YASKAWA

iQpump®605 DRIVE

INSTALLATION & PRIMARY OPERATION

INTELLIGENT PUMP CONTROLLER

CATALOG CODE:
WM65Wxxxxxxx

CAPACITIES:
208 V class: 2.2 to 110 kW (3 to 150 HP)
480 V class: 2.2 to 450 kW (3 to 600 HP)

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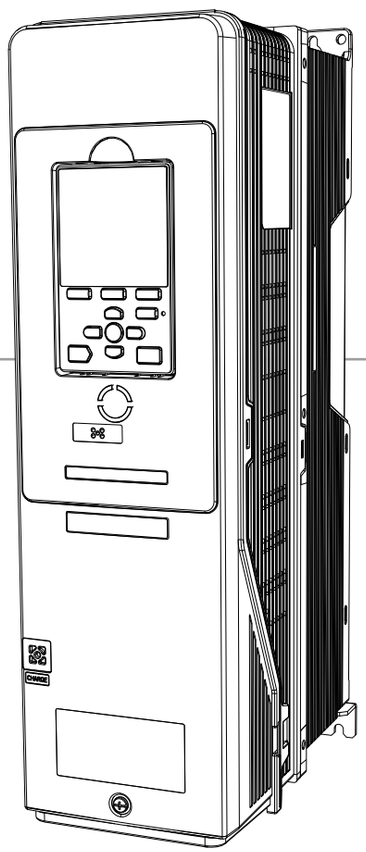
yaskawa.com/TOEPYAIWM6501



Simplify Drive Installation
Get DriveWizard® Mobile

https://www.yaskawa.com/dwm

DOCUMENT NUMBER: TOEPYAIWM6501

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Table of Contents

1 General Information

The products and specifications given in this manual and the manual contents can change without notice to make the product and manual better.

Be sure to always use the latest version of this manual. Use this manual to correctly install, wire, set, and operate this product.

Users can download additional manuals for this product from the Yaskawa documentation website printed on the back cover.

◆ Glossary

Phrase	Definition
Drive	YASKAWA AC Drive iQpump®605
EDM	External Device Monitor
EZOLV	EZ Open Loop Vector Control
IPM motor	Interior Permanent Magnet motors
MFAI	Multi-Function Analog Input
MFAO	Multi-Function Analog Output
MFDI	Multi-Function Digital Input
MFDO	Multi-Function Digital Output
OLV/PM	Open Loop Vector Control for Permanent Magnet Motors
PM motor	Permanent Magnet Synchronous motor (generic name for IPM motors and SPM motors)
SIL	Safety Integrity Level
SPM motor	Surface Permanent Magnet motors
V/f	V/f Control

2 Safety

Read the safety instructions carefully before you install, wire, or operate this product.

◆ Explanation of Signal Words

⚠ WARNING *Read and understand this manual before you install, operate, or do maintenance on the drive. Install the drive as specified by this manual and local codes. The symbols in this section identify safety messages in this manual. If you do not obey these safety messages, the hazards can cause serious injury, death, or damage to the products and related equipment and systems.*

These identifier words categorize and emphasize important safety precautions in these instructions.

⚠ DANGER *This signal word identifies a hazard that will cause serious injury or death if you do not prevent it.*

⚠ WARNING *This signal word identifies a hazard that can cause death or serious injuries if you do not prevent it.*

⚠ CAUTION *This signal word identifies a hazard that can cause minor or moderate injuries if you do not prevent it.*

NOTICE *This signal word identifies a property damage message that is not related to personal injury.*

◆ General Safety

General Precautions
• Some figures in the instructions include options and drives without covers or safety shields to more clearly show the inside of the drive. Replace covers and shields before operation. Use options and drives only as specified by the instructions. • The figures in this manual are examples only. All figures do not apply to all products included in this manual. • Yaskawa can change the products, specifications, and content of the instructions without notice to make the product and/or the instructions better. • If you damage or lose these instructions, contact a Yaskawa representative or the nearest Yaskawa sales office on the rear cover of the manual, and tell them the document number on the front cover to order new copies.

⚠ DANGER *Do not ignore the safety messages in this manual. If you ignore the safety messages in this manual, it will cause serious injury or death. The manufacturer is not responsible for injuries or damage to equipment.*

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

⚠ WARNING *Crush Hazard. Test the system to make sure that the drive operates safely after you wire the drive and set parameters. If you do not test the system, it can cause damage to equipment or serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Before you do a test run, make sure that the setting values for virtual input and output function parameters are correct. Virtual input and output functions can have different default settings and operation than wired input and output functions. Incorrect function settings can cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Remove all personnel and objects from the area around the drive, motor, and machine and attach covers, couplings, shaft keys, and machine loads before you energize the drive. If personnel are too close or if there are missing parts, it can cause serious injury or death.*

⚠ WARNING *Arc Flash Hazard. Obey local codes and Arc Flash safety requirements contained in the Standard for Electrical Safety in the Workplace NFPA 70E (2009 Edition or later) and the Workplace Electrical Safety, Canadian Standards Association (CSA) Z462-12. Obey safe work procedures and use applicable personal protective equipment (PPE). If you do not obey these requirements and procedures, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Do not modify the drive body or drive circuitry. Modifications to drive body and circuitry can cause serious injury or death, will cause damage to the drive, and will void the warranty. Yaskawa is not responsible for modifications of the product made by the user.*

⚠ WARNING *Electrical Shock Hazard. Only let approved personnel install, wire, maintain, examine, replace parts, and repair the drive. If personnel are not approved, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. If you touch the internal components of an energized drive, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. After the drive blows a fuse or trips a GFCI, do not immediately energize the drive or operate peripheral devices. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. If you do not know the cause of the problem, contact Yaskawa before you energize the drive or peripheral devices. If you do not fix the problem before you operate the drive or peripheral devices, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Disconnect all power to the drive and remove all wires to do maintenance on the drive. If you only turn OFF the built-in Main Switch before you do maintenance, there can be high voltage on input terminals R/L1, S/L2, and T/L3 of the Main Switch and touching energized terminals will cause serious injury or death.*

⚠ WARNING *Damage to Equipment. Do not apply incorrect voltage to the main circuit of the drive. Operate the drive in the specified range of the input voltage on the drive nameplate. Voltages that are higher than the permitted nameplate tolerance can cause damage to the drive.*

⚠ WARNING *Fire Hazard. Install sufficient branch circuit short circuit protection as specified by applicable codes and this manual. The drive is suitable for circuits that supply not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (208 V Class), 480 Vac maximum (480 V Class). Incorrect branch circuit short circuit protection can cause serious injury or death.*

⚠ CAUTION *Crush Hazard. Tighten terminal cover screws and hold the case safely when you move the drive. If the drive or covers fall, it can cause moderate injury.*

NOTICE *Use an inverter-duty motor or vector-duty motor with reinforced insulation and windings applicable for use with an AC drive. If the motor does not have the correct insulation, it can cause a short circuit or ground fault from insulation deterioration.*

NOTICE *Damage to Equipment. When you touch the drive and circuit boards, make sure that you observe correct electrostatic discharge (ESD) procedures. If you do not follow procedures, it can cause ESD damage to the drive circuitry.*

NOTICE *Damage to Equipment. Do not do a withstand voltage test or use a megohmmeter or megger insulation tester on the drive. These tests can cause damage to the drive.*

NOTICE *Do not operate a drive or connected equipment that has damaged or missing parts. You can cause damage to the drive and connected equipment.*

NOTICE *Damage to Equipment. Do not use steam or other disinfectants to fumigate wood for packaging the drive. Use alternative methods, for example heat treatment, before you package the components. Gas from wood packaging fumigated with halogen disinfectants, for example fluorine, chlorine, bromine, iodine or DOP gas (phthalic acid ester), can cause damage to the drive.*

NOTICE *Damage to Equipment. Do not energize and de-energize the drive more frequently than one time each 30 minutes. If you frequently energize and de-energize the drive, it can cause drive failure.*

NOTICE *Damage to Equipment. Do not cycle the Main Switch more than 6000 times. If you cycle the Main Switch more times than the limit, it will cause the contact failure, or you cannot open or close the Main Switch.*

NOTICE *Damage to Equipment. Make sure that you stop the motor before you turn ON/OFF the Main Switch. If you turn ON/OFF the Main Switch during run, it can cause Main Switch failure.*

◆ Exclusion of Liability

- This product is not designed and manufactured for use in life-support machines or systems.
- Contact a Yaskawa representative or your Yaskawa sales representative if you are considering the application of this product for special purposes, such as machines or systems used for passenger cars, medicine, airplanes and aerospace, nuclear power, electric power, or undersea relaying.

⚠ WARNING *Injury to Personnel. When you use this product in applications where its failure could cause the loss of human life, a serious accident, or physical injury, you must install applicable safety devices. If you do not correctly install safety devices, it can cause serious injury or death.*

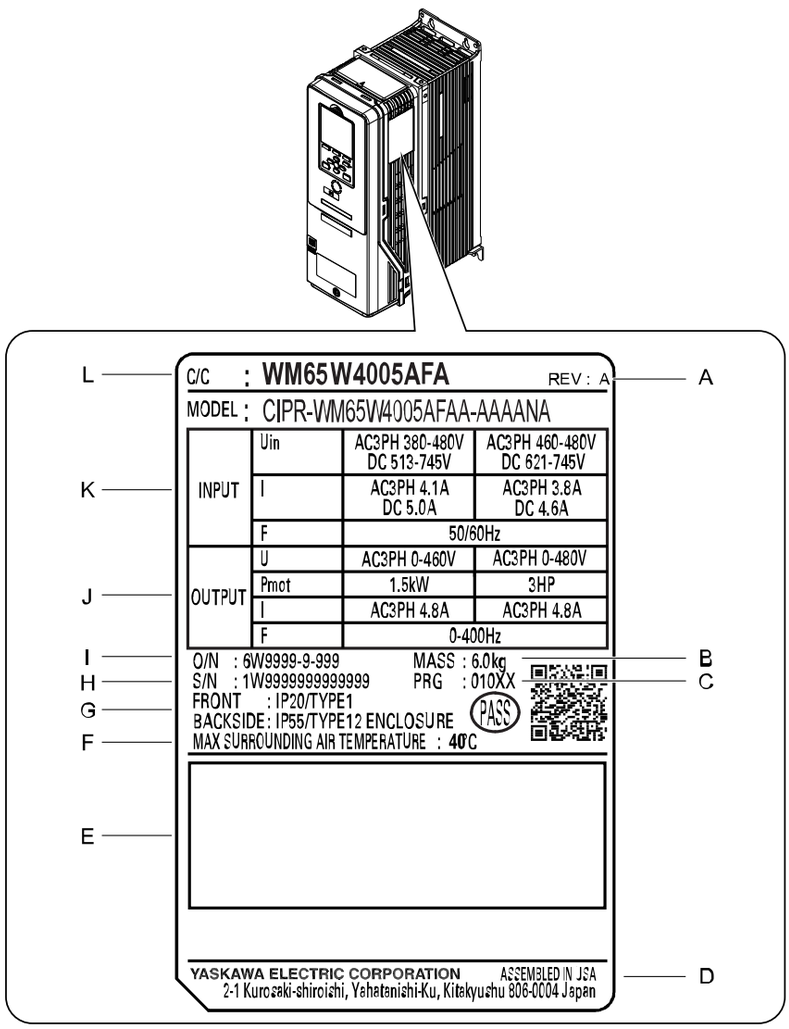
3 Cybersecurity

This product is designed to connect and communicate information and data through a network interface. It is the sole responsibility of the customer to provide and continuously guarantee a secure connection between the product and the customer's network or if applicable, any other network. The customer must establish and maintain the appropriate measures (such as, but not limited to, the installation of firewalls, the application of authentication measures, the encryption of data, the installation of antivirus programs, etc.) to protect the product, the network, its system and the interface against all types of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. Yaskawa and its affiliates are not responsible for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

4 Receiving

1. Examine the product for damage and missing parts. Immediately contact the shipping company if the drive is damaged. The Yaskawa warranty does not cover damage from shipping.
2. Verify the catalog code in the “C/C” section of the drive nameplate to make sure that you received the correct model.
3. If you did not receive the correct drive or if your drive does not operate correctly, contact your supplier.
4. Examine each drive and each motor for systems that use more than one drive.

NOTICE *Damage to Equipment. Do not install or use damaged parts or damaged motors into the drive system.*



A - Hardware revision
B - Weight
C - Drive software version
D - The address of the head office of Yaskawa Electric Corporation
E - Accreditation standards
F - Surrounding air temperature
G - Protection design
H - Serial number
I - Lot number
J - Output specifications
K - Input specifications
L - Catalog code

Figure 4.1 Nameplate Location

◆ How to Read Catalog Codes

Use the information in Figure 4.2 and Table 4.1 to read the drive catalog codes.

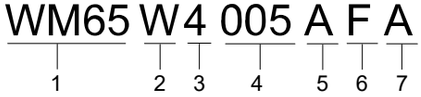


Figure 4.2 Drive Catalog Code

Table 4.1 Catalog Code Details

No.	Description
1	Product series
2	Region code W: iQpump, Americas
3	Input power supply voltage • 2: Three-Phase 200 Vac to 240 Vac • 4: Three-Phase 380 Vac to 480 Vac
4	Rated output current **Note:** Refer to the rated output current list for more information.
5	EMC filter A: No built-in EMC filter
6	Protection design • B: IP20/UL Open Type • F: IP20/UL Type 1 • V: IP55/UL Type 12 • T: IP55/UL Type 12 with Main Switch *1 • W: IP55/UL Type 12 Heatsink External Mounting
7	Environmental specification A: Standard

*1 IP55/UL Type 12 drives with Main Switch are certified as IP55 Category 2 as specified by IEC60529.

■ Rated Output Current

Table 4.2 and Table 4.3 give the rated output current values.

Note:
- These output current values are applicable for drives that operate at standard specifications.
- Derate the current in applications that:
  – Increase the carrier frequency
  – Have high ambient temperature
  – Use side-by-side installation.

Table 4.2 Output Current for Three-Phase AC 208 V Class Models (NEMA Rating)

Model	Maximum Applicable Motor Output kW (HP)	Rated Output Current A
2011	2.2 (3)	10.6
2017	3.7 (5)	16.7
2024	5.5 (7.5)	24.2
2031	7.5 (10)	30.8
2046	11 (15)	46.2
2059	15 (20)	59.4
2075	18.5 (25)	74.8
2088	22 (30)	88
2114	30 (40)	114
2143	37 (50)	143
2169	45 (60)	169
2211	55 (75)	211
2273	75 (100)	273
2343	90 (125)	343
2396	110 (150)	396

Table 4.3 Output Current for Three-Phase AC 480 V Class Models (NEMA Rating)

Model	Maximum Applicable Motor Output kW (HP)	Rated Output Current A
4005	2.2 (3)	4.8
4008	3.7 (5)	7.6
4011	5.6 (7.5)	11
4014	7.5 (10)	14
4021	11.2 (15)	21
4027	15 (20)	27
4034	18.6 (25)	34
4040	22 (30)	40
4052	30 (40)	52
4065	37 (50)	65
4077	45 (60)	77
4096	56 (75)	96
4124	75 (100)	124
4156	93 (125)	156
4180	112 (150)	180
4240	150 (200)	240
4302	186 (250)	302
4361	224 (300)	361
4414	261 (350)	414
4477	300 (400)	477
4515	335 (450)	515
4590	375 (500)	590
4720	450 (600)	720

5 Common Drive Specifications

Note:
To get the longest product life, install the drive in an environment that meets the necessary specifications.

Table 5.1 Control Characteristics

Item	Specification
Control Methods	• V/f Control (V/f) • PM Open Loop Vector Control (OLV/PM) • EZ Open Loop Vector Control (EZOLV)
Frequency Control Range	• EZOLV: 0.01 Hz to 120 Hz • V/f and OLV/PM: 0.01 Hz to 400 Hz
Frequency Accuracy (Temperature Fluctuation)	Digital inputs: Within ±0.01% of the maximum output frequency (-10 °C to +40 °C (14 °F to 104 °F)) Analog inputs: Within ±0.1% of the maximum output frequency (25 °C ±10 °C (77 °F ±18 °F))
Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/2048 of the maximum output frequency (11-bit)
Output Frequency Resolution	0.001 Hz
Frequency Setting Signal	Main speed frequency reference: 0 Vdc to 10 Vdc (20 kΩ), 4 mA to 20 mA (250 Ω), 0 mA to 20 mA (250 Ω) Main speed reference: Pulse train input (maximum 32 kHz)
Starting Torque	• V/f: 140%/3 Hz • OLV/PM: 100%/10% speed • EZOLV: 100%/10% speed

Item	Specification
Speed Control Range	• For Induction Motors: – V/f: 1:40 – EZOLV: 1:10 • For Permanent Magnet Motors and Synchronous Reluctance Motors: – OLV/PM: 1:20 – EZOLV: 1:10
Torque Limits	Parameter settings allow different limits in four quadrants in EZOLV control method.
Accel/Decel Time	0.0 s to 6000.0 s The drive can set two pairs of different acceleration and deceleration times.
V/f Characteristics	Select from 15 pre-defined V/f patterns, or a user-set V/f pattern.
Main Control Functions	Restart After Momentary Power Loss, Speed Search, Overtorque/Undertorque Detection, Torque Limit, 17 Step Speed (max.), Accel/Decel Switch, S-curve Acceleration/Deceleration, 3-wire Sequence, Auto-Tuning (Rotational and Stationary), Dwell Function, Cooling Fan ON/OFF Switch, Slip Compensation, Torque Compensation, Jump Frequency, Upper/Lower Limits for Frequency Reference, DC Injection Braking at Start and Stop, Overexcitation Braking, High Slip Braking, PID Control (with Sleep Function), Energy Saving Control, MEMOBUS/Modbus Communication (RS-485 max. 115.2 kbps), Auto Restart, Application Presets, KEB, Overexcitation Deceleration, Overvoltage Suppression

Table 5.2 Protection Functions

Item	Specification
Motor Protection	Electronic thermal overload protection
Momentary Overcurrent Protection	Drive stops when the output current is more than 175% of the drive rated output current.
Overload Protection	Drive stops when the output current is more than these overload tolerances: • 110% of the rated output current for 60 seconds • 140% of the rated output current for 2.5 seconds when the drive output frequency is 3 Hz The permitted frequency of overload is one time each 10 minutes. **Note:** If output frequency < 6 Hz, the drive can trigger the overload protection function when the output current is in the overload tolerance range.
Overvoltage Protection	208 V class: Stops when the DC bus voltage is more than approximately 410 V 480 V class: Stops when the DC bus voltage is more than approximately 820 V
Undervoltage Protection	208 V class: Stops when the DC bus voltage decreases to less than approximately 190 V 480 V class: • Stops when the DC bus voltage decreases to less than approximately 350 V when you use an input voltage less than 400 V • Stops when the DC bus voltage decreases to less than approximately 380 V when you use an input voltage less than 460 V • Stops when the DC bus voltage decreases to less than approximately 440 V when you use an input voltage of 460 V or more
Momentary Power Loss Ride-thru	Immediately stops when power loss is 15 ms or longer. Continues operation if power loss is shorter than 2 s (depending on parameter settings). **Note:** Stop time may be shortened depending on the load and motor speed.
Heatsink Overheat Protection	The drive stops when the thermistor detects an IGBT temperature more than approximately 100 °C (212 °F). The trip temperature level is different for different drive models.
Stall Prevention	Stall prevention is available during acceleration, deceleration, and during run.
Ground Fault Protection	Electronic circuit protection **Note:** This protection detects ground faults during run. The drive will not provide protection when: • There is a low-resistance ground fault for the motor cable or terminal block • Energizing the drive when there is a ground fault.
DC Bus Charge LED	Charge LED illuminates when DC bus voltage is more than 50 V.

Table 5.3 Environment

Item	Specification
Area of Use	Indoors
Power Supply	Overvoltage Category III

Item	Specification
Ambient Temperature Setting	IP20/UL Open Type/Heatsink External Mounting: -10 °C to +50 °C (14 °F to 122 °F) IP20/UL Type 1: -10 °C to +40 °C (14 °F to 104 °F) IP55/UL Type 12 Heatsink External Mounting; front side: -10 °C to +50 °C (14 °F to 122 °F) IP55/UL Type 12 Heatsink External Mounting; back side: -10 °C to +40 °C (14 °F to 104 °F) • When you install the drive in an enclosure, use a cooling fan or air conditioner to keep the internal air temperature in the permitted range. • Do not let the drive freeze. • You can use IP20/UL Open Type and IP20/UL Type 1 drives at a maximum of 60 °C (140 °F) when you derate the output current. • You can use IP55/UL Type 12 drives at a maximum of 50 °C (122 °F) when you derate the output current.
Humidity	95% RH or less Do not let condensation form on the drive.
Storage Temperature	-20 °C to +70 °C (-4 °F to +158 °F) (short-term temperature during transportation)
Surrounding Area	Pollution degree 2 or less Install the drive in an area without: • Oil mist, corrosive or flammable gas, or dust • Metal powder, oil, water, or other unwanted materials • Radioactive materials or flammable materials, including wood • Harmful gas or fluids • Salt • Direct sunlight
Altitude	1000 m (3281 ft) maximum **Note:** Derate the output current by 1% for each 100 m (328 ft) to install the drive in altitudes between 1000 m to 4000 m (3281 ft to 13123 ft). It is not necessary to derate the rated voltage in these conditions: • When you install the drive at 2000 m (6562 ft) or lower • When you install the drive between 2000 m to 4000 m (6562 ft to 13123 ft) and ground the neutral point on the power supply.
Vibration	• For models 2xxxxB/F/V/W and 4xxxxB/F/V/W without Main Switch: – 10 Hz to 20 Hz: 1 G (9.8 m/s^2, 32.15 ft/s^2) – 20 Hz to 55 Hz: 2011 to 2031, 4005 to 4034: 0.6 G (5.9 m/s^2, 19.36 ft/s^2) 2046 to 2396, 4040 to 4720: 0.2 G (1.96 m/s^2, 6.43 ft/s^2) • For models 2xxxxT and 4xxxxT with Main Switch: – 10 Hz to 20 Hz: 1 G (9.8 m/s^2, 32.15 ft/s^2) – 20 Hz to 55 Hz: 0.2 G (1.96 m/s^2, 6.43 ft/s^2)
Installation Orientation	Install the drive vertically for sufficient airflow to cool the drive.

Table 5.4 Standard

Item	Specification
Harmonized Standard	• UL508C *1* • EN 61800-3 • IEC/EN 61800-5-1 • EN ISO 13849-1:2015 • IEC/EN 61508 (SIL3) • IEC/EN IEC 62061 (SIL3)

*1 Models 2143xV/T, 2169xV/T, 4124xT and 4156xV/T are compatible with UL61800-5-1.

Table 5.5 Enclosure Ratings

Item	Specification
Protection Design	IP20/UL Open Type IP20/UL Type 1 IP55/UL Type 12 IP55/UL Type 12 with Main Switch IP55/UL Type 12 Heatsink External Mounting **Note:** Install a UL Type 1 kit on an IP20/UL Open Type drive to convert the drive to an IP20/UL Type 1.

◆ Area of Use

Install this product in a location with Overvoltage Category III and pollution degree 2 or less.

■ Ambient Temperature Setting

Maintain the ambient temperature within the following ranges according to the enclosure type.

- IP20/UL Open Type/Heatsink External Mounting: -10 °C to +50 °C (14 °F to 122 °F)
- IP20/UL Type 1: -10 °C to +40 °C (14 °F to 104 °F)
- IP55/UL Type 12 Heatsink External Mounting; front side: -10 °C to +50 °C (14 °F to 122 °F)
- IP55/UL Type 12 Heatsink External Mounting; back side: -10 °C to +40 °C (14 °F to 104 °F)

6 Mechanical Installation

This section gives information about the standard environment for correct installation.

◆ Moving the Drive

Obey local laws and regulations when you move and install this product.

⚠ CAUTION *Crush Hazard. Tighten terminal cover screws and hold the case safely when you move the drive. If the drive or covers fall, it can cause moderate injury.*

Drive Weight	Persons Necessary to Move the Drive
< 15 kg (33 lbs.)	1
≥ 15 kg (33 lbs.)	2 + using appropriate lifting equipment

Refer to *Using the Hanging Brackets to Move the Drive on page 15* for information about how to use suspension systems, wires, or hanging metal brackets to move the drive.

◆ Using the Hanging Brackets to Move the Drive

Use the hanging brackets attached to the drive to temporarily lift the drive when you install the drive to a control panel or wall or when you replace the drive. Do not let the drive stay vertically or horizontally suspended or move the drive over a long distance while it is suspended.

Before you install the drive, make sure that you read these precautions:

⚠ WARNING *Crush Hazard. Before you hang the drive vertically, use screws to correctly attach the drive front cover and other drive components. If you do not secure the front cover, it can fall and cause minor injury.*

⚠ WARNING *Crush Hazard. When you use a crane or hoist to lift the drive during installation or removal, prevent more than 1.96 m/s^2 (0.2 G) vibration or impact. Too much vibration or impact can cause serious injury or death from falling equipment.*

⚠ WARNING *Crush Hazard. When you lift the drive during installation or removal, do not try to turn the drive over and do not ignore the hanging drive. If you move a hanging drive too much or if you ignore it, the drive can fall and cause serious injury or death.*

⚠ WARNING *Crush Hazard. When you install the drive, do not hold the front cover. Install the drive with holding the heatsink. If you hold the front cover, the cover will come off and the drive will fall, then it can cause injury.*

◆ Installation Position and Distance

Install the drive vertically for sufficient airflow to cool the drive.

A - Vertical installation **B - Horizontal installation**

Figure 6.1 Installation Position

■ Single Drive Installation

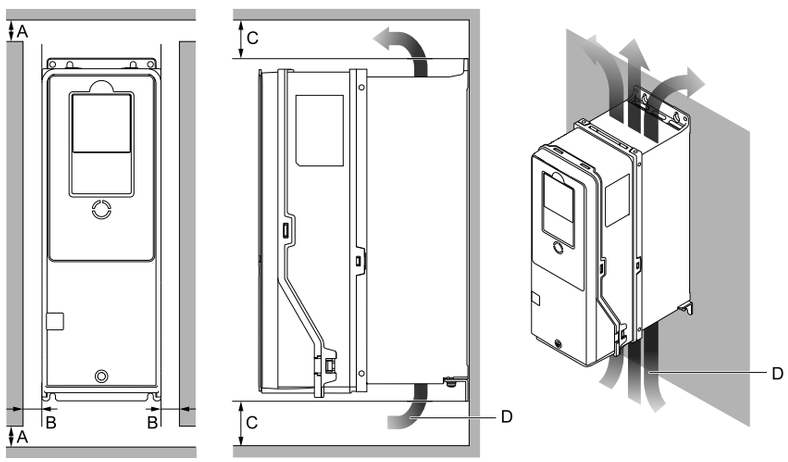
Use the clearances specified in Figure 6.2 to install the drive. Make sure that there is sufficient space for wiring and airflow.

NOTICE *Damage to Equipment. Remove the top protective cover from the drive when you install IP20/UL Type 1 models 2011 to 2169, 4005 to 4052, and 4077 to 4156 in an enclosure or when you install the drive with the heatsink external to the enclosure. If you do not remove the cover, the drive temperature will increase and it can cause damage to the drive.*

NOTICE *Damage to Equipment. Do not remove the top protective cover of model 4065. If you remove the cover, the drive temperature will increase and it can cause damage to the drive.*

Note:

When you install models 2011 to 2169 and 4005 to 4156 in an enclosure or when you install the drive with the heatsink external to the enclosure, set *L8-35 = 0 [Installation Method Selection = IP20/UL Open Type]*.



A - 50 mm (2 in) minimum **C - 120 mm (4.7 in) minimum** **2*
B - 30 mm (1.2 in) minimum **1* **D - Airflow direction**

Figure 6.2 Single Drive Installation Distances

*1 For IP55/UL Type 12 enclosure drives, 50 mm (2 in) minimum is necessary to remove the front cover.
*2 This is the distance from a drive component or mounting bracket that has the maximum height. The highest component of the drive is different for different models.

■ Side-by-Side Installation

Side-by-Side Installation lets you install more than one drive in the minimum mounting space. This method helps you to use and set up a more compact control panel.

You can install drive models 2011 to 2114 and 4005 to 4124 side-by-side at ambient temperature 40 °C (104 °F).

Note:

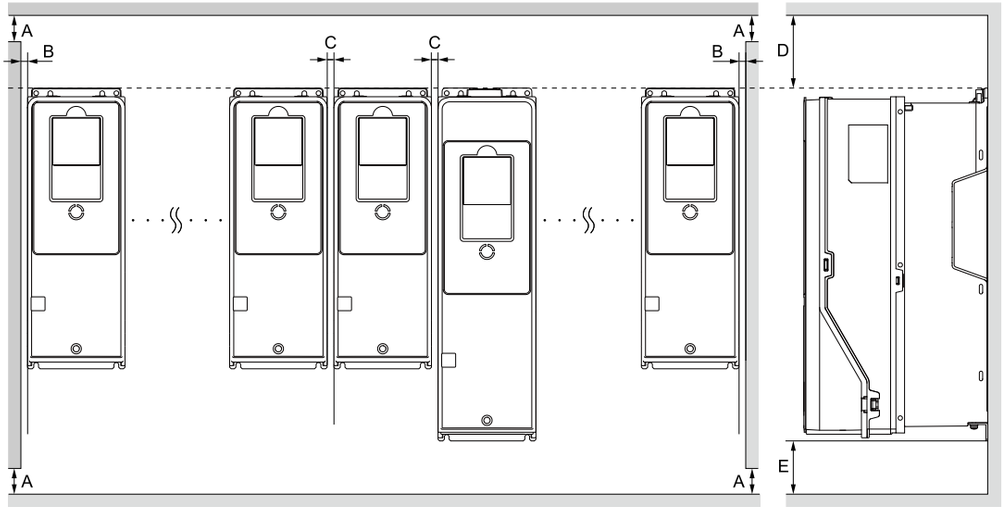
You cannot install the drives that have IP55/UL Type 12 protection level side-by-side.

When you install IP20/UL Type 1 models 2011 to 2114 and 4005 to 4124 side-by-side:

- Use the clearances specified in Figure 6.3. Make sure that there is sufficient space.
- Set *L8-35 = 1 [Installation Method Selection = Side-by-Side Mounting]*.
- Set the derating for the ambient temperature.

NOTICE *Damage to Equipment. Remove the top protective covers from all drives when you install IP20/UL Type 1 models 2011 to 2114, 4005 to 4052, and 4077 to 4124 side-by-side. If you do not remove the covers, the drive temperature will increase and it can cause damage to the drives.*

NOTICE *Damage to Equipment. Do not remove the top protective cover of model 4065. If you remove the cover, the drive temperature will increase and it can cause damage to the drive.*



A - 50 mm (2 in) minimum
B - 2 mm (0.08 in) minimum
C - 2 mm (0.08 in) minimum
D - 300 mm (11.8 in) minimum
E - 120 mm (4.7 in) minimum

Figure 6.3 Installation Distances for More than One Drive (Side-by-Side)

Note:
Align the tops of drives that have different dimensions to help when you replace cooling fans.

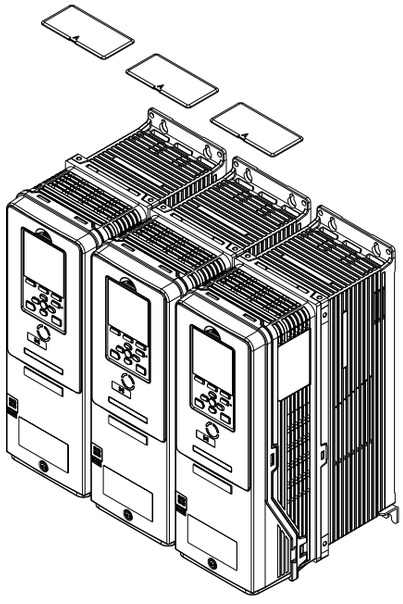
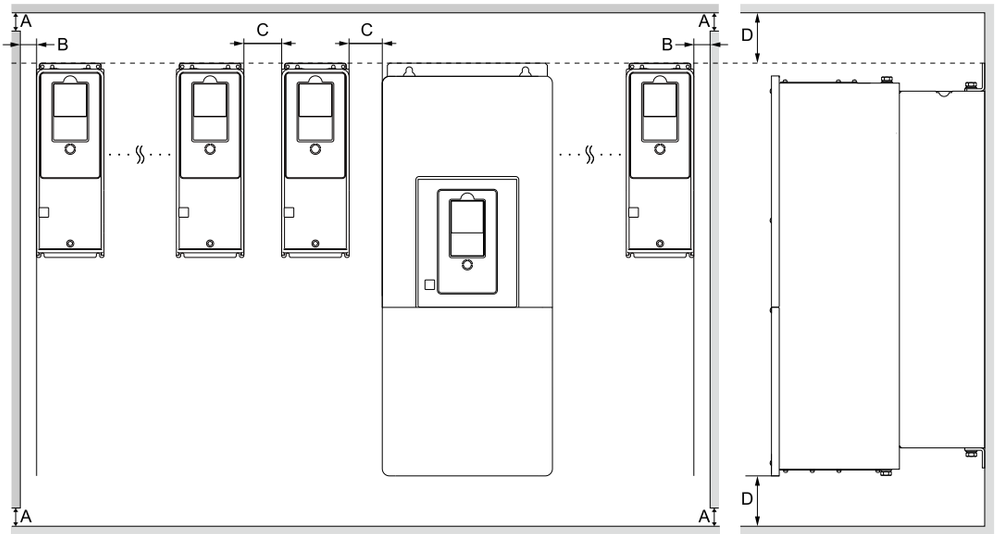


Figure 6.4 IP20/UL Type 1 Drives Installed Side-by-Side

■ Installing More than One Drive Adjacent to Each Other without Derating

Use the clearances specified in Figure 6.5. Make sure that there is sufficient space.



A - 50 mm (2 in) minimum
B - 30 mm (1.2 in) minimum
C - 60 mm (2.4 in) minimum
D - 120 mm (4.7 in) minimum

Figure 6.5 Installation Distances for More than One Drive without Derating

Note:
Align the tops of drives that have different dimensions to help when you replace cooling fans.

■ Remove the Top Protective Cover: 2011 to 2114, 4005 to 4052, and 4077 to 4124

NOTICE *Damage to Equipment. Do not remove the top protective cover of model 4065. If you remove the cover, the drive temperature will increase and it can cause damage to the drive.*

Put the end of a straight-edge screwdriver into the small hole on the front edge of the top protective cover, then carefully apply pressure to remove the cover from the drive.

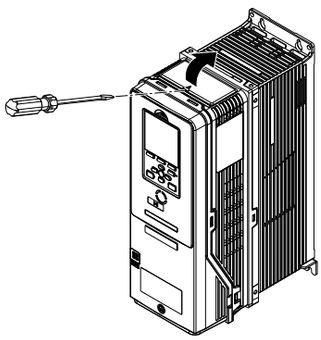


Figure 6.6 Remove the Top Protective Cover (2011 to 2114, 4005 to 4052, and 4077 to 4124)

■ Remove the Top Protective Cover: 2143, 2169, and 4156

Remove the screws to remove the top protective cover from the drive.

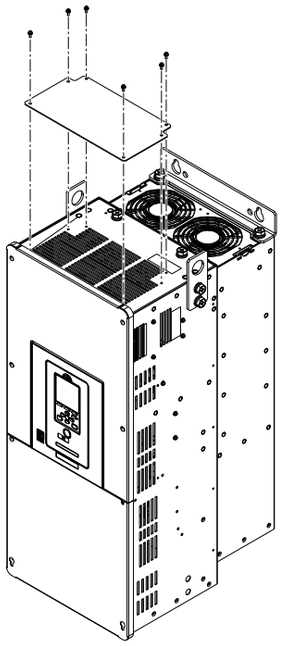


Figure 6.7 Remove the Top Protective Cover (2143, 2169, and 4156)

◆ Removing/Reattaching Covers

This section gives information about how to remove and reattach the front cover and terminal cover for wiring and inspection.

Different drive models have different procedures to remove and reattach the covers. Refer to Table 6.1 for more information.

Table 6.1 Procedures to Remove Covers by Drive Model

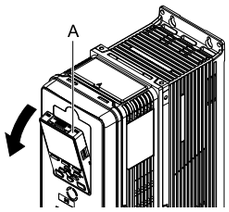
Model	IP20/UL Type 1 and IP20/UL Open Type		IP55/UL Type 12	
	Procedure	Reference	Procedure	Reference
2011 - 2114 4005 - 4096	Procedure A	19	Procedure C	23
4124				
2143 - 2169 4156	Procedure B	21	Procedure D	26
2211 - 2396 4180 - 4720			-	

■ Removing/Reattaching the Cover Using Procedure A

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

Remove the Front Cover

1. Remove the keypad from the drive.



A - Keypad

Figure 6.8 Remove the Keypad

2. Loosen the front cover screw.

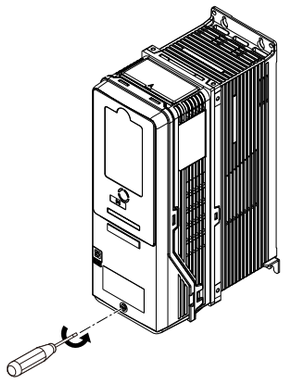


Figure 6.9 Loosen the Front Cover Screw

3. Push on the tabs in the sides of the front cover then pull the front cover forward to remove it from the drive.

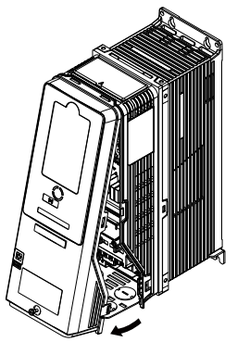


Figure 6.10 Remove the Front Cover

Reattach the Front Cover

1. Wire the drive and other peripheral devices.
2. Reverse the steps to reattach the cover.

Note:
- Make sure that you did not pinch wires or signal lines between the front cover and the drive before you reattach the cover.
- Make sure that the tabs on the sides of the front cover correctly click into the hook.
- Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in).

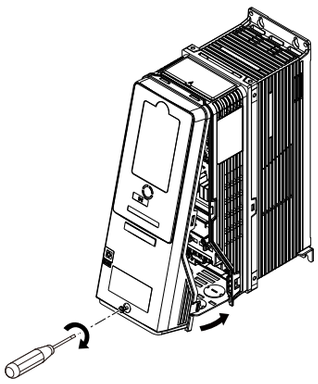


Figure 6.11 Reattach the Front Cover

3. Reattach the keypad to its initial position.

■ Removing/Reattaching the Cover Using Procedure B

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

Remove the Terminal Cover

1. Loosen the screws on the terminal cover, then pull down on the cover.

   ⚠ CAUTION *Crush Hazard. Loosen the cover screws. Do not fully remove them. If you fully remove the cover screws, the terminal cover can fall and cause moderate injury.*

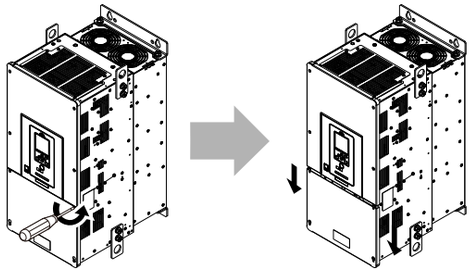


Figure 6.12 Loosen the Terminal Cover Mounting Screws

2. Pull the terminal cover away from the drive.

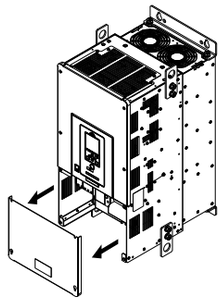
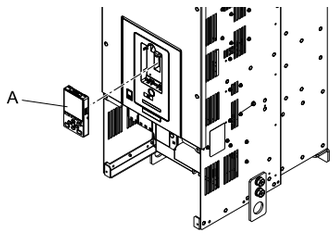


Figure 6.13 Remove the Terminal Cover

Remove the Front Cover

1. Remove the keypad from the drive.



A - Keypad

Figure 6.14 Remove the Keypad

2. Loosen the front cover screws.

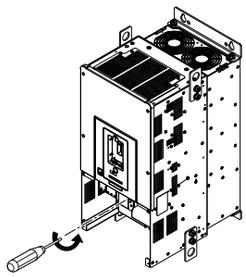
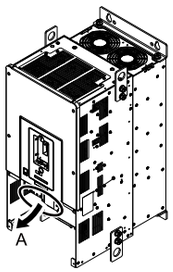


Figure 6.15 Loosen the Front Cover Screws

3. Pull part A of the front cover forward to remove the cover from the drive.



A - Pull forward to remove the front cover.

Figure 6.16 Pull Forward to Remove the Front Cover

4. Remove the front cover from the drive.

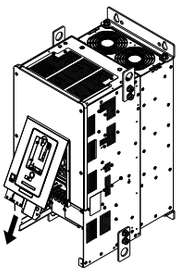
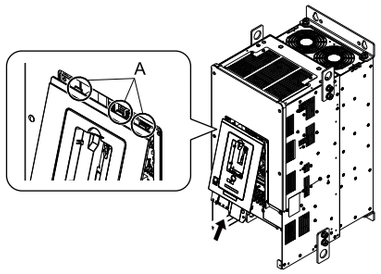


Figure 6.17 Remove the Front Cover

Reattach the Front Cover

Wire the drive and other peripheral devices then reattach the front cover.

1. Move the front cover to connect the hooks at the top of the front cover to the drive.



A - Hooks

Figure 6.18 Reattach the Front Cover

2. Move the front cover while pushing on the hooks on the left and right sides of the front cover until it clicks into position.

Note:
Make sure that you did not pinch wires or signal lines between the front cover and the drive before you reattach the cover.

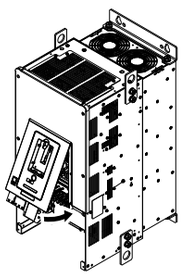


Figure 6.19 Reattach the Front Cover

3. Reattach the keypad to its initial position.

Reattach the Terminal Cover

Wire the drive and other peripheral devices then reattach the terminal cover.

Note:
- Make sure that you do not pinch wires or signal lines between the wiring cover and the drive before you reattach the cover.
- Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in).

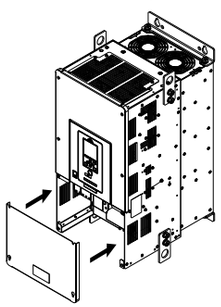


Figure 6.20 Reattach the Terminal Cover

■ Removing/Reattaching the Cover Using Procedure C

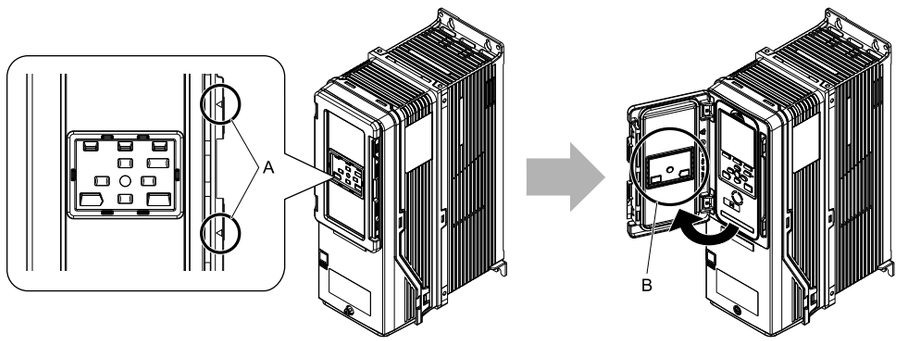
⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

Remove the Front Cover

1. Push in the two tabs on the right side of the IP55/UL Type 12 keypad cover door and pull the door to the left to open.

   NOTICE *Damage to Equipment. Do not open the IP55/UL Type 12 keypad cover door too far. If you open the door too far, it will fall off.*

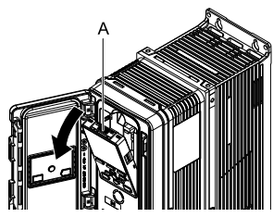
   NOTICE *Damage to Equipment. When the IP55/UL Type 12 keypad cover door is open, do not push the keypad key cover. If you push the keypad key cover, it will fall off.*



A - Tabs **B - Keypad key cover**

Figure 6.21 Open the IP55/UL Type 12 Keypad Cover Door

2. Remove the keypad from the drive.



A - Keypad

Figure 6.22 Remove the Keypad

3. Loosen the front cover screw.

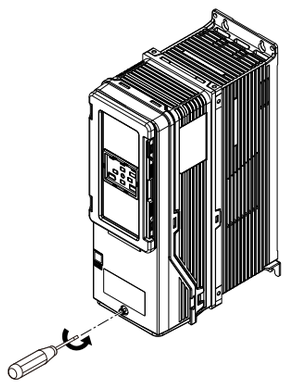


Figure 6.23 Loosen the Front Cover Screw

4. Push in the tabs on the sides of the front cover and pull the front cover forward to remove it from the drive.

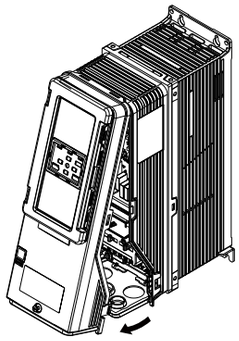


Figure 6.24 Remove the Front Cover

Reattach the Front Cover

1. Wire the drive and other peripheral devices.
2. Reverse the steps to reattach the cover. Reattach the cover carefully and make sure that the gasket on the conduit bracket does not twist.

Note:
- Make sure that you did not pinch wires or signal lines between the front cover and the drive before you reattach the cover.
- Make sure that the tabs on the sides of the front cover correctly click into the hook.
- Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in).

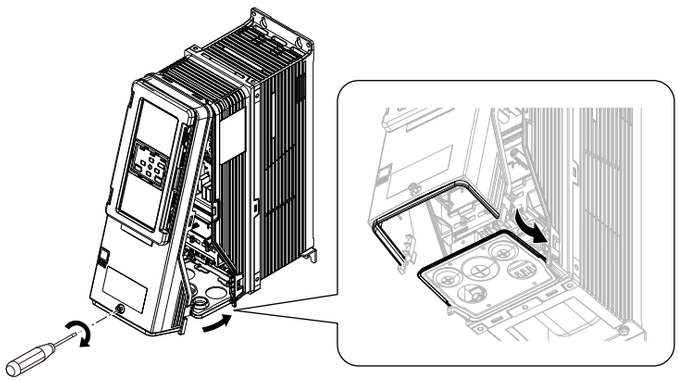


Figure 6.25 Reattach the Front Cover

3. Open the IP55/UL Type 12 keypad cover door and reattach the keypad to its initial position, then close the door until the two tabs click into position.

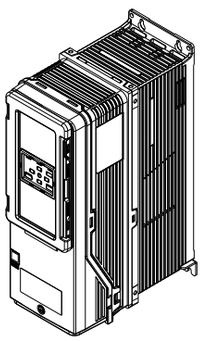


Figure 6.26 Reattach the Keypad and Close the Keypad Cover Door

■ Opening/Closing the Door Using Procedure D

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

Open the Front Door

Loosen the screws on the front door, then open the front door.

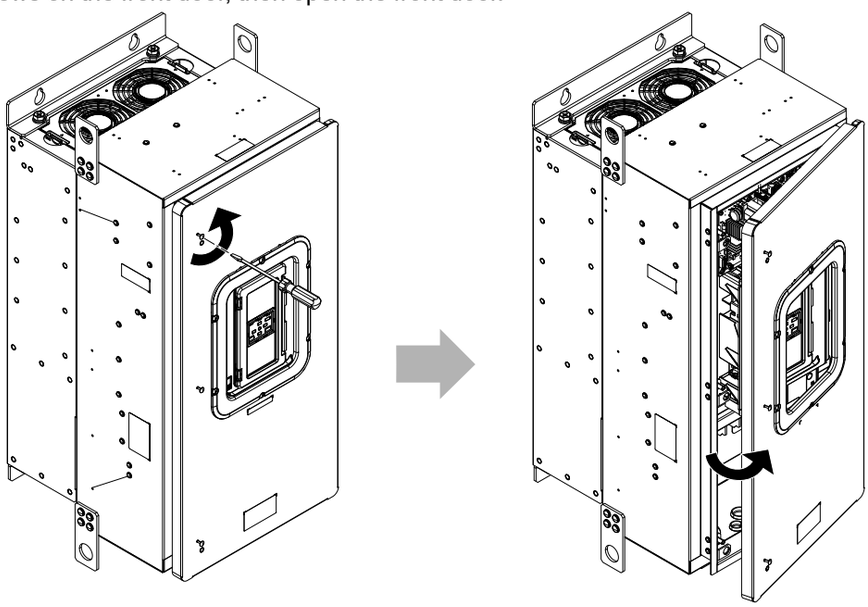


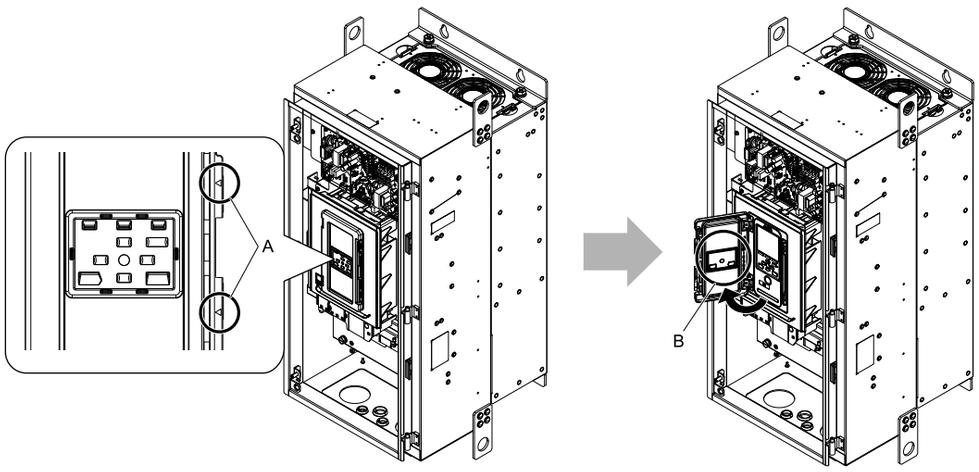
Figure 6.27 Open the Front Door

Remove the Keypad

1. Push in the two tabs on the right side of the IP55/UL Type 12 keypad cover door and pull the door to the left to open.

   NOTICE *Damage to Equipment. Do not open the IP55/UL Type 12 keypad cover door too far. If you open the door too far, it will fall off.*

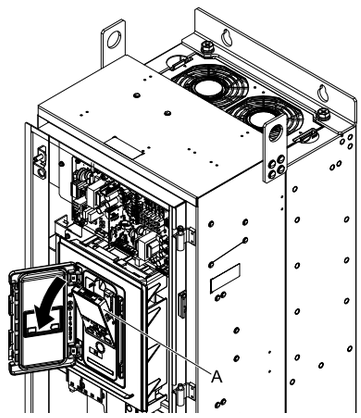
   NOTICE *Damage to Equipment. When the IP55/UL Type 12 keypad cover door is open, do not push the keypad key cover. If you push the keypad key cover, it will fall off.*



A - Tabs **B - Keypad key cover**

Figure 6.28 Open the IP55/UL Type 12 Keypad Cover Door

2. Remove the keypad from the drive.



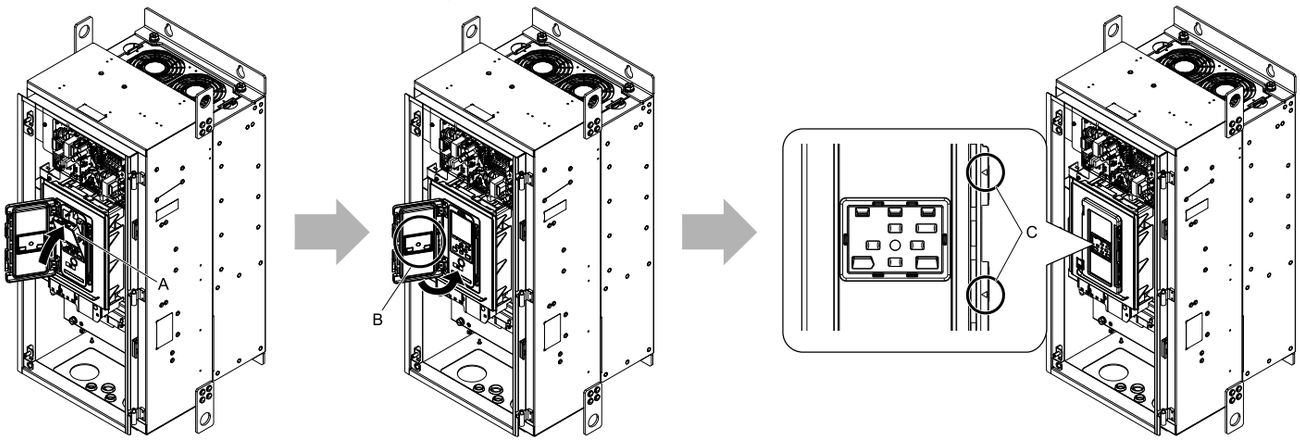
A - Keypad

Figure 6.29 Remove the Keypad

Close the Front Door

1. Wire the drive and other peripheral devices.

2. Open the IP55/UL Type 12 keypad cover door and reattach the keypad to its initial position, then close the door until the two tabs click into position.



A - Keypad
B - Keypad key cover
C - Tabs

Figure 6.30 Reattach the Keypad and Close the Door

3. Reverse the steps to close the front door.

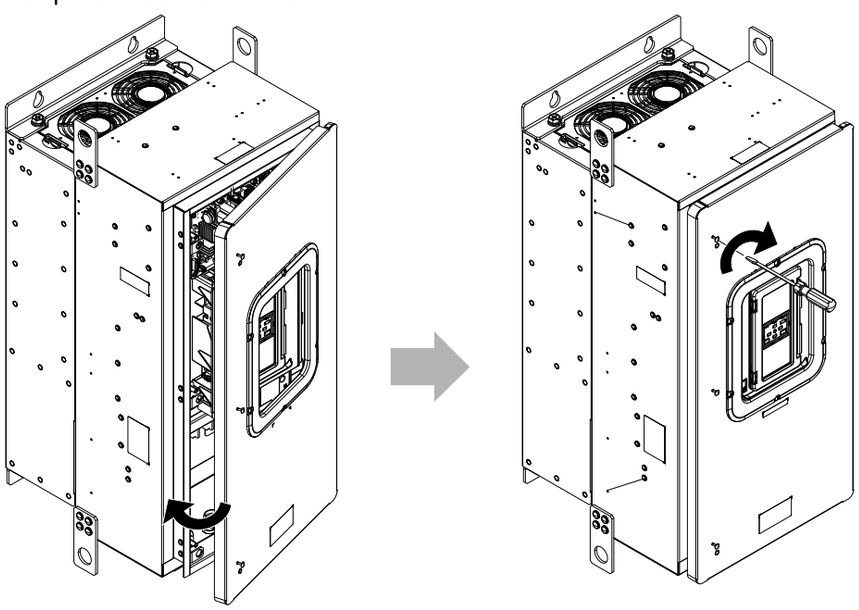


Figure 6.31 Close the Front Door

Note:
- Make sure that you did not pinch fingers, wires or signal lines between the front door and the drive before you close the door.
- Tighten the screws to a tightening torque of 0.98 N·m to 1.33 N·m (8.67 lbf·in to 11.77 lbf·in).

7 Electrical Installation

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

⚠ WARNING *Electrical Shock Hazard. De-energize the drive and wait 5 minutes minimum until the Charge LED turns off. Remove the front cover and terminal cover to do work on wiring, circuit boards, and other parts. Use terminals for their correct function only. Incorrect wiring, incorrect ground connections, and incorrect repair of protective covers can cause death or serious injury.*

⚠ WARNING *Electrical Shock Hazard. Correctly ground the drive before you turn on the EMC filter switch. If you touch electrical equipment that is not grounded, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Use the terminals for the drive only for their intended purpose. Refer to the technical manual for more information about the I/O terminals. Wiring and grounding incorrectly or modifying the cover may damage the equipment or cause injury.*

◆ Standard Connection Diagram

⚠ WARNING *Sudden Movement Hazard. Set the MFDI parameters before you close control circuit switches. Incorrect Run/Stop circuit sequence settings can cause serious injury or death from moving equipment.*

⚠ WARNING *Sudden Movement Hazard. Correctly wire the start/stop and safety circuits before you energize the drive. If you momentarily close a digital input terminal, it can start a drive that is programmed for 3-Wire control and cause serious injury or death from moving equipment.*

⚠ WARNING *Sudden Movement Hazard. When you use a 3-Wire sequence, set A1-03 = 3330 [Initialize Parameters = 3-Wire Initialization] and make sure that b1-17 = 0 [Run Command at Power Up = Disregard Existing RUN Command]. If you do not correctly set the drive parameters for 3-Wire operation before you energize the drive, the motor can suddenly rotate in reverse when you energize the drive.*

⚠ WARNING *Sudden Movement Hazard. Check the I/O signals and the external sequences for the drive before you set the Application Preset function. When you set the Application Preset function (A1-06 ≠ 0), it changes the I/O terminal functions for the drive and it can cause equipment to operate unusually. This can cause serious injury or death.*

⚠ WARNING *Fire Hazard. Install sufficient branch circuit short circuit protection as specified by applicable codes and this manual. The drive is suitable for circuits that supply not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (208 V Class), 480 Vac maximum (480 V Class). Incorrect branch circuit short circuit protection can cause serious injury or death.*

NOTICE *When the input voltage is 440 V or higher or the wiring distance is longer than 100 m (328 ft), make sure that the motor insulation voltage is sufficient or use an inverter-duty motor or vector-duty motor with reinforced insulation. Motor winding and insulation failure can occur.*

Note:

Do not connect the AC control circuit ground to the drive enclosure. Incorrect ground wiring can cause the control circuit to operate incorrectly.

■ Standard Drive Connection Diagram

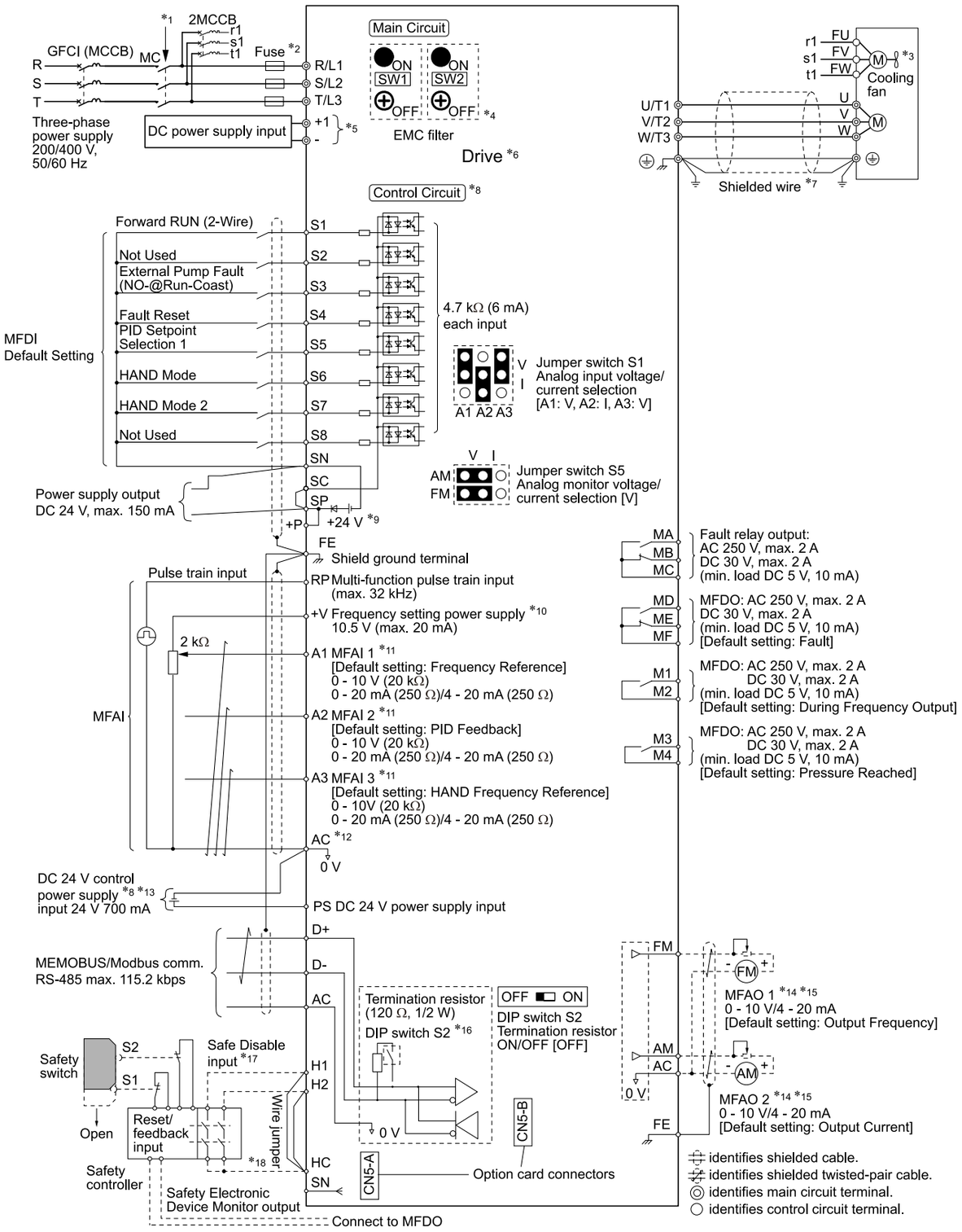


Figure 7.1 Standard Drive Connection Diagram

*1 Set the wiring sequence to de-energize the drive with the fault relay output. If the drive outputs a fault during fault restart when you use the fault restart function, set *L5-02 = 1 [Fault Contact at Restart Select = Always Active]* to de-energize the drive. Be careful when you use a cut-off sequence. The default setting for *L5-02* is *0 [Active Only when Not Restarting]*.

*2 Use branch circuit protection devices as recommended in this manual.
*3 Cooling fan wiring is not necessary for self-cooling motors.
*4 EMC filter switches are only available on drive models 2xxxC and 4xxxC with the built-in EMC filter for C2.

NOTICE *Damage to Equipment. When you use the drive with a non-grounding, high-resistance grounding, or asymmetric-grounding network, put the EMC Filter screw or screws in the OFF position to disable the built-in EMC filter. If you do not disable the built-in EMC filter, it will cause damage to the drive.*

*5 Connect DC power supply input to terminals - and +1.

⚠ WARNING *Fire Hazard. Only connect factory-recommended devices or circuits to drive terminals - and +1. Do not connect AC power to these terminals. Incorrect wiring can cause damage to the drive and serious injury or death from fire.*

*6 Refer to *Motor and Main Circuit Connections on page 32* and *Wiring the Control Circuit Terminal on page 69* for wiring.
*7 Use braided shield cable for the drive and motor wiring, or run the wiring through a metal conduit.
*8 Connect a 24 V power supply to terminals PS-AC to operate the control circuit while the main circuit power supply is OFF.
*9 To set the MFDI power supply (Sinking/Sourcing Mode or internal/external power supply), install or remove a jumper between terminals SC-SP or SC-SN depending on the application.

NOTICE *Damage to Equipment. Do not close the circuit between terminals SP-SN. If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.*

- Sinking Mode, Internal power supply: Install the jumper to close the circuit between terminals SC-SP.

  NOTICE *Damage to Equipment. Do not close the circuit between terminals SC-SN. If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.*

- Sourcing Mode, Internal power supply: Install the jumper to close the circuit between terminals SC-SN.

  NOTICE *Damage to Equipment. Do not close the circuit between terminals SC-SP. If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.*

- External power supply: Remove the jumper from the MFDI terminals. It is not necessary to close the circuit between terminals SC-SP and terminals SC-SN.

*10 The maximum output current capacity for terminal +V on the control circuit is 20 mA.

NOTICE *Damage to Equipment. Do not install a jumper between terminals +V and AC. A closed circuit between these terminals will cause damage to the drive.*

*11 Jumper switch S1 sets terminals A1, A2, and A3 for voltage or current input signal. The default setting for S1 is voltage input (“V” side) for A1 and A3 and current input (“I” side) for A2.
*12 **NOTICE** *Do not ground the AC control circuit terminals and only connect the AC terminals as specified by the product instructions. If you connect the AC terminals incorrectly, it can cause damage to the drive.*

*13 Connect the positive lead from an external 24 Vdc power supply to terminal PS and the negative lead to terminal AC.

NOTICE *Connect terminals PS and AC correctly for the 24 V power supply. If you connect the wires to the incorrect terminals, it will cause damage to the drive.*

*14 Use multi-function analog monitor outputs with analog frequency meters, ammeters, voltmeters, and wattmeters. Do not use monitor outputs with feedback-type signal devices.
*15 Jumper switch S5 sets terminal FM and AM for voltage or current output. The default setting for S5 is voltage output (“V” side).
*16 Set DIP switch S2 to “ON” to enable the termination resistor in the last drive in a MEMOBUS/Modbus network.
*17 Use only Sourcing Mode for Safe Disable input.
*18 Disconnect the jumpers between H1 and HC and H2 and HC to use the Safe Disable input.

◆ Main Circuit Terminal Functions

Refer to Table 7.1 for the functions of drive main circuit terminals.

Table 7.1 Main Circuit Terminal Functions

Terminal	Function
R/L1	Line side
S/L2	
T/L3	
U/T1	Load side
V/T2	
W/T3	

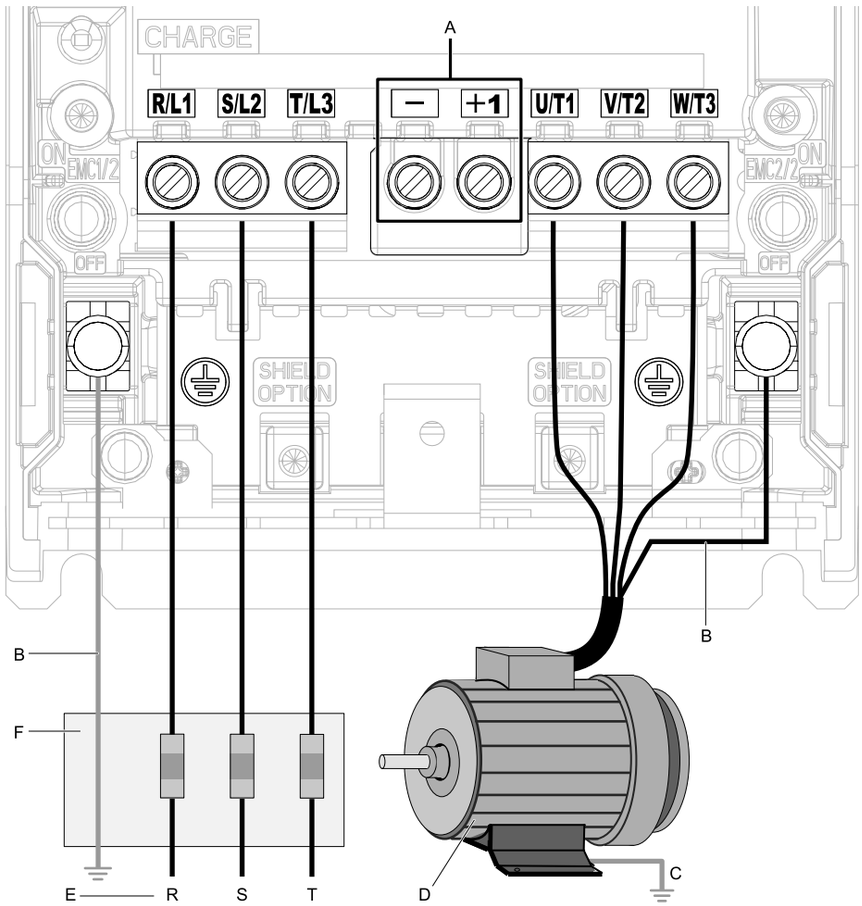
Terminal	Function
-	DC input terminal
+1	
⏚	Ground terminal

◆ Motor and Main Circuit Connections

⚠ WARNING *Electrical Shock Hazard. Do not connect terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, -, or +1 to the ground terminal. If you connect these terminals to earth ground, it can cause damage to the drive or serious injury or death.*

NOTICE *Incorrect Operation. Route motor wiring and power wiring in separate conduits or cable trays to decrease possible interference-related issues.*

■ Wiring the Main Circuit and Motor



Note:
The location of terminals are different for different drive models.

A - DC bus terminal
B - Connect to the drive ground terminal.
C - Ground the motor case.
D - Three-Phase Motor
E - Use R, S, T for input power supply.
F - Input Protection (Fuses or Circuit Breakers)

◆ Main Circuit Terminal Block Wiring

■ Wire Selection

Select the correct wires for main circuit wiring.

Refer to *Main Circuit Wire Gauges and Tightening Torques on page 160* for wire gauges and tightening torques as specified by European standards.

Refer to *Wire Gauge and Torque Specifications for UL Listing on page 33* for wire gauges and tightening torques as specified by UL standards.

Wire Selection Precautions

⚠ WARNING *Electrical Shock Hazard. Make sure that the protective ground wire complies with technical standards and local safety regulations. The IEC/EN 61800-5-1:2007 standard specifies that you must wire the power supply to automatically de-energize when the protective ground wire disconnects. You can also connect a protective ground wire that has a minimum cross-sectional area of 10mm² (copper wire) or 16 mm² (aluminum wire). For drive models on which you cannot use a protective ground wire of 10 mm² or more, install two protective ground wires that have the same cross-sectional area. If you do not obey the standards and regulations, it can cause serious injury or death. The leakage current of the drive will be more than 3.5 mA.*

Think about line voltage drop before you select wire gauges. Select wire gauges that drop the voltage by 2% or less of the rated voltage. Increase the wire gauge and the cable length when the risk of voltage drop increases. Calculate line voltage drop with this formula:

Line voltage drop (V) = $\sqrt{3}$ × wire resistance (Ω/km) × wiring distance (m) × motor rated current (A) × 10^{-3}.

Precautions during Wiring

Use terminals +1 and - to connect a regenerative converter or regenerative unit.

Wire Gauge and Torque Specifications for UL Listing

⚠ WARNING *Electrical Shock Hazard. Make sure that the protective ground wire complies with technical standards and local safety regulations. The IEC/EN 61800-5-1:2007 standard specifies that you must wire the power supply to automatically de-energize when the protective ground wire disconnects. You can also connect a protective ground wire that has a minimum cross-sectional area of 10mm² (copper wire) or 16 mm² (aluminum wire). For drive models on which you cannot use a protective ground wire of 10 mm² or more, install two protective ground wires that have the same cross-sectional area. If you do not obey the standards and regulations, it can cause serious injury or death. The leakage current of the drive will be more than 3.5 mA.*

Refer to *Three-Phase 208 V Class Wire Gauges and Torques on page 34* and *Three-Phase 480 V Class Wire Gauges and Torques on page 36* for the recommended wire gauges and tightening torques of the main circuit terminals.

Note:

The recommended wire gauges are based on drive continuous current ratings with 75 °C (167 °F) 600 V class copper wire. Assume these conditions:

- Ambient temperature: 40 °C (104 °F) or lower
- Wiring distance: 100 m (3281 ft) or shorter
- Normal Duty Rated current value

Screw Shapes

Table 7.2 Icons to Identify Screw Shapes

Icon	Screw Shape	Icon	Screw Shape
⊕	Phillips/slot combo (+/-)	⊖	Hex bolt (slotted)
⊖	Slotted (-)	⬡	Hex self-locking nut
✱	Pozidriv #2	④	Hex socket cap (WAF: 4 mm)
⊕	Hex bolt (cross-slotted)	⬡⬡	Hex bolt and hex self-locking nut

Three-Phase 208 V Class Wire Gauges and Torques

Model	Terminals	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil (mm²) *1	IP20 Applicable Gauge *2 AWG, kcmil (mm²) *1	Wire Stripping Length *3 mm	Terminal Screw Size and Shape	Tightening Torque N·m (lbf·in)
2011	R/L1, S/L2, T/L3	14	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	-, +1	14	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	⏚	12	14 - 8 (2.5 - 10)	-	-	M5 ⊕	2.0 - 2.5 (17.7 - 22.1)
2017	R/L1, S/L2, T/L3	12	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	10	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	-, +1	10	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (2.5 - 10)	-	-	M5 ⊕	2.0 - 2.5 (17.7 - 22.1)
2024	R/L1, S/L2, T/L3	10	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	-, +1	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (2.5 - 10)	-	-	M5 ⊕	2.0 - 2.5 (17.7 - 22.1)
2031	R/L1, S/L2, T/L3	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	-, +1	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (2.5 - 10)	-	-	M5 ⊕	2.0 - 2.5 (17.7 - 22.1)
2046	R/L1, S/L2, T/L3	8	14 - 4 (2.5 - 25)	-	18	M5 ⊖	4.1 - 4.5 (36 - 40)
	U/T1, V/T2, W/T3	6	14 - 4 (2.5 - 25)	-	18	M5 ⊖	4.1 - 4.5 (36 - 40)
	-, +1	6	14 - 4 (2.5 - 25)	-	18	M5 ⊖	4.1 - 4.5 (36 - 40)
	⏚	8	14 - 4 (2.5 - 25)	-	-	M6 ⊕	4.0 - 5.0 (35.4 - 44.3)
2059	R/L1, S/L2, T/L3	4	14 - 4 (2.5 - 25)	-	18	M5 ⊖	4.1 - 4.5 (36 - 40)
	U/T1, V/T2, W/T3	4	14 - 4 (2.5 - 25)	-	18	M5 ⊖	4.1 - 4.5 (36 - 40)
	-, +1	4	14 - 4 (2.5 - 25)	-	18	M5 ⊖	4.1 - 4.5 (36 - 40)
	⏚	6	14 - 4 (2.5 - 25)	-	-	M6 ⊕	4.0 - 5.0 (35.4 - 44.3)

Model	Terminals	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil (mm²) *1	IP20 Applicable Gauge *2 AWG, kcmil (mm²) *1	Wire Stripping Length *3 mm	Terminal Screw Size and Shape	Tightening Torque N·m (lbf·in)
2075	R/L1, S/L2, T/L3	4	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	U/T1, V/T2, W/T3	3 or 2	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	-, +1	2	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	⏚	6	8 - 2/0 (10 - 70)	-	-	M8	9.0 - 11 (79.7 - 97.4)
2088	R/L1, S/L2, T/L3	3 or 2	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	U/T1, V/T2, W/T3	2	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	-, +1	1	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	⏚	6	8 - 2/0 (10 - 70)	-	-	M8	9.0 - 11 (79.7 - 97.4)
2114	R/L1, S/L2, T/L3	1/0	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	U/T1, V/T2, W/T3	1/0	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	-, +1	2/0	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	⏚	6	8 - 2/0 (10 - 70)	-	-	M8	9.0 - 11 (79.7 - 97.4)
2143	R/L1, S/L2, T/L3	2/0	6 - 4/0 (16 - 95)	-	-	M8	13.5 - 15 (119.5 - 132.8)
	U/T1, V/T2, W/T3	3/0	6 - 4/0 (16 - 95)	-	-	M8	13.5 - 15 (119.5 - 132.8)
	-, +1	3/0	6 - 4/0 (16 - 95)	-	-	M8	13.5 - 15 (119.5 - 132.8)
	⏚	4	6 - 4/0 (16 - 95)	-	-	M8	9.0 - 11 (79.7 - 97.4)
2169	R/L1, S/L2, T/L3	3/0	6 - 4/0 (16 - 95)	-	-	M8	13.5 - 15 (119.5 - 132.8)
	U/T1, V/T2, W/T3	4/0	6 - 4/0 (16 - 95)	-	-	M8	13.5 - 15 (119.5 - 132.8)
	-, +1	1/0 × 2	6 - 4/0 (16 - 95)	-	-	M8	13.5 - 15 (119.5 - 132.8)
	⏚	4	6 - 4/0 (16 - 95)	-	-	M8	9.0 - 11 (79.7 - 97.4)
2211	R/L1, S/L2, T/L3	1/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	U/T1, V/T2, W/T3	1/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	-, +1	2/0 × 2	2 - 250 × 2P (35 - 120 × 2P)	4/0 - 250 × 2P (95 - 120 × 2P)	-	M10	18 - 20 (159.3 - 177)
	⏚	3 or 2	4 - 350 (25 - 185)	-	-	M10	18 - 23 (159 - 204)

Model	Terminals	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil (mm²) *1	IP20 Applicable Gauge *2 AWG, kcmil (mm²) *1	Wire Stripping Length *3 mm	Terminal Screw Size and Shape	Tightening Torque N·m (lbf·in)
2273	R/L1, S/L2, T/L3	2/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	U/T1, V/T2, W/T3	2/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	-, +1	4/0 × 2	2 - 250 × 2P (35 - 120 × 2P)	4/0 - 250 × 2P (95 - 120 × 2P)	-	M10	18 - 20 (159.3 - 177)
	⏚	2	4 - 350 (25 - 185)	-	-	M10	18 - 23 (159 - 204)
2343	R/L1, S/L2, T/L3	4/0 × 2	2/0 - 300 × 2P (70 - 150 × 2P)	250 - 300 × 2P (120 - 150 × 2P)	-	M12	31.5 - 35 (279 - 310)
	U/T1, V/T2, W/T3	4/0 × 2	2/0 - 300 × 2P (70 - 150 × 2P)	250 - 300 × 2P (120 - 150 × 2P)	-	M12	31.5 - 35 (279 - 310)
	-, +1	250 × 2	4/0 - 400 × 2P (95 - 185 × 2P)	300 - 400 × 2P (150 - 185 × 2P)	-	M12	31.5 - 35 (279 - 310)
	⏚	1/0	1 - 350 (50 - 185)	-	-	M12	32 - 40 (283 - 354)
2396	R/L1, S/L2, T/L3	250 × 2	2/0 - 300 × 2P (70 - 150 × 2P)	250 - 300 × 2P (120 - 150 × 2P)	-	M12	31.5 - 35 (279 - 310)
	U/T1, V/T2, W/T3	250 × 2	2/0 - 300 × 2P (70 - 150 × 2P)	250 - 300 × 2P (120 - 150 × 2P)	-	M12	31.5 - 35 (279 - 310)
	-, +1	350 × 2	4/0 - 400 × 2P (95 - 185 × 2P)	300 - 400 × 2P (150 - 185 × 2P)	-	M12	31.5 - 35 (279 - 310)
	⏚	1/0	1 - 350 (50 - 185)	-	-	M12	32 - 40 (283 - 354)

*1 The metric wire gauge values are provided as reference information from equivalent AWG sizes and not exactly the same sizes as the AWG/kcmil values. Obey local safety regulations for wire sizes and make sure that the ferrule or crimp terminals are correct for your size.
*2 For IP20 protection, use wires that are in the range of applicable gauges.
*3 Remove insulation from the ends of wires to expose the length of wire shown.

Three-Phase 480 V Class Wire Gauges and Torques

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil (mm²) *1	IP20 Applicable Gauge *2 AWG, kcmil (mm²) *1	Wire Stripping Length *3 mm	Terminal Screw Size and Shape	Tightening Torque N·m (lbf·in)
4005	R/L1, S/L2, T/L3	14	14 - 8 (2.5 - 10)	-	10	M4	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 8 (2.5 - 10)	-	10	M4	1.5 - 1.7 (13.5 - 15)
	-, +1	14	14 - 8 (2.5 - 10)	-	10	M4	1.5 - 1.7 (13.5 - 15)
	⏚	14	14 - 8 (2.5 - 10)	-	-	M5	2.0 - 2.5 (17.7 - 22.1)
4008	R/L1, S/L2, T/L3	14	14 - 8 (2.5 - 10)	-	10	M4	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 8 (2.5 - 10)	-	10	M4	1.5 - 1.7 (13.5 - 15)
	-, +1	14	14 - 8 (2.5 - 10)	-	10	M4	1.5 - 1.7 (13.5 - 15)
	⏚	14	14 - 8 (2.5 - 10)	-	-	M5	2.0 - 2.5 (17.7 - 22.1)

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil (mm²) *1	IP20 Applicable Gauge *2 AWG, kcmil (mm²) *1	Wire Stripping Length *3 mm	Terminal Screw Size and Shape	Tightening Torque N·m (lbf·in)
4011	R/L1, S/L2, T/L3	14	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	14	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	-, +1	14	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	⏚	12	14 - 8 (2.5 - 10)	-	-	M5 ⊕	2.0 - 2.5 (17.7 - 22.1)
4014	R/L1, S/L2, T/L3	14	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	12	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	-, +1	12	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (2.5 - 10)	-	-	M5 ⊕	2.0 - 2.5 (17.7 - 22.1)
4021	R/L1, S/L2, T/L3	10	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	10	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	-, +1	10	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (2.5 - 10)	-	-	M5 ⊕	2.0 - 2.5 (17.7 - 22.1)
4027	R/L1, S/L2, T/L3	10	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	-, +1	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (2.5 - 10)	-	-	M5 ⊕	2.0 - 2.5 (17.7 - 22.1)
4034	R/L1, S/L2, T/L3	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	U/T1, V/T2, W/T3	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	-, +1	8	14 - 8 (2.5 - 10)	-	10	M4 ⊖	1.5 - 1.7 (13.5 - 15)
	⏚	10	14 - 8 (2.5 - 10)	-	-	M5 ⊕	2.0 - 2.5 (17.7 - 22.1)
4040	R/L1, S/L2, T/L3	8	14 - 4 (2.5 - 25)	-	18	M5 ⊖	4.1 - 4.5 (36 - 40)
	U/T1, V/T2, W/T3	8	14 - 4 (2.5 - 25)	-	18	M5 ⊖	4.1 - 4.5 (36 - 40)
	-, +1	6	14 - 4 (2.5 - 25)	-	18	M5 ⊖	4.1 - 4.5 (36 - 40)
	⏚	8	14 - 4 (2.5 - 25)	-	-	M6 ⊕	4.0 - 5.0 (35.4 - 44.3)

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil (mm²) *1	IP20 Applicable Gauge *2 AWG, kcmil (mm²) *1	Wire Stripping Length *3 mm	Terminal Screw Size and Shape	Tightening Torque N·m (lbf·in)
4052	R/L1, S/L2, T/L3	6	14 - 4 (2.5 - 25)	-	18	M5	4.1 - 4.5 (36 - 40)
	U/T1, V/T2, W/T3	6	14 - 4 (2.5 - 25)	-	18	M5	4.1 - 4.5 (36 - 40)
	-, +1	4	14 - 4 (2.5 - 25)	-	18	M5	4.1 - 4.5 (36 - 40)
	⏚	8	14 - 4 (2.5 - 25)	-	-	M6	4.0 - 5.0 (35.4 - 44.3)
4065	R/L1, S/L2, T/L3	4	14 - 4 (2.5 - 25)	-	18	M5	4.1 - 4.5 (36 - 40)
	U/T1, V/T2, W/T3	4	14 - 4 (2.5 - 25)	-	18	M5	4.1 - 4.5 (36 - 40)
	-, +1	4	14 - 4 (2.5 - 25)	-	18	M5	4.1 - 4.5 (36 - 40)
	⏚	6	14 - 4 (2.5 - 25)	-	-	M6	4.0 - 5.0 (35.4 - 44.3)
4077	R/L1, S/L2, T/L3	4	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	U/T1, V/T2, W/T3	3 or 2	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	-, +1	2	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	⏚	6	8 - 2/0 (10 - 70)	-	-	M8	9.0 - 11 (79.7 - 97.4)
4096	R/L1, S/L2, T/L3	2	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	U/T1, V/T2, W/T3	1	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	-, +1	1	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	⏚	6	8 - 2/0 (10 - 70)	-	-	M8	9.0 - 11 (79.7 - 97.4)
4124	R/L1, S/L2, T/L3	1/0	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	U/T1, V/T2, W/T3	2/0	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	-, +1	2/0	8 - 2/0 (10 - 70)	-	-	M8	5.4 - 6.0 (47.8 - 53.1)
	⏚	4	8 - 2/0 (10 - 70)	-	-	M8	9.0 - 11 (79.7 - 97.4)
4156	R/L1, S/L2, T/L3	2/0	6 - 4/0 (16 - 95)	-	-	M8	13.5 - 15 (119.5 - 132.8)
	U/T1, V/T2, W/T3	3/0	6 - 4/0 (16 - 95)	-	-	M8	13.5 - 15 (119.5 - 132.8)
	-, +1	4/0	6 - 4/0 (16 - 95)	-	-	M8	13.5 - 15 (119.5 - 132.8)
	⏚	4	6 - 4/0 (16 - 95)	-	-	M8	9.0 - 11 (79.7 - 97.4)

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil (mm²) *1	IP20 Applicable Gauge *2 AWG, kcmil (mm²) *1	Wire Stripping Length *3 mm	Terminal Screw Size and Shape	Tightening Torque N·m (lbf·in)
4180	R/L1, S/L2, T/L3	1/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	U/T1, V/T2, W/T3	1/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	-, +1	1/0 × 2	2 - 250 × 2P (35 - 120 × 2P)	4/0 - 250 × 2P (95 - 120 × 2P)	-	M10	18 - 20 (159.3 - 177)
	⏚	3 or 2	4 - 350 (25 - 185)	-	-	M10	18 - 23 (159 - 204)
4240	R/L1, S/L2, T/L3	1/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	U/T1, V/T2, W/T3	1/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	-, +1	3/0 × 2	2 - 250 × 2P (35 - 120 × 2P)	4/0 - 250 × 2P (95 - 120 × 2P)	-	M10	18 - 20 (159.3 - 177)
	⏚	2	4 - 350 (25 - 185)	-	-	M10	18 - 23 (159 - 204)
4302	R/L1, S/L2, T/L3	3/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	U/T1, V/T2, W/T3	3/0 × 2	3 - 4/0 × 2P (25 - 95 × 2P)	2/0 - 4/0 × 2P (70 - 95 × 2P)	-	M10	18 - 20 (159.3 - 177)
	-, +1	4/0 × 2	2 - 250 × 2P (35 - 120 × 2P)	4/0 - 250 × 2P (95 - 120 × 2P)	-	M10	18 - 20 (159.3 - 177)
	⏚	1/0	1 - 350 (50 - 185)	-	-	M10	18 - 23 (159 - 204)
4361	R/L1, S/L2, T/L3	4/0 × 2	2/0 - 300 × 2P (70 - 150 × 2P)	250 - 300 × 2P (120 - 150 × 2P)	-	M12	31.5 - 35 (279 - 310)
	U/T1, V/T2, W/T3	4/0 × 2	2/0 - 300 × 2P (70 - 150 × 2P)	250 - 300 × 2P (120 - 150 × 2P)	-	M12	31.5 - 35 (279 - 310)
	-, +1	300 × 2	4/0 - 400 × 2P (95 - 185 × 2P)	300 - 400 × 2P (150 - 185 × 2P)	-	M12	31.5 - 35 (279 - 310)
	⏚	1/0	1 - 350 (50 - 185)	-	-	M12	32 - 40 (283 - 354)
4414	R/L1, S/L2, T/L3	250 × 2	2/0 - 300 × 2P (70 - 150 × 2P)	250 - 300 × 2P (120 - 150 × 2P)	-	M12	31.5 - 35 (279 - 310)
	U/T1, V/T2, W/T3	300 × 2	2/0 - 300 × 2P (70 - 150 × 2P)	250 - 300 × 2P (120 - 150 × 2P)	-	M12	31.5 - 35 (279 - 310)
	-, +1	350 × 2	4/0 - 400 × 2P (95 - 185 × 2P)	300 - 400 × 2P (150 - 185 × 2P)	-	M12	31.5 - 35 (279 - 310)
	⏚	1/0	1 - 350 (50 - 185)	-	-	M12	32 - 40 (283 - 354)
4477	R/L1, S/L2, T/L3	3/0 × 4	2/0 - 300 × 4P (70 - 150 × 4P)	250 - 300 × 4P (120 - 150 × 4P)	-	M12	31.5 - 35 (279 - 310)
	U/T1, V/T2, W/T3	3/0 × 4	2/0 - 300 × 4P (70 - 150 × 4P)	250 - 300 × 4P (120 - 150 × 4P)	-	M12	31.5 - 35 (279 - 310)
	-, +1	4/0 × 4	3/0 - 400 × 4P (95 - 185 × 4P)	300 - 400 × 4P (150 - 185 × 4P)	-	M12	31.5 - 35 (279 - 310)
	⏚	2/0	2/0 - 300 (70 - 150)	-	-	M12	32 - 40 (283 - 354)

Model	Terminal	Recommended Gauge AWG, kcmil	Applicable Gauge AWG, kcmil (mm²) *1	IP20 Applicable Gauge *2 AWG, kcmil (mm²) *1	Wire Stripping Length *3 mm	Terminal Screw Size and Shape	Tightening Torque N·m (lbf·in)
4515	R/L1, S/L2, T/L3	4/0 × 4	2/0 - 300 × 4P (70 - 150 × 4P)	250 - 300 × 4P (120 - 150 × 4P)	-	M12 ⬡	31.5 - 35 (279 - 310)
	U/T1, V/T2, W/T3	4/0 × 4	2/0 - 300 × 4P (70 - 150 × 4P)	250 - 300 × 4P (120 - 150 × 4P)	-	M12 ⬡	31.5 - 35 (279 - 310)
	-, +1	250 × 4	3/0 - 400 × 4P (95 - 185 × 4P)	300 - 400 × 4P (150 - 185 × 4P)	-	M12 ⬡	31.5 - 35 (279 - 310)
	⏚	2/0	2/0 - 300 (70 - 150)	-	-	M12 ⬭	32 - 40 (283 - 354)
4590	R/L1, S/L2, T/L3	4/0 × 4	2/0 - 300 × 4P (70 - 150 × 4P)	250 - 300 × 4P (120 - 150 × 4P)	-	M12 ⬡	31.5 - 35 (279 - 310)
	U/T1, V/T2, W/T3	250 × 4	2/0 - 300 × 4P (70 - 150 × 4P)	250 - 300 × 4P (120 - 150 × 4P)	-	M12 ⬡	31.5 - 35 (279 - 310)
	-, +1	300 × 4	3/0 - 400 × 4P (95 - 185 × 4P)	300 - 400 × 4P (150 - 185 × 4P)	-	M12 ⬡	31.5 - 35 (279 - 310)
	⏚	3/0	2/0 - 300 (70 - 150)	-	-	M12 ⬭	32 - 40 (283 - 354)
4720	R/L1, S/L2, T/L3	300 × 4	2/0 - 300 × 4P (70 - 150 × 4P)	250 - 300 × 4P (120 - 150 × 4P)	-	M12 ⬡	31.5 - 35 (279 - 310)
	U/T1, V/T2, W/T3	300 × 4	2/0 - 300 × 4P (70 - 150 × 4P)	250 - 300 × 4P (120 - 150 × 4P)	-	M12 ⬡	31.5 - 35 (279 - 310)
	-, +1	400 × 4	3/0 - 400 × 4P (95 - 185 × 4P)	300 - 400 × 4P (150 - 185 × 4P)	-	M12 ⬡	31.5 - 35 (279 - 310)
	⏚	4/0	2/0 - 300 (70 - 150)	-	-	M12 ⬭	32 - 40 (283 - 354)

*1 The metric wire gauge values are provided as reference information from equivalent AWG sizes and not exactly the same sizes as the AWG/kcmil values. Obey local safety regulations for wire sizes and make sure that the ferrule or crimp terminals are correct for your size.
*2 For IP20 protection, use wires that are in the range of applicable gauges.
*3 Remove insulation from the ends of wires to expose the length of wire shown.

◆ Main Circuit Terminal Block Wiring Procedure

⚠ DANGER *Electrical Shock Hazard. Do not examine, connect, or disconnect wiring on an energized drive. Before servicing, disconnect all power to the equipment and wait for the time specified on the warning label at a minimum. The internal capacitor stays charged after the drive is de-energized. The charge indicator LED extinguishes when the DC bus voltage decreases below 50 Vdc. When all indicators are OFF, remove the covers before measuring for dangerous voltages to make sure that the drive is safe. If you do work on the drive when it is energized, it will cause serious injury or death from electrical shock.*

⚠ WARNING *Electrical Shock Hazard. Make sure that there is an electrical bond between the metallic conduit and the metallic conduit mounting bracket after installation is complete. If there is not an electrical bond, it can cause injury or death from electrical shock.*

The procedures to wire the main circuit terminal block are different for different drive models. Refer to Table 7.3 for procedures by drive model.

Table 7.3 Types of Wiring Procedure for the Main Circuit Terminal Block

Model	IP20/UL Open Type or IP20/UL Type 1 Models: 2xxxxB/F/W and 4xxxxB/F/W		IP55/UL Type 12 Models: 2xxxxV and 4xxxxV	
	Procedure	Reference	Procedure	Reference
2011 - 2059 4005 - 4065	Procedure A	43	Procedure E	50
2075 - 2114 4077 - 4096	Procedure B	44	Procedure F	51
4124				

Model	IP20/UL Open Type or IP20/UL Type 1 Models: 2xxxxB/F/W and 4xxxxB/F/W		IP55/UL Type 12 Models: 2xxxxV and 4xxxxV	
	Procedure	Reference	Procedure	Reference
2143, 2169 4156	Procedure C	46	Procedure G	53
2211 - 2296 4180 - 4720	Procedure D	48	-	

■ Notes on Wiring the Main Circuit Terminal Block of Models 2011 to 2059 and 4005 to 4065

Read these safety messages and notes before you wire the main circuit terminal block.

⚠ WARNING *Fire Hazard. Do not use bent or crushed wires. Remove the damaged end of the wire before you use it. Incorrect connections can cause death or serious injury from fire.*

⚠ WARNING *Fire Hazard. If you use stranded wire, make sure that all of the wire strands are in the connection. Also, do not twist the stranded wire too much. Incorrect connections can cause death or serious injury from fire.*

NOTICE *Do not solder stranded wire. Soldered wire connections can become loose over time and cause unsatisfactory drive performance.*

NOTICE *If you use power tools to tighten the terminal screws, use a low speed setting (300 min^{-1} (r/min) to 400 min^{-1} (r/min)). High speeds can cause damage to the terminal screws.*

NOTICE *Do not tighten the terminal screws at an angle of 5 degrees or more. Incorrect positioning can cause damage to the terminal screws.*

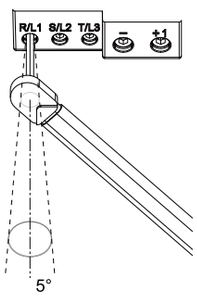


Figure 7.2 Permitted Angle

Note:
- Use UL Listed vinyl-coated insulated copper wires for operation with a continuous maximum permitted temperature of 75 °C at 600 V.
- Remove all unwanted objects that are near the terminal block connections.
- Remove the insulation from the connection wires to the wire stripping lengths shown in the manual.
- Put the wire all the way into the terminal block. Remove the insulation from the wire to the recommended wire stripping length to fit the wire with insulation in the plastic housing.
- Use a torque driver, torque ratchet, or torque wrench for the screws. A slotted driver or a hex tool will be necessary to wire the screw clamp terminal. Use applicable tools as specified by the recommended conditions in the product manual.
- Users can purchase wiring tools from Yaskawa. Contact Yaskawa or your nearest sales representative for more information.
- Wire gauges on existing drive models to be replaced may not match wire gauge ranges on new drives. Contact Yaskawa or your nearest sales representative for more information about the connection procedures.
- Put the bit all the way into the hex socket to tighten the hex socket cap screw.
- When tightening slotted screws, hold the straight-edge screwdriver perpendicularly to the screw. Take care to ensure that the tip of the straight-edge screwdriver is aligned with the screw groove.

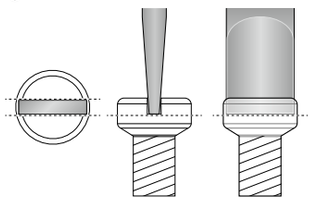
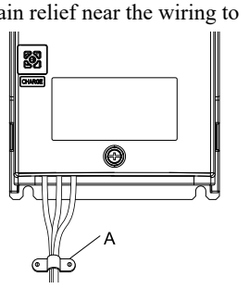


Figure 7.3 Tightening Slotted Screws

- After connecting the wires to the terminal block, lightly pull on the wires to make sure that they do not come out of the terminals.
- Remove the correct section of the wiring cover to make wiring easier.
- Do not let strain on the wiring cause damage. Use a strain relief near the wiring to release the tension. Refer to Figure 7.4 for an example.



A - Cable clamp

Figure 7.4 Strain Relief Example

Table 7.4 Recommended Wiring Tools

Screw Size and Shape	Adapter	Bit Model Manufacturer: PHOENIX CONTACT	Torque Driver Model (Adjustable Tightening Torque)
M3.5 ✱	Pozidriv screw driver #2	-	-
M4 ⊖	Bit	SF-BIT-SL 1,0X4,0-70	TSD-M 3NM (0.2 - 3 N·m (1.8 - 26.6 lbf·in))
M5 *1 ⊖	Bit	SF-BIT-SL 1,2X6,5-70	TSD-M 3NM (0.2 - 3 N·m (1.8 - 26.6 lbf·in))
M5 ✱	Pozidriv screw driver #2	-	-

*1 For M5 screw size and the tightening torque is more than 3 N·m, use a torque wrench with the recommended bit.

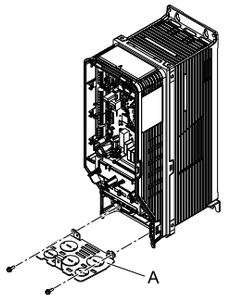
■ Notes on Wiring the Main Circuit Terminal Block of Models 2075 to 2114 and 4077 to 4124

Note:
- After the wiring, do not twist or shake the electrical wires too much.
- Be sure to use only wires with the correct size, stripped wire length, and tightening torque as specified by Yaskawa.
- Use tools that fit the shape of the screw head to tighten and loosen the terminal block screws.
- Make sure that there are no loose stranded wires or frayed wires after wiring is complete.

■ Wiring the Main Circuit Terminal Block Using Procedure A

Main Circuit Terminal Block Wiring Procedure

1. Remove the keypad and front cover.
2. Remove the screws that attach the conduit bracket and remove the conduit bracket from the drive.

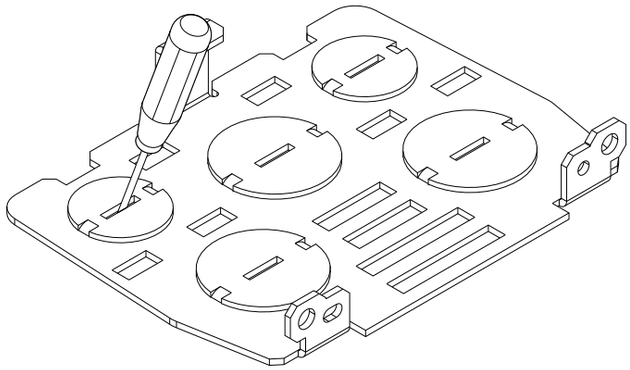


A - Conduit bracket

Figure 7.5 Remove the Conduit Bracket

3. Put the end of a straight-edge screwdriver into the center hole and move it up and down to remove the knock-out hole.

   ⚠ WARNING *Injury to Personnel. Carefully move the screwdriver to remove the knock-out holes. If you use too much pressure on the circular metal plates, they can eject and cause injury.*



4. Use a file to make the rough surface of the knock-out hole edge smooth.
5. Put the conduit bracket in its initial position.

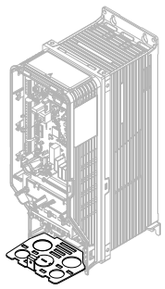


Figure 7.6 Reattach the Conduit Bracket

6. Put the ends of prepared wires through the conduits and into the terminal block, then tighten the terminal screws to the specified torque.

Note:
- When you use terminals - and +1 and these terminals have covers, remove them to install the wire.
- Use conduits to keep the IP20 protection level and to prevent damage to the wires. To comply with UL standards, you must use conduits for wiring.

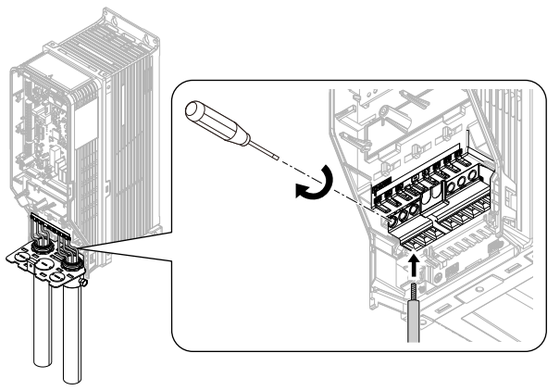


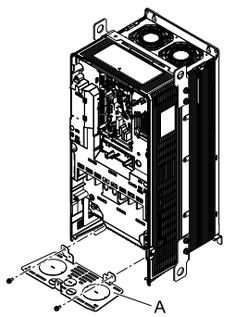
Figure 7.7 Install the Electrical Wires

7. Install the front cover and the keypad to their initial positions.

■ Wiring the Main Circuit Terminal Block Using Procedure B

Main Circuit Terminal Block Wiring Procedure

1. Remove the keypad and front cover.
2. Remove the screws that attach the conduit bracket and remove the conduit bracket from the drive.

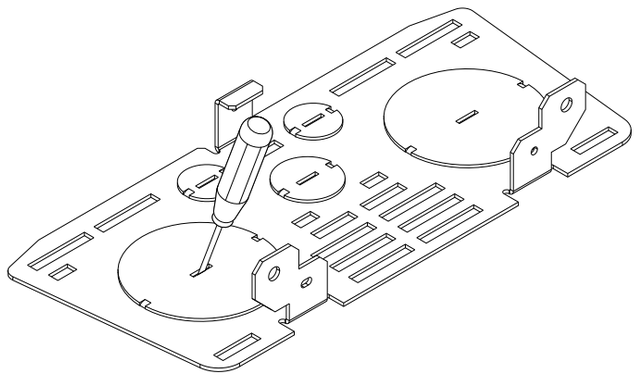


A - Conduit bracket

Figure 7.8 Remove the Conduit Bracket

3. Put the end of a straight-edge screwdriver into the center hole and move it up and down to remove the knock-out hole.

   ⚠ WARNING *Injury to Personnel. Carefully move the screwdriver to remove the knock-out holes. If you use too much pressure on the circular metal plates, they can eject and cause injury.*



4. Use a file to make the rough surface of the knock-out hole edge smooth.

5. Put the conduit bracket in its initial position.

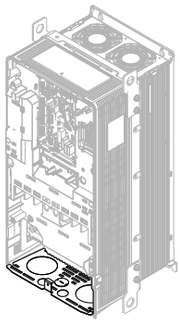
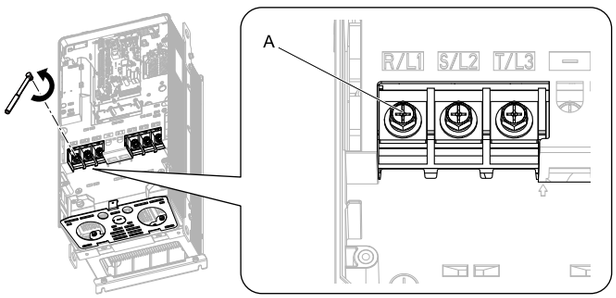


Figure 7.9 Reattach the Conduit Bracket

6. Remove the terminal block bolts.



A - Bolt

Figure 7.10 Remove the Terminal Block Bolts

7. Put the ends of wires with closed-loop crimp terminals through the conduits.

Note:

- When you use terminals - and +1 and these terminals have covers, remove them to install the wire.
- Use conduits to keep the IP20 protection level and to prevent damage to the wires. To comply with UL standards, you must use conduits for wiring.

8. Align the closed-loop crimp terminals with the bolt holes on main circuit terminal block and attach the crimp terminal to the main circuit terminal block.

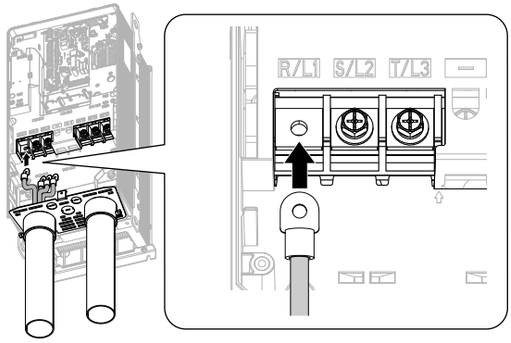


Figure 7.11 Install the Electrical Wires

9. Tighten the bolts to the specified torque.

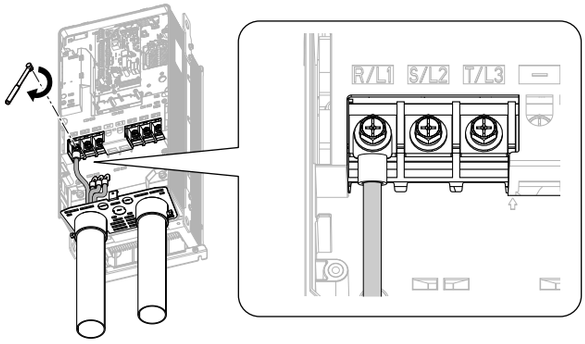


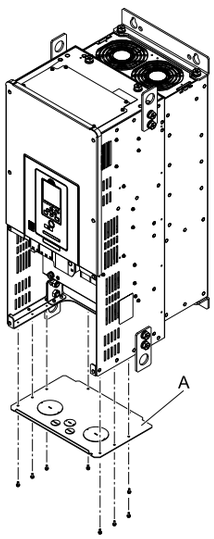
Figure 7.12 Tighten the Terminal Block Bolts

10. Put the terminal cover back in its initial position.

■ Wiring the Main Circuit Terminal Block Using Procedure C

Main Circuit Terminal Block Wiring Procedure

1. Remove the terminal cover.
2. Remove the screws that attach the conduit bracket and remove the conduit bracket from the drive.

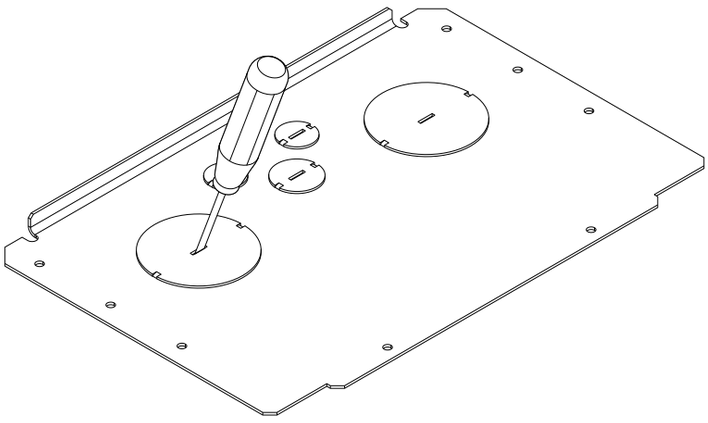


A - Conduit bracket

Figure 7.13 Remove the Conduit Bracket

3. Put the end of a straight-edge screwdriver into the center hole and move it up and down to remove the knock-out hole.

⚠ WARNING *Injury to Personnel. Carefully move the screwdriver to remove the knock-out holes. If you use too much pressure on the circular metal plates, they can eject and cause injury.*



4. Use a file to make the rough surface of the knock-out hole edge smooth.
5. Put the conduit bracket in its initial position.

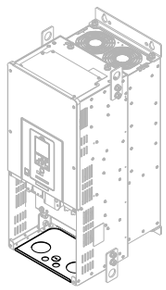
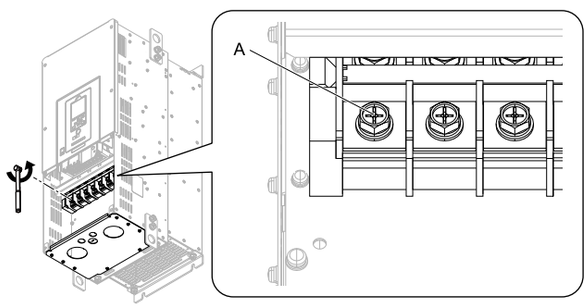


Figure 7.14 Reattach the Conduit Bracket

6. Remove the terminal block bolts.



A - Bolt

Figure 7.15 Remove the Terminal Block Bolts

7. Put the ends of wires with closed-loop crimp terminals through the conduits.

Note:

Use conduits to keep the IP20 protection level and to prevent damage to the wires. To comply with UL standards, you must use conduits for wiring.

8. Align the closed-loop crimp terminals with the bolt holes on main circuit terminal block and attach the crimp terminal to the main circuit terminal block.

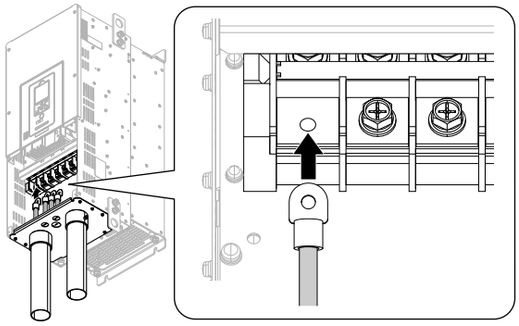


Figure 7.16 Install the Electrical Wires

9. Tighten the bolts to the specified torque.

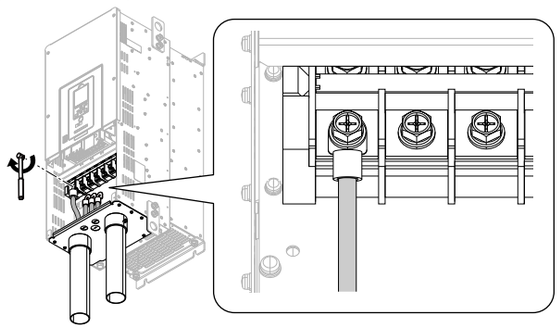


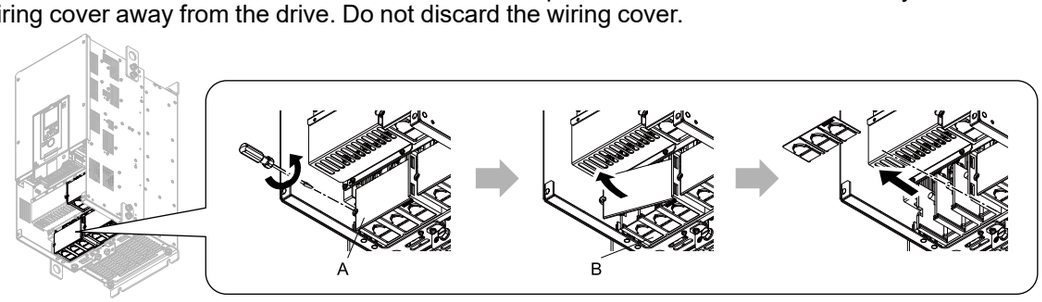
Figure 7.17 Tighten the Terminal Block Bolts

10. Put the terminal cover back in its initial position.

■ Wiring the Main Circuit Terminal Block Using Procedure D

Main Circuit Terminal Block Wiring Procedure

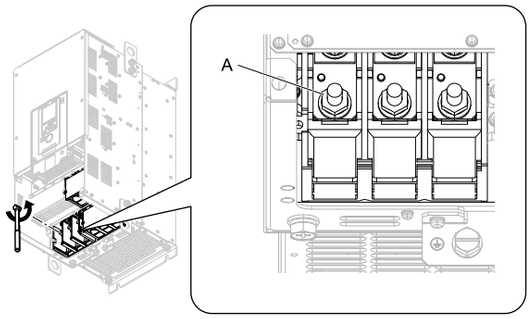
1. Remove the terminal cover.
2. Remove the screws on the terminal block cover and pull the terminal block cover away from the drive. Pull the wiring cover away from the drive. Do not discard the wiring cover.



A - Terminal block cover **B - Wiring cover**

Figure 7.18 Remove the Wiring Cover

3. Remove the terminal block nuts.



A - Nut

Figure 7.19 Remove the Terminal Block Nuts

4. Put the ends of wires with closed-loop crimp terminals on the main circuit terminal block studs.

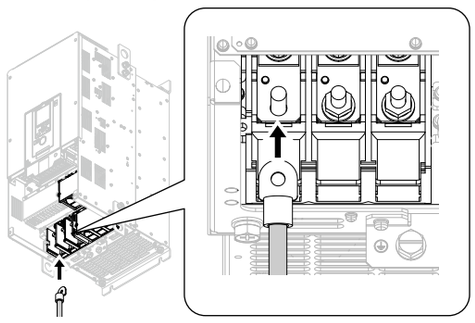


Figure 7.20 Install the Electrical Wires

5. Tighten the nuts to the specified torque.

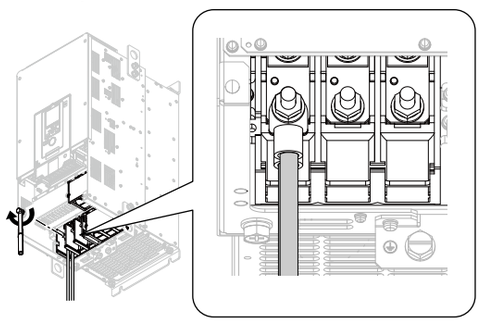
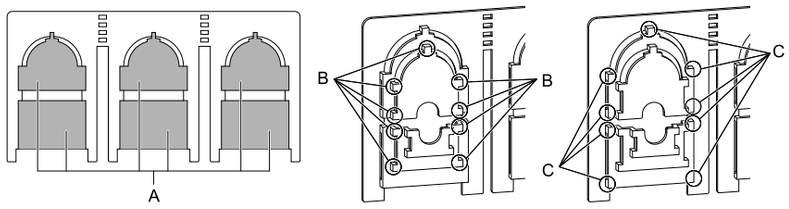


Figure 7.21 Tighten the Terminal Block Nuts

6. Check the signal from the wired terminal and use a diagonal-cutting pliers to remove areas of the wiring cover cutaway section.
   Cut the correct areas shown in Figure 7.22 for your wire gauges.



A - Cutaway section
B - Use a diagonal-cutting pliers to clip this area for small wires.
C - Use a diagonal-cutting pliers to clip this area for large wires.

Figure 7.22 Clip the Cutaway Section of the Wiring Cover

Note:
- Different drive models have different wiring covers.
- Remove only the areas of the wiring cover that apply to the wired terminals. If you remove areas that do not apply to the wired terminal, the drive will not keep its IP20 protective level.
- Make sure that you hold the cutaway section tightly when you remove pieces of the cutaway section. Pieces of the cutaway section can fly out and cause injury.
- Remove sharp edges from the wiring cover cutaway section to prevent damage to the wires.
- If you use the wiring cover correctly, but you use wires that are not specified by Yaskawa, the drive will not necessarily keep its IP20 protective level.
- When you use the recommended gauge for the electrical wires, it is not necessary to attach the wiring cover of the main circuit power input terminal and the drive output terminal. If you use the applicable gauge for the electrical wires, you must attach the wiring cover.

7. Attach the wiring cover and terminal block cover to their initial positions and tighten the screws on the terminal block cover.

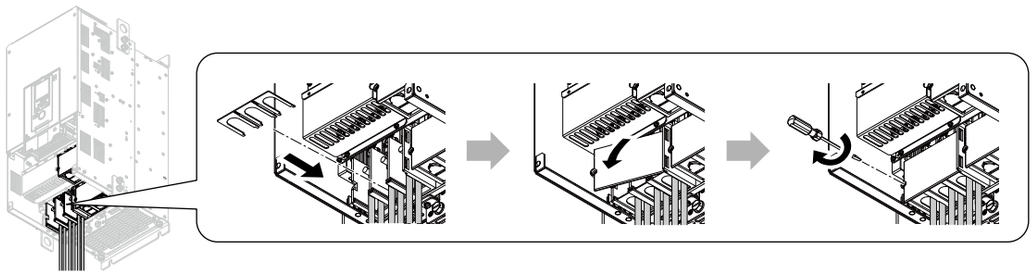


Figure 7.23 Reattach the Wiring Cover

8. Put the terminal cover back in its initial position.

■ Wiring the Main Circuit Terminal Block Using Procedure E

Main Circuit Terminal Block Wiring Procedure

1. Remove the keypad and front cover.
2. Put the ends of prepared wires through the conduits and into the terminal block, then tighten the terminal screws to the specified torque.

Note:
When you use terminals - and +1 and these terminals have covers, remove them to install the wire.

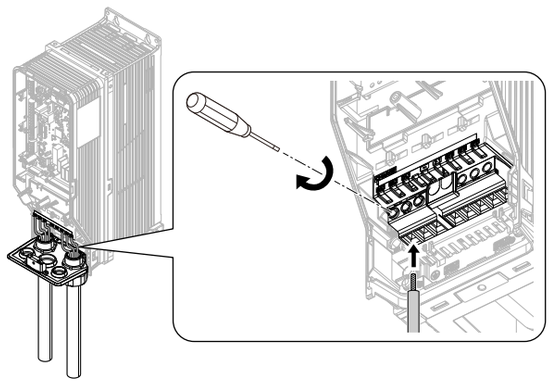
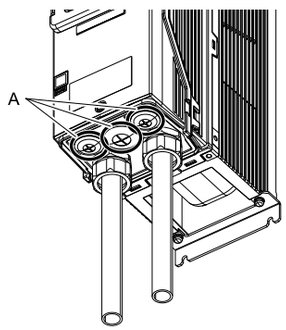


Figure 7.24 Install the Electrical Wires

3. Install the front cover and the keypad to their initial positions.

Note:
- Install the correct control circuit conduit to keep the protection level. Install the included rubber waterproofing grommets for any knock-out holes that you do not use for control circuit wiring.
- The knock-out holes for main circuit wiring do not have rubber grommets. Install the correct conduit to keep the IP55/UL Type 12 protection level.



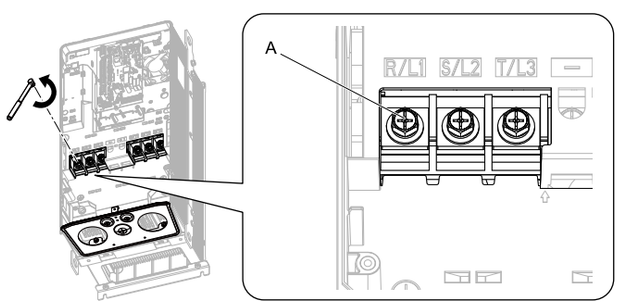
A - Rubber grommets

■ Wiring the Main Circuit Terminal Block Using Procedure F

Main Circuit Terminal Block Wiring Procedure

1. Remove the keypad and front cover.
2. Remove the terminal block bolt.

Note:
When you use terminals - and +1 and these terminals have covers, remove them to install the wire.



A - Bolt

Figure 7.25 Remove the Terminal Block Bolts

3. Put the ends of wires with closed-loop crimp terminals through the conduits.

4. Align the closed-loop crimp terminals with the bolt holes on main circuit terminal block and attach the crimp terminal to the main circuit terminal block.

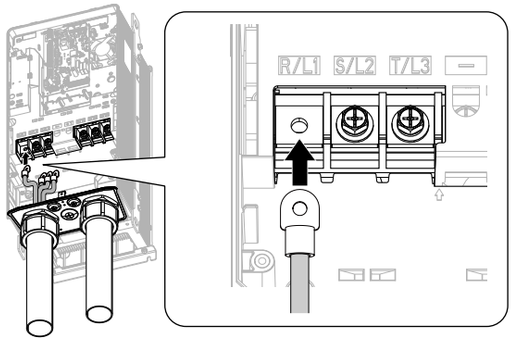


Figure 7.26 Install the Electrical Wires

5. Tighten the bolts to the specified torque.

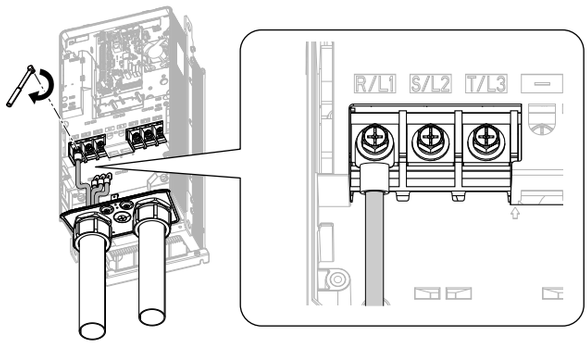
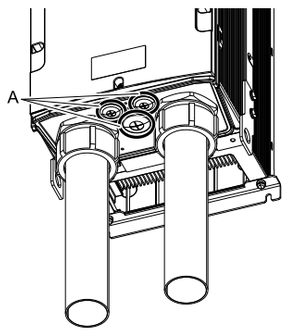


Figure 7.27 Tighten the Terminal Block Bolts

6. Install the front cover and the keypad to their initial positions.

Note:
- Install the correct control circuit conduit to keep the protection level. Install the included rubber waterproofing grommets for any knock-out holes that you do not use for control circuit wiring.
- The knock-out holes for main circuit wiring do not have rubber grommets. Install the correct conduit to keep the IP55/UL Type 12 protection level.



A - Rubber grommets

■ Wiring the Main Circuit Terminal Block Using Procedure G

Main Circuit Terminal Block Wiring Procedure

1. Open the front door.

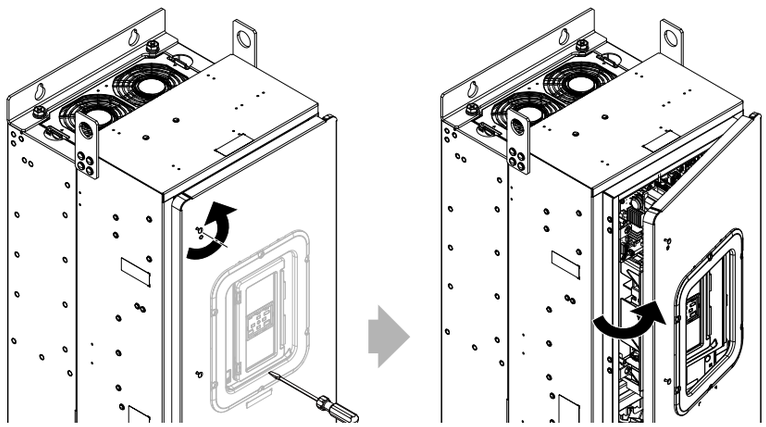
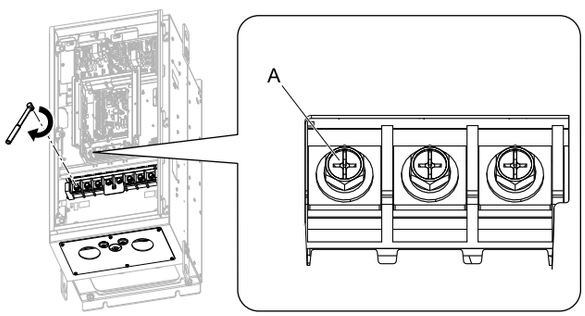


Figure 7.28 Open the Front Door

2. Remove the terminal block bolts.

Note:
When you use terminals - and +1 and these terminals have covers, remove them to install the wire.



A - Bolt

Figure 7.29 Remove the Terminal Block Bolts

3. Put the ends of wires with closed-loop crimp terminals through the conduits.
4. Align the closed-loop crimp terminals with the bolt holes on main circuit terminal block and attach the crimp terminal to the main circuit terminal block.

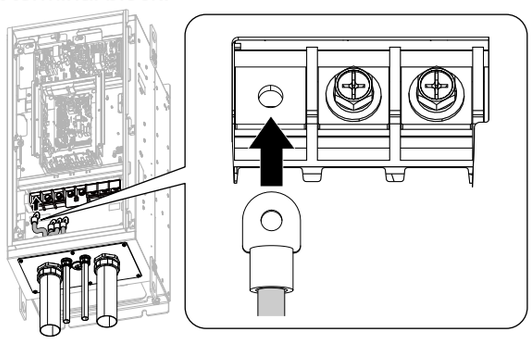


Figure 7.30 Install the Electrical Wires

5. Tighten the bolts to the specified torque.

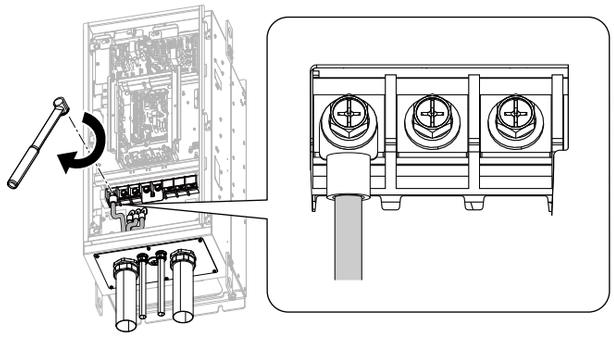


Figure 7.31 Tighten the Terminal Block Bolts

6. Close the front door.

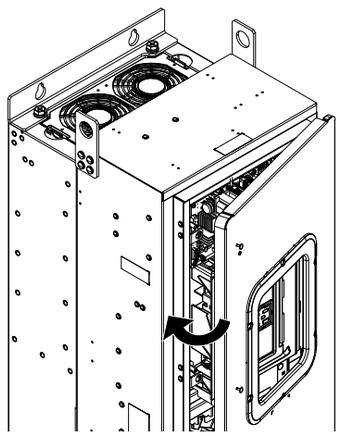
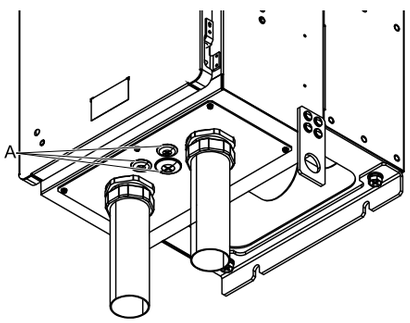


Figure 7.32 Close the Front Door

Note:
- Install the correct control circuit conduit to keep the protection level. Install the included rubber waterproofing grommets for any knock-out holes that you do not use for control circuit wiring.
- The knock-out holes for main circuit wiring do not have rubber grommets. Install the correct conduit to keep the IP55/UL Type 12 protection level.



A - Rubber grommets

8 Keypad: Names and Functions

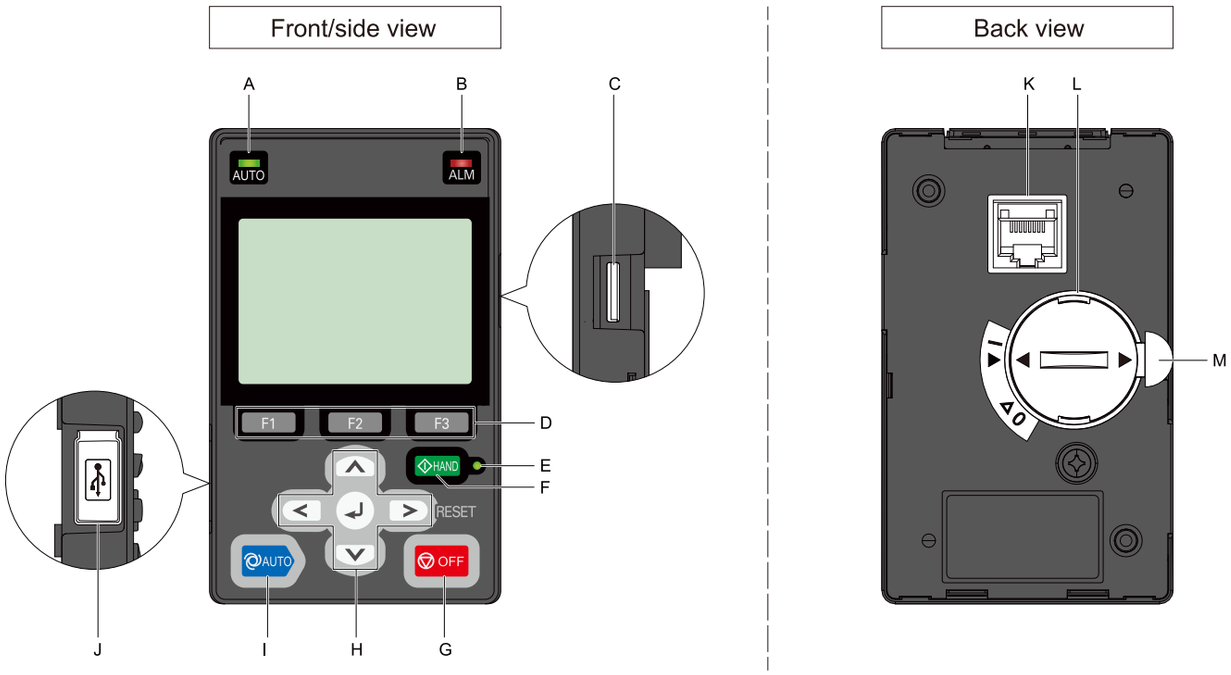
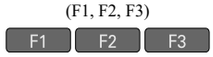


Figure 8.1 Keypad

Table 8.1 Keypad: Names and Functions

No.	Name	Function
A	AUTO LED *1* 	Illuminates to show that the drive is in AUTO Mode.
B	ALM LED 	Illuminates when the drive detects a fault. Flashes when the drive detects: • An alarm • An oPE parameter setting error • A fault or alarm during Auto-Tuning The LED turns off when there are no drive faults or alarms.
C	microSD Card Insertion Slot	The insertion point for a microSD card.
D	Function Keys (F1, F2, F3) 	The menu shown on the keypad sets the functions for function keys. The name of each function is in the lower half of the display window.
E	HAND LED *1* 	Illuminates to show that the drive is in HAND Mode.
F	HAND Key 	Sets drive operation to HAND Mode. The drive uses the *Y5-01 [HAND Frequency Reference Source]* setting.
G	OFF Key 	Stops drive operation. **Note:** The OFF key has highest priority. Push  to stop the motor even when a Run command is active at an external Run command source. Set *o2-02 = 0 [OFF Key Function Selection = Disabled]* to disable  priority. You can only disable  when *b1-02/b1-16 = 1, 2, or 3 [Run Command Selection 1/Run Command Selection 2 = Digital Input, Serial Communications, or Option PCB]*.

No.	Name	Function
H	Left Arrow Key	Moves the cursor to the left. Navigates to the Standard Monitor menu from the Home screen.
	Up Arrow Key/Down Arrow Key	• Scrolls up or down to display the next item or the previous item. • Selects parameter numbers, and increments or decrements setting values. • Scrolls through 18 custom monitors set in *o1-24*, *o1-27* to *o1-35*, and *o1-90* to *o1-97* from the Home screen.
	Right Arrow Key (RESET)	• Moves the cursor to the right. • Continues to the next screen. • Clears drive faults. • Navigates to the Parameter Group Shortcuts from the Home screen.
	ENTER Key	• Enters parameter values and settings. • Selects menu items to move the user between keypad displays. • Selects each mode, parameter, and set value.
I	AUTO Key	Sets drive operation to AUTO Mode. The drive uses the *b1-01 [Frequency Reference Selection 1]* and *b1-02 [Run Command Selection 1]* settings. **Note:** Push HAND on the keypad to set the drive to HAND Mode before you use the keypad to operate the motor.
J	USB Terminal	For factory adjustment.
K	RJ-45 Connector	Uses an RJ-45 8-pin straight through UTP CAT5e extension cable or keypad connector to connect to the drive.
L	Clock Battery Cover	Cover for the clock battery. **Note:** The battery included with the keypad is for operation check. It may be exhausted earlier than the expected battery life described in the manual. To replace the battery, use a Hitachi Maxell "CR2016 Lithium Manganese Dioxide Lithium Battery" or an equivalent battery with these properties: • Nominal voltage: 3 V • Operating temperature range: -20 °C to +85 °C (-4 °F to +185 °F)
M	Insulation Sheet	An insulating sheet is attached to the keypad battery to prevent battery drain. Remove the insulation sheet before you use the keypad for the first time.

*1 Refer to *AUTO LED and HAND LED Indications on page 56* for more information about AUTO LED and HAND LED indications.

◆ AUTO LED and HAND LED Indications

Table 8.2 AUTO LED and HAND LED Indications

AUTO LED	HAND LED	Status
OFF	OFF	OFF Mode
OFF	ON	HAND Mode
OFF	Long blink (50% duty)	HAND Mode • When the Frequency Reference is 0 or during deceleration • *H1-xx = 70 [Drive Enable No Run Cycle]* removed while HAND MFDI closed
OFF	Double blink	HAND Mode • When an MFDI sends a Fast Stop signal to stop the drive • When you clear the Run command and enter the Run command again during the time set in *C1-02 [Deceleration Time 1]* • Drive Enable Command removed while HAND MFDI closed • OFF pressed while running in HAND from MFDI • Exited Emergency Override with HAND MFDI closed
ON	OFF	AUTO Mode

AUTO LED	HAND LED	Status
Long blink (50% duty)	OFF	AUTO Mode • When the Frequency Reference is 0 or during deceleration • During PI Sleep • When *b1-02/b1-16 = 7/8/9* and AUTO is pressed, waiting for RUN command (from External/Serial/Option) • When *b1-02/b1-16 = 7/8/9* and Run command given (from External/Serial/Option) and waiting for AUTO press • When *b1-02/b1-16 = 7/8/9* and the HAND MFDI is removed while the Run command is present • When *b1-02/b1-16 = 0*, AUTO is pressed and *H1-xx = 70 [Drive Enable No Run Cycle]* is opened
Double blink	OFF	AUTO Mode • When an MFDI sends a Fast Stop signal to stop the drive • Drive Enable input removed while an external Run command is present • *b1-02/b1-16 = 1/2/3* and *Y5-03 = 0 [HAND/AUTO Switchover During Run]* and HAND MFDI is opened while external run input is present • Drive exits Emergency Override operation with an external Run command present

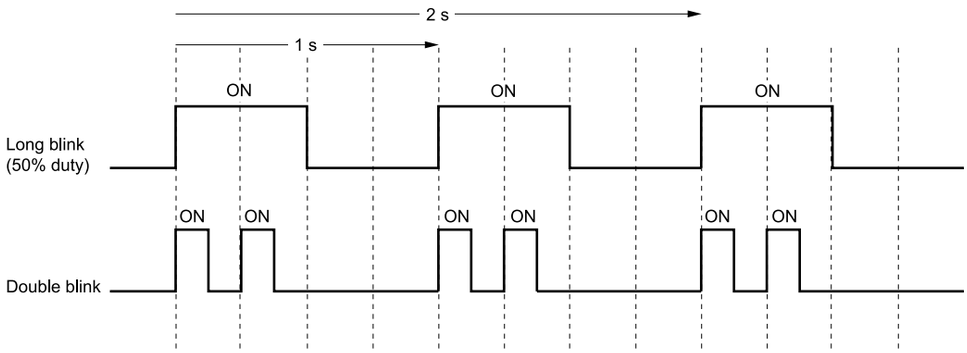


Figure 8.2 AUTO LED and HAND LED Timing Status

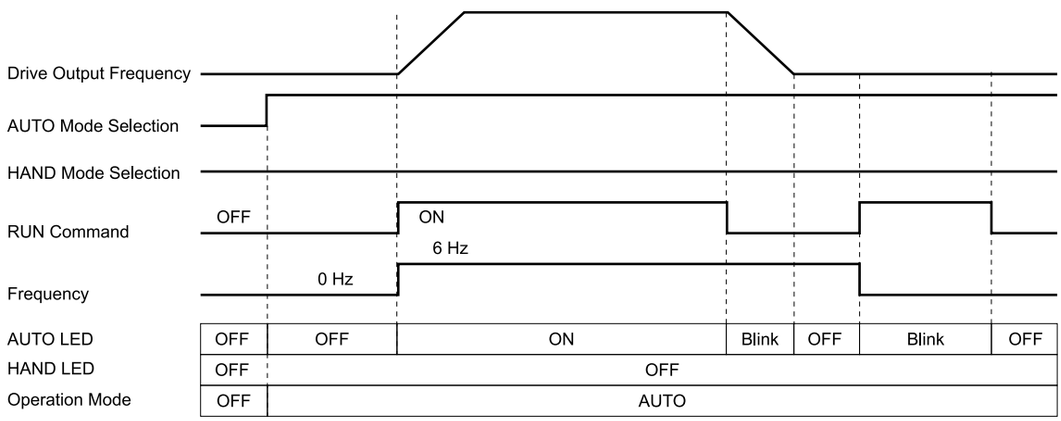


Figure 8.3 LEDs and Drive Operation in AUTO Mode

◆ Keypad Mode and Menu Displays

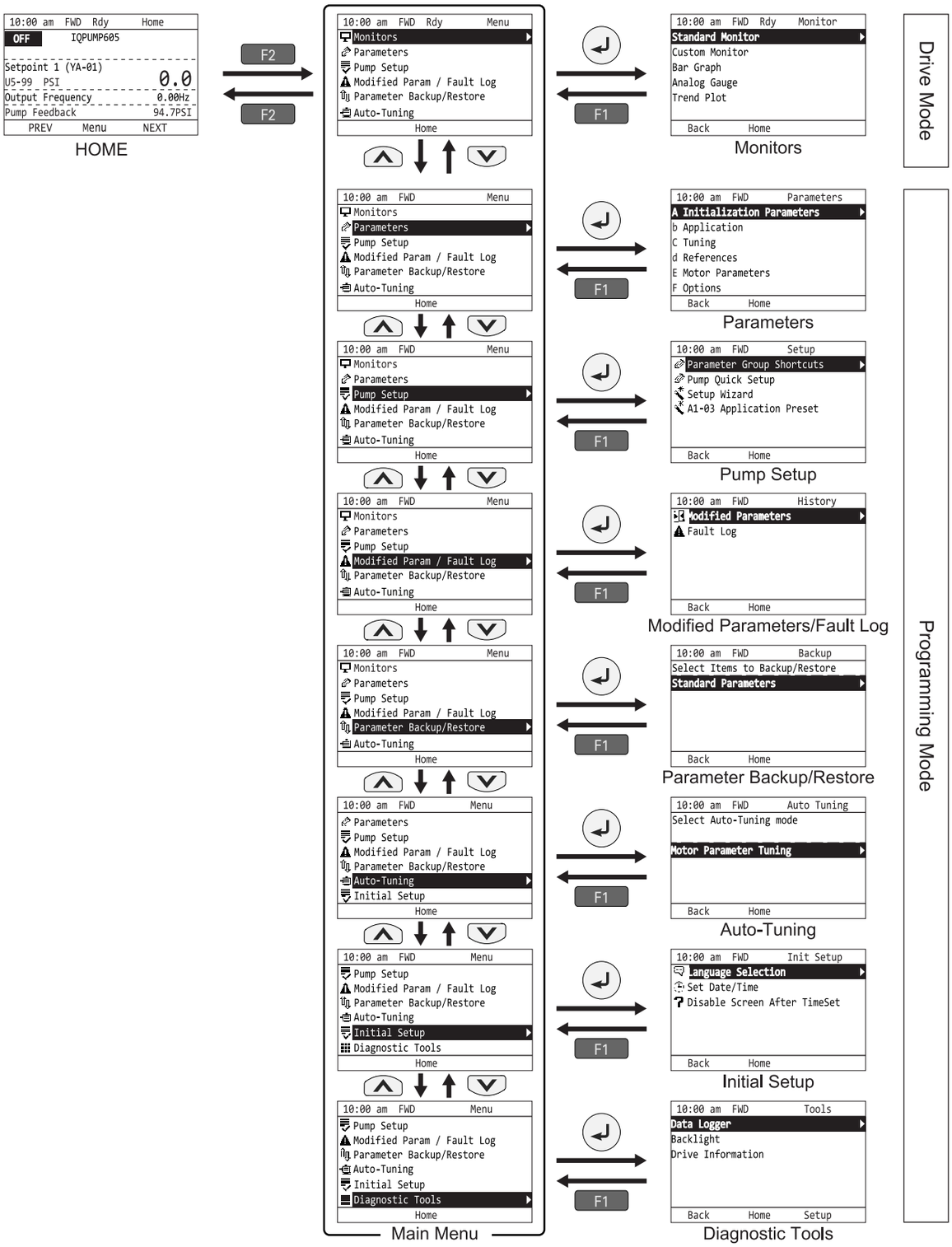


Figure 8.4 Keypad Functions and Display Levels

Note:

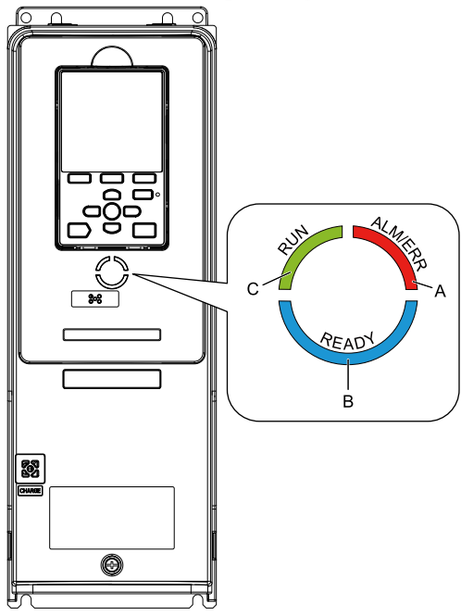
- Energize the drive with factory defaults to show the Initial Setup screen. Push F2 (Home) to show the HOME screen.
  – Select [TURN OFF power up setup screen] from the [Disable Screen After TimeSet] setting to not display the Initial Setup screen.
- Push < from the Home screen to show drive monitors.
- Push ↵ to set *U5-99/YA-01 [Reference 1]* when you set *b1-01 = 0 [Frequency Reference Selection 1 = Keypad]*.
- The keypad will show [Rdy] when the drive is in Drive Mode. The drive is prepared to accept a Run command.
- The drive will not accept a Run command in Programming Mode in the default setting. Set *b1-08 [Run Command Select in PRG Mode]* to accept or reject a Run command from an external source while in Programming Mode.
  – Set *b1-08 = 0 [Disregard RUN while Programming]* to reject the Run command from an external source while in Programming Mode (default).
  – Set *b1-08 = 1 [Accept RUN while Programming]* to accept the Run command from an external source while in Programming Mode.
  – Set *b1-08 = 2 [Allow Programming Only at Stop]* to prevent changes from Drive Mode to Programming Mode while the drive is operating.

Table 8.3 Drive Mode Screens and Functions

Mode	Keypad Screen	Function
Drive Mode	Monitors	Sets monitor items to display.
Programming Mode	Parameters	Changes parameter settings.
	Pump Setup	Shows Parameter Group Shortcuts, Pump Quick Setup, and Wizards.
	Modified Parameters/Fault Log	Shows modified parameters and fault history.
	Parameter Backup/Restore	Saves parameters to the keypad as backup.
	Auto-Tuning	Auto-Tunes the drive.
	Initial Setup	Changes initial settings.
	Diagnostic Tools	Sets data logs and backlight.

9 LED Status Ring

The LED Status Ring on the drive cover shows the drive operating status.



A - ALM/ERR **C - RUN**
B - Ready

LED		Status	Description
A	ALM/ERR	Illuminated	The drive detects a fault.
		Flashing *1	The drive detects: • An alarm • An oPE parameter setting error • An Auto-Tuning error **Note:** If the drive detects a fault and an alarm at the same time, the LED will illuminate to identify a fault.
		OFF	There are no drive faults or alarms.
B	Ready	Illuminated	The drive is operating or is prepared for operation.
		Flashing *1	The drive is in *STo [Safe Torque OFF]* condition.
		Flashing Quickly *1	The voltage of the main circuit power supply dropped, and only the external 24 V power supply is providing the power to the drive.
		OFF	• The drive detects a fault. • There is no fault and the drive received a Run command, but the drive cannot operate. For example, in Programming Mode.
C	RUN	Illuminated	The drive is in regular operation.
		Flashing *1	• The drive is decelerating to stop. • The drive received a Run command with a frequency reference of 0 Hz. • The drive received a DC Injection Braking command. • *H1-xx = 70 [Drive Enable No Run Cycle]* removed while HAND MFDI closed. • When *b1-02/b1-16 = 7/8/9* and AUTO is pressed, waiting for RUN command (from External/Serial/Option). • When *b1-02/b1-16 = 7/8/9* and Run command given (from External/Serial/Option) and waiting for AUTO press. • When *b1-02/b1-16 = 7/8/9* and the HAND MFDI is removed while the Run command is present. • When *b1-02/b1-16 = 0*, AUTO is pressed and *H1-xx = 70 [Drive Enable No Run Cycle]* is opened.
		Flashing Quickly *1	• The drive received a Run command from the MFDI terminals when *b1-02 = 0 [Run Command Selection 1 = Keypad]* and you changed the setting to *b1-02 = 1 or 7 [Digital Input or AUTO Command + Term Run]*. • The drive received a Run command from the MFDI terminals when the drive is not in Drive Mode. • The drive received a Fast Stop command. • The safety function shuts off the drive output. • You pushed OFF on the keypad when the drive is operated from a REMOTE source. • The drive is energized with an active Run command and *b1-17 = 0 [Run Command at Power Up = Disregard Existing RUN Command]*. • The drive is set to coast-to-stop with timer (*b1-03 = 3 [Stopping Method Selection = Coast to Stop with Timer]*), and the Run command is disabled then enabled during the Run wait time. • Drive Enable Command removed while HAND MFDI closed. • OFF pressed while running in HAND from MFDI. • Exited Emergency Override with HAND MFDI closed. • Drive Enable input removed while an external Run command is present. • *b1-02/b1-16 = 1/2/3* and *Y5-03 = 0 [HAND/AUTO Switchover During Run]* and HAND MFDI is opened while external run input is present. • Drive exits Emergency Override operation with an external Run command present.
		OFF	The motor is stopped.

*1 Refer to Figure 9.1 for the difference between “flashing” and “flashing quickly”.

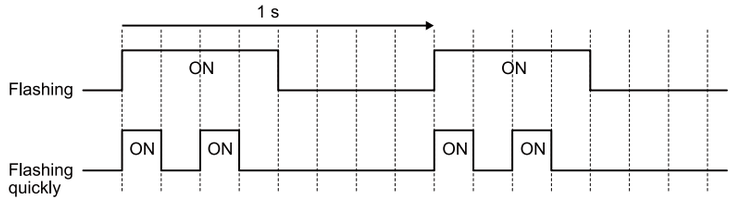


Figure 9.1 LED Flashing Statuses

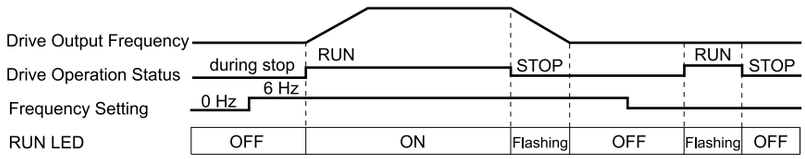


Figure 9.2 Relation between RUN LED and Drive Operation

10 Drive Start-Up Procedure

1. Confirm the drive and motor specifications.
2. Confirm the correct drive installation environment.
3. Use the enclosed drilling template (if applicable) to install the drive.
4. Select the motor and power wires, wire strip length, crimp terminals, and branch circuit protection.
5. Remove the keypad, front cover, terminal cover, conduit bracket, and knock-outs. Reinstall the bracket for non-cabinet installations.
6. Install the motor wiring and power wiring.
7. Install the front cover, terminal cover, and keypad.
8. Energize the drive and confirm it is ready.
9. Set the Real-Time Clock and disable the Initial Setup Screen.
10. Run the Setup Wizard or select an Application Preset.
11. Set the drive for HAND mode and check the motor rotation direction and feedback signal.

The drive is prepared to run.

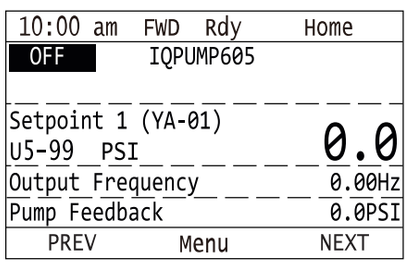
◆ Change Parameter Settings

This example shows how to change the setting value for *C1-01 [Acceleration Time 1]*. Do the steps in this procedure to set parameters for the application.

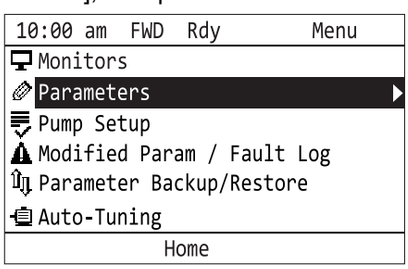
1. Push F2 (Home) to show the HOME screen.

Note:
- When the drive is in HOME Mode, the screen shows [Home] in the upper right-hand corner of the screen.
- If [Home] is not shown above the F2, push F1 (Back).

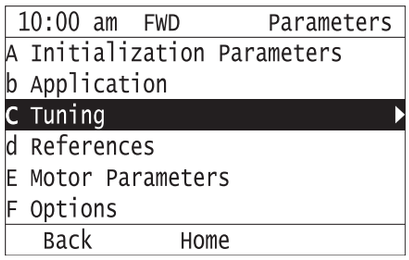
2. Push F2 (Menu).



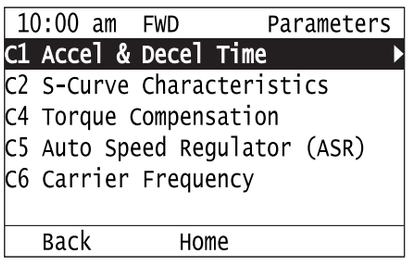
3. Push ▲ or ▼ to select [Parameters], then push ↵.



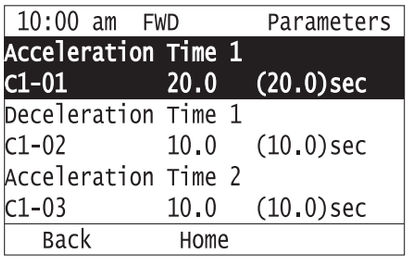
4. Push ▲ or ▼ to select [C Tuning], then push ↵.



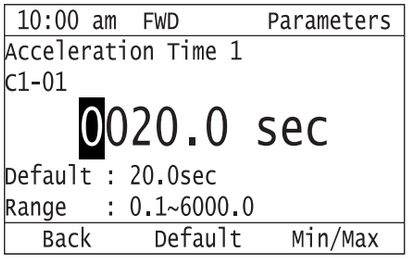
5. Push ▲ or ▼ to select [C1 Accel & Decel Time], then push ↵.



6. Push ▲ or ▼ to select *C1-01*, then push ↵.

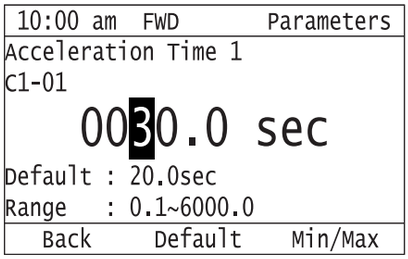


7. Push ◀ or ▶ to select the specified digit, then push ▲ or ▼ to select the correct number.



- Push F2 (Default) to set the parameters to factory defaults.
- Push F3 (Min/Max) to show the minimum value or the maximum value on the display.

8. Push ↵ to keep the changes.



9. Continue to change parameters, then push F1 (Back), F2 (Home) to go back to the home screen after you change all the applicable parameters.

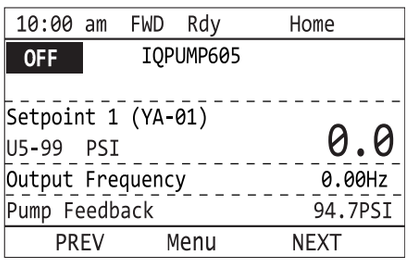
◆ Disable the Initial Setup Screen

Do the steps in this procedure to not show the initial start-up screen when the drive is energized.

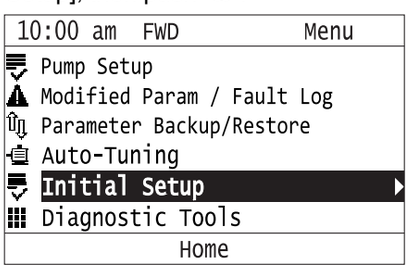
1. Push F2 (Home) to show the HOME screen.

Note:
- When the drive is in HOME Mode, the screen shows [Home] in the upper right-hand corner of the screen.
- If the screen does not show [Home] for F2, push F1 (Back), and then push F2 to show [Home].

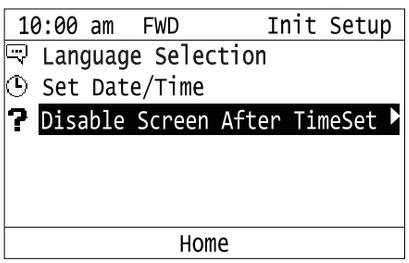
2. Push F2 (Menu).



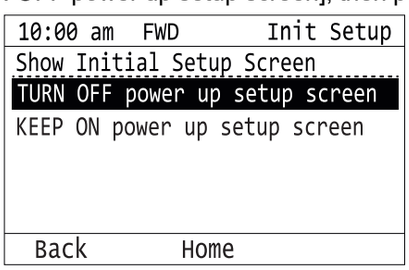
3. Push ^ / v to select [Initial Setup], then push ↵.



4. Push ^ / v to select [Disable Screen After Timeset], then push ↵.



5. Push ^ / v to select [TURN OFF power up setup screen], then push ↵.



◆ Control Circuit Terminal Block Functions

Hx-xx parameters set functions for the multi-function input and output terminals.

⚠ WARNING *Sudden Movement Hazard. Correctly wire and test all control circuits to make sure that the control circuits operate correctly. If you use a drive that has incorrect control circuit wiring or operation, it can cause death or serious injury.*

⚠ WARNING *Sudden Movement Hazard. Check the I/O signals and the external sequences for the drive before you set the Application Preset function. When you set the Application Preset function (A1-06 ≠ 0), it changes the I/O terminal functions for the drive and it can cause equipment to operate unusually. This can cause serious injury or death.*

NOTICE *Damage to Equipment. Do not energize and de-energize the drive more frequently than one time each 30 minutes. If you frequently energize and de-energize the drive, it can cause drive failure.*

■ Input Terminals

Refer to Table 10.1 for a list of input terminals and functions.

Table 10.1 Multi-function Input Terminals

Type	Terminal	Name (Default)	Function (Signal Level)
MFDI	S1	MFDI selection 1 (ON: Forward RUN (2-Wire) OFF: Stop)	Multi-Function Digital Input • Photocoupler • 24 V, 6 mA **Note:** Install the wire jumpers between terminals SC-SP and SC-SN to set the MFDI power supply (sinking/sourcing mode or internal/external power supply). • Sinking Mode: Install a jumper between terminals SC and SP. **NOTICE** *Damage to Equipment. Do not close the circuit between terminals SC-SN. If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.* • Sourcing Mode: Install a jumper between terminals SC and SN. **NOTICE** *Damage to Equipment. Do not close the circuit between terminals SC-SP. If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.* • External power supply: No jumper necessary between terminals SC-SN and terminals SC-SP.
	S2	MFDI selection 2 (Not Used)	
	S3	MFDI selection 3 (External Pump Fault (NO-@Run-Coast))	
	S4	MFDI selection 4 (Fault Reset)	
	S5	MFDI selection 5 (PID Setpoint Selection 1)	
	S6	MFDI selection 6 (HAND Mode)	
	S7	MFDI selection 7 (HAND Mode 2)	
	S8	MFDI selection 8 (Not Used)	
	SN	MFDI power supply 0 V	MFDI power supply, 24 V (maximum 150 mA) **NOTICE** *Damage to Equipment. Do not close the circuit between terminals SP-SN. If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.*
	SC	MFDI selection common	
	SP	MFDI power supply +24 Vdc	
Safe Disable Input	H1	Safe Disable input 1	Safe Disable Input Remove the jumper between terminals H1-HC and H2-HC to use the Safe Disable input. • 24 V, 6 mA • ON: Normal operation • OFF: Coasting motor • Internal impedance 4.7 kΩ • OFF Minimum OFF time of 2 ms.
	H2	Safe Disable input 2	
	HC	Safe Disable function common	Safe Disable function common **NOTICE** *Do not close the circuit between terminals HC and SN. A closed circuit between these terminals will cause damage to the drive.*

Type	Terminal	Name (Default)	Function (Signal Level)
Master Frequency Reference	RP	Multi-function pulse train input (Frequency Reference)	• Response frequency: 0 Hz to 32 Hz • H level duty: 30% to 70% • H level voltage: 3.5 V to 13.2 V • L level voltage: 0.0 V to 0.8 V • Input impedance: 3 kΩ
	+V	Power supply for frequency setting	Power Supply for Multi-Function Analog Input • 10.5 V (allowable current 20 mA maximum)
	A1	MFAI 1 (Frequency Reference)	Voltage input or current input Select terminal A1 with Jumper switch S1 and *H3-01 [Terminal A1 Signal Level Select]*. • 0 V to 10 V/100% (input impedance: 20 kΩ) • 4 mA to 20 mA/100%, 0 mA to 20 mA/100% (input impedance: 250 Ω)
	A2	MFAI 2 (PID Feedback)	Voltage input or current input Select terminal A2 with Jumper switch S1 and *H3-09 [Terminal A2 Signal Level Select]* • 0 V to 10 V/100% (input impedance: 20 kΩ) • 4 mA to 20 mA/100%, 0 mA to 20 mA/100% (input impedance: 250 Ω)
	A3	MFAI 3 (HAND Frequency Reference)	Voltage input or current input Select terminal A3 with Jumper switch S1 and *H3-05 [Terminal A3 Signal Level Select]* • 0 V to 10 V/100% (input impedance: 20 kΩ) • 4 mA to 20 mA/100%, 0 mA to 20 mA/100% (input impedance: 250 Ω)
	AC	Frequency reference common	Signal Ground for Multi-Function Analog Input • 0 V
	FE	Connecting shielded cable	Frame Earth

■ Output Terminals

Refer to Table 10.2 and Table 10.3 for a list of output terminals and functions.

Table 10.2 Control Circuit Output Terminals

Type	Terminal	Name (Default)	Function (Signal Level)
Fault Relay Output	MA	N.O. output (Fault)	Drive Fault Signal Output • Relay output • 30 Vdc, 10 mA to 2 A • 250 Vac, 10 mA to 2 A • Minimum load: 5 V, 10 mA (Reference value)
	MB	N.C. output (Fault)	
	MC	Digital output common	
MFDO	M1	MFDO (During Frequency Output)	Multi Function Digital Output • Relay output • 30 Vdc, 10 mA to 2 A • 250 Vac, 10 mA to 2 A • Minimum load: 5 V, 10 mA (Reference value) **Note:** Do not set functions that frequently switch ON/OFF to MFDO (M1 to M4) because this will decrease the performance life of the relay contacts. Yaskawa estimates switching life at 200,000 times (assumes 1 A, resistive load).
	M2		
	M3	MFDO (Pressure Reached)	
	M4		
	MD	N.O. output (Fault)	Multi Function Digital Output • Relay output • 30 Vdc, 10 mA to 2 A • 250 Vac, 10 mA to 2 A • Minimum load: 5 V, 10 mA (Reference value)
	ME	N.C. output (Fault)	
	MF	Digital output common	

Table 10.3 Control Circuit Monitor Output Terminals

Type	Terminal	Name (Default)	Function (Signal Level)
Monitor Output	FM	MFAO 1 (Output frequency)	Multi Function Analog Output Select voltage or current output. • 0 V to 10 V/0% to 100% • 4 mA to 20 mA (receiver recommended impedance: 250 Ω) **Note:** Select with jumper switch S5 and *H4-07 [Terminal FM Signal Level Select]* or *H4-08 [Terminal AM Signal Level Select]*.
	AM	MFAO 2 (Output current)	
	AC	Monitor common	0 V
External Power Supply Output	+P	External power supply	Power supply for external devices. • 24 V (150 mA maximum)

■ External Power Supply Input Terminals

Refer to Table 10.4 for a list of the functions of the external power supply input terminals.

Table 10.4 External Power Supply Input Terminals

Type	Terminal	Name (Default)	Function
External Power Supply Input Terminals	PS	External 24 V power supply input	Supplies backup power to the drive control circuit, keypad, and option board. 21.6 VDC to 26.4 VDC, 700 mA
	AC	External 24 V power supply ground	0 V

■ Serial Communication Terminals

Refer to Table 10.5 for a list of serial communication terminals and functions.

Table 10.5 Serial Communication Terminals

Type	Terminal	Terminal Name	Function (Signal Level)	
Serial Communication	D+	Communication input/output (+)	MEMOBUS/Modbus communications Use an RS-485 cable to connect the drive. **Note:** Set DIP switch S2 to ON to enable the termination resistor in the last drive in a MEMOBUS/Modbus network.	• RS-485 • MEMOBUS/Modbus communications: Maximum 115.2 kbps
	D-	Communication output (-)		
	AC	Signal ground	0 V	
	FE	Option card ground	-	

◆ Control Circuit Terminal Configuration

The control circuit terminals are in the positions shown in Figure 10.1.

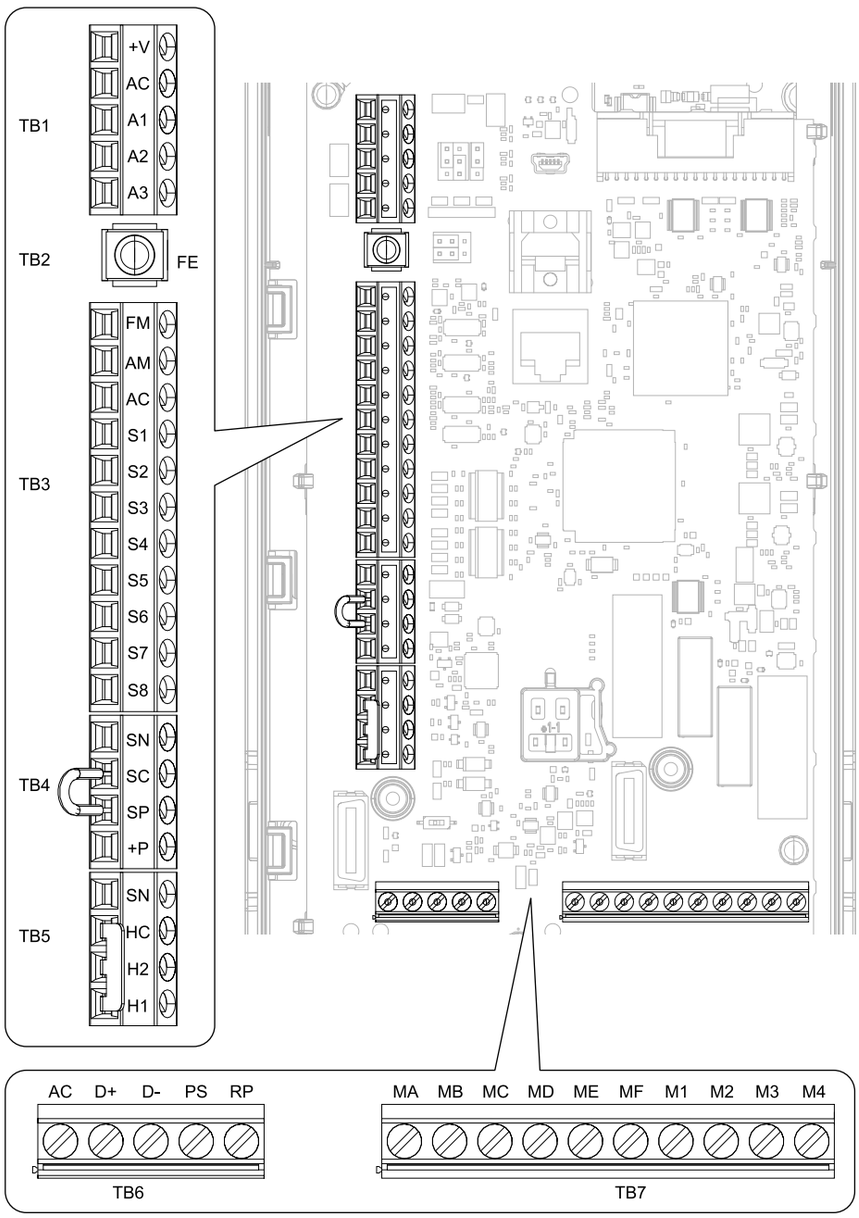


Figure 10.1 Control Circuit Terminal Arrangement

The tightening torque for the terminal screws is shown on the reverse side or the lower front side of the front cover.

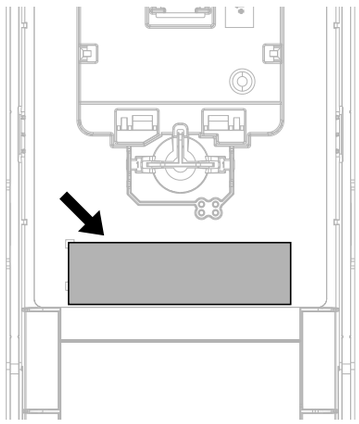


Figure 10.2 Tightening Torque Display Location (Reverse Side of Front Cover)

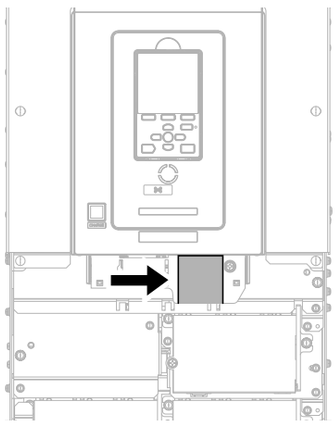


Figure 10.3 Tightening Torque Display Location (Lower Front Side of Front Cover)

■ Control Circuit Wire Gauges and Tightening Torques

Use the tables in this section to select the correct wires. Use shielded wire to wire the control circuit terminal block. Use crimp ferrules on the wire ends to make the wiring procedure easier and more reliable.

Table 10.6 Control Circuit Wire Gauges and Tightening Torques

Terminal Block	Terminal	Screw Size	Tightening Torque N·m (lbf·in)	Bare Wire		Crimp Ferrule	
				Recommended Gauge mm² (AWG)	Applicable Gauge mm² (AWG)	Recommended Gauge mm² (AWG)	Applicable Gauge mm² (AWG)
TB1	+V, AC, A1, A2, A3	M3	0.5 - 0.6 (4.4 - 5.3)	0.75 (18)	Stranded wire: 0.25 - 1.5 (24 - 16) Solid wire: 0.25 - 1.5 (24 - 16)	0.75 (18)	0.25 - 1.5 (24 - 16)
TB3	FM, AM, AC, S1 - S8						
TB4	SN, SC, SP, +P						
TB5	SN, HC, H1, H2						
TB6	AC, D+, D-, PS, RP						
TB7	MA, MB, MC, MD, ME, MF, M1 - M4						
TB2	FE		1.0 - 1.2 (8.85 - 10.62)	0.75 (18)	Stranded wire: 0.12 - 0.75 (26 - 18) Solid wire: 0.2 - 1.5 (26 - 16)	0.75 (18)	0.25 - 1.5 (24 - 16)

Crimp Ferrules

Attach an insulated sleeve when you use crimp ferrules. Refer to Table 10.7 for the recommended external dimensions and model numbers of the crimp ferrules.

Use the CRIMPFOX 6, a crimping tool made by PHOENIX CONTACT.

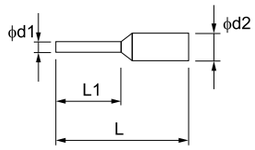


Figure 10.4 External Dimensions of Crimp Ferrules

Table 10.7 Crimp Ferrule Models and Sizes

Wire Gauge mm² (AWG)	Model	L (mm)	L1 (mm)	φd1 (mm)	φd2 (mm)
0.25 (24)	AI 0.25-8YE	12.5	8	0.8	2.0
0.34 (22)	AI 0.34-8TQ	12.5	8	0.8	2.0
0.5 (20)	AI 0.5-8WH AI 0.5-8OG	14	8	1.1	2.5
0.75 (18)	AI 0.75-8 GY	14	8	1.3	2.8

◆ Wiring the Control Circuit Terminal

⚠ WARNING *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. If you touch the internal components of an energized drive, it can cause serious injury or death.*

NOTICE *Do not let wire shields touch other signal lines or equipment. Insulate the wire shields with electrical tape or shrink tubing. If you do not insulate the wire shields, it can cause a short circuit and damage the drive.*

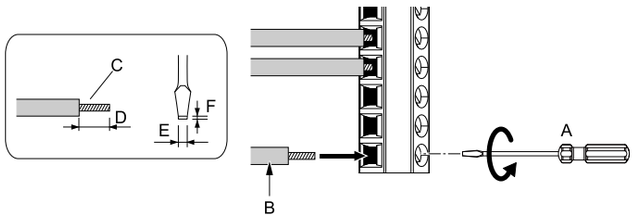
Note:
- Isolate control circuit wiring from main circuit wiring (terminals R/L1, S/L2, T/L3, U/T1, V/T2, W/T3, -, +1) and other high-power wiring. If the control circuit wires are adjacent to the main circuit wires, electrical interference can cause the drive or the devices around the drive to malfunction.
- Isolate contact output terminals MA, MB, MC and M1-M4, MD, ME, MF from other control circuit wiring. If the output terminal wires are adjacent to other control circuit wires, electrical interference can cause the drive or devices around the drive to malfunction.
- Use a UL Listed Class 2 Power Supply to connect external power to the control terminals. If the power supply for peripheral devices is incorrect, it can cause a decrease in drive performance.
- Connect the shield of shielded cable to the applicable ground terminal. If the grounding is not correct, electrical interference can cause the drive or devices around the drive to malfunction.

Correctly ground the drive terminals and complete main circuit wiring before you wire the control circuit. Remove the keypad and front cover.

1. Refer to Figure 10.5 and wire the control circuit.

   ⚠ WARNING *Fire Hazard. Tighten all terminal screws to the correct tightening torque. Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.*

Note:
- Use shielded wires and shielded twisted-pair wires for the control circuit terminal wiring. If the grounding is not correct, electrical interference can cause the drive or devices around it to malfunction.
- Do not use control circuit wiring that is longer than 50 m (164 ft) to supply the frequency reference with an analog signal from a remote source. Wiring that is too long can cause unsatisfactory system performance.



A - Loosen the screws and put the wire into the opening on the terminal block.

B - Wire with a crimp ferrule attached, or use wire that is not soldered with the core wires lightly twisted.

C - Pull back the shielding and lightly twist the end with your fingers to keep the ends from fraying.

D - If you do not use crimp ferrules, remove approximately 5.5 mm (0.21 in) of the covering at the end of the wire.

E - Blade width of 2.5 mm (0.1 in) or less

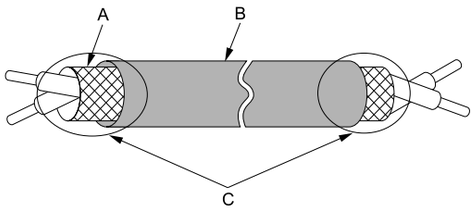
F - Blade depth of 0.4 mm (0.01 in) or less

Figure 10.5 Wiring Procedure for the Control Circuit

⚠ WARNING *Fire Hazard. Tighten all terminal screws to the correct tightening torque. Connections that are too loose or too tight can cause incorrect operation and damage to the drive. Incorrect connections can also cause death or serious injury from fire.*

NOTICE *Do not solder the core wire. Soldered wire connections can become loose over time and cause unsatisfactory drive performance.*

Note:
- Refer to Figure 10.6 for information to prepare terminal ends of the shielded wire.
- Connect the shield to terminal FE of the drive.



A - Connect the shield to terminal FE of the drive.

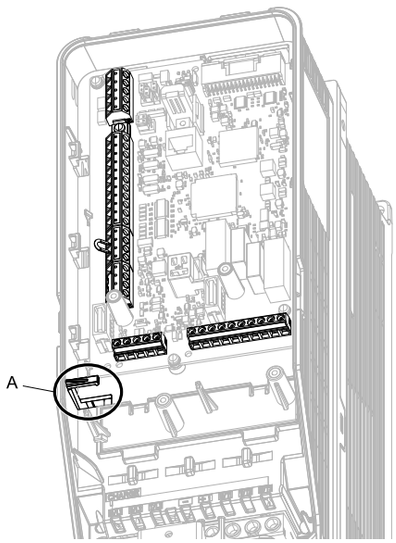
B - Sheath

C - Insulate with electrical tape or shrink tubing.

Figure 10.6 Prepare the Ends of Shielded Wire

Note:
If you use multi-conductor shielded cable that is too thick to put through the hook on the drive, you can remove the cable sheath.

NOTICE *Damage to Equipment. When you remove the cable sheath, also remove the shield. If you keep the shield on the wire, it can cause a short circuit and damage to the drive.*



A - Hook

2. Put the cables through the clearance of the drive and knock-out holes.

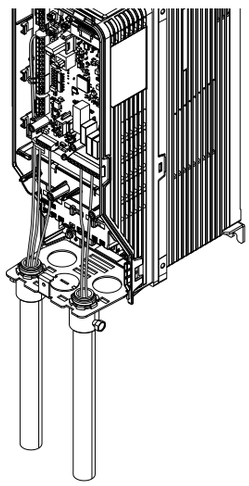


Figure 10.7 Control Circuit Wiring

3. Install the front cover and the keypad to their initial positions.

◆ Switches and Jumpers on the Terminal Board

The terminal board has switches to adapt the drive I/Os to the external control signals as shown in Figure 10.8. Set the switches to select the functions for each terminal.

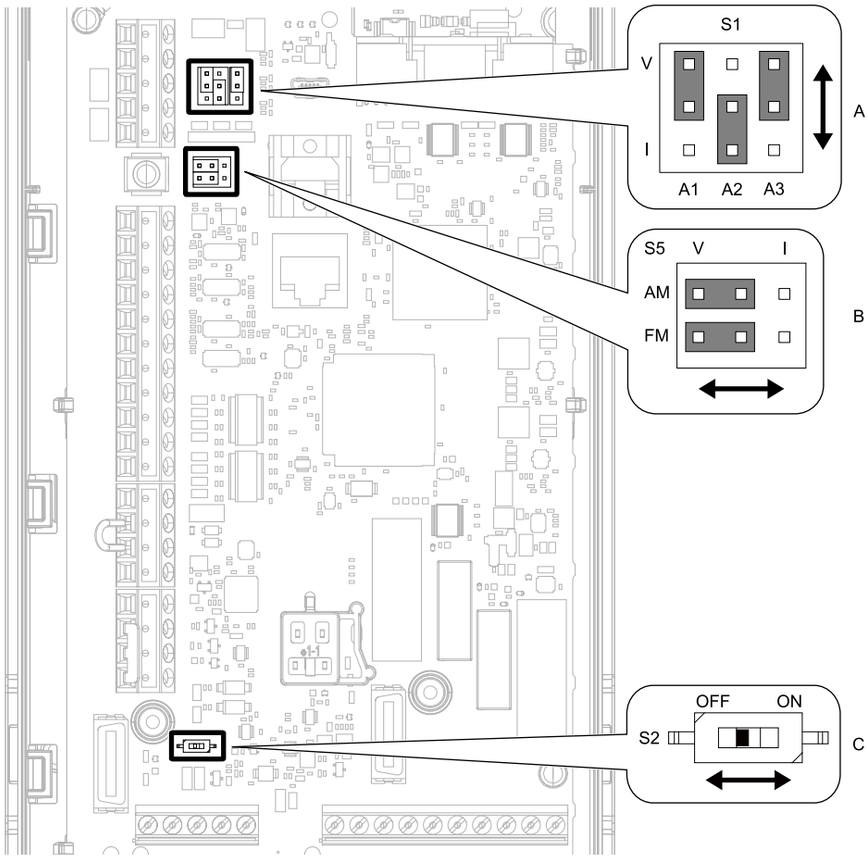


Figure 10.8 Locations of Switches

Table 10.8 I/O Terminals and Switches Functions

Position	Switch	Terminal	Function	Default Setting
A	Jumper switch S1	A1, A2, A3	Sets terminals A1 to A3 to voltage or current output.	A1: V (voltage input) A2: I (current input) A3: V (voltage input)
B	Jumper switch S5	FM, AM	Sets terminals FM and AM to voltage or current output.	FM: V (voltage output) AM: V (voltage output)
C	DIP switch S2	-	Enables and disables the termination resistor of MEMOBUS/ Modbus communications.	OFF

◆ Control I/O Connections

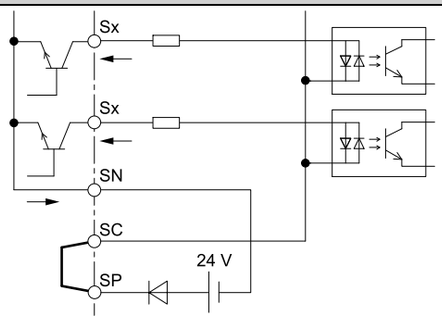
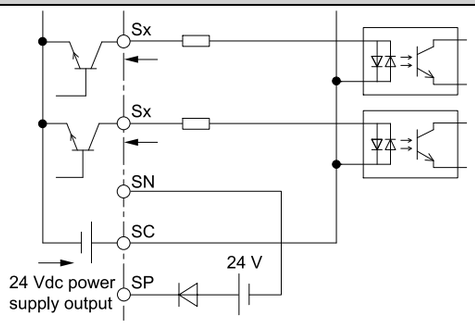
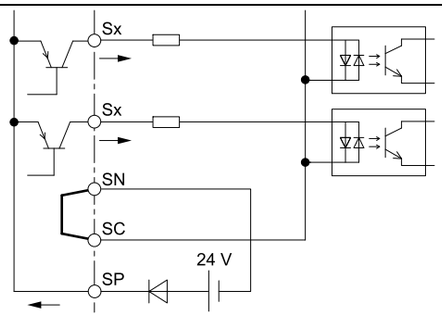
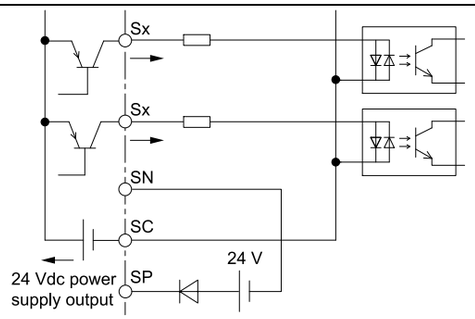
This section gives information about the settings for the listed control circuit I/O signals.

- MFDI (terminals S1 to S8)
- MFDO (terminals M1 to M4 and MD to MF)
- MFAI (terminals A1 to A3)
- MFAO (terminals FM, AM)
- MEMOBUS/Modbus communications (terminals D+, D-, AC)

■ Set Sinking Mode/Sourcing Mode

Close the circuit between terminals SC-SP and SC-SN to set the sinking mode/sourcing mode and the internal/ external power supply for the MFDI terminals. The default setting for the drive is internal power supply sinking mode.

NOTICE *Damage to Equipment. Do not close the circuit between terminals SP-SN. If you close the circuits between terminals SC-SP and terminals SC-SN at the same time, it will cause damage to the drive.*

Mode	Internal Power Supply (Terminal SN-SP)	External 24 V Power Supply
Sinking Mode (NPN)		
Sourcing Mode (PNP)		

■ Set Input Signals for MFAI Terminals A1 to A3

Use terminals A1 to A3 to input a voltage or a current signal. Set the signal type as shown in Table 10.9.

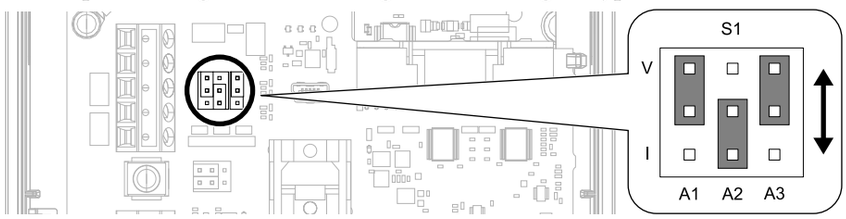


Figure 10.9 Location of Jumper Switch S1

Table 10.9 MFAI Terminals A1 to A3 Signal Settings

Terminal	Types of Input Signals	Parameter	
		No.	Signal Level
A1	Voltage input (Default)	H3-01	0: 0 V to 10 V/0% to 100% (input impedance: 20 kΩ)
	Current input		2: 4 mA to 20 mA/0% to 100% (input impedance: 250 Ω) 3: 0 mA to 20 mA/0% to 100% (input impedance: 250 Ω)
A2	Voltage input	H3-09	0: 0 V to 10 V/0% to 100% (input impedance: 20 kΩ)
	Current input (Default)		2: 4 mA to 20 mA/0% to 100% (input impedance: 250 Ω) 3: 0 mA to 20 mA/0% to 100% (input impedance: 250 Ω)
A3	Voltage input (Default)	H3-05	0: 0 V to 10 V/0% to 100% (input impedance: 20 kΩ)
	Current input		2: 4 mA to 20 mA/0% to 100% (input impedance: 250 Ω) 3: 0 mA to 20 mA/0% to 100% (input impedance: 250 Ω)

Note:

Set *H3-02, H3-10, H3-05 = 0 [Terminal A1 Function Selection, Terminal A2 Function Selection, Terminal A3 Function Selection = Frequency Reference]* to set A1 to A3 to frequency reference. The drive will add the analog input values together to make the frequency reference.

■ Set Output Signals for MFAO Terminals FM, AM

Set the signal type for terminals AM and FM to voltage or current output. Use jumper switch S5 and *H4-07, H4-08 [Terminal FM Signal Level Select, Terminal AM Signal Level Select]* to set the signal type.

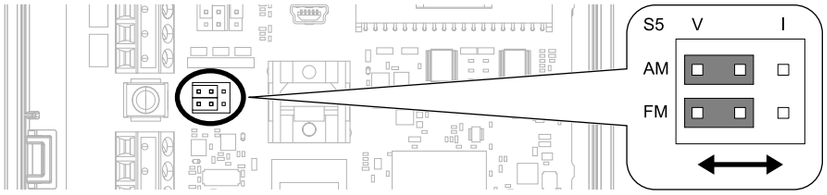
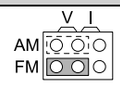
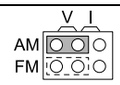
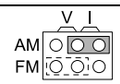


Figure 10.10 Location of Jumper Switch S5

Terminal	Types of Output Signals	Jumper Switch S5	Parameter	
			No.	Signal Level
FM	Voltage output (Default)		H4-07	0: 0 V to 10 V
	Current output			2: 4 mA to 20 mA
AM	Voltage output (Default)		H4-08	0: 0 V to 10 V
	Current output			2: 4 mA to 20 mA

■ Switch ON Termination Resistor for MEMOBUS/Modbus Communications

When the drive is the last slave in a MEMOBUS/Modbus communications, set DIP switch S2 to the ON position. This drive has a built-in termination resistor for the RS-485 interface.

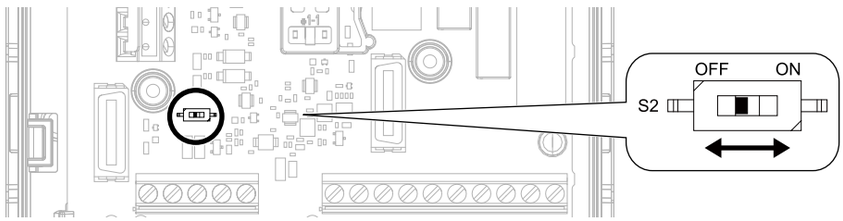


Figure 10.11 Location of DIP Switch S2

Table 10.10 RS-485 Communications Termination Resistor Setting

DIP Switch S2	Description
ON	The built-in termination resistor is ON.
OFF (Default)	The built-in termination resistor is OFF.

11 Drive Parameters and Programming

◆ Selecting the Control Method

This section gives information about these basic control methods:

- V/f Control
- EZ Open Loop Vector Control (EZOLV) for induction motors only

Refer to the User Manual for information about speed feedback and Permanent Magnet/Synchronous Reluctance motor control methods.

Use *A1-02 [Control Method Selection]* to select the most applicable control method for your application.

Control Method	A1-02 Setting	Main Applications
V/f	0	• General variable-speed. Best method to operate more than one motor from one drive. • When motor parameters are not available.
EZOLV	8	• General variable-speed • No high precision, no high speed response, and no speed feedback

◆ Auto-Tuning

⚠ WARNING *Injury to Personnel. Rotational Auto-Tuning rotates the motor at 50% or more of the motor rated frequency. Make sure that there are no issues related to safety in the area around the drive and motor. Increased motor frequency can cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Before you do Rotational Auto-Tuning, disconnect the load from the motor. The load can move suddenly and cause serious injury or death.*

Auto-Tuning automatically sets parameters on the drive connected to the motor. You must input some parameters individually during Auto-Tuning.

1. Select [Auto-Tuning] from the main menu to select the Auto-Tuning Mode.
2. Use the information in Table 11.1 and Table 11.2 to select the correct Auto-Tuning for your application.
3. Push AUTO to start Auto-Tuning.
   Refer to the User Manual for more information about Auto-Tuning.

Table 11.1 Auto-Tuning Mode Selection

Type	Application Conditions and Benefits	A1-02 = 0 [V/f]
Rotational Auto-Tuning	Recommended tuning mode for the most accurate results. Select this tuning mode when: • You can decouple the motor from the load. • You cannot decouple the motor from the load, but the motor load is less than 30%.	Yes
Stationary Line-Line Resistance	Select this tuning mode when: • The drive and motor capacities are different. • The drive is in V/f Control. • You have replaced the drive and motor.	Yes

Table 11.2 EZ Tuning Mode Selection

Type	Application Conditions and Benefits	A1-02 = 8 [EZOLV]
Motor Parameter Setting	Set the motor parameters.	Yes
Line-to-Line Resistance	Select this tuning mode after you replace the drive, motor, and motor cables.	Yes

◆ Drive Parameters

Icon	Description
V/f	The parameter is available when operating the drive with V/f Control.
OLV/PM	The parameter is available when operating the drive with Open Loop Vector Control for PM motors.

Icon	Description
EZOLV	The parameter is available when operating the drive with EZ Open Loop Vector Control.
RUN	You can change the parameter setting during run.

Note:
Gray icons identify parameters that are not available in the specified control method.

Refer to the following table when setting the most important parameters.

No. (Hex.)	Name	Description
A1-00 (0100) RUN	Language Selection	V/f OLV/PM EZOLV Sets the language for the LCD keypad. 0 : English 3 : French 5 : Spanish 6 : Portuguese
A1-01 (0101) RUN	Access Level Selection	V/f OLV/PM EZOLV Sets user access to parameters. The access level controls which parameters the keypad will display and which parameters the user can set. 0 : Operation Only 1 : User Parameters 2 : Advanced Level 3 : Expert Level 4 : Lock Parameters
A1-02 (0102)	Control Method Selection	V/f OLV/PM EZOLV Sets the control method for the drive application and the motor. 0 : V/f Control 5 : PM Open Loop Vector 8 : EZ Vector Control
A1-03 (0103)	Initialize Parameters	V/f OLV/PM EZOLV Sets parameters to default values. 0 : No Initialization 1110 : User Initialization 2220 : 2-Wire Initialization 3330 : 3-Wire Initialization 6008 : Pressure Control 6009 : Pump Down Level Control 6011 : Vertical Turbine Pressure Ctl 6012 : Pivot Panel Vert. Turbine Ctl 6013 : Advanced Pressure Control 6014 : Pivot Panel Submersible 6015 : Pivot Panel Pump Command 6016 : Pivot Panel Sub. Pump Command 7005 : Serial Comms External HOA 7006 : Serial Comms HOA Keys 7770 : General Purpose 7771 : Sub. Pump General Purpose
A1-04 (0104)	Password	V/f OLV/PM EZOLV Entry point for the password set in *A1-05 [Password Setting]*. The user can view the settings of parameters that are locked without entering the password. Enter the correct password in this parameter to change parameter settings.
A1-05 (0105)	Password Setting	V/f OLV/PM EZOLV Set the password to lock parameters and prevent changes to parameter settings. Enter the correct password in *A1-04 [Password]* to unlock parameters and accept changes.

No. (Hex.)	Name	Description
A1-06 (0127)	Application Preset	V/f OLV/PM EZOLV Sets the drive to operate in selected application conditions. 0 : Pressure Control 1 : General Purpose 2 : Sub. Pump General Purpose 3 : Pivot Panel Pump Command 4 : Pivot Panel Sub. Pump Command 5 : Serial Comms External HOA 6 : Serial Comms HOA Keys 8 : Pressure Control 9 : Pump Down Level Control 11 : Vertical Turbine Pressure Ctl 12 : Pivot Panel Vert. Turbine Ctl 13 : Advanced Pressure Control 14 : Pivot Panel Submersible
A1-07 (0128) Expert	DriveWorksEZ Function Selection	V/f OLV/PM EZOLV If the frequency reference changes for more than the level set to this parameter, then the bias value will be held. The value is set as a percentage of the maximum output frequency. 0 : DWEZ Disabled 1 : DWEZ Enabled 2 : Enabled/Disabled wDigital Input
A1-11 (111D) Expert	Firmware Update Lock	V/f OLV/PM EZOLV Protects the drive firmware. When you enable the protection, you cannot update the drive firmware. 0 : Disabled 1 : Enabled
A1-12 (1564)	Bluetooth ID	V/f OLV/PM EZOLV Sets the password necessary to use Bluetooth to control the drive with a smartphone or tablet.
b1-01 (0180)	Frequency Reference Selection 1	V/f OLV/PM EZOLV Sets the input method for the frequency reference. 0 : Keypad 1 : Analog Input 2 : Memobus/Modbus Communications 3 : Option PCB 4 : Pulse Train Input
b1-02 (0181)	Run Command Selection 1	V/f OLV/PM EZOLV Sets the input method for the Run command. 0 : Keypad 1 : Digital Input 2 : Serial Communications 3 : Option PCB 7 : AUTO Command + Term Run 8 : AUTO Command + Serial Run 9 : AUTO Command + Option Run
b1-03 (0182)	Stopping Method Selection	V/f OLV/PM EZOLV Sets the method to stop the motor after removing a Run command or entering a Stop command. 0 : Ramp to Stop 1 : Coast to Stop 2 : DC Injection Braking to Stop 3 : Coast to Stop with Timer
b1-04 (0183)	Reverse Operation Selection	V/f OLV/PM EZOLV Sets the reverse operation function. Disable reverse operation in fan or pump applications where reverse rotation is dangerous. 0 : Reverse Enabled 1 : Reverse Disabled
b1-08 (0187)	Run Command Select in PRG Mode	V/f OLV/PM EZOLV Sets the conditions for the drive to accept a Run command entered from an external source when using the keypad to set parameters. 0 : Disregards Existing RUN Command 1 : Accept RUN while Programming 2 : Allow Programming Only at Stop
b1-11 (01DF)	Run Delay @ Stop (Backspin)	V/f OLV/PM EZOLV Sets the amount of time that the drive will not accept the Run command again after the Run command is removed.

No. (Hex.)	Name	Description
b1-12 (01E0)	Run Delay Memory Selection	V/f OLV/PM EZOLV Sets how the drive saves Run Delay Timer to the EEPROM during power loss. 0 : Disabled 1 : Only at Stop 2 : Running & Stop
b1-14 (01C3)	Phase Order Selection	V/f OLV/PM EZOLV Sets the phase order for output terminals U/T1, V/T2, and W/T3. This parameter can align the Forward Run command from the drive and the forward direction of the motor without changing wiring. 0 : Standard 1 : Switch Phase Order
b1-15 (01C4)	Frequency Reference Selection 2	V/f OLV/PM EZOLV Sets the input method for the frequency reference. 0 : Keypad 1 : Analog Input 2 : Memobus/Modbus Communications 3 : Option PCB 4 : Pulse Train Input
b1-16 (01C5)	Run Command Selection 2	V/f OLV/PM EZOLV Sets the input method for Run Command 2 when the user switches the control circuit terminals ON/OFF to change the Run command source. 0 : Keypad 1 : Digital Input 2 : Serial Communications 3 : Option PCB 7 : AUTO Command + Term Run 8 : AUTO Command + Serial Run 9 : AUTO Command + Option Run
b1-17 (01C6)	Run Command at Power Up	V/f OLV/PM EZOLV Sets drive response when the CPU changes from de-energized to energized and there is an active Run command. Set this parameter in applications where energizing or de-energizing the drive enables the Run command. When the CPU stays energized during loss of power, *L2-01 [Power Loss Ride Through Select]* sets operation. 0 : Disregard Existing RUN Command 1 : Accept Existing RUN Command
b1-40 (3BCF)	Deceleration Abort Time	V/f OLV/PM EZOLV Sets the maximum time until the drive shuts off the output to decelerate to stop.
b5-01 (01A5)	PID Mode Setting	V/f OLV/PM EZOLV Sets the type of PID control. 0 : Disabled 1 : Standard
b5-02 (01A6) RUN	Proportional Gain (P)	V/f OLV/PM EZOLV Sets the proportional gain (P) that is applied to PID input.
b5-03 (01A7) RUN	Integral Time (I)	V/f OLV/PM EZOLV Sets the integral time (I) that is applied to PID input.
b5-04 (01A8) RUN	Integral Limit	V/f OLV/PM EZOLV Sets the upper limit for integral control (I) as a percentage of the Maximum Output Frequency.
b5-05 (01A9) RUN	Derivative Time (D)	V/f OLV/PM EZOLV Sets the derivative time (D) for PID control. This parameter adjusts system responsiveness.
b5-06 (01AA) RUN	PID Output Limit	V/f OLV/PM EZOLV Sets the maximum possible output from the PID controller as a percentage of the Maximum Output Frequency.
b5-07 (01AB) RUN	PID Offset Adjustment	V/f OLV/PM EZOLV Sets the offset for the PID control output as a percentage of the Maximum Output Frequency.
b5-08 (01AC) RUN	PID Primary Delay Time Constant	V/f OLV/PM EZOLV Sets the primary delay time constant for the PID control output. Usually it is not necessary to change this setting.

No. (Hex.)	Name	Description
b5-09 (01AD)	PID Output Level Selection	V/f OLV/PM EZOLV Sets the polarity of the PID output. 0 : Normal Output (Direct Acting) 1 : Reverse Output (Reverse Acting)
b5-10 (01AE) RUN	PID Output Gain Setting	V/f OLV/PM EZOLV Sets the amount of gain to apply to the PID output.
b5-11 (01AF)	PID Output Reverse Selection	V/f OLV/PM EZOLV Sets the function that enables and disables reverse motor rotation for negative PID control output. 0 : Lower Limit is Zero 1 : Negative Output Accepted
b5-17 (01B5) RUN	PID Accel/Decel Time	V/f OLV/PM EZOLV Raises or lowers the PID setpoint using the acceleration and deceleration times set to the drive. This is a soft-starter for the PID setpoint.
b5-34 (019F) RUN	PID Output Lower Limit Level	V/f OLV/PM EZOLV Sets the output lower limit for the PID control as a percentage of the Maximum Output Frequency.
b5-35 (01A0) RUN	PID Input Limit Level	V/f OLV/PM EZOLV Sets the output upper limit for the PID control as a percentage of the Maximum Output Frequency.
b5-39 (01FF)	PID User Unit Display Digits	V/f OLV/PM EZOLV Sets the number of digits to set and show the PID setpoint. 0 : No Decimal Places (XXXXX) 1 : One Decimal Place (XXXX.X) 2 : Two Decimal Places (XXX.XX) 3 : Three Decimal Places (XX.XXX)
b5-40 (017F)	Frequency Reference Monitor @PID	V/f OLV/PM EZOLV Sets the contents for monitor *U1-01 [Frequency Reference]* in PID control. 0 : U1-01 Includes PID Output 1 : U1-01 Excludes PID Output
b5-41 (0160)	PID Output 2 Unit	V/f OLV/PM EZOLV Sets the display units in *U5-14 [PID Out2 Upper 4]* and *U5-15 [PID Out2 Lower 4]*. 0 : "WC: inches of water column 1 : PSI: pounds per square inch 2 : GPM: gallons/min 3 : °F: Fahrenheit 4 : ft^3/min: cubic feet/min 5 : m^3/h: cubic meters/hour 6 : L/h: liters/hour 7 : L/s: liters/sec 8 : bar: bar 9 : Pa: Pascal 10 : °C: Celsius 11 : m: meters 12 : ft: feet 13 : L/min: liters/min 14 : m^3/min: cubic meters/min 15 : "Hg: Inch Mercury 16 : kPa: kilopascal 25 : Flow (Use Y6-04) 48 : %: Percent 49 : Custom(Y1-32~34) 50 : None
b5-42 (0161) RUN	PID Output 2 Calc Mode	V/f OLV/PM EZOLV Sets how to calculate the original PID output. 0 : Linear 1 : Square Root 2 : Quadratic 3 : Cubic

No. (Hex.)	Name	Description
b5-43 (0162) RUN	PID Out2 Monitor MAX Upper4 Dig	V/f OLV/PM EZOLV Sets the upper 4 digits of the maximum monitor value. Used with *b5-44 [PID Out2 Monitor MAX Lower4 Dig]* to set maximum monitor value of *U5-14 [PID Out2 Upper 4]* and *U5-15 [PID Out2 Lower 4]* at maximum frequency.
b5-44 (0163) RUN	PID Out2 Monitor MAX Lower4 Dig	V/f OLV/PM EZOLV Sets the lower 4 digits of the maximum monitor value. Used with *b5-43 [PID Out2 Monitor MAX Upper4 Dig]* to set maximum monitor value of *U5-14 [PID Out2 Upper 4]* and *U5-15 [PID Out2 Lower 4]* at maximum frequency.
b5-45 (0164) RUN	PID Out2 Monitor MIN for Linear	V/f OLV/PM EZOLV Sets the minimum display value to show when at zero speed. Only effective when *b5-42 = 0 [PID Output 2 Calc Mode = Linear]*.
b5-53 (0B8F) RUN	PID Integrator Ramp Limit	V/f OLV/PM EZOLV Sets the responsiveness of PID control when the PID feedback changes quickly.
b5-71 (3C22)	Min PID Transducer Scaling	V/f OLV/PM EZOLV Sets the minimum PID level corresponding to the lowest analog input signal level.
b5-82 (31B0)	Feedback Loss 4 ~ 20mA Detect Sel	V/f OLV/PM EZOLV Sets the drive to do a 4 to 20 mA wire-break detection on the analog input set for PID feedback. 0 : Disabled 1 : Alarm Only 2 : Fault 3 : Run At b5-83
b5-83 (31B1) RUN	Feedback Loss GoTo Frequency	V/f OLV/PM EZOLV Sets the speed at which the drive will run if the drive detects a 4 to 20 mA wire-break on the PID Feedback and *b5-82 = 3 [Feedback Loss 4 ~ 20mA Detect Sel = Run At b5-83]*.
b5-84 (31B2) RUN	Feedback Loss Loss Of Prime Lvl	V/f OLV/PM EZOLV Sets the level at which the drive will detect Loss of Prime in the pump.
b5-85 (31B3) RUN	Feedback Loss GoTo Freq Timeout	V/f OLV/PM EZOLV When *b5-82 = 3 [Feedback Loss 4 ~ 20mA Detect Sel = Run At b5-83]* and the Feedback signal is lost, the drive will run at the *b5-83 [Feedback Loss Goto Frequency]* speed for this length of time, after which the drive will fault on *FDBKL [WIRE Break]*.
b5-86 (31B4) RUN	Feedback Loss Start Delay	V/f OLV/PM EZOLV When you initiate a Run command, the drive will wait for this length of time before it will fault on *FDBKL [WIRE Break]* or use parameter *b5-83 [Feedback Loss Goto Frequency]*.
C1-01 (0200) RUN	Acceleration Time 1	V/f OLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.
C1-02 (0201) RUN	Deceleration Time 1	V/f OLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.
C1-03 (0202) RUN	Acceleration Time 2	V/f OLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.
C1-04 (0203) RUN	Deceleration Time 2	V/f OLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.
C1-05 (0204) RUN	Acceleration Time 3	V/f OLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.
C1-06 (0205) RUN	Deceleration Time 3	V/f OLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.
C1-07 (0206) RUN	Acceleration Time 4	V/f OLV/PM EZOLV Sets the length of time to accelerate from zero to maximum output frequency.
C1-08 (0207) RUN	Deceleration Time 4	V/f OLV/PM EZOLV Sets the length of time to decelerate from maximum output frequency to zero.

No. (Hex.)	Name	Description
C1-09 (0208) RUN	Fast Stop Time	V/f OLV/PM EZOLV Sets the length of time that the drive will decelerate to zero for a Fast Stop.
C1-10 (0209)	Accel/Decel Time Setting Units	V/f OLV/PM EZOLV Sets the setting units for *C1-01 to C1-08 [Accel/Decel Times 1 to 4]*, *C1-09 [Fast Stop Time]*, *L2-06 [Kinetic Energy Backup Decel Time]*, and *L2-07 [Kinetic Energy Backup Accel Time]*. 0 : 0.01 s (0.00 to 600.00 s) 1 : 0.1 s (0.0 to 6000.0 s)
C1-11 (020A)	Accel/Decel Time Switching Frequency	V/f OLV/PM EZOLV Sets the frequency at which the drive will automatically change acceleration and deceleration times.
C2-01 (020B)	S-Curve Time @ Start of Accel	V/f OLV/PM EZOLV Sets the S-curve acceleration time at start.
C2-02 (020C)	S-Curve Time @ End of Accel	V/f OLV/PM EZOLV Sets the S-curve acceleration time at completion.
C2-03 (020D)	S-Curve Time @ Start of Decel	V/f OLV/PM EZOLV Sets the S-curve deceleration time at start.
C2-04 (020E)	S-Curve Time @ End of Decel	V/f OLV/PM EZOLV Sets the S-curve deceleration time at completion.
C6-02 (0224)	Carrier Frequency Selection	V/f OLV/PM EZOLV Sets the carrier frequency for the transistors in the drive. 1 : 2.0 kHz 2 : 5.0 kHz 3 : 8.0 kHz 4 : 10.0 kHz 5 : 12.5 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 : Leakage Current Rejection PWM F : User Defined (C6-03 to C6-05)
C6-03 (0225)	Carrier Frequency Upper Limit	V/f OLV/PM EZOLV Sets the upper limit of the carrier frequency. Set *C6-02 = F [Carrier Frequency Selection = User Defined (C6-03 to C6-05)]* to set this parameter.
C6-04 (0226)	Carrier Frequency Lower Limit	V/f OLV/PM EZOLV Sets the lower limit of the carrier frequency. Set *C6-02 = F [Carrier Frequency Selection = User Defined (C6-03 to C6-05)]* to set this parameter.
C6-05 (0227)	Carrier Freq Proportional Gain	V/f OLV/PM EZOLV Sets the proportional gain for the carrier frequency. Set *C6-02 = F [Carrier Frequency Selection = User Defined (C6-03 to C6-05)]* to set this parameter.
d1-01 (0280) RUN	Reference 1	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-02 (0281) RUN	Reference 2	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-03 (0282) RUN	Reference 3	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-04 (0283) RUN	Reference 4	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-05 (0284) RUN	Reference 5	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-06 (0285) RUN	Reference 6	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.

No. (Hex.)	Name	Description
d1-07 (0286) RUN	Reference 7	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-08 (0287) RUN	Reference 8	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-09 (0288) RUN	Reference 9	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-10 (028B) RUN	Reference 10	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-11 (028C) RUN	Reference 11	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-12 (028D) RUN	Reference 12	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-13 (028E) RUN	Reference 13	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-14 (028F) RUN	Reference 14	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-15 (0290) RUN	Reference 15	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-16 (0291) RUN	Reference 16	V/f OLV/PM EZOLV Sets the frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*.
d1-17 (0292) RUN	Jog Reference	V/f OLV/PM EZOLV Sets the Jog frequency reference in the units from *o1-03 [Frequency Display Unit Selection]*. Set *H1-xx = 6 [MFDI Function Selection = Jog Reference Selection]* to use the Jog frequency reference.
E1-01 (0300)	Input AC Supply Voltage	V/f OLV/PM EZOLV Sets the drive input voltage.
E1-03 (0302)	V/f Pattern Selection	V/f OLV/PM EZOLV Sets the V/f pattern for the drive and motor. You can use one of the preset patterns or you can make a custom pattern. 0 : Const Trq, 50Hz base, 50Hz max 1 : Const Trq, 60Hz base, 60Hz max 2 : Const Trq, 50Hz base, 60Hz max 3 : Const Trq, 60Hz base, 72Hz max 4 : VT, 50Hz, 65% Vmid reduction 5 : VT, 50Hz, 50% Vmid reduction 6 : VT, 60 Hz, 65% Vmid reduction 7 : VT, 60Hz, 50% Vmid reduction 8 : High Trq, 50Hz, 25% Vmin boost 9 : High Trq, 50Hz, 65% Vmin boost A : High Trq, 60Hz, 25% Vmin boost B : High Trq, 60Hz, 65% Vmin boost C : High Freq, 60Hz base, 90Hz max D : High Freq, 60Hz base, 120Hz max E : High Freq, 60Hz base, 180Hz max F : Custom
E1-04 (0303)	Maximum Output Frequency	V/f OLV/PM EZOLV Sets the maximum output frequency for the V/f pattern.
E1-05 (0304)	Maximum Output Voltage	V/f OLV/PM EZOLV Sets the maximum output voltage for the V/f pattern.
E1-06 (0305)	Base Frequency	V/f OLV/PM EZOLV Sets the base frequency for the V/f pattern.

No. (Hex.)	Name	Description
E1-07 (0306)	Mid Point A Frequency	V/f OLV/PM EZOLV Sets a middle output frequency for the V/f pattern.
E1-08 (0307)	Mid Point A Voltage	V/f OLV/PM EZOLV Sets a middle output voltage for the V/f pattern.
E1-09 (0308)	Minimum Output Frequency	V/f **OLV/PM** EZOLV Sets the minimum output frequency for the V/f pattern.
E1-10 (0309)	Minimum Output Voltage	V/f OLV/PM EZOLV Sets the minimum output voltage for the V/f pattern.
E1-11 (030A) Expert	Mid Point B Frequency	V/f OLV/PM EZOLV Sets a middle output frequency for the V/f pattern.
E1-12 (030B) Expert	Mid Point B Voltage	V/f OLV/PM EZOLV Sets a middle point voltage for the V/f pattern.
E1-13 (030C) Expert	Base Voltage	V/f OLV/PM EZOLV Sets the base voltage for the V/f pattern.
E2-01 (030E)	Motor Rated Current (FLA)	V/f OLV/PM EZOLV Sets the motor rated current in amps.
E2-02 (030F)	Motor Rated Slip	V/f OLV/PM EZOLV Sets motor rated slip.
E2-03 (0310)	Motor No-Load Current	V/f OLV/PM EZOLV Sets the no-load current for the motor in amps when operating at the rated frequency and the no-load voltage.
E2-04 (0311)	Motor Pole Count	V/f OLV/PM EZOLV Sets the number of motor poles.
E2-05 (0312)	Motor Line-to-Line Resistance	V/f OLV/PM EZOLV Sets the line-to-line resistance for the motor stator windings.
E2-06 (0313)	Motor Leakage Inductance	V/f OLV/PM EZOLV Sets the voltage drop from motor leakage inductance when the motor is operating at the rated frequency and rated current. This value is a percentage of Motor Rated Voltage.
E2-10 (0317)	Motor Iron Loss	V/f OLV/PM EZOLV Sets the motor iron loss.
E2-11 (0318)	Motor Rated Power	V/f OLV/PM EZOLV Sets the motor rated output in the units from *o1-58 [Motor Power Unit Selection]*.
H1-01 (0438)	Terminal S1 Function Selection	V/f **OLV/PM** **EZOLV** Sets the function for MFDI terminal S1.
H1-02 (0439)	Terminal S2 Function Selection	V/f **OLV/PM** **EZOLV** Sets the function for MFDI terminal S2.
H1-03 (0400)	Terminal S3 Function Selection	V/f **OLV/PM** **EZOLV** Sets the function for MFDI terminal S3.
H1-04 (0401)	Terminal S4 Function Selection	V/f **OLV/PM** **EZOLV** Sets the function for MFDI terminal S4.
H1-05 (0402)	Terminal S5 Function Selection	V/f **OLV/PM** **EZOLV** Sets the function for MFDI terminal S5.
H1-06 (0403)	Terminal S6 Function Selection	V/f **OLV/PM** **EZOLV** Sets the function for MFDI terminal S6.
H1-07 (0404)	Terminal S7 Function Selection	V/f **OLV/PM** **EZOLV** Sets the function for MFDI terminal S7.
H1-08 (0405)	Terminal S8 Function Selection	V/f **OLV/PM** **EZOLV** Sets the function for MFDI terminal S8.
H1-21 (0B70) RUN	EF1 Delay Time	V/f **OLV/PM** **EZOLV** Sets the amount of time delay applied to the *EF1* fault and alarm. ($20 \leq H1\text{-}01 \leq 2F$)

No. (Hex.)	Name	Description
H1-22 (0B71) RUN	EF2 Delay Time	V/f OLV/PM EZOLV Sets the amount of time delay applied to the *EF2* fault and alarm. (*20 ≤ H1-02 ≤ 2F*)
H1-23 (0B72) RUN	EF3 Delay Time	V/f OLV/PM EZOLV Sets the amount of time delay applied to the *EF3* fault and alarm. (*20 ≤ H1-03 ≤ 2F*)
H1-24 (0B73) RUN	EF4 Delay Time	V/f OLV/PM EZOLV Sets the amount of time delay applied to the *EF4* fault and alarm. (*20 ≤ H1-04 ≤ 2F*)
H1-25 (0B74) RUN	EF5 Delay Time	V/f OLV/PM EZOLV Sets the amount of time delay applied to the *EF5* fault and alarm. (*20 ≤ H1-05 ≤ 2F*)
H1-26 (0B75) RUN	EF6 Delay Time	V/f OLV/PM EZOLV Sets the amount of time delay applied to the *EF6* fault and alarm. (*20 ≤ H1-06 ≤ 2F*)
H1-27 (0B76) RUN	EF7 Delay Time	V/f OLV/PM EZOLV Sets the amount of time delay applied to the *EF7* fault and alarm. (*20 ≤ H1-07 ≤ 2F*)
H1-28 (0B77) RUN	EF8 Delay Time	V/f OLV/PM EZOLV Sets the amount of time delay applied to the *EF8* fault and alarm. (*20 ≤ H1-08 ≤ 2F*)
H1-40 (0B54)	Mbus Reg 15C0h bit0 Input Func	V/f OLV/PM EZOLV Sets the MFDI function assigned to *bit 0* of the MEMOBUS register *15C0 (Hex.)*.
H1-41 (0B55)	Mbus Reg 15C0h bit1 Input Func	V/f OLV/PM EZOLV Sets the MFDI function assigned to *bit 1* of the MEMOBUS register *15C0 (Hex.)*.
H1-42 (0B56)	Mbus Reg 15C0h bit2 Input Func	V/f OLV/PM EZOLV Sets the MFDI function assigned to *bit 2* of the MEMOBUS register *15C0 (Hex.)*.
H1-61 (39E1) RUN	Terminal S1 On-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S1 to be closed before the drive does the programmed function.
H1-62 (39E2) RUN	Terminal S2 On-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S2 to be closed before the drive does the programmed function.
H1-63 (39E3) RUN	Terminal S3 On-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S3 to be closed before the drive does the programmed function.
H1-64 (39E4) RUN	Terminal S4 On-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S4 to be closed before the drive does the programmed function.
H1-65 (39E5) RUN	Terminal S5 On-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S5 to be closed before the drive does the programmed function.
H1-66 (39E6) RUN	Terminal S6 On-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S6 to be closed before the drive does the programmed function.
H1-67 (39E7) RUN	Terminal S7 On-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S7 to be closed before the drive does the programmed function.
H1-68 (39E8) RUN	Terminal S8 On-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S8 to be closed before the drive does the programmed function.
H1-71 (39EB) RUN	Terminal S1 Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S1 to be open before the drive removes the programmed function.
H1-72 (39EC) RUN	Terminal S2 Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S2 to be open before the drive removes the programmed function.

No. (Hex.)	Name	Description
H1-73 (39ED) RUN	Terminal S3 Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S3 to be open before the drive removes the programmed function.
H1-74 (39EE) RUN	Terminal S4 Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S4 to be open before the drive removes the programmed function.
H1-75 (39EF) RUN	Terminal S5 Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S5 to be open before the drive removes the programmed function.
H1-76 (39F0) RUN	Terminal S6 Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S6 to be open before the drive removes the programmed function.
H1-77 (39F1) RUN	Terminal S7 Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S7 to be open before the drive removes the programmed function.
H1-78 (39F2) RUN	Terminal S8 Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time necessary for Terminal S8 to be open before the drive removes the programmed function.
0	3-Wire Sequence	V/f OLV/PM EZOLV Sets the direction of motor rotation for 3-wire sequence.
2	External Reference 1/2 Selection	V/f OLV/PM EZOLV Sets the drive to use Run command source 1/2 or Reference command source 1/2 when in REMOTE Mode. ON : *b1-15 [Frequency Reference Selection 2], b1-16 [Run Command Selection 2]* OFF : *b1-01 [Frequency Reference Selection 1], b1-02 [Run Command Selection 1]*
3	Multi-Step Speed Reference 1	V/f OLV/PM EZOLV Uses speed references *d1-01 to d1-16* to set a multi-step speed reference.
4	Multi-Step Speed Reference 2	V/f OLV/PM EZOLV Uses speed references *d1-01 to d1-16* to set a multi-step speed reference.
5	Multi-Step Speed Reference 3	V/f OLV/PM EZOLV Uses speed references *d1-01 to d1-16* to set a multi-step speed reference.
6	Jog Reference Selection	V/f OLV/PM EZOLV Sets the drive to use the JOG Frequency Reference (JOG command) set in *d1-17*. The JOG Frequency Reference (JOG command) overrides *Frequency References 1 to 16 (d1-01 to d1-16)*.
7	Accel/Decel Time Selection 1	V/f OLV/PM EZOLV Sets the drive to use *Acceleration/Deceleration Time 1 [C1-01, C1-02]* or *Acceleration/Deceleration Time 2 [C1-03, C1-04]*.
8	Baseblock Command (N.O.)	V/f OLV/PM EZOLV Sets the command that stops drive output and coasts the motor to stop when the input is ON. ON : Baseblock (drive output stop) OFF : Normal operation
9	Baseblock Command (N.C.)	V/f OLV/PM EZOLV Sets the command that stops drive output and coasts the motor to stop when the input terminal is OFF. ON : Normal operation OFF : Baseblock (drive output stop)
A	Accel/Decel Ramp Hold	V/f OLV/PM EZOLV Momentarily pauses motor acceleration and deceleration when the terminal is turned ON, retains the output frequency that was stored in the drive at the time of the pause, and restarts motor operation.
B	Overheat Alarm (oH2)	V/f OLV/PM EZOLV Sets the drive to show an *oH2 [External Overheat (H1-XX=B)]* alarm when the input terminal is ON. The alarm does not have an effect on drive operation.
C	Analog Terminal Enable Selection	V/f OLV/PM EZOLV Sets the command that enables or disables the terminals selected in *H3-14 [Analog Input Terminal Enable Sel]*. ON : Terminal selected with *H3-14* is enabled OFF : Terminal selected with *H3-14* is disabled
E	ASR Integral Reset	V/f OLV/PM EZOLV Sets the command to reset the integral value and use PI control or P control for the speed control loop. ON : P control OFF : PI control

No. (Hex.)	Name	Description
F	Not Used	V/f OLV/PM EZOLV Use this setting for unused terminals or to use terminals in through mode.
10	Up Command	V/f OLV/PM EZOLV Sets the command to use a push button switch to increase the drive frequency reference. You must also set *Setting 11 [Down Command]*. ON : Increases the frequency reference. OFF : Holds the current frequency reference.
11	Down Command	V/f OLV/PM EZOLV Sets the command to use a push button switch to decrease the drive frequency reference. You must also set *Setting 10 [Up Command]*. ON : Decreases the frequency reference. OFF : Holds the current frequency reference.
12	Forward Jog	V/f OLV/PM EZOLV Sets the command to operate the motor in the forward direction at the Jog Frequency set in *d1-17 [Jog Reference]*.
13	Reverse Jog	V/f OLV/PM EZOLV Sets the command to operate the motor in the reverse direction at the Jog Frequency set in *d1-17 [Jog Reference]*.
14	Fault Reset	V/f OLV/PM EZOLV Sets the command to reset the current fault when the Run command is inactive.
15	Fast Stop (N.O.)	V/f OLV/PM EZOLV Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is activated while the drive is operating.
16	Motor 2 Selection	V/f OLV/PM EZOLV Sets the command for the drive to operate motor 1 or motor 2. Stop the motors before switching. ON : Selects motor 2. OFF : Selects motor 1.
17	Fast Stop (N.C.)	V/f OLV/PM EZOLV Sets the command to ramp to stop in the deceleration time set in *C1-09 [Fast Stop Time]* when the input terminal is activated while the drive is operating.
18	Timer Function	V/f OLV/PM EZOLV Sets the command to start the timer function. Use this setting with *Timer Output [H2-xx = 12]*.
19	PID Disable	V/f OLV/PM EZOLV Sets the command to disable PID control when *b5-01 = 1 [PID Mode Setting = Standard]*. ON : PID control disabled OFF : PID control enabled
1B	Programming Lockout	V/f OLV/PM EZOLV Sets the command to prevent parameter changes when the terminal is OFF. ON : Programming Lockout OFF : Parameter Write Prohibit
1E	Reference Sample Hold	V/f OLV/PM EZOLV Sets the command to sample the frequency reference at terminals A1, A2, or A3 and hold the frequency reference at that frequency.
20	Ext Pump Fault (NO-Always-Ramp)	V/f OLV/PM EZOLV When the terminal activates, the drive ramps to stop in the selected deceleration time. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive always detects external faults whether the drive is stopped or running.
21	Ext Pump Fault (NC-Always-Ramp)	V/f OLV/PM EZOLV When the terminal deactivates, the drive ramps to stop in the selected deceleration time. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive always detects external faults whether the drive is stopped or running.
22	Ext Pump Fault (NO-@Run-Ramp)	V/f OLV/PM EZOLV When the terminal activates during run, the drive ramps to stop in the selected deceleration time. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive does not detect external faults while the drive is stopped.
23	Ext Pump Fault (NC-@Run-Ramp)	V/f OLV/PM EZOLV When the terminal deactivates during run, the drive ramps to stop in the selected deceleration time. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive does not detect external faults while the drive is stopped.
24	Ext Pump Fault (NO-Always-Coast)	V/f OLV/PM EZOLV When the terminal activates, the drive shuts off the output and the motor coasts to stop. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive always detects external faults whether the drive is stopped or running.

No. (Hex.)	Name	Description
25	Ext Pump Fault (NC-Always-Coast)	V/f OLV/PM EZOLV When the terminal deactivates, the drive shuts off the output and the motor coasts to stop. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive always detects external faults whether the drive is stopped or running.
26	Ext Pump Fault (NO-@Run-Coast)	V/f OLV/PM EZOLV When the terminal activates during run, the drive shuts off the output and the motor coasts to stop. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive does not detect external faults while the drive is stopped.
27	Ext Pump Fault (NC-@Run-Coast)	V/f OLV/PM EZOLV When the terminal deactivates during run, the drive shuts off the output and the motor coasts to stop. Fault relay output terminal MA-MC will turn ON, and MB-MC will turn OFF. The drive does not detect external faults while the drive is stopped.
28	Ext Pump Fault (NO-Always-FStop)	V/f OLV/PM EZOLV When the terminal activates, the drive stops the motor in the deceleration time set to *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF. Stopped drives and running drives will detect external faults.
29	Ext Pump Fault (NC-Always-FStop)	V/f OLV/PM EZOLV When the terminal deactivates, the drive stops the motor in the deceleration time set to *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF. Stopped drives and running drives will detect external faults.
2A	Ext Pump Fault (NO-@Run-FStop)	V/f OLV/PM EZOLV When the terminal activates during run, the drive stops the motor in the deceleration time set to *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF. Stopped drives will not detect external faults.
2B	Ext Pump Fault (NC-@Run-FStop)	V/f OLV/PM EZOLV When the terminal deactivates during run, the drive stops the motor in the deceleration time set to *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF. Stopped drives will not detect external faults.
2C	Ext Pump Fault (NO-Always-Alarm)	V/f OLV/PM EZOLV When the terminal activates, the keypad shows *EFx [Pump Fault (Terminal Sx)]* and the output terminal set for *Alarm [H2-01 to H2-03 = 10]* activates. The drive continues operation. The drive always detects external faults whether the drive is stopped or running.
2D	Ext Pump Fault (NC-Always-Alarm)	V/f OLV/PM EZOLV When the terminal deactivates, the keypad shows *EFx [Pump Fault (Terminal Sx)]* and the output terminal set for *Alarm [H2-01 to H2-03 = 10]* activates. The drive continues operation. The drive always detects external faults whether the drive is stopped or running.
2E	Ext Pump Fault (NO-@Run-Alarm)	V/f OLV/PM EZOLV When the terminal activates during run, the keypad shows *EFx [Pump Fault (Terminal Sx)]* and the output terminal set for *Alarm [H2-01 to H2-03 = 10]* activates. The drive continues operation. The drive does not detect external faults while the drive is stopped.
2F	Ext Pump Fault (NC-@Run-Alarm)	V/f OLV/PM EZOLV When the terminal deactivates during run, the keypad shows *EFx [Pump Fault (Terminal Sx)]* and the output terminal set for *Alarm [H2-01 to H2-03 = 10]* activates. The drive continues operation. The drive does not detect external faults while the drive is stopped.
30	PID Integrator Reset	V/f OLV/PM EZOLV Sets the command to reset and hold the PID control integral to 0 when the terminal is ON.
31	PID Integrator Hold	V/f OLV/PM EZOLV Sets the command to hold the integral value of the PID control while the terminal is activated.
32	Multi-Step Speed Reference 4	V/f OLV/PM EZOLV Uses speed references *d1-01 to d1-16* to set a multi-step speed reference.
34	PID Soft Starter Disable	V/f OLV/PM EZOLV Sets the PID soft starter function. ON : Disable OFF : Enabled
35	PID Input (Error) Invert	V/f OLV/PM EZOLV Sets the command to turn the terminal ON and OFF to switch the PID input level (polarity).
40	Forward RUN (2-Wire)	V/f OLV/PM EZOLV Sets the Forward Run command for 2-wire sequence 1. Set this function and *H1-xx = 41 [Reverse RUN (2-Wire)]* together. ON : Forward Run OFF : Stop
41	Reverse RUN (2-Wire)	V/f OLV/PM EZOLV Sets the Forward Run command for 2-wire sequence 1. Set this function and *H1-xx = 40 [Forward RUN (2-Wire)]* together. ON : Reverse Run OFF : Stop

No. (Hex.)	Name	Description
42	Run Command (2-Wire Sequence 2)	V/f OLV/PM EZOLV Sets the Run command for 2-wire sequence 2. Set this function and *H1-xx = 43 [FWD/REV (2-Wire Sequence 2)]* together. ON : Run OFF : Stop
43	FWD/REV (2-Wire Sequence 2)	V/f OLV/PM EZOLV Sets the direction of motor rotation for 2-wire sequence 2. Set this function and *H1-xx = 42 [Run Command (2-Wire Sequence 2)]* together. ON : Reverse Run OFF : Forward Run
50	Motor Pre-heat 2	V/f OLV/PM EZOLV Sets the command to apply the motor pre-heat current set in *b2-09 [Pre-heat Current 2]*.
51	Sequence Timer Disable	V/f OLV/PM EZOLV Sets the function for the drive to ignore sequence timers and run normally. ON : Drive ignores sequence timers and runs normally (based on b1-02 source). OFF : Drive follows sequence timer programming
52	Sequence Timer Cancel	V/f OLV/PM EZOLV Sets the function to disable the currently active sequence timer. ON : When the input changes from open to closed, the currently active sequence timer is disabled. Operation will resume with the next scheduled sequence timer. Re-cycling the run command after the current sequence timer has been canceled will re-enable the sequence timer. OFF : Drive follows sequence timer programming.
60	DC Injection Braking Command	V/f OLV/PM EZOLV Sets the command to use DC Injection Braking to stop the motor.
61	Speed Search from Fmax	V/f OLV/PM EZOLV Sets the function to use an external reference to start speed search although *b3-01 = 0 [Speed Search Selection at Start = Disabled]* to not allow speed search at start.
62	Speed Search from Fref	V/f OLV/PM EZOLV Sets the function to use an external reference to start speed search although *b3-01 = 0 [Speed Search Selection at Start = Disabled]* to not allow speed search at start.
63	Field Weakening	V/f OLV/PM EZOLV Sets the function to send the Field Weakening Level and Field Weakening Frequency Limit commands set in *d6-01 [Field Weakening Level] and d6-02 [Field Weakening Frequency Limit]* when the input terminal is activated.
65	KEB Ride-Thru 1 Activate (N.C.)	V/f OLV/PM EZOLV Sets operation of the KEB1 function through the KEB Ride-Thru 1 (N.C.). ON : Normal operation OFF : Deceleration during momentary power loss
66	KEB Ride-Thru 1 Activate (N.O.)	V/f OLV/PM EZOLV Sets operation of the KEB1 function through the KEB Ride-Thru 1 (N.O.). ON : Deceleration during momentary power loss OFF : Normal operation
67	Communications Test Mode	V/f OLV/PM EZOLV Sets the function for the drive to self-test RS-485 serial communications operation.
68	High Slip Braking (HSB) Activate	V/f OLV/PM EZOLV Sets the command to use high-slip braking to stop the motor.
6A	Drive Enable	V/f OLV/PM EZOLV Sets the function to show *dnE [Drive Disabled]* on the keypad and ignore Run commands when the terminal is OFF.
70	Drive Enable No Run Cycle	V/f OLV/PM EZOLV Prevents the drive from executing a Run command until the *Drive Enable No Run Cycle* input is closed. The drive will run when the Run and *Drive Enable No Run Cycle* inputs are both closed. If the *Drive Enable No Run Cycle* input is opened while the drive is running, the drive will stop according to the *b1-03* setting. ON : Run command is accepted. OFF : The drive cannot execute a Run command. If a Run command is given while the terminal is OFF, it will trigger a *WFR Waiting for Run* alarm. The drive will be allowed to run when the terminal is ON. If the terminal turns OFF while the drive is already running, the drive will stop according to *b1-03 [Stopping Method Selection]* and it will trigger a *WFR Waiting for Run* alarm. Turning ON the terminal will allow the drive to resume running.
75	Up 2 Command	V/f OLV/PM EZOLV Sets the function to increase the frequency reference bias value to accelerate the motor when the terminal is activated. Set this function and *H1-xx = 76 [Down 2 Command]* together.
76	Down 2 Command	V/f OLV/PM EZOLV Sets the function to decrease the frequency reference bias value to decelerate the motor when the terminal is activated. Set this function and *H1-xx = 75 [Up 2 Command]* together.

No. (Hex.)	Name	Description
77	ASR Gain (C5-03) Select	V/f OLV/PM EZOLV Sets the function to switch the ASR proportional gain to *C5-01 [ASR Proportional Gain 1]* or *C5-03 [ASR Proportional Gain 2]*. ON : C5-03 OFF : C5-01
7A	KEB Ride-Thru 2 Activate (N.C.)	V/f OLV/PM EZOLV Sets operation of the KEB2 function through the KEB Ride-Thru 2 (N.C.). ON : Normal operation OFF : Deceleration during momentary power loss
7B	KEB Ride-Thru 2 Activate (N.O.)	V/f OLV/PM EZOLV Sets operation of the KEB2 function through the KEB Ride-Thru 2 (N.O.). ON : Deceleration during momentary power loss OFF : Normal operation
7C	Short Circuit Braking (N.O.)	V/f OLV/PM EZOLV Sets operation of Short Circuit Braking (N.O.). ON : Short Circuit Braking is enabled. OFF : Normal operation
7D	Short Circuit Braking (N.C.)	V/f OLV/PM EZOLV Sets operation of Short Circuit Braking (N.C.). ON : Normal operation OFF : Short Circuit Braking is enabled.
80	HAND Mode	V/f OLV/PM EZOLV Sets the function to operate the drive in HAND Mode. ON : Drive is operating in HAND Mode. Frequency reference source is determined by *Y5-01 [HAND Frequency Reference Source]* and *Y5-02 [HAND Frequency Reference 1]*. OFF : Drive is not set to be in HAND Mode.
81	HAND Mode 2	V/f OLV/PM EZOLV Sets the function to operate the drive in HAND Mode 2. ON : Drive is operating in HAND Mode 2. Frequency reference is determined by *Y5-05 [HAND Frequency Reference 2]* . OFF : Drive is not set to be in HAND Mode 2.
82	PI Switch to Aux	V/f OLV/PM EZOLV Sets *YF-xx [PI Auxiliary Control]* parameters as primary PI loop parameters and disables *b5-xx [PID Control]*.
88	Volute Thermostat Fault	V/f OLV/PM EZOLV Sets the drive to show the *VLTS [Volute Thermostat Fault]* when the input terminal is ON.
90 - 97	DWEZ Digital Inputs 1 to 8	V/f OLV/PM EZOLV Sets digital inputs used with DriveWorksEZ. Refer to the DriveWorksEZ online manual for more information.
9F	DWEZ Disable	V/f OLV/PM EZOLV Sets operation of the DriveWorksEZ program saved in the drive. ON : Disabled OFF : Enabled
A8	PI2 Control Disable	V/f OLV/PM EZOLV Sets the command to disable the PI2 Control function. Parameter *S3-12 [PI2 Control Disable Mode Sel]* sets the output performance. ON : Enabled OFF : Disabled
AA	PI2 Control Inverse Operation	V/f OLV/PM EZOLV Sets the command to change the sign of the PI2 Control input.
AB	PI2 Control Integral Reset	V/f OLV/PM EZOLV Sets the command to reset the PI2 Control integral value.
AC	PI2 Control Integral Hold	V/f OLV/PM EZOLV Sets the command to lock the PI2 Control integral value.
AD	Select PI2 Control PI Parameters	V/f OLV/PM EZOLV Sets the command to use the *S3-06 [PI2 Control Proportional Gain]* and *S3-07 [PI2 Control Integral Time]* values instead of the *b5-02 [Proportional Gain (P)]* and *b5-03 [Integral Time (I)]* values. Set *S3-01 = 0 [PI2 Control Enable Selection = Disabled]* to enable this function.
AF	Emergency Override FWD	V/f OLV/PM EZOLV Sets the command to use the speed set in *S6-02 [Emergency Override Ref Selection]* to run the drive in the forward direction.

No. (Hex.)	Name	Description
B0	Emergency Override REV	V/f OLV/PM EZOLV Sets the command to use the speed set in *S6-02 [Emergency Override Ref Selection]* to run the drive in the reverse direction.
B8	Low City Pressure	V/f OLV/PM EZOLV Sets the command to show that there is not sufficient pressure at the inlet to the pump. OFF : Insufficient pressure is present on the inlet to the pump
B9	Disable Pre-charge	V/f OLV/PM EZOLV Sets the command to disable the Pre-charge function. ON : Pre-charge function is disabled
BB	Low Water Level	V/f OLV/PM EZOLV Sets the drive to show an *LWL [Low Water Level]* fault when the input terminal is ON. ON : Low Water Level Fault OFF : Reservoir/Tank is filled to normal level
BC	High Water Level	V/f OLV/PM EZOLV Sets the drive to show an *HWL [High Water Level]* fault when the input terminal is ON. ON : High Water Level Fault OFF : Reservoir/Tank is filled to normal level.
BD	Remote Drive Disable	V/f OLV/PM EZOLV Sets the function to stop or prohibit the drive operation when the input terminal is ON. ON : Stops and prohibits the drive from running. OFF : If MFDI was previously ON, drive will enter Pre-Charge mode if it is programmed.
BE	Single Phase Converter Ready NC	V/f OLV/PM EZOLV Sets the function to send a signal from Single Phase Converter to the attached drive that the converter is in a NOT READY or FAULTED state when the input terminal is OFF. ON : Single Phase Converter is in a normal state. OFF : Single Phase Converter is in a NOT READY or FAULTED state.
BF	Reset Accumulation	V/f OLV/PM EZOLV Sets the function to reset the accumulated volume to zero. ON : Accumulated volume will be reset to zero (and held at zero if digital input remains closed). OFF : Accumulation will function normally if programmed.
C0	Dedicated Multi-Setpoint YA-02	V/f OLV/PM EZOLV Sets the function to set the PID setpoint to *YA-02 [Setpoint 2]*. ON : *YA-02 [Setpoint 2]* is PID setpoint. OFF : *YA-01 [Setpoint 1]* is PID setpoint.
C1	Dedicated Multi-Setpoint YA-03	V/f OLV/PM EZOLV Sets the function to set the PID setpoint to *YA-03 [Setpoint 3]*. ON : *YA-03 [Setpoint 3]* is PID setpoint. OFF : *YA-01 [Setpoint 1]* is PID setpoint.
C2	Dedicated Multi-Setpoint YA-04	V/f OLV/PM EZOLV Sets the function to set the PID setpoint to *YA-04 [Setpoint 4]*. ON : *YA-04 [Setpoint 4]* is PID setpoint. OFF : *YA-01 [Setpoint 1]* is PID setpoint.
C3	Dedicated Multi-Setpoint YA-05	V/f OLV/PM EZOLV Sets the function to set the PID setpoint to *YA-05 [Setpoint 5]*. ON : *YA-05 [Setpoint 5]* is PID setpoint. OFF : *YA-01 [Setpoint 1]* is PID setpoint.
C4	Dedicated Multi-Setpoint YA-06	V/f OLV/PM EZOLV Sets the function to set the PID setpoint to *YA-06 [Setpoint 6]*. ON : *YA-06 [Setpoint 6]* is PID setpoint. OFF : *YA-01 [Setpoint 1]* is PID setpoint.
C5	Dedicated Multi-Setpoint YA-07	V/f OLV/PM EZOLV Sets the function to set the PID setpoint to *YA-07 [Setpoint 7]*. ON : *YA-07 [Setpoint 7]* is PID setpoint. OFF : *YA-01 [Setpoint 1]* is PID setpoint.
C6	Dedicated Multi-Setpoint YA-08	V/f OLV/PM EZOLV Sets the function to set the PID setpoint to *YA-08 [Setpoint 8]*. ON : *YA-08 [Setpoint 8]* is PID setpoint. OFF : *YA-01 [Setpoint 1]* is PID setpoint.

No. (Hex.)	Name	Description
C7	PID Setpoint Selection 1	V/f OLV/PM EZOLV Sets the function to switch the PID setpoint to *YA-02 [Setpoint 2]*, *YA-04 [Setpoint 4]*, *YA-06 [Setpoint 6]*, or *YA-08 [Setpoint 8]*. Set this function, *H1-xx = C8 [PID Setpoint Selection 2]*, and *H1-xx = C9 [PID Setpoint Selection 3]* at the same time. ON : Sets the function to switch the PID setpoint to *YA-02 [Setpoint 2], YA-04 [Setpoint 4], YA-06 [Setpoint 6]*, or *YA-08 [Setpoint 8]*. OFF : Sets the PID setpoint according to status of all setpoint selection MFDIs.
C8	PID Setpoint Selection 2	V/f OLV/PM EZOLV Sets the function to switch the PID setpoint to *YA-03 [Setpoint 3]*, *YA-04 [Setpoint 4]*, *YA-07 [Setpoint 7]*, or *YA-08 [Setpoint 8]*. Set this function, *H1-xx = C7 [PID Setpoint Selection 1]*, and *H1-xx = C9 [PID Setpoint Selection 3]* at the same time. ON : Sets the function to switch the PID setpoint to *YA-03 [Setpoint 3], YA-04 [Setpoint 4], YA-07 [Setpoint 7],* or *YA-08 [Setpoint 8]*. OFF : Sets the PID setpoint according to status of all setpoint selection MFDIs.
C9	PID Setpoint Selection 3	V/f OLV/PM EZOLV Sets the function to switch the PID setpoint to *YA-05 [Setpoint 5]*, *YA-06 [Setpoint 6]*, *YA-07 [Setpoint 7]*, or *YA-08 [Setpoint 8]*. Set this function, *H1-xx = C7 [PID Setpoint Selection 1]*, and *H1-xx = C8 [PID Setpoint Selection 2]* at the same time. ON : Sets the function to switch the PID setpoint to *YA-05 [Setpoint 5], YA-06 [Setpoint 6], YA-07 [Setpoint 7],* or *YA-08 [Setpoint 8]*. OFF : Sets the PID setpoint according to status of all setpoint selection MFDIs.
188	!Volute Thermostat Fault	V/f OLV/PM EZOLV Sets the drive to show the *VLTS [Volute Thermostat Fault]* when the input terminal is OFF.
190 -197	!DWEZ Digital Inputs 1 to 8	V/f OLV/PM EZOLV Sets digital inputs used with DriveWorksEZ. Refer to the DriveWorksEZ online manual for more information.
19F	!DWEZ Disable	V/f OLV/PM EZOLV Sets operation of the DriveWorksEZ program saved in the drive. ON : Enabled OFF : Disabled
1A8	!PI2 Control Disable	V/f OLV/PM EZOLV Sets the command to disable the PI2 Control function. Parameter *S3-12 [PI2 Control Disable Mode Sel]* sets the output performance. ON : Disabled OFF : Enabled
1B8	!Low City Pressure	V/f OLV/PM EZOLV Sets the command to show that there is not sufficient pressure at the inlet to the pump. ON : Insufficient pressure is present on the inlet to the pump
1BB	!Low Water Level	V/f OLV/PM EZOLV Sets the drive to show an *LWL [Low Water Level]* fault when the input terminal is OFF. ON : Reservoir/Tank is filled to normal level. OFF : Low Water Level Fault
1BC	!High Water Level	V/f OLV/PM EZOLV Sets the drive to show an *HWL [High Water Level]* fault when the input terminal is OFF. ON : Reservoir/Tank is filled to normal level. OFF : High Water Level Fault
1BD	!Remote Drive Disable	V/f OLV/PM EZOLV Sets the function to stop or prohibit the drive operation when the input terminal is OFF. ON : If MFDI was previously ON, drive will enter Pre-Charge mode if it is programmed. OFF : Stops and prohibits the drive from running.
H2-01 (040B)	Term M1-M2 Function Selection	V/f OLV/PM EZOLV Sets the function for MFDO terminal M1-M2.
H2-02 (040C)	Term M3-M4 Function Selection	V/f OLV/PM EZOLV Sets the function for MFDO terminal M3-M4.
H2-03 (040D)	Term MD-ME-MF Function Selection	V/f OLV/PM EZOLV Sets the function for MFDO terminal MD-ME-MF.
H2-06 (0437)	Watt Hour Output Unit Selection	V/f OLV/PM EZOLV Sets the unit for the output signal when *H2-01 to H2-03 = 39 [MFDO Function Selection = Watt Hour Pulse Output]*. 0 : 0.1 kWh units 1 : 1 kWh units 2 : 10 kWh units 3 : 100 kWh units 4 : 1000 kWh units

No. (Hex.)	Name	Description
H2-07 (0B3A) Expert	Modbus Register 1 Address Select	V/f OLV/PM EZOLV Sets the address of the MEMOBUS/Modbus register output to the MFDO terminal.
H2-08 (0B3B) Expert	Modbus Register 1 Bit Select	V/f OLV/PM EZOLV Sets the bit of the MEMOBUS/Modbus register output to the MFDO terminal.
H2-09 (0B3C) Expert	Modbus Register 2 Address Select	V/f OLV/PM EZOLV Sets the address of the MEMOBUS/Modbus register output to the MFDO terminal.
H2-10 (0B3D) Expert	Modbus Register 2 Bit Select	V/f OLV/PM EZOLV Sets the bit of the MEMOBUS/Modbus register output to the MFDO terminal.
H2-40 (0B58) Expert	Mbus Reg 15E0h bit0 Output Func	V/f OLV/PM EZOLV Sets the MFDO for bit 0 of MEMOBUS register 15E0 (Hex.).
H2-41 (0B59) Expert	Mbus Reg 15E0h bit1 Output Func	V/f OLV/PM EZOLV Sets the MFDO for bit 1 of MEMOBUS register 15E0 (Hex.).
H2-42 (0B5A) Expert	Mbus Reg 15E0h bit2 Output Func	V/f OLV/PM EZOLV Sets the MFDO for bit 2 of MEMOBUS register 15E0 (Hex.).
H2-60 (1B46) Expert	Term M1-M2 Secondary Function	V/f OLV/PM EZOLV Sets the second function for terminal M1-M2. Outputs the logical calculation results of the terminals assigned to functions by *H2-01 [Term M1-M2 Function Selection]*.
H2-61 (1B47) Expert	Terminal M1-M2 Logical Operation	V/f OLV/PM EZOLV Sets the logical operation for the functions set in *H2-01 [Term M1-M2 Function Selection]* and *H2-60 [Term M1-M2 Secondary Function]*.
H2-62 (1B48) Expert	Terminal M1-M2 Delay Time	V/f OLV/PM EZOLV Sets the minimum on time used to output the logical calculation results from terminal M1-M2.
H2-63 (1B49) Expert	Term M3-M4 Secondary Function	V/f OLV/PM EZOLV Sets the second function for terminal M3-M4. Outputs the logical calculation results of the terminals assigned to functions by *H2-02 [Term M3-M4 Function Selection]*.
H2-64 (1B4A) Expert	Terminal M3-M4 Logical Operation	V/f OLV/PM EZOLV Sets the logical operation for the functions set in *H2-02 [Term M3-M4 Function Selection]* and *H2-63 [Term M3-M4 Secondary Function]*.
H2-65 (1B4B) Expert	Terminal M3-M4 Delay Time	V/f OLV/PM EZOLV Sets the minimum on time used to output the logical calculation results from terminal M3-M4.
H2-66 (1B4C) Expert	Term MD-ME-MF Secondary Function	V/f OLV/PM EZOLV Sets the second function for terminal MD-ME-MF. Outputs the logical calculation results of the terminals assigned to functions by *H2-03 [Terminal MD-ME-MF Function Selection]*.
H2-67 (1B4D) Expert	Terminal MD-ME-MF Logical Operation	V/f OLV/PM EZOLV Sets the logical operation for the functions set in *H2-03 [Term MD-ME-MF Function Selection]* and *H2-66 [Term MD-ME-MF Secondary Function]*.
H2-68 (1B4E) Expert	Terminal MD-ME-MF Delay Time	V/f OLV/PM EZOLV Sets the minimum on time used to output the logical calculation results from terminal MD-ME-MF.
0	During Run	V/f OLV/PM EZOLV The terminal activates when you input a Run command and when the drive is outputting voltage. ON : Drive is running OFF : Drive is stopping
1	Zero Speed	V/f OLV/PM EZOLV The terminal activates when the output frequency < *E1-09 [Minimum Output Frequency]*. ON : Output frequency < *E1-09*. OFF : Output frequency ≥ *E1-09*.

No. (Hex.)	Name	Description
2	Speed Agree 1	V/f OLV/PM EZOLV The terminal activates when the output frequency is in the range of the frequency reference ± *L4-02 [Speed Agree Detection Width]*. ON : The output frequency is in the range of "frequency reference ± *L4-02*". OFF : The output frequency does not align with the frequency reference although the drive is running.
3	User-Set Speed Agree 1	V/f OLV/PM EZOLV The terminal activates when the output frequency is in the range of *L4-01 [Speed Agree Detection Level]* ± *L4-02 [Speed Agree Detection Width]* and in the range of the frequency reference ± *L4-02*. ON : The output frequency is in the range of "*L4-01* ± *L4-02*" and the range of frequency reference ± *L4-02*. OFF : The output frequency is not in the range of "*L4-01* ± *L4-02*" or the range of frequency reference ± *L4-02*.
4	Frequency Detection 1	V/f OLV/PM EZOLV The terminal deactivates when the output frequency > "*L4-01 [Speed Agree Detection Level]* + *L4-02 [Speed Agree Detection Width]*". After the terminal deactivates, the terminal stays deactivated until the output frequency is at the value of *L4-01*. ON : The output frequency < *L4-01*, or the output frequency ≤ "*L4-01* + *L4-02*" OFF : The output frequency > "*L4-01* + *L4-02*"
5	Frequency Detection 2	V/f OLV/PM EZOLV The terminal activates when the output frequency > *L4-01 [Speed Agree Detection Level]*. After the terminal activates, the terminal stays activated until the output frequency is at the value of "*L4-01 - L4-02 [Speed Agree Detection Width]*". ON : The output frequency > *L4-01* OFF : The output frequency < "*L4-01 - L4-02*", or the output frequency ≤ *L4-01*
6	Drive Ready	V/f OLV/PM EZOLV The terminal activates when the drive is ready and running.
7	DC Bus Undervoltage	V/f OLV/PM EZOLV The terminal activates when the DC bus voltage or control circuit power supply is at the voltage set in *L2-05 [Undervoltage Detection Lvl (Uv1)]* or less. The terminal also activates when there is a fault with the DC bus voltage. ON : The DC bus voltage ≤ *L2-05* OFF : The DC bus voltage > *L2-05*
8	During Baseblock (N.O.)	V/f OLV/PM EZOLV The terminal activates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage. ON : During baseblock OFF : The drive is not in baseblock.
9	Frequency Reference from Keypad	V/f OLV/PM EZOLV Shows the selected frequency reference source. ON : The keypad is the frequency reference source. OFF : Parameter *b1-01 [Frequency Reference Selection 1]* is the frequency reference source.
B	Torque Detection 1 (N.O.)	V/f OLV/PM EZOLV The terminal activates when the drive detects overtorque or undertorque. ON : The output current/torque > *L6-02 [Torque Detection Level 1]*, or the output current/torque < *L6-02* for longer than the time set in *L6-03 [Torque Detection Time 1]*.
C	Frequency Reference Loss	V/f OLV/PM EZOLV The terminal activates when the drive detects a loss of frequency reference.
E	Fault	V/f OLV/PM EZOLV The terminal activates when the drive detects a fault.
F	Not Used	V/f OLV/PM EZOLV Use this setting for unused terminals or to use terminals in through mode. Also use this setting as the PLC contact output via MEMOBUS/Modbus or the communication option. This signal does not function if you do not configure signals from the PLC.
10	Alarm	V/f OLV/PM EZOLV The terminal activates when the drive detects a minor fault.
11	Fault Reset Command Active	V/f OLV/PM EZOLV The terminal activates when the drive receives the Reset command from the control circuit terminal, serial communications, or the communication option.
12	Timer Output	V/f OLV/PM EZOLV Sets the terminal as the timer output. Use this setting with the timer input set in *H1-xx = 18 [MFDI Function Selection = Timer Function]*.
13	Speed Agree 2	V/f OLV/PM EZOLV The terminal activates when the output frequency is in the range of the frequency reference ± *L4-04 [Speed Agree Detection Width (+/-)]*. ON : The output frequency is in the range of "frequency reference ± *L4-04*". OFF : The output frequency is not in the range of "frequency reference ± *L4-04*".

No. (Hex.)	Name	Description
14	User-Set Speed Agree 2	V/f OLV/PM EZOLV The terminal activates when the output frequency is in the range of *L4-03 [Speed Agree Detection Level (+/-)]* ± *L4-04 [Speed Agree Detection Width (+/-)]* and in the range of the frequency reference ± *L4-04*. ON : The output frequency is in the range of "*L4-03* ± *L4-04*" and the range of frequency reference ± *L4-04*. OFF : The output frequency is not in the range of "*L4-03* ± *L4-04*" or the range of frequency reference ± *L4-04*.
15	Frequency Detection 3	V/f OLV/PM EZOLV The terminal deactivates when the output frequency > "*L4-03 [Speed Agree Detection Level (+/-)]* + *L4-04 [Speed Agree Detection Width (+/-)]*". After the terminal deactivates, the terminal stays deactivated until the output frequency is at the value of *L4-03*. ON : The output frequency < *L4-03*, or the output frequency ≤ *L4-03* + *L4-04*. OFF : The output frequency > "*L4-03* + *L4-04*".
16	Frequency Detection 4	V/f OLV/PM EZOLV The terminal activates when the output frequency > *L4-03 [Speed Agree Detection Level (+/-)]*. After the terminal activates, the terminal stays activated until the output frequency is at the value of "*L4-03* - *L4-04*". ON : The output frequency > *L4-03*. OFF : The output frequency < "*L4-03* - *L4-04*", or the output frequency ≤ *L4-03*.
17	Torque Detection 1 (N.C.)	V/f OLV/PM EZOLV The terminal deactivates when the drive detects overtorque or undertorque. OFF : The output current/torque > *L6-02 [Torque Detection Level 1]*, or the output current/torque < *L6-02* for longer than the time set in *L6-03 [Torque Detection Time 1]*.
18	Torque Detection 2 (N.O.)	V/f OLV/PM EZOLV The terminal activates when the drive detects overtorque or undertorque. ON : The output current/torque > *L6-05 [Torque Detection Level 2]*, or the output current/torque < *L6-05* for longer than the time set in *L6-06 [Torque Detection Time 2]*.
19	Torque Detection 2 (N.C.)	V/f OLV/PM EZOLV The terminal deactivates when the drive detects overtorque or undertorque. OFF : The output current/torque > *L6-05 [Torque Detection Level 2]*, or the output current/torque < *L6-05* for longer than the time set in *L6-06 [Torque Detection Time 2]*.
1A	During Reverse	V/f OLV/PM EZOLV The terminal activates when the motor operates in the reverse direction. ON : The motor is operating in the reverse direction. OFF : The motor is operating in the forward direction or the motor stopped.
1B	During Baseblock (N.C.)	V/f OLV/PM EZOLV The terminal deactivates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage. ON : The drive is not in baseblock. OFF : During baseblock
1C	Motor 2 Selected	V/f OLV/PM EZOLV The terminal activates when you select motor 2. ON : Motor 2 Selected OFF : Motor 1 Selected
1E	Executing Auto-Restart	V/f OLV/PM EZOLV The terminal activates when the Auto Restart function is trying to restart after a fault.
1F	Motor Overload Alarm (oL1)	V/f OLV/PM EZOLV The terminal activates when the electronic thermal protection value of the motor overload protective function is a minimum of 90% of the detection level.
20	Drive Overheat Pre-Alarm (oH)	V/f OLV/PM EZOLV The terminal activates when the drive heatsink temperature is at the level set with *L8-02 [Overheat Alarm Level]*.
21	Safe Torque OFF	V/f OLV/PM EZOLV The terminal activates (safety stop state) when the safety circuit and safety diagnosis circuit are operating correctly and when terminals H1-HC and H2-HC are OFF (Open). ON : Safety stop state OFF : Safety circuit fault or RUN/READY
2F	Maintenance Notification	V/f OLV/PM EZOLV The terminal activates when drive components are at their estimated maintenance period.
30	During Torque Limit	V/f OLV/PM EZOLV The terminal activates when the torque reference is the torque limit set with *L7 parameters*, *H3-02, H3-06, or H3-10 [MFAI Function Selection]*.
37	During Frequency Output	V/f OLV/PM EZOLV The terminal activates when the drive outputs frequency. ON : The drive is outputting frequency. OFF : The drive is not outputting frequency.

No. (Hex.)	Name	Description
38	Drive Enabled	V/f OLV/PM EZOLV This terminal activates when the *H1-xx = 6A [Drive Enable] or 70 [Drive Enable No Run Cycle]* terminal activates.
39	Watt Hour Pulse Output	V/f OLV/PM EZOLV Outputs the pulse that shows the watt hours.
3A	Drive Overheat Alarm	V/f OLV/PM EZOLV The terminal activates when the drive heatsink temperature is at the *L8-02 [Overheat Alarm Level]* setting while *L8-03 = 4 [Overheat Pre-Alarm Selection = Operate at Reduced Speed (L8-19)]* and the drive is running.
3D	During Speed Search	V/f OLV/PM EZOLV The terminal activates when the drive is doing speed search.
42	Pressure Reached	V/f OLV/PM EZOLV The terminal activates when the pressure feedback is at the Pressure Setpoint.
4A	During KEB Ride-Thru	V/f OLV/PM EZOLV The terminal activates during KEB Ride-Thru.
4B	During Short Circuit Braking	V/f OLV/PM EZOLV The terminal activates during Short Circuit Braking.
4C	During Fast Stop	V/f OLV/PM EZOLV The terminal activates when the fast stop is in operation.
4D	oH Pre-Alarm Reduction Limit	V/f OLV/PM EZOLV The terminal activates when *L8-03 = 4 [Overheat Pre-Alarm Selection = Operate at Reduced Speed (L8-19)]* and *oH [Heatsink Overheat]* does not clear after the drive decreases the frequency for 10 cycles.
51	Sequence Timer 1	V/f OLV/PM EZOLV Sets the function to activate Sequence Timer 1. ON : Sequence Timer 1 is active.
52	Sequence Timer 2	V/f OLV/PM EZOLV Sets the function to activate Sequence Timer 2. ON : Sequence Timer 2 is active.
53	Sequence Timer 3	V/f OLV/PM EZOLV Sets the function to activate Sequence Timer 3. ON : Sequence Timer 3 is active.
54	Sequence Timer 4	V/f OLV/PM EZOLV Sets the function to activate Sequence Timer 4. ON : Sequence Timer 4 is active.
58	UL6 Underload Detected	V/f OLV/PM EZOLV The terminal activates when the drive detected *UL6 [Underload or Belt Break Detected]*.
60	Internal Cooling Fan Failure	V/f OLV/PM EZOLV The terminal activates when the drive detects a cooling fan failure in the drive.
61	Pole Position Detection Complete	V/f OLV/PM EZOLV The terminal activates when drive receives a Run command and the drive detects the motor magnetic pole position of the PM motor.
62	Modbus Reg 1 Status Satisfied	V/f OLV/PM EZOLV The terminal activates when the bit specified by *H2-08 [Modbus Register 1 Bit Select]* for the MEMOBUS register address set with *H2-07 [Modbus Register 1 Address Select]* activates.
63	Modbus Reg 2 Status Satisfied	V/f OLV/PM EZOLV The terminal activates when the bit specified by *H2-10 [Modbus Register 2 Bit Select]* for the MEMOBUS register address set with *H2-09 [Modbus Register 2 Address Select]* activates.
69	External Power 24V Supply	V/f OLV/PM EZOLV The terminal activates when there is an external 24V power supply between terminals PS-AC. ON : The external 24V power supply is supplying power. OFF : The external 24V power supply is not supplying power.
6A	Data Logger Error	V/f OLV/PM EZOLV The terminal activates when the drive detects a *LoG [Com Error / Abnormal SD card]*.
71	Low PI2 Control Feedback Level	V/f OLV/PM EZOLV The terminal activates when the PI2 Control Feedback Level is less than *S3-13 [PI2 Control Low Feedback Lvl]*.
72	High PI2 Control Feedback Level	V/f OLV/PM EZOLV The terminal activates when the PI2 Control Feedback Level is more than *S3-15 [PI2 Control High Feedback Lvl]*.
89	Output Current Lim	V/f OLV/PM EZOLV The terminal activates when the output current limit is limiting the drive output speed.

No. (Hex.)	Name	Description
8A	Pump 2 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a second pump. ON : Pump 2 Running
8B	Pump 3 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a third pump. ON : Pump 3 Running
8C	Pump 4 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a fourth pump. ON : Pump 4 Running
8D	Pump 5 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a fifth pump. ON : Pump 5 Running
8E	Pump 6 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a sixth pump. ON : Pump 6 Running
90 to 92	DWEZ Digital Outputs 1 to 3	V/f OLV/PM EZOLV Sets the DriveWorksEZ digital output. Refer to the DriveWorksEZ online manual for more information.
94	Loss of Prime	V/f OLV/PM EZOLV The terminal activates when the drive is in an *LOP [Loss of Prime]* condition.
95	Volute Thermostat Fault	V/f OLV/PM EZOLV The terminal activates when the terminal set for *H1-xx = 88 [MFDI Function Selection = Volute Thermostat Fault]* is active.
96	High Feedback	V/f OLV/PM EZOLV The terminal activates when the drive is in a High Feedback Condition as specified by *Y1-11 [High Feedback Level]* and *Y1-12 [High Feedback Lvl Fault Dly Time]* and when the drive detects an *HFB [High Feedback Sensed]* fault or an *HIFB [High Feedback Sensed]* alarm.
97	Low Feedback	V/f OLV/PM EZOLV The terminal activates when the drive is in a Low Feedback Condition as specified by *Y1-08 [Low Feedback Level]* and *Y1-09 [Low Feedback Lvl Fault Dly Time]* and when the drive detects an *LFB [Low Feedback Sensed]* fault or an *LOFB [High Feedback Sensed]* alarm.
9E	Low PI Auxiliary Control Level	V/f OLV/PM EZOLV The terminal activates when the PI Aux Feedback Level is less than *YF-09 [PI Aux Control Low Level Detect]* or if the drive detects an *LoAux [Low PI Aux Feedback Level]* fault.
9F	High PI Auxiliary Control Level	V/f OLV/PM EZOLV The terminal activates when the PI Aux Feedback Level is more than *YF-12 [PI Aux Control High Level Detect]* or if the drive detects an *HiAux [High PI Aux Feedback Level]* fault.
A0 to A7	DWEZ Extended Digital Outputs 1 to 8	V/f OLV/PM EZOLV Sets the digital output for the DriveWorksEZ DO-A3 option card. Refer to the DriveWorksEZ online manual for more information.
AA	Utility Delay	V/f OLV/PM EZOLV The terminal activates when the drive is stopped and is waiting for the timer set in *Y4-17 [Utility Start Delay]* to expire.
AB	Thrust Mode	V/f OLV/PM EZOLV The terminal activates when the output frequency is between 0.0 Hz and the value set in *Y4-12 [Thrust Frequency]* and the Thrust Bearing function is active.
AC	Setpoint Not Maintained	V/f OLV/PM EZOLV The terminal activates when the drive detects *NMS [Setpoint Not Met]* condition.
B8	Pump Fault	V/f OLV/PM EZOLV The terminal activates when one of these faults is active:
B9	Transducer Loss	V/f OLV/PM EZOLV The terminal activates when the current into the analog input associated with PID feedback is more than 21 mA or less than 3 mA, or an *FDBKL [WIRE Break]* Fault or an *FDBKL [Feedback Loss Wire Break]* Alarm is active.
BA	WL/SP/PIAux Control Active	V/f OLV/PM EZOLV The terminal activates when Water Level / Suction Pressure / PI Auxiliary Control is affecting the output speed.
BB	Differential Feedback Exceeded	V/f OLV/PM EZOLV The terminal activates when the difference between the PID Feedback and the value from the terminal set for *H3-xx = 2D [Differential Feedback]* is more than *Y4-18 [Differential Level]* for the time set in *Y4-19 [Differential Lvl Detection Time]*.
BC	Sleep Active	V/f OLV/PM EZOLV The terminal activates when the Sleep function is active and the drive is not operating.

No. (Hex.)	Name	Description
BD	Start Delay	V/f OLV/PM EZOLV The terminal activates when the Feedback is more than the start level or the Feedback is less than the Inverse PID and the start timer is timing.
BE	Pre-Charge	V/f OLV/PM EZOLV The terminal activates when the drive is in Pre-Charge Mode.
C0	HAND Mode	V/f OLV/PM EZOLV The terminal activates when the drive is in HAND Mode operation.
C1	AUTO Mode	V/f OLV/PM EZOLV The terminal activates when the drive is in AUTO Mode operation.
C2	OFF Mode	V/f OLV/PM EZOLV The terminal activates when the drive is in OFF Mode.
C3	Main Feedback Lost	V/f OLV/PM EZOLV The terminal activates when the drive loses the main PID feedback.
C4	Backup Feedback Lost	V/f OLV/PM EZOLV The terminal activates when the drive loses the backup PID feedback.
C5	De-Scale Active	V/f OLV/PM EZOLV Sets the drive to go into the De-Scale function when the output terminal is ON. ON : De-Scale is running
C6	Lube Pump	V/f OLV/PM EZOLV Sets the drive to go into the Lube Pump function when the output terminal is ON. ON : This will energize and delay the drive output for the time set in *Y4-31 [Lube Pump Time]* each time the drive is supposed to start. It will energize during Run when *Y4-30 = 1 [Lube Pump During Run = Active During Run]*.
C8	Low Flow	V/f OLV/PM EZOLV The terminal activates when the flow rate is less than *Y6-06 [Low Flow Level]* for *Y6-07 [Low Flow Detection Time]*.
C9	Accumulation Level	V/f OLV/PM EZOLV The terminal activates when the accumulated volume is at or above the level set in *Y6-11 to Y6-14*.
CA	High Flow	V/f OLV/PM EZOLV The terminal activates when the flow rate is higher than *Y6-17 [High Flow Level]* for *Y6-18 [High Flow Detection Time]*.
CB	Low Water Level	V/f OLV/PM EZOLV The terminal activates when the water level feedback is below *Yd-09 [Low Water Level Detection Level]*.
CC	Low Suction Pressure	V/f OLV/PM EZOLV The terminal activates when the Suction Pressure feedback is less than *YE-09 [Low Suction Pressure Det Level]*.
CD	High Suction Pressure	V/f OLV/PM EZOLV The terminal activates when the Suction Pressure feedback is higher than *YE-12 [High Suction Pressure Det Level]*.
CE	Anti-Jam/De-Rag Active	V/f OLV/PM EZOLV The terminal activates when the drive is running in Anti-Jam/De-Rag mode (configured by *Y7-xx*).
CF	Flow Rate Limit	V/f OLV/PM EZOLV The terminal activates when the flow rate (limit) is affecting output speed.
D3	Harmonic Filter Output	V/f OLV/PM EZOLV The terminal activates when the drive exceeds the speed/current conditions set in *Y4-50 [Harmonic Filter Output Selection]*.
D4	External Fan Switch	V/f OLV/PM EZOLV The terminal activates when the external fan is turned on when drive is running.
100	!During Run	V/f OLV/PM EZOLV The terminal deactivates when you input a Run command and when the drive is outputting voltage. ON : Drive is stopping OFF : Drive is running
101	!Zero Speed	V/f OLV/PM EZOLV The terminal deactivates when the output frequency < *E1-09 [Minimum Output Frequency]*. ON : Output frequency ≥ value of *E1-09*. OFF : Output frequency < value of *E1-09*.
102	!Speed Agree 1	V/f OLV/PM EZOLV The terminal deactivates when the output frequency is in the range of the frequency reference ± *L4-02 [Speed Agree Detection Width]*. ON : The output frequency does not align with the frequency reference although the drive is running. OFF : The output frequency is in the range of “frequency reference ± *L4-02*”.

No. (Hex.)	Name	Description
103	!User-Set Speed Agree 1	V/f OLV/PM EZOLV The terminal deactivates when the output frequency is in the range of *L4-01 [Speed Agree Detection Level]* ± *L4-02 [Speed Agree Detection Width]* and in the range of the frequency reference ± *L4-02*. ON : The output frequency is not in the range of "*L4-01* ± *L4-02*" or the range of frequency reference ± *L4-02*. OFF : The output frequency is in the range of "*L4-01* ± *L4-02*" and the range of frequency reference ± *L4-02*.
104	!Frequency Detection 1	V/f OLV/PM EZOLV The terminal activates when the output frequency > "*L4-01 [Speed Agree Detection Level]* + *L4-02 [Speed Agree Detection Width]*". After the terminal activates, the terminal stays activated until the output frequency is at the value of *L4-01*. ON : The output frequency > "*L4-01* + *L4-02*" OFF : The output frequency < *L4-01*, or the output frequency ≤ "*L4-01* + *L4-02*"
105	!Frequency Detection 2	V/f OLV/PM EZOLV The terminal deactivates when the output frequency > *L4-01 [Speed Agree Detection Level]*. After the terminal deactivates, the terminal stays deactivated until the output frequency is at the value of "*L4-01* - *L4-02 [Speed Agree Detection Width]*". ON : The output frequency < "*L4-01* - *L4-02*", or the output frequency ≤ *L4-01* OFF : The output frequency > *L4-01*
106	!Drive Ready	V/f OLV/PM EZOLV The terminal deactivates when the drive is ready and running.
107	!DC Bus Undervoltage	V/f OLV/PM EZOLV The terminal deactivates when the DC bus voltage or control circuit power supply is at the voltage set in *L2-05 [Undervoltage Detection Lvl (Uv1)]* or less. The terminal also deactivates when there is a fault with the DC bus voltage. ON : The DC bus voltage > *L2-05* OFF : The DC bus voltage ≤ *L2-05*
108	!During Baseblock (N.O.)	V/f OLV/PM EZOLV The terminal deactivates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage. ON : The drive is not in baseblock. OFF : During baseblock.
109	!Frequency Reference from Keypad	V/f OLV/PM EZOLV Shows the selected frequency reference source. ON : Parameter *b1-01 [Frequency Reference Selection 1]* is the frequency reference source. OFF : The keypad is the frequency reference source.
10B	!Torque Detection 1 (N.O.)	V/f OLV/PM EZOLV The terminal deactivates when the drive detects overtorque or undertorque. OFF : The output current/torque > *L6-02 [Torque Detection Level 1]*, or < *L6-02* for longer than the time set with *L6-03 [Torque Detection Time 1]*.
10C	!Frequency Reference Loss	V/f OLV/PM EZOLV The terminal deactivates when the drive detects a loss of frequency reference.
10E	!Fault	V/f OLV/PM EZOLV The terminal deactivates when the drive detects a fault.
110	!Alarm	V/f OLV/PM EZOLV The terminal deactivates when the drive detects a minor fault.
111	!Fault Reset Command Active	V/f OLV/PM EZOLV The terminal deactivates when the drive receives the Reset command from the control circuit terminal, serial communications, or the communication option.
112	!Timer Output	V/f OLV/PM EZOLV Sets the terminal as the timer output. Use this setting with the timer input set in *H1-xx = 118 [MFDI Function Selection = !Timer Function]*.
113	!Speed Agree 2	V/f OLV/PM EZOLV The terminal deactivates when the output frequency is in the range of the frequency reference ± *L4-04 [Speed Agree Detection Width (+/-)]*. ON : The output frequency is not in the range of "frequency reference ± *L4-04*". OFF : The output frequency is in the range of "frequency reference ± *L4-04*".
114	!User-Set Speed Agree 2	V/f OLV/PM EZOLV The terminal deactivates when the output frequency is in the range of *L4-03 [Speed Agree Detection Level (+/-)]* ± *L4-04 [Speed Agree Detection Width (+/-)]* and in the range of the frequency reference ± *L4-04*. ON : The output frequency is not in the range of "*L4-03* ± *L4-04*" or the range of frequency reference ± *L4-04*. OFF : The output frequency is in the range of "*L4-03* ± *L4-04*" and the range of frequency reference ± *L4-04*.

No. (Hex.)	Name	Description
115	!Frequency Detection 3	V/f OLV/PM EZOLV The terminal activates when the output frequency > "*L4-03 [Speed Agree Detection Level (+/-)] + L4-04 [Speed Agree Detection Width (+/-)]*". After the terminal activates, the terminal stays activated until the output frequency is at the value of *L4-03*. ON : The output frequency > "*L4-03 + L4-04*" OFF : The output frequency < *L4-03*, or the output frequency ≤ "*L4-03 + L4-04*"
116	!Frequency Detection 4	V/f OLV/PM EZOLV The terminal deactivates when the output frequency > *L4-03 [Speed Agree Detection Level (+/-)]*. After the terminal deactivates, the terminal stays deactivated until the output frequency is at the value of "*L4-03 - L4-04*". ON : The output frequency < "*L4-03 - L4-04*", or the output frequency ≤ *L4-03* OFF : The output frequency > *L4-03*
117	!Torque Detection 1 (N.C.)	V/f OLV/PM EZOLV The terminal activates when the drive detects overtorque or undertorque. ON : The output current/torque > *L6-02 [Torque Detection Level 1]*, or the output current/torque < *L6-02* for longer than the time set in *L6-03 [Torque Detection Time 1]*.
118	!Torque Detection 2 (N.O.)	V/f OLV/PM EZOLV The terminal deactivates when the drive detects overtorque or undertorque. OFF : The output current/torque > *L6-05 [Torque Detection Level 2]*, or the output current/torque < *L6-05* for longer than the time set in *L6-06 [Torque Detection Time 2]*.
119	!Torque Detection 2 (N.C.)	V/f OLV/PM EZOLV The terminal activates when the drive detects overtorque or undertorque. ON : The output current/torque > *L6-05 [Torque Detection Level 2]*, or the output current/torque < *L6-05* for longer than the time set in *L6-06 [Torque Detection Time 2]*.
11A	!During Reverse	V/f OLV/PM EZOLV The terminal deactivates when the motor operates in the reverse direction. ON : The motor is operating in the forward direction or the motor stopped. OFF : The motor is operating in the reverse direction.
11B	!During Baseblock (N.C.)	V/f OLV/PM EZOLV The terminal activates during baseblock. When the drive is in baseblock, the drive output transistor stops switching and does not make DC bus voltage. ON : During baseblock. OFF : The drive is not in baseblock.
11C	!Motor 2 Selected	V/f OLV/PM EZOLV The terminal deactivates when motor 2 is selected. ON : Motor 1 Selection OFF : Motor 2 Selection
11E	!Executing Auto-Restart	V/f OLV/PM EZOLV The terminal deactivates when the Auto Restart function is trying to restart after a fault.
11F	!Motor Overload Alarm (oL1)	V/f OLV/PM EZOLV The terminal deactivates when the electronic thermal protection value of the motor overload protective function is a minimum of 90% of the detection level.
120	!Drive Overheat Pre-Alarm (oH)	V/f OLV/PM EZOLV The terminal deactivates when the drive heatsink temperature is at the level set with *L8-02 [Overheat Alarm Level]*.
121	!Safe Torque OFF	V/f OLV/PM EZOLV The terminal deactivates (safety stop state) when the safety circuit and safety diagnosis circuit are operating correctly and when terminals H1-HC and H2-HC are OFF (Open). ON : Safety circuit fault or RUN/READY OFF : Safety stop state
12F	!Maintenance Notification	V/f OLV/PM EZOLV The terminal deactivates when drive components are at their estimated maintenance period.
130	!During Torque Limit	V/f OLV/PM EZOLV The terminal deactivates when the torque reference is the torque limit set with *L7 parameters*, *H3-02, or H3-10 [MFAI Function Selection]*.
137	!During Frequency Output	V/f OLV/PM EZOLV The terminal deactivates when the drive outputs frequency. ON : The drive is not outputting frequency. OFF : The drive is outputting frequency.
138	!Drive Enabled	V/f OLV/PM EZOLV This terminal deactivates when the *H1-xx = 6A [Drive Enable] or 70 [Drive Enable No Run Cycle]* terminal deactivates.
139	!Watt Hour Pulse Output	V/f OLV/PM EZOLV Outputs the pulse that shows the watt hours.

No. (Hex.)	Name	Description
13A	!Drive Overheat Alarm	V/f OLV/PM EZOLV The terminal deactivates when the drive heatsink temperature is at the *L8-02 [Overheat Alarm Level]* setting while *L8-03 = 4 [Overheat Pre-Alarm Selection = Operate at Reduced Speed (L8-19)]* and the drive is running.
13D	!During Speed Search	V/f OLV/PM EZOLV The terminal deactivates when the drive is doing speed search.
142	!Pressure Reached	V/f OLV/PM EZOLV The terminal deactivates when the pressure feedback is at the Pressure Setpoint.
14A	!During KEB Ride-Thru	V/f OLV/PM EZOLV The terminal deactivates during KEB Ride-Thru.
14B	!During Short Circuit Braking	V/f OLV/PM EZOLV The terminal deactivates during Short Circuit Braking.
14C	!During Fast Stop	V/f OLV/PM EZOLV The terminal deactivates when the fast stop is in operation.
14D	!oH Pre-Alarm Reduction Limit	V/f OLV/PM EZOLV The terminal deactivates when *L8-03 = 4 [Overheat Pre-Alarm Selection = Operate at Reduced Speed (L8-19)]* and *oH [Heatsink Overheat]* does not clear after the drive decreases the frequency for 10 cycles.
151	!Sequence Timer 1	V/f OLV/PM EZOLV The terminal deactivates when Sequence Timer 1 is active.
152	!Sequence Timer 2	V/f OLV/PM EZOLV The terminal deactivates when Sequence Timer 2 is active.
153	!Sequence Timer 3	V/f OLV/PM EZOLV The terminal deactivates when Sequence Timer 3 is active.
154	!Sequence Timer 4	V/f OLV/PM EZOLV The terminal deactivates when Sequence Timer 4 is active.
158	!UL6 Underload Detected	V/f OLV/PM EZOLV The terminal deactivates when the drive detected *UL6 [Underload or Belt Break Detected]*.
160	!Internal Cooling Fan Failure	V/f OLV/PM EZOLV The terminal deactivates when the drive detects a cooling fan failure in the drive.
161	!Pole Position Detection Complete	V/f OLV/PM EZOLV The terminal deactivates when drive receives a Run command and the drive detects the motor magnetic pole position of the PM motor.
162	!Modbus Reg 1 Status Satisfied	V/f OLV/PM EZOLV The terminal deactivates when the bit specified by *H2-08 [Modbus Register 1 Bit Select]* for the MEMOBUS register address set with *H2-07 [Modbus Register 1 Address Select]* activates.
163	!Modbus Reg 2 Status Satisfied	V/f OLV/PM EZOLV The terminal deactivates when the bit specified by *H2-10 [Modbus Register 2 Bit Select]* for the MEMOBUS register address set with *H2-09 [Modbus Register 2 Address Select]* activates.
169	!External Power 24V Supply	V/f OLV/PM EZOLV The terminal deactivates when there is an external 24 V power supply between terminals PS-AC. ON : The external 24 V power supply is not supplying power. OFF : The external 24 V power supply is supplying power.
16A	!Data Logger Error	V/f OLV/PM EZOLV The terminal deactivates when the drive detects *LoG [Com Error / Abnormal SD card]*.
171	!Low PI2 Control Feedback Level	V/f OLV/PM EZOLV The terminal deactivates when the PI2 Control Feedback Level is less than *S3-13 [PI2 Control Low Feedback Lvl]*.
172	!High PI2 Control Feedback Level	V/f OLV/PM EZOLV The terminal deactivates when the PI2 Control Feedback Level is more than *S3-15 [PI2 Control High Feedback Lvl]*.
189	!Output Current Lim	V/f OLV/PM EZOLV The terminal deactivates when the output current limit is limiting the drive output speed.
18A	!Pump 2 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a second pump. OFF : Pump 2 Running
18B	!Pump 3 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a third pump. OFF : Pump 3 Running

No. (Hex.)	Name	Description
18C	!Pump 4 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a fourth pump. OFF : Pump 4 Running
18D	!Pump 5 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a fifth pump. OFF : Pump 5 Running
18E	!Pump 6 Control	V/f OLV/PM EZOLV Sets the function to do a contactor control for a sixth pump. OFF : Pump 6 Running
190 to 192	!DWEZ Digital Outputs 1 to 3	V/f OLV/PM EZOLV Sets the DriveWorksEZ digital output. Refer to the DriveWorksEZ online manual for more information.
194	!Loss of Prime	V/f OLV/PM EZOLV The terminal deactivates when the drive is in an *LOP [Loss of Prime]* condition.
195	!Volute Thermostat Fault	V/f OLV/PM EZOLV The terminal deactivates when the terminal set for *H1-xx = 88 [MFDI Function Selection = Volute Thermostat Fault]* is active.
196	!High Feedback	V/f OLV/PM EZOLV The terminal deactivates when the drive is in a High Feedback Condition as specified by *Y1-11 [High Feedback Level]* and *Y1-12 [High Feedback Lvl Fault Dly Time]* and when the drive detects an *HFB [High Feedback Sensed]* fault or an *HIFB [High Feedback Sensed]* alarm.
197	!Low Feedback	V/f OLV/PM EZOLV The terminal deactivates when the drive is in a Low Feedback Condition as specified by *Y1-08 [Low Feedback Level]* and *Y1-09 [Low Feedback Lvl Fault Dly Time]* and when the drive detects an *LFB [Low Feedback Sensed]* fault or an *LOFB [High Feedback Sensed]* alarm.
19E	!Low PI Auxiliary Control Level	V/f OLV/PM EZOLV The terminal deactivates when the PI Aux Feedback Level is less than *YF-09 [PI Aux Control Low Level Detect]* or if the drive detects an *LoAux [Low PI Aux Feedback Level]* fault.
19F	!High PI Auxiliary Control Level	V/f OLV/PM EZOLV The terminal deactivates when the PI Aux Feedback Level is more than *YF-12 [PI Aux Control High Level Detect]* or if the drive detects an *HiAux [High PI Aux Feedback Level]* fault.
1A0 to 1A7	!DWEZ Extended Digital Outputs 1 to 8	V/f OLV/PM EZOLV Sets the digital output for the DriveWorksEZ DO-A3 option card. Refer to the DriveWorksEZ online manual for more information.
1AA	!Utility Delay	V/f OLV/PM EZOLV The terminal deactivates when the drive is stopped and is waiting for the timer set in *Y4-17 [Utility Start Delay]* to expire.
1AB	!Thrust Mode	V/f OLV/PM EZOLV The terminal deactivates when the output frequency is between 0.0 Hz and the value set in *Y4-12 [Thrust Frequency]* and the Thrust Bearing function is active.
1AC	!Setpoint Not Maintained	V/f OLV/PM EZOLV The terminal deactivates when the drive detects *NMS [Setpoint Not Met]* condition.
1B8	!Pump Fault	V/f OLV/PM EZOLV The terminal deactivates when one of these faults is active:
1B9	!Transducer Loss	V/f OLV/PM EZOLV The terminal deactivates when the current into the analog input associated with PID feedback is more than 21 mA or less than 3 mA, or an *FDBKL [WIRE Break]* Fault or an *FDBKL [Feedback Loss Wire Break]* Alarm is active.
1BA	!WL/SP/PIAux Control Active	V/f OLV/PM EZOLV The terminal deactivates when Water Level / Suction Pressure / PI Auxiliary Control is affecting the output speed.
1BB	!Differential Feedback Exceeded	V/f OLV/PM EZOLV The terminal deactivates when the difference between the PID Feedback and the value from the terminal set for *H3-xx = 2D [Differential Feedback]* is more than *Y4-18 [Differential Level]* for the time set in *Y4-19 [Differential Lvl Detection Time]*.
1BC	!Sleep Active	V/f OLV/PM EZOLV The terminal deactivates when the Sleep function is active and the drive is not operating.
1BD	!Start Delay	V/f OLV/PM EZOLV The terminal deactivates when the Feedback is more than the start level or the Feedback is less than the Inverse PID and the start timer is timing.
1BE	!Pre-Charge	V/f OLV/PM EZOLV The terminal deactivates when the drive is in Pre-Charge Mode.
1C0	!HAND Mode	V/f OLV/PM EZOLV The terminal deactivates when the drive is in HAND Mode operation.

No. (Hex.)	Name	Description
1C1	!AUTO Mode	V/f OLV/PM EZOLV The terminal deactivates when the drive is in AUTO Mode operation.
1C2	!OFF Mode	V/f OLV/PM EZOLV The terminal deactivates when the drive is in OFF Mode.
1C3	!Main Feedback Lost	V/f OLV/PM EZOLV The terminal deactivates when the drive loses the main PID feedback.
1C4	!Backup Feedback Lost	V/f OLV/PM EZOLV The terminal deactivates when the drive loses the backup PID feedback.
1C5	!De-Scale Active	V/f OLV/PM EZOLV Sets the drive to go into the De-Scale function when the output terminal is OFF. OFF : De-Scale is running
1C6	!Lube Pump	V/f OLV/PM EZOLV Sets the drive to go into the Lube Pump function when the output terminal is OFF. OFF : This will energize and delay the drive output for the time set in *Y4-31 [Lube Pump Time]* each time the drive is supposed to start. It will energize during Run when *Y4-30 = 1 [Lube Pump During Run = Active During Run]*.
1C8	!Low Flow	V/f OLV/PM EZOLV The terminal deactivates when the flow rate is less than *Y6-06 [Low Flow Level]* for *Y6-07 [Low Flow Detection Time]*.
1C9	!Accumulation Level	V/f OLV/PM EZOLV The terminal deactivates when the accumulated volume is at or above the level set in *Y6-11 to Y6-14*.
1CA	!High Flow	V/f OLV/PM EZOLV The terminal deactivates when the flow rate is higher than *Y6-17 [High Flow Level]* for *Y6-18 [High Flow Detection Time]*.
1CB	!Low Water Level	V/f OLV/PM EZOLV The terminal deactivates when the water level feedback is below *Yd-09 [Low Water Level Detection Level]*.
1CC	!Low Suction Pressure	V/f OLV/PM EZOLV The terminal deactivates when the Suction Pressure feedback is less than *YE-09 [Low Suction Pressure Det Level]*.
1CD	!High Suction Pressure	V/f OLV/PM EZOLV The terminal deactivates when the Suction Pressure feedback is higher than *YE-12 [High Suction Pressure Det Level]*.
1CE	!Anti-Jam/De-Rag Active	V/f OLV/PM EZOLV The terminal deactivates when the drive is running in Anti-Jam/De-Rag mode (configured by *Y7-xx*).
1CF	!Flow Rate Limit	V/f OLV/PM EZOLV The terminal deactivates when the flow rate (limit) is affecting output speed.
1D3	!Harmonic Filter Output	V/f OLV/PM EZOLV The terminal deactivates when the drive exceeds the speed/current conditions set in *Y4-50 [Harmonic Filter Output Selection]*.
1D4	!External Fan Switch	V/f OLV/PM EZOLV The terminal deactivates when the external fan is turned on when drive is running.
H3-01 (0410)	Terminal A1 Signal Level Select	V/f OLV/PM EZOLV Sets the input signal level for MFAI terminal A1. 0 : 0 to 10V (Lower Limit at 0) 2 : 4 to 20 mA 3 : 0 to 20 mA
H3-02 (0434)	Terminal A1 Function Selection	V/f OLV/PM EZOLV Sets a function for MFAI terminal A1.
H3-03 (0411) RUN	Terminal A1 Gain Setting	V/f OLV/PM EZOLV Sets the gain of the analog signal input to MFAI terminal A1.
H3-04 (0412) RUN	Terminal A1 Bias Setting	V/f OLV/PM EZOLV Sets the bias of the analog signal input to MFAI terminal A1.
H3-05 (0413)	Terminal A3 Signal Level Select	V/f OLV/PM EZOLV Sets the input signal level for MFAI terminal A3. 0 : 0-10V (Lower Limit at 0) 2 : 4 to 20 mA 3 : 0 to 20 mA
H3-06 (0414)	Terminal A3 Function Selection	V/f OLV/PM EZOLV Sets the function for MFAI terminal A3.

No. (Hex.)	Name	Description
H3-07 (0415) RUN	Terminal A3 Gain Setting	V/f OLV/PM EZOLV Sets the gain of the analog signal input to MFAI terminal A3.
H3-08 (0416) RUN	Terminal A3 Bias Setting	V/f OLV/PM EZOLV Sets the bias of the analog signal input to MFAI terminal A3.
H3-09 (0417)	Terminal A2 Signal Level Select	V/f OLV/PM EZOLV Sets the input signal level for MFAI terminal A2. 0 : 0-10V (LowLim=0) 2 : 4 to 20 mA 3 : 0 to 20 mA
H3-10 (0418)	Terminal A2 Function Selection	V/f OLV/PM EZOLV Sets the function for MFAI terminal A2.
H3-11 (0419) RUN	Terminal A2 Gain Setting	V/f OLV/PM EZOLV Sets the gain of the analog signal input to MFAI terminal A2.
H3-12 (041A) RUN	Terminal A2 Bias Setting	V/f OLV/PM EZOLV Sets the bias of the analog signal input to MFAI terminal A2.
H3-14 (041C)	Analog Input Terminal Enable Sel	V/f OLV/PM EZOLV Sets the enabled terminal or terminals when *H1-xx = C [MFDI Function Select = Analog Terminal Enable Selection]* is ON. 1 : Terminal A1 only 2 : Terminal A2 only 3 : Terminals A1 and A2 4 : Terminal A3 only 5 : Terminals A1 and A3 6 : Terminals A2 and A3 7 : Terminals A1, A2, and A3
H3-16 (02F0)	Terminal A1 Offset	V/f OLV/PM EZOLV Sets the offset level for analog signals input to terminal A1. Usually it is not necessary to change this setting.
H3-17 (02F1)	Terminal A2 Offset	V/f OLV/PM EZOLV Sets the offset level for analog signals input to terminal A2. Usually it is not necessary to change this setting.
H3-18 (02F2)	Terminal A3 Offset	V/f OLV/PM EZOLV Sets the offset level for analog signals input to terminal A3. Usually it is not necessary to change this setting.
H3-40 (0B5C) Expert	Mbus Reg 15C1h Input Function	V/f OLV/PM EZOLV Sets the MEMOBUS AI1 function.
H3-41 (0B5F) Expert	Mbus Reg 15C2h Input Function	V/f OLV/PM EZOLV Sets the MEMOBUS AI2 function.
H3-42 (0B62) Expert	Mbus Reg 15C3h Input Function	V/f OLV/PM EZOLV Sets the MEMOBUS AI3 function.
H3-43 (117F) Expert	Mbus Reg Inputs FilterTime Const	V/f OLV/PM EZOLV Sets the time constant to apply a primary delay filter to the MEMOBUS analog input register values.
H3-45 (335B)	Terminal A1 Filter Time Constant	V/f OLV/PM EZOLV Sets the time constant when applying a primary delay filter to the A1 MFAI terminal.
H3-46 (335C)	Terminal A2 Filter Time Constant	V/f OLV/PM EZOLV Sets the time constant when applying a primary delay filter to the A2 MFAI terminal.
H3-47 (335D)	Terminal A3 Filter Time Constant	V/f OLV/PM EZOLV Sets the time constant when applying a primary delay filter to the A3 MFAI terminal.
H3-48 (335E)	Option V1 Filter Time Constant	V/f OLV/PM EZOLV Sets the time constant when applying a primary delay filter to the AI-A3 Option V1 MFAI terminal.
H3-49 (335F)	Option V2 Filter Time Constant	V/f OLV/PM EZOLV Sets the time constant when applying a primary delay filter to the AI-A3 Option V2 MFAI terminal.

No. (Hex.)	Name	Description
H3-50 (3360)	Option V3 Filter Time Constant	V/f OLV/PM EZOLV Sets the time constant when applying a primary delay filter to the AI-A3 Option V3 MFAI terminal.
H3-61 (336B)	A1 Unit Selection	V/f OLV/PM EZOLV Sets the units shown in *U1-13 [Terminal A1 Level]*. 0 : Percent (%) 1 : Units (mA or VDC)
H3-62 (336C)	A2 Unit Selection	V/f OLV/PM EZOLV Sets the units shown in *U1-14 [Terminal A2 Level]*. 0 : Percent (%) 1 : Units (mA or VDC)
H3-63 (336D)	A3 Unit Selection	V/f OLV/PM EZOLV Sets the units shown in *U1-15 [Terminal A3 Level]*. 0 : Percent (%) 1 : Units (mA or VDC)
0	Frequency Reference	V/f OLV/PM EZOLV The input value from the MFAI terminal set with this function becomes the master frequency reference.
1	Frequency Gain	V/f OLV/PM EZOLV The drive multiplies the analog frequency reference with the input value from the MFAI set with this function.
2	Auxiliary Frequency Reference 1	V/f OLV/PM EZOLV Sets Reference 2 through multi-step speed reference to enable the command reference (Auxiliary Frequency Reference 1) from the analog input terminal set here. This value is a percentage where the Maximum Output Frequency setting is a setting value of 100%.
3	Auxiliary Frequency Reference 2	V/f OLV/PM EZOLV Sets Reference 3 through multi-step speed reference to enable the command reference (Auxiliary Frequency Reference 2) from the analog input terminal set here. This value is a percentage where the Maximum Output Frequency setting is a setting value of 100%.
4	Output Voltage Bias	V/f OLV/PM EZOLV Set this parameter to input a bias signal and amplify the output voltage.
5	Accel/Decel Time Gain	V/f OLV/PM EZOLV Enters a signal to adjust the gain used for *C1-01 to C1-04 [Acceleration/Deceleration Times 1 and 2]* and *C1-09 [Fast Stop Time]* when the full scale analog signal (10 V or 20 mA) is 100%.
6	DC Injection Braking Current	V/f OLV/PM EZOLV Enters a signal to adjust the current level used for DC Injection Braking when the drive rated output current is 100%.
7	Torque Detection Level	V/f OLV/PM EZOLV Enters a signal to adjust the overtorque/undertorque detection level.
8	Stall Prevent Level During Run	V/f OLV/PM EZOLV Enters a signal to adjust the stall prevention level during run if the drive rated current is 100%.
9	Output Frequency Lower Limit	V/f OLV/PM EZOLV Enters a signal to adjust the output frequency lower limit level as a percentage of the maximum output frequency.
B	PID Feedback	V/f OLV/PM EZOLV Enter the PID feedback value as a percentage of the maximum output frequency.
C	PID Setpoint	V/f OLV/PM EZOLV Enters the PID setpoint as a percentage of the maximum output frequency.
D	Frequency Bias	V/f OLV/PM EZOLV Enters the bias value added to the frequency reference as a percentage of the maximum output frequency.
E	Motor Temperature (PTC Input)	V/f OLV/PM EZOLV Uses the motor Positive Temperature Coefficient (PTC) thermistor to prevent heat damage to the motor as a percentage of the current value when the 10 V analog signal is input.
F	Not Used	V/f OLV/PM EZOLV Use this setting for unused terminals or to use terminals in through mode.
10	Forward Torque Limit	V/f OLV/PM EZOLV Enters the forward torque limit when the motor rated torque is 100%.
11	Reverse Torque Limit	V/f OLV/PM EZOLV Enters the load torque limit if the motor rated torque is 100%.
12	Regenerative Torque Limit	V/f OLV/PM EZOLV Enters the regenerative torque limit if the motor rated torque is 100%.

No. (Hex.)	Name	Description
15	General Torque Limit	V/f OLV/PM EZOLV Enters the torque limit that is the same for all quadrants for forward, reverse, and regenerative operation if the motor rated torque is 100%.
16	Differential PID Feedback	V/f OLV/PM EZOLV Enters the PID differential feedback value if the full scale analog signal (10 V or 20 mA) is 100%.
1F	Not Used	V/f OLV/PM EZOLV Use this setting for unused terminals or to use terminals in through mode.
24	PID Feedback Backup	V/f OLV/PM EZOLV Enters the PID Feedback Backup signal for the drive to use when it loses the primary PID feedback set for *H3-xx = B [PID Feedback]*.
25	PI2 Control Setpoint	V/f OLV/PM EZOLV Enters the PI2 Control setpoint level as a percentage of the *S3-02 [PI2 Control Transducer Scale]* value.
26	PI2 Control Feedback	V/f OLV/PM EZOLV Enters the PI2 Control feedback level as a percentage of the *S3-02 [PI2 Control Transducer Scale]* value.
27	PI Auxiliary Control Feedback	V/f OLV/PM EZOLV Enters the PI Auxiliary Control feedback value when *YF-01 = 1 [PI Aux Control Selection = Enabled]*.
2B	Emergency Override PID Feedback	V/f OLV/PM EZOLV This input is the PID Feedback source when Emergency Override is running in PID mode (*S6-02 = 2 or 3 [Emergency Override Ref Selection = System PID Mode or Independent PID Mode]*).
2C	Emergency Override PID Setpoint	V/f OLV/PM EZOLV This input is the PID Setpoint source when Emergency Override is running in PID mode (*S6-02 = 2 or 3 [Emergency Override Ref Selection = System PID Mode or Independent PID Mode]*).
2D	Differential Level Source	V/f OLV/PM EZOLV Enters a feedback value to calculate the Differential Level between the *Differential Level Source* feedback and the primary *PID Feedback [H3-xx = B]*.
2E	HAND Frequency Reference	V/f OLV/PM EZOLV HAND mode Frequency Reference while *Y5-01 = 0*.
30	DWEZ Analog Input 1	V/f OLV/PM EZOLV Use with DriveWorksEZ. Refer to the DriveWorksEZ online manual for more information.
31	DWEZ Analog Input 2	V/f OLV/PM EZOLV Use with DriveWorksEZ. Refer to the DriveWorksEZ online manual for more information.
32	DWEZ Analog Input 3	V/f OLV/PM EZOLV Use with DriveWorksEZ. Refer to the DriveWorksEZ online manual for more information.
3A	Flow Meter	V/f OLV/PM EZOLV Analog input source for supplying the flow rate to the Flow Meter function. Full scale: *Y6-01*.
3B	Water Level / Suct Pres Feedback	V/f OLV/PM EZOLV Supplies the feedback for Water Level Control / Suction Pressure Control / Vacuum Control depending on which control is enabled.
H4-01 (041D)	Terminal FM Analog Output Select	V/f OLV/PM EZOLV Sets the monitoring number (Ux-xx) to be output from MFAO terminal FM.
H4-02 (041E) RUN	Terminal FM Analog Output Gain	V/f OLV/PM EZOLV Sets the gain of the monitor signal that is sent from MFAO terminal FM.
H4-03 (041F) RUN	Terminal FM Analog Output Bias	V/f OLV/PM EZOLV Sets the bias of the monitor signal that is sent from MFAO terminal FM.
H4-04 (0420)	Terminal AM Analog Output Select	V/f OLV/PM EZOLV Sets the monitoring number (Ux-xx) to be output from MFAO terminal AM.
H4-05 (0421) RUN	Terminal AM Analog Output Gain	V/f OLV/PM EZOLV Sets the gain of the monitor signal that is sent from MFAO terminal AM.
H4-06 (0422) RUN	Terminal AM Analog Output Bias	V/f OLV/PM EZOLV Sets the bias of the monitor signal that is sent from MFAO terminal AM.

No. (Hex.)	Name	Description
H4-07 (0423)	Terminal FM Signal Level Select	V/f OLV/PM EZOLV Sets the MFAO terminal FM output signal level. 0 : 0 to 10 Vdc 2 : 4 to 20 mA
H4-08 (0424)	Terminal AM Signal Level Select	V/f OLV/PM EZOLV Sets the MFAO terminal AM output signal level. 0 : 0 to 10 Vdc 2 : 4 to 20 mA
H4-20 (0B53)	Analog Power Monitor 100% Level	V/f OLV/PM EZOLV Sets the level at 10 V when you set *U1-08 [Output Power]* for analog output.
L1-01 (0480)	Motor Overload (oL1) Protection	V/f OLV/PM EZOLV Sets the motor overload protection with electronic thermal protectors. 0 : Disabled 1 : Variable Torque 2 : Constant Torque 10:1 Speed Range 3 : Constant Torque 100:1 SpeedRange 4 : PM Variable Torque 5 : PM Constant Torque 6 : Variable Torque (50Hz)
L1-02 (0481)	Motor Overload Protection Time	V/f OLV/PM EZOLV Sets the operation time for the electronic thermal protector of the drive to prevent damage to the motor. Usually it is not necessary to change this setting.
L1-03 (0482)	Motor Thermistor oH Alarm Select	V/f OLV/PM EZOLV Sets drive operation when the PTC input signal entered into the drive is at the *oH3 [Motor Overheat (PTC Input)]* detection level. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only
L1-04 (0483)	Motor Thermistor oH Fault Select	V/f OLV/PM EZOLV Sets the drive operation when the PTC input signal to the drive is at the *oH4 [Motor Overheat Fault (PTC Input)]* detection level. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09)
L1-05 (0484)	Motor Thermistor Filter Time	V/f OLV/PM EZOLV Sets the primary delay time constant for the PTC input signal entered to the drive. This parameter prevents accidental motor overheat faults.
L1-08 (1103)	oL1 Current Level	V/f OLV/PM EZOLV Sets the reference current for the motor 1 thermal overload detection. When the current level > 0.0 A, you cannot set this value < 10% of drive rated current.
L1-09 (1104)	oL1 Current Level for Motor 2	V/f OLV/PM EZOLV Sets the reference current for the motor 2 thermal overload detection. When the current level > 0.0 A, you cannot set this value < 10% of drive rated current.
L1-13 (046D)	Motor Overload Memory Selection	V/f OLV/PM EZOLV Sets the function that keeps the current electronic thermal protector value after power loss. 0 : Disabled 1 : Enabled 2 : Enabled, using RTC
L1-22 (0768) Expert RUN	Leakage Current Filter Time1	V/f OLV/PM EZOLV Sets the leakage current detection reduction filter time constant during constant speed run.
L1-23 (0769) Expert RUN	Leakage Current Filter Time2	V/f OLV/PM EZOLV Sets the leakage current detection reduction filter time constant during acceleration/deceleration.

No. (Hex.)	Name	Description
L2-01 (0485)	Power Loss Ride Through Select	V/f OLV/PM EZOLV Sets the drive operation after a momentary power loss. 0 : Disable 1 : Enabled 2 : Enabled while CPU Power Active 3 : Kinetic Energy Backup: L2-02 4 : Kinetic Energy Backup: CPU Power 5 : Kinetic Energy Backup: DecelStop
L2-02 (0486)	Power Loss Ride Through Time	V/f OLV/PM EZOLV Sets the maximum time that the drive will wait until it tries to restart after power loss.
L2-03 (0487)	Minimum Baseblock Time	V/f OLV/PM EZOLV Sets the minimum time to continue the drive output block (baseblock) after a baseblock.
L2-04 (0488)	Powerloss V/f Recovery Ramp Time	V/f OLV/PM EZOLV Sets the time for the drive output voltage to go back to the correct voltage after it completes speed searches.
L2-05 (0489)	Undervoltage Detection Lvl (Uv1)	V/f OLV/PM EZOLV Sets the voltage at which the drive triggers a *Uv1 [DC Bus Undervoltage]* fault or at which it activates the KEB function. Usually it is not necessary to change this setting.
L2-06 (048A) Expert	Kinetic Energy Backup Decel Time	V/f OLV/PM EZOLV Sets the deceleration time during KEB operation to decrease the maximum output frequency to 0.
L2-07 (048B) Expert	Kinetic Energy Backup Accel Time	V/f OLV/PM EZOLV Sets the acceleration time to return the frequency to the frequency reference before a power loss after canceling KEB operation.
L2-08 (048C) Expert	Frequency Gain at KEB Start	V/f OLV/PM EZOLV Sets the quantity of output frequency reduction used when KEB operation starts as a percentage of the motor rated slip before starting KEB operation.
L2-09 (048D) Expert	KEB Minimum Frequency Level	V/f OLV/PM EZOLV Sets the quantity of output frequency reduction used as a percentage of *E2-02 [Motor Rated Slip]* when KEB operation starts.
L2-10 (048E) Expert	Minimum KEB Time	V/f OLV/PM EZOLV Sets the minimum length of time to operate the KEB after the drive detects a momentary power loss.
L2-11 (0461) Expert	KEB DC Bus Voltage Setpoint	V/f OLV/PM EZOLV Sets the target value that controls the DC bus voltage to a constant level in Single Drive KEB Ride-Thru 2. Sets the DC bus voltage level that completes the KEB operation for all other KEB methods.
L2-29 (0475) Expert	Kinetic Energy Backup Method	V/f OLV/PM EZOLV Sets the KEB function operation mode. 0 : Single Drive KEB Ride-Thru 1 1 : Single Drive KEB Ride-Thru 2 3 : System KEB Ride-Thru 2
L2-30 (045E) Expert	KEB Zero Speed Operation	V/f OLV/PM EZOLV Sets the operation when the output frequency decreases below the zero level (DC braking injection starting frequency) during KEB deceleration when *L2-01 = 3 to 5 [Power Loss Ride Through Select = Kinetic Energy Backup: L2-02, Kinetic Energy Backup: CPU Power, or Kinetic Energy Backup: DecelStop]*. 0 : Baseblock 1 : DC/SC Braking
L2-31 (045D) Expert	KEB Start Voltage Offset Level	V/f OLV/PM EZOLV Sets the KEB start voltage offset.
L5-01 (049E)	Number of Auto-Restart Attempts	V/f OLV/PM EZOLV Sets the number of times that the drive will try to restart.
L5-02 (049F)	Fault Contact at Restart Select	V/f OLV/PM EZOLV Sets the function that sends signals to the MFDO terminal set for *Fault [H2-xx = E]* while the drive is automatically restarting. 0 : Active Only when Not Restarting 1 : Always Active
L5-04 (046C)	Interval Method Restart Time	V/f OLV/PM EZOLV Sets the time interval between each Auto Restart attempt.

No. (Hex.)	Name	Description
L5-07 (0B2A)	Fault Reset Enable Select Grp1	V/f OLV/PM EZOLV Use these 4 digits to set the Auto Restart function for *oL1* to *oL4*. From left to right, the digits set *oL1*, *oL2*, *oL3*, and *oL4*, in order. 0000 : Disabled 0001 : Enabled (—/—/—/oL4) 0010 : Enabled (—/—/oL3/—) 0011 : Enabled (—/—/oL3/oL4) 0100 : Enabled (—/oL2/—/—) 0101 : Enabled (—/oL2/—/oL4) 0110 : Enabled (—/oL2/oL3/—) 0111 : Enabled (—/oL2/oL3/oL4) 1000 : Enabled (oL1/—/—/—) 1001 : Enabled (oL1/—/—/oL4) 1010 : Enabled (oL1/—/oL3/—) 1011 : Enabled (oL1/—/oL3/oL4) 1100 : Enabled (oL1/oL2/—/—) 1101 : Enabled (oL1/oL2/—/oL4) 1110 : Enabled (oL1/oL2/oL3/—) 1111 : Enabled (oL1/oL2/oL3/oL4)
L5-08 (0B2B)	Fault Reset Enable Select Grp2	V/f OLV/PM EZOLV Use these 4 digits to set the Auto Restart function for *Uv1*, *ov*, *oH1*, and *GF*. From left to right, the digits set *Uv1*, *ov*, *oH1*, and *GF*, in order. 0000 : Disabled 0001 : Enabled (—/–/—/GF) 0010 : Enabled (—/–/oH1/–) 0011 : Enabled (—/–/oH1/GF) 0100 : Enabled (—/ov/—/–) 0101 : Enabled (—/ov/—/GF) 0110 : Enabled (—/ov/oH1/–) 0111 : Enabled (—/ov/oH1/GF) 1000 : Enabled (Uv1/–/—/–) 1001 : Enabled (Uv1/–/—/GF) 1010 : Enabled (Uv1/–/oH1/–) 1011 : Enabled (Uv1/–/oH1/GF) 1100 : Enabled (Uv1/ov/—/–) 1101 : Enabled (Uv1/ov/—/GF) 1110 : Enabled (Uv1/ov/oH1/–) 1111 : Enabled (Uv1/ov/oH1/GF)
L5-40 (3670)	Low Feedback Flt Retry Selection	V/f OLV/PM EZOLV Sets the drive to do an Auto Restart when the drive detects an *LFB [Low Feedback Sensed]* fault. 0 : No Retry 1 : Retry
L5-41 (3671)	Hi Feedback Flt Retry Selection	V/f OLV/PM EZOLV Sets the drive to do an Auto Restart when the drive detects an *HFB [High Feedback Sensed]* fault. 0 : No Retry 1 : Retry
L5-42 (3672)	Feedback Loss Fault Retry Select	V/f OLV/PM EZOLV Sets the drive to try an Auto Restart when the drive detects an *FDBKL [WIRE Break]* fault. 0 : No Retry 1 : Retry
L5-43 (3673)	LowFeedback Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number of restart attempts when the drive detects an *LFB Low Feedback Sensed* condition.
L5-44 (3674)	Hi Feedback Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number of restart attempts when the drive detects an *HFB High Feedback Sensed* condition.
L5-45 (3675)	Fdbk Loss Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number of restart attempts when the drive detects a *FBL Feedback Loss* condition.
L5-46 (3676)	Low Feedback Fault Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *LFB Low Feedback Sensed* auto-restart attempt.
L5-47 (3677)	Hi Feedback Fault Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *HFB High Feedback Sensed* auto-restart attempt.
L5-48 (3678)	Feedback Loss Fault Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *FDBKL Feedback Loss* auto-restart attempt.

No. (Hex.)	Name	Description
L5-49 (3679)	Fault Retry Speed Search Select	V/f OLV/PM EZOLV Sets the drive to do a speed search at the start of a Fault Retry. 0 : Disabled 1 : Enabled
L5-50 (367A)	Setpoint Not Met Fault Retry Sel	V/f OLV/PM EZOLV Sets the drive to try an Auto Restart when it detects an *NMS [SetPoint Not Met]* fault. 0 : No Retry 1 : Retry
L5-51 (367B)	Loss of Prime Fault Retry Select	V/f OLV/PM EZOLV Sets the drive to try an Auto Restart if it detects an *LOP [Loss Of Prime]* fault. 0 : No Retry 1 : Retry 2 : Infinite Retries
L5-52 (367C)	Over Cycle Fault Retry Selection	V/f OLV/PM EZOLV Sets the drive to try an Auto Restart if it detects an *POC [Pump Over Cycle]* fault. 0 : No Retry 1 : Retry 2 : Infinite Retries
L5-53 (3251)	VoluteThermostat Fault Retry Sel	V/f OLV/PM EZOLV Sets the drive to try an Auto Restart if it detects a *VLTS [Volute Thermostat Fault]* fault. 0 : No Retry 1 : Retry
L5-54 (367E)	Setpoint Not Met Retry Attempts	V/f OLV/PM EZOLV Sets the number restart attempts when the drive detects an *NMS Setpoint Not Met* condition.
L5-55 (367F)	Loss of Prime Flt Retry Attempts	V/f OLV/PM EZOLV Sets the number restart attempts when the drive detects an *LOP Loss of Prime* condition. If *L5-51 = 2 [Loss of Prime Fault Retry Select = Infinite Retries]*, the drive will ignore this parameter.
L5-56 (3680)	Over Cycle Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number of restart attempts when the drive detects an *POC Pump Over Cycle* condition.
L5-57 (3681)	Volute Thermostat Retry Attempts	V/f OLV/PM EZOLV Sets the number restart attempts when the drive detects a *VLTS [Volute Thermostat Fault]* condition.
L5-58 (3682)	Setpoint Not Met Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *NMS Setpoint Not Met* auto-restart attempt.
L5-59 (3683)	Over Cycle Fault Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *POC Pump Over Cycle* auto-restart attempt.
L5-60 (3684)	Volute Thermostat Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *VLTS [Volute Thermostat Fault]* auto-restart attempt.
L5-61 (3685)	Low Water Level Fault Retry Sel	V/f OLV/PM EZOLV Sets the auto-restart function after the drive detects an *LWL Low Water Level Digital Input* fault. 0 : No Retry 1 : Retry
L5-62 (3686)	Low Water Level Retry Attempts	V/f OLV/PM EZOLV Sets the number restart attempts when the drive detects a *LWL Low Water Level Digital Input* condition.
L5-63 (3687)	Low Water Level Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *LWL Low Water Level Digital Input* auto-restart attempt.
L5-64 (3688)	High Water Level Fault Retry Sel	V/f OLV/PM EZOLV Sets the auto-restart function after the drive detects an *HWL High Water Level Digital Input* fault. 0 : No Retry 1 : Retry
L5-65 (3689)	High Water Level Retry Attempts	V/f OLV/PM EZOLV Sets the number restart attempts when the drive detects a *HWL High Water Level Digital Input* condition.
L5-66 (368A)	High Water Level Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *HWL High Water Level Digital Input* auto-restart attempt.
L8-02 (04AE)	Overheat Alarm Level	V/f OLV/PM EZOLV Sets the *oH* detection level temperature.

No. (Hex.)	Name	Description
L8-03 (04AF)	Overheat Pre-Alarm Selection	V/f OLV/PM EZOLV Sets drive operation if it detects an *oH* alarm. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09) 3 : Alarm Only 4 : Operate at Reduced Speed (L8-19)
L8-05 (04B1)	Input Phase Loss Protection Sel	V/f OLV/PM EZOLV Sets the function to enable and disable input phase loss detection. 0 : Disabled 1 : Enabled
L8-07 (04B3)	Output Phase Loss Protection Sel	V/f OLV/PM EZOLV Sets the function to enable and disable output phase loss detection. The drive starts output phase loss detection when the output current decreases to less than 5% of the drive rated current. 0 : Disabled 1 : Fault when one phase is lost 2 : Fault when two phases are lost
L8-09 (04B5)	Output Ground Fault Detection	V/f OLV/PM EZOLV Sets the function to enable and disable ground fault protection. 0 : Disabled 1 : Enabled
L8-10 (04B6)	Heatsink Fan Operation Selection	V/f OLV/PM EZOLV Sets operation of the heatsink cooling fan. 0 : During Run, w/ L8-11 Off-Delay 1 : Always On 2 : Temperature-Dependent Fan Ctrl.
L8-11 (04B7)	Heatsink Fan Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time that the drive will wait before it stops the cooling fan after it cancels the Run command when *L8-10 = 0 [Heatsink Fan Operation Selection = During Run, w/ L8-11 Off-Delay]*.
L8-12 (04B8)	Ambient Temperature Setting	V/f OLV/PM EZOLV Sets the ambient temperature of the drive installation area.
L8-15 (04BB)	Drive oL2 @ Low Speed Protection	V/f OLV/PM EZOLV Sets the function to decrease the drive overload level at which the drive will trigger *oL2 [Drive Overload]* during low speed operation (6 Hz or slower) to prevent damage to the main circuit transistors. 0 : Disabled (No Additional Derate) 1 : Enabled (Reduced oL2 Level)
L8-18 (04BE)	Software Current Limit Selection	V/f OLV/PM EZOLV Set the software current limit selection function to prevent damage to the main circuit transistor caused by too much current. 0 : Disabled 1 : Enabled
L8-19 (04BF)	Freq Reduction @ oH Pre-Alarm	V/f OLV/PM EZOLV Sets the ratio at which the drive derates the frequency reference during an *oH* alarm.
L8-27 (04DD)	Overcurrent Detection Gain	V/f OLV/PM EZOLV Sets the PM motor overcurrent detection level as a percentage of the motor rated current value.
L8-29 (04DF)	Output Unbalance Detection Sel	V/f OLV/PM EZOLV Sets the function to detect *LF2 [Output Current Imbalance]*. 0 : Disabled 1 : Enabled
L8-31 (04E1)	LF2 Detection Time	V/f OLV/PM EZOLV Sets the LF2 [Output Current Imbalance] detection time.
L8-35 (04EC)	Installation Method Selection	V/f OLV/PM EZOLV Sets the type of drive installation. 0 : IP20/UL Open Type 1 : Side-by-Side Mounting 2 : IP20/UL Type 1 3 : IP55/UL Type 12

No. (Hex.)	Name	Description
L8-38 (04EF)	Carrier Frequency Reduction	V/f OLV/PM EZOLV Sets the carrier frequency reduction function. The drive decreases the carrier frequency when the output current is more than a specified level. 0 : Disabled 1 : Enabled below 6 Hz 2 : Enabled for All Speeds 3 : Enable at Overload 4 : Enabled for All Speeds/Overheat
L8-41 (04F2)	High Current Alarm Selection	V/f OLV/PM EZOLV Sets the function to cause an *HCA [High Current Alarm]* when the output current is more than 150% of the drive rated current. 0 : Disabled 1 : Enabled
L8-90 (0175) Expert	STPo Detection Level (Low Speed)	V/f OLV/PM EZOLV Sets the detection level that the control fault must be equal to or more than to cause an *STPo [Motor Step-Out Detected]*.
L8-97 (3104)	Carrier Freq Reduce during OH	V/f OLV/PM EZOLV Sets the function to decrease carrier frequency during oH pre-alarm. 0 : Disabled 1 : Enabled
o1-03 (0502)	Frequency Display Unit Selection	V/f OLV/PM EZOLV Sets the display units for the frequency reference and output frequency. 0 : 0.01Hz units 1 : 0.01% units 2 : min^{-1} (r/min) unit 3 : User Units (o1-09 -o1-11)
o1-05 (0504) RUN	LCD Contrast Adjustment	V/f OLV/PM EZOLV Sets the contrast of the LCD display on the keypad.
o1-09 (051C)	Freq. Reference Display Units	V/f OLV/PM EZOLV Sets the unit of display for the frequency reference parameters and frequency-related monitors when *o1-03 = 3 [Frequency Display Unit Selection = User Units (o1-09 ~ o1-11)]*. 0 : “WC: inches of water column 1 : PSI: pounds per square inch 2 : GPM: gallons/min 3 : °F: Fahrenheit 4 : ft^3/min: cubic feet/min 5 : m^3/h: cubic meters/hour 6 : L/h: liters/hour 7 : L/s: liters/sec 8 : bar: bar 9 : Pa: Pascal 10 : °C: Celsius 11 : m: meters 12 : ft: feet 13 : L/min: liters/min 14 : m^3/min: cubic meters/min 15 : “Hg: Inch Mercury 16 : kPa: kilopascal 48 : %: Percent 49 : Custom(o1-13~15) 50 : None
o1-10 (0520)	User Units Maximum Value	V/f OLV/PM EZOLV Sets the value that the drive shows as the maximum output frequency.
o1-11 (0521)	User Units Decimal Position	V/f OLV/PM EZOLV Sets the number of decimal places for frequency reference and monitor values. 0 : No Decimal Places (XXXXX) 1 : One Decimal Place (XXXX.X) 2 : Two Decimal Places (XXX.XX) 3 : Three Decimal Places (XX.XXX)
o1-13 (3105)	Freq. Reference Custom Unit 1	V/f OLV/PM EZOLV Sets the first character of the custom unit display when *o1-03 = 3 [Frequency Display Unit Selection = User Units]* and *o1-09 = 49 [Freq. Reference Display Units = Custom (o1-13~15)]*.

No. (Hex.)	Name	Description
o1-14 (3106)	Freq. Reference Custom Unit 2	V/f OLV/PM EZOLV Sets the second character of the custom unit display when *o1-03 = 3 [Frequency Display Unit Selection = User Units]* and *o1-09 = 49 [Freq. Reference Display Units = Custom (o1-13~15)]*.
o1-15 (3107)	Freq. Reference Custom Unit 3	V/f OLV/PM EZOLV Sets the third character of the custom unit display when *o1-03 = 3 [Frequency Display Unit Selection = User Units]* and *o1-09 = 49 [Freq. Reference Display Units = Custom (o1-13~15)]*.
o1-18 (310A)	User Defined Parameter 1	V/f OLV/PM EZOLV Lets you set values to use as reference information.
o1-19 (310B)	User Defined Parameter 2	V/f OLV/PM EZOLV Lets you set values to use as reference information.
o1-24 (11AD) RUN	Custom Monitor 1	V/f OLV/PM EZOLV Sets Custom Monitor 1 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-25 (11AE) RUN	Custom Monitor 2	V/f OLV/PM EZOLV Sets Custom Monitor 2 to be displayed on the home screen. This monitor is not in the cycling list.
o1-26 (11AF) RUN	Custom Monitor 3	V/f OLV/PM EZOLV Sets Custom Monitor 3 to be displayed on the home screen. This monitor is not in the cycling list.
o1-27 (11B0) RUN	Custom Monitor 4	V/f OLV/PM EZOLV Sets Custom Monitor 4 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-28 (11B1) RUN	Custom Monitor 5	V/f OLV/PM EZOLV Sets Custom Monitor 5 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-29 (11B2) RUN	Custom Monitor 6	V/f OLV/PM EZOLV Sets Custom Monitor 6 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-30 (11B3) RUN	Custom Monitor 7	V/f OLV/PM EZOLV Sets Custom Monitor 7 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-31 (11B4) RUN	Custom Monitor 8	V/f OLV/PM EZOLV Sets Custom Monitor 8 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-32 (11B5) RUN	Custom Monitor 9	V/f OLV/PM EZOLV Sets Custom Monitor 9 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-33 (11B6) RUN	Custom Monitor 10	V/f OLV/PM EZOLV Sets Custom Monitor 10 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-34 (11B7) RUN	Custom Monitor 11	V/f OLV/PM EZOLV Sets Custom Monitor 11 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-35 (11B8) RUN	Custom Monitor 12	V/f OLV/PM EZOLV Sets Custom Monitor 12 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-36 (11B9) RUN	LCD Backlight Brightness	V/f OLV/PM EZOLV Sets the intensity of the LCD keypad backlight.
o1-37 (11BA) RUN	LCD Backlight ON/OFF Selection	V/f OLV/PM EZOLV Sets the automatic shut off function for the LCD backlight. 0 : OFF 1 : ON
o1-38 (11BB) RUN	LCD Backlight Off-Delay	V/f OLV/PM EZOLV Sets the time until the LCD backlight automatically turns off.

No. (Hex.)	Name	Description
o1-39 (11BC) RUN	Show Initial Setup Screen	V/f OLV/PM EZOLV Sets the function to show the LCD keypad initial setup screen each time you energize the drive. This parameter is only available with an LCD keypad. 0 : TURN OFF power up setup screen 1 : KEEP ON power up setup screen
o1-58 (3125)	Motor Power Unit Selection	V/f OLV/PM EZOLV Sets the setting unit for parameters that set the motor rated power. 0 : kW 1 : HP
o1-83 (31BD)	Drive Name	V/f OLV/PM EZOLV Selects the text to be displayed on the top line of the Status Monitor as the drive name. 0 : Disabled - No Text 1 : IQPUMP605 2 : iQpump 3 : Auxiliary Pump 4 : Backup Pump 5 : Booster Pump 6 : Canal Pump 7 : Chopper Pump 8 : Emergency Pump 9 : High Service Pump 10 : Irrigation Pump 11 : Jockey Pump 12 : Lift Pump 13 : Main Feed Pump 14 : Prog. Cavity Pump 15 : Pump 16 : Reservoir Pump 17 : Slurry Pump 18 : Standby Pump 19 : Storage Tank 20 : Submersible Pump 21 : Sump Pump 22 : Transfer Pump 23 : Trash Pump 24 : Vert. Turbine Pump 25 : Well Pump 26 : Zone 27 : North Pump 28 : South Pump 29 : East Pump 30 : West Pump 31 : NW Pump 32 : NE Pump 33 : SW Pump 34 : SE Pump
o1-84 (31BE)	Drive Name Unit Number	V/f OLV/PM EZOLV Selects the unit number to be displayed on the top line of the Status Monitor. The unit number will show up as a 2–digit number (zero-filled).
o1-90 (31C4) RUN	Custom Monitor 13	V/f OLV/PM EZOLV Sets Custom Monitor 13 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-91 (31C5) RUN	Custom Monitor 14	V/f OLV/PM EZOLV Sets Custom Monitor 14 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-92 (31C6) RUN	Custom Monitor 15	V/f OLV/PM EZOLV Sets Custom Monitor 15 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-93 (31C7) RUN	Custom Monitor 16	V/f OLV/PM EZOLV Sets Custom Monitor 16 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.

No. (Hex.)	Name	Description
o1-94 (31C8) RUN	Custom Monitor 17	V/f OLV/PM EZOLV Sets Custom Monitor 17 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-95 (31C9) RUN	Custom Monitor 18	V/f OLV/PM EZOLV Sets Custom Monitor 18 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-96 (31CA) RUN	Custom Monitor 19	V/f OLV/PM EZOLV Sets Custom Monitor 19 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o1-97 (31CB) RUN	Custom Monitor 20	V/f OLV/PM EZOLV Sets Custom Monitor 20 to be displayed on the home screen. A setting of 0 removes this custom monitor from the cycling list.
o2-02 (0506)	OFF Key Function Selection	V/f OLV/PM EZOLV Sets the function to use the OFF key on the keypad to stop the drive when the Run command source for the drive is REMOTE (external) and not assigned to the keypad. 0 : Disabled 1 : Enabled
o2-03 (0507)	User Parameter Default Value	V/f OLV/PM EZOLV Sets the function to keep the settings of changed parameters as user parameter defaults to use during initialization. 0 : No change 1 : Set defaults 2 : Clear all
o2-04 (0508)	Drive Model (KVA) Selection	V/f OLV/PM EZOLV Sets the Drive Model code. Set this parameter after you replace the control board.
o2-05 (0509)	Home Mode Freq Ref Entry Mode	V/f OLV/PM EZOLV Sets the function that makes it necessary to push ↵ to use the keypad to change the frequency reference value while in Drive Mode. 0 : ENTER Key Required 1 : Immediate / MOP-style
o2-06 (050A)	Keypad Disconnect Detection	V/f OLV/PM EZOLV Sets the function that stops the drive if you disconnect the keypad connection cable from the drive or if you damage the cable while the keypad is the Run command source. 0 : Disabled 1 : Enabled
o2-07 (0527)	Keypad RUN Direction @ Power-up	V/f OLV/PM EZOLV Sets the direction of motor rotation when the drive is energized and the keypad is the Run command source. 0 : Forward 1 : Reverse
o2-09 (050D)	Reserved	-
o2-19 (061F)	Parameter Write during Uv	V/f OLV/PM EZOLV Enables and disables the function to change parameter settings during a *Uv [DC Bus Undervoltage]* condition. 0 : Disabled 1 : Enabled
o2-23 (11F8) RUN	External 24V Powerloss Detection	V/f OLV/PM EZOLV Sets the function to give a warning if the backup external 24 V power supply turns off when the main circuit power supply is in operation. 0 : Disabled 1 : Enabled
o2-24 (11FE)	LED Light Function Selection	V/f OLV/PM EZOLV Sets the function to show the LED status rings and keypad LED lamps. 0 : Enable Status Ring & Keypad LED 1 : LED Status Ring Disable 2 : Keypad LED Light Disable
o2-26 (1563)	Alarm Display at Ext. 24V Power	V/f OLV/PM EZOLV When you connect a backup external 24 V power supply, this parameter sets the function to trigger an alarm when the main circuit power supply voltage decreases. 0 : Disabled 1 : Enabled

No. (Hex.)	Name	Description
o2-27 (1565)	bCE Detection Selection	V/f OLV/PM EZOLV Sets drive operation if the Bluetooth device is disconnected when you operate the drive in Bluetooth Mode. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use *C1-09*) 3 : Alarm Only 4 : No Alarm Display
o4-01 (050B)	Elapsed Operating Time Setting	V/f OLV/PM EZOLV Sets the initial value of the cumulative drive operation time in 10-hour units.
o4-02 (050C)	Elapsed Operating Time Selection	V/f OLV/PM EZOLV Sets the condition that counts the cumulative operation time. 0 : U4-01 Shows Total Power-up Time 1 : U4-01 Shows Total RUN Time
o4-03 (050E)	Fan Operation Time Setting	V/f OLV/PM EZOLV Sets the value from which to start the cumulative drive cooling fan operation time in 10-hour units.
o4-05 (051D)	Capacitor Maintenance Setting	V/f OLV/PM EZOLV Sets the *U4-05 [Capacitor Life Mon]* monitor value.
o4-07 (0523)	Softcharge Relay Maintenance Set	V/f OLV/PM EZOLV Sets the *U4-06 [PreChargeRelayMon]* monitor value.
o4-09 (0525)	IGBT Maintenance Setting	V/f OLV/PM EZOLV Sets the *U4-07 [IGBT Maintenance]* monitor value.
o4-11 (0510)	Fault Trace/History Init (U2/U3)	V/f OLV/PM EZOLV Resets the records of Monitors *U2-xx [Fault Trace]* and *U3-xx [Fault History]*. 0 : Disabled 1 : Enabled
o4-12 (0512)	kWh Monitor Initialization	V/f OLV/PM EZOLV Resets the monitor values for *U4-10 [kWh, Lower 4 Digits]* and *U4-11 [kWh, Upper 5 Digits]*. 0 : No Reset 1 : Reset
o4-13 (0528)	RUN Command Counter @ Initialize	V/f OLV/PM EZOLV Resets the monitor values for *U4-02 [Total Run Commands]*, *U4-24 [Number of Runs (Low)]*, and *U4-25 [Number of Runs (High)]*. 0 : No Reset 1 : Reset
o4-22 (154F) RUN	Time Format	V/f OLV/PM EZOLV Sets the time display format. This parameter is only available when using an LCD keypad. 0 : 24 Hour Clock 1 : 12 Hour Clock 2 : 12 Hour JP Clock
o4-23 (1550) RUN	Date Format	V/f OLV/PM EZOLV Sets the date display format. This parameter is only available on an LCD keypad. 0 : YYYY/MM/DD 1 : DD/MM/YYYY 2 : MM/DD/YYYY
o4-24 (310F) RUN	bAT Detection Selection	V/f OLV/PM EZOLV Sets operation when the drive detects *bAT [Keypad Battery Low Voltage]* and *TiM [Keypad Time Not Set]*. 0 : Disable 1 : Enable (Alarm Detected) 2 : Enable (Fault Detected)
S2-01 (3206)	Timer 1 Start Time	V/f OLV/PM EZOLV Sets the start time for timer 1.
S2-02 (3207)	Timer 1 Stop Time	V/f OLV/PM EZOLV Sets the stop time for timer 1.

No. (Hex.)	Name	Description
S2-03 (3208)	Timer 1 Day Selection	V/f OLV/PM EZOLV Sets the days for which sequence timer 1 is active. 0 : Timer Disabled 1 : Daily 2 : Mon - Fri 3 : Sat - Sun 4 : Monday 5 : Tuesday 6 : Wednesday 7 : Thursday 8 : Friday 9 : Saturday 10 : Sunday
S2-04 (3209)	Timer 1 Sequence Selection	V/f OLV/PM EZOLV Sets the drive response when sequence timer 1 is active. 0 : Digital Out Only 1 : Run 2 : Run - PID Disable 3 : Allow Alternation
S2-05 (320A)	Timer 1 Reference Source	V/f OLV/PM EZOLV Selects the frequency reference source to run the drive when sequence timer 1 is active (only applicable when *S2-04 > 0 [Timer 1 Sequence Selection ≠ Digital Out Only]*). 0 : Operator (d1-01/YA-01) 1 : Operator (d1-02/YA-02) 2 : Operator (d1-03/YA-03) 3 : Operator (d1-04/YA-04) 4 : Terminals 5 : Serial Com 6 : Option PCB 7 : Pulse Input 8 : Set by b1-01/b1-15 9 : Operator (d1-05/YA-05) 10 : Operator (d1-06/YA-06) 11 : Operator (d1-07/YA-07) 12 : Operator (d1-08/YA-08)
S2-06 (320B)	Timer 2 Start Time	V/f OLV/PM EZOLV Sets the start time for timer 2.
S2-07 (320C)	Timer 2 Stop Time	V/f OLV/PM EZOLV Sets the stop time for timer 2.
S2-08 (320D)	Timer 2 Day Selection	V/f OLV/PM EZOLV Sets the days for which sequence timer 2 is active. 0 : Timer disabled 1 : Daily 2 : Mon - Fri 3 : Sat - Sun 4 : Monday 5 : Tuesday 6 : Wednesday 7 : Thursday 8 : Friday 9 : Saturday 10 : Sunday
S2-09 (320E)	Timer 2 Sequence Selection	V/f OLV/PM EZOLV Sets the drive response when sequence timer 2 is active. 0 : Digital Out Only 1 : Run 2 : Run - PID Disable 3 : Allow Alternation

No. (Hex.)	Name	Description
S2-10 (320F)	Timer 2 Reference Source	V/f OLV/PM EZOLV Selects the frequency reference source to run the drive when sequence timer 2 is active (only applicable when *S2-09 > 0 [Timer 2 Sequence Selection ≠ 0]*). 0 : Operator (d1-01/YA-01) 1 : Operator (d1-02/YA-02) 2 : Operator (d1-03/YA-03) 3 : Operator (d1-04/YA-04) 4 : Terminals 5 : Serial Com 6 : Option PCB 7 : Pulse Input 8 : Set by b1-01/b1-15 9 : Operator (d1-05/YA-05) 10 : Operator (d1-06/YA-06) 11 : Operator (d1-07/YA-07) 12 : Operator (d1-08/YA-08)
S2-11 (3210)	Timer 3 Start Time	V/f OLV/PM EZOLV Sets the start time for timer 3.
S2-12 (3211)	Timer 3 Stop Time	V/f OLV/PM EZOLV Sets the stop time for timer 3.
S2-13 (3212)	Timer 3 Day Selection	V/f OLV/PM EZOLV Sets the days for which sequence timer 3 is active. 0 : Timer Disabled 1 : Daily 2 : Mon - Fri 3 : Sat - Sun 4 : Monday 5 : Tuesday 6 : Wednesday 7 : Thursday 8 : Friday 9 : Saturday 10 : Sunday
S2-14 (3213)	Timer 3 Sequence Selection	V/f OLV/PM EZOLV Sets the drive response when sequence timer 3 is active. 0 : Digital Out Only 1 : Run 2 : Run - PID Disable 3 : Allow Alternation
S2-15 (3214)	Timer 3 Reference Source	V/f OLV/PM EZOLV Selects the frequency reference source to run the drive when sequence timer 3 is active (only applicable when *S2-14 > 0 [Timer 3 Sequence Selection ≠ Digital Out Only]*). 0 : Operator (d1-01/YA-01) 1 : Operator (d1-02/YA-02) 2 : Operator (d1-03/YA-03) 3 : Operator (d1-04/YA-04) 4 : Terminals 5 : Serial Com 6 : Option PCB 7 : Pulse Input 8 : Set by b1-01/b1-15 9 : Operator (d1-05/YA-05) 10 : Operator (d1-06/YA-06) 11 : Operator (d1-07/YA-07) 12 : Operator (d1-08/YA-08)
S2-16 (3215)	Timer 4 Start Time	V/f OLV/PM EZOLV Sets the start time for timer 4.
S2-17 (3216)	Timer 4 Stop Time	V/f OLV/PM EZOLV Sets the stop time for timer 4.

No. (Hex.)	Name	Description
S2-18 (3217)	Timer 4 Day Selection	V/f OLV/PM EZOLV Sets the days for which sequence timer 4 is active. 0 : Timer disabled 1 : Daily 2 : Mon - Fri 3 : Sat - Sun 4 : Monday 5 : Tuesday 6 : Wednesday 7 : Thursday 8 : Friday 9 : Saturday 10 : Sunday
S2-19 (3218)	Timer 4 Sequence Selection	V/f OLV/PM EZOLV Sets the drive response when sequence timer 4 is active. 0 : Digital Out Only 1 : Run 2 : Run - PID Disable 3 : Allow Alternation
S2-20 (3219)	Timer 4 Reference Source	V/f OLV/PM EZOLV Selects the frequency reference source to run the drive when sequence timer 4 is active (only applicable when *S2-19 > 0 [Timer 4 Sequence Selection ≠ Digital Out Only]*). 0 : Operator (d1-01/YA-01) 1 : Operator (d1-02/YA-02) 2 : Operator (d1-03/YA-03) 3 : Operator (d1-04/YA-04) 4 : Terminals 5 : Serial Com 6 : Option PCB 7 : Pulse Input 8 : Set by b1-01/b1-15 9 : Operator (d1-05/YA-05) 10 : Operator (d1-06/YA-06) 11 : Operator (d1-07/YA-07) 12 : Operator (d1-08/YA-08)
S3-01 (321A) RUN	PI2 Control Enable Selection	V/f OLV/PM EZOLV Sets when the PI Auxiliary Control function is enabled: 0 : Disabled 1 : Always 2 : Drive Running 3 : Motor Running
S3-02 (321B) RUN	PI2 Control Transducer Scale	V/f OLV/PM EZOLV Sets the full scale (10 V or 20 mA) output of the pressure transducer that is connected to the analog input terminals programmed for PI2 (Setpoint or Feedback).
S3-03 (321C) RUN	PI2 Control Decimal Place Pos	V/f OLV/PM EZOLV Sets the decimal place display for secondary PI units. 0 : No Decimal Places (XXXXX) 1 : One Decimal Place (XXXX.X) 2 : Two Decimal Places (XXX.XX) 3 : Three Decimal Places (XX.XXX)

No. (Hex.)	Name	Description
S3-04 (321D) RUN	PI2 Control Unit Selection	V/f OLV/PM EZOLV Sets the units displayed for the PI2 Control parameters and monitor. 0 : “WC: inches of water column 1 : PSI: pounds per square inch 2 : GPM: gallons/min 3 : °F: Fahrenheit 4 : ft^3/min: cubic feet/min 5 : m^3/h: cubic meters/hour 6 : L/h: liters/hour 7 : L/s: liters/sec 8 : bar: bar 9 : Pa: Pascal 10 : °C: Celsius 11 : m: meters 12 : ft: feet 13 : L/min: liters/min 14 : m^3/min: cubic meters/min 15 : “Hg: Inch Mercury 16 : kPa: kilopascal 48 : %: Percent 49 : Custom(S3-18~20) 50 : None
S3-05 (321E) RUN	PI2 Control Setpoint	V/f OLV/PM EZOLV Sets the PI2 Control target setpoint.
S3-06 (321F) RUN	PI2 Control Proportional Gain	V/f OLV/PM EZOLV Sets the proportional gain of the PI2 Control. Set this parameter to 0.00 to disable proportional control.
S3-07 (3220) RUN	PI2 Control Integral Time	V/f OLV/PM EZOLV Sets the integral time for the suction pressure control. Set this parameter to 0.00 to disable the integrator.
S3-08 (3221) RUN	PI2 Control Integral Max Limit	V/f OLV/PM EZOLV Sets the maximum output possible from the integrator.
S3-09 (3222) RUN	PI2 Control Output Upper Limit	V/f OLV/PM EZOLV Sets the maximum output possible from the PI Auxiliary Control function.
S3-10 (3223) RUN	PI2 Control Output Lower Limit	V/f OLV/PM EZOLV Sets the minimum output possible from the PI Auxiliary Control function.
S3-11 (3224) RUN	PI2 Control Output Level Sel	V/f OLV/PM EZOLV Sets the PI2 controller output direction. 0 : Direct Acting (Normal Output) 1 : Inverse Acting (Reverse Output)
S3-12 (3225) RUN	PI2 Control Disable Mode Sel	V/f OLV/PM EZOLV Sets what *U5-20 [PI2 Control Output]* will output when disabled. 0 : No Output (0%) 1 : Lower Limit (S3-10) 2 : Setpoint
S3-13 (3226) RUN	PI2 Control Low Feedback Lvl	V/f OLV/PM EZOLV Sets the secondary PI low feedback detection level.
S3-14 (3227) RUN	PI2 Control Low Feedback Time	V/f OLV/PM EZOLV Sets the secondary PI low feedback detection delay time in seconds.
S3-15 (3228) RUN	PI2 Control High Feedback Lvl	V/f OLV/PM EZOLV Sets the secondary PI high feedback detection level.

No. (Hex.)	Name	Description
S3-16 (3229) RUN	PI2 Control High Feedback Time	V/f OLV/PM EZOLV Sets the secondary PI high feedback detection delay time in seconds.
S3-17 (322A) RUN	PI2 Control Feedback Det Sel	V/f OLV/PM EZOLV Sets when the low and high feedback detection multifunction outputs (71h and 72h) for PI2 Control are active. 0 : While PI2 Control Enabled 1 : Always
S3-18 (322B) RUN	PI2 Control Custom Unit 1	V/f OLV/PM EZOLV Sets the first character of the PI2 Control custom unit display when *S3-04 = 49 [PI2 Control Unit Selection = Custom(S3-18~20)]*.
S3-19 (322C) RUN	PI2 Control Custom Unit 2	V/f OLV/PM EZOLV Sets the second character of the PI2 Control custom unit display when *S3-04 = 49 [PI2 Control Unit Selection = Custom (S3-18~20)]*.
S3-20 (322D) RUN	PI2 Control Custom Unit 3	V/f OLV/PM EZOLV Sets the third character of the PI2 Control custom unit display when *S3-04 = 49 [PI2 Control Unit Selection = Custom (S3-18~20)]*.
Y1-01 (3C00)	Multiplex Mode	V/f OLV/PM EZOLV Sets the base operation mode of the drive controller. 0 : Drive Only 1 : Contactor Multiplex 3 : Network Multiplex
Y1-02 (3C01)	System Units	V/f OLV/PM EZOLV Sets the units the drive will use for standard PID. 0 : “WC: inches of water column 1 : PSI: pounds per square inch 2 : GPM: gallons/min 3 : °F: Fahrenheit 4 : ft^3/min: cubic feet/min 5 : m^3/h: cubic meters/hour 6 : L/h: liters/hour 7 : L/s: liters/sec 8 : bar: bar 9 : Pa: Pascal 10 : °C: Celsius 11 : m: meters 12 : ft: feet 13 : L/min: liters/min 14 : m^3/min: cubic meters/min 15 : “Hg: Inch Mercury 16 : kPa: kilopascal 25 : Flow (Use Y6-04) 48 : %: Percent 49 : Custom(Y1-32~34) 50 : None
Y1-03 (3C02)	Feedback Device Scaling	V/f OLV/PM EZOLV Sets the value that the drive sets or shows as the PID setpoint when at maximum output frequency.
Y1-04 (3C03) RUN	Sleep Wake-up Level	V/f OLV/PM EZOLV Sets the level that feedback must be less than for the time set in *Y1-05 [Sleep Wake-up Level Delay Time]* to start the system. This level also sets the wake up level when the drive is in Sleep Mode. When *Y1-04 < 0*, the feedback level must decrease this amount to less than the setpoint.
Y1-05 (3C04) RUN	Sleep Wake-up Level Delay Time	V/f OLV/PM EZOLV Sets the drive to start the System again when the feedback decreases to less than *Y1-04 [Sleep Wake-up Level]* for the time set in this parameter.
Y1-06 (3C05) RUN	Minimum Speed	V/f OLV/PM EZOLV Sets the minimum frequency at which the drive will run. The drive applies this setting to HAND and AUTO Modes.
Y1-07 (3C06)	Minimum Speed Units	V/f OLV/PM EZOLV Sets the units and decimal place for *Y1-06 [Minimum Speed]*. 0 : Hz 1 : RPM

No. (Hex.)	Name	Description
Y1-08 (3C07) RUN	Low Feedback Level	V/f OLV/PM EZOLV Sets the lower detection level for the PID feedback.
Y1-09 (3C08) RUN	Low Feedback Lvl Fault Dly Time	V/f OLV/PM EZOLV Sets the delay time for the drive to detect an *LFB [Low Feedback Sensed]* fault after the feedback level decreases to less than the value set in *Y1-08 [Low Feedback Level]*.
Y1-10 (3C09)	Low Feedback Selection	V/f OLV/PM EZOLV Sets the drive response when the feedback decreases to less than *Y1-08 [Low Feedback Level]* for longer than the time set in *Y1-09 [Low Feedback Lvl Fault Dly Time]*. 0 : Fault (and Digital Output) 1 : Alarm (and Digital Output) 2 : Digital Output Only
Y1-11 (3C0A) RUN	High Feedback Level	V/f OLV/PM EZOLV Sets the upper detection level for the PID feedback.
Y1-12 (3C0B) RUN	High Feedback Lvl Fault Dly Time	V/f OLV/PM EZOLV Sets the delay time between when the drive detects high feedback until the drive faults on an *HFB [High Feedback Sensed]* fault.
Y1-13 (3C0C)	High Feedback Selection	V/f OLV/PM EZOLV Sets the drive response when the feedback increased to more than *Y1-11 [High Feedback Level]* for longer than the time set in *Y1-12 [High Feedback Lvl Fault Dly Time]*. 0 : Fault (and Digital Output) 1 : Alarm (and Digital Output) 2 : Digital Output Only
Y1-14 (3C0D) RUN	Feedback Hysteresis Level	V/f OLV/PM EZOLV Sets the hysteresis level for low and high level feedback detection.
Y1-15 (3C0E) RUN	Maximum Setpoint Difference	V/f OLV/PM EZOLV Sets a percentage of difference between the setpoint and the feedback. The difference must be more than this value for the time set in *Y1-16 [Not Maintaining Setpoint Time]* to trigger the drive response set in *Y1-17 [Not Maintaining Setpoint Sel]*.
Y1-16 (3C0F) RUN	Not Maintaining Setpoint Time	V/f OLV/PM EZOLV Sets the delay time before a Setpoint Not Met condition occurs. The drive must detect the setpoint difference set in *Y1-15 [Maximum Setpoint Difference]* before the timer will start.
Y1-17 (3C10)	Not Maintaining Setpoint Sel	V/f OLV/PM EZOLV Sets the drive response when the feedback increases to more or decreases to less than the setpoint for more than the amount set in *Y1-15 [Maximum Setpoint Difference]*. 0 : Fault (and Digital Output) 1 : Alarm (and Digital Output) 2 : Digital Output Only
Y1-18 (3C11)	Prime Loss Detection Method	V/f OLV/PM EZOLV Sets the units and quantity that the drive will use to determine *LOP [Loss of Prime]*. 0 : Current (A) 1 : Power (kW) 2 : Torque (%)
Y1-19 (3C12) RUN	Prime Loss Level	V/f OLV/PM EZOLV Sets the level to detect the *LOP [Loss of Prime]* in the pump during RUN or Sleep Boost Mode.
Y1-20 (3C13) RUN	Prime Loss Time	V/f OLV/PM EZOLV Sets the delay time before the drive detects an *LOP [Loss of Prime]* condition. The timer starts when the drive detects the conditions in *Y1-18 [Prime Loss Detection Method]* and *Y1-19 [Prime Loss Level]*.
Y1-21 (3C14)	Prime Loss Activation Freq	V/f OLV/PM EZOLV Sets the frequency level above which the drive enables Loss of Prime detection.
Y1-22 (3C15)	Prime Loss Selection	V/f OLV/PM EZOLV Sets the drive response when the drive is in the Loss of Prime condition. 0 : Fault (and Digital Output) 1 : Alarm (and Digital Output) 2 : Digital Output Only
Y1-23 (3C16)	Prime Loss Max Restart Time	V/f OLV/PM EZOLV Sets the time in minutes that the drive will wait before it tries a restart after a restart fails or after it does not do a restart because of a fault.

No. (Hex.)	Name	Description
Y1-24 (3C17) RUN	Level at Full Speed	V/f OLV/PM EZOLV Sets the level used to override the programmed P-gain *[b5-02]* and I-limit *[b5-04]* with calculated values based on Sleep level, Wake-up level, Minimum Pump Speed, Transducer Scaling, and Maximum Frequency. The value programmed in this parameter should be the target level when at full-speed operation.
Y1-32 (3FCF)	System Unit Custom Character 1	V/f OLV/PM EZOLV Sets the first character of the custom unit display when *Y1-02 = 49 [System Units = Custom(Y1-32~34)]* or when *b5-41 = 49 [PID Output 2 Unit = Custom (Y1-32~34)]*.
Y1-33 (3FD0)	System Unit Custom Character 2	V/f OLV/PM EZOLV Sets the second character of the custom unit display when *Y1-02 = 49 [System Units = Custom(Y1-32~34)]* or when *b5-41 = 49 [PID Output 2 Unit = Custom (Y1-32~34)]*.
Y1-34 (3FD1)	System Unit Custom Character 3	V/f OLV/PM EZOLV Sets the third character of the custom unit display when *Y1-02 = 49 [System Units = Custom(Y1-32~34)]* or when *b5-41 = 49 [PID Output 2 Unit = Custom (Y1-32~34)]*.
Y1-36 (3C23)	High/Low Water DI Fault Det Sel	V/f OLV/PM EZOLV Sets when the MFDI terminals set for *H1-xx = BB or BC [Low Water Level or High Water Level]* will be active to detect the *LWL [Low Water Level]* and *HWL [High Water Level]* faults. 0 : During Run 1 : Always
Y1-37 (3C24)	External Fan Delay Off Time	V/f OLV/PM EZOLV Sets the delay time after the drive is turned off and before the External Fan Switch MFDO is deactivated.
Y1-40 (3C27) RUN	Maximum Speed	V/f OLV/PM EZOLV Sets the maximum speed.
Y2-01 (3C64)	Sleep Level Type	V/f OLV/PM EZOLV Sets the data source that the drive uses to know when to activate the Sleep Function. 0 : Output Frequency 1 : Output Current 2 : Feedback 3 : Output Speed (RPM) 4 : Flow Meter 5 : Output Frequency (non-PID)
Y2-02 (3C65) RUN	Sleep Level	V/f OLV/PM EZOLV Sets the level that the level type set in *Y2-01 [Sleep Level Type]* must be at for the time set in *Y2-03 [Sleep Delay Time]* for the drive to enter Sleep Mode.
Y2-03 (3C66) RUN	Sleep Delay Time	V/f OLV/PM EZOLV Sets the delay time before the drive enters Sleep Mode when the drive is at the sleep level set in *Y2-02 [Sleep Level]*.
Y2-04 (3C67) RUN	Sleep Activation Level	V/f OLV/PM EZOLV Sets the level above which the output frequency must increase to activate the Sleep Function when *Y2-01 = 0, 3, or 5 [Sleep Level Type = Output Frequency, Output Speed (RPM), or Output Frequency (non-PID)]*.
Y2-05 (3C68) RUN	Sleep Boost Level	V/f OLV/PM EZOLV Sets the quantity of boost that the drive applies to the setpoint before it goes to sleep.
Y2-06 (3C69) RUN	Sleep Boost Hold Time	V/f OLV/PM EZOLV Sets the length of time that the drive will keep the boosted pressure before it goes to sleep.
Y2-07 (3C6A) RUN	Sleep Boost Max Time	V/f OLV/PM EZOLV Sets the length of time that the system (feedback) has to reach the boosted setpoint. The system must reach the boosted setpoint in the time set in this parameter, or it will go to sleep.
Y2-08 (3C6B) RUN	Delta Feedback Drop Level	V/f OLV/PM EZOLV Sets the level of the PID Error (set-point minus feedback) to deactivate the Sleep Mode operation.
Y2-09 (3C6C) RUN	Feedback Drop Detection Time	V/f OLV/PM EZOLV Sets the time during which the software monitors the feedback to detect a flow/no-flow condition. Refer to *Y2-08 [Delta Feedback Drop Level]* for more information.
Y2-10 (3C6D) RUN	Max Cycling Protection Allowed	V/f OLV/PM EZOLV Maximum number of cycles allowed within time specified in *Y2-11 [Cycling Count Decrement Time]* before the system faults on *POC [Pump Over Cycle]*. One cycle is defined when the drive transfers from normal operation in AUTO Mode to Sleep Mode. Set this parameter to 0 to disable the function.

No. (Hex.)	Name	Description
Y2-11 (3C6E) RUN	Cycling Count Decrement Time	V/f OLV/PM EZOLV Sets the time for which the drive needs to be running in AUTO Mode before the cycle counter is decremented. One cycle is defined when the drive transfers from normal operation in AUTO Mode to sleep mode. When no cycling occurs within the programmed time, the drive will decrease the internal cycle register.
Y2-12 (3C6F)	Over Cycle Mode	V/f OLV/PM EZOLV Sets how the drive will respond when it detects an Over Cycle condition. 0 : Disabled 1 : Alarm 2 : Fault 3 : AUTO Setpoint Compensation
Y2-13 (3C70)	Setpoint Compensation	V/f OLV/PM EZOLV Sets the amount of setpoint the drive will compensate when there is too much cycling.
Y2-14 (3C71)	Maximum Setpoint Compensation	V/f OLV/PM EZOLV Sets the maximum allowed setpoint compensation for the over cycling function.
Y2-15 (3C72) RUN	Sleep AUTO → OFF Selection	V/f OLV/PM EZOLV Selects if sleep is allowed with *Y1-04 Sleep Wake-up Level] = 0.0* and also cause the drive to switch to OFF when sleep conditions are met. 0 : Disabled 1 : Enabled 2 : Enabled with Timer
Y2-16 (3C73) RUN	Sleep AUTO → OFF Delay Timer	V/f OLV/PM EZOLV Set the length of time that the drive will sleep before the drive will switch to OFF when sleep conditions are met. The timer begins after Sleep Boost and Feedback Drop are complete.
Y2-23 (3C7A) RUN	Anti-No-Flow Bandwidth	V/f OLV/PM EZOLV Sets the quantity of PI error bandwidth that the drive uses to detect an Anti- No-Flow condition.
Y2-24 (3C7B) RUN	Anti-No-Flow Detection Time	V/f OLV/PM EZOLV Sets the time delay before the drive starts the increased deceleration rate after it detects Anti-No-Flow.
Y2-25 (3C7C) RUN	Anti-No-Flow Release Level	V/f OLV/PM EZOLV Sets the amount below the setpoint which the feedback must decrease before the drive will disengage Anti-No-Flow and return to normal PI operation.
Y3-00 (3CC7)	Number of Lag Pumps in System	V/f OLV/PM EZOLV Sets the number of lag pumps present.
Y3-01 (3CC8)	Lag Pump Staging Method	V/f OLV/PM EZOLV Sets the method to add contactor lag pumps to the system. 0 : Output Frequency 1 : Feedback 2 : Feedback + Output Frequency
Y3-02 (3CC9)	Lag Pump Shutdown Method	V/f OLV/PM EZOLV Sets the method to remove contactor pumps from the system. 0 : Output Frequency 1 : Feedback 2 : Feedback + Output Frequency
Y3-03 (3CCA) RUN	Multiplex Max Speed Staging Lvl	V/f OLV/PM EZOLV Sets the maximum level used for the multiplex pumping operation.
Y3-04 (3CCB) RUN	Add Lag Pump Delta Level	V/f OLV/PM EZOLV Sets the level used for the multiplex pumping operation.
Y3-05 (3CCC) RUN	Add Lag Pump Delay Time	V/f OLV/PM EZOLV Sets the delay time before the drive adds a pump to the system.
Y3-06 (3CCD) RUN	Freq Reduction after Staging	V/f OLV/PM EZOLV Sets the upper limit of the output frequency after a lag pump is staged.
Y3-07 (3CCE) RUN	Freq Reduction Time after Stage	V/f OLV/PM EZOLV Sets the amount of time that the output frequency will be limited after lag pump is staged.

No. (Hex.)	Name	Description
Y3-08 (3CCF) RUN	Shutdown Lag Pump Delta Level	V/f OLV/PM EZOLV Sets the shutdown level used for the multiplex pumping operation.
Y3-09 (3CD0) RUN	Shutdown Lag Pump Delay Time	V/f OLV/PM EZOLV Sets the delay time before the drive shuts down one of the lag pump.
Y3-10 (3CD1) RUN	Max Setpoint Boost@ De-stage	V/f OLV/PM EZOLV Sets the maximum amount of boost that can be added to the setpoint after a de-stage occurs.
Y3-11 (3CD2) RUN	Setpoint Boost Time	V/f OLV/PM EZOLV Sets the amount of time that the setpoint will remain boosted after lag pump is de-staged.
Y3-12 (3CD3) RUN	Multi Pump Setpoint Increase	V/f OLV/PM EZOLV Sets the system setpoint increase each time a new pump is brought online.
Y3-13 (3CD4) RUN	Multi Pump Setpoint Decrease	V/f OLV/PM EZOLV Sets the system setpoint decrease each time a new pump is brought online.
Y3-14 (3CD5) RUN	Multiplex Stabilization Time	V/f OLV/PM EZOLV Sets the time used to stabilize the system when the drive adds or shuts down a pump during multiplex operation.
Y3-15 (3CD6) RUN	High Feedback Quick De-stage	V/f OLV/PM EZOLV Sets the High Feedback level that will trigger a quick de-stage. The quick de-stage uses an internal 2 s delay.
Y3-16 (3CD7) RUN	Low Feedback Quick De-stage	V/f OLV/PM EZOLV Sets the Low Feedback level that will trigger a quick de-stage. The quick de-stage uses an internal 2 s delay.
Y3-30 (3CE5)	Stage Selection Mode	V/f OLV/PM EZOLV Sets the method of staging for the pumps. 0 : Sequential 1 : Stop History
Y3-31 (3CE6)	De-stage Selection Mode	V/f OLV/PM EZOLV Sets the method to remove contactor pumps. 0 : Last In, First Out 1 : First In, First Out
Y3-40 (3CEF)	Pre-Charge Helper Pump Select	V/f OLV/PM EZOLV Sets which of the lag pumps can come on during Pre-Charge. 0 : Disabled 2 : Pump 2 (MFDO 8A) 3 : Pump 3 (MFDO 8B) 4 : Pump 4 (MFDO 8C) 5 : Pump 5 (MFDO 8D) 6 : Pump 6 (MFDO 8E)
Y3-41 (3CF0)	Pre-Charge Helper Pump Time	V/f OLV/PM EZOLV Sets how long the helper pump specified in *Y3-40 [Pre-Charge Helper Pump Select]* is energized.
Y3-42 (3CF1)	Helper Pump after Pre-Charge	V/f OLV/PM EZOLV Sets whether the helper pump that was used in *Y3-40 [Pre-Charge Helper Pump Select]* turns off or maintains its state when Pre-Charge is finished: 0 : Turn Off 1 : Continue
Y3-43 (3CF2)	Pre-Charge Helper On-Delay Time	V/f OLV/PM EZOLV Sets how long the drive is in the Pre-Charge mode before the helper pump specified in *Y3-40 [Pre-Charge Helper Pump Select]* energized.
Y3-50 (3CF9) RUN	Pump 2 Shutdown Frequency	V/f OLV/PM EZOLV Sets the shutdown frequency used for Pump 2 in multiplex pumping operation.
Y3-60 (3CC3) RUN	Pump 3 Shutdown Frequency	V/f OLV/PM EZOLV Sets the shutdown frequency used for Pump 3 in multiplex pumping operation.

No. (Hex.)	Name	Description
Y3-70 (3CC4) RUN	Pump 4 Shutdown Frequency	V/f OLV/PM EZOLV Sets the shutdown frequency used for Pump 4 in multiplex pumping operation.
Y3-80 (3CC5) RUN	Pump 5 Shutdown Frequency	V/f OLV/PM EZOLV Sets the shutdown frequency used for Pump 5 in multiplex pumping operation.
Y3-90 (3CC6) RUN	Pump 6 Shutdown Frequency	V/f OLV/PM EZOLV Sets the shutdown frequency used for Pump 6 in multiplex pumping operation.
Y4-01 (3CFA) RUN	Pre-Charge Level	V/f OLV/PM EZOLV Sets the level at which the drive will activate the pre-charge function when the drive is running at the frequency set in *Y4-02 [Pre-Charge Frequency]*.
Y4-02 (3CFB) RUN	Pre-Charge Frequency	V/f OLV/PM EZOLV Sets the frequency at which the pre-charge function will operate.
Y4-03 (3CFC) RUN	Pre-Charge Time	V/f OLV/PM EZOLV Sets the length of time that the Pre-Charge function will run.
Y4-05 (3CFE) RUN	Pre-Charge Loss of Prime Level	V/f OLV/PM EZOLV Detects loss of prime in the pump. If the measured quantity set in *Y1-18 [Prime Loss Detection Method]* is less than the level set in this parameter for the length of time set in *Y1-20 [Prime Loss Time]* and the output frequency is at the level set in *Y4-02 [Pre-Charge Frequency]*, it will trigger a “Loss Of Prime” condition .
Y4-06 (3CFF) RUN	Pre-Charge Frequency 2	V/f OLV/PM EZOLV Sets the frequency reference that the drive uses when the Pre-Charge 2 function is active.
Y4-07 (3D00) RUN	Pre-Charge Time 2	V/f OLV/PM EZOLV Sets the length of time that the drive will spend at the Pre-Charge Frequency 2 speed during Pre-Charge.
Y4-08 (3D01) RUN	Pre-Charge Loss of Prime Level 2	V/f OLV/PM EZOLV Detects loss of prime in the pump. If the measured quantity set in *Y1-18 [Prime Loss Detection Method]* is less than the level set in this parameter for the length of time set in *Y1-20 [Prime Loss Time]* and the output frequency is at the level set in *Y4-06 [Pre-Charge Frequency 2]*, it will trigger a “Loss Of Prime” condition .
Y4-10 (3D03)	AUTO Key Memory at Power Down	V/f OLV/PM EZOLV Sets whether the drive will save the AUTO key of the keypad on power-down. 0 : Disabled 1 : Enabled
Y4-11 (3D04) RUN	Thrust Acceleration Time	V/f OLV/PM EZOLV Sets the time at which the drive output frequency will ramp up to the reference frequency set in *Y4-12 [Thrust Frequency]*.
Y4-12 (3D05) RUN	Thrust Frequency	V/f OLV/PM EZOLV Sets the Thrust Frequency that the drive will use to know which acceleration and deceleration time to use. The drive will accelerate to this frequency in the *Y4-11 [Thrust Acceleration Time]* time and decelerate from this frequency in the *Y4-13 [Thrust Deceleration Time]* time.
Y4-13 (3D06) RUN	Thrust Deceleration Time	V/f OLV/PM EZOLV Sets the length of time necessary for the drive to go from the Thrust Frequency in *Y4-12 [Thrust Frequency]* to stop when Thrust Mode is active.
Y4-17 (3D0A) RUN	Utility Start Delay	V/f OLV/PM EZOLV Sets the length of time that the drive will delay starting when there is a Run command at power-up.
Y4-18 (3D0B) RUN	Differential Level	V/f OLV/PM EZOLV Sets the maximum difference that the drive will allow when it subtracts the Differential Feedback from the Primary PID Feedback.
Y4-19 (3D0C) RUN	Differential Lvl Detection Time	V/f OLV/PM EZOLV Sets the length of time that the difference between PID Feedback and the Differential Feedback must be more than *Y4-18 [Differential Level]* before the drive will respond as specified by *Y4-20 [Differential Level Detection Selection]*.
Y4-20 (3D0D) RUN	Differential Level Detection Sel	V/f OLV/PM EZOLV Sets the drive response during a Differential Level Detected condition. 0 : Fault (and Digital Out) 1 : Alarm (and Digital Out) 2 : Digital Out Only

No. (Hex.)	Name	Description
Y4-22 (3D0F) RUN	Low City On-Delay Time	V/f OLV/PM EZOLV Sets the length of time that the drive will wait to stop when the drive detects a Low City Pressure condition.
Y4-23 (3D10) RUN	Low City Off-Delay Time	V/f OLV/PM EZOLV Sets the length of time that the drive will wait to start again after you clear a Low City Pressure condition.
Y4-24 (3D11) RUN	Low City Alarm Text	V/f OLV/PM EZOLV Sets the alarm message to show on the keypad when the drive detects a Low City Pressure condition. 0 : Low City Pressure 1 : Low Suction Pressure 2 : Low Water in Tank
Y4-29 (3D16) RUN	Lube Pump Text	V/f OLV/PM EZOLV Selects the display text when Lube Pump is active. It also changes the text for the Lube Pump Digital Output selection *[H2-xx = C6]*. 0 : Lube Pump 1 : Digital Out Delay 2 : Primer Pump 3 : Screen Motor Starter
Y4-30 (3D17) RUN	Lube Pump During Run	V/f OLV/PM EZOLV When enabled, the Lube Pump digital output *[H2-xx = C6]* stays activated after the timer expires and the drive starts to run normally. The output will deactivate only when the drive stops, faults, or sleeps. 0 : Disabled 1 : Active During Run
Y4-31 (3D18) RUN	Lube Pump Time	V/f OLV/PM EZOLV Sets the length of time that the drive output is delayed and the Lube Pump digital output *[H2-xx = C6]* is energized before the drive will run. Set this parameter to 0.0 to disable the feature.
Y4-32 (3D19) RUN	Pre-Charge Level 2	V/f OLV/PM EZOLV For normal PI operation and during Pre-Charge 2, if the PI Feedback signal is more than the level set in this parameter, Pre-Charge 2 is cancelled and the drive resumes normal operation.
Y4-36 (3D1D) RUN	Pressure Reached Exit Conditions	V/f OLV/PM EZOLV Sets how the digital output responds to Feedback changes after it activates. 0 : Hysteresis Above & Below 1 : Hysteresis 1-Way
Y4-37 (3D1E) RUN	Pressure Reached Hysteresis Lvl	V/f OLV/PM EZOLV Sets the hysteresis level that will cause the drive to exit the Pressure Reached condition.
Y4-38 (3D1F) RUN	Pressure Reached On Delay Time	V/f OLV/PM EZOLV Sets the length of time that the drive will wait before it activates the Pressure Reached condition.
Y4-39 (3D20) RUN	Pressure Reached Off Delay Time	V/f OLV/PM EZOLV Sets the length of time that the drive will wait before it deactivates the Pressure Reached condition.
Y4-40 (3D21) RUN	Pressure Reached Detection Sel	V/f OLV/PM EZOLV Sets the drive status that triggers the Pressure Reached Detection digital output. 0 : Always 1 : Drive Running 2 : Run Command
Y4-41 (3D22) RUN	Diff Lvl Src Fdbk Backup Select	V/f OLV/PM EZOLV Sets the function to enable or disable *Differential Level Source [H3-xx = 2D]* as the backup transducer if there is a failure with the primary PID Feedback transducer *[H3-xx = B]* and the PID Feedback Backup transducer *[H3-xx = 24]* is not available. 0 : Disabled 1 : Enabled
Y4-42 (3D23)	Output Disconnect Detection Sel	V/f OLV/PM EZOLV Sets the drive response when you open the output disconnect then connect it again. 0 : Disabled 1 : Alarm - Speed Search 2 : Alarm - Start at Zero 3 : Fault

No. (Hex.)	Name	Description
Y4-43 (3D24)	Output Disconnect Inject Current	V/f OLV/PM EZOLV Sets the level of DC injection current during output disconnect as a percentage of the drive rated current.
Y4-50 (3D2B)	Harmonic Filter Output Selection	V/f OLV/PM EZOLV Sets how the harmonic filter output will close. 0 : Speed 1 : Current 2 : Speed + Current
Y4-51 (3D2C)	HFO Speed Point	V/f OLV/PM EZOLV Sets the speed point that must be exceeded to close the harmonic filter output (as a percentage of maximum frequency).
Y4-52 (3D2D)	HFO Current Point	V/f OLV/PM EZOLV Sets the current point that must be exceeded to close the harmonic filter output (as a percentage of motor rated current).
Y4-53 (3D2E)	HFO Delay On-Time	V/f OLV/PM EZOLV Sets a delay for the activation of HFO.
Y4-54 (3D2F)	HFO Delay Off-Time	V/f OLV/PM EZOLV Sets a delay for the deactivation of HFO.
Y5-01 (3D40)	HAND Frequency Reference Source	V/f OLV/PM EZOLV Sets the frequency reference source when HAND Mode is active. 0 : HAND Analog Input 1 : HAND Reference 1 (Y5-02)
Y5-02 (3D41) RUN	HAND Frequency Reference	V/f OLV/PM EZOLV Sets the frequency reference when HAND Mode is active and *Y5-01 = 1 [HAND Frequency Reference Source = HAND Reference 1 (Y5-02)]*.
Y5-03 (3D42)	HAND/AUTO Switchover During Run	V/f OLV/PM EZOLV Sets the function to enable or disable switching between HAND and AUTO Mode during run. Switching from AUTO to HAND is not permitted when the drive is running in MEMOBUS Multiplex mode with auxiliary drives enabled. 0 : Disabled 1 : Enabled
Y5-04 (3D43)	Operation HAND Key	V/f OLV/PM EZOLV Sets the HAND key on the HOA keypad to let you switch between HAND Mode and AUTO Mode. 0 : Disabled 1 : Enabled
Y5-05 (3D44) RUN	HAND Frequency Reference 2	V/f OLV/PM EZOLV Sets the frequency reference when HAND Mode 2 is active.
Y5-06 (3D45) RUN	HAND Reference Prime Loss Level	V/f OLV/PM EZOLV Detects loss of prime in the pump during HAND mode. If the measured quantity (determined by *Y1-18*) is less than this level for the time specified in *Y1-20* and the output frequency is at or more than the *Y5-02* level, a “Loss Of Prime” condition occurs.
Y5-07 (3D46) RUN	HAND Reference Prime Loss Level 2	V/f OLV/PM EZOLV Detects loss of prime in the pump during HAND mode 2. If the measured quantity in *Y1-18* is less than this level for the time specified in *Y1-20* and the output frequency is at or more than the *Y5-05* level, the drive will detect a *Loss Of Prime* condition.
Y5-09 (3D48)	HAND MOP Selection	V/f OLV/PM EZOLV Sets whether you can use MOP to change HAND references from the Home screen. 0 : ENTER Key Required 1 : Immediate/MOP-style
Y6-01 (3D5E)	Flow Meter Scaling	V/f OLV/PM EZOLV This parameter enables the flow meter functions when set ≠ 0.0. It sets the display scaling when “Flow Rate” is used as the PID feedback and sets the scaling for the “Flow Rate” analog output. When you use a pulse input is for the flow rate, this parameter will also set the scaling for the “Flow Rate” analog input.
Y6-02 (3D5F)	Turbine Input Scaling Coarse	V/f OLV/PM EZOLV Sets the scaling for the turbine in units of pulses/gallon. Pulses/Gallon = *Y6-02 + Y6-03 [Turbine Input Scaling Fine]*.
Y6-03 (3D60)	Turbine Input Scaling Fine	V/f OLV/PM EZOLV Sets the scaling for the turbine in units of pulses/gallon. Pulses/Gallon = *Y6-02 [Turbine Input Scaling Coarse] + Y6-03*.

No. (Hex.)	Name	Description
Y6-04 (3D61)	Water Flow Units	V/f OLV/PM EZOLV Sets the display units for flow meter related parameters and monitors 0 : U.S. Gallons / min (GPM) 1 : U.S. Gallons / hour (GPH) 2 : Cubic Feet / min (CFM) 3 : Cubic Meters / hour (CMH) 4 : Acre-Feet / year (AFY)
Y6-05 (3D62) RUN	Flow Accumulation Set Reset	V/f OLV/PM EZOLV Resets the accumulated flow and sets monitors *UA-84* to *UA-89* to *0*. 0 : No Reset 7770 : Reset Accumulation 8880 : Set Accumulation (Y6-31 - Y6-34)
Y6-06 (3D63) RUN	Low Flow Level	V/f OLV/PM EZOLV Sets the level below which the flow must be for longer than the time set in *Y6-07 [Low Flow Detection Time]* to trigger a Low Flow condition.
Y6-07 (3D64) RUN	Low Flow Detection Time	V/f OLV/PM EZOLV Sets the length of time that the flow rate must be below the level set in *Y6-06 [Low Flow Level]* to detect a Low Flow condition.
Y6-08 (3D65) RUN	Low Flow Detection Wait Time	V/f OLV/PM EZOLV Sets the length of time that the drive will wait after coming out of a zero speed condition before activating Low Flow detection.
Y6-09 (3D66)	Low Flow Behavior	V/f OLV/PM EZOLV Sets how the drive will respond when it detects a *LowFl Low Flow* condition. 0 : Digital Output Only 1 : Alarm (and Digital Output) 2 : Fault (and Digital Output) 3 : Auto-Restart (time set by Y6-10)
Y6-10 (3D67)	Low Flow Auto-Restart Time	V/f OLV/PM EZOLV Sets the length of time that the drive will wait before it tries to auto-restart after a *LowFl Low Flow* fault.
Y6-11 (3D68) RUN	Accumulation Level - Millions	V/f OLV/PM EZOLV Sets the accumulated volume that will trigger the *Accumulated Flow Level* alarm, *Accumulated Flow Level* fault, or the Accumulated Flow Level digital output.
Y6-12 (3D69) RUN	Accumulation Level - Thousands	V/f OLV/PM EZOLV Sets the accumulated volume that will trigger the *Accumulated Flow Level* alarm, *Accumulated Flow Level* fault, or the Accumulated Flow Level digital output.
Y6-13 (3D6A) RUN	Accumulation Level - Ones	V/f OLV/PM EZOLV Sets the accumulated volume that will trigger the *Accumulated Flow Level* alarm, *Accumulated Flow Level* fault, or the Accumulated Flow Level digital output.
Y6-14 (3D6B) RUN	Accumulation Level - Decimal	V/f OLV/PM EZOLV Sets the accumulated volume that will trigger the *Accumulated Flow Level* alarm, *Accumulated Flow Level* fault, or the Accumulated Flow Level digital output.
Y6-15 (3D6C) RUN	Accumulated Volume Behavior	V/f OLV/PM EZOLV Sets how the drive will respond when the accumulated volume reaches the level set by Accumulation Level parameters *Y6-11* to *Y6-14*. When you use settings 2 to 5, *Y6-20 [Accumulator Stopping Method]* sets the stopping method when the accumulated volume reaches the target value. 0 : Digital Output Only 1 : Alarm (and Digital Output) 2 : Fault (and Digital Output) 3 : Fault + MFDO + Accum Reset 4 : Stop + Alarm + MFDO 5 : Stop + Alarm + MFDO + AccumReset
Y6-16 (3D6D)	Flow Meter Accumulator Units	V/f OLV/PM EZOLV Sets the units that the drive uses to accumulate flow. 1 : Gallons (gal) 2 : Acre-Feet (A-F)
Y6-17 (3D6E) RUN	High Flow Level	V/f OLV/PM EZOLV Sets the level above which the flow must be for longer than the time set in *Y6-18 [High Flow Detection Time]* to trigger a High Flow condition.

No. (Hex.)	Name	Description
Y6-18 (3D6F) RUN	High Flow Detection Time	V/f OLV/PM EZOLV Sets the length of time that the flow rate must be above the level set in *Y6-17 [High Flow Level]* to detect a High Flow condition.
Y6-19 (3D70)	High Flow Behavior	V/f OLV/PM EZOLV Sets how the drive will respond it detects a *HiFlo High Flow* condition. 0 : Digital Output Only 1 : Alarm (and Digital Output) 2 : Fault (and Digital Output) 3 : Auto-Restart (time set by Y6-42)
Y6-20 (3D71)	Accumulator Stopping Method	V/f OLV/PM EZOLV Sets how the drive will stop when the accumulated volume reaches the level set by Accumulation Level parameters *Y6-11* to *Y6-14*. 0 : Ramp to Stop 1 : Coast to Stop 2 : Fast Stop (Use C1-09)
Y6-21 (3D72) RUN	Low Flow Det Wait Time Cancel	V/f OLV/PM EZOLV Sets the length of time that the flow rate must be above the level set in *Y6-06 [Low Flow Level]* to cancel the delay wait time set in *Y6-08 [Low Flow Detection Wait Time]* and start Low Flow Detection.
Y6-22 (3D73)	Flow Meter Decimal Place Pos	V/f OLV/PM EZOLV Sets the number of decimal places for the Flow Meter parameters and monitors. 0 : No Decimal Places (XXXXX) 1 : One Decimal Place (XXXX.X) 2 : Two Decimal Places (XXX.XX)
Y6-26 (3D77)	Flow Rate Limit Selection	V/f OLV/PM EZOLV Enables and disables the Flow Rate Limiter. 0 : Disabled 1 : Enabled 2 : Enabled - Low Limit
Y6-27 (3D78) RUN	Flow Rate Limit Level	V/f OLV/PM EZOLV Sets the Flow Rate Limit according to the *Y6-26 [Flow Rate Limit Selection]* setting. When *Y6-26 = 1 [Enabled]*, the drive decreases speed when the Flow rate increases rapidly or is more than this level (PI control). When *Y6-26 = 2 [Enabled - Low Limit]*, the drive decreases speed when the Flow rate decreases rapidly or is less than this level (PI control).
Y6-28 (3D79) RUN	Flow Rate Limit Regulator P Gain	V/f OLV/PM EZOLV Sets the responsiveness of the Flow Rate limit regulator. Increasing the setting increases the responsiveness.
Y6-29 (3D7A) RUN	Flow Rate Limit Regulator I Time	V/f OLV/PM EZOLV Sets the responsiveness of the Flow Rate limit regulator. Reducing the setting increases the responsiveness.
Y6-30 (3D7B) RUN	Flow Limit Regulator Delay	V/f OLV/PM EZOLV Sets the length of time before the Flow Rate Limiter activates after the drive has started to run.
Y6-31 (3D7C) RUN	Set Accumulation Level Millions	V/f OLV/PM EZOLV Sets the stored accumulated volume.
Y6-32 (3D7D) RUN	Set Accumulation Level Thousands	V/f OLV/PM EZOLV Sets the stored accumulated volume.
Y6-33 (3D7E) RUN	Set Accumulation Level Ones	V/f OLV/PM EZOLV Sets the stored accumulated volume.
Y6-34 (3D7F) RUN	Set Accumulation Level Decimal	V/f OLV/PM EZOLV Sets the stored accumulated volume.
Y6-35 (3D80) RUN	Accumulator Delta Save Selection	V/f OLV/PM EZOLV Sets and resets the starting value used to calculate monitor *UA-89 [Delta Volume Accum]*. 0 : - - 1 : Set 2 : Reset

No. (Hex.)	Name	Description
Y6-36 (3D81) RUN	Delta Accumulator Level Millions	V/f OLV/PM EZOLV Sets the starting value used for monitor *UA-89 [Delta Volume Accum]*.
Y6-37 (3D82) RUN	Delta Accumulator Lvl Thousands	V/f OLV/PM EZOLV Sets the starting value used for monitor *UA-89 [Delta Volume Accum]*.
Y6-38 (3D83) RUN	Delta Accumulator Level Ones	V/f OLV/PM EZOLV Sets the starting value used for monitor *UA-89 [Delta Volume Accum]*.
Y6-39 (3D84) RUN	Delta Accumulator Level Decimal	V/f OLV/PM EZOLV Sets the starting value used for monitor *UA-89 [Delta Volume Accum]*.
Y6-40 (3D85)	Low Flow Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number of times that the drive will try to restart when a *LowFl Low Flow* condition is detected.
Y6-41 (3D86)	High Flow Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number of times that the drive will try to restart when a *HiFlo High Flow* condition is detected.
Y6-42 (3D87)	High Flow Fault Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *HiFlo High Flow* auto-restart attempt.
Y7-01 (3D90)	Anti-Jam Selection	V/f OLV/PM EZOLV Enables and disables the Anti-Jam function. 0 : Disabled 1 : Enabled
Y7-02 (3D91) RUN	Anti-Jam Cycle Count	V/f OLV/PM EZOLV Sets the maximum number of cycles that the drive will try before triggering an Anti-Jam fault.
Y7-03 (3D92) RUN	AJ Detection Current Lvl @ Start	V/f OLV/PM EZOLV Sets the current level (at start) that will trigger the Anti-Jam function. Set as a percentage of motor rated current.
Y7-04 (3D93) RUN	AJ Detection Current Lvl @ Start	V/f OLV/PM EZOLV Sets the length of time the current must be more than the *Y7-03 [AJ Detection Current Lvl @ Start]* level to trigger the Anti-Jam function.
Y7-05 (3D94) RUN	AJ Detection Current Level @ Run	V/f OLV/PM EZOLV Sets the current level (during run) that will trigger the Anti-Jam function. Set as a percentage of motor rated current. A setting of 0% disables Anti-Jam during run.
Y7-06 (3D95) RUN	Anti-Jam Detection Time @ Run	V/f OLV/PM EZOLV Sets the length of time that the current must be more than the *Y7-05 [AJ Detection Current Level @ Run]* level to trigger the Anti-Jam function (during run).
Y7-07 (3D96) RUN	Anti-Jam Frequency Reference	V/f OLV/PM EZOLV Sets the maximum speed when the Anti-Jam feature is operating.
Y7-08 (3D97) RUN	Anti-Jam Release Time	V/f OLV/PM EZOLV Sets the length of time that the current must be less than the level set in *Y7-03 [AJ Detection Current Lvl @ Start]* to resume normal operation.
Y7-09 (3D98) RUN	Anti-Jam Display Text Selection	V/f OLV/PM EZOLV Selects the text shown when the Anti-Jam function is active. This selection also changes the fault and alarm text that will display if the drive was unable to clear the debris from the impeller in the number of tries set in *Y7-02 [Anti-Jam Cycle Count]*. 0 : Anti-Jam 1 : De-Rag
Y8-01 (3DE0)	De-Scale Operation Selection	V/f OLV/PM EZOLV Sets the drive De-Scale functionality. 0 : Disabled 1 : De-Scale Enabled 2 : Force De-Scale
Y8-02 (3DE1) RUN	De-Scale Cycle Count	V/f OLV/PM EZOLV Sets the number of forward/reverse cycles for the De-Scale function.

No. (Hex.)	Name	Description
Y8-03 (3DE2) RUN	De-Scale Forward Speed	V/f OLV/PM EZOLV Sets the speed during the forward portion of the De-Scale operation.
Y8-04 (3DE3) RUN	De-Scale Forward Run Time	V/f OLV/PM EZOLV Set the amount of time the drive will run in the forward portion of the De-Scale cycle.
Y8-05 (3DE4) RUN	De-Scale Reverse Run Time	V/f OLV/PM EZOLV Set the amount of time the drive will run in the reverse portion of the De-Scale cycle.
Y8-06 (3DE5) RUN	De-Scale Acceleration Time	V/f OLV/PM EZOLV Sets the amount of time it will take the drive to accelerate from zero to the De-Scale frequency reference *Y8-03 [De-Scale Forward Speed]* or *Y8-09 [De-Scale Reverse Speed]*.
Y8-07 (3DE6) RUN	De-Scale Deceleration Time	V/f OLV/PM EZOLV Sets the amount of time it will take the drive to decelerate from the De-Scale frequency reference *Y8-03 [De-Scale Forward Speed]* or *Y8-09 [De-Scale Reverse Speed]* to zero.
Y8-08 (3DE7) RUN	Run Time before De-Scale	V/f OLV/PM EZOLV Sets the number of pump operating hours (*U1-16 ≠ 0 [SFS Output Freq ≠ 0]*) before a De-Scale routine will run.
Y8-09 (3DE8) RUN	De-Scale Reverse Speed	V/f OLV/PM EZOLV Sets the speed during the reverse portion of the De-Scale operation.
Y9-01 (3DF4)	Lead Drive Selection	V/f OLV/PM EZOLV Specifies how the next Lead Drive is selected. This parameter is always used when there is a network request to stage. 0 : Next Available 1 : Lowest Runtime 2 : Stop History
Y9-02 (3DF5)	System Feedback Source	V/f OLV/PM EZOLV Defines which signal to use for PID Feedback when *Y1-01 = 3 [Multiplex Mode = Network Multiplex]*. 0 : Analog Only 1 : Ana→Net, No Alarm 2 : Ana→Net, Alarm 3 : Network Only
Y9-03 (3DF6) RUN	Alternation Time	V/f OLV/PM EZOLV Specifies the time for a drive to request alternation, influenced by *Y9-04 [Alternation Mode]*. The alternation feature is disabled when this parameter is set to 0.
Y9-04 (3DF7)	Alternation Mode	V/f OLV/PM EZOLV Sets the method of alternation. The new lead drive is selected using *Y9-01 [Lead Drive Selection]*. 0 : FIFO Auto 1 : FIFO Forced 2 : LIFO 3 : FIFO @Sleep
Y9-05 (3DF8)	Lag Drive Mode	V/f OLV/PM EZOLV Sets how lag drives function and defines the running fixed speed, turning off, and following the output speed of the Lead drive. 0 : Fixed Speed 2 : Turn Off 3 : Follow Lead Speed
Y9-06 (3DF9) RUN	Lag Fixed Speed	V/f OLV/PM EZOLV Sets the speed at which the drive will run when the drive changes from a lead to a lag and *Y9-05 = 0 [Lag Drive Mode = Fixed Speed]* after the time set in *Y9-07 [Lag Fixed Speed Delay]* expires.
Y9-07 (3DFA) RUN	Lag Fixed Speed Delay	V/f OLV/PM EZOLV Sets the length of time that the speed is latched when the drive changes from a lead to a lag before the drive responds based on the *Y9-05* setting.
Y9-08 (3DFB)	Staging Mode	V/f OLV/PM EZOLV Sets the detection method for staging a new drive. 0 : Output Frequency 1 : Feedback 2 : Feedback + Output Frequency 3 : Flow Meter

No. (Hex.)	Name	Description
Y9-09 (3DFC) RUN	Staging Frequency Level	V/f OLV/PM EZOLV When *Y9-08 = 0 [Staging Mode = Output Frequency]*, sets the level above which the output frequency must be for the time set in *Y9-11 [Staging Delay Time]* for the lead drive to request a new lead drive through the iQpump MEMOBUS network. When *Y9-08 = 2 [Feedback + Output Frequency]*, sets the level above which the output frequency must be when the delta feedback (setpoint – feedback for direct acting PID, feedback – setpoint for reverse acting PID) is more than the level set in *Y9-10 [Staging Delta Feedback Level]* for the time set in *Y9-11*, for the lead drive to request a new lead drive through the iQpump MEMOBUS network.
Y9-10 (3DFD) RUN	Staging Delta Feedback Level	V/f OLV/PM EZOLV When *Y9-08 = 1 [Staging Mode = Feedback]*, sets the level above which the delta feedback must be for the time set in *Y9-11 [Staging Delay Time]* for the lead drive to request a new lead drive through the iQpump MEMOBUS network. When *Y9-08 = 2 [Feedback + Output Frequency]*, sets the level above which the delta feedback (setpoint – feedback for direct acting PID, feedback – setpoint for reverse acting PID) must be when the output frequency is more than *Y9-09 [Staging Frequency Level]* for the time set in *Y9-11* for the lead drive to request a new lead drive through the iQpump MEMOBUS network.
Y9-11 (3DFE) RUN	Staging Delay Time	V/f OLV/PM EZOLV Sets the delay time before a new lead drive is added to the system.
Y9-12 (3DFF)	De-staging Mode	V/f OLV/PM EZOLV Sets the detection method for de-staging to the previous lead drive. 0 : Output Frequency 1 : Feedback 2 : Feedback + Output Frequency 3 : Flow Meter
Y9-13 (3E00) RUN	De-staging Frequency Level	V/f OLV/PM EZOLV When *Y9-12 = 0 [De-staging Mode = Output Frequency]*, sets the level below which the output frequency must be for the time set in *Y9-15 [De-staging Delay Time]* for the lead drive to request to be removed through the iQpump MEMOBUS network. When *Y9-12 = 2 [Feedback + Output Frequency]*, sets the level below which the output frequency must be when the delta feedback (setpoint – feedback for direct acting PID, feedback – setpoint for reverse acting PID) is more than the level set in *Y9-14 [De-staging Delta Feedback Level]* for the time set in *Y9-15*, for the lead drive to request to be removed through the iQpump MEMOBUS network.
Y9-14 (3E01) RUN	De-staging Delta Feedback Level	V/f OLV/PM EZOLV When *Y9-12 = 1 [De-staging Mode = Feedback]*, sets the level above which the delta feedback (setpoint – feedback for direct acting PID, feedback – setpoint for reverse acting PID) must be for the time set in *Y9-15 [De-staging Delay Time]* for the lead drive to request to be removed through the iQpump MEMOBUS network. When *Y9-12 = 2 [Feedback + Output Frequency]*, sets the level above which the delta feedback must be when the output frequency is less than *Y9-13 [De-staging Frequency Level]* for the time set in *Y9-15* for the lead drive to request to be removed through the iQpump MEMOBUS network.
Y9-15 (3E02) RUN	De-staging Delay Time	V/f OLV/PM EZOLV Sets the delay time before the lead drive is removed from the system.
Y9-16 (3E03) RUN	Stabilization Time	V/f OLV/PM EZOLV Sets the time used to stabilize the system when a drive is staged or de-staged. Lead-lag control and pump protection is suspended during this time. The lead drive will resume lead-lag control and pump protection behavior when the this timer expires.
Y9-17 (3E04) RUN	Setpoint Modifier	V/f OLV/PM EZOLV Sets the value to increment the System Setpoint depending on the number of drives running.
Y9-18 (3E05) RUN	High Feedback De-stage Level	V/f OLV/PM EZOLV Sets the feedback level as a percentage of *Y1-11 [High Feedback Level]* that will trigger a quick de-stage. The quick de-stage ignores *Y9-12* to *Y9-15* and uses an internal 2-second delay.
Y9-19 (3E06) RUN	Alternation Time Unit	V/f OLV/PM EZOLV Sets the units for *Y9-03 [Alternation Time]*. 0 : Hours (H) 1 : Minutes (min)
Y9-20 (3E07)	Allow Network Run	V/f OLV/PM EZOLV Sets when a network Run command is allowed. 0 : Always 1 : First/Alternation 2 : First Only 3 : Alternation Only
Y9-21 (3E08) RUN	Run Priority	V/f OLV/PM EZOLV Sets the Lead Drive selection priority overriding the *Y9-01 [Lead Drive Selection]* value. The drive with the lowest *Y9-21* value has the highest priority and will become the Lead Drive first. If more than one drive has the lowest *Y9-21* value, *Y9-01* determines which drive becomes the Lead.

No. (Hex.)	Name	Description
Y9-22 (3E09) RUN	System Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number of times that the iQpump MEMOBUS network will allow automatic restarts of system faults. The drive uses *L5-04 [Interval Method Restart Time*] to decide when to attempt a system fault restart.
Y9-23 (3E0A)	Max Drives Allowed to Run	V/f OLV/PM EZOLV Sets a limit on the maximum number of drives that can run on the system.
Y9-24 (3E0B) RUN	Lead Swap at Sleep Delay Time	V/f OLV/PM EZOLV When the Lead Drive has been in Sleep Mode for the length of time set in this parameter and there is another drive available with a lower *Y9-21 [Run Priority]* value, the available drive will request for a swap.
Y9-25 (3E0C)	Highest Node Address	V/f OLV/PM EZOLV Sets the highest possible node address in the MEMOBUS network. For optimal network performance, it is recommended to set the serial communication address *H5-01* starting from 1h then consecutively up to the last drive and then setting this parameter to that *H5-01* address.
Y9-26 (3E0D)	Master Time-out	V/f OLV/PM EZOLV Sets the minimum length of time that the slave drives will wait for a message from the master before doing the action set in *Y9-27 [Network Recovery]*.
Y9-27 (3E0E)	Network Recovery	V/f OLV/PM EZOLV Sets the response for slave drives when no messages are received from the master for the time set in *Y9-26 [Master Time-out]*. 0 : Automatic 1 : Slave/Resume 2 : Slave/Stop 3 : Fault MSL
Y9-28 (3E0F)	NETSCAN Alarm Time	V/f OLV/PM EZOLV Sets the length of time that the slave drives will wait for a message from the master before displaying a *NETSCAN* alarm
Y9-29 (3E10) RUN	Network AUTO Start Delay	V/f OLV/PM EZOLV Sets the length of time that the network will wait before it selects and stars the Lead Drive after the first drive on the network is put on AUTO Mode.
Y9-30 (3E11) RUN	Lag Speed Follower Gain	V/f OLV/PM EZOLV When *Y9-05 = 3 [Lag Drive Mode = Follow Lead Speed]*, the drive will follow the speed of the current lead drive applying this gain and *Y9-31 [Lag Speed Follower Bias]*.
Y9-31 (3E12) RUN	Lag Speed Follower Bias	V/f OLV/PM EZOLV When *Y9-05 = 3 [Lag Drive Mode = Follow Lead Speed]*, the drive will follow the speed of the current lead drive applying this bias and *Y9-30 [Lag Speed Follower Gain]*.
Y9-32 (3E13) RUN	Lag Follower Deceleration Rate	V/f OLV/PM EZOLV Sets the deceleration time when *Y9-05 = 3 [Lag Drive Mode = Follow Lead Speed]* and the *Y9-33 [Lag Follower Decel Active Time]* timer is running.
Y9-33 (3E14) RUN	Lag Follower Decel Active Time	V/f OLV/PM EZOLV Sets the window during which the *Y9-32 [Lag Follower Deceleration Rate]* deceleration time is effective. The drive will use the standard deceleration rates when it expires.
Y9-34 (3E15) RUN	Low Feedback De-stage	V/f OLV/PM EZOLV Sets the low feedback level that will trigger a quick de-stage. The quick de-stage ignores *Y9-12* to *Y9-15* and uses an internal 2 s delay.
Y9-35 (3E16) RUN	Alternation Stabilize Time	V/f OLV/PM EZOLV Sets the maximum length of time that the drive will stay running when it was called to alternate-out. The drive is put into the Alternation Stabilization Mode during this period.
Y9-36 (3E17) RUN	Alternation Stabilize Bias	V/f OLV/PM EZOLV Sets the minimum amount of PID error applied to the drive during Alternation Stabilization Mode. A lower value can cause it to stay running longer, while a higher value will make the transition faster at the cost of a more significant pressure change.
Y9-40 (3E1B) RUN	Flow Rate Source	V/f OLV/PM EZOLV Defines the Flow Meter input source when *Y1-01 = 3 [Multiplex Mode = Memobus Network]*. 0 : Analog 3 : Network
Y9-41 (3E1C) RUN	Add Flow Level	V/f OLV/PM EZOLV When *Y9-08 = 3 [Staging Mode = Flow Meter]* and the Flow Rate is more than the level set in this parameter times the number of pumps running for the length of time set in *Y9-11 [Staging Delay Time]*, the lead drive will request for a new lead drive through the iQpump MEMOBUS network.
Y9-42 (3E1D) RUN	Remove Flow Level	V/f OLV/PM EZOLV When *Y9-12 = 3 [De-staging Mode = Flow Meter]* and the Flow Rate is less than the level set in this parameter times the number of pumps running for the length of time set in *Y9-15 [De-staging Delay Time]*, the lead drive will request to be removed from the system through the iQpump MEMOBUS network.

No. (Hex.)	Name	Description
Y9-50 (3E25)	WaterLvl/SuctPres/PI Aux Source	V/f OLV/PM EZOLV Sets the signal to use for Water Level Control *[Yd-xx]*, Suction Pressure Control *[YE-xx]*, or PI Aux Control *[YF-xx]* when *Y1-01 = 3 [Multiplex Mode = Network Multiplex]*. 0 : Analog Only 1 : Ana→Net, No Alrm 2 : Ana→Net, Alarm 3 : Network Only
Y9-51 (3E26)	WaterLvl/SuctPres/PI Aux TurnOff	V/f OLV/PM EZOLV Sets the MEMOBUS Multiplex response to Water Level, Suction Pressure, or PI Aux Control. 0 : Disabled 1 : Enabled
Y9-55 (3E2A)	VFD Run Time Offset	V/f OLV/PM EZOLV Sets an offset to the drive run time used for lead drive selection. Impacts lead drive selection only when *Y9-01 = 1 [Lead Drive Selection = Lowest Runtime]*.
Y9-98 (3E55)	Network Parameter Push	V/f OLV/PM EZOLV Sets how System-wide Parameters are pushed into the MEMOBUS Multiplex network. 0 : Disabled 1 : Enabled/Prompt
YA-01 (3E58) RUN	Setpoint 1	V/f OLV/PM EZOLV Sets the PID Setpoint when *b1-01 = 0 [Frequency Reference Selection 1 = Keypad or Multi-Speed Selection]*.
YA-02 (3E59) RUN	Setpoint 2	V/f OLV/PM EZOLV Sets the PID Setpoint as specified by the Multi-Setpoint digital inputs.
YA-03 (3E5A) RUN	Setpoint 3	V/f OLV/PM EZOLV Sets the PID Setpoint as specified by the Multi-Setpoint digital inputs.
YA-04 (3E5B) RUN	Setpoint 4	V/f OLV/PM EZOLV Sets the PID Setpoint as specified by the Multi-Setpoint digital inputs.
YA-05 (3E5C) RUN	Setpoint 5	V/f OLV/PM EZOLV Sets the PID Setpoint as specified by the Multi-Setpoint digital inputs.
YA-06 (3E5D) RUN	Setpoint 6	V/f OLV/PM EZOLV Sets the PID Setpoint as specified by the Multi-Setpoint digital inputs.
YA-07 (3E5E) RUN	Setpoint 7	V/f OLV/PM EZOLV Sets the PID Setpoint as specified by the Multi-Setpoint digital inputs.
YA-08 (3E5F) RUN	Setpoint 8	V/f OLV/PM EZOLV Sets the PID Setpoint as specified by the Multi-Setpoint digital inputs.
YA-09 (3E60)	AUTO PID Setpoint MOP Selection	V/f OLV/PM EZOLV Sets whether you can use MOP to change AUTO PID Setpoint from the Home screen. 0 : ENTER Key Required 1 : Immediate/MOP-style
YC-01 (3EBC)	Output Current Limit Select	V/f OLV/PM EZOLV Sets the function to enable or disable the output current regulator. 0 : Disabled 1 : Enabled
YC-02 (3EBD) RUN	Current Limit	V/f OLV/PM EZOLV Sets the current limit.
YC-03 (3EBE) RUN Expert	Current Limit Regulator Gain	V/f OLV/PM EZOLV Sets the responsiveness of the current limit regulator. A higher value is more responsive.

No. (Hex.)	Name	Description
YC-04 (3EBF) RUN Expert	Current Limit Reg. Integral Time	V/f OLV/PM EZOLV Sets the responsiveness of the current limit regulator. A lower value is more responsive.
YC-06 (3EC1)	Current Limit Start Delay	V/f OLV/PM EZOLV Sets the delay time before Current Limit is operational.
YC-10 (3EC5)	Single Phase Foldback Sel	V/f OLV/PM EZOLV Sets the function to enable or disable the single phase ripple regulator. 0 : Disabled 1 : Enabled
YC-11 (3EC6)	Ripple Regulator Setpoint	V/f OLV/PM EZOLV Sets the ripple regulator setpoint as a percentage of the maximum amount of ripple permitted before the drive detects a *PF [Input Phase Loss]* fault.
YC-12 (3EC7)	Current Limit Reg. Integral Time	V/f OLV/PM EZOLV Enables and disables the ripple voltage feedback ramp and how often the feedback ramp is updated. 0 : Ramp Disabled 1 - 100 : Ramp Enabled
YC-14 (3EC9)	Behavior when SPC is Not Ready	V/f OLV/PM EZOLV Sets the drive behavior when the Single Phase Converter faults or is not ready. 0 : Coast to Stop - Fault 1 : Coast to Stop - Alarm
Yd-01 (3EEE)	Water Level Selection	V/f OLV/PM EZOLV Enables and disables Water Level Control. 0 : Disabled 1 : Enabled
Yd-02 (3EEF) RUN	Water Level Transducer Scaling	V/f OLV/PM EZOLV Sets the full scale (20 mA) output of the pressure transducer connected to analog input terminal *H3-0x = 3B [Water Level / Suct Pres Feedback]*.
Yd-03 (3EF0) RUN	Water Level Setpoint	V/f OLV/PM EZOLV Sets the amount of water above the sensor to which the drive will attempt to regulate.
Yd-04 (3EF1) RUN	Minimum Water Level	V/f OLV/PM EZOLV When the amount of water above the sensor is less than this level for longer than the length of time set in *Yd-05 [Water Level Sleep Delay Time]*, the drive will go to sleep.
Yd-05 (3EF2) RUN	Water Level Sleep Delay Time	V/f OLV/PM EZOLV Sets the length of time that the drive will delay before going to sleep after the water level is less than the level set in *Yd-04 [Minimum Water Level]*.
Yd-06 (3EF3) RUN	Water Level Sleep Wake-up Level	V/f OLV/PM EZOLV Sets the level above which the water must be for longer than the time set in *Yd-07 [Water Level Sleep Wake-up Time]* to wake up the drive after being forced to sleep based on *Yd-04 [Minimum Water Level]*.
Yd-07 (3EF4)	Water Level Sleep Wake-up Time	V/f OLV/PM EZOLV Sets the length of time that the water must be above the level set in *Yd-06 [Water Level Sleep Wake-Up Level]* to wake up the drive after being forced to sleep based on *Yd-04 [Minimum Water Level]*.
Yd-08 (3EF5) RUN	Water Level Sleep Wake-up Time	V/f OLV/PM EZOLV Sets the minimum speed at which the drive will be allowed to run when the drive is controlling the water level. When the drive is controlling pressure or when this parameter is set to a value less than *Y1-06 [Minimum Speed]* or *Y4-12 [Thrust Frequency]*, the drive will use the *Y1-06* or *Y4-12* value as the minimum speed .
Yd-09 (3EF6) RUN	Low Water Level Detection Level	V/f OLV/PM EZOLV When the amount of water above the sensor is lower than this level for longer than the time set in *Yd-10 [Low Water Level Detection Time]*, the drive will respond based on the *Yd-11 [Low Water Level Behavior]* setting.
Yd-10 (3EF7) RUN	Low Water Level Detection Time	V/f OLV/PM EZOLV Sets the length of time delay that the water level must be less than the level set in *Yd-09 [Low Water Level Detection Level]* before the drive will react. This detection time only applies when *Yd-11 = 2 or 3 [Fault (and Digital Output) or Auto-Restart (time set by Yd-12)]*.

No. (Hex.)	Name	Description
Yd-11 (3EF8)	Low Water Level Behavior	V/f OLV/PM EZOLV Sets the drive response when the water level in the well is less than the level set in *Yd-09 [Low Water Level Detection Level]* for longer than the time set in *Yd-10 [Low Water Level Detection Time]*. 0 : Digital Output Only 1 : Alarm (and Digital Output) 2 : Fault (and Digital Output) 3 : Auto-Restart (time set by Yd-12)
Yd-12 (3EF9)	Water Lvl Ctrl Auto-Restart Time	V/f OLV/PM EZOLV Sets the length of time that the drive will wait before it tries to auto-restart after a *LowWL Low Water Level* fault. This is effective only when *Yd-11 = 3 [Low Water Level Behavior = Auto-Restart (time set by Yd-12)]* and *Yd-39 ≠ 0 [LowWaterLevel Flt Retry Attempts]*.
Yd-13 (3EFA) RUN	Water Level Control P Gain	V/f OLV/PM EZOLV Sets the proportional gain when the drive is operating in Water Level Control.
Yd-14 (3EFB) RUN	Water Level Control I Time	V/f OLV/PM EZOLV Sets the integral time when the drive is operating in Water Level Control. Setting this parameter to 0.0 disables the water level control integrator.
Yd-15 (3EFC)	Low Water Level Detect Time Unit	V/f OLV/PM EZOLV Sets the time units for *Yd-10 [Low Water Level Detection Time]*. 0 : Minutes (min) 1 : Seconds (sec)
Yd-16 (3EFD)	Water Level Feedback Wire Break	V/f OLV/PM EZOLV Sets behavior when the analog input selected for water level feedback is programmed to receive a 4 to 20 mA signal and the signal is lost. 0 : No Display 1 : Alarm Only 2 : Fault (no retry, coast to stop) 3 : Auto-Restart (time set by Yd-38)
Yd-20 (3F02)	Water Level Speed Control	V/f OLV/PM EZOLV Enables and disables the effect of the Water Level Controller on output speed 0 : Disabled 1 : Enabled
Yd-22 (3F04)	Water Level Decimal Place Pos	V/f OLV/PM EZOLV Sets the number of decimal places for the Water Level parameters and monitor. 0 : No Decimal Places (XXXXX) 1 : One Decimal Place (XXXX.X) 2 : Two Decimal Places (XXX.XX) 3 : Three Decimal Places (XX.XXX)
Yd-25 (3F07) RUN	Water Lvl Ctrl Activation Level	V/f OLV/PM EZOLV Sets the level at which the amount of water above the sensor must be less than for longer than the time set in *Yd-26 [Water Lvl Ctrl Activation Delay]* to activate Water Level Control and affect the output frequency. Also sets the level at which the amount of water below the sensor must be above for longer than the *Yd-26* time to deactivate Water Level Control and have no effect on the output frequency. Water Level Control is always active (if enabled) when set to 0.0.
Yd-26 (3F08) RUN	Water Lvl Ctrl Activation Delay	V/f OLV/PM EZOLV Sets the time for which the amount of water above the sensor must be less than the level set in *Yd-25 [Water Lvl Ctrl Activation Level*] to activate Water Level Control and affect the output frequency. Also sets the time for which the amount of water below the sensor must be above the *Yd-25* level to deactivate Water Level Control and have no effect on the output frequency.
Yd-35 (3F11) RUN	Water Level Min Transducer Scale	V/f OLV/PM EZOLV Sets the minimum scale output of the water level transducer connected to the *H3-xx = 3B [Water Level / Suction Pressure]* analog input terminal.
Yd-36 (3F12) RUN	Water Lvl Lo Lvl Det Hysteresis	V/f OLV/PM EZOLV Sets the hysteresis level used for *LowWL Low Water* detection.
Yd-37 (3F13)	WaterLvlLoss Flt Retry Attempts	V/f OLV/PM EZOLV Sets the number of times that the drive will try to restart when a *WLL Water Level Feedback Loss* condition is detected.
Yd-38 (3F14)	WaterLvlLoss Fault Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *WLL Water Level Feedback Loss* auto-restart attempt.
Yd-39 (3F15)	LowWaterLevel Flt Retry Attempts	V/f OLV/PM EZOLV Sets the number of times that the drive will try to restart when a *LowWL Low Water Level* condition is detected.

No. (Hex.)	Name	Description
YE-01 (3F20)	Suction Pressure Control Select	V/f OLV/PM EZOLV Enables and disables Suction Pressure Control and Vacuum Control. 0 : Disabled 1 : Suction Pressure (PSI) 2 : Vacuum ("Hg)
YE-02 (3F21) RUN	Suction Pres Transducer Scaling	V/f OLV/PM EZOLV Sets the full scale (20 mA) output of the pressure transducer connected to the analog input terminal programmed for *Water Level / Suct Pres Feedback [H3-xx = 3B]*.
YE-03 (3F22) RUN	Suction Pressure Setpoint	V/f OLV/PM EZOLV Sets the amount of suction pressure to which the drive will attempt to regulate.
YE-04 (3F23) RUN	Minimum Suction Pressure	V/f OLV/PM EZOLV Sets the level below which the suction pressure must be for the length of time set in *YE-05 [Suction Pres Sleep Delay Time]* to put the drive to sleep.
YE-05 (3F24) RUN	Suction Pres Sleep Delay Time	V/f OLV/PM EZOLV Sets the length of time that the drive will delay before going to sleep after the suction pressure is below the level set in *YE-04 [Minimum Suction Pressure]*.
YE-06 (3F25) RUN	Suction Pres Sleep Wake-up Level	V/f OLV/PM EZOLV Sets the level above which the suction pressure must be for longer than the time set in *YE-07 [Suction Pres Sleep Wake-up Time]* to wake the drive up after it has been forced to sleep based on *YE-04 [Minimum Suction Pressure]*.
YE-07 (3F26)	Suction Pres Sleep Wake-up Time	V/f OLV/PM EZOLV Sets the length of time that the suction pressure must be more than the level set in *YE-06 [Suction Pres Sleep Wake-up Level]* for the drive to wake up if it has been forced to sleep based on *YE-04 [Minimum Suction Pressure]*.
YE-08 (3F27) RUN	Suction Pres Ctrl Minimum Speed	V/f OLV/PM EZOLV Sets the minimum speed at which the drive will be allowed to run when the drive is controlling suction pressure. When the drive is controlling outlet pressure or this parameter is set less than *Y1-06 [Minimum Speed]* or *Y4-12 [Thrust Frequency]*, *Y1-06* or *Y4-12* will be used as the minimum speed.
YE-09 (3F28) RUN	Low Suction Pressure Det Level	V/f OLV/PM EZOLV Sets the level below which the suction pressure must be for longer than the time set in *YE-10 [Low Suction Pressure Det Time]* to trigger the drive response set in *YE-11 [Low Suction Pressure Behavior]*.
YE-10 (3F29) RUN	Low Suction Pressure Det Time	V/f OLV/PM EZOLV Sets the length of time that the water level must be below *YE-09 [Low Suction Pressure Det Level]* before the drive will react.
YE-11 (3F2A)	Low Suction Pressure Behavior	V/f OLV/PM EZOLV Sets how the drive will respond to a *LoSuc Low Suction Pressure* condition when the water level in the well is less than the level set in *YE-09 [Low Suction Pressure Det Level]* for longer than the time set in *YE-10 [Low Suction Pressure Det Time]*. 0 : Digital Output Only 1 : Alarm (and Digital Output) 2 : Fault (and Digital Output) 3 : Auto-Restart (time set by YE-15)
YE-12 (3F2B) RUN	High Suction Pressure Det Level	V/f OLV/PM EZOLV Sets the level above which the suction pressure must be for longer than the time set in *YE-13 [High Suction Pressure Det Time]*, to trigger the drive response set in *YE-14 [High Suction Pressure Behavior]*.
YE-13 (3F2C) RUN	High Suction Pressure Det Time	V/f OLV/PM EZOLV Sets the length of time that the water level must be more than *YE-12 [High Suction Pressure Det Level]* before the drive will react. This is effective only when *YE-14 = 2 or 3 [High Suction Pressure Behavior = Fault (and Digital Output) or Auto-Restart (time set by YE-15)]*.
YE-14 (3F2D)	High Suction Pressure Behavior	V/f OLV/PM EZOLV Sets how the drive will respond to a *HiSuc High Suction Pressure* condition when the water level in the well is more than the level set in *YE-12 [High Suction Pressure Det Level]* for longer than the time set in *YE-13 [High Suction Pressure Det Time]*. 0 : Digital Output Only 1 : Alarm (and Digital Output) 2 : Fault (and Digital Output) 3 : Auto-Restart (time set by YE-15)
YE-15 (3F2E)	Suction Pres Auto-Restart Time	V/f OLV/PM EZOLV Sets the length of time that the drive will wait before it tries an auto-restart of a *LoSuc Low Suction Pressure* or *HiSuc High Suction Pressure* fault.
YE-16 (3F2F) RUN	Suction Pressure Control P Gain	V/f OLV/PM EZOLV Sets the proportional gain for when the drive is operating in Suction Pressure Control.

No. (Hex.)	Name	Description
YE-17 (3F30) RUN	Suction Pressure Control I Time	V/f OLV/PM EZOLV Sets the integral time for when the drive is operating in Suction Pressure Control.
YE-18 (3F31)	Suction Pressure Det Time Unit	V/f OLV/PM EZOLV Sets the time units for *YE-10 [Low Suction Pressure Det Time]* and *YE-13 [High Suction Pressure Det Time]*. 0 : Minutes (min) 1 : Seconds (sec)
YE-19 (3F32)	Suction Pressure Fdbk Wire Break	V/f OLV/PM EZOLV Sets behavior when the analog input selected for water level feedback is programmed to receive a 4 to 20 mA signal and the signal is lost. 0 : No Display 1 : Alarm Only 2 : Fault (no retry, coast to stop) 3 : Auto-Restart (time set by YE-38)
YE-20 (3F36)	Suction Pressure Speed Control	V/f OLV/PM EZOLV Enables and disables Suction Pressure Controller effect on output speed 0 : Disabled 1 : Enabled
YE-22 (3F38)	Suction Pressure Dec Place Pos	V/f OLV/PM EZOLV Sets the number of decimal places for the Suction Pressure parameters and monitors. 0 : No Decimal Places (XXXXX) 1 : One Decimal Place (XXXX.X) 2 : Two Decimal Places (XXX.XX) 3 : Three Decimal Places (XX.XXX)
YE-25 (3F3B) RUN	Suc Pres Ctrl Activation Level	V/f OLV/PM EZOLV Sets the level below which the pressure be for the time set in *YE-26 [Suc Pres Ctrl Activation Delay]* to activate Suction Pressure Control and let it affect the output frequency. When the suction pressure is more than this level for longer than the time set in *YE-26*, Suction Pressure Control is deactivated and it will not have an effect on the output frequency.
YE-26 (3F3C) RUN	Suc Pres Ctrl Activation Delay	V/f OLV/PM EZOLV Sets the length of time for which the suction pressure must be less than the level set in *YE-25 [Suc Pres Ctrl Activation Level]* to activate Suction Pressure Control and let it affect the output frequency. When the suction pressure is more than the *YE-25* level for longer than this time, Suction Pressure Control is deactivated and it will not have an effect on the output frequency.
YE-35 (3F45) RUN	Suc Pres Min Transducer Scale	V/f OLV/PM EZOLV Sets the minimum scale output of the suction pressure transducer connected to the *H3-xx = 3B [Water Level / Suct Pres Feedback]* analog input terminal.
YE-36 (3F46) RUN	SucPres LoHi Lvl Det Hysteresis	V/f OLV/PM EZOLV Sets the Hysteresis Level used for low and high level detection.
YE-37 (3F47)	SuctPresLoss Flt Retry Attempts	V/f OLV/PM EZOLV Sets the number of times that the drive will try to restart after it detects a *SPL Suction Pressure Feedback Loss* condition.
YE-38 (3F48)	SuctPresLoss Fault Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *SPL Suction Pressure Feedback Loss* auto-restart attempt.
YE-39 (3F49)	Low Suction Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number of times that the drive will try to restart after it detects a *LoSuc Low Suction Pressure* condition.
YE-40 (3F4A)	High Suction Flt Retry Attempts	V/f OLV/PM EZOLV Sets the number of times that the drive will try to restart after it detects a *HISuc High Suction Pressure* condition.
YF-01 (3F50)	PI Aux Control Selection	V/f OLV/PM EZOLV Sets the PI Auxiliary Control function. 0 : Disabled 1 : Enabled
YF-02 (3F51) RUN	PI Aux Control Transducer Scale	V/f OLV/PM EZOLV Sets the full scale (10 V or 20 mA) output of the pressure transducer connected to the analog input terminal programmed for *H3-xx = 27 [PI Aux Control Feedback Level]*.
YF-03 (3F52) RUN	PI Aux Control Setpoint	V/f OLV/PM EZOLV Sets the level to which the drive will try to regulate.
YF-04 (3F53) RUN	PI Aux Control Minimum Level	V/f OLV/PM EZOLV Sets the level below which the drive must be for longer than *YF-05 [PI Aux Control Sleep Delay Time]* before the drive goes to sleep and turns off all lag pumps.

No. (Hex.)	Name	Description
YF-05 (3F54) RUN	PI Aux Control Sleep Delay Time	V/f OLV/PM EZOLV Sets the length of time that the drive will delay before it goes to sleep after the level is less than *YF-04 [PI Aux Control Minimum Level]* (when *YF-23 = 1 [PI Aux Ctrl Output Level Select = Inverse Acting]*) or more than *YF-24 [PI Auxiliary Ctrl Maximum Level]* (when *YF-23 = 0 [Direct Acting]*).
YF-06 (3F55) RUN	PI Aux Control Wake-up Level	V/f OLV/PM EZOLV Sets the level to wake up the drive when the drive after *YF-04 [PI Aux Control Minimum Level]* or *YF-24 [PI Auxiliary Ctrl Maximum Level]* put the drive to sleep.
YF-07 (3F56)	PI Aux Control Wake-up Time	V/f OLV/PM EZOLV Sets the time to wake up the drive when the drive after *YF-04 [PI Aux Control Minimum Level]* or *YF-24 [PI Auxiliary Ctrl Maximum Level]* put the drive to sleep.
YF-08 (3F57) RUN	PI Aux Control Minimum Speed	V/f OLV/PM EZOLV Sets the minimum speed at which the drive can run when the PI Auxiliary Control has an effect on the output speed.
YF-09 (3F58) RUN	PI Aux Control Low Level Detect	V/f OLV/PM EZOLV Sets the level below which the drive must be for longer than *YF-10 [PI Aux Control Low Lvl Det Time]* to respond as specified by *YF-11 [PI Aux Control Low Level Det Sel]*.
YF-10 (3F59) RUN	PI Aux Low Level Detection Time	V/f OLV/PM EZOLV Sets the length of time that the PI Aux Feedback must be less than *YF-09 [PI Aux Control Low Lvl Detection]* to trigger a drive response when *YF-11 = 2 and 3 [PI Aux Control Low Level Det Sel = Fault and Auto-Restart (time set by YF-15)]*.
YF-11 (3F5A)	PI Aux Control Low Level Det Sel	V/f OLV/PM EZOLV Sets drive response when the PI Aux Feedback decreases to less than *YF-09 [PI Aux Control Low Lvl Detection]* for longer than *YF-10 [PI Aux Control Low Lvl Det Time]*. 0 : Digital Output Only 1 : Alarm (and Digital Output) 2 : Fault (and Digital Output) 3 : Auto-Restart (time set by YF-15)
YF-12 (3F5B) RUN	PI Aux Control High Level Detect	V/f OLV/PM EZOLV Sets the value above which the level must be for longer than *YF-13 [PI Aux High Level Detection Time]* to respond as specified by *YF-14 [PI Aux Hi Level Detection Select]*.
YF-13 (3F5C) RUN	PI Aux High Level Detection Time	V/f OLV/PM EZOLV Sets the length of time that the level must be more than *YF-12 [PI Aux Control High Level Detect]* before the drive will respond when *YF-14 = 2, 3 [PI Aux Hi Level Detection Select]*.
YF-14 (3F5D)	PI Aux Control Hi Level Det Sel	V/f OLV/PM EZOLV Sets the drive response when the PI Aux Feedback increases to more than the *YF-12 [PI Aux Control High Level Detect]* level for longer than the time set in *YF-13 [PI Aux High Level Detection Time]*. 0 : Digital Output Only 1 : Alarm (and Digital Output) 2 : Fault (and Digital Output) 3 : Auto-Restart (time set by YF-15)
YF-15 (3F5E)	PI Aux Level Detect Restart Time	V/f OLV/PM EZOLV Sets the length of time the drive will wait before it tries an Auto-Restart of *LoAux [Low PI Aux Feedback Level]* or *HiAux [High PI Aux Feedback Level]* fault.
YF-16 (3F5F) RUN	PI Auxiliary Control P Gain	V/f OLV/PM EZOLV Sets the proportional gain for the suction pressure control.
YF-17 (3F60) RUN	PI Auxiliary Control I Time	V/f OLV/PM EZOLV Sets the integral time for the suction pressure control.
YF-18 (3F61)	PI Aux Control Detect Time Unit	V/f OLV/PM EZOLV Sets the time unit for *YF-10 [PI Aux Control Low Lvl Det Time]* and *YF-13 [PI Aux High Level Detection Time]*. 0 : Minutes (min) 1 : Seconds (sec)
YF-19 (3F62)	PI Aux Ctrl Feedback Wire Break	V/f OLV/PM EZOLV Sets how the analog input selected for PI Aux Feedback will respond when it is programmed to receive a 4 mA to 20 mA signal and the signal is lost. 0 : No Display 1 : Alarm Only 2 : Fault (no retry, coast to stop) 3 : Auto-Restart (time set by YF-38)

No. (Hex.)	Name	Description
YF-20 (3F63)	PI Aux Main PI Speed Control	V/f OLV/PM EZOLV Sets if the PI Auxiliary Controller has an effect on output speed. 0 : Disabled 1 : Enabled
YF-21 (3F64)	PI Aux Ctrl Level Unit Selection	V/f OLV/PM EZOLV Set the units shown for the PI Aux Level parameters and monitors. 0 : "WC: inches of water column 1 : PSI: pounds per square inch 2 : GPM: gallons/min 3 : °F: Fahrenheit 4 : ft^3/min: cubic feet/min 5 : m^3/h: cubic meters/hour 6 : L/h: liters/hour 7 : L/s: liters/sec 8 : bar: bar 9 : Pa: Pascal 10 : °C: Celsius 11 : m: meters 12 : ft: feet 13 : L/min: liters/min 14 : m^3/min: cubic meters/min 15 : "Hg: Inch Mercury 16 : kPa: kilopascal 48 : %: Percent 49 : Custom (YF-32 ~ 34) 50 : None
YF-22 (3F65)	PI Aux Level Decimal Place Pos	V/f OLV/PM EZOLV Sets the number of decimal places for the PI Aux Level parameters and monitors. 0 : No Decimal Places (XXXXX) 1 : One Decimal Place (XXXX.X) 2 : Two Decimal Places (XXX.XX) 3 : Three Decimal Places (XX.XXX)
YF-23 (3F66)	PI Aux Ctrl Output Level Select	V/f OLV/PM EZOLV Sets the PI Auxiliary Controller to be Direct-acting or Inverse-acting. 0 : Direct Acting 1 : Inverse Acting
YF-24 (3F67) RUN	PI Auxiliary Ctrl Maximum Level	V/f OLV/PM EZOLV Sets the maximum level for PI Auxiliary Control. When the level is more than this setting for longer than *YF-05 [PI Aux Control Sleep Delay Time]*, the drive will go to sleep and turn off all lag drives.
YF-25 (3F68) RUN	PI Aux Control Activation Level	V/f OLV/PM EZOLV Sets the level to activate the PI Auxiliary Control.
YF-26 (3F69) RUN	PI Aux Control Activation Delay	V/f OLV/PM EZOLV Sets the delay time to activate the PI Auxiliary Control.
YF-32 (3F6F)	PI Aux Custom Unit Character 1	V/f OLV/PM EZOLV Sets the first character of the PI Aux custom unit display when *YF-21 = 49 [PI Aux Ctrl Level Unit Selection = Custom (YF-32 ~ 34)]*.
YF-33 (3F70)	PI Aux Custom Unit Character 2	V/f OLV/PM EZOLV Sets the second character of the PI Aux custom unit display when *YF-21 = 49 [PI Aux Ctrl Level Unit Selection = Custom (YF-32 ~ 34)]*.
YF-34 (3F71)	PI Aux Custom Unit Character 3	V/f OLV/PM EZOLV Sets the third character of the PI Aux custom unit display when *YF-21 = 49 [PI Aux Ctrl Level Unit Selection = Custom (YF-32 ~ 34)]*.
YF-35 (3F72) RUN	PI Aux Minimum Transducer Scale	V/f OLV/PM EZOLV Sets the minimum scale output of the pressure transducer that is connected to the terminal set for *H3-xx = 27 [MFAI Function Selection = PI Auxiliary Control Feedback]*.
YF-36 (3F73) RUN	PI Aux Lo Hi Lvl Det Hysteresis	V/f OLV/PM EZOLV Sets the Hysteresis Level used for low and high level detection.

No. (Hex.)	Name	Description
YF-37 (3F74)	PI Aux Fdbk Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number restart attempts when the drive detects a *AuxFB PI Aux Feedback Level Loss* condition.
YF-38 (3F75)	PI Aux Fdbk Fault Restart Time	V/f OLV/PM EZOLV Sets the time interval between each *AuxFB PI Aux Feedback Level Loss* auto-restart attempt.
YF-39 (3F76)	Low PI Aux Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number restart attempts when the drive detects a *LoAux Low PI Auxiliary Feedback Level* condition.
YF-40 (3F77)	High PI Aux Fault Retry Attempts	V/f OLV/PM EZOLV Sets the number restart attempts when the drive detects a *HiAux High PI Auxiliary Feedback Level* condition.
UA-01 (1EC1)	Network PID Feedback	V/f OLV/PM EZOLV Network PID Feedback recognized by the iQpump Memobus Network.
UA-02 (1EC2)	Network Activity	V/f OLV/PM EZOLV Shows network traffic. A fluctuating number from 0.0% to 100.0% identifies activity, while a relatively constant 0.0% identifies no activity.
UA-03 (1EC3)	Time to Alternation	V/f OLV/PM EZOLV Time remaining before a drive requests alternation, which is dependent on *Y9-04 [Alternation Mode]*.
UA-04 (1EC4)	Running Queue No	V/f OLV/PM EZOLV Position in the iQpump MEMOBUS Multiplex Running Queue.
UA-05 (1EC5)	iQ Drives Running	V/f OLV/PM EZOLV Drives that are running on the MEMOBUS Network. Bit positions correspond to the node address: bit 0 -> address 01h… bit 7 -> address 08h.
UA-06 (1EC6)	iQ Drives Available	V/f OLV/PM EZOLV Drives that can be controlled on the MEMOBUS Network. Bit positions correspond to the node address: bit 0 -> address 01h, bit 1 -> address 02h … bit 7 -> address 08h.
UA-07 (1EC7)	VFD Run Time+Offset	V/f OLV/PM EZOLV Shows the cumulative run time of the drive added to the run time offset set in *Y9-55 [VFD Run Time Offset]*. The maximum value that this monitor can display is 65535.
UA-79 (37AF)	PID Feedback Backup	V/f OLV/PM EZOLV Shows the PID Feedback Backup *[H3-xx = 24]* signal that the drive uses when it loses PID Feedback *[H3-xx = B]*.
UA-81 (3BB0)	Diff Level Source	V/f OLV/PM EZOLV Shows the Differential Feedback signal from the terminal set for *H3-xx = 2D [Differential Level Source]*.
UA-83 (3B9E)	Flow Rate	V/f OLV/PM EZOLV Shows the flow rate based on the pulse input frequency or the analog voltage (flow rate input) and *Y6-01 [Flow Meter Scaling]* and *Y6-04 [Water Flow Units]*.
UA-84 (3B9F)	AccumLvl - Millions	V/f OLV/PM EZOLV Monitors *UA-84* to *UA-87* display the volume recorded from the flow meter (Pulse Input or Analog).
UA-85 (3BA0)	AccumLvl - Thousands	V/f OLV/PM EZOLV Monitors *UA-84* to *UA-87* display the volume recorded from the flow meter (Pulse Input or Analog).
UA-86 (3BA1)	AccumLvl - Ones	V/f OLV/PM EZOLV Monitors *UA-84* to *UA-87* display the volume recorded from the flow meter (Pulse Input or Analog).
UA-87 (3BA2)	AccumLvl - Decimals	V/f OLV/PM EZOLV Monitors *UA-84* to *UA-87* display the volume recorded from the flow meter (Pulse Input or Analog).
UA-88 (3BA3)	Total Volume Accum	V/f OLV/PM EZOLV Displays the total accumulated volume.
UA-89 (3BA4)	Delta Volume Accum	V/f OLV/PM EZOLV Displays the delta of the total accumulated volume.
UA-90 (3BA5)	Pump Setpoint	V/f OLV/PM EZOLV Shows the PID Setpoint.
UA-91 (3BA6)	Pump Feedback	V/f OLV/PM EZOLV Shows the PID Feedback.

No. (Hex.)	Name	Description
UA-92 (3BA7)	Pump Status	V/f OLV/PM EZOLV Shows pump running status where 0 = (OFF) and 1 = (Running). bit 0 : Drive bit 1 : Pump 2 bit 2 : Pump 3 bit 3 : Pump 4 bit 4 : Pump 5 bit 5 : Pump 6 bit 6 : Not used (normal value of 0). bit 7 : Not used (normal value of 0).
UA-93 (3BA8)	Total Setpoint Comp.	V/f OLV/PM EZOLV Shows the total setpoint compensation in absolute value.
UA-94 (3BA9)	Motor Speed	V/f OLV/PM EZOLV Shows the absolute value of *U1-02 [Output Frequency]* converted to RPM.
UA-96 (3BAB)	PI Aux Ctrl Feedback	V/f OLV/PM EZOLV Shows the PI Auxiliary Control Feedback level from the terminal set for *H3-xx = 27 [PI Auxiliary Control Feedback]*.
UA-97 (3BAC)	Water Level	V/f OLV/PM EZOLV Displays the amount of water above the water level sensor. [LPF]
UA-98 (3BAD)	Suction Pressure	V/f OLV/PM EZOLV Shows the amount of suction pressure.
UA-99 (3BB1)	Anti-No-Flow Timer	V/f OLV/PM EZOLV Shows the value of the anti-no-flow timer. When this value is at the *Y2-24 [Anti-No-Flow Detection Time]* setting, the anti-no-flow feature starts to decrease the output frequency.

12 UL Standards

Figure 12.1 UL/cUL Mark

The UL/cUL Mark identifies that this product conforms to rigid safety standards. This mark appears on products in the United States and Canada. It shows UL approval, which identifies that the product complies with safety standards after careful inspection and assessment. You must use UL Listed or UL Recognized parts for all primary components that are built into electrical equipment that has UL approval.

This product has been tested in accordance with UL standard UL508C, and has been verified to be in compliance with UL standards.

Machines and devices integrated with this product must satisfy the following conditions for compliance with UL standards.

Note:
UL61800-5-1 is supported.

◆ Area of Use

Install this product in a location with Overvoltage Category III and pollution degree 2 or less.

■ Ambient Temperature Setting

Maintain the ambient temperature within the following ranges according to the enclosure type.

- IP20/UL Open Type/Heatsink External Mounting: -10 °C to +50 °C (14 °F to 122 °F)
- IP20/UL Type 1: -10 °C to +40 °C (14 °F to 104 °F)
- IP55/UL Type 12 Heatsink External Mounting; front side: -10 °C to +50 °C (14 °F to 122 °F)
- IP55/UL Type 12 Heatsink External Mounting; back side: -10 °C to +40 °C (14 °F to 104 °F)

◆ Main Circuit Wire Gauges and Tightening Torques

Refer to *Wire Gauge and Torque Specifications for UL Listing on page 33* for the recommended wire gauges and tightening torques of the main circuit terminals.

Comply with local standards for correct wire gauges in the region where the drive is used.

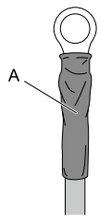
⚠ WARNING *Electrical Shock Hazard. Only connect 12-pulse output, 18-pulse output, or DC power input to terminals - and +1. Incorrect wiring can cause damage to the drive and serious injury or death from fire.*

Note:
- The recommended wire gauges are based on drive continuous current ratings with 75 °C (167 °F) 600 V class cooper wire. Assume these conditions:
  - Ambient temperature: 40 °C (104 °F) or lower
  - Wiring distance: 100 m (3281 ft) or shorter
  - Normal Duty Rated current value
- For drive models 2075 to 2396 and 4077 to 4720, use UL Listed closed-loop crimp terminals on the drive main circuit terminals. Use the tools recommend by the terminal manufacturer and make sure that the terminals are correctly connected.

◆ Ferrules and Closed-Loop Crimp Terminals

To comply with UL standards on drive models 2075 to 2396 and 4077 to 4720, use UL Listed closed-loop crimp terminals. Use the tools recommend by the terminal manufacturer to crimp the closed-loop crimp terminal. Yaskawa recommends closed-loop crimp terminals from PANDUIT Corp.

Install UL Recognized heat-shrinkable tubes to the closed-loop crimp terminals. If you do not use the tubes with the closed-loop crimp terminals, the insulating distance will be too short and it can cause short circuits.



A - UL Recognized heat-shrinkable tube

Comply with local standards for correct wire gauges in the region where the drive is used.

Refer to Table 12.1 to select ferrules and crimp terminals as specified by drive model and wire gauge.

Note:

To comply with UL standards, use UL Listed vinylcoated insulated copper wires for operation with a continuous maximum permitted temperature of 75 °C at 600 V.

Table 12.1 Ferrules and Closed-Loop Crimp Terminals

Model	Terminals	Recommended Gauge AWG, kcmil	Ferrule *1	Crimp Terminal Part Number Manufacturer: PANDUIT Corp.		
				Type LCA	Type P	Type S
2011	R/L1, S/L2, T/L3	14	F80-10	N/A	N/A	N/A
	U/T1, V/T2, W/T3	14	F80-10	N/A	N/A	N/A
	-, +1	14	F80-10	N/A	N/A	N/A
	⏚	12	N/A	LCA10-14-L	P10-14R-L	N/A
2017	R/L1, S/L2, T/L3	12	F81-10	N/A	N/A	N/A
	U/T1, V/T2, W/T3	10	F82-10	N/A	N/A	N/A
	-, +1	10	F82-10	N/A	N/A	N/A
	⏚	10	N/A	LCA10-14-L	P10-14R-L	N/A
2024	R/L1, S/L2, T/L3	10	F82-10	N/A	N/A	N/A
	U/T1, V/T2, W/T3	8	F83-12	N/A	N/A	N/A
	-, +1	8	F83-12	N/A	N/A	N/A
	⏚	10	N/A	LCA10-14-L	P10-14R-L	N/A
2031	R/L1, S/L2, T/L3	8	F83-12	N/A	N/A	N/A
	U/T1, V/T2, W/T3	8	F83-12	N/A	N/A	N/A
	-, +1	8	F83-12	N/A	N/A	N/A
	⏚	10	N/A	LCA10-14-L	P10-14R-L	N/A
2046	R/L1, S/L2, T/L3	8	F83-18	N/A	N/A	N/A
	U/T1, V/T2, W/T3	6	F84-18	N/A	N/A	N/A
	-, +1	6	F84-18	N/A	N/A	N/A
	⏚	8	N/A	LCA8-14-L	P8-14R-Q	S8-14R-Q
2059	R/L1, S/L2, T/L3	4	F85-18	N/A	N/A	N/A
	U/T1, V/T2, W/T3	4	F85-18	N/A	N/A	N/A
	-, +1	4	F85-18	N/A	N/A	N/A
	⏚	6	N/A	LCA6-14-L	P6-14R-E	S6-14R-E

Model	Terminals	Recommended Gauge AWG, kcmil	Ferrule *1	Crimp Terminal Part Number Manufacturer: PANDUIT Corp.		
				Type LCA	Type P	Type S
2075	R/L1, S/L2, T/L3	4	N/A	LCA4-56-L	P4-56R-E	S4-56R-E
	U/T1, V/T2, W/T3	3 or 2	N/A	LCA4-56-L or LCA2-56-Q	P2-56R-X *2	S2-56R-X *2
	-, +1	2	N/A	LCA2-56-Q	P2-56R-X	S2-56R-X
	⏚	6	N/A	LCA6-56-L	P6-56R-E	S6-56R-E
2088	R/L1, S/L2, T/L3	3 or 2	N/A	LCA4-56-L or LCA2-56-Q	P2-56R-X *2	S2-56R-X *2
	U/T1, V/T2, W/T3	2	N/A	LCA2-56-Q	P2-56R-X	S2-56R-X
	-, +1	1	N/A	LCA1-56-E	N/A	S2-56R-X
	⏚	6	N/A	LCA6-56-L	P6-56R-E	S6-56R-E
2114	R/L1, S/L2, T/L3	1/0	N/A	LCA1/0-56-X	N/A	S1/0-56R-X
	U/T1, V/T2, W/T3	1/0	N/A	LCA1/0-56-X	N/A	S1/0-56R-X
	-, +1	2/0	N/A	LCA2/0-56-X	N/A	S2/0-56R-X
	⏚	6	N/A	LCA6-56-L	P6-56R-E	S6-56R-E
2143	R/L1, S/L2, T/L3	2/0	N/A	LCA2/0-56-X	N/A	S2/0-56R-X
	U/T1, V/T2, W/T3	3/0	N/A	LCA3/0-56-X	N/A	S3/0-56R-5
	-, +1	3/0	N/A	LCA3/0-56-X	N/A	S3/0-56R-5
	⏚	4	N/A	LCA4-56-L	P4-56R-E	S4-56R-E
2169	R/L1, S/L2, T/L3	3/0	N/A	LCA3/0-56-X	N/A	S3/0-56R-5
	U/T1, V/T2, W/T3	4/0	N/A	LCA4/0-56-X	N/A	S4/0-56R-5
	-, +1	1/0 × 2	N/A	LCA1/0-56-X	N/A	S1/0-56R-X
	⏚	4	N/A	LCA4-56-L	P4-56R-E	S4-56R-E
2211	R/L1, S/L2, T/L3	1/0 × 2	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
	U/T1, V/T2, W/T3	1/0 × 2	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
	-, +1	2/0 × 2	N/A	LCA2/0-12-X	N/A	S2/0-76R-X or S2/0-12R-X
	⏚	3 or 2	N/A	LCA4-12-L or LCA2-12-Q	P2-12R-X *2	S2-12R-X *2
2273	R/L1, S/L2, T/L3	2/0 × 2	N/A	LCA2/0-12-X	N/A	S2/0-76R-X or S2/0-12R-X
	U/T1, V/T2, W/T3	2/0 × 2	N/A	LCA2/0-12-X	N/A	S2/0-76R-X or S2/0-12R-X
	-, +1	4/0 × 2	N/A	LCA3/0-12-X	N/A	S3/0-76R-5 or S3/0-12R-5
	⏚	2	N/A	LCA2-12-Q	P2-12R-X	S2-12R-X

Model	Terminals	Recommended Gauge AWG, kcmil	Ferrule *1	Crimp Terminal Part Number Manufacturer: PANDUIT Corp.		
				Type LCA	Type P	Type S
2343	R/L1, S/L2, T/L3	4/0 × 2	N/A	LCA4/0-12-X	N/A	S4/0-12R-5
	U/T1, V/T2, W/T3	4/0 × 2	N/A	LCA4/0-12-X	N/A	S4/0-12R-5
	-, +1	250 × 2	N/A	LCA250-12-X	N/A	S250-12R-5
	⏚	1/0	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
2396	R/L1, S/L2, T/L3	250 × 2	N/A	LCA250-12-X	N/A	S250-12R-5
	U/T1, V/T2, W/T3	250 × 2	N/A	LCA250-12-X	N/A	S250-12R-5
	-, +1	350 × 2	N/A	LCA350-12-X	N/A	N/A
	⏚	1/0	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
4005	R/L1, S/L2, T/L3	14	F80-10	N/A	N/A	N/A
	U/T1, V/T2, W/T3	14	F80-10	N/A	N/A	N/A
	-, +1	14	F80-10	N/A	N/A	N/A
	⏚	14	N/A	LCA10-14-L	P10-14R-L	N/A
4008	R/L1, S/L2, T/L3	14	F80-10	N/A	N/A	N/A
	U/T1, V/T2, W/T3	14	F80-10	N/A	N/A	N/A
	-, +1	14	F80-10	N/A	N/A	N/A
	⏚	14	N/A	LCA10-14-L	P10-14R-L	N/A
4011	R/L1, S/L2, T/L3	14	F80-10	N/A	N/A	N/A
	U/T1, V/T2, W/T3	14	F80-10	N/A	N/A	N/A
	-, +1	14	F80-10	N/A	N/A	N/A
	⏚	12	N/A	LCA10-14-L	P10-14R-L	N/A
4014	R/L1, S/L2, T/L3	14	F80-10	N/A	N/A	N/A
	U/T1, V/T2, W/T3	12	F81-10	N/A	N/A	N/A
	-, +1	12	F81-10	N/A	N/A	N/A
	⏚	10	N/A	LCA10-14-L	P10-14R-L	N/A
4021	R/L1, S/L2, T/L3	10	F82-10	N/A	N/A	N/A
	U/T1, V/T2, W/T3	10	F82-10	N/A	N/A	N/A
	-, +1	10	F82-10	N/A	N/A	N/A
	⏚	10	N/A	LCA10-14-L	P10-14R-L	N/A
4027	R/L1, S/L2, T/L3	10	F82-10	N/A	N/A	N/A
	U/T1, V/T2, W/T3	8	F83-12	N/A	N/A	N/A
	-, +1	8	F83-12	N/A	N/A	N/A
	⏚	10	N/A	LCA10-14-L	P10-14R-L	N/A
4034	R/L1, S/L2, T/L3	8	F83-12	N/A	N/A	N/A
	U/T1, V/T2, W/T3	8	F83-12	N/A	N/A	N/A
	-, +1	8	F83-12	N/A	N/A	N/A
	⏚	10	N/A	LCA10-14-L	P10-14R-L	N/A

Model	Terminals	Recommended Gauge AWG, kcmil	Ferrule *1	Crimp Terminal Part Number Manufacturer: PANDUIT Corp.		
				Type LCA	Type P	Type S
4040	R/L1, S/L2, T/L3	8	F83-18	N/A	N/A	N/A
	U/T1, V/T2, W/T3	8	F83-18	N/A	N/A	N/A
	-, +1	6	F84-18	N/A	N/A	N/A
	⏚	8	N/A	LCA8-14-L	P8-14R-Q	S8-14R-Q
4052	R/L1, S/L2, T/L3	6	F84-18	N/A	N/A	N/A
	U/T1, V/T2, W/T3	6	F84-18	N/A	N/A	N/A
	-, +1	4	F85-18	N/A	N/A	N/A
	⏚	8	N/A	LCA8-14-L	P8-14R-Q	S8-14R-Q
4065	R/L1, S/L2, T/L3	4	F85-18	N/A	N/A	N/A
	U/T1, V/T2, W/T3	4	F85-18	N/A	N/A	N/A
	-, +1	4	F85-18	N/A	N/A	N/A
	⏚	6	N/A	LCA6-14-L	P6-14R-E	S6-14R-E
4077	R/L1, S/L2, T/L3	4	N/A	LCA4-56-L	P4-56R-E	S4-56R-E
	U/T1, V/T2, W/T3	3 or 2	N/A	LCA4-56-L or LCA2-56-Q	P2-56R-X *2	S2-56R-X *2
	-, +1	2	N/A	LCA2-56-Q	P2-56R-X	S2-56R-X
	⏚	6	N/A	LCA6-56-L	P6-56R-E	S6-56R-E
4096	R/L1, S/L2, T/L3	2	N/A	LCA2-56-Q	P2-56R-X	S2-56R-X
	U/T1, V/T2, W/T3	1	N/A	LCA1-56-E	N/A	S2-56R-X
	-, +1	1	N/A	LCA1-56-E	N/A	S2-56R-X
	⏚	6	N/A	LCA6-56-L	P6-56R-E	S6-56R-E
4124	R/L1, S/L2, T/L3	1/0	N/A	LCA1/0-56-X	N/A	S1/0-56R-X
	U/T1, V/T2, W/T3	2/0	N/A	LCA2/0-56-X	N/A	S2/0-56R-X
	-, +1	2/0	N/A	LCA2/0-56-X	N/A	S2/0-56R-X
	⏚	4	N/A	LCA4-56-L	P4-56R-E	S4-56R-E
4156	R/L1, S/L2, T/L3	2/0	N/A	LCA2/0-56-X	N/A	S2/0-56R-X
	U/T1, V/T2, W/T3	3/0	N/A	LCA3/0-56-X	N/A	S3/0-56R-5
	-, +1	4/0	N/A	LCA4/0-56-X	N/A	S4/0-56R-5
	⏚	4	N/A	LCA4-56-L	P4-56R-E	S4-56R-E
4180	R/L1, S/L2, T/L3	1/0 × 2	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
	U/T1, V/T2, W/T3	1/0 × 2	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
	-, +1	1/0 × 2	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
	⏚	3 or 2	N/A	LCA4-12-L or LCA2-12-Q	P2-12R-X *2	S2-12R-X *2
4240	R/L1, S/L2, T/L3	1/0 × 2	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
	U/T1, V/T2, W/T3	1/0 × 2	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
	-, +1	3/0 × 2	N/A	LCA3/0-12-X	N/A	S3/0-76R-5 or S3/0-12R-5
	⏚	2	N/A	LCA2-12-Q	P2-12R-X	S2-12R-X

Model	Terminals	Recommended Gauge AWG, kcmil	Ferrule *1	Crimp Terminal Part Number Manufacturer: PANDUIT Corp.		
				Type LCA	Type P	Type S
4302	R/L1, S/L2, T/L3	3/0 × 2	N/A	LCA3/0-12-X	N/A	S3/0-76R-5 or S3/0-12R-5
	U/T1, V/T2, W/T3	3/0 × 2	N/A	LCA3/0-12-X	N/A	S3/0-76R-5 or S3/0-12R-5
	-, +1	4/0 × 2	N/A	LCA4/0-12-X	N/A	S4/0-76R-5 or S4/0-12R-5
	⏚	1/0	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
4361	R/L1, S/L2, T/L3	4/0 × 2	N/A	LCA4/0-12-X	N/A	S4/0-12R-5
	U/T1, V/T2, W/T3	4/0 × 2	N/A	LCA4/0-12-X	N/A	S4/0-12R-5
	-, +1	300 × 2	N/A	LCA300-12-X	N/A	N/A
	⏚	1/0	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
4414	R/L1, S/L2, T/L3	250 × 2	N/A	LCA250-12-X	N/A	S250-12R-5
	U/T1, V/T2, W/T3	300 × 2	N/A	LCA300-12-X	N/A	N/A
	-, +1	350 × 2	N/A	LCA350-12-X	N/A	N/A
	⏚	1/0	N/A	LCA1/0-12-X	N/A	S1/0-12R-X
4477	R/L1, S/L2, T/L3	3/0 × 4	N/A	LCA3/0-12-X	N/A	S3/0-12R-5
	U/T1, V/T2, W/T3	3/0 × 4	N/A	LCA3/0-12-X	N/A	S3/0-12R-5
	-, +1	4/0 × 4	N/A	LCA4/0-12-X	N/A	S4/0-12R-5
	⏚	2/0	N/A	LCA2/0-12-X	N/A	S2/0-12R-X
4515	R/L1, S/L2, T/L3	4/0 × 4	N/A	LCA4/0-12-X	N/A	S4/0-12R-5
	U/T1, V/T2, W/T3	4/0 × 4	N/A	LCA4/0-12-X	N/A	S4/0-12R-5
	-, +1	250 × 4	N/A	LCA250-12-X	N/A	S250-12R-5
	⏚	2/0	N/A	LCA2/0-12-X	N/A	S2/0-12R-X
4590	R/L1, S/L2, T/L3	4/0 × 4	N/A	LCA4/0-12-X	N/A	S4/0-12R-5
	U/T1, V/T2, W/T3	250 × 4	N/A	LCA250-12-X	N/A	S250-12R-5
	-, +1	300 × 4	N/A	LCA300-12-X	N/A	N/A
	⏚	3/0	N/A	LCA3/0-12-X	N/A	S3/0-12R-5
4720	R/L1, S/L2, T/L3	300 × 4	N/A	LCA300-12-X	N/A	N/A
	U/T1, V/T2, W/T3	300 × 4	N/A	LCA300-12-X	N/A	N/A
	-, +1	400 × 4	N/A	LCA400-12-6	N/A	N/A
	⏚	4/0	N/A	LCA4/0-12-X	N/A	S4/0-12R-5

*1 Use recommended ferrule or bare wire.
*2 The recommended wire gauge for this part is AWG 2.

◆ Short Circuit Protection Requirements for UL Listing

⚠ WARNING *Electrical Shock Hazard. After the input protective device trips, do not immediately energize the drive or operate peripheral devices. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. If you do not know the cause of the problem, contact Yaskawa before you energize the drive or peripheral devices. If you do not fix the problem before you operate the drive or peripheral devices, it can cause serious injury or death.*

■ UL Compliance

Install one of the types of short circuit protection devices in Table 12.2 or Table 12.3 to comply with UL 508C *1.

*1 Models 2143xV/T, 2169xV/T, 4124xT and 4156xV/T are compatible with UL61800-5-1.

Semiconductor protective type fuses are recommended, but the tables also show alternative short circuit protection devices. Make sure that you install this product in a location with Overvoltage Category III and pollution degree 2 or less.

Molded Case Circuit Breaker (MCCB) Ratings

- Maximum MCCB rating is 250% of the drive full load output amp (FLA) rating for models 2011 to 2273 and 4005 to 4302.
- Maximum MCCB rating is 200% of the drive full load output amp (FLA) rating for models 2343, 2396, and 4361 to 4720.
- When you use MCCBs you must mount the drive in a ventilated enclosure according to the minimum enclosure volume specified in this document.

Note:

When you use MCCBs, current limiting type are recommended, but not required.

Semiconductor Fuses and Motor Circuit Protectors (MCPs)

When you use semiconductor fuses or Motor Circuit Protectors (MCPs) for drive protection, you must mount them in the same enclosure with the drive.

Non-Semiconductor Fuse Ratings

- Maximum CC, J, or T fuse rating is 175% of the drive full load output amp (FLA) rating for models 2011 to 2396 and 4005 to 4302.
- Maximum J or T fuse rating is 175% of the drive full load output amp (FLA) rating and enclosed into a ventilated enclosure with a minimum enclosure volume as described in this document for models 4361 to 4720.

Short Circuit Current Rating (SCCR)

The maximum SCCR provided by the drive with approved protection device listed in this document is 100,000 RMS symmetrical amps.

Electric Code Compliance

The user must provide short circuit protection to protect input branch circuits as specified by the National Electric Code (NEC), the Canadian Electric Code, Part 1 (CEC), and local codes.

Required Short Circuit Protection

Table 12.2 Required Short Circuit Protection for iQpump605 AC Drives (240 V Class)

Drive Catalog Code WM65W	Drive Mounted without Supplemental Enclosure (Using Type 1 Kit)		Drive Mounted in Supplemental Enclosure						
			Any Size Protected Enclosure (Ventilated or Non-Ventilated)		Restricted Size Protected Enclosure (Ventilated Only)			Enclosure Volume Minimum (in^3)	
	Semiconductor Fuse *1 *2 Part Number (Permitted Only in Type 1 Kit) *Manufacturer: Eaton/Bussmann*	Class CC, J, or T Fuse *3 Maximum Amps	Semiconductor Fuse *1 *2 Part Number *Manufacturer: Eaton/Bussmann*	Class CC, J, or T Fuse *3 *4 Maximum Amps	Class CC, J, or T Fuse *3 *4 Maximum Amps	MCCB *4 Maximum Amps	MCP *1 Part Number *Manufacturer: Schneider*	External Heatsink	Internal Heatsink
2011	Not allowed. Does not support internal fuses for these drive models.	17.5	FWH-40B	17.5	Enclosure volume not restricted. Refer to the values in the column to the left for fuses.	25	HLL36030M71	3056	3056
2017		25	FWH-45B	25		40	HLL36030M71	3056	3056
2024		40	FWH-80B	40		60	HLL36050M72	3056	3056
2031		50	FWH-125B	50		75	HLL36050M72	3056	3056
2046		80	FWH-125B	80		110	HLL36100M73	5520	5520
2059		100	FWH-175B	100		125	HLL36100M73	5520	5520
2075		125	FWH-200B	125		175	HLL36150M74	5520	5520
2088		150	FWH-225A	150		200	HLL36150M74	5520	5520
2114		200	FWH-225A	200		250	HLL36150M74	5520	5520
2143		250	FWH-250A	250		350	JLL36250M75	21582	14657
2169		250	FWH-275A	250		400	JLL36250M75	21582	14657
2211		350	FWH-600A	350		500	LAL3640036M or LLL36400M37X	52800	14657
2273		450	FWH-800A	450		600	LAL3640036M or LLL36400M37X	52800	14657
2343		600	FWH-1000A or FWH-1000B	600		700	PLL34060M68	52800	52800
2396		700	FWH-1000A or FWH-1000B	700		800	PLL34060M68	52800	52800

*1 Protection device must be in same enclosure with drive.
*2 When you use semiconductor fuses as UL listed drive protection, the drives and fuses must be in the same enclosure.
*3 Class T fuses are fast-acting (non-time-delay) only. Class CC and J can be either time-delay or non-time-delay.
*4 Protection device and drive permitted in same or separate enclosure.

Table 12.3 Required Short Circuit Protection for iQpump605 AC Drives (480 V Class)

Drive Catalog Code WM65W	Drive Mounted without Supplemental Enclosure (Using Type 1 Kit)		Drive Mounted in Supplemental Enclosure						
			Any Size Protected Enclosure (Ventilated or Non-Ventilated)		Restricted Size Protected Enclosure (Ventilated Only)				
	Semiconductor Fuse *1 *2 Part Number (Permitted Only in Type 1 Kit) *Manufacturer: Eaton/Bussmann*	Class CC, J, or T Fuse *3 Maximum Amps	Semiconductor Fuse *1 *2 Part Number *Manufacturer: Eaton/Bussmann*	Class CC, J, or T Fuse *3 *4 Maximum Amps	Class CC, J, or T Fuse *3 *4 Maximum Amps	MCCB *4 Maximum Amps	MCP *1 Part Number *Manufacturer: Schneider*	Enclosure Volume Minimum (in³)	
								External Heatsink	Internal Heatsink
4005	Not allowed. Does not support internal fuses for these drive models.	8	FWH-25A14F	8	Enclosure volume not restricted. Refer to the values in the column to the left for fuses.	15	HLL36030M71	3056	3056
4006		9	FWH-30A14F	9		15	HLL36030M71	3056	3056
4008		12	FWH-30A14F	12		15	HLL36030M71	3056	3056
4011		17.5	FWH-40B	17.5		25	HLL36030M71	3056	3056
4014		20	FWH-45B	20		35	HLL36030M71	3056	3056
4021		35	FWH-60B	35		50	HLL36030M71	3056	3056
4027		45	FWH-80B	45		60	HLL36050M72	3056	3056
4034		60	FWH-100B	60		80	HLL36050M72	3056	3056
4040		70	FWH-125B	70		100	HLL36100M73	5520	5520
4052		90	FWH-150B	90		125	HLL36100M73	5520	5520
4065		110	FWH-200B	110		150	HLL36100M73	5520	5520
4077		125	FWH-225A	125		175	HLL36100M73	5520	5520
4096		150	FWH-225A	150		225	HLL36150M74	5520	5520
4124		200	FWH-225A	200		300	JLL36250M75	5520	5520
4156		250	FWH-325A	250		350	JLL36250M75	21582	14657
4180		300	FWH-500A	300		450	JLL36250M75	52800 *5	14657
4240		400	FWH-600A	400		600	LAL3640036M or LLL36400M37X	52800 *5	14657
4302		500	FWH-700A	500		700	LAL3640036M or LLL36400M37X	52800 *5	14657
4361	FWH-800A	Not allowed. Must use semiconductor fuses.	FWH-800A	Not allowed. Must use minimum enclosure volume requirements.	600	700	PLL34060M68	52800 *5	52800
4414	FWH-1000A or FWH-1000B		FWH-1000A or FWH-1000B		700	800	PLL34060M68	52800 *5	52800
4477	FWH-1200A or FWH-1200B		FWH-1200A or FWH-1200B		800	900	PLL34080M68	52800 *5	52800
4515	FWH-1200A or FWH-1200B		FWH-1200A or FWH-1200B		900	1000	PLL34080M68	52800 *5	52800
4590	FWH-1400A		FWH-1400A		1000	1200	PLL34080M68	52800 *5	52800
4720	FWH-1400A		FWH-1400A		1200	1400	PLL34100M69	52800 *5	52800

*1 Protection device must be in same enclosure with drive.
*2 When you use semiconductor fuses as UL listed drive protection, the drives and fuses must be in the same enclosure.
*3 Class T fuses are fast-acting (non-time-delay) only. Class CC and J can be either time-delay or non-time-delay.
*4 Protection device and drive permitted in same or separate enclosure.
*5 External heatsink installation on these models requires a heatsink shroud and filter.

◆ Low Voltage Wiring for Control Circuit Terminals

You must provide low voltage wiring as specified by the National Electric Code (NEC), the Canadian Electric Code, Part I (CEC), and local codes. Yaskawa recommends the NEC class 1 circuit conductor. Use the UL Listed class 2 power supply for external power supply.

Table 12.4 Control Circuit Terminal Power Supplies

Input/Output	Terminals	Power Supply Specifications
Digital input	S1 to S8, SN, SC, SP	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
Analog input	A1 to A3, AC, +V	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
Analog output	FM, AM, AC	Uses the LVLC power supply in the drive.
Pulse train input	RP, AC	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
Safe disable input	H1, H2, HC	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
Serial communication input/output	D+, D-, AC	Uses the LVLC power supply in the drive. Use the UL Listed class 2 power supply for external power supply.
24 V external power supply input/output	PS, AC, +P	Use the UL Listed class 2 power supply.

◆ Drive Motor Overload and Overheat Protection

The drive motor overload and overheat protection function complies with the National Electric Code (NEC) and the Canadian Electric Code, Part I (CEC).

Set the Motor Rated Current and *L1-01 through L1-04 [Motor Overload Protection Select]* correctly to enable motor overload and overheat protection.

Refer to the control method and set the motor rated current with *E2-01 [Motor Rated Current (FLA)]*, *E5-03 [PM Motor Rated Current (FLA)]*, or *E9-06 [Motor Rated Current (FLA)]*.

■ E2-01: Motor Rated Current (FLA)

No. (Hex.)	Name	Description	Default (Range)
E2-01 (030E)	Motor Rated Current (FLA)	V/f OLV/PM EZOLV Sets the motor rated current in amps.	Determined by o2-04 (10% to 200% of the drive rated current)

Note:
- If *E2-01 < E2-03 [Motor No-Load Current]* the drive will detect *oPE02 [Parameter Range Setting Error]*.
- The default settings and setting ranges are in these units:
  - 0.01 A: 2011 to 2046, 4005 to 4014
  - 0.1 A: 2059 to 2396, 4021 to 4720

The value set for *E2-01* becomes the reference value for motor protection and the torque limit. Enter the motor rated current as written on the motor nameplate. The value of *E2-01* is automatically set to the value input for "Motor Rated Current" by the Auto-Tuning process.

■ E5-03: PM Motor Rated Current (FLA)

No. (Hex.)	Name	Description	Default (Range)
E5-03 (032B)	PM Motor Rated Current (FLA)	V/f OLV/PM EZOLV Sets the PM motor rated current (FLA).	Determined by o2-04 (10% to 200% of the drive rated current)

Note:

When the drive model changes, the display units for this parameter also change.
- 0.01 A: 2011 to 2046, 4005 to 4014
- 0.1 A: 2059 to 2396, 4021 to 4720

The drive automatically sets *E5-03* to the value input for "PM Motor Rated Current" after you do these types of Auto-Tuning:

- PM Motor Parameter Settings
- PM Stationary Auto-Tuning
- PM StaTun for Stator Resistance
- PM Rotational Auto-Tuning

■ E9-06: Motor Rated Current (FLA)

No. (Hex.)	Name	Description	Default (Range)
E9-06 (11E9)	Motor Rated Current (FLA)	V/f OLV/PM EZOLV Sets the motor rated current in amps.	Determined by E9-01 and o2-04 (10% to 200% of the drive rated current)

Note:

When the drive model changes, the display units for this parameter also change.
- 0.01 A: 2011 to 2046, 4005 to 4014
- 0.1 A: 2059 to 2396, 4021 to 4720

The setting value of *E9-06* is the reference value for motor protection. Enter the motor rated current shown on the motor nameplate. Auto-Tuning the drive will automatically set *E9-06* to the value input for "Motor Rated Current".

■ L1-01: Motor Overload (oL1) Protection

No. (Hex.)	Name	Description	Default (Range)
L1-01 (0480)	Motor Overload (oL1) Protection	V/f OLV/PM EZOLV Sets the motor overload protection with electronic thermal protectors.	Determined by A1-02 (0 - 6)

This parameter enables and disables the motor overload protection with electronic thermal protectors.

The cooling capability of the motor changes when the speed control range of the motor changes. Use an electronic thermal protector that aligns with the permitted load characteristics of the motor to select motor protection.

The electronic thermal protection of the drive uses these items to calculate motor overload tolerance and supply overload protection for the motor:

- Output current
- Output frequency
- Motor thermal characteristics
- Time characteristics

If the drive detects motor overload, the drive will trigger an *oL1 [Motor Overload]* and stop drive output.

Set *H2-01 = 1F [Term M1-M2 Function Selection = Motor Overload Alarm (oL1)]* to set a motor overload alarm. If the motor overload level is more than 90% of the *oL1* detection level, the output terminal activates and triggers an overload alarm.

0 : Disabled

Disable motor protection when motor overload protection is not necessary or when the drive is operating more than one motor.

Refer to Figure 12.2 for an example of the circuit configuration to connect more than one motor to one drive.

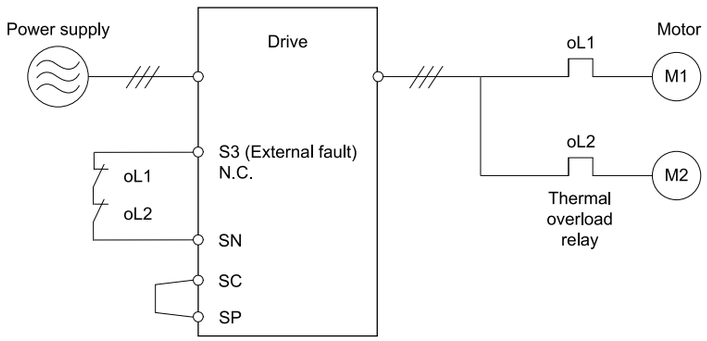


Figure 12.2 Protection Circuit Configuration to Connect More than One Motor to One Drive

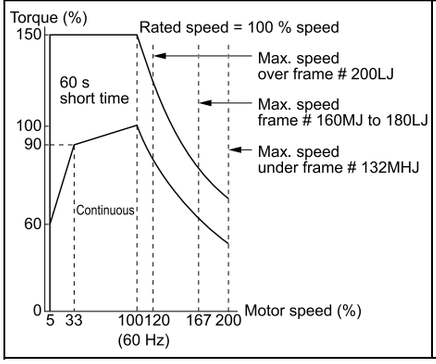
NOTICE *When you connect more than one motor to one drive or when the motor amp rating is higher than the drive amp rating, set L1-01 =0 [Motor Overload (oL1) Protection = Disabled] and install thermal overload relays for each motor. The electronic thermal protection of the drive will not function and it can cause damage to the motor.*

1 : Variable Torque

Use this setting for general-purpose motors with a 60 Hz base frequency.

The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

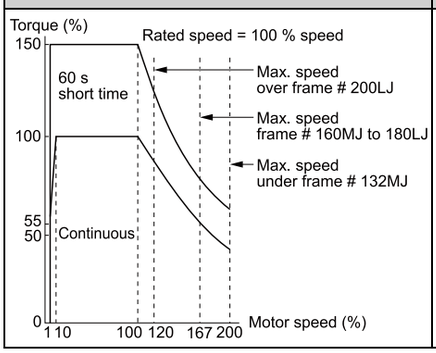
The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protection. This provides motor overheat protection from low speed to high speed across the full speed range.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to operate with commercial line power. Operate at a 60 Hz base frequency to maximize the motor cooling ability.	If the motor operates at frequencies less than 60 Hz, the drive will detect *oL1*. The drive triggers a fault relay output and the motor coasts to stop.

2 : Constant Torque 10:1 Speed Range

Use this setting for drive-dedicated motors with a speed range for constant torque of 1:10.

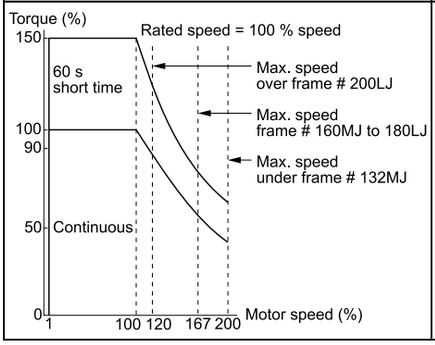
The speed control for this motor is 10% to 100% when at 100% load. Operating slower than 10% speed at 100% load will cause motor overload.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (10% base frequency).	The motor operates continuously at 10% to 100% base frequency. Operating slower than 10% speed at 100% load will cause motor overload.

3 : Constant Torque 100:1 SpeedRange

Use this setting for vector motors with a speed range for constant torque of 1:100.

The speed control for this motor is 1% to 100% when at 100% load. Operating slower than 1% speed at 100% load will cause motor overload.

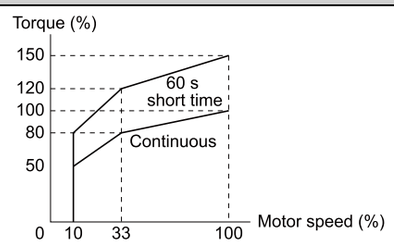
Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (1% base frequency).	The motor operates continuously at 1% to 100% base frequency. Operating slower than 1% speed at 100% load will cause motor overload.

4 : PM Variable Torque

Use this setting for PM motors with derated torque characteristics.

The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

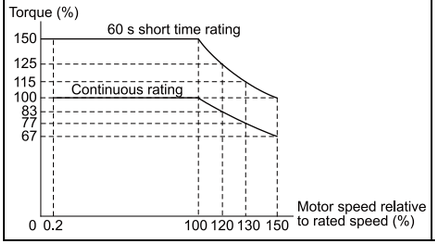
The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protection. This provides motor overheat protection from low speed to high speed across the full speed range.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation at rated speed and rated torque.	If the motor operates continuously at lower speed than rated rotation speed at more than 100% torque, the drive will detect *oL1*. The drive triggers a fault relay output and the motor coasts to stop.

5 : PM Constant Torque

Use this setting with a PM motor for constant torque that has a speed range for constant torque of 1:500.

The speed control for this motor is 0.2% to 100% when at 100% load. Operating slower than 0.2% speed at 100% load will cause motor overload.

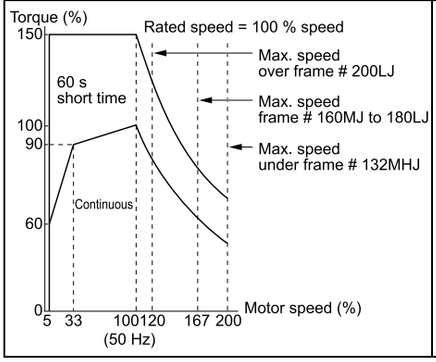
Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to withstand increased temperatures during continuous operation in the low speed range (0.2% base frequency).	The motor operates continuously at 0.2% to 100% rated speed. Operating slower than 0.2% speed at 100% load will cause motor overload.

6 : Variable Torque (50Hz)

Use this setting for general-purpose motors with a 50 Hz base frequency.

The overload tolerance decreases as motor speed decreases because the cooling fan speed decreases and the ability of the motor to cool decreases in the low speed range.

The overload tolerance characteristics of the motor change the trigger point for the electronic thermal protection. This provides motor overheat protection from low speed to high speed across the full speed range.

Load Tolerance	Cooling Capability	Overload Characteristics (at 100% motor load)
	This motor is designed to operate with commercial line power. Operate at a 50 Hz base frequency to maximize the motor cooling ability.	If the motor operates at frequencies less than commercial line power, the drive will detect *oL1*. The drive triggers a fault relay output and the motor coasts to stop.

■ L1-02: Motor Overload Protection Time

No. (Hex.)	Name	Description	Default (Range)
L1-02 (0481)	Motor Overload Protection Time	V/f OLV/PM EZOLV Sets the operation time for the electronic thermal protector of the drive to prevent damage to the motor. Usually it is not necessary to change this setting.	1.0 min (0.1 - 5.0 min)

Set the overload tolerance time to the length of time that the motor can operate at 150% load from continuous operation at 100% load.

When the motor operates at 150% load continuously for 1 minute after continuous operation at 100% load (hot start), the default setting triggers the electronic thermal protector.

Figure 12.3 shows an example of the electronic thermal protector operation time. Motor overload protection operates in the range between a cold start and a hot start.

This example shows a general-purpose motor operating at the base frequency with *L1-02* set to 1.0 min.

- Cold start
  Shows the motor protection operation time characteristics when the overload occurs immediately after starting operation from a complete stop.
- Hot start
  Shows the motor protection operation time characteristics when overload occurs from continuous operation below the motor rated current.

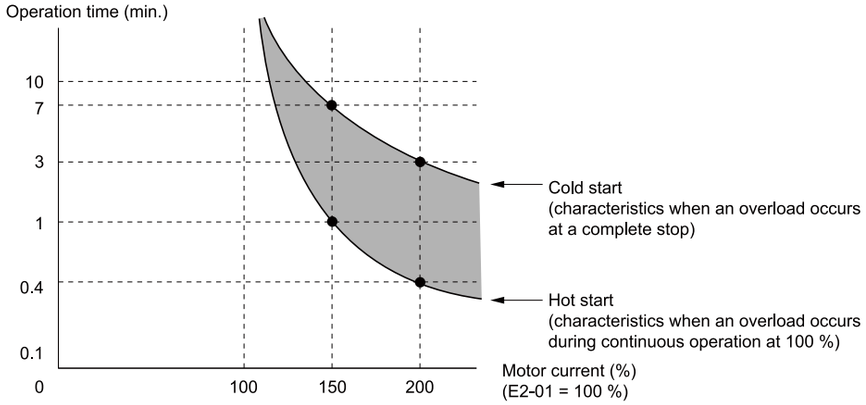


Figure 12.3 Protection Operation Time for a General-purpose Motor at Rated Output Frequency

■ L1-03: Motor Thermistor oH Alarm Select

No. (Hex.)	Name	Description	Default (Range)
L1-03 (0482)	Motor Thermistor oH Alarm Select	V/f OLV/PM EZOLV Sets drive operation when the PTC input signal entered into the drive is at the *oH3 [Motor Overheat (PTC Input)]* detection level.	3 (0 - 3)

0 : Ramp to Stop

The drive ramps the motor to stop in the deceleration time. Fault relay output terminal MA-MC turns ON and MB-MC turns OFF.

1 : Coast to Stop

The output turns OFF and the motor coasts to stop. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

2 : Fast Stop (Use C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

3 : Alarm Only

The keypad shows *oH3*, and operation continues. The output terminal set for *Alarm [H2-01 to H2-03 = 10]* turns ON.

■ L1-04: Motor Thermistor oH Fault Select

No. (Hex.)	Name	Description	Default (Range)
L1-04 (0483)	Motor Thermistor oH Fault Select	V/f OLV/PM EZOLV Sets the drive operation when the PTC input signal to the drive is at the *oH4 [Motor Overheat Fault (PTC Input)]* detection level.	1 (0 - 2)

0 : Ramp to Stop

The drive ramps the motor to stop in the deceleration time. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

1 : Coast to Stop

The output turns OFF and the motor coasts to stop. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

2 : Fast Stop (Use C1-09)

The drive stops the motor in the deceleration time set in *C1-09 [Fast Stop Time]*. Fault relay output terminal MA-MC turns ON, and MB-MC turns OFF.

13 European Standards

Figure 13.1 CE Mark

The CE Mark identifies that the product meets environmental and safety standards in the European Union. Products manufactured, sold, or imported in the European Union must display the CE Mark.

European Union standards include standards for electrical appliances (Low Voltage Directive), standards for electrical noise (EMC Directive), and standards for machinery (Machinery Directive).

This product displays the CE Mark in accordance with the Low Voltage Directive, the EMC Directive, and the Machinery Directive.

Table 13.1 Harmonized Standards

European Directive	Harmonized Standards
Low Voltage Directive 2014/35/EU	EN 61800-5-1 *1
EMC Directive 2014/30/EU	EN 61800-3 *1
Machinery Directive 2006/42/EC	• EN ISO 13849-1:2015 (PL e (Cat.3)) • EN IEC 62061 (SIL3) *1 • EN 61800-5-2 (SIL3) *1
Restriction of the use of certain hazardous substances (RoHS) 2011/65/EU	EN IEC 63000 *1

*1 Refer to *EU Declaration of Conformity on page 158* for the years of the unified standards.

The customer must display the CE Mark on the final device containing this product. Customers must verify that the final device complies with EU standards.

◆ EU Declaration of Conformity

Go to www.yaskawa.com and search for “EU Declaration of Conformity” to get an original copy of the EU Declaration of Conformity.

Yaskawa declares that this product complies with the following directives and standards.

◆ CE Low Voltage Directive Compliance

It has been confirmed that this product complies with the CE Low Voltage Directive by conducting a test according to IEC/EN 61800-5-1.

The following conditions must be satisfied for machines and devices incorporating this product to comply with the CE Low Voltage Directive.

■ Area of Use

Install this product in a location with Overvoltage Category III and pollution degree 2 or less.

■ Guarding Against Debris

When you install IP20/UL Open Type drives (model: 2xxxxB, 4xxxxB), use an enclosure panel that does not let unwanted material enter the drive from above or below.

■ Electrical Installation

Refer to Figure 13.2 for an example of a drive that is wired to comply with the CE Low Voltage Directive.

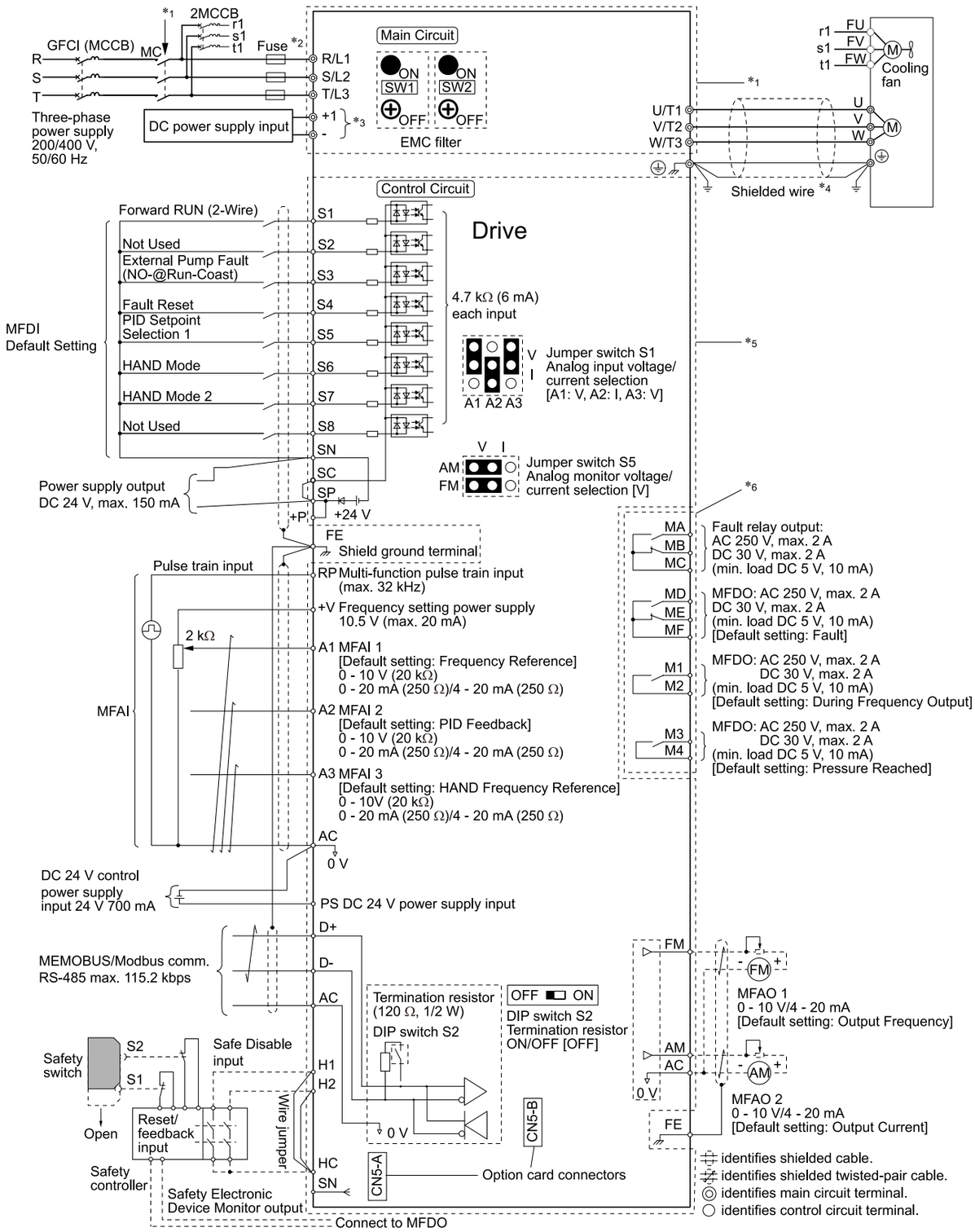


Figure 13.2 Wiring Diagram for CE Low Voltage Directive Compliance

*1 For circuit protection, the main circuit is separated from the surface case that can touch the main circuit.

*2 To comply with LVD standard requirement, set *L8-05 = 1 [Input Phase Loss Protection Sel = Enabled]* to protect the drive from the high current caused by Input Phase Loss condition.

*3 Use terminals - and +1 to connect options to the drive.

⚠ WARNING *Sudden Movement Hazard. Make sure that the polarity is correct before you send a Run command. If the drive incorrectly detects the polarity, the drive can rotate in the direction opposite of the Run command and cause serious injury or death.*

*4 Use braided shield cable for the drive and motor wiring, or run the wiring through a metal conduit.
*5 The control circuit is a Safety Extra-Low Voltage circuit. Separate this circuit from other circuits with reinforced insulation. Make sure to connect the Safety Extra-Low Voltage circuit as specified.
*6 Reinforced insulation separates the output terminals from other circuits. When the drive output is 250 Vac 1 A maximum or 30 Vdc 1 A maximum, you can also connect circuits that are not Safety Extra-Low Voltage circuits.

■ Main Circuit Wire Gauges and Tightening Torques

⚠ WARNING *Electrical Shock Hazard. Only connect 12-pulse output, 18-pulse output, or DC power input to terminals - and +1. Incorrect wiring can cause damage to the drive and serious injury or death from fire.*

Refer to *Wire Gauge and Torque Specifications for UL Listing on page 33* for the recommended wire gauges and tightening torques of the main circuit terminals.

Note:

The recommended wire gauges are based on drive continuous current ratings with 75 °C (167 °F) 600 V class copper wire. Assume these conditions:

- Ambient temperature: 40 °C (104 °F) or lower
- Wiring distance: 100 m (3281 ft) or shorter
- Normal Duty Rated current value

■ Connect a Fuse and a GFCI to the Input Side (Primary Side)

The drive circuit protection must comply with IEC/EN 61800-5-1 for protection against a short circuit in the internal circuitry. Yaskawa recommends connecting a semiconductor protection fuse and a Ground Fault Circuit Interrupter (GFCI) on the input side for branch circuit protection.

⚠ WARNING *Electrical Shock Hazard. After the drive blows a fuse or trips a GFCI, do not immediately energize the drive or operate peripheral devices. Wait for the time specified on the warning label at a minimum and make sure that all indicators are OFF. Then check the wiring and peripheral device ratings to find the cause of the problem. If you do not know the cause of the problem, contact Yaskawa before you energize the drive or peripheral devices. If you do not fix the problem before you operate the drive or peripheral devices, it can cause serious injury or death.*

Table 13.2 Factory-Recommended Semiconductor Protection Fuses (208 V Class)

Drive Model	Semiconductor Protection Fuse *1 Model Manufacturer: EATON/Bussmann	Drive Model	Semiconductor Protection Fuse *1 Model Manufacturer: EATON/Bussmann
2011	FWH-40B	2114	FWH-225A
2017	FWH-45B	2143	FWH-250A
2024	FWH-80B	2169	FWH-275A
2031	FWH-125B	2211	FWH-600A
2046	FWH-125B	2273	FWH-800A
2059	FWH-175B	2343	FWH-1000A or FWH-1000B
2075	FWH-200B	2396	FWH-1000A or FWH-1000B
2088	FWH-225A		

*1 When you use semiconductor protection fuses as UL listed drive protection, the drives and fuses must be in the same enclosure.

Table 13.3 Factory-Recommended Semiconductor Protection Fuses (480 V Class)

Drive Model	Semiconductor Protection Fuse *1 Model Manufacturer: EATON/Bussmann	Drive Model	Semiconductor Protection Fuse *1 Model Manufacturer: EATON/Bussmann
4005	FWH-25A14F	4021	FWH-60B
4008	FWH-30A14F	4027	FWH-80B
4011	FWH-40B	4034	FWH-100B
4014	FWH-45B	4040	FWH-125B

Drive Model	Semiconductor Protection Fuse *1 Model Manufacturer: EATON/Bussmann
4052	FWH-150B
4065	FWH-200B
4077	FWH-225A
4096	FWH-225A
4124	FWH-225A
4156	FWH-325A
4180	FWH-500A
4240	FWH-600A

Drive Model	Semiconductor Protection Fuse *1 Model Manufacturer: EATON/Bussmann
4302	FWH-700A
4361	FWH-800A
4414	FWH-1000A or FWH-1000B
4477	FWH-1200A or FWH-1200B
4515	FWH-1200A or FWH-1200B
4590	FWH-1400A
4720	FWH-1400A

*1 When you use semiconductor protection fuses as UL listed drive protection, the drives and fuses must be in the same enclosure.

Table 13.4 Factory-Recommended GFCI (208 V Class)

Drive Model	GFCI Model Manufacturer: Mitsubishi Electric	Rated Current A	Rated Leakage Current mA
2011	NV32-SV	20	500
2017	NV32-SV	32	500
2024	NV63-SV	50	500
2031	NV63-SV	60	500
2046	NV125-SV	100	500
2059	NV125-SV	125	500
2075	NV250-SV	150	500
2088	NV250-SV	175	500
2114	NV250-SV	225	500
2143	NV400-SW	300	500
2169	NV400-SW	350	500
2211	NV400-SW	300	500
2273	NV400-SW	400	500
2343	NV630-SW	500	500
2396	NV630-SW	600	500

Table 13.5 Factory-Recommended GFCI (480 V Class)

Drive Model	GFCI Model Manufacturer: Mitsubishi Electric	Rated Current A	Rated Leakage Current mA
4005	NV32-SV	15	500
4008	NV32-SV	15	500
4011	NV32-SV	20	500
4014	NV32-SV	30	500
4021	NV63-SV	50	500
4027	NV63-SV	63	500
4034	NV63-SV	63	500
4040	NV125-SV	100	500
4052	NV125-SV	125	500
4065	NV125-SV	125	500
4077	NV250-SV	150	500
4096	NV250-SV	200	500

Drive Model	GFCI Model Manufacturer: Mitsubishi Electric	Rated Current A	Rated Leakage Current mA
4124	NV250-SV	250	500
4156	NV400-SEW	300	500
4180	NV400-SW	300	500
4240	NV400-SW	350	500
4302	NV400-SW	400	500
4361	NV630-SW	500	500
4414	NV630-SW	630	500
4477	NV630-SW	630	500
4515	NV800-SEW	800	500
4590	NV800-SEW	800	500
4720	NV800-SEW	800	500

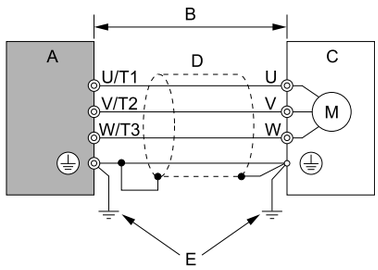
◆ EMC Directive

Drives with built-in EMC filters were tested in accordance with European standard IEC/EN 61800-3, and comply with the EMC Directive.

■ Install a Drive to Conform to the EMC Directive

Use this procedure to install drives that comply with the EMC Directive when the drive is a single unit or installed in a larger device.

1. Install the drive on a grounded metal plate.
2. Wire the drive and motor.
3. Ground the wire shielding on the drive side and motor side.



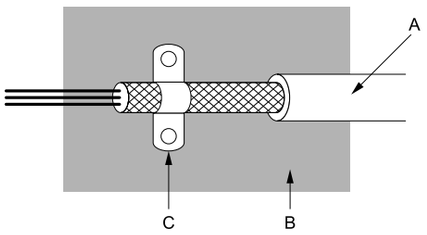
A - Drive
B - 100 m (328 ft) maximum
C - Motor
D - Metal conduit
E - Grounding wire

Figure 13.3 Wiring the Drive and Motor

Note:
- Use a braided shield cable for the drive and motor wiring or put the wires through a metal conduit.
- The maximum wiring length between the drive and motor is 100 m (328 ft). Keep the wire as short as possible.
- Keep the grounding wire as short as possible.

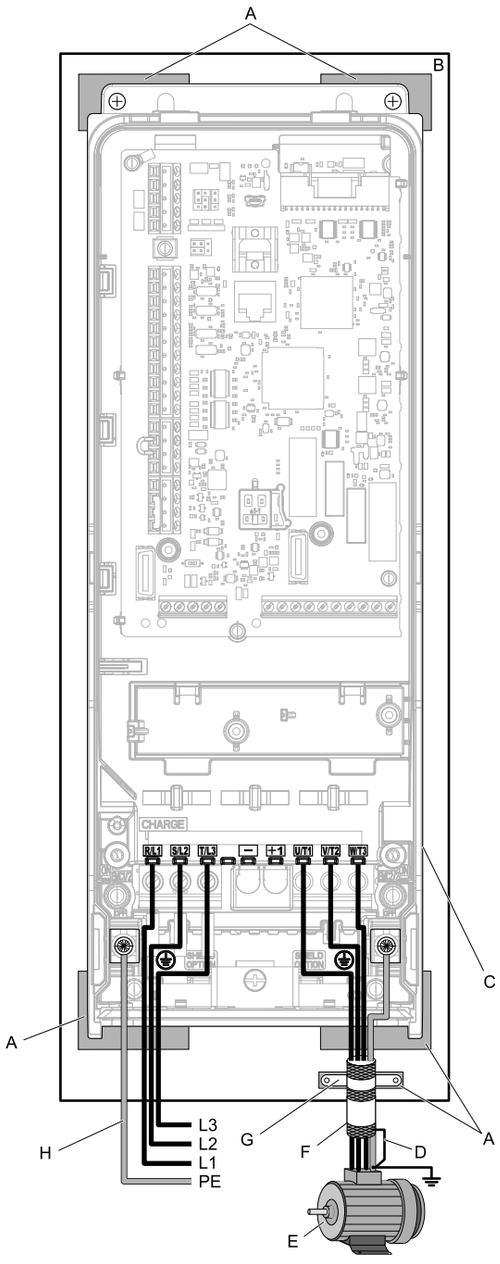
4. Use a cable clamp to ground the motor cable to the metal plate.

Note:
Make sure that the protective ground wire complies with technical specifications and local safety standards.



A - Braided shield cable
B - Metal plate
C - Cable clamp (conductive)

Figure 13.4 Ground the shield



A - Grounding surface (Remove any paint or sealant.)
B - Metal plate
C - Drive
D - Shielded wire
E - Motor
F - Motor cable (Braided shield cable: 10 m (32.8 ft) maximum)
G - Cable clamp
H - Grounding wire

Figure 13.5 Install a Drive with a Built-in EMC Filter

Ground Wiring

⚠ WARNING *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. If you touch the internal components of an energized drive, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Ground the neutral point on the power supply of the drives to comply with the EMC Directive before you turn on the EMC filter. If you turn ON the EMC filter, but you do not ground the neutral point, it can cause serious injury or death.*

Enable the Internal EMC Filter

Move the screws to turn ON and OFF (enable and disable) the EMC filter.

Make sure that you apply a symmetric grounding network and install the screws in the ON position to enable the built-in EMC filter in compliance with the EMC Directive. The default position of the EMC filter switch screws is the OFF position. Refer to Table 13.7 and the Switch Location Diagrams for more information about the available EMC filter switch screws for each drive model.

⚠ WARNING *Electrical Shock Hazard. Disconnect all power to the drive, wait for the time specified on the warning label, and check the drive for dangerous voltages before you remove covers or touch EMC filter screws. If you touch the screws when there are dangerous voltages, it will cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. If you touch the internal components of an energized drive, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Ground the neutral point on the power supply of the drives to comply with the EMC Directive before you turn on the EMC filter. If you turn ON the EMC filter, but you do not ground the neutral point, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Connect the ground cable correctly. If you touch electrical equipment that is not grounded, it can cause serious injury or death.*

NOTICE *To disable the internal EMC filter, move the screws from ON to OFF and then tighten to the specified torque. If you fully remove the screws or tighten the screws to an incorrect torque, it can cause drive failure.*

NOTICE *Move the EMC switch screw or screws to the OFF position for networks that are not symmetrically grounded. If the screws are not in the correct position, it can cause damage to the drive.*

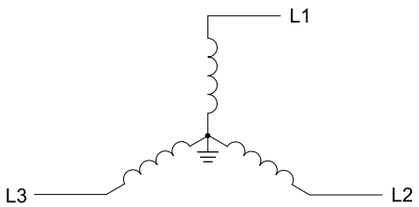
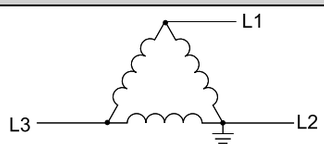
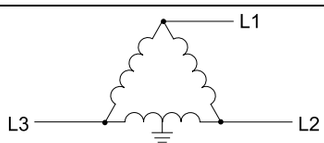


Figure 13.6 Symmetric Grounding

NOTICE *Damage to Equipment. When you use the drive with a non-grounding, high-resistance grounding, or asymmetric-grounding network, put the EMC Filter screw or screws in the OFF position to disable the built-in EMC filter. If you do not disable the built-in EMC filter, it will cause damage to the drive.*

Table 13.6 shows asymmetric grounding networks.

Table 13.6 Asymmetric Grounding

Type of Grounding	Diagram
Grounded at the corner of the delta connection	
Grounded at the middle of the side	

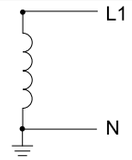
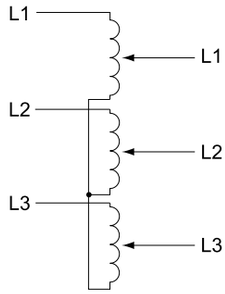
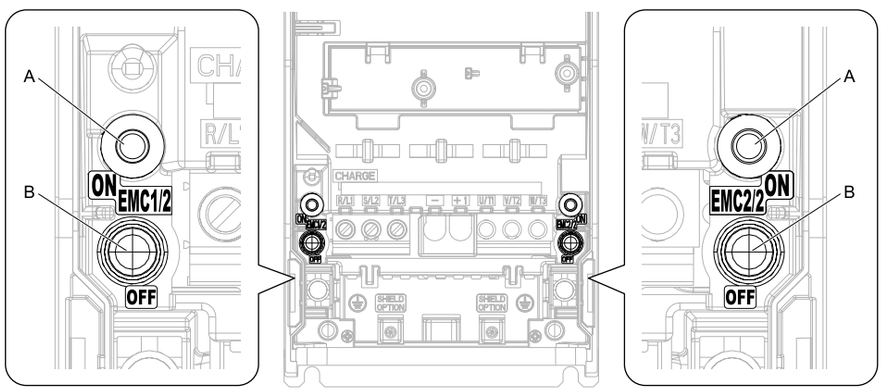
Type of Grounding	Diagram
Single-phase, grounded at the end point	
Three-phase variable transformer without solidly grounded neutral	

Table 13.7 EMC Filter Switch Location

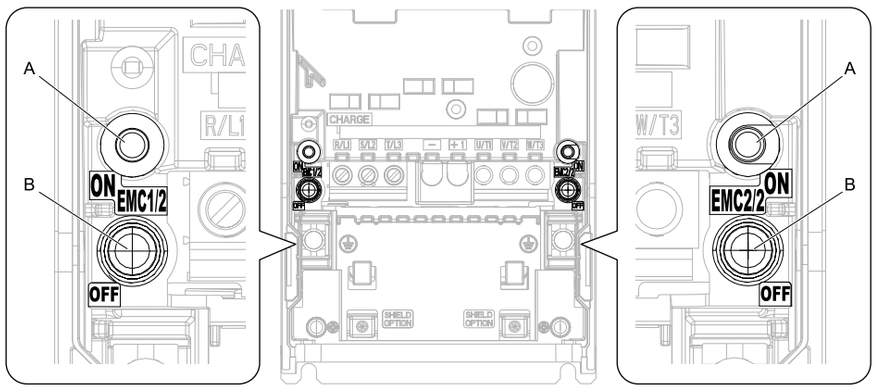
Model	Switch Location Diagram	
	IP20/UL Open Type or IP20/UL Type 1 Models: 2xxxxB/F/W and 4xxxxB/F/W	IP55/UL Type 12 Models: 2xxxxV and 4xxxxV
2011, 2017, 4005 - 4014	Figure 13.7	
2024, 2031, 4021 - 4034	Figure 13.8	
2046, 2059, 4040 - 4065	Figure 13.9	
2075 - 2114, 4077 - 4124	Figure 13.10	
2143, 2169, 4156	Figure 13.11	



A - SW (ON) **B - Screw (OFF)**

Note:
To comply with IEC61800-3 on drive models 2xxxA and 4xxxA with no built-in EMC filter, turn on the EMC filter switch on the left side.

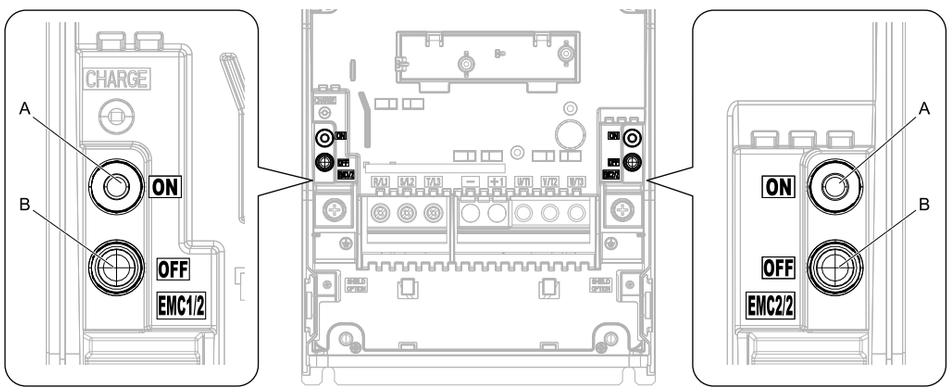
Figure 13.7 EMC Filter Switch Location 1



A - SW (ON) **B - Screw (OFF)**

Note:
To comply with IEC61800-3 on drive models 2xxxA and 4xxxA with no built-in EMC filter, turn on the EMC filter switch on the left side.

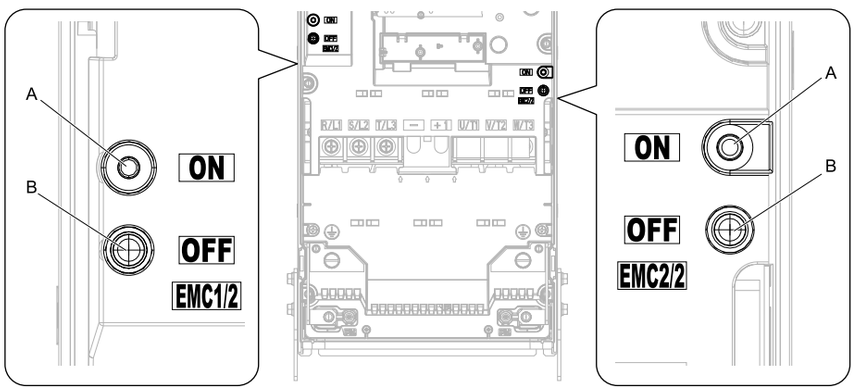
Figure 13.8 EMC Filter Switch Location 2



A - SW (ON) **B - Screw (OFF)**

Note:
To comply with IEC61800-3 on drive models 2xxxA and 4xxxA with no built-in EMC filter, turn on the EMC filter switch on the left side.

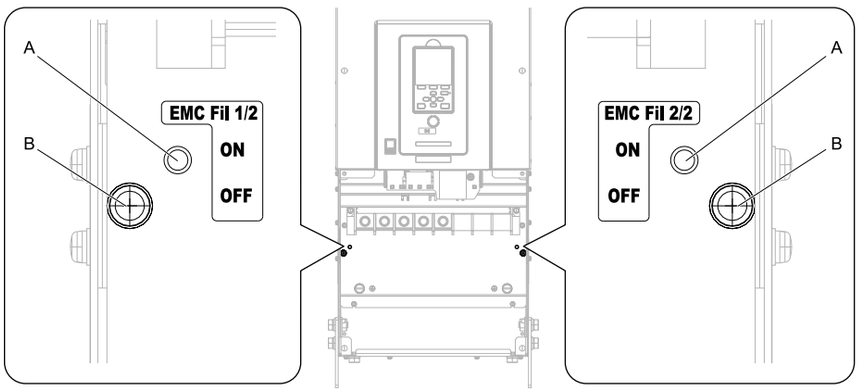
Figure 13.9 EMC Filter Switch Location 3



A - SW (ON) **B - Screw (OFF)**

Note:
To comply with IEC61800-3 on drive models 2xxxA and 4xxxA with no built-in EMC filter, turn on the EMC filter switch on the right side.

Figure 13.10 EMC Filter Switch Location 4



A - SW (ON) **B - Screw (OFF)**

Figure 13.11 EMC Filter Switch Location 6

If you lose an EMC filter switch screw, use Table 13.8 to find the correct replacement screw and install the new screws with the correct tightening torque.

NOTICE *Only use the screws specified in this manual. If you use screws that are not approved, it can cause damage to the drive.*

Table 13.8 Screw Sizes and Tightening Torques

Model	Screw Size	Tightening Torque N·m
2011 - 2059, 4005 - 4065	M4 × 20	1.0 - 1.3
2075 - 2114, 4077 - 4124	M4 × 30	1.0 - 1.3
2143, 2169, 4156	M5 × 25	2.0 - 2.5

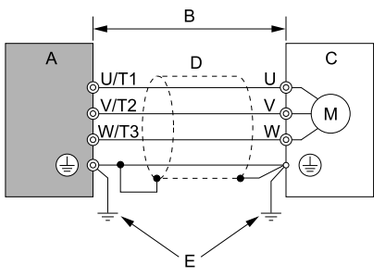
■ Install the External EMC Noise Filter

Drive models 2xxxA and 4xxxA must meet conditions in this section to comply with IEC/EN 61800-3.

Connect an EMC noise filter that complies with European standards as specified by Yaskawa to the input side (primary side). Refer to *External EMC Noise Filter Selection on page 171* to select the correct EMC noise filter.

Use this procedure to install an EMC noise filter to make equipment and devices added to the drive comply with the EMC Directive.

1. Install the drive and EMC noise filter on the same grounded metal plate.
2. Wire the drive and motor.
3. Ground the wire shielding on the drive side and motor side.



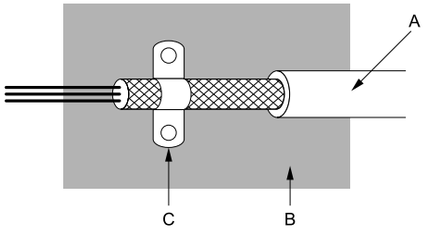
A - Drive **D - Metal conduit**
B - 10 m (32.8 ft) maximum **E - Grounding wire**
C - Motor

Figure 13.12 Wiring the Drive and Motor

Note:
- Use a braided shield cable for the drive and motor wiring or put the wires through a metal conduit.
- The maximum wiring length between the drive and motor is 10 m (32.8 ft). Keep the wire as short as possible.
- Keep the grounding wire as short as possible.

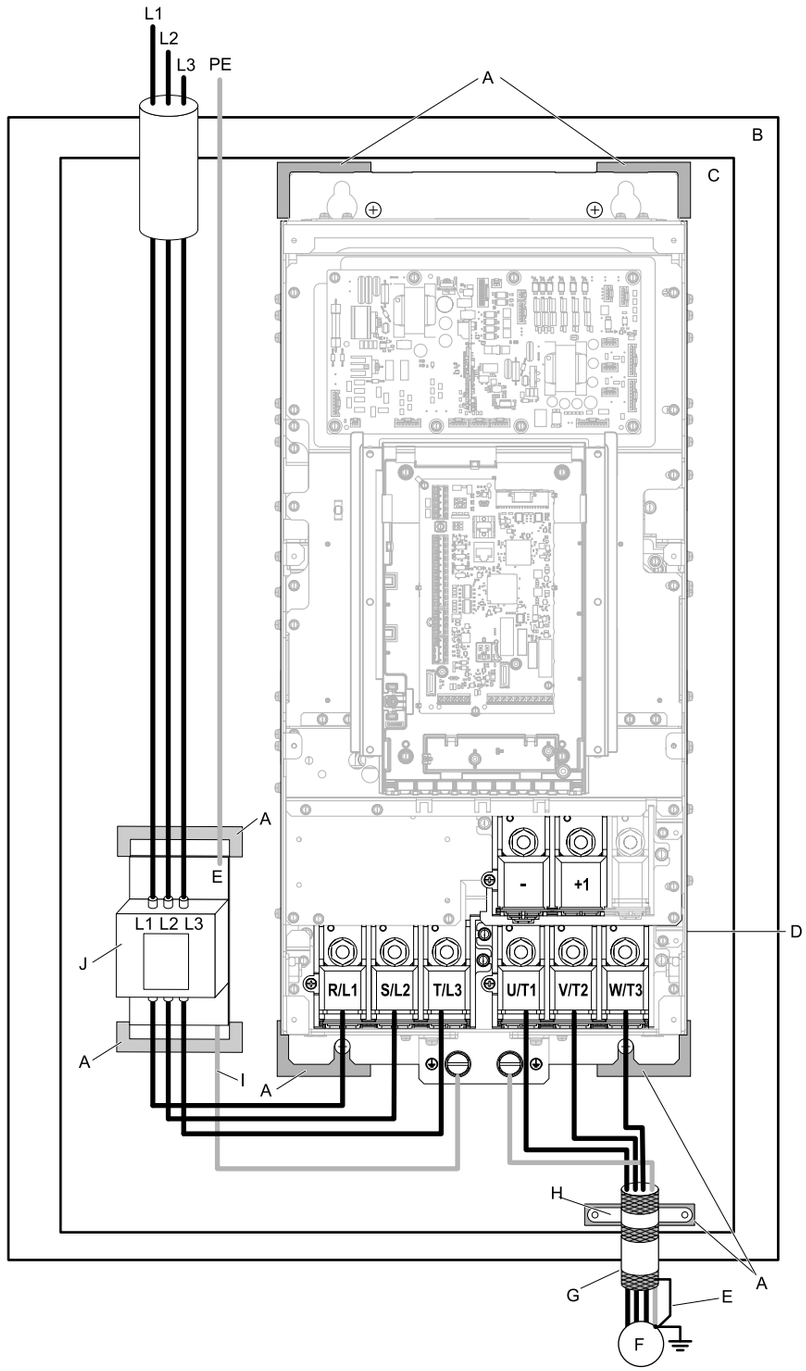
4. Use a cable clamp to ground the motor cable to the metal plate.

Note:
Make sure that the protective ground wire complies with technical specifications and local safety standards.



A - Braided shield cable
B - Metal plate
C - Cable clamp (conductive)

Figure 13.13 Ground the Shield



A - Grounding surface (Remove any paint or sealant.)
B - Enclosure panel
C - Metal plate
D - Drive
E - Ground the shield.
F - Motor
G - Motor cable (Braided shield cable: 10 m (32.8 ft) maximum)
H - Cable clamp
I - Grounding wire
J - EMC noise filter

Figure 13.14 EMC Noise Filter and Drive Installation Procedure

Ground Wiring

⚠ WARNING *Electrical Shock Hazard. Do not remove covers or touch circuit boards while the drive is energized. If you touch the internal components of an energized drive, it can cause serious injury or death.*

⚠ WARNING *Electrical Shock Hazard. Ground the neutral point on the power supply of the drives to comply with the EMC Directive before you turn on the EMC filter. If you turn ON the EMC filter, but you do not ground the neutral point, it can cause serious injury or death.*

External EMC Noise Filter Selection

Table 13.9 External EMC Noise Filter for Three-Phase 208 V Class

Model	EMC Noise Filter Model	Quantity	Manufacturer
2211	B84743A0300R176	1	TDK
2273	B84743B0410S176	1	TDK
2343	B84743B0410S176	1	TDK
2396	B84743B0410S176	1	TDK

Table 13.10 External EMC Noise Filter for Three-Phase 480 V Class

Model	EMC Noise Filter Model	Quantity	Manufacturer
4180	B84743A0300R176	1	TDK
4240	B84743A0300R176	1	TDK
4302	B84743A0300R176	1	TDK
4361	B84743B0410S176	1	TDK
4414	B84743B0410S176	1	TDK
4477	B84743A0660S176	1	TDK
4515	B84743A0660S176	1	TDK
4590	B84743A0660S176	1	TDK
4720	B84743A1200S176	1	TDK

14 China RoHS Compliance

Figure 14.1 China RoHS Mark

The China RoHS mark is displayed on products containing six specified hazardous substances that are in excess of regulatory limits, based on the “Administrative Measures for the Restriction of the Use of Hazardous Substances in Electrical and Electronic Products” and “Marking for the Restricted Use of Hazardous Substances in Electronic and Electrical Products” (SJ/T 11364-2014), which were promulgated on January 26, 2016. The number displayed in the center of the mark indicates the environment-friendly use period (number of years) in which electrical and electronic products that are being produced, sold, or imported to China can be used. The date of manufacture of the electrical and electronic product is the starting date of the environment-friendly use period for the product. The six specified hazardous substances contained in the product will not leak outside of the product during normal use within this period and will have no serious impact on the environment, the human body, or property.

The environment-friendly use period for this product is 15 years. This period is not the product warranty period.

◆ Information on Hazardous Substances in This Product

Table 14.1 shows the details on hazardous substances contained in this product.

Table 14.1 Contents of Hazardous Substances in This Product

Parts Name	Hazardous Substances					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
Circuit Board	×	○	○	○	○	○
Electronic Parts	×	○	○	○	○	○
Brass Screw	×	○	○	○	○	○
Aluminum Die Casting	×	○	○	○	○	○

This table has been prepared in accordance with the provisions outlined in SJ/T 11364.
○: Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below or equal to the limit requirement of GB/T 26572.
×: Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.
Note:
This product complies with EU RoHS directives. In this table, "×" indicates that hazardous substances that are exempt from EU RoHS directives are contained.

15 对应中国RoHS指令

图 15.1 中国RoHS标志

中国RoHS标志依据2016年1月26日公布的《电器电子产品有害物质限制使用管理办法》，以及《电子电气产品有害物质限制使用标识要求》（SJ/T 11364-2014）作成。电子电气产品中特定6种有害物质的含量超过规定值时，应标识此标志。中间的数字为在中国生产销售以及进口的电子电气产品的环保使用期限（年限）。电子电气产品的环保使用期限从生产日期算起。在期限内，正常使用产品的过程中，不会有特定的6种有害物质外泄进而对环境、人和财产造成深刻影响。

本产品的环保使用期限为15年。但需要注意的是环保使用期限并非产品的质量保证期限。

◆ 本产品中含有有害物质的信息

本产品中所含有害物质的详细信息如表 15.1所示。

表 15.1 本产品中有害物质的名称及含量

部件名称	有害物质					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
实装基板	×	○	○	○	○	○
电子元件	×	○	○	○	○	○
黄铜螺钉	×	○	○	○	○	○
铝压铸	×	○	○	○	○	○

本表格依据SJ/T 11364的规定编制。
○:表示该有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下。
×:表示该有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。
（注） 本产品符合欧盟RoHS指令。上表中的"×"表示含有欧盟RoHS指令豁免的有害物质。

16 Safe Disable Input

This section gives precautions to support the Safe Disable input. Contact Yaskawa for more information.

The safety function complies with the standards shown in Table 16.1.

Table 16.1 Safety Standards and Applicable Harmonized Standards

Safety Standards	Applicable Harmonized Standards
Functional Safety	• IEC/EN 61508-1,2 (SIL3) • IEC/EN IEC 62061 (SIL3) • IEC/EN 61800-5-2 (SIL3)
Safety of Machinery	ISO/EN ISO 13849-1:2015 (Cat.3, PL e)
EMC	• IEC/EN 61000-6-7 • IEC/EN 61326-3-1
LVD	IEC/EN 61800-5-1

Note:

SIL = Safety Integrity Level.

◆ Safe Disable Specifications

The Safe Disable input provides the stop function that complies with “Safe Torque Off” as specified by IEC/EN 61800-5-2. The Safe Disable input meets the requirements of EN ISO 13849-1 and IEC/EN 61508. It also has a safety status monitor to detect safety circuit errors.

When you install the drive as a component in a system, you must make sure that the system complies with the applicable safety standards.

Refer to Table 16.2 for safety function specifications.

Table 16.2 Safe Disable Specifications

Item		Description	
Input/Output		• Input: 2 Safe Disable input (H1, H2) Signal ON level: 18 Vdc to 28 Vdc Signal OFF level: -4 Vdc to +4 Vdc • Output: 1 MFDO safety monitor output for external device monitor (EDM)	
Response time from when the input opens to when the drive output stops		3 ms or less	
Response time from when the H1 and H2 terminal inputs open to when the EDM signal operates		20 ms or less	
Mission time *1		10 years	20 years
Failure probability	Less frequent operation request mode	PFD = $9.28E^{-6}$	PFD = $1.84E^{-5}$
	Frequent operation request mode or continuous mode	PFH = $1.19E^{-9}$	PFH = $1.19E^{-9}$
Performance level		e	
HFT (hardware fault tolerance)		N = 1	
Type of subsystem		Type B	
MTTFD		High (2410 years)	
DCavg		Medium (91.24%)	

*1 Parameter used for the statistical calculation required by functional safety standards and this is not linked to the warranty / guarantee period.

Note:

EDM = External Device Monitoring

PFD = Probability of Failure on Demand

PFH = Probability of Dangerous Failure per Hour

◆ Notes

⚠ DANGER *Sudden Movement Hazard. When you use the Safe Disable function in the safety system of a machine, do a full risk assessment for the system to make sure that all parts of the system comply with applicable safety standards. Incorrect application of the Safe Disable function can cause serious injury or death.*

⚠ DANGER *Sudden Movement Hazard. If the output circuit of the drive is damaged and the Safe Disable function turns OFF the drive output to a permanent magnet (PM) motor, the motor can rotate 180 electrical degrees. Prevent damage to equipment and injury to personnel during this condition. Sudden motor movement can cause serious injury or death. It is possible for current to flow through the motor winding in these conditions.*

⚠ DANGER *Electrical Shock Hazard. You cannot depend on the Safe Disable function to prevent electrical shock. Disconnect all power to the drive and wait for the time specified on the warning label before you remove covers. Check the drive for dangerous voltages before servicing or repair work. If you do work on the drive when it is energized and there is no cover over the electronic circuits, it can cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Although the Safe Disable function is in operation, gravity or other external forces in the vertical axis can move the motor. Incorrect application of the Safe Disable function can cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Do not use the drive output signals to control external holding brakes or dynamic brakes for functional safety. Use a system that conforms to the functional safety requirements. Incorrect application of the Safe Disable function can cause serious injury or death. Systems that use drive output signals (including EDM) for safety are not safe because drive output signals are not safety components.*

⚠ WARNING *Sudden Movement Hazard. Connect the Safe Disable inputs to the devices as specified by the safety requirements. If you connect the Safe Disable inputs incorrectly, it can cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. To use the Safe Disable inputs, remove the jumpers between terminals H1-HC and H2-HC. If the Safe Disable circuit does not work correctly, it can cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. When you clear the Safe Disable input, make sure that the Safe Disable Monitor output operates correctly as the specification for Safe Disable function. If the Safe Disable circuit does not operate correctly, it can cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Regularly examine the Safe Disable input and all other safety features. A system that does not operate correctly can cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Only let approved personnel who know about the drive, instruction manual, and safety standards wire, examine, and maintain the Safe Disable input. If personnel are not approved, it can cause serious injury or death.*

⚠ WARNING *Sudden Movement Hazard. Only use the Safe Disable Monitor (multi-function output terminal set to the EDM function) to monitor the Safe Disable status or to find a malfunction in the Safe Disable inputs. The monitor output is not a safety output. If you use the Safe Disable Monitor incorrectly, it can cause death or serious injury.*

Note:
- Drives that have a built-in safety function must be replaced 10 years after first use.
- Safe Disable input wiring should not exceed 30 m.
- A maximum of 3 ms will elapse from when terminals H1 or H2 shut off until the drive switches to the “Safe Torque Off” status. Set the OFF status for terminals H1 and H2 to hold for at least 3 ms. The drive may not be able to switch to the “Safe Torque Off” status if terminals H1 and H2 are only open for less than 2 ms.

◆ Using the Safe Disable Function

■ Safe Disable Circuit

The Safe Disable circuit has two isolated channels (terminals H1 and H2) that stop the output transistors. The input can use the internal power supply of the drive.

Set the EDM function to one of the MFDO terminals *[H2-xx = 21 or 121]* to monitor the status of the Safe Disable function. This is the “Safe Disable monitor output function”.

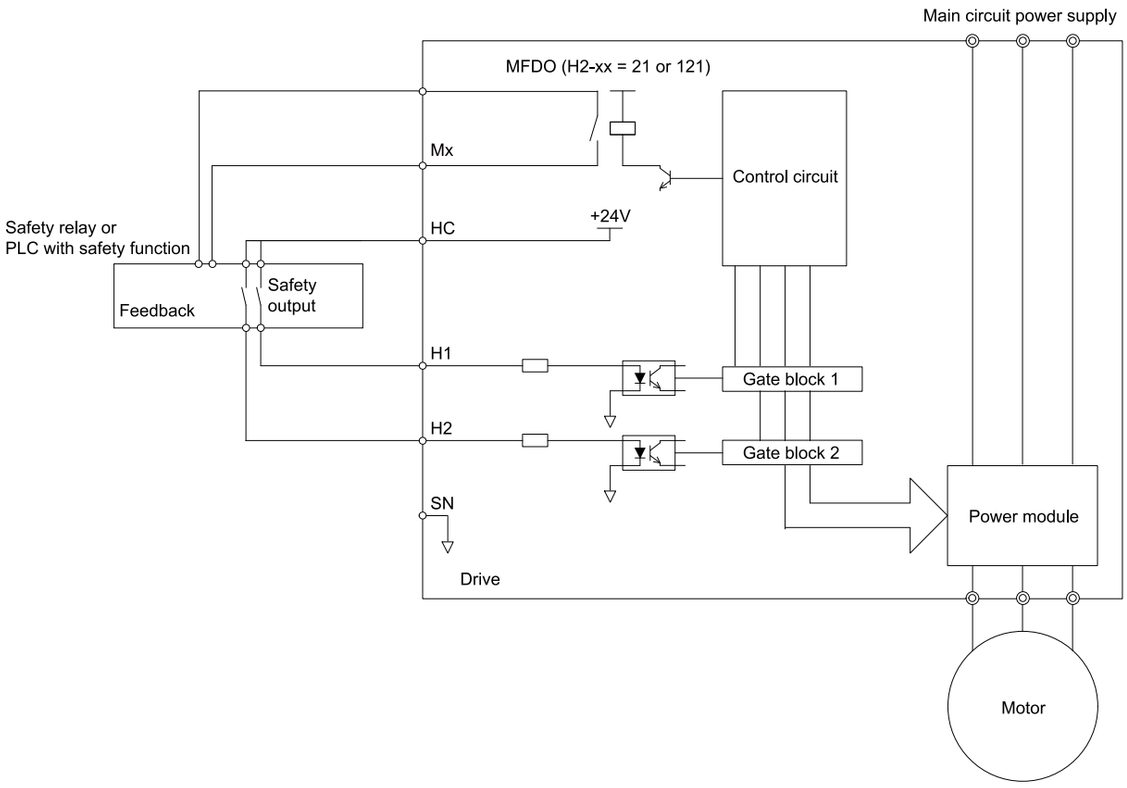


Figure 16.1 Safe Disable Function Wiring Example

■ Connect Safe Disable Input Contacts to Multiple Drives

To Use the Drive Internal Power Supply

Figure 16.2 shows an example of how to connect Safe Disable contacts.

Use terminals HC-SN on drive 1 to supply the power for the Safe Disable function on the applicable drives. These conditions limit the number of drives that you can connect:

- Internal power supply capacity
- Number of MFDIs used
- Supply current to the external sensors

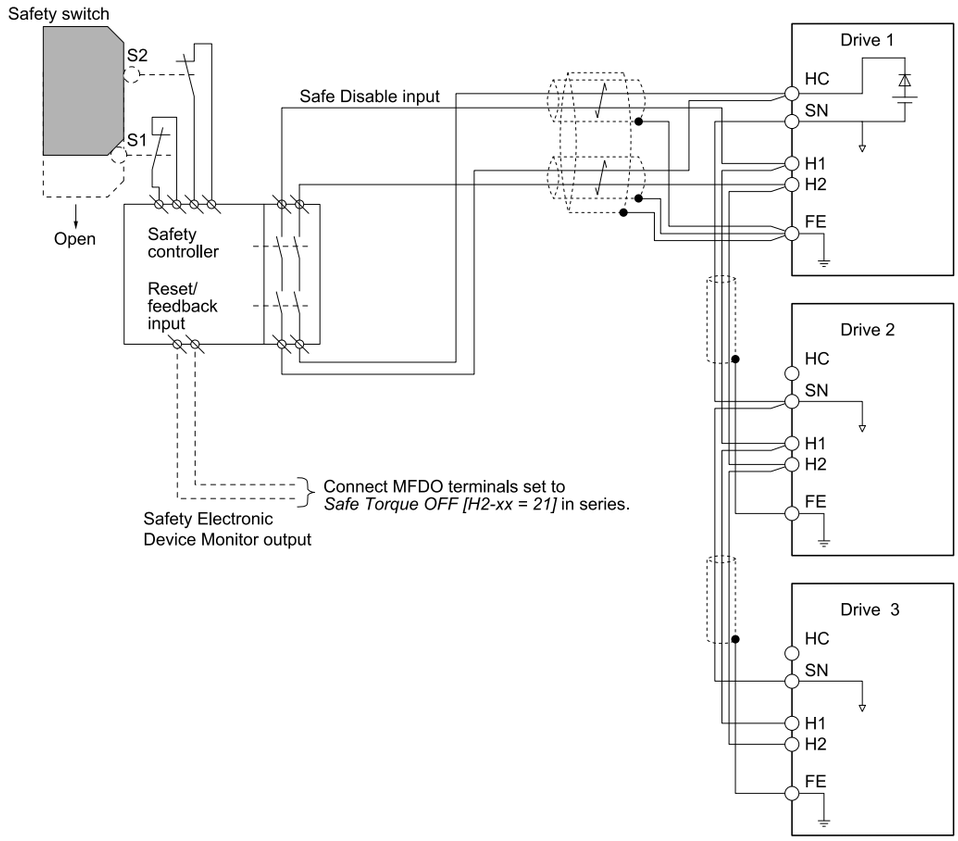


Figure 16.2 Connection Example to Use the Internal Power Supply

To Use 24 V External Power Supply

Figure 16.3 shows an example of how to connect Safe Disable contacts. These conditions limit the number of drives that you can connect:

- External power supply capacity
- Number of MFDIs used
- Supply current to the external sensors

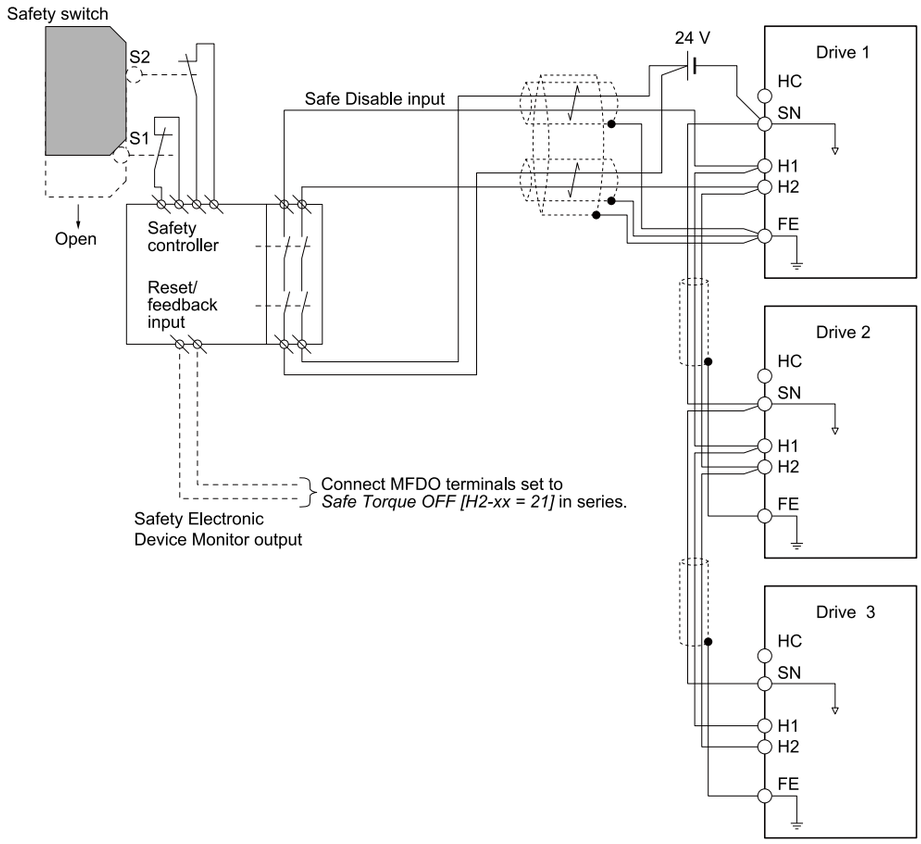


Figure 16.3 Connection Example to Use 24 V External Power Supply

The Number of Possible Units to Connect

Power Supply	MFDI	24 V Output	+P Output	Number of Drive Units
Internal power supply (Drive 1)	Yes (8-channel input)	Yes *1	Yes *1	1
		No	No	25
	No	Yes *1	Yes *1	4
		No	No	29
External power supply	-			Different for different external power supply capacities *2

*1 This is when you use a maximum of 150 mA.
*2 24 V, 12 mA is necessary for each drive.

Use this formula to calculate the number of units to connect:

$$n = (Io_{max} - I_{MFDI} \times n_{MFDI} - I_{sensor} - I_{+P}) / I_{safety}$$

- n: Number of units to connect
- Io_{max}: Maximum current that can be supplied from the power supply (354 mA for the internal power supply)
- I_{MFDI}: Current consumed per MFDI (6 mA)
- n_{MFDI}: Maximum number of MFDIs that can be activated at the same time (maximum of 7-channel)
- I_{sensor}: Current externally supplied for sensor power supply (maximum of 150 mA)
- I_{+P}: Current externally supplied for sensor power supply (maximum of 150 mA)
- I_{safety}: Current consumed by Safe Disable terminals H1 and H2 (12 mA)

Note:
Round the values off to the first decimal place.

■ Enabling and Disabling the Drive Output (“Safe Torque Off”)

Refer to Figure 16.4 for an example of drive operation when the drive changes from “Safe Torque Off” status to usual operation.

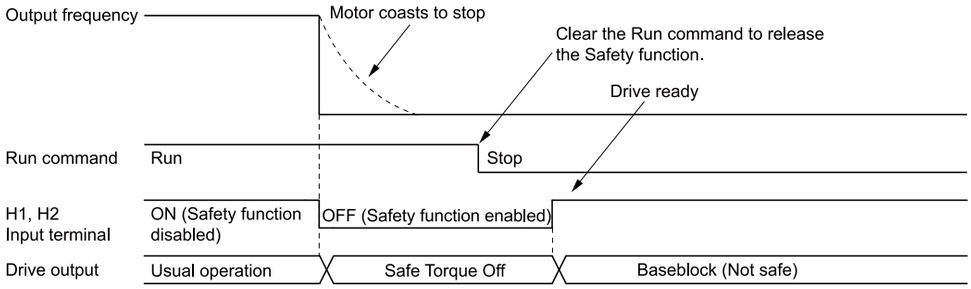


Figure 16.4 Safe Disable Operation

Switching from Usual Operation to “Safe Torque Off”

Turn OFF (open) safety input terminal H1 or H2 to enable the Safe Disable function. When the Safe Disable function is enabled while the motor is operating, the drive output and motor torque turn off and the motor always coasts to stop. The *b1-03 [Stopping Method Selection]* setting does not have an effect on the stopping method.

The “Safe Torque Off” status is only possible with the Safe Disable function. Clear the Run command to stop the drive. Turning off drive output (a baseblock condition) ≠ “Safe Torque Off”.

Note:

- When it is necessary to ramp to stop the motor, do not turn off terminals H1 and H2 until the motor fully stops. This will prevent the motor from coasting to stop during usual operation.
- A maximum of 3 ms will elapse from when terminals H1 or H2 shut off until the drive switches to the “Safe Torque Off” status. Set the OFF status for terminals H1 and H2 to hold for at least 2 ms. The drive may not be able to switch to the “Safe Torque Off” status if terminals H1 and H2 are only open for less than 2 ms.

Going from “Safe Torque Off” to Usual Operation

The safety input will only release when there is no Run command.

- During Stop
  When the Safe Disable function is triggered during stop, close the circuit between terminals H1-HC and H2-HC to disable “Safe Torque Off”. Enter the Run command after the drive stops correctly.
- During Run
  When the Safe Disable function is triggered during run, close the circuit between terminals H1-HC and H2-HC to disable “Safe Torque Off” after clearing the Run command. Enter the Stop command, then enter the Run command when terminals H1 and H2 are ON or OFF.

■ Safe Disable Monitor Output Function and Keypad Display

Refer to Table 16.3 for information about the relation between the input channel status, Safety monitor output status, and drive output status.

Table 16.3 Safe Disable Input and External Device Monitor (EDM) Terminal Status

Input Channel Status	Input 1 (H1-HC)	ON (Close the circuit)	OFF (Open)	ON (Close the circuit)	OFF (Open)
	Input 2 (H2-HC)	ON (Close the circuit)	ON (Close the circuit)	OFF (Open)	OFF (Open)
MFDO Terminal (H2-xx = 21)	MFDO Terminal (H2-xx = 21)	OFF	OFF	OFF	ON
	MFDO Terminal (H2-xx = 121)	ON	ON	ON	OFF
Drive Output Status		Baseblock (Drive ready)	Safety status (STo)	Safety status (STo)	Safety status (STo)
Keypad Display		Normally displayed	SToF (Flashing)	SToF (Flashing)	STo (Flashing)
LED Status Ring		Ready: Illuminated	ALM/ERR: Flashing	ALM/ERR: Flashing	Ready: Flashing
MEMOBUS Register 0020 (Hex.)		bit C: 0 bit D: 0	bit C: 1 bit D: 0	bit C: 1 bit D: 0	bit C: 0 bit D: 1

Safety Function Status Monitor

The drive Safety monitor output sends a feedback signal about the status of the Safety function. The Safety monitor output is one of the possible settings available for the MFDO terminals. If there is damage to the Safe Disable circuit, a controller (PLC or safety relay) must read this signal as an input signal to hold the “Safe Torque Off” status. This will help verify the condition of the safety circuit. Refer to the manual for the safety device for more information about the Safety function.

You can use the MFDO function settings to switch the polarity of the Safety monitor output signal. Refer to Table 16.3 for setting instructions.

Keypad Display

If the two input channels are OFF (Open), the keypad will flash *STo [Safe Torque OFF]*.

If there is damage to the Safe disable circuit or the drive, the keypad will flash *SToF [Safe Torque OFF Hardware]* when one input channel is OFF (Open) and the other is ON (Close the circuit). When you use the Safe disable circuit correctly, the keypad will not show *SToF*.

If there is damage to the drive, the keypad will show *SCF [Safety Circuit Fault]* when the drive detects a fault in the Safe disable circuit. Refer to the chapter on Troubleshooting for more information.

■ Validating the Safe Disable Function

After you replace parts or do maintenance on the drive, first complete all necessary wiring to start the drive, then test the Safe Disable input with these steps. Keep a record of the test results.

Note:

Validate the Safe Disable function at least one time every three months to guarantee the specification values of the safety parameters.

1. When the two input channels are OFF (Open), make sure that the keypad flashes *STo [Safe Torque OFF]*, and make sure that the motor is not running.
2. Monitor the ON/OFF status of the input channels and make sure that MFDO set to the EDM function operates as shown in Table 16.3.
   If one or more of these items are true, the ON/OFF status of the MFDO may not display correctly on the keypad:
   - Incorrect parameter settings.
   - A problem with an external device.
   - The external wiring has a short circuit or is disconnected.
   - There is damage to the device.

   Find the cause and repair the problem to correctly display the status.
3. Make sure that the EDM signal operates during usual operation as shown in Table 16.3.

17 Seismic Standards

The Yaskawa drives in this manual are capable of structurally and operationally withstanding the seismic response criteria as defined in the International Building Code (IBC), ASCE7, and California Department of Health Care Access and Information (HCAI).

The models in this manual were tested in compliance with AC-156 to meet the IBC seismic certification as shown on the certification labels.

Note:

Models 2143xV/T,2169xV/T,4124xT,4156xV/T are excluded.

Refer to the label on your product for the applicable IBC year(s).

Figure 17.1 Seismic Certification Label Example for Drives

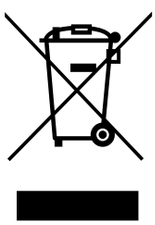
18 Disposal Instructions

Correctly discard the drive, packing material, battery, and microSD card as specified by regional, local, and municipal laws and regulations for this product.

Note:

- Remove the battery and microSD card from the keypad before you discard the drive.
- You cannot recycle the battery. Discard used batteries as specified by the battery manufacturer.
- Customers are responsible for microSD card data protection.
  PC functions that format and delete the data may not be sufficient to fully erase the microSD card data. Yaskawa recommends that customers physically destroy the microSD card in a shredder or use data wipe software to fully erase the card.

◆ WEEE Directive



The wheelie bin symbol on this product, its manual, or its packaging identifies that you must recycle it at the end of its product life.

You must discard the product at an applicable collection point for electrical and electronic equipment (EEE). Do not discard the product with usual waste.

19 Maintenance

Refer to the Maintenance & Troubleshooting Manual (TOEPYAIWM6503) for more information.

Only let authorized persons do maintenance, examine, or replace components on the drive.

Read this manual carefully and know all the precautions and safety information before installing, wiring, repairing, or examining the drive or replacing components.

Examine and maintain the drive and peripheral devices regularly to extend the life of the drive and decrease performance deterioration, decrease early wear, and decrease drive failures.

Regular examinations and maintenance will also decrease system downtime.

Refer to the User Manual (SIEPYAIWM6502) for more information about maintenance and examinations.

Examine the drive one time each year at a minimum.

The operating conditions, environmental conditions, and use conditions will have an effect on the examination frequency for connected equipment.

Examine the drive more frequently if you use the drive in bad conditions or in these conditions:

- High ambient temperatures
- Frequent starting and stopping
- Changes in the AC power supply or load
- Too much vibration or shock loading
- Dust, metal dust, salt, sulfuric acid, or chlorine atmospheres
- Unsatisfactory storage conditions.

The drive has Maintenance Monitors that monitor component wear and give warnings when the performance life estimate is approaching. When you use the maintenance monitors, you remove the need to shut down all system components when you have problems. Refer to these monitors:

- *U4-04 [Cool Fan Maintenance]*
- *U4-05 [Capacitor Life Mon]*
- *U4-07 [IGBT Maintenance]*

You can set alarm notifications to inform you about the maintenance periods for specific drive components. Refer to these Maintenance setting parameters:

- *o4-05 [Capacitor Maintenance Setting]*
- *o4-07 [Softcharge Relay Maintenance Set]*
- *o4-09 [IGBT Maintenance Setting]*

20 Troubleshooting

Refer to the Maintenance & Troubleshooting Manual (TOEPYAIWM6503) for more information.

If the drive or motor do not operate correctly, look at the drive keypad for fault and alarm information.

- For drive faults:
  - The keypad shows the fault code.
  - When *o2-24 = 0 or 1 [LED Light Function Selection = Enable Status Ring & Keypad LED or LED Status Ring Disable]*, ALM and ALM/ERR on the LED Status Ring illuminate continuously.
  - The drive shuts off output and the fault relay output activates. The motor coasts to stop.
- For drive alarms:
  - The keypad shows the alarm code.
  - When *o2-24 = 0 or 1*, ALM and ALM/ERR on the LED Status Ring flash.
  - Usually, the drive will continue to operate the motor. Some alarms let you select a motor stopping method.

Note:

If there is no information on the display when you energize the keypad, there can be a connection error. Remove the keypad and connect it again to make sure that you correctly connected the connection cable between the drive and the keypad.

◆ Fault Reset

1. Remove the cause of the fault or alarm.
2. While the keypad is showing the fault or alarm code, push F1 (RESET) or > on the keypad.

◆ Fault

This section gives information about some of the causes and possible solutions of faults. You must use the Fault Reset operation to remove the fault before you can operate the drive. Use the information in this table to remove the cause of the fault.

Code	Name	Causes	Possible Solutions
Accum	Accumulated Level Reached	Accumulated volume has is more than the *Y6-11* to *Y6-14* settings and *Y6-15 = 2 or 3 [Accumulated Volume Behavior = Fault (and Digital Output) or Fault + MFDO + Accum Reset]*	Set *Y6-05 = 7770 [Flow Accumulation Set Reset = Reset Accumulation]* or via Reset Accumulation digital input).
AJF	Anti-Jam Fault	The drive could not clear the debris from the impeller in fewer than the number of tries set in *Y7-02 [Anti-Jam Cycle Count]*. Display text for Anti-Jam function is set to Anti-Jam *[Y7-09 = 0]*.	• Check for correct pump operation. • Adjust the *Y7-03 [AJ Detection Current Lvl @ Start]* level or the *Y7-02* counts. • If text is incorrect check *Y7-09 [Anti-Jam Display Text Selection]*.
AuxFB	PI Aux Feedback Level Loss	The analog input from the terminal set for *PI Auxiliary Control Feedback Level [H3-xx = 27]* is more than 21 mA or less than 3 mA for longer than 1 s.	Repair transducer or wiring.
bAT	Keypad Battery Low Voltage	The keypad battery voltage is low.	Replace the keypad battery.
bCE	Bluetooth Communication Fault	The smartphone or tablet with DriveWizard Mobile or DriveWizard installed is too far from the keypad.	Use the smartphone or tablet 10 m (32.8 ft) or nearer to the keypad. **Note:** *bCE* can occur when the smartphone or tablet is 10 m (32.8 ft) or nearer to the keypad depending on the specifications of the smartphone or tablet.
		Radio waves from a different device are causing interference with communications between the smartphone or tablet and keypad.	Make sure that no device around the keypad uses the same radio bandwidth (2400 MHz to 2480 MHz), and prevent radio interference.
bUS	Option Communication Error	The drive did not receive a signal from the controller.	Correct wiring errors.
		The communications cable wiring is incorrect.	
		There is a short-circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.

Code	Name	Causes	Possible Solutions
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The option is incorrectly installed to the drive.	Correctly install the option to the drive.
		The option is damaged.	If the fault continues and the wiring is correct, replace the option.
CE	Modbus Communication Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
CoF	Current Offset Fault	The drive starts operation while the induced voltage stays in the motor (during coasting to a stop or after fast deceleration).	• Make a sequence that does not restart operation when induced voltage stays in the motor. • Set *b3-01 = 1 [Speed Search at Start Selection = Enabled]*. • Use *Speed Search from Fmax or Fref [H1-xx = 61, 62]* to do a speed search through one of the external terminals. **Note:** When controlling the PM motor, External Speed Search commands 1 and 2 operate the same.
		A drive hardware problem occurred.	• Do a Fault Reset to clear the fault or de-energize the drive. • If the fault stays, replace the drive.
CPF00	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF01	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF02	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF03	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF06	Control Circuit Error (EEPROM memory Data Error)	The drive power supply was de-energized while a communication option entered a parameter Write command.	Set *A1-03 = 2220, 3330 [Initialize Parameters = 2-Wire Initialization, 3-Wire Initialization]* and initialize the drive.
		An EEPROM peripheral circuit error occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about how to replace the control board, contact Yaskawa or your nearest sales representative.
CPF07	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF08	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Code	Name	Causes	Possible Solutions
CPF11	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF12	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF13	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF14	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF16	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF17	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF18	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF19	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF20	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF21	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF22	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF23	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF24	Control Circuit Error (Drive Unit Signal Fault)	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF26	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF27	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF28	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF29	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.

Code	Name	Causes	Possible Solutions
CPF30	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF31	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF32	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF33	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF34	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF35	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF36	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF37	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF38	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
CPF39	Control Circuit Error	A drive hardware problem occurred.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
dEv	Speed Deviation	The load is too heavy.	Decrease the load.
		Acceleration and deceleration times are set too short.	Increase the values set in *C1-01 to C1-04 [Acceleration/ Deceleration Time]*.
		The *dEv* detection level settings are incorrect.	Adjust *F1-10 [Speed Deviation Detection Level]* and *F1-11 [Speed Deviation Detect DelayTime]*.
		The load is locked up.	Examine the machine.
		The holding brake is stopping the motor.	Release the holding brake.
DIFF	Differential Feedback Exceeded	The difference between the PID Feedback and *Differential Level Source [H3-xx = 2D]* is more than the level set in *Y4-18 [Differential Level]* for the time set in *Y4-19 [Differential Lvl Detection Time]*.	• Replace the feedback transducer or transducers. • Make sure that the settings of *Y4-18 [Differential Level] to Y4-20 [Differential Level Detection Sel]* are correct.
DRF	De-Rag Fault	The drive could not clear the debris from the impeller in fewer than the number of tries set in *Y7-02 [Anti-Jam Cycle Count]*. Display text for Anti-Jam function is set to De-Rag *[Y7-09 = 1]*.	• Check for correct pump operation. • Adjust the *Y7-03 [AJ Detection Current Lvl @ Start]* level or the *Y7-02* counts. • If text is incorrect check *Y7-09 [Anti-Jam Display Text Selection]*.
dv7	Polarity Judge Timeout	There is a disconnection in the motor coil winding.	Measure the motor line-to-line resistance and replace the motor if a coil is disconnected.
		The screws on the drive output terminals are loose.	Tighten the terminal screws to the correct tightening torque.
dWF1	EEPROM Memory DWEZ Data Error	There is an error in the EEPROM peripheral circuit.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		There is a problem with the EEPROM data.	Set *A1-03 = 2220, 3330 [Initialize Parameters = 2-Wire Initialization, 3-Wire Initialization]* to initialize the drive, then upload the DriveWorksEZ project to the drive again.

Code	Name	Causes	Possible Solutions
dWFL	DriveWorksEZ Fault	There was a fault in the DriveWorksEZ program.	Examine the DriveWorksEZ program and remove the cause of the fault. This is not a drive fault.
dWF2	DriveWorksEZ Fault 2	There was a fault in the DriveWorksEZ program.	Examine the DriveWorksEZ program and remove the cause of the fault. This is not a drive fault.
dWF3	DriveWorksEZ Fault 3	There was a fault in the DriveWorksEZ program.	Examine the DriveWorksEZ program and remove the cause of the fault. This is not a drive fault.
EF0	Option Card External Fault	The communication option received an external fault from the controller.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input from the controller.
		A programming error occurred on the controller side.	Examine the operation of the controller program.
EF1	Pump Fault (Terminal S1)	MFDI terminal S1 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S1.
		Pump Fault [H1-01 = 20 to 2B] is set to MFDI terminal S1, but the terminal is not in use.	Correctly set the MFDI.
EF2	Pump Fault (Terminal S2)	MFDI terminal S2 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S2.
		Pump Fault [H1-02 = 20 to 2B] is set to MFDI terminal S2, but the terminal is not in use.	Correctly set the MFDI.
EF3	Pump Fault (Terminal S3)	MFDI terminal S3 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S3.
		Pump Fault [H1-03 = 20 to 2B] is set to MFDI terminal S3, but the terminal is not in use.	Correctly set the MFDI.
EF4	Pump Fault (Terminal S4)	MFDI terminal S4 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S4.
		Pump Fault [H1-04 = 20 to 2B] is set to MFDI terminal S4, but the terminal is not in use.	Correctly set the MFDI.
EF5	Pump Fault (Terminal S5)	MFDI terminal S5 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S5.
		Pump Fault [H1-05 = 20 to 2B] is set to MFDI terminal S5, but the terminal is not in use.	Correctly set the MFDI.
EF6	Pump Fault (Terminal S6)	MFDI terminal S6 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S6.
		Pump Fault [H1-06 = 20 to 2B] is set to MFDI terminal S6, but the terminal is not in use.	Correctly set the MFDI.
EF7	Pump Fault (Terminal S7)	MFDI terminal S7 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S7.
		Pump Fault [H1-07 = 20 to 2B] is set to MFDI terminal S7, but the terminal is not in use.	Correctly set the MFDI.
EF8	Pump Fault (Terminal S8)	MFDI terminal S8 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S8.
		Pump Fault [H1-08 = 20 to 2B] is set to MFDI terminal S8, but the terminal is not in use.	Correctly set the MFDI.

Code	Name	Causes	Possible Solutions
Err	EEPROM Write Error	There was a problem with the EEPROM hardware.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. Contact Yaskawa or your nearest sales representative to replace the board.
		Electrical interference corrupted the data while it was writing to the EEPROM of the drive.	• Push ENTER Key. • Set the parameters again.
FAn1	Drive Cooling Fan Fault	The cooling fan stopped operating correctly.	• Examine cooling fan operation. • Re-energize the drive. • Examine *U4-03 [Fan Elapsed Time]* and *U4-04 [Fan Life Mon]*. If the performance life of the cooling fan is expired or if there is damage to the fan, replace the fan.
		The circulation fan is damaged.	• Examine circulation fan operation. • Re-energize the drive. • Examine *U4-03 [Fan Elapsed Time]* and *U4-04 [Fan Life Mon]*. If there is damage to the circulation fan or if the performance life of the fan is expired, replace the fan.
FDBKL	WIRE Break	The analog input from the terminal set for *PID Feedback [H3-xx = B]* is more than 21mA or less than 3mA for longer than 1 s in these conditions: • *b5-82 = 2 [Feedback Loss 4 ~ 20mA Detect Sel = Fault]* • *b5-01 ≠ 0 [PID Mode Setting ≠ Disabled]* • *H3-01, H3-09, or H3-05 = 2 [Terminal A1/A2/A3 Signal Level Selection = 4 to 20 mA]*	Make sure that you install the PID feedback source and it operates correctly.
GF	Ground Fault	Overheating caused damage to the motor or the motor insulation is not satisfactory.	Measure the motor insulation resistance, and replace the motor if there is electrical conduction or unserviceable insulation.
		The motor main circuit cable is contacting ground to make a short circuit.	• Examine the motor main circuit cable for damage, and repair short circuits. • Measure the resistance between the motor main circuit cable and the ground terminal. If there is electrical conduction, replace the cable.
		An increase in the stray capacitance of the cable and the ground terminal caused an increase in the leakage current.	• If the wiring length of the cable is more than 100 m, decrease the carrier frequency. • Decrease the stray capacitance.
		There was a problem with the drive hardware.	Replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
HFB	High Feedback Sensed	The feedback level is more than the level set in *Y1-11 [High Feedback Level]* for the time set in *Y1-12 [High Feedback Lvl Fault Dly Time]*.	• Decrease the feedback level less than *Y1-11*. • Set *Y1-11* and *Y1-12* correctly.
HiAux	High PI Aux Feedback Level	PI Auxiliary Feedback is more than the level set in *YF-12 [PI Aux Control High Level Detect]* for the time set in *YF-13 [PI Aux High Level Detection Time]* in these conditions: • The drive is running. • The output frequency > 0.	• Decrease the PI Auxiliary Feedback level less than *YF-12*. • Set *YF-12* and *YF-13* correctly.
HiFlo	High Flow	Flow rate was more the level set in *Y6-17 [High Flow Level]* for longer than the time set in *Y6-18 [High Flow Detection Time]* and *Y6-19 = 2 or 3 [High Flow Behavior = Fault (and Digital Output) or Auto-Restart (time set by Y6-10)]*.	Reprogram *Y6-17* to *Y6-19* if flow rate is acceptable.
HiSuc	High Suction Pressure	Suction pressure is more than the level set in *YE-12 [High Suction Pressure Det Level]* for longer than the time set in *YE-13 [High Suction Pressure Det Time]*, and the drive is running (AUTO or HAND) and *YE-14 = 2 or 3 [High Suction Pressure Behavior = Fault (and Digital Output) or Auto-Restart (time set by YE-15)]*.	Decrease suction pressure.
HLCE	High Level Communication Errors	Communication data error occurred between the option and the master drive when you use Gateway function. The master drive detects *oFxxx* and the slave drive detects *HLCE*.	Examine the wiring between the option and the master drive and remove the cause of the fault.
HWL	High Water Level Digital Input	• The digital input terminal set to *H1-xx = BC [MFDI Function Selection = High Water Level]* activated or is defective. • The digital input terminal set to *H1-xx = 1BC [! High Water Level]* deactivated or is defective.	• Decrease the water level. • Adjust the terminal set to *H1-xx = BC or 1BC*.
LF	Output Phase Loss	The motor main circuit cable is disconnected.	Connect motor main circuit cable wiring. Correct wiring errors in the main circuit drive input power.

Code	Name	Causes	Possible Solutions
		There is a disconnection in the motor coil winding.	If a coil is disconnected, measure the motor Line-to-Line Resistance and replace the motor.
		The screws on the drive output terminals are loose.	Tighten the terminal screws to the correct tightening torque.
		The rated output current of the motor is less than 5% of the drive rated current.	Examine the drive capacity or the motor output to be applied.
		You are trying to use a single-phase motor.	The drive cannot operate a single-phase motor.
		The output transistor in the drive is damaged.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
LF2	Output Current Imbalance	Phase loss occurred in the wiring on the output side of the drive.	Examine for wiring errors or disconnected wires on the output side of the drive, and repair problems.
		The output terminal screws of the drive are loose.	Tighten the terminal screws to the correct tightening torque.
		There is not balance between the three phases of the PM motor impedance.	• Measure the Line-to-Line Resistance for each motor phase and make sure that resistance is equal in the three phases, and that all wires are connected correctly. • Replace the motor.
		The drive output circuit is broken.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
LFB	Low Feedback Sensed	The feedback level is less than the level set in *Y1-08 [Low Feedback Level]* for the time set in *Y1-09 [Low Feedback Lvl Fault Dly Time]*.	• Increase the feedback level to more than *Y1-08*. • Set *Y1-08* and *Y1-09* correctly.
LoAux	Low PI Aux Feedback Level	When the drive is running, PI Auxiliary Feedback is less than the level set in *YF-09 [PI Aux Control Low Lvl Detection]* for the time set in *YF-10 [PI Aux Control Low Lvl Det Time]*.	• Increase the PI Auxiliary Feedback level to be more than *YF-09*. • Set *YF-09* and *YF-10* correctly.
LOP	Loss of Prime	The drive used the *Y1-18 [Prime Loss Detection Method]* setting and measured a pump load that is less than the level set in *Y1-19 [Prime Loss Level]* for the time set in *Y1-20 [Prime Loss Time]*, and the output frequency is *Y1-21 [Prime Loss Activation Freq]* or more.	• Examine for a dry well, air in the system, or no water in the system. Use preferred priming method suggested by the pump manufacturer to restart the pump. • When there is resistance in the pump, let the system pump water again. • Set *Y1-18* to *Y1-21* correctly.
LoSuc	Low Suction Pressure	Suction pressure is less than the level set in *YE-09 [Low Suction Pressure Det Level]* for longer than the time set in *YE-10 [Low Suction Pressure Det Time]*, and the drive is running (AUTO or HAND) and *YE-11 = 2 or 3 [Low Suction Pressure Behavior = Fault (and Digital Output) or Auto-Restart (time set by YE-15)]*.	Increase suction pressure.
LowFl	Low Flow	Flow rate was below the level set in *Y6-06 [Low Flow Level]* for longer than the time set in *Y6-07 [Low Flow Detection Time]* and *Y6-09 = 2 or 3 [Low Flow Behavior = Fault (and Digital Output) or Auto-Restart (time set by Y6-10)]*.	Reprogram *Y6-06* to *Y6-09* if flow rate is acceptable.
LowWL	Low Water Level	Water level is below the level set in *Yd-09 [Low Water Level Detection Level]* for longer than the time set in *Yd-10 [Low Water Level Detection Time]*, and the drive is running (AUTO or HAND) with *Yd-11 = 2 or 3 [Low Water Level Behavior = Fault (and Digital Output) or Auto-Restart (time set by Yd-12)]*.	Increase the water level.
LWL	Low Water Level Digital Input	• The digital input terminal set to *H1-xx = BB [MFDI Function Selection = Low Water Level]* activated or is defective. • The digital input terminal set to *H1-xx = 1BB [! Low Water Level]* deactivated or is defective.	• Increase the water level. • Adjust the terminal set to *H1-xx = BB or 1BB*.
NMS	Setpoint Not Met	The feedback deviates from the setpoint at a level more than *Y1-15 [Maximum Setpoint Difference]* for the time set in *Y1-16 [Not Maintaining Setpoint Time]*.	• Examine for a blocked impeller, over cycling, or broken pipe. • Set *Y1-15* and *Y1-16* correctly.
nSE	Node Setup Error	The drive received a Run command while the Node Setup function was active.	Stop the drive when the Node Setup function is in use.
oC	Overcurrent	The load is too large.	• Measure the current flowing into the motor. • Replace the drive with a larger capacity model if the current value is more than the drive rated current. • Decrease the load or replace with a larger drive to prevent sudden changes in the current level.
		Overheating caused damage to the motor or the motor insulation is not satisfactory.	Measure the motor insulation resistance, and replace the motor if there is electrical conduction or unserviceable insulation.

Code	Name	Causes	Possible Solutions
		The motor main circuit cable is contacting ground to make a short circuit.	• Examine the motor main circuit cable for damage, and repair short circuits. • Measure the resistance between the motor main circuit cable and the ground terminal. If there is electrical conduction, replace the cable.
		A short circuit or ground fault on the drive output side caused damage to the output transistor of the drive.	• Make sure that there is not a short circuit in terminals - and terminals U/T1, V/T2, and W/T3. • If there is a short circuit, contact Yaskawa or your nearest sales representative.
		The acceleration time is too short.	• Calculate the torque necessary during acceleration related to the load inertia and the specified acceleration time. • Increase the values set in *C1-01 or C1-03 [Acceleration Times]* to get the necessary torque. • Increase the values set in *C2-01 to C2-04 [S-Curve Characteristics]* to get the necessary torque. • Replace the drive with a larger capacity model.
		The drive is trying to operate a specialized motor or a motor that is larger than the maximum applicable motor output of the drive.	• Examine the motor nameplate, the motor, and the drive to make sure that the drive rated current is larger than the motor rated current. • Replace the drive with a larger capacity model.
		A magnetic contactor was switched at the output.	Set the operation sequence to not turn ON or OFF the magnetic contactor while the drive is outputting voltage.
		The V/f pattern settings are incorrect.	• Examine the ratios between the V/f pattern frequency and voltage. Decrease the voltage if it is too high compared to the frequency. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*. For motor 2, adjust *E3-04 to E3-10*.
		The torque compensation gain is too large.	Decrease the value set in *C4-01 [Torque Compensation Gain]* to make sure that the motor does not stall.
		Electrical interference caused a problem.	Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference.
		The gain during overexcitation operation is too large.	• Find the time when the fault occurs. • If the fault occurs at the same time as overexcitation operation, decrease the value set in *n3-13 [OverexcitationBraking (OEB) Gain]* and consider the motor flux saturation.
		The drive received a Run command while the motor was coasting.	• Examine the sequence and input the Run command after the motor fully stops. • Set *b3-01 = 1 [Speed Search at Start Selection = Enabled]* or set *H1-xx = 61, 62 [Speed Search from Fmax or Fref]* to input speed search commands from the MFDI terminals.
		The motor code setting is incorrect for PM Control Methods.	• Enter the correct motor code to *E5-01 [PM Motor Code Selection]* as specified by the PM motor. • For specialized motors, refer to the motor test report and set *E5-xx [PM Motor Settings]* correctly.
		The current flowing in the motor is more than the value set in *L8-27 [Overcurrent Detection Gain]* for PM Control Methods.	Correct the value set in *L8-27*.
		The control method is set incorrectly for the motor.	Set *A1-02 [Control Method Selection]* correctly.
		The motor main circuit cable is too long.	Replace the drive with a larger capacity model.
		Speed search does not complete at start when *A1-02 = 8 [EZ Vector Control]* and you use an induction motor.	When *E9-01 = 0 [Motor Type Selection = Induction (IM)]*, set *b3-24 = 2 [Speed Search Method Selection = Current Detection Speed Search]*.
		The relay or contactor on the soft-charge bypass relay is damaged.	• Re-energize the drive. • If the fault stays, replace the control board or the drive.
		An overcurrent condition occurred during overexcitation deceleration.	• Decrease the value set in *n3-13 [OverexcitationBraking (OEB) Gain]*. • Decrease the value set in *n3-21 [HSB Current Suppression Level]*.
		You are using a premium efficiency motor.	Set these parameters: • *b3-03 [Speed Search Deceleration Time]* = default value × 2 • *L2-03 [Minimum Baseblock Time]* = default value × 2 • *L2-04 [Powerloss V/f Recovery Ramp Time]* = default value × 2
OD	Output Disconnect	The output circuit between the drive and the motor is open, and the drive output current is less than 5% of *E2-01 [Motor Rated Current (FLA)]*.	Close the disconnected output circuit between the drive and the motor.
oFA00	Option Not Compatible with Port	The option connected to connector CN5-A is not compatible.	Connect the option to the correct connector.

Code	Name	Causes	Possible Solutions
		• The DIP switches on the JOHB-SMP3 Multi-Protocol Ethernet Card are at factory default settings. • The DIP switches on the JOHB-SMP3 are not set to a valid protocol. • The DIP switches on the JOHB-SMP3 are set to a valid protocol that is not supported by the drive.	Remove power from the drive, wait for the charge light to go out, then set the DIP switches on the JOHB-SMP3 to the desired protocol.
		The option failed. Check the LED flash pattern on the option as specified by the option manual.	Replace the option.
oFA01	Option Fault/Connection Error	The option card connected to connector CN5-A is not compatible.	1. De-energize the drive. 2. Refer to the option card manual and correctly connect the option card to the connector on the drive.
oFA02	Duplicate Options	The same option cards or the same type of option cards are connected to connectors CN5-A and B.	Connect the option card to the correct connector.
oFA03	Diagnostic Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA04	Flash Write Mode	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA05	Option A/D Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA06	Option Communication Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA10	Option RAM Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA11	Option Ope Mode Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA12	Drive Receive CRC Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA13	Drive Receive Frame Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA14	Drive Receive Abort Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA15	Option Receive CRC Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA16	Option Receive Frame Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA17	Option Receive Abort Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.

Code	Name	Causes	Possible Solutions
oFA30	COM ID Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA31	Type Code Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA32	SUM Check Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA33	Option Receive Time Over	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA34	Memobus Time Over	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA35	Drive Receive Time Over 1	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA36	CI Check Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA37	Drive Receive Time Over 2	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA38	Control Reference Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA39	Drive Receive Time Over 3	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA40	CtrlResSel 1Err	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA41	Drive Receive Time Over 4	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA42	CtrlResSel 2Err	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFA43	Drive Receive Time Over 5	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb00	Option Not Compatible with Port	The option connected to connector CN5-B is not compatible.	Connect the option to the correct connector. **Note:** The communication options cannot connect to connector CN5-B.
oFb01	Option Fault/Connection Error	The option card connected to connector CN5-B was changed during operation.	1. De-energize the drive. 2. Refer to the option card manual and correctly connect the option card to the connector on the drive.

Code	Name	Causes	Possible Solutions
oFb02	Duplicate Options	The same option cards or the same type of option cards are connected to connectors CN5-A and B.	Connect the option card to the correct connector.
oFb03	Diagnostic Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb04	Flash Write Mode	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb05	Option A/D Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb06	Option Communication Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb10	Option RAM Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb11	Option Ope Mode Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb12	Drive Receive CRC Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb13	Drive Receive Frame Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb14	Drive Receive Abort Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb15	Option Receive CRC Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb16	Option Receive Frame Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oFb17	Option Receive Abort Error	A fault occurred in the option card.	1. De-energize the drive. 2. Make sure that the option card is correctly connected to the connector. 3. If the problem continues, replace the option card.
oH	Heatsink Overheat	The ambient temperature is high and the heatsink temperature of the drive is more than the value set in *L8-02 [Overheat Alarm Level]*.	• Measure the ambient temperature. • Increase the airflow in the control panel. • Install a cooling device (cooling fan or air conditioner) to lower the ambient temperature. • Remove objects near the drive that are producing too much heat.
		The load is too heavy.	• Measure the output current. • Decrease the load. • Decrease the value set in *C6-02 [Carrier Frequency Selection]*.
		The internal cooling fan of the drive stopped.	1. Use the procedures in this manual to replace the cooling fan. 2. Set *o4-03 = 0 [Fan Operation Time Setting = 0 h]*.

Code	Name	Causes	Possible Solutions
oH1	Heatsink Overheat	The ambient temperature is high and the heatsink temperature of the drive is more than the *oH1* detection level.	• Measure the ambient temperature. • Increase the airflow in the control panel. • Install a cooling device (cooling fan or air conditioner) to lower the ambient temperature. • Remove objects near the drive that are producing too much heat.
		The load is too heavy.	• Measure the output current. • Decrease the load. • Decrease the value set in *C6-02 [Carrier Frequency Selection]*.
oH3	Motor Overheat (PTC Input)	The thermistor wiring that detects motor temperature is defective.	Correct wiring errors.
		A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault
		The motor has overheated.	• Check the load level, acceleration/deceleration time, and motor start/stop frequency (cycle time). • Decrease the load. • Increase the values set in *C1-01 to C1-04 [Acceleration/ Deceleration Times]*. • Set *E2-01 [Motor Rated Current (FLA)]* correctly to the value specified by the motor nameplate. • Make sure that the motor cooling system is operating correctly, and repair or replace it if it is damaged. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*. For motor 2, adjust *E3-04 to E3-10*. Decrease the values set in *E1-08 [Mid Point A Voltage]* and *E1-10 [Minimum Output Voltage]*. **Note:** If the values set in *E1-08* and *E1-10* are too low, the overload tolerance will decrease at low speeds.
oH4	Motor Overheat Fault (PTC Input)	The motor has overheated.	• Check the load level, acceleration/deceleration time, and motor start/stop frequency (cycle time). • Decrease the load. • Increase the values set in *C1-01 to C1-04 [Acceleration/ Deceleration Times]*. • Set *E2-01 [Motor Rated Current (FLA)]* correctly to the value specified by the motor nameplate. • Make sure that the motor cooling system is operating correctly, and repair or replace it if it is damaged. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*. For motor 2, adjust *E3-04 to E3-10*. Decrease the values set in *E1-08 [Mid Point A Voltage]* and *E1-10 [Minimum Output Voltage]*. **Note:** If *E1-08* and *E1-10* are set too low, the overload tolerance will decrease at low speeds.
oL1	Motor Overload	The load is too heavy.	Decrease the load. **Note:** Reset *oL1* when *U4-16 [Motor oL1 Level]* < 100.
		The acceleration/deceleration times or cycle times are too short.	• Examine the acceleration/deceleration times and the motor start/stop frequencies (cycle times). • Increase the values set in *C1-01 to C1-04 [Acceleration/ Deceleration Times]*.
		Overload occurred while running at low speed.	• Decrease the load when running at low speed. • Increase the motor speed. • If the motor is run frequently at low speeds, replace the motor with a larger motor or use a drive-dedicated motor. **Note:** For general-purpose motors, overload can occur while running at low speed when operating at below the rated current.
		L1-01 [Motor Overload (oL1) Protection] is set incorrectly.	Set *L1-01* in as specified by the motor qualities for a drive-dedicated motor.
		The V/f pattern does not fit the motor qualities.	• Examine the ratios between the V/f pattern frequency and voltage. Decrease the voltage if it is too high compared to the frequency. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*. For motor 2, adjust *E3-04 to E3-10*. Decrease the values set in *E1-08 [Mid Point A Voltage]* and *E1-10 [Minimum Output Voltage]*. **Note:** If the values set in *E1-08* and *E1-10* are too low, the overload tolerance will decrease at low speeds.
		E1-06 [Base Frequency] is set incorrectly.	Set *E1-06* to the rated frequency shown on the motor nameplate.

Code	Name	Causes	Possible Solutions
		One drive is operating more than one motor.	Set *L1-01 = 0 [Motor Overload (oL1) Protection = Disabled]*, connect thermal overload relay to each motor to prevent damage to the motor.
		The electronic thermal protector qualities and the motor overload properties do not align.	• Examine the motor qualities and set *L1-01 [Motor Overload (oL1) Protection]* correctly. • Connect a thermal overload relay to the motor.
		The electronic thermal protector is operating at an incorrect level.	Set *E2-01 [Motor Rated Current (FLA)]* correctly to the value specified by the motor nameplate.
		There is increased motor loss from overexcitation operation.	• Lower the value set in *n3-13 [OverexcitationBraking (OEB) Gain]*. • Set *L3-04 ≠ 4 [Stall Prevention during Decel ≠ Overexcitation/ High Flux]*. • Set *n3-23 = 0 [Overexcitation Braking Operation = Disabled]*.
		The speed search-related parameters are set incorrectly.	• Examine the settings for all speed search related parameters. • Adjust *b3-03 [Speed Search Deceleration Time]*. • Set *b3-24 = 1 [Speed Search Method Selection = Speed Estimation]* after Auto-Tuning.
		Phase loss in the input power supply is causing the output current to change.	Make sure that there is no phase loss, and repair problems.
		Overload occurred during overexcitation deceleration.	• Decrease the value set in *n3-13 [OverexcitationBraking (OEB) Gain]*. • Decrease the value set in *n3-21 [HSB Current Suppression Level]*.
oL2	Drive Overload	The load is too large.	Decrease the load.
		The acceleration/deceleration times or cycle times are too short.	• Examine the acceleration/deceleration times and the motor start/ stop frequencies (cycle times). • Increase the values set in *C1-01 to C1-04 [Acceleration/ Deceleration Times]*.
		The V/f pattern does not fit the motor qualities.	• Examine the ratios between the V/f pattern frequency and voltage. Decrease the voltage if it is too high compared to the frequency. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*. Decrease the values set in *E1-08 [Mid Point A Voltage]* and *E1-10 [Minimum Output Voltage]*. For motor 2, adjust *E3-04 to E3-10*. **Note:** If the values set in *E1-08* and *E1-10* are too low, the overload tolerance will decrease at low speeds.
		The drive capacity is too small.	Replace the drive with a larger capacity model.
		Overload occurred while running at low speed.	• Decrease the load when running at low speed. • Replace the drive with a larger capacity model. • Decrease the value set in *C6-02 [Carrier Frequency Selection]*.
		The torque compensation gain is too large.	Decrease the value set in *C4-01 [Torque Compensation Gain]* to make sure that the motor does not stall.
		The speed search-related parameters are set incorrectly.	• Examine the settings for all speed search-related parameters. • Adjust *b3-03 [Speed Search Deceleration Time]*. • Set *b3-24 = 1 [Speed Search Method Selection = Speed Estimation]* after Auto-Tuning.
		Phase loss in the input power supply is causing the output current to change.	• Correct errors with the wiring for main circuit drive input power. • Make sure that there is no phase loss, and repair problems.
		Overload occurred during overexcitation deceleration.	• Decrease the value set in *n3-13 [OverexcitationBraking (OEB) Gain]*. • Decrease the value set in *n3-21 [HSB Current Suppression Level]*.
oL3	Overtorque Detection 1	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Torque Detection Level 1]* and *L6-03 [Torque Detection Time 1]* settings.
oL4	Overtorque Detection 2	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Torque Detection Level 2]* and *L6-06 [Torque Detection Time 2]* settings.

Code	Name	Causes	Possible Solutions
oL7	High Slip Braking Overload	The load inertia is too large.	Decrease deceleration times in *C1-02 and C1-04 [Deceleration Times]* for applications that do not use High Slip Braking.
		An external force on the load side rotated the motor.	
		Something is preventing deceleration on the load side.	
		The value set in *n3-04 [HSB Overload Time]* is too small.	• Increase the value set in *n3-04*. • Connect a thermal overload relay to the motor, and set *n3-04 = 1200 s (maximum value)*.
oPr	Keypad Connection Fault	The keypad is not securely connected to the connector on the drive.	Examine the connection between the keypad and the drive.
		The connection cable between the drive and the keypad is disconnected.	• Remove the keypad and connect it again. • If the cable is damaged, replace it.
oS	Overspeed	There is overshoot.	Decrease *C5-01 [ASR Proportional Gain 1]* and increase *C5-02 [ASR Integral Time 1]*.
ov	Overvoltage	Deceleration time is too short and regenerative energy is flowing from the motor into the drive.	• Set *L3-04 = 1 [Stall Prevention during Decel = General Purpose]*. • Increase the values set in *C1-02 or C1-04 [Deceleration Times]*. • Perform Deceleration Rate Auto-Tuning.
		The acceleration time is too short.	• Make sure that sudden drive acceleration does not cause the fault. • Increase the values set in *C1-01 or C1-03 [Acceleration Times]*. • Increase the value set in *C2-02 [S-Curve Time @ End of Accel]*. • Set *L3-11 = 1 [Overvoltage Suppression Select = Enabled]*.
		The drive output cable or motor is shorted to ground (the current short to ground is charging the main circuit capacitor of the drive through the power supply).	1. Examine the motor main circuit cable, terminals, and motor terminal box, and then remove ground faults. 2. Re-energize the drive.

		If the drive detects *ov* in these conditions, the speed search-related parameters are incorrect:
		• During speed search
		• During momentary power loss recovery
		• When the drive starts again automatically
		• When you set *A1-02 = 0 [Control Method Selection = V/f Control]* and do rotational Auto-Tuning
		• You are using a premium efficiency motor
			• Examine the settings for all speed search related parameters.
			• Set *b3-19 ≠ 0 [Speed Search Restart Attempts ≠ 0 times]*.
			• Adjust *b3-03 [Speed Search Deceleration Time]* setting.
			• Do Stationary Auto-Tuning for Line-to-Line Resistance and then set *b3-24 = 1 [Speed Search Method Selection = Speed Estimation]*.
			• Increase the value set in *L2-04 [Powerloss V/f Recovery Ramp Time]*.
			• Set these parameters:
			  • *b3-03 [Speed Search Deceleration Time]* = default value × 2
			  • *L2-03 [Minimum Baseblock Time]* = default value × 2
			  • *L2-04 [Powerloss V/f Recovery Ramp Time]* = default value × 2

		The power supply voltage is too high.	Decrease the power supply voltage to align with the drive rated voltage.
		Electrical interference caused a drive malfunction.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary.
		The load inertia is set incorrectly.	• Examine the load inertia settings with KEB, overvoltage suppression, or stall prevention during deceleration. • Adjust *L3-25 [Load Inertia Ratio]* to align with the qualities of the machine.
		There is motor hunting.	• Adjust *n1-02 [Hunting Prevention Gain Setting]* settings. • Adjust *n8-45 [Speed Feedback Detection Gain]* and *n8-47 [Pull-in Current Comp Filter Time]* settings.
		Speed search does not complete at start when you use an induction motor in EZOLV control.	When *E9-01 = 0 [Motor Type Selection = Induction (IM)]*, set *b3-24 = 2 [Speed Search Method Selection = Current Detection 2]*.
ov2	DC Bus Overvoltage 2	The wiring is too long and DC bus voltage is too large.	• Shorten the shielded motor cable. • Decrease the carrier frequency. • If the power supply has a neutral ground, switch on the internal EMC filter.
PE1	PLC Fault 1	The communication option detected a fault.	Refer to the manual for the communication option card.
PE2	PLC Fault 2	The communication option detected a fault.	Refer to the manual for the communication option card.
PF	Input Phase Loss	There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		There is loose wiring in the drive input power terminals.	Tighten the terminal screws to the correct tightening torque.

Code	Name	Causes	Possible Solutions
		The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		There is unsatisfactory balance between voltage phases.	• Examine the input power for problems. • Make the drive input power stable. • Set *L8-05 = 0 [Input Phase Loss Protection Sel = Disabled]*.
		The main circuit capacitors have become unserviceable.	• Examine the capacitor maintenance time in monitor *U4-05 [Capacitor Life Mon]*. If *U4-05* is more than 90%, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative. • If drive input power is correct and the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
POC	Pump Over Cycle	Pump in the system exceeded the number cycles from normal operation to sleep mode set in *Y2-10 [Max Cycling Protection Allowed]* in the time set in *Y2-11 [Cycling Count Decrement Time]*.	Adjust sleep parameters to prevent the system from over cycling between normal operation and sleep mode.
PSE	JOHB-SMP3 Protocol Set Error	• The DIP switches on the JOHB-SMP3 Multi-Protocol Ethernet Card are at factory default settings. • The DIP switches on the JOHB-SMP3 are not set to a valid protocol.	Remove power from the drive, wait for the charge light to go out, then set the DIP switches on the JOHB-SMP3 to the desired protocol. **Note:** Refer to the instructions packaged with the JOHB-SMP3 for more information about DIP switch settings.
SC	Short Circuit/IGBT Failure	Overheating caused damage to the motor or the motor insulation is not satisfactory.	Measure the motor insulation resistance, and replace the motor if there is electrical conduction or unserviceable insulation.
		The motor main circuit cable is contacting ground to make a short circuit.	• Examine the motor main circuit cable for damage, and repair short circuits. • Measure the resistance between the motor main circuit cable and the ground terminal. If there is electrical conduction, replace the cable.
		A short circuit or ground fault on the drive output side caused damage to the output transistor of the drive.	• Make sure that there is not a short circuit in terminals +1 and terminals U/T1, V/T2, and W/T3. Make sure that there is not a short circuit in terminals - and terminals U/T1, V/T2, and W/T3. • If there is a short circuit, contact Yaskawa or your nearest sales representative.
		When *A1-02 = 5 [Control Method Selection = OLV/PM]*, the output current is more than the value set in *L8-27 [Overcurrent Detection Gain]*.	Set *L8-27* correctly.
SCF	Safety Circuit Fault	The safety circuit is broken.	• Make sure that you ground the drive correctly and re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
SEr	Speed Search Retries Exceeded	The speed search-related parameters are set incorrectly.	• Decrease *b3-10 [Speed Estimation Detection Gain]*. • Increase *b3-17 [Speed Est Retry Current Level]*. • Increase *b3-18 [Speed Est Retry Detection Time]*. • Do Auto-Tuning again.
		The motor is coasting in the opposite direction of the Run command.	Set *b3-14 = 1 [Bi-directional Speed Search = Enabled]*.
SPCNR	Single Phase Converter Not Ready	When *YC-14 = 0 [Behavior when SPC is Not Ready = Coast to Stop - Fault]*, the digital input set to *H1-xx = BE [MFDI Function Selection = Single Phase Converter Ready NC]* deactivated to show the attached converter is faulted or not ready.	• Examine the wiring between the drive and converter. • Examine the error code on converter.
SPL	Suction Pressure Feedback Loss	Wire Break detection for suction pressure. The analog input programmed for *Water Level / Suct Pres Feedback* is less than 3 mA or more than 21 mA for longer than 1 second and *YE-19 = 2 or 3 [Suction Pressure Fdbk Wire Break = Fault (and Digital Output) or Auto-Restart (time set by YE-38)]*.	• Repair level sensor. • Repair wiring.
STPo	Motor Step-Out Detected	The motor code is set incorrectly for PM Control Methods.	• Set *E5-01 [PM Motor Code Selection]* correctly as specified by the motor. • For specialized motors, refer to the motor test report and set *E5-xx* correctly.

Code	Name	Causes	Possible Solutions
		The load is too large.	• Increase the value set in *n8-55 [Motor to Load Inertia Ratio]*. • Increase the value set in *n8-51 [Pull-in Current @ Acceleration]*. If the drive detects *STPo* during deceleration when increasing the value set in *n8-51*, set the value of *n8-79 [Pull-in Current @ Deceleration]* lower than *n8-51*. • Decrease the load. • Replace the drive and motor with larger capacity models.
		The load inertia is too large.	Increase the value set in *n8-55*.
		The acceleration/deceleration times are too short.	• Increase the values set in *C1-01 to C1-04 [Acceleration/ Deceleration Times]*. • Increase the value set in *C2-01 [S-Curve Time @ Start of Accel]*.
		Speed response is too slow.	Increase the value set in *n8-55*.
TiM	Keypad Time Not Set	There is a battery in the keypad, but the date and time are not set.	Use the keypad to set the date and time.
UL3	Undertorque Detection 1	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Torque Detection Level 1]* and *L6-03 [Torque Detection Time 1]* settings.
UL4	Undertorque Detection 2	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Torque Detection Level 2]* and *L6-06 [Torque Detection Time 2]* settings.
UL6	Underload or Belt Break Detected	The output current decreased less than the motor underload curve set in *L6-14 [Motor Underload Level @ Min Freq]* for longer than the time set in *L6-03 [Torque Detection Time 1]*.	Adjust the *L6-14* setting to set the output current to stay the level more than the motor underload curve during usual operations.
Uv1	DC Bus Undervoltage	There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		There is loose wiring in the drive input power terminals.	Tighten the terminal screws to the correct tightening torque.
		The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		There was a loss of power.	Use a better power supply.
		The main circuit capacitors have become unserviceable.	Examine the capacitor maintenance time in monitor *U4-05 [Capacitor Life Mon]*. If *U4-05* is more than 90%, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		The relay or contactor on the soft-charge bypass relay is damaged.	*U4-06 [PreChargeRelayMon]* shows the performance life of the soft-charge bypass relay. If *U4-06* is more than 90%, replace the board or the drive. For information about replacing the board, contact Yaskawa or your nearest sales representative.
Uv2	Control Power Undervoltage	The value set in *L2-02 [Power Loss Ride Through Time]* increased and the momentary power loss recovery unit is not connected to the drive.	Connect the momentary power loss recovery unit to the drive.
		There was a problem with the drive hardware.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
Uv3	Soft Charge Answerback Fault	The relay or contactor on the soft-charge bypass relay is damaged.	• Re-energize the drive. • If the fault stays, replace the control board or the drive. • Check monitor *U4-06 [PreChargeRelayMon]*, which shows the performance life of the soft-charge bypass relay. If *U4-06* is more than 90%, replace the board or the drive. For information about replacing the board, contact Yaskawa or your nearest sales representative.
		Air inside the drive is too hot.	Check the ambient temperature of the drive.
VLTS	Volute Thermostat Fault	The digital input from the terminal set for *Volute Thermostat Fault [H1-xx = 88 or 188]* is active.	Examine the wiring or wait for the motor to cool.
WLL	Water Level Feedback Loss	Wire Break detection for water level. The Analog input programmed for Water Level / Suction Pressure is less than 3 mA or is more than 21 mA for longer than 1 second with *Yd-16 ≠ 0 [Water Level Feedback Wire Break ≠ No Display]*.	• Repair level sensor. • Repair wiring.

◆ Minor Faults/Alarms

This section gives information about the causes and possible solutions when a minor fault or alarm occurs. Use the information in this table to remove the cause of the minor fault or alarm.

Code	Name	Causes	Possible Solutions
Accum	Accumulated Level Reached	Accumulated volume has is more than the *Y6-11* to *Y6-14* settings and *Y6-15 = 1 or 4 [Accumulated Volume Behavior = Alarm (and Digital Output) or Stop + Alarm + MFDO]*	Set *Y6-05 = 7770 [Flow Accumulation Set Reset = Reset Accumulation]* or via Reset Accumulation digital input).
AEr	Station Address Setting Error	The node address for the communication option is not in the permitted setting range.	For CANopen communication, set *F6-35 [CANopen Node ID Selection]* correctly.
AFBL	Analog Fdbk Lost Switched to Net	Defective or broken analog input source.	Make sure that the PID Feedback source is installed and working correctly. If there is no PID Feedback source, set *Y9-02 = 3 [System Feedback Source = Network Only]* to have it always read from the Network PID Feedback of another drive.
		H3-0x ≠ B [PID Feedback]	Set *H3-0x = B [PID Feedback]* if the analog input source is to be used for PID Feedback. When the drive does not have an analog PID Feedback source, set *Y9-02 = 3* .
AJA	Anti-Jam Active	The drive is doing the Anti-Jam function.	The alarm will clear when the function is complete.
ALRC	Accum Lvl Reached Cycle Run Cmd	Accumulated volume has is more than the *Y6-11* to *Y6-14* settings and *Y6-15 = 5 [Accumulated Volume Behavior = Stop + Alarm + MFDO + AccumReset]*	Cycle the Run command.
AUdiS	Low WL/SP/PI Aux FB Drv Disabled	Drive is not allowed to run in MEMOBUS Multiplex when *Y9-51 = 1 [WaterLvl/SuctPres/PI Aux TurnOff = Enabled]*, WL/SP/PI Aux Feedback is below the *Yd-06/YE-06/YF-06* setting, and the drive is stopped or running as a Lag drive.	• Confirm the setting of *Yd-06/YE-06/YF-06*. • Wait for the WL/SP/PI Aux Control Feedback to recover.
AUFbL	WL/SP/PI Aux Fdbk Lost Using Net	Defective or broken analog input source. The drive detected a wire break with the PI Auxiliary Control Feedback Level analog signal *[H3-xx = 27]* or the Water Level / Suction Pressure analog signal *[H3-xx = 3B]*.	• Make sure that the Water Level/Suction Pressure/PI Auxiliary Control Feedback source is installed and working correctly. • Confirm that Water Level/Suction Pressure/PI Auxiliary Control Feedback Wire break Behavior parameter *Yd-16/YE-19/YF-19* is set correctly • If there is no analog feedback, set *Y9-50 = 3 [WaterLvl/SuctPres/PI Aux Source = Network Only]* so that it will always read from the Water Level/Suction Pressure/PI Auxiliary Control Feedback network of another drive.
AuxFB	PI Aux Feedback Level Loss	The analog input from the terminal set to *H3-xx = 27 [MFAI Function Selection = PI Auxiliary Control Feedback Level]* is more than 21 mA or less than 3 mA for longer than 1 s.	Repair transducer or wiring.
bAT	Keypad Battery Low Voltage	The keypad battery voltage is low.	Replace the keypad battery.
bb	Baseblock	An external baseblock command was entered through one of the MFDI terminals Sx, and the drive output stopped as shown by an external baseblock command.	Examine the external sequence and timing of the baseblock command input.
bCE	Bluetooth Communication Error	The smartphone or tablet with DriveWizard Mobile or DriveWizard is too far from the keypad.	Move to 10 m (32.8 ft) or less from the keypad. **Note:** *bCE* can occur when the smartphone or tablet is 10 m (32.8 ft) or nearer to the keypad for different smartphone and tablet specifications.
		Radio waves from a different device are causing interference with communications between the smartphone or tablet and keypad.	Make sure that no device around the keypad uses the same radio bandwidth (2400 MHz to 2480 MHz), and prevent radio interference.
BuDif	Main Fdbk Lost, Using Diff Fdbk	Parameter *Y4-41 = 1 [Diff Lvl Src Fdbk Backup Select = Enabled]* and the drive detected a wire-break on the analog input terminal set for *PID Feedback [H3-xx = B]*.	Examine the connection of the Main PID Feedback Transducer.
		Main PID Feedback Transducer is broken.	Replace Main PID Feedback Transducer.
Bu-Fb	Main Fdbk Lost Using Backup Fdbk	The drive detected wire-break on the analog input terminal set to *H3-xx = B [MFAI Function Selection = PID Feedback]*.	Examine the connection of the Main PID Feedback Transducer.
		Main PID Feedback Transducer is broken.	Replace Main PID Feedback Transducer.
BuFbl	Backup Fdbk Lost Chk/Repl Xducer	The drive detected wire-break on the analog input terminal set for *PID Feedback Backup [H3-xx = 24]*.	Examine the connection of the Differential PID Feedback transducer.
		Backup PID Feedback Transducer is broken.	Replace Backup PID Feedback Transducer.
		Parameter *Y4-41 = 1 [Diff Lvl Src Fdbk Backup Select = Enabled]* and the drive detected a wire-break on the analog input terminal set for *Differential Level Source [H3-xx = 2D]*.	Examine the connection of the Differential PID Feedback transducer.

Code	Name	Causes	Possible Solutions
		Parameter *Y4-41 = 1* and the Differential PID Feedback Transducer is broken.	• Replace the Differential PID Feedback Transducer. • Set *Y4-41 = 0 [Disabled]*.
bUS	Option Communication Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short-circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The option card is incorrectly installed to the drive.	Correctly install the option card to the drive.
		The option card is damaged.	If the alarm continues and the wiring is correct, replace the option card.
bUSy	Busy	You set the drive to use MEMOBUS/Modbus communications to change parameters, but you used the keypad to change parameters.	Use MEMOBUS/Modbus communications to enter the enter command, then use the keypad to change the parameter.
		You tried to change a parameter while the drive was changing setting.	Wait until the process is complete.
CALL	Serial Comm Transmission Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit in the communications cable or the communications cable is not connected.	• Repair the short-circuited or disconnected portion of the cable. • Replace the defective communications cable.
		A programming error occurred on the controller side.	Examine communications at start-up and correct programming errors.
		There is damage to the communications circuitry.	• Do a self-diagnostics check. • If the problem continues, replace the control board or the drive. Contact Yaskawa or your nearest sales representative to replace the control board.
		The termination resistor setting for MEMOBUS/ Modbus communications is incorrect.	On the last drive in a MEMOBUS/Modbus network, set DIP switch S2 to the ON position to enable the termination resistor.
CE	Modbus Communication Error	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only the recommended cables or other shielded line. Ground the shield on the controller side or the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The communication protocol is not compatible.	• Examine the values set in *H5-xx*. • Examine the settings on the controller side and correct the difference in communication conditions.
		The value set in *H5-09 [CE Detection Time]* is too small for the communications cycle.	• Change the controller software settings. • Increase the value set in *H5-09*.
		The controller software or hardware is causing a communication problem.	Examine the controller and remove the cause of the problem.
CE	Run at H5-34 (CE Go-To-Freq)	The communications cable wiring is incorrect.	Correct wiring errors.
		There is a short circuit in the communications cable or the communications cable is not connected.	• Repair short circuits and connect cables. • Replace the defective communications cable.

Code	Name	Causes	Possible Solutions
		Electrical interference caused a communication data error.	• Examine the control circuit lines, main circuit lines, and ground wiring, and decrease the effects of electrical interference. • Make sure that a magnetic contactor is not the source of the electrical interference, then use a Surge Protective Device if necessary. • Use only recommended shielded line. Ground the shield on the controller side or on the drive input power side. • Separate the communication wiring from drive power lines, and install a noise filter to the input side of the power supply for communication. • Decrease the effects of electrical interference from the controller.
		The communication protocol is not compatible.	• Examine the values set in *H5-xx*. • Examine the settings on the controller side and correct the difference in communication conditions.
		The value set in *H5-09 [CE Detection Time]* is too small for the communications cycle.	• Make sure that the settings are compatible. • Change the software settings in the PLC. • Increase the value set in *H5-09*.
		The controller software or hardware is causing a communication problem.	Examine the controller and remove the cause of the problem.
CrST	Cannot Reset	The drive received a fault reset command when a Run command was active.	Turn off the Run command then de-energize and re-energize the drive.
CyPo	Cycle Power to Accept Changes	Although *F6-15 = 1 [Comm. Option Parameters Reload = Reload Now]*, the drive does not update the communication option parameters.	Re-energize the drive to update the communication option parameters.
dEv	Speed Deviation	The load is too heavy	Decrease the load.
		Acceleration and deceleration times are set too short.	Increase the values set in *C1-01 to C1-04 [Acceleration/ Deceleration Time]*.
		The *dEv* detection level settings are incorrect.	Adjust *F1-10 [Speed Deviation Detection Level]* and *F1-11 [Speed Deviation Detect DelayTime]*.
		The load is locked up.	Examine the machine.
		The holding brake is stopping the motor.	Release the holding brake.
DIFF	Differential Feedback Exceeded	The difference between the PID Feedback and *Differential Level Source [H3-xx = 2D]* is more than the level set in *Y4-18 [Pre-Charge Loss of Prime Level 2]* for the time set in *Y4-19 [Differential Lvl Detection Time]*.	• Replace the feedback transducer or transducers. • Set *Y4-18* and *Y4-19* correctly.
dnE	Drive Disabled	A terminal set for *H1-xx = 6A [MFDI Function Selection = Drive Enable]* deactivated.	Examine the operation sequence.
DRA	De-Rag Active	The drive is doing the De-Rag function.	The alarm will clear when the function is complete.
dWAL	DriveWorksEZ Alarm	There was an error in the DriveWorksEZ program.	Examine the DriveWorksEZ program and remove the cause of the error. This is not a drive fault.
dWA2	DriveWorksEZ Alarm 2	There was an error in the DriveWorksEZ program.	Examine the DriveWorksEZ program and remove the cause of the error. This is not a drive fault.
dWA3	DriveWorksEZ Alarm 3	There was an error in the DriveWorksEZ program.	Examine the DriveWorksEZ program and remove the cause of the error. This is not a drive fault.
DS	De-Scale/De-Rag Active	The terminal is set to *H2-xx = C5 or 1C5 [MFDO Function Selection De-Scale or !De-Scale]* and the set length of run time elapsed.	• If you do not want to do De-Scale/De-Rag, set *Y8-01 = 0 [De-Scale Operation Selection = Disabled]*. • Adjust the *Y8-08 [Run Time before De-Scale]* setting.
EF	FWD/REV Run Command Input Error	The drive received a forward command and a reverse command at the same time for longer than 0.5 s.	Examine the forward and reverse command sequence and correct the problem.
EF0	Option Card External Fault	The communication option card received an external fault from the controller.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input from the controller.
		Programming error occurred on the controller side.	Examine the operation of the controller program.
EF1	Pump Fault (Terminal S1)	MFDI terminal S1 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S1.
		Pump Fault [H1-01 = 2C to 2F] is set to MFDI terminal S1, but the terminal is not in use.	Correctly set the MFDI.
EF2	Pump Fault (Terminal S2)	MFDI terminal S2 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.

Code	Name	Causes	Possible Solutions
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S2.
		Pump Fault [H1-02 = 2C to 2F] is set to MFDI terminal S2, but the terminal is not in use.	Correctly set the MFDI.
EF3	Pump Fault (Terminal S3)	MFDI terminal S3 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S3.
		Pump Fault [H1-03 = 2C to 2F] is set to MFDI terminal S3, but the terminal is not in use.	Correctly set the MFDI.
EF4	Pump Fault (Terminal S4)	MFDI terminal S4 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S4.
		Pump Fault [H1-04 = 2C to 2F] is set to MFDI terminal S4, but the terminal is not in use.	Correctly set the MFDI.
EF5	Pump Fault (Terminal S5)	MFDI terminal S5 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S5.
		Pump Fault [H1-05 = 2C to 2F] is set to MFDI terminal S5, but the terminal is not in use.	Correctly set the MFDI.
EF6	Pump Fault (Terminal S6)	MFDI terminal S6 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S6.
		Pump Fault [H1-06 = 2C to 2F] is set to MFDI terminal S6, but the terminal is not in use.	Correctly set the MFDI.
EF7	Pump Fault (Terminal S7)	MFDI terminal S7 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S7.
		Pump Fault [H1-07 = 2C to 2F] is set to MFDI terminal S7, but the terminal is not in use.	Correctly set the MFDI.
EF8	Pump Fault (Terminal S8)	MFDI terminal S8 caused an external fault through an external device.	1. Find the device that caused the external fault and remove the cause. 2. Clear the external fault input in the MFDI.
		The wiring is incorrect.	Correctly connect the signal line to MFDI terminal S8.
		Pump Fault [H1-08 = 2C to 2F] is set to MFDI terminal S8, but the terminal is not in use.	Correctly set the MFDI.
EOF	Emergency Override FWD	The digital input terminal set to *H1-xx = AF [MFDI Function Selection = Emergency Override FWD]* activated.	When the emergency condition is gone, deactivate the digital input set to *Emergency Override FWD*.
EOR	Emergency Override REV	The digital input terminal set to *H1-xx = B0 [MFDI Function Selection = Emergency Override REV]* activated.	When the emergency condition is gone, deactivate the digital input set to *Emergency Override REV*.
EP24v	External Power 24V Supply	The voltage of the main circuit power supply decreased, and the 24 V power supply is supplying power to the drive.	• Examine the main circuit power supply. • Turn ON the main circuit power supply to run the drive.
FDBKL	Feedback Loss Wire Break	The analog input from the terminal set to *H3-xx = B [MFAI Function Selection = PID Feedback]* is more than 21 mA or less than 3 mA for longer than 1 s in these conditions: • *b5-82 = 1 [Feedback Loss 4 ~ 20mA Detect Sel = Alarm Only]* • *b5-01 ≠ 0 [PID Mode Setting ≠ Disabled]* • *H3-01, H3-09, or H3-05 = 2 [Terminal A1/A2/A3 Signal Level Selection = 4 to 20 mA]*	Make sure that you install the PID feedback source and it operates correctly.

Code	Name	Causes	Possible Solutions
FLGT	Feedback Loss, Go To Freq b5-83	The analog input from the terminal set to *H3-xx = B [MFAI Function Selection = PID Feedback]* is more than 21 mA or less than 3 mA for longer than 1 s in these conditions: • *b5-82 = 3 [Feedback Loss 4 ~ 20mA Detect Sel = Run At b5-83]* • *b5-01 ≠ 0 [PID Mode Setting ≠ Disabled]* • *H3-01, H3-09, or H3-05 = 2 [Terminal A1/A2/A3 Signal Level Selection = 4 to 20 mA]*	Make sure that you install the PID feedback source and it operates correctly.
FMLST	Net Flow Meter Lost:Check Source	There is no drive on the MEMOBUS Network with a valid Flow Meter source. When *Y1-01 = 3 [Multiplex Mode = Network Multiplex]*, *Y6-01 [Flow Meter Scaling] > 0.0* and *Y9-40 = 0 [Flow Rate Source = Network]*, the Flow Meter function needs a valid Flow Rate from the network that is originating from another drive that also has *Y6-01 > 0.0* with *Y9-40 = 0*.	• If the drive has an operational Flow Meter connected to an analog or pulse input terminal, set *Y9-40 = 0 [Analog]*. • If another drive on the MEMOBUS Network has a Flow meter connected to an analog or pulse input terminal, confirm that drive is online with *Y6-01 > 0.0* and *Y9-40 = 0*.
FR<MS	Freq Ref < Minimum Speed (Y1-06)	The drive frequency reference setting is less than the value set in *Y1-06 [Minimum Speed]* in these conditions: • The drive is not in PI Mode • The drive is running • *Minimum Speed* is enabled (*Y1-06 > 0.00*) • *Y1-06 > Y4-12 [Thrust Frequency]*	Increase the frequency reference to a value more than *Y1-06*.
FR<TH	Freq. Reference < Thrust (Y4-12)	The drive frequency reference setting is less than the value set in *Y4-12 [Thrust Frequency]* in these conditions: • The drive is not in PI Mode • The drive is running • *Thrust* is enabled (*Y4-11 [Thrust Acceleration Time] > 0.00* and *Y4-12 > Y1-06 [Minimum Speed]*)	Increase the frequency reference to a value more than *Y4-12*.
HCA	High Current Alarm	The load is too heavy.	• Decrease the load for applications with repetitive starts and stops. • Replace the drive with a larger capacity model.
		The acceleration time is too short.	• Calculate the torque necessary during acceleration related to the load inertia and the specified acceleration time. • Increase the values set in *C1-01 or C1-03 [Acceleration Times]* until you get the necessary torque. • Increase the values set in *C2-01 to C2-04 [S-Curve Characteristics]* until you get the necessary torque. • Replace the drive with a larger capacity model.
		The drive is trying to operate a specialized motor or a motor that is larger than the maximum applicable motor output of the drive.	• Examine the motor nameplate, the motor, and the drive to make sure that the drive rated current is larger than the motor rated current. • Replace the drive with a larger capacity model.
		The current level temporarily increased because of speed search after a momentary power loss or while trying to Auto Restart.	If speed search or Auto Restart cause an increase in current, the drive can temporarily show this alarm. The time that the drive shows the alarm is short. No more steps are necessary to clear the alarm.
HiAux	High PI Aux Feedback Level	PI Auxiliary Feedback is more than the level set in *YF-12 [PI Aux Control High Level Detect]* for the time set in *YF-13 [PI Aux High Level Detection Time]* in these conditions: • The drive is running. • The output frequency > 0.	• Decrease the PI Auxiliary Feedback level to less than *YF-12*. • Set *YF-12* and *YF-13* correctly.
HIFB	High Feedback Sensed	The feedback level is more than the level set in *Y1-11 [High Feedback Level]*.	• Decrease the feedback level to less than *Y1-11 - Y1-14 [Hysteresis Level]*. • Set *Y1-11* and *Y1-12* correctly.
HiFlo	High Flow	Flow rate was more the level set in *Y6-17 [High Flow Level]* for longer than the time set in *Y6-18 [High Flow Detection Time]* and *Y6-19 = 1 [High Flow Behavior = Alarm (and Digital Output)]*.	Reprogram *Y6-17* to *Y6-19* if flow rate is acceptable.
HiSuc	High Suction Pressure	Suction pressure is more than the level set in *YE-12 [High Suction Pressure Det Level]* for longer than the time set in *YE-13 [High Suction Pressure Det Time]*, and the drive is running (AUTO or HAND) and *YE-14 = 1 [High Suction Pressure Behavior = Alarm (and Digital Output)]*.	Decrease suction pressure.
L24v	Loss of External Power 24 Supply	The voltage of the backup 24 V power supply has decreased. The main circuit power supply is operating correctly.	• Examine the external 24 V power supply for disconnected wires and wiring errors and repair the problems. • Examine the external 24 V power supply for problems.

Code	Name	Causes	Possible Solutions
LCP	Low City Pressure	Insufficient pressure is present on the inlet to the pump in these conditions: • *Y4-24 = 0 [Low City Alarm Text = Low City Pressure]* • The terminal set for *H1-xx = B8 or 1B8 [MFDI Function Selection = Low City Pressure or !Low City Pressure]* activates	• Examine the pressure switch contact for correct operation. • Examine control wiring to drive terminal strip from pressure switch contact. • Make sure that suction pressure is present with an isolated measuring device. • Set *Y4-22 [Low City On-Delay Time]* and *Y4-23 [Low City Off-Delay Time]* correctly. • Deactivate the digital input terminals set to *H1-xx = B8 or 1B8*.
LoAux	Low PI Aux Feedback Level	When the drive is running, PI Auxiliary Feedback is less than the level set in *YF-09 [PI Aux Control Low Lvl Detection]* for the time set in *YF-10 [PI Aux Control Low Lvl Det Time]*.	• Increase the PI Auxiliary Feedback level more than *YF-09*. • Set *YF-09* and *YF-10* correctly.
LOFB	Low Feedback Sensed	The feedback level is less than the level set in *Y1-08 [Low Feedback Level]* for the time set in *Y1-09 [Low Feedback Lvl Fault Dly Time]*.	• Increase the feedback level to more than *Y1-08 + Y1-14 [High Feedback Hysteresis Level]*. • Set *Y1-08* and *Y1-09* correctly.
LoG	Com Error / Abnormal SD Card	There is not a micro SD card in the keypad.	Put a micro SD card in the keypad.
		• The drive is connected to USB. • The number of log communication files is more than 1000. • The micro SD card does not have available memory space. • The line number data in a log communication file was changed. • A communication error between the keypad and drive occurred during a log communication.	Set *o5-01 = 0 [Log Start/Stop Selection = OFF]*.
		You started short-term data logging on a keypad that does not support short-term data logs.	• Connect a keypad that supports short-term data logs. **Note:** The LCD keypad and Bluetooth LCD keypad with REV: H or later support short-term data logging. The keypad version "REV" is located on the nameplate on the back of the keypad. • Set *o5-00 = 0 [Log Type = Long Term Log]* • Set *o5-01 = 0 [Log Start/Stop Selection = OFF]*.
LOP	Loss of Prime	The drive used the method set in *Y1-18 [Prime Loss Detection Method]* to detect that the pump load is less than the level set in *Y1-19 [Prime Loss Level]* for the time set in *Y1-20 [Prime Loss Time]*, and the output frequency is *Y1-21 [Prime Loss Activation Freq]* or more.	• Examine a dry well, air in the system, or no water in the system. Use preferred priming method suggested by the pump manufacturer to restart the pump. • When there is resistance in the pump, allow the system to pump water again. • Set *Y1-18* to *Y1-21* correctly.
LoSuc	Low Suction Pressure	Suction pressure is less than the level set in *YE-09 [Low Suction Pressure Det Level]* for longer than the time set in *YE-10 [Low Suction Pressure Det Time]*, and the drive is running (AUTO or HAND) and *YE-11 = 1 [Low Suction Pressure Behavior = Alarm (and Digital Output)]*.	Increase suction pressure.
LowFl	Low Flow	Flow rate was below the level set in *Y6-06 [Low Flow Level]* for longer than the time set in *Y6-07 [Low Flow Detection Time]* and *Y6-09 = 1 [Low Flow Behavior = Alarm (and Digital Output)]*.	Reprogram *Y6-06* to *Y6-09* if flow rate is acceptable.
LowWL	Low Water Level	Water level is below the level set in *Yd-09 [Low Water Level Detection Level]* with *Yd-11 = 1 [Low Water Level Behavior = Alarm (and Digital Output)]*.	Increase the water level.
LSP	Low Suction Pressure	An external input has indicated that an insufficient suction pressure condition exists in these conditions: • *Y4-24 = 1 [Low City Alarm Text = Low Suction Pressure]* • The terminal set for *H1-xx = B8 or 1B8 [MFDI Function Selection = Low City Pressure or !Low City Pressure]* activates	• Examine the pressure switch contact for correct operation. • Examine control wiring to drive terminal strip from pressure switch contact. • Make sure that suction pressure is present with an isolated measuring device. • Increase the system pressure. • Set *Y4-22 [Low City On-Delay Time]* and *Y4-23 [Low City Off-Delay Time]* correctly. • Deactivate the digital input terminals set to *H1-xx = B8 or 1B8*.
LT-1	Cooling Fan Maintenance Time	The cooling fan is at 90% of its performance life estimate.	1. Replace the cooling fan. 2. Set *o4-03 = 0 [Fan Operation Time Setting = 0 h]* to reset the cooling fan operation time.
LT-2	Capacitor Maintenance Time	The capacitors for the main circuit and control circuit are at 90% of their performance life estimate.	Replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
LT-3	SoftChargeBypassRelay MainteTime	The soft charge bypass relay is at 90% of its performance life estimate.	Replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
LT-4	IGBT Maintenance Time (50%)	The IGBT is at 50% of its performance life estimate.	Check the load, carrier frequency, and output frequency.

Code	Name	Causes	Possible Solutions
LWT	Low Water In Tank	An external input has indicated that the water level in the tank is too low in these conditions: • *Y4-24 = 2 [Low City Alarm Text = Low Water in Tank]* • The terminal set for *H1-xx = B8 or 1B8 [MFDI Function Selection = Low City Pressure or !Low City Pressure]* activates	• Examine the pressure switch contact for correct operation. • Examine control wiring to drive terminal strip from pressure switch contact. • Make sure that suction pressure is present with an isolated measuring device. • Increase the water level. • Set *Y4-22 [Low City On-Delay Time]* and *Y4-23 [Low City Off-Delay Time]* correctly. • Deactivate the digital input terminals set to *H1-xx = B8 or 1B8*.
NETSC	NETSCAN Waiting for Master	No message received from the master within the time specified in *Y9-28 [NETSCAN Alarm Time]*.	• Increase *Y9-28* to account for network latency. • Make sure that there is a drive on the network with *Y1-01 = 3 [Multiplex Mode = Contactor Multiplex]* and *Y9-27 = 0 [Network Recovery = Automatic]*.
NMS	Setpoint Not Met	The feedback deviates from the setpoint at a level more than *Y1-15 [Maximum Setpoint Difference]* for the time set in *Y1-16 [Not Maintaining Setpoint Time]*.	• Examine for a blocked impeller, over cycling, or broken pipe. • Set *Y1-15* and *Y1-16* correctly.
OD	Output Disconnect	The output circuit between the drive and the motor is open, and the drive output current is less than 5% of *E2-01 [Motor Rated Current (FLA)]*.	• Close the disconnected output circuit between the drive and the motor. • If you do not use a motor disconnect, set *Y4-42 = 0 [Disabled]*.
oH	Heatsink Overheat	The ambient temperature is high and the heatsink temperature is more than the *L8-02 [Overheat Alarm Level]*.	• Measure the ambient temperature. • Increase the airflow around the drive. • Install a cooling device (cooling fan or air conditioner) to decrease the ambient temperature. • Remove objects near the drive that are producing too much heat.
		There is not sufficient airflow around the drive.	• Give the drive the correct installation space as shown in the manual. • Make sure that there is sufficient circulation around the control panel. • Examine the drive for dust or other unwanted materials that could clog the cooling fan. • Remove unwanted materials that prevent air circulation.
		The internal cooling fan or fans stopped.	1. Replace the cooling fan. 2. Set *o4-03 = 0 [Fan Operation Time Setting = 0 h]* to reset the cooling fan operation time.
oH2	External Overheat (H1-XX=B)	An external device sent an *oH2* alarm.	1. Find the external device that output the overheat alarm. 2. Remove the cause of the problem. 3. Clear the *Overheat Alarm (oH2) [H1-xx = B]* in MFDI terminals S1 to S8.
oH3	Motor Overheat (PTC Input)	The thermistor wiring that detects motor temperature is defective.	Correct wiring errors.
		A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault
		The motor has overheated.	• Check the load level, acceleration/deceleration time, and motor start/stop frequency (cycle time). • Decrease the load. • Increase the values set in *C1-01 to C1-04 [Acceleration/ Deceleration Times]*. • Set *E2-01 [Motor Rated Current (FLA)]* correctly to the value specified by the motor nameplate. • Make sure that the motor cooling system is operating correctly, and repair or replace it if it is damaged. • Adjust *E1-04 to E1-10 [V/f Pattern Parameters]*. For motor 2, adjust *E3-04 to E3-10*. Decrease the values set in *E1-08 [Mid Point A Voltage]* and *E1-10 [Minimum Output Voltage]*. **Note:** If the values set in *E1-08* and *E1-10* are too low, the overload tolerance will decrease at low speeds.
oL3	Overtorque 1	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Torque Detection Level 1]* and *L6-03 [Torque Detection Time 1]* settings.
oL4	Overtorque 2	A fault occurred on the machine. Example: The machine is locked.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Torque Detection Level 2]* and *L6-06 [Torque Detection Time 2]* settings.

Code	Name	Causes	Possible Solutions
oS	Overspeed	There is overshoot.	Decrease *C5-01 [ASR Proportional Gain 1]* and increase *C5-02 [ASR Integral Time 1]*.
ov	DC Bus Overvoltage	The drive output cable or motor is shorted to ground (the current short to ground is charging the main circuit capacitor of the drive through the power supply).	1. Examine the motor main circuit cable, terminals, and motor terminal box, and then remove ground faults. 2. Re-energize the drive.
		The power supply voltage is too high.	Decrease the power supply voltage to align with the drive rated voltage.
		Electrical interference caused a drive malfunction.	• Examine the control circuit lines, main circuit lines, and ground wiring, and minimize the effects of noise. • Find the source of the noise. If a magnetic contactor is the source, use Surge Protective Device if necessary. • Set *L5-01 ≠ 0 [Number of Auto-Restart Attempts ≠ 0 times]*.
ovEr	Too Many Parameters Changed	You tried to change more than 150 parameters.	Make sure that parameters that do not have an effect on drive operation are at their default settings. **Note:** • You can change 150 parameters maximum. • If you change parameters that have dependencies, the drive can detect *ovEr* when the number of changed parameters is fewer than 150.
PASS	Modbus Communication Test	The MEMOBUS/Modbus communications test is complete.	The *PASS* display will turn off after communications test mode is cleared.
PF	Input Phase Loss	There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		Loose wiring in the input power terminals.	Tighten the terminal screws to the correct tightening torque.
		The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable.
		Unsatisfactory balance between voltage phases.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		The main circuit capacitors are unserviceable.	• Examine the capacitor maintenance time in monitor *U4-05 [Capacitor Life Mon]*. • If *U4-05* is more than 90%, replace the capacitor. Contact Yaskawa or your nearest sales representative for more information.
			• Examine the input power for problems. • Re-energize the drive. • If the alarm stays, replace the circuit board or the drive. Contact Yaskawa or your nearest sales representative for more information.
POC	Pump Over Cycle	Pump in the system exceeded the number cycles from normal operation to sleep mode set in *Y2-10 [Max Cycling Protection Allowed]* in the time set in *Y2-11 [Cycling Count Decrement Time]*.	Adjust sleep parameters to prevent the system from over cycling between normal operation and sleep mode.
R-DNE	Remote Drive Disable	• The digital input set to *H1-xx = BD [MFDI Function Selection = Remote Drive Disable]* activated. • The digital input set to *H1-xx = 1BD [!Remote Drive Disable]* deactivated.	Examine the statuses of the digital input terminals set to *H1-xx = BD or 1BD*
rUn	Motor Switch during Run	The drive received a *Motor 2 Selection [H1-xx = 16]* during run.	Make sure that the drive receives the Motor 2 Selection while the drive is stopped.
SE	Modbus Test Mode Error	MEMOBUS/Modbus communications self-diagnostics *[H1-xx = 67]* was done while the drive was running.	Stop the drive and do MEMOBUS/Modbus communications self-diagnostics.
SPCNR	Single Phase Converter Not Ready	When *YC-14 = 1 [Behavior when SPC is Not Ready = Coast to Stop - Alarm]*, the digital input set to *H1-xx = BE [MFDI Function Selection = Single Phase Converter Ready NC]* deactivated to show that the attached converter is faulted or not ready.	• Examine the wiring between the drive and converter. • Examine the error code on converter.
SPL	Suction Pressure Feedback Loss	Wire Break detection for suction pressure. The analog input programmed for *Water Level / Suct Pres Feedback* is less than 3 mA or more than 21 mA for longer than 1 second and *YE-19 = 1 [Suction Pressure Fdbk Wire Break = Alarm (and Digital Output)]*.	• Repair level sensor. • Repair wiring.
STo	Safe Torque OFF	Safe Disable inputs H1-HC and H2-HC are open.	• Make sure that the Safe Disable signal is input from an external source to terminal H1-HC and H2-HC. • When the Safe Disable function is not in use, use a jumper to connect terminals H1-HC and H2-HC.

Code	Name	Causes	Possible Solutions
		There is internal damage to the two Safe Disable channels.	Replace the board or the drive. Contact Yaskawa or your nearest sales representative to replace the board.
SToF	Safe Torque OFF Hardware	One of the two terminals H1-HC or H2-HC received the Safe Disable input signal.	• Make sure that the Safe Disable signal is input from an external source to terminals H1-HC or H2-HC. • When the Safe Disable function is not in use, use a jumper to connect terminals H1-HC and H2-HC.
		The Safe Disable input signal is wired incorrectly.	
		There is internal damage to one Safe Disable channel.	Replace the board or the drive. Contact Yaskawa or your nearest sales representative to replace the board.
TiM	Keypad Time Not Set	There is a battery in the keypad, but you have not set the date and time.	Use the keypad to set the date and time.
TrPC	IGBT Maintenance Time (90%)	The IGBT is at 90% of its performance life estimate.	Replace the IGBT or the drive. For more information, contact Yaskawa or your nearest sales representative.
UL3	Undertorque Detection 1	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-02 [Torque Detection Level 1]* and *L6-03 [Torque Detection Time 1]* settings.
UL4	Undertorque Detection 2	A fault occurred on the machine. Example: There is a broken pulley belt.	Examine the machine and remove the cause of the fault.
		The parameters are incorrect for the load.	Adjust *L6-05 [Torque Detection Level 2]* and *L6-06 [Torque Detection Time 2]* settings.
UL6	Underload or Belt Break Detected	The output current decreased less than the motor underload curve set in *L6-14 [Motor Underload Level @ Min Freq]* for longer than the time set in *L6-03 [Torque Detection Time 1]*.	Examine parameters *L6-13 [Motor Underload Curve Select]* and *L6-14*.
		The belt has broken disconnecting the motor from the load.	
Uv	Undervoltage	The drive input power voltage is changing too much.	• Examine the input power for problems. • Make the drive input power stable. • If the input power supply is good, examine the magnetic contactor on the main circuit side for problems.
		There is a phase loss in the drive input power.	Correct errors with the wiring for main circuit drive input power.
		There is loose wiring in the drive input power terminals.	Tighten the terminal screws to the correct tightening torque.
		There was a loss of power.	Use a better power supply.
		The main circuit capacitors have become unserviceable.	Examine the capacitor maintenance time in monitor *U4-05 [Capacitor Life Mon]*. If *U4-05* is more than 90%, replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		The drive input power transformer is too small and voltage drops when the power is switched on.	• Check for an alarm when a molded-case circuit breaker, Leakage Breaker (ELCB or GFCI) (with overcurrent protective function), or magnetic contactor is ON. • Check the capacity of the drive power supply transformer.
		Air inside the drive is too hot.	Check the ambient temperature of the drive.
		The Charge LED is broken.	Replace the control board or the entire drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
WFR	Waiting for Run	The drive has *Drive Enable No Run Cycle* active (closed) on the digital input and the drive is OFF.	Examine the operation sequence.
WLL	Water Level Feedback Loss	Wire Break detection for water level. The Analog input programmed for Water Level / Suction Pressure is less than 3 mA or is more than 21 mA for longer than 1 second with *Yd-16 = 1 [Water Level Feedback Wire Break = Alarm Only]*.	• Repair level sensor. • Repair wiring.

◆ Parameter Setting Errors

Parameter setting errors occur when multiple parameter settings do not agree, or when parameter setting values are not correct. Refer to the table in this section, examine the parameter setting that caused the error, and remove the cause of the error. You must first correct the parameter setting errors before you can operate the drive. The drive will not send notification signals for the faults and alarms when these parameter setting errors occur.

Code	Name	Causes	Possible Solutions
oPE01	Drive Capacity Setting Error	The value set in *o2-04 [Drive Model (KVA) Selection]* does not agree with the drive model.	Set *o2-04* to the correct value.
oPE02	Parameter Range Setting Error	Parameters settings are not in the applicable setting range.	1. Push ↵ to show *U1-18 [oPE Fault Parameter]*, and find parameters that are not in the applicable setting range. 2. Correct the parameter settings. **Note:** If more than one error occurs at the same time, other *oPExx* errors have priority over *oPE02*.
		You set *E2-01 ≤ E2-03 [Motor Rated Current (FLA) ≤ Motor No-Load Current]*.	Make sure that *E2-01 > E2-03*. **Note:** If it is necessary to set *E2-01 < E2-03*, first lower the value set in *E2-03*, and then set *E2-01*.
		The settings for these parameters do not agree: • *L8-12 [Ambient Temperature Setting] = 60 °C* and *L8-35 = 1 or 3 [Installation Method Selection = Side-by-Side Mounting or IP55/UL Type 12]* for models 2011 to 2169 and 4005 to 4156 • *L8-35 = 1 or 3* for models 2211 to 2396 and 4180 to 4720	Set *L8-35 = 0 or 2 [IP20/UL Open Type or IP20/UL Type 1]*.
		You set *S3-09 < S3-10 [PI2 Control Output Upper Limit < PI2 Control Output Lower Limit]*.	Make sure that *S3-09 > S3-10* at all times.
		You set *S3-13 > S3-15 [PI2 Control Low Feedback Lvl > PI2 Control High Feedback Lvl]*.	Make sure that *S3-13 < S3-15* at all times.
		H2-xx = D3 [Harmonic Filter Output] and *n1-13 = 0 [DC Bus Stabilization Control = Disabled]* while *A1-02 = 0 or 8 (Control Method Selection= V/f or EZ Vector Control]*.	Set *n1-13 = 1 [Enabled]* or de-program digital output *D3*.
		One of the following conflicting parameters has been set: • *Y1-01 = 3 [Multiplex Mode = Network Multiplex]* and *F6-16 ≠ 0 [Gateway Mode ≠ Disabled]*. • *Y1-01 = 3 [Multiplex Mode = Network Multiplex]* and *A1-07 ≠ 0 [DriveWorksEZ Function Selection ≠ DWEZ Disabled]*. • *Q7-01 ≠ 0 [Remote I/O Slave Address ≠ 0]* and *H1-xx ≠ 9F [Multi-Function Digital Input ≠ DWEZ Disabled]*.	When *Y1-01 = 3*, set *F6-16 = 0*, or disable DriveWorksEZ while *Q1-07 ≠ 0*.
oPE03	Multi-Function Input Setting Err	The settings for these parameters do not agree: • *F3-10 to F3-25 [Terminal D1 to DF Function Selection]* • *H1-01 to H1-08 [Terminals S1 to S8 Function Selection]* • *H7-01 to H7-04 [Virtual Multi-Function Inputs 1 to 4]*	Correct the parameter settings.
		The settings for MFDIs overlap. **Note:** This does not include *H1-xx = 20 to 2F [MFDI Function Selection = Ext Pump Fault]* and *[Reserved]*.	Set the parameters correctly to prevent MFDI function overlap.
		These pairs of MFDI functions are not set to Digital Inputs (*H1-xx*, *F3-10 to F3-25*, and *H7-01 to H7-04*) at the same time: • Setting values *10 [Up Command]* and *11 [Down Command]* • Setting values *75 [Up 2 Command]* and *76 [Down 2 Command]* • Setting values *42 [Run Command (2-Wire Sequence 2)]* and *43 [FWD/REV (2-Wire Sequence 2)]*	Set the MFDI pairs.
		A minimum of two of these MFDI combinations are set to Digital Inputs (*H1-xx*, *F3-10 to F3-25*, and *H7-01 to H7-04*) at the same time: • Setting values *10 [Up Command]* and *11 [Down Command]* • Setting values *75 [Up 2 Command]* and *76 [Down 2 Command]* • Setting value *A [Accel/Decel Ramp Hold]* • Setting value *1E [Reference Sample Hold]*	Remove the function settings that are not in use.

Code	Name	Causes	Possible Solutions
		The parameter settings are enabled at the same time. • *b5-01 [PID Mode Setting]* • *H1-xx = 10 [Up Command]* • *H1-xx = 11 [Down Command]*	• Set *b5-01 = 0 [Disabled]*. • Remove the function Up/Down command settings.
		These commands are set in Digital Inputs (*H1-xx*, *F3-10 to F3-25*, and *H7-01 to H7-04*) at the same time: • Setting values *61 [Speed Search from Fmax]* and *62 [Speed Search from Fref]* • Setting values *65, 66, 7A, 7B [KEB Ride-Thru 1 or 2 Activate]* and *68 [High Slip Braking (HSB) Activate]* • Setting values *16 [Motor 2 Selection]* and *1A [Accel/Decel Time Selection 2]* • Setting values *65, 66 [KEB Ride-Thru 1 Activate]* and *7A, 7B [KEB Ride-Thru 2 Activate]* • Setting values *40, 41 [Forward RUN (2-Wire), Reverse RUN (2-Wire)]* and *42, 43 [Run Command (2-Wire Sequence 2), FWD/REV (2-Wire Sequence 2)]* • Setting values *60 [DC Injection Braking Command]* and *6A [Drive Enable]* • Setting values *16 [Motor 2 Selection]* and *75,j 76 [Up 2 Command, Down 2 Command]*	Remove the function settings that are not in use.
		These groups of MFDI functions are not set to Digital Inputs (*H1-xx*, *F3-10 to F3-25*, and *H7-01 to H7-04*) at the same time: • Setting values *C7 [PID Setpoint Selection 1], C8 [PID Setpoint Selection 2],* and *C9 [PID Setpoint Selection 3]* • Setting values *C0 [Dedicated Multi-Setpoint YA-02], C1 [Dedicated Multi-Setpoint YA-03], C2 [Dedicated Multi-Setpoint YA-04], C3 [Dedicated Multi-Setpoint YA-05], C4 [Dedicated Multi-Setpoint YA-06], C5 [Dedicated Multi-Setpoint YA-07],* and *C6 [Dedicated Multi-Setpoint YA-08]*	Set the MFDI groups correctly.
		Two of these three MFDI functions are set to Digital Inputs (*H1-xx*, *F3-10 to F3-25*, and *H7-01 to H7-04*) at the same time: • Setting value *50 [Motor Pre-heat 2]* • Setting value *60 [DC Injection Braking Command]* • Setting value *6A [Drive Enable]*	Remove the function setting that are not in use and use only one function.
		Settings for N.C. and N.O. input *[H1-xx]* for these functions were selected at the same time: • Setting value *15 [Fast Stop (N.O.)]* • Setting value *17 [Fast Stop (N.C.)]*	Remove one of the function settings.
		These settings were entered while *H1-xx = 2 [External Reference 1/2 Selection]*: • *b1-15 = 4 [Frequency Reference Selection 2 = Pulse Train Input]* • *H6-01 ≠ 0 [Terminal RP Pulse Train Function ≠ Frequency Reference]*	Set *H6-01 = 0*.
		These settings were entered while *H1-xx = 2 [External Reference 1/2 Selection]*: • *b1-15 = 3 [Option PCB]* or *b1-16 = 3 [Run Command Selection 2 = Option PCB]* • No option card is connected to the drive.	Connect an input option card to the drive.
		These settings were entered while *H1-xx = 2 [External Reference 1/2 Selection]*: • *b1-15 = 1 [Analog Input]* • *H3-02 ≠ 0 [Terminal A1 Function Selection ≠ Frequency Reference]* or *H3-10 ≠ 0 [Terminal A2 Function Selection ≠ Frequency Reference]*	Set *H3-02 = 0* or *H3-10 = 0*.
		These MFDI/MFDO functions are set at the same time: • *H1-xx ≠ 6A [Drive Enable]* and *H1-xx ≠ 70 [Drive Enable No Run Cycle]* • *H2-xx = 38 [Drive Enabled]*	• Set *H1-xx = 6A or 70*. • Change the MFDO setting.
		These MFDI functions are set at the same time: • *H1-xx = 6A [Drive Enable]* • *H1-xx = 70 [Drive Enable No Run Cycle]*	Remove one of the function settings.

Code	Name	Causes	Possible Solutions
		These MFDI functions are set at the same time: • *H1-xx = 67 [Communications Test Mode]* • *H1-xx = AF or B0 [Emergency Override FWD or Emergency Override REV]*	Remove one of the function settings.
		These parameters are set at the same time: • *H1-xx = 62 [Speed Search from Fref]* • *H5-22 = 1 [Speed Search from MODBUS = Enabled]*	Remove one of the function settings.
		These parameters are set at the same time: • *H1-xx = 70 [Drive Enable No Run Cycle]* • *b1-02 ≠ 0 [Run Command Selection 1 ≠ Keypad]*	Remove the *H1-xx = 70* function setting or set *b1-02 = 0*.
		These parameters are set at the same time: • *H1-xx = 70 [Drive Enable No Run Cycle]* • *b1-16 ≠ 0 [Run Command Selection 2 ≠ Keypad]*	Remove the *H1-xx = 70* function setting or set *b1-16 = 0*.
		These parameters are set at the same time: • *H1-xx = 70 [Drive Enable No Run Cycle]* • *H1-xx = 0 [3-Wire Sequence]*	Remove one of the function settings.
		Parameter *S3-01 ≠ 0 [PI2 Control Enable Selection ≠ Disabled]* and MFDI set for *H1-xx = AD [Select PI2 Control PI Parameters]* is ON.	• Set *S3-01 = 0* to use *H1-xx = AD* for the adjustments of *S3-06 [PI2 Control Proportional Gain]* and *S3-07 [PI2 Control Integral Time]* instead of the primary PI controller Proportional and Integral adjustments. • When PI2 Control is necessary, remove the MFDI function setting.
oPE05	Run Cmd/Freq Ref Source Sel Err	The setting to assign the Run command or frequency reference to an option card or the pulse train input is incorrect.	Correct the parameter settings.
		b1-01 = 3 [Frequency Reference Selection 1 = Option PCB] is set, but there is no option card connected to the drive.	Connect an option card to the drive.
		b1-02 = 3 [Run Command Selection 1 = Option PCB] is set, but there is no option card connected to the drive.	
		These parameters are set at the same time: • *b1-01 = 4 [Pulse Train Input]* • *H6-01 ≠ 0 [Terminal RP Pulse Train Function ≠ Frequency Reference]*	Set *H6-01 = 0*.
		These parameters are set at the same time: • *F3-01 = 6 [Digital Input Function Selection = BCD (5-digit), 0.01 Hz]* • *F3-03 = 0, 1 [Digital Input Data Length Select = 8-bit, 12-bit]*	Set *F3-03 = 2 [16-bit]*.
		These parameters are set at the same time: • *b1-01 = 3 [Frequency Reference Selection 1= Option PCB]* • *F2-01 = 0 or 2 [Analog Input Function Selection = 3 Independent Channels or 3 Additional Channels]*	Correct the parameter settings.
		These parameters are set and there is an AI-A3 option card connected to the drive: • *H1-xx = 2 [External Reference 1/2 Selection]* • *b1-15 = 3 [Frequency Reference Selection 2 = Option PCB]* • *F2-01 = 0 [Analog Input Function Selection = 3 Independent Channels]*	Correct the parameter settings.
oPE07	Analog Input Selection Error	The settings for *H3-02, H3-06, H3-10 [MFAI Function Selection]* and *H7-30 [Virtual Analog Input Selection]* overlap.	Set *H3-02, H3-06, H3-10, and H7-30* correctly to prevent overlap. **Note:** It is possible to set these functions to multiple analog input terminals at the same time: • Setting value *0 [Frequency Reference]* • Setting values *F and 1F [Not Used]*
		These parameters are set at the same time: • *H3-02, H3-06, H3-10, H7-30 = B [PID Feedback]* • *H6-01 = 1 [Terminal RP Pulse Train Function = PID Feedback Value]*	Remove the function settings that are not in use.
		These parameters are set at the same time: • *H3-02, H3-06, H3-10, H7-30 = C [PID Setpoint]* • *H6-01 = 2 [PID Setpoint Value]*	

Code	Name	Causes	Possible Solutions
		These parameters are set at the same time: • *H3-02, H3-06, H3-10, H3-40, H3-41, H3-42, H7-30 = 24 [PID Feedback Backup]* • *Y4-41 = 1 [Diff Lvl Src Fdbk Backup Select = Enabled]*	• Use only *H3-xx = 2D [Differential Level Source]* as a backup PID feedback and remove the function setting of *H3-xx = 24*. • Use *H3-xx = 24* as a backup PID feedback and set *Y4-41 = 0 [Disabled]* to not let the drive use *H3-xx = 2D* as a backup PID feedback.
		These parameters are set at the same time when *F2-01 = 2 [Analog Input Function Selection = 3 Additional Channels]*: • *F2-05, F2-09, F2-13 [Terminal Vx Function Selection], H3-40, H3-41, H3-42 = B [PID Feedback]* • *H6-01 = 1*	• Remove the function settings that are not in use. • When you use *H6-01* and *F2-05*, *F2-09*, *F2-13* at the same time, set *F2-01 ≠ 2*.
		These parameters are set at the same time when *F2-01 = 2*: • *F2-05, F2-09, F2-13, H3-40, H3-41, H3-42 = C [PID Setpoint]* • *H6-01 = 2*	
		The settings for *F2-05, F2-09, and F2-13* overlap when *F2-01 = 2*.	• Set the parameters correctly to prevent overlap. • Set *F2-01 ≠ 2*.
		The settings for *F2-05, F2-09, F2-13* and the settings for these parameters overlap when *F2-01 = 2*: • *H3-02, H3-06, H3-10* • *H3-40, H3-41, H3-42* • *H7-30*	
		The settings for these parameters overlap: • *H3-02, H3-06, H3-10* • *H3-40, H3-41, H3-42* • *H7-30*	Set these parameters correctly to prevent overlap
oPE08	Parameter Selection Error	You set a function that is not compatible with the control method set in *A1-02 [Control Method Selection]*.	1. Push ↵ to show *U1-18 [oPE Fault Parameter]*, and find parameters that are not in the applicable setting range. 2. Correct the parameter settings. **Note:** If more than one error occurs at the same time, other *oPExx* errors have priority over *oPE02*.
		When *A1-02 = 0 [V/f]*, you set these parameters: • *S1-01 = 1 [Dynamic Noise Control = Enabled]* • *Y4-42 ≠ 0 [Output Disconnect Detection Sel ≠ Disabled]*	Set *S1-01 = 0* or *Y4-42 = 0*.
		When *A1-02 = 0 [V/f]*, you used *H1-xx = 16 [MFDI Function Selection = Motor 2 Selection]*.	Correct the parameter setting.
		When *A1-02 = 5 [OLV/PM]*, you set *E5-02 to E5-07 [PM Motor Parameters] = 0*.	• Set *E5-01 [PM Motor Code Selection]* correctly as specified by the motor. • For specialized motors, refer to the motor test report and set *E5-xx* correctly.
		When *A1-02 = 5*, you used these parameter settings: • *E5-09 = 0.0 [PM Back-EMF Vpeak (mV/(rad/s)) = 0.0 mV/(rad/s)]* • *E5-24 = 0.0 [PM Back-EMF L-L Vrms (mV/rpm) = 0.0 mV/min^{-1}]*	Set *E5-09* or *E5-24* to the correct value.
		When *A1-02 = 5*, you set *E5-09 ≠ 0* and *E5-24 ≠ 0*.	Set *E5-09 = 0* or *E5-24 = 0*.
		When *A1-02 = 8 [EZOLV]*, you used these parameter settings: • *E9-01 = 1, 2 [Motor Type Selection = Permanent Magnet (PM), Synchronous Reluctance (SynRM)]* • *b3-24 = 2 [Speed Search Method Selection = Current Detection 2]*	When *E9-01 = 1 or 2*, set *b3-24 = 1 [Speed Estimation]*.
		You set *L6-02 [Torque Detection Level 1] < L6-14 [Motor Underload Level @ Min Freq]*.	Set parameters to be *L6-02 ≥ L6-14*.

Code	Name	Causes	Possible Solutions
oPE09	PID Control Selection Fault	These parameters are set at the same time: • *b5-01 = 1* • *b5-11 = 1 [PID Output Reverse Selection = Negative Output Accepted]* And one of these parameters is set: • *d2-02 ≠ 0.0 [Frequency Reference Lower Limit ≠ 0.0%]* • *Y1-06 ≠ 0.0 [Minimum Speed ≠ 0.0%]* • *Y4-12 ≠ 0.0 [Thrust Frequency ≠ 0.0%]* • *Y1-01 ≠ 0 [Multiplex Mode ≠ Drive Only]* • *Yd-01 ≠ 0 [Water Level Selection ≠ Disabled]* • *YE-01 ≠ 0 [Suction Pressure Control Select ≠ Disabled]* • *YF-01≠ 0 [PI Aux Control Selection ≠ Disabled]*	Correct the parameter settings.
		These parameters are set at the same time: • *Y2-01 = 5 [Sleep Level Type = Output Frequency (non-PID)]* • *Y2-02 [Sleep Level]* > 0.0 Hz • *Y4-17 [Utility Start Delay Time]* > 0.0 min	Correct the parameter settings.
oPE10	V/f Data Setting Error	The parameters that set the V/f pattern do not satisfy these conditions: • For motor 1: *E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04 [Minimum Output Frequency ≤ Mid Point A Frequency < Base Frequency ≤ Mid Point B Frequency ≤ Maximum Output Frequency]* • For motor 2: *E3-09 ≤ E3-07 < E3-06 ≤ E3-11 ≤ E3-04 [Minimum Output Frequency ≤ Mid Point A Frequency < Base Frequency ≤ Mid Point B Frequency ≤ Maximum Output Frequency]*	Set the parameters correctly to satisfy the conditions.
oPE11	Carrier Frequency Setting Error	These parameters are set at the same time: • *C6-05 > 6 [Carrier Freq Proportional Gain > 6]* • *C6-04 > C6-03 [Carrier Frequency Lower Limit > Carrier Frequency Upper Limit]* **Note:** When *C6-05 < 7*, *C6-04* becomes disabled. *C6-03* stays active.	Set *C6-02 to C6-05* correctly.
		C6-02 to C6-05 settings are not in the applicable setting range.	
oPE16	Energy Saving Constants Error	The Energy Saving parameters are not set in the applicable setting range.	Make sure that *E5-xx* is set correctly as specified by the motor nameplate data.
		These parameters are set at the same time: • *b8-01 = 1 [Energy Saving Control Selection = Enabled]* • *S1-01 = 1 [Dynamic Noise Control = Enabled]*	Disable Energy Saving Control or Dynamic Noise Control.
oPE33	Digital Output Selection Error	These two parameters are set at the same time: • *H2-60 ≠ F [Term M1-M2 Secondary Function ≠ Not Used]* • *H2-01 = 1xx [Term M1-M2 Function Selection = Inverse output of xx]*	Clear the *H2-01 to H2-03 = 1xx [Inverse output of xx]* settings. **Note:** It is not possible to set *H2-01 to H2-03 = 1xx [Inverse output of xx]* when using output functions for logic operations (*H2-60, H2-63, H2-66 ≠ F*).
		These two parameters are set at the same time: • *H2-63 ≠ F [Term M3-M4 Secondary Function ≠ Not Used]* • *H2-02 = 1xx [Term M3-M4 Function Selection = Inverse output of xx]*	
		These two parameters are set at the same time: • *H2-66 ≠ F [Term MD-ME-MF Secondary Function ≠ Not Used]* • *H2-03 = 1xx [Term MD-ME-MF Function Selection = Inverse output of xx]*	
oPE35	Network WL/SP/PI Aux Mode	These two parameters are set at the same time: • *Y9-51 = 1 [WaterLvl/SuctPres/PI Aux TurnOff = Enabled]* • *Y9-50 ≠ 0 [WaterLvl/SuctPres/PI Aux Source ≠ Analog Only]*	Confirm the settings for *Y9-50* and *Y9-51*.
		These two parameters are set at the same time: • *Y9-51 = 1 [WaterLvl/SuctPres/PI Aux TurnOff = Enabled]* • *YE-01 ≠ 0 [Suction Pressure Control Select ≠ Disabled]*	Confirm the settings for *YE-01* and *Y9-51*.

Code	Name	Causes	Possible Solutions
oPE43	Flow Meter Input	These two parameters are set at the same time: • *H6-01 = 5 [Terminal RP Pulse Train Function = Flow Meter]* • *H3-xx = 3A [MFAI = Flow Meter]*	De-program one of the flow meter inputs.
		Flow Meter Scaling is set to zero and flow meter is being used as PID feedback. *Y6-01 = 0 [Flow Meter Scaling = 0.0]*, *Y1-02 = 25 System Units = Flow (Use Y6-04)]*, and *b5-01 = 1 [PID Mode Setting = Standard]*.	• Adjust *Y6-01*. • Reprogram *Y1-02* or *b5-01*.
oPE44	Water Level / Suct Pres / PI Aux	More than one of the following parameters have been set to a non-zero value: • *Yd-01 [Water Level Selection]* • *YE-01 [Suction Pressure Control Select]* • *YF-01 [PI Aux Control Selection]*	Confirm the settings for *Yd-01, YF-01* and *YE-01*.
		Water Level / Suct Pres Feedback MFAI and PI Auxiliary Control Feedback MFAI have been programmed simultaneously.	Confirm the *H3-xx* settings.

◆ Auto-Tuning Errors

This table gives information about errors detected during Auto-Tuning. If the drive detects an Auto-Tuning error, the keypad will show the error and the motor will coast to stop. The drive will not send notification signals for faults and alarms when Auto-Tuning errors occur.

Two types of Auto-Tuning errors are: *Endx* and *Erx*. *Endx* identifies that Auto-Tuning has successfully completed with calculation errors. Find and repair the cause of the error and do Auto-Tuning again, or set the motor parameters manually. You can use the drive in the application if you cannot find the cause of the *Endx* error.

Erx identifies that Auto-Tuning was not successful. Find and repair the cause of the error and do Auto-Tuning again.

Code	Name	Causes	Possible Solutions
End1	Excessive Rated Voltage Setting	The torque reference was more than 20% during Auto-Tuning or the no-load current that was measured after Auto-Tuning is more than 80%.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data. • If you can uncouple the motor and load, remove the motor from the machine and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, use the results from Auto-Tuning.
End2	Iron Core Saturation Coefficient	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
End3	Rated Current Setting Alarm	The rated current value is incorrect.	Do Auto-Tuning again and set the correct rated current shown on the motor nameplate.
End4	Adjusted Slip Calculation Error	The Auto-Tuning results were not in the applicable parameter setting range.	• Make sure the input motor nameplate data is correct. • Do Rotational Auto-Tuning again and correctly set the motor nameplate data. • If you cannot uncouple the motor and load, do Stationary Auto-Tuning 2.
		The motor rated slip that was measured after Stationary Auto-Tuning was 0.2 Hz or lower.	
		The secondary resistor measurement results were not in the applicable range.	
End5	Resistance Tuning Error	The Auto-Tuning results of the Line-to-Line Resistance were not in the applicable range.	• Make sure that the input motor nameplate data is correct. • Examine and repair damaged motor wiring.
End6	Leakage Inductance Alarm	The Auto-Tuning results were not in the applicable parameter setting range.	Make sure that the input motor nameplate data is correct, and do Auto-Tuning again.
		A1-02 [Control Method Selection] setting is not applicable.	• Examine the value set in *A1-02*. • Make sure that the input motor nameplate data is correct, and do Auto-Tuning again.
End7	No-Load Current Alarm	The Auto-Tuning results of the motor no-load current value were not in the applicable range.	Examine and repair damaged motor wiring.
		Auto-Tuning results were less than 5% of the motor rated current.	Make sure that the input motor nameplate data is correct, and do Auto-Tuning again.

Code	Name	Causes	Possible Solutions
End8	HFI Alarm	• Inductance saliency ratio (*E5-07*/*E5-06*) is too small. • The drive cannot find the *n8-36 [HFI Frequency Level for L Tuning]* value.	• Set the correct value on the motor nameplate to *E5-xx [PM Motor Settings]* or do rotational/stationary Auto-Tuning. • When it is necessary to set *n8-35 = 1 [Initial Pole Detection Method = High Frequency Injection]*, make sure that there is no unusual noise in the low speed range (10% or less) and that the motor does not rotate in reverse at start. **Note:** If the drive detects *End8*, it will automatically set *n8-35 =0 [Pull-in]*. Do not change the settings unless necessary.
End9	Initial Pole Detection Alarm	The drive cannot calculate the correct value for *n8-84 [Polarity Detection Current]* during High Frequency Injection Tuning.	When *n8-35 = 1 [Initial Pole Detection Method = High Frequency Injection]*, make sure that the motor does not rotate in reverse at start. **Note:** If the drive detects *End9*, it will automatically set *n8-35 =0 [Pull-in]*. Do not change the settings unless necessary.
Er-01	Motor Data Error	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		The combination of the motor rated power and motor rated current do not match.	• Examine the combination of drive capacity and motor output. • Do Auto-Tuning again, and correctly set the motor rated power and motor rated current.
		The combination of the motor rated current that was entered during Auto-Tuning and *E2-03 [Motor No-Load Current]* do not match.	• Examine the motor rated current and the no-load current. • Set *E2-03* correctly. • Do Auto-Tuning again, and correctly set the motor rated current.
		The combination of the setting values of Motor Base Frequency and Motor Base Speed do not match.	Do Auto-Tuning again, and correctly set the Motor Base Frequency and Motor Base Speed.
Er-02	Drive in an Alarm State	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the motor nameplate data entered in Auto-Tuning is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		You did Auto-Tuning while the drive had a minor fault or alarm.	Clear the minor fault or alarm and do Auto-Tuning again.
		There is a defective motor cable or cable connection.	Examine and repair motor wiring.
		The load is too large.	• Decrease the load. • Examine the machine area to see if, for example, the motor shaft is locked.
		The drive detected a minor fault during Auto-Tuning.	1. Stop Auto-Tuning. 2. Examine the minor fault code and remove the cause of the problem. 3. Do Auto-Tuning again.
Er-03	OFF Button was Pressed	You pushed the OFF button during Auto-Tuning.	Auto-Tuning did not complete correctly. Do Auto-Tuning again.
Er-04	Line-to-Line Resistance Error	The Auto-Tuning results were not in the applicable parameter setting range.	• Examine and repair motor wiring. • Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		Auto-Tuning did not complete in a pre-set length of time.	
		There is a defective motor cable or cable connection.	
		The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
Er-05	No-Load Current Error	The Auto-Tuning results were not in the applicable parameter setting range.	• Examine and repair motor wiring. • Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		Auto-Tuning did not complete in a pre-set length of time.	
		The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.
		Rotational Auto-Tuning was done with a load that was more than 30% of the rating connected to the motor.	• Disconnect the machine from the motor and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, make sure that the load is less than 30% of the motor rating. If a mechanical brake is installed in the motor, release the brake during Rotational Auto-Tuning.
Er-08	Rated Slip Error	The motor nameplate data entered during Auto-Tuning is incorrect.	• Make sure that the input motor nameplate data is correct. • Do Auto-Tuning again and correctly set the motor nameplate data.

Code	Name	Causes	Possible Solutions
		Auto-Tuning did not complete in a pre-set length of time.	• Examine and repair the motor wiring. • If the motor and machine are connected during Rotational Auto-Tuning, decouple the motor from the machinery.
		The Auto-Tuning results were not in the applicable parameter setting range.	
		Rotational Auto-Tuning was done with a load that was more than 30% of the rating connected to the motor.	• Disconnect the machine from the motor and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, make sure that the load is less than 30% of the motor rating. If a mechanical brake is installed in the motor, release the brake during Rotational Auto-Tuning.
Er-09	Acceleration Error	The motor did not accelerate for the specified acceleration time.	1. Increase the value set in *C1-01 [Acceleration Time 1]*. 2. Disconnect the machine from the motor and do Rotational Auto-Tuning again.
		Rotational Auto-Tuning was done with a load that was more than 30% of the rating connected to the motor.	• Disconnect the machine from the motor and do Rotational Auto-Tuning again. • If you cannot uncouple the motor and load, make sure that the load is less than 30% of the motor rating. If a mechanical brake is installed in the motor, release the brake during Rotational Auto-Tuning.
Er-12	Current Detection Error	There is a phase loss in the drive input power. (U/T1, V/T2, W/T3)	Examine and repair motor wiring.
		The current exceeded the current rating of the drive.	• Check the motor wiring for any short circuits between the wires. • Check and turn ON any magnetic contactors used between motors. • Replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
		The output current is too low.	
		You tried Auto-Tuning without a motor connected to the drive.	Connect the motor and do Auto-Tuning.
		There was a current detection signal error.	Replace the control board or the drive. For information about replacing the control board, contact Yaskawa or your nearest sales representative.
Er-13	Leakage Inductance Error	The motor rated current value is incorrect.	Correctly set the rated current indicated on the motor nameplate and do Auto-Tuning again.
		The drive could not complete tuning for leakage inductance in fewer than 300 s.	Examine and repair motor wiring.
Er-18	Back EMF Error	The result of the induced voltage tuning was not in the applicable range.	1. Make sure that the input motor nameplate data is correct. 2. Do Auto-Tuning again and correctly set the motor nameplate data.
Er-19	PM Inductance Error	The Auto-Tuning results of the PM motor inductance were not in the applicable range.	1. Make sure that the input motor nameplate data is correct. 2. Do Auto-Tuning again and correctly set the motor nameplate data.
Er-20	Stator Resistance Error	The Auto-Tuning results of the PM Motor Stator Resistance were not in the applicable range.	1. Make sure that the input motor nameplate data is correct. 2. Do Auto-Tuning again and correctly set the motor nameplate data.
Er-25	HighFreq Inject Param Tuning Err	The motor data is incorrect.	Do Stationary Auto-Tuning again. **Note:** If the drive detects *Er-25* after you do Stationary Auto-Tuning, it is possible that the motor cannot use high frequency injection. For more information, contact Yaskawa or your nearest sales representative.

◆ Backup Function Operating Mode Display and Errors

■ Operating Mode Display

When you use the backup function from the keypad, the keypad will show messages related to the current operation. These messages will not identify errors in the drive operation.

Keypad Display	Name	Display	State
Drive and Keypad mismatch. Should the parameters be restored?	Detection of inconsistency between the drive and keypad	Normally displayed	The drive detected the connection of a keypad from a different drive. Select [Yes] to copy parameters backed up in the keypad to the connected drive.
Restore Restore from keypad	Restoring parameters	Flashing	The parameters stored in the keypad have been restored to the drive.

Keypad Display	Name	Display	State
End	Backup/restore/verify operation ended normally	Normally displayed	The parameter backup, restore, or verify operation ended normally.
Backup Backup from Drive	Backing up parameters	Flashing	The parameters stored in the drive are being backed up to the keypad.
Verify Keypad & Drive	Verifying parameters	Flashing	The parameter settings stored in the keypad and the parameter settings in the drive align or are being compared.

■ Backup Function Runtime Errors

When an error occurs, the keypad shows a code to identify the error.

The table in this section shows the error codes. Refer to this table to remove the cause of the errors.

Note:

Push any key on the keypad to clear an error.

Code	Name	Causes	Possible Solutions
CPEr	Control Mode Mismatch	The keypad setting and drive setting for *A1-02 [Control Method Selection]* do not agree.	1. Set *A1-02* on the drive to the same value that is on the keypad. 2. Restore the parameters.
CPyE	Error Writing Data	Parameter restore did not end correctly.	Restore the parameters.
CSEr	Control Mode Mismatch	The keypad is broken.	Replace the keypad.
dFPS	Drive Model Mismatch	You tried to restore parameters to a different drive model than the one that you backed up.	1. Examine the drive model that you used to back up the parameters. 2. Restore the parameters.
iFEr	Keypad Communication Error	There was a communications error between the keypad and the drive.	Examine the connector or cable connection.
ndAT	Error Received Data	The parameter settings for model and specifications (power supply voltage and capacity) are different between the keypad and the drive.	1. Make sure that drive model and the value set in *o2-04 [Drive Model (KVA) Selection]* agree. 2. Restore the parameters.
		The parameters are not stored in the keypad.	1. Connect a keypad that has the correct parameters. 2. Restore the parameters.
PWEr	DWEZ Password Mismatch	The password set in the backup operation with Qx-xx *[DriveWorksEZ Parameters]* and *Rx-xx [DriveWorksEZ Connections]* is incorrect.	Set the DWEZ PC software password supplied by Yaskawa for the DWEZ program user ID downloaded to the drive.
rdEr	Error Reading Data	You tried to back up the data when *o3-02 = 0 [Copy Allowed Selection = Disabled]*.	Set *o3-02 = 1 [Enabled]* and back up again.
vAEr	Voltage Class, Capacity Mismatch	The power supply specifications or drive capacity parameter settings are different between the keypad and the drive.	1. Make sure that drive model and the value set in *o2-04 [Drive Model (KVA) Selection]* agree. 2. Restore the parameters.
vFyE	Parameters do not Match	The parameters that are backed up in the keypad and the parameters in the drive are not the same.	1. Restore or backup the parameter again. 2. Verify the parameters.

◆ Status Messages

The HOA keypad will show these status messages on line 1 of the keypad display during the conditions listed below. These are not faults or alarms.

Keypad Display	Description
Current Limit Foldback	Drive output speed is being limited due to the output current limit. Decrease the load or replace with higher capacity drive.
De-staging Lag in XXX min **1*	De-stage is in progress. X indicates the length of time before de-stage takes place. One or more of the de-stage conditions have been met: • High Feedback Quick De-stage • Low Feedback Quick De-stage • Normal De-stage • Low Water Level De-stage • Suction Pressure De-stage • PI Auxiliary Control De-stage Adjust parameter settings if de-stage is not desired given the system conditions.

Keypad Display	Description
Digital Out Dly: Exit in XXXmin *1	The drive is delaying the start of the motor and the Lube Pump digital output is energized with *Y4-29 = 1 [Lube Pump Text = Digital Out Delay]*. Wait or cycle the Run command. Verify setting of *Y4-31 [Lube Pump Time]*.
Flow Rate Limit Foldback	Drive output speed is being limited due to too much (*Y6-26 = 1 [Flow Rate Limit Selection = Enabled]*) or not enough (*Y6-26 = 2 [Enabled - Low Limit]*) Flow Rate (*UA-83*). If the Flow Rate Limiter is activating incorrectly, confirm and adjust Flow Rate parameters *Y6-01, Y6-26, Y6-27, Y6-28* and/or *Y6-29*.
Level Control Active	*Yd-01 = 1 [Water Level Selection = Enabled]* and is active. Set *Yd-01 = 0 [Disabled]* or adjust *Yd-25 [Water Lvl Ctrl Activation Level]*.
Lube Pump Active: Exit in XXXmin *1	The drive is delaying the start of the motor and the Lube Pump digital output is energized with *Y4-29 = 0 [Lube Pump Text = Lube Pump]*. Wait or cycle the Run command. Verify setting of *Y4-31 [Lube Pump Time]*.
Net Drv Err: Check Faulted Drive	Another drive in the network has a system fault (*NMS, HFB, HWL, LFB, LWL, LowFl, HiFlo, or ACCUM*). Another drive in the network has a *Low City Pressure* alarm. Check the other drives in the system.
Net FB Lost: Check FB Source	Network PID Feedback has been lost. No valid analog PID feedback source can be found on the network. Repair the source of network feedback or add an analog source.
Net WL/SP/PI Aux Feedback Lost	Network source for Water Level, Suction Control Pressure, or Aux PI Feedback has been lost. Valid analog source for Water Level, Suction Control Pressure, or Aux PI Feedback cannot be found on the network. Check the source on drives configured with *Y9-50 ≠ 3 [WaterLvl/SuctPres/PI Aux Source ≠ Network Only]*.
Network Pre-Charge Active	Pre-Charge is active on another networked drive. If the MFDI was previously open, drive will enter Pre-Charge if required.
Network Start Delay: Y9-29	System was on the Pump Off Network state and a drive has been put on AUTO Mode. The iQpump MEMOBUS network is waiting for *Y9-29 [Network AUTO Start Delay]* to elapse.
[o1-83 value *2] XX	Parameter *o1-83 > 0 [Drive Name]*. The “XX" on the screen will be replaced *o1-84 [Drive Name Unit Number]* value when *o1-84 > 0*. Change *o1-83* or *o1-84* settings.
PI Aux Control Active	*YF-01 = 2 [PI Aux Control Selection = Enabled]* and is active. Set *YF-01 = 0 [Disabled]* or adjust *YF-25 [PI Aux Control Activation Level]*.
Pre-Charge: Exit in XXX min *1	Pre-Charge active. X indicates time left before Pre-Charge exits due to timers (*Y4-03 + Y4-07*). Pressure Feedback is low. Adjust the Pre-Charge parameters.
PrimerPump Activ: Exit in XXXmin *1	The drive is delaying the start of the motor and the Lube Pump digital output is energized with *Y4-29 = 2 [Lube Pump Text = Primer Pump]*. Wait or cycle the Run command. Verify setting of *Y4-31 [Lube Pump Time]*.
Scrn Mtr Starter: Exit in XXXmin *1	The drive is delaying the start of the motor and the Lube Pump digital output is energized with *Y4-29 = 3 [Lube Pump Text = Screen Motor Starter]*. Wait or cycle the Run command. Verify setting of *Y4-31 [Lube Pump Time]*.
Seq Timer Set: Wait for RUN Cmd	Sequence Timers are programmed to run the drive but there is no Run Command.
Sequence Timer Active: IDLE	Sequence Timers are programmed to run the drive, the Run Command is applied, but the timer has not started yet.
Sequence Timer 1: RUN	Sequence Timers are programmed to run the drive, the Run Command is applied and the timer is running the drive. The active timer number is displayed.
Single Phase Foldback	The drive is limiting output speed because of too much DC Bus voltage ripple. The drive lost an input phase, or for a single phase application, the motor is drawing too much load. Make sure that all input phases are present and decrease the output load.
Sleep Active Minimum Water Level	Water Level Control caused the drive to sleep. The water level was below the *Yd-04 [Minimum Water Level]* level for longer than the *Yd-05 [Water Level Sleep Delay Time]* time and forced the drive to go into a sleep condition. Confirm Water Level sleep settings.
Sleep Active Min Suct Pressure	Drive is in sleep due to Suction Pressure Control. The Suction Pressure dropped below the YE-04 level for more than the YE-05 time, forcing the drive to go to a sleep condition. Confirm Suction Pressure sleep parameter settings.
Sleep AUTO→Off AUTO Cmd to RUN	Drive switched to OFF due to entering sleep with *Y2-15 = 1 or 2 [Sleep AUTO → OFF Selection = Enabled or Enabled with Timer]*. Issue a Run command.

Keypad Display	Description
Staging Lag in XXX min **1*	Stage is in progress. X indicates the length of time before staging takes place. The conditions for staging a new drive have been met. Adjust parameter settings if staging is not desired given the system conditions.
Suction Control Active	*YE-01 = 1 [Suction Pressure Control Select = Suction Pressure (PSI)]* and is active. Set *YE-01 = 0 [Disabled]* or adjust *YE-25 [Suc Pres Ctrl Activation Level]*.
Vacuum Control Active	*YE-01 = 2 [Suction Pressure Control Select = Vacuum ("Hg)]* and is active. Set *YE-01 = 0 [Disabled]* or adjust *YE-25 [Suc Pres Ctrl Activation Level]*.

*1 Unit changes to “sec” for values less than or equal to 180 seconds.
*2 The text shown here will be different for different *o1-83* values.

Revision History

Date of Publication	Revision Number	Section	Revised Content
October 2025	<2>	11	Addition: Increased the number of parameters listed.
August 2025	<1>	All	Revision: Removed procedure data for 2xxxxT and 4xxxxT with Main Switch models.
July 2025	-	-	First Edition

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Specifications are subject to change without notice for ongoing product modifications and improvements.

Original instructions.

YASKAWA America, Inc.

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