscillation at speeds between 10 and 40 Hz.	AFR Time Constant 1 (n2-02)	• To improve motor torque speed response, gradually reduce this setting by 10 ms and check the performance. • If motor hunting and oscillation occur as a result of load inertia, gradually increase the setting by 50 ms and check the performance. **Note:** Ensure that n2-02 ≤ n2-03. When making adjustments to n2-02, set C4-02 (Torque Compensation Primary Delay Time Constant 1) accordingly.	50 ms	50 to 2000 ms
• Overvoltage trips when accelerating, decelerating, or during sudden speed or load changes.	AFR Time Constant 2 (n2-03)	• If overvoltage trips occur, gradually increase this setting by 50 ms. • If response is slow, gradually reduce this setting by 10 ms. **Note:** Ensure that n2-02 ≤ n2-03. When making adjustments to n2-03, increase the value of C4-06 (Torque Compensation Primary Delay Time 2) proportionally.	750 ms	750 to 2000 ms
	Torque Compensation Primary Delay Time Constant 2 (C4-06)	• If overvoltage trips occur, gradually increase this setting by 10 ms and check the performance. • If response is slow, gradually reduce this setting by 2 ms and check the performance. **Note:** Ensure that C4-02 ≤ C4-06. When changing C4-06 (Torque Compensation Primary Delay Time Constant 2), increase the value of n2-03 proportionally.	150 ms	150 to 750 ms

Problem	Parameter No.	Countermeasure	Default Value	Suggested Setting
• Poor motor torque and speed response • Motor hunting and oscillation.	Torque Compensation Primary Delay Time Constant 1 (C4-02)	• To improve motor torque speed response, gradually reduce this setting by 2 ms and check the performance. • If motor hunting and oscillation occur, gradually increase this setting by 10 ms. **Note:** Ensure that C4-02 ≤ C4-06. When making adjustments to C4-02, increase n2-02 (AFR Time Constant) proportionally.	20 ms <1>	20 to 100 ms
• Poor speed response and stability	Slip Compensation Primary Delay Time Constant (C3-02)	• If response is slow, gradually decrease the setting by 10 ms. • If speed is unstable, gradually increase the setting by 10 ms.	200 ms <1>	100 to 500 ms
• Poor speed precision	Slip Compensation Gain (C3-01)	• If speed is too slow, gradually increase the setting by 0.1 ms. • If speed is too fast, gradually decrease the setting by 0.1 ms.	1.0 <1>	0.5 to 1.5
• Motor noise • Control motor hunting and oscillation occur at speeds below 10 Hz.	Carrier Frequency Selection (C6-02)	• If there is too much motor noise, the carrier frequency is too high. • If motor hunting and oscillation occur at low speeds, reduce the carrier frequency. • The default setting for the carrier frequency depends on the drive capacity (o2-04) and Drive Duty Selection (C6-01).	dep. on drive capacity	0 to the default setting
• Poor motor torque at low speeds • Poor speed response • Motor instability at motor start.	Mid Output Voltage A (E1-08) Minimum Output Voltage (E1-10)	• If motor torque and speed response are too slow, increase the setting. • If the motor exhibits excessive instability at start-up, reduce the setting. **Note:** The default value is for 200 V class units. Double this value when using a 400 V class drive. When working with a relatively light load, increasing this value too much can create an excessively high of a torque reference.	E1-08: 12.0 V <1> E1-10: 2.5 V <1>	Initial ±2 V

<1> Default settings change when the Control Method is changed (A1-02) or a different V/f pattern is selected using parameter E1-03. The default setting shown is for V/f Control.

When using OLV Motor Control, leave the torque compensation gain (C4-01) at its default setting of 1.00. To increase speed precision during regeneration in OLV Motor Control, enable slip compensation during regeneration (C3-04 = “1”).

◆ Motor Hunting and Oscillation Control Parameters

In addition to the parameters discussed in *V/f Pattern Selection: E1-03 on page 134*, the following parameters indirectly affect motor hunting and oscillation.

Table 5.3 Parameters that Affect Control Performance in Applications

Name (Parameter No.)	Application
Dwell Function (b6-01 through b6-04)	Prevents motor speed loss by maintaining the output frequency when working with heavy loads or when there is powerful backlash on the machine side.
Accel/Decel Time (C1-01 through C1-11)	Adjusting accel and decel times will affect the torque presented to the motor during acceleration or deceleration.
S-Curve Characteristics (C2-01 through C2-04)	Prevents shock at the beginning and end of acceleration and deceleration.
Jump Frequency (d3-01 through d3-04)	Skips over the resonant frequencies of connected machinery.
Analog Filter Time Constant (H3-13)	Prevents fluctuation in the analog input signal due to noise.
Stall Prevention (L3-01 through L3-06, L3-11)	• Prevents motor speed loss and overvoltage. Used when the load is too heavy and also during sudden acceleration/deceleration. • Adjustment is not normally required because Stall Prevention is enabled as a default. Disable Stall Prevention during deceleration (L3-04 = “0”) when using a braking resistor.
Torque Limits (L7-01 through L7-04, L7-06, L7-07)	• Sets the maximum torque for Open Loop Vector Control. • Ensure that the drive capacity is greater than the motor capacity when increasing this setting. Be careful when reducing this value because motor speed loss may occur with heavy loads.

5.3 Drive Alarms, Faults, and Errors

◆ Types of Alarms, Faults, and Errors

Check the LED operator for information about possible faults if the drive or motor fails to operate. ***Refer to Using the Digital LED Operator on page 87***.

If problems occur that are not covered in this manual, contact the nearest OYMC representative with the following information:

- Drive model
- Software version
- Date of purchase
- Description of the problem

Table 5.4 contains descriptions of the various types of alarms, faults, and errors that may occur while operating the drive.

Contact OYMC or an OYMC representative in the event of drive failure.

Table 5.4 Types of Alarms, Faults, and Errors

Type	Drive Responses to Alarms, Faults, and Errors
Faults	• When the drive detects a fault: • The digital operator displays text that indicates the specific fault and the ALM indicator LED remains lit until the fault is reset. • The fault interrupts drive output and the motor coasts to a stop. • Depending on the setting, the drive and motor may stop via different methods than listed. • If a digital output is programmed for fault output (H2-☐☐ = E), it will close if a fault occurs. • When the drive detects a fault, it will remain inoperable until that fault has been reset. ***Refer to Fault Reset Methods on page 223***.
Minor Faults and Alarms	• When the drive detects an alarm or a minor fault: • The digital operator displays text that indicates the specific alarm or minor fault and the ALM indicator LED flashes. • The motor does not stop. • One of the multi-function contact outputs closes if set to be tripped by a minor fault (H2-☐☐ = 10), but not by an alarm. • The digital operator displays text indicating a specific alarm and ALM indicator LED flashes. • Remove the cause of an alarm or minor fault to automatically reset.
Operation Errors	• When parameter settings conflict with one another or do not match hardware settings (such as with an option card), it results in an operation error. • When the drive detects an operation error: • The digital operator displays text that indicates the specific error. • Multi-function contact outputs do not operate. • When the drive detects an operation error, it will not operate the motor until the error has been reset. Correct the settings that caused the operation error to reset.

Type	Drive Responses to Alarms, Faults, and Errors
Tuning Errors	• Tuning errors occur while performing Auto-Tuning. • When the drive detects a tuning error: • The digital operator displays text indicating the specific error. • Multi-function contact outputs do not operate. • Motor coasts to stop. • Remove the cause of the error and repeat the Auto-Tuning process.

◆ Alarm and Error Displays

■ Faults

When the drive detects a fault, the ALM indicator LEDs remain lit without flashing. If the LEDs flash, the drive has detected a minor fault or alarm. ***Refer to Minor Faults and Alarms on page 180*** for more information. An overvoltage situation trips both faults and minor faults, therefore it is important to note whether the LEDs remain lit or if the LEDs flash.

LED Operator Display		Name	Page
bUS	bUS	Option Communication Error	*183*
CE	CE	MEMOBUS/Modbus Communication Error	*183*
CF	CF	Control Fault	*184*
CoF	CoF	Current Offset Fault	*184*
CPF02	CPF02	A/D Conversion Error	*184*
CPF03	CPF03	PWM Data Fault	*184*
CPF06	CPF06	Drive specification mismatch during Terminal Board or Control Board replacement	*184*
CPF07	CPF07	Terminal Board Communication Fault	*185*
CPF08	CPF08	EEPROM Serial Communications Fault	*185*
CPF11	CPF11	RAM Fault	*185*

LED Operator Display		Name	Page
CPF22	CPF22	A/D Conversion Error	*186*
CPF23	CPF23	PWM Feedback Data Fault	*187*
CPF24	CPF24	Drive Capacity Signal Fault	*187*
dEv	dEv	Excessive Speed Deviation (for Simple V/f with PG)	*187*
EF0	EF0	Option Card External Fault	*187*
EF1 to EF6	EF1 to EF6	External Fault (input terminal S1 to S6)	*188*
FbH	FbH	Excessive PID Feedback	*188*
FbL	FbL	PID Feedback Loss	*189*
GF	GF	Ground Fault	*189*
LF	LF	Output Phase Loss	*189*

LED Operator Display		Name	Page
CPF12	CPF12	FLASH Memory Fault	185
CPF13	CPF13	Watchdog Circuit Exception	185
CPF14	CPF14	Control Circuit Fault	186
CPF16	CPF16	Clock Fault	186
CPF17	CPF17	Timing Fault	186
CPF18	CPF18	Control Circuit Fault	186
CPF19	CPF19	Control Circuit Fault	186
CPF20 or CPF21	CPF20 or CPF21	RAM Fault	186
		FLASH Memory Fault	186
		Watchdog Circuit Exception	186
		Clock Fault	186
oH3	oH3	Motor Overheat 1 (PTC input)	193
oH4	oH4	Motor Overheat 2 (PTC input)	193
oL1	oL1	Motor Overload	193
oL2	oL2	Drive Overload	194
oL3	oL3	Overtorque Detection 1	195
oL4	oL4	Overtorque Detection 2	195
oL5	oL5	Mechanical Weakening Detection 1	195
oL7	oL7	High Slip Braking OL	195
oPr	oPr	Operator Connection Fault	196

LED Operator Display		Name	Page
LF2	LF2	Output Open Phase	190
oC	oC	Overcurrent	190
oFA00	oFA00	Option Card Fault (port A)	191
oH	oH	Heatsink Overheat	192
oH1	oH1	Heatsink Overheat	192
PGo	PGo	PG Disconnect (for Simple V/f with PG)	198
rH	rH	Dynamic Braking Resistor	198
rr	rr	Dynamic Braking Transistor	199
SEr	SEr	Too Many Speed Search Restarts	199
STO	STO	Pull-Out Detection	199
UL3	UL3	Undertorque Detection 1	199
UL4	UL4	Undertorque Detection 2	200
UL5	UL5	Mechanical Weakening Detection 2	200
Uv1	Uv1	Undervoltage	200
Uv2	Uv2	Control Power Supply Undervoltage	201
Uv3	Uv3	Soft Charge Circuit Fault	201
oS	oS	Overspeed (for Simple V/f with PG)	196
ov	ov	Overvoltage	196
PF	PF	Input Phase Loss	197

Note: If faults CPF11 through CPF19 occur, the LED operator will display CPF00 or CPF11.

Troubleshooting

5

■ Minor Faults and Alarms

When a minor fault or alarm occurs, the ALM LED flashes and the text display shows an alarm code. A fault has occurred if the text remains lit and does not flash. *Refer to Alarm Detection on page 202*. An overvoltage situation, for example, can trigger both faults and minor faults. It is therefore important to note whether the LEDs remain lit or if the LEDs flash.

Table 5.5 Minor Fault and Alarm Displays

LED Operator Display		Name	Minor Fault Output (H2-□□ = 10)	Page
bb	bb	Drive Baseblock	No output	202
bUS	bUS	Option Card Communications Error	YES	202
CALL	CALL	Serial Communication Transmission Error	YES	203
CE	CE	MEMOBUS/Modbus Communication Error	YES	203
CrST	CrST	Can not Reset	YES	204
dEv	dEv	Excessive Speed Deviation (for Simple V/f with PG)	YES	204
dnE	dnE	Drive Disabled	YES	205
EF	EF	Run Command Input Error	YES	205
EF0	EF0	Option Card External Fault	YES	205
EF1 to EF6	EF1 to EF6	External Fault (input terminal S1 to S6)	YES	206
FbH	FbH	Excessive PID Feedback	YES	206
FbL	FbL	PID Feedback Loss	YES	206
Hbb	Hbb	Safe Disable Signal Input	YES	207
HbbF	HbbF	Safe Disable Signal Input	YES	207
SE	SE	MEMOBUS/Modbus Test Mode Fault	YES	
oL5	oL5	Mechanical Weakening Detection 1	YES	195
UL5	UL5	Mechanical Weakening Detection 2	YES	200

LED Operator Display		Name	Minor Fault Output (H2-□□ = 10)	Page
dWAL	dWAL	FBD’s Alarm	YES	*187*
HCA	HCA	Current Alarm	YES	*207*
oH	oH	Heatsink Overheat	YES	*208*
oH2	oH2	Drive Overheat	YES	*208*
oH3	oH3	Motor Overheat	YES	*208*
oL3	oL3	Overtorque 1	YES	*209*
oL4	oL4	Overtorque 2	YES	*209*
oS	oS	Overspeed (for Simple V/f with PG)	YES	*209*
ov	ov	Overvoltage	YES	*210*
PASS	PASS	MEMOBUS/Modbus Test Mode Complete	No output	*210*
PGo	PGo	PG Disconnect (for Simple V/f with PG)	YES	*211*
rUn	rUn	During Run 2, Motor Switch Command Input	YES	*211*
UL3	UL3	Undertorque 1	YES	*211*
UL4	UL4	Undertorque 2	YES	*211*
Uv	Uv	Undervoltage	YES	*212*

■ Operation Errors

Table 5.6 Operation Error Displays

LED Operator Display		Name	Page
oPE01	oPE01	Drive Unit Setting Error	*213*
oPE02	oPE02	Parameter Setting Range Error	*213*
oPE03	oPE03	Multi-Function Input Setting Error	*213*
oPE08	oPE08	Parameter Selection Error	*215*
oPE09	oPE09	PID Control Selection Error	*216*
oPE10	oPE10	V/f Data Setting Error	*216*

LED Operator Display		Name	Page
oPE04	oPE04	Terminal Board Mismatch Error	214
oPE05	oPE05	Run Command Selection Error	215
oPE07	oPE07	Multi-Function Analog Input Selection Error	215
oPE11	oPE11	Carrier Frequency Setting Error	216
oPE13	oPE13	Pulse Train Monitor Selection Error	217
oPE14	oPE14	Application setup error	217

■ Auto-Tuning Errors

Table 5.7 Auto-Tuning Error Displays

LED Operator Display		Name	Page
Er-01	Er-01	Motor Data Error	218
Er-02	Er-02	Alarm	218
Er-03	Er-03	STOP button Input	218
Er-04	Er-04	Line-to-Line Resistance Error	219
Er-05	Er-05	No-Load Current Error	219
Er-08	Er-08	Rated Slip Error	219
Er-09	Er-09	Acceleration Error	219
Er-11	Er-11	Motor Speed Error	220
Er-12	Er-12	Current Detection Error	220
End1	End1	Excessive V/f Setting	220
End2	End2	Motor Iron Core Saturation Coefficient Error	220
End3	End3	Rated Current Setting Alarm	221

5.4 Fault Detection

◆ Fault Displays, Causes, and Possible Solutions

Table 5.8 Detailed Fault Displays, Causes, and Possible Solutions

<table>
<tr><th colspan="2">LED Operator Display</th><th>Fault Name</th></tr>
<tr><td rowspan="2">bUS</td><td rowspan="2">bUS</td><td>Option Communication Error</td></tr>
<tr><td>• After establishing initial communication, the connection was lost.
• Only detected when the run command frequency reference is assigned to an option card.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">No signal received from the PLC.</td><td rowspan="2">• Check for faulty wiring.
• Correct the wiring.
• Check for loose wiring and short circuits. Repair as needed.</td></tr>
<tr><td colspan="2">The communication cable is faulty or a short circuit exists.</td></tr>
<tr><td colspan="2">A communications data error occurred due to noise.</td><td>• Check the various options available to minimize the effects of noise.
• Counteract noise in control circuit, main circuit, and ground wiring.
• Ensure that other equipment such as switches or relays do not cause noise and use surge suppressors if required.
• Use cables recommended by OYMC or another type of shielded line. Ground the shield on the controller side or on the drive input power side.
• Separate all wiring for communications devices from drive input power lines. Install a noise filter to the input side of the drive input power.</td></tr>
<tr><td colspan="2">The option card is damaged.</td><td>• Replace the option card if there are no problems with the wiring and the error continues to occur.</td></tr>
<tr><td colspan="2">The option card is not properly connected to the drive.</td><td>• The connector pins on the option card are not properly lined up with the connector pins on the drive.
• Reinstall the option card.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Fault Name</th></tr>
<tr><td rowspan="2">CE</td><td rowspan="2">CE</td><td>MEMOBUS/Modbus Communication Error</td></tr>
<tr><td>Control data was not received for the CE detection time set to H5-09.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">Faulty communications wiring, or a short circuit exists.</td><td>• Check for faulty wiring.
• Correct the wiring.
• Check for loose wiring and short circuits. Repair as needed.</td></tr>
<tr><td colspan="2">A communications data error occurred due to noise.</td><td>• Check the various options available to minimize the effects of noise.
• Counteract noise in control circuit, main circuit, and ground wiring.
• Ensure that other equipment such as switches or relays do not cause noise and use surge suppressors if required.
• Use OYMC-recommended cables, or another type of shielded line. Ground the shield on the controller side or on the drive input power side.
• Separate all wiring for communications devices from drive input power lines. Install a noise filter to the input side of the drive input power.</td></tr>
</table>

LED Operator Display		Fault Name
CF	CF	Control Fault
		A torque limit was reached continuously for three seconds or longer during a ramp to stop while in Open Loop Vector Control.
Cause		**Possible Solution**
Motor parameters are not set properly.		Check the motor parameter settings and repeat Auto-Tuning.
Torque limit is too low.		Set the torque limit to the most appropriate setting (L7-01 through L7-04).
Load inertia is too big.		• Adjust the deceleration time (C1-02, -04, -06, -08). • Set the frequency to the minimum value and interrupt the run command when the drive finishes decelerating.
LED Operator Display		**Fault Name**
CoF	CoF	Current Offset Fault
		There is a problem with the current detection circuit or the drive attempted to start a coasting PM motor.
Cause		**Possible Solution**
While the drive automatically adjusted the current offset, the calculated value exceeded the allowable setting range. This problem may occur when attempting to restart a coasting PM motor.		Enable Speed Search at start (b3-01 = 1). Use the multi-function terminals to execute External Speed Search 1 and 2 (H1-☐☐. = 61 or 62). **NOTE:** When using a PM motor, both External Speed Search 1 and 2 perform the same operation.
LED Operator Display		**Fault Name**
CPF02	CPF02	A/D Conversion Error
		An A/D conversion error occurred.
Cause		**Possible Solution**
Control circuit is damaged.		Cycle power to the drive. If the problem continues, replace the drive.
Control circuit terminals have shorted out (+V, AC).		• Check for wiring errors along the control circuit terminals. • Correct the wiring.
		Check the resistance of the speed potentiometer and related wiring.
Control terminal input current has exceeded allowable levels.		• Check the input current. • Reduce the current input to control circuit terminal (+V) to 20 mA.
LED Operator Display		**Fault Name**
CPF03	CPF03	PWM Data Error
		There is a problem with the PWM data.
Cause		**Possible Solution**
Drive hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF06	CPF06	EEPROM Data Error
		There is an error in the data saved to EEPROM.

Cause		Possible Solution
Control circuit is damaged.		Cycle power to the drive. If the problem continues, replace the drive.
The power supply was switched off when parameter were written (e.g. using a communications option card).		Reinitialize the drive (A1-03).
LED Operator Display		**Fault Name**
CPF07	CPF07	Terminal Board Communications Error
		A communication error occurred at the terminal board.
Cause		**Possible Solution**
There is a fault connection between the terminal board and control board.		Turn the power off and reconnect the control circuit terminals.
LED Operator Display		**Fault Name**
CPF08	CPF08	EEPROM Serial Communication Fault
		EEPROM communications are not functioning properly.
Cause		**Possible Solution**
Terminal board or control board is not connected properly.		Turn the power off and check the control terminal connections.
LED Operator Display		**Fault Name**
CPF11	CPF11	RAM Fault
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF12	CPF12	FLASH Memory Fault
		Problem with the ROM (FLASH memory).
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF13	CPF13	Watchdog Circuit Exception
		Self-diagnostics problem.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.

LED Operator Display		Fault Name
CPF14	CPF14	Control Circuit Fault
		CPU error (CPU operates incorrectly due to noise, etc.)
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF16	CPF16	Clock Fault
		Standard clock error.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF17	CPF17	Timing Fault
		A timing error occurred during an internal process.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF18	CPF18	Control Circuit Fault
		CPU error (CPU operates incorrectly due to noise, etc.)
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF19	CPF19	Control Circuit Fault
		CPU error (CPU operates incorrectly due to noise, etc.)
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF20 or CPF21	CPF20 or CPF21	One of the following faults occurred: RAM fault, FLASH memory error, watchdog circuit exception, clock error
		• RAM fault. • FLASH memory error (ROM error). • Watchdog circuit exception (self-diagnostic error). • Clock error.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF22	CPF22	A/D Conversion Fault
		A/D conversion error.

Cause		Possible Solution
Control circuit is damaged.		• Cycle power to the drive. ***Refer to Diagnosing and Resetting Faults on page 222***. • If the problem continues, replace the drive.
LED Operator Display		**Fault Name**
CPF23	CPF23	PWM Feedback Fault
		PWM feedback error.
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
CPF24	CPF24	Drive Capacity Signal Fault
		Entered a capacity that does not exist. (Checked when the drive is powered up.)
Cause		**Possible Solution**
Hardware is damaged.		Replace the drive.
LED Operator Display		**Fault Name**
dEu	dEv	Speed Deviation (for Simple V/f with PG)
		According to the pulse input (RP), the speed deviation is greater than the setting in F1-10 for longer than the time set to F1-11.
Cause		**Possible Solution**
Load is too heavy.		Reduce the load.
Acceleration and deceleration times are set too short.		Increase the acceleration and deceleration times (C1-01 through C1-08).
The load is locked up.		Check the machine.
Parameters are not set appropriately.		Check the settings of parameters F1-10 and F1-11.
Motor brake engaged.		Ensure the motor brake releases properly.
LED Operator Display		**Fault Name**
dWFL	dWFL	FBD's Fault
dWAL	dWAL	FBD's fault
Cause		**Possible Solution**
Fault output by a FBD's program		• Correct whatever caused the fault to occur.
LED Operator Display		**Fault Name**
EF0	EF0	Option Card External Fault
		An external fault condition is present.
Cause		**Possible Solution**
An external fault was received from the PLC with F6-03 = 3 "alarm only" (the drive continued to run).		• Remove the cause of the external fault. • Remove the external fault input from the PLC.

Problem with the PLC program.		Check the PLC program and correct problems.
LED Operator Display		**Fault Name**
EF1	EF1	External Fault (input terminal S1)
		External fault at multi-function input terminal S1.
EF2	EF2	External Fault (input terminal S2)
		External fault at multi-function input terminal S2.
EF3	EF3	External Fault (input terminal S3)
		External fault at multi-function input terminal S3.
EF4	EF4	External Fault (input terminal S4)
		External fault at multi-function input terminal S4.
EF5	EF5	External Fault (input terminal S5)
		External fault at multi-function input terminal S5.
EF6	EF6	External Fault (input terminal S6)
		External fault at multi-function input terminal S6.
Cause		**Possible Solution**
An external device has tripped an alarm function.		Remove the cause of the external fault and reset the fault.
Wiring is incorrect.		• Ensure the signal lines have been connected properly to the terminals assigned for external fault detection (H1-☐☐ = 20 to 2F). • Reconnect the signal line.
Incorrect setting of multi-function contact inputs.		• Check if the unused terminals set for H1-☐☐ = 20 to 2F (External Fault). • Change the terminal settings.
LED Operator Display		**Fault Name**
Err	Err	EEPROM Write Error
		Data does not match the EEPROM being written to.
Cause		**Possible Solution**
-		• Press the ENTER button. • Correct the parameter settings. • Cycle power to the drive. ***Refer to Diagnosing and Resetting Faults on page 222***.
LED Operator Display		**Fault Name**
FbH	FbH	Excessive PID Feedback
		PID feedback input is greater than the level set b5-36 for longer than the time set to b5-37. To enable fault detection, set b5-12 = “2” or “5”.
Cause		**Possible Solution**
Parameters are not set appropriately.		Check the settings of parameters b5-36 and b5-37.
Wiring for PID feedback is incorrect.		Correct the wiring.

There is a problem with the feedback sensor.		• Check the sensor on the control side. • Replace the sensor if damaged.
LED Operator Display		**Fault Name**
FbL	FbL	PID Feedback Loss
		This fault occurs when PID Feedback Loss Detection is programmed to fault (b5-12 = 2) and the PID Feedback < PID Feedback Loss Detection Level (b5-13) for the PID Feedback Loss Detection Time (b5-14).
Cause		**Possible Solution**
Parameters are not set appropriately.		Check the settings of parameters b5-13 and b5-14.
Wiring for PID feedback is incorrect.		Correct the wiring.
There is a problem with the feedback sensor.		Check the sensor on the controller side. If damaged, replace the sensor.
LED Operator Display		**Fault Name**
GF	GF	Ground Fault
		• Current shorted to ground exceeded 50% of rated current on output side of the drive. • Setting L8-09 to 1 enables ground fault detection in models 5.5 kW or larger.
Cause		**Possible Solution**
Motor insulation is damaged.		• Check the insulation resistance of the motor. • Replace the motor.
A damaged motor cable is creating a short circuit.		• Check the motor cable. • Remove the short circuit and turn the power back on.
		• Check the resistance between the cable and the ground terminal ⏚. • Replace the cable.
The leakage current at the drive output is too high.		• Reduce the carrier frequency. • Reduce the amount of stray capacitance.
The drive started to run during Current Offset Fault or while coasting to a stop.		• The value set exceeds the allowable setting range while the drive automatically adjusts the current offset (this happens only attempting to restart a PM motor that is coasting to stop). • Enable Speed Search at start (b3-01 = 1). • Perform Speed Search 1 or 2 (H1-xx = 61 or 62) via one of the external terminals. Note: Speed Search 1 and 2 are the same when using PM OLV.
Hardware problem.		• Replace the drive.
LED Operator Display		**Fault Name**
LF	LF	Output Phase Loss
		• Phase loss on the output side of the drive. • Phase Loss Detection is enabled when L8-07 is set to “1” or “2”.
Cause		**Possible Solution**
The output cable is disconnected.		• Check for wiring errors and ensure the output cable is connected properly. • Correct the wiring.

<table>
<tr><td colspan="2">The motor winding is damaged.</td><td>• Check the resistance between motor lines.
• Replace the motor if the winding is damaged.</td></tr>
<tr><td colspan="2">The output terminal is loose.</td><td>• Apply the tightening torque specified in this manual to fasten the terminals. *Refer to Wire Size on page 68*.</td></tr>
<tr><td colspan="2">The motor being used is less than 5% of the drive rated current.</td><td>Check the drive and motor capacities.</td></tr>
<tr><td colspan="2">An output transistor is damaged.</td><td>Replace the drive.</td></tr>
<tr><td colspan="2">A single phase motor is being used.</td><td>The drive being used cannot operate a single phase motor.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Fault Name</th></tr>
<tr><td rowspan="2">LF2</td><td rowspan="2">LF2</td><td>Output current imbalance</td></tr>
<tr><td>One or more of the phases in the output current is lost.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">Phase loss has occurred on the output side of the drive.</td><td>• Check for faulty wiring or poor connections on the output side of the drive.
• Correct the wiring.</td></tr>
<tr><td colspan="2">Terminal wires on the output side of the drive are loose.</td><td>Apply the tightening torque specified in this manual to fasten the terminals. *Refer to Wire Size on page 68*.</td></tr>
<tr><td colspan="2">No signal displays from the gate driver board.</td><td>Replace the drive. Contact OYMC or an OYMC representative for assistance.</td></tr>
<tr><td colspan="2">Motor impedance or motor phases are uneven.</td><td>• Measure the line-to-line resistance for each motor phase. Ensure all values are the same.
• Replace the motor. Contact OYMC or an OYMC representative for assistance.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Fault Name</th></tr>
<tr><td rowspan="2">oC</td><td rowspan="2">oC</td><td>Overcurrent</td></tr>
<tr><td>Drive sensors have detected an output current greater than the specified overcurrent level.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">The motor has been damaged due to overheating or the motor insulation is damaged.</td><td>Check the insulation resistance.
Replace the motor.</td></tr>
<tr><td colspan="2" rowspan="2">One of the motor cables has shorted out or there is a grounding problem.</td><td>• Check the motor cables.
• Remove the short circuit and power the drive back up.</td></tr>
<tr><td>• Check the resistance between the motor cables and the ground terminal ⏚.
• Replace damaged cables.</td></tr>
<tr><td colspan="2">The load is too heavy.</td><td>• Measure the current flowing into the motor.
• Replace the drive with a larger capacity unit if the current value exceeds the rated current of the drive.
• Determine if there is sudden fluctuation in the current level.
• Reduce the load to avoid sudden changes in the current level or switch to a larger drive.</td></tr>
</table>

The acceleration or deceleration times are too short.	• Calculate the torque needed during acceleration relative to the load inertia and the specified acceleration time. • If the right amount of torque cannot be set, make the following changes: • Increase the acceleration time (C1-01, -03, -05, -07) • Increase the S-curve characteristics (C2-01 through C2-04) • Increase the capacity of the drive.
The drive is attempting to operate a specialized motor or a motor larger than the maximum size allowed.	• Check the motor capacity. • Ensure that the rated capacity of the drive is greater than or equal to the capacity rating found on the motor nameplate.
Magnetic contactor (MC) on the output side of the drive has turned on or off.	Set up the operation sequence so that the MC is not tripped while the drive is outputting current.
V/f setting is not operating as expected.	• Check the ratios between the voltage and frequency. • Set parameter E1-04 through E1-10 appropriately. Set E3-04 through E3-10 when using a second motor. • Lower the voltage if it is too high relative to the frequency.
Excessive torque compensation.	• Check the amount of torque compensation. • Reduce the torque compensation gain (C4-01) until there is no speed loss and less current.
Drive fails to operate properly due to noise interference.	• Review the possible solutions provided for handling noise interference. • Review the section on handling noise interference and check the control circuit lines, main circuit lines and ground wiring.
Overexcitation gain is set too high.	• Check if fault occurs simultaneously to overexcitation function operation. • Consider motor flux saturation and reduce the value of n3-13 (Overexcitation Deceleration Gain).
Run command applied while motor was coasting.	• Enable Speed Search at start (b3-01 = “1”). • Program the Speed Search command input through one of the multi-function contact input terminals (H1-☐☐ = “61” or “62”).
The wrong motor code has been entered for PM Open Loop Vector (Yaskawa motors only).	Enter the correct motor code to E5-01 to indicate that a PM motor is connected.
The motor control method and motor do not match.	• Check which motor control method the drive is set to (A1-02). • For IM motors, set A1-02 = “0” or “2”. • For PM motors, set A1-02 = “5”.
The motor cable is too long.	Use a larger drive.

LED Operator Display		Fault Name
oFA00	oFA00	Option Card Fault (Port A) The option card is incompatible with the drive.
Cause		**Possible Solution**
The option card is incompatible with the drive.		Use a compatible option card.

LED Operator Display		Fault Name
oFA01	oFA01	Option Card Fault (Port A) Replace the option card.

Troubleshooting 5

Cause		Possible Solution
The option card is not connected properly to the drive.		Turn the power off and reconnect the option card.
LED Operator Display		**Fault Name**
oFA03	oFA03	Option Card Fault (port A)
		Option card self-diagnostic error
oFA04	oFA04	Option Card Fault (port A)
		An error occurred attempting to write to the option card memory.
oFA30 thru oFA43	oFA30 thru oFA43	Option Card Fault (port A)
		Communication ID error
Cause		**Possible Solution**
Option card or hardware is damaged.		Replace the option card. Contact OYMC or an OYMC representative for consultation.
LED Operator Display		**Fault Name**
oH	oH	Heatsink Overheat
		The temperature of the heatsink exceeded the value set to L8-02 (90-100°C). Default value for L8-02 is determined by drive capacity (o2-04).
Cause		**Possible Solution**
Surrounding temperature is too high.		• Check the temperature surrounding the drive. Verify temperature is within drive specifications. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool the surrounding area. • Remove anything near the drive that might be producing excessive heat.
Load is too heavy.		• Measure the output current. • Decrease the load. • Lower the carrier frequency (C6-02).
Internal cooling fan is stopped.		• Replace the cooling fan. *Refer to Cooling Fan Replacement on page 250*. • After replacing the drive, reset the cooling fan maintenance parameter (o4-03 = “0”).
LED Operator Display		**Fault Name**
oH1	oH1	Overheat 1 (Heatsink Overheat)
		The temperature of the heatsink has exceeded the value set to L8-02 (100-110°C). Default value for L8-02 is determined by drive capacity (o2-04).
Cause		**Possible Solution**
Surrounding temperature is too hot.		• Check the temperature surrounding the drive. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool the surrounding area. • Remove anything near the drive that might be producing excessive heat.
Load is too heavy.		• Measure the output current. • Reduce the load. • Lower the carrier frequency (C6-02).

The internal cooling fan has reached its performance life or has malfunctioned.		• Check the maintenance time for the cooling fan (U4-04). • If U4-04 exceeds 90%, replace the cooling fan. ***Refer to Cooling Fan Replacement on page 250***. • After replacing fan, reset the fan maintenance time (o4-03 = "0").
Current flowing to control circuit terminal +V exceeded the tolerance level.		• Check the current level of the terminal. • Set the current to the control circuit terminal to be 20 mA or less.
LED Operator Display		**Fault Name**
oH3	oH3	Motor Overheat Alarm (PTC Input)
		• The motor overheat signal to analog input terminal A1 or A2 exceeded the alarm detection level. • Detection requires multi-function analog input H3-02 or H3-10 be set to "E".
Cause		**Possible Solution**
Motor has overheated		• Check the size of the load, the accel/decel times and the cycle times. • Decrease the load. • Increase the acceleration and deceleration times (C1-01 through C1-08).
		• Adjust the preset V/f pattern (E1-04 through E1-10). This will mainly involve reducing E1-08 and E1-10. • Be careful not to lower E1-08 and E1-10 excessively, as this reduces load tolerance at low speeds.
		• Check the motor-rated current. • Enter the motor-rated current as indicated on the motor nameplate (E2-01). • Ensure the motor cooling system is operating normally. • Repair or replace the motor cooling system.
LED Operator Display		**Fault Name**
oH4	oH4	Motor Overheat Fault (PTC Input)
		• The motor overheat signal to analog input terminal A1 or A2 exceeded the fault detection level. • Detection requires that multi-function analog input H3-02 or H3-10 = "E".
Cause		**Possible Solution**
Motor has overheated.		• Check the size of the load, the accel/decel times and the cycle times. • Decrease the load. • Increase the acceleration and deceleration times (C1-01 through C1-08).
		• Adjust the preset V/f pattern (E1-04 through E1-10). This will mainly involve reducing E1-08 and E1-10.Be careful not to lower E1-08 and E1-10 excessively because this reduces load tolerance at low speeds
		• Check the motor-rated current. • Enter the motor-rated current as indicated on the motor nameplate (E2-01). • Ensure the motor cooling system is operating normally. • Repair or replace the motor cooling system.
LED Operator Display		**Fault Name**
oL1	oL1	Motor Overload
		The electrothermal sensor tripped overload protection.

Cause	Possible Solution
Load is too heavy.	Reduce the load.
Cycle times are too short during acceleration and deceleration.	Increase the acceleration and deceleration times (C1-01 through C1-08).
• Drive overloaded at low speeds. • Overload may occur at low speeds when using a general-purpose motor, even if operating within the rated current limitation.	• Reduce the load. • Increase the speed. • If the drive is supposed to operate at low speeds, either increase the motor capacity or use a motor specifically designed to operate with the drive.
Although a special type of motor is being used, the motor protection selection is set for a general-purpose motor (L1-01 = 1).	Set L1-01 = “2”.
Voltage is too high for the V/f characteristics.	• Adjust the user set V/f patterns (E1-04 through E1-10). Parameters E1-08 and E1-10 may need to be reduced. • If E1-08 and E1-10 are set too high, there may be very little load tolerance at low speed.
The wrong motor-rated current is set to E2-01.	• Check the motor-rated current. • Enter the value written on the motor nameplate to parameter E2-01.
The maximum frequency for the drive input power is set too low.	• Check the rated frequency indicated on the motor nameplate. • Enter the rated frequency to E1-06 (Base Frequency).
Multiple motors are running off the same drive.	Disable the Motor Protection function (L1-01 = “0”) and install a thermal relay to each motor.
The electrical thermal protection characteristics and motor overload characteristics do not match.	• Check the motor characteristics. • Correct the value set to L1-01 (Motor Protection Function). • Install an external thermal relay.
The electrical thermal relay is operating at the wrong level.	• Check the current rating listed on the motor nameplate. • Check the value set for the motor-rated current (E2-01).
Cause	**Possible Solution**
Overexcitation current is enabled.	• Overexcitation is a potential serious danger to the motor. • Reduce the excitation deceleration gain (n3-13). • Set L3-04 (Stall Prevention during Deceleration) to a value other than 4. • Disable overexcitation (n3-23 = “0”).
Speed Search related parameters are not set to the proper values.	• Check values set to Speed Search related parameters. • Adjust the Speed Search current and Speed Search deceleration times (b3-02 and b3-03 respectively). • After Auto-Tuning, enable Speed Estimation Type Search (b3-24 = “1”).
Output current fluctuation due to input phase loss.	Check the power supply for phase loss.

LED Operator Display		Fault Name
oL2	oL2	Drive Overload
		The thermal sensor of the drive triggered overload protection.
Cause		**Possible Solution**
Load is too heavy.		Reduce the load.

Cycle times are too short during acceleration and deceleration.		Increase the settings for the acceleration and deceleration times (C1-01 through C1-08).
Voltage is too high for the V/f characteristics.		• Adjust the preset V/f pattern (E1-04 through E1-10). This will mainly involve reducing E1-08 and E1-10. • Be careful not to lower E1-08 and E1-10 excessively because this reduces load tolerance at low speeds.
Drive capacity is too small.		Replace the drive with a larger model.
Overload occurred when operating at low speeds.		• Reduce the load when operating at low speeds. • Replace the drive with a model that is one frame size larger. • Lower the carrier frequency (C6-02).
Excessive torque compensation.		Reduce the torque compensation gain (C4-01) until there is no speed loss but less current.
Speed Search related parameters are not set correctly.		• Check the settings for all Speed Search related parameters. • Adjust the current used during Speed Search and the Speed Search deceleration time (b3-03 and b3-02 respectively). • After Auto-Tuning the drive, enable the Speed Search Estimation Type (b3-24 = “1”).
Output current fluctuation due to input phase loss.		Check the power supply for phase loss.
LED Operator Display		**Fault Name**
oL3	oL3	Overtorque Detection 1
		The current has exceeded the value set for torque detection (L6-02) for longer than the allowable time (L6-03).
Cause		**Possible Solution**
Parameter settings are not appropriate for the type of load.		Check the settings of parameters L6-02 and L6-03.
There is a fault on the machine side (e.g., the machine is locked up).		Check the status of the load. Remove the cause of the fault.
LED Operator Display		**Fault Name**
oL4	oL4	Overtorque Detection 2
		The current has exceeded the value set for Overtorque Detection 2 (L6-05) for longer than the allowable time (L6-06).
Cause		**Possible Solution**
Parameter settings are not appropriate for the type of load.		Check the settings of parameters L6-05 and L6-06.
There is a fault on the machine side (e.g., the machine is locked up).		Check the status of the load. Remove the cause of the fault.
LED Operator Display		**Fault Name**
oL7	oL7	High-Slip Braking OL
		The output frequency stayed constant for longer than the time set in n3-04 during High-slip Braking.

<table>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">Excessive load inertia.</td><td rowspan="3">• Reduce deceleration times using parameters C1-02, -04, -06 and -08 in applications that do not use High-slip Braking.
• Use a braking resistor to shorten deceleration time.</td></tr>
<tr><td colspan="2">Motor is driven by the load.</td></tr>
<tr><td colspan="2">Something on the load side is restricting deceleration.</td></tr>
<tr><td colspan="2">The overload time during High-slip Braking is too short.</td><td>• Increase parameter n3-04 (High-slip Braking Overload Time).
• Install a thermal relay and increase the parameter setting of n3-04 to the maximum value.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Fault Name</th></tr>
<tr><td rowspan="2">oPr</td><td rowspan="2">oPr</td><td>Digital Operator Connection Fault</td></tr>
<tr><td>• The LCD operator has been disconnected from the drive. Note: An oPr fault will occur when all of the following conditions are true:
• Output is interrupted when the operator is disconnected (o2-06 = 1).
• The run command is assigned to the LCD operator (b1-02 = 0 and LOCAL has been selected).</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">LCD operator is not properly connected to the drive.</td><td>• Check the connection between the LCD operator and the drive.
• Replace the cable if damaged.
• Turn off the drive input power and disconnect the LCD operator. Next reconnect the operator and turn the drive input power back on.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Fault Name</th></tr>
<tr><td rowspan="2">oS</td><td rowspan="2">oS</td><td>Overspeed (Simple V/f with PG)</td></tr>
<tr><td>Pulse input (RP) indicates that motor speed feedback exceeded F1-08 setting.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">Overshoot or undershoot is occurring.</td><td>• Adjust the gain by using the pulse train input parameters (H6-02 through H6-05).
• Increase the settings for C5-01 (Speed Control Proportional Gain 1) and reduce C5-02 (Speed Control Integral Time 1).</td></tr>
<tr><td colspan="2">Incorrect PG pulse settings.</td><td>Set the H6-02 (Pulse Train Input Scaling) = 100%, the number of pulses during maximum motor revolutions.</td></tr>
<tr><td colspan="2">Inappropriate parameter settings.</td><td>Check the setting for the overspeed detection level and the overspeed detection time (F1-08 and F1-09).</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Fault Name</th></tr>
<tr><td rowspan="2">ou</td><td rowspan="2">ov</td><td>Overvoltage</td></tr>
<tr><td>Voltage in the DC bus has exceeded the overvoltage detection level.
For 200 V class: approximately 410 V
For 400 V class: approximately 820 V (740 V when E1-01 is less than 400)</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">Deceleration time is too short and regenerative energy flows from the motor into the drive.</td><td>• Increase the deceleration time (C1-02, -04, -06, -08).
• Install a braking resistor or a dynamic braking resistor unit.
• Enable stall prevention during deceleration (L3-04 = “1”). Stall prevention is enabled as the default setting.</td></tr>
</table>

Acceleration time is too short.	• Check if sudden drive acceleration triggers an overvoltage alarm. • Increase the acceleration time. • Use longer S-curve acceleration and deceleration times.
Excessive braking load.	The braking torque was too high, causing regenerative energy to charge the DC bus. Reduce the braking torque, use a braking option, or lengthen decel time.
Surge voltage entering from the drive input power.	Install a DC reactor. **Note:** Voltage surge can result from thyristor convertor and phase advancing capacitor using same drive main input power supply.
Ground fault in the output circuit causing the DC bus capacitor to overcharge.	• Check the motor wiring for ground faults. • Correct grounding shorts and turn the power back on.
Improper Setting of Speed Search related parameters. (Includes Speed Search after a momentary power loss and after a fault restart.)	• Check the settings for Speed Search related parameters. • Enable Speed Search Retry function (b3-19 greater than or equal to 1 to 10). • Adjust the current level during Speed Search and the deceleration time (b3-02 and b3-03 respectively). • Perform Line-to-Line Resistance Auto-Tuning and then enable Speed Estimation Type Speed Search (b3-24 = “1”).
Excessive regeneration when overshoot occurs after acceleration.	Enable the Overvoltage Suppression function (L3-11 = “1”). Lengthen the S-curve at acceleration end.
Drive input power voltage is too high.	• Check the voltage. • Lower drive input power voltage within the limits listed in the specifications.
The dynamic braking transistor is damaged.	Replace the drive.
The braking transistor is wired incorrectly.	• Check braking transistor wiring for errors. • Properly rewire the braking resistor device.
Drive fails to operate properly due to noise interference.	• Review the list of possible solutions provided for controlling noise. • Review the section on handling noise interference and check the control circuit lines, main circuit lines and ground wiring.
Load inertia has been set incorrectly.	• Check the load inertia settings when using KEB, overvoltage suppression or Stall Prevention during deceleration. • Adjust L3-25 (Load Inertia Ratio) in accordance with the load.
Braking function is being used in PM Open Loop Vector Control.	Connect a braking resistor.
Motor hunting occurs.	• Adjust the parameters that control hunting. • Set the hunting prevention gain (n1-02). • Adjust the AFR time constant (n2-02 and n2-03) when in OLV Control. • Use parameters n8-45 (PM Speed Feedback Detection Suppression Gain) and n8-47 (Pull-In Current Compensation Time Constant).
LED Operator Display	**Fault Name**
PF PF	Input Phase Loss
	Drive input power has an open phase or has a large imbalance of voltage between phases. Detected when L8-05 = 1 (enabled).
Cause	**Possible Solution**
There is phase loss in the drive input power.	• Check for wiring errors in the main circuit drive input power. • Correct the wiring.

<table>
<tr><td colspan="2">There is loose wiring in the drive input power terminals.</td><td>• Ensure the terminals are tightened properly.
• Apply the tightening torque specified in this manual to fasten the terminals. *Refer to Wire Gauges and Tightening Torque on page 59*</td></tr>
<tr><td colspan="2">There is excessive fluctuation in the drive input power voltage.</td><td>• Check the voltage from the drive input power.
• Review the possible solutions for stabilizing the drive input power.
• Disable Input Phase Loss Detection (L8-05 = “0”). PF is detected if DC bus ripple is too high. If it is disabled, there is no fault but the ripple is still too high, thereby the capacitors are stressed more and lose lifetime.</td></tr>
<tr><td colspan="2">There is poor balance between voltage phases.</td><td>• Stabilize drive input power or disable phase loss detection.</td></tr>
<tr><td colspan="2" rowspan="2">The main circuit capacitors are worn.</td><td>• Check the maintenance time for the capacitors (U4-05).
• Replace the drive if U4-05 is greater than 90%.</td></tr>
<tr><td>• Check for anything wrong with the drive input power.
• If nothing is wrong with the drive input power, try the following solutions if the alarm continues:
• Disable Input Phase Loss Protection selection (L8-05 = “0”). PF is detected if DC bus ripple is too high. If it is disabled, there is no fault but the ripple is still too high, thereby the capacitors are stressed more and lose lifetime.
• Replace the drive.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Fault Name</th></tr>
<tr><td rowspan="2">PGo</td><td rowspan="2">PGo</td><td>PG Disconnect (for Simple V/f with PG)</td></tr>
<tr><td>No PG pulses are received for longer than the time set to F1-14.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">Pulse input (RP) is disconnected.</td><td>Reconnect the pulse input (RP).</td></tr>
<tr><td colspan="2">Pulse input (RP) wiring is wrong.</td><td>Correct the wiring.</td></tr>
<tr><td colspan="2">Motor brake engaged.</td><td>Ensure the motor brake releases properly.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Fault Name</th></tr>
<tr><td rowspan="2">rH</td><td rowspan="2">rH</td><td>Braking Resistor Overheat</td></tr>
<tr><td>Braking resistor protection was triggered.
Fault detection is enabled when L8-01 = 1 (disabled as a default).</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solution</th></tr>
<tr><td colspan="2">Deceleration time is too short and excessive regenerative energy is flowing back into the drive.</td><td>• Check the load, deceleration time and speed.
• Reduce the load.
• Increase the acceleration and deceleration times (C1-01 through C1-08).
• Replace the braking option with a larger device that can handle the power that is discharged.</td></tr>
<tr><td colspan="2">Excessive braking inertia.</td><td>Recalculate braking load and braking power. Then try reducing the braking load and checking the braking resistor settings and improve braking capacity.</td></tr>
<tr><td colspan="2">The proper braking resistor has not been installed.</td><td>• Check the specifications and conditions for the braking resistor device.
• Select the optimal braking resistor.</td></tr>
<tr><td colspan="3">Note: The magnitude of the braking load trips the braking resistor overheat alarm, NOT the surface temperature. Using the braking resistor more frequently than its rating trips the alarm even when the braking resistor surface is not very hot.</td></tr>
</table>

LED Operator Display		Fault Name
rr	rr	Dynamic Braking Transistor
		The built-in dynamic braking transistor failed.
Cause		**Possible Solution**
The braking transistor is damaged.		• Cycle power to the drive and check if the fault reoccurs. ***Refer to Diagnosing and Resetting Faults on page 222***. • Replace the drive if the fault continues.
The control circuit is damaged.		
LED Operator Display		**Fault Name**
SEr	SEr	Too Many Speed Search Restarts
		The number of speed search restarts exceeded the number set to b3-19.
Cause		**Possible Solution**
Speed Search parameters are set to the wrong values.		• Reduce the detection compensation gain during Speed Search (b3-10). • Increase the current level when attempting Speed Search (b3-17). • Increase the detection time during Speed Search (b3-18). • Repeat Auto-Tuning.
The motor is coasting in the opposite direction of the run command.		Enable Bi-directional Speed Search (b3-14 = “1”).
LED Operator Display		**Fault Name**
STO	STO	Pull-Out Detection
		Motor pull-out has occurred.
Cause		**Possible Solution**
The wrong motor code has been set (Yaskawa motors only).		• Enter the correct motor code for the PM being used into E5-01. • For special-purpose motors, enter the correct data to all E5 parameters according to the Test Report provided for the motor.
Load is too heavy.		• Increase the value set to n8-55 (Load Inertia for PM). • Increase the value set to n8-51 (Pull-In Current during Accel/Decel for PM). • Reduce the load. • Increase the motor or drive capacity.
Load inertia is too heavy.		Increase n8-55 (Load Inertia for PM).
Acceleration and deceleration times are too short.		• Increase the acceleration and deceleration times (C1-01 through C1-08). • Increase the S-curve acceleration and deceleration times (C2-01).
LED Operator Display		**Fault Name**
UL3	UL3	Undertorque Detection 1
		The current has fallen below the minimum value set for torque detection (L6-02) for longer than the allowable time (L6-03).
Cause		**Possible Solution**
Parameter settings are not appropriate for the type of load.		Check the settings of parameters L6-02 and L6-03.
There is a fault on the machine side.		Check the load for any problems.

LED Operator Display		Fault Name
UL4	UL4	Undertorque Detection 2
		The current has fallen below the minimum value set for torque detection (L6-05) for longer than the allowable time (L6-06).
Cause		**Possible Solution**
Parameter settings are not appropriate for the type of load.		Check the settings of parameters L6-05 and L6-06.
There is a fault on the machine side.		Check the load for any problems.
LED Operator Display		**Fault Name**
UL5	UL5	Mechanical Weakening Detection 2
		The operation conditions matched the conditions set to L6-08.
Cause		**Possible Solution**
Undertorque was detected and matched the condition of mechanical loss detection operation selection (L6-08).		Check the load side for any problems.
LED Operator Display		**Fault Name**
Uv1	Uv1	DC Bus Undervoltage
		One of the following conditions occurred while the drive was stopped: • Voltage in the DC bus fell below the undervoltage detection level (L2-05). • For 200 V class: approximately 190 V (160 V for single phase drives) • For 400 V class: approximately 380 V (350 V when E1-01 is less then 400) The fault is output only if L2-01 = 0 or L2-01 = 1 and the DC bus voltage is under L1-05 for longer than L2-02.
Cause		**Possible Solution**
Input power phase loss.		• The main circuit drive input power is wired incorrectly. • Correct the wiring.
One of the drive input power wiring terminals is loose.		• Ensure there are no loose terminals. • Apply the tightening torque specified in this manual to fasten the terminals. ***Refer to Wire Size on page 68***
There is a problem with the voltage from the drive input power.		• Check the voltage. • Correct the voltage to within range listed in drive input power specifications.
The power has been interrupted.		Correct the drive input power.
Drive internal circuitry has become worn.		• Check the maintenance time for the capacitors (U4-05). • Replace the drive if U4-05 exceeds 90%.
The drive input power transformer is not large enough and voltage drops after switching on power.		Check the capacity of the drive input power transformer.
Air inside the drive is too hot.		Check the drive's internal temperature.
Problem with the CHARGE indicator.		Replace the drive.

LED Operator Display		Fault Name
Uv2	Uv2	Control Power Supply Voltage Fault
		Voltage is too low for the control drive input power.
Cause		**Possible Solution**
L2-02 changed from its default value in drive that is 7.5 kW or smaller without installing a Momentary Power Loss Ride-Thru.		Correct parameter L2-02 setting or install optional Momentary Power Loss Ride-Thru unit.
The wiring for the control power supply is damaged.		• Cycle power to the drive. Check if the fault reoccurs. • Replace the drive if the fault continues to occur.
Internal circuitry is damaged.		• Cycle power to the drive. Check if the fault reoccurs. • Replace the drive if the fault continues to occur.
LED Operator Display		**Fault Name**
Uv3	Uv3	Undervoltage 3 (Inrush Prevention Circuit Fault)
		The inrush prevention circuit has failed.
Cause		**Possible Solution**
The contactor on the inrush prevention circuit is damaged.		• Cycle power to the drive. Check if the fault reoccurs. • Replace the drive if the fault continues to occur. • Check monitor U4-06 for the performance life of the inrush prevention circuit. • Replace the drive if U4-06 exceeds 90%.

5.5 Alarm Detection

Alarms are drive protection functions that do not operate the fault contact. The drive will return to original status when the cause of the alarm has been removed.

During an alarm condition, the Digital Operator display flashes and an alarm output is generated at the multi-function outputs (H2-01 to H2-03), if programmed.

Investigate the cause of the alarm and refer to *Table 5.9* for the appropriate action.

◆ Alarm Codes, Causes, and Possible Solutions

Table 5.9 Alarm Codes, Causes, and Possible Solutions

<table>
<tr><th colspan="2">LED Operator Display</th><th colspan="2">Minor Fault Name</th></tr>
<tr><td rowspan="2">bb</td><td rowspan="2">bb</td><td colspan="2">Baseblock</td></tr>
<tr><td colspan="2">Drive output interrupted as indicated by an external baseblock signal.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th><th>Minor Fault (H2-□□ = 10)</th></tr>
<tr><td colspan="2">External baseblock signal entered via multi-function input terminal (S1 to S6).</td><td>Check external sequence and baseblock signal input timing.</td><td>No output</td></tr>
<tr><th colspan="2">LED Operator Display</th><th colspan="2">Minor Fault Name</th></tr>
<tr><td rowspan="2">bUS</td><td rowspan="2">bUS</td><td colspan="2">Option Communication Error</td></tr>
<tr><td colspan="2">• After initial communication was established, the connection was lost.
• Assign a run command frequency reference to the option card.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th><th>Minor Fault (H2-□□ = 10)</th></tr>
<tr><td colspan="2">Connection is broken or master controller stopped communicating.</td><td>• Check for faulty wiring.
• Correct the wiring.
• Repair ground wiring or disconnected cables.</td><td>YES</td></tr>
<tr><td colspan="2">Option card is damaged.</td><td>If there are no problems with the wiring and the fault continues to occur, replace the option card.</td><td>YES</td></tr>
<tr><td colspan="2">The option card is not properly connected to the drive.</td><td>• The connector pins on the option card are not properly lined up with the connector pins on the drive.
• Reinstall the option card.</td><td>YES</td></tr>
</table>

A data error occurred due to noise.	• Check options available to minimize the effects of noise. • Take steps to counteract noise in the control circuit wiring, main circuit lines and ground wiring. • Try to reduce noise on the controller side. • Use surge absorbers on magnetic contactors or other equipment causing the disturbance. • Use cables recommended by OYMC, or another type of shielded line. The shield should be grounded on the controller side or on the drive input power side. • All wiring for communications devices should be separated from drive input power lines. Install a noise filter to the input side of the drive input power.	YES
LED Operator Display	**Minor Fault Name**	
CALL / CALL	Serial Communication Transmission Error	
	Communication has not yet been established.	
Cause	**Possible Solutions**	**Minor Fault (H2-□□ = 10)**
Communications wiring is faulty, there is a short circuit, or something is not connected properly.	• Check for wiring errors. • Correct the wiring. • Remove and ground shorts and reconnect loose wires.	YES
Programming error on the master side.	Check communications at start-up and correct programming errors.	YES
Communications circuitry is damaged.	• Perform a self-diagnostics check. • Replace the drive if the fault continues to occurs.	YES
Terminal resistance setting is incorrect.	The terminal slave drive must have the internal terminal resistance switch set correctly. Place DIP switch S2 to the ON position. ***Refer to MEMOBUS/Modbus Switch Settings on page 391***.	YES
LED Operator Display	**Minor Fault Name**	
CE / CE	MEMOBUS/Modbus Communication Error	
	Control data was not received correctly for two seconds.	
Cause	**Possible Solutions**	**Minor Fault (H2-□□ = 10)**
A data error occurred due to noise.	• Check options available to minimize the effects of noise. • Counteract noise in the control circuit wiring, main circuit lines and ground wiring. • Reduce noise on the controller side. • Use surge absorbers on magnetic contactors or other equipment causing the disturbance. • Use cables recommended by OYMC or another type of shielded line. The shield should be grounded on the controller side or on the drive input power side. • Separate all wiring for communications devices from drive input power lines. Install a noise filter to the input side of the drive input power.	YES

Communication protocol is incompatible.	• Check the H5 parameter settings as well as the protocol setting in the controller. • Ensure settings are compatible.	YES
The CE detection time (H5-09) is set shorter than the time required for a communication cycle to take place.	• Check the PLC. • Change the software settings in the PLC. • Set a longer CE detection time (H5-09).	YES
Incompatible PLC software settings or there is a hardware problem.	• Check the PLC. • Remove the cause of the error on the controller side.	YES
Communications cable is disconnected or damaged.	• Check the connector for a signal through the cable. • Replace the communications cable.	YES
LED Operator Display	**Minor Fault Name**	
CrST	Can Not Reset	
	Fault reset was being executed when a run command was entered.	
Cause	**Possible Solutions**	**Minor Fault (H2-☐☐ = 10)**
Fault reset was being executed when a run command was entered.	• Ensure that a run command cannot be entered from the external terminals or option card during fault reset. • Turn off the run command.	YES
LED Operator Display	**Minor Fault Name**	
dEv	Speed Deviation (for Simple V/f with PG)	
	According to the pulse input (RP), the speed deviation is greater than the setting in F1-10 for a time longer than the setting in F1-11.	
Cause	**Possible Solutions**	**Minor Fault Output (H2-☐☐ = 10)**
Load is too heavy	Reduce the load.	YES
Acceleration and deceleration times are set too short.	Increase the acceleration and deceleration times (C1-01 through C1-08).	YES
The load is locked up.	Check the machine.	YES
Parameter settings are inappropriate.	Check the settings of parameters F1-10 and F1-11.	YES
The motor brake engaged.	Ensure the brake releases properly.	YES

LED Operator Display		Minor Fault Name	
dnE	dnE	Drive Disabled	
Cause		Possible Solutions	Minor Fault Output (H2-□□ = 10)
“Drive Enable” is set to a multi-function contact input (H1-□□ = 6A) and that signal was switched off.		Check the operation sequence.	YES
LED Operator Display		**Minor Fault Name**	
EF	EF	Forward/Reverse Run Command Input Error	
		Both forward run and reverse run closed simultaneously for over 0.5 s.	
Cause		**Possible Solutions**	**Minor Fault Output (H2-□□ = 10)**
Sequence error		Check the forward and reverse command sequence and correct the problem. **Note:** When minor fault EF detected, motor ramps to stop.	YES
LED Operator Display		**Minor Fault Name**	
EF0	EF0	Option Card External Fault	
		An external fault condition is present.	
Cause		**Possible Solutions**	**Minor Fault Output (H2-□□ = 10)**
An external fault was received from the PLC with F6-03 = 3 (causing the drive to continue running when an external fault occurs).		• Remove the cause of the external fault. • Remove the external fault input from the PLC.	YES
There is a problem with the PLC program.		Check the PLC program and correct problems.	YES
LED Operator Display		**Minor Fault Name**	
EF1	EF1	External fault (input terminal S1)	
		External fault at multi-function input terminal S1.	
EF2	EF2	External fault (input terminal S2)	
		External fault at multi-function input terminal S2.	
EF3	EF3	External fault (input terminal S3)	
		External fault at multi-function input terminal S3.	
EF4	EF4	External fault (input terminal S4)	
		External fault at multi-function input terminal S4.	

EF5	EF5	External fault (input terminal S5)	
		External fault at multi-function input terminal S5.	
EF6	EF6	External fault (input terminal S6)	
		External fault at multi-function input terminal S6.	
Cause		**Possible Solutions**	**Minor Fault Output (H2-☐☐ = 10)**
An external device has tripped an alarm function.		Remove the cause of the external fault and reset the multi-function input value.	YES
Wiring is incorrect.		• Ensure the signal lines have been connected properly to the terminals assigned for external fault detection (H1-☐☐ = 20 to 2F). • Reconnect the signal line.	YES
Multi-function contact inputs are set incorrectly.		• Check if the unused terminals have been set for H1-☐☐ = 20 to 2F (External Fault). • Change the terminal settings.	YES
LED Operator Display		**Minor Fault Name**	
FbH	FbH	Excessive PID Feedback	
		The PID feedback input is higher than the level set in b5-36 for longer than the time set in b5-37, and b5-12 is set to 1 or 4.	
Cause		**Possible Solutions**	**Minor Fault Output (H2-☐☐ = 10)**
Parameters settings for b5-36 and b5-37 are incorrect.		Check parameters b5-36 and b5-37.	YES
PID feedback wiring is faulty.		Correct the wiring.	YES
Feedback sensor has malfunctioned.		Check the sensor and replace it if damaged.	YES
Feedback input circuit is damaged.		Replace the drive.	YES
LED Operator Display		**Minor Fault Name**	
FbL	FbL	PID Feedback Loss	
		The PID feedback input is lower than the level set in b5-13 for longer than the time set in b5-14, and b5-12 is set to 1 or 4.	
Cause		**Possible Solutions**	**Minor Fault Output (H2-☐☐ = 10)**
Parameters settings for b5-13 and b5-14 are incorrect.		Check parameters b5-13 and b5-14.	YES
PID feedback wiring is faulty.		Correct the wiring.	YES
Feedback sensor has malfunctioned.		Check the sensor and replace it if damaged.	YES

Feedback input circuit is damaged.	Replace the drive.	YES
LED Operator Display	**Minor Fault Name**	
Hbb — Hbb	Safe Disable Signal Input	
	Both Safe Disable input channels open.	
Cause	**Possible Solutions**	**Minor Fault Output (H2-☐☐ = 10)**
Both Safe Disable Inputs H1 and H2 are open.	• Check if external safety circuit tripped and disabled the drive. • If the Safe Disable function is not utilized, check if the terminals HC, H1 and H2 are linked.	YES
Internally, both Safe Disable channels are broken.	Replace the drive.	YES
LED Operator Display	**Minor Fault Name**	
HbbF — HbbF	Safe Disable Signal Input	
	One Safe Disable input channels open.	
Cause	**Possible Solutions**	**Minor Fault Output (H2-☐☐ = 10)**
One of the inputs H1 and H2 is open while the other is closed.	• Check the wiring to device that controls the Safe Disable inputs. • If the Safe Disable function is not utilized, check if the terminals HC, H1 and H2 are linked properly.	YES
One of the Safe Disable channels is faulty.	Replace the drive.	YES
LED Operator Display	**Minor Fault Name**	
HCA — HCA	Current Alarm	
	Drive current exceeded overcurrent warning level (150% of the rated current).	
Cause	**Possible Solutions**	**Minor Fault Output (H2-☐☐ = 10)**
Load is too heavy.	• Measure the current flowing through the motor. • Reduce the load or increase the capacity of the drive.	YES
Acceleration and deceleration times are too short.	• Calculate the torque required during acceleration and for the inertia moment. • If the torque level is not right for the load, take the following steps: • Increase the acceleration and deceleration times (C1-01 through C1-08). • Increase the capacity of the drive.	YES

A special-purpose motor is being used, or the drive is attempting to run a motor greater than the maximum allowable capacity.		• Check the motor capacity. • Use a motor appropriate for the drive. Ensure the motor is within the allowable capacity range.	YES
The current level increased due to Speed Search after a momentary power loss or while attempting to perform a fault restart.		The alarm will appear only briefly. There is no need to take action to prevent the alarm from occurring in such instances.	YES
LED Operator Display		**Minor Fault Name**	
oH	oH	Heatsink Overheat	
		The temperature exceeded the maximum allowable value.	
Cause		**Possible Solutions**	**Minor Fault (H2-□□ = 10)**
Surrounding temperature is too high		• Check the surrounding temperature. • Improve the air circulation within the enclosure panel. • Install a fan or air conditioner to cool surrounding area. • Remove anything near drive that may cause extra heat.	YES
Internal cooling fan has stopped.		• Replace the cooling fan. ***Refer to Cooling Fan Replacement on page 250***. • After replacing the drive, reset the cooling fan maintenance parameter to (o4-03 = “0”).	YES
Airflow around the drive is restricted.		• Provide proper installation space around the drive as indicated in the manual. ***Refer to Correct Installation Spacing on page 40***. • Allow for the specified space and ensure that there is sufficient circulation around the control panel.	YES
		• Check for dust or foreign materials clogging cooling fan. • Clear debris caught in the fan that restricts air circulation.	YES
LED Operator Display		**Minor Fault Name**	
oH2	oH2	Drive Overheat Warning	
		“Drive Overheat Warning” was input to a multi-function input terminal, S1 through S6 (H1-□□ = B).	
Cause		**Possible Solutions**	**Minor Fault (H2-□□ = 10)**
An external device triggered and overheat warning in the drive.		• Search for the device that tripped the overheat warning. • Solving the problem will clear the warning.	YES
LED Operator Display		**Minor Fault Name**	
oH3	oH3	Motor Overheat	
		The motor overheat signal entered to a multi-function analog input terminal exceeded the alarm level (H3-02 or H13-10 = E).	

Cause	Possible Solutions	Minor Fault (H2-□□ = 10)
Motor thermostat wiring is fault (PTC input).	Repair the PTC input wiring.	YES
There is a fault on the machine side (e.g., the machine is locked up).	• Check the status of the machine. • Remove the cause of the fault.	YES
Motor has overheated.	• Check the load size, accel/decel times, and cycle times. • Decrease the load. • Increase accel and decel times (C1-01 to C1-08). • Adjust the preset V/f pattern (E1-04 through E1-10). This will mainly involve reducing E1-08 and E1-10. **Note:** Do not lower E1-08 and E1-10 excessively, because this reduces load tolerance at low speeds. • Check the motor-rated current. • Enter motor-rated current on motor nameplate (E2-01). • Ensure the motor cooling system is operating normally. • Repair or replace the motor cooling system.	YES

LED Operator Display		Minor Fault Name
oL3	oL3	Overtorque 1
		Drive output current (or torque in OLV) was greater than L6-02 for longer than the time set in L6-03.

Cause	Possible Solutions	Minor Fault (H2-□□ = 10)
Inappropriate parameter settings.	Check parameters L6-02 and L6-03.	YES
There is a fault on the machine side (e.g., the machine is locked up).	• Check the status of the machine. • Remove the cause of the fault.	YES

LED Operator Display		Minor Fault Name
oL4	oL4	Overtorque 2
		Drive output current (or torque in OLV) was greater than L6-05 for longer than the time set in L6-06.

Cause	Possible Solutions	Minor Fault Output (H2-□□ = 10)
Parameter settings are not appropriate.	Check parameters L6-05 and L6-06.	YES
There is a fault on the machine side (e.g., the machine is locked up).	• Check the status of the machine being used. • Remove the cause of the fault.	YES

LED Operator Display		Minor Fault Name
oS	oS	Overspeed (for Simple V/f with PG)
		Pulse input (RP) indicates that motor speed feedback exceeded F1-08 setting.

Cause	Possible Solutions	Minor Fault Output (H2-□□ = 10)
Overshoot or undershoot is occurring.	• Adjust the gain by using the pulse train input parameters (H6-02 through H6-05). Adjust the speed feedback accuracy. • Increase the settings for C5-01 (Speed Control Proportional Gain 1) and reduce C5-02 (Speed Control Integral Time 1).	YES
PG pulse settings are incorrect.	Set the H6-02 (Pulse Train Input Scaling) = 100%, the number of pulses during maximum motor revolutions.	YES
Parameter settings are inappropriate.	Check the setting for the overspeed detection level and the overspeed detection time (F1-08 and F1-09).	YES
LED Operator Display	**Minor Fault Name**	
ov	DC Bus Overvoltage	
	The DC bus voltage exceeded the trip point. For 200 V class: approximately 410 V For 400 V class: approximately 820 V (740 V when E1-01 < 400)	
Cause	**Possible Solutions**	**Minor Fault (H2-□□ = 10)**
Surge voltage present in the drive input power.	• Install a DC reactor or an AC reactor. • Voltage surge can result from a thyristor convertor and a phase advancing capacitor operating on the same drive input power system.	YES
• The motor has short-circuited. • Ground current has over-charged the main circuit capacitors via the drive input power.	• Check the motor power cable, relay terminals and motor terminal box for short circuits. • Correct grounding shorts and turn the power back on.	YES
Noise interference causes the drive to operate incorrectly.	• Review possible solutions for handling noise interference. • Review section on handling noise interference and check control circuit lines, main circuit lines and ground wiring. • If the magnetic contactor is identified as a source of noise, install a surge protector to the MC coil.	YES
	Set number of fault restarts (L5-01) to a value other than 0.	YES
LED Operator Display	**Minor Fault Name**	
PASS	MEMOBUS/Modbus Comm. Test Mode Complete	
Cause	**Possible Solutions**	**Minor Fault Output (H2-□□ = 10)**
MEMOBUS/Modbus test has finished normally.	This verifies that the test was successful.	No output

LED Operator Display		Minor Fault Name	
PGo	PGo	PG Disconnect (for Simple V/f with PG)	
		Detected when no PG pulses received for a time longer than setting in F1-14.	
Cause		**Possible Solutions**	**Minor Fault Output (H2-□□ = 10)**
Pulse input (RP) is disconnected.		Reconnect the pulse input (RP).	YES
Pulse input (RP) wiring is wrong.		Correct the wiring.	YES
Motor brake is engaged.		Ensure the brake releases properly	YES
LED Operator Display		**Minor Fault Name**	
rUn	rUn	Motor Switch during Run	
		A command to switch motors was entered during run.	
Cause		**Possible Solutions**	**Minor Fault Output (H2-□□ = 10)**
A motor switch command was entered during run.		Change the operation pattern so that the motor switch command is entered while the drive is stopped.	YES
LED Operator Display		**Minor Fault Name**	
UL3	UL3	Undertorque Detection 1	
		Drive output current (or torque in OLV) less than L6-02 for longer than L6-03 time.	
Cause		**Possible Solutions**	**Minor Fault (H2-□□ = 10)**
Inappropriate parameter settings.		Check parameters L6-02 and L6-03.	YES
Load has dropped or decreased significantly.		• Check for broken parts in the transmission system.	YES
LED Operator Display		**Minor Fault Name**	
UL4	UL4	Undertorque Detection 2	
		Drive output current (or torque in OLV) less than L6-05 for longer than L6-06 time.	
Cause		**Possible Solutions**	**Minor Fault (H2-□□ = 10)**
Inappropriate parameter settings.		Check parameters L6-05 and L6-06.	YES
The load has dropped or decreased significantly.		• Check for broken parts in the transmission system.	YES

<table>
<tr><th colspan="2">LED Operator Display</th><th colspan="2">Minor Fault Name</th></tr>
<tr><td rowspan="2">Uv</td><td rowspan="2">Uv</td><td colspan="2">Undervoltage</td></tr>
<tr><td colspan="2">• One of the following conditions was true when the drive was stopped and a run command was entered:
• DC bus voltage dropped below the level specified in L2-05.
• Contactor to suppress inrush current in the drive was open.
• Low voltage in the control drive input power. This alarm outputs only if L2-01 is not 0 and DC bus voltage is under L2-05.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th><th>Minor Fault (H2-□□ = 10)</th></tr>
<tr><td colspan="2">Phase loss in the drive input power.</td><td>Check for wiring errors in the main circuit drive input power. Correct the wiring.</td><td>YES</td></tr>
<tr><td colspan="2">Loose wiring in the drive input power terminals.</td><td>• Ensure the terminals have been properly tightened.
• Apply the tightening torque specified in this manual to fasten the terminals. Refer to Wire Gauges and Tightening Torque on page 59</td><td>YES</td></tr>
<tr><td colspan="2">There is a problem with the drive input power voltage.</td><td>• Check the voltage.
• Lower the voltage of the drive input power so that it is within the limits listed in the specifications.</td><td>YES</td></tr>
<tr><td colspan="2">Drive internal circuitry is worn.</td><td>• Check the maintenance time for the capacitors (U4-05).
• Replace the drive if U4-05 exceeds 90%.</td><td>YES</td></tr>
<tr><td colspan="2">The drive input power transformer is not large enough and voltage drops when the power is switched on.</td><td>• Check for a tripped alarm when the magnetic contactor, line breaker and leakage breaker are turned on.
• Check the capacity of the drive input power transformer.</td><td>YES</td></tr>
<tr><td colspan="2">Air inside the drive is too hot.</td><td>• Check the temperature inside the drive.</td><td>YES</td></tr>
<tr><td colspan="2">The CHARGE indicator light is broken or disconnected.</td><td>• Replace the drive.</td><td>YES</td></tr>
</table>

5.6 Operator Programming Errors

An Operator Programming Error (oPE) occurs when an inappropriate parameter is set or an individual parameter setting is inappropriate. The drive will not operate until the parameter is set correctly; however, no alarm or fault outputs will occur. If an oPE occurs, investigate the cause and refer to *Table 5.10* for the appropriate action. When oPE error is displayed, press the ENTER button to display U1-34 (oPE fault constant). This monitor displays the parameter causing the oPE error.

◆ oPE Codes, Causes, and Possible Solutions

Table 5.10 oPE Codes, Causes, and Possible Solutions

<table>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE01</td><td rowspan="2">oPE01</td><td>Drive Capacity Setting Fault</td></tr>
<tr><td>Drive capacity and then value set to o2-04 do not match.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">The drive capacity setting
(o2-04) and the actual capacity of the drive are not the same.</td><td>Correct the value set to o2-04.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE02</td><td rowspan="2">oPE02</td><td>Parameter Range Setting Error</td></tr>
<tr><td>Use U1-18 to find which parameters were set outside the setting range.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Parameters were set outside the possible setting range.</td><td>Set parameters to the proper values.</td></tr>
<tr><td colspan="3">Note: Other errors are given precedence over oPE02 when multiple errors occur at the same time.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE03</td><td rowspan="2">oPE03</td><td>Multi-Function Input Selection Error</td></tr>
<tr><td>A contradictory setting is assigned to multi-function contact inputs H1-01 through to H1-06.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">• The same function is assigned to two multi-function inputs.
• Excludes “Not used” and “External Fault.”</td><td>• Ensure all multi-function inputs are assigned to different functions.
• Re-enter the multi-function settings to ensure this does not occur.</td></tr>
<tr><td colspan="2">The Up command was set but the Down command was not, or vice versa (settings 10 vs. 11).</td><td rowspan="2">Correctly set functions that need to be enabled in combination with other functions.</td></tr>
<tr><td colspan="2">The Up 2 command was set but the Down 2 command was not, or vice versa (settings 75 vs. 76).</td></tr>
</table>

Troubleshooting

5

• Run /Stop command for 2-wire sequence 2 was set (H1-□□ = 42), but forward/reverse command (H1-□□ = 43) was not. • “Drive Enable” is set to multi-function input S1 or S2 (H1-01 = 6A or H1-02 = 6A).		Correctly set functions that need to be enabled in combination with other functions.
• Two of the following functions are set at the same time: • Up / Down Command (10 vs. 11) • Up 2 / Down 2 Command (75 vs. 76) • Hold Accel/Decel Stop (A) • Analog Frequency Reference Sample / Hold (1E) • Offset Frequency 1, 2, 3 Calculations (44, 45, 46)		• Check if contradictory settings have been assigned to the multi-function input terminals at the same time. • Correct setting errors.
The Up/Down command (10, 11) is enabled at the same time as PID control (b5-01).		Disable control PID (b5-01 = “0”) or disable the Up/ Down command.
• One of the following settings at the multi-function input terminals: • External Search Command 1 and External Search Command 2 (61 vs. 62) • Fast-Stop N.O. and Fast-Stop N.C. (15 vs. 17) • KEB for Momentary Power Loss and High Slip Braking (65, 66, 7A, 7B vs. 68) • Motor Switch Command and Accel/Decel Time 2 (16 vs. 1A) • KEB Command 1 and KEB Command 2 (65, 66 vs. 7A, 7B) • FWD Run Command (or REV) and FWD/REV Run Command (2-wire) (40, 41 vs. 42, 43) • External DB Command and Drive Enable (60 vs. 6A)) • Motor Switch Command and UP2/DOWN2 Command (16 vs. 75, 76)		Check for contradictory settings assigned to the multi-function input terminals at the same time. Correct setting errors.
• One of the following settings was entered while H1-□□ = 2 (External Reference 1/2): • b1-15 = 4 (Pulse Train Input) and H6-01 (Pulse Train Input Function Selection) not = 0 (Frequency Reference) • b1-15 or b1-16 set to 3 but no option card connected • Although b1-15 = 1 (Analog Input) and H3-02 or H3-10 are set to 0 (Frequency Bias).		Correct the settings for the multi-function input terminal parameters.
H2-□□ = 38 (Drive Enabled) but H1-□□ is not set to 6A (Drive Enable).		
H1-□□ = 7E (Direction Detection) although H6-01 is not set to 3 (Simple V/f with PG).		
LED Operator Display		**Error Name**
oPE04	oPE04	Initialization required.

<table>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">The drive, control board, or terminal board has been replaced and the parameter settings between the control board and the terminal board no longer match.</td><td>To load the parameter settings to the drive that are stored in the terminal board, set A1-03 to 5550.
Initialize parameters after drive replacement by setting A1-03 to 1110 or 2220.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE05</td><td rowspan="2">oPE05</td><td>Run Command Selection Error</td></tr>
<tr><td>The Run command selection parameter b1-02 is set to 3 but no option board is installed.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Frequency reference is assigned to an option card (b1-01 = 3) that is not connected to the drive.</td><td rowspan="2">Reconnect the option card to the drive.</td></tr>
<tr><td colspan="2">The Run command is assigned to an option card (b1-02 = 3) that is not connected to the drive.</td></tr>
<tr><td colspan="2">Frequency reference is assigned to the pulse train input (b1-01 = 4), but terminal RP is not set for pulse train input (H6-01 is greater than 0).</td><td>Set H6-01 to “0”.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE07</td><td rowspan="2">oPE07</td><td>Multi-Function Analog Input Selection Error</td></tr>
<tr><td>A contradictory setting is assigned to multi-function analog inputs H3-02 through to H3-10 and PID functions conflict.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">H3-02 and H3-10 are set to the same value.</td><td>Change the settings to H3-02 and H3-10 so that functions no longer conflict. Note: Both 0 (primary analog frequency reference) and F (Not Used) can be set to H3-02 and H3-10 at the same time.</td></tr>
<tr><td colspan="2">The following simultaneous contradictory settings:
H3-02 or H3-10 = B (PID Feedback) and H6-01 (Pulse Train Input) = 1 (PID Feedback)</td><td rowspan="4">Disable one of the PID selections.</td></tr>
<tr><td colspan="2">The following simultaneous contradictory settings:
H3-02 or H3-10 = C (PID Target Value) and H6-01 = 2 (pulse train input sets the PID target value)</td></tr>
<tr><td colspan="2">The following simultaneous contradictory settings:
H3-02 or H3-10 = C (PID Target Value) and b5-18 = 1 (enables b5-19 as the target PID value)</td></tr>
<tr><td colspan="2">The following simultaneous contradictory settings:
H6-01 or H3-10 = C (PID Target Value) and b5-18 = 1 (enables b5-19 as the target PID value)</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE08</td><td rowspan="2">oPE08</td><td>Parameter Selection Error</td></tr>
<tr><td>A function has been set that cannot be used in the motor control method selected.</td></tr>
</table>

5.6 Operator Programming Errors

<table>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Attempted to use a function in the V/f motor control method that is only possible in Open Loop Vector Control.</td><td>Check the motor control method and the functions available.</td></tr>
<tr><td colspan="2">Simple V/f with PG was enabled while not in V/f Control (H6-01 = 3).</td><td>To use Simple V/f with PG, ensure the motor control method has been set to V/f Control (A1-02 = “0”).</td></tr>
<tr><td colspan="2">In Open Loop Vector Control, n2-02 is greater than n2-03</td><td>Correct parameter settings so that n2-02 is less than n2-03.</td></tr>
<tr><td colspan="2">In Open Loop Vector Control, C4-02 is greater than C4-06</td><td>Correct parameter settings so that C4-02 is less than C4-06.</td></tr>
<tr><td colspan="2">In PM Open Loop Vector Control, parameters E5-02 to E5-07 are set to 0.</td><td>• Set the correct motor code in accordance with the motor being used (E5-01).
• When using a special-purpose motor, set E5-□□ in accordance with the Test Report provided.</td></tr>
<tr><td colspan="2">The following conditions are true in PM Open Loop Vector Control:
E5-03 does not equal 0
E5-09 and E5-24 are both equal to 0, or neither equals 0</td><td>Set E5-09 or E5-24 to the correct value, and set the other to “0”.
Set the motor-rated current for PM to “0” (E5-03).</td></tr>
<tr><td colspan="3">Note: Use U1-18 to find which parameters are set outside the specified setting range.
Other errors are given precedence over OPE08 when multiple errors occur at the same time.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE09</td><td rowspan="2">oPE09</td><td>PID Control Selection Fault</td></tr>
<tr><td>PID control function selection is incorrect.
Requires that PID control is enabled (b5-01 = 1 to 4).</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">The following simultaneous contradictory settings:
b5-15 not 0.0 (PID Sleep Function Operation Level)
The stopping method is set to either DC injection braking or coast to stop with a timer (b1-03 = 2 or 3).</td><td>• Set b5-15 to another value besides 0.
• Set the stopping method to coast to stop or ramp to stop (b1-03 = “0” or “1”).</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE10</td><td rowspan="2">oPE10</td><td>V/f Data Setting Error</td></tr>
<tr><td>The following setting errors have occurred where:
E1-04 is greater than or equal to E1-06 is greater than or equal to E1-07 is greater than or equal to E1-09.
Or the following setting errors have occurred:
E3-04 is greater than or equal to E3-06 is greater than or equal to E3-07 is greater than or equal to E3-09.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">—</td><td>Correct the settings for E1-04, -06, -07 and -09 (or E-04, -06, -07, -09 for motor 2).</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE11</td><td rowspan="2">oPE11</td><td>Carrier Frequency Setting Error</td></tr>
<tr><td>Correct the setting for the carrier frequency.</td></tr>
</table>

<table>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">The following simultaneous contradictory settings:
C6-05 is greater than 6 and C6-04 is greater than C6-03 (carrier frequency lower limit is greater than the upper limit). If C6-05 is less than or equal to 6, the drive operates at C6-03.</td><td rowspan="2">Correct the parameter settings.</td></tr>
<tr><td colspan="2">Upper and lower limits between C6-02 and C6-05 contradict each other.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE13</td><td rowspan="2">oPE13</td><td>Pulse Monitor Selection Error</td></tr>
<tr><td>Incorrect setting of monitor selection for Pulse Train (H6-06).</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Scaling for the Pulse Train monitor is set to 0 (H6-07 = 0) while H6-06 is not set to 101, 102, 105, or 116.</td><td>Change scaling for the Pulse Train monitor or set H6-06 to 101, 102, 105, or 116.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td rowspan="2">oPE14</td><td rowspan="2">oPE14</td><td>Application setting error</td></tr>
<tr><td>Incorrect setting in combination with simple positioning stop or Bi-directional output conversion.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Parameter b1-03 = 9 (simple positioning stop) and
• Drive is not initialized to European settings (o2-09 is not 2)
• Dwell function is activated (b6-03 or b6-04 are not 0)
• the KEB function is activated (H1-□□ = 65/66/7A/7B)
• Stall prevention during deceleration is enabled (L3-04 is not 0)
• Over voltage suppression is enabled (L3-11 = 1)
• High slip braking is enabled (H1-□□ = 68)
• An S-curve is applied to the deceleration ramp (C2-03 and C2-04 are not 0)
PID output or frequency reference to bi-directional output frequency reference is enabled (d4-11 = 1) and the drive not initialized to European settings.</td><td>Check the initialization mode in parameter o2-09.
Correct the parameter settings.</td></tr>
</table>

5.7 Auto-Tuning Fault Detection

Auto-Tuning faults are shown below. When the following faults are detected, the fault is displayed on the Digital Operator and the motor coasts to a stop. No fault or alarm outputs will occur

◆ Auto-Tuning Codes, Causes, and Possible Solutions

Table 5.11 Auto-Tuning Codes, Causes, and Possible Solutions

<table>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-01</td><td>Er-01</td><td>Motor Data Error</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Motor data or data entered during Auto-Tuning incorrect.</td><td>• Check that the motor data entered to the T1 parameters match the information written on the motor nameplate input before Auto-Tuning.
• Start Auto-Tuning over again and enter the correct information.</td></tr>
<tr><td colspan="2">Motor output and motor-rated current settings (T1-02 and T1-04) do not match.</td><td>• Check the drive and motor capacities.
• Correct the settings of parameters T1-02 and T1-04.</td></tr>
<tr><td colspan="2">Motor output and no-load current settings (T1-04 and E2-03) do not match.
This data is required only when Auto-Tuning for Open Loop Vector Control or when performing Stationary Auto-Tuning.</td><td>• Check the motor-rated current and no-load current.
• Correct the settings of parameters T1-04 and E2-03.</td></tr>
<tr><td colspan="2">Base frequency and base motor rotations (T1-05 and T1-07) do not match.</td><td>Set T1-05 and T1-07 to the correct value.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-02</td><td>Er-02</td><td>Minor Fault</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Motor data entered during Auto-Tuning was incorrect.</td><td>• Motor data entered to the T1 parameters does not match the information written on the motor nameplate. Enter the correct data.
• Start Auto-Tuning over again and enter the correct information.</td></tr>
<tr><td colspan="2">The wiring is faulty.</td><td rowspan="2">• Check the wiring and correct defective connections.
• Check around the machine.
• Check the load.
• Use the information on page 237 to find out what caused the problem.</td></tr>
<tr><td colspan="2">Load is too heavy.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-03</td><td>Er-03</td><td>STOP Button Input</td></tr>
</table>

<table>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Auto-Tuning canceled by pressing STOP button.</td><td>Auto-Tuning did not complete properly and will have to be performed again.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-04</td><td>Er-04</td><td>Line-to-Line Resistance Error</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Motor data entered during Auto-Tuning was incorrect.</td><td>• Motor data entered to the T1 parameters does not match the information written on the motor nameplate. Enter the correct data.
• Start Auto-Tuning over again and enter the correct information.</td></tr>
<tr><td colspan="2">Auto-Tuning did not complete within designated time frame.</td><td rowspan="2">• Check and correct faulty motor wiring.
• Disconnect the motor from machine and perform Rotational Auto-Tuning.</td></tr>
<tr><td colspan="2">Drive-calculated values outside parameter setting range.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-05</td><td>Er-05</td><td>No-Load Current Error</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Motor data entered during Auto-Tuning was incorrect.</td><td>• Motor data entered to the T1 parameters does not match the information written on the motor nameplate. Enter the correct data.
• Restart Auto-Tuning and enter the correct information.</td></tr>
<tr><td colspan="2">Auto-Tuning did not complete within designated time frame.</td><td rowspan="2">• Check and correct faulty motor wiring.
• Disconnect the motor from machine and perform Rotational Auto-Tuning.</td></tr>
<tr><td colspan="2">Drive-calculated values outside parameter setting range.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-08</td><td>Er-08</td><td>Rated Slip Error</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Motor data entered during Auto-Tuning was incorrect.</td><td>• Motor data entered to the T1 parameters does not match the information written on the motor nameplate. Enter the correct data.
• Restart Auto-Tuning and enter the correct information.</td></tr>
<tr><td colspan="2">Auto-Tuning did not complete within designated time frame.</td><td rowspan="2">• Check and correct faulty motor wiring.
• Disconnect the motor from machine and perform Auto-Tuning.</td></tr>
<tr><td colspan="2">Values calculated by the drive are outside the allowable parameter setting ranges.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>Er-09</td><td>Er-09</td><td>Acceleration Error (detected only during Rotational Auto-Tuning)</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">The motor did not accelerate for the specified acceleration time.</td><td>• Increase the acceleration time (C1-01).
• Check if it is possible to disconnect the machine from the motor.</td></tr>
</table>

<table>
<tr><td colspan="2">Torque limit when motoring is too low (L7-01 and L7-02).</td><td>• Check the settings of parameters L7-01 and L7-02).
• Increase the setting.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>Er - 11</td><td>Er-11</td><td>Motor Speed Fault (detected only when Auto-Tuning is enabled)</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Torque reference is too high. (Enabled in OLV only.)</td><td>• Increase the acceleration time (C1-01).
• Disconnect the machine from the motor, if possible.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>Er - 12</td><td>Er-12</td><td>Current Detection Error</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">One of the motor phases is missing (U/T1, V/T2, W/T3).</td><td>Check motor wiring and correct problems.</td></tr>
<tr><td colspan="2">Current exceeded the current rating of the drive.</td><td rowspan="2">• Check the motor wiring for a short between motor lines.
• If a magnetic contactor is used between motors, ensure it is on.
• Replace the drive.</td></tr>
<tr><td colspan="2">The current is too low.</td></tr>
<tr><td colspan="2">Attempted Auto-Tuning without motor connected to the drive.</td><td>Connect the motor and perform Auto-Tuning.</td></tr>
<tr><td colspan="2">Current detection signal error.</td><td>Replace the drive.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>End1</td><td>End1</td><td>Excessive V/f Setting. Detected only during Rotational Auto-Tuning, and displayed after Auto-Tuning is complete.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">The torque reference exceeded 20% during Auto-Tuning.</td><td rowspan="2">• Before Auto-Tuning the drive, verify the information written on the motor nameplate and enter that data to T1-03 through T1-05.
• Enter proper information to parameters T1-03 to T1-05 and repeat Auto-Tuning.
• If possible, disconnect the motor from the load and perform Auto-Tuning.</td></tr>
<tr><td colspan="2">The results from Auto-Tuning the no-load current exceeded 80%.</td></tr>
<tr><th colspan="2">LED Operator Display</th><th>Error Name</th></tr>
<tr><td>End2</td><td>End2</td><td>Motor Iron-Core Saturation Coefficient. Detected only during Rotational Auto-Tuning and displayed after Auto-Tuning is complete.</td></tr>
<tr><th colspan="2">Cause</th><th>Possible Solutions</th></tr>
<tr><td colspan="2">Motor data entered during Auto-Tuning was incorrect.</td><td>• Motor data entered to the T1 parameters does not match the information written on the motor nameplate.
• Restart Auto-Tuning and enter the correct information.</td></tr>
<tr><td colspan="2">Auto-Tuning calculated values outside the parameter setting range, assigning the iron-core saturation coefficient (E2-07, -08) a temporary value.</td><td>• Check and correct faulty motor wiring.
• Disconnect the motor from machine and perform Rotational Auto-Tuning.</td></tr>
</table>

LED Operator Display		Error Name
End3	End3	Rated Current Setting Alarm (displayed after Auto-Tuning is complete)
Cause		**Possible Solutions**
• The motor line-to-line resistance and the motor-rated current are not consistent with one another. • The correct current rating printed on the nameplate was not entered into T1-04.		• Check the setting of parameter T1-04. • Check the motor data and repeat Auto-Tuning.

5.8 Diagnosing and Resetting Faults

When a fault occurs and the drive stops, follow the instructions below to remove whatever conditions triggered the fault, then restart the drive.

◆ Fault Occurs Simultaneously with Power Loss

WARNING! *Electrical Shock Hazard. Ensure there are no short circuits between the main circuit terminals (R/L1, S/L2, and T/L3) or between the ground and main circuit terminals before restarting the drive. Failure to comply may result in serious injury or death and will cause damage to equipment.*

1. Turn on the drive input power.
2. Use monitor parameters U2-□□ to display data on the operating status of the drive just before the fault occurred.
3. Remove the cause of the fault and reset.

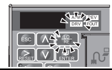
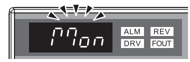
Note: To find out what faults were triggered, check U2-02 (Fault History). Information on drive status when the fault occurred such as the frequency, current and voltage, can be found in U2-03 through U2-17. ***Refer to Viewing Fault Trace Data after Fault on page 223*** for information on how to view fault trace data.

Note: When the fault continues to be displayed after cycling power, remove the cause of the fault and reset.

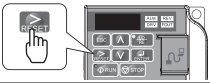
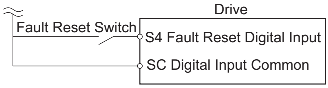
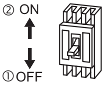
◆ If the drive still has power after a fault occurs

1. Look at the LED operator for information on the fault that occurred.
2. ***Fault Displays, Causes, and Possible Solutions on page 183***
3. Reset the fault. ***Refer to Fault Reset Methods on page 223***.

◆ Viewing Fault Trace Data after Fault

	Step		Display/Result
1.	Turn on the drive input power. The first screen displays.	⇒	
2.	Press ∧ until the monitor screen is displayed.	⇒	
3.	Press ENTER to display the parameter setting screen.	⇒	
4.	Press ∧ and > until U2-02 (Fault History) is displayed.	⇒	
5.	Press ENTER to view most recent fault (here, oC).	⇒	
6.	Press ∧ to view drive status information when fault occurred.		
7.	Parameters U2-03 through U2-17 help determine cause of fault.	⇒	

◆ Fault Reset Methods

After the Fault Occurs	Procedure	
Fix the cause of the fault, restart the drive, and reset the fault	Press the RESET button on the digital operator	
Resetting via Fault Reset Digital Input S4	Close then open the fault signal digital input via terminal S4. S4 is set fault reset as default (H1-04 = 12)	
If the above methods do not reset the fault, turn off the drive main power supply. Reapply power after LED operator display is out.		

Troubleshooting

5

5.9 Troubleshooting without Fault Display

This section is for troubleshooting problems that do not trip an alarm or fault.

◆ Cannot Change Parameter Settings

Cause	Possible Solutions
The drive is running the motor (i.e., the Run command is present).	• Stop the drive and switch over to the Programming Mode. • Most parameters cannot be edited during run.
The Access Level is set to restrict access to parameter settings.	• Set the Access Level to allow parameters to be edited (A1-02 = 2).
The operator is not in the Parameter Setup Mode (the LED screen will display "PAr").	• See what mode the LED parameter is current set for. • Parameters cannot be edited when in the Setup Mode ("STUP"). Switch modes so that "PAr" appears on the screen.
A multi-function contact input terminal is set to allow or restrict parameter editing (H1-01 through H1-06 = 1B).	• When the terminal is open, parameters cannot be edited. • Turn on the multi-function contact input set to 1B.
The wrong password was entered.	• If the password entered to A1-04 does not match the password saved to A1-05, then drive settings cannot be changed. • Reset the password. • If you cannot remember the password: • Display parameter A1-04. Press the STOP button while pressing ∧ at the same time. Parameter A1-05 will appear. • Set a new password to parameter A1-05.
Undervoltage was detected.	• Check the drive input power voltage by looking at the DC bus voltage • (U1-07). • Check all main circuit wiring.

◆ Motor Does Not Rotate Properly after Pressing RUN Button or After Entering External Run Command

■ Motor Does Not Rotate

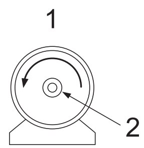
Cause	Possible Solutions
The drive is not in the Drive Mode.	• Check if the DRV light on the LED operator is lit. • Enter the Drive Mode to begin operating the motor. ***Refer to The Drive and Programming Mode on page 93***.

Cause	Possible Solutions
The LO/RE button was pushed.	• Stop the drive and check if the correct frequency reference source is selected. If the operator keypad shall be the source, the LO/RE button LED must be on, if the source is REMOTE, it must be off. • Take the following steps to solve the problem: • Push the LO/RE button. • If o2-01 is set to 0, then the LO/RE button will be disabled.
Auto-Tuning has just completed.	• When Auto-Tuning has completed, the drive is switched back to the Programming Mode. The Run command will not be accepted unless the drive is in the Drive Mode. • Use the LED operator to enter the Drive Mode. ***Refer to The Drive and Programming Mode on page 93***.
A Fast-Stop was executed and has not yet been reset.	Reset the Fast-Stop command.
Settings are incorrect for the source that provides the run command.	Check parameter b1-02 (Run Command Selection). Set b1-02 so that it corresponds with the correct run command source. 0: LED/LCD operator 1: Control circuit terminal (default setting) 2: MEMOBUS/Modbus communications 3: Option card
One of the Safety Inputs is open.	• Check for a short-circuit between terminals H1 and HC. • See if one of the Safety Inputs is open. • Correct any faulty wiring.
There is faulty wiring in the control circuit terminals.	• Check the wiring for the control terminal. • Correct wiring mistakes. • Check the input terminal status monitor (U1-10).
The drive has been set to accept the frequency reference from the incorrect source.	Check parameter b1-01 (Frequency Reference Selection 1). Set b1-01 to the correct source of the frequency reference. 0: LED operator 1: Control circuit terminal (default setting) 2: MEMOBUS/Modbus communications 3: Option card 4: Pulse train input (RP)
The terminal set to accept the main speed reference is set to the incorrect voltage and/or current.	Check DIP switch S1. Next assign the correct input level to terminal A2 (H3-09). ***Refer to Terminal A2 Switch on page 75***.
Selection for the sink/source mode is incorrect.	Check DIP switch S3. ***Refer to Sinking/Sourcing Mode Switch on page 73***.
Frequency reference is too low.	• Check the frequency reference monitor (U1-01). • Increase the frequency by changing the maximum output frequency (E1-09).

Cause	Possible Solutions
Multi-function analog input is set up to accept gain for the frequency reference, but no voltage (current) has been provided.	• Check the multi-function analog input settings. • Check if analog input A1 or A2 is set for frequency reference gain (H3-02/10 = 1). If so, check if the correct signal is applied to the terminal. The gain and the frequency reference will be 0 if no signal is applied to the gain input. • Check if H3-02 and H3-10 have been set to the proper values. • Check if the analog input value has been set properly.
The STOP button was pressed when the drive was started from a REMOTE source.	• When the STOP button is pressed, the drive will decelerate to stop. • Switch off the run command and then re-enter a run command. • The STOP button is disabled when o2-02 is set to 0.
Motor is not producing enough torque in the V/f motor control method.	• Ensure the selected V/f pattern corresponds with the characteristics of the motor being used. • Set the correct V/f pattern to E1-03. • When E1-03 = F, increase both the minimum and mid output frequency voltages (E1-08, E1-10).
	Increase the frequency reference so that it is higher than the minimum frequency reference (E1-09).
	Perform Line-to-Line Resistance Auto-Tuning when using particularly long motor cables.
	Increase the torque compensation gain (C4-01).
Motor is not producing enough torque in Open Loop Vector Control.	• Execute Rotational Auto-Tuning. • If the motor cables are replaced with longer cables after Rotational Auto-Tuning was performed, Auto-Tuning may need to be repeated due to voltage drop across the line.
	• Check if the torque limit parameters have been set too low (L7-01 through L7-04). • Reset the torque limit back to its default setting (200%).
	Increase both the minimum and mid output frequency voltages (E1-08 and E-10).
The drive is set for both 2-wire and 3-wire sequence at the same time.	• The drive is set for a 3-wire sequence when one of parameters H1-03 through H1-06 is set to 0. • If the drive is supposed to be set up for a 2-wire sequence, then ensure parameters H1-03 through H1-06 are not set to 0. • If the drive is supposed to be set up for a 3-wire sequence, then H1-□□ must be set to 0. Refer to *Table 5.2* for additional information.

■ Motor Rotates in the Opposite Direction from the Run Command

Cause	Possible Solutions
Phase wiring between the drive and motor is incorrect.	• Check the motor wiring. • Switch two motor cables (U, V, and W) to reverse motor direction. • Connect drive output terminals U/T1, V/T2 and W/T3 in the right order to the corresponding motor terminals U, V, and W.

Cause	Possible Solutions
The forward direction for the motor is set-up incorrectly.	• Typically, forward is designated as being counterclockwise when looking from the motor shaft (refer to the figure below).  • **1. Forward Rotating Motor (looking down the motor shaft)** **2. Motor Shaft**
The motor is running at almost 0 Hz and the Speed Search estimated the speed to be in the opposite direction.	• Disable bi-directional search (b3-14 = “0”) so that Speed Search is performed only in the specified direction.

Note: Check the motor specifications for the forward and reverse directions. The motor specifications will vary depending on the manufacturer of the motor.

■ Motor Rotates in One Direction Only

Cause	Possible Solutions
The drive prohibits reverse rotation.	• Check parameter b1-04. • Set the drive to allow the motor to rotate in reverse (b1-04 = “0”).
A Reverse run signal has not been entered, although 3-wire sequence is selected.	• Make sure that one of the input terminals S3 to S6 used for the 3-wire sequence has been set for reverse.

■ Motor is Too Hot

Cause	Possible Solutions
The load is too heavy.	• If the load is too heavy for the motor, the motor will overheat as it exceeds its rated torque value for an extended period of time. • Keep in mind that the motor also has a short-term overload rating in addition to the possible solutions provided below: • Reduce the load. • Increase the acceleration and deceleration times. • Check the values set for the motor protection (L1-01, L1-02) as well as the motor rated current (E2-01). • Increase motor capacity.
The air around the motor is too hot.	• Check the ambient temperature. • Cool the area until it is within the specified temperature range.
The drive is operating in a vector control mode but Auto-Tuning has not yet been performed.	• Perform Auto-Tuning. • Calculate the motor value and reset the motor parameters. • Change the motor control method to V/f Control (A1-02 = “0”).

Cause	Possible Solutions
Insufficient voltage insulation between motor phases.	When the motor is connected to terminals U/T1, V/T2, and W/T3, voltage surges occur between the motor coils and drive switching. Normally, surges can reach up to three times the drive input power supply voltage (600 V for 200 V class, and 1200 V for 400 V class). Use a motor with voltage tolerance higher than the max voltage surge. Use a motor designed to work specifically with a drive when using a 400 V class unit. Install an AC reactor on the output side of the drive.
The motor fan has stopped or is clogged.	Check the motor fan.

■ Drive Does Not Allow Selection of Rotational Auto-Tuning

Cause	Possible Solutions
The drive is in the incorrect motor control method for Rotational Auto-Tuning.	• Check if the drive is set to V/f Control by accident (A1-02 = 0). • Change the motor control method to Open Loop Vector Control (A1-02 = "2").

■ Motor Hunting Occurs at Low Speeds

Cause	Possible Solutions
Excessive load inertia in Open Loop Vector Control.	• Excess load inertia can cause motor hunting in Open Loop Vector Control due to slow motor response. • Increase the speed feedback detection control time constant (n2-02) from its default value of 50 ms to an appropriate level between 200 and 1000 ms. Adjust this setting in combination with n2-03 (Feedback Detection Control Time Constant 2).

■ Overvoltage Occurs When Running at a Constant Speed

Cause	Possible Solutions
Excessive load inertia in Open Loop Vector Control.	• Loads with a lot of inertia (fans, etc.) can trigger an overvoltage fault when operating in Open Loop Vector Control. • Switch to the V/f motor control method. • Adjust the values set for the speed feedback detection control time constant (n2-02, n2-03).

■ Motor Stalls During Acceleration or With Large Loads

Cause	Possible Solutions
Load is too heavy.	• Take the following steps to resolve the problem: • Reduce the load. • Increase the acceleration time. • Increase motor capacity. • Although the drive has a Stall Prevention function and a Torque Compensation Limit function, accelerating too quickly or trying to drive an excessively large load can exceed the capabilities of the motor.

■ Motor Will Not Accelerate or the Acceleration Time is Too Long

Cause	Possible Solutions
Frequency reference is too low.	• Check the maximum output frequency (E1-04). • Increase E1-04 if it is set too low.
	Check U1-01 for proper frequency reference.
	Check if a frequency reference signal switch has been set to one of the multi-function input terminals.
	Check for low gain level set to terminals A1 or A2 (H3-03, H3-11).
Load is too heavy.	• Reduce the load so that the output current remains within the motor-rated current. • In extruder and mixer applications, the load will sometimes increase as the temperature drops.
	Check if the mechanical brake is fully releasing as it should.
The torque limit function is operating in Open Loop Vector Control.	• Check the torque limit setting. It may be too low. (L7-01 through L7-04). • Reset the torque limit to its default value (200%).
Acceleration time has been set too long.	Check if the acceleration time parameters have been set too long (C1-01, -03, -05, -07).
Motor characteristics and drive parameter settings are incompatible with one another in V/f Control.	• Select the correct V/f pattern so that it matches the characteristics of the motor being used. • Check E1-03 (V/f Pattern Selection).
The right combination of motor characteristics have not been set in Open Loop Vector Control.	Execute Rotational Auto-Tuning.
Incorrect frequency reference setting.	• Check the multi-function analog input settings. • Check if multi-function analog input terminal A1 or A2 is set for frequency gain (H3-02 or H3-10 = “1”). If so, the frequency reference will be 0 if there is no voltage (current) input provided. • Ensure H3-02 and H3-10 are set to the proper values. • Ensure the analog input value is set to the right value (U1-13, U1-14).
The Stall Prevention level during acceleration and deceleration set too low.	• Check the Stall Prevention level during acceleration (L3-02). • If L3-02 is set too low, acceleration will take a fair amount of time. • Increase L3-02.

Cause	Possible Solutions
The Stall Prevention level during run has been set too low.	• Check the Stall Prevention level during run (L3-06). • If L3-06 is set too low, speed will drop as the drive outputs torque. • Increase the setting value.
Although the drive is operating in Open Loop Vector motor control method, Auto-Tuning has not been performed.	• Perform Auto-Tuning. • Calculate motor data and reset motor parameters. • Switch to the V/f motor control method (A1-02 = “0”).
Drive reached the limitations of the V/f motor control method.	• The motor cable may be long enough (over 50 m) to require Auto-Tuning for line-to-line resistance. Also be aware that V/f Control is comparatively limited when it comes to producing torque at low speeds. • Consider switching to Open Loop Vector Control.

■ Drive Frequency Reference Differs from the Controller Frequency Reference Command

Cause	Possible Solutions
The analog input frequency gain and bias are set to incorrect values.	• Check the frequency reference terminal input gain level assigned to terminals A1 and A2, as well as the frequency reference input bias to terminal A1 and A2 (parameters H3-03, H3-04, and H3-12). • Set these parameters to the appropriate values.
A frequency bias signal is being entered via analog input terminals A1 or A2.	• If multi-function analog input terminals A1 and A2 are set for frequency reference (H3-02 = 0 and H3-10 = 0), the addition of both signals builds the frequency reference. • Ensure that H3-02 and H3-10 are set appropriately. • Check the input level set for terminals A1 and A2 (U1-13, U1-14).

■ Poor Speed Control Accuracy

Cause	Possible Solutions
Drive reached the slip compensation limit.	• Check the slip compensation limit (C3-03). • Increase the value set to C3-03.
Motor-rated voltage is set too high in Open Loop Vector Control.	• The input voltage for the drive determines the maximum output voltage. A drive with an input of 200 Vac can only output a maximum of 200 Vac. Open Loop Vector Control sometimes calculates an output voltage reference value that exceeds the maximum drive output voltage level, resulting in a loss of speed control accuracy. • Use a motor with a lower voltage rating (a vector control motor). • Increase the input power voltage.
Auto-Tuning did not complete properly for Open Loop Vector Control.	• Perform Auto-Tuning again.

■ Deceleration Takes Too Long With Dynamic Braking Enabled

Cause	Possible Solutions
L3-04 is set incorrectly.	• Check the Stall Prevention Level during deceleration (L3-04). • If a braking resistor option has been installed, disable Stall Prevention during deceleration (L3-04 = "0").
The deceleration time is set too long.	Set deceleration to more appropriate time (C1-02, C1-04, C1-06, C1-08).
Insufficient motor torque.	• Assuming parameter settings are normal and that no overvoltage occurs when there is insufficient torque, it is likely that the demand on the motor has exceeded the motor capacity. • Use a larger motor.
Reaching the torque limit.	• Check the settings for the torque limit (L7-01 through L7-04). • If the torque limit is enabled, deceleration might take longer than expected because the drive cannot output more torque than the limit setting. Ensure the torque limit is set to a large enough value. • Increase the torque limit setting.
	• If multi-function analog input terminal A1 or A2 is set to torque limit (H3-02 or H3-10 equals 10, 11, 12, or 15), ensure that the analog input levels are set to the correct levels. • Ensure H3-02 and H3-10 are set to the right levels. • Ensure the analog input is set to the correct value.
Load exceeded the internal torque limit determined by the drive rated current.	Switch to a larger capacity drive.

■ Motor Hunting Occurs When Operating With a Light Load

Cause	Possible Solutions
Carrier frequency is too high.	Lower the carrier frequency setting C6-02.
Large V/f setting value at low speeds triggers overexcitation.	• Select the proper V/f pattern (E1-03). • Use parameters E1-04 through E1-10 to set the V/f pattern in relation to the load characteristics.
The maximum output frequency and the base frequency reference are not set properly in relationship to each other.	Set the proper values for the maximum output frequency and base frequency (E1-04, E1-06).
Hunting Prevention is disabled (V/f control only).	• Enable Hunting Prevention by setting n1-01 = "1". • (OLV only) Increase the speed feedback detection control gain and time constant (n2-01, n2-02).

■ Load Falls When Brake is Applied (Hoist-Type Applications)

Cause	Possible Solutions
The timing for the brake to close and release is not set properly.	• Use frequency reference detection for closing and releasing the brake. • At start: Release the brake after creating enough torque. • At stop: Close the brake when the motor still produces torque. • Make the following setting changes to hold the brake: • Set the frequency detection inactive during baseblock (L4-07 = 0). • Multi-function contact output terminal will switch on when the output frequency is greater than the frequency detection level set in L4-01. Set L4-01 between 1.0 and 3.0 Hz. • Slipping may occur when stopping because hysteresis is used in Frequency Reference 2 (where the frequency agree setting in L4-02 is 2.0 Hz). To prevent this, change the setting to 0.1 Hz. • Do not use the multi-function contact output setting “During Run” (H2-01 = 0) for the brake signal.
Insufficient DC Injection Braking.	Increase the amount of DC Injection Braking (b2-02).

■ Noise From Drive or Output Lines When the Drive is Powered On

Cause	Possible Solutions
Relay switching in the drive generates excessive noise.	• Lower the carrier frequency (C6-02). • Install a noise filter on the input side of drive input power. • Install a noise filter on the output side of the drive. • Place the wiring inside a metal conduit to shield it from switching noise. • Ground the drive and motor properly • Separate the main circuit wiring and the control lines.

■ Ground Fault Circuit Interrupter (GFCI) Trips During Run

Cause	Possible Solutions
Excessive leakage current trips MCCB.	• Increase the GFCE sensitivity or use GFCI with a higher threshold. • Lower the carrier frequency (C6-02). • Reduce the length of the cable used between the drive and the motor. • Install a noise filter or reactor on the output side of the drive.

■ Connected Machinery Vibrates When Motor Rotates

Excessive Motor Oscillation and Erratic Rotation

Cause	Possible Solutions
Poor balance between motor phases.	Check drive input power voltage to ensure that it provides stable power.

Unexpected Noise from Connected Machinery

Cause	Possible Solutions
The carrier frequency is at the resonant frequency of the connected machinery.	Adjust the carrier frequency using parameters C6-02 through C6-05.
The drive output frequency is the same as the resonant frequency of the connected machinery.	• Adjust the parameters used for the Jump Frequency function (d3-01 through d3-04) to skip the problem-causing bandwidth. • Place the motor on a rubber pad to reduce vibration.

Note: The drive may have trouble assessing the status of the load due to white noise generated when using Swing PWM (C6-02 = 7 to A, or 7 if set for Normal Duty).

■ Oscillation or Hunting

Cause	Possible Solutions
Insufficient tuning in Open Loop Vector Control.	Adjust the following parameters in the order listed. An increase in gain should be followed with an increase in the primary delay time constant. • C4-02 (Torque Compensation Primary Delay Time) n2-01 (Speed Feedback Detection Control [AFR] Time Constant 1) C3-02 (Slip Compensation Primary Delay Time) The response for torque compensation and slip compensation will drop as the time constant is increased.
Auto-Tuning has not yet been performed (required for Open Loop Vector Control).	• Perform Auto-Tuning. • Set motor parameters after calculating the proper values. • Change the motor control method to V/f Control (A1-02 = “0”).
Insufficient tuning in V/f Control.	Adjust the following parameters in the order listed. • .n1-02 (Hunting Prevention Gain Setting) • n1-03 (Hunting Prevention Time Constant Setting) • n1-05 (Hunting Prevention Time Constant in Reverse Direction) when hunting occurs in reverse rotation direction only.
Gain is too low when using PID control.	Check the period of oscillation and adjust P, I, and D settings accordingly.
The frequency reference is assigned to an external source.	• Ensure that noise is not affecting the signal lines. • Separate main circuit wiring and control circuit wiring. • Use twisted-pair cables or shielded wiring for the control circuit. • Increase the analog input time filter constant (H3-13).
The cable between the drive and motor is too long.	• Perform Auto-Tuning. • Reduce the length of the cable.

■ PID output fault

Cause	Possible Solutions
No PID feedback input.	• Check the multi-function analog input terminal settings. • Set multi-function analog input terminal A1 or A2 for PID feedback (H3-02 or H3-10 = “B”). • A signal input to the terminal selection for PID feedback is necessary. • Check the connection of the feedback signal. • Check the various PID-related parameter settings. • No PID feedback input to the terminal causes the value detected to be 0, causing a PID fault and the drive to operate at max frequency.
The level of detection and the target value do not correspond with each other.	• PID control keeps the difference between target and detection values at 0. Set the input level for the values relative to one another. • Use analog input gains H3-03/11 to adjust PID target and feedback signal scaling.
Reverse drive output frequency and speed detection. When output frequency rises, the sensor detects a speed decrease.	Set PID output for reverse characteristics (b5-09 = “1”).

■ Insufficient Motor Torque

Cause	Possible Solutions
Auto-Tuning has not yet been performed (required for OLV Control).	Perform Auto-Tuning.
The control mode was changed after performing Auto-Tuning.	Perform Auto-Tuning again.
Only Line-to-Line Resistance Auto-Tuning was performed.	Perform Rotational Auto-Tuning.

■ Motor Rotates After the Drive Output is Shut Off

Cause	Possible Solutions
Low DC Injection Braking and the drive cannot decelerate properly.	• Adjust the DC Injection braking settings. • Increase the value of b2-02 (DC Injection Braking Current). • Increase the b2-04 (DC Injection Braking Time at Stop).

■ OV or Speed Loss Occurs When Starting into a Rotating Load

Cause	Possible Solutions
The load is already rotating when the drive is trying to start it.	• Stop the motor using DC Injection braking. Restart the motor. • Increase the value of b2-03 (DC Injection Braking Time at start). • Enable Speed Search at start (b3-01 = “1”). • Set a multi-function input terminal for external Speed Search command (H1-□□=“61”or “62” during restart). *Figure 4.17* on *on page 126*.

■ Output Frequency is not as High as Frequency Reference

Cause	Possible Solutions
Frequency reference is set within the range of the Jump Frequency.	• Adjust the parameters used for the Jump Frequency function (d3-01 through d3-03). • Enabling the Jump Frequency prevents the drive from outputting the frequencies specified in the Jump Frequency range.
Upper limit for the frequency reference has been exceeded.	• Set the maximum output frequency and the upper limit for the frequency reference to more appropriate values (E1-04, d2-01). • The following calculation yields the upper value for the output frequency = E1-04 × d2-01 / 100
Large load triggered Stall Prevention function during acceleration.	• Reduce the load. • Adjust the Stall Prevention level during acceleration (L3-02).

■ Buzzing Sound from Motor at 2 kHz

Cause	Possible Solutions
Exceeded 110% of the rated output current of the drive while operating at low speeds.	• If the output current rises too high at low speeds, the carrier frequency automatically reduces and causes a whining or buzzing sound. • If the sound is coming from the motor, disable carrier frequency derating (L8-38 = “0”). • Disabling the automatic carrier frequency derating increases the chances of an overload fault (oL2). Switch to a larger capacity motor if oL2 faults occur too frequently.

■ Unstable Motor Speed when Using PM or IPM

Cause	Possible Solutions
The motor code for PM (E5-01) is set incorrectly. (Yaskawa motors only)	Set parameter E5-01 in accordance with the motor being used.
The drive is operating at less than 10% of the speed reference.	Consult with OYMC about using a different type of motor when attempting to operate at 10% of the speed reference.
Motor hunting occurs.	Set and carefully adjust the following parameters in the order listed: n8-45 (Speed Feedback Detection Suppression Gain) n8-55 (Load Inertia for PM Motors) C4-02 (Torque Compensation Primary Delay Time)
Hunting occurs at start.	Increase the S-curve time at the start of acceleration (C2-01).
Too much current is flowing through the drive.	If using a PM motor, set the correct motor code to E5-01. If using a specialized motor, set parameter E5-xx to the correct value according to the Motor Test Report.

■ Motor Does Not Operate When the RUN Button on the Digital Operator is

Pressed

Cause	Possible Solutions
The LOCAL/REMOTE mode is not selected properly.	Press the LOCAL/REMOTE button to switch. The LO/RE LED should be on for LOCAL mode.
The drive is not in drive mode.	A run command will not be issued. Exit to the drive mode and cycle the run command.
The frequency reference is too low.	• If the frequency reference is set below the frequency set in E1-09 (Minimum Output Frequency), the drive will not operate. • Raise the frequency reference to at least the minimum output frequency.

■ Motor Does Not Operate When an External Run Command is Input

Cause	Possible Solutions
The LOCAL/REMOTE mode is not selected properly.	Press the LOCAL/REMOTE button to switch. The LO/RE LED should be off for REMOTE mode.
The drive is not in Drive Mode.	A run command will not be issued. Exit to the Drive mode and cycle the run command.
The frequency reference is too low.	• If the frequency reference is set below the frequency set in E1-09 (Minimum Output Frequency), the drive will not operate. • Raise the frequency reference to at least the minimum output frequency.

■ Motor Stops During Acceleration or When a Load is Connected

Cause	Possible Solution
• The load is too heavy. • The limit of motor response may be reached during rapid acceleration. This may be a result of improper stall prevention or automatic torque boost function adjustment. (L3-01 = 2)	Increase the acceleration time (C1-01) or reduce the motor load. Also, consider increasing the motor size and/or drive size.

■ Motor Rotates in One Direction Only

Cause	Possible Solution
"Reverse run prohibited" is selected. If b1-04 (Reverse Prohibit Operation) is set to 1 (reverse run prohibited), the drive will not accept a reverse run command.	Set b1-04 = “0” to allow reverse run operation.

■ Motor Operates at a Higher Speed than the Speed Command

Cause	Possible Solution
PID is enabled. If the PID mode is enabled (b5-01 = 1 to 4), the drive output frequency will change to regulate the process variable to the target setpoint. The PID can command a speed up to maximum output frequency (E1-04).	If PID operation is not target, disable PID by setting b5-01 = “0”.

■ Poor Speed Control Accuracy Above Base Speed in Open-Loop Vector Motor Control Method

Cause	Possible Solution
The maximum output voltage of the drive is determined by its input voltage. Vector control uses voltage to control the currents within the motor. If the vector control voltage reference value exceeds the drive output voltage capability, the speed control accuracy will decrease because the motor currents cannot be properly controlled.	Use a motor with a lower rated voltage compared to the input voltage.

■ Peripheral Devices Affected by Drive Operation

Cause	Possible Solutions
Radio frequency interference may be generated by drive output PWM waveform.	• Change the 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 input power terminals. • Install an Output Noise Filter at the motor terminals. • Use conduit. Metal can shield electrical noise. • Ground the drive and motor. • Separate main circuit wiring from control wiring.

■ Ground Fault Interrupter Activates When Drive is Running

Cause	Possible Solutions
The output of the drive is a series of high frequency pulses (PWM), so there is a certain amount of leakage current. This may cause the ground fault interrupter to operate and cut off the drive input power.	• Change to a ground fault interrupter with a higher leakage current detection level (such as, a sensitivity current of 200 mA or greater per Unit, with an operating time of 0.1 s or more), or one that incorporates high-frequency countermeasures. • Change the Carrier Frequency Selection (C6-02) to lower the carrier frequency. **Note:** Leakage current increases in proportion to cable length.

6

Periodic Inspection & Maintenance

This chapter describes the periodic inspection and maintenance of the drive to ensure that it receives the proper care to maintain overall performance.

6.1 Section Safety

DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection, and servicing must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of AC drives.

WARNING

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire.

Attach the drive to metal or other noncombustible material.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded, twisted-pair wires and ground the shield to the ground terminal of the drive.

Do not allow unqualified personnel to use the product.

Failure to comply could result in damage to the drive or braking circuit.

Carefully review instruction manual TOBPC72060000 when connecting a braking option to the drive.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

OYMC is not responsible for any modification of the product made by the user. This product must not be modified.

Check all the wiring to ensure that all connections are correct after installing the drive and connecting any other devices.

Failure to comply could result in damage to the drive.

6.2 Inspection

Power electronics have limited life and may exhibit changed characteristics or performance deterioration after years of use under normal conditions. To help avoid such problems, it is important to perform preventive maintenance and periodic inspection on the drive.

Drives contain a variety of power electronics such as power transistors, semi-conductors, capacitors, resistors, fans, and relays. The electronics in the drive serve a critical role in maintaining proper motor control.

Follow the inspection lists provided in this chapter as a part of a regular maintenance program.

Note: The drive will require more frequent inspection if it is placed in harsh environments, such as:

-high ambient temperatures

-frequent starting and stopping

-fluctuations in the AC supply or load

-excessive vibrations or shock loading

-dust, metal dust, salt, sulfuric acid, chlorine atmospheres

-poor storage conditions.

Perform the first equipment inspection 3 months after installation.

◆ Recommended Daily Inspection

Table 6.1 outlines the recommended daily inspection for OYMC drives. Check the following items on a daily basis to avoid premature deterioration in performance or product failure. Copy this checklist and mark the “Checked” column after each inspection.

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure the DC bus voltage level to confirm safe level.*

Table 6.1 General Recommended Daily Inspection Checklist

Inspection Category	Inspection Points	Corrective Action	Checked
Motor	• Inspect for abnormal oscillation or noise coming from the motor.	• Check the load coupling • Measure motor vibration • Tighten all loose components	
Cooling	• Inspect for abnormal heat generated from the drive or motor and visible discoloration.	• Check for excessive load • Loose connections • Check for dirty heatsink or motor • Ambient temperature	
Cooling	• Inspect drive cooling fan operation.	• Check for clogged or dirty fan. • Check fan operation drive parameter.	
Environment	• Verify the drive environment complies with the specifications listed in the Installation section of this manual.	• Eliminate the source of contaminants or correct poor environment.	
Load	• The drive output current should not be higher than the motor or drive rating for an extended period of time.	• Check for excessive load. • Check the motor parameter settings of the drive.	
Power Supply Voltage	• Check main power supply and control voltages.	• Correct the voltage or power supply to within nameplate specifications. • Verify all main circuit phases.	

◆ Recommended Periodic Inspection

Table 6.2 outlines the recommended periodic inspections for OYMC drive installations. Periodic inspections should generally be checked every 3-6 months; however, the drive may require more frequent inspection due to poor environments or rigorous use. Operating and environmental conditions, along with experience in each application, will determine the actual inspection frequency for each installation. Periodic inspection will help to avoid premature deterioration in performance or product failure. Copy this checklist and mark the "Checked" column after each inspection.

■ Periodic Inspection

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure the DC bus voltage level to confirm safe level.*

Table 6.2 Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Main Circuit Periodic Inspection			
General	• Overall check of the main power circuit and ground terminals	Take appropriate actions (e.g., tightening loose connections).	
	• Inspect equipment for discoloration from overheating or deterioration. • Inspect for damaged or deformed parts.	• Replace damaged components as required. • The drive has few serviceable parts and may require complete drive replacement.	
	• Inspect for dirt, foreign particles, or dust collection on components.	• Inspect enclosure door seal if present. Replace components if cleaning is not possible. • Use dry air to clear away foreign matter. Use a pressure of 39.2×10^4 to 58.8×10^4 Pa (4 - 6 kg •cm^2).	
Conductors and Wiring	• Inspect wiring and connections for discoloration, damage, or heat stress. • Inspect wire insulation and shielding for wear.	• Repair or replace damaged wiring.	
Terminals	• Inspect terminals for stripped, damaged, or loose connections.	• Tighten loose screws and replace damaged screws or terminals.	
Relays and Contactors	• Inspect contactors and relays for excessive noise during operation. • Inspect coils for signs of overheating such as melted or cracked insulation.	• Check coil voltage for over or under voltage conditions. • Replace damaged removable relays contactors or circuit board.	

6.2 Inspection

Inspection Area	Inspection Points	Corrective Action	Checked
Braking Resistors	• Inspect for discoloration of heat stress on or around resistors.	• Minor discoloration may be acceptable. • If discoloration exists check for loose connections.	
Electrolytic (bus) Capacitors	• Inspect for leakage, discoloration, or cracks. • Inspect the relief valve for swelling, rupture, or leakage.	• The drive has few serviceable parts and may require complete drive replacement.	
Diodes and IGBTs	• Inspect for accumulation of dust or other foreign particles on components.	• Use dry air to clear away foreign matter. • Use a pressure of: 39.2 x 10^4 to 58.8 x 10^4 Pa (4 - 6 kg •cm^2).	
Motor Periodic Inspection			
Operation Check	• Check for increased vibration or abnormal noise.	• Stop the motor and contact qualified maintenance personnel as required.	
Control Circuit Periodic Inspection			
General	• Inspect terminals for stripped, damaged or loose connections. • Check for tightness.	• Tighten loose screws and replace damaged screws or terminals. • If terminals are integral to a circuit board then board or drive replacement may be required.	
Printed Circuit Boards	• Inspect for unusual discoloration, burning or strange odor, noticeable rust or corrosion, proper seating of connectors, dust, oil, or other contamination.	• Re-seat loose connectors. • Replace PCBs if wiping or vacuuming with anti-static vacuum cannot clean the PCB. • Do not use solvents on PCBs. • Use dry air to clear away foreign matter. Use a pressure of 39.2 x 10^4 to 58.8 x 10^4 Pa (4 - 6 kg •cm^2). • The drive has few serviceable parts and may require complete drive replacement.	
Cooling System Periodic Inspection			
Cooling Fan	• Check for abnormal oscillation or unusual noise. • Check for damaged or missing fan blades.	• Replace as required. • Refer to ***Drive Cooling Fans on page 250*** for information on cleaning or replacing the cooling fan.	
Heatsink	• Inspect for dust or other foreign material collected on the surface.	• Use dry air to clear away foreign matter. • Use a pressure of 39.2 x 10^4 to 58.8 x 10^4 Pa (4 - 6 kg•cm^2).	

Inspection Area	Inspection Points	Corrective Action	Checked
Air Duct	• Inspect air intake and exhaust openings. They must be free from obstruction and properly installed.	• Visually inspect the area. • Clear obstructions and clean air duct as required.	
LED Periodic Inspection			
LEDs	• Make sure the LED lights correctly. • Inspect for dust or other foreign material that may have collected on surrounding components.	• Contact your OYMC representative if there is any trouble with the LED or keypad. • Clean the LED.	

Note: Periodic inspections should be performed every one or two years. The drive, however, may require more frequent inspection due to poor environments or rigorous use.

6.3 Periodic Maintenance

The drive has various "maintenance monitors". This feature provides advance maintenance warning and eliminates the need to shut down the entire system for unexpected problems. The drive allows the user to check the following maintenance periods.

- Cooling Fan
- Electrolytic Capacitors (Main Circuit)
- Inrush prevention circuit
- IGBT

◆ Replacement Parts

Table 6.3 contains the estimated performance life of components that require replacement during the life of the drive. Only use OYMC replacement parts for the appropriate drive model and revision.

Table 6.3 Estimated Performance Life

Component	Estimated Performance Life
Cooling Fan	10 years
Electrolytic Capacitors (Main Circuit)	10 years <1>

<1> The drive has few serviceable parts and may require complete drive replacement.

NOTICE: *Estimated performance life based on specific usage conditions. These conditions are provided for the purpose of replacing parts to maintain performance. Some parts may require more frequent replacement due to poor environments or rigorous use.*
Usage conditions for estimated performance life:
- *Ambient temperature: Yearly average of 40°C*
- *Load factor: 80% maximum*
- *Operation time: 24 hours a day*

■ Performance Life Monitors

The drive calculates the maintenance period for components that may require replacement during the life of the drive. A percentage of the maintenance period is displayed on the LED digital operator by viewing the appropriate monitor parameter.

When the maintenance period reaches 100%, there is increased risk that the drive may malfunction. OYMC recommends checking the maintenance period regularly to ensure maximum performance life.

Refer to Recommended Periodic Inspection on page 245 for more details.

Table 6.4 Performance Life Monitors Used for Component Replacement

Parameter	Component	Contents
U4-03	Cooling Fan	Displays the accumulated operation time of the cooling fan, from 0 to 99999 hours. This value is automatically reset to 0 once it reaches 99999.
U4-04		Displays the accumulated cooling fan operation time as a percentage of the specified maintenance period (displayed in percent%).
U4-05	Main Circuit (DC bus) Electrolytic Capacitors	Displays the accumulated time the capacitors are used as a percentage of the specified maintenance period.
U4-06	Inrush (pre-charge) relay	Displays the number of times the drive is powered up as a percentage of the performance life of the inrush circuit.
U4-07	IGBT	Displays the percentage of the maintenance period reached by the IGBTs.

■ Related Drive Parameters

Table 6.5 Maintenance Parameter Settings

Parameter	Parameter Name	Control Mode		
	Operator Display	V/f	Open Loop Vector	Open Loop Vector for PM
o4-03	Cooling Fan Maintenance Setting (Operation Time)	A	A	A
o4-05	Capacitor Maintenance Setting	A	A	A
o4-07	Inrush Prevention Relay (pre-charge) Maintenance Setting	A	A	A
o4-09	IGBT Maintenance Setting	A	A	A

NOTICE: *After replacing parts, reset the appropriate maintenance parameters (o4-03, o4-05, o4-07, and o4-09) to 0. If these parameters are not reset, the function will continue to count down the performance life of the new replaced components.*

6.4 Drive Cooling Fans

NOTICE: *Follow cooling fan replacement instructions. The cooling fan cannot operate properly when installed incorrectly and could seriously damage the drive. To ensure maximum useful product life, replace all cooling fans when performing maintenance.*

Contact your OYMC representative or supplier to order replacement cooling fans as required.

Some drive models have multiple cooling fans.

For drives with multiple cooling fans, replace all the fans when performing maintenance to ensure maximum useful product life.

◆ Cooling Fan Replacement

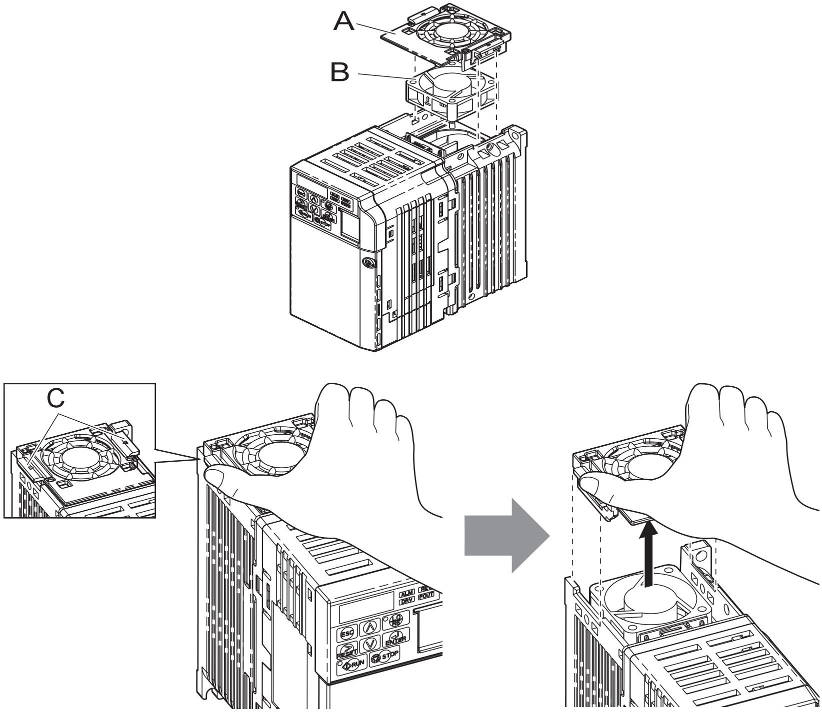
The cooling fan is installed on the top of the drive. The cooling fan can easily be replaced without tools or removal of the drive or enclosure parts.

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure the DC bus voltage level to confirm safe level.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

■ Removing the Cooling Fan

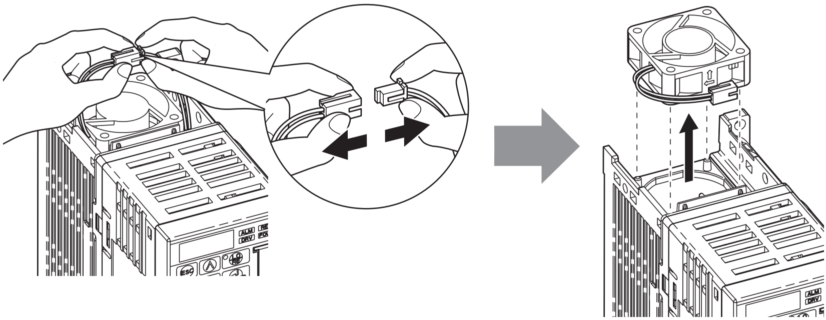
1. Depress the right and left sides of the fan cover tabs and pull upward. Remove the fan cover from the top of the drive. The figure illustrates a drive with a single cooling fan.



A – Fan cover
B – Cooling fan
C – Tab

Figure 6.1 Remove the Cooling Fan Cover

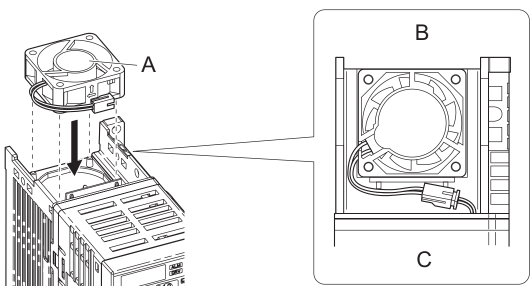
2. Remove the fan cable carefully, disconnect the pluggable connector and remove the fan.



■ Installing the Cooling Fan

NOTICE: *Prevent Equipment Damage. Follow cooling fan replacement instructions. Improper cooling fan replacement could result in the damage to equipment. When installing the replacement cooling fan into the drive, make sure the fan is facing upwards.To ensure maximum useful product life, replace all cooling fans when performing maintenance.*

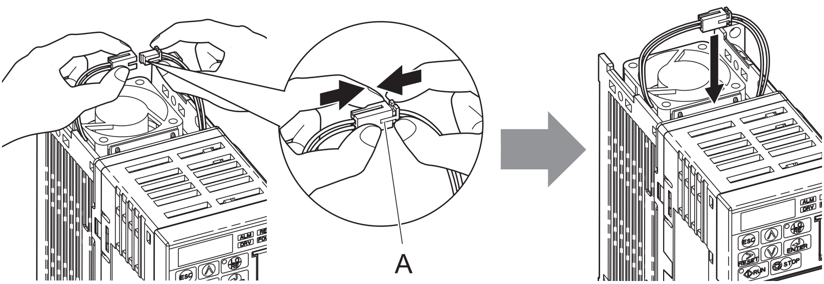
1. Install the replacement cooling fan into the drive, ensuring the alignment pins line up, as shown in the figure below:



A – Label facing up
B – Back
C – Front

Figure 6.2 Cooling Fan Orientation

2. Ensure the connectors are properly connected and place the cable back into the recess of the drive.



A – Push the connectors together so no space remains between them.

Figure 6.3 Connectors

3. Align the left and right cover tabs to install the fan cover back on the top of the drive.

Note: Ensure that the left and right tabs are locked back into place.

6.5 Drive Replacement

◆ Serviceable Parts

The drive contains few serviceable parts. The following parts are considered replacement parts on the drive:

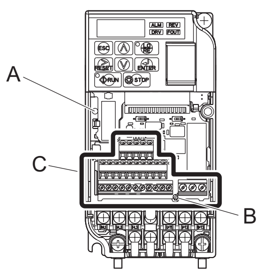
- Main control board and I/O Terminal board I/O PCBs.
- Cooling fan(s)
- Front cover

Replace the drive if the main power circuitry is damaged. Contact your local OYMC representative before replacing parts if the drive is still under warranty. OYMC reserves the right to replace or repair the drive according to OYMC warranty policy.

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are OFF and measure the DC bus voltage level to confirm safe level.*

◆ Terminal Board Overview

The drive has a modular I/O terminal block that facilitates quick drive replacement. The terminal board contains on-board memory that stores all drive parameter settings and allows the parameters to be saved and transferred to the replacement drive by disconnecting the terminal board from the damaged drive then reconnecting the terminal board to the replacement drive. There is no need to manually reprogram the replacement drive.



A – Charge LED
B – Terminal Board Locking Pin
C – Removable Terminal Board

Figure 6.4 Terminal Board

◆ Replacing the drive

WARNING! *Electrical Shock Hazard. Never connect or disconnect wiring, remove connectors or option cards, or replace the cooling fan while the power is on. Failure to comply may result in serious injury. Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off.*

WARNING! *Electrical Shock Hazard. Do not allow unqualified personnel to perform work on the drive. Failure to comply could result in serious injury. Installation, maintenance, inspection and servicing must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.*

NOTICE: *Damage to Equipment. Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards. Failure to comply may result in ESD damage to the drive circuitry.*

1. Loosen the screw on the front of the drive and remove the front cover.

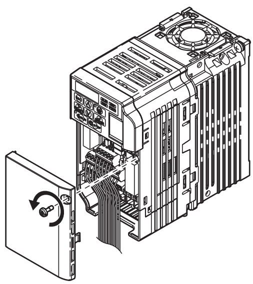


Figure 6.5 Remove Front Cover

2. Pull the pin on the ground terminal out of the removable terminal block.

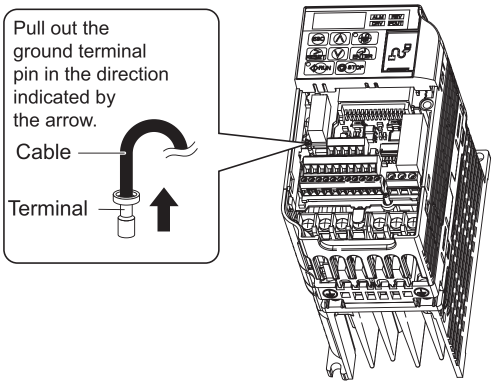
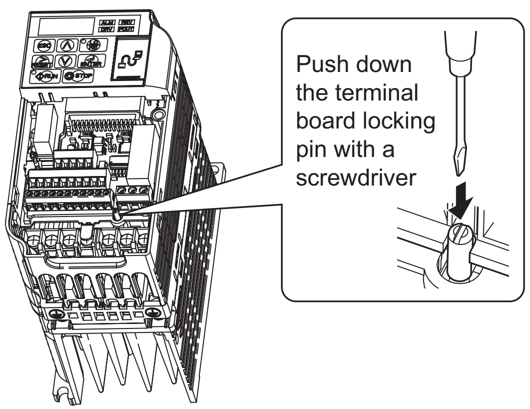


Figure 6.6 Depress Plastic Tab

3. Push down the terminal board locking pin on the terminal board with a screwdriver



4. While holding down the locking pin from step 3, slide the removable terminal block in the direction of the arrows in the following figure.

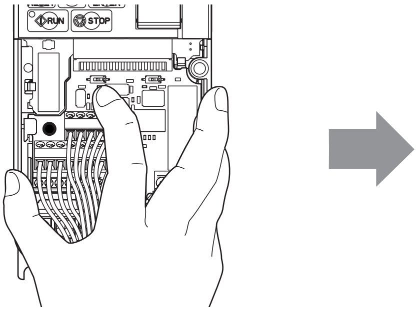


Figure 6.7 Removing the Terminal Board

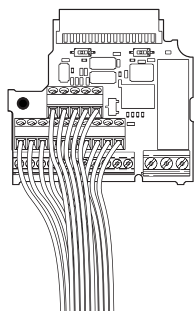


Figure 6.8 Removable Terminal Board disconnected from the drive

■ Terminal Board Replacement

1. Replace the removable terminal block on the drive according to ***Figure 6.9***

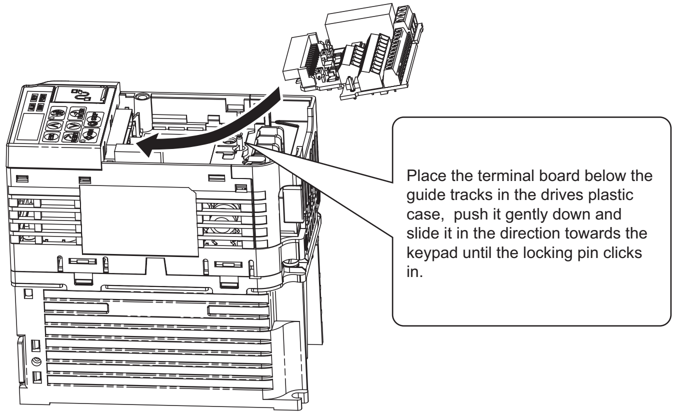


Figure 6.9 Terminal Board Replacement

2. Ensure the terminal block is firmly fastened to the connector.

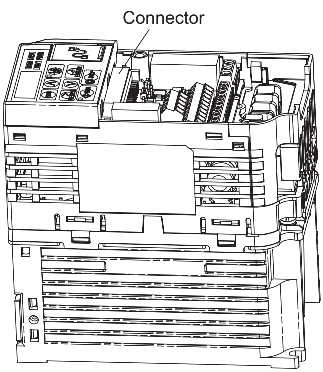


Figure 6.10 Terminal Board Installed

7

Peripheral Devices & Options

This chapter explains the installation of available peripheral devices and options for the drive.

7.1 Section Safety

DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

Disconnect all power to the drive, wait at least five minutes after all indicators are off, measure the DC bus voltage to confirm safe level, and check for unsafe voltages before servicing to prevent electric shock. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

WARNING

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection and servicing must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing and wear eye protection before beginning work on the drive.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

WARNING

Do not change wiring or remove option cards while power is running through the drive.

Failure to comply could result in death or serious injury.

Disconnect all power to the drive and check for unsafe voltages before servicing.

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

7.2 Peripheral Devices

The following table of peripheral devices lists the names of the various devices/options available for OYMC drives.

- **Peripheral Device Selection**: Refer to OYMC catalog for selection and part numbers.
- **Peripheral Device Installation**: Refer to option manual for option installation instructions.

Table 7.1 Available Peripheral Devices

Name	
DC Reactor	For Harmonics suppression and power factor improvement
AC Reactor	Protects the drive when the power supply is too large. Required for power supplies greater than 600 kVA.
Braking Resistor	For applications requiring dynamic braking.
Heatsink External Mounting Attachment	For heatsink put through cabinet wall mounting. Side-by-side mounting possible.
DIN Rail Attachments	For mounting drives on a DIN rail
NEMA Type 1 Kit	Makes the drive NEMA Type 1 conform
Connection Cable for Engineering Tools	Used to connect the V1000 to the RS232 port of a PC
USB Adapter / Copy Unit	Used to connect the V1000 to the USB port of a PC or as copy unit.
24 Vdc power supply option	Used to supply the drives controller with external 24 Vdc during power loss.
CX Drive	PC Software tool parameter handling and monitoring

7.3 Connecting Peripheral Devices

Figure 7.1 illustrates how the drive and motor connect together with various peripheral devices.

- Refer to peripheral device option manual for detailed installation instructions.

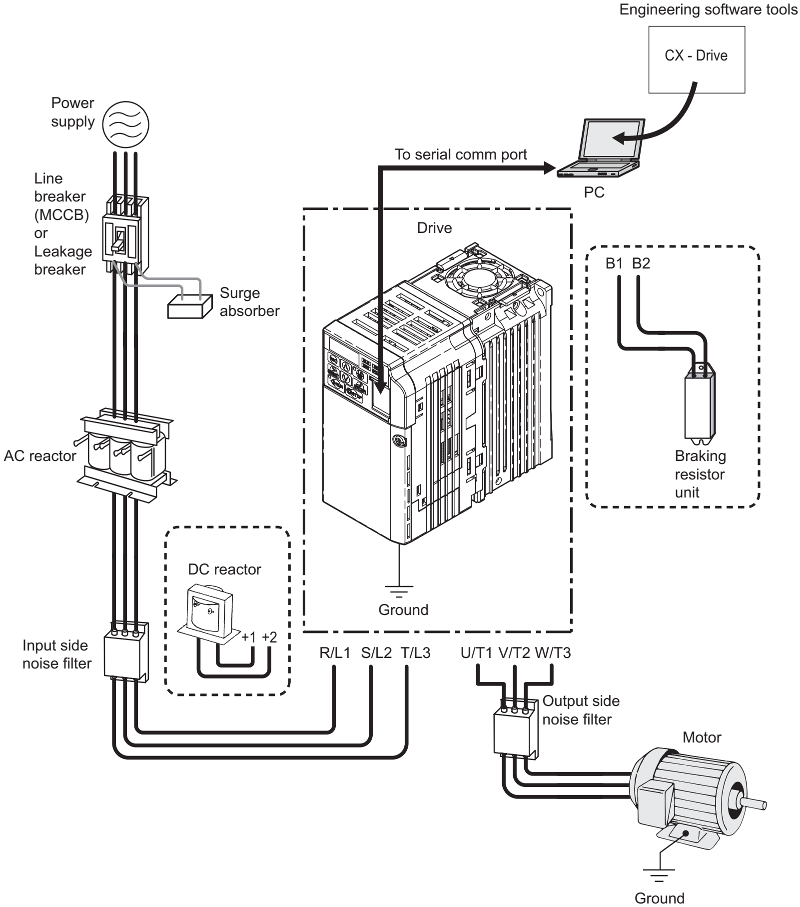


Figure 7.1 Connecting Peripheral Devices

7.4 Installing Peripheral Devices

This section describes the proper steps and precautions to take when installing or connecting various peripheral devices to the drive.

- Refer to peripheral device manual for detailed installation instructions.

NOTICE: *Use a class 2 power supply (UL standard) when connecting to the control terminals. Improper application of peripheral devices could result in drive performance degradation due to improper power supply.*

◆ Installing a Molded Case Circuit Breaker (MCCB)

Install a MCCB for line protection between the power supply and the main circuit power supply input terminals R/L1, S/L2 and T/L3. This protects the main circuit and devices wired to the main circuit while also providing overload protection.

Consider the following when selecting and installing a MCCB:

- The capacity of the MCCB should be 1.5 to 2 times the rated output current of the drive. Use an MCCB keep the drive from faulting out instead of using overheat protection (150% for one minute at the rated output current).
- If several drives are connected to one MCCB or an MCCB is shared with other equipment, use a sequence that shuts the power OFF when errors are output by using magnetic contactor (MC) as shown the following figure.

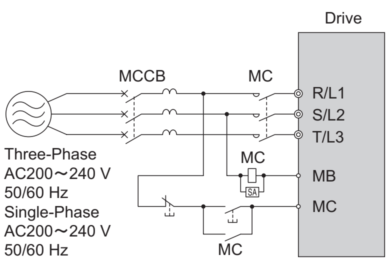


Figure 7.2 Example for Connecting an MCCB

WARNING! *Electrical Shock Hazard. Disconnect the MCCB and MC before wiring terminals. Failure to comply may result in serious injury or death.*

Peripheral Devices & Options

7

◆ Installing a Leakage Breaker

Drive outputs generate high-frequency leakage current as a result of high-speed switching. Install a Ground Fault Circuit Interrupter (GFCI) on the input side of the drive to switch off potentially harmful leakage current.

Factors in determining leakage current:

- Size of the AC drive
- AC drive carrier frequency
- Motor cable type and length
- EMI/RFI filter

In order to safely protect the drive system, select a breaker that senses all types of current (AC and DC) and high frequency currents

Note: Choose a GFCI designed specifically for an AC drive. The operation time should be at least 0.1 second with sensitivity amperage of at least 200 mA per drive.
The output waveform of the drive may cause the leakage current to increase. This may, in turn, cause the leakage breaker to malfunction. Take the following steps to correct the problem:
• Increase the sensitivity amperage.
• Lower the carrier frequency.

◆ Installing a Magnetic Contactor

■ Disconnecting the Power Supply

The drive can be shut off in the case of a fault in external equipment such as braking resistors through use of a Magnetic Contactor (MC).

NOTICE: *Install the MC on the input side of the drive when the drive should not automatically restart after power loss. To get the full performance life out of the electrolytic capacitors and circuit relays, refrain from switching the MC more than once every 30 minutes. Frequent use can damage the drive. Use the drive to stop and start the motor.*

■ Protecting the Braking Resistor or Braking Resistor Unit

Use an MC on the input side of the drive to protect a braking resistor or braking resistor unit from overheat or fire.

WARNING! *Fire Hazard. When using a braking unit, use a thermal relay on the braking resistors and configure a fault contact output for the braking resistor unit to disconnect drive main power via an input contactor. Inadequate braking circuit protection could result in death or serious injury by fire from overheating resistors.*

◆ Connecting an AC or DC Reactor

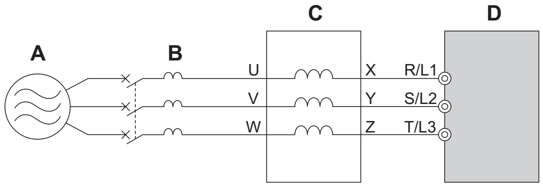
AC and DC reactors suppress surges in current and improve the power factor on the input side of the drive.

Use a DC reactor or AC reactor or both:

- To suppress harmonic current or improve the power factor of the power supply.
- When using an advancing capacitor switch.
- With a large capacity power supply transformer (over 600 kVA).

Note: Use an AC or DC reactor when also connecting a thyristor converter (such as a DC drive) to the same power supply system, regardless of the conditions of the power supply.

■ Connecting an AC Reactor

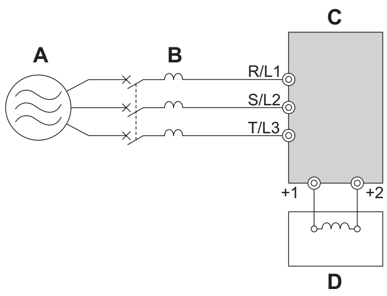


A – Power supply
B – MCCB
C – AC reactor
D – Drive

Figure 7.3 Connecting an AC Reactor

■ Connecting a DC Reactor

Ensure the jumper between terminals +1 and +2 (terminals are jumpered for shipment) is removed when connecting a DC reactor. The jumper must be installed if no DC reactor is used. Refer to ***Figure 7.4*** for an example of DC reactor wiring.



A – Power supply
B – MCCB
C – Drive
D – DC reactor

Figure 7.4 Connecting a DC Reactor

◆ Connecting a Surge Protector

A surge protector suppresses surge voltage generated from switching an inductive load near the drive. Inductive loads include magnetic contactors, relays, valves, solenoids and brakes. Always use a surge protector or diode when operating with an inductive load.

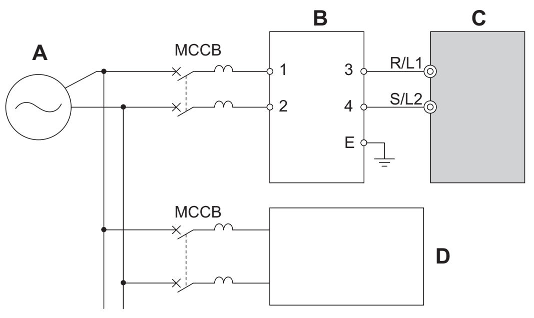
Note: Never connect a surge protector to the drive output.

◆ Connecting a Noise Filter

■ Input-Side Noise Filter

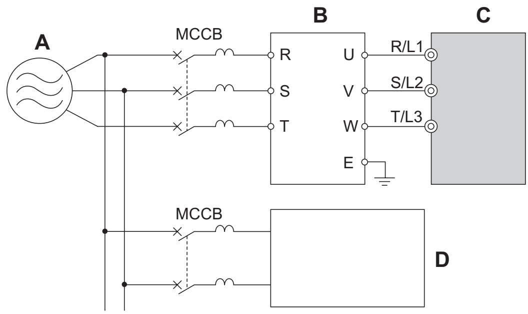
Drive outputs generate noise as a result of high-speed switching. This noise flows from inside the drive back toward the power supply, possible affecting other equipment. Installing a noise filter to the input side of the drive can reduce the amount of noise flowing back into the power supply. This also prevents noise from entering the drive from the power supply.

- Use a noise filter specifically designed for AC drives.
- Install the noise filter as close as possible to the drive.



A – Power supply
B – Input-side noise filter
C – Drive
D – Other control device

Figure 7.5 Input-Side Noise Filter (Single-Phase 200 V)



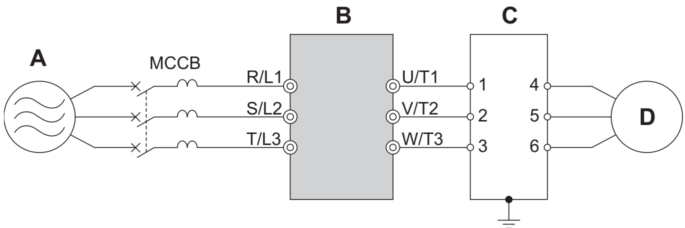
A – Power supply
B – Input-side noise filter
C – Drive
D – Other control device

Figure 7.6 Input-Side Noise Filter (Three-Phase 200/400 V)

■ Output-Side Noise Filter

A noise filter on the output side of the drive reduces inductive noise and radiated noise. *Figure 7.7* illustrates an example of output-side noise filter wiring.

NOTICE: *Do not connect phase-advancing capacitors or LC/RC noise filters to the output circuits. Improper application of noise filters could result in damage to the drive.*



A – Power supply
B – Drive
C – Output-side noise filter
D – Motor

Figure 7.7 Output-Side Noise Filter

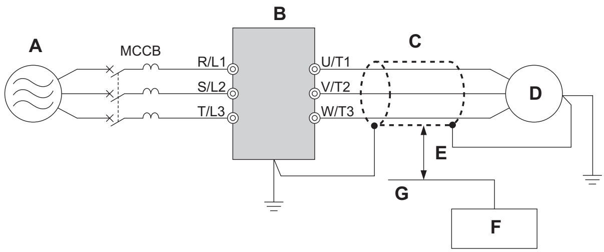
TERMS

Radiated noise: Electromagnetic waves radiated from the drive and cables create noise throughout the radio bandwidth that can affect devices.

Induced noise: Noise generated by electromagnetic induction can affect the signal line and may cause the controller to malfunction.

Preventing Induced Noise

Use a noise filter on the output side or use shielded cables. Lay the cables at least 30 cm away from the signal line to prevent induced noise.



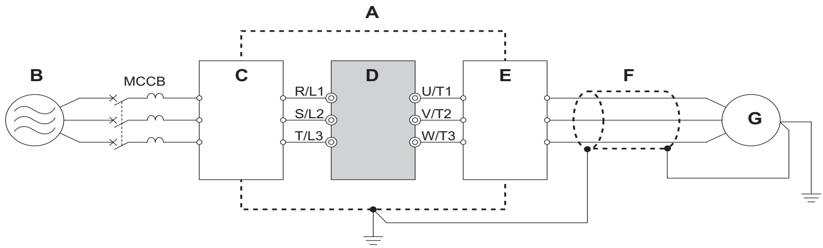
A	**– Power supply**	**E**	**– Separate at least 30 cm**
B	**– Drive**	**F**	**– Controller**
C	**– Shielded motor cable**	**G**	**– Signal line**
D	**– Motor**	**H**	**–**

Figure 7.8 Preventing Induced Noise

Reducing Radiated/Radio Frequency Noise

The drive, input lines, and output lines generate radio frequency noise. Use noise filters on input and output sides and install the drive in a metal enclosure panel to reduce radio frequency noise.

Note: The cable running between the drive and motor should be as short as possible.



A – Metal enclosure
B – Power supply
C – Noise filter
D – Drive
E – Noise filter
F – Shielded motor cable
G – Motor

Figure 7.9 Reducing Radio Frequency Noise

◆ EMC Filter Installation

This drive is tested according to European standards EN61800-3 and it complies with the EMC guidelines. *Refer to EMC Filter Installation on page 403* for details about EMC filter selection and installation.

◆ Installing a Motor Thermal Overload Relay on the Drive Output

Motor thermal overload relays protect the motor by disconnecting power lines to the motor due to a motor overload condition.

Install a motor thermal overload relay between the drive and motor:

- When operating multiple motors on a single AC drive.
- When using a power line bypass to operate the motor directly from the power line.

It is not necessary to install a motor thermal overload relay when operating a single motor from a single AC drive. The AC drive has UL recognized electronic motor overload protection built into the drive software.

Note: Disable the motor protection function (L1-0 1 = “0”) when using an external motor thermal overload relay. The relay should shut off main power on the input side of the main circuit when triggered.

■ General Precautions when Using Thermal Overload Relays

The following application precautions should be considered when using motor thermal overload relays on the output of AC drives in order to prevent nuisance trips or overheat of the motor at low speeds:

1. Low speed motor operation
2. Use of multiple motors on a single AC drive
3. Motor cable length
4. Nuisance tripping resulting from high AC drive carrier frequency

Low Speed Operation and Motor Thermal OL Relays

Generally, thermal relays are applied on general-purpose motors. When general-purpose motors are driven by AC drives, the motor current is approximately 5 ~ 10% greater than if driven by the commercial power supply. In addition, the cooling capacity of a motor with a shaft-driven fan decreases when operating at low speeds so that even if the load current is within the motor rated value, motor overheating may occur. A thermal relay cannot effectively protect the motor due to the reduction of cooling at low speeds. For this reason, apply the UL-recognized electronic thermal overload protection function built into the drive whenever possible.

UL recognized electronic thermal overload function of the drive: Speed-dependent heat characteristics are simulated using data from standard motors and force-ventilated motors. The motor is protected from overload using this function.

Using One Drive with Multiple Motors

Turn off the electronic thermal overload function. Please refer to the appropriate product instruction manual to determine which parameter disables this function.

The UL recognized electronic thermal overload function of the drive cannot be applied when using multiple motors on one drive!

Long motor cables

When long motor cables and high carrier frequency are being used, nuisance tripping of the thermal relay may occur due to increased leakage current. Therefore, reduce the carrier frequency or increase the tripping level of the thermal overload relay.

Nuisance Tripping Resulting from High AC Drive Carrier Frequency

Current waveforms generated by high carrier frequency PWM drives tend to create additional temperature rise in overload relays. Therefore, it may be necessary to increase the trip level setting when encountering nuisance triggering of the relay.

WARNING! *Risk of Fire. Confirm an actual motor overload condition is not present prior to increasing the thermal OL trip setting. Check local electrical codes before making adjustments to motor thermal overload settings.*

7.5 Communication Options

Table 7.2 gives detailed information about the available option cards that allow OYMC drives to connect to various communications networks. Using a communication option a host controller can control the drive, read or change parameters and monitor the drive operation. Refer to *Table 7.2* to determine which option cards may be necessary for a given environment. Contact OYMC to order option cards.

- **Option Card Selection**: Refer to OYMC catalog for option card selection and part numbers.
- **Option Card Installation**: Refer to option card manual for option card installation instructions.

Table 7.2 Available Option Cards

Option Card	Model	Function
Profibus	SI-P3/V	Allows the drive to connect to a Profibus-DP network.
CANopen	SI-S3/V	Allows the drive to connect to a CANopen network.
DeviceNet	SI-N3/V	Allows the drive to connect to a DeviceNet network.

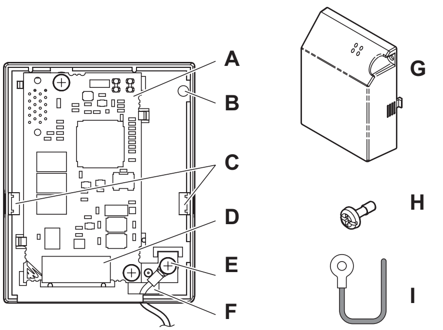
7.6 Connecting an Option Card

The drive can communicate with other devices through a specially designed option card. The following section describes how to install an option card.

Refer to option card manual for detailed installation instructions.

Note: *Refer to Available Option Cards on page 273* for a list of option cards for use with this product.

◆ Verifying Option Card and Product Type



A – Option card
B – Option card cover installation screw holes
C – Tabs for mounting front cover
D – Comm. connector (CN1)
E – Ground lead connection
F – Wire through-hole
G – Option card cover
H – Cover screw
I – Ground lead

Figure 7.10 Option Card

◆ Connecting the Option Card

1. Loosen the screw on the front cover of the drive to remove the cover.

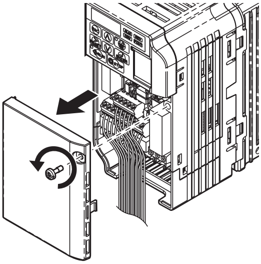
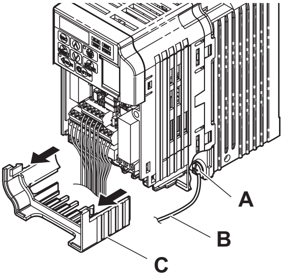


Figure 7.11 Remove Cover

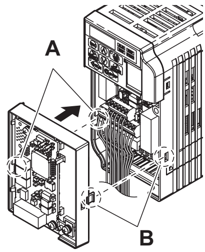
2. Remove the terminal cover. Connect the lead from the option card to the drive ground terminal.



A – Ground terminal
B – Ground lead
C – Terminal cover

Figure 7.12 Connect Lead

3. Reattach the terminal cover.
4. Attach the option card to the drive.



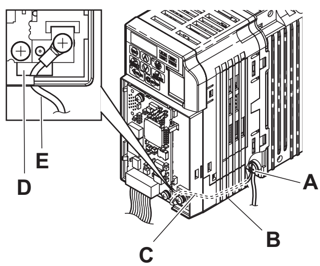
A – Line up the tab with the mounting hole.

B – Line up the tab with the mounting hole.

Figure 7.13 Attach Option Card

Note: Gently pack wires to fit behind the left and right side of the cover into the provided recess.

5. Connect the lead from the drive ground terminal to the same terminal as the option card lead.
   The option card lead should exit through the holes provided on the underside of the drive as it gets routed passed the ground terminal.



A – Drive ground terminal

B – Route the lead wire on the inside of the lower cover.

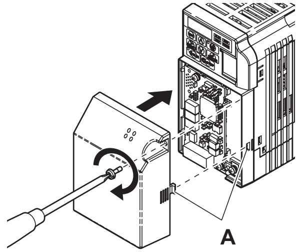
C – Ground lead

D – Ground lead through-hole

E – Ground lead

Figure 7.14 Lead Wire Connection

6. Reattach the option card cover.



A – Align the tab with the mounting hole.

Figure 7.15 Reattach Cover

Appendix: A

Specifications

A.1 Heavy Duty and Normal Duty Ratings

The capacity of the drive is based on two types of load characteristics: Heavy Duty (HD) and Normal Duty (ND).

Refer to *Table A.1* for the differences between HD and ND. Specifications for capacity ratings appear are listed on the following pages.

Table A.1 Selecting the Appropriate Load Rating

Setting Parameter C6-01	Rated Output Current	Overload Tolerance	Default Carrier Frequency
0: Heavy Duty (default)	HD Rating varies by model <1>	150% rated output current for 60 s	8 / 10 kHz varies by model
1: Normal Duty	ND Rating varies by model <1>	120% rated output current for 60 s. Varies by model	2 kHz, Swing PWM

<1> The following pages list information on rating changes based on drive model.

TERMS

HD and ND

- HD refers to applications requiring constant torque output, while ND refers to applications with variable torque needs.
- The drive allows the user to select HD or ND torque depending on the application. Fans, pumps, and blowers should use ND (C6-01 = “1”), and other applications generally use HD (C6-01 = “0”).

Swing PWM

- Swing PWM equivalent to a 2 kHz audible noise. This function turns the motor noise into a less obtrusive white noise.

Note: Differences between HD ratings and ND ratings for the drive include rated input and output current, overload capacity, carrier frequency, and current limit. The default setting is for HD (C6-01=0).

A.2 Single/Three-Phase 200 V Class Drive

Table A.2 Power Ratings

Item				Specification						
Three-Phase: VZA☐				**20P1**	**20P2**	**20P4**	**20P7**	**21P5**	**22P2**	**24P0**
Single-Phase: VZA☐ <1>				**B0P1**	**B0P2**	**B0P4**	**B0P7**	**B1P5**	**B2P2**	**B4P0 <2>**
Maximum Motor Size Allowed (kW) <3>			HD Rating	0.1	0.2	0.4	0.75	1.5	2.2	4.0
			ND Rating	0.2	0.4	0.75	1.1	2.2	3.0	5.5
Input	Input Current (A) <4>	Three-Phase	HD Rating	0.7	1.5	2.9	5.8	7.5	11.0	18.9
			ND Rating	1.1	1.9	3.9	7.3	10.8	13.9	24.0
		Single-Phase	HD Rating	1.4	2.8	5.5	11.0	14.1	20.6	35.0
			ND Rating	2.0	3.6	7.3	13.8	20.2	24.0	–
Output	Rated Output Capacity (kVA) <5>		HD Rating	0.3	0.6	1.1	1.9	3.0	4.2	6.7
			ND Rating	0.5	0.7	1.3	2.3	3.7	4.6	7.5
	Output Current (A)		HD Rating	0.8 <6>	1.6 <6>	3.0 <6>	5.0 <6>	8.0 <7>	11.0 <7>	17.5 <7>
			ND Rating <8>	1.2	1.9	3.5 (3.3)	6.0	9.6	12.0	19.6
	Overload Tolerance			ND Rating: 120% of rated output current for 1 minute HD Rating: 150% of rated output current for 1 minute (Derating may be required for applications that start and stop frequently)						
	Carrier Frequency			User adjustable between 2 and 15 kHz (see HD output current line of this table for default values)						
	Max Output Voltage (V)			Three-phase 200 to 240 V (proportional to input voltage)						
	Max Output Frequency (Hz)			400 Hz (user-adjustable)						
Power Supply	Rated Voltage Rated Frequency			Three-phase power: Three-phase 200 to 240 V 50/60 Hz Single-phase power: 200 to 240 V 50/60 Hz						
	Allowable Voltage Fluctuation			-15 to 10%						
	Allowable Frequency Fluctuation			±5%						
Harmonic Countermeasures		DC Reactor		Optional						

<1> Drives with a single-phase power supply input will output three-phase power, and cannot run a single-phase motor.
<2> This drive does not have a Normal Duty rating.
<3> The motor capacity (kW) refers to a Yaskawa 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor rated current.
<4> Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.
<5> Rated motor capacity is calculated with a rated output voltage of 220 V.
<6> Carrier frequency is set to 10 kHz. Current derating is required in order to raise the carrier frequency.
<7> Carrier frequency is set to 8 kHz. Current derating is required in order to raise the carrier frequency.
<8> Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

Table A.3 Power Ratings Continued

Item				Specification			
Three-Phase: VZA☐				25P5	27P5	2011	2015
Single-Phase: VZA☐ <1>				-	-	-	-
Maximum Motor Size Allowed (kW) <2>			HD Rating	5.5	7.5	11.0	15.0
Maximum Motor Size Allowed (kW) <2>			ND Rating	7.5	11.0	15.0	18.5
Input	Input Current (A) <3>	Three-Phase	HD Rating	26.0	35.4	51.9	70.8
Input	Input Current (A) <3>	Three-Phase	ND Rating	34.7	50.9	69.4	85.6
Input	Input Current (A) <3>	Single-Phase	HD Rating	-	-	-	-
Input	Input Current (A) <3>	Single-Phase	ND Rating	-	-	-	-
Output	Rated Output Capacity (kVA) <4>		HD Rating	9.5	12.6	17.9	22.9
Output	Rated Output Capacity (kVA) <4>		ND Rating	11.4	15.2	21.3	26.3
Output	Output Current (A)		HD Rating	25.0 <5>	33.0 <5>	47.0 <5>	60.0 <5>
Output	Output Current (A)		ND Rating <6>	30.0	40.0	56.0	69.0
Output	Overload Tolerance			ND Rating: 120% of rated output current for 1 minute HD Rating: 150% of rated output current for 1 minute (Derating may be required for applications that start and stop frequently)			
Output	Carrier Frequency			User adjustable between 2 and 15 kHz (see HD output current line of this table for default values)			
Output	Max Output Voltage (V)			Three-phase 200 to 240 V (proportional to input voltage)			
Output	Max Output Frequency (Hz)			400 Hz (user-adjustable)			
Power Supply	Rated Voltage Rated Frequency			Three-phase power: Three-phase 200 to 240 V 50/60 Hz Single-phase power: 200 to 240 V 50/60 Hz			
Power Supply	Allowable Voltage Fluctuation			-15 to 10%			
Power Supply	Allowable Frequency Fluctuation			±5%			
Harmonic Countermeasures	DC Reactor			Optional			

<1> Drives with a single-phase power supply input will output three-phase power, and cannot run a single-phase motor.
<2> The motor capacity (kW) refers to a Yaskawa 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor rated current.
<3> Input current rating varies depending on the power supply transformer, input reactor, wiring connections, and power supply impedance.
<4> Rated motor capacity is calculated with a rated output voltage of 220 V.
<5> Carrier frequency is set to 8 kHz. Current derating is required in order to raise the carrier frequency.
<6> Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

Note: Differences between Heavy Duty (HD) ratings and Normal Duty (ND) ratings for the drive include rated input and output current, overload capacity, carrier frequency and current limit. Set parameter C6-01 to “0” (default) for HD or “1” for ND.

A.3 Three-Phase 400 V Class Drives

Table A.4 Power Ratings

Item			Specification						
VZA☐			40P2	40P4	40P7	41P5	42P2	43P0	44P0
Maximum Applicable Motor Capacity (kW) <1>		HD Rating	0.2	0.4	0.75	1.5	2.2	3.0	3.7
		ND Rating	0.4	0.75	1.5	2.2	3.0	3.7	5.5
Input	Input Current (A) <2>	HD Rating	1.2	1.8	3.2	4.4	6.0	8.2	10.4
		ND Rating	1.2	2.1	4.3	5.9	8.1	9.4	14.0
Output	Output Current (kVA) <3>	HD Rating <4>	0.9	1.4	2.6	3.7	4.2	5.5	7.0
		ND Rating <5>	0.9	1.6	3.1	4.1	5.3	6.7	8.5
	Output Current (A)	HD Rating <4>	1.2	1.8	3.4	4.8	5.5	7.2	9.2
		ND Rating <5>	1.2	2.1	4.1	5.4	6.9	8.8	11.1
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)						
	Carrier Frequency		User adjustable between 2 and 15 kHz (see HD output current line of this table for default values)						
	Maximum Output Voltage (V)		Three-phase: 380 to 480 V (proportional to input voltage)						
	Maximum Output Frequency (Hz)		400 Hz (user-adjustable)						
Power Supply	Rated Voltage Rated Frequency		Three-phase: 380 to 480 V 50/60 Hz						
	Allowable Voltage Fluctuation		-15 to 10%						
	Allowable Frequency Fluctuation		±5%						
Harmonic Countermeasures	DC Reactor		Optional						

<1> The motor capacity (kW) refers to a Yaskawa 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor rated current.
<2> .Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance.
<3> Rated motor capacity is calculated with a rated output voltage of 440 V.
<4> Carrier frequency is set to 8 kHz. Current derating is required in order to raise the carrier frequency.
<5> Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

A.3 Three-Phase 400 V Class Drives

Table A.5 Power Ratings Continued

Item			Specification			
VZA□			**45P5**	**47P5**	**4011**	**4015**
Maximum Applicable Motor Capacity (kW) <1>		HD Rating	5.5	7.5	11.0	15.0
		ND Rating	7.5	11.0	15.0	18.5
Input	Input Current (A) <2>	HD Rating	15.0	20.0	29.0	39.0
		ND Rating	20.0	24.0	38.0	44.0
Output	Output Current (kVA) <3>	HD Rating <4>	11.3	13.7	18.3	23.6
		ND Rating <5>	13.3	17.5	23.6	29.0
	Output Current (A)	HD Rating <4>	14.8	18.0	24.0	31.0
		ND Rating <5>	17.5	23.0	31.0	38.0
	Overload Tolerance		ND Rating: 120% of rated output current for 60 s HD Rating: 150% of rated output current for 60 s (Derating may be required for applications that start and stop frequently)			
	Carrier Frequency		User adjustable between 2 and 15 kHz (see HD output current line of this table for default values)			
	Maximum Output Voltage (V)		Three-phase: 380 to 480 V (proportional to input voltage)			
	Maximum Output Frequency (Hz)		400 Hz (user-adjustable)			
Power Supply	Rated Voltage Rated Frequency		Three-phase: 380 to 480 V 50/60 Hz			
	Allowable Voltage Fluctuation		-15 to 10%			
	Allowable Frequency Fluctuation		±5%			
Harmonic Countermeasures	DC Reactor		Optional			

<1> The motor capacity (kW) refers to a Yaskawa 4-pole motor. The rated output current of the drive output amps should be equal to or greater than the motor rated current.
<2> .Input current rating varies depending on the power supply transformer, input reactor, wiring conditions, and power supply impedance.
<3> Rated motor capacity is calculated with a rated output voltage of 440 V.
<4> Carrier frequency is set to 8 kHz. Current derating is required in order to raise the carrier frequency.
<5> Carrier frequency is set to 2 kHz. Current derating is required in order to raise the carrier frequency.

Note: Differences between Heavy Duty (HD) ratings and Normal Duty (ND) ratings for the drive include rated input and output current, overload capacity, carrier frequency and current limit. Set parameter C6-01 to “0” (default) for HD or “1” for ND.

A.4 Drive Specifications

Note: Perform rotational Auto-Tuning to obtain OLV performance specifications.
Note: For optimum performance life of the drive, install the drive in an environment that meets the environmental conditions.

Item		Specification
Control Characteristics	Control Method	The following control methods are available: Open Loop Vector Control (current vector), V/f Control, and PM Open Loop Vector for (for use with SPM and IPM)
	Frequency Control Range	0.01 to 400 Hz
	Frequency Accuracy	Digital input: within ±0.01% of the max output frequency (-10 to +50 °C) Analog input: within ±0.5% of the max output frequency (25°C ±10 °C)
	Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/1000 of maximum output frequency
	Output Frequency Calculation Resolution	$1/2^{20}$ x Maximum output frequency (E1-04)
	Frequency Setting Signal	Main frequency reference: 0 to +10 Vdc (20 kΩ), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω) Main speed reference: Pulse Train Input (max 33 kHz)
	Starting Torque	200%/0.5 Hz (Open Loop Vector Control, HD rating, IM of 3.7 kW or smaller), 50%/6 Hz (PM Open Loop Vector Control)
	Speed Control Range	1:100 (Open Loop Vector Control), 1:40 (V/f Control), 1:10 (PM Open Loop Vector Control)
	Speed Control Accuracy	0.2% in Open Loop Vector Control <1>
	Speed Response	5 Hz (20 °C ±10 °C) in Open Loop Vector Control (excludes temperature fluctuation when performing Rotational Auto-Tuning)
	Torque Limit	Open Loop Vector Control only. Adjustable in 4 quadrants.
	Accel/Decel Time	0.00 to 6000.0 s (allows four separate settings for accel and decel)
	Braking Torque	Instantaneous Average Decel Torque <2>: 0.1/0.2 kW: over 150%, 0.4/0.75 kW: over 100%, 1.5 kW: over 50%, 2.2 kW and above: over 20% Continuous Regen Torque: 20%, 125% with a Braking Resistor Unit <3>: (10% ED) 10 s with an internal braking resistor.
	V/f Characteristics	Preset V/f patterns and user-set program available.

A.4 Drive Specifications

Item		Specification
Control Characteristics	Functions	Momentary Power Loss Ride-Thru, Speed Search, Over /Undertorque detection, Torque Limit, Multi-Step Speed (17 steps max), Accel/Decel Time Switch, S-Curve Accel/Decel, 3-Wire Sequence, Rotational Auto-Tuning, Stationary Auto-Tuning of Line-to-Line Resistance, Dwell, Cooling Fan ON/OFF, Slip Compensation, Torque Compensation, Frequency Jump, Frequency Reference Upper/Lower Limit, DC Injection Braking (start and stop), High Slip Braking, PID Control (with Slip Function), Energy Saving, MEMOBUS (RS-485/422 Max 115.2 kbps), Fault Reset, Parameter Copy.
Protection Functions	Motor Protection Momentary	Motor overheat protection via output current sensor
	Overcurrent Protection	Drives stops when output exceeds 200% of the rated current (Heavy Duty)
	Overload Protection	A stop command will be entered after operating at 150% for 60 s (Heavy Duty) <4>
	Low Voltage Protection	Drive stops when DC bus voltage falls below the levels indicated: <5> 190 V (3-phase 200 V), 160 V (single-phase 200 V), 380 V (3-phase 400 V), 350 V (3-phase 380 V)
	Momentary Power Loss Ride-Thru	3 selections available: Ridethru disabled (stops after 15 ms), time base of 0.5 s, and continue running until power is restored. <6>
	Heatsink Overheat Protection	Protected by thermistor
	Braking Resistor Overheat Protection	Overheat sensor for braking resistor (Optional ERF-type, 3%ED)
	Stall Prevention	Stall prevention is available during acceleration, deceleration, and during run. Separate settings for each type of stall prevention determine the current level at which stall prevention is triggered.
	Cooling Fan Failure Protection	Circuit protection ("fan-lock" sensor)
	Ground Protection	Electronic circuit protection (triggered by the same levels as momentary current protection) <7>
	DC Bus Charge LED	Remains lit until DC bus voltage falls below 50 V
Environment	Storage/Installation Area	Indoors
	Ambient Temperature	-10 to +40 °C (wall-mounted enclosure) -10 to +50 °C (open chassis)
	Humidity	95 RH% or less with no condensation
	Storage Temperature	-20 to +60 °C allowed for short-term transport of the product
	Altitude	1000 m or less
	Shock, Impact	10 to 20 Hz: 9.8 m/S 2 20 to 55 Hz: 5.9 m/S 2

Item		Specification
Environment	Surrounding Area	Install the drive in an area free from: • oil mist and dust • metal shavings, oil, water or other foreign materials • radioactive materials • combustible materials • harmful gases and liquids • excessive vibration • chlorides • direct sunlight
	Orientation	Install the drive vertically to maintain maximum cooling effects
Safety Regulations and Standards		Safe Disable Input according to UL508C, EN954-1 Safety Category 3; EN61508, SIL2; Time from input open to drive output stop is less than 1 ms.
Protective Enclosure		Open chassis (IP20) Wall-mounted enclosure (NEMA Type 1): available as an option
Cooling Method		VZAB0P1 to B0P7: self-cooled VZAB1P5 to B4P0: cooling fan VZA20P1 to 20P4: self-cooled VZA20P7 to 2015: cooling fan VZA40P2 to 40P7: self-cooled VZA41P5 to 4015: cooling fan

<1> Speed control accuracy varies somewhat according to the type of motor and drive settings.

<2> Instantaneous average deceleration torque refers to the torque required to decelerate the motor (uncoupled from the load) from 60 Hz in the shortest time.

<3> Ensure that Stall Prevention Selection during Deceleration is disabled (L3-04 = 0) or set to 3 when using a braking resistor or the Braking Resistor Unit. The default setting for the stall prevention function will interfere with the braking resistor.

<4> Overload protection may be triggered when operating with 150% of the rated output current if the output frequency is less than 6 Hz.

<5> Parameter settings allow up to 150 V.

<6> A Momentary Power Loss Ridethru Unit is required for 200/400 V class drives 7.5 kW and less if the application needs to continue running during a momentary power loss up to 2 seconds.

<7> Ground protection cannot be provided under the following circumstances when a ground fault is likely in the motor windings during run: Low ground resistance for the motor cable and terminal block; low ground resistance for the motor cable and terminal block; or the drive is powered up from a ground short.

A.5 Drive Watts Loss Data

Table A.6 Watts Loss 200 V Class Single-Phase Models

Model Number VZA	Heavy Duty (Carrier frequency 8kHz)				Normal Duty (Carrier frequency 2kHz)			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
B0P1	0.8	4.3	7.4	11.7	1.2	5.0	8.5	13.5
B0P2	1.6	7.9	8.9	16.7	1.9	7.6	9.7	17.3
B0P4	3.0	16.1	11.5	27.7	3.2	14.6	14.4	29.1
B0P7	5.0	33.7	16.8	50.5	6.0	30.1	19.4	49.5
B1P1	8.0	54.8	25.9	80.7	9.6	51.7	29.8	81.4
B2P2	11.0	70.7	34.1	104.8	12.0	61.3	37.1	98.4
B4P0	17.5	110.5	51.4	161.9	-	-	-	-

Table A.7 Watts Loss 200 V Class Three-Phase Models

Model Number VZA	Heavy Duty (Carrier frequency 8kHz)				Normal Duty (Carrier frequency 2kHz)			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
20P1	0.8	4.3	7.3	11.6	1.2	5.0	8.0	13.0
20P2	1.6	7.9	8.8	16.7	1.9	7.6	9.5	17.1
20P4	3.0	16.2	11.5	27.7	3.5	15.8	13.6	29.4
20P7	5.0	27.4	15.9	43.3	6.0	27.5	17.2	44.7
21P5	8.0	54.8	23.8	78.6	9.6	51.7	25.8	77.5
22P2	11.0	70.7	29.9	100.6	12.0	61.3	30.4	91.7
24P0	17.5	110.5	43.3	153.8	19.6	98.7	46.3	145.0
25P5	25.0	231.5	72.2	303.7	30.0	246.4	88.9	335.3
27P5	33.0	339.5	82.8	321.3	40.0	266.7	112.8	379.6
2011	47.0	347.6	117.6	465.2	56.0	357.9	151.8	509.7
2015	60.0	437.7	151.4	589.1	69.0	461.7	184.5	646.2

Table A.8 Watts Loss 400 V Class Three-Phase Models

Model Number VZA	Heavy Duty (Carrier frequency 8kHz)				Normal Duty (Carrier frequency 2kHz)			
	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)	Rated Amps (A)	Heatsink Loss (W)	Interior Unit Loss (W)	Total Loss (W)
40P2	1.2	19.2	11.5	30.7	1.2	10.0	9.6	19.6
40P4	1.8	28.9	14.8	43.7	2.1	18.5	13.9	32.4
40P7	3.4	42.3	17.9	60.2	4.1	30.5	16.8	47.3
41P5	4.8	70.7	26.2	96.9	5.4	44.5	21.8	66.3
42P2	5.5	81.0	30.7	111.7	6.9	58.5	28.4	86.9
43P0	7.2	84.6	32.9	117.5	8.8	63.7	31.4	95.1
44P0	9.2	107.2	41.5	148.7	11.1	81.7	46.0	127.7
45P5	14.8	166.0	62.7	228.7	17.5	181.2	80.1	261.3
47P5	18.0	207.1	78.1	285.2	23.0	213.4	107.7	321.1
4011	24.0	266.9	105.9	372.8	31.0	287.5	146.1	433.6
4015	31.0	319.1	126.6	445.7	38.0	319.2	155.8	475.0

A.6 Drive Derating Data

The drive can be operated at above rated temperature, altitude and default carrier frequency by derating the drive capacity. For example, a 10 amp continuous rated drive may be operated at higher temperatures if it is only used to supply 8 amps continuous.

◆ Carrier Frequency Derating

As the carrier frequency of the drive is increased above the factory setting the drive capacity should be derated according to *Figure A.1*.

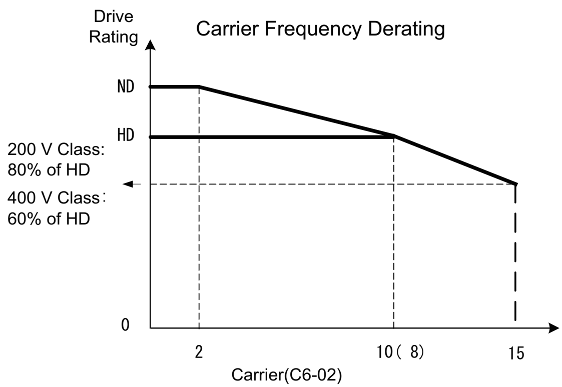


Figure A.1 Carrier Frequency Derating

◆ Temperature Derating

As the ambient temperature for the drive is increased above the drive specification the drive should be derated. Additionally parameter L8-35 Installation Method Selection on page *290* should be set according to enclosure type and mounting method as illustrated in *Figure A.2 Ambient Temperature and Installation Method Derating on page 291*.

■ Output Current Derating Due to Ambient Temperature

If the ambient temperature is above the drive specification or if drives are side-by-side mounted in a cabinet, the parameters L8-12 and L8-35 must be set according to the installation conditions. The output current is derated as shown in *Figure A.2*.

No.	Name	Description	Range	Def.
L8-12	Ambient Temperature Setting	Adjust the drive overload (OL2) protection level when the drive is installed in an environment that exceeds its ambient temperature rating.	40 to 60	40 °C
L8-35	Installation Method Selection	0: Disabled (standard installation) 1: Side-by-Side installation 2: IP20/NEMA Type 1 3: Finless/Fin Outside installation	0 to 3	0

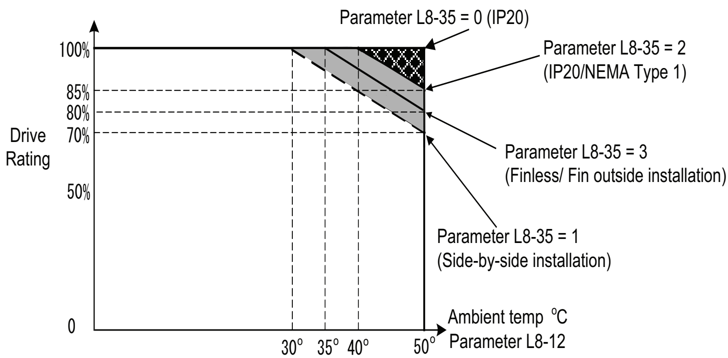


Figure A.2 Ambient Temperature and Installation Method Derating

◆ Altitude Derating

The drives standard ratings are valid for an installation altitude up to 1000 m. If the altitude exceeds 1000m both, the drive input voltage and the rated output current must be derated for 1 % per 100 m. The maximum altitude is 3000 m.

A.6 Drive Derating Data

Appendix: B

Parameter List

This chapter contains a full listing of all parameters and settings available in the drive

B.1 Parameter Groups

Parameter Group	Name	Page	Parameter Group	Name	Page
A1	Initialization	295	H4	Analog Outputs	333
A2	User Parameters	296	H5	Serial Communications Setup	334
b1	Sequence	297	H6	Pulse Train I/O Setup	335
b2	DC Injection Braking	298	L1	Motor Overload	337
b3	Speed Search	299	L2	Power Loss Ride-Thru	338
b4	Delay Timer	300	L3	Stall Prevention	339
b5	PID Control	300	L4	Reference Detection	342
b6	Dwell Function	303	L5	Fault Restart	342
b8	Energy Saving	303	L6	Overtorque Detection	344
C1	Acceleration/Deceleration Time	304	L7	Torque Limit	347
C2	S-Curve Accel/Decel	305	L8	Hardware Protection	347
C3	Motor Slip Compensation	305	n1	Hunting Prevention	350
C4	Motor Torque Compensation	306	n2	Speed Feedback Protection	351
C5	Speed Control (ASR)	307	n3	High-Slip Braking	351
C6	Carrier Frequency	307	n6	Motor Line-to-Line Resistance Online Tuning	352
d1	Frequency Reference	309	n8	PM Motor Control	352
d2	Reference Limits	310	o1	Monitor Display Selection	354
d3	Jump Frequencies	311	o2	Operator Keypad Functions	355
d4	Frequency Reference Hold	311	o4	Maintenance Functions	356
d7	Off-Set Frequency	313	q	FBD’s Parameters	357
E1	V/f Pattern	314	r	FBD’s Connection	357
E2	Motor Setup	315	T1	Auto-Tuning	359
E3	Motor 2 V/f Pattern	316	U1	Status Monitor	360
E4	Motor Setup 2	317	U2	Fault Trace	363
E5	PM Motor Setup	319	U3	Fault History	364
F1	Fault Detection during PG Speed Control	321	U4	Maintenance Monitor	366
F6	Network Communications	322	U5	Application Monitor	369
F7	Network Communications	322	U6	Control Monitor	369
H1	Digital Inputs	325	U8	FBD’s Custom Monitors	370
H2	Digital Outputs	329			
H3	Analog Inputs	332			

B.2 Parameter Table

◆ A: Initialization Parameters

The A parameter group creates the operating environment for the drive. This includes the parameter Access Level, Motor Control Method, Password, User Parameters and more.

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Name</th><th rowspan="2">Description</th><th rowspan="2">Range</th><th rowspan="2">Def.</th><th colspan="3">Control Mode</th><th rowspan="2">Addr. Hex</th><th rowspan="2">Pg.</th></tr>
<tr><th>V/f</th><th>OLV</th><th>PM</th></tr>
<tr><td colspan="10">A1: Initialization Parameters
Use A1 parameters to configure the basic environment for drive operation.</td></tr>
<tr><td>A1-01
<22>
<16></td><td>Access Level Selection</td><td>Selects which parameters are accessible via the digital operator.
0: Operation only
1: User Parameters (access to a set of parameters selected by the user)
2: Advanced Access Level</td><td>0 to 2</td><td>2</td><td>A</td><td>A</td><td>A</td><td>101H</td><td>—</td></tr>
<tr><td>A1-02</td><td>Control Method Selection</td><td>Selects the Control Method of the drive.
0: V/f Control without PG
2: Open Loop Vector (OLV)
5: PM Open Loop Vector (PM)
Note: Does not return to the default setting when the drive is initialized.</td><td>0, 2, 5</td><td>0</td><td>S</td><td>S</td><td>S</td><td>102</td><td>118</td></tr>
<tr><td rowspan="2">A1-03</td><td rowspan="2">Initialize Parameters</td><td rowspan="2">Resets all parameters to factory default settings. (Initializes the drive then returns A1-03 to 0)
0: No Initialize
1110: User Initialize (First set user parameter values must be stored using parameter o2-03)
2220: 2-Wire Initialization
3330: 3-Wire Initialization
5550: OPE04 Error Reset</td><td>0 to 3330</td><td>0</td><td>A</td><td>A</td><td>A</td><td>103</td><td>—</td></tr>
<tr><td colspan="7">The following parameters are not reset when the performing initialization:
A1-00, A1-02, A1-07, and all U2 and U3 monitors.</td></tr>
<tr><td>A1-04</td><td>Password 1</td><td rowspan="3">When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 thru A1-03, A1-06, and A2-01 thru A2-32 cannot be changed.</td><td>0 to 9999</td><td>0</td><td>A</td><td>A</td><td>A</td><td>104</td><td>—</td></tr>
<tr><td rowspan="2">A1-05</td><td rowspan="2">Password 2</td><td>0 to 9999</td><td>0</td><td>A</td><td>A</td><td>A</td><td>105</td><td>—</td></tr>
<tr><td colspan="6">This parameter is hidden from view. To access A1-05, first display A1-04. Then press the STOP key while holding down the up arrow key. Parameter A1-05 will appear.</td><td>—</td></tr>
</table>

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
A1-06	Application Preset	Sets parameters that are commonly used in certain applications to A2-01 through A2-16 for easier access. 0: General-purpose (A2 parameters are not affected) 1: Water supply pump 2: Conveyor 3: Exhaust fan 4: HVAC fan 5: Air compressor 6: Hoist 7: Travelling	0 to 7	0	A	A	A	127	—
A1-07	FBD's Function Selection	0: Disabled 1: Enabled 2: Multi-function input (enabled when H1-☐☐ = 9F)	0 to 2	0	A	A	A		—
A2: User Parameters Use A2 parameters to program the drive.									
A2-01 to A2-32	User Parameters, 1 to 32	Parameters that were recently edited are listed here. The user can also select parameters to appear here for quick access. Parameters will be stored here for quick access when A1-01 = 1.	b1-01 to o2-08	-- *<16>*	A	A	A	106 to 125	—
A2-33	User Parameter Automatic Selection	0: Parameters A2-01 through A2-32 are reserved for the user to create a list of User Parameters. 1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quick access.	0,1	1 *<4>*	A	A	A	126	—

<4> Default setting value is dependent on parameter A1-06. This setting value is 0 when A1-06 = 0, and 1 when A1-06 does not = 0.
<16> Default setting value is dependent on parameter A1-06, Application Selection.
<22> Parameter can be changed during run.

◆ b: Application

Application parameters configure the Run Command Source, DC Injection Braking, Speed Search, Timer functions, PID control, the Dwell function, Energy Savings and a variety of other application-related settings.

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
b1: Operation Mode Selection Use b1 parameters to configure the operation mode.									
b1-01	Frequency Reference Selection 1	Selects the frequency reference input source. 0: Operator - Digital preset speed d1-01 to d1-17. 1: Terminals - Analog input terminal A1 or A2. 2: Memobus communications 3: Option PCB 4: Pulse Input (Terminal RP)	0 to 4	1	S	S	S	180	120
b1-02	Run Command Selection 1	Selects the run command input source. 0: Operator - RUN and STOP keys on the digital operator. 1: Digital input terminals S1 to S6 2: Memobus communications 3: Option PCB.	0 to 3	1	S	S	S	181	123
b1-03	Stopping Method Selection	Selects the stopping method when the run command is removed. 0: Ramp to Stop 1: Coast to Stop 2: DC Injection Braking to Stop 3: Coast with Timer (A new run command is ignored if received before the timer expires) 9: Simple Positioning	0 to 3, 9	0	S	S	S	182	125
			DC Injection Braking at Stop cannot be selected when using Open Loop Vector for PM motors.						
b1-04	Reverse Operation Selection	Permits or prohibits reverse operation. 0: Reverse enabled. 1: Reverse disabled.	0,1	0	A	A	A	183	—
b1-07	Local/Remote Run Selection	Determines the operation when the Run command source is switched from LOCAL to REMOTE or between Run source 1 and 2 while an external Run command is active at the new source. 0: External Run command has to be cycled at the new source to be activated. 1: External Run command at new source is accepted immediately.	0,1	0	A	A	A	186	—
b1-08	Run Command Selection while in Programming Mode	0: Run command accepted only in the operation menu. 1: Run command accepted in all menus. 2: Prohibit entering programming mode during Run	0 to 2	0	A	A	A	187	—

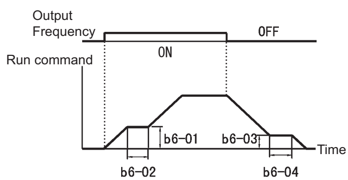
No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
b1-14	Phase Order Selection	Sets the phase order for drive output terminals U/T1, V/T2 and W/T3. 0: Standard 1: Switch phase order	0,1	0	A	A	A	1C3	—
b1-15	Frequency Reference 2	Selects the frequency reference input source. 0: Operator - Digital preset speed d1-01 to d1-17. 1: Terminals - Analog input terminal A1 or A2 2: Memobus communications 3: Option PCB 4: Pulse Input (Terminal RP)	0 to 4	0	A	A	A	1C4	—
b1-16	Run Command Source 2	Selects the run command input source. 0: Operator - RUN and STOP keys on the digital operator. 1: Digital input terminals S1 to S6 2: Memobus communications 3: Option PCB	0 to 3	0	A	A	A	1C5	—
b1-17	Run Command at Power Up	Determines the operation when a Run command is active at power up of the drive. 0: Run command not issued, needs to be cycled 1: Run command issued, motor operation start	0,1	0	A	A	A	1C6	—
b2: DC Injection Braking Use b2 parameters to configure DC Injection Braking operation									
b2-01	DC Injection Braking Start Frequency	Sets the frequency at which DC Injection Braking starts when Ramp to Stop (b1-03 = 0) is selected. If b2-01< E1-09, DC Injection Braking starts at E1-09.	0.0 to 10.0	0.5 Hz	A	A	A	189	—
b2-02	DC Injection Braking Current	Sets the DC Injection Braking current as a percentage of the drive rated current.	0 to 75	50%	A	A	–	18A	—
b2-03	DC Injection Braking Time/DC Excitation Time at Start	Sets DC Injection Braking time at start. Disabled when set to 0.00 seconds.	0.00 to 10.00	0.00 s <1>	A	A	–	18B	—
b2-04	DC Injection Braking Time at Stop	Sets DC Injection Braking time at stop.When b1-03 = 2, actual DC Injection time is calculated as follows: (b2-04) x 10 x (Output Freq) / (E1-04). When b1-03 = 0, this parameter sets the amount of DC Injection time applied to the motor at the end of the decel ramp or High Slip Braking. Disabled when set to 0.00.	0.00 to 10.00	0.50 s	A	A	–	18C	—
b2-08	Magnetic Flux Compensation Capacity	Sets the magnetic flux compensation as a percentage of the no-load current value (E2-03).	0 to 1000	0%	–	A	–	190	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
b2-12	Short Circuit Brake Time at Start	Sets the time for Short-Circuit Brake operation at start. Disabled when set to 0.00. <32>	0.00 to 25.50	0.00 s	–	–	A	1BA	—
b2-13	Short Circuit Brake Time at Stop	Sets Short-Circuit Brake operation time at stop. Used to stop a motor rotating due to inertia. Disabled when set to 0.00 seconds. <32>	0.00 to 25.50	0.50 s	–	–	A	1BB	—
b3: Speed Search Use B3 parameters to configure Speed Search function operation.									
b3-01	Speed Search Selection	Enables/disables speed search function at start. 0: Disabled - Speed Search is not automatically performed at start. 1: Enabled - Speed Search is automatically performed at start.	0 to 1	0	A	A	A	191	—
b3-02	Speed Search Deactivation Current	Sets the current level at which the speed is assumed to be detected and Speed Search is ended. Set in percent of the drive rated current.	0 to 200	120 <2>	A	A	–	192	—
b3-03	Speed Search Deceleration Time	Sets the time constant used to reduce the output frequency during speed search. Related to a change from max. output frequency to 0.	0.1 to 10.0	2.0 s	A	A	–	193	—
b3-05	Speed Search Delay Time	Delays the speed search operation after a momentary power loss to allow time for an external output contactor to close.	0.0 to 100	0.2 s	A	A	A	195	—
b3-06	Output Current 1 during Speed Search	Sets the current injected to the motor at the beginning of Estimation type Speed Search. Set as a factor to the motor rated current.	0.0 to 2.0	<12>	A	A	–	196	—
b3-10	Speed Search Detection Compensation Gain	Sets the gain which is applied to the speed detected by Speed Estimation Speed Search before the motor is reaccelerated.Increase this setting if OV occurs when performing speed search.	1.00 to 1.20	1.05	A	A	–	19A	—
b3-14	Bi-Directional Speed Search Selection	Selects if Speed Search detects the motor rotation direction during speed search. 0: Disabled–Frequency reference direction used 1: Enabled–Detected direction used	0,1	0	A	A	–	19E	—
b3-17	Speed Search Restart Current Level	Sets the speed search restart current level in percentage of the drive rated current.	0 to 200	150 %	A	A	–	1F0	—
b3-18	Speed Search Restart Detection Time	Sets the time in seconds for speed search restart to be detected.	0.00 to 1.00	0.10 s	A	A	–	1F1	—
b3-19	Number of Speed Search Restarts	Sets the number of restarts possible for speed search restart operations.	0 to 10	3	A	A	–	1F2	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
b3-24	Speed Search Method Selection	Sets the Speed Search detection mode. 0: Current Detection Type 1: Speed Estimation Type	0,1	0	A	A	–	1C0	—
b3-25	Speed Search Retry Interval Time	Sets the wait time before Speed Search restarts.	0 to 30.0	0.5 s	A	A	A	1C8	—
b4: Timer Function Use b4 parameters to configure timer function operation.									
b4-01	Timer Function On-Delay Time	Used in conjunction with a multi-function digital input (H1-☐☐ = 18) and a multi-function digital output (H2-☐☐ = 12) programmed for the timer function. This sets the amount of time between digital input closure and digital output activation.	0.0 to 300.0	0.0 s	A	A	A	1A3	—
b4-02	Timer Function Off-Delay Time	Used in conjunction with a multi-function digital input (H1-☐☐ = 18) and a multi-function digital output programmed for the timer function. This sets the amount of time the output remains activated after the digital input is opened.	0.0 to 300.0	0.0 s	A	A	A	1A4	—
b5: PID Control Use b5 parameters to configure the PID control drive function.									
b5-01	PID Function Setting	Sets the PID control mode. 0: Disabled 1: Enable (Deviation is D-controlled) 2: Enable (Feedback is D-controlled) 3: Enable (Deviation is D-controlled, PID output added to Freq. Ref.) 4: Enable (Feedback is D-controlled, PID output added to Freq. Ref.)	0 to 4	0	A	A	A	1A5	—
b5-02 <22>	Proportional Gain Setting (P)	Sets the proportional gain of the PID controller. A setting of 0.00 disables P control.	0.00 to 25.00	1.00	A	A	A	1A6	—
b5-03 <22>	Integral Time Setting (I)	Sets the integral time for the PID controller. A setting of 0.0 s disables integral control.	0.0 to 360.0	1.0 s	A	A	A	1A7	—
b5-04 <22>	Integral Limit Setting	Sets the maximum output possible from the integrator.	0.0 to 100.0	100.0 %	A	A	A	1A8	—
b5-05 <22>	Derivative Time (D)	Sets D control derivative time. A setting of 0.00 s disables derivative control.	0.00 to 10.00	0.00 s	A	A	A	1A9	—
b5-06 <22>	PID Output Limit	Sets the maximum output possible from the entire PID controller.	0.0 to 100.0	100.0 %	A	A	A	1AA	—
b5-07 <22>	PID Offset Adjustment	Applies an offset to the PID controller output.	-100.0 to +100.0	0.0%	A	A	A	1AB	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
b5-08 <22>	PID Primary Delay Time Constant	Sets the amount of time for the filter on the output of the PID controller.	0.00 to 10.00	0.00 s	A	A	A	1AC	—
b5-09	PID Output Level Selection	Sets the PID controller output direction. 0: Normal Output (direct acting) 1: Reverse Output (reverse acting)	0,1	0	A	A	A	1AD	—
b5-10	PID Output Gain Setting	Sets the gain applied to the PID output.	0.00 to 25.00	1.00	A	A	A	1AE	—
b5-11	PID Output Reverse Selection	Sets the drive operation with negative PID output. 0: Drive stops with negative PID output 1: Rotation direction reverses with negative PID output. When using setting 1 make sure, reverse operation is permitted by parameter b1-04.	0,1	0	A	A	A	1AF	—
b5-12	PID Feedback Reference Missing Detection Selection	Configures the PID feedback loss detection. 0: Disabled. 1: Feedback loss detected when PID enabled. Alarm output, operation is continued without triggering a fault contact. 2: Feedback loss detected when PID enabled. Fault output, operation is stopped and a fault contact is triggered. 3: Feedback loss detection even when PID is disabled by digital input. No alarm/fault output. “PID feedback loss” digital output is switched, 4: PID Feedback error detection even when PID is disabled by digital input. An alarm is triggered and the drive continues to run. 5: PID Feedback error detection even when PID is disabled by digital input. Fault is triggered and output is shut off.	0 to 5	0	A	A	A	1B0	—
b5-13	PID Feedback Loss Detection Level	Sets the PID feedback loss detection level.	0 to 100	0%	A	A	A	1B1	—
b5-14	PID Feedback Loss Detection Time	Sets the PID feedback loss detection delay time in terms of seconds.	0.0 to 25.5	1.0 s	A	A	A	1B2	—
b5-15	PID Sleep Function Start Level	Sets the sleep function start frequency. **Note:** Also enabled when PID is not active.	0.0 to 400.0	0.0 Hz	A	A	A	1B3	—
b5-16	PID Sleep Delay Time	Sets the sleep function delay time in units of 0.1 seconds.	0.0 to 25.5	0.0 s	A	A	A	1B4	—
b5-17	PID Accel/Decel Time	Applies an accel/decel time to the PID setpoint reference.	0 to 255	0 s	A	A	A	1B5	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
b5-18	PID Setpoint Selection	Selects b5-19 as PID setpoint value. 0: Disabled 1: Enabled, b5-19 becomes PID target	0,1	0	A	A	A	1DC	—
b5-19	PID Setpoint Value	Sets the PID target value when b5-18 = 1.	0.00 to 100.00	0.00 %	A	A	A	1DD	—
b5-20	PID Setpoint Scaling	Sets the units for b5-19, and for parameter monitors U5-01 (PID Feedback) and U5-04 (PID Setpoint). 0: 0.01Hz units 1: 0.01% units (100% = max output frequency) 2: r/min (motor pole number must be set up) 3: User-set (set to b5-38 and b5-39)	0 to 3	1	A	A	A	1E2	—
b5-34 <22>	PID Output Lower Limit	Sets the minimum output possible from the PID controller.	-100.0 to +100.0	0.00 %	A	A	A	19F	—
b5-35 <22>	PID Input Limit	Limits the PID control input (deviation signal). Acts as a bipolar limit.	0 to 1000.0	1000.0%	A	A	A	1A0	—
b5-36	PID Feedback High Detection Level	Sets the PID feedback high detection level.	0 to 100	100 %	A	A	A	1A1	—
b5-37	PID Feedback High Level Detection Time	Sets the PID feedback high level detection delay time.	0.0 to 25.5	1.0 s	A	A	A	1A2	—
b5-38	PID Setpoint / User Display	0 to 60000: User-Set Display if b5-20=3 Set the numbers displayed by designating the maximum PID target.	1 to 60000	<5>	A	A	A	1FE	—
b5-39	PID Setpoint Display Digits	Sets the number of digits the PID setpoint. 0: No decimal places 1: One decimal places 2: Two decimal places 3: Three decimal places	0 to 3	<5>	A	A	A	1FF	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
b6: Dwell Function Use b6 parameters to configure dwell function operation.									
b6-01	Dwell Reference at Start	The Dwell function is used to temporarily hold the frequency when driving a motor with a heavy load. Parameters b6-01 and b6-02 set the frequency to hold and the time to maintain that frequency at start. Parameters b6-03 and b6-04 set the frequency to hold and the time to maintain that frequency at stop.	0.0 to 400.0	0.0 Hz	A	A	A	1B6	—
b6-02	Dwell Time at Start		0.0 to 10.0	0.0 s	A	A	A	1B7	—
b6-03	Dwell Frequency at Stop		0.0 to 400.0	0.0 Hz	A	A	A	1B8	—
b6-04	Dwell Time at Stop		0.0 to 10.0	0.0 s	A	A	A	1B9	—
b8: Energy Saving Use b8 parameters to configure the energy saving/conservation drive function.									
b8-01	Energy Saving Control Selection	Selects the Energy Savings function. 0: Disabled 1: Enabled (set b8-04)	0,1	0	A	A	–	1CC	—
b8-02 <22>	Energy Saving Gain	Sets energy savings control gain when in Open Loop Vector (OLV) control mode.	0.0 to 10.0	0.7	–	A	–	1CD	—
b8-03 <22>	Energy Saving Control Filter Time Constant	Sets energy saving control filter time constant when in Open Loop Vector control.	0.00 to 10.00	0.50	–	A	–	1CE	—
b8-04	Energy Saving Coefficient Value	Sets the Energy Saving coefficient and is used to fine adjustments in V/f Control.	0.0 to 655.00	<57>	A	–	–	1CF	—
b8-05	Power Detection Filter Time	Sets a filter time for the Power Detection used by Energy Savings in V/f Control.	0 to 2000	20 ms	A	–	–	1D0	—
b8-06	Search Operation Voltage Limit	Sets the limit for the voltage search operation performed by Energy Savings in V/f Control. Set as a percentage of the motor base voltage. Disabled when set to 0%.	0 to 100	0%	A	–	–	1D1	—

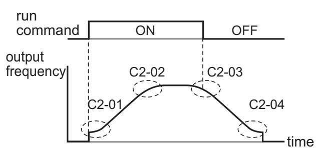
<1> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 2-OLV control.
<2> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 0-V/f Control.
<5> Default setting is dependent on parameter b5-20, PID Setpoint Scaling.
<12> Default setting value is dependent on parameter o2-04, Drive Unit Selection.
<14> Default setting value is dependent on parameter o2-09, Initialization Spec. Selection.

<22> Parameter can be changed during run.
<32> A coasting motor may require a braking resistor circuit to bring the motor to a stop in the required time.
<33> Increase the setting value in increments of 0.1 when estimating the minimum output frequency for a motor coasting at high speed while attempting Speed-Estimation Type Speed Search.
<34> Increase this value if an OV overvoltage fault occurs when performing Speed Search at start.
<57> Default setting value is dependent on parameter o2-04, Drive Unit Selection and C6-01, Drive Duty Selection.

◆ C: Tuning

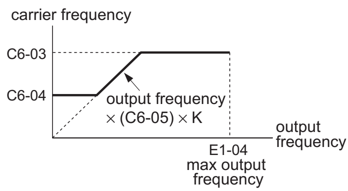
C parameters are used to adjust the acceleration and deceleration times, S-curves, c functions and carrier frequency selections.

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
C1: Acceleration and Deceleration Times Use C1 parameters to configure motor acceleration and deceleration.									
C1-01 <22>	Acceleration Time 1	Sets the time to accelerate from 0 to maximum frequency.	0.0 to 6000.0 <6>	10.0 s	S	S	S	200	129
C1-02 <22>	Deceleration Time 1	Sets the time to decelerate from maximum frequency to 0.	0.0 to 6000.0 <6>	10.0 s	S	S	S	201	129
C1-03 <22>	Acceleration Time 2	Sets the time to accelerate from 0 to maximum frequency when Accel/Decel times 2 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	202	—
C1-04 <22>	Deceleration Time 2	Sets the time to decelerate from maximum frequency to 0 when Accel/Decel times 2 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	203	—
C1-05 <22>	Acceleration Time 3 (Motor 2 Accel Time 1)	Sets the time to accelerate from 0 to maximum frequency when Accel/Decel times 3 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	204	—
C1-06 <22>	Deceleration Time 3 (Motor 2 Decel Time 1)	Sets the time to decelerate from maximum frequency to 0 when Accel/Decel times 3 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	205	—
C1-07 <22>	Acceleration Time 4 (Motor 2 Accel Time 2)	Sets the time to accelerate from 0 to maximum frequency when Accel/Decel times 4 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	206	—
C1-08	Deceleration Time 4 (Motor 2 Decel Time 2)	Sets the time to decelerate from maximum frequency to 0 when Accel/Decel times 4 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	207	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
C1-09	Fast-Stop Time	Sets the time to decelerate from maximum frequency to 0 for the multi-function input fast-stop function. **Note:** This parameter is also used by selecting “Fast-Stop” as a Stop Method when a fault is detected.	0.0 to 6000.0 <6>	10.0 s	A	A	A	208	—
C1-10	Accel/Decel Time Setting Units	Sets the resolution of C1-01 to C1-09. 0: 0.01 s (0.00 to 600.00 s) 1: 0.1 s (0.0 to 6000.0 s)	0,1	1	A	A	A	209	—
C1-11	Accel/Decel Time Switching Frequency	Sets the frequency for automatic acceleration/deceleration switching. Below set frequency: Accel/Decel Time 4 Above set frequency: Accel/Decel Time 1 The multi-function input “Accel/Decel Time 1” or “Accel/Decel Time 2” take priority.	0.0 to 400.0 Hz	0.0 Hz	A	A	A	20A	—
C2: S-Curve Characteristics Use C2 parameters to configure S-curve operation.									
C2-01	S-Curve Characteristic at Accel Start	The S-curve can be controlled in the four points shown below. S-curve is used to further	0.00 to 10.00	0.20 s <2>	A	A	A	20B	—
C2-02	S-Curve Characteristic at Accel End		0.00 to 10.0	0.20 s	A	A	A	20C	—
C2-03	S-Curve Characteristic at Decel Start		0.00 to 10.0	0.20 s	A	A	A	20D	—
C2-04	S-Curve Characteristic at Decel End	soften the starting and stopping ramp. The longer the S-curve time, the softer the starting and stopping ramp.	0.00 to 10.0	0.00 s	A	A	A	20E	—
C3: Slip Compensation Use C3 parameters to configure the slip compensation function.									
C3-01 <22>	Slip Compensation Gain	Sets the slip compensation gain. Decides for what amount the output frequency is boosted in order to compensate the slip. **Note:** Adjustment is not normally required.	0.0 to 2.5	0.0 <2>	A	A	–	20F	—
C3-02	Slip Compensation Primary Delay Time	Adjusts the slip compensation function delay time. Decrease the setting when the slip compensation response is too slow, increase it when the speed is not stable. Disabled when Simple V/f Control with PG (H6-01 = 3) is used.	0 to 10000	2000 ms <2>	A	A	–	210	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
C3-03	Slip Compensation Limit	Sets the slip compensation upper limit. Set as a percentage of motor rated slip (E2-02). Disabled when Simple V/f Control with PG (H6-01 = 3) is used.	0 to 250	200%	A	A	–	211	—
C3-04	Slip Compensation Selection during Regeneration	Selects slip compensation during regenerative operation. 0: Disabled 1: Enabled Using the Slip Compensation function during regeneration may require a braking option to handle momentary increasing regenerative energy.	0,1	0	A	A	–	212	—
C3-05	Output Voltage Limit Operation Selection	Selects if the motor magnetic flux is reduced during output voltage saturation. 0: Disabled 1: Enabled	0,1	0 <2>	–	A	–	213	—
C4: Torque Compensation Use C4 parameters to configure Torque Compensation function.									
C4-01 <23>	Torque Compensation Gain	V/f control: Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque. Increase this setting when using a long motor cable or when the motor is significantly smaller than the drive capacity. Decrease this setting when motor oscillation occurs. Set the value so that the current at low speed does not exceeds the drives rated current. Open Loop Vector: Sets the torque compensation function gain. Normally no change is required.	0.00 to 2.50	1.00	A	A	A	215	—
C4-02	Torque Compensation Primary Delay Time	Sets the torque compensation filter time. Increase this setting when motor oscillation occurs. Reduce the setting if there is not enough response from the motor.	0 to 60000	200 ms <1>	A	A	A	216	—
C4-03	Torque Compensation at Forward Start	Sets torque compensation at forward start as a percentage of motor torque.	0.0 to 200.0	0.0%	–	A	–	217	—
C4-04	Torque Compensation at Reverse Start	Sets torque compensation at reverse start as a percentage of motor torque.	-200.0 to 0.0	0.0%	–	A	–	218	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
C4-05	Torque Compensation Time Constant	Sets the time constant for torque compensation at forward start and reverse start (C4-03 and C4-04). The filter is disabled if the time is set to 4 ms or less.	0 to 200	10 ms	–	A	–	219	—
C4-06	Torque Compensation Primary Delay Time 2	Sets the torque compensation time 2. When an OV fault occurs with sudden load changes or at the and of an acceleration, increase the setting. Note: Adjustment is not normally required. If adjusted then AFR time 2 (n2-03) should be adjusted too.	0 to 10000	150 ms	–	A	–	21AH	—
C5: Speed Control (ASR) Use C5 parameters to configure the Automatic Speed Regulator (ASR). C5 parameters are available only when using V/f with Simple PG (H6-01 = 3).									
C5-01 <22>	ASR Proportional Gain 1	Sets the proportional gain of the speed control loop (ASR).	0.00 to 300.00	0.20	A	–	–	21B	—
C5-02 <22>	ASR Integral Time 1	Sets the integral time of the speed control loop (ASR).	0.000 to 10.000	0.200	A	–	–	21C	—
C5-03 <22>	ASR Proportional Gain 2	Sets the speed control gain 2 of the speed control loop (ASR).	0.00 to 300.00	0.02	A	–	–	21D	—
C5-04 <22>	ASR Integral Time 2	Sets the integral time 2 of the speed control loop (ASR).	0.000 to 10.000	0.050 s	A	–	–	21E	—
C5-05 <22>	ASR Limit	Sets the upper limit for the speed control loop (ASR) as a percentage of the maximum output frequency (E1-04).	0.0 to 20.0	5.0%	A	–	–	21F	—
C6: Carrier Frequency Use C6 parameters to configure the carrier frequency drive settings.									
C6-01	Normal/Heavy Duty Selection	Selects the load rating for the drive. 0: Heavy Duty (HD) for constant torque applications. 1: Normal Duty (ND) for variable torque applications. This setting affects the Rated output current and overload tolerance of the drive.	0,1	0	S	S	S	223	130

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
C6-02	Carrier Frequency Selection	Selects the carrier frequency 1: 2.0 kHz 2: 5.0 kHz 3: 8.0 kHz 4: 10.0 kHz 5: 12.5 kHz 6: 15.0 kHz 7: Swing PWM1 (Audible sound 1) 8: Swing PWM2 (Audible sound 2) 9: Swing PWM3 (Audible sound 3) A: Swing PWM4 (Audible sound 4) B to E: No setting possible F: User defined (determined by C6-03 through C6-05)	1 to F	<3>	S	S	S	224	*131*
C6-03	Carrier Frequency Upper Limit	Open Loop Vector: C6-03 defines the fixed carrier frequency if C6-02 = F. V/f control: C6-03 and C6-04 set upper and lower limits for the carrier frequency.	1.0 to 15.0	<8>	A	A	A	225	—
C6-04	Carrier Frequency Lower Limit	 The coefficient K depends on C6-03: C6-03 ≥ 10.0 kHz: K = 3 10.0 kHz > C6-03 ≥ 5.0 kHz: K = 2 5.0 kHz > C6-03: K = 1 When C6-05 ≤ 6, C6-04 is disabled (makes the carrier frequency C6-03 value).	0.4 to 15.0	<8>	A	-	-	226	—
C6-05	Carrier Frequency Proportional Gain	Sets the relationship of output frequency to carrier frequency when C6-02 = F.	00 to 99	<8>	A	-	-	227	—

<1> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 2-OLV control.
<2> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 0-V/f Control.
<3> Default setting value is dependent on parameters o2-04, Drive Unit Selection, A1-02, Control Method Selection and C6-01, Normal/Heavy Duty selection.
<6> Setting range value is dependent on parameter C1-10, Accel/Decel Time Setting Units. When C1-10 = 0 (units of 0.01 seconds), the setting range becomes 0.00 to 600.00 seconds.
<8> Default setting value is dependent on parameter C6-02, Carrier Frequency Selection.
<22> Parameter can be changed during run.

<23> Parameter cannot be changed during run when parameter A1-02 = 5-PM OLV Control.

◆ d: References

Reference parameters are used to set the various frequency reference values during operation.

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
d1: Frequency Reference Use d1 parameters to configure the drive frequency reference.									
d1-01 <22>	Frequency Reference 1	Frequency reference	0.00 to 400.00 Hz <11> <19>	0.00 Hz	S	S	S	280	120
d1-02 <22>	Frequency Reference 2	Frequency reference when digital input "Multi-Step Speed Reference 1" (H1-□□ = 3) is on.		0.00 Hz	S	S	S	281	120
d1-03 <22>	Frequency Reference 3	Frequency reference when digital input "Multi-Step Speed Reference 2" (H1-□□ = 4) is on.		0.00 Hz	S	S	S	282	120
d1-04 <22>	Frequency Reference 4	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 2" (H1-□□ = 3 and 4) are on.		0.00 Hz	S	S	S	283	120
d1-05 <22>	Frequency Reference 5	Frequency reference when digital input "Multi-Step Speed Reference 3" (H1-□□ = 5) is on.		0.00 Hz	A	A	A	284	—
d1-06 <22>	Frequency Reference 6	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 3 " (H1-□□ = 3 and 5) are on.		0.00 Hz	A	A	A	285	—
d1-07 <22>	Frequency Reference 7	Frequency reference when digital inputs "Multi-Step Speed Reference 2, 3" (H1-□□ = 4 and 5) are on.		0.00 Hz	A	A	A	286	—
d1-08 <22>	Frequency Reference 8	Frequency reference when multi-function input "Multi-Step speed reference 1, 2, 3" (H1-□□ = 3, 4, 5) are on.		0.00 Hz	A	A	A	287	—
d1-09 <22>	Frequency Reference 9	Frequency reference when multi-function input "Multi-Step Speed Reference 4" (H1-□□ = 32) is on.		0.00 Hz	A	A	A	288	—
d1-10 <22>	Frequency Reference 10	Frequency reference when digital input "Multi-Step Speed Reference 1, 4" (H1-□□ = 3 and 32) are on.		0.00 Hz	A	A	A	28B	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
d1-11 <22>	Frequency Reference 11	Frequency reference when digital inputs "Multi-Step Speed Reference 2, 4" (H1-☐☐ = 4 and 32) are on.	0.00 to 400.00 Hz <11> <19>	0.00 Hz	A	A	A	28C	—
d1-12 <22>	Frequency Reference 12	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 2, 4" (H1-☐☐ = 3, 4, 32) are on.		0.00 Hz	A	A	A	28D	—
d1-13 <22>	Frequency Reference 13	Frequency reference when digital inputs "Multi-Step Speed Reference 3, 4" (H1-☐☐ = 5 and 32) are on.		0.00 Hz	A	A	A	28E	—
d1-14 <22>	Frequency Reference 14	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 3, 4" (H1-☐☐ = 3, 5, 32) are on.		0.00 Hz	A	A	A	28F	—
d1-15 <22>	Frequency Reference 15	Frequency reference when digital inputs "Multi-Step Speed Reference 2, 3, 4" (H1-☐☐ = 4, 5, 32) are on.		0.00 Hz	A	A	A	290	—
d1-16 <22>	Frequency Reference 16	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 2, 3, 4" (H1-☐☐ = 3, 4, 5, 32) are on.		0.00 Hz	A	A	A	291	—
d1-17 <22>	Jog Frequency Reference	Frequency reference when digital inputs "Jog Frequency Reference", "Forward Jog" or "Reverse Jog." are on. "Jog Frequency Reference" has priority over "Multi-Step Speed Reference 1 to 16".		6.00 Hz	S	S	S	292	120
d2: Frequency Upper and Lower Limits Use d2 parameters to configure the frequency reference limits.									
d2-01	Frequency Reference Upper Limit	Sets the frequency reference upper limit as a percentage of maximum output frequency (E1-04). Output speed is limited to this value even if the frequency reference is higher. This limit applies to all frequency reference sources.	0.0 to 110.0	100.0 %	A	A	A	289	—
d2-02	Frequency Reference Lower Limit	Sets the frequency reference lower limit as a percentage of maximum output frequency (E1-04). Output speed is limited to this value even if the frequency reference is lower. This limit applies to all frequency reference sources.	0.0 to 110.0	0.0%	A	A	A	28A	—
d2-03	Master Speed Reference Lower Limit	Sets the minimum frequency reference lower limit if the frequency reference is input using an analog input. Set as a percentage of maximum output frequency (E1-04). The higher of both values d2-01 and d2-03 will be the lower limit.	0.0 to 110.0	0.0%	A	A	A	293	—

No.	Name	Description	Range	Def.	Control Mode V/f	OLV	PM	Addr. Hex	Pg.
d3: Jump Frequency Use d3 parameters to configure the drive Jump Frequency settings.									
d3-01	Jump Frequency 1	d3-01 to d3-04 allow programming of three prohibited frequency reference points for eliminating problems with resonant vibration of the motor / machine. This feature does not eliminate the selected frequency values, but accelerates and decelerates the motor through the prohibited bandwidth. The parameters must be according to the rule; d3-01 ≥ d3-02 ≥ d3-03.	0.0 to 400.0	0.0 Hz	A	A	A	294	—
d3-02	Jump Frequency 2			0.0 Hz	A	A	A	295	—
d3-03	Jump Frequency 3			0.0 Hz	A	A	A	296	—
d3-04	Jump Frequency Width	This parameter sets the dead-band width around each selected prohibited frequency reference point. The bandwidth becomes the designated Jump frequency, plus or minus d3-04.	0.0 to 20.0	1.0 Hz	A	A	A	297	—
d4: Frequency Reference Hold Use d4 parameters to configure the drive frequency reference hold function.									
d4-01	Frequency Reference Hold Function Selection	This parameter is used to hold the last frequency reference in U1-01 (d1-01) when power is removed. 0: Disabled 1: Enabled This function is available when the multi-function inputs “accel/decel ramp hold” or “up/down” commands are selected (H1-□□ = A or 10 and 11).	0,1	0	A	A	A	298	—
d4-03 <22>	Frequency Reference Bias Step (Up/Down 2)	Sets the bias added to the frequency reference when the Up/Down 2 digital inputs are set. When set to 0.00 Hz, the bias value is increased or decreased according to d4-04. When greater than 0.0 Hz, the bias value d4-03 is added or subtracted to/from the frequency reference. The acceleration or deceleration rate is ultimately determined by d4-04.	0.00 to 99.99 Hz	0.00 Hz	A	A	A	2AA	—
d4-04 <22>	Frequency Reference Accel/Decel (Up/Down 2)	0: Adjusts the bias value according to the currently selected accel/decel time. 1: Adjusts the bias value by Accel/Decel Time 4 (C1-07 and C1-08).	0,1	0	A	A	A	2AB	—

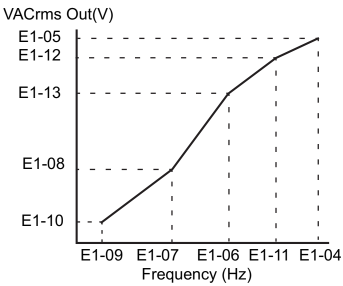
No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
d4-05 <22>	Frequency Reference Bias Operation Mode Selection (Up/Down 2)	0: Holds the bias value when Up/Down 2 reference is on or off. 1: When the Up 2 reference and Down 2 reference are both on or both off, the applied bias becomes 0. Currently selected accel/ decel. times are used. Enabled only when d4-03 = 0.	0,1	0	A	A	A	2AC	—
d4-06	Frequency Reference Bias (Up/Down 2)	The Up/Down 2 bias value is saved in d4-06 once the frequency reference is adjusted. It is limited by d4-08 and d4-09. The bias can be set by the user, but will be disabled under the following conditions: • When none of the digital inputs are assigned to Up2/Down2 commands. • When the frequency reference source has been changed (including multi-step speed). • When both d4-03 = 0 and d4-05 = 1 and the Up 2 / Down 2 commands are both on or both off. • When the max output frequency E1-04 has changed. • When the digital frequency reference has changed.	-99.9 to +100.0	0.0%	A	A	A	2AD	—
d4-07 <22>	Analog Frequency Reference Fluctuation Limit (Up/Down 2)	When during Up2/Down2 the frequency reference value from analog or pulse input changes for more than the level set in d4-07, the bias value is hold and the reference is changed to the new value. After the speed reaches the frequency reference the bias hold is released. (Works with frequency reference from analog or pulse input only)	0.1 to +100.0	1.0%	A	A	A	2AE	—
d4-08 <22>	Frequency Reference Bias Upper Limit (Up/Down 2)	Sets the upper limit for d4-06 in percent of the maximum output frequency E1-04.	0.1 to 100.0	0.0%	A	A	A	2AF	—
d4-09 <22>	Frequency Reference Bias Lower Limit (Up/Down 2)	Sets the lower limit for d4-06 in percent of the maximum output frequency E1-04.	-99.9 to 0.0	0.0%	A	A	A	2B0	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
d4-10	Up/Down Frequency Reference Limit Selection	Selects which value is used as frequency reference lower limit if the Up/Down function is used. 0: The lower limit is determined by d2-02 or analog input (H3-02/10 = 0). The higher of both values becomes the reference limit. 1: The lower limit is determined by d2-02.	0 or 1	0	A	A	A	2B6	—
d4-11	Bi-directional Output Selection	Enables or disables conversion of frequency reference or PID output value into bi-directional internal frequency reference. 0: Disabled - 0 to 100% reference or PID output: Operation in selected direction 1: Enabled - < 50% reference or PID output: Reverse operation > 50% reference or PID output: Operation in selected direction	0 or 1	0	A	A	A	2B7	
d4-12	Stop Position Gain	Sets the gain used by the simple positioning stop function to fine adjust the position.	0.50 to 2.55	1.00	A	A	A	2B8	
d7: Offset Frequency Use d7 parameters to set the offset frequency.									
d7-01 <22>	Offset Frequency 1	Added to the frequency reference when the digital input “Frequency Offset 1” (H1-□□ = 44) is switched on.	-100.0 to +100.0	0.0%	A	A	A	2B2	—
d7-02 <22>	Offset Frequency 2	Added to the frequency reference when the digital input “Frequency Offset 2” (H1-□□ = 45) is switched on.	-100.0 to +100.0	0.0%	A	A	A	2B3	—
d7-03 <22>	Offset Frequency 3	Added to the frequency reference when the digital input “Frequency Offset 3” (H1-□□ = 46) is switched on.	-100.0 to +100.0	0.0%	A	A	A	2B4	—

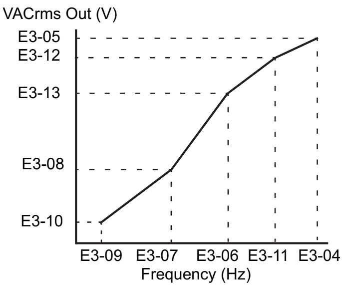
<11> Default setting value is dependent on parameter o1-03, Digital Operator Display Selection.
<19> Range upper limit is dependent on parameters E1-04, Maximum Output Frequency, and d2-01, Frequency Reference Upper Limit.
<22> Parameter can be changed during run.

◆ E: Motor Parameters

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
E1: V/f Pattern Characteristics Use E1 parameters to set V/f characteristics for the motor.									
E1-01	Input Voltage Setting	This parameter must be set to the power supply voltage. It sets the maximum and base voltage used by preset V/f patterns (E1-03 = 0 to E) and adjusts levels used by certain functions. Refer to page 130 for details **WARNING!** Drive input voltage (not motor voltage) must be set in E1-01 for the protective features of the drive to function properly. failure to do so may result in equipment damage and/or death or personal injury.	155 to 255	200 V	S	S	S	300	*133*
E1-03	V/f Pattern Selection	Selects a preset V/f pattern. 0: 50 Hz Constant torque 1 1: 60 Hz Constant torque 2 2: 60 Hz Constant torque 3 (50Hz base) 3: 72 Hz Constant torque 4 (60 Hz base) 4: 50 Hz Variable torque 1 5: 50 Hz Variable torque 2 6: 60 Hz Variable torque 3 7: 60 Hz Variable torque 4 8: 50 Hz High starting torque 1 9: 50 Hz High starting torque 2 A: 60 Hz High starting torque 3 B: 60 Hz High starting torque 4 C: 90 Hz (60 Hz base) D: 120 Hz (60 Hz base) E: 180 Hz (60 Hz base) F: Custom V/f. E1-04 through E1-13 settings define the V/f pattern.	0 to F	F	A	A	–	302	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
E1-04	Max Output Frequency	These parameters are only applicable when E1-03 is set to F. To set linear V/f characteristics, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Ensure that the four frequencies are set according to these rules: E1-04 ≥ E1-06> E1-07 ≥ E1-09  	40.0 to 400.0 <21>	50 Hz <10>	S	S	S	303	134
E1-05 <24>	Max Output Voltage		0.0 to 255.0	200 V <10>	S	S	S	304	134
E1-06	Base Frequency		0.0 to E1-04	50 Hz <10>	S	S	S	305	134
E1-07	Mid Output Frequency		0.0 to E1-04	2.5 Hz <2>	A	A	-	306	—
E1-08 <24>	Mid Output Frequency Voltage		0.0 to 255.0	16.0 V <2> <12>	A	A	-	307	—
E1-09	Minimum Output Freq.		0.0 to E1-04	1.3 Hz <2> <10>	S	S	S	308	134
E1-10 <24>	Minimum Output Freq. Voltage		0.0 to 255.0	12.0 V <2> <12>	A	A	-	309	—
E1-11 <26>	Mid Output Frequency 2		0.0 to E1-04	0.0 Hz	A	A	-	30A	—
E1-12 <24> <26>	Mid Output Frequency Voltage 2		0.0 to 255.0	0.0 V	A	A	-	30B	—
E1-13 <24>	Base Voltage		0.0 to 255.0	0.0 V	A	S	-	30C	—
E2: Motor Parameters Use E2 parameters to set motor-related data.									
E2-01	Motor Rated Current	Sets the motor nameplate full load current in amperes (A). Automatically set during Auto-Tuning.	10 to 200% of drive rated current <27>	<57>	S	S	–	30E	379
E2-02	Motor Rated Slip	Sets the motor rated slip in Hertz (Hz). Automatically set during rotational Auto-Tuning.	0.00 to 20.00	<57>	A	A	–	30F	—
E2-03	Motor No-Load Current	Sets the magnetizing current of the motor in Ampere. Automatically set during rotational Auto-Tuning.	0 to less than E2-01	<57>	A	A	–	310	—
E2-04	Number of Motor Poles	Sets the number of motor poles. Automatically set during Auto-Tuning.	2 to 48	4 poles	A	A	–	311	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
E2-05	Motor Line-to-Line Resistance	Sets the phase-to-phase motor resistance in ohms. Automatically set during Auto-Tuning.	0.000 to 65.000 <37>	<57>	A	A	–	312	—
E2-06	Motor Leakage Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. Automatically set during Auto-Tuning.	0.0 to 40.0	<57>	A	A	–	313	—
E2-07	Motor Iron-Core Saturation Coefficient 1	Sets the motor iron saturation coefficient at 75% of magnetic flux. Automatically set during Auto-Tuning.	E2-07 to 0.50	0.50	–	A	–	314	—
E2-08	Motor Iron-Core Saturation Coefficient 2	Sets the motor iron saturation coefficient at 75% of magnetic flux. Automatically set during Auto-Tuning.	[E2-07] to 0.75	0.75	–	A	–	315	—
E2-09	Motor Mechanical Loss	Sets the motor mechanical loss as a percentage of motor rated power (kW). Adjust in the following circumstances: When there is a large amount of torque loss due to motor bearing friction. When there is a large amount of torque loss.	0.0 to 10.0	0.0%	–	A	–	316	—
E2-10	Motor Iron Loss for Torque Compensation	Sets the motor iron loss in watts (W).	0 to 65535	<57>	A	–	–	317	—
E2-11	Motor Rated Output	Sets the motor rated power in kilowatts (kW). Automatically set during Auto-Tuning. (1HP = 0.746 kW).	0.00 to 650.00	0.40 kW <12>	S	S	–	318	380
E2-12	Motor Iron-Core Saturation Coefficient 3	Set to the motor iron saturation coefficient at 130% of magnetic flux. Automatically set during rotational Auto-Tuning.	1.30 to 5.00	1.30	–	A	–	328	—
E3: Motor 2 V/f Characteristics Use E3 parameters to set the V/f pattern for a second motor.									
E3-01	Motor 2 Control Method	0: V/f Control 2: Open Loop Vector (OLV)	0 or 2	0	A	A	–	319	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
E3-04	Motor 2 Max Output Frequency	These parameters set the V/f pattern for motor 2. To set linear V/f characteristics, set the same values for E3-07 and E3-09. In this case, the setting for E3-08 will be disregarded. Ensure that the four frequencies are set according to these rules or OPE10 fault will occur: E3-04 ≥ E3-06 > E3-07 > E3-09  	40.0 to 400.0	50 Hz	A	A	–	31A	—
E3-05 <24>	Motor 2 Max Voltage		0.0 to 255.0	200.0 V	A	A	–	31B	—
E3-06	Motor 2 Base Frequency		0.0 to E3-04	50 Hz	A	A	–	31C	—
E3-07	Motor 2 Mid Output Freq.		0.0 to E3-04	2.5 Hz <53>	A	A	–	31D	—
E3-08 <24>	Motor 2 Mid Output Freq. Voltage		0.0 to 255.0	16.0 V <12> <53>	A	A	–	31E	—
E3-09	Motor 2 Min. Output Freq.		0.0 to E3-04	1.3 Hz <53>	A	A	–	31F	—
E3-10 <24>	Motor 2 Min. Output Freq. Voltage		0.0 to 255.0	12.0 V <12> <53>	A	A	–	320	—
E3-11 <26>	Motor 2 Mid Output Frequency 2		0.0 to E3-04	0.0 Hz	A	A	–	345	—
E3-12 <24> <52>	Motor 2 Mid Output Frequency Voltage 2		0.0 to 255.0 <24>	0.0 Vac	A	A	–	346	—
E3-13 <24>	Motor 2 Base Voltage		0.0 to 255.0 <24>	0.0 Vac	A	S	–	347	—
E4: Motor 2 Parameters Use E4 parameters to control a second motor operating on the same drive.									
E4-01	Motor 2 Rated Current	Sets the motor 2 name plate full load current in amperes (A). This value is automatically set during Auto-Tuning.	10 to 200% of drive rated current	<57>	A	A	–	321	—
E4-02	Motor 2 Rated Slip	Sets the motor 2 name plate full load current in amperes (A). Automatically set during Auto-Tuning.	0.00 to 20.00	<57>	A	A	–	322	—
E4-03	Motor 2 Rated No-Load Current	Sets the magnetizing current of motor 2 in Ampere. Automatically set during Rotational Auto-Tuning.	0 to less than [E4-01] <27>	<57>	A	A	–	323	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
E4-04	Motor 2 Motor Poles	Sets the number of poles of motor 2. This value is automatically set during Auto-Tuning.	2 to 48	4 poles	A	A	–	324	—
E4-05	Motor 2 Line-to-Line Resistance	Sets the phase-to-phase resistance of motor 2 in ohms. Automatically during Auto-Tuning.	0.000 to 65.000 <37>	<57>	A	A	–	325	—
E4-06	Motor 2 Leakage Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of rated voltage of motor 2. Automatically set during Auto-Tuning.	0.0 to 40.0	<57>	A	A	–	326	—
E4-07	Motor 2 Motor Iron-Core Saturation Coefficient 1	Set to the motor iron saturation coefficient at 50% of magnetic flux. Automatically set during Rotational Auto-Tuning.	0.00 to 0.50	0.50	–	A	–	343	—
E4-08	Motor 2 Motor Iron-Core Saturation Coefficient 2	Set to the motor iron saturation coefficient at 75% of magnetic flux. This value is automatically set during Rotational Auto-Tuning.	Setting for E4-07 to 0.75	0.75	–	A	–	344	—
E4-09	Motor 2 Mechanical Loss	Sets the motor mechanical loss as a percentage of motor rated power (kW) capacity. Adjust in the following circumstances: When there is a large amount of torque loss due to motor bearing friction. When there is a large amount of torque loss.	0.00 to 10.0	0.0	–	A	–	33F	—
E4-10	Motor 2 Iron Loss	Sets the motor iron loss in watts.	0 to 65535	<57>	A	–	–	340	—
E4-11	Motor 2 Rated Capacity	Sets the motor rated capacity in kW. Automatically set during Auto-Tuning.	0.00 to 650.00	<12>	A	A	–	327	—
E4-12	Motor 2 Iron-Core Saturation Coefficient 3	Set to the motor iron saturation coefficient at 130% of magnetic flux. Automatically set during Rotational Auto-Tuning.	1.30 to 5.00	1.30	–	A	–	342	—
E4-14 <22>	Motor 2 Slip Compensation Gain	Sets the slip compensation gain for motor 2. The function is the same as C3-01 for motor 1. Refer to the C3-01 description.	0.0 to 2.5	0.0 <53>	A	A	–	341	—
E4-15	Torque Compensation Gain - Motor 2	Sets the torque compensation gain for motor 2. The function is the same as C4-01 for motor 1. Refer to the C4-01 description.	1.00 to 2.50	1.00	A	A	–	341	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
E5: PM Motor Parameters									
E5-01 *<25>*	Motor Code Selection (for PM motor)	Enter the Yaskawa motor code for the PM motor being used. Various motor parameters are automatically set based on the value of this parameter. **Note:** Set to FFFF when using a specialized or custom motor. For all other motors: 0 0 0 0 Last two digits: Motor voltage class and capacity First digit: 0: Pico motor (SMRA series); 1: Derated torque IPM motor (SSR1 series); 2: Constant torque IPM motor (SST4 series) Second digit: 0: 1800 r/min series; 1: 3600 r/min series; 2: 1750 r/min series; 3: 1450 r/min series; 4: 1150 r/min series; F: Custom motor All motor parameters are re-initialized to factory settings when this parameter is set.	0000 to FFFF	*<12>* *<38>*	–	–	S	329	*379*
E5-02 *<25>*	Motor Rated Capacity (for PM motor)	Sets the rated capacity of the motor.	0.10 to 18.5	*<10>*	–	–	S	32A	*382*
E5-03	Motor Rated Current	Sets the motor rated current in amps.	10 to 200% of drive rated current *<27>*	*<4>*	–	–	S	32B	*382*
E5-04 *<25>*	Motor Poles	Sets the number of motor poles.	2 to 48	*<10>*	–	–	S	32C	*382*
E5-05 *<25>*	Motor Resistance	Set the resistance for each motor phase in units of 0.001 Ω.	0.000 to 65.000	*<10>*	–	–	S	32D	*382*
E5-06 *<25>*	Motor d Axis Inductance	Sets the d axis inductance in units of 0.01 mH.	0.00 to 300.00	*<10>*	–	–	S	32E	*382*

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
E5-07 <25>	Motor q Axis Inductance	Sets the q axis inductance in units of 0.01 mH.	0.00 to 600.00	<10>	–	–	S	32F	382
E5-09 <25>	Motor Induction Voltage Constant 1	Set the induced phase peak voltage in units of 0.1 mV (rad/s) [electrical angle]. Set this parameter when using a Yaskawa SSR1 series PM motor with derate torque, or a Yaskawa SST4 series motor with constant torque. When setting this parameter, E5-24 should be set to 0. An alarm will be triggered if both E5-09 and E5-24 are set to 0, or if neither parameter is set to 0.	0.0 to 2000.0	<10>	–	–	S	331	382
E5-24 <25>	Motor Induction Voltage Constant 2	Set the induced phase-to-phase rms voltage in units of 0.1 mV/(r/min) [mechanical angle]. Set this parameter when using a Yaskawa SMRA series pico motor. When setting this parameter, E5-09 should be set to 0. An alarm will be triggered if both E5-09 and E5-24 are set to 0, or if neither parameter is set to 0. If E5-03 (Motor Rated Current) is set to 0, however, then an alarm will not be triggered when both E5-09 and E5-24 are set to 0.	0.0 to 2000.0	0 <10>	–	–	S	353	382

<1> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 2-OLV control.
<2> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 0-V/f Control.
<4> Default setting value is dependent on parameter A1-06. This setting value is 0 when A1-06 = 0, and 1 when A1-06 does not = 0.
<10> Default setting value is dependent on parameter E5-01, Motor Code Selection.
<12> Default setting value is dependent on parameter o2-04, Drive Unit Selection.
<17> Default setting value is dependent on parameter o2-04, Drive Capacity, when parameter H1-☐☐ = 16 Motor 2 is selected as a digital input. The value shown is when o2-04 = 98 (62H) 200 V class 0.4 kW drive.
<20> Range upper limit is dependent on parameters E5-01, Motor Code Selection, and A1-02, Control Method Selection. The value shown is for A1-02 = 5-PM OLV control.
<21> Range upper limit is dependent on parameter E4-01 Motor 2 Rated Current.
<22> Parameter can be changed during run.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<25> Parameter setting value is not reset to the default value during drive initialization, A1-03 = 1110, 2220, 3330.
<26> Parameter ignored when E1-11, Motor 1 Mid Output Frequency 2, and E1-12, Motor 1 Mid Output Frequency Voltage 2, are set to 0.0.
<27> Setting units for this parameter are determined by o2-04, Drive Unit Selection. Less than 11 kW: 2 decimal points, 11 kW and above: 1 decimal point.
<28> When parameter A1-02 = 5-PM OLV Control, E3-13 Motor 2 Base Voltage will be equal to T1-03, Motor Rated Voltage, after Auto-Tuning the drive
<35> Default setting is determined by the V/f pattern selected to parameter E1-03.
<36> Default setting changes when using OLV Control for PM motors.
<37> Setting range becomes 0.00 to 130.00 for drives 0.2 kW and smaller.

<38> If using a Yaskawa pico motor, the default setting is 1800 r/min.
<52> Parameter ignored when E3-11, Motor 2 Mid Output Frequency 2, and E3-12, Motor 2 Mid Output Frequency Voltage 2, are set to 0.
<53> Default setting depends on the control mode for motor 2 set in parameter E3-01. The given value is for V/f control.
<57> Default setting value is dependent on parameter o2-04, Drive Unit Selection and C6-01, Drive Duty Selection.

◆ F: Options

F parameters are used to program the drive for PG feedback and to function with option cards.

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
F1: Simple PG V/f Parameters Use F1 parameters to set up the drive for Simple PG V/f control. These parameters are enabled only when H6-01 = 03									
F1-02	Operation Selection at PG Open Circuit (PGO)	Sets stopping method when a PG open circuit fault (PGO) occurs. Refer to parameter F1-14. 0: Ramp to Stop - Decelerate to stop using the active deceleration time. 1: Coast to Stop 2: Fast-stop - Decelerate to stop using the deceleration time in C1-09. 3: Alarm only - Drive continues operation.	0 to 3	1	A	–	–	381	—
F1-03	Operation Selection at Overspeed (OS)	Sets the stopping method when an overspeed (OS) fault occurs. Refer to F1-08 and F1-09. 0: Ramp to stop - Decelerate to stop using the active deceleration time. 1: Coast to stop 2: Fast - Stop - Decelerate to stop using the deceleration time in C1-09. 3: Alarm Only - Drive continues operation.	0 to 3	1	A	–	–	382	—
F1-04	Operation Selection at Deviation	Sets the stopping method when a speed deviation (DEV) fault occurs. Refer to F1-10 and F1-11. 0: Ramp to stop - Decelerate to stop using the active deceleration time. 1: Coast to stop 2: Fast-stop - Decelerate to stop using the deceleration time in C1-09. 3: Alarm only - Drive continues operation.	0 to 3	3	A	–	–	383	—
F1-08	Overspeed Detection Level	Sets the speed feedback level which has to be exceeded for the time set in F1-09 before an OS fault will occur. Set as a percentage of the maximum output frequency (E1-04).	0 to 120	115%	A	–	–	387	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
F1-09	Overspeed Detection Delay Time	Sets the time in seconds for which the speed feedback has to exceed the overspeed detection level F1-08 before an OS fault will occur.	0.0 to 2.0	1.0	A	–	–	388	—
F1-10	Excessive Speed Deviation Detection Level	Sets the allowable deviation between motor speed and frequency reference before a speed deviation fault (DEV) is triggered. Set as a percentage of the maximum output frequency (E1-04).	0 to 50	10%	A	–	–	389	—
F1-11	Excessive Speed Deviation Detection Delay Time	Sets the time in seconds for which a deviation between motor speed and frequency reference has to exceed the speed deviation detection level F1-10 before a DEV fault will occur.	0.0 to 10.0	0.5 s	A	–	–	38A	—
F1-14	PG Open-Circuit Detection Time	Sets the time for which no PG pulses must be detected before a PG Open (PGO) fault is triggered.	0.0 to 10.0	2.0 s	A	–	–	38D	—
F6 and F7: Serial Communications Option Card Settings Use F6 parameters to program the drive for serial communication.									
F6-01	Communications Error operation Selection	Selects the operation after a communications error occurred. 0: Ramp to stop using current accel/decel time 1: Coast to stop 2: Fast Stop using C1-09 3: Alarm only	0 to 3	1	A	A	A	3A2	
F6-02	External fault from comm. option selection	Sets when an external fault from a comm option is detected. 0: Always detected 1: Detection during Run only	0 or 1	0	A	A	A	3A3	
F6-03	External fault from comm. option operation selection	Selects the operation after an external fault set by a communications option (EF0). 0: Ramp to stop using current accel/decel time 1: Coast to stop 2: Fast Stop using C1-09 3: Alarm only	0 to 3	1	A	A	A	3A4	
F6-04	Bus Error Detection Time	Set the delay time for error detection if a bus error occurs.	0.0 to 5.0	2.0 s	A	A	A	3A5	
F6-10	CC-Link Node Address	Sets the node address if a CC-Link option card is installed	0 to 63	0	A	A	A	3E6	
F6-11	CC-Link communications speed	0: 156 Kbps 1: 625 Kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps	0 to 4	0	A	A	A	3E7	

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
F6-14	BUS Error auto reset	Selects if a BUS fault can be automatically reset.	0 or 1	0	A	A	A	3BB	
F6-20	DeviceNet MAC Address	Selects the drives MAC address for DeviceNet	0 to 63	0	A	A	A	3C1	
F6-21	Device Net Communications Speed	0: 125 kbps 1: 250 kbps 2: 500 kbps 3: Detect automatically	0 to 3	3	A	A	A	3C2	
F6-22	DeciveNet PCA setting	I/O Polled Consuming Assembly Data Instance	0 to 255	0	A	A	A	3C3	
F6-23	DeciveNet PPA setting	I/O Polled Producing Assembly Data Instance	0 to 255	0	A	A	A	3C4	
F6-24	DeciveNet Idle mode fault detection	Selects if a fault s is detected during communication idle mode. 0: Disabled 1: Enabled	0 or 1	0	A	A	A	3C5	
F6-30	Profibus node address	Sets the node address for a Profibus option.	0 to 125	0	A	A	A	3CB	
F6-31	Profibus Clear mode selection	Selects the operation when a "Clear Mode" command is received. 0: Resets back to zero. 1: Maintains the previous value.	0 or 1	0	A	A	A	3CC	
F6-32	Profibus Map selections	0: PPO Type 1: Conventional	0 or 1	0	A	A	A	3CD	
F6-35	CANopen Node ID selection	Sets the Node ID for a CANopen option	0 to 127	99	A	A	A	3D0	
F6-36	CANopen Communications speed	0: Auto-adjust 1: 10kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1 Mbps	0 to 8	6	A	A	A	3D1	
F6-40	CompoNet Node ID	Sets the Node ID for a CompoNet option.	0 to 63	0	A	A	A	3D5	
F6-41	CompoNet Speed	0: 93.75kbit/s 1: Reserved 2: 1.5Mbit/s 3: 3Mbit/s 4: 4Mbit/s 5-255: Reserved	0 to 255	0	A	A	A	3D6	

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
F7-01	Ethernet IP Address 1	Combining these parameters like F7-01.F7-02.F7-03.F7-04 sets the Ethernet IP address. Example: (192.168.1.10)	0 to 255	0	A	A	A	3E5	
F7-02	Ethernet IP Address 1		0 to 255	0	A	A	A	3E6	
F7-03	Ethernet IP Address 1		0 to 255	0	A	A	A	3E7	
F7-04	Ethernet IP Address 1		0 to 255	0	A	A	A	3E8	
F7-05	Subnet Mask 1	Combining these parameters like F7-05.F7-06.F7-07.F7-08 sets the Ethernet Subnet Mask.Example: (255.255.255.0)	0 to 255	0	A	A	A	3E9	
F7-06	Subnet Mask 2		0 to 255	0	A	A	A	3EA	
F7-07	Subnet Mask 3		0 to 255	0	A	A	A	3EB	
F7-08	Subnet Mask 4		0 to 255	0	A	A	A	3EC	
F7-09	Gateway Address 1	Combining these parameters like F7-09.F7-10.F7-11.F7-12 sets the Ethernet Gateway Address.Example: (192.168.1.1)	0 to 255	0	A	A	A	3ED	
F7-10	Gateway Address 2		0 to 255	0	A	A	A	3EE	
F7-11	Gateway Address 3		0 to 255	0	A	A	A	3EF	
F7-12	Gateway Address 4		0 to 255	0	A	A	A	3F0	
F7-13	Adress Mode at Startup	Selects how the Ethernet IP address is set. 0:User defined 1:BOOTP 2:DHCP	0 to 2	0	A	A	A	3F1	
F7-14	Security password	Sets the password required for setup changes via the network. 0: No password required 1 - 9999: 4 digit password	0 to 9999	0	A	A	A	3F2	
F7-15	Duplex Mode Selection	0:Auto Negotiate 1:Half Duplex forced 2:Full Duplex forced	0 to 2	0	A	A	A	3F3	
F7-18	Communication Speed Selection	0:Auto Negotiate 10:10 Mbps speed setting 100:100Mbps Speed Setting	0, 10, 100	0	A	A	A	3F6	
F7-19	Web Page Access	Selects the mode for modification on the Ethernet option board Web page settings 0: All access 1: Only during stop 2: Never	0 to 2	0	A	A	A	3F7	
F7-20	Gateway selection	0: Gateway not used 1: Use Gateway	0 or 1	1	A	A	A	3F8	
F7-21	Communication loss time out	Multiplier for communication loss detection timeout value.	0 to 300	0	A	A	A	3F9	

◆ H Parameters: Multi-Function Terminals

H parameters assign functions to the multi-function input and output terminals.

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
H1: Multi-Function Digital Input H1 parameters to assign functions to the multi-function digital input terminals. Unused terminals should be set to "F".									
H1-01	Multi-Function Digital Input Terminal S1 Function Selection	Selects the function of terminals S1 to S6 Refer to "Multi-Function Digital Input Selection Table" for a description of setting values.	1 to 9F <40>	40	A	A	A	438	—
H1-02	Multi-Function Digital Input Terminal S2 Function Selection			41	A	A	A	439	—
H1-03	Multi-Function Digital Input Terminal S3 Function Selection			24	A	A	A	400	—
H1-04	Multi-Function Digital Input Terminal S4 Function Selection			14	A	A	A	401	—
H1-05	Multi-Function Digital Input Terminal S5 Function Selection			3(0) <18>	A	A	A	402	—
H1-06	Multi-Function Digital Input Terminal S6 Function Selection			4(3) <18>	A	A	A	403	—

<18> Parenthetical value is the default when parameter A1-03 = 3330 3-Wire Initialization.
<40> The availability of certain functions depends on the control method used.

H1 Multi-Function Digital Input Selections						
H1-□□ Setting	**Function**	**Description**	**Control Mode V/f**	**Control Mode OLV**	**Control Mode PM**	**Pg.**
0	3-Wire Sequence	Closed: Reverse rotation (only if the drive is set up for 3-wire sequence)	O	O	O	—
1	Local/Remote Selection	Open: Remote, Reference 1 or 2 (b1-01/02 or b1-15/16) Closed: Local, LED operator is run and reference source	O	O	O	—
2	External Reference 1/2	Open: Run and frequency reference source 1 (b1-01/02) Closed: Run and frequency reference source 2 (b1-15/16)	O	O	O	—
3	Multi-Step Speed Reference 1	Used to select Multi-Step Speeds set in d1-01 to d1-16	O	O	O	—
4	Multi-Step Speed Reference 2		O	O	O	—
5	Multi-Step Speed Reference 3		O	O	O	—

H1 Multi-Function Digital Input Selections						
H1-□□ Setting	Function	Description	Control Mode			Pg.
			V/f	OLV	PM	
6	Jog Reference Selection	Open: Selected speed reference Closed: Jog Frequency reference (d1-17). Jog has priority over all other reference sources.	O	O	O	—
7	Accel/Decel Time 1	Used to switch between Accel/Decel. Time 1/2	O	O	O	—
8	Baseblock Command (N.O.)	Open: Normal operation Closed: No drive output	O	O	O	—
9	Baseblock Command (N.C.)	Open: No drive output Closed: Normal operation	O	O	O	—
A	Accel/Decel Ramp Hold	Closed: The drive pauses during acceleration or deceleration and maintains the output frequency.	O	O	O	—
B	Drive Overheat Alarm (OH2)	Closed: Displays an OH2 alarm	O	O	O	—
C	Terminal A2 Enable	Open: Terminal A2 disabled Closed: Terminal A2 enabled	O	O	O	—
F	Not used	Select this setting when not using the terminal or when using the terminal in a pass-through mode.	O	O	O	—
10	Up Command	Open: Maintains the current frequency reference Closed: Increases or decreases the current frequency reference. Ensure that the increase and decrease commands are set in conjunction with one another. The frequency reference source must be set to operator (b1-01 = 0).	O	O	O	—
11	Down Command		O	O	O	—
12	Forward Jog	Closed: Runs forward at the Jog Frequency d1-17.	O	O	O	—
13	Reverse Jog	Closed: Runs reverse at the Jog Frequency d1-17.	O	O	O	—
14	Fault Reset	Closed: Resets faults if the cause is cleared and the Run command is removed.	O	O	O	—
15	Fast-Stop (N.O.)	Closed: Decelerates at the Fast-Stop time C1-09. To restart the Fast-Stop input must be released and Run must be cycled.	O	O	O	—
16	Motor 2 Selection	Open: Motor 1 (E1-□□, E2-□□) Closed: Motor 2 (E3-□□, E4-□□)	O	O	O	—
17	Fast-stop (N.C.)	Open: Decelerates according to C1-09 (Fast-stop Time)	O	O	O	—
18	Timer Input Function	Set the timer delay using parameters b4-01 and b4-02. Ensure this function is set in conjunction with the multi-function output timer (H2-□□ = 12).	O	O	O	—
19	PID Disable	Closed: PID control disabled	O	O	O	—
1A	Accel/Decel Time Selection 2	Switches Accel/Decel times.	O	O	O	—

H1 Multi-Function Digital Input Selections						
H1-□□ Setting	Function	Description	Control Mode			Pg.
			V/f	OLV	PM	
1B	Program Lockout	Open: Parameters can not be edited. (except U1-01 if reference source is set for operator) Closed: Parameters may be edited and saved.	O	O	O	—
1E	Reference Sample Hold	Closed: Samples the analog frequency reference and operates the drive at that speed.	O	O	O	—
20 to 2F	External Fault	20: N.O., Always Detected, Ramp To Stop 21: N.C., Always Detected, Ramp To Stop 22: N.O., During Run, Ramp To Stop 23: N.C., During Run, Ramp To Stop 24: N.O., Always Detected, Coast To Stop 25: N.C., Always Detected, Coast To Stop 26: N.O., During Run, Coast To Stop 27: N.C., During Run, Coast To Stop 28: N.O., Always Detected, Fast-stop 29: N.C., Always Detected, Fast-stop 2A: N.O., During Run, Fast-stop 2B: N.C., During Run, Fast-stop 2C: N.O., Always Detected, Alarm Only (continue running) 2D: N.C., Always Detected, Alarm Only (continue running) 2E: N.O., During Run, Alarm Only (continue running) 2F: N.C., During Run, Alarm Only (continue running)	O	O	O	—
30	PID Integral Reset	Closed: Resets the PID control integral value.	O	O	O	—
31	PID Integral Hold	Closed: Maintains the current PID control integral value.	O	O	O	—
32	Multi-Step Speed Reference 4	Used to select Multi-Step Speeds set in d1-01 to d1-16	O	O	O	—
34	PID Soft Starter	Closed: Disables the PID soft starter b5-17.	O	O	O	—
35	PID Input Switch	Closed: Inverses the PID input signal	O	O	O	—
40	Forward Run Command (2-wire sequence)	Open: Stop Closed: Forward run **Note:** Can not be set together with Settings 42 or 43.	O	O	O	—
41	Reverse Run Command (2-wire sequence)	Open: Stop Closed: Reverse run **Note:** Can not be set together with Settings 42 or 43.	O	O	O	—
42	Run Command (2-wire sequence 2)	Open: Stop Closed: Run **Note:** Can not be set together with Settings 40 or 41.	O	O	O	—
43	FWD/REV Command (2-wire sequence 2)	Open: Forward Closed: Reverse **Note:** Can not be set together with Settings 40 or 41.	O	O	O	—

H1-□□ Setting	Function	Description	Control Mode V/f	OLV	PM	Pg.
44	Offset Frequency 1 Addition	Closed: Adds d7-01 to the frequency reference.	O	O	O	—
45	Offset Frequency 2 Addition	Closed: Adds d7-02 to the frequency reference.	O	O	O	—
46	Offset Frequency 3 Addition	Closed: Adds d7-03 to the frequency reference.	O	O	O	—
60	DC Injection Braking Command	Closed: Triggers DC Injection Braking (b2-02)	O	O	-	—
61	External Search Command 1	Closed: Activates Current Detection Speed Search from the max. output frequency (E1-04) if b3-01=0. Activates Speed Estimation Type Speed search if b3-01 =1.	O	O	O	—
62	External Search Command 2	Closed: Activates Current Detection Speed Search from the frequency reference b3-01=0. Activates Speed Estimation Type Speed search if b3-01 =1.	O	O	O	—
65	KEB Ride-Thru 1 (N.C.)	Open: KEB Ride-Thru 1 enabled Closed: Normal operation	O	O	O	—
66	KEB Ride-Thru 1 (N.O.)	Open: Normal operation Closed: KEB Ride-Thru 1 enabled	O	O	O	—
67	Communications Test Mode	Tests the MEMOBUS/Modbus RS-485/422 interface.	O	O	O	—
68	High-Slip Braking	Closed: High-Slip braking is executed. Drive stops.	O	-	-	—
6A	Drive Enable	Open: Drive disabled. If this input is opened during run, then the drive will stop as specified by parameter b1-03. Closed: Ready for operation.	O	O	O	—
75	Up 2 Command	Open: Maintains the current frequency reference Closed: Increases or decreases the frequency reference.UP 2 and Down 2 commands must be set in combination with each other. The frequency reference source must be assigned to the operator (b1-01 = “0”).	O	O	O	—
76	Down 2 Command		O	O	O	—
7A	KEB Ride-Thru 2 (N.C.)	Open: KEB Ride-Thru 2 enabled Closed: Normal operation	O	O	O	—
7B	KEB Ride-Thru 2 (N.O.)	Open: Normal operation Closed: KEB Ride-Thru 2 enabled	O	O	O	—
7C	Short-Circuit Braking (N.O.)	Open: Normal operation Closed: Short-Circuit Braking	-	-	O	—
7D	Short-Circuit Braking (N.C.)		-	-	O	—
7E	Forward/Reverse Detection	Direction of rotation detection (for Simple V/f w/PG)	O	-	-	—
7F	Bi-directional PID output selection	Enables or disables conversion of PID output to bi-directional reference if parameter d4-11 = 1. Open: Bi-directional output disabled Closed: Bi-directional output enabled	O	O	O	—
9F	FBD’s enable	Open: FBD’s enabled Closed: FBD’s disabled	O	O	O	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
H2: Multi-Function Digital Outputs **Use** H2 parameters to assign functions to the multi-function digital outputs.									
H2-01	Terminal MA, MB and MC Function Selection (relay)	Refer to “Multi-Function Digital Output Selection Table” for a description of setting values.	0 to 192 <40>	E	A	A	A	40B	—
H2-02	Terminal P1 Function Selection (open-collector)			0	A	A	A	40C	—
H2-03	Terminal P2 Function Selection (open-collector)			2	A	A	A	40D	—
H2-06	Watt Hour Output Unit Selection	Sets the display units for one of the multi-function output terminals that is assigned to output the watt hours (H2-☐☐ = 39) is the value every 200 ms. An output pulse of 200 ms is provided for every kWh that occurs. Intended to drive a counter, meter or PLC for logging kWh. 0: 0.1 kWh units 1: 1 kWh units 2: 10 kWh units 3: 100 kWh units 4: 1000 kWh units	0 to 4	0	A	A	A	437	—

<40> The availability of certain functions depends on the control method used.

H2 Multi-Function Digital Output Settings

H2-☐☐ Setting	Function	Description	Control Mode V/f	Control Mode OLV	Control Mode PM	Pg.
0	During Run	Closed: A Run command is active or voltage is output.	O	O	O	—
1	Zero Speed	Closed: Output frequency is 0.	O	O	O	—
2	Fref/Fout Agree 1	Closed: Output frequency equals the speed reference (plus or minus the hysteresis set to L4-02).	O	O	O	—
3	Fref/Fset Agree 1	Closed: Output frequency and speed reference equal the value in L4-01 (plus or minus the hysteresis of L4-02).	O	O	O	—
4	Frequency (FOUT) Detection 1	Closed: Output frequency is less than or equal to the value in L4-01 with hysteresis determined by L4-02.	O	O	O	—
5	Frequency (FOUT) Detection 2	Closed: Output frequency is greater than or equal to the value in L4-01, with hysteresis determined by L4-02.	O	O	O	—

H2-□□ Setting	Function	Description	Control Mode V/f	Control Mode OLV	Control Mode PM	Pg.
6	Drive Ready	Closed: Drive Ready. The drive is powered up, not in a fault state, and in the Drive mode.	O	O	O	—
7	DC Bus Undervoltage	Closed: DC bus voltage is below the UV trip level set in L2-05.	O	O	O	—
8	During Baseblock	Closed: There is no output voltage	O	O	O	—
9	Frequency reference selection	Open: External Reference 1 or 2 supplies the frequency reference Closed: Digital operator supplies the frequency reference.	O	O	O	—
A	Run command selection	Open: External Reference 1 or 2 supplies the Run command Closed: Digital operator supplies the Run command.	O	O	O	—
B	Torque Detection 1 (N.O.)	Closed: Output current/torque exceeds the torque value set in parameter L6-02 for longer than the time set in parameter L6-03.	O	O	O	—
C	Loss of Reference	Closed: Loss of the analog frequency reference detected. Enabled when L4-05 = 1.	O	O	O	—
D	Braking Resistor Fault	Closed: Braking resistor or transistor is overheated or faulted out. This selection requires that braking resistor protection parameter be set for ERF (L8-01 = “1”).	O	O	O	—
E	Fault	Closed: Fault occurred (other than CPF00 and CPF01).	O	O	O	—
F	Not used	Set this value when the terminal is not used, or when using the terminal in the pass-through mode.	O	O	O	—
10	Alarm	Closed: An alarm is triggered.	O	O	O	—
11	Reset Command Active	Closed: Reset command to the drive is active.	O	O	O	—
12	Timer Output	Timer output, controlled by b4-01 and b4-02. Used in conjunction with the digital input (H1-□□ = 18 “timer function”).	O	O	O	—
13	Fref/Fout Agree 2	Closed: When drive output frequency equals the frequency reference +/- L4-04.	O	O	O	—
14	Fref/Fset Agree 2	Closed: When the drive output frequency is equal to the value in L4-03 (plus or minus L4-04).	O	O	O	—
15	Frequency Detection 3	Closed: When the drive output frequency is less than or equal to the value in L4-03 with the hysteresis determined by L4-04.	O	O	O	—
16	Frequency Detection 4	Closed: When the output frequency is greater than or equal to the value in L4-03 with the hysteresis determined by L4-04.	O	O	O	—
17	Torque Detection 1 (N.C.)	Open: When the output current/torque exceeds the value set in parameter L6-02 for more time than is set in parameter L6-03.	O	O	O	—
18	Torque Detection 2 (N.O.)	Closed: When the output current/torque exceeds the value set in parameter L6-05 for more time than is set in parameter L6-06.	O	O	O	—
19	Torque Detection 2 (N.C.)	Open: Output current/torque exceeds the value set in parameter L6-05 for more time than is set in parameter L6-06.	O	O	O	—
1A	Reverse Direction	Closed: Drive is running in the reverse direction.	O	O	O	—

H2 Multi-Function Digital Output Settings						
H2-☐☐ Setting	Function	Description	Control Mode			Pg.
			V/f	OLV	PM	
1B	Baseblock 2	Open: Drive is in base block condition. Output is disabled.	O	O	O	—
1C	Motor 2 Selection	Closed: Motor 2 is selected by a digital input (H1-☐☐ = 16)	O	O	–	—
1E	Restart Enabled	Closed: An automatic restart is performed	O	O	O	—
1F	Overload Alarm OL1	Closed: OL1 is at 90% of its trip point or greater.	O	O	O	—
20	OH Pre alarm	Closed: Heatsink temperature exceeds the parameter L8-02 value.	O	O	O	—
22	Mechanical Weakening (N.O.)	Closed: Mechanical Weakening detected.	O	O	O	—
30	During Torque Limit	Closed: When the torque limit has been reached.	–	O	–	—
37	During Frequency Output	Closed: Frequency is output Open: Operation stopped, Baseblock, DC Injection Braking, or Initial Excitation is being performed.	O	O	O	—
38	Drive Enable	Closed: Multi-function input closes (H1-☐☐ = 6A)	O	O	O	—
39	Watt Hour Pulse Output	Output units are determined by H2-06, outputs 200 ms pulse for each incremented kWh count.	O	O	O	—
3C	Drive Mode	Closed: Local Open: Remote (this signal combines setting values 9 and A).	O	O	O	—
3D	Speed Search	Closed: Speed search is being executed.	O	O	O	—
3E	PID Feedback Loss	Closed: PID Feedback Loss. PID feedback value is below the level set to b5-13 for longer than the time set in b5-14.	O	O	O	—
3F	PID Feedback Fault	Closed: PID Feedback Fault.PID feedback value exceeds the level set to b5-36 for longer than the time set to b5-37.	O	O	O	—
4A	KEB Operation	Closed: KEB is being performed.	O	O	O	—
4B	Short-Circuit Brake	Closed: Short-Circuit Braking is active.	–	–	O	—
4C	During Fast-stop	Closed: Fast-stop command is entered	O	O	O	—
4D	OH Pre-alarm Time Limit	Closed: OH Pre-alarm time limit is passed.	O	O	O	—
100 to 14D	H2 Parameter Functions Reversed Output Switching of 0 to 92	Reverse the output switching of the multi-function output functions. Set the last two digits of 1☐☐ to reverse the output signal of that specific function.Examples: Setting “108” reverses the output of “During baseblock,” which is setting value 08. Setting “14A” reverses the output of “During KEB operation”, which is setting “4A”.	O	O	O	—

Parameter List

B

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
H3: Analog Inputs Use H3 parameters to set the multi-function analog input terminals.									
H3-01	Terminal A1 Signal Level Selection	Sets the input level for terminal A1. 0: 0 to +10 V (lower limit) 1: 0 to +10 V (no lower limit)	0, 1	0	A	A	A	410	—
H3-02	Terminal A1 Function Selection	Sets the function of terminal A1. When terminal A1 is not used or is used as a through terminal, this parameter must be set to “F”.	0 to 31 *<40>*	0	A	A	A	434	—
H3-03 *<22>*	Terminal A1 Gain Setting	Sets the level of the input value selected in H3-02 when 10V is input at terminal A1.	-999.9 to 999.9	100.0 %	A	A	A	411	—
H3-04 *<22>*	Terminal A1 Bias Setting	Sets the level of the input value selected in H3-02 when 0V is input at terminal A1.	-999.9 to 999.9	0.0%	A	A	A	412	—
H3-09	Terminal A2 Signal Level Selection	Sets the input signal level for terminal A2. 0: 0 to +10 V (with lower limit) 1: 0 to +10 V (no lower limit) 2: 4 to 20 mA 3: 0 to 20 mA	0 to 3	2	A	A	A	417	—
			Switch between current or voltage inputs by using DIP switch S1-2 switch on the terminal board. ***Refer to I/O Connections on page 73***.						
H3-10	Terminal A2 Function Selection	Sets the function of terminal A2. When terminal A2 is not used or is used as a through terminal, this parameter must be set to “F”.	0 to 31 *<40>*	0	A	A	A	418	—
H3-11 *<22>*	Terminal A2 Gain Setting	Sets the level of the input value selected in H3-10 when 10 V (20 mA) is input at terminal A2.	-999.9 to 1000.0	100.0 %	A	A	A	419	—
H3-12 *<22>*	Terminal A2 Input Bias	Sets the level of the input value selected in H3-10 when 0 V (0 or 4 mA) is input at terminal A2.	-999.9 to 999.-	0.0%	A	A	A	41A	—
H3-13	Analog Input Filter Time Constant	Sets the primary delay filter time constant for terminals A1 and A2. Used for noise filtering.	0.00 to 2.00	0.03 s	A	A	A	41B	—

<22> Parameter can be changed during run.
<40> The availability of certain parameters depends on the control method used.

H3 Multi-Function Analog Input Settings						
H3-□□ Setting	Function	Maximum Input Level Possible	Control Mode			Pg.
			V/f	OLV	PM	
0	Frequency Bias	Max output frequency (E1-04).Same value can be set using H3-02 and H3-10.	O	O	O	—
1	Frequency Gain	Frequency reference (voltage)	O	O	O	—
2	Auxiliary Frequency Reference (used as a multi step speed 2)	Max output frequency (E1-04)	O	O	O	—
4	Output Voltage Bias	Motor rated voltage (E1-05).	O	–	–	—
7	Overtorque/Undertorque Detection Level	Open Loop Vector: Motor rated torque V/f control: Drive rated current	O	O	O	—
B	PID Feedback	10V = 100%	O	O	O	—
C	PID Set Point	10V = 100%	O	O	O	—
E	Motor Temperature (PTC input)	10 V = 100.00% Determined by L1-03 and L1-04.	O	O	O	—
F	Not used / Pass-through mode	–	O	O	O	—
10	FWD Torque Limit	Motor rated torque	–	O	–	—
11	REV Torque Limit	Motor rated torque	–	O	–	—
12	Regenerative Torque Limit	Motor rated torque	–	O	–	—
15	FWD/REV Torque Limit	Motor rated torque	–	O	–	—
16	Differential PID Feedback	10 V = 100%	O	O	O	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
H4: Multi-Function Analog Outputs Use H4 parameters to configure the multi-function analog output terminals.									
H4-01	Multi-Function Analog Output Terminal AM)	Selects the data to be output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter “103” for U1-03. When using this terminal in trough mode or when not using it at all, set “000” or “031”.	000 to 999 <40>	102	A	A	A	41D	—
H4-02 <22>	Multi-Function Analog Output Terminal AM Gain	Sets terminal AM output level when selected monitor is at 100%. Maximum output voltage is 10 V.	-999.9 to 999.9	100.0 %	S	S	S	41E	—

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No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
H4-03 <22>	Multi-Function Analog Output Terminal AM Gain	Sets terminal AM output level when selected monitor is at 0%.	-999.9 to 999.9	0.0%	A	A	A	41F	—
H5: MEMOBUS/Modbus Communications Use H5 Parameters to connect the drive to a MEMOBUS/Modbus network.									
H5-01 <39>	Drive Node Address	Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.	0 to 20 H	1F	A	A	A	425	—
H5-02	Communication Speed Selection	Selects the baud rate for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps	0 to 8	3	A	A	A	426	—
H5-03	Communication Parity Selection	Selects the communication parity for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0	A	A	A	427	—
H5-04	Stopping Method After Communication Error	Selects the stopping method when a communication time-out fault (CE) is detected. 0: Ramp to stop 1: Coast to stop 2: Fast-stop 3: Alarm only	0 to 3	3	A	A	A	428	—
H5-05	Communication Fault Detection Selection	Enables or disables the communications time-out fault (CE) detection. 0: Disabled 1: Enabled - If communication is lost for more than two seconds, a CE fault will occur.	0,1	1	A	A	A	429	—
H5-06	Drive Transmit Wait Time	Set the wait time between receiving and sending data.	5 to 65	5 ms	A	A	A	42A	—
H5-07	RTS Control Selection	Selects "request to send" (RTS) control: 0: Disabled - RTS is always on. 1: Enabled - RTS turns on only when sending.	0,1	1	A	A	A	42B	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
H5-09	CE Detection Time	Sets the time required to detect a communications error. Adjustment may be need when networking several drives.	0.0 to 10.0 s	2.0 s	A	A	A	435	—
H5-10	Unit Selection for MEMOBUS/Modbus Register 0025H	Selects the units used for MEMOBUS/Modbus register 0025H (Output Voltage Reference Monitor). 0: 0.1 V units 1: 1 V units	0, 1	0	A	A	A	436	—
H5-11	Communications ENTER Function Selection	Select the function for the enter command that saves parameter data to the drive. 0: Parameter changes are activated when ENTER command is entered. 1: Parameter changes are activated immediately without ENTER command (compatible with Varispeed VS606-V7).	0, 1	1	A	A	A	43C	—
H5-12	Run Command Method Selection	0: FWD/STOP, REV/STOP Method 1: RUN/STOP, FWD/REV Method	0, 1	0	A	A	A	43D	—
H6: Pulse Train Input/Output Use H6 parameters to configure Pulse Train I/O operation.									
H6-01	Pulse Train Input Terminal RP Function Selection	Selects pulse train input function. 0: Frequency reference 1: PID feedback value 2: PID setpoint value 3: Simple PG V/f control mode (can be set only when using motor 1 in the V/f control mode)	0 to 3	0	A	A	A	42C	—
H6-02 <22>	Pulse Train Input Scaling	Sets the number of pulses (Hz) that is equal to 100% of the value selected in H6-01.	1000 to 32000	1440 Hz	A	A	A	42D	—
H6-03 <22>	Pulse Train Input Gain	Sets the level of the value selected in H6-01 when a frequency with the value set in H6-02 is input.	0.0 to 1000.0	100.0 %	A	A	A	42E	—
H6-04 <22>	Pulse Train Input Bias	Sets the level of the value selected in H6-01 when 0 Hz is input.	-100.0 to +100.0	0.0%	A	A	A	42F	—

Parameter List

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No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
H6-05 <22>	Pulse Train Input Filter Time	Sets the pulse train input filter time constant.	0.00 to 2.00	0.10 s	A	A	A	430	—
H6-06 <22>	Pulse Train Monitor Terminal MP Selection	Select the pulse train monitor output function (value of the □-□□ part of U□-□□). Refer to *U: Monitors on page 360* for the list of U monitors. Example: To select U5-01, set "501." When not using this parameter or when using in the through mode, set "000".	000, 031, 101, 102, 105, 116, 501, 502	102	A	A	A	431	—
H6-07 <22>	Pulse Train Monitor Scaling	Sets the pulse output frequency in Hz when the monitor value is 100%. Set H6-06 to "2" and H6-07 to "0", to make the pulse train monitor output equal to the output frequency.	0 to 32000	1440 Hz	A	A	A	432	—

<22> Parameter can be changed during run.
<39> If this parameter is set to 0, the drive will be unable to respond to MEMOBUS/Modbus commands.
<40> The availability of certain functions depends on the control method used.

Note: Cycle power to the drive to enable MEMOBUS/Modbus settings.

◆ L: Protection Function

L parameters provide protection to the drive and motor, such as: control during momentary power loss, stall prevention, frequency detection, fault restarts, overtorque detection, torque limits and other types of hardware protection.

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L1: Motor Protection Functions Use L1 parameters to configure motor protective functions.									
L1-01	Motor Overload Protection Selection	Sets the motor thermal overload protection (OL1) based on the cooling capacity of the motor. 0: Disabled 1: Standard Fan Cooled (< 10:1 motor) 2: Standard Blower Cooled (≥ 10:1 motor) 3: Vector Motor (100:1 motor) 4: PM motor with variable torque **NOTICE:** When multiple motors are used the drive may not be able to provide protection, even if it is enabled in L1-01. Set L1-01 to “0” and ensure each motor has a thermal relay installed.	0 to 4	1 <2>	S	S	S	480	382
L1-02	Motor Overload Protection Time	Sets the motor thermal overload protection (OL1) time. A larger L1-02 time will increase the time for an OL1 fault to occur. This parameter does not typically require adjustment. Should be set in accordance with the overload tolerance of the motor.	0.1 to 5.0	1.0 min	A	A	A	481	—
L1-03	Motor Overheat Alarm Operation Selection (PTC input)	Sets operation when the motor temperature analog input (H3-02/10 = E) exceeds the OH3 alarm level. 0: Ramp to Stop 1: Coast to Stop 2: Fast-stop using C1-09 3: Alarm Only (“oH3” will flash)	0 to 3	3	A	A	A	482	—
L1-04	Motor Overheat Fault Operation Selection (PTC input)	Sets stopping method when the motor temperature analog input (H3-02/10 = E) exceeds the OH4 fault level. 0: Ramp to Stop 1: Coast to Stop 2: Fast-stop	0 to 2	1	A	A	A	483	—
L1-05	Motor Temperature Input Filter Time (PTC input)	This parameter adjusts the filter on the motor temperature analog input (H3-02 or H3-10 = E). Increase to add stability, decrease to improve response.	0.00 to 10.00	0.20 s	A	A	A	484	—
L1-13	Continuous Electrothermal Operation Selection	Determines whether or not to hold the electrothermal value when the power supply is interrupted. 0: Disabled 1: Enabled	0 to 1	1	A	A	A	46D	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L2: Momentary Power Loss Use L2 parameters to configure drive functions for momentary power loss conditions.									
L2-01	Momentary Power Loss Operation Selection	Enables and disables the momentary power loss function. 0: Disabled - Drive trips on (UV1) fault when power is lost. 1: Power Loss Ride-Thru Time - Drive will restart if power returns within the time set in L2-02. 2: CPU Power Active - Drive will restart if power returns as long as the CPU is working.	0 to 2	0	A	A	A	485	—
			For a restart to occur, the run command must be maintained throughout the ride-thru period.						
L2-02	Momentary Power Loss Ride-Thru Time	Sets the Power Loss Ride-Thru time. Only effective when L2-01 = 1.	0.0 to 25.5	<12>	A	A	A	486	—
L2-03	Momentary Power Loss Minimum Baseblock Time	Sets the minimum wait time for residual motor voltage decay before the drive output reenergizes after power loss ride-thru. If L2-03 is greater than L2-02, operation resumes after the time set in L2-03.	0.1 to 5.0	<57>	A	A	A	487	—
L2-04	Momentary Power Loss Voltage Recovery Ramp Time	Sets the time for the output voltage to return to the preset V/f pattern during speed search.	0.0 to 5.0	<12>	A	A	A	488	—
L2-05 <24>	Undervoltage Detection Level (UV)	Sets the DC Bus undervoltage trip level. If this is set lower than the default setting, additional AC input impedance or DC bus reactance may be necessary. Consult with the manufacturer before changing this parameter setting. This value is used for KEB activation if L2-01 > 0.	150 to 210	<9> <12>	A	A	A	489	—
L2-06	KEB Deceleration Time	Sets the time required to decelerate from the speed when KEB was activated to zero speed.	0.0 to 200.0	0.0 s	A	A	A	48A	—
L2-07	KEB Acceleration Time	Set the time to accelerate to the set speed after recovery from a momentary power loss. If set to 0.0, the active acceleration time is used.	0.0 to 25.5	0.0 s	A	A	A	48B	—
L2-08	KEB Start Output Frequency Reduction	Sets the percentage of output frequency reduction at the beginning of deceleration when a KEB command is input from multi-function input. Reduction = (slip frequency before KEB) x L2-08 x 2	0 to 300	100%	A	A	A	48C	—
L2-11 <24>	Desired DC Bus Voltage during KEB	Sets the desired value of the DC bus voltage during KEB.	150 to 400 V	E1-01 x 1.22	A	A	A	461	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
L3: Stall Prevention Function Use L3 parameters to configure the stall prevention function.									
L3-01	Stall Prevention Selection during Acceleration	Selects the stall prevention method used to prevent excessive current during acceleration. 0: Disabled - Motor accelerates at active acceleration rate. The motor may stall if load is too heavy or accel time is too short. 1: General Purpose - When output current exceeds L3-02 level, acceleration stops. Acceleration will continue when the output current level falls below the L3-02 level. 2: Intelligent - The active acceleration rate is ignored. Acceleration is completed in the shortest amount of time without exceeding the current value set in L3-02.	0 to 2 <29>	1	A	A	A	48F	—
L3-02	Stall Prevention Level during Acceleration	Used when L3-01 = 1 or 2. 100% is equal to the drive rated current. Decrease the set value if stalling or excessive current occurs with default setting.	0 to 150	<7>	A	A	A	490	—
L3-03	Stall Prevention Limit during Acceleration	Sets stall prevention lower limit during acceleration when operating in the constant power range. Set as a percentage of the drive's rated current.	0 to 100	50%	A	A	A	491	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L3-04	Stall Prevention Selection during Deceleration	When using a braking resistor, use setting "0". Setting "3" is used in specific applications. 0: Disabled - The drive decelerates at the active deceleration rate. If the load is too large or the deceleration time is too short, an OV fault may occur. 1: General Purpose - The drive decelerates at the active deceleration rate, but if the main circuit DC bus voltage reaches the stall prevention level (380/760 VDC), deceleration will stop. Deceleration will continue once the DC bus level drops below the stall prevention level. 2: Intelligent - The active deceleration rate is ignored and the drive decelerates as fast as possible without hitting OV fault level. Range: C1-02 / 10. 3: Stall Prevention with Braking Resistor - Stall prevention during deceleration is enabled in coordination with dynamic braking. 4: Overexcitation Deceleration - Decelerates with the flux level determined by n3-13 (Overexcitation Gain).	0 to 4 <50>	1	S	S	S	492	340
L3-05	Stall Prevention Selection during Run	Selects the stall prevention method to use to prevent drive faults during run. 0: Disabled - Drive runs a set frequency. A heavy load may cause the drive to trip on an OC or OL fault. 1: Decel Time 1 - The drive will decelerate at Decel Time 1 (C1-02) if the output current exceeds the level set by L3-06. Once the current level drops below the L3-06 level, the drive will accelerate back to its frequency reference at the active acceleration rate. 2: Decel Time 2 - Same as setting 1 except the drive decelerates at Decel Time 2 (C1-04). When output frequency is 6 Hz or less, stall prevention during run is disabled regardless of the setting in L3-05.	0 to 2	1	A	–	A	493	—
L3-06	Stall Prevention Level during Run	Enabled when L3-05 is set to "1" or "2". 100% is equal to the drive rated current.Decrease the set value if stalling or excessive current occurs with the default settings.	30 to 200	<7>	A	–	A	494	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L3-11	OV Suppression Function Selection	Enables or disables OV suppression function, which allows the drive to change the output frequency as the load changes, thus preventing an OV fault. 0: Disabled 1: Enabled **Note:** The frequency reference and motor speed diverge as the regenerative energy begins to flow back into the DC bus and triggers the OV suppression function. Disable this function when using a braking resistor.	0, 1	0	A	A	-	4C7	—
L3-17 <24>	Overvoltage Suppression and Stall Prevention Desired DC Bus Voltage	Sets the desired value for the DC bus voltage during overvoltage suppression and stall prevention during deceleration. Enabled only when L3-04 = 2 or L3-11 = 1.	150 to 400 V	370 V <9>	A	A	A	462	—
L3-20	Main Power Circuit Voltage Adjustment Gain	Sets the proportional gain used by KEB, Stall prevention and overvoltage suppression. If OV or UV1 occurs at the beginning of KEB deceleration, slowly increase this setting by 0.1.	0.00 to 5.00	1.00	A	A	A	465	—
L3-21	Accel/Decel Rate Calculation Gain	Sets the proportional gain used to calculate the deceleration rate during KEB, OV suppression function and stall prevention during deceleration (L3-04 = 2). This parameter does not typically require adjustment. Increase the value in steps of 1.0 if overcurrent and overvoltage occur.	0.00 to 200.00	1.00	A	A	A	466	—
L3-22	Deceleration Time at Stall Prevention during Acceleration	Sets the deceleration time used for stall prevention during acceleration in Open Loop Vector control for PM motors. When set to 0, the drive decelerates at the normal deceleration time.	0.0 to 6000.0	0.0 s	–	–	A	4F9	—
L3-23	Automatic Reduction Selection for Stall Prevention during Run	0: Sets the stall prevention level throughout the entire frequency range to the value in parameter L3-06. 1: Automatically lowers the stall prevention level in the constant output range. The lower limit value is 40% of L3-06.	0, 1	0	A	A	A	4FD	—
L3-24	Motor Acceleration Time for Inertia Calculations	Sets the time needed to accelerate the uncoupled motor at rated torque from stop to the maximum frequency. Setting the drive capacity to parameter o2-04 or changing E2-11 will automatically set this parameter for a 4-pole motor.	0.001 to 10.000	<10> <51> <57>	A	A	A	46E	—

Parameter List

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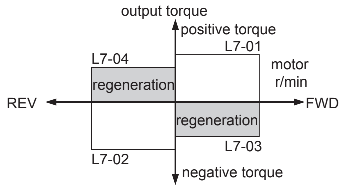
No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L3-25	Load Inertia Ratio	Sets the ratio between the motor and machine inertia.	0.0 to 1000.0	1.0	A	A	A	46F	—
L4: Frequency Detection Use L4 parameters to configure frequency detection operation.									
L4-01	Speed Agreement Detection Level	These parameters configure the multi-function output (H2-□□ = 2, 3, 4, 5) settings "Fref/Fout Agree 1", "Fref/Set Agree 1", "Frequency Detection 1," and "Frequency detection 2". Parameter L4-01 sets the level while parameter L4-02 sets the hysteresis for the Speed Detection Output Function.	0.0 to 400.0	0.0 Hz	A	A	A	499	—
L4-02	Speed Agreement Detection Width		0.0 to 20.0	2.0 Hz	A	A	A	49A	—
L4-03	Speed Agreement Detection Level (+/-)	These parameters configure the Multi-Function Output (H2-□□ = 13, 14, 15, 16) settings "Fref/Fout Agree 2", "Fref/Set Agree 2", "Frequency Detection 3," or "Frequency Detection 4". Parameter L4-03 sets the level while parameter L4-04 sets the hysteresis for the Speed Detection Output Function.	-400.0 to +400.0	0.0 Hz	A	A	A	49B	—
L4-04	Speed Agreement Detection Width (+/-)		0.0 to 20.0	2.0 Hz	A	A	A	49C	—
L4-05	Frequency Reference Loss Detection Selection	Sets operation when the frequency reference is lost (reference drops 90% or more within 400 ms). 0: Stop - Drive will stop. 1: Run at L4-06 PrevRef - Drive will run at the percentage set in L4-06 of the frequency reference before loss.	0,1	0	A	A	A	49D	—
L4-06	Frequency Reference at Reference Loss	Sets the frequency reference when a reference loss was detected and L4-05 = 1. Reference will be: Fref = Fref at time of loss x L4-06.	0.0 to 100.0	80.0 %	A	A	A	4C2	—
L4-07	Frequency Detection Conditions	0: No detection during baseblock. 1: Detection always enabled.	0 to 1	0	A	A	A	470H	—
L5: Fault Reset Use L5 parameters to configure Automatic Restart after fault.									
L5-01	Number of Auto Restart Attempts	Sets the counter for the number of times the drive attempts to restart when the following faults occur: GF, LF, OC, OV, PF, PUF, RH, RR, OL1, OL2, OL3, OL4, UV1. If the drive faults after an auto restart attempt, the counter is incremented. When the drive operates without fault for 10 minutes, the counter will be reset.	0 to 10	0	A	A	A	49E	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
L5-02	Auto Restart Operation Selection	Sets fault contact activation during automatic restart attempts. 0: Fault output (H2-☐☐ = E) not active. 1: Fault output (H2-☐☐ = E) active during restart attempt.	0,1	0	A	A	A	49F	—
L5-04	Fault Reset Interval Time	Sets the amount of time to wait between performing fault restarts. Enabled when L5-05 is set to 1.	0.5 to 600.0 s	10.0 s	A	A	A	46C	—
L5-05	Fault Reset Operation Selection	Selects the method of incrementing the restart counter. 0: Continuously attempt to restart and increment counter after successful restart (like Varispeed VS616-F7/G7) 1: Attempt to restart with the interval time set in L5-04. Every trial increments the counter. (like Varispeed VS606-V7)	0 to 1	0	A	A	A	467	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L6: Overtorque Detection Use L6 parameters to configure overtorque detection.									
L6-01	Torque Detection Selection 1	Selects the overtorque/undertorque operation. overtorque and undertorque are determined by the settings in parameters L6-02 and L6-03. The multi-function output settings (H2-☐☐ = B and 17) are also active if programmed. 0: Disabled 1: OL3 at Speed Agree - Alarm (overtorque detection only active during Speed Agree and operation continues after detection). 2: OL3 at RUN - Alarm (overtorque detection is always active and operation continues after detection). 3: OL3 at Speed Agree - Fault (overtorque detection only active during Speed Agree and drive output will shut down on an OL3 fault). 4: OL3 at RUN - Fault (overtorque detection is always active and drive output will shut down on an OL3 fault). 5: UL3 at Speed Agree - Alarm (undertorque detection is only active during Speed Agree and operation continues after detection). 6: UL3 at RUN - Alarm (undertorque detection is always active and operation continues after detection). 7: UL3 at Speed Agree - Fault (undertorque detection only active during Speed Agree and drive output will shut down on an OL3 fault). 8: UL3 at RUN - Fault (undertorque detection is always active and drive output will shut down on an OL3 fault).	0 to 8	0	A	A	A	4A1	—
L6-02	Torque Detection Level 1	Sets the overtorque/undertorque detection level. 100% is equal to the motor rated current in V/f control and the motor rated torque in Open Loop Vector control.	0 to 300	150%	A	A	A	4A2	—
L6-03	Torque Detection Time 1	Sets the length of time an overtorque/ undertorque condition must exist before Torque Detection 1 is triggered.	0.0 to 10.0	0.1 s	A	A	A	4A3	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L6-04	Torque Detection Selection 2	Sets the response to an overtorque/undertorque condition. overtorque and undertorque are determined by the settings in parameters L6-05 and L6-06. The multi-function output settings (H2-□□ = 18 and 19). 0: Disabled 1: OL4 at Speed Agree - Alarm (overtorque Detection only active during Speed Agree and Operation continues after detection). 2: OL4 at RUN - Alarm (overtorque Detection is always active and operation continues after detection). 3: OL4 at Speed Agree - Fault (overtorque Detection only active during Speed Agree and drive output will shut down on an OL4 fault). 4: OL4 at RUN - Fault (overtorque Detection is always active and drive output will shut down on an OL4 fault). 5: UL4 at Speed Agree - Alarm (undertorque Detection is only active during Speed Agree and operation continues after detection). 6: UL4 at RUN - Alarm (undertorque Detection is always active and operation continues after detection). 7: UL4 at Speed Agree - Fault (undertorque Detection only active during Speed Agree and drive output will shut down on an OL4 fault). 8: UL4 at RUN - Fault (undertorque Detection is always active and drive output will shut down on an OL4 fault).	0 to 8	0	A	A	A	4A4	—
L6-05	Torque Detection Level 2	Sets the overtorque/undertorque detection level. 100% is equal to the motor rated current in V/f control and the motor rated torque in Open Loop Vector control.	0 to 300	150%	A	A	A	4A5	—
L6-06	Torque Detection Time 2	Sets the length of time an overtorque/ undertorque condition must exist before torque detection 2 is recognized by the drive.	0.0 to 10.0	0.1 s	A	A	A	4A6	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L6-08	Mechanical Weakening (OL5) Detection Operation	This function can detect an over/undertorque in a certain speed range as a result of machine fatigue. It is triggered by a certain operation time and uses the OL1 detection settings (L6-01 to L6-03) 0: Mechanical Weakening Detection disabled. 1: Continue running if the speed (signed) is greater than L6-09 (alarm only). 2: Continue running if the speed (not signed) is greater than L6-09 (alarm only). 3: Interrupt drive output when the motor speed (signed) is greater than L6-09 (protection operation). 4: Interrupt drive output when the motor speed (not signed) is greater than L6-09 (protection operation). 5: Continue running if the speed (signed) is less than L6-09 (alarm only). 6: Continue running if the speed (not signed) is less than L6-09 (alarm only). 7: Interrupt drive output when the motor speed (signed) is less than L6-09 (protection operation). 8: Interrupt drive output when the motor speed (not signed) is less than L6-09 (protection operation).	0 to 8	0	A	A	A	468	—
L6-09	Mechanical Weakening Detection Speed Level	• Sets the speed that triggers mechanical weakening detection. • When L6-08 is set for an unsigned value, the absolute value is used even if the setting is negative.	-110.0 to +110.0%	110%	A	A	A	469	—
L6-10	Mechanical Weakening Detection Time	Sets the time a mechanical weakening has to be detected before an Alarm/Fault is triggered.	0.0 to 10.0 s	0.1 s	A	A	A	46A	—
L6-11	Mechanical Weakening Detection Start Time	Sets the operation time (U1-04) that has to be passed before Mechanical weakening detection is active.	0 to 65535	0	A	A	A	46B	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L7: Torque Limit Use L7 parameters to configure the torque limit function.									
L7-01	Forward Torque Limit	Sets the torque limit value as a percentage of the motor rated torque. Four individual quadrants can be set.	0 to 300	200%	–	A	–	4A7	—
L7-02	Reverse Torque Limit		0 to 300	200%	–	A	–	4A8	—
L7-03	Forward Regenerative Torque Limit		0 to 300	200%	–	A	–	4A9	—
L7-04	Reverse Regenerative Torque Limit		0 to 300	200%	–	A	–	4AA	—
L7-06	Torque Limit Integral Time Constant	Sets the integral time constant for the torque limit.	5 to 10000	200 ms	–	A	–	4AC	—
L7-07	Torque Limit Control Method Selection during Accel/Decel	Selects the method of torque limit control during accel/decel. 0: Proportional Control (change to integral controls at fixed speeds). Use this setting when acceleration to the desired speed has priority over torque limitation. 1: Integral Control. Use this setting if the torque limitation has priority. When torque limit is applied to the motor, accel/decel time may increase and motor speed may not meet the speed reference.	0, 1	0	–	A	–	4C9	—
L8: Hardware Protection Use L8 parameters to configure hardware protection functions.									
L8-01	Internal Dynamic Braking Resistor Protection Selection (ERF type)	Selects the Braking resistor when using a 3% duty cycle heatsink mounted OYMC braking resistor. This parameter does not enable or disable the braking transistor of the drive. 0: Resistor overheat protection disabled 1: Resistor overheat protection enabled	0,1	0	A	A	A	4AD	—
L8-02	Overheat Alarm Level	When the heatsink temperature exceeds the value set in this parameter, an Overheat Alarm (OH) will occur.	50 to 130	<12>	A	A	A	4AE	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
L8-03	Overheat Pre-Alarm Operation Selection	Sets the drive operation when an overheat alarm OH is detected. 0: Ramp to Stop using the active decel time. 1: Coast to Stop. 2: Fast-stop using the time set in C1-09. 3: Alarm Only. Drive continues running, but displays an alarm. 4: Reduced Speed Operation. Drive continues to run with reduced frequency reference as specified in L8-19. Settings 0 through 2 trigger a fault relay if the heatsink becomes too hot.	0 to 4	3	A	A	A	4AF	—
L8-05	Input Phase Loss Protection Selection	Selects the detection of input current phase loss, power supply voltage imbalance, or main circuit electrolytic capacitor deterioration. 0: Disabled 1: Enabled	0,1	1 <56>	A	A	A	4B1	—
L8-07	Output Phase Loss Protection	Selects the output phase loss detection. 0: Disabled 1: Enabled (triggered by a single phase loss). 2: Enabled (triggered when two phases are lost).Output phase loss is detected when operating with less than 5% of the drive rated current. Detection can mistakenly occur if the motor is too small relative to the drive capacity rating (this parameter should be disabled in such cases).	0 to 2	1	A	A	A	4B3	—
L8-09	Output Ground Fault Detection Selection	Selects the output ground fault detection. 0: Disabled 1: Enabled	0,1	<12>	A	A	A	4B5	—
L8-10	Heatsink Cooling Fan Operation Selection	Controls the heatsink cooling fan operation. 0: Fan On-Run Mode - Fan will operate only when the drive is running and for L8-11 seconds after stop. 1: Fan always on - Cooling fan operates whenever the drive is powered up.	0,1	0	A	A	A	4B6	—
L8-11	Heatsink Cooling Fan Operation Delay Time	This parameter sets the delay time for the cooling fan to shut off after the run command is removed when L8-10 = 0.	0 to 300	60 s	A	A	A	4B7	—
L8-12	Ambient Temperature Setting	Used to input the ambient temperature. This value adjusts the drives OL2 detection level.	-10 to 50	40 °C	A	A	A	4B8	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
L8-15	OL2 Characteristics Selection at Low Speeds	Sets the OL2 characteristics at output frequencies below 6 Hz. 0: No OL2 level reduction below 6Hz. 1: OL2 level is reduced linearly below 6 Hz. It is halved at 0 Hz.	0,1	1	A	A	A	4BB	—
L8-18	Soft CLA Selection	Selects the software current limit function. Typically no adjustment is required. 0: Disabled 1: Enabled	0,1	1	A	A	–	4BE	—
L8-19	Frequency Reduction Rate during OH Pre-Alarm	Specifies the frequency reference reduction gain at overheat prealarm when L8-03 = 4.	0.1 to 1.0	0.8	A	A	A	4BF	—
L8-29	Current Unbalance Detection (LF2)	Selects the detection of unbalanced output currents caused by faulty devices in the output circuit. 0: Disabled 1: Enabled	0 to 1	1	–	–	A	4DF	—
L8-35	Installation Method Selection	Selects the installation type: 0: Standard installation of Open Chassis drive 1: Side-by-Side installation with top cover removed 2: Standard Installation of NEMA Type 1 drive 3: Finless / Fin outside installation	0 to 3	<12> <25>	A	A	A	4ECH	—
L8-38	Carrier Frequency Reduction	Provides protection to the IGBTs by reducing the carrier frequency at low speeds. 0: Disabled 1: Enabled below 6Hz 2: Enabled for the whole speed range	0 to 2	<12>	A	A	A	4EF	—
L8-40	Carrier Frequency Reduction Time	Sets the time for that the drive continues running with reduced carrier frequency after the carrier reduction condition has gone (see also L8-38). A setting of 0.00 s disables the carrier frequency reduction time.	0.00 to 2.00	0.50	A	A	A	4F1	
L8-41	Current Alarm Selection	Configures an alarm when the output current exceeds 150% of the drive rated current. 0: Alarm disabled. 1: Alarm enabled (alarm is output).	0,1	0	A	A	A	4F2	—

<2> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 0-V/f Control.
<7> Default setting value is 120% when C6-01 is set to 1 (ND) and 150% when C6-01 is set to 0 (HD).
<9> Default setting value is dependent on parameter E1-01, Input Voltage Setting.
<10> Default setting value is dependent on parameter E5-01, Motor Code Selection.
<12> Default setting value is dependent on parameter o2-04, Drive Unit Selection.

<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<25> Parameter setting value is not reset to the default value during drive initialization, A1-03 = 1110, 2220, 3330.
<29> Setting value 2 is not available A1-02 = 5-PM OLV Control. When enabled, the drive stops accelerating when it exceeds the value of L3-02, Stall Prevention Level. The drive decelerates after 100 ms and begins accelerating again after restoring the current level.
<31> Use caution when working with regenerative loads as motor speed can exceed the frequency reference during overvoltage suppression function operation. Set to "Disable" when motor speed needs to accurately match the frequency reference, and also when using a braking resistor. An OV fault may still occur even when this function is enabled if there is a sudden increase in the regenerative load.
<50> The setting range depends on the control mode set in A1-02. For PM OLV Control the setting range is 0 to 2.
<51> Parameter value is changed if E2-11 is manually changed or changed by Auto-Tuning.
<56> The default value is 0 for all 200 V Single-Phase drives.
<57> Default setting value is dependent on parameter o2-04, Drive Unit Selection and C6-01, Drive Duty Selection.

◆ n: Advanced Performance Set-Up

The n parameters are used to adjust more advanced performance characteristics such as hunting prevention, speed feedback detection, high-slip braking and R1 online tuning.

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
n1: Hunting Prevention Use n1 parameters to configure hunting prevention operation.									
n1-01	Hunting Prevention Selection	If the motor vibrates while lightly loaded, Hunting Prevention may reduce the vibration. 0: Disabled 1: Enabled When quick response is needed disable Hunting Prevention.	0,1	1	A	–	–	580	—
n1-02	Hunting Prevention Gain Setting	Sets the gain for the Hunting Prevention Function. If the motor vibrates while lightly loaded and n1-01 = 1, increase the gain by 0.1 until vibration ceases. If the motor stalls while n1-01 = 1, decrease the gain by 0.1 until the stalling ceases.	0.00 to 2.50	1.00	A	–	–	581	—
n1-03	Hunting Prevention Time Constant	Sets the time constant used for hunting prevention.	0 to 500	<12>	A	–	–	582	—
n1-05	Hunting Prevention Gain while in Reverse	Sets the gain used for Hunting Prevention. When set to 0, the gain n1-02 is used for operation in reverse direction.	0.00 to 2.50	0.00	A	–	–	530	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
n2: Speed Feedback Detection Control Function Use n2 parameters to configure the Speed Feedback Detection Control function operation.									
n2-01	Speed Feedback Detection Control (AFR) Gain	Sets the internal speed feedback detection control gain in the automatic frequency regulator (AFR). This parameter does not typically require adjustment. Adjust this parameter as follows: If hunting occurs, increase the set value. If response is low, decrease the set value.	0.00 to 10.00	1.00	–	A	–	584	—
			Adjust the setting by 0.05 units at a time, while checking the response.						
n2-02	Speed Feedback Detection Control (AFR) Time Constant	Sets the AFR time constant 1.	0 to 2000	50 ms	–	A	–	585	—
n2-03	Speed Feedback Detection Control (AFR) Time Constant 2	Sets the AFR time constant 2. Increase the setting if overvoltage occurs during sudden load changes or the speed overshoots during fast acceleration.	0 to 2000	750 ms	–	A	–	586	—
n3: High-Slip Braking Use n3 parameters to configure the high-slip braking function.									
n3-01	High-Slip Braking Deceleration Frequency Width	Sets the output frequency reduction step width when the drive stops the motor using high-slip braking (HSB). If Overvoltage (OV) faults occur during HSB, this parameter may need to be increased.	1 to 20	5%	A	–	–	588	—
n3-02	High-Slip Braking Current Limit	Sets the current limit during HSB. Higher n3-02 settings will shorten motor stopping times but increase the motor current, and therefore motor heating.	100 to 200	150 %	A	–	–	589	—
n3-03	High-Slip Braking Dwell Time at Stop	Sets the time the drive will run with minimum frequency (E1-09) at the end of deceleration. If this time is set too low, the machine inertia can cause the motor to rotate slightly after HSB completion.	0.0 to 10.0	1.0 s	A	–	–	58A	—
n3-04	High-Slip Braking Overload Time	Sets the time required for an HSB overload fault (OL7) to occur when the drive output frequency does not change during an HSB stop. This parameter does not typically require adjustment.	30 to 1200	40 s	A	–	–	58B	—
n3-13	Overexcitation Deceleration Gain	Applies a gain to the V/f pattern during deceleration (L3-04=4). Returns to normal values after ramp to stop or at re-acceleration. To improve the braking power of overexcitation, increase the gain by 1.25 to 1.30.	1.00 to 1.40	1.10	A	A	–	531	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
n3-21	High-Slip Suppression Current Level	If overcurrent or overload occur during high-slip deceleration, reduce the high-slip suppression current level. Set as a percentage of the drive rated current.	0 to 150	100 %	A	A	–	579	—
n3-23	Overexcitation Operation Selection	0: Disabled 1: Enabled only when rotating forward 2: Enabled only when in reverse	0 to 2	0	A	A	–		—
n6: Online Tuning of Resistance between Motor Lines Use n6 parameters to adjust the motor line-to-line resistance while the drive is online.									
n6-01	Line-to-Line Motor Resistance Online Tuning	Tunes the line-to-line motor resistance continuously during operation. 0: Disabled 1: Enabled	0,1	1	–	A	–	570	—
n8: Permanent Magnet (PM) Motor Control Use n8 parameters to control the PM motor control.									
n8-45	Speed Feedback Detection Control Gain	Sets the gain for internal speed feedback detection control. This parameter does not typically require adjustment. Increase this setting if hunting occurs. Decrease to lower the response.	0.0 to 10.0	0.8	–	–	A	538	—
n8-47	Pull-In Current Compensation Time Constant	Sets the time constant to make the pull-in current and actual current value agree. Decrease the value if the motor begins to oscillate. Increase the value if it takes too long for the current reference to equal the output current.	0.0 to 100.0 s	5.0 s	–	–	A	53A	—
n8-48	Pull-In Current	Defines the amount of current provided to the motor during no load operation at a constant speed. Set as a percentage of the motor rated current. Increase this setting when hunting occurs while running at a constant speed.	20 to 200%	30%	–	–	A	53B	—
n8-49	Load Current	Sets the amount of d-axis current when using Energy Saving control.	-200.0 to 0.0%	0%	–	–	A	53C	—
n8-51	Acceleration Pull-In Current	Sets the pull-in current during acceleration as a percentage of the motor rated current (E5-03). Set to a high value when more starting torque is needed.	0 to 200%	50%	–	–	A	53E	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
n8-54	Voltage Error Compensation Time Constant	Sets the time constant for voltage error compensation. Adjust the value when • hunting occurs at low speed. • hunting occurs with sudden load changes. Increase in steps of 0.1 or disable the compensation by setting n8-45 to 0. • oscillations occur ar start. Increase the value in steps of 0.1.	0.00 to 10.00 s	1.00s	–	–	A	56D	—
n8-55	Load Inertia	Sets the ratio between motor and machine inertia. 0: less than 1:10. 1: between 1:10 to 1:30. 2: between 1:30 to 1:50. 3: higher than 1:50.	0 to 3	0	–	–	A	56E	—
n8-62 <24>	Output Voltage Limit	Sets the limit for the output voltage. Adjustment is normally needed only if the input voltage is below the n8-62 set value. In this case set n8-62 to the input voltage.	0.0 to 230.0	200 Vac	-	-	A	57D	—

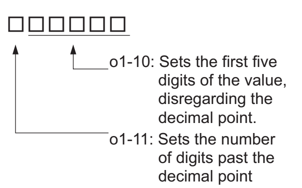
<12> Default setting value is dependent on parameter o2-04, Drive Unit Selection.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

Parameter List

B

◆ o: Operator Related Parameters

o parameters are used to set up the LED digital operator displays.

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
		o1: Display Settings Use o1 parameters to configure the digital operator display.							
o1-01 <22>	Drive Mode Unit Monitor Selection	Selects which monitor will be displayed in the operation menu upon power-up when o1-02 = 5. The monitor parameter number is entered into the spaces provided: U□-□□. For example, set “403” to display monitor parameter U4-03.	104 to 621	106	A	A	A	500	—
			Set to U1-06 as a default (Output Voltage Reference).						—
o1-02 <22>	User Monitor Selection After Power Up	Selects the monitor to display upon power-up. 1: Frequency Reference (U1-01) 2: Forward/Reverse 3: Output Frequency (U1-02) 4: Output Current (U1-03) 5: User Monitor (set by o1-01)	1 to 5	1	A	A	A	501	—
o1-03	Digital Operator Display Selection	Sets the units to display the frequency reference and output frequency. 0: Hz 1: % (100% = E1-04) 2: r/min (enter the number of motor poles into E2-04/E4-04/E5-04) 3: User defined by parameters o1-10 and o1-11	0 to 3	0	A	A	A	502	—
o1-10	Frequency Reference Setting and User-Set Display	These settings define the display values when o1-03 is set to 3. o1-10 sets display values when operating at the maximum output frequency. o1-11 sets the position of the decimal positions.	1 to 60000	<11>	A	A	A	520	—
o1-11	Frequency Reference Setting / Decimal Display	 	0 to 3	<11>	A	A	A	521	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
o2: Operator Keypad Functions Use o2 parameters to configure LED digital operator key functions.									
o2-01	LOCAL/REMOTE Key Function Selection	Enables/Disables the digital operator LOCAL/ REMOTE key. 0: Disabled 1: Enabled	0,1	1	A	A	A	505	—
o2-02	STOP Key Function Selection	Enables/Disables the operator panel STOP key when the drive is operated form external sources (not operator). 0: Disabled 1: Enabled	0,1	1	A	A	A	506	—
o2-03	User Parameter Default Value	Allows storing of parameter settings as a User Initialization Selection (value 1110 for A1-03). The value returns to 0 after entering 1 or 2. 0: No Change 1: Set Defaults - Saves current parameter settings as user initialization. 2: Clear All - Clears the currently saved user initialization.	0 to 2	0	A	A	A	507	—
o2-04	Drive Unit Selection	Sets the capacity of the drive. This parameter only needs to be set when installing a new control board. Do not change for other reason.	0 to FF	<12>	A	A	A	508	—
o2-05	Frequency Reference Setting Method Selection	Selects if the ENTER key must be pressed when inputting the frequency reference by the operator keypad. 0: Data/Enter key must be pressed to enter a frequency reference. 1: Data/Enter key is not required. The frequency reference is adjusted by the “up” and “down” arrow keys.	0,1	0	A	A	A	509	—
o2-06	Operation Selection when Digital Operator is Disconnected	Sets drive action when the digital operator is removed in Local mode or with b1-02 = 0. 0: The drive will continue operation 1: The drive will trigger a fault (OPR) and the motor will coast to stop	0,1	0	A	A	A	50A	—
o2-07	Motor Direction at Power Up when Using Operator	0: Forward 1: Reverse This parameter requires that drive operation be assigned to the digital operator.	0 to 1	0	A	A	A	527	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
o2-09	Initialization mode	Changes some parameter default settings depending on the region. 0: Japan 1: America 2: Europe 3: China	0 to 3	dep. on drive spec.	A	A	A	50D	—
o4: Maintenance Period Use o4 parameters to perform maintenance.									
o4-01	Accumulated Operation Time Setting	Sets the starting value for the cumulative operation time of the drive in units of 10h.	0 to 9999	0	A	A	A	50B	—
o4-02	Accumulated Operation Time Selection	Sets this parameter to log the cumulative operation time (U4-01). 0: Logs power-on time 1: Logs operation time when the drive output is active (output operation time).	0 to 1	0	A	A	A	50C	—
o4-03	Cooling Fan Operation Time Setting	Used to resets the Cooling Fan operation time counter U1-04.	0 to 9999	0	A	A	A	50E	—
o4-05	Capacitor Maintenance Setting	Resets the capacitor maintenance time monitor U4-05.	0 to 150	0%	A	A	A	51D	—
o4-07	Inrush Prevention Relay Maintenance Setting	Resets the Inrush Prevention Relay Maintenance monitor U4-06.	0 to 150	0%	A	A	A	523	—
o4-09	IGBT Maintenance Setting	Resets the counter that logs the IGBTs usage time. Refer to U4-07 (IGBT Maintenance).	0 to 150	0%	A	A	A	525	—
o4-11	U2, U3 Initialize Selection	Selects if U2-□□ (Fault Trace), U3-□□ (Fault History) monitors are reset at drive initialization. 0: Saves the fault monitor data 1: Resets the fault monitor data	0 to 1	0	A	A	A	510	—
o4-12	kWh Monitor Initialize Selection	Selects if U4-10 and U4-11 (kWh monitor) are reset at drive initialization. 0: Saves the U4-10 and U4-11 monitor data. 1: Resets the U4-10 and U4-11 monitor data.	0 to 1	0	A	A	A	512	—
o4-13	Number of Run Commands Initialize Selection	Selects if the Run command counter (U4-02) is reset at drive initialization. 0: Saves the number of Run commands 1: Resets the number of Run commands	0 to 1	0	A	A	A	528	—

<9> Default setting value is dependent on parameter E1-01, Input Voltage Setting.
<11> Default setting value is dependent on parameter o1-03, Digital Operator Display Selection.
<12> Default setting value is dependent on parameter o2-04, Drive Unit Selection.
<22> Parameter can be changed during run.

◆ r: FBD's Parameters

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
r1-01	FBD's Connection Parameter 1 (upper)	Parameter 1 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	1840	—
r1-02	FBD's Connection Parameter 1 (lower)	Parameter 1 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	1841	—
r1-03	FBD's Connection Parameter 2 (upper)	Parameter 2 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	1842	—
r1-04	FBD's Connection Parameter 2 (lower)	Parameter 1 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	1843	—
r1-05	FBD's Connection Parameter 3 (upper)	Parameter 1 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	1844	—
r1-06	FBD's Connection Parameter 3 (lower)	Parameter 3 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	1845	—
r1-07	FBD's Connection Parameter 4 (upper)	Parameter 4 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	1846	—
r1-08	FBD's Connection Parameter 4 (lower)	Parameter 4 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	1847	—
r1-09	FBD's Connection Parameter 5 (upper)	Parameter 5 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	1848	—
r1-10	FBD's Connection Parameter 5 (lower)	Parameter 5 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	1849	—
r1-11	FBD's Connection Parameter 6 (upper)	Parameter 6 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	184A	—
r1-12	FBD's Connection Parameter 6 (lower)	Parameter 6 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	184BH	—
r1-13	FBD's Connection Parameter 7 (upper)	Parameter 7 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	184C	—
r1-14	FBD's Connection Parameter 7 (lower)	Parameter 7 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	184D	—
r1-15	FBD's Connection Parameter 8 (upper)	Parameter 8 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	184E	—
r1-16	FBD's Connection Parameter 8 (lower)	Parameter 8 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	184F	—
r1-17	FBD's Connection Parameter 9 (upper)	Parameter 9 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	1850	—
r1-18	FBD's Connection Parameter 9 (lower)	Parameter 9 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	1851	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
r1-19	FBD’s Connection Parameter 10 (upper)	Parameter 10 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	1852	—
r1-20	FBD’s Connection Parameter 10 (lower)	Parameter 10 for connecting FBD’s (lower).	0 to FFFFH	0	–	A	A	1853	—
r1-21	FBD’s Connection Parameter 11 (upper)	Parameter 11 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	1854	—
r1-22	FBD’s Connection Parameter 11 (lower)	Parameter 11 for connecting FBD’s (lower).	0 to FFFFH	0	–	A	A	1855	—
r1-23	FBD’s Connection Parameter 12 (upper)	Parameter 12 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	1856	—
r1-24	FBD’s Connection Parameter 12 (lower)	Parameter 12 for connecting FBD’s (lower).	0 to FFFFH	0	–	A	A	1857	—
r1-25	FBD’s Connection Parameter 13 (upper)	Parameter 13 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	1858	—
r1-26	FBD’s Connection Parameter 13 (lower)	Parameter 13 for connecting FBD’s (lower).	0 to FFFFH	0	–	A	A	1859	—
r1-27	FBD’s Connection Parameter 14 (upper)	Parameter 14 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	185A	—
r1-28	FBD’s Connection Parameter 14 (lower)	Parameter 14 for connecting FBD’s (lower).	0 to FFFFH	0	–	A	A	185B	—
r1-29	FBD’s Connection Parameter 15 (upper)	Parameter 15 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	185C	—
r1-30	FBD’s Connection Parameter 15 (lower)	Parameter 15 for connecting FBD’s (lower).	0 to FFFFH	0	–	A	A	185D	—
r1-31	FBD’s Connection Parameter 16 (upper)	Parameter 16 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	185E	—
r1-32	FBD’s Connection Parameter 16 (lower)	Parameter 16 for connecting FBD’s (lower).	0 to FFFFH	0	–	A	A	185F	—
r1-33	FBD’s Connection Parameter 17 (upper)	Parameter 17 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	1860	—
r1-34	FBD’s Connection Parameter 17 (lower)	Parameter 17 for connecting FBD’s (lower).	0 to FFFFH	0	–	A	A	1861	—
r1-35	FBD’s Connection Parameter 18 (upper)	Parameter 18 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	1862	—
r1-36	FBD’s Connection Parameter 18 (lower)	Parameter 18 for connecting FBD’s (lower).	0 to FFFFH	0	–	A	A	1863	—
r1-37	FBD’s Connection Parameter 19(upper)	Parameter 19 for connecting FBD’s (upper).	0 to FFFFH	0	–	A	A	1864	—

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
r1-38	FBD's Connection Parameter 19 (lower)	Parameter 19 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	1865	—
r1-39	FBD's Connection Parameter 20 (upper)	Parameter 20 for connecting FBD's (upper).	0 to FFFFH	0	–	A	A	1866	—
r1-40	FBD's Connection Parameter 20 (lower)	Parameter 20 for connecting FBD's (lower).	0 to FFFFH	0	–	A	A	1867	—

◆ T: Motor Tuning

Enter data into the following parameters to tune the motor and drive for optimal performance

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex	Pg.
					V/f	OLV	PM		
T1-00	Motor Selection 1/2	Selects which set of motor parameters are used and set during Auto-Tuning. If Motor 2 selection (H1-□□ = 16) is not selected, this parameter will not be displayed. 1: 1st Motor - E1 to E2 2: 2nd Motor - E3 to E4 (this selection is not displayed if motor 2 has not been selected)	1, 2	1	A	A	–	700	—
T1-01	Auto-Tuning Mode Selection	Selects the Auto-Tuning mode. 0: Rotational Auto-Tuning 2: Stationary Auto-Tuning, Terminal resistance only, 3: Rotational Auto-Tuning for V/f control (necessary for Energy Savings and Speed Estimation type speed search)	0, 2, 3 <54>	2 or 3 in V/f 0 or 2 in OLV 2 for Motor 2	A	A	–	701	—
T1-02	Motor Rated Power	Sets the motor rated power in kilowatts (kW). **Note:** If motor power is given in horsepower, power in kW can be calculated using the following formula: kW = HP x 0.746.	0.00 to 650.00	0.40 kW	A	A	–	702	—
T1-03 <24>	Motor Rated Voltage	Sets the motor rated voltage in volts (V).	0.0 to 255.5	200.0 V	A	A	–	703	—
T1-04	Motor Rated Current	Sets the motor rated current in amperes (A).	10 to 200% of drive rated current	<12>	A	A	–	704	—

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex	Pg.
T1-05	Motor Base Frequency	Sets the base frequency of the motor in Hertz (Hz).	0.0 to 400.0	60.0 Hz	A	A	–	705	—
T1-06	Number of Motor Poles	Sets the number of motor poles.	2 to 48	4	A	A	–	706	—
T1-07	Motor Base Speed	Sets the base speed of the motor in revolutions per minute r/min (RPM).	0 to 24000	1750 r/min	A	A	–	707	—
T1-11	Motor Iron Loss	Provides the iron loss for determining the Energy Saving coefficient. The value set to E2-10 (motor iron loss) when the power is cycled. If T1-02 is changed, an initial value valid for the selected capacity will be shown.	0 to 65535	14W	A	–	–	70B	—
				These values differ depending on the motor code value and motor parameter settings.					

<12> Default setting value is dependent on parameter o2-04, Drive Unit Selection.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<54> The available tuning methods depend on control mode. Select values 2 or 3 in V/f control, 0 or 2 in OLV control, and 2 for Motor 2 control.

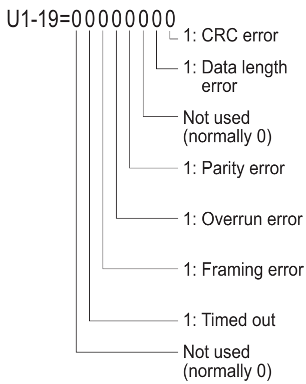
◆ U: Monitors

Monitor parameters allow the user to view drive status, fault information, and other information about drive operation.

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U1: Operation Status Monitors Use U1 monitors to display the operation status of the drive.								
U1-01	Frequency Reference	Monitors the frequency	10 V: Max frequency	0.01 Hz	A	A	A	40
U1-02	Output Frequency	Displays the output voltage. Display units are determined by o1-03.	10 V: Max frequency	0.01 Hz <27>	A	A	A	41
U1-03	Output Current	Displays the output current.	10 V: Drive rated current	0.01 A	A	A	A	42
U1-04	Control Mode	Control method set in A1-02. 0: V/f without PG 2: Open Loop Vector (OLV) 5: PM Open Loop Vector (PM)	No output signal available	–	A	A	A	43

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U1-05	Motor Speed	Displays the motor speed feedback. Display units are determined by o1-03.	10 V: Maximum speed	0.01 Hz	–	A	A	44
U1-06	Output Voltage Reference	Displays the output voltage.	10 V: 200 Vrms (400 Vrms)	0.1 V	A	A	A	45
U1-07	DC Bus Voltage	Displays the DC bus voltage.	10 V: 400 V (800 V)	1 V	A	A	A	46
U1-08	Output Power	Displays the output voltage (this value is determined internally).	10 V: Drive capacity (kW) (max. motor capacity allowed)	<27>	A	A	A	47
U1-09	Torque Reference	Monitor of internal torque reference value for Open Loop Vector (OLV) control	10 V: Motor rated torque	–	–	A	–	
U1-10	Input Terminal Status	Displays the input terminal status. U1-10=0000000 1: Digital input 1 (terminal S1) enabled 1: Digital input 2 (terminal S2) enabled 1: Digital input 3 (terminal S3) enabled 1: Digital input 4 (terminal S4) enabled 1: Digital input 5 (terminal S5) enabled 1: Digital input 6 (terminal S6) enabled	No output signal available	–	A	A	A	49

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U1-11	Output Terminal Status	Displays the output terminal status. U1-11=000 1: Multi-Function Digital Output (fault) (terminal MA/MB-MC) 1: Multi-Function Digital Output 1 (terminal P1) enabled 1: Multi-Function Digital Output 2 (terminal P2) enabled	No output signal available	–	A	A	A	4A
U1-12	Drive Status	Verifies the drive operation status. U1-12=00000000 1: During run 1: During zero-speed 1: During REV 1: During fault reset signal input 1: During speed agree 1: Drive ready 1: During alarm detection 1: During fault detection	No output signal available	–	A	A	A	4B
U1-13	Terminal A1 Input Level	Displays the analog input A1 input level. 100% when the input is 10 V	10 V: 100%	0.1%	A	A	A	4E
U1-14	Terminal A2 Input Level	Displays the analog input A2 input level. 100% when the input is 10 V / 20 mA	10 V: 100%	0.1%	A	A	A	4F
U1-16	Output Frequency after Soft Starter	Displays the output frequency including ramp times, S-curves. Units are determined by o1-03.	10 V: Max frequency	0.01 Hz	A	A	A	53

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U1-18	OPE Fault Parameter	Displays the parameter number for oPE☐☐ or Err (operator error) where the error occurred.	No output signal available	–	A	A	A	61
U1-19	MEMOBUS/Modbus Error Code	Displays the contents of a MEMOBUS/ Modbus error. 	No output signal available	–	A	A	A	66
U1-24	Input Pulse Monitor	Displays the Pulse Train input RP frequency.	32000					7D
U1-25	Software No. (Flash)	Flash ID	No signal output available					4D
U1-26	Software No. (ROM)	ROM ID	No signal output available					5B
U2: Fault Trace Use U2 monitor parameters to view fault trace data.								
U2-01	Current Fault	Display of the current fault.	No signal output avail.	–	A	A	A	80
U2-02	Previous Fault	Display of the previous fault.	No signal output avail.	–	A	A	A	81
U2-03	Frequency Reference at Previous Fault	Displays the frequency reference at the previous fault.	No signal output avail.	0.01 Hz	A	A	A	82
U2-04	Output Frequency at Previous Fault	Displays the output frequency at the previous fault.	No signal output avail.	0.01 Hz	A	A	A	83

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U2-05	Output Current at Previous Fault	Displays the output current at the previous fault.	No signal output avail.		A	A	A	84
U2-06	Motor Speed at Previous Fault	Displays the motor speed at the previous fault.	No signal output avail.	0.01 Hz	–	A	–	85
U2-07	Output Voltage at Previous Fault	Displays the output voltage at the previous fault.	No signal output avail.	0.1 V	A	A	A	86
U2-08	DC Bus Voltage at Previous Fault	Displays the DC bus voltage at the previous fault.	No signal output avail.	1 V	A	A	A	87
U2-09	Output Power at Previous Fault	Displays the output power at the previous fault.	No signal output avail.	0.1 kW	A	A	A	88
U2-10	Torque Reference at Previous Fault	Displays the torque reference at the previous fault.	No signal output avail.	0.1%	–	A	–	89
U2-11	Input Terminal Status at Previous Fault	Displays the input terminal status at the previous fault. Displayed as in U1-10.	No signal output avail.	–	A	A	A	8A
U2-12	Output Terminal Status at Previous Fault	Displays the output status at the previous fault. Displays the same status displayed in U1-11.	No signal output available	–	A	A	A	8B
U2-13	Drive Operation Status at Previous Fault	Displays the operation status of the drive at the previous fault. Displays the same status displayed in U1-12.	No signal output available	–	A	A	A	8C
U2-14	Cumulative Operation Time at Previous Fault	Displays the cumulative operation time at the previous fault.	No signal output available	1 H	A	A	A	8D
U2-15	Soft Starter Speed Reference at Previous Fault	Displays the speed reference for the soft starter at the previous fault.	No signal output available	0.01 %	A	A	A	7E0
U2-16	Motor q-Axis Current at Previous Fault	Displays the q-axis current for the motor at the previous fault.	No signal output avail.	0.10 %	–	A	A	7E1
U2-17	Motor d-Axis Current at Previous Fault	Displays the d-axis current for the motor at the previous fault.	No signal output avail.	0.10 %	–	A	A	7E2
U3: Fault History Use U3 parameters to display fault data.								
U3-01	Most Recent Fault	Displays the most recent fault.	No signal output avail.	–	A	A	A	90 (800)
U3-02	2nd Most Recent Fault	Displays the second most recent fault.	No signal output avail.	–	A	A	A	91 (801)
U3-03	3rd Most Recent Fault	Displays the third most recent fault.	No signal output avail.	–	A	A	A	92 (802)

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U3-04	4th Most Recent Fault	Displays the fourth most recent fault.	No signal output available	–	A	A	A	93 (803)
U3-05	5th Most Recent Fault	Displays the fifth most recent fault.	No signal output available	–	A	A	A	804
U3-06	6th Most Recent Fault	Displays the sixth most recent fault.	No signal output available	–	A	A	A	805
U3-07	7th Most Recent Fault	Displays the seventh most recent fault.	No signal output available	–	A	A	A	806
U3-08	8th Most Recent Fault	Displays the eighth most recent fault.	No signal output available	–	A	A	A	807
U3-09	9th Most Recent Fault	Displays the ninth most recent fault.	No signal output available	–	A	A	A	808
U3-10	10th Most Recent Fault	Displays the tenth most recent fault.	No signal output available	–	A	A	A	809
U3-11	Cumulative Operation Time at Most Recent Fault	Displays the cumulative operation time at the most recent fault.	No signal output available	1 h	A	A	A	94 (80A)
U3-12	Cumulative Operation Time at 2nd Most Recent Fault	Displays the cumulative operation time at the second most recent fault.	No signal output available	1 h	A	A	A	95 (80B)
U3-13	Cumulative Operation Time at 3rd Most Recent Fault	Displays the cumulative operation time at the third most recent fault.	No signal output available	1 h	A	A	A	96 (80C)
U3-14	Cumulative Operation Time at 4th Most Recent Fault	Displays the cumulative operation time at the fourth most recent fault.	No signal output available	1 h	A	A	A	97 (80D)
U3-15	Cumulative Operation Time at 5th Most Recent Fault	Displays the cumulative operation time at the fifth most recent fault.	No signal output available	1 h	A	A	A	80E
U3-16	Cumulative Operation Time at 6th Most Recent Fault	Displays the cumulative operation time at the sixth most recent fault.	No signal output available	1 h	A	A	A	80F

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U3-17	Cumulative Operation Time at 7th Most Recent Fault	Displays the cumulative operation time at the seventh most recent fault.	No signal output available	1 h	A	A	A	810E
U3-18	Cumulative Operation Time at 8th Most Recent Fault	Displays the cumulative operation time at the eighth most recent fault.	No signal output available	1 h	A	A	A	811E
U3-19	Cumulative Operation Time at 9th Most Recent Fault	Displays the cumulative operation time at the ninth most recent fault.	No signal output available	1 h	A	A	A	812
U3-20	Cumulative Operation Time at 10th Most Recent Fault	Displays the cumulative operation time at the tenth most recent fault.	No signal output available	1 h	A	A	A	813
U4: Maintenance Monitors Use U4 parameters to display drive maintenance information.								
U4-01	Accumulated Operation Time	Displays the cumulative operation time of the drive. The value for the cumulative operation time counter can be set in parameter o4-01. Use parameter o4-02 to determine if the operation time should start as soon as the power is switched on or only while the run command is present. The maximum number displayed is 99999, after which the value is reset to 0.	No signal output avail.	1 h	A	A	A	4C
U4-02	Number of Run Commands	Displays the number of times the run command is entered. Reset the number of run commands using parameter o4-13. This value will reset to 0 and start counting again after reaching 65535.	No signal output avail.		A	A	A	76
U4-03	Cooling Fan Operation Time	Displays the cumulative operation time of the cooling fan. The default value for the fan operation time is set to parameter o4-03. This value will reset to 0 and start counting again after reaching 65535.	No signal output avail.	1H	A	A	A	67
U4-05	Capacitor Maintenance	Displays main circuit capacitor usage time in in percent of their expected performance life. Parameter o4-06 resets this monitor.	No signal output avail.	1%	A	A	A	7C
U4-06	Soft Charge Circuit Maintenance	Displays the soft charge MC relay maintenance time as a percentage of the estimated product life. Parameter o4-07 resets this monitor.	No signal output avail.	1%	A	A	A	7D6
U4-07	IGBT Maintenance	Displays IGBT usage time as a percent of expected performance life. Parameter o4-09 resets this monitor.	No signal output avail.	1%	A	A	A	7D7

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U4-09	LED Check	Lights all segments of the LED to verify that the display is working properly.	No signal output avail.	–	A	A	A	3C
U4-10	kWH, Lower 4 Digits	Monitors the drive output power. The value is shown as a 9 digit number displayed across two monitor parameters, U4-10 and U4-11. Example: 12345678.9 kWh is displayed as: U4-10: 678.9 kWh U4-11: 12345 MWh Analog monitor: No output signal available.	No signal output avail.	kWh	A	A	A	5C
U4-11	kWH, Upper 5 Digits			MWh	A	A	A	5D
U4-13	Peak Hold Current	Displays the peak hold current during run.	10 V: Motor rated current	0.01 A	A	A	A	7CF
U4-14	Peak Hold Output Frequency	Displays the output frequency when operating at the peak hold current.	10 V: Max frequency	0.01 Hz	A	A	A	7D0
U4-16	Motor Overload Estimate (OL1)	100% = OL1 detection level	100% = OL1 detection level	0.1%	A	A	A	7D8
U4-18	Frequency Reference Source Selection	Displays the source for the frequency reference as XY-nn. X: indicates which reference is used: 1 = Reference 1 (b1-01) 2 = Reference 2 (b1-15) Y-nn: indicates the reference source 0-01 = Operator (d1-01) 1-01 = Analog (terminal A1) 1-02 = Analog (terminal A2) 2-02 to 17 = Multi-step speed (d1-02 to 17) 3-01 = MEMOBUS/Modbus comm. 4-01 = Option 5-01 = Pulse Input 6-01 = CASE 7-01 = FBD’s			A	A	A	7DA
U4-19	Frequency Reference from MEMOBUS/ Modbus Comm.	Displays the frequency reference provided by MEMOBUS/Modbus (decimal)			A	A	A	7DB
U4-20	Option Frequency Reference	Displays the frequency reference input by an option card (decimal).			A	A	A	7DD

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U4-21	Run Command Source Selection	Displays the source for the Run command as XY-nn. X: Indicates which Run source is used: 1 = Reference 1 (b1-02) 2 = Reference 2 (b1-16) Y: Input power supply data 0 = Operator 1 = External terminals 2 = Not used 3 = MEMOBUS/Modbus communications 4 = Option 5 = Not used 6 = CASE 7 = FBD’s nn: Run command limit status data 00: No limit status. 01: Run command was left on when stopped in the PRG mode. 02: Run command was left on when switching from local to remote operation. 03: Waiting for the soft charge bypass contactor after the power is switched on (UV or UV1 flashes after 10 seconds). 04: Waiting for “Run Command Prohibited” time period to end. 05: Fast-stop (digital input (H1-□□ = 15), operator) 06: b1-17 (run command given at power-up). 07: During Baseblock while coast to stop with timer 08: Frequency reference is below minimal reference during base block 09: Waiting for Enter command			A	A	A	7DD
U4-22	MEMOBUS/Modbus Communications Reference	Displays the drive control data set by MEMOBUS/Modbus communications register No. 0001H as a 4 digit hexadecimal number.			A	A	A	7DE
U4-23	Option Card Reference	Displays drive control data set by an option card as a 4 digit hexadecimal number.			A	A	A	7DF

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U5: Application Monitor Use U5 parameters to view application-specific settings.								
U5-01	PID Feedback	Displays the PID feedback value in.	10V: 100% (max. freq.)	0.01 %	A	A	A	57
U5-02	PID Input	Displays the amount of PID input (deviation between PID target and feedback).		0.01 %	A	A	A	63
U5-03	PID Output	Displays PID control output.		0.01 %	A	A	A	64
U5-04	PID Setpoint	Displays the PID setpoint.		0.01 %	A	A	A	65
U5-05	PID differential feedback	Displays the 2nd PID feedback value if differential feedback is used.		0.01 %	A	A	A	
U5-06	PID Adjusted Feedback	Displays the subtraction value of both feedback values if differential feedback is used.		0.01 %	A	A	A	
U6: Application Monitor Use U6 parameters to display drive control information.								
U6-01	Motor Secondary Current (Iq)	Displays the value of the motor secondary current (Iq).	10 V: 100%	0.1%	A	A	A	51
U6-02	Motor Excitation Current (ld)	Displays the value calculated for the motor excitation current (Id).	10 V: 100%	0.1%	–	A	A	52
U6-03	ASR Input	Displays the ASR input value if Simple PG is used in V/f control.	10V: 100% (max. freq.)	0.1%	A	–	–	
U6-04	ASR Output	Displays the ASR output value if Simple PG is used in V/f control.	10V: 100% (max. freq.)	0.1%	A	–	–	55
U6-05	Output voltage reference (Vq)	Output voltage reference (Vq). (q-axis)	10 V: 200 V (400 V)	0.1 Vac	–	A	A	59
U6-06	Output Voltage Reference (Vd)	Output voltage reference (Vd). (d-axis)	10 V: 200 V (400 V)	0.1 Vac	–	A	A	5A
U6-07	q-axis ACR Output	Displays the current control (ACR) output of for the motor secondary current (Iq).	10 V: 100%	0.1%	–	A	–	5F
U6-08	d-Axis ACR Output	Displays the current control (ACR) output of for the motor excitation current (Id).	10 V: 100%	0.1%	–	A	–	60
U6-20	Frequency Reference Bias (Up/Down 2)	Displays the bias value used to adjust the frequency reference.	10 V: max. frequency	0.1%	A	A	A	7D4
U6-21	Offset Frequency	Displays the frequency added to the main frequency reference.	10 V: max. frequency	0.1%	A	A	A	7D5

No.	Name	Description	Analog Output Level	Unit	Control Mode			Addr. Hex
					V/f	OLV	PM	
U8: Custom Monitors for FBD's U8 parameters are reserved for FBD's								
U8-01	–	Reserved for FBD's, Monitor 1.	–	0.01 %	A	A	A	1950
U8-02	–	Reserved for FBD's, Monitor 2.	–	0.01 %	A	A	A	1951
U8-03	–	Reserved for FBD's, Monitor 3.	–	0.01 %	A	A	A	1952
U8-04	–	Reserved for FBD's, Monitor 4.	–	0.01 %	A	A	A	1953
U8-05	–	Reserved for FBD's, Monitor 5.	–	0.01 %	A	A	A	1954
U8-06	–	Reserved for FBD's, Monitor 6.	–	0.01 %	A	A	A	1955
U8-07	–	Reserved for FBD's, Monitor 7.	–	0.01 %	A	A	A	1956
U8-08	–	Reserved for FBD's, Monitor 8.	–	0.01 %	A	A	A	1957
U8-09	–	Reserved for FBD's, Monitor 9.	–	0.01 %	A	A	A	1958
U8-10	–	Reserved for FBD's, Monitor 10.	–	0.01 %	A	A	A	1959

<27> Setting units for this parameter are determined by o2-04, Drive Unit Selection. Less than 11 kW: 2 decimal points, 11 kW and above: 1 decimal point.

◆ Control Mode Dependent Parameter Default Values

The tables below list parameters that depend on the control mode selection (A1-02 for motor 1, E3-01 for motor 2). These parameters are initialized to the shown values if the control mode is changed.

Table B.1 A1-02 (Motor 1 Control Mode) Dependent Parameters and Default Values

Para-meter	Description	Setting Range	Resolution	Control Modes (A1-02)		
				V/f (0)	OLV (2)	PM (5)
b3-02	Speed Search deactivation current	0 to 200	1 %	120	100	–
b8-02	Energy Saving gain	0.0 to 10.0	0.1	–	0.7	–
C2-01	S-curve time at acceleration start	0.00 to 10.00	0.01 s	0.20	0.20	1.00
C3-01	Slip compensation gain	0.0 to 2.5	0.1	0.0	1.0	–
C3-02	Slip compensation time constant	0 to 10000	1 msec	2000	200	–
C4-01	Torque comp. gain	0.00 to 2.50	0.01	1.00	1.00	0.00
C4-02	Torque comp. primary delay time	0 to 10000	1 msec	200	20	100
C6-02	Carrier frequency	1 to F	1	7 <12>	7 <12>	2
E1-04	Maximum output frequency	40.0 to 400.0	0.1 Hz	50.0	50.0	<10>
E1-05	Maximum output voltage <24>	0.0 to 255.0	0.1 V	200.0	200.0	<10>
E1-06	Base Frequency	0.0 to 400.0	0.1 Hz	50.0	50.0	<10>
E1-07	Middle output frequency	0.0 to 400.0	0.1 Hz	2.5	3.0	–
E1-08	Middle output freq. voltage <24>	0.0 to 255.0	0.1 V	16.0	14.4	–
E1-09	Minimum output frequency	0.0 to 400.0	0.1 Hz	1.3	0.5	<10>
E1-10	Minimum output voltage <24>	0.0 to 255.0	0.1 V	12.0	3.0	–
E1-11	Middle output frequency 2	0.0 to 400.0	0.1 Hz	0.0	0.0	–
E1-12	Middle output freq. voltage 2 <24>	0.0 to 255.0	0.1 V	0.0	0.0	–
E1-13	Base voltage <24>	0.0 to 255.0	0.1 V	0.0	0.0	–
L1-01	Motor protection selection	0 to 4	-	1	1	4
L3-20	Accel/Decel rate calculation rate	0.00 to 5.00	0.01	1.00	0.30	0.65
L3-21	Decel time at stall prevention during acceleration	0.00 to 200.00	0.01	1.00	1.00	2.50

<10> Default setting value is dependent on parameter E5-01, Motor Code Selection.
<12> Default setting value is dependent on parameter o2-04, Drive Unit Selection.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

Table B.2 E3-01 (Motor 2 Control Mode) Dependent Parameters and Default Values

Para-meter	Description	Setting Range	Resolution	Control Modes (E3-01)	
				V/f (0)	OLV (2)
E3-04	Maximum output frequency	40.0 to 400.0	0.1 Hz	50.0	50.0
E3-05	Maximum output voltage <24>	0.0 to 255.0	0.1 V	200.0	200.0
E3-06	Base Frequency	0.0 to 400.0	0.1Hz	50.0	50.0
E3-07	Middle output frequency	0.0 to 400.0	0.1Hz	2.5	3.0
E3-08	Middle output freq. voltage <24>	0.0 to 255.0	0.1 V	16.0	14.4
E3-09	Minimum output frequency	0.0 to 400.0	0.1 Hz	1.3	0.5
E3-10	Minimum output voltage <24>	0.0 to 255.0	0.1 V	12.0	3.0
E3-11	Middle output frequency 2	0.0 to 400.0	0.1 Hz	0.0	0.0
E3-12	Middle output freq. voltage 2 <24>	0.0 to 255.0	0.1 V	0.0	0.0
E3-13	Base voltage <24>	0.0 to 255.0	0.1 V	0.0	0.0
E3-14	Motor 2 Slip compensation gain	0.0 to 2.5	0.1	0.0	1.0

<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

◆ V/f Pattern Default Values

The tables below show the V/f pattern settings default values depending on the control mode (A1-02) and the V/f pattern selection (E1-03 in V/f control).

Table B.3 E1-03 V/f Pattern Settings for Drive Capacity: VZAB0P1 to VZAB1P5; VZA20P1 to VZA21P5; VZA40P2 to VZA41P5

No.	U	V/f Control																OLV
E1-03	–	0 <55>	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120	180	60.0	50.0
E1-05 <24>	V	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	50.0
E1-07	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0
E1-08 <24>	V	16.0	16.0	16.0	16.0	35.0	50.0	35.0	50.0	19.0	24.0	19.0	24.0	16.0	16.0	16.0	16.0	14.4
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.5	0.5
E1-10 <24>	V	12.0	12.0	12.0	12.0	8.0	9.0	8.0	9.0	12.0	13.0	12.0	15.0	12.0	12.0	12.0	12.0	3.0

<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<55> Used as default settings for E1-04 to E1-10 and E2-04 to E2-10

**Table B.4 E1-03 V/f Pattern Settings for Drive Capacity:
VZAB2P2 to VZAB4P0; VZA22P2 to VZA2015; VZA42P2 to VZA4012**

No.	U	V/f Control																OLV
E1-03	–	**0 <55>**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**	
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120	180	60.0	50.0
E1-05 <24>	V	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0	50.0
E1-07	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	3.0	3.0
E1-08 <24>	V	14.0	14.0	14.0	14.0	35.0	50.0	35.0	50.0	18.0	23.0	18.0	23.0	14.0	14.0	14.0	14.0	13.2
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.5	0.5
E1-10 <24>	V	7.0	7.0	7.0	7.0	6.0	7.0	6.0	7.0	9.0	11.0	9.0	13.0	7.0	7.0	7.0	7.0	2.4

<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<55> Used as default settings for E1-04 to E1-10 and E2-04 to E2-10

◆ Default Settings Determined by Drive Capacity (o2-04) and ND/HD Selection (C6-01)

Default settings for the following parameters will vary based on drive capacity.

**Table B.5 Single-Phase, 200 V Class Drives
Default Settings by Drive Capacity and ND/HD Settings**

No.	Description	Unit	Default Settings					
–	Model VZA☐	–	B0P1		B0P2		B0P4	
C6-01	Normal/Heavy Duty Sel.	–	HD	ND	HD	ND	HD	ND
o2-04	Drive Unit Selection	Hex	30		31		32	
E2-11 (E4-11, T1-02)	Motor rated power	kW	0.1	0.2	0.2	0.4	0.4	0.75
b3-06	Speed Search current 1	–	1	1	1	1	1	1
b8-04	Energy saving coefficient	–	481.7	356.9	356.9	288.2	288.2	223.7
C6-02	Carrier frequency	–	4	7	4	7	4	7
E2-01 (E4-01, T1-04)	Motor rated current	A	0.6	1.1	1.1	1.9	1.9	3.3
E2-02 (E4-02)	Motor rated slip	Hz	2.5	2.6	2.6	2.9	2.9	2.5
E2-03 (E4-03)	Motor no load current	A	0.4	0.8	0.8	1.2	1.2	1.8
E2-05 (E4-05)	Motor line-to-line resistance	Ω	35.98	20.56	20.56	9.842	9.842	5.156
E2-06 (E4-06)	Motor leakage inductance	%	21.6	20.1	20.1	18.2	18.2	13.8
E2-10 (E4-10)	Motor Iron Loss	W	6	11	11	14	14	26
E5-01	Motor code	hex	FFFF	FFFF	FFFF	FFFF	0002	0002
L2-02	Momentary power loss ride-through time	s	0.1	0.1	0.1	0.1	0.1	0.1
L2-03	Mom. power loss base block time	s	0.2	0.2	0.2	0.2	0.2	0.3
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	160	160	160	160	160	160
L3-24	Motor acceleration time	s	0.178	0.178	0.178	0.178	0.178	0.142
L8-02	Overheat alarm level	°C	115	115	115	115	110	110
L8-09	Ground fault selection	–	0	0	0	0	0	0
L8-38	Carrier freq. reduction sel.	–	1	1	1	1	1	1
n1-03	Hunting Prev. Time Const.	ms	10	10	10	10	10	10

No.	Description	Unit	Default Settings						
–	**Model VZA☐**	–	**B0P7**		**B1P1**		**B2P2**		**B4P0**
C6-01	**Normal/Heavy Duty**	–	**HD**		**HD**	**ND**	**HD**	**ND**	**HD**
o2-04	**Drive Unit Selection**	**Hex**	**33**		**34**		**35**		**37**
E2-11 (E4-11, T1-02)	**Motor rated power**	**kW**	**0.75**	**1.1**	**1.5**	**2.2**	**2.2**	**3.0**	**3.7**
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	223.7	169.4	169.4	156.8	156.8	136.4	122.9
C6-02	Carrier frequency	–	4	7	3	7	3	7	3
E2-01 (E4-01, T1-04)	Motor rated current	A	3.3	6.2	6.2	8.5	8.5	11.4	14.0
E2-02 (E4-02)	Motor rated slip	Hz	2.5	2.6	2.6	2.9	2.9	2.7	2.73
E2-03 (E4-03)	Motor no load current	A	1.8	2.8	2.8	3	3	3.7	4.5
E2-05 (E4-05)	Motor line-to-line resistance	Ω	5.156	1.997	1.997	1.601	1.601	1.034	0.771
E2-06 (E4-06)	Motor leakage inductance	%	13.8	18.5	18.5	18.4	18.4	19	19.6
E2-10 (E4-10)	Motor Iron Loss	W	26	53	53	77	77	91	112
E5-01	Motor Code	hex	0003	0003	0005	0005	0006	0006	0008
L2-02	Momentary power loss ride-through time	s	0.2	0.2	0.3	0.3	0.5	0.5	1.0
L2-03	Momentary power loss base block time	s	0.3	0.4	0.4	0.5	0.5	0.5	0.6
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	160	160	160	160	160	160	160
L3-24	Motor acceleration time	s	0.142	0.142	0.166	0.145	0.145	0.145	0.154
L8-02	Overheat alarm level	°C	105	105	100	100	95	95	100
L8-09	Ground fault selection	–	0	0	0	0	0	0	0
L8-38	Carrier frequency reduction selection	–	1	1	1	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10

**Table B.6 Three-Phase, 200 V Class Drives
Default Settings by Drive Capacity and ND/HD Setting**

No.	Description	Unit	Default Settings									
–	Model VZA☐	–	20P1		20P2		20P4		20P7		21P5	
C6-01	Normal/Heavy Duty Sel.	–	HD	ND	HD	ND	HD	ND	HD	ND	HD	ND
o2-04	Drive Unit Selection	Hex	60		61		62		63		65	
E2-11 (E4-11, T1-02)	Motor rated power	kW	0.1	0.2	0.2	0.4	0.4	0.75	0.75	1.1	1.5	2.2
b3-06	Speed Search current 1	–	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	481.7	356.9	356.9	288.2	288.2	223.7	223.7	196.6	169.4	156.8
C6-02	Carrier frequency	–	4	7	4	7	4	7	4	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	0.6	1.1	1.1	1.9	1.9	3.3	3.3	4.9	6.2	8.5
E2-02 (E4-02)	Motor rated slip	Hz	2.5	2.6	2.6	2.9	2.9	2.5	2.5	2.6	2.6	2.9
E2-03 (E4-03)	Motor no load current	A	0.4	0.8	0.8	1.2	1.2	1.8	1.8	2.3	2.8	3.0
E2-05 (E4-05)	Motor line-to-line resistance	W	35.98	20.56	20.56	9.842	9.842	5.156	5.156	3.577	1.997	1.601
E2-06 (E4-06)	Motor leakage inductance	%	21.6	20.1	20.1	18.2	18.2	13.8	13.8	18.5	18.5	18.4
E2-10 (E4-10)	Motor Iron Loss	W	6	11	11	14	14	26	26	38	53	77
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	0002	0002	0003	0003	0005	0005
L2-02	Momentary power loss ride-through time	s	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3
L2-03	Momentary power loss base block time	s	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	190	190	190	190	190	190	190	190	190	190
L3-24	Motor acceleration time	s	0.178	0.178	0.178	0.178	0.178	0.142	0.142	0.142	0.166	0.145
L8-02	Overheat alarm level	°C	110	110	110	110	115	115	100	100	100	100
L8-09	Ground fault selection	–	0	0	0	0	0	0	0	0	0	0
L8-35	Installation Method Sel.	–	0	0	0	0	0	0	0	0	0	0
L8-38	Carrier frequency reduction selection	–	1	1	1	1	1	1	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10	10	10	10

No.	Description	Unit	Default Settings					
–	Model VZA☐	–	22P2		24P0		25P5	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND
o2-04	Drive Unit Selection	Hex	66		68		6A	
E2-11 (E4-11, T1-02)	Motor rated power	kW	2.2	3.0	3.7	5.5	5.5	7.5
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	156.8	136.4	122.9	94.75	94.75	72.69
C6-02	Carrier frequency	–	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	8.5	11.4	14	19.6	19.6	26.6
E2-02 (E4-02)	Motor rated slip	Hz	2.9	2.7	2.73	1.5	1.5	1.3
E2-03 (E4-03)	Motor no load current	A	3.0	3.7	4.5	5.1	5.1	8.0
E2-05 (E4-05)	Motor line-to-line resistance	Ω	1.601	1.034	0.771	0.399	0.399	0.288
E2-06 (E4-06)	Motor leakage inductance	%	18.4	19	19.6	18.2	18.2	15.5
E2-10 (E4-10)	Motor Iron Loss	W	77	91	112	172	172	262
E5-01	Motor Code	hex	0006	0006	0008	0008	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	0.5	0.5	1	1	1.0	1.0
L2-03	Momentary power loss base block time	s	0.5	0.5	0.6	0.7	0.7	0.8
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	190	190	190	190	190	190
L3-24	Motor acceleration time	s	0.145	0.145	0.154	0.168	0.168	0.175
L8-02	Overheat alarm level	°C	100	100	110	110	115	115
L8-09	Ground fault selection	–	0	0	0	0	1	1
L8-35	Installation Method Sel.	–	0	0	0	0	2	2
L8-38	Carrier frequency reduction selection	–	1	1	1	1	2	2
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10

B.2 Parameter Table

No.	Description	Unit	Default Settings					
–	**Model VZA☐**	–	**27P5**		**2011**		**2015**	
C6-01	**Normal/Heavy Duty**	–	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**
o2-04	**Drive Unit Selection**	**Hex**	**6B**		**6D**		**6E**	
E2-11 (E4-11, T1-02)	**Motor rated power**	**kW**	**7.5**	**11.0**	**11.0**	**15.0**	**15.0**	**18.5**
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	72.69	70.44	70.44	63.13	63.13	57.87
C6-02	Carrier frequency	–	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	26.6	39.7	39.7	53	53	65.8
E2-02 (E4-02)	Motor rated slip	Hz	1.3	1.7	1.7	1.6	1.6	1.67
E2-03 (E4-03)	Motor no load current	A	8.0	11.2	11.2	15.2	15.2	15.7
E2-05 (E4-05)	Motor line-to-line resistance	Ω	0.288	0.230	0.230	0.138	0.138	0.101
E2-06 (E4-06)	Motor leakage inductance	%	15.5	19.5	19.5	17.2	17.2	15.7
E2-10 (E4-10)	Motor Iron Loss	W	262	245	245	272	272	505
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	1.0	1.0	2.0	2.0	2.0	2.0
L2-03	Momentary power loss base block time	s	0.8	0.9	0.9	1.0	1.0	1.0
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.6	0.6
L2-05	UV detection voltage	V dc	190	190	190	190	190	190
L3-24	Motor acceleration time	s	0.175	0.265	0.265	0.244	0.244	0.317
L8-02	Overheat alarm level	°C	121	121	120	120	120	120
L8-09	Ground fault selection	–	1	1	1	1	1	1
L8-35	Installation Method Sel.	–	2	2	2	2	2	2
L8-38	Carrier frequency reduction selection	–	2	2	2	2	2	2
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10

Table B.7 Three-Phase 400 V Class Drives Default Settings by Drive Capacity and ND/HD Setting

No.	Description	Unit	Default Settings							
–	Model VZA☐	–	40P2		40P4		40P7		41P5	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND	HD	ND
o2-04	Drive Unit Selection	Hex	91		92		93		94	
E2-11 (E4-11, T1-02)	Motor rated power	kW	0.2	0.4	0.4	0.75	0.75	1.5	1.5	2.2
b3-06	Speed Search current 1	–	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	713.8	576.4	576.4	447.4	447.4	338.8	338.8	313.6
C6-02	Carrier frequency	–	3	7	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	0.6	1	1	1.6	1.6	3.1	3.1	4.2
E2-02 (E4-02)	Motor rated slip	Hz	2.5	2.9	2.9	2.6	2.6	2.5	2.5	3
E2-03 (E4-03)	Motor no load current	A	0.4	0.6	0.6	0.8	0.8	1.4	1.4	1.5
E2-05 (E4-05)	Motor line-to-line resistance	Ω	83.94	38.198	38.198	22.459	22.459	10.1	10.1	6.495
E2-06 (E4-06)	Motor leakage inductance	%	21.9	18.2	18.2	14.3	14.3	18.3	18.3	18.7
E2-10 (E4-10)	Motor Iron Loss	W	12	14	14	26	26	53	53	77
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3
L2-03	Momentary power loss base block time	s	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	380	380	380	380	380	380	380	380
L3-24	Motor acceleration time	s	0.178	0.178	0.178	0.142	0.142	0.166	0.166	0.145
L8-02	Overheat alarm level	°C	110	110	110	110	110	110	90	90
L8-09	Ground fault selection	–	0	0	0	0	0	0	0	0
L8-35	Installation Method Sel.	–	0	0	0	0	0	0	0	0
L8-38	Carrier frequency reduction selection	–	1	1	1	1	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10	10

B.2 Parameter Table

No.	Description	Unit	Setting Range							
–	**Model VZA□**	–	**42P2**		**43P0**		**44P0**		**45P5**	
C6-01	**Normal/Heavy Duty Sel.**	–	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**
o2-04	**Drive Unit Selection**	–	**95**		**96**		**97**		**99**	
E2-11 (E4-11, T1-02)	**Motor rated power**	**kW**	**2.2**	**3.0**	**3.0**	**3.7**	**4.0**	**5.5**	**5.5**	**7.5**
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	313.6	265.7	265.7	245.8	245.8	189.5	189.5	145.38
C6-02	Carrier frequency	–	3	7	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	4.2	5.7	5.7	7	7	9.8	9.8	13.38
E2-02 (E4-02)	Motor rated slip	Hz	3	2.7	2.7	2.7	2.7	1.5	1.5	1.3
E2-03 (E4-03)	Motor no load current	A	1.5	1.9	1.9	2.3	2.3	2.6	2.6	4.0
E2-05 (E4-05)	Motor line-to-line resistance	Ω	6.495	4.360	4.360	3.333	3.333	1.595	1.595	1.152
E2-06 (E4-06)	Motor leakage inductance	%	18.7	19	19	19.3	19.3	18.2	18.2	15.5
E2-10 (E4-10)	Motor Iron Loss	W	77	105	105	130	130	193	193	263
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8
L2-03	Momentary power loss base block time	s	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	380	380	380	380	380	380	380	380
L3-24	Motor acceleration time	s	0.145	0.145	0.145	0.154	0.154	0.154	0.168	0.175
L8-02	Overheat alarm level	°C	100	100	100	100	100	100	110	110
L8-09	Ground fault selection	–	0	0	0	0	0	0	1	1
L8-35	Installation Method Sel.	–	0	0	0	0	0	0	2	2
L8-38	Carrier frequency reduction selection	–	1	1	1	1	1	1	2	2
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10	10

No.	Description	Unit	Setting Range					
–	**Model VZA☐**	–	**47P5**		**4011**		**4015**	
C6-01	**Normal/Heavy Duty Sel.**	–	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**
o2-04	**Drive Unit Selection**	–	**9A**		**9C**		**9D**	
E2-11 (E4-11, T1-02)	**Motor rated power**	**kW**	**7.5**	**11.0**	**11.0**	**15.0**	**15.0**	**18.5**
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	145.38	140.88	140.88	126.26	126.26	115.74
C6-02	Carrier frequency	–	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	13.3	19.9	19.9	26.5	26.5	32.9
E2-02 (E4-02)	Motor rated slip	Hz	1.30	1.70	1.70	1.60	1.60	1.67
E2-03 (E4-03)	Motor no load current	A	4.0	5.6	5.6	7.6	7.6	7.8
E2-05 (E4-05)	Motor line-to-line resistance	Ω	1.152	0.922	0.922	0.550	0.550	0.403
E2-06 (E4-06)	Motor leakage inductance	%	15.5	19.6	19.6	17.2	17.2	20.1
E2-10 (E4-10)	Motor Iron Loss	W	263	385	385	440	440	508
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	1	1	2	2	2	2
L2-03	Momentary power loss base block time	s	0.8	0.9	0.9	1.0	1.0	1.0
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.6	0.6	0.6
L2-05	UV detection voltage	V dc	380	380	380	380	380	380
L3-24	Motor acceleration time	s	0.175	0.265	0.265	0.244	0.244	0.317
L8-02	Overheat alarm level	°C	110	110	110	110	110	110
L8-09	Ground fault selection	–	1	1	1	1	1	1
L8-35	Installation Method Sel.	–	2	2	2	2	2	2
L8-38	Carrier frequency reduction selection	–	2	2	2	2	2	2
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10

◆ Parameters that Change with the Motor Code Selection

The following tables show parameters and default settings that change with the motor code selection E5-01 when Open Loop Vector for PM motors is used.

■ Yaskawa Pico Motor (SPM motor)

Table B.8 1800 rpm Type Yaskawa Pico Motor Settings

Par.	Description	Unit	Default Settings				
E5-01	Motor Code	–	0002	0003	0005	0006	0008
	Voltage class Rated power	–	200 Vac 0.4 kW	200 Vac 0.75 kW	200 Vac 1.5 kW	200 Vac 2.2 kW	200 Vac 3.7 kW
	Rated speed	min-1	1800	1800	1800	1800	1800
E5-02	Motor rated power	kW	0.4	0.75	1.5	2.2	3.7
E5-03	Motor rated current	A	2.1	4.0	6.9	10.8	17.4
E5-04	Motor pole number	–	8	8	8	8	8
E5-05	Motor winding resistance	W	2.47	1.02	0.679	0.291	0.169
E5-06	d-axis inductance	mH	12.7	4.8	3.9	3.6	2.5
E5-07	q-axis inductance	mH	12.7	4.8	3.9	3.6	2.5
E5-09	Induction voltage constant 1	mVsec/rad	0	0	0	0	0
E5-24	Induction voltage constant 2	mV/min-1	62.0	64.1	73.4	69.6	72.2
E1-04	Maximum output frequency	Hz	120	120	120	120	120
E1-05	Maximum output voltage	V	200.0	200.0	200.0	200.0	200.0
E1-06	Base voltage	Hz	120	120	120	120	120
E1-09	Minimum output frequency	Hz	6	6	6	6	6
L3-24	Motor acceleration time	s	0.064	0.066	0.049	0.051	0.044
n8-49	Pull-in current	%	0	0	0	0	0

Table B.9 3600 rpm Type Yaskawa Pico Motor Settings

Par.	Description	Unit	Default Settings			
E5-01	Motor Code	–	0103	0105	0106	0108
	Voltage class Rated power	–	200 Vac 0.75 kW	200 Vac 1.5 kW	200 Vac 2.2 kW	200 Vac 3.7 kW
	Rated speed	min-1	3600	3600	3600	3600
E5-02	Motor rated power	kW	0.75	1.5	2.2	3.7
E5-03	Motor rated current	A	4.1	8.0	10.5	16.5
E5-04	Motor pole number	–	8	8	8	8
E5-05	Motor winding resistance	W	0.538	0.20	0.15	0.097
E5-06	d-axis inductance	mH	3.2	1.3	1.1	1.1
E5-07	q-axis inductance	mH	3.2	1.3	1.1	1.1
E5-09	Induction voltage constant 1	mVsec/rad	0	0	0	0
E5-24	Induction voltage constant 2	mV/min-1	32.4	32.7	36.7	39.7
E1-04	Maximum output frequency	Hz	240	240	240	240
E1-05	Maximum output voltage	V	200.0	200.0	200.0	200.0
E1-06	Base voltage	Hz	240	240	240	240
E1-09	Minimum output frequency	Hz	12	12	12	12
L3-24	Motor acceleration time	s	0.064	0.066	0.049	0.051
n8-49	Pull-in current	%	0	0	0	0

■ SS5 Motor: Yaskawa SSR1 Series IPM Motor

Table B.10 200 V, 1750 rpm Type Yaskawa SSR1 Series Motor

Par.	Description	Unit	Default Settings				
E5-01	Motor Code	–	1202	1203	1205	1206	1208
	Voltage class Rated power	–	200 Vac 0.4 kW	200 Vac 0.75 kW	200 Vac 1.5 kW	200 Vac 2.2 kW	200 Vac 3.7 kW
	Rated speed	min-1	1750	1750	1750	1750	1750
E5-02	Motor rated power	kW	0.4	0.75	1.5	2.2	3.7
E5-03	Motor rated current	A	1.65	2.97	5.50	8.10	13.40
E5-04	Motor pole number	–	6	6	6	6	6
E5-05	Motor winding resistance	W	8.233	2.284	1.501	0.827	0.455
E5-06	d-axis inductance	mH	54.84	23.02	17.08	8.61	7.20
E5-07	q-axis inductance	mH	64.10	29.89	21.39	13.50	10.02
E5-09	Induction voltage constant 1	mVsec/rad	233.0	229.5	250.9	247.9	248.6
E5-24	Induction voltage constant 2	mV/min-1	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum output frequency	Hz	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum output voltage	V	190.0	190.0	190.0	190.0	190.0
E1-06	Base voltage	Hz	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum output frequency	Hz	4.4	4.4	4.4	4.4	4.4
L3-24	Motor acceleration time	s	0.092	0.076	0.051	0.066	0.075
n8-49	Pull-in current	%	–7.2	–10.8	–11.1	–17.8	–17.5

Par.	Description	Unit	Default Settings			
E5-01	Motor Code	–	120A	120B	120D	120E
	Voltage class Rated power	–	200 Vac 5.5 kW	200 Vac 7.5 kW	200 Vac 11 kW	200 Vac 15 kW
	Rated speed	min-1	1750	1750	1750	1750
E5-02	Motor rated power	kW	5.5	7.5	11.0	15
E5-03	Motor rated current	A	19.80	27.00	39.7	53.2
E5-04	Motor pole number	–	6	6	6	6
E5-05	Motor winding resistance	W	0.246	0.198	0.094	0.066
E5-06	d-axis inductance	mH	4.86	4.15	3.40	2.65
E5-07	q-axis inductance	mH	7.43	5.91	3.91	3.11
E5-09	Induction voltage constant 1	mVsec/rad	249.6	269.0	249.3	266.6
E5-24	Induction voltage constant 2	mV/min-1	0.0	0.0	0.0	0.0
E1-04	Maximum output frequency	Hz	87.5	87.5	87.5	87.5
E1-05	Maximum output voltage	V	190.0	190.0	190.0	190.0
E1-06	Base voltage	Hz	87.5	87.5	87.5	87.5
E1-09	Minimum output frequency	Hz	4.4	4.4	4.4	4.4
L3-24	Motor acceleration time	s	0.083	0.077	0.084	0.102
n8-49	Pull-in current	%	–22.0	–17.3	–10.1	–10.3

Table B.11 400 V, 1750 rpm Type Yaskawa SSR1 Series Motor

Par.	Description	Unit	Default Settings				
E5-01	Motor Code	–	1232	1233	1235	1236	1238
	Voltage class Rated power	–	400 Vac 0.4 kW	400 Vac 0.75 kW	400 Vac 1.5 kW	400 Vac 2.2 kW	400 Vac 3.7 kW
	Rated speed	min-1	1750	1750	1750	1750	1750
E5-02	Motor rated power	kW	0.4	0.75	1.5	2.2	3.7
E5-03	Motor rated current	A	0.83	1.49	2.75	4.05	6.80
E5-04	Motor pole number	–	6	6	6	6	6
E5-05	Motor winding resistance	W	32.932	9.136	6.004	3.297	1.798
E5-06	d-axis inductance	mH	219.36	92.08	68.32	40.39	32.93
E5-07	q-axis inductance	mH	256.40	119.56	85.56	48.82	37.70
E5-09	Induction voltage constant 1	mVsec/rad	466.0	459.0	501.8	485.7	498.7
E5-24	Induction voltage constant 2	mV/min-1	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum output frequency	Hz	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum output voltage	V	380.0	380.0	380.0	380.0	380.0
E1-06	Base voltage	Hz	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum output frequency	Hz	4.4	4.4	4.4	4.4	4.4
L3-24	Motor acceleration time	s	0.092	0.076	0.051	0.066	0.075
n8-49	Pull-in current	%	–7.2	–10.7	–11.1	–8.9	–7.9

Par.	Description	Unit	Default Settings			
E5-01	Motor Code	–	123A	123B	123D	123E
	Voltage class Rated power	–	400 Vac 5.5 kW	400 Vac 7.5 kW	400 Vac 11 kW	400 Vac 15 kW
	Rated speed	min-1	1750	1750	1750	1750
E5-02	Motor rated power	kW	5.5	7.5	11.0	15
E5-03	Motor rated current	A	9.90	13.10	19.9	26.4
E5-04	Motor pole number	–	6	6	6	6
E5-05	Motor winding resistance	W	0.982	0.786	0.368	0.263
E5-06	d-axis inductance	mH	22.7	16.49	13.38	10.51
E5-07	q-axis inductance	mH	26.80	23.46	16.99	12.77
E5-09	Induction voltage constant 1	mVsec/rad	498.0	541.7	508.7	531.9
E5-24	Induction voltage constant 2	mV/min-1	0.0	0.0	0.0	0.0
E1-04	Maximum output frequency	Hz	87.5	87.5	87.5	87.5
E1-05	Maximum output voltage	V	380.0	380.0	380.0	380.0
E1-06	Base voltage	Hz	87.5	87.5	87.5	87.5
E1-09	Minimum output frequency	Hz	4.4	4.4	4.4	4.4
L3-24	Motor acceleration time	s	0.083	0.077	0.084	0.102
n8-49	Pull-in current	%	–10.2	–17.4	–15.8	–12.6

B.2 Parameter Table

Appendix: C

Network Communications

This appendix details the specifications, connections, and programming of the drive for MEMOBUS/Modbus communication.

C.1 MEMOBUS/Modbus Basic Set-Up

Serial communication can be performed with Program Logic Controllers (PLCs) or similar master devices using the MEMOBUS/Modbus protocol.

◆ MEMOBUS/Modbus Communication Configuration

MEMOBUS/Modbus communication is configured using 1 master (PLC) and a maximum of 31 slaves. Serial communication between master and slave is normally initiated by the master and responded to by the slaves.

The master performs serial communication with one slave at a time. Consequently, the slave address of each slave must be initially set, so that the master can perform serial communication using that address. Slaves receiving commands from the master perform the specified functions, and send a response back to the master.

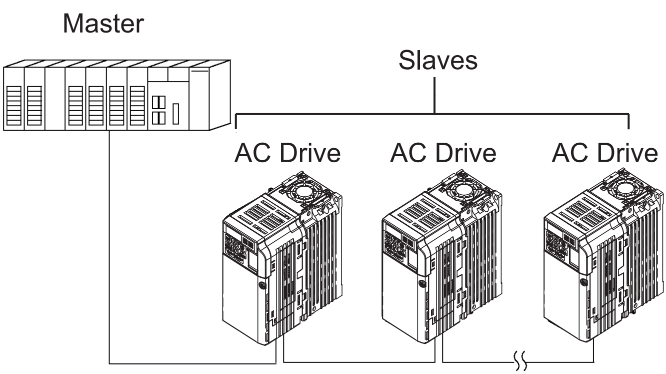


Figure C.1 Example of Connections between Master and Drive

◆ Communication Specifications

The MEMOBUS/Modbus communication specifications are explained in *Table C.1*.

Table C.1 MEMOBUS/Modbus Communication Specifications

Item	Specifications	
Interface	RS-422, RS-485	
Communications Cycle	Asynchronous (Start-stop synchronization)	
Communications Parameters	Baud rate:	Select from 1200 to 115200 bps.
	Data length:	8 bits fixed
	Parity:	Select from even, odd, or none.
	Stop bits:	1 bit selected
Communications Protocol	MEMOBUS/Modbus RTU	
Number of Connectable Units	31 units maximum	

◆ Communication Connection Terminal

MEMOBUS/Modbus communication uses the following terminals: S+, S-, R+, and R-. The terminating resistor must be turned ON only if the Drive is at the very end of the serial communication chain. Set the terminating resistor by turning ON pin 1 of switch S2.

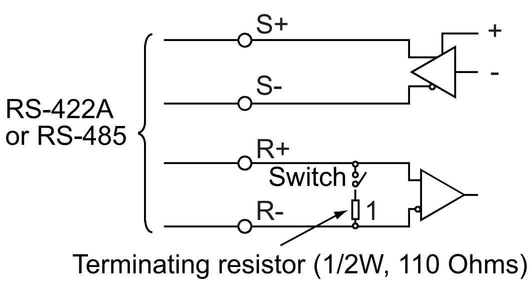


Figure C.2 MEMOBUS/Modbus Switch

Table C.2 MEMOBUS/Modbus Switch Settings

S2 Position	Description
ON	Internal terminal resistance ON
OFF	Internal terminal resistance OFF (no terminal resistance); default setting

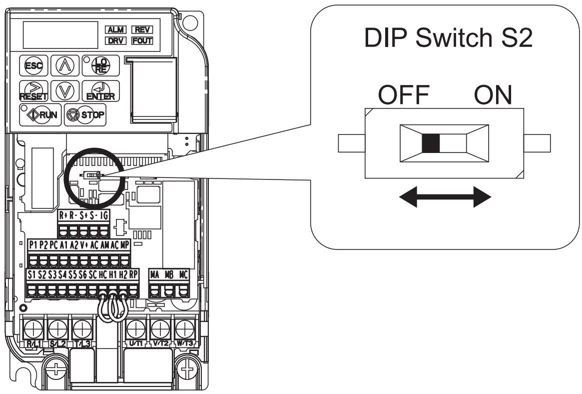


Figure C.3 MEMOBUS/Modbus Terminal Resistor Switch

Note:
1. Separate the communication cables from the main circuit cables and control circuit wiring.
2. Use shielded cables for the communication cable, and use proper shield clamps. Shield at one end only.
3. When using RS-485 communication, connect S+ to R+, and S- to R-, on the control circuit terminal board. Refer to *Figure C.4*.

■ Serial Communication Terminals

Table C.3 Control Circuit Terminals: Serial Communications

Type	No.	Signal Name	Function (Signal Level) Default Setting	
MEMOBUS/Modbus Communication	R+	Communications input (+)	MEMOBUS/Modbus communication: Use a RS-485 or RS-422 cable to connect the drive.	RS-485/422 MEMOBUS/Modbus communication protocol 115.2 kBps (max.)
	R–	Communications input (–)		
	S+	Communications output (+)		
	S-	Communications output (–)		
	IG	Shield ground	0 V	

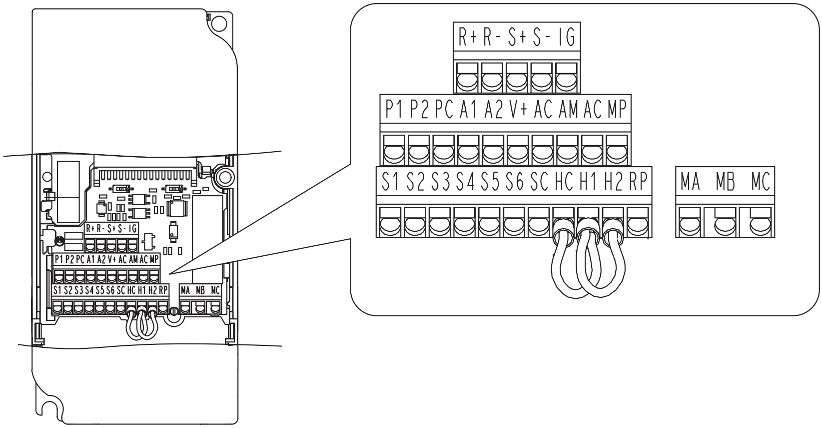


Figure C.4 Control Circuit Terminal Block Configuration

◆ Communication Set-Up Procedure

Use the following procedure to communicate with the PLC.

1. Turn OFF the input to the drive power and connect the communication cable between the PLC (or other master device) and the drive.
2. Turn ON the input power to the drive.
3. Set the required communication parameters (H5-01 to H5-07) using the Digital Operator.
4. Turn OFF the input to the drive power, and check that the Digital Operator display has completely extinguished.
5. Turn ON the input power to the drive once again.
6. Perform communication with the master device.

Table C.4 Serial Communication Related Parameters

Parameter No.	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting
b1-01	Frequency Reference Selection Reference Source	Selects the frequency reference input source. 0: Operator - Digital preset speed U1-01 or d1-01 to d1-17. 1: Terminals - Analog input terminal A1 (or terminal A2 based on parameter H3-09). 2: Serial Com - MEMOBUS/Modbus RS-422/485 terminals R+, R-, S+ and S-. 3: Option PCB 4: Pulse Input (Terminal RP)	0 to 4	1
b1-02	Run Command Selection Run Source	Selects the run command input source. 0: Operator - RUN and STOP keys on the digital operator. 1: Terminals - Contact closure on terminals S1 or S2. 2: Serial Com - MEMOBUS/Modbus RS-422/485 terminals R+, R-, S+ and S-. 3: Option PCB.	0 to 3	1
H5-01	Drive Node Address Serial Comm Adr	Selects drive station node number (address) for MEMOBUS/ Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.	0 to 20 Hex	1F
H5-02	Communication Speed Selection Serial Baud Rate	Selects the baud rate for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps	0 to 8	3
H5-03	Communication Parity Selection Serial Com Sel	Selects the communication parity for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0
H5-04	Stopping Method After Communication Error Serial Fault Sel	Selects the stopping method when a communication time-out fault (CE) is detected. 0: Ramp to stop 1: Coast to stop 2: Fast-stop 3: Alarm only	0 to 3	3

Parameter No.	Parameter Name Digital Operator Display	Description	Setting Range	Factory Setting
H5-05	Communication Fault Detection Selection Serial Flt Dtct	Enables or disables the communications time-out fault (CE). 0: Disabled - A communication loss will not cause a communication fault. 1: Enabled - If communication is lost for more than two seconds, a CE fault will occur.	0 or 1	1
H5-06	Drive Transmit Wait Time Transmit WaitTIM	Set the delay time from when the drive receives data to when the drive sends data.	5 to 65	5ms
H5-07	RTS Control Selection RTS Control Sel	Enables or disables "request to send" (RTS) control: 0: Disabled - RTS is always on. 1: Enabled - RTS turns on only when sending.	0 to 1	1

MEMOBUS/Modbus communication can perform the following operations regardless of the settings in b1-01 and b1-02:

- Monitor the operation status of the drive
- Set and read drive parameters
- Reset faults
- Input multi-function digital input commands
- Control multi-function digital and analog outputs.

Note: An OR operation is performed between the multi-function command input from the master device and the command input from multi-function digital input terminals S3 to S6.

Appendix: D

Standards Compliance

This chapter explains the guidelines and criteria for maintaining CE and UL standards.

D.1 Section Safety

DANGER

Electrical Shock Hazard

Do not connect or disconnect wiring while the power is on.

Failure to comply will result in death or serious injury.

WARNING

Electrical Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show drives without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the drives and run the drives according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least five minutes after all indicators are off and measure the DC bus voltage level to confirm safe level.

WARNING

Do not allow unqualified personnel to perform work on the drive.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection, and servicing must be performed only by authorized personnel familiar with installation, adjustment and maintenance of AC drives.

Do not perform work on the drive while wearing loose clothing, jewelry or without eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the drive.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

WARNING

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the drive matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire.

Attach the drive to metal or other noncombustible material.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards.

Failure to comply may result in ESD damage to the drive circuitry.

Never connect or disconnect the motor from the drive while the drive is outputting voltage.

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded twisted-pair wires and ground the shield to the ground terminal of the drive.

Do not allow unqualified personnel to use the product.

Failure to comply could result in damage to the drive or braking circuit.

Carefully review instruction manual TOBPC72060000 when connecting a braking option to the drive.

Do not modify the drive circuitry.

Failure to comply could result in damage to the drive and will void warranty.

OYMC is not responsible for modification of the product made by the user. This product must not be modified.

Check all the wiring to ensure that all connections are correct after installing the drive and connecting other devices.

Failure to comply could result in damage to the drive.

D.2 European Standards

Figure D.1 CE Mark

The CE mark indicates compliance with European safety and environmental regulations and is required for engaging in business and commerce in Europe.

European standards include the Machinery Directive for machine manufacturers, the Low Voltage Directive for electronics manufacturers and the EMC guidelines for controlling noise.

This drive displays the CE mark based on the EMC guidelines and the Low Voltage Directive.

- **EMC Guidelines:** Devices used in combination with this drive must also be CE certified and display the CE mark. When using drives displaying the CE mark in combination with other devices, it is ultimately the responsibility of the user to ensure compliance with CE standards. After setting up the device, verify that conditions meet European standards.
- **Low Voltage Directive:** 73/23/EEC, 93/68/EEC

◆ CE Low Voltage Directive Compliance

This drive has been tested according to European standard EN50178, and it fully complies with the Low Voltage Directive.

To comply with the Low Voltage Directive, be sure to meet the following conditions when combining this drive with other devices:

■ Area of Use

Do not use drives in areas with pollution higher than severity 2 and overvoltage category 3 in accordance with IEC664.

■ Installing Fuses on the Input Side

Install recommended UL-approved fuses at the main power input of the drive. Select fuses according to *Table D.1*.

Table D.1 Recommended Input Fuse Selection

Drive Model VZA☐	Time Delay/ Class RK5 Fuses 600 Vac, 200 kAIR	Fuse Ampere Rating	Non-Time Delay/ Class T Fuses 600 Vac, 200 kAIR
200 V Class Single-Phase Drives			
B0P1	TRS5R	5	Contact your OYMC sales representative
B0P2	TRS10R	10	
B0P4	TRS20R	20	
B0P7	TRS35R	35	
B1P5	TRS50R	50	
B2P2	TRS60R	60	
B4P0	Contact your OYMC sales representative		
200 V Class Three-Phase Drives			
20P1	TRS5R	5	Contact your OYMC sales representative
20P2	TRS5R	5	
20P4	TRS10R	10	
20P7	TRS15R	15	
21P5	TRS25R	25	
22P2	TRS35R	35	
24P0	TRS60R	60	
25P5	Not Available	70	A6T70
27P5		100	A6T100
2011		150	A6T150
2015		200	A6T200
400 V Class Three-Phase Drives			
40P2	TRS2.5R	2.5	Contact your OYMC sales representative
40P4	TRS5R	5	
40P7	TRS10R	10	
41P5	TRS20R	20	
42P2	TRS20R	20	
43P0	TRS20R	20	
44P0	TRS30R	30	

Drive Model VZA□	Time Delay/ Class RK5 Fuses 600 Vac, 200 kAIR	Fuse Ampere Rating	Non-Time Delay/ Class T Fuses 600 Vac, 200 kAIR
45P5	Not Available	50	A6T50
47P5		60	A6T60
4011		70	A6T70
4015		80	A6T80

■ Guarding Against Harmful Materials

When installing IP20/Open-Chassis drives, use an enclosure that prevents foreign material from entering the drive from above or below.

■ Grounding

The drive is designed to be used in T-N (grounded neutral point) networks. If installing the drive in other types of grounded systems, contact your dealer for instructions.

◆ EMC Guidelines Compliance

This drive is tested according to European standards EN61800-3 and it complies with the EMC guidelines.

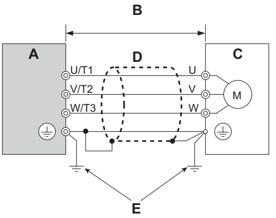
■ EMC Filter Installation

The following conditions must be met to ensure continued compliance with guidelines. Refer to *EMC Filters on page 407* for EMC filter selection.

Installation Method

Verify the following installation conditions to ensure that other devices and machinery used in combination with this drive also comply with EMC guidelines.

1. Install an EMC noise filter to the input side specified by OYMC for compliance with European standards.
2. Place the drive and EMC noise filter in the same enclosure.
3. Use braided shield cable for the drive and motor wiring or run the wiring through a metal conduit.
4. Keep wiring as short as possible. Ground the shield on both the drive side and the motor side.



A – Drive

B – 20 m max cable length between drive and motor

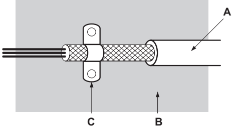
C – Motor

D – Metal conduit

E – Ground wire should be as short as possible.

Figure D.2 Installation Method

5. Ground the largest possible surface area of the shield to the metal conduit when using braided shield cable. OYMC recommends using a cable clamp.



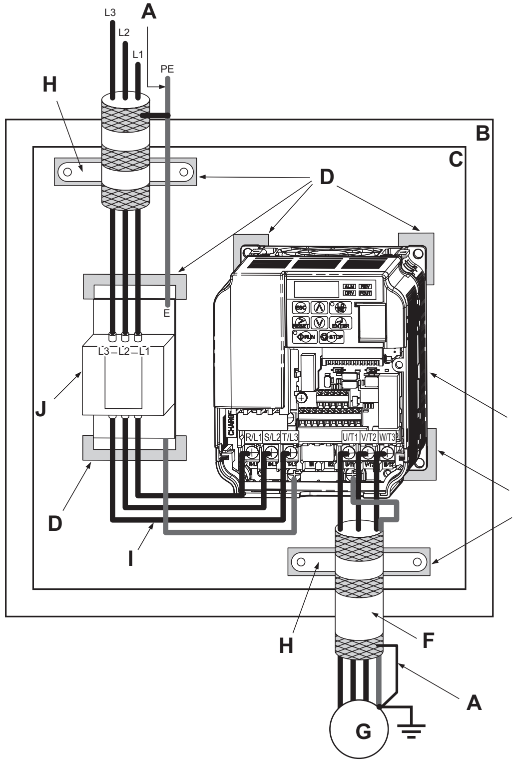
A – Braided shield cable

B – Metal panel

C – Cable clamp (conductive)

Figure D.3 Ground Area

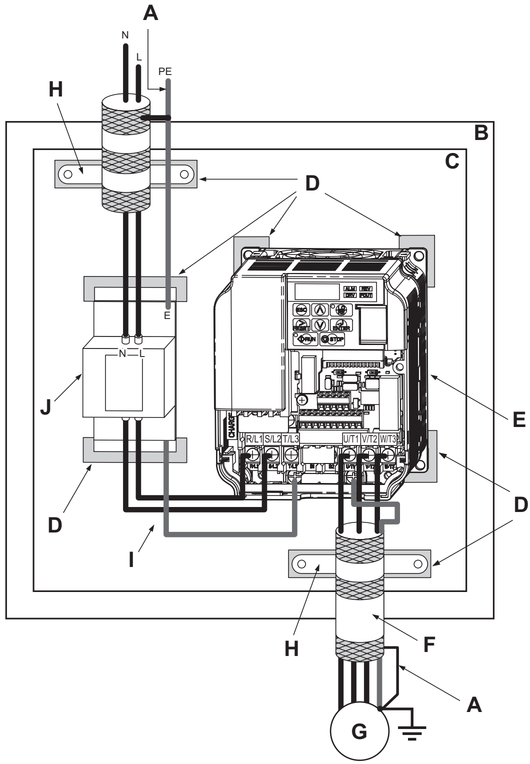
Three-Phase 200 V / 400 V Class



A – Ground the cable shield	F – Motor cable (braided shield cable, max. 20 m)
B – Enclosure panel	G – Motor
C – Metal plate	H – Cable clamp
D – Grounding surface (remove any paint or sealant)	I – Max. distance between drive and noise filter
E – Drive	J – EMC noise filter

Figure D.4 EMC Filter and Drive Installation for CE Compliance (Three-Phase 200 V / 400 V Class)

Single-Phase 200 V Class



A – Ground the cable shield	**F – Motor cable (braided shield cable, max. 20 m)**
B – Enclosure panel	**G – Motor**
C – Metal plate	**H – Cable clamp**
D – Grounding surface (remove any paint or sealant)	**I – Max. distance between drive and noise filter**
E – Drive	**J – EMC noise filter**

Figure D.5 EMC Filter and Drive Installation for CE Compliance (Single-Phase 200 V Class)

■ EMC Filters

The drive should be installed with the EMC filters listed below in order to comply with the EN 61800-3, category C1 requirements.

Table D.2 EN 61800-3 Category C1 Filters

Drive VZA□	Filter Data (Manufacturer: Schaffner)						
	Type Rasmi (RE)/ Schaffner(SE)	Rated Current [A] RE/SE	Weight [kg] RE/SE	Dimensions [W × L × H]	Y × X	Drive Mounting Screw A	Filter Mounting Screw
200 V Single-Phase Units							
B0P1	A1000-FIV1010-RE/ A1000-FIV1010-SE	10/10	0.6/0.4	71 × 169 × 45	51 × 156	M4	M5
B0P2							
B0P4							
B0P7	A1000-FIV1020-RE/ A1000-FIV1020-SE	20/20	1.0/0.7	111 × 169 × 50	91 × 156	M4	M5
B1P5							
B2P2	A1000-FIV1030-RE A1000-FIV1030-SE	30/30	1.2/1.0	144 × 174 × 50	120 × 161	M4	M5
B4P0	Contact your OYMC sales representative						
200 V Three-Phase Units							
20P1	A1000-FIV2010-RE A1000-FIV2010-SE	10/10	0.8/0.7	82 × 194 × 50	62 × 181	M4	M5
20P2							
20P4							
20P7							
21P5	A1000-FIV2020-RE A1000-FIV2020-SE	16/20	1.0/0.8	111 × 169 × 50	91 × 156	M4	M5
22P2							
24P0	A1000-FIV2030-RE A1000-FIV2030-SE	Under development					
25P5	A1000-FIV2060-RE A1000-FIV2050-SE						
27P5							
2011	A1000-FIV2100-RE						
2015							
400 V Class Three-Phase Drives							
40P2	A1000-FIV3005-RE A1000-FIV3005-SE	5/5	1.0/0.5	111 × 169 × 45	91 × 156	M4	M5
40P4							

Drive VZA□	Filter Data (Manufacturer: Schaffner)						
	Type Rasmi (RE)/ Schaffner(SE)	Rated Current [A] RE/SE	Weight [kg] RE/SE	Dimensions [W × L × H]	Y × X	Drive Mounting Screw A	Filter Mounting Screw
40P7	A1000-FIV3010-RE A1000-FIV3010-SE	10/10	1.0/ 0.75	111 × 169 × 45	91 × 156	M4	M5
41P5							
42P2							
43P0							
44P0	A1000-FIV3020-RE A1000-FIV3020-SE	15/20	1.1/1.0	144 × 174 × 50	120 × 161	M4	M5
45P5	A1000-FIV3030-RE A1000-FIV3030-SE	Under development					
47P5							
4011	A1000-FIV3050-RE						
4015							

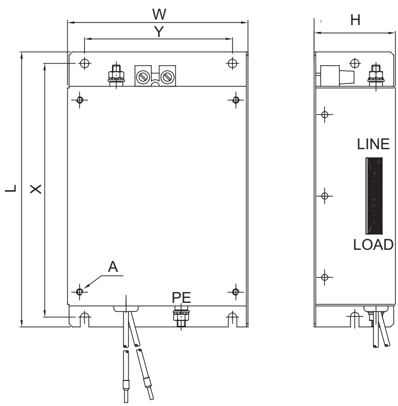


Figure D.6 EMC Filter Dimensions

■ DC Reactors for EN 61000-3-2 compliance

Table D.3 DC Reactors for Harmonics Reduction

Inverter Type VZA☐	DC Reactor	
	Rated Current	Inductance
200 V Single Phase Units		
B0P1	3.5 A	3.0 mH
B0P2		
B0P4	6.7 A	25 mH
400 V Three Phase Units		
40P2	3.5 A	3.0 mH
40P4	2.7 A	12.5 mH

Note: Contact your OYMC sales representative for information about DC reactors for other models.

D.3 UL Standards

The UL/cUL mark applies to products in the United States and Canada indicates that UL has performed product testing and evaluation and determined that their stringent standards for product safety have been met. For a product to receive UL certification, all components inside that product must also receive UL certification.

Figure D.7 UL/cUL Mark

◆ UL Standards Compliance

This drive is tested in accordance with UL standard UL508C and complies with UL requirements. The following conditions must be met to maintain compliance when using this drive in combination with other equipment:

■ Installation Area

Do not install the drive to an area greater than pollution severity 2 (UL standard).

■ Main Circuit Terminal Wiring

OYMC recommends using UL-listed copper wires (rated at 75°C) and closed-loop connectors or CSA-certified ring connectors sized for the selected wire gauge to maintain proper clearances when wiring the drive. Use the correct crimp tool to install connectors per manufacturer recommendation. *Table D.4* lists a suitable closed-loop connector manufactured by JST Corporation.

Table D.4 Closed-Loop Crimp Terminal Size (JIS C 2805) (same for 200 V and 400 V)

Wire Gauge mm^2 (AWG)	Terminal Screws	Crimp Terminal Model Numbers	Tightening Torque N m (lb. to in.)
0.75 (18)	M3.5	R1.25-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R1.25-4	1.2 to 1.5 (10.6 to 13.3)
1.25 (16)	M3.5	R1.25-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R1.25-4	1.2 to 1.5 (10.6 to 13.3)

Wire Gauge mm² (AWG)	Terminal Screws	Crimp Terminal Model Numbers	Tightening Torque N m (lb. to in.)
2 (14)	M3.5	R2-3.5	0.8 to 1.0 (7.1 to 8.9)
	M4	R2-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R2-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R2-6	4.0 to 5.0 (35.4 to 44.3)
3.5/5.5 (12/10)	M4	R5.5-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R5.5-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R5.5-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R5.5-8	9.0 to 11.0 (79.7 to 97.4)
8 (8)	M4	R8-4	1.2 to 1.5 (10.6 to 13.3)
	M5	R8-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R8-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R8-8	9.0 to 11.0 (79.7 to 97.4)
14 (6)	M4	R8-4 <1>	1.2 to 1.5 (10.6 to 13.3)
	M5	R14-5	2.0 to 2.5 (17.7 to 22.1)
	M6	R14-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R14-8	9.0 to 11.0 (79.7 to 97.4)
22 (4)	M6	R22-6	4.0 to 5.0 (35.4 to 44.3)
	M8	R22-8	9.0 to 11.0 (79.7 to 97.4)
30/38 (3/2)	M8	R38-8	9.0 to 11.0 (79.7 to 97.4)

<1> Use the specified crimp terminals (Model 14-NK4) when using VZA25P5, VZA27P5, VZA47P5 with 14 mm² (6 AWG).

Note: Use crimp insulated terminals or insulated shrink tubing for wiring connections. Wires should have a continuous maximum allowable temperature of 75°C 600 Vac UL-approved vinyl-sheathed insulation.

Table D.5 Recommended Input Fuse Selection

Drive Model VZA□	Time Delay/ Class RK5 Fuses 600 Vac, 200 kAIR	Fuse Ampere Rating
200 V Single-Phase Units		
B0P1	TRS5R	5
B0P2	TRS10R	10
B0P4	TRS20R	20
B0P7	TRS35R	35
B1P5	TRS50R	50
B2P2	TRS60R	60

Standards Compliance

D

Drive Model VZA☐	Time Delay/ Class RK5 Fuses 600 Vac, 200 kAIR	Fuse Ampere Rating
B4P0	Contact your OYMC sales representative	
200 V Three-Phase Units		
20P1	TRS5R	5
20P2	TRS5R	5
20P4	TRS10R	10
20P7	TRS15R	15
21P5	TRS25R	25
22P2	TRS35R	35
24P0	TRS60R	60
25P5	Contact your OYMC sales representative	70
27P5		100
2011		150
2015		200
400 V Class Three-Phase Drives		
40P2	TRS2.5R	2.5
40P4	TRS5R	5
40P7	TRS10R	10
41P5	TRS20R	20
42P2	TRS20R	20
43P0	TRS20R	20
44P0	TRS30R	30
45P5	Contact your OYMC sales representative	50
47P5		60
4011		70
4015		80

■ Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. Use a class 2 (UL regulations) power supply for the control circuit terminal.

Table D.6 Control Circuit Terminal Power Supply

Input / Output	Terminal Signal	Power Supply Specifications
Digital outputs	P1*, P2*, PC*, MA, MB, MC, MP	*Requires class 2 power supply.
Digital inputs	S1, S2, S3, S4, S5, S6, SC	Use the internal power supply of the drive. Use class 2 for external power supply.

Input / Output	Terminal Signal	Power Supply Specifications
Main frequency reference (multi-function analog inputs)	RP, +V, A1, A2, AC	Use the internal power supply of the drive. Use class 2 for external power supply.

■ Drive Short-Circuit Rating

This drive has undergone the UL short-circuit test, which certifies that during a short circuit in the power supply the current flow will not rise above 30,000 amps maximum at 240 V for 200 V class drives and 480 V for 400 V class drives.

- The MCCB and breaker protection and fuse ratings shall be equal to or greater than the short-circuit tolerance of the power supply being used.
- Suitable for use on a circuit capable of delivering not more than 30,000 RMS symmetrical amperes for 240 V in 200 V class drives (up to 480 V for 400 V class drives) motor overload protection.

◆ Drive Motor Overload Protection

Set parameter E2-01 (motor rated current) to the appropriate value to enable motor overload protection. The internal motor overload protection is UL listed and in accordance with the NEC and CEC.

■ E2-01 Motor Rated Current

Setting Range: Model Dependent

Factory Default: Model Dependent

Parameter E2-01 (motor rated current) protects the motor if parameter L1-01 is not set to 0 (default is 1, standard induction motor protection enabled).

If Auto-Tuning has been performed successfully, the motor data that was entered in T1-04 is automatically written into parameter E2-01. If Auto-Tuning has not been performed, manually enter the correct motor rated current in parameter E2-01.

■ L1-01 Motor Overload Protection Selection

The drive has an electronic overload protection function (OL1) based on time, output current and output frequency, which protects the motor from overheating. The electronic thermal overload function is UL-recognized, so it does not require an external thermal overload relay for single motor operation.

This parameter selects the motor overload curve used according to the type of motor applied.

Table D.7 Overload Protection Settings

Setting	Description
0	Disabled
1	Std. Fan Cooled (< 10:1 motor) (factory default)
2	Standard Blower Cooled (10:1 motor)
3	Vector Motor (1000:1 motor)
4	PM motor

Disable the electronic overload protection (L1-01 = 0: Disabled) and wire each motor with its own motor thermal overload when connecting the drive to more than one motor for simultaneous operation.

Enable the motor overload protection (L1-01 = "1", "2", or "3") when connecting the drive to a single motor unless there is another means of preventing motor thermal overload. The electronic thermal overload function causes an OL1 fault, which shuts off the output of the drive and prevents additional overheating of the motor. The motor temperature is continually calculated as long as the drive is powered up.

Setting L1-01 = 1 selects a motor with limited cooling capability below rated (base) speed when running at 100% load. The OL1 function derates the motor when it is running below base speed.

Setting L1-01 = 2 selects a motor capable of cooling itself over a 10:1 speed range when running at 100% load. The OL1 function derates the motor when it is running at 1/10 or less of its rated speed.

Setting L1-01 = 3 selects a motor capable of cooling itself at any speed — including zero speed — when running at 100% load. The OL1 function does not derate the motor at any speed.

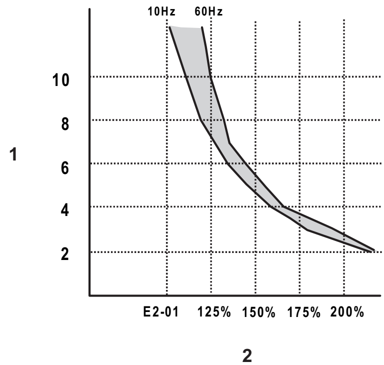
Setting L1-01 = 4 selects protection for a PM motor.

■ L1-02 Motor Overload Protection Time

Setting Range: 0.1 to 20.0 Minutes

Factory Default: 8.0 Minutes

The L1-02 parameter sets the allowed operation time before the OL1 fault occurs when the drive is running at 60 Hz and 133% of the full load amp rating (E2-01) of the motor. Adjusting the value of L1-02 can shift the set of OL1 curves up the Y-axis of the diagram below but will not change the shape of the curves.



A – Time (minutes)

B – Output Current (Percent of motor FLA)

Figure D.8 Motor Overload Protection Time

D.4 Safe Disable Input Precautions

◆ Safe Disable Function Description

The Safe Disable function can be utilized to perform a safe stop according to the EN60204-1, stop category 0 (Uncontrolled stop by power removal). It is designed to meet the requirements of the EN954-1, Safety Category 3 and EN61508, SIL2.
Removing the voltage from both terminals H1 and H2 disables the drive output, i.e. the power supply to the motor is cut by stopping the switching of the output transistors in a safe way. “Hbb” is shown on the display. Always use both inputs to disable the drive. If for any reason only one channel is opened, the drive output is stopped too but the display shows “HbbF”. In this case the Safe Disable input wiring must be checked.
Safe Disable is applicable for induction and permanent magnet motors.

◆ Installation

If the Safe Disable function is utilized, the wire link between the terminals HC, H1 and H2 that is preinstalled at the shipment has to be removed entirely. Follow the instructions given in *Wiring Procedure on page 69*.

Connect the drive to an EN954-1, Safety Category 3 interrupting device so that in case of a Safe Disable request the connection between terminal HC and both terminals H1 and H2 is opened.

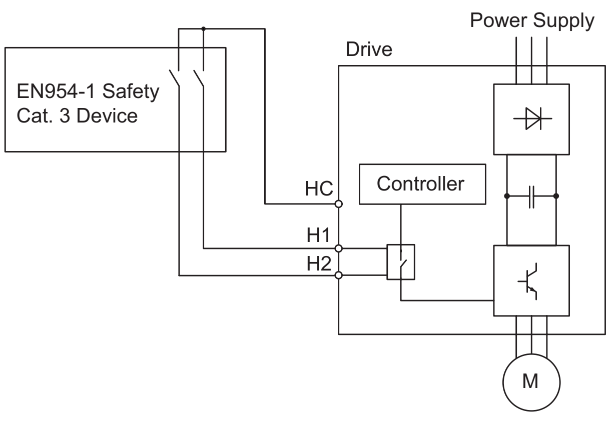


Figure D.9 Safe Disable Wiring Example

■ Installation Precautions

1. To assure, that the Safe Disable function appropriately fulfills the safety requirements of the application, a throughout risk assessment for the whole safety system has to be carried out.
2. If only one signal line from the safety device to the drive is used (H1 and H2 are linked at the drive), the drive must be installed in an enclosure with protection degree of at least IP54 in order to maintain EN954-1, safety category 3 compliance.
   If two separate signal lines from the safety device to the inputs H1 and H2 are used (like shown above), the drive must not necessarily be installed in an IP54 enclosure.
3. If the safety device and the drive are installed in separate cabinets, the Safe Disable wires must be installed in a short circuit proof way.
4. The Safe Disable function does not cut the power supply to the drive and does not provide electrical isolation. Before any installation or maintenance work is done, the drives power supply must be switched off.
5. When PM motors are used, the following must be considered:
   Even if the Safe Disable function is active, although unlikely a failure in two of the drives power devices can occur which means that current flows through the motor winding. In an induction motor no torque can be produced by that. However, if this happens and a PM motor is connected a torque is produced causing an alignment of the rotor magnets. The rotor may turn up to 180 deg electrically. It must be ensured, that this possible failure mode is not safety critical for the application.
6. The wiring distance for the Safe Disable inputs should be shorter than 30 m.
7. The time from opening the Safe Disable input until the drive output is switched off is less than 1 ms.

D.5 User Setting Table

No.	Name	User Setting
A1-01	Access Level Selection	
A1-02	Control Method Selection	
A1-03	Initialize Parameters	
A1-04	Password 1	
A1-05	Password 2	
A1-06	Application Preset	
A1-07	FBD's Function Selection	
A2-01 to A2-32	User Parameters, 1 to 32	
A2-33	User Parameter Automatic Selection	
b1-01	Frequency Reference Selection 1	
b1-02	Run Command Selection 1	
b1-03	Stopping Method Selection	
b1-04	Reverse Operation Selection	
b1-07	Local/Remote Run Selection	
b1-08	Run Command Selection while in Programming Mode	
b1-14	Phase Order Selection	
b1-15	Frequency Reference 2	
b1-16	Run Command Source 2	
b1-17	Run Command at Power Up	
b2-01	DC Injection Braking Start Frequency	
b2-02	DC Injection Braking Current	
b2-03	DC Injection Braking Time/ DC Excitation Time at Start	

No.	Name	User Setting
b2-04	DC Injection Braking Time at Stop	
b2-08	Magnetic Flux Compensation Capacity	
b2-12	Short Circuit Brake Time at Start	
b2-13	Short Circuit Brake Time at Stop	
b3-01	Speed Search Selection	
b3-02	Speed Search Deactivation Current	
b3-03	Speed Search Deceleration Time	
b3-05	Speed Search Delay Time	
b3-06	Output Current 1 during Speed Search	
b3-10	Speed Search Detection Compensation Gain	
b3-14	Bi-Directional Speed Search Selection	
b3-17	Speed Search Restart Current Level	
b3-18	Speed Search Restart Detection Time	
b3-19	Number of Speed Search Restarts	
b3-24	Speed Search Method Selection	
b3-25	Speed Search Retry Interval Time	
b4-01	Timer Function On-Delay Time	
b4-02	Timer Function Off-Delay Time	

No.	Name	User Setting
b5-01	PID Function Setting	
b5-02	Proportional Gain Setting (P)	
b5-03	Integral Time Setting (I)	
b5-04	Integral Limit Setting	
b5-05	Derivative Time	
b5-06	PID Output Limit	
b5-07	PID Offset Adjustment	
b5-08	PID Primary Delay Time Constant	
b5-09	PID Output Level Selection	
b5-10	PID Output Gain Setting	
b5-11	PID Output Reverse Selection	
b5-12	PID Feedback Reference Missing Detection Selection	
b5-13	PID Feedback Loss Detection Level	
b5-14	PID Feedback Loss Detection Time	
b5-15	PID Sleep Function Start Level	
b5-16	PID Sleep Delay Time	
b5-17	PID Accel/Decel Time	
b5-18	PID Setpoint Selection	
b5-19	PID Setpoint Value	
b5-20	PID Setpoint Scaling	
b5-34	PID Output Lower Limit	
b5-35	PID Input Limit	
b5-36	PID Feedback High Detection Level	
b5-37	PID Feedback High Level Detection Time	
b5-38	PID Setpoint / User Display	
b5-39	PID Setpoint and Display Digits	

No.	Name	User Setting
b6-01	Dwell Reference at Start	
b6-02	Dwell Time at Start	
b6-03	Dwell Frequency at Stop	
b6-04	Dwell Time at Stop	
b8-01	Energy Saving Control Selection	
b8-02	Energy Saving Gain	
b8-03	Energy Saving Control Filter Time Constant	
b8-04	Energy Saving Coefficient Value	
b8-05	Power Detection Filter Time	
b8-06	Search Operation Voltage Limit	
C1-01	Acceleration Time 1	
C1-02	Deceleration Time 1	
C1-03	Acceleration Time 2	
C1-04	Deceleration Time 2	
C1-05	Acceleration Time 3 (Motor 2 Accel Time 1)	
C1-06	Deceleration Time 3 (Motor 2 Decel Time 1)	
C1-07	Acceleration Time 4 (Motor 2 Accel Time 2)	
C1-08	Deceleration Time 4 (Motor 2 Decel Time 2)	
C1-09	Fast-Stop Time	
C1-10	Accel/Decel Time Setting Units	
C1-11	Accel/Decel Time Switching Frequency	
C2-01	S-Curve Characteristic at Accel Start	

D.5 User Setting Table

No.	Name	User Setting
C2-02	S-Curve Characteristic at Accel End	
C2-03	S-Curve Characteristic at Decel Start	
C2-04	S-Curve Characteristic at Decel End	
C3-01	Slip Compensation Gain	
C3-02	Slip Compensation Primary Delay Time	
C3-03	Slip Compensation Limit	
C3-04	Slip Compensation Selection during Regeneration	
C3-05	Output Voltage Limit Operation Selection	
C4-01	Torque Compensation Gain	
C4-02	Torque Compensation Primary Delay Time	
C4-03	Torque Compensation at Forward Start	
C4-04	Torque Compensation at Reverse Start	
C4-05	Torque Compensation Time Constant	
C4-06	Torque Compensation Primary Delay Time 2	
C5-01	ASR Proportional Gain 1 (for Simple PG V/f Control)	
C5-02	ASR Integral Time 1 (for Simple PG V/f Control)	
C5-03	ASR Proportional Gain 2 (for Simple PG V/f Control)	
C5-04	ASR Integral Time 2 (for Simple PG V/f Control)	
C5-05	ASR Limit (for Simple PG V/f Control)	
C6-01	Duty Mode Selection	

No.	Name	User Setting
C6-02	Carrier Frequency Selection	
C6-03	Carrier Frequency Upper Limit	
C6-04	Carrier Frequency Lower Limit	
C6-05	Carrier Frequency Proportional Gain	
d1-01	Frequency Reference 1	
d1-02	Frequency Reference 2	
d1-03	Frequency Reference 3	
d1-04	Frequency Reference 4	
d1-05	Frequency Reference 5	
d1-06	Frequency Reference 6	
d1-07	Frequency Reference 7	
d1-08	Frequency Reference 8	
d1-09	Frequency Reference 9	
d1-10	Frequency Reference 10	
d1-11	Frequency Reference 11	
d1-12	Frequency Reference 12	
d1-13	Frequency Reference 13	
d1-14	Frequency Reference 14	
d1-15	Frequency Reference 15	
d1-16	Frequency Reference 16	
d1-17	Jog Frequency Reference	
d2-01	Frequency Reference Upper Limit	
d2-02	Frequency Reference Lower Limit	
d2-03	Master Speed Reference Lower Limit	
d3-01	Jump Frequency 1	
d3-02	Jump Frequency 2	
d3-03	Jump Frequency 3	
d3-04	Jump Frequency Width	
d4-01	Frequency Reference Hold Function Selection	

No.	Name	User Setting
d4-03	Frequency Reference Bias Step (Up/Down 2)	
d4-04	Frequency Reference Accel/ Decel (Up/Down 2)	
d4-05	Frequency Reference Bias Operation Mode Selection (Up/ Down 2)	
d4-06	Frequency Reference Bias (Up/ Down 2)	
d4-07	Analog Frequency Reference Fluctuation Limit (Up/Down 2)	
d4-08	Frequency Reference Bias Upper Limit (Up/Down 2)	
d4-09	Frequency Reference Bias Lower Limit (Up/Down 2)	
d4-10	Up/Down Frequency Reference Limit Selection	
d4-11	Bi-directional Output Selection	
d4-12	Stop Position Gain	
d7-01	Offset Frequency 1	
d7-02	Offset Frequency 2	
d7-03	Offset Frequency 3	
E1-01	Input Voltage Setting	
E1-03	V/f Pattern Selection	
E1-04	Max Output Frequency	
E1-05	Max Voltage	
E1-06	Base Frequency	
E1-07	Mid Output Frequency	
E1-08	Mid Output Frequency Voltage	
E1-09	Minimum Output Freq.	
E1-10	Minimum Output Freq.Voltage	
E1-11	Mid Output Frequency 2	
E1-12	Mid Output Frequency Voltage 2	

No.	Name	User Setting
E1-13	Base Voltage	
E2-01	Motor Rated Current	
E2-02	Motor Rated Slip	
E2-03	Motor No-Load Current	
E2-04	Number of Motor Poles	
E2-05	Motor Line-to-Line Resistance	
E2-06	Motor Leakage Inductance	
E2-07	Motor Iron-Core Saturation Coefficient 1	
E2-08	Motor Iron-Core Saturation Coefficient 2	
E2-09	Motor Mechanical Loss	
E2-10	Motor Iron Loss for Torque Compensation	
E2-11	Motor Rated Output	
E2-12	Motor Iron-Core Saturation Coefficient 3	
E3-01	Motor 2 Control Method Selection	
E3-04	Motor 2 Max Output Frequency	
E3-05	Motor 2 Max Voltage	
E3-06	Motor 2 Base Frequency	
E3-07	Motor 2 Mid Output Frequency	
E3-08	Motor 2 Mid Output Frequency Voltage	
E3-09	Motor 2 Minimum Output Freq.	
E3-10	Motor 2 Minimum Output Freq. Voltage	
E3-11	Motor 2 Mid Output Freq. 2	
E3-12	Motor 2 Mid Output Freq. Voltage 2	
E3-13	Motor 2 Base Voltage	
E4-01	Motor 2 Rated Current	

No.	Name	User Setting
E4-02	Motor 2 Rated Slip	
E4-03	Motor 2 Rated No-Load Current	
E4-04	Motor 2 Motor Poles	
E4-05	Motor 2 Line-to-Line Resistance	
E4-06	Motor 2 Leakage Inductance	
E4-07	Motor 2 Motor Iron-Core Saturation Coefficient 1	
E4-08	Motor 2 Motor Iron-Core Saturation Coefficient 2	
E4-09	Motor 2 Mechanical Loss	
E4-10	Motor 2 Iron Loss	
E4-11	Motor 2 Rated Capacity	
E4-12	Motor 2 Iron-Core Saturation Coefficient 3	
E4-14	Motor 2 Slip Compensation Gain	
E4-15	Torque Compensation Gain - Motor 2	
E5-01	Motor Code Selection (PM motor)	
E5-02	Motor Rated Capacity (PM motor)	
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