YASKAWA

iQpump Micro AC Drive

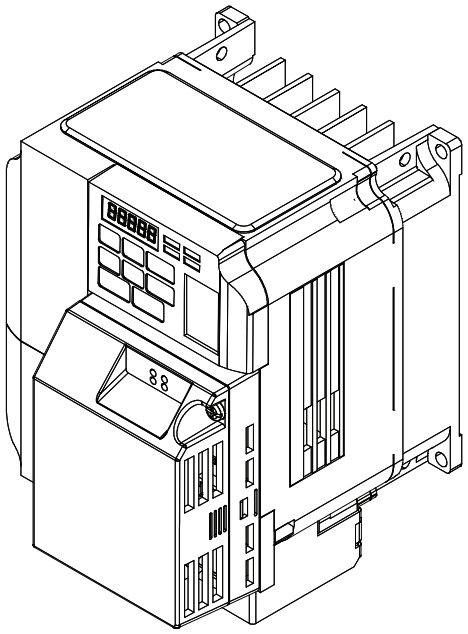
Compact Intelligent Pump Controller

Quick Start Guide

Type: CIMR-PW □□□□

Models: 200 V Class, Single-Phase Input: 1 to 5 HP ND
200 V Class, Three-Phase Input: 1.5 to 25 HP ND
400 V Class, Three-Phase Input: 1 to 25 HP ND

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



MANUAL NO. TOEP YAIQPM 02C

◆ Quick Start Procedure

This procedure is a supplement to other documentation supplied with this equipment and guides the user in properly wiring the iQpump and motor. It also shows the configuration for a simplex pump application.

WARNING! *Read and adhere to all safety messages contained in this manual prior to performing this procedure. When installing the system be sure to follow good wiring practices and all applicable codes. Ensure that the mounting of the various components are secure and that the environment, such as extreme dampness, poor ventilation etc. will not cause system degradation. Please read this cheat sheet and other documentation provided with the iQpump thoroughly before attempting any installation.*

The setup procedure begins on the next page.

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iQpump Micro
Quick Start Procedure

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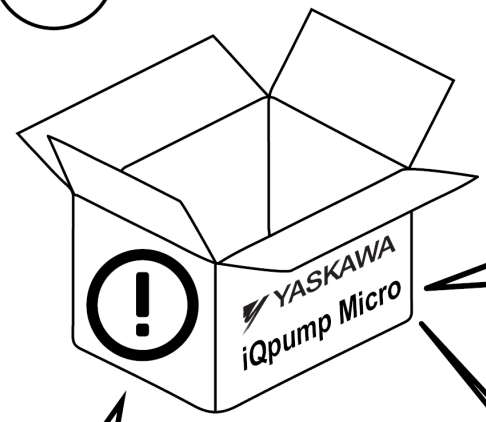
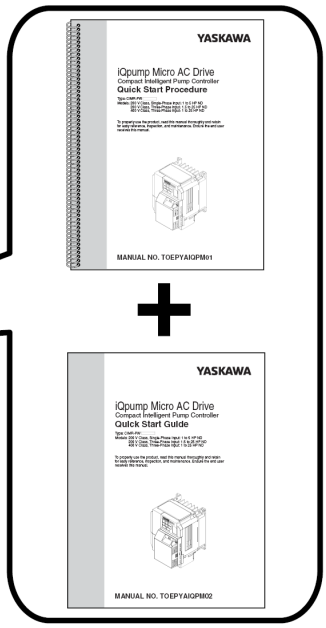
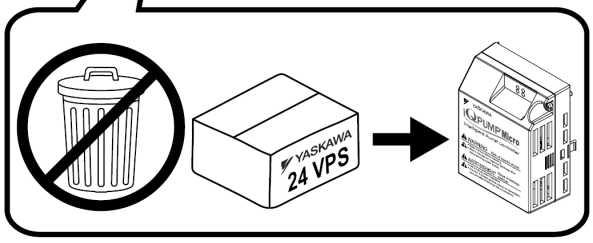
STEP 1

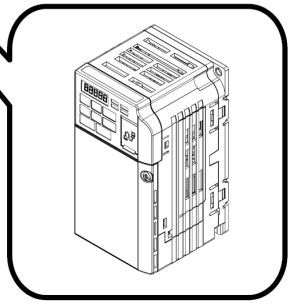
☐ Unpack the iQpump Micro

1 **Remove all contents prior to discarding packaging !**



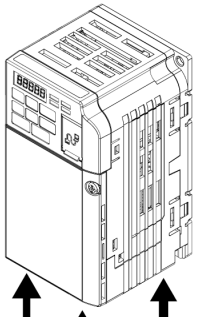






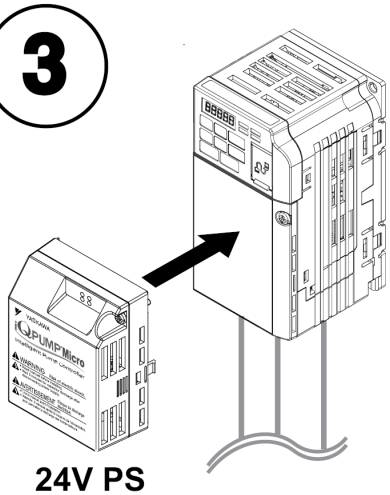
NOTICE: Connect LINE, MOTOR, and CONTROL circuit wiring <u>BEFORE</u> installing 24V power supply.

2



LINE
MOTOR
CONTROL

3



24V PS

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STEP 2

☐ Identify the Model for Installation

Safety Symbols in this Document

WARNING!
Read and understand users manual before using this equipment. Failure to follow users instructions may result in serious injury or death.

WARNING!
Hazardous Voltage. Contact may cause electric shock or burn. Turn-off and lock-out system and facility power before servicing.

WARNING!
Stay Clear- Equipment starts automatically. Clear all personnel from equipment, install shields or guards, locate and verify emergency SHUT-OFF is functional. Failure to comply may result in serious injury to personnel.

WARNING!
Improper Operation Sequence. DO NOT RUN THE MOTOR. Failure to comply may result in serious injury to personnel.

WARNING!
Do not operate equipment with covers or guards removed. Install or replace cover and/or guards before operation. Failure to comply may result in serious injury to personnel.

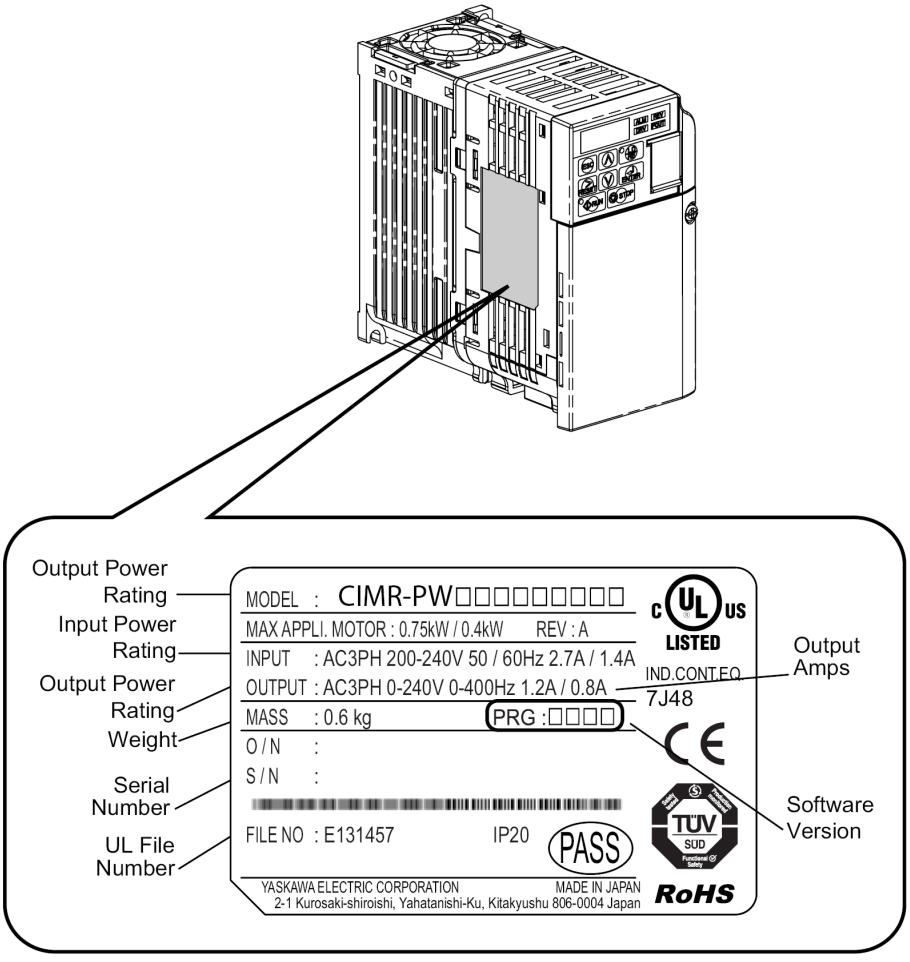
This Quick Start Procedure serves as general guide to help install, configure and perform test run operation. Refer to the iQpump Micro User Manual No. TOEP YAIQPM 03 for complete instructions to configure this product for each specific installation site.

2.1 Verify the correct model and ratings.

Follow this procedure for each iQpumpMicro and motor combination.

a. Locate the nameplate and your order information.
b. Verify the Model No: (E) matches the line item(s) on your order, to confirm receipt of the correct model.
c. Locate the nameplate of motor that will be connected.
d. Confirm the motor nameplate Amperage, Voltage, and Frequency (Hz) are within the Output specifications (B) shown on the iQpump Micro nameplate.

2.2 Verify main power source is adequate by reviewing the Input specifications (A) shown on the iQpump Micro nameplate.



STEP 3

☐ Perform Mechanical Installation

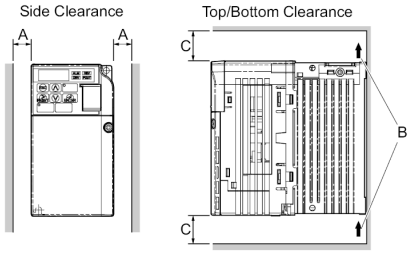
3.1 Verify installation environment.

Mechanical installation and mounting footprint vary by model. Refer to the iQpump Micro User Manual No. TOEP YAIQPM 03, Chapter 2: Mechanical Installation for details. Ensure the installation conditions are suitable to prolong and optimize performance life.

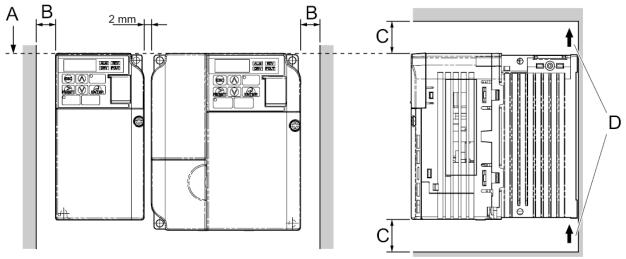
Environment	Conditions
Installation Area	Indoors
Ambient Temperature	-10 to + 40 °C (+14 to +104 °F) NEMA 1, UL Type 1 Enclosure
Humidity	95% RH or less and free of condensation
Storage Temperature	-20 °C to +60 °C (-4 °F to +104 °F)
Surrounding Area	Install the drive in an area free from: • oil mist and dust • metal shavings, oil, water, or other foreign materials • radioactive materials • combustible materials (e.g., wood) • harmful gases and liquids • excessive vibration • chlorides • direct sunlight.
Altitude	Up to 1000 meters without derating. Up to 3000 meters with output current and voltage derating
Orientation	Install the unit vertically to maintain maximum cooling effects.

3.2 Maintain installation clearances.

Single Drive Installation



Multiple Drive Installation



Ensure the back panel is placed against a closed flat surface for proper cooling.

NOTICE: Abnormal Operation. Avoid placing peripheral devices, transformers, or other electronics near the bypass as the noise created can lead to abnormal operation. Take proper steps to shield the bypass from electrical interference if such devices must be used in close proximity to the Bypass.

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

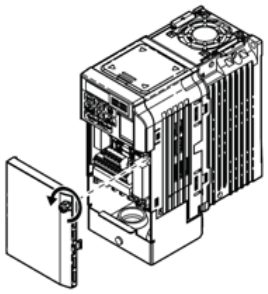
Install Type	Minimum Spacing			
	A	B	C	D
Single drive	30 mm (1.18 in)	• Airflow direction	100 mm (3.93 in)	-
Multiple drive installation	Align the tops of the units	30 mm (1.18 in)	100 mm (3.93 in)	Airflow direction

STEP 4

☐ Motor, Line Power and Start/Stop Circuit

4.1 Remove the front cover

NEMA 1, UL Type 1 Enclosure



NOTICE: Improper removal of the the drive's protective covers and conduit bracket (NEMA 1, UL Type 1) can cause damage to the drive. Adhere to iQpump User Manual, Section 3, Protective Covers to avoid drive damage.

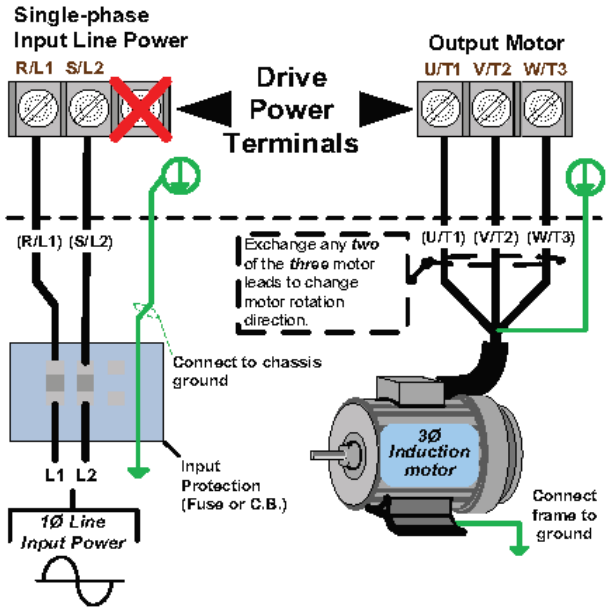
4.2 Connect main input power and motor wiring to the drive.

Refer to **Figure 1** for single-phase input power drive models.
Refer to **Figure 2** for three-phase input power drive models.

Follow accepted wiring practices and applicable electric codes. Ensure all equipment is properly grounded.

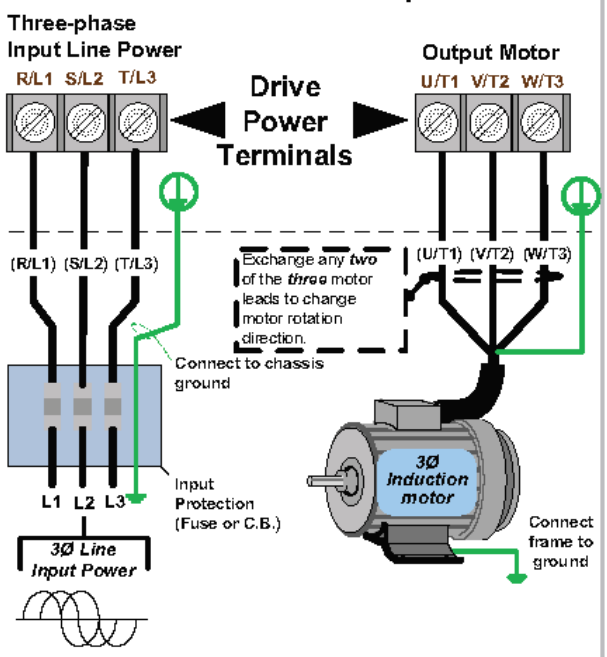
WARNING! Fire Hazard. Do not connect terminals B1, B2 (-), +1, +2 terminals to earth ground. Only connect ground wiring to designated ground terminals.

Figure 1: Line and Motor Electrical Connections - Single-Phase Input Power



Sizing note: Verify the drive is properly sized for single phase input power. The drive input line voltage must be equal to or greater than motor rated voltage for best performance.

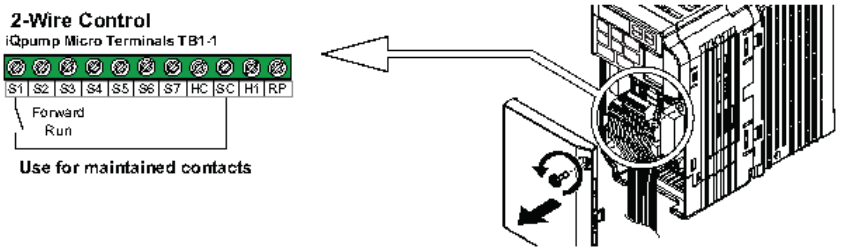
Figure 2: Line and Motor Electrical Connections - Three-Phase Input Power



4.3 Select start / stop control method, (parameter b1-02).

Remove the drive terminal cover to access the control terminals. The drive will START and STOP from the keypad from the factory. If this is the preferred start/stop method then continue to the feedback signal connection section. Refer to the wiring diagram below to START/STOP the drive using an external switch or contact

2-Wire Start/Stop Wiring Diagrams

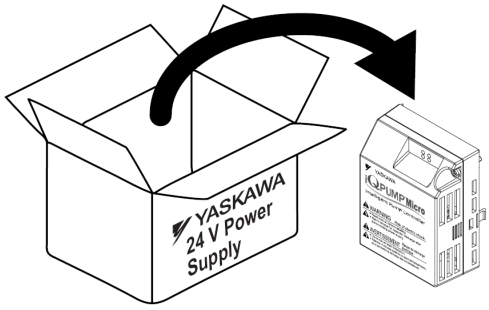


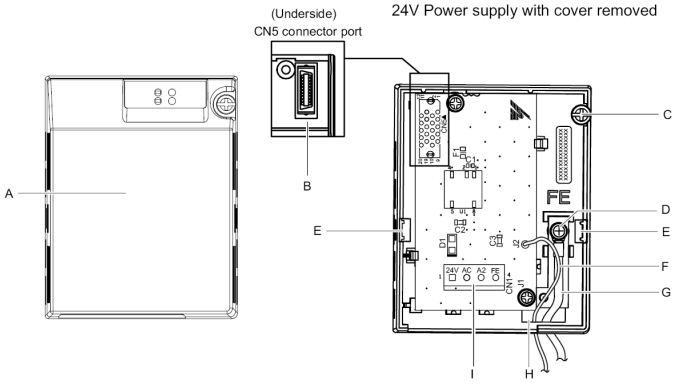
STEP 5

☐ Install the 24 V Transducer Power Supply

5.1 24V Power Supply Components

Unpack the 24 V Power Supply





A – 24V Power Supply cover
B – CN5 Connector to drive
C – Screw hole (attaches 24V Power Supply cover)
D – Functional Earth cable connection (FE)
E – Mounting tabs
F – J2/A2 (white) conductor wire
G – Ground wire <1>
H – Through-slot for J2/A2 wire and ground wire
I – CN1 Terminal Block-Customer Connections

Figure 1.1 24V Power Supply Components

<1> **One of the four ground wires packaged with the 24V Power Supply must be connected during installation.**

IP20/NEMA 1, UL Type 1 Dimensions with 24V Power Supply

The installed 24 V power supply option adds 27 mm (1.06 in.) to the total depth of the drive. Height and width dimensions are unaffected.

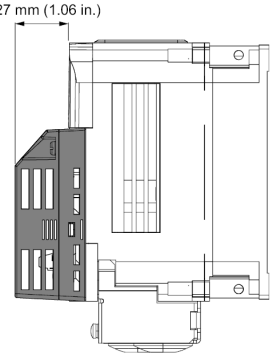


Figure 1.2 24 V Power Supply Dimensions

STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

5.2 Prior to Installing the 24V Power Supply

Prior to installing the 24V Power Supply, wire the drive, make necessary connections to the drive terminals, and verify that the drive functions normally without the 24V Power Supply installed. Refer to the product manual packaged with the drive for information on wiring and connecting the drive.

The installation procedure differs slightly depending on enclosure type. The enclosure type is identified within the drive model number.

5.3 Locate the drive model number using ***Figure 1.3***.

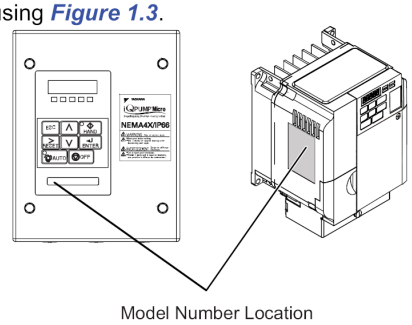


Figure 1.3 Model Number Location

5.4 Identify the drive enclosure type. Use ***Figure 1.4*** to find the digit within the model number that identifies the enclosure type.

Note: Installing the 24V Power Supply on an IP20/NEMA 1, UL Type 1 enclosure drive voids NEMA 1, UL Type 1 protection while maintaining IP20 conformity.

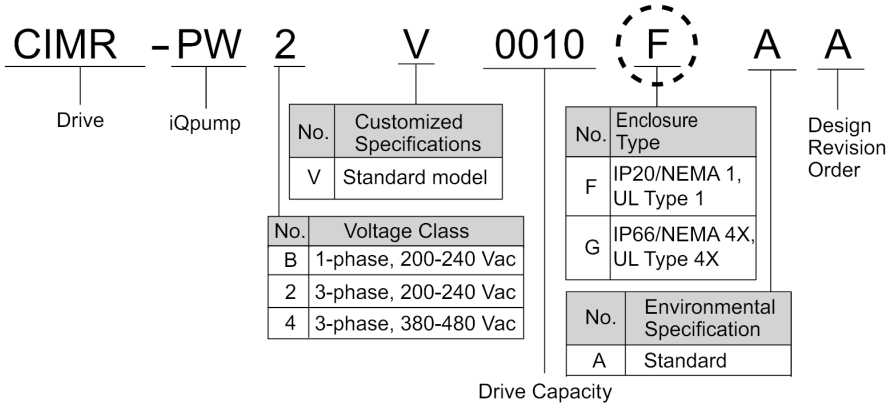


Figure 1.4 Drive Enclosure Type Identification

5.5 Select proper installation tools according to enclosure type and model.

Note: Tools required to prepare the 24V Power Supply cables for wiring are not listed in this manual.

Table 1.1 Tool and Material Requirements (Customer Supplied)

Model Number Enclosure Type Digit	Drive Enclosure Type	Drive Capacity	Tools		Materials
			Screwdriver	Socket Wrench	Wire Tie with Adhesive Mount
F	IP20/NEMA 1, UL Type 1	All	Phillips screwdriver M3 metric #1, #2 U.S. standard size Note: Screw sizes vary by drive capacity. Select a screwdriver appropriate for the drive capacity.	Not applicable	All models
G	IP66/NEMA 4X, UL Type 4X	2V0030 to 2V0069 4V0018 to 4V0038		10 mm socket wrench	Not applicable
		Other capacities		8 mm socket wrench	

STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

5.6 Installation Procedure

5.7 Shut off power to the drive. Wait at least five minutes after confirming the DC bus voltage is safe.

On **IP20/NEMA 1, UL Type 1** models, loosen the screw that fastens the front cover in place and remove the front cover. This drive front cover will be replaced by the 24V Power Supply cover. Cover removal varies depending on drive size.

On **IP66/NEMA 4X, UL Type 4X** models, loosen the 4 bolts that attach the enclosure front cover in place, gently move the front cover away from the enclosure, press firmly on the digital operator cable connector release tab to disconnect the cable from port CN1 on the drive, then remove the front cover. Refer to ***Table 1.3*** for installation bolt size.

Table 1.2 Remove the Drive or Enclosure Front Cover

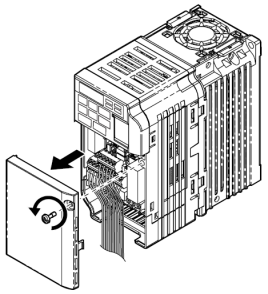
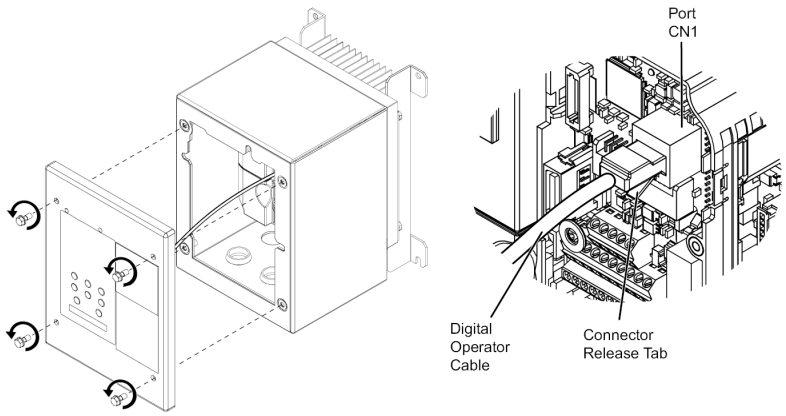
IP20/NEMA 1, UL Type 1	IP66/NEMA 4X, UL Type 4X
	

Table 1.3 IP66/NEMA 4X, UL Type 4X Enclosure Front Cover Installation Bolt Size

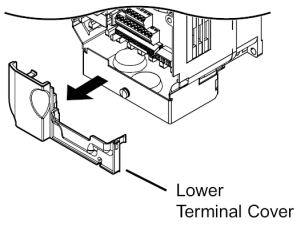
Voltage Class	Drive Model	Installation Bolt Size
Single-Phase 200 V Class	BV0001G to BV0012G	M5
Three-Phase 200 V Class	2V0001G to 2V0020G	M5
	2V0030G to 2V0069G	M6
Three-Phase 400 V Class	4V0001G to 4V0011G	M5
	4V0018G to 4V0038G	M6

5.8 On **IP20/NEMA 1, UL Type 1** enclosure models, loosen the screw on the front of the bottom cover and remove it from the drive. All models except 2V0006F require removing a plastic lower terminal cover prior to removing the bottom cover.

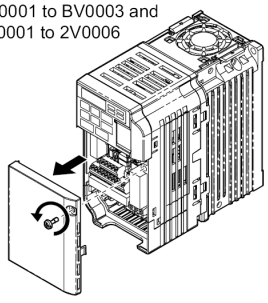
On **IP66/NEMA 4X, UL Type 4X**enclosure models, remove the lower terminal cover (if provided) from the drive.

The lower terminal cover is not present on certain models.

Models **With** Lower Terminal Cover



Models **Without** Lower Terminal Cover: BV0001 to BV0003 and 2V0001 to 2V0006



STEP 5

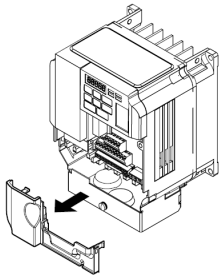
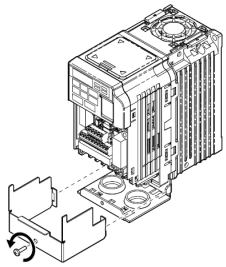
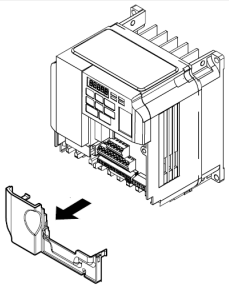
☐ Install the 24 V Transducer Power Supply (continued)

Note: The lower terminal cover is required for secure mounting of the 24V Power Supply on the models shown in ***Table 1.4***. Contact your Yaskawa representative for ordering if you have a model listed in ***Table 1.4*** and the lower terminal cover is not present on your drive.

Table 1.4 Lower Terminal Cover Part Number by Model

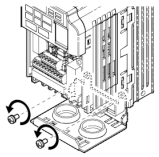
Drive Model	Terminal Cover Part Number
BV0006☐ and BV0010☐ 2V0010☐ and 2V0012☐ 4V0002☐ to 4V0009☐	CVST31300
BV0012☐ 2V0020☐ 4V0011☐	CVST31301
Other models	Not required

Table 1.5 Remove the Bottom Cover and Lower Terminal Cover

IP20/NEMA 1, UL Type 1		IP66/NEMA 4X, UL Type 4X
Lower Terminal Cover on All Models Except Models: BV0001 to BV0003 2V0001 to 2V0006	**Bottom Cover on All Models**	**Terminal Cover on Models BV0006G to BV0010G 2V0010G to 2V0020G 4V0002G to 4V0011G**
		

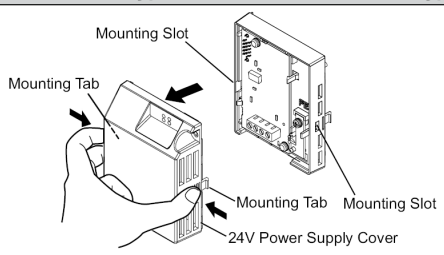
5.9 On IP20/NEMA 1, UL Type 1 enclosure models, loosen the screws attaching the NEMA 1, UL Type 1 conduit bracket to the drive to allow the bracket to swing out to provide easier access to the ground screw. Do not remove the screws.

Table 1.6 Loosen Conduit Bracket Screws

IP20/NEMA 1, UL Type 1	IP66/NEMA 4X, UL Type 4X
	Not applicable.

5.10 Remove the 24V Power Supply cover.

Table 1.7 Remove 24V Power Supply Cover

IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X


STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

5.11 Select one of the four ground wires packaged with the 24V Power Supply unit and attach the ground wire to the drive.

Select the correct ground wire shown in ***Figure 1.5*** by first removing the drive ground terminal screw as shown in ***Table 1.8***. Yaskawa recommends using a long Phillips screwdriver with a magnetic tip to aid in keeping the screw captive during removal and installation.

Test fit the screw (size M3.5 to M6) into each of the four ground wire drive-side ring lugs prior to installation. Ground wire selection varies by drive model.

With the appropriate screw removed, attach the drive-side of the ground wire to the drive ground terminal and tighten all loosened screws.

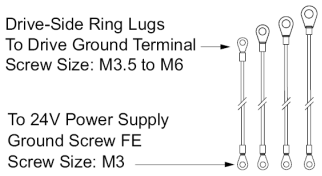
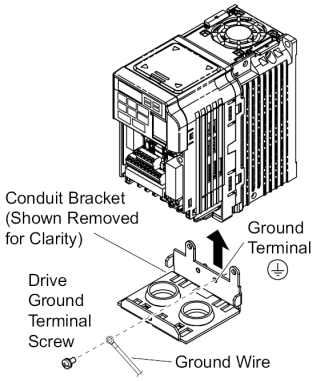
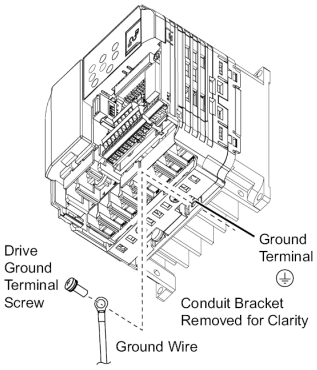
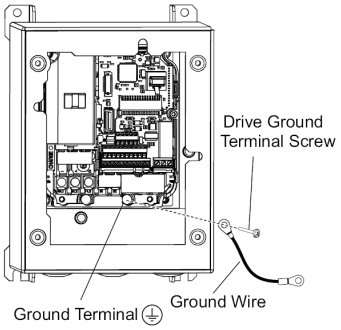


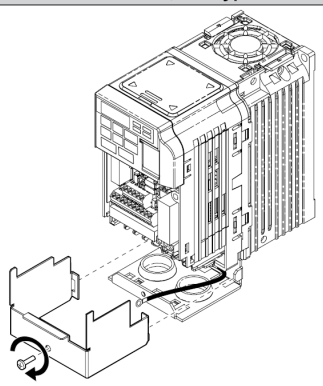
Figure 1.5 Ground Wire Selections

Table 1.8 Drive Ground Terminal and Screw Location

IP20/NEMA 1, UL Type 1		IP66/NEMA 4X, UL Type 4X
Models BV0001 to BV0003 2V0001 to 2V0006	**All Other Models**	
		

5.12 Reattach the bottom terminal cover.

Table 1.9 Reattach Bottom Terminal Cover

IP20/NEMA 1, UL Type 1	IP66/NEMA 4X, UL Type 4X
	Not applicable.

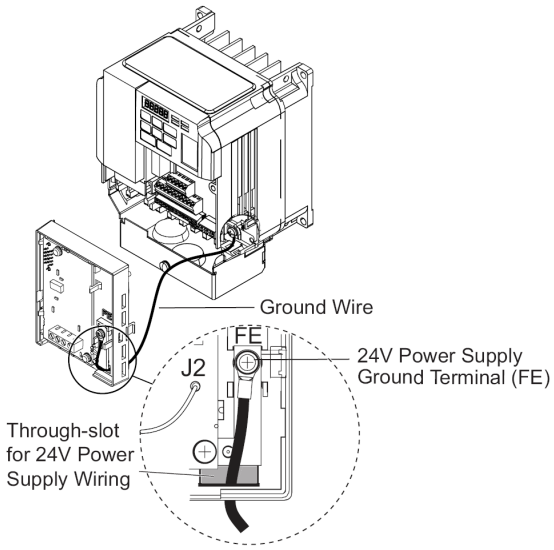
STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

5.13 Connect the ground wire to the 24V Power Supply at ground terminal FE.

Route the free end of the ground wire to the front of the 24V Power Supply via the through-slot as shown in ***Table 1.10*** and connect the ground wire. Tighten the screw to 0.5 ~ 0.6 Nm or (4.4 ~ 5.3 in lbs) using an M3 Phillips screwdriver.

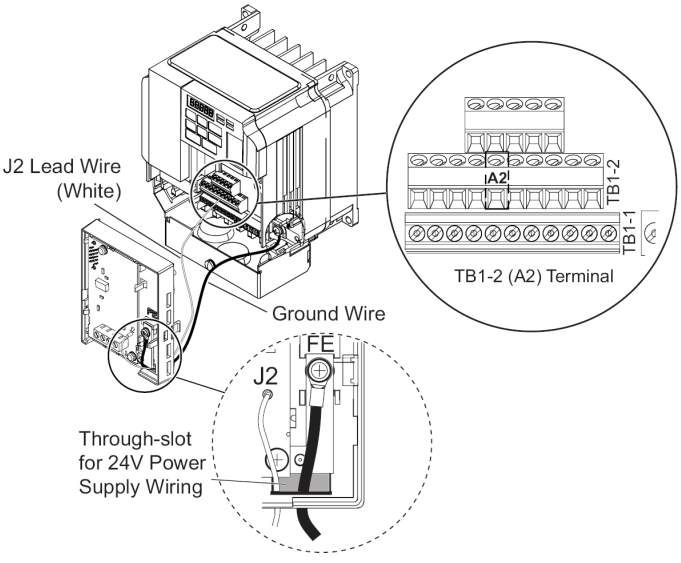
Table 1.10 Connect Ground Wire to 24V Power Supply

IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X


5.14 Connect the white J2 lead wire to terminal A2 on drive terminal block TB1-2.

Route the free end of the J2 wire to the A2 terminal on the drive via the through-slot on the 24V Power supply as shown in ***Table 1.11***.

Table 1.11 Connect J2 Lead Wire to Drive

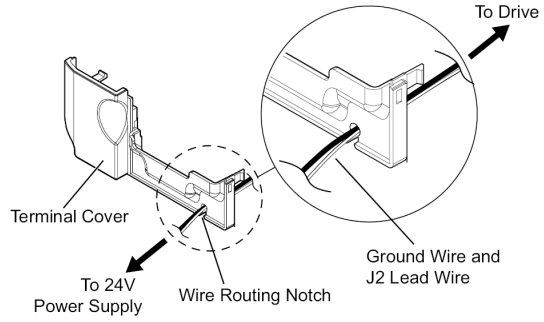
IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X


STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

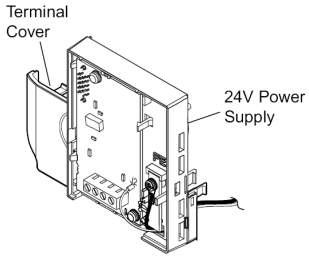
5.15 On models BV0006☐ to BV0018☐, 2V0010☐ to 2V0020☐, and 4V0002☐ to 4V0011☐, insert the ground wire and J2 lead wire into the terminal cover wire notch.

Table 1.12 Insert Wires Into Routing Notch

IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X


After inserting the ground wire and J2 lead wire into the notch, attach the terminal cover to the 24V Power Supply.

Table 1.13 Connect Terminal Cover to 24V Power Supply

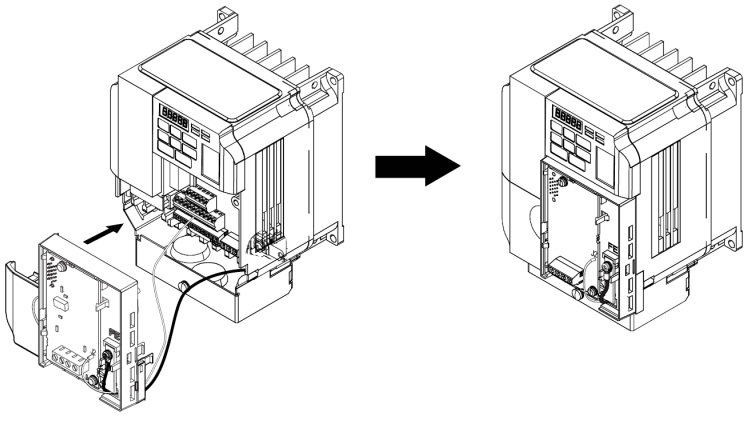
IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X


5.16 Attach the 24V Power Supply or 24V Power Supply/Terminal Cover combination to the drive.

Properly seat the tabs on the left and right sides of the 24V Power Supply unit into the drive case mounting slots and snap into place.

NOTICE: *Damage to Equipment. Take proper precautions when attaching the 24V Power Supply to the drive so that no cables are pinched between the 24V Power Supply and the drive. Failure to comply may result in damage to circuitry and equipment.*

Table 1.14 Attach 24V Power Supply to Drive

IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X


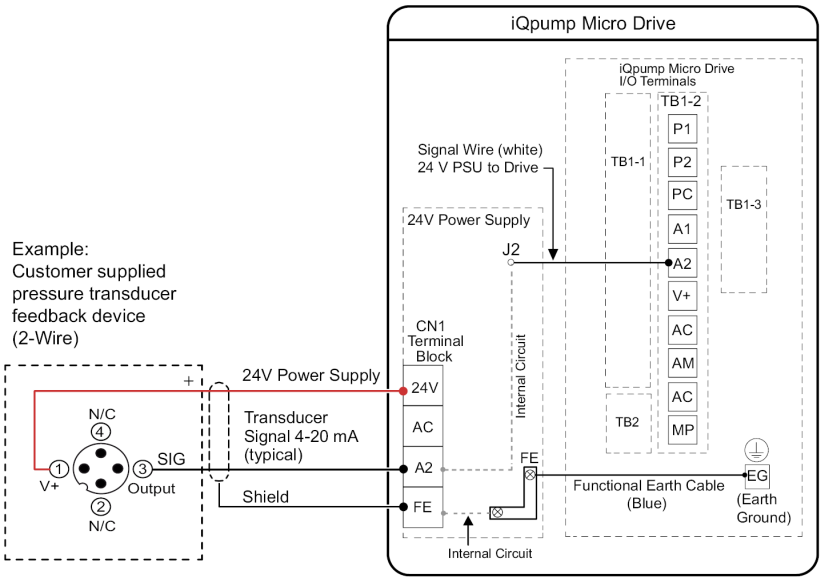
STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

5.17 Connect wiring from customer-supplied transducer to 24V Power Supply.

Refer to Figure 1.6 Transducer (2-Wire) connection or Figure 1.7 Transducer (3-Wire) connection based on the application.

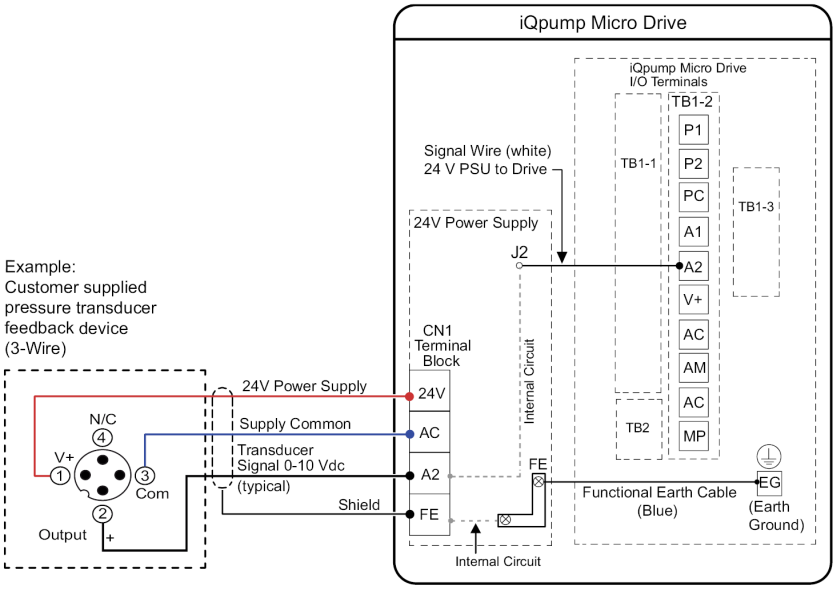
Figure 1.6 (2-Wire) 4 to 20 mA Transducer



Note: Transducer wire colors and numbering may vary depending on feedback device used, consult feedback device manual.

Figure 1.7 (3-Wire) 0 to 10 V Transducer

Note: Set DIP switch S1 located on drive to V position for use with 0 to 10V transducer.

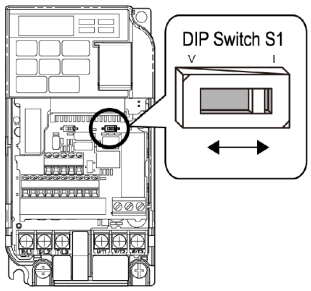


Setting DIP Switch S1 for Terminal A2 Signal Type Selection

Terminal A2: DIP Switch S1 Signal Type Selection

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

DIP Switch S1 Location



Parameter H3-09 Details

No.	Parameter Name
H3-09	Frequency ref. (current) terminal **A2** signal level selection
Description	
Selects the signal level for terminal A2. 0: 0 to +10 V, unipolar input (with lower limit) 1: 0 to +10 V, bipolar input (no lower limit) 2: 4 to 20 mA 3: 0 to 20 mA	

Note: Refer to the iQpump Micro User Manual, (No. TOEPYAIQPM03) to program the iQpump Micro drive for network communication if required.

STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

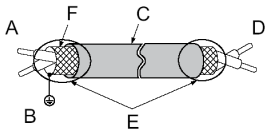
5.18 (continued)

Select appropriate transducer wire type and size from ***Table 1.15***. For simpler and more reliable wiring, you may choose to crimp ferrules to the wire ends. Refer to ***Figure 1.9*** and ***Table 1.16*** for ferrule terminal types and sizes.

Table 1.15 24V Power Supply Wire Size and Torque Specifications

Terminal	Screw Size	Tightening Torque N•m (in-lbs)	Bare Wire Terminal		Ferrule-Type Terminal		
			Applic. wire size mm² (AWG)	Recomm. mm² (AWG)	Applic. wire size mm² (AWG)	Recomm. mm² (AWG)	Wire Type
24V, AC, A2, FE	M3	0.5 to 0.6 (4.4 to 5.3)	Stranded: 0.25 to 1.5 (24 to 16) Single: 0.25 to 1.5 (24 to 16)	0.75 (18)	0.25 to 1.0 (24 to 17)	0.5 (20)	Shielded line, etc.

5.19 Prepare the ends of the transducer wires as shown in ***Figure 1.8***.



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

Figure 1.8 Preparing the Ends of Shielded Cables

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

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

5.20 If desired, select the correct ferrule-type wire termination.

Crimp a ferrule to signal wiring to improve wiring simplicity and reliability. Use CRIMPFOX 6, a crimping tool manufactured by PHOENIX CONTACT.

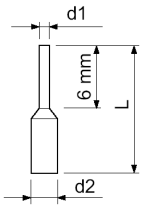


Figure 1.9 Ferrule Dimensions

Table 1.16 Ferrule Terminal Types and Sizes

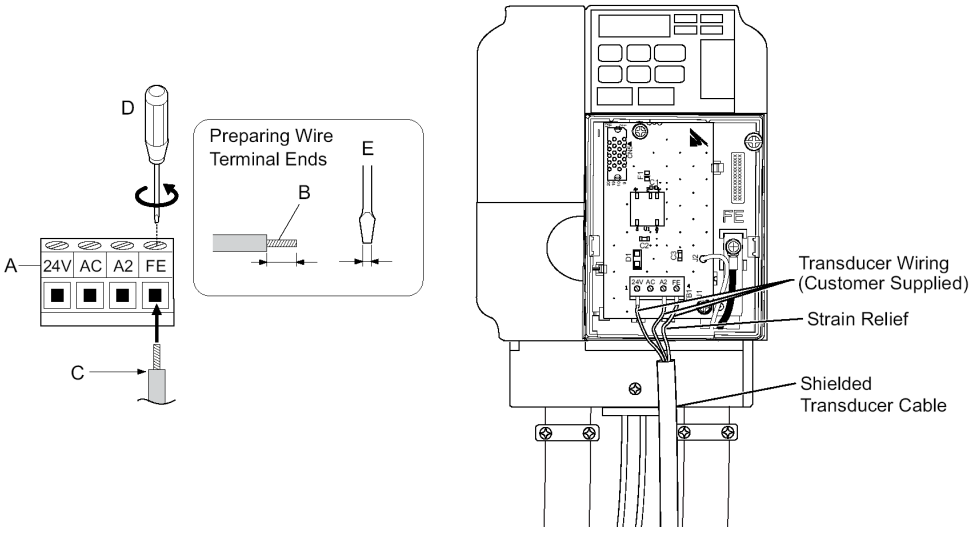
Size mm² (AWG)	Type	L (mm)	d1 (mm)	d2 (mm)	Manufacturer
0.25 (24)	AI 0.25-6YE	10.5	0.8	2.0	PHOENIX CONTACT
0.34 (22)	AI 0.34-6TQ	10.5	0.8	2.0	
0.5 (20)	AI 0.5-6WH	12	1.1	2.5	
0.75 (18)	AI 0.75-6GY	12	1.3	2.8	
1.0	AI 1-6RD	12	1.5	3.0	

Note: Do not route shielded cable through bottom conduit bracket cable glands on IP20/NEMA 1, UL Type 1 enclosures.

STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

5.21 Connect transducer wiring to the 24V Power Supply terminals using ***Figure 1.10*** as a guide.



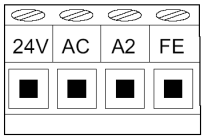
A – Terminal block CN1
B – Avoid fraying wire strands when stripping insulation from wire. Strip length 5.5 mm.
C – Single wire or stranded wire
D – Loosen screw to insert wire.
E – Blade depth of 0.4 mm or less Blade width of 2.5 mm or less

Figure 1.10 24V Power Supply Wiring Guide

NOTICE: *Separate transducer wiring from main circuit wiring (terminals R/L1, S/L2, T/L3, B1, B2, U/T1, V/T2, W/T3, ⊖, ⊕1, ⊕2) and other high-power lines. Improper wiring practices could result in drive malfunction due to electrical interference.*

NOTICE: *Damage to Equipment. Do not tighten screws beyond the specified tightening torque. Failure to comply may damage the terminal block.* ***Refer to 24V Power Supply Wire Size and Torque Specifications on page 13*** *for details.*

Table 1.17 24V Power Supply Terminal Block CN1

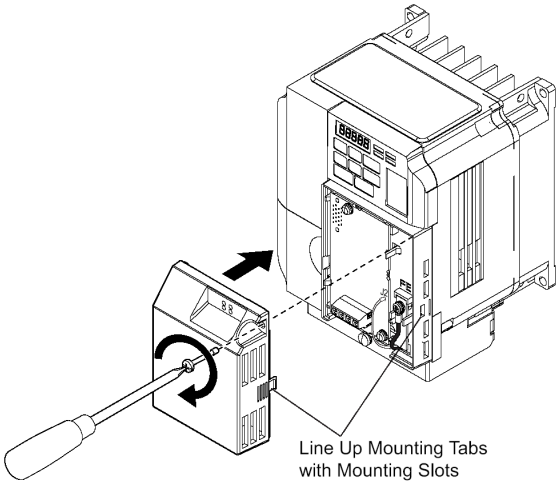
CN1 Terminal Block	Terminal No.	Terminal Name (Function)	Function (Signal Level) Default Setting
	24V	Tranducer Power Supply	+20V to +24V Vdc 30 mA
	AC	Power Supply Common	0 Vdc
	A2	Analog input	4-20 mA, 0-20 mA, 0-10 Vdc
	FE	Functional Earth Ground for Shielded Connection	⏚

STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

5.22 Attach the 24V Power Supply cover by aligning the tabs with the mounting slots, seat the front cover into place, and tighten the screw on the front.

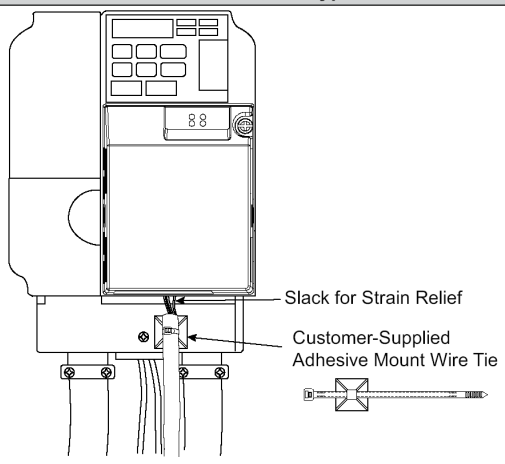
Table 1.18 Attach the 24V Power Supply Cover

IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X


NOTICE: *Damage to Equipment. Take proper precautions when wiring the 24V Power Supply unit so that the front covers will easily fit back onto the drive. Make sure no cables are pinched between the front covers and the drive when replacing the cover. Failure to comply may result in damage to circuitry and equipment.*

5.23 Secure the shielded cable with a customer-supplied adhesive mount wire tie positioned on the lower drive cover to complete the installation procedure for IP20/NEMA 1, UL Type 1 enclosures.

Table 1.19 Secure the Shielded Cable

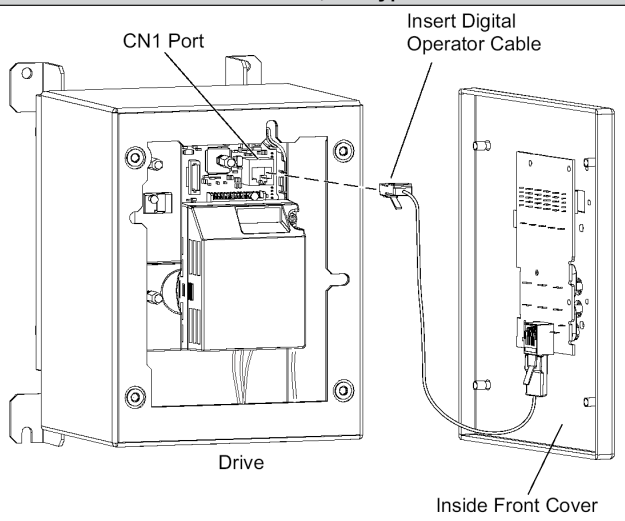
IP20/NEMA 1, UL Type 1	IP66/NEMA 4X, UL Type 4X
	Not applicable.

STEP 5

☐ Install the 24 V Transducer Power Supply (continued)

5.24 On IP66/NEMA 4X, UL Type 4X models, insert the digital operator cable from the front cover into port CN1 on the drive.

Table 1.20 Insert Digital Operator Cable

IP20/NEMA 1, UL Type 1	IP66/NEMA 4X, UL Type 4X
Not applicable.	

5.25 To complete the installation procedure on IP66/NEMA 4X, UL Type 4X enclosures, reattach the front cover of the drive enclosure. Refer to *Table 1.22* for tightening torque specifications.

NOTICE: *Damage to Equipment. Take proper precautions when wiring the 24V Power Supply unit so that the front covers will easily fit back onto the drive. Make sure no cables are pinched between the front covers and the drive when replacing the cover. Failure to comply may result in damage to circuitry and equipment.*

Table 1.21 Attach Enclosure Front Cover

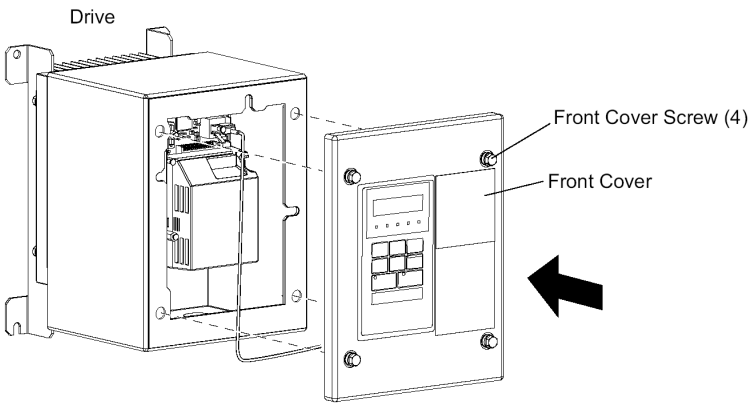
IP20/NEMA 1, UL Type 1	IP66/NEMA 4X, UL Type 4X
Not applicable.	

Table 1.22 IP66/NEMA 4X, UL Type 4X Enclosure Front Cover Installation Bolt Size and Tightening Torque

Voltage Class	Drive Model	Installation Screw Size	Tightening Torque N•m (lb-in)
Single-Phase 200 V Class	BV0001G to BV0012G	M5	2.0 to 2.5 (17.7 to 22.1)
Three-Phase 200 V Class	2V0001G to 2V0020G	M5	2.0 to 2.5 (17.7 to 22.1)
	2V0030G to 2V0069G	M6	5.4 to 6.0 (47.8 to 53)
Three-Phase 400 V Class	4V0001G to 4V0011G	M5	2.0 to 2.5 (17.7 to 22.1)
	4V0018G to 4V0038G	M6	5.4 to 6.0 (47.8 to 53)

STEP 6

☐ Prepare to Use the Digital Operator

6.1 The iQpump Micro is supplied with a standard 7-segment red color LED digital operator for basic use. This Quick Start Procedure is provided for use with both standard or optional JVOP-183 digital

JVOP-183 Description (optional)

The (optional) JVOP-183 LCD (Model: UOP000016) digital operator; provides Real-time clock, HOA, LCD keypad display, 5 lines x 16 characters, backlit, 8 languages, Copy function. Mounts to RJ-45 keypad port.

The optional JVOP-183;

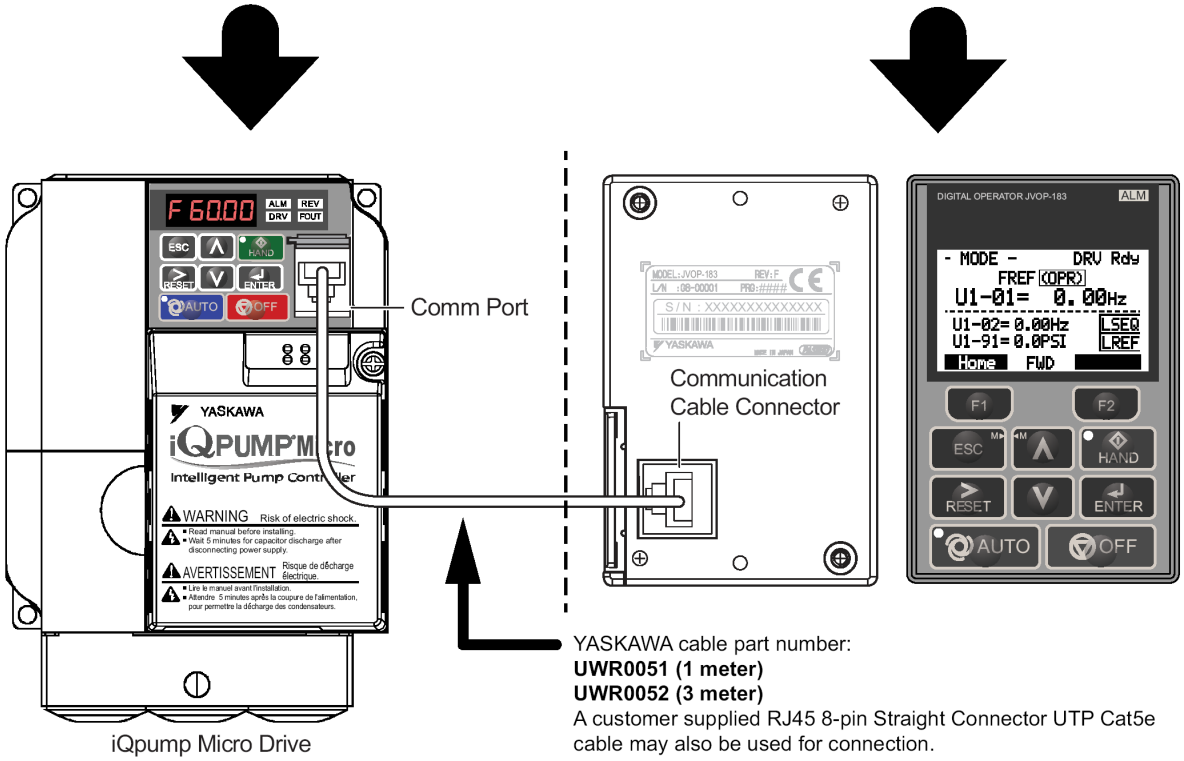
- simplifies iQpump Micro programming
- provides enhanced unit user interface
- allows operation of the iQpump Micro up to 3 meters away
- and can display information in 8 languages.

Additionally the JVOP-183 simplifies the task of interfacing with the iQpump Micro to;

- read or modify unit parameters
- read and copy unit parameter settings to another iQpump Micro
- operate the unit.
- monitor unit operation status.

7-Segment LED Digital Operator (standard)

JVOP-183 Digital Operator (optional) Model No. UOP000016



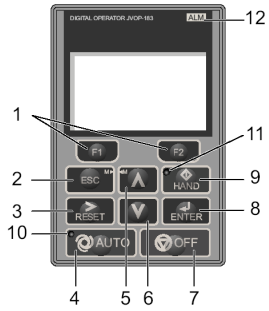
YASKAWA cable part number:
UWR0051 (1 meter)
UWR0052 (3 meter)
A customer supplied RJ45 8-pin Straight Connector UTP Cat5e cable may also be used for connection.

Refer to this URL for keypad mounting kit information:
https://www.yaskawa.com/pycprd/products/specialty-pump-drives/drives/iqpump-micro/tab1/link10

STEP 6

☐ JVOP-183 HOA Keypad Tutorial (Optional)

6.2 Review this tutorial if using the JVOP-183 operator.



No.	Display	Key or Indicator Name	Function
1	F1 / F2	Function F1 (RLY)	Selects Drive Test Mode Note: Applies specifically to drives configured with 3-contactor. Pressing the F1 (RLY) key places the drive in Drive Test Mode. Power is applied to the drive in the bypass mode.
		Function F2 (BYP/DRV)	Toggles selection between Bypass Mode and Drive Mode.
2	ESC	ESC	• Returns to the previous display. • Moves the cursor one space to the left. • In Drive Mode, repeatedly pressing this button will return to the Frequency Reference display. • In Bypass Mode, repeatedly pressing this button will return to the UB-01 “Bypass Current” display. • During parameter entry, allows aborting the current edited value and exits the parameter editing mode.
3	RESET	RESET	• Moves the cursor to the right. • Resets the bypass or drive to clear a fault situation • Certain drive conditions may require pressing the OFF key before the RESET key will clear a fault..
4	AUTO	AUTO	Selects AUTO mode.
5	∧	Up Arrow	Scrolls up to display the next item, selects parameter numbers, and increments setting values.
6	∨	Down Arrow	Scrolls down to display the previous item, selects parameter numbers, and decrements setting values.
7	OFF	OFF Key	If the drive was operating the motor, the motor will stop according to the stopping method selected in b1-03. If the bypass was operating the motor, the bypass contactor opens and the motor coasts to a stop.
8	ENTER	ENTER	• Enters parameter values and settings. • Selects a menu item to move between displays.
9	HAND	HAND	Selects HAND mode.
10	AUTO	AUTO Light	Lit or flashing while the drive is in AUTO mode.
11	HAND	HAND Light	Lit while the drive is in HAND mode.
12	ALM	ALARM Light	• Flashing: Indicates Alarm (minor fault) • Solid: Indicates Fault (major fault)

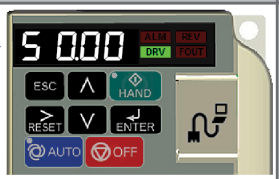
STEP 7

☐ Adjust and Monitor iQpump Micro Settings

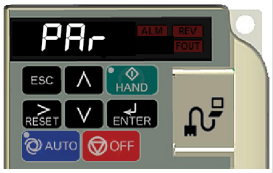
7.1 Access the Parameter Menu and Change Parameter Values. DO NOT RUN THE MOTOR. Ensure all protective covers are installed and power is turned on.

LED Digital Operator (Standard)

iQpump Micro digital operator power-up state



Press ∨ two times until the digital operator shows the parameter menu (PAr) then press ENTER.



Select Parameter Menu

Press RESET to select the digit you would like to change. Next use ∧ and ∨ to select the parameter group, sub-group or number.

Select Parameter

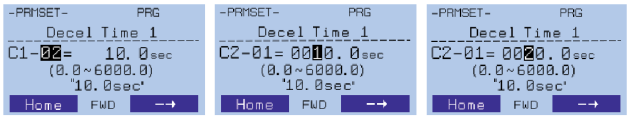
Modify the parameter value using ∧ and ∨ and press ENTER to save the new value.

LCD Digital Operator (Optional JVOP-183)

Press ∨ two times until the digital operator shows the parameter menu.

2X ∨ → ENTER → RESET

Increase/Decrease Selection — Go to Next Digit — Increase/Decrease Selection



ENTER → ∧ ∨ → ENTER

Switch to Edit Mode — Modify Value — Save New Value

Hold ESC button for 3 sec. to go back to the main menu.

Monitor Motor Frequency and Current (Standard)

iQpump Micro digital operator power-up state

Press ∧ until the **FOUT** LED turns on. The display now shows the actual drive output frequency in Hz.

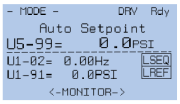
Output Frequency

Pressing ∧ again will show the motor output current. The 'A' behind the value means 'Amps'.

Motor Current

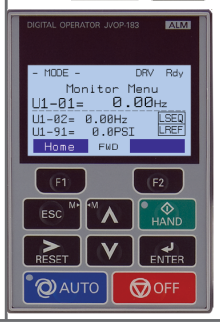
Monitor Motor Frequency and Current (Optional JVOP-183)

iQpump Micro digital operator power-up state



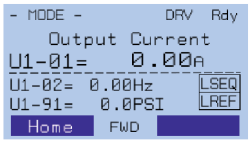
Output Frequency and Transducer Feedback can be monitored simultaneously. Use F1 and F2 to select monitor signals.

Press ESC M ∧ M simultaneously shows the monitor menu.



Press ENTER to access monitor menu.

Use ∧ ∨ to select monitor.



Motor Current

Refer to the iQpump Micro User Manual, (Document No. TOEPYAIQPM03) to access additional drive monitors

STEP 8

☐ Application Specific Setup

8.1 Configure the iQpump Micro for a dedicated pump application. DO NOT RUN THE MOTOR. Ensure all protective covers are installed and power is turned on.

Available iQpump Micro Application Macro Settings using parameter A1-03 :

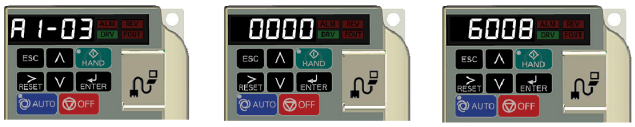
- 6008 Constant Pressure Mode (PSI) [Factory Default] **Note: Do not change unless pump application differs from default.**
- 6009 Pump Down Level Mode (Ft)
- 7770 General Purpose Mode
- 7771 Submersible Motor GP Mode

8.2 Select Application Macro Parameter A1-03

LED Digital Operator (Standard)

Press V two times until the digital operator shows the parameter menu.

2X V → ENTER → 2X RESET

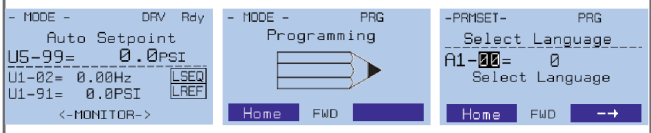


Inc./Dec. Selection → Switch to Edit Mode → Select Application

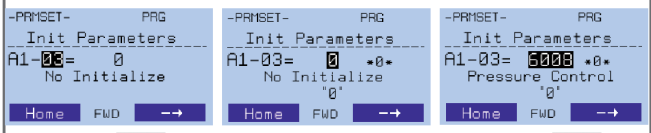
Press ENTER to select.

LCD Digital Operator (Optional JVOP-183)

Press V two times until the digital operator shows the parameter menu.



2X V → ENTER → 2X RESET Select Digit



Inc./Dec. Selection → Switch to Edit Mode → Select Application

Press ENTER to select.

Enter Application Parameters (Standard)

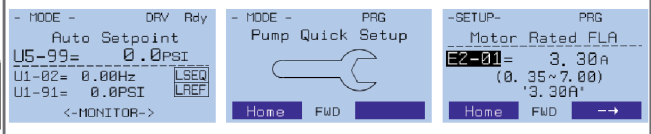
Hold ESC button for 3 sec. to go back to the main menu.

3X V → ENTER → Select Parameter.

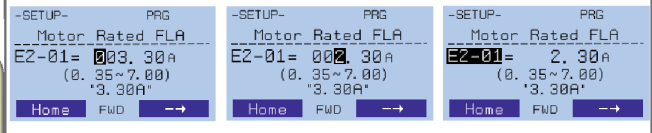
Switch to Edit Mode → Modify Value → Save New Value

Enter Application Parameters (Optional JVOP-183)

Hold ESC button for 3 sec. to go back to the main menu.



3X V → ENTER → Select Parameter.



Switch to Edit Mode → Modify Value → Save New Value

Go Back to Main Menu (Standard)

Hold ESC button for 3 sec. to go back to the main menu.

Go Back to Main Menu (Optional JVOP-183)

Hold ESC button for 3 sec. to go back to the main menu.

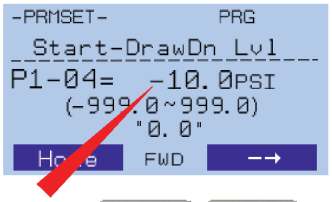
STEP 9

☐ Parameter Overview-Quick Setting Menu (Simplex)

Step. Task	Parameter	Name	Description/Menu Access	Default Value
9.1 Read-only parameter. It cannot be modified. Factory set to (0: Pressure control)	A1-06	Application Preset	Displays selected applications, see Step 5. Quick Setting 	Factory set to (0: Pressure control). Dependent on Initialization Mode
9.2 Set to the motor nameplate full load amps Set service factor amps (SFA). for submersible motors use	E2-01	Motor Rated Current	Motor nameplate full load amps. Quick Setting 	Drive Size Dependent
9.3 Enter '4' for an 1800 RPM motor and '2' for a 3600 RPM motor. Confirm number of poles: • 2 Pole Motor = 3600 RPM • 4 Pole Motor = 1800 RPM • 6 Pole Motor = 1200 RPM • 8 Pole Motor = 900 RPM	E2-04	Number of Motor Poles	Sets the number of motor poles. Number of motor poles is used to show the correct motor RPM on the display Quick Setting 	2
9.4 System Scaling: Enter feedback device maximum: Example: Enter 200 for pressure transducer with a maximum of 200 PSI at 20mA. Confirm feedback device scaling. (See Illustration 1)	P1-03	Feedback Device Scaling	Sets the scaling of feedback device in user-set units. Quick Setting 	145.0
9.5 Set to system pressure	Q1-01	PID Controller Setpoint 1	Sets the PID Setpoint when b1-01 is set to 0. Quick Setting 	0.0
9.6 Choose one of two types of Start Level programming: 1. Program the Start Level as an Absolute OR 2. Program the Start Level as a Delta Level from the System Setpoint	P1-04	Start / Drawn Down Level	The system starts when the feedback level drops below the start level for the time set in P1-05 (default 1 sec). This level also specifies the wakeup level when the drive is in Sleep Mode. When this parameter is set to a negative value, the feedback level must drop that amount below the setpoint. Setting this parameter to 0.0 disables the function. When P1-01, Pump Mode, is set to 3 (MEMOBUS network), this function is active only on the first drive in the network. Quick Setting 	0.0 PSI

STEP 9

☐ Parameter Overview-Quick Setting Menu (Simplex) continued.

Step. Task	Parameter	Name	Description/Menu Access	Default Value
9.7 Program the Start Level as an Absolute Value. Start / Draw Down Level must be programmed to a positive value for the Start / Draw Down Level to be an absolute value. Example: Start / Draw Down Level P1-04 set to 50 PSI and delay time P1-05 set to 5 sec. Result: Pump system will start when the pressure drops below 50 PSI for 5 sec. **OR** Program the Start Level as a Delta Level from the System Setpoint Start / Draw Down Level must be programmed to a negative value for the Start Level to be a delta value from the setpoint. Example: Start / Draw Down Level P1-04 set to –10 PSI with a system setpoint of 50 PSI and delay time P1-05 set to 5 sec. Result: Pump system will start when the pressure drops below 40 PSI (50 - 10) for 5 sec.		**Important! It is mandatory to program the Start / Draw Down Level in order to use the sleep function.** **LED Digital Operator (Standard)**  Use ∧ ∨ to change the sign **LCD Digital Operator (Optional JVOP-183)**  Use ∧ ∨ to change the sign		
9.8 Set Minimum Pump Frequency to the value at which the pump enters a no-flow condition.	P1-06	Minimum Pump Speed	Minimum speed (Hz) for pump motor operation. Quick Setting	40.0 Hz
9.9 Recommended for use when the Start/Stop command is from the digital operator **WARNING!** Sudden Movement Hazard. If the drive is powered down while running, it will automatically initiate an internal Run command upon power-up.	P4-10	AUTO Mode Operator Run Power Down Storage	Stores the run status in the AUTO mode when operating from digital operator (b1-02=0). 0: Disabled 1: Enabled	0: Disabled
Optional step: HAND key on digital operator.	P5-04	HAND Key Function Selection	Enables or disables the HAND key on the digital operator. 0: Disabled 1: Enabled	1: Enabled

STEP 10

☐ iQpump Micro Parameters - Advanced Settings

Task	Parameter	Name	Description/Menu Access	Default Value
10.1 **NOTICE:** Setting value may cause PID control loop instability if misadjusted.	b5-03	Integral Time Setting (I)	Sets the integral time for the PID controller. Decrease integral time to make iQpumpMicro more responsive. Quick Setting	3.0 sec.
10.2 **NOTE**: Disable parameter b5-12 if a transducer is not installed.	b5-12	Feedback Loss 4 to 20 mA Detection Selection	Performs a 4 to 20 mA wire break detection on the analog input that is programmed for PID feedback. Terminal TB1-1 A2 (typical) 0: Disabled, continue running, no message is displayed 1: Alarm, display warning on the digital operator when the feedback device fails or is disconnected. 2: Fault, stop the pump system when the feedback fails or is disconnected 3: Run at the setting value of parameter Quick Setting	2 (Fault)
10.3 Adjust depending on system performance	C1-01	Acceleration Time 1	Sets the time to accelerate the pump motor from zero to maximum speed. NOTE: The factory default with Thrust Mode enabled is 12.0 sec, 20.0 sec when disabled.	20.0 sec. See Note
	C1-02	Deceleration Time 1	Sets the time to decelerate the pump motor from maximum speed to zero. NOTE: The factory default with Thrust Mode enabled is 5.0 sec, 10.0 sec when disabled.	10.0 sec. See Note
10.5 Refer to L5 parameter group. The number of restart attempts is set by L5-01. Configurable iQpump Micro System Protection Faults for Auto-restart: - Low Level Feedback - High Level Feedback - Transducer Loss - Not Maintaining Setpoint - Loss of Prime - Pump Over Cycle.	L5-01	Number of Restart Attempts	Sets the number of times the drive may attempt to restart after these faults occur: – oC-Overcurrent – GF-Ground Fault – LF-Output Phase Loss – PF-Input Phase Loss – oL2-iQpumpMicro Overload – oL1-Motor Overload – oL3/4-Overtorque – DC Bus Fuse Blown – Uv1-DC Bus Undervoltage – ov-DC Bus Overvoltage – oH1-Overheat	5
10.6 P1-06 should be set to the level at which the pump produces minimum pressure even at zero flow. Example: Base pump motor speed is 3600 RPM, minimum speed is 2400 RPM. Set minimum pump frequency to 40.0 Hz. (2400 ÷ 3600 x 60 Hz=40Hz)	P1-06	Minimum Pump Speed	Minimum frequency at which the drive will run. Applies to both HAND and AUTO modes. NOTE: For minimum pump frequency, the drive will use the highest setting from among P1-06, P4-12 (Thrust Bearing Frequency), or d2-02 (Reference Lower Limit)	40.0 Hz

STEP 10 ☐ iQpump Micro Parameters - Advanced Settings (continued)

Task	Parameter	Name	Description/Menu Access	Default Value
10.7 Adjust according to system requirements.	P2-03	Sleep Delay Time	Sets the delay time before the drive enters Sleep Mode when the selected signal level (P2-01) falls below the specified sleep level (P2-02).	5 sec.
10.8 Primarily used for submersible pumps. Program P4-12 = 0.0 Hz to disable function when iQpump Micro is used with a centrifugal pump.	P4-12	Thrust Bearing Frequency	Sets the frequency reference used when the thrust bearing function is active. The drive will accelerate to this frequency in the time set to P4-11. The drive will decelerate from the frequency in the time set to P4-13.	30.0 Hz
10.9 Set the amount of time for the drive to delay starting if a Run command is present at power-up. Note: Utility Star Delay is active when P4-10 is enabled (1) and operation (start/stop) is from the digital operator.	P4-17	Utility Start Delay	Sets the amount of time that the drive will delay starting if a Run command is present at power-up. When P1-01, Pump Mode, is set to 3 (MEMOBUS network), the drive is unavailable to the network (Pump Off Network) when the function is active. The iQpump Micro waits the time specified in P4-11 before auto operation becomes active when utility power is restored and P4-10 is enabled (1).	0.2 Min Setting this parameter to 0.0 disables the function.

STEP 11 ☐ Fine-tune Settings for Pumping Application

11.1 SYSTEM FEEDBACK UNIT / FEEDBACK DEVICE SCALING

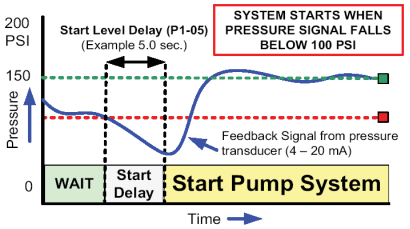
P1-02 Feedback Unit

0: No Unit
1: PSI: lb.SqrInch
2: Pa: Pascals
3: Bar
4: WC: Inch Water
5: "Hg: Inch Mercury
6: ft: Feet
7: m: meters
8: °F:DegFarenheit
9: °C:DegCelsius
10: %: Percent

P1-03 = 200.0 PSI Feedback Scaling
Feedback Maximum

11.2 START / DRAW DOWN LEVEL

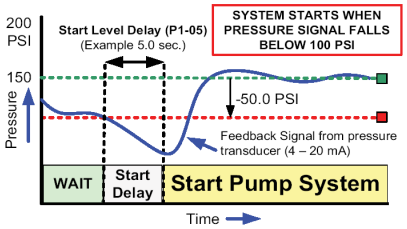
Example: Absolute Level (Positive Start Level)



System Setpoint (Example 150.0 PSI)
Feedback Scaling (P1-03) (Example 200.0 PSI)
System Units (P1-02) (Example PSI)
Start / Draw Down Level (P1-04) (Example 100.0 PSI)

START / DRAW DOWN LEVEL

Example: Delta Level (Negative Start Level)

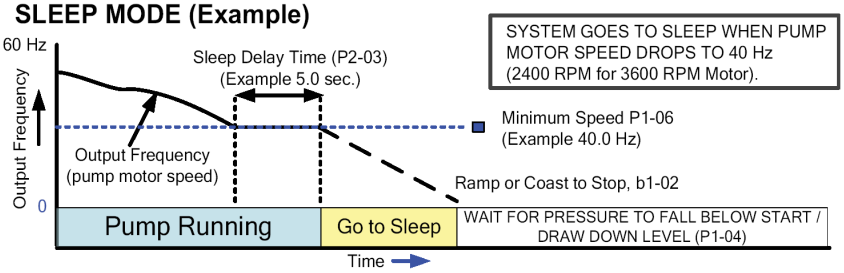


System Setpoint (Example 150.0 PSI)
Feedback Scaling (P1-03) (Example 200.0 PSI)
System Units (P1-02) (Example PSI)
Start / Draw Down Level (P1-04) (Example -50.0 PSI, (150.0 – 50.0)

STEP 11

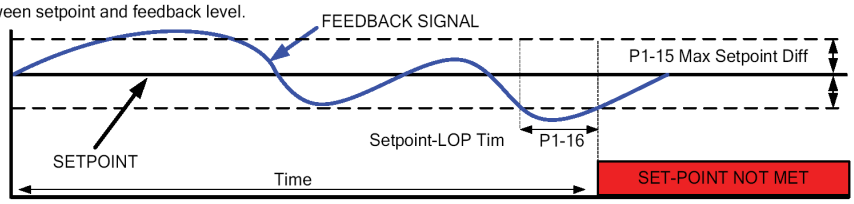
☐ Fine-tune Settings for Pumping Application (continued)

11.3 SLEEP MODE (Example)



11.4 PUMP SYSTEM FAULT SETUP

The iQpump Micro can display a 'Setpoint Not Met' fault when the iQpump Micro is unable to maintain the programmed system setpoint due a problem with the pump system. Set P1-15 to the maximum allowed difference between setpoint and feedback level.

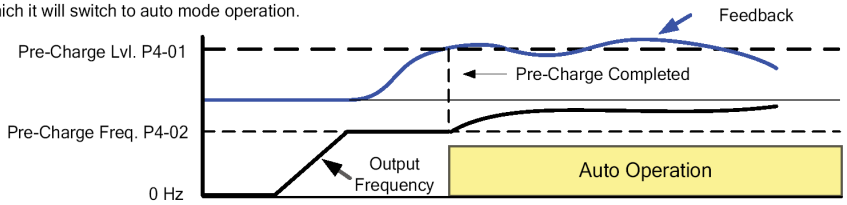


11.5 LOW/HIGH FEEDBACK LEVEL DETECTION

The iQpump Micro continuously monitors the system feedback signal. Set the low feedback level parameter P1-08 to the minimum feedback level allowed for your system to display a 'Low Feedback' fault. Set the high feedback level parameter P1-11 to the maximum feedback level allowed to display a 'High Feedback' fault.

11.6 PRE-CHARGE OPERATION

This function is used when the pump system requires a pre-charge before normal operation. Upon start the iQpump Micro will run at a fixed speed for a specified time or until the feedback signal reaches a programmed level after which it will switch to auto mode operation.



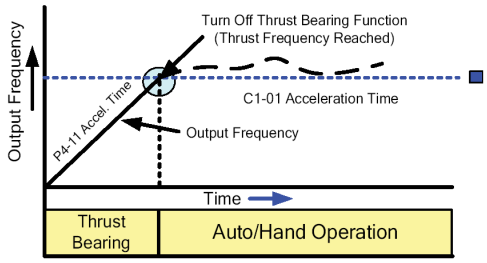
P4-01 Pre-Charge Level: Specified feedback level to stop pre-charge operation
P4-02 Pre-Charge Frequency: Set desired pre-charge speed
P4-03 Pre-Charge Time: Specified maximum pre-charge operation time

11.7 THRUST BEARING - SUBMERSIBLE MOTORS

The factory recommends using the Thrust Bearing function to prevent excess motor wear when using a submersible motor in combination with the iQpump Micro. Enter the minimum motor frequency in parameter P4-11 to enable this function. Example: Minimum motor speed 1800 RPM, 1800 RPM ÷ 3600 RPM x 60.0 Hz = 30.0 Hz

Thrust Acceleration Time P4-11 (Example 1.0 sec.)
Thrust Bearing Frequency P4-12 (Example 30.0 Hz)

DEFAULT SETTING



11.8 AUTO OPERATION - POWER DOWN STORAGE

Allows the iQpump Micro to automatically start after power failure when operated from the digital operator. This function is recommended when operating the iQpump Micro in remote/unmanned areas.
Use parameter P4-10 to enable this function.

WARNING! Stay Clear- Equipment starts automatically. An internal run command will automatically occur on power-up if the iQpump Micro is powered down while running.

STEP 12

☐ Verify Pump Rotation and Transducer Feedback

12.1 Check the motor for proper direction and operation.

This test is performed solely from the digital operator. Apply power to the iQpump Micro after electrical connections are terminated and protective covers are installed. At this point, DO NOT RUN THE MOTOR, The digital operator should display as shown in Figure 3.

LED Digital Operator (Standard)	LCD Digital Operator (Optional JVOP-183)

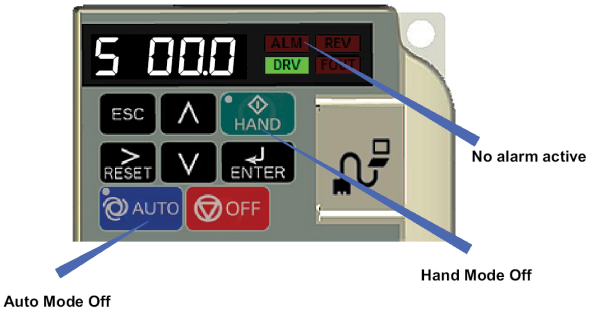


Figure 3: LED Digital Operator (Standard)

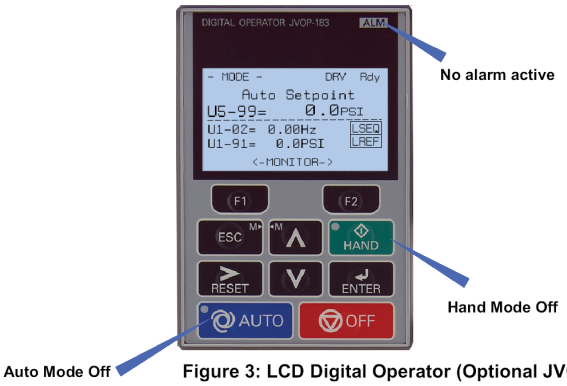


Figure 3: LCD Digital Operator (Optional JVOP-183)

12.2 Motor Rotation Test (Standard)

Press HAND on the digital operator; the display should read

and the **HAND** ● LED should be ***ON***.

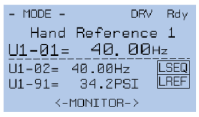
The motor should be operating in the correct direction of pump.

Press OFF on the digital operator; the display should read as in Figure 3.

Press ENTER to access Hand Speed. Use ∧ ∨ RESET to change HAND Speed value. Press ENTER to save value.

12.2 Motor Rotation Test (Optional JVOP-183)

Press HAND on the Digital Operator; the display should read



and the **HAND** ● LED should be ***ON***.

The motor should now be operating at in the correct direction of pump.

Press OFF

Press ENTER to access HAND Speed. Use ∧ ∨ RESET to change HAND Speed value. Press ENTER to save value.

NOTE: If the motor direction is not correct, de-energize the iQpump Micro and follow instructions below.

WARNING! Hazardous Voltage. Contact may cause electric shock or burn. Turn-off and lock-out system and facility power before servicing. After the power has been turned OFF, wait at least five minutes until the charge indicator extinguishes completely before touching any wiring, circuit boards or components.

Digital operator turned off.

Refer to ***STEP 3,*** exchange any **two** of the **three** output leads to the motor (U/T1, V/T2 and W/T3). Recheck motor direction after the wiring change.

Digital operator turned off.

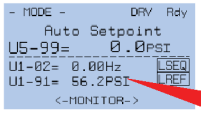
12.3 Feedback Signal Check (Standard)

Verify the transducer feedback signal level on the digital operator display matches a mechanical pressure gauge.

From HOME screen, press ∧ to access "**FEEdb**" screen. "**FEEdb**" will display for 2 seconds, then automatically change to display the feedback signal level.

FEEDBACK SIGNAL LEVEL

12.3 Feedback Signal Check (Optional JVOP-183)



Refer to parameter P1-02 and P1-03, if the feedback device scaling or system units are incorrect.

FEEDBACK SIGNAL LEVEL

STEP 13

☐ AUTO Mode Operation

13.1 AUTO Mode

The iQpump Micro is operated in AUTO mode by performing the following tasks: Program all parameters

- Verify motor rotation direction
- Auto Mode: Select the **Reference source** setting in parameter b1-01
- Auto Mode: Select the **Run source** setting in parameter b1-02 (Refer to STEP 4)

LED Digital Operator (Standard)	LCD Digital Operator (Optional JVOP-183)

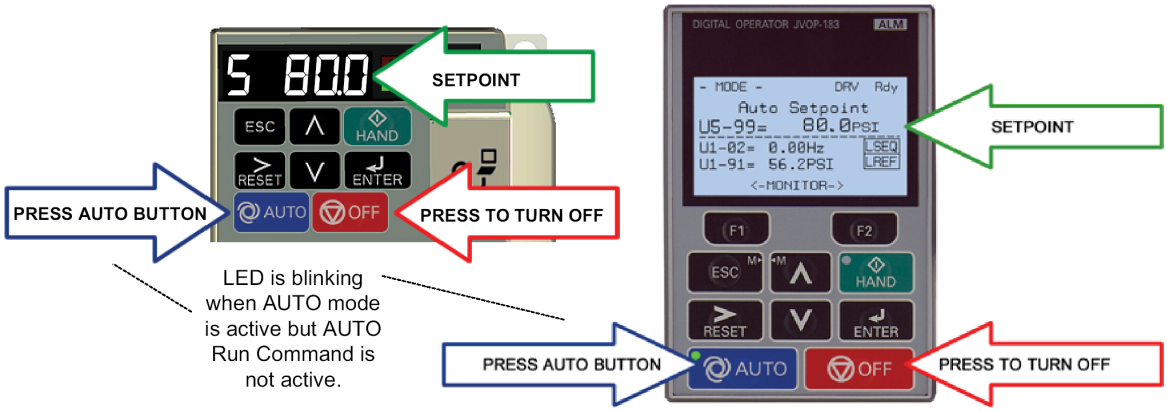


Figure 4: Digital Operator

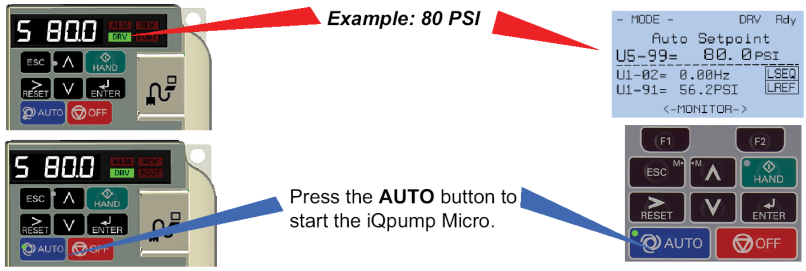
Press the **AUTO** button to place the iQpump Micro into AUTO mode.

The AUTO mode will start and stop based on the Run Source Selection setting parameter b1-02. (Refer to Step 3) The Reference Source Selection parameter b1-01 setting configures the AUTO mode reference source.

13.2 Set System Setpoint

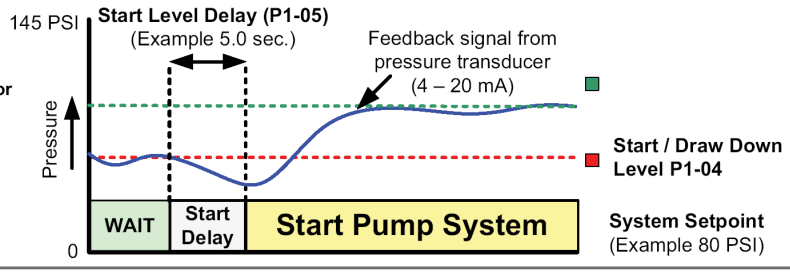
LED Digital Operator (Standard)	LCD Digital Operator (Optional JVOP-183)

Press ENTER to access or modify the system setpoint in parameter Q1-01 within the iQpump Micro Quick Setup Menu. iQpump Micro Quick Setup Menu. Use RESET to select the digit and ∧ ∨ . Next press ENTER to store setpoint. Next press ENTER to store setpoint. Next, press F1 to return to the main menu (LCD Digital Operator)



The iQpump Micro starts in AUTO Mode when the feedback signal level falls below the level programmed in parameter P1-04 for the specified time in P1-05.

Refer to STEP 8, parameter P1-04 for details on the Start Level Function.



STEP 14

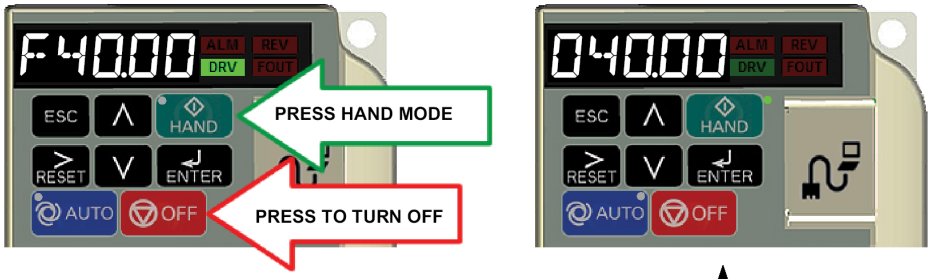
☐ Hand Mode Operation

14.1 HAND Mode

The iQpump Micro is operated in HAND mode by performing the following tasks:

- Program all parameters
- Verify motor rotation direction

LED Digital Operator (Standard)



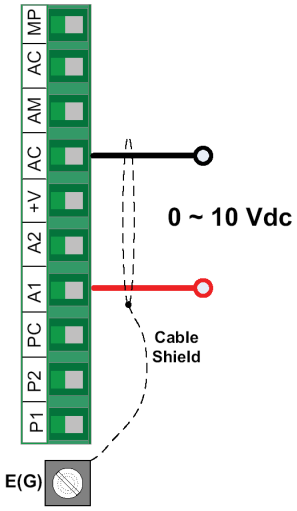
Press ENTER to access HAND Speed. Use ∧ ∨ RESET to change HAND Speed value.

Press ENTER to save value.

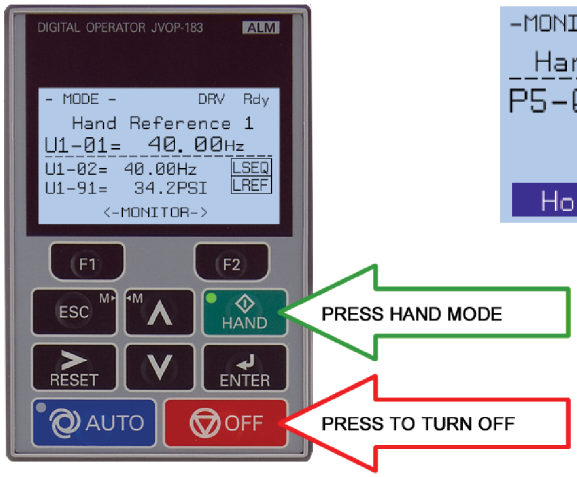
Hand Speed Reference from Analog Input (0 to 10 Vdc)

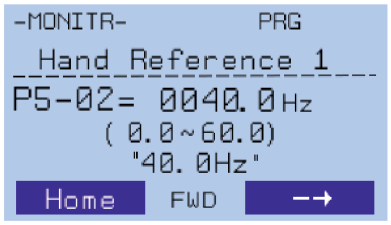
Set parameter P5-01 'HAND Mode Ref.' to '0' to adjust the hand mode reference from an external 0 – 10V signal connected to terminals TB1-1, A1 and AC.

0 to 10 Vdc Connection

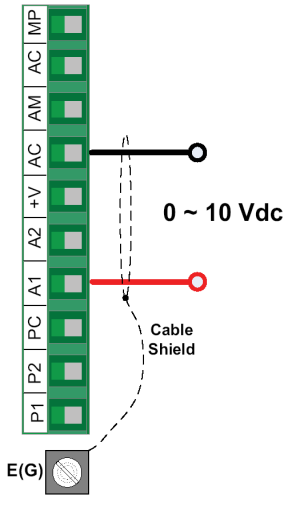


LCD Digital Operator (Optional JVOP-183)





0 to 10 Vdc Connection



Press ENTER to access HAND Speed. Use ∧ ∨ RESET to change HAND Speed value.

Press ENTER to save value.

Hand Speed Reference from Analog Input (0 to 10 Vdc)

Set parameter P5-01 'HAND Mode Ref.' to '0' to adjust the hand mode reference from an external 0 – 10V signal connected to terminals TB1-1, A1 and AC.

STEP 15

☐ Configure Sleep and Anti-No-Flow (ANF)

15.1 Sleep and Anti-No-Flow (ANF Detection) (Parameters P2-23, P2-24, P2-25)

Note: Ensure the pump system is regulating pressure/flow satisfactory while operating under normal running conditions prior to adjusting Anti-No-Flow operation.

15.2 Verify No-flow/Sleep Operation

a. Continue to **STEP 16.3** below if pump operation is stable.
b. Disable Anti-No-Flow function if pump operation is unstable.
   - Set parameter P2-23 = 0.00% and adjust PI control parameters b5-02 and b5-03 to stabilize pump system.
   - Refer to the iQpump Micro User Manual (Document No.TOEPYAIQPM03) for additional information.
c. Re-enable the Anti-No-Flow function by setting P2-23 to 0.40% and continue to Step 1 to verify no-flow/sleep operation once the system is stable.

15.3 Verify the system holds pressure by creating a no-flow situation (e.g. close off discharge valve).

15.4 Press the OFF button on the digital operator, wait 1 minute until system stabilizes and verify system pressure feedback using parameter U1-91. Adjust P2-25 to the actual delta pressure drop plus 1 PSI if the pressure drops more than 3 PSI (use Monitor U1-91).

Example: Setpoint is 80 PSI, pressure feedback U1-91 shows 76 PSI, P2-25 should be 4 + 1 or 5 PSI.

Note: This value should always be more than the P1-04 Start Level. If not, the system pressure is not holding and must be corrected or the pump system will continue to cycle on and off.

15.5 Operate the system in normal AUTO operation with flow. Observe monitor U1-99 “ANF Timer” and verify the value is increments and resets to zero continuously. If the value holds at 10 sec. (P2-24) increase P2-24 “Anti-No-Flow Detection Time” by increments of 5 seconds. Repeat Step 3 each time P2-24 is adjusted.

15.6 Create a no-flow situation (e.g. close discharge valve). Use monitor U1-99 “ANF Timer” to verify the value is increments and holds at the P2-24 time (value set in Step 3). Once the Anti-No-Flow timer expires, the speed will reduce gradually until reaching minimum pump speed (P1-06) where it will hold for 5 seconds according to P2-03, before going to sleep.

15.7 Operate the system in normal AUTO operation and verify sleep and wake-up functions satisfactory.

NOTES:

NOTES:

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i.10 STANDARDS COMPLIANCE....112

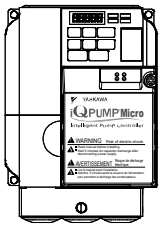
i.1 Preface

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

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

◆ Applicable Documentation

The following manuals are available for iQpump Micro drives:

	iQpump Micro Quick Start Procedure (TOEPYAIQPM01)
	This sheet is packaged together with the drive and contains a step-by-step guide to enable the user to properly wire the drive and motor and connect the 24 V power supply.
	iQpump Micro AC Drive Quick Start Guide (TOEPYAIQPM02)
	Read this guide first. This guide is packaged together with the product and contains basic information required to install and wire the drive. It also gives an overview of fault diagnostics, maintenance, and parameter settings. The purpose of this guide is to prepare the drive for basic operation. The most recent version of this manual is available for download on our documentation website, www.yaskawa.com.
	iQpump Micro AC Drive User Manual (TOEPYAIQPM04)
	This manual provides detailed information on parameter settings, fault diagnostics, and drive functions. Use this manual to expand drive functionality and to take advantage of higher performance features. The most recent version of this manual is available for download on our documentation website, www.yaskawa.com.

◆ Supplemental Safety Information

General Precautions

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

⚠ WARNING

Read and understand this manual before installing, operating or servicing this drive. The drive must be installed according to this manual and local codes.

The following conventions are used to indicate safety messages in this manual. Failure to heed these messages could result in serious or fatal injury or damage to the products or to related equipment and systems.

⚠ DANGER

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

⚠ WARNING

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

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

⚠ CAUTION

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

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

NOTICE

Indicates a property damage message.

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

◆ Safety Messages

⚠ DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

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

Electrical Shock Hazard

Before servicing, disconnect all power to the equipment.

The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait for at least the time specified on the warning label, once all indicators are OFF, measure for unsafe voltages to confirm the drive is safe prior to servicing.

Failure to comply will result in death or serious injury.

⚠ WARNING

Sudden Movement Hazard

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

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

Electrical Shock Hazard

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

Failure to comply could result in death or serious injury.

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

Do not allow unqualified personnel to use equipment.

Failure to comply could result in death or serious injury.

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

⚠ WARNING

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

Failure to comply could result in death or serious injury.

Make sure the protective earthing conductor complies with technical standards and local safety regulations.

Always use appropriate equipment for Ground Fault Circuit Interrupters (GFCIs).

The drive can cause a residual current with a DC component in the protective earthing conductor. Where a residual current operated protective or monitoring device is used for protection in case of direct or indirect contact, always use a type B GFCI according to IEC/EN 60755.

Fire Hazard

Do not use an improper voltage source.

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

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

Install adequate branch circuit protection according to applicable local codes and this Installation Manual. Failure to comply could result in fire and damage to the drive or injury to personnel.

The device is suitable for use on a circuit capable of delivering not more than 100,000 RMS symmetrical amperes, 240 Vac maximum (200 V class) and 480 Vac maximum (400 V class) when protected by branch circuit protection devices specified in this document.

Crush Hazard

Do not use this drive in lifting applications without installing external safety circuitry to prevent accidental dropping of the load.

The drive does not possess built-in load drop protection for lifting applications.

Failure to comply could result in death or serious injury from falling loads.

Install electrical and/or mechanical safety circuit mechanisms independent of drive circuitry.

⚠ CAUTION

Crush Hazard

Do not carry the drive by the front cover.

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

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the drive and circuit boards. Failure to comply may result in ESD damage to the drive circuitry.

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

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

Do not operate damaged equipment.

Failure to comply could result in further damage to the equipment. Do not connect or operate any equipment with visible damage or missing parts.

If a fuse is blown or a Ground Fault Circuit Interrupter (GFCI) is tripped, check the wiring and the selection of the peripheral devices.

Contact your supplier if the cause cannot be identified after checking the above.

Do not restart the drive immediately operate the peripheral devices if a fuse is blown or a GFCI is tripped.

Check the wiring and the selection of peripheral devices to identify the cause. Contact your supplier before restarting the drive or the peripheral devices if the cause cannot be identified.

Do not expose the drive to halogen group disinfectants.

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

Do not pack the drive in wooden materials that have been fumigated or sterilized. Do not sterilize the entire package after the product is packed.

■ General Application Precautions

Selection

Installing a Reactor

Use an AC reactor or DC link choke in the following situations:

- to suppress harmonic current.
- to smooth peak current that results from capacitor switching.
- when the power supply is above 600 kVA.
- when the drive is running from a power supply system with thyristor converters.

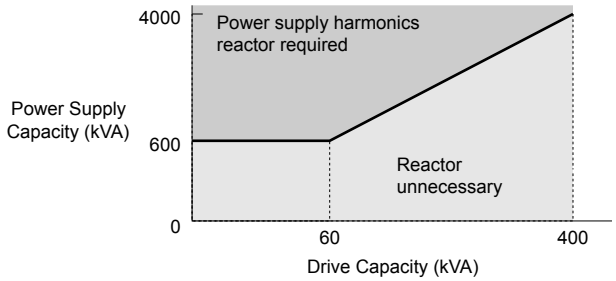


Figure i.1 Installing a Reactor

Drive Capacity

For specialized motors, make sure that the motor rated current is less than the rated output current for the drive.

When running more than one motor in parallel from a single drive, the capacity of the drive should be larger than [total motor rated current × 1.1].

Starting Torque

The overload rating of the drive determines the starting and accelerating characteristics of the motor. Expect lower running torque than when running the motor from line power. To get more starting torque, use a larger drive or increase both the motor and drive capacity.

Emergency/Fast Stop

During a drive fault condition, a protective circuit is activated and drive output is shut off. The motor may coast to a stop or attempt to decelerate depending on parameter settings. If the emergency/fast stop cannot stop the load as fast as desired, a customer-supplied mechanical brake may be required. Test emergency stop circuitry before putting drive into operation.

■ Repetitive Starting/Stopping

Applications with frequent starts and stops often exceed 150% of their rated current values. Heat stress generated from repetitive high current can shorten the life span of the IGBTs. The expected lifetime for the IGBTs is about 8 million start and stop cycles with a 4 kHz carrier frequency and a 150% peak current.

Yaskawa recommends lowering the carrier frequency, particularly when audible noise is not a concern. The user can also choose to reduce the load, increase the acceleration and deceleration times, or switch to a larger drive. This will help keep peak current levels under 150%. Be sure to check the peak current levels when starting and stopping repeatedly during the initial test run, and make adjustments accordingly.

■ Installation

Enclosure Panels

Keep the drive in a clean environment by installing the drive in an enclosure panel or selecting an installation area free of airborne dust, lint, and oil mist. Be sure to leave the required space between drives to provide for cooling, and take proper measures so the ambient temperature remains within allowable limits and keep flammable materials away from the drive. Yaskawa offers protective designs for drives that must be used in areas subjected to oil mist and excessive vibration. Contact Yaskawa or your Yaskawa agent for details.

Installation Direction

NOTICE: *Install the drive upright as specified in the manual.* ***Refer to Mechanical Installation on page 48*** *for more information on installation. Failure to comply may damage the drive due to improper cooling.*

■ Settings

Upper Limits

NOTICE: *The drive is capable of running the motor up to 400 Hz. Be sure to set the upper limit for the frequency of the drive to prevent the possible danger of accidentally operating equipment at higher than rated speed. The default setting for the maximum output frequency is 60 Hz.*

Lower Limits

NOTICE: *Many pumps have a minimum safe operating speed. Be sure to properly set the minimum pump speed in to protect the pump from damage.*

DC Injection Braking

NOTICE: *Excessive current during DC Injection Braking and excessive duration of DC Injection Braking can cause motor overheat.*

Acceleration/Deceleration Times

Acceleration and deceleration times are affected by the amount of torque generated by the motor, the load torque, and the inertia moment. Set a longer accel/decel time when Stall Prevention is enabled. The accel/decel times are lengthened for as long as the Stall Prevention function is in operation.

■ General Handling

Wiring Check

NOTICE: *Do not connect power supply lines to output terminals U/T1, V/T2, or W/T3. Failure to comply will destroy the drive. Be sure to perform a final check of all sequence wiring and other connections before turning on the power and also check for short circuits on the control terminals, which may damage the drive.*

Selecting a Circuit Breaker or Circuit Interrupter

Yaskawa recommends installing a Ground Fault Circuit Interrupter (GFCI) to the power supply side. The GFCI should be designed for use with AC drives (e.g., Type B according to IEC 60755).

Select a Molded Case Circuit Breaker (MCCB) or GFCI with a rated current 1.5 to 2 times higher than the drive rated input current to avoid nuisance trips caused by harmonics in the drive input current.

Magnetic Contactor Installation

NOTICE: *To get the full performance life out of the electrolytic capacitors and circuit relays, refrain from switching the drive power supply off and on more than once every 30 minutes. Frequent use can damage the drive. Use the drive to stop and start the motor.*

Inspection and Maintenance

WARNING! *Electrical Shock Hazard. Capacitors in the drive do not immediately discharge after shutting off the power. Wait for at least the amount of time specified on the drive before touching any components after shutting off the power. Failure to comply may cause injury to personnel from electrical shock.*

WARNING! *Burn Hazard. Because the heatsink can get very hot during operation, take proper precautions to prevent burns. When replacing the cooling fan, shut off the power and wait at least 15 minutes to be sure that the heatsink has cooled down. Failure to comply may cause burn injury to personnel.*

Wiring

Yaskawa recommends using ring terminals on all drive models. UL/cUL approval requires the use of UL Listed closed-loop crimp terminals when wiring the drive main circuit terminals. Use only the tools recommended by the terminal manufacturer for crimping.

Transporting the Drive

NOTICE: *Never steam clean the drive. During transport, keep the drive from coming into contact with salts, fluorine, bromine, phthalate ester, and other such harmful chemicals.*

◆ Motor Application Precautions

■ Standard Induction Motors

Low Speed Range

The cooling fan of a standard motor is usually designed to sufficiently cool the motor at the rated speed. As the self-cooling capability of such a motor reduces with the speed, applying full torque at low speed will possibly damage the motor. To prevent motor damage from overheat, reduce the load torque as the motor slows. ***Figure i.2*** shows the allowable load characteristics for a Yaskawa standard motor. A motor designed specifically for operation with a drive should be used when 100% continuous torque is needed at low speeds.

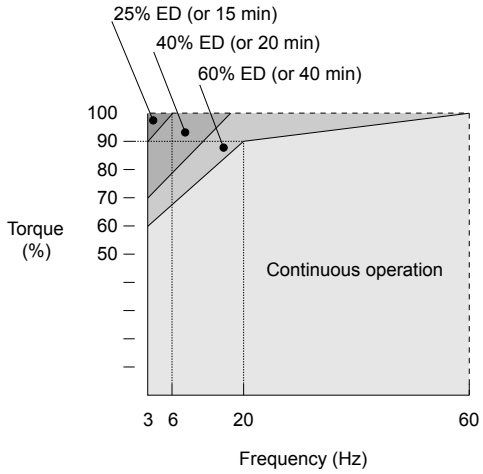


Figure i.2 Allowable Load Characteristics for a Yaskawa Motor

Insulation Tolerance

NOTICE: *Consider motor voltage tolerance levels and motor insulation in applications with an input voltage of over 440 V or particularly long wiring distances.*

High-Speed Operation

NOTICE: *Problems may occur with the motor bearings and dynamic balance of the machine when operating a motor beyond its rated speed. Contact the motor or machine manufacturer.*

Torque Characteristics

Torque characteristics differ compared to operating the motor directly from line power. The user should have a full understanding of the load torque characteristics for the application.

Vibration and Shock

The drive allows selection of high carrier PWM control and low carrier PWM. Selecting high carrier PWM can help reduce motor oscillation (drive current derating may be required).

Take particular caution when adding a variable speed drive to an application running a motor from line power at a constant speed. If resonance occurs, use shock absorbing mounts to the motor base and enable the Jump frequency selection to prevent continuous operation in the resonant frequency range.

Audible Noise

The audible noise of the motor varies based on the carrier frequency setting. However, drive current derating may be required. When using a high carrier frequency, audible noise from the motor is comparable to the motor noise generated when running from line power.

■ Specialized Motors

Multi-Pole Motor

Because the rated current will differ from a standard motor, be sure to check the maximum current when selecting a drive. Always stop the motor before switching between the number of motor poles. If a regen overvoltage (oV) fault occurs or if overcurrent protection (oC) is triggered, the motor will coast to stop.

Submersible Motor

The rated current of a submersible motor is greater than that of a standard motor, so select the drive accordingly. Use a motor cable large enough to avoid decreasing the maximum torque level from voltage drop caused by a long motor cable.

Explosion-Proof Motor

The motor and the drive must be tested together to be certified as explosion-proof. The drive is not designed for explosion-proof areas.

Geared Motor

Make sure that the gear and the lubricant are rated for the desired speed range to avoid gear damage when operating at low speeds or very high speeds. Consult with the manufacturer for applications that require operation outside the rated speed range of the motor or gear box.

Single-Phase Motor

Variable speed drives are not designed to operate with single phase motors. Using capacitors to start the motor causes excessive current to flow and can damage drive components. A split-phase start or a repulsion start can burn out the starter coils because the internal centrifugal switch is not activated. The drive is for use with three-phase motors only.

■ Notes on Power Transmission Machinery

Installing an AC drive in machinery that was previously connected directly to the power supply will allow the machine to operate at variable speeds. Continuous operation outside of the rated speeds can wear out lubrication material in gear boxes and other power transmission parts. Make sure that lubrication is sufficient within the entire speed range to avoid machine damage. Note that operation above the rated speed can increase the noise generated by the machine.

◆ Drive Label Warning Example

Always heed the warning information listed in ***Figure i.3***.

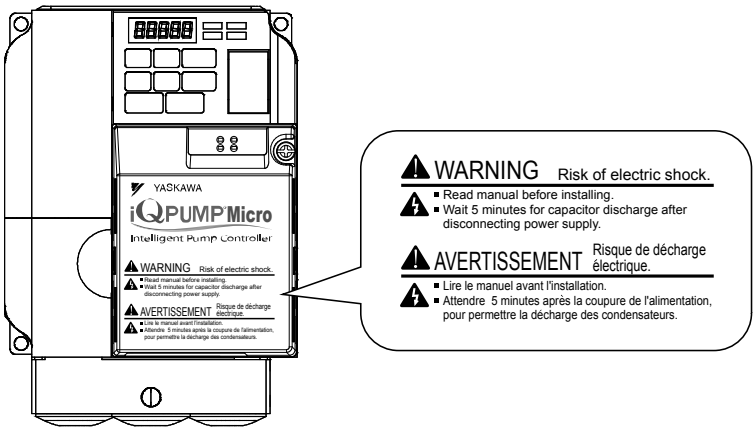


Figure i.3 Warning Information Example

◆ Warranty Information

■ Restrictions

The drive is not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.

Customers who intend to use the product described in this manual for devices or systems relating to transportation, health care, space aviation, atomic power, electric power, or in underwater applications must first contact their Yaskawa representatives or the nearest Yaskawa sales office.

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

i.2 Receiving

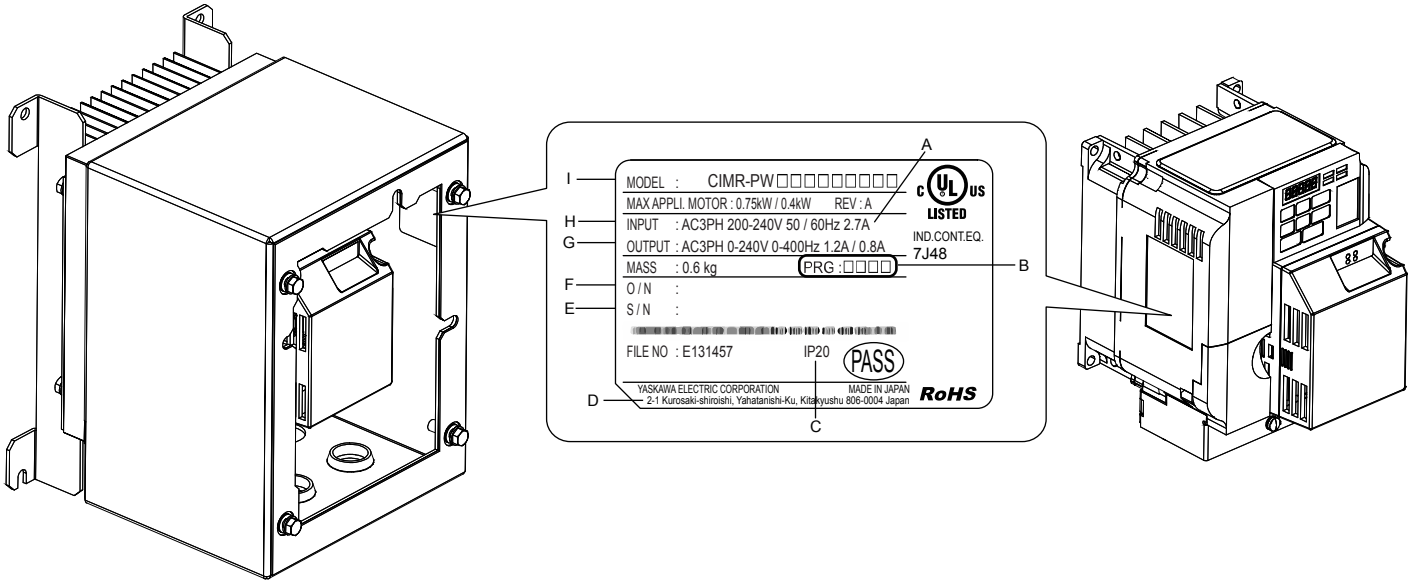
◆ Model Number and Nameplate Check

Please perform the following tasks after receiving the drive:

- Inspect the drive for damage.

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

◆ Nameplate



A – Normal Duty Amps
B – Software version
C – Enclosure type
D – Address <1>
E – Serial number
F – Lot number
G – Output specifications
H – Input specifications
I – AC drive model

Figure i.4 Nameplate Information Example

<1> The address of the head office of Yaskawa Electric Corporation (responsible for product liability) is shown on the nameplate.

CIMR – PW 2 V 0010 F A A

- CIMR: Drive
- PW: iQpump
- 2: Voltage Class

No.	Voltage Class
B	1-phase, 200-240 Vac
2	3-phase, 200-240 Vac
4	3-phase, 380-480 Vac

- V: Customized Specifications

No.	Customized Specifications
V	Standard model

- 0010: Refer to the following tables
- F: Enclosure Type <1>

No.	Enclosure Type <1>
F	IP20/NEMA 1 UL Type 1
G	IP66/NEMA 4X UL Type 4X

- A: Environmental Specification <2>

No.	Environmental Specification <2>
A	Standard

- A: Design Revision Order

<1> *Refer to Mechanical Installation on page 48* for differences regarding enclosure protection types and component descriptions.

<2> Please contact Yaskawa for details regarding Environmental Specifications.

■ Single-Phase 200 V Class

Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A
BV0006	1.1 (1)	6.0
BV0010	2.2 (3)	9.6
BV0012	3.0 (3)	12.0
BV0018	3.7 (5)	17.5

■ Three-Phase 200 V Class

Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A
2V0006	1.1 (1.5)	6.0
2V0010	2.2 (3)	9.6
2V0012	3.0 (3)	12.0
2V0020	5.5 (5)	19.6
2V0030	7.5 (10)	30.0
2V0040	11 (10)	40.0
2V0056	15 (20)	56.0
2V0069	18.5 (25)	69.0

■ Three-Phase 400 V Class

Drive Model	Max. Motor Capacity kW (HP)	Rated Output Current A
4V0002	0.75 (1)	2.1
4V0004	1.5 (2)	4.1
4V0005	2.2 (3)	5.4
4V0007	3.0 (3)	6.9
4V0009	3.7 (5)	8.8
4V0011	5.5 (7.5)	11.1
4V0018	7.5 (10)	17.5
4V0023	11 (15)	23.0
4V0031	15 (20)	31.0
4V0038	18.5 (25)	38.0

i.3 Mechanical Installation

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

◆ Installation Environment

To help prolong the optimum performance life of the drive, install the drive in the proper environment. *Table i.1* describes the appropriate environment for the drive.

Table i.1 Installation Environment

Environment	Conditions
Installation Area	Indoors
Ambient Temperature	IP20/NEMA 1, UL Type 1 enclosure: -10 °C to +40 °C (14 °F to 104 °F) IP66/NEMA 4X, UL Type 4X enclosure: -10 °C to +40 °C (14 °F to 104 °F) Drive reliability improves in environments without wide temperature fluctuations. When using an enclosure panel, install a cooling fan or air conditioner in the area to ensure that the air temperature inside the enclosure does not exceed the specified levels. Do not allow ice to develop on the drive.
Humidity	95% RH or less and free of condensation
Storage Temperature	-20 °C to +60 °C (-4 °F to +104 °F)
Surrounding Area	Install the drive in an area free from: • oil mist and dust • metal shavings, oil, water or other foreign materials • radioactive materials • combustible materials (e.g., wood) • harmful gases and liquids • excessive vibration • chlorides • direct sunlight For IP66/NEMA 4X, UL Type 4X enclosure drives, install the drive in an environment suitable for IP66/NEMA 4X, UL Type 4X enclosures: • NEMA 4X, UL Type 4X – Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, hose-directed water, and corrosion; and that will be undamaged by the external formation of ice on the enclosure. • IP66 – Dust-tight enclosures to do not allow any dust to penetrate. The enclosure guards the drive against powerful jetting water sprayed from any direction and is protected against access to hazardous parts with a wire.
Altitude	Up to 1000 meters without derating; up to 3000 meters with output current, ambient temperature, and voltage derating.
Vibration	10 to 20 Hz at 9.8 m/s^2 20 to 55 Hz at 5.9 m/s^2
Orientation	Install the drive vertically to maintain maximum cooling effects.

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

NOTICE: *Avoid placing drive peripheral devices, transformers, or other electronics near the drive. Failure to comply could result in erroneous operation. If such devices must be used in close proximity to the drive, take proper steps to shield the drive from noise.*

◆ Installation Orientation and Spacing

NOTICE: *Install the drive upright as illustrated in Figure i.5. Failure to comply may damage the drive due to improper cooling.*

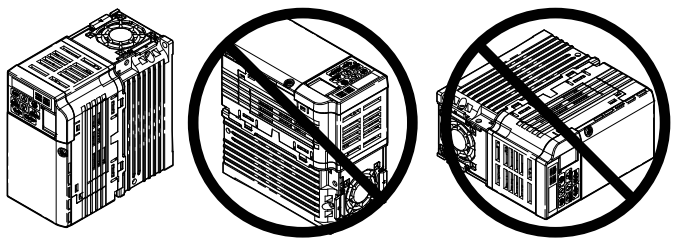
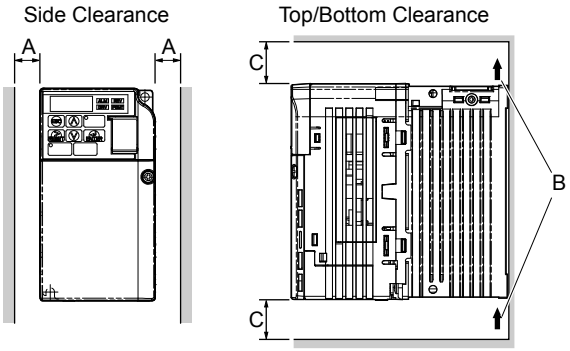


Figure i.5 Correct Installation Orientation

■ Single Drive Installation

Figure i.6 shows the required installation spacing to maintain sufficient space for airflow and wiring for IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X enclosures. Install the heatsink against a closed surface to avoid diverting cooling air around the heatsink.



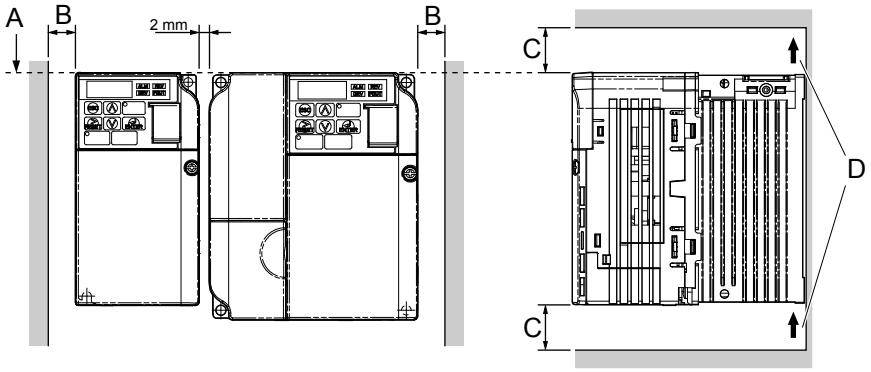
A – 30 mm minimum
B – Airflow direction
C – 100 mm minimum

Figure i.6 Correct Installation Spacing

Note: IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X enclosure models require the same amount of space above and below the drive for installation.

■ Multiple Drive Installation

When installing multiple drives into the same enclosure panel, mount the drives according to *Figure i.6*. When mounting drives with a minimum side-by-side clearance of 2 mm according to *Figure i.7*, derating must be considered and parameter L8-35 must be set.



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

Figure i.7 Space Between Drives (Side-by-Side Mounting)

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

NOTICE: *When mounting IP20/NEMA 1, UL Type 1 enclosure drives side by side, the top covers of all drives must be removed as shown in Figure i.8.*

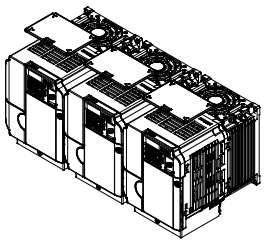


Figure i.8 IP20/NEMA 1, UL Type 1 Side-by-Side Mounting in Enclosure

◆ Drive Dimensions

NOTICE

Refer to the iQpump Micro User Manual TOEP YAIQPM 03 for IP20/NEMA 1, UL Type 1 and IP66/NEMA 4X, UL Type 4X dimensions.

The iQpump Micro User Manual TOEP YAIQPM 03 is available on the Yaskawa website, www.yaskawa.com.

i.4 Electrical Installation

◆ Standard Connection Diagram

Connect the drive and peripheral devices as shown in ***Figure i.9***. It is possible to run the drive via the digital operator without connecting digital I/O wiring. ***Refer to Start-Up Programming and Operation on page 67*** for instructions on operating the drive

NOTICE: *Inadequate branch short circuit protection could result in damage to the drive. Install adequate branch circuit short circuit protection per applicable codes. The drive is suitable for circuits capable of delivering not more than 31,000 RMS symmetrical amperes, 240 Vac maximum (200 V Class) and 480 Vac maximum (400 V Class).*

NOTICE: *When the wiring distance is greater than 100 meters, pay special attention to the motor insulation voltage or use a drive duty motor. Failure to comply could lead to motor insulation breakdown.*

NOTICE: *Correctly set Sink/Source jumper S3 for internal power supply. Failure to comply may result in damage to the drive.*

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

NOTICE: *Route motor leads U/T1, V/T2, and W/T3 separate from all other leads to reduce possible interference related issues. Failure to comply may result in abnormal operation of drive and nearby equipment.*

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

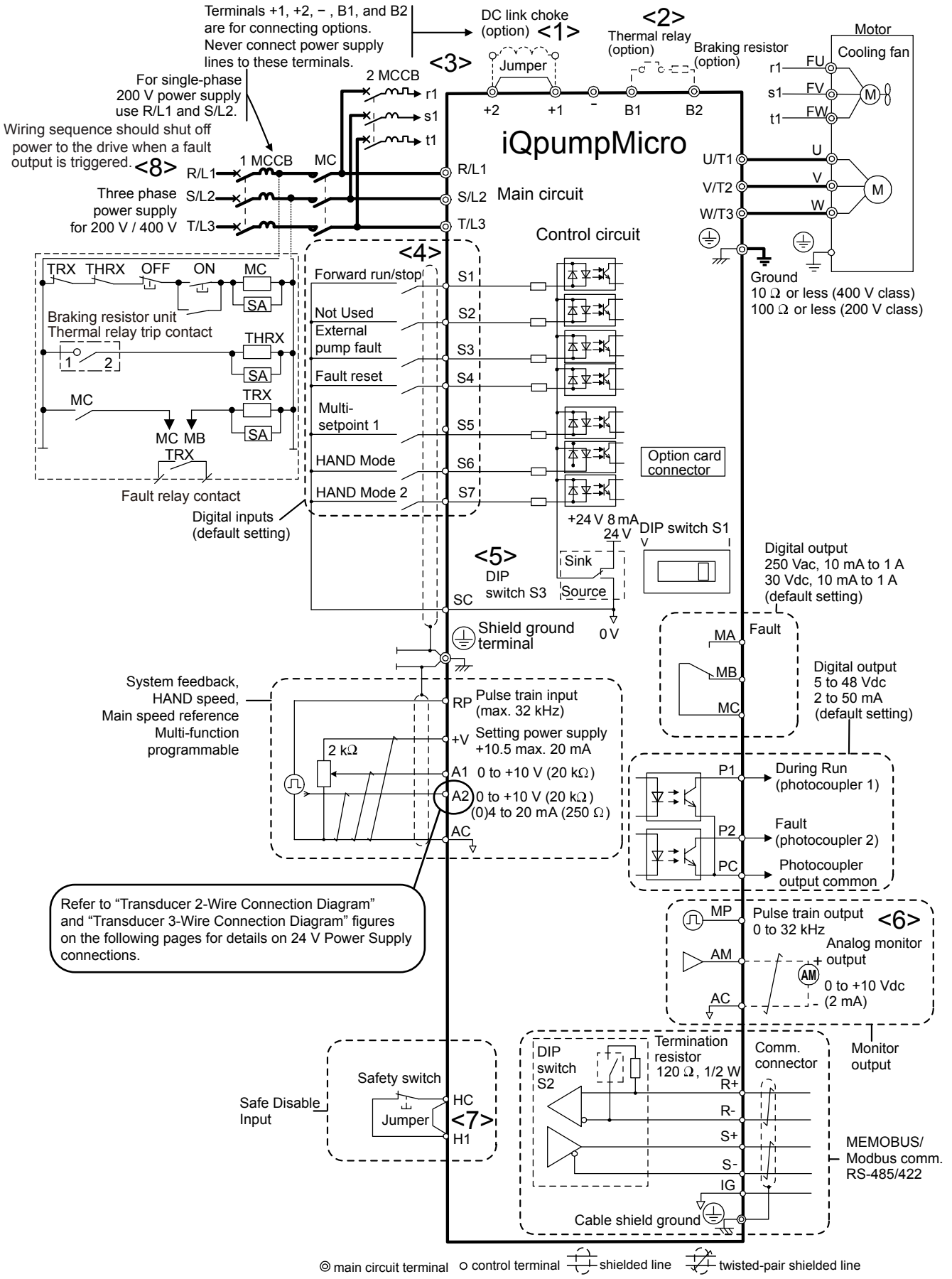


Figure i.9 Drive Standard Connection Diagram

<1> Remove the jumper when installing an optional DC link choke.

<2> The MC on the input side of the main circuit should open when the thermal relay is triggered.

<3> Self-cooled motors do not require separate cooling fan motor wiring.

<4> Connected using sequence input signal (S1 to S7) from NPN transistor; Default: sink mode (0 V com).

<5> Use only a +24 V internal power supply in sinking mode; the source mode requires an external power supply.

<6> Monitor outputs work with devices such as analog frequency meters, ammeters, voltmeters and wattmeters; they are not intended for use as a feedback-type of signal.

<7> Disconnect the wire jumper between HC and H1 when utilizing the safety input. ***Refer to Wiring the Control Circuit Terminal on page 61*** for details on removing the jumper. The wire length for the Safe Disable input should not exceed 30 m.

<8> Note that if the drive is set to trigger a fault output whenever the fault restart function is activated (L5-02 = 1), then a sequence to interrupt power when a fault occurs will result in shutting off the power to the drive as the drive attempts to restart itself. The default setting for L5-02 is 0 (fault output active during restart attempt).

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

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

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

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

Figure i.10 illustrates an example of a 3-Wire sequence.

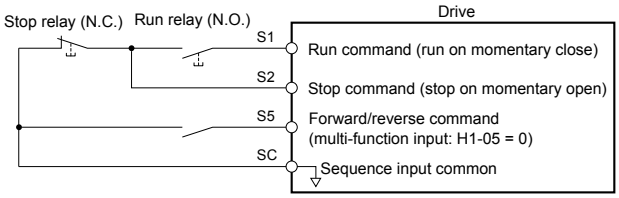


Figure i.10 3-Wire Sequence

◆ Transducer Connection Diagrams

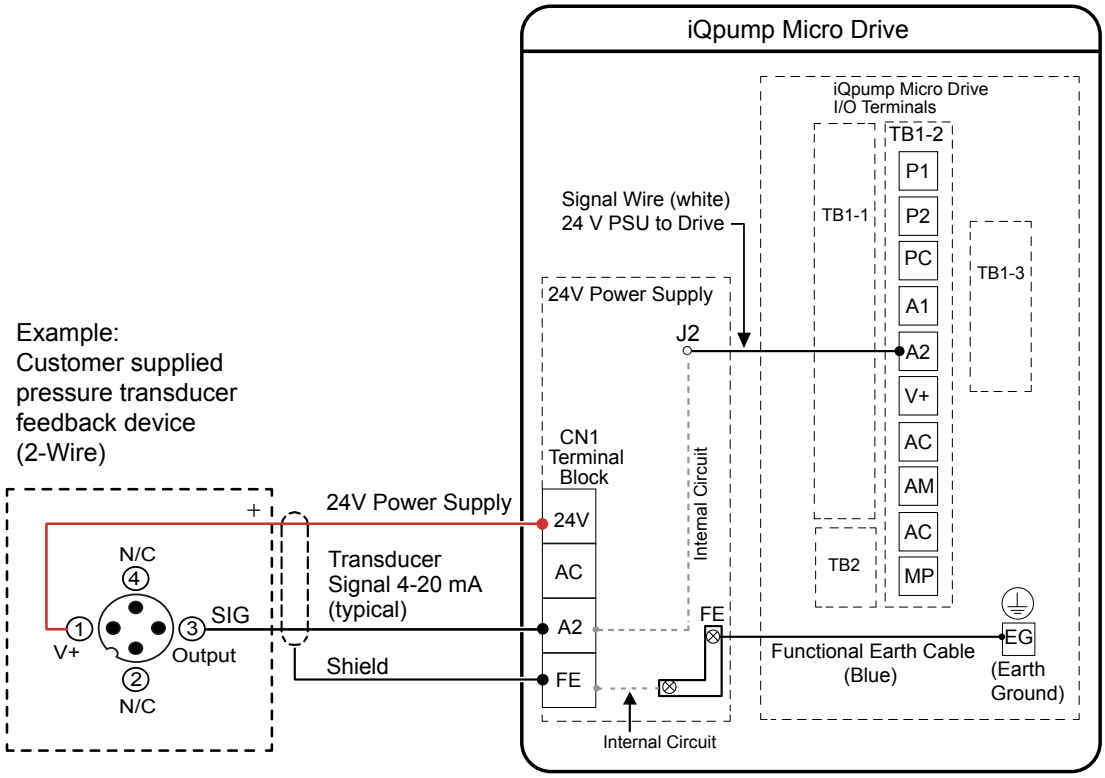


Figure i.11 Transducer 2-Wire Connection Diagram

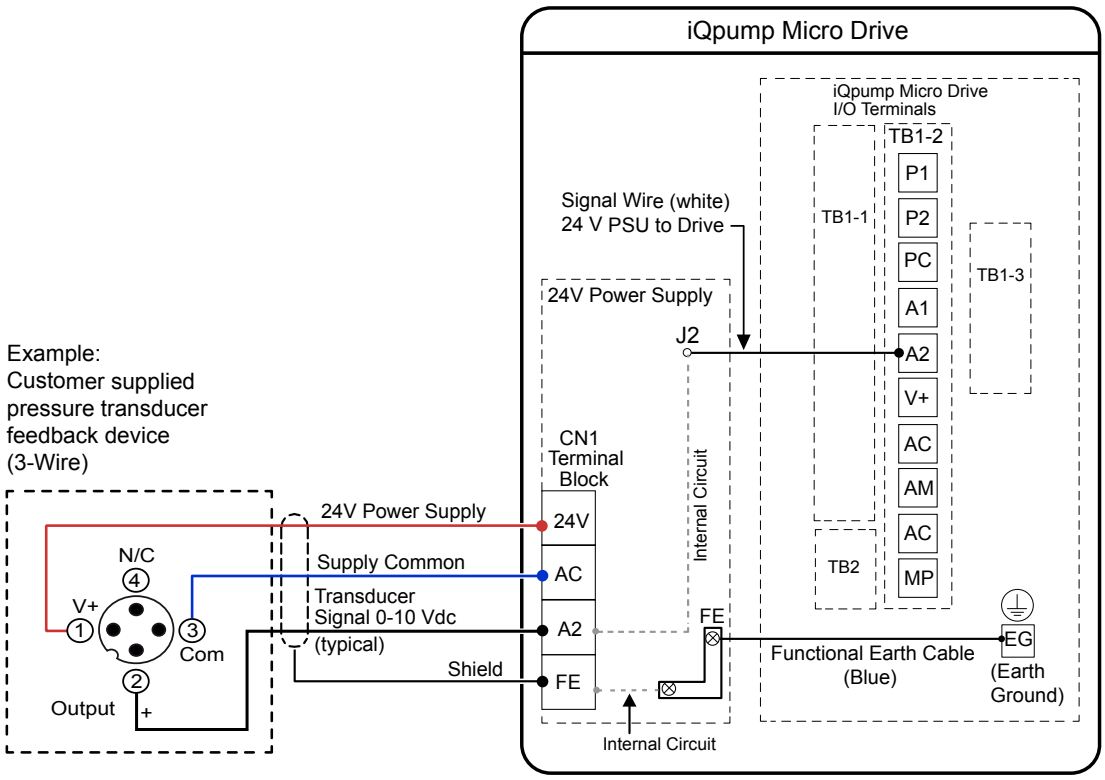


Figure i.12 Transducer 3-Wire Connection Diagram

i.5 Main Circuit Wiring

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

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

◆ Main Circuit Terminal Functions

Table i.2 Main Circuit Terminal Functions

Terminal	Type	Function	Reference
R/L1 S/L2 T/L3	Main circuit power supply input	Connects line power to the drive. Drives with single-phase 200 V input power use terminals R/L1 and S/L2 only. Do NOT use T/L3.	–
U/T1 V/T2 W/T3	Drive output	Connects to the motor.	*58*
B1 B2	Braking resistor	Available for connecting a braking resistor or the braking resistor unit option.	–
⊕1 ⊕2	DC link choke connection	These terminals are shorted at shipment. Remove the shorting bar between ⊕1 and ⊕2 when connecting a DC link choke to this terminal.	–
⊕1 ⊖	DC power supply input	For connecting a DC power supply.	–
⏚ (2 terminals)	Ground	Grounding Terminal	*58*

◆ Wire Gauges and Tightening Torques

Select the appropriate wires and crimp terminals from *Table i.3* through *Table i.5*.

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

- Consider the amount of voltage drop when selecting wire gauges. Increase the wire gauge when the voltage drop is greater than 2% of motor rated voltage. Ensure the wire gauge is suitable for the terminal block. Use the following formula to calculate the amount of voltage drop:
- Line drop voltage (V) = √3 x wire resistance (Ω/km) x wire length (m) x current (A) x 10^{-3}
- Refer to instruction manual TOBP C720600 00 for braking unit or braking resistor unit wire gauges.
- *Refer to UL Standards Compliance on page 112* for information on UL compliance.

■ Single-Phase 200 V Class

Table i.3 Wire Gauge and Torque Specifications

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N•m (lb.in.)
BV0006	R/L1, S/L2, T/L3	12	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10	14 to 10		
BV0010	R/L1, S/L2, T/L3	10	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10	14 to 10		

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N•m (lb.in.)
BV0012	R/L1, S/L2, T/L3	10	14 to 10	M4	2.3 to 2.5 (20.4 to 22.1)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10	14 to 10		
BV0018	R/L1, S/L2, T/L3	8	12 to 8	M5	2.3 to 2.5 (20.4 to 22.1)
	U/T1, V/T2, W/T3	10	12 to 8		
	⊖, ⊕1, ⊕2	–	12 to 8		
	B1, B2	–	12 to 8		
	⏚	8	12 to 8		2 to 2.5 (17.7 to 22.1)

■ Three-Phase 200 V Class

Table i.4 Wire Gauge and Torque Specifications

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N•m (lb.in.)
2V0006	R/L1, S/L2, T/L3	14	18 to 14	M3.5	0.8 to 1.0 (7.1 to 8.9)
	U/T1, V/T2, W/T3	14	18 to 14		
	⊖, ⊕1, ⊕2	–	18 to 14		
	B1, B2	–	18 to 14		
	⏚	14	18 to 14		
2V0010	R/L1, S/L2, T/L3	12	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10	14 to 10		
2V0012	R/L1, S/L2, T/L3	12	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10	14 to 10		
2V0020	R/L1, S/L2, T/L3	10	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	10	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10	14 to 10		
2V0030	R/L1, S/L2, T/L3	8	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	8	10 to 6		
	⊖, ⊕1, ⊕2	–	10 to 6		
	B1, B2	–	14 to 10		
	⏚	8	10 to 6	M5	2 to 2.5 (17.7 to 22.1)
2V0040	R/L1, S/L2, T/L3	6	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	8	10 to 6		
	⊖, ⊕1, ⊕2	–	10 to 6		
	B1, B2	–	14 to 10		
	⏚	6	10 to 6	M5	2 to 2.5 (17.7 to 22.1)

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N•m (lb.in.)
2V0056	R/L1, S/L2, T/L3	4	6 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
	U/T1, V/T2, W/T3	4	6 to 4		
	⊖, ⊕1, ⊕2	–	6 to 4		
	B1, B2	–	10 to 6	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	6	8 to 4	M6	5.4 to 6.0 (47.8 to 53.1)
2V0069	R/L1, S/L2, T/L3	3	8 to 2	M8	9.9 to 11 (87.6 to 97.4)
	U/T1, V/T2, W/T3	3	8 to 2		
	⊖, ⊕1, ⊕2	–	8 to 2		
	B1, B2	–	8 to 6	M5	2.7 to 3.0 (23.9 to 26.6)
	⏚	6	6 to 4	M6	5.4 to 6.0 (47.8 to 53.1)

■ Three-Phase 400 V Class

Table i.5 Wire Gauge and Torque Specifications

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N•m (lb.in.)
4V0002 4V0004	R/L1, S/L2, T/L3	14	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	14	14 to 10		
4V0005 4V0007 4V0009	R/L1, S/L2, T/L3	14	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10	14 to 10		
4V0011	R/L1, S/L2, T/L3	12	14 to 10	M4	1.2 to 1.5 (10.6 to 13.3)
	U/T1, V/T2, W/T3	14	14 to 10		
	⊖, ⊕1, ⊕2	–	14 to 10		
	B1, B2	–	14 to 10		
	⏚	10	14 to 10		
4V0018	R/L1, S/L2, T/L3	10	14 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	10	14 to 6		
	⊖, ⊕1, ⊕2	–	14 to 6		
	B1, B2	–	14 to 10		
	⏚	8	14 to 6	M5	2 to 2.5 (17.7 to 22.1)
4V0023	R/L1, S/L2, T/L3	10	10 to 6	M4	2.1 to 2.3 (18.6 to 20.4)
	U/T1, V/T2, W/T3	10	10 to 6		
	⊖, ⊕1, ⊕2	–	10 to 6		
	B1, B2	–	14 to 10		
	⏚	8	10 to 6	M5	2 to 2.5 (17.7 to 22.1)

Drive Model	Terminal	Recomm. Gauge AWG, kcmil	Wire Range AWG, kcmil	Screw Size	Tightening Torque N•m (lb.in.)
4V0031	R/L1, S/L2, T/L3	8	10 to 6	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	8	10 to 6		
	⊖, ⊕1, ⊕2	–	10 to 6		
	B1, B2	–	14 to 10		2.7 to 3.0 (23.9 to 26.6)
	⏚	6	10 to 6	M6	5.4 to 6.0 (47.8 to 53.1)
4V0038	R/L1, S/L2, T/L3	6	10 to 6	M5	3.6 to 4.0 (31.8 to 35.4)
	U/T1, V/T2, W/T3	8	10 to 6		
	⊖, ⊕1, ⊕2	–	10 to 6		
	B1, B2	–	10 to 8		2.7 to 3.0 (23.9 to 26.6)
	⏚	6	10 to 6	M6	5.4 to 6.0 (47.8 to 53.1)

◆ Main Circuit Terminal Power Supply and Motor Wiring

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

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

NOTICE: *Route motor leads U/T1, V/T2, and W/T3 separate from all other leads to reduce possible interference related issues. Failure to comply may result in abnormal operation of drive and nearby equipment.*

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

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

■ Cable Length Between Drive and Motor

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

Adjust the drive carrier frequency according to the following table. If the motor wiring distance exceeds 100 m because of the system configuration, reduce the ground currents.

Refer to ***Table i.6*** to set the carrier frequency to an appropriate level.

Table i.6 Cable Length Between Drive and Motor

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

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

■ Ground Wiring

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

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

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

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

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

Refer to ***Figure i.13*** when using multiple drives. Do not loop the ground wire.

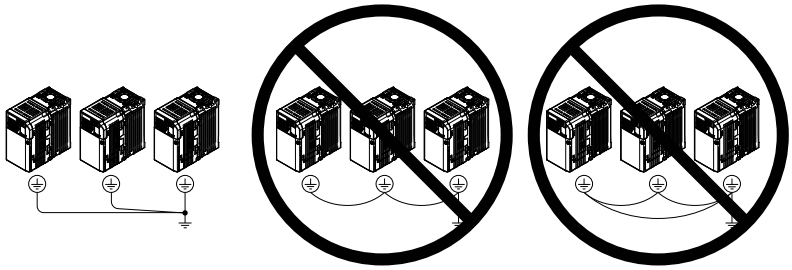


Figure i.13 Multiple Drive Wiring

◆ Control Circuit Terminal Block Functions

Drive parameters determine which functions apply to the multi-function digital inputs (S1 to S7), multi-function digital outputs (MA, MB), multi-function pulse inputs and outputs (RP, MP) and multi-function photocoupler outputs (P1, P2). The default is called out next to each terminal in ***Figure i.9***.

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

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

■ Input Terminals

Table i.7 Control Circuit Input Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Multi-Function Digital Inputs	S1	Multi-function input 1 (Closed: Forward run, Open: Stop)	Photocoupler 24 Vdc, 8 mA **Note:** Drive preset to sinking mode. When using source mode, set DIP switch S3 to allow for a 24 Vdc (±10%) external power supply. ***Refer to Sinking/Sourcing Mode Switch on page 63***.
	S2	Multi-function input 2 (Not used/Through mode)	
	S3	Multi-function input 3 (External pump fault (N.O.)	
	S4	Multi-function input 4 (Fault reset)	
	S5	Multi-function input 5 (Multi-step speed reference 1)	
	S6	Multi-function input 6 (HAND Mode)	
	S7	Multi-function input 7 (HAND Mode 2)	
	SC	Multi-function input common (Control common)	Sequence common
Safe Disable Input	HC	Power supply for safe disable input	+24 Vdc (max 10 mA allowed)
	H1	Safe disable input	Open: Output disabled Closed: Normal operation **Note:** Disconnect wire jumper between HC and H1 when using the safe disable input. The wire length should not exceed 30 m.
Main Frequency Reference Input	RP	Multi-function pulse train input (frequency reference)	Response frequency: 0.5 to 32 kHz (Duty Cycle: 30 to 70%) (High level voltage: 3.5 to 13.2 Vdc) (Low level voltage: 0.0 to 0.8 Vdc) (input impedance: 3 kΩ)
	+V	Analog input power supply	+10.5 Vdc (max allowable current 20 mA)
	A1	Multi-function analog input 1 (frequency reference)	Input voltage 0 to +10 Vdc (20 kΩ) resolution 1/1000
	A2	Multi-function analog input 2 (frequency reference)	Input voltage or input current (Selected by DIP switch S1 and H3-09) 0 to +10 Vdc (20 kΩ), Resolution: 1/1000 4 to 20 mA (250 Ω) or 0 to 20 mA (250 Ω), Resolution: 1/500
	AC	Frequency reference common	0 Vdc

■ Output Terminals

Table i.8 Control Circuit Output Terminals

Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Multi-Function Digital Output <1>	MA	N.O. (fault)	Digital output 30 Vdc, 10 mA to 1 A; 250 Vac, 10 mA to 1 A Minimum load: 5 Vdc, 10 mA (reference value)
	MB	N.C. output (fault)	
	MC	Digital output common	

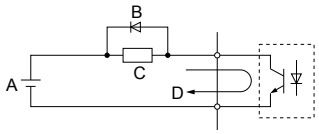
Type	No.	Terminal Name (Function)	Function (Signal Level) Default Setting
Multi-Function Photocoupler Output	P1	Photocoupler output 1 (During run)	Photocoupler output 48 Vdc, 2 to 50 mA <2>
	P2	Photocoupler output 2 (Frequency agree)	
	PC	Photocoupler output common	
Monitor Output	MP	Pulse train output (Output frequency)	32 kHz (max) <3> <4>
	AM	Analog monitor output	0 to 10 Vdc (2 mA or less) Resolution: 1/1000
	AC	Monitor common	0 V

<1> Do not assign functions to digital relay outputs that involve frequent switching. This may shorten relay performance life. Switching life is estimated at 200,000 times (assumes 1 A, resistive load).

<2> Connect a suppression diode as shown in ***Figure i.14*** when driving a reactive load such as a relay coil. Ensure the diode rating is greater than the circuit voltage.

<3> When set for sourcing. +5 V/1.5 kΩ or higher, +8 V/3.5 kΩ or higher, +10 V/10 kΩ or higher.

<4> When set for sinking, the external power supply should be +12 Vdc, ±5% with 16 mA or less.



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

Figure i.14 Connecting a Suppression Diode

■ Serial Communication Terminals

Table i.9 Control Circuit Terminals: Serial Communications

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

◆ Terminal Configuration

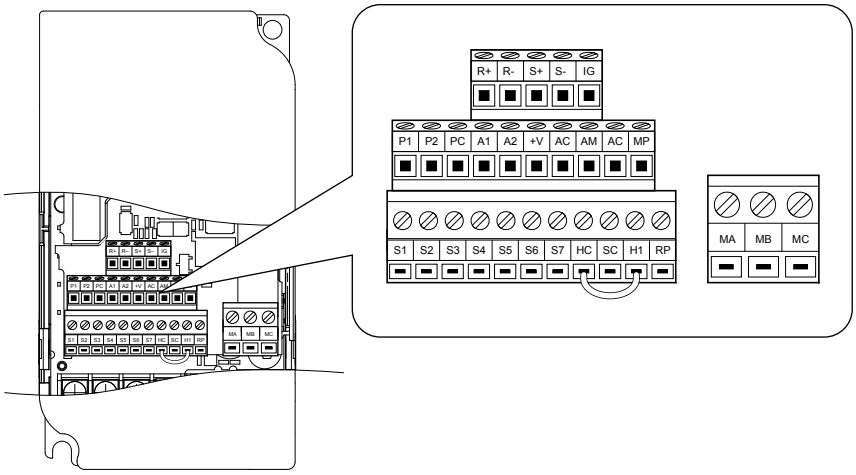


Figure i.15 Removable Control Circuit Terminal Block

■ Wire Size and Torque Specifications

Select appropriate wire type and size from ***Table i.10***. For simpler and more reliable wiring, crimp ferrules to the wire ends. Refer to ***Table i.11*** for ferrule terminal types and sizes.

Table i.10 Wire Size and Torque Specifications (Same for All Models)

Terminal	Screw Size	Tightening Torque N•m (in-lbs)	Bare Wire Terminal		Ferrule-Type Terminal		
			Applic. wire size mm² (AWG)	Recomm. mm² (AWG)	Applic. wire size mm² (AWG)	Recomm. mm² (AWG)	Wire Type
MA, MB, MC	M3	0.5 to 0.6 (4.4 to 5.3)	Stranded: 0.25 to 1.5 (24 to 16) Single: 0.25 to 1.5 (24 to 16)	0.75 (18)	0.25 to 1.0 (24 to 17)	0.5 (20)	Shielded line, etc.
S1-S7, SC, RP, +V, A1, A2, AC, HC, H1, P1, P2, PC, MP, AM, AC, S+, S-, R+, R-, IG	M2	0.22 to 0.25 (1.9 to 2.2)	Stranded: 0.25 to 1.0 (24 to 18) Single: 0.25 to 1.5 (24 to 16)	0.75 (18)	0.25 to 0.5 (24 to 20)	0.5 (20)	

■ Ferrule-Type Wire Terminations

Crimp a ferrule to signal wiring to improve wiring simplicity and reliability. Use CRIMPFOX 6, a crimping tool manufactured by PHOENIX CONTACT.

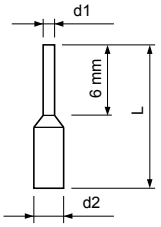


Figure i.16 Ferrule Dimensions

Table i.11 Ferrule Terminal Types and Sizes

Size mm² (AWG)	Type	L (mm)	d1 (mm)	d2 (mm)	Manufacturer
0.25 (24)	AI 0.25-6YE	10.5	0.8	2.0	PHOENIX CONTACT
0.34 (22)	AI 0.34-6TQ	10.5	0.8	2.0	
0.5 (20)	AI 0.5-6WH	12	1.1	2.5	
0.75 (18)	AI 0.75-6GY	12	1.3	2.8	
1.0	AI 1-6RD	12	1.5	3.0	

◆ Wiring the Control Circuit Terminal

This section describes the proper procedures and preparations for wiring the control terminals.

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

NOTICE: *Separate control circuit wiring from main circuit wiring (terminals R/L1, S/L2, T/L3, B1, B2, U/T1, V/T2, W/T3, ⊖, ⊕1, ⊕2) and other high-power lines. Improper wiring practices could result in drive malfunction due to electrical interference.*

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

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

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

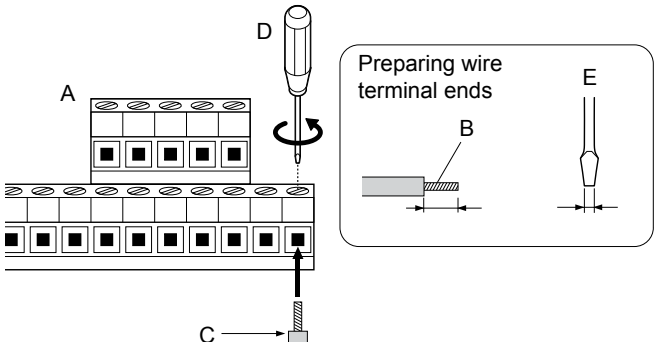
NOTICE: *Connect the shield of shielded cable to the appropriate ground terminal. Improper equipment grounding could result in drive or equipment malfunction or nuisance trips.*

Wire the control terminals using ***Figure i.17*** as a guide. Prepare the ends of the control circuit wiring as shown in ***Figure i.18***. ***Refer to Wire Size and Torque Specifications on page 61***.

NOTICE: *Do not tighten screws beyond the specified tightening torque. Failure to comply may damage the terminal block.*

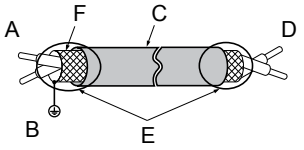
NOTICE: *Use shielded twisted-pair cables as indicated to prevent operating faults. Improper wiring practices could result in drive or equipment malfunction due to electrical interference.*

Connect control wires as shown in the following figure:



A – Control terminal block
B – Avoid fraying wire strands when stripping insulation from wire. Strip length 5.5 mm.
C – Single wire or stranded wire
D – Loosen screw to insert wire.
E – Blade depth of 0.4 mm or less Blade width of 2.5 mm or less

Figure i.17 Terminal Board Wiring Guide

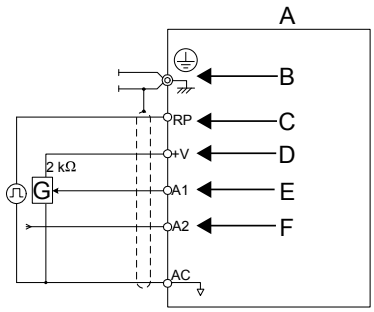


A – Drive side
B – Connect shield to ground terminal of drive.
C – Insulation
D – Control device side
E – Shield sheath (Insulate with tape)
F – Shield

Figure i.18 Preparing the Ends of Shielded Cables

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

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



A – Drive
B – Ground terminal (shield connection)
C – (RP) Pulse train (maximum 32 kHz)
D – (+V) Frequency setting power source +10.5 Vdc maximum 20 mA
E – (A1) Main speed frequency reference 0 to +10 Vdc (20 kΩ)
F – (A2) Multi-function analog input 0 to +10 Vdc (20 kΩ) or 4 to 20 mA (250 Ω)/ 0 to 20 mA (250 Ω)
G – Frequency setting potentiometer

Figure i.19 Wiring the Frequency Reference to the Control Circuit Terminals (External Reference)

◆ Sinking/Sourcing Mode Switch

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

Table i.12 Sinking/Sourcing Mode Setting

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

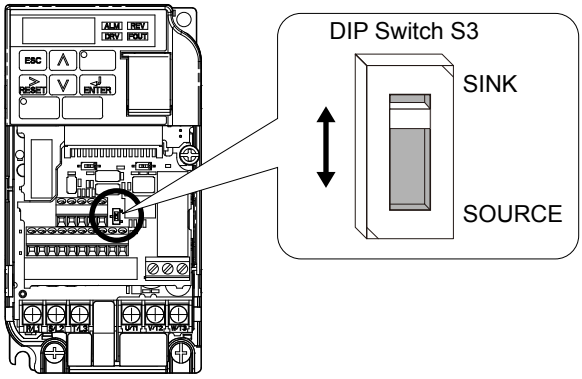


Figure i.20 DIP Switch S3

■ Transistor Input Signal Using 0 V Common/Sink Mode

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

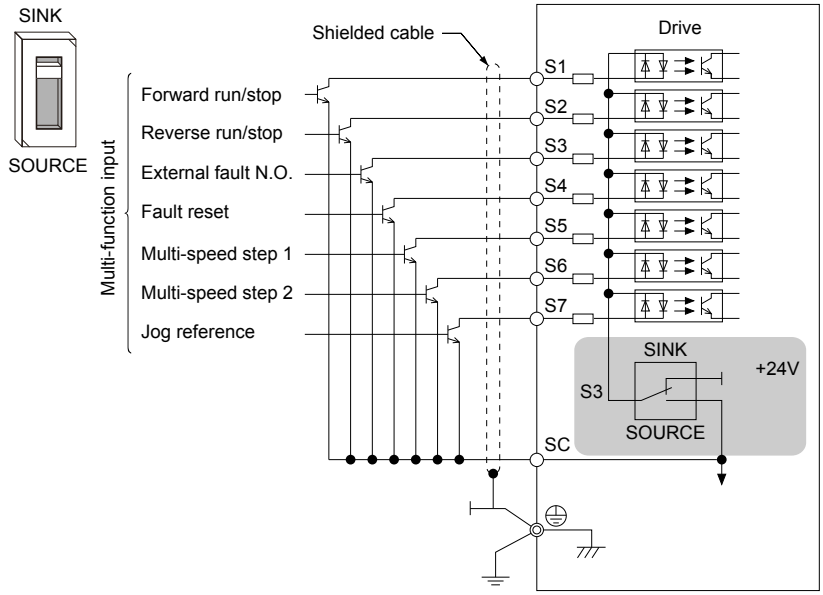


Figure i.21 Sinking Mode: Sequence from NPN Transistor (0 V Common)

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

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

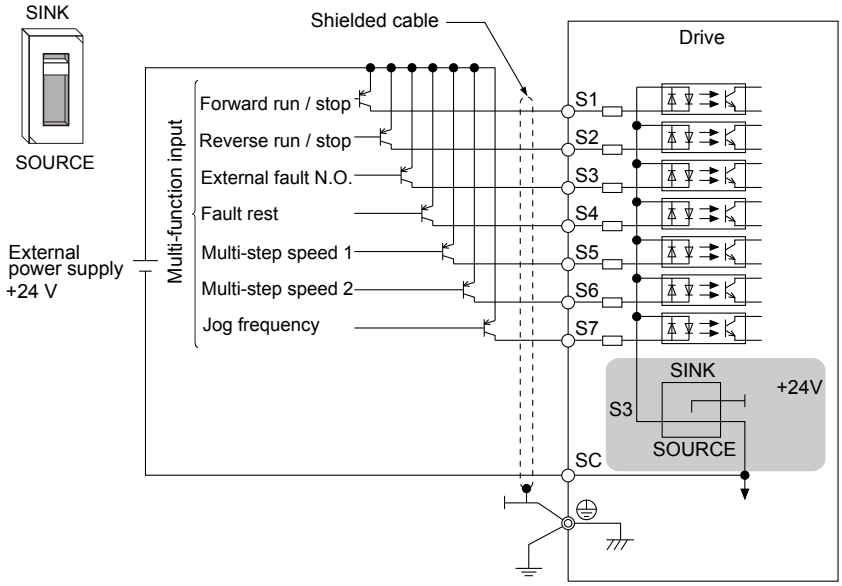


Figure i.22 Source Mode: Sequence from PNP Transistor (+24 V Common)

◆ DIP Switch S1 Analog Input Signal Selection

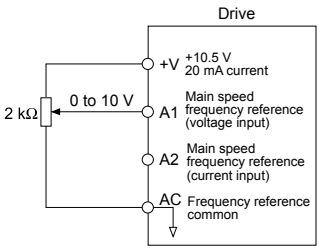
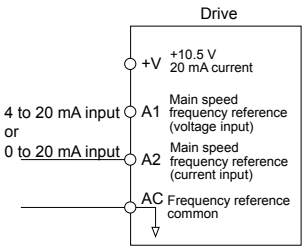
The main frequency reference can either be a voltage or current signal input. For voltage signals both analog inputs, A1 and A2, can be used, for current signals A2 must be used.

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

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

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

Table i.13 Frequency Reference Configurations

Voltage Input	Current Input
	

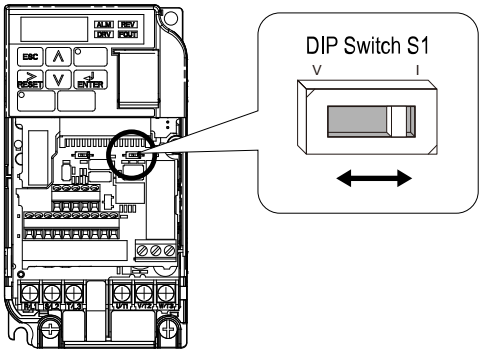


Figure i.23 DIP Switch S1

Table i.14 DIP Switch S1 Settings

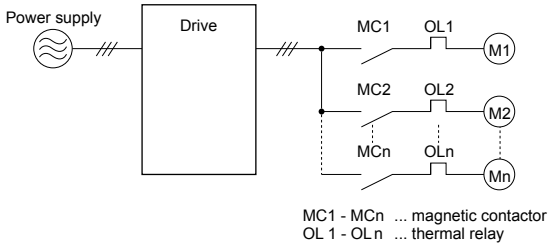
Setting Value	Description
V (eft position)	Voltage input (0 to 10 V)
I (right position)	Current input (4 to 20 mA or 0 to 20 mA): default setting

Table i.15 Parameter H3-09 Details

No.	Parameter Name	Description	Setting Range	Default Setting
H3-09	Frequency ref. (current) terminal A2 signal level selection	Selects the signal level for terminal A2. 0: 0 to +10 V, unipolar input (with lower limit) 1: 0 to +10 V, bipolar input (no lower limit) 2: 4 to 20 mA 3: 0 to 20 mA	0 to 3	2

◆ Wiring Checklist

☑	No.	Item	Page
		Drive, peripherals, option cards	
☐	1	Check drive model number to ensure receipt of correct model.	*46*
☐	2	Check for correct braking resistors, DC link chokes, noise filters, and other peripheral devices.	–
		Installation area and physical setup	
☐	3	Ensure area surrounding the drive complies with specifications.	*48*
		Power supply voltage, output voltage	
☐	4	The voltage from the power supply should fall within the input voltage specification range of the drive.	–
☐	5	The voltage rating for the motor should match the drive output specifications.	*46*
		Main circuit wiring	
☐	6	Confirm proper branch circuit protection exists per National and Local codes.	*51*
☐	7	Properly wire the power supply to drive terminals R/L1, S/L2 and T/L3.	–
☐	8	Properly wire the drive and motor together. The motor lines and drive output terminals R/T1, V/T2 and W/T3 should match in order to produce the desired phase order. If the phase order is incorrect, the drive will rotate in the opposite direction.	*58*
☐	9	Use 600 Vac vinyl-sheathed wire for the power supply and motor lines.	*55*
☐	10	Use the correct wire gauges for the main circuit. Refer to *Table i.3*, *Table i.4*, or *Table i.5*.	*55*
		When using comparatively long motor cable, calculate the amount of voltage drop. Motor rated voltage (V) x 0.02 ≥ 3 x voltage resistance (Ω/km) x cable length (m) x motor rated current (A) x 10^{-3}	*55*
		If the cable between the drive and motor exceeds 50 m, adjust the carrier frequency (C6-02) accordingly.	*58*
☐	11	Properly ground the drive.	*58*
☐	12	Tightly fasten all terminal screws. Refer to *Table i.3*, *Table i.4*, or *Table i.5*.	*55*

☑	No.	Item	Page
☐	13	Set up overload protection circuits when running multiple motors from a single drive.  **Note:** Close MC1 through MCn before operating the drive.	–
☐	14	If using a braking resistor or dynamic braking resistor unit, install a magnetic contactor. Properly install the resistor, and ensure that overload protection shuts off the power supply.	–
☐	15	Verify phase advancing capacitors are NOT installed on the output side of the drive.	–
Control circuit wiring			
☐	16	Use twisted-pair cables for all drive control circuit wiring.	–
☐	17	Ground the shields of shielded wiring to the GND ⏚ terminal.	*61*
☐	18	If using a 3-Wire sequence, set parameters for MFDI terminals S1 through S7, and properly wire control circuits.	*53*
☐	19	Check for any other wiring mistakes. Only use a multimeter to check wiring.	–
☐	20	Properly fasten the control circuit terminal screws in the drive. Refer to *Table i.3*, *Table i.4*, or *Table i.5*.	*55*
☐	21	Pick up all wire clippings.	–
☐	22	Ensure that no frayed wires on the terminal block are touching other terminals or connections.	–
☐	23	Properly separate control circuit wiring and main circuit wiring.	–
☐	24	Analog signal line wiring should not exceed 50 m.	–
☐	25	Safe Disable Input wiring should not exceed 30 m.	–

i.6 Start-Up Programming and Operation

◆ Keys, Displays, and LEDs on the Standard LED Operator

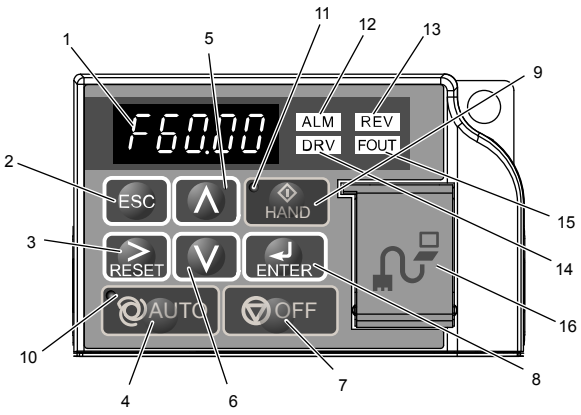


Table i.16 Keys and Displays on the LED Operator

No.	Display	Name	Function
1	F60.00	Data Display Area	Displays the frequency reference, parameter number, etc.
2	ESC	ESC Key	Returns to the previous menu.
3	RESET	RESET Key	Moves the cursor to the right. Resets the drive to clear a fault situation.
4	AUTO	AUTO Key	Selects the source of Run command and frequency reference. • Set the drive to AUTO mode. • Run command input source depends on b1-02. • Frequency reference input source depends on b1-01.
5		Up Arrow Key	Scrolls up to display the next item, selects parameter numbers, and increments setting values.
6		Down Arrow Key	Scrolls down to display the previous item, selects parameter numbers, and decrements setting values.
7	OFF	OFF Key	Follows the stopping method set in b1-03 to stop drive operation.
8	ENTER	ENTER Key	• Enters parameter values and settings. • Selects a menu item to move between displays.
9	HAND	HAND Key	The drive runs at a selectable frequency reference source as set by P5-01. • Set the drive to HAND mode. • When P5-03 is set to 1, HAND and AUTO mode can be switched while the drive is running.
10	AUTO	AUTO Light	Lit while the drive is in AUTO mode.
11	HAND	HAND Light	Lit while the drive is in HAND mode.
12	ALM	ALM LED Light	Lit or flashing when the drive detects an alarm or error.
13	REV	REV LED Light	Lit when motor is rotating in reverse.
14	DRV	DRV LED Light	Lit when in Drive Mode or Auto-Tuning.
15	FOUT	FOUT LED Light	Lit then displaying output frequency.

No.	Display	Name	Function
16	–	Communication Port	Port used for USB Copy Unit, LCD Operator Keypad, and for connecting to a PC. **NOTICE:** *Use only specified cable when making connections to the drive. Failure to comply may damage the drive.* **NOTICE:** *Do not open the port cover wider than 90 degrees. Failure to comply may break the port cover and leave the unprotected port susceptible to damage.*

◆ Menu Structure for Digital LED Operator

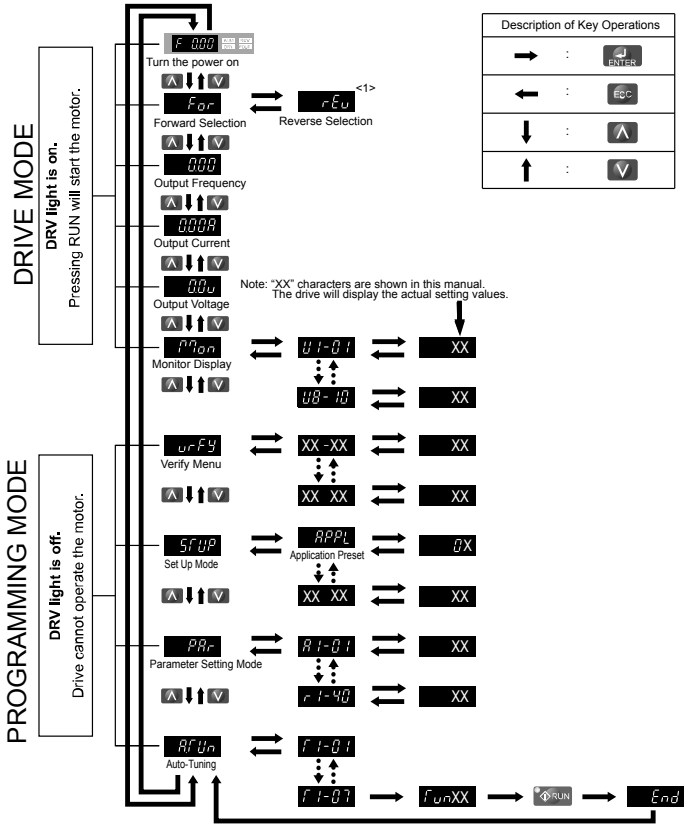


Figure i.24 Digital LED Operator Screen Structure

<1> Reverse can only be selected when LOCAL is set.

■ Powering Up the Drive

Review the following checklist before turning the power on.

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

◆ Keys and Displays on the Optional HOA Keypad

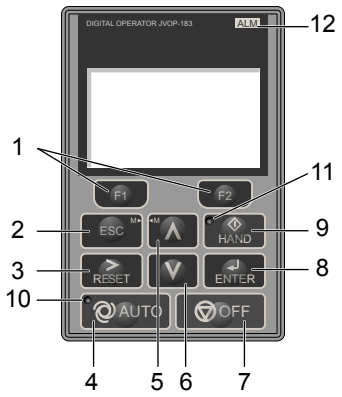


Figure i.25 Keys and Displays on the HOA Keypad

No.	Display	Name	Function
1	F1 F2	Function Key (F1, F2)	The functions assigned to F1 and F2 vary depending on the currently displayed menu. The name of each function appears in the lower half of the display window.
2	ESC	ESC Key	• Returns to the previous display. • Moves the cursor one space to the left. • Pressing and holding this button will return to the Frequency Reference display.
3	RESET	RESET Key	• Moves the cursor to the right. • Resets the drive to clear a fault situation.
4	AUTO	AUTO Key	Selects the source of Run command and frequency reference. • Set the drive to AUTO mode. • Run command input source depends on b1-02. • Frequency reference input source depends on b1-01.
5		Up Arrow Key	Scrolls up to display the next item, selects parameter numbers, and increments setting values.
6		Down Arrow Key	Scrolls down to display the previous item, selects parameter numbers, and decrements setting values.
7	OFF	OFF Key	Follows the stopping method set in b1-03 to stop drive operation.
8	ENTER	ENTER Key	• Enters parameter values and settings. • Selects a menu item to move between displays.
9	HAND	HAND Key	The drive runs at a selectable frequency reference source as set by P5-01. • Set the drive to HAND mode. • When P5-03 is set to 1, HAND and AUTO mode can be switched while the drive is running.
10	AUTO	AUTO Light	Lit while the drive is in AUTO mode.
11	HAND	HAND Light	Lit while the drive is in HAND mode.
12	ALM	ALM LED Light	Lit or flashing when the drive detects an alarm or error.

◆ LCD Display

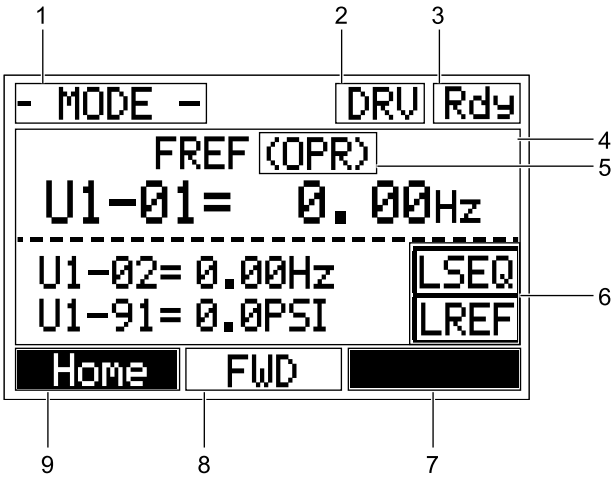


Figure i.26 LCD Display

Table i.17 Display and Contents

No.	Name	Display	Content
1	Operation Mode Menus	MODE	Displayed when in Mode Selection.
		QMONI: Use F1/F2	Instructions to access the Quick Monitors.
		MENU: Use UP/ DWN	Instructions to access the next menu item.
		MONITR	Displayed when in Monitor Mode.
		VERIFY	Indicates the Verify Menu.
		PRMSET	Displayed when in Parameter Setting Mode.
		A.TUNE	Displayed during Auto-Tuning.
		SETUP	Displayed when in Setup Mode.
2	Mode Display Area	DRV	Displayed when in Drive Mode.
		PRG	Displayed when in Programming Mode.
3	Ready	Rdy	Indicates the drive is ready to run.
4	Data Display	—	Displays specific data and operation data.
5	Frequency Reference Assignment <1>	OPR	Displayed when the frequency reference is assigned to the HOA keypad.
		COM	Displayed when the frequency reference is assigned to the MEMOBUS/Modbus Communication Inputs of the drive.
		OP	Displayed when the frequency reference is assigned to option card connected to the drive.
		AI	Displayed when the function reference is assigned to an analog input.
		OFF	Displayed when HAND mode is OFF.
6	LOCAL/REMOTE Display <2>	RSEQ	Displayed when the Run command is supplied from a remote source. **Note:** This display will blink when b1-02 is set to 1 (Digital Inputs).
		LSEQ	Displayed when the Run command is supplied from the HOA keypad.
		RREF	Displayed when the Run command is supplied from a remote source. **Note:** This display will blink when b1-01 is set to 1 (Analog Inputs).
		LREF	Displayed when the Run command is supplied from the HOA keypad.
7	Function Key 2 (F2)	<-MONITOR->	Pressing F2 displays the next Quick Monitor.
		DATA	Pressing F2 scrolls to the next display.
		→	Pressing F2 scrolls the cursor to the right.
		RESET	Pressing F2 resets the existing drive fault error.
		Monitor	Pressing F2 switches Monitor mode.

No.	Name	Display	Content
8	FWD/REV	FWD	Indicates forward motor operation.
		REV	Indicates reverse motor operation.
9	Function Key 1 (F1)	<-MONITOR->	Pressing F1 displays the next Quick Monitor.
		←	Pressing F1 scrolls the cursor to the left.
		Home	Pressing F1 returns to the top menu (Frequency Reference).
		ESC	Pressing F1 returns to the previous display.
		Monitor	Pressing F1 switches Monitor mode.

<1> Displayed when in Frequency Reference Mode.

<2> Displayed when in Frequency Reference Mode and Monitor Mode.

◆ Setting the Real Time Clock

The time and date must be set when a new HOA keypad is plugged in and the drive is powered up. The HOA keypad will display the time and date setup screen for 30 seconds. If a button is not pressed during this time, the display will clear and a "Clock Not Set" alarm will flash. Pressing the F2 (Data) key will display the setting screen again.

■ Feedback Loss Wire Break Alarm

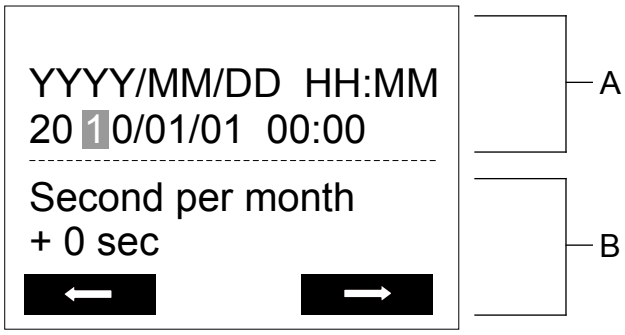
If there is no sensor wired to the drive, a "Feedback Loss – Wire Break" alarm will flash on the display. Providing the proper feedback device signal will clear the Feedback Loss alarm.

The drive requires a feedback device (e.g., pressure transducer, flow meter, etc.) to perform automatic system regulation. Any analog 0~10 V or 4-20 mA feedback device can be used in combination with the drive.

Note: The factory default setting for the drive is 4~20 mA feedback device connected to analog input A2.

■ Real Time Clock Setting Display

Note: Setting the Real-Time Clock will clear a "Clock Not Set" alarm.



A – Real Time Clock Setting Display Set in 24-Hour Clock Time

B – Gain/Loss Adjustment Display

Figure i.27 Real Time Clock Adjustment Display

Display	Description
YYYY	Set the year with the last two digits.
MM	Set the month with two digits.
DD	Set the day with two digits.
HH:MM	Set the hours and minutes, with two digits for each. **Note:** Set in 24-hour clock time. After initial setup, the time will display in 12-hour clock time.
Second per month	Set the gain or loss in seconds per month. **Note:** This does not need to be set for the RTC to function properly.

Moving the Cursor

Pressing the F2 key or the RESET key will move the cursor to the digit on the right. Pressing the F1 key will move the cursor to the left.

Changing Settings

- **Changing YYYY/MM/DD HH:MM:** Pressing the up arrow key will increase the number selected by the cursor from 0 to 9. Pressing the down arrow key will decrease the number selected by the cursor from 0 to 9.
- **Setting the Seconds per Month:** *This setting does not need to be adjusted.* Pressing the up arrow key will increase the number selected by the cursor from -504 to +488 in increments of 8. Pressing the down arrow key will decrease the number selected by the cursor from -504 to +488 in increments of 8.

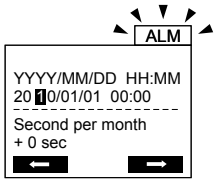
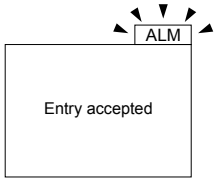
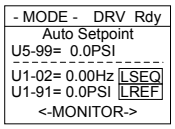
  The feature is used to keep the RTC in sync with an external device clock, like a PLC or BAS system, and will adjust the clock by a set amount of seconds every month.

■ Real-Time Clock Setting at Initial Power-up of a New Drive

Setting the Real-time clock is required at power-up of a new HOA operator or after digital operator battery replacement.

Table i.18 illustrates how to set the Real-Time Clock at initial power-up of a new drive.

Table i.18 Clock Adjustment Procedure at Power-up of a New Drive

Procedure			Display
1	Turn the power on. The Real Time Clock Adjustment Display will appear. Use the right arrow key to select the desired digit, then set the correct date and 24-hour clock time using the up and down arrow keys.	→	
2	After entering the Real-Time Clock data, press the ENTER key to save the changes. The display will indicate “Entry Accepted” and return to the initial display in step 3 and the alarm LED will be OFF.	→	
3	Initial display.	→	

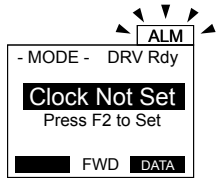
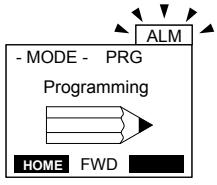
■ Manual Clock Adjustment by Setting o4-17 to 1

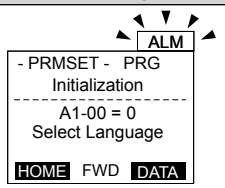
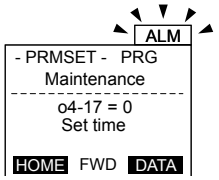
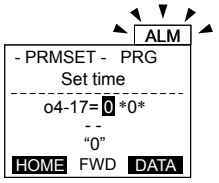
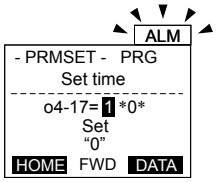
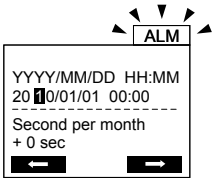
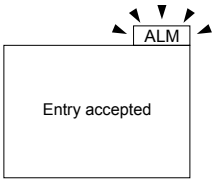
The following actions are possible in the Clock Adjustment Mode:

- Set the current time
- Check the time set to the drive Real-Time Clock

Table i.19 illustrates how to set the Real-Time Clock manually.

Table i.19 Manual Clock Adjustment Procedure by Setting o4-17 to 1

Procedure			Display
1	The “Clock Not Set” display will appear if the Real-Time Clock data is not entered within 30 seconds of power-up of a drive with an HOA operator that has not yet been set.	→	
2	Use the up and down arrow keys to scroll through display menu until the screen shows “Programming”.	→	

Procedure			Display
3	Press the ENTER key to enter select the parameter setting mode.	→	
4	Use the up and down arrow keys to scroll through display menu until parameter o4-17 appears.	→	
5	Press the ENTER key until “0” flashes.	→	
6	Press the up arrow key so that the display changes to “1”.	→	
7	Press the ENTER key and the time setting screen will appear. Use the right arrow key to select the desired digit, then set the correct date and time using the up and down arrow keys.	→	
8	After entering the correct time, press the ENTER key to save the changes. The display will return to the display shown in step 5 and the alarm LED will be OFF.	→	

■ o4-17: Real-Time Clock Setting (Resetting RTC to Factory Default)

No. (Addr. Hex)	Name	Description	Values
o4-17 (3100)	Set/Reset Real-time Clock	Sets the current date and time for the Real-Time Clock. 0: — — No Setting 1: Real-Time Clock Set 2: Real-Time Clock Reset	Default: 0 Range: 0 to 2

Setting 0: — —

No Setting (Default)

Setting 1: Set

The digital operator will show the Clock Adjustment display. In Clock Adjustment Mode the user can adjust the Real-Time Clock.

Setting 2: Reset

The Real-Time Clock data is cleared. A Clock Not Set alarm will occur until o4-17 is set to 1 and the Real-Time Clock is set.

◆ Menu Structure for HOA Keypad

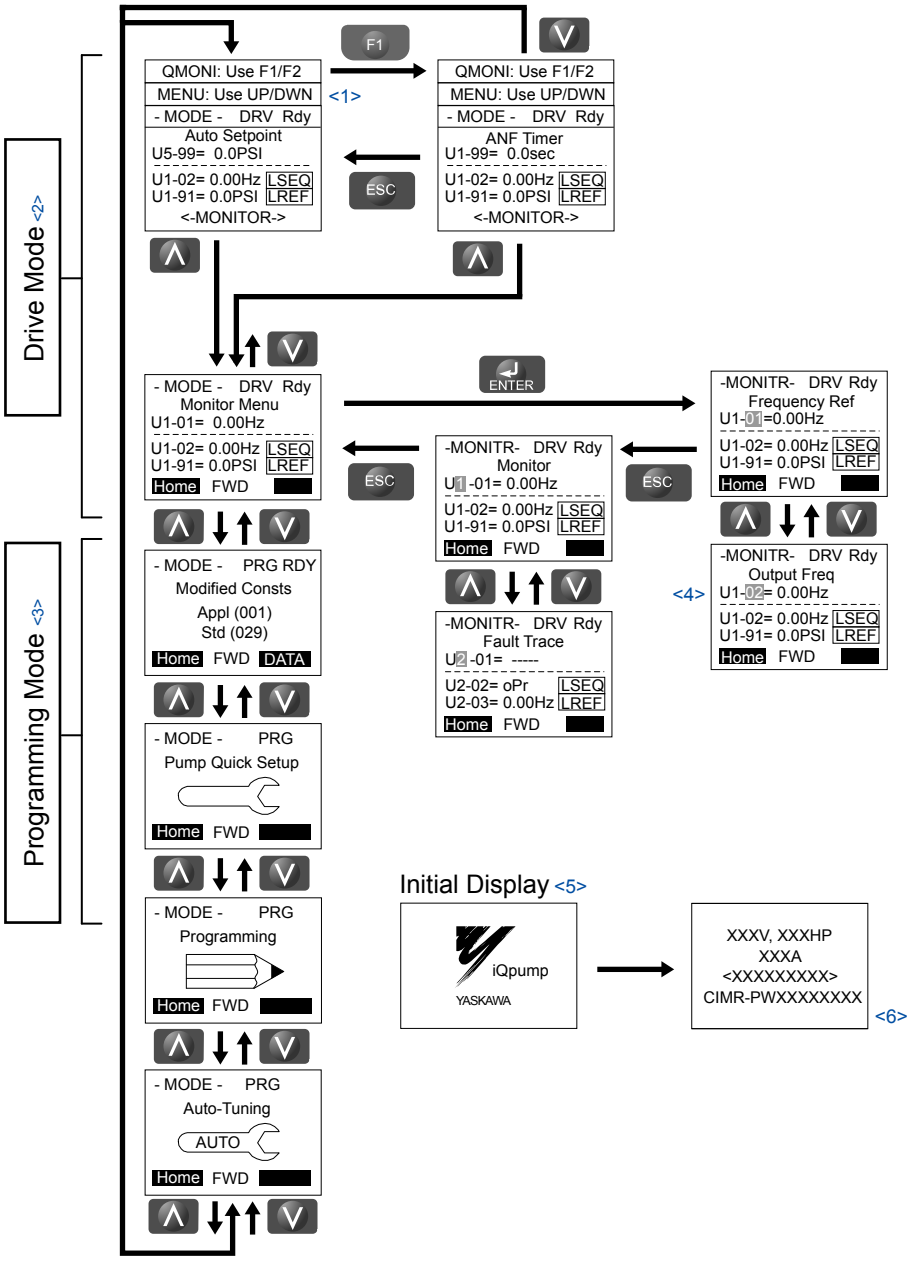


Figure i.28 HOA Keypad Menu and Screen Structure

<1> The display cycles between these three displays on the initial startup screen and the Quick Monitor screens.
<2> Pressing “AUTO” or “HAND” will start the motor.
<3> Drive cannot operate motor.
<4> Flashing characters are shown with white letters on gray background. (Example: 0)
<5> The Frequency Reference appears after the initial display that shows the product name.
<6> The information that appears on the display will vary depending on the drive model.

◆ Detailed Parameter Descriptions

■ A1-03: Initialize Parameters

Resets parameters to default values or performs an Application Preset for fan or pump applications. After initialization, the setting for A1-03 automatically returns to 0.

No.	Parameter Name	Setting Range	Default
A1-03	Initialize Parameters	0, 1110, 2220, 3330, 5550, 6008, 6009, 7770, 7771	0

Setting 1110: User Initialize

Resets parameters to the values selected by the user as User Settings. User Settings are stored when parameter o2-03 is set to "1: Set defaults".

Note: User Initialization resets all parameters to a user-defined set of default values previously saved to the drive. Set parameter o2-03 to 2 to clear the user-defined default values.

Setting 2220: 2-Wire Initialization

Resets parameters to default settings with digital inputs S1 and S2 configured as Forward run and Reverse run, respectively.

Setting 3330: 3-Wire Initialization

Resets parameters to default settings with digital inputs S1, S2, and S5 configured as Run, Stop, and Forward/Reverse respectively.

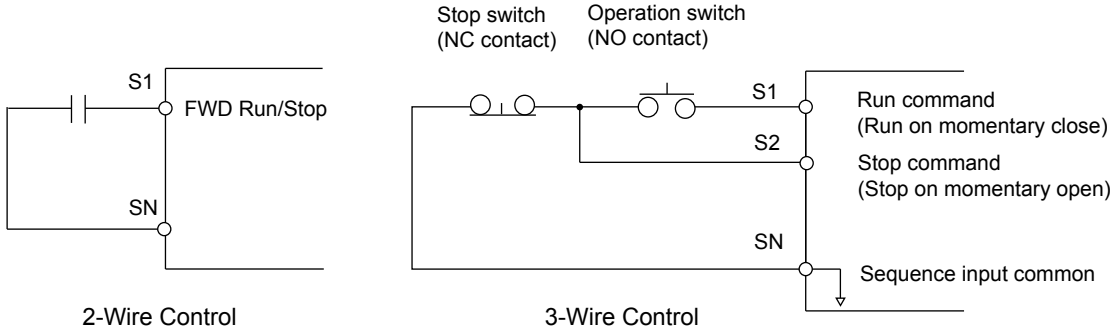


Figure i.29 2-Wire and 3-Wire Control Wiring Examples

Notes on Parameter Initialization

The parameters shown in *Table i.20* will not be reset when the drive is initialized by setting A1-03 = 2220 or 3330.

Table i.20 Parameters Not Changed by Drive Initialization

No.	Parameter Name
A1-00	Language Selection
E1-03	V/f Pattern Selection
F6-08	Communication Parameter Reset
L8-35	Installation Selection
o2-04	Drive/kVA Selection

Setting 5550: Terminal/Control Initialize

An oPE04 error appears on the digital operator when a terminal block with settings saved to its built-in memory is installed in a drive that has edited parameters. Set A1-03 to 5550 to use the parameter settings saved to the terminal block memory.

Application Presets are available to facilitate drive setup for commonly used applications. Selecting one of these Application Presets automatically assigns functions to the input and output terminals and sets a predefined group of parameters to values appropriate for the selected application.

In addition, the parameters most likely to be changed are assigned to the group of User Parameters, A2-01 through A2-16. User Parameters are part of the Setup Group, which provides quicker access by eliminating the need to scroll through multiple menus.

Setting 6008: Pressure Control

Application Preset for Pressure Control applications.

Setting 6009: Pump Down Level

Application Preset for Pump Down Level applications.

Setting 7770: General Purpose

General Purpose Application Preset.

Setting 7771: Submersible Motor General Purpose Operation

General Purpose Application Preset.

■ b1-01: Frequency Reference Selection 1

Selects the frequency reference source 1 for the AUTO mode.

Note: If a Run command is input to the drive but the frequency reference entered is 0 or below the minimum frequency, the RUN indicator LED on the digital operator will light and the STOP indicator will flash.

No.	Parameter Name	Setting Range	Default
b1-01	Frequency Reference Selection 1	0 to 4	0

In order to run the drive and motor, the drive must receive a Run command and an Auto Setpoint command. Parameter b1-01 specifies the origin of the Auto setpoint when in AUTO Mode. Switch to AUTO mode by pressing the AUTO button on the HOA keypad while the drive is stopped.

Note: If a Run command is input to the drive without a corresponding Auto setpoint, the Run indicator on the HOA keypad will turn on and the STOP indicator on the keypad will blink.

If the drive should follow the “HAND Reference” set by the HOA keypad, use HAND Mode by pressing the HAND key and set P5-01 to “1: Hand Reference (P5-02).” The HAND reference can then be entered into the U1-01 monitor parameter in the “-DRIVE-” Menu.

The drive offers the ability to provide four types of “Auto Setpoint” reference sources. These Auto Setpoint reference sources are determined by the setting of b1-01 and the drive set to AUTO Mode by pressing the AUTO key on the keypad.

Prior to programming, it is recommended to select the system units (P1-02) and the feedback device, Scaling (P1- 03) first. P1-03 will automatically scale the drive setpoint.

Example: P1-02 = 1: PSI

P1-03 = 200, feedback range = 200 PSI.

If the drive should follow an “Auto Set-Point” set by the HOA keypad: Set b1-01 to “0: Operator” (factory default). The Auto setpoint can then be entered into the U5-99 monitor parameter in the “-DRIVE-” menu.

Setting 0: Operator (HOA keypad)

Using this setting, the frequency reference can be input by:

- switching between the multi-speed references in the d1-☐☐ parameters.
- entering the frequency reference on the operator keypad.

This selection will also switch PID setpoint to Q1-01.

Setting 1: Terminals (Analog Input Terminals)

Using this setting, an analog frequency reference can be entered from:

- Terminal A1 using a 0 to 10 Vdc signal.
- Terminal A2 using either a 0 to 10 Vdc or a 0/4 to 20 mA signal.

Note: Terminal A2 supports voltage and current input. The input signal type must be set up by setting DIP switch S1 and adjusting parameter H3-09.

Entering only the main frequency reference:

Using Control Circuit Terminal A1 (0 to 10 Vdc voltage input):

Use a circuit such as the one shown in ***Figure i.30*** or an external 0 to 10 Vdc voltage source like a PLC analog output and set the input level selection for A1 in parameter H3-02 as desired.

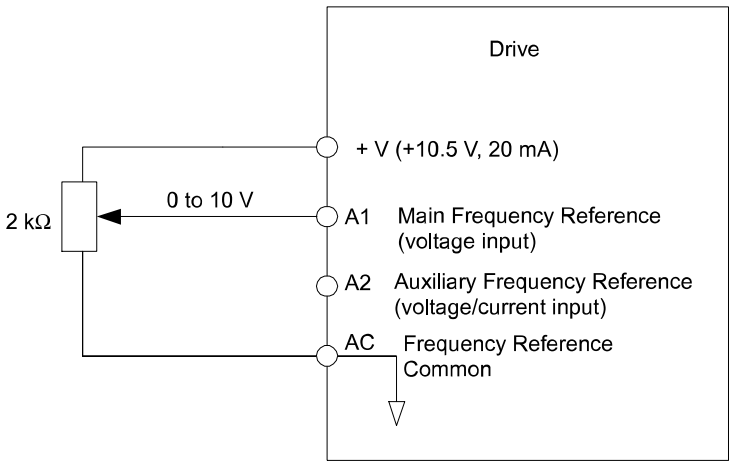


Figure i.30 Setting the Frequency Reference by Voltage Input

• Using Control Circuit Terminal A2 (0 to 10 Vdc voltage input)

Use the same connection as explained for terminal A1 for terminal A2. Make sure that switch S1 is set to "V" and set the appropriate signal level for terminal A2 by entering 0 or 1 into parameter H3-09. The terminal A2 function must be set to frequency bias by entering 0 into parameter H3-10.

• Using Control Circuit Terminal A2 (0/4 to 20 mA current input)

Connect input A2 to an external current source such as the one shown in ***Figure i.31***. Make sure that switch S1 is set to "I" and set the appropriate signal level for terminal A2 by entering 2 (4 to 20 mA) or 3 (0 to 20 mA) into parameter H3-09. The terminal A2 function must be set to frequency bias by entering 0 into parameter H3-10.

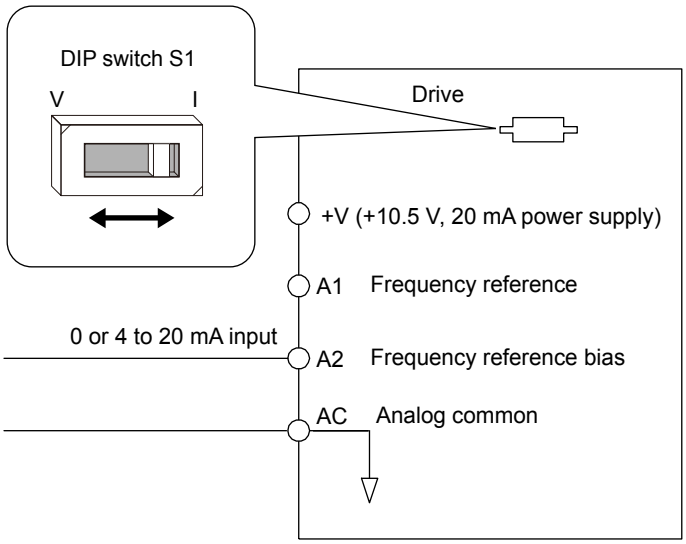


Figure i.31 Setting the Frequency Reference by Current Input

Switching between Main/Auxiliary Frequency References

The frequency reference input can be switched between terminal A1 (main) and terminal A2 (auxiliary). When using this function:

• Make sure that b1-01 is set to "1" (Frequency reference from analog input).
• Set the terminal A2 function to auxiliary frequency (H3-10 = 2).
• Set one digital input to multi-speed 1 (H1-☐☐ = 3, default for S5).

The frequency reference value is read from

• Terminal A1 when the digital input set for multi-speed 1 is open.
• Terminal A2 when the digital input set for multi-speed 1 is closed.

Figure i.31 shows a wiring example for main/auxiliary reference switching using digital input S5.

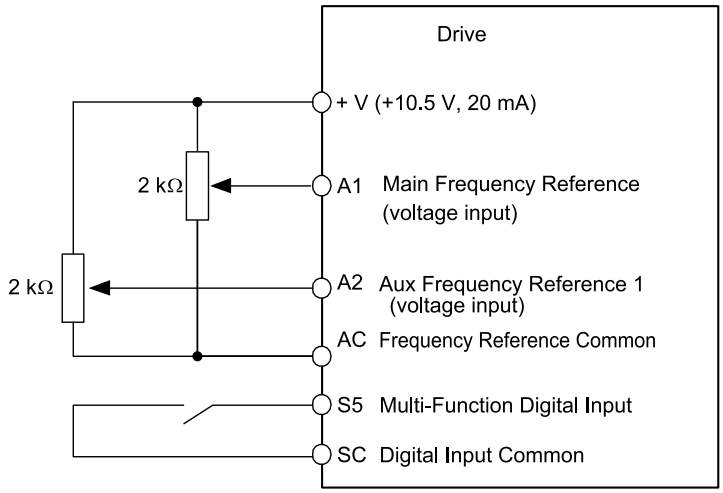


Figure i.32 Switching between Analog Reference 1 and 2

Setting 2: MEMOBUS/Modbus Communications

This setting requires entering the frequency reference via the RS-485/422 serial communications port (control terminals R+, R-, S+, S-).

To setup the drive to receive the "Auto Setpoint" from serial communication, set b1-01 to "2: Serial Com," and connect the RS-422/RS-485 serial communications cable to terminals R+, R-, S+, and S- on the control I/O terminal block. Refer to *78* to see the connection diagram using a PC to provide the auto setpoint reference to the drive.

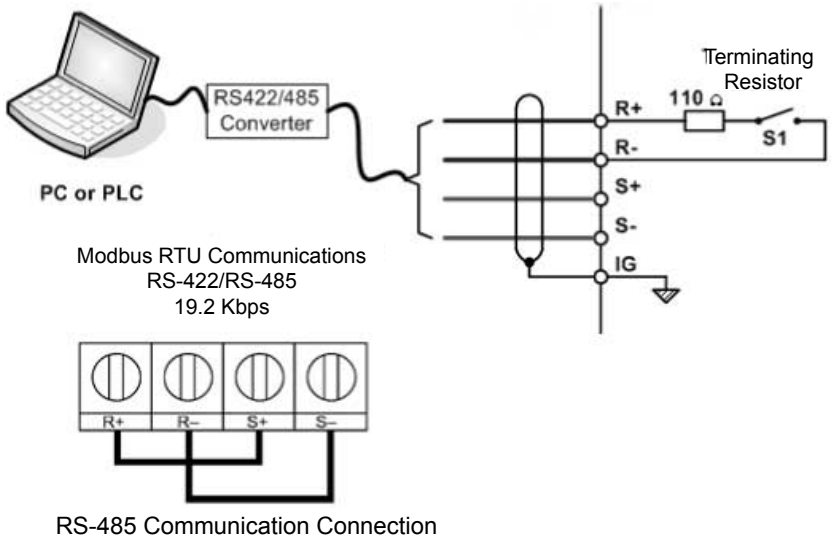


Figure i.33 PC or PLC Connection Diagram

Setting 3: Option card

This setting requires entering the frequency reference via an option board plugged into connector CN5 on the drive control board. Consult the option board manual for instructions on integrating the drive with the communication system.

Note: If the frequency reference source is set for Option PCB (b1-01 = 3), but an option board is not installed, an oPE05 Operator Programming Error will be displayed on the digital operator and the drive will not run.

To setup the drive to receive the "Auto Setpoint" for a network communication option card, set b1-01 to "3: Option PCB", and plug a supported communication option card into the drive control PCB. Consult the manual supplied with the option for instructions on integrating the drive into the network system.

Setting 4: Pulse Train Input

This setting requires a pulse train signal to terminal RP to provide the frequency reference. Follow the directions below to verify that the pulse signal is working properly.

Pulse Train Input Specifications	
Response Frequency	0.5 to 32 kHz
Duty Cycle	30 to 70%
High Level Voltage	3.5 to 13.2 V
Low Level Voltage	0.0 to 0.8 V
Input Impedance	3 kΩ

Verifying the Pulse Train is Working Properly

- Set b1-01 to 4 and set H6-01 to 0.
- Set the H6-02 to the pulse train frequency value that equals 100% of the frequency reference.
- Enter a pulse train signal to terminal RP and check for the correct frequency reference on the display.

■ b1-02: Run Command Selection 1

Determines the Run command source 1 in AUTO Mode.

The drive comes factory programmed for Start and Stop from the keypad, but the user can program the drive to receive a Run command from four different inputs: digital operator, terminals, serial communications, or an option PCB.

WARNING! *Sudden Movement Hazard. Clear personnel, secure equipment, and check sequence and safety circuitry before starting the drive. Failure to comply could result in death or serious injury from moving equipment.*

To set the drive to receive the Run command from the HOA keypad, set b1-02 to "0: Operator," and the HAND key will be used to provide the Run command to the drive.

To set the drive to receive the Run command from the external terminals, set b1-02 to "1: Terminals" and initiate an external Run command by a contact closure between terminals S1 and SN.

Note: Using the external terminals requires setting the drive to AUTO Mode by pressing the AUTO key.

No.	Parameter Name	Setting Range	Default
b1-02	Run Command Selection 1	0 to 3	0

Setting 0: Operator (HOA keypad)

This setting requires entering the Run command via the HOA keypad AUTO key and also illuminates the HAND indicator on the digital operator.

Setting 1: Control Circuit Terminal

This setting requires entering the Run command via the digital input terminals using one of following sequences:

- 2-Wire sequence 1:

  Two inputs (FWD/Stop-REV/Stop). Set A1-03 to 2220 to initialize the drive and preset terminals S1 and S2 to these functions. This is the default setting of the drive.
- 2-Wire sequence 2:

  Two inputs (Start/Stop-FWD/REV).
- 3-Wire sequence:

  Three inputs (Start-Stop-FWD/REV). Set A1-03 to 3330 to initialize the drive and preset terminals S1, S2, and S5 to these functions.

Setting 2: MEMOBUS/Modbus Communications

This setting requires entering the Run command via serial communications by connecting the RS-485/422 serial communication cable to control terminals R+, R-, S+, and S- on the removable terminal block.

Setting 3: Option Card

This setting requires entering the Run command via the communication option board by plugging a communication option board into the CN5 port on the control PCB. Refer to the option board manual for instructions on integrating the drive into the communication system.

Note: If b1-02 is set to 3, but an option board is not installed in CN5, an oPE05 operator programming error will be displayed on the digital operator and the drive will not run.

■ b1-03: Stopping Method Selection

Selects how the drive stops the motor when the Run command is removed or when a Stop command is entered.

Note: Parameter b1-11, Run Delay at Stop (Back Spin Timer), is effective for all stopping methods (b1-03 = 0 to 3), not only Coast to Stop w/ Timer (b1-03 =3).

No.	Parameter Name	Setting Range	Default
b1-03	Stopping Method Selection	0 to 3	1

Setting 0: Ramp to Stop

When the Run command is removed, the drive will decelerate the motor to stop. The deceleration rate is determined by the active deceleration time. The default deceleration time is set to parameter C1-02.

When the output frequency falls below the level set in parameter b2-01, the drive will start DC injection, Zero Speed Control, or Short Circuit Braking.

Setting 1: Coast to Stop

When the Run command is removed, the drive will shut off its output and the motor will coast (uncontrolled deceleration) to stop. The stopping time is determined by the inertia and the friction in the driven system.

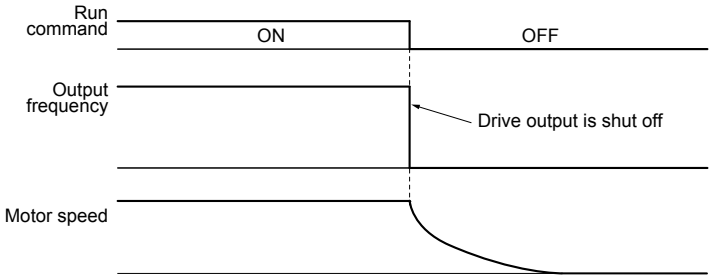


Figure i.34 Coast to Stop

Note: After a stop is initiated, any subsequent Run command entered will be ignored until the minimum baseblock time (L2-03) has expired. Do not enter Run command until it has come to a complete stop. Use DC Injection at Start or Speed Search to restart the motor before it has completely stopped.

Setting 2: DC Injection Braking to Stop

When the Run command is removed, the drive will enter baseblock (turn off its output) for the minimum baseblock time (L2-03). When the minimum baseblock time has expired, the drive will inject the amount DC Injection Braking is set in parameter b2-02 into the motor windings to brake the motor. The stopping time in DC Injection Braking to Stop is significantly faster compared to Coast to Stop.

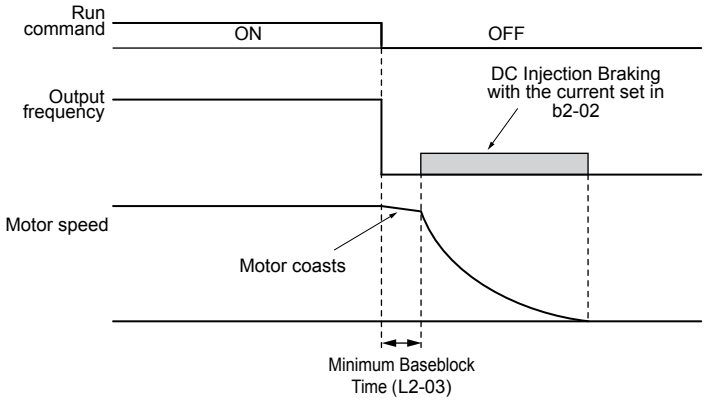


Figure i.35 DC Injection Braking to Stop

DC Injection Braking time is determined by the value set to b2-04 and the output frequency at the time the Run command is removed. It can be calculated by:

$$\text{DC Injection brake time} = \frac{\text{(b2-04) x 10 x Output frequency}}{\text{Max. output frequency (E1-04)}}$$

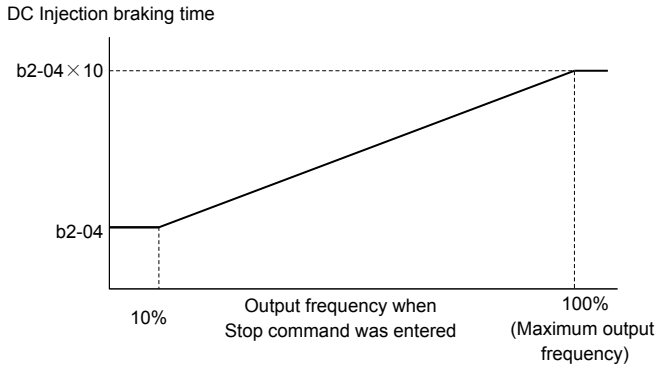


Figure i.36 DC Injection Braking Time Depending on Output Frequency

Note: If an overcurrent (oC) fault occurs during DC Injection Braking to Stop, lengthen the minimum baseblock time (L2-03) until the fault no longer occurs.

Setting 3: Coast to Stop with Timer (Used for Back Spin Control on Vertical Turbine Pumps)

When the Run command is removed, the drive coasts to a stop. If parameter b1-11 = 0, the coast-timer (Run Delay at Stop) becomes a value determined by a combination of output frequency and C1-02. However, if b1-11 > 0, the Run Delay at Stop timer is set to b1-11. If the Run command is reissued during the Run Delay at Stop timer time, the drive WILL restart when the timer expires without the need to re-cycle the Run command. The Run Delay at Stop timer will operate for both AUTO Mode and HAND Mode. The Run Delay at Stop timer will still operate when the drive goes to sleep and then wakes up. During the Run Delay at Stop timer execution, the HOA keypad will display a Start Delay message.

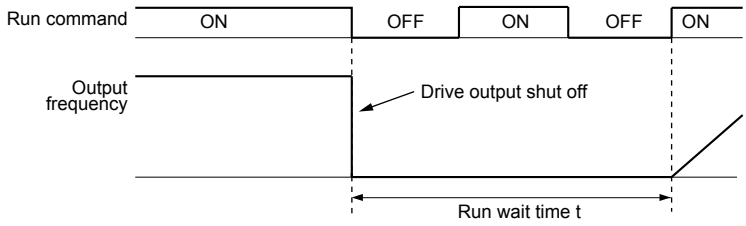


Figure i.37 Coast to Stop with Timer

The wait time t is determined by the output frequency when the Run command is removed and by the active deceleration time.

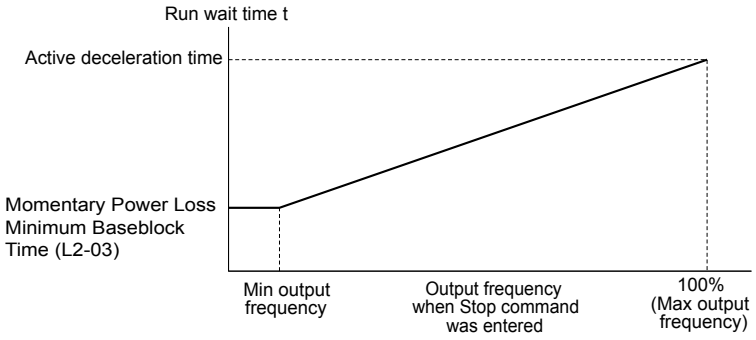


Figure i.38 Run Wait Time Depending on Output Frequency

■ b3-01: Speed Search Selection at Start

Determines if Speed Search is automatically performed when a Run command is issued.

No.	Parameter Name	Setting Range	Default
b3-01	Speed Search Selection at Start	0, 1	0

Setting 0: Disabled

This setting starts operating the drive at the minimum output frequency when the Run command is entered. If external Speed Search 1 or 2 is already enabled by a digital input, the drive will start operating with Speed Search.

Setting 1: Enabled

This setting performs Speed Search when the Run command is entered. The drive begins running the motor after Speed Search is complete.

■ b5-01: PID Function Setting

Enables and disables the PID operation and selects the PID operation mode.

No.	Parameter Name	Setting Range	Default
b5-01	PID Function Setting	0, 1	1

Setting 0: PID disabled

Setting 1: Output frequency = PID output 1

The PID controller is enabled and the PID output builds the frequency reference. The PID input is D controlled.

■ C1-01 to C1-04: Accel, Decel Times 1 and 2

Two different sets of acceleration and deceleration times can be set in the drive by digital inputs, motor selection, or switched automatically.

Acceleration time parameters always set the time to accelerate from 0 Hz to the maximum output frequency (E1-04). Deceleration time parameters always set the time to decelerate from maximum output frequency to 0 Hz. C1-01 and C1-02 are the default active accel/decel settings.

No.	Parameter Name	Setting Range	Default
C1-01	Acceleration Time 1	0.0 to 6000.0 s <1>	20.0 s
C1-02	Deceleration Time 1		10.0 s
C1-03	Acceleration Time 2		
C1-04	Deceleration Time 2		

<1> The setting range for the acceleration and deceleration times is determined by the accel/decel time setting units in C1-10. For example, if the time is set in units of 0.01 s (C1-10 = 0), the setting range becomes 0.00 to 600.00 s.

Switching Acceleration Times by Digital Input

Accel/decel time 1 is active by default if no input is set. Activate accel/decel times 2, 3, and 4 by digital inputs (H1-☐☐ = 7 and 1A) as explained in *Table i.21*.

Table i.21 Accel/Decel Time Selection by Digital Input

Accel/Decel Time Sel. 1 H1-☐☐ = 7	Accel/Decel Time Sel. 2 H1-☐☐ = 1A	Active Times	
		Acceleration	Deceleration
0	0	C1-01	C1-02
1	0	C1-03	C1-04

Figure i.39 shows an operation example for changing accel/decel times. The example below requires that the stopping method be set for “Ramp to stop” (b1-03 = 0).

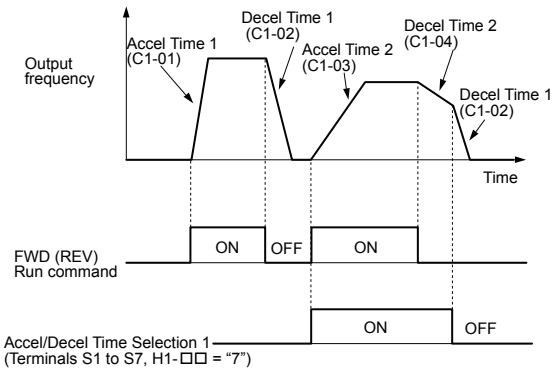


Figure i.39 Timing Diagram of Accel/Decel Time Change

■ E2-01: Motor Rated Current

Provides motor control, protects the motor, and calculates torque limits. Set E2-01 to the full load amps (FLA) stamped on the motor nameplate. If Auto-Tuning completes successfully, the value entered to T1-04 will automatically be saved to E2-01.

No.	Parameter Name	Setting Range	Default
E2-01	Motor Rated Current	10% to 200% of the drive rated current <1>	Determined by o2-04

<1> Display is in the following units:
BV0006 to BV0018, 2V0006 to 2V0040, and 4V0002 to 4V0023: 0.01 A units.
2V0056 to 2V0069 and 4V0031 to 4V0038: 0.1 A units.

Note: An oPE02 error will occur if the motor rated current in E2-01 is set lower than the motor no-load current in E2-03. Set E2-03 correctly to prevent this error.

■ H1-01 to H1-07: Functions for Terminals S1 to S7

These parameters assign functions to the multi-function digital inputs.

No.	Parameter Name	Setting Range	Default
H1-01	Multi-Function Digital Input Terminal S1 Function Selection	2 to B0	40 (F) <1> : Forward Run Command (2-Wire sequence)
H1-02	Multi-Function Digital Input Terminal S2 Function Selection	2 to B0	F: Through Mode
H1-03	Multi-Function Digital Input Terminal S3 Function Selection	0 to B0	26: External Pump Fault
H1-04	Multi-Function Digital Input Terminal S4 Function Selection	0 to B0	14: Fault Reset
H1-05	Multi-Function Digital Input Terminal S5 Function Selection	0 to B0	8D (0) <1> : Multi Setpoint 1
H1-06	Multi-Function Digital Input Terminal S6 Function Selection	0 to B0	80 (3) <1> : HAND Mode
H1-07	Multi-Function Digital Input Terminal S7 Function Selection	0 to B0	81 (4) <1> : HAND Mode 2

<1> Number appearing in parenthesis is the default value after performing a 3-Wire initialization (A1-03 = 3330).

Setting F: Not Used/Through Mode

Select this setting when using the terminal in a pass-through mode. When set to F, an input does not trigger any function in the drive. Setting F, however, still allows the input status of the terminal (open or closed) to be read out by a PLC via a communication option or MEMOBUS/Modbus communications. The drive input terminals can then be used as remote I/O by the PLC.

Setting 14: Fault Reset

When the drive detects a fault condition, the fault output contact closes, the drive output shuts off, and the motor coasts to stop (specific stopping methods can be selected for some faults such as L1-04 for motor overheat). After removing the Run command, clear the fault either by pressing the RESET key on the digital operator or closing a digital input configured as a Fault Reset (H1-☐☐ = 14).

Note: Remove the Run command prior to resetting a fault. Fault Reset commands are ignored while the Run command is present.

Setting 20 to 2F: External Fault

The External fault command stops the drive when problems occur with external devices.

To use the External fault command, set one of the multi-function digital inputs to a value between 20 and 2F. The digital operator will display EF☐ where ☐ is the number of the terminal to which the external fault signal is assigned.

For example, if an external fault signal is input to terminal S3, “EF3” will be displayed.

Select the value to be set in H1-☐☐ from a combination of any of the following three conditions:

- Signal input level from peripheral devices (N.O., N.C.)
- External fault detection method
- Operation after external fault detection

An “On-Delay” timer will be applied to the external fault if it is “Normally Open” and an “Off-Delay” timer will be applied to the external fault if it is “Normally Closed”.

If the external fault is set to “During Run”, the time delay will start after the Run command is received.

Table i.22 shows the relationship between the conditions and the value set to H1-☐☐:

Terminal statuses, detection conditions, and stopping methods marked with an “O” are applicable to the corresponding settings.

Table i.22 Stopping Method for External Fault

Setting	Terminal Status <1>		Detection Conditions <2>		Stopping Method			
	N.O.	N.C.	Always Detected	Detected during Run only	Ramp to Stop (fault)	Coast to Stop (fault)	Fast Stop (fault)	Alarm Only (continue running)
20	O		O		O			
21		O	O		O			
22	O			O	O			
23		O		O	O			
24	O		O			O		
25		O	O			O		
26	O			O		O		
27		O		O		O		
28	O		O				O	
29		O	O				O	
2A	O			O			O	
2B		O		O			O	
2C	O		O					O
2D		O	O					O
2E	O			O				O
2F		O		O				O

<1> Determine the terminal status for each fault, i.e., whether the terminal is normally open or normally closed.

<2> Determine whether detection for each fault should be enabled only during run or always detected.

Settings 40, 41: Forward Run, Reverse Run Command for 2-Wire Sequence

Configures the drive for a 2-Wire sequence.

When an input terminal set to 40 closes, the drive operates in the forward direction. When an input set for 41 closes, the drive operates in reverse. Closing both inputs simultaneously will result in an external fault.

Note: **1.** This function cannot be used simultaneously with settings 42 and 43.

2. The same functions are assigned to terminals S1 and S2 when the drive is initialized for 2-Wire sequence.

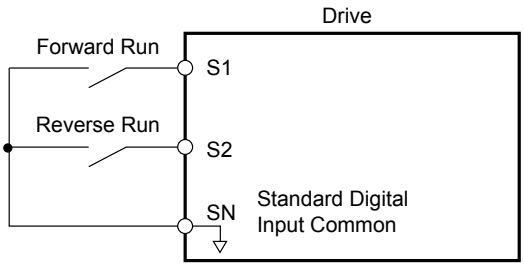


Figure i.40 Example Wiring Diagram for 2-Wire Sequence

Setting 80: HAND Mode

Closing this input will put the drive in HAND Mode.

If this contact is closed within one second of power-up, the drive will honor the utility delay time.

Note: When inputs 80 and 81 are closed simultaneously, input 80 has priority and P5-01 determines the frequency reference.

Setting 81: HAND Mode 2

Closing this input will put the drive in HAND Mode using P5-05 as a frequency reference.

If this contact is closed within one second of power-up, the drive will honor the utility delay time.

Note: When inputs 80 and 81 are closed simultaneously, input 80 has priority and P5-01 determines the frequency reference.

Settings 8D and 8E: Multi Setpoints 1 and 2

Settings 8D and 8E will override all other PID setpoints when closed.

Table i.23 Multi Setpoints 1 and 2

Multi Setpoint 1 (H1-0□ = 8D)	Multi Setpoint 2 (H1-0□ = 8E)	Setpoint Source
Open	Open	Frequency Ref (dependent on b1-01), Set-Point 1 - Q1-01 (when b1-01 = 0), Analog Setpoint (H3-0□ = C), Pulse Input Setpoint (H6-01 = 2), or Memobus setpoint.
Closed	Open	Set Point 2 – Q1-02
Open	Closed	Set Point 3 – Q1-03
Closed	Closed	Set Point 4 – Q1-04

■ H2-01 to H2-03: Terminal MA/MB/MC, P1/PC, and P2/PC Function Selection

The drive has three multi-function output terminals.

No.	Parameter Name	Setting Range	Default
H2-01	Terminal MA, MB and MC Function Selection (relay)	0 to 1AA	E: Fault
H2-02	Terminal P1 Function Selection (open-collector)	0 to 1AA	37: During Frequency Output
H2-03	Terminal P2 Function Selection (open-collector)	0 to 1AA	E: Fault

Setting E: Fault

The output closes when the drive faults (excluding CPF00 and CPF01 faults).

Setting 37: During Frequency Output

The output closes when the drive is outputting a frequency.

Status	Description
Open	Drive is stopped or one of the following functions is being performed: baseblock, DC Injection Braking, Short Circuit Braking.
Closed	Drive is outputting frequency.

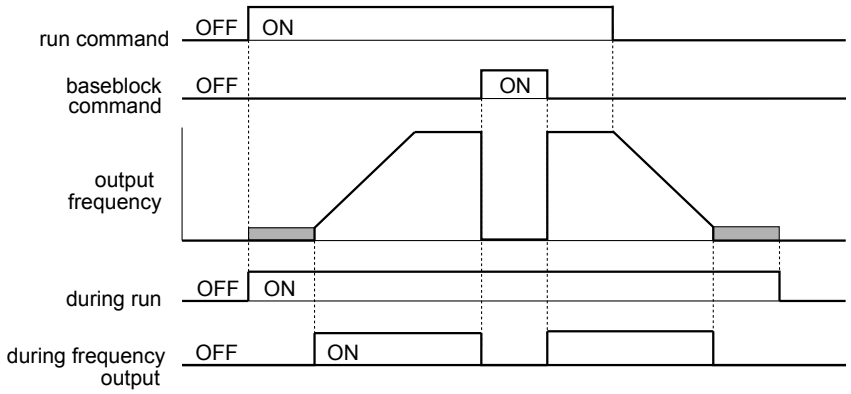


Figure i.41 During Frequency Output Time Chart

■ P1-01: Pump Mode

Selects the base operation mode of the drive controller.

No.	Parameter Name	Setting Range	Default
P1-01	Pump Mode	0, 3	0

Setting 0: Drive only

Designed for single pump stand-alone applications

Setting 3: MEMOBUS network

Up to eight drives can be networked together to provide for system redundancy and precise control.

Staging is disabled when and the drive PID output is influenced by the Water Level / Suction Pressure Control.

The functions listed below will behave slightly different when P1-01 is set to 3:

- **Start Level:** Active on the first pump in the network. Drives in the process of alternation will not undergo this process.
- **Sleep:** Active when the drive is the only drive running on the network.

- **Over-cycle Protection:** Active when the drive is the only drive running on the network.
- **Pre-charge:** Active only on the first drive to run in the network.
- **Low City Pressure:** Active on any drive in the network. An alarm condition will cause other drives in the network to stop running and show a “Net Pump Err” message.
- **Utility Delay:** When this function is active, the drive is unavailable to the iQpump MEMOBUS Network and will force the Home Screen text to show “Pump Off Network”.
- **Remote Drive Disable:** When this function is active, the drive is unavailable to the iQpump MEMOBUS Network and will force the Home Screen text to show “Pump Off Network”.

■ P1-02: System Units

Selects the base unit in which most drive PID setpoints, scaling, monitors, limits, and faults/alarm levels will be set.

Note: Set this parameter prior to changing other parameters, as internal scaling is based on P1-02.

No.	Parameter Name	Setting Range	Default
P1-02	System Units	0 to 10	1

Setting 0: No unit
Setting 1: PSI: Pounds per square inch
Setting 2: Pa: Pascals
Setting 3: Bar: Bar
Setting 4: "WC: Inch of water
Setting 5: "Hg: Inch of Mercury
Setting 6: ft: feet
Setting 7: m: meters
Setting 8: °F: Degrees Fahrenheit
Setting 9: °C: Degrees Celsius
Setting 10: Percent

■ P1-03: Feedback Device Scaling

Sets the feedback device scaling used for the PID controller. This information can be found on the nameplate or specification sheet and is usually expressed as the maximum output of the device.

For example, a pressure sensor scaling might be 145.0 PSI at 20 mA output and would require setting P1-03 to 145.0 PSI.

Note: Set this parameter prior to changing other parameters related to the PID feedback, as internal scaling is based on P1-03.

No.	Parameter Name	Setting Range	Default
P1-03	Feedback Device Scaling	0.1 to 6000.0	145.0 PSI

■ P1-04: Start / Draw Down Level

Sets the wake up level from the Sleep function. This setting is dependent on whether PID is normal or inverse acting (b5-09). When the drive is asleep and the PID feedback signal rises above (normal acting) or falls below (inverse acting) this setting for the time set in P1-05, Start Level Delay Time, the drive will wake up.

No.	Parameter Name	Setting Range	Default
P1-04	Start / Draw Down Level	<1>	0.0 PSI

<1> Range is 0.0 to 999.9 with sign-bit “-” or “+” indicating Delta to Setpoint.
Range is -999.9 to 999.9 in drive software versions PRG: 8551 and earlier.

■ Q1-01: PID Controller Setpoint 1

Sets the PID setpoint for the controller. The drive will use the system feedback signal and modulate the pump speed to regulate the feedback at the Q1-01 setpoint. The units for Q1-01 are selected by b1-01 and the scaling is set in parameter P1-03. This parameter is active when b1-01 (Reference Source) is set to 0 (HOA keypad).

No.	Parameter Name	Setting Range	Default
Q1-01	PID Controller Setpoint 1	0.0 to 6000.0	0.0 PSI

i.7 Troubleshooting

NOTICE

Refer to the iQpump Micro User Manual TOEP YAIQPM 03 for complete information on Troubleshooting causes and solutions.

The iQpump Micro User Manual TOEP YAIQPM 03 is available on the Yaskawa website, www.yaskawa.com.

◆ Fault Detection

■ Fault Displays

Digital Operator Display		Fault Name
LED Operator Display 	LCD Operator Display JVOP-183 	
AJF <1>	AJF Anti-Jam Fault	Anti-Jam Fault
bUS	bUS	Option Communication Error • The connection was lost after establishing initial communication. • Only detected when the run command frequency reference is assigned to an option card.
CE	CE	MEMOBUS/Modbus Communication Error Control data was not received for the CE detection time set to H5-09.
CPF02	CPF02	A/D Conversion Error An A/D conversion error or control circuit error occurred.
CPF03	CPF03	PWM Data Error There is a problem with the PWM data.
CPF06 <1>	CPF06	EEPROM Memory Data Error Error in the data saved to EEPROM
CPF07	CPF07	Terminal Board Communications Error A communication error occurred at the terminal board.
CPF08	CPF08	EEPROM Serial Communication Fault EEPROM communications are not functioning properly.
CPF 11	CPF11	RAM Fault
CPF 12	CPF12	FLASH Memory Fault Problem with the ROM (FLASH memory).
CPF 13	CPF13	Watchdog Circuit Exception Self-diagnostics problem.
CPF 14	CPF14	Control Circuit Fault CPU error (CPU operates incorrectly due to noise, etc.)
CPF 16	CPF16	Clock Fault Standard clock error.
CPF 17	CPF17	Timing Fault A timing error occurred during an internal process.
CPF 18	CPF18	Control Circuit Fault CPU error. Non-Maskable Interrupt (An unusual interrupt was triggered by noise, etc.)
CPF 19	CPF19	Control Circuit Fault CPU error (Manual reset due to noise, etc.)
CPF20 or CPF21	CPF20 or CPF21	One of the following faults occurred: RAM fault, FLASH memory error, watchdog circuit exception, clock error

Digital Operator Display		Fault Name
LED Operator Display 	LCD Operator Display JVOP-183 	
CPF22	CPF22	A/D Conversion Fault
		A/D conversion error.
CPF23	CPF23	PWM Feedback Fault
CPF24 <1>	CPF24	Drive Unit Signal Fault
		The drive capacity cannot be detected correctly (drive capacity is checked when the drive is powered up).
CPF25	CPF25	Terminal Board Not Connected
CPF26 to CPF35 ------- CPF40 to CPF43	CPF26 to CPF35 ------- CPF40 to CPF43	Control Circuit Error
		CPU error
E5	E5	SI-T3 Watchdog Timer Error
		The watchdog timed out.
EF0	EF0	Option Card External Fault
		An external fault condition is present.
EF 1	EF1	Pump Fault (input terminal S1)
		External fault at multi-function input terminal S1.
EF2	EF2	Pump Fault (input terminal S2)
		External fault at multi-function input terminal S2.
EF3	EF3	Pump Fault (input terminal S3)
		External fault at multi-function input terminal S3.
EF4	EF4	Pump Fault (input terminal S4)
		External fault at multi-function input terminal S4.
EF5	EF5	Pump Fault (input terminal S5)
		External fault at multi-function input terminal S5.
EF6	EF6	Pump Fault (input terminal S6)
		External fault at multi-function input terminal S6.
EF7	EF7	Pump Fault (input terminal S7)
		External fault at multi-function input terminal S7.
Err	Err	EEPROM Write Error
		Data cannot be written to the EEPROM
FAn	FAn	Internal Cooling Fan Failure
Fdb-L	FDBKL Wire Break	PID Feedback Loss
		The analog input programmed for PID feedback has risen above 21 mA or fallen below 3 mA.
GF	GF	Ground Fault
		• A current short to ground exceeded 50% of rated current on the output side of the drive. • Setting L8-09 to 1 enables ground fault detection in models 2V0020 to 2V0069 and 4V0011 to 4V0038.
HFb	HFB	High Feedback
		The feedback signal is too high.
H IH20	HWL	High Water Level
		The “High Water Level” digital input is active (H1-0□ = 90).

Digital Operator Display		Fault Name
LED Operator Display 	LCD Operator Display JVOP-183 	
LF	LF	Output Phase Loss • Phase loss on the output side of the drive. • Setting L8-07 to 1 or 2 enables Phase Loss Detection.
LF2	LF2	Output Current Imbalance One or more of the phases in the output current are lost.
LFb	LFB	Low Feedback The feedback signal is too low.
LoP	LOP	Loss of Prime The pump has lost its prime.
LoH2O	LWL	Low Water Level The "Low Water Level" digital input is active (H1-0□ = 8F).
nSL	MSL Net Master Loss	Net Master Lost The MEMOBUS master has been lost
notS	NMS	Not Maintaining Setpoint The setpoint cannot be maintained and P1-17 is set to 0.
nSE	nSE	Node Setup Error A terminal assigned to the node setup function closed during run.
oC	oC	Overcurrent Drive sensors detected an output current greater than the specified overcurrent level.
oFA00 <1>	oFA00	Option Card Connection Error at Option Port CN5 Option compatibility error
oFA01	oFA01	Option Card Fault at Option Port CN5 Option not properly connected
oFA03 oFA04	oFA03 oFA04	Option Card Error Occurred at Option Port CN5
oFA30 to oFA43	oFA30 to oFA43	Communication Option Card Connection Error (CN5)
oH	oH	Heatsink Overheat The heatsink temperature exceeded the overheat pre-alarm level set to L8-02.
oH1	oH1	Overheat 1 (Heatsink Overheat) The heatsink temperature exceeded the drive overheat level.
oH4	oH4	Motor Overheat Fault (PTC Input) • The motor overheat signal to analog input terminal A1 or A2 exceeded the fault detection level. • Detection requires setting multi-function analog inputs H3-02 or H3-10 to E.
oL1	oL1	Motor Overload The electronic motor overload protection tripped
oL2	oL2	Drive Overload The thermal sensor of the drive triggered overload protection.
oL3	oL3	Overtorque Detection 1 The current has exceeded the value set for Torque Detection Level 1 (L6-02) for longer than the allowable time (L6-03).
oL4	oL4	Overtorque Detection 2 The current has exceeded the value set for Torque Detection Level 2 (L6-05) for longer than the allowable time (L6-06).
oL5	oL5	Mechanical Weakening Detection 1 Overtorque occurred, matching the conditions specified in L6-08.

Digital Operator Display		Fault Name
LED Operator Display 	LCD Operator Display JVOP-183 	
oPr	oPr	External Operator Connection Fault
		The external operator has been disconnected from the drive. **Note:** An oPr fault will occur when all of the following conditions are true: • Output is interrupted when the keypad is disconnected (o2-06 = 1). • The Run command is assigned to the operator (b1-02 = 0 and HAND has been selected).
ou	ov	Overvoltage
		Voltage in the DC bus has exceeded the overvoltage detection level. • For 200 V class drives: approximately 410 V • For 400 V class drives: approximately 820 V (740 V when E1-01 is less than 400)
PF	PF	Input Phase Loss
		Drive input power has an open phase or has a large imbalance of voltage between phases. Detected when L8-05 is set 1 (enabled).
PoC	PoC	Pump Over Cycle
rH	rH	Braking Resistor Overheat
		Braking resistor protection was triggered. Fault detection is enabled when L8-01 = 1 (disabled as a default).
rr	rr	Dynamic Braking Transistor
		The built-in dynamic braking transistor failed.
SC	SC	IGBT Short Circuit or Ground Fault
SEr	SEr	Too Many Speed Search Restarts
		The number of Speed Search restarts exceeded the value set to b3-19.
1PH	Single Phase Foldback	Single Phase Foldback
		Output speed is being limited because of excessive DC Bus voltage ripple.
tIE	TIE	Time Interval Error
UL3	UL3	Undertorque Detection 1
		The current has fallen below the minimum value set for Torque Detection Level 1 (L6-02) for longer than the allowable time (L6-03).
UL4	UL4	Undertorque Detection 2
		The current has fallen below the minimum value set for Torque Detection Level 2 (L6-05) for longer than the allowable time (L6-06).
UL6	UL6 Underload Det 6	Motor Underload
		The load has fallen below the underload curve defined in L6-14.
Uv1 <1>	Uv1 <1>	Control Circuit Undervoltage Fault
		One of the following conditions occurred while the drive was running: • Voltage in the DC bus fell below the undervoltage detection level (L2-05). • For 200 V class: approximately 190 V (160 V for single phase drives) • For 400 V class: approximately 380 V (350 V when E1-01 is less than 400) The fault is output only if L2-01 = 0 or L2-01 = 1 and the DC bus voltage is under L2-05 for longer than L2-02. The fault is output only if L2-01 is set to 0 or 1 and the DC bus voltage has fallen below the level set to L2-05 for longer than the time set to L2-02.
Uv2 <1>	Uv2 <1>	Control Power Supply Voltage Fault
		Voltage is too low for the control drive input power.
Uv3 <1>	Uv3 <1>	Undervoltage 3 (Soft-Charge Bypass Relay Fault)
		The soft-charge bypass relay failed.
uLtS	VLTS	Volute-Thermostat Fault

<1> Fault history is not kept for this fault.

◆ Alarm Detection

■ Alarm Codes

An alarm is indicated by a code on the data display and the flashing ALM LED. The drive output is not necessarily switched off.

To remove an alarm, trace and remove the cause, and reset the drive by pushing the Reset key on the operator or cycle the power supply.

Digital Operator Display		Alarm Name
LED Operator Display 	LCD Operator Display JVOP-183 	
AEr	AEr	Station Address Setting Error (CC-Link, CANopen, MECHATROLINK)
		Option card node address is outside of the acceptable setting range.
AbFL	AnalogFB lost Switched to Net	Analog Feedback Lost
		Analog feedback has not been detected and the network PI feedback signal is now used.
AJA	Anti-Jam Active	Anti-Jam Alarm
bAt	bAT	Digital Operator Battery Voltage Low
bb	bb	Baseblock
		Drive output interrupted as indicated by an external baseblock signal.
bUS	bUS	Option Communication Error
		• The connection was lost after establishing initial communication. • Only detected when the run command frequency reference is assigned to an option card.
CALL	CALL	Serial Communication Transmission Error
		Communication has not yet been established.
CE	CE	MEMOBUS/Modbus Communication Error
		Control data was not received for the CE detection time set to H5-09.
CrSt	CrST	Cannot Reset
CyC	CyC	MECHATROLINK Comm. Cycle Setting Error
		Comm. Cycle Setting Error was detected.
dnE	dnE	Drive Disabled
E5	E5	SI-T3 Watchdog Timer Error
		The watchdog timed out.
EF	EF	Forward/Reverse Run Command Input Error
		Both forward run and reverse run closed simultaneously for longer than 0.5 s.
EF0	EF0	Option Card External Fault
		An external fault condition is present.
EF 1	EF1	Pump Fault (input terminal S1)
		External fault at multi-function input terminal S1.
EF2	EF2	Pump Fault (input terminal S2)
		External fault at multi-function input terminal S2.
EF3	EF3	Pump Fault (input terminal S3)
		External fault at multi-function input terminal S3.
EF4	EF4	Pump Fault (input terminal S4)
		External fault at multi-function input terminal S4.
EF5	EF5	Pump Fault (input terminal S5)
		External fault at multi-function input terminal S5.
EF6	EF6	Pump Fault (input terminal S6)
		External fault at multi-function input terminal S6.

Digital Operator Display		Alarm Name
LED Operator Display 	LCD Operator Display JVOP-183 	
EF7	EF7	Pump Fault (input terminal S7)
		External fault at multi-function input terminal S7.
EoF	EoF	Emergency Override Forward Run
Eor	Eor	Emergency Override Reverse Run
FAn	FAn	Internal Cooling Fan Error
Hbb	Hbb	Safe Disable Signal Input
		Both Safe Disable Input channels are open.
HbbF	HbbF	Safe Disable Signal Input
		One Safe Disable channel is open while the other channel is closed.
FLGt	Feedback Loss Go To Freq. b5-13	PI Feedback Loss The drive will run at the speed set in b5-13, Feedback Loss Goto Frequency.
Fdb-L	Feedback Loss Wire Break	PI Feedback Loss
		The analog input programmed for PID feedback has gone above 21 mA or fallen below 3 mA.
PFrEF	Freq. Ref Pump Min (P1-06)	Minimum Pump Frequency Reference
		Drive frequency reference is set lower than P1-06, Minimum Pump Frequency.
PtHrt	Freq. Ref Thrust (P4-12)	Thrust Frequency Reference
		The fixed frequency reference is set to a value lower than the P4-12, Thrust Frequency, setting.
HCA	HCA	Current Alarm
		Drive current exceeded overcurrent warning level (150% of the rated current).
H IFb	High Feedback High FB Sensed	High Feedback Level Alarm
		The feedback signal is too high.
LoP	LOP	Loss of Prime
		The pump has lost its prime and P1-22 is set to 1.
LCP	Low City Pressure	Low City Pressure
LoFb	Low Feedback Low FB Sensed	Low Feedback Level Alarm
		The feedback signal is too low.
LSP	Low Suction Pressure	Low Suction Pressure
LWJt	Low Water in Tank	Low Water in Tank
Lt-1	LT-1	Cooling Fan Maintenance Time
		The cooling fan has reached its expected maintenance period and may need to be replaced. **Note:** An alarm output (H2-☐☐ = 10) will only be triggered if both (H2-☐☐ = 2F and H2-☐☐ = 10) are set.
Lt-2	LT-2	Capacitor Maintenance Time
		The main circuit and control circuit capacitors are nearing the end of their expected performance life. **Note:** An alarm output (H2-☐☐ = 10) will only be triggered if H2-☐☐ = 2F.
Lt-3	LT-3	Soft Charge Bypass Relay Maintenance Time
		The DC bus soft charge relay is nearing the end of its expected performance life. **Note:** An alarm output (H2-☐☐ = 10) will only be triggered if H2-☐☐ = 2F.
Lt-4	LT-4	IGBT Maintenance Time (50%)
		IGBTs have reached 50% of their expected performance life. **Note:** An alarm output (H2-☐☐ = 10) will only be triggered if H2-☐☐ = 2F.

Digital Operator Display		Alarm Name
LED Operator Display 	LCD Operator Display JVOP-183 	
nEtSC	NETSCAN Waiting for Master	NETSCAN Drive is waiting for a message from the master.
notSP	NMS	Not Maintaining Setpoint The setpoint cannot be maintained and P1-17 is set to 1.
oH	oH	Heatsink Overheat The temperature of the heatsink exceeded the overheat pre-alarm level set to L8-02.
oH2	oH2	Heatsink Overheat Warning “Heatsink Overheat Warning” was input to a multi-function input terminal, S1 through S7 (H1-□□= B).
oH3	oH3	Motor Overheat The motor overheat signal entered to a multi-function analog input terminal exceeded the alarm level (H3-02 or H3-10 = E).
oL 1	oL1	Motor Overload The electronic motor overload protection tripped
oL2	oL2	Drive Overload The thermal sensor of the drive triggered overload protection.
oL3	oL3	Overtorque Detection 1 The current has exceeded the value set for Torque Detection Level 1 (L6-02) for longer than the allowable time (L6-03).
oL4	oL4	Overtorque Detection 2 The current has exceeded the value set for Torque Detection Level 2 (L6-05) for longer than the allowable time (L6-06).
ou	ov	Control Circuit Overvoltage Voltage in the control circuit exceeded the trip point. • For 200 V class drives: approximately 410 V • For 400 V class drives: approximately 820 V (740 V when E1-01 < 400)
PCyC	PCyC	Pump Over Cycle
rdd	R-DNE-S□	Remote Drive Disable
SE	SE	MEMOBUS/Modbus Communication Test Mode Error **Note:** This alarm will not trigger a multi-function output terminal that is set for alarm output (H2-□□ = 10).
tdE	TdE	Time Data Error
trPC	TrPC	IGBT Maintenance Time (90%) IGBTs have reached 90% of their expected performance life.
UL3	UL3	Undertorque Detection 1 The current has fallen below the minimum value set for Torque Detection Level 1 (L6-02) for longer than the allowable time (L6-03).
UL4	UL4	Undertorque Detection 2 The current has fallen below the minimum value set for Torque Detection Level 2 (L6-05) for longer than the allowable time (L6-06).
UL6	UL6 Underload Det 6	Motor Underload The load has fallen below the underload curve defined in L6-14.

Digital Operator Display		Alarm Name
LED Operator Display 	LCD Operator Display JVOP-183 	
Uu	Uv	Control Circuit Undervoltage
		One of the following conditions occurred: • Contactor to suppress inrush current in the drive was opened. • Low voltage in the control drive input power. This alarm outputs only if L2-01 is not 0 and DC bus voltage is under L2-05.

◆ Operator Programming Errors

■ oPE Codes

An Operator Programming Error (oPE) occurs when a contradictory parameter is set or an individual parameter is set to an inappropriate value.

The drive will not operate until the parameter or parameters causing the problem are set correctly. An oPE, however, does not trigger an alarm or fault output. When an oPE appears on the operator display, press the ENTER button to view U1-18 and see which parameter is causing the oPE.

Digital Operator Display		Error Name
LED Operator Display 	LCD Operator Display JVOP-183 	
oPE01	oPE01	Drive Capacity Setting Fault
		Drive capacity and the value set to o2-04 do not match.
oPE02	oPE02	Parameter Range Setting Error
		Use U1-18 to find parameters set outside the range.
oPE03	oPE03	Multi-Function Input Selection Error
		A contradictory setting is assigned to multi-function contact inputs H1-01 to H1-07.
oPE04	oPE04	Initialization Required, Term <–> Ctrl Chg
oPE05	oPE05	Run Command/Frequency Reference Source Selection Error
oPE07	oPE07	Multi-Function Analog Input Selection Error
		A contradictory setting is assigned to multi-function analog inputs H3-02 or H3-06 and PID functions conflict.
oPE08	oPE08	Parameter Selection Error
		A function has been set that cannot be used in the motor control method selected.
oPE09	oPE09	PID Control Selection Fault
		PID control function selection is incorrect. Requires that PID control is enabled (b5-01 = 1).
oPE10	oPE10	V/f Data Setting Error
		One of the following setting errors has occurred: E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04
oPE11	oPE11	Carrier Frequency Setting Error
		Correct the setting for the carrier frequency.
oPE33	oPE33 Net Incompatible	Parameter selection is incompatible with the selected network P9-99

◆ Digital Operator Display Messages

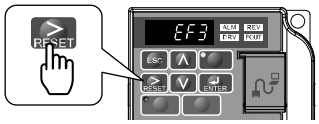
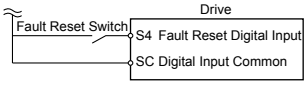
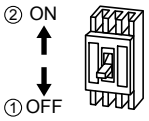
Table i.24 lists messages and errors that may appear during normal pump operation.

These messages do not trigger multi-function output terminals that have been set up to close when a fault or alarm occurs.

Table i.24 Digital Operator Display Messages

Digital Operator Display		Description
LED Operator Display 	LCD Operator Display JVOP-183 	
CrSt	CrST Cannot Reset	Fault reset was being executed when a Run command was entered. Ensure that a Run command cannot be entered from the external terminals or option during fault reset. Turn off the Run command.
CUr	Current Limit Foldback	Displayed when drive output speed is being limited due to the output current limit. Reduce the load or replace with higher capacity drive.
dStGE	De-staging in X sec	Displayed during multiplexing when drive de-staging is in progress. X sec indicates the time left before the de-staging takes place.
(no indication)	DigitalOut Delay Active	Displayed when the Digital Output Delay function is active.
FbCH	Feedback Drop Check	Displayed when the drive is determining whether the feedback will change abruptly when the drive enters Sleep Mode. Drop Level is configured by P2-08, Delta Sleep Feedback Drop Level, and P2-09 Feedback Detection Drop Time.
LoC-P	LOCK Parameter Locked	Displayed after an attempt to change a parameter when A1-01 = 3. Unlock the keypad by setting A1-01 = 2.
(no indication)	Lube Pump Active	Displayed when the Lube Pump digital output is energized.
nEtEr	Net Pump Err Chk Faulted Pump	Displayed when the drive has been stopped because another drive in the network has a system fault or a Low City Pressure alarm.
nEtSt	Net Start Delay P9-29 Active	Displayed when the MEMOBUS network is waiting for the P9-29 timer to elapse.
nEtFb	Network FB Lost Check FB Source	Displayed when no valid analog PI feedback source can be found on the network and network PI feedback has been lost.
PASS	PASS MEMOBUS/Modbus Comm. Test Mode Complete	MEMOBUS/Modbus test has finished normally.
PrCHG	Pre Chg Mode Exit in Xsec	Pre-charge 1 or 2 active. X indicates time left before pre-charge exits due to timers (P4-03 + P4-07).
IPH	Single Phase Foldback	Displayed when an input phase has been lost, or when excess load is being drawn by the motor in a single phase application.
SLEEP	Sleep Active Wait for Start	Displayed when the drive is in Sleep Mode or when the drive is waiting for the feedback level to reach the level set in P1-04, Start Level.
booSt	Sleep Boost Active	Displayed when the drive entering Sleep Mode and the pressure setpoint is being boosted. During this time, the U1-01, Frequency Reference, monitor will be updated with the boosted setpoint.
StAGE	Staging in X sec	Displayed during multiplexing when drive staging is in progress. X sec indicates the time left before the staging takes place.
bUA It	Start Delay Adjust b1-11	Displayed when the drive start is being delayed by Coast to Stop with Timer (Back Spin Timer). This time is adjusted by parameter b1-11, Coast to Stop with Timer Time.
bUA It	Start Delay Timer Active	Displayed when the feedback level has reached the level set in P1-04, Start Level, and the Start Delay timer is incrementing.
tHrSt	Thrust Mode Thrust Active	Displayed during Thrust Mode.
Ut IL	Utility Delay Adjust by P4-17	Displayed when the drive is delaying the Run command due to the Utility Start Delay Function.

◆ Fault Reset Methods

After the Fault Occurs	Procedure	
Fix the cause of the fault, restart the drive, and reset the fault	Press RESET on the digital operator.	
	Press RESET on the optional HOA keypad.	
Fix the cause of the fault and reset via Fault Reset Digital Input S4.	Close then open the fault signal digital input via terminal S4. S4 is set to fault reset as default (H1-04 = 12).	
Turn off the main power supply if the above methods do not reset the fault. Reapply power after the digital operator display has turned off.		

i.8 Drive Specifications

Note: For optimum performance life of the drive, install the drive in an environment that meets the required specifications.

Item		Specification
Control Characteristics	Control Method	V/f Control (V/f)
	Frequency Control Range	0.01 to 400 Hz
	Frequency Accuracy	Digital input: within ±0.01% of the max output frequency (-10 to +50 °C) Analog input: within ±0.5% of the max output frequency (25 °C ±10 °C)
	Frequency Setting Resolution	Digital inputs: 0.01 Hz Analog inputs: 1/1000 of maximum output frequency
	Output Frequency Calculation Resolution	$1/2^{20}$ x Maximum output frequency (E1-04)
	Frequency Setting Signal	Main frequency reference: 0 to +10 Vdc (20 kΩ), 4 to 20 mA (250 Ω), 0 to 20 mA (250 Ω) Main speed reference: Pulse Train Input (max 32 kHz)
	Starting Torque	V/f: 150% at 3 Hz
	Speed Control Range	1:40 (V/f Control)
	Accel/Decel Time	0.00 to 6000.0 s (allows four separate settings for accel and decel)
	Braking Torque	Instantaneous Average Decel Torque <1> : 0.1/0.2 kW: over 150%, 0.4/0.75 kW: over 100%, 1.5 kW: over 50%, 2.2 kW and above: over 20% Continuous Regen Torque: 20%, 125% with a Braking Resistor Unit <2> : (10% ED) 10 s with an internal braking resistor.
	V/f Characteristics	Preset V/f patterns and user-set program available.
	Functions	Momentary Power Loss Ride-Thru Speed Search Over/Undertorque Detection Multi-Step Speed (17 steps max) Accel/Decel Time Switch S-Curve Accel/Decel, 2-Wire/3-Wire Sequence Stationary Auto-Tuning of Line-to-Line Resistance Dwell Cooling Fan ON/OFF Slip Compensation Torque Compensation Jump Frequencies (reference dead band) Frequency Reference Upper/Lower Limit DC Injection Braking (start and stop) PID Control (with Sleep Function) MEMOBUS/Modbus (RS-485/RS-422 Max 115.2 kbps) Fault Reset Parameter Copy Fault Restart Removable Terminals with Parameter Backup Function
Protection Functions	Motor Protection	Motor overheat protection via output current sensor
	Overcurrent Protection	Drives stops when output exceeds 170% of the rated current
	Overload Protection	Drive stops when output current is 120% rated current for 60 sec. <3>
	Overvoltage Specification	200 V Class: Stops when DC bus voltage exceeds approx. 410 V 400 V Class: Stops when DC bus voltage exceeds approx. 820 V
	Low Voltage Protection	Drive stops when DC bus voltage falls below the levels indicated: 190 V (3-phase 200 V), 160 V (single-phase 200 V), 380 V (3-phase 400 V), 350 V (3-phase 380 V)
	Momentary Power Loss Ride-Thru	3 selections available: Ride-Thru disabled (stops after 15 ms), time base of 0.5 s, and continue running as long as the drive control board is powered up. <4>

i.8 Drive Specifications

Item		Specification	
Protection Functions	Heatsink Overheat Protection	Protected by thermistor	
	Braking Resistor Overheat Protection	Overheat input signal for braking resistor (Optional ERF-type, 3% ED)	
	Stall Prevention	Stall prevention is available during acceleration, deceleration, and during run. Separate settings for each type of stall prevention determine the current level at which stall prevention is triggered.	
	Cooling Fan Failure Protection	Circuit protection (“fan-lock” sensor)	
	Ground Fault Protection	Electronic circuit protection <5>	
	DC Bus Charge LED	Remains lit until DC bus voltage falls below 50 V	
Environment	Storage/Installation Area	Indoors	
	Ambient Temperature	IP20/NEMA 1, UL Type 1 enclosure: -10 °C to +40 °C (14 °F to 104 °F) IP66/NEMA 4X, UL Type 4X enclosure: -10 °C to +40 °C (14 °F to 104 °F)	
	Humidity	95% RH or less with no condensation	
	Storage Temperature	-20 to +60 °C (-4 to +140 °F) allowed for short-term transport of the product	
	Altitude	Up to 1000 meters without derating; up to 3000 meters with output current and voltage derating.	
	Shock, Impact	10 to 20 Hz: 9.8 m/s^2 20 to 55 Hz: 5.9 m/s^2	
	Surrounding Area	Install the drive in an area free from: • oil mist and dust • metal shavings, oil, water or other foreign materials • radioactive materials • combustible materials (e.g., wood) • harmful gases and liquids • excessive vibration • chlorides • direct sunlight For IP66/NEMA 4X, UL Type 4X enclosure drives, install the drive in an environment suitable for IP66/NEMA 4X, UL Type 4X enclosures: • NEMA 4X, UL Type 4X – Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, hose-directed water, and corrosion; and that will be undamaged by the external formation of ice on the enclosure. • IP66 – Dust-tight enclosures to not allow any dust to penetrate. The enclosure guards the drive against powerful jetting water sprayed from any direction and is protected against access to hazardous parts with a wire.	
	Orientation	Install the drive vertically to maintain maximum cooling effects	
Standards		cULus	
Protective Enclosure		IP20/NEMA 1, UL Type 1 IP66/NEMA 4X, UL Type 4X	
Cooling Method		BV0006F: self-cooled BV0010F to BV0018F: cooling fan 2V0006F to 2V0069F: cooling fan 4V0002F to 4V0004F: self-cooled 4V0005F to 4V0038F: cooling fan	BV0006G and BV0010G: self-cooled BV0012G: internal cooling fan 2V0006G to 2V0012G: self-cooled 2V0020G: internal cooling fan 2V0030G to 2V0069G: internal and external cooling fans 4V0002G to 4V0005G: self-cooled 4V0007G to 4V0011G: internal cooling fan 4V0018G to 4V0038G: internal and external cooling fans

<1> Instantaneous average deceleration torque refers to the torque required to decelerate the motor (uncoupled from the load) from the rated motor speed down to zero in the shortest time.

<2> Ensure that Stall Prevention Selection during Deceleration is disabled (L3-04 = 0) or set to 3 when using a braking resistor or the Braking Resistor Unit. The default setting for the stall prevention function will interfere with the braking resistor.

<3> Overload protection may be triggered when operating with 150% of the rated output current if the output frequency is less than 6 Hz.

<4> A Momentary Power Loss Ride-Thru Unit is required for 200/400 V class drives 7.5 kW and less if the application needs to continue running during a momentary power loss up to 2 seconds.

<5> Ground protection cannot be provided under the following circumstances when a ground fault is likely in the motor windings during run: Low ground resistance for the motor cable and terminal block; low ground resistance for the motor cable and terminal block; or the drive is powered up from a ground short.

◆ Single-Phase Derating

iQpump Micro drives are compatible for use with both three-phase and single-phase input power supplies. The drive output to the motor is always three-phase, regardless of number of input phases.

Output capacity to the motor is derated when using single-phase input power and the drive firmware includes protection for single-phase input applications. This protection is enabled by default. Disabling this protection for single-phase input applications can void warranty and result in premature failure.

Selection of larger models always results in greater output capacity to the motor when supplying the drive with three-phase input power. However, the selection of larger models does not always yield greater output capacity when using the drive with single-phase input power.

Several factors affect the amount of derated drive output capacity when single-phase input power is supplied to the drive:

- Single-phase input voltage level
- Motor voltage rating
- Amount of input impedance.

The tables in this section assist in model selection by considering factors that affect the amount of derating in single-phase input power applications.

■ Single-Phase Input Sizing

The rated output current listed in the tables allows for a 120% overload for 60 seconds. Contact Yaskawa if assistance is needed in selecting drive models with higher overload requirements. Adding more impedance than is specified will degrade performance.

Table i.25 240 V Single-Phase Input (-5% to +10%)

Drive Model	Without Input Reactor			With Input Reactor			
	Rated Input Current (A)	Rated Output Current (A)	Max Applicable Motor (HP)	Yaskawa Reactor Part Number	Rated Input Current (A)	Rated Output Current (A)	Max Applicable Motor (HP)
2V0006	7.3	4.9	1.0	URX000303	7.3	4.9	1.0
2V0010	10.8	6.8	1.5	URX000307	10.8	6.8	1.5
2V0012	13.9	7.5	2.0	URX000311	13.9	7.5	2.0
2V0020	24.0	9.7	2.0	URX000319	24.0	12.3	3.0
2V0030	37.0	7.5	2.0	URX000326	37.0	15.2	3.0
2V0040	52.0	16.7	5.0	URX000329	52.0	21.0	5.0
2V0056	68.0	23.4	5.0	URX000335	68.0	27.7	7.5
2V0069	80.0	25.8	7.5	URX000335	80.0	30.8	10.0

Table i.26 480 V Single-Phase Input (-5% to +10%)

Drive Model	Without Input Reactor			With Input Reactor			
	Rated Input Current (A)	Rated Output Current (A)	Max Applicable Motor (HP)	Yaskawa Reactor Part Number	Rated Input Current (A)	Rated Output Current (A)	Max Applicable Motor (HP)
4V0002	2.1	1.3	0.5	URX000292	2.1	1.7	0.5
4V0004	4.3	2.4	1.0	URX000300	4.3	2.8	1.0
4V0005	5.9	3.5	1.5	URX000304	5.9	3.9	2.0
4V0007	8.1	3.5	1.5	URX000309	8.1	5.4	2.0
4V0009	9.4	5.1	2.0	URX000308	9.4	5.5	3.0
4V0011	14.0	5.5	3.0	URX000312	14.0	7.5	3.0
4V0018	20.0	4.5	2.0	URX000316	20.0	8.7	5.0
4V0023	24.0	5.5	3.0	URX000320	24.0	10.5	5.0
4V0031	38.0	7.9	3.0	URX000327	38.0	13.5	7.5
4V0038	44.0	11.3	5.0	URX000327	44.0	16.1	10.0

i.9 Parameter Table

This parameter table shows the most important parameters. Default settings are in **bold type**. Refer to the User Manual for more detailed descriptions of parameters and settings.

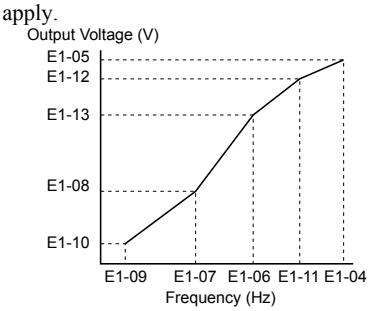
No.	Name	Description
A1-00	Language Selection	**0: English** 1: Japanese 2: German 3: French 4: Italian 5: Spanish 6: Portuguese 7: Chinese
A1-01	Access Level Selection	0: View and set A1-01 and A1-04. U□-□□ parameters can also be viewed. 1: User Parameters (access to parameters selected by the user, A2-01 to A2-32) **2: Advanced Access (access to view and set all parameters)** 3: Lock parameters
A1-03	Initialize Parameters	**0: No initialization** 1110: User Initialize (parameter values must be stored using parameter o2-03) 2220: 2-Wire initialization 3330: 3-Wire initialization 5550: Terminal->Control Initialize 6008: Pressure Control 6009: Pump down level 7770: General purpose 7771: Submersible motor GP operation
A1-04	Password	When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 through A1-03 and A2-01 through A2-33 cannot be changed.
A1-05	Password Setting	
A1-06	Application Preset	**0: Pressure control** 1: General purpose 2: Submersible motor GP operation 8: Pressure control 9: Pump down level **Note:** This parameter is not settable. It is used as a monitor only.
A2-01 to A2-32	User Parameters 1 to 32	Recently edited parameters are listed here. The user can also select parameters to appear here for quicker access.
A2-33	User Parameter Automatic Selection	**0: A2-01 to A2-32 are reserved for the user to create a list of User Parameters.** 1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quicker access.
b1-01	Frequency Reference Selection 1	**0: Operator (will also switch PID setpoint to Q1-01)** 1: Analog input terminals 2: MEMOBUS/Modbus communications 3: Option PCB 4: Pulse input (terminal RP)
b1-02	Run Command Selection 1	**0: HOA keypad** 1: Digital input terminals 2: MEMOBUS/Modbus communications 3: Option PCB
b1-03	Stopping Method Selection	0: Ramp to stop **1: Coast to stop** 2: DC Injection Braking to stop 3: Coast with timer
b1-04	Reverse Operation Selection	0: Reverse enabled **1: Reverse disabled**
b1-07	Run Command Retention when Source is Changed	**0: Require Cycle** 1: Retain Run Command

No.	Name	Description
b1-08	Run Command Selection in Programming Mode	**0: Run command is not accepted while in Programming Mode.** 1: Run command is accepted while in Programming Mode. 2: Prohibit entering Programming Mode during run.
b1-11	Run Delay at Stop (Back Spin Timer)	Sets the amount of time that the drive will disallow the reapplication of the Run command after the Run command is lost. b1-11 is active for all b1-03 settings.
b1-12	Run Delay Memory Selection	0: Disabled 1: Only at Stop **2: Running & Stop** **Note:** A JVOP-183 HOA Keypad must be plugged into the drive for settings 1 and 2 to function. If the keypad is removed, b1-12 will function as setting 0 (Disabled).
b1-14	Phase Order Selection	**0: Standard** 1: Switch phase order (reverses the direction of the motor)
b1-15	Frequency Reference Selection 2	**0: Operator** 1: Analog Input 2: Serial Communications 3: Option PCB 4: Pulse Input
b1-16	Run Command Selection 2 Run Source 2	**0: Operator** 1: Digital Inputs 2: Communication 3: Option PCB
b1-17	Run Command at Power Up	0: Disregarded. A new Run command must be issued after power up. **1: Allowed. Drive will run immediately after power up if a Run command is present.**
b2-01	DC Injection Braking Start Frequency	Sets the frequency at which DC Injection Braking starts when "Ramp to stop" (b1-03 = 0) is selected.
b2-02	DC Injection Braking Current	Sets the DC Injection Braking current as a percentage of the drive rated current.
b2-03	DC Injection Braking Time at Start	Sets DC Injection Braking time at start. Disabled when set to 0.00 seconds.
b2-04	DC Injection Braking Time at Stop	Sets DC Injection Braking time at stop.
b3-01	Speed Search Selection at Start	0: Disabled 1: Enabled
b3-02	Speed Search Deactivation Current	Sets the current level at which the speed is assumed to be detected and Speed Search is ended. Set as a percentage of the drive rated current.
b3-03	Speed Search Deceleration Time	Sets output frequency reduction time during Speed Search.
b3-05	Speed Search Delay Time	When using an external contactor on the output side, b3-05 delays executing Speed Search after a momentary power loss to allow time for the contactor to close.
b3-06	Output Current 1 during Speed Search	Sets the current injected to the motor at the beginning of Speed Estimation Speed Search. Set as a coefficient for the motor rated current.
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	Sets the proportional gain for the current controller during Speed Search.

No.	Name	Description
b3-10	Speed Search Detection Compensation Gain	Sets the gain which is applied to the speed detected by Speed Estimation Speed Search before the motor is reaccelerated. Increase this setting if ov occurs when performing Speed Search after a relatively long period of baseblock.
b3-14	Bi-Directional Speed Search Selection	0: Disabled (uses the direction of the frequency reference) 1: Enabled (drive detects which way the motor is rotating)
b3-17	Speed Search Restart Current Level	Sets the Speed Search restart current level as a percentage of the drive rated current.
b3-18	Speed Search Restart Detection Time	Sets the time to detect Speed Search restart.
b3-19	Number of Speed Search Restarts	Sets the number of times the drive can attempt to restart when performing Speed Search.
b3-24	Speed Search Method Selection	**0: Current Detection** 1: Speed Estimation
b3-25	Speed Search Wait Time	Sets the time the drive must wait between each Speed Search restart attempt.
b4-01	Timer Function On-Delay Time	Sets the on-delay and off-delay times for a digital timer output (H2-□□=12). The output is triggered by a digital input programmed to H1-□□=18).
b4-02	Timer Function Off-Delay Time	
b5-01	PID Function Setting	0: Disabled **1: Enabled (PID output becomes output frequency reference, deviation D controlled)**
b5-02	Proportional Gain Setting (P)	Sets the proportional gain of the PID controller.
b5-03	Integral Time Setting (I)	Sets the integral time for the PID controller.
b5-04	Integral Limit Setting	Sets the maximum output possible from the integrator as a percentage of the maximum output frequency.
b5-05	Derivative Time (D)	Sets D control derivative time.
b5-06	PID Output Limit	Sets the maximum output possible from the entire PID controller as a percentage of the maximum output frequency.
b5-07	PID Offset Adjustment	Applies an offset to the PID controller output. Set as a percentage of the maximum output frequency.
b5-08	PID Primary Delay Time Constant	Sets a low pass filter time constant on the output of the PID controller.
b5-09	PID Output Level Selection	**0: Direct acting** 1: Inverse acting
b5-10	PID Output Gain Setting	Sets the gain applied to the PID output.
b5-11	PID Output Reverse Selection	**0: Negative PID output triggers zero limit.** 1: Rotation direction reverses with negative PID output. **Note:** When using setting 1, make sure reverse operation is permitted by b1-04.
b5-12	Feedback Loss 4 to 20 mA Detection Selection	0: Disabled 1: Alarm only **2: Fault** 3: Run at b5-13
b5-13	Feedback Loss Goto Frequency	Sets the speed at which the drive will run if a 4 to 20 mA wire break is detected on the PID Feedback and when b5-12 is set to 3 (Run at b5-13).
b5-14	Feedback Loss of Prime Level	Detects loss of prime in the pump when a wire break condition has occurred.

No.	Name	Description
b5-15	Feedback Loss Go To Frequency Time Out	When b5-12 = 3 and the Feedback signal is lost, the drive will run at the b5-13 speed for the b5-15 time, after which the drive will fault on Feedback Loss (FDBKL).
b5-16	Feedback Loss Start Delay	When an AUTO Run command is initiated, the drive will not fault on Feedback Loss (FDBKL) or use the Feedback Loss GoTo Frequency (b5-13) until the b5-16 time has expired.
b5-17	PID Accel/Decel Time	Sets the acceleration and deceleration time to PID setpoint.
b5-32	Integrator Ramp Limit	When set to a value greater than zero, the PI Integrator is forced to be within +/- this amount of the soft starter output.
b5-34	PID Output Lower Limit	Sets the minimum output possible from the PID controller as a percentage of the maximum output frequency.
b5-35	PID Input Limit	Limits the PID control input (deviation signal) as a percentage of the maximum output frequency. Acts as a bipolar limit.
b5-39	PID System Units Display Digits	0: No decimal place **1: One decimal place** 2: Two decimal places 3: Three decimal places
b5-40	Frequency Reference Monitor Content during PID	**0: Display the frequency reference (U1-01) after PID compensation has been added.** 1: Display the frequency reference (U1-01) before PID compensation has been added.
b5-47	Reverse Operation Selection 2 by PID Output	0: Zero limit when PID output is a negative value. **1: Reverse operation when PID output is a negative value**
b6-01	Dwell Reference at Start	Parameters b6-01 and b6-02 set the frequency to hold and the time to maintain that frequency at start.
b6-02	Dwell Time at Start	
b6-03	Dwell Reference at Stop	Parameters b6-03 and b6-04 set the frequency to hold and the time to maintain that frequency at stop.
b6-04	Dwell Time at Stop	
C1-01	Acceleration Time 1	Sets the time to accelerate from 0 to maximum frequency.
C1-02	Deceleration Time 1	Sets the time to decelerate from maximum frequency to 0.
C1-03	Acceleration Time 2	Sets the time to accelerate from 0 to maximum frequency.
C1-04	Deceleration Time 2	Sets the time to decelerate from maximum frequency to 0.
C1-09	Fast Stop Time	Sets the time for the Fast Stop function.
C1-10	Accel/Decel Time Setting Units	0: 0.01 s (0.00 to 600.00 s) **1: 0.1 s (0.0 to 6000.0 s)**
C1-11	Accel/Decel Time Switching Frequency	Sets the frequency to switch between accel/decel time settings.
C1-14	Accel/Decel Rate Frequency	Sets the base frequency used to calculate acceleration and deceleration times.
C2-01	S-Curve Characteristic at Accel Start	S-curve at acceleration start.
C2-02	S-Curve Characteristic at Accel End	S-curve at acceleration end.
C2-03	S-Curve Characteristic at Decel Start	S-curve at deceleration start.
C2-04	S-Curve Characteristic at Decel End	S-curve at deceleration end.
C3-01	Slip Compensation Gain	Sets the gain for the motor slip compensation function used for motor 1.
C3-02	Slip Compensation Primary Delay Time	Adjusts the slip compensation function delay time used for motor 1.

No.	Name	Description
C3-03	Slip Compensation Limit	Sets an upper limit for the slip compensation function as a percentage of motor rated slip for motor 1 (E2-02).
C3-04	Slip Compensation Selection during Regeneration	**0: Disabled** 1: Enabled above 6 Hz
C4-01	Torque Compensation Gain	Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque. Used for motor 1.
C4-02	Torque Compensation Primary Delay Time 1	Sets the torque compensation filter time.
C6-02	Carrier Frequency Selection	1: 2.0 kHz 2: 5.0 kHz (4.0 kHz) 3: 8.0 kHz (6.0 kHz) 4: 10.0 kHz (8.0 kHz) 5: 12.5 kHz (10.0 kHz) 6: 15.0 kHz (12.0 kHz) **7: Swing PWM1 (Audible sound 1)** 8: Swing PWM2 (Audible sound 2) 9: Swing PWM3 (Audible sound 3) A: Swing PWM4 (Audible sound 4) B: Leakage Current Rejection PWM C to E: No setting possible F: User-defined (determined by C6-03 through C6-05)
C6-03	Carrier Frequency Upper Limit	Determines the upper and lower limits for the carrier frequency.
C6-04	Carrier Frequency Lower Limit	
C6-05	Carrier Frequency Proportional Gain	
d1-01 to d1-16	Frequency Reference 1 to 16	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03.
d1-17	Jog Frequency Reference	Sets the Jog frequency reference. Setting units are determined by parameter o1-03.
d2-01	Frequency Reference Upper Limit	Sets the frequency reference upper limit as a percentage of the maximum output frequency.
d2-02	Frequency Reference Lower Limit	Sets the frequency reference lower limit as a percentage of the maximum output frequency.
d2-03	Master Speed Reference Lower Limit	Sets the lower limit for frequency references from analog inputs as a percentage of the maximum output frequency.
d3-01	Jump Frequency 1	Eliminates problems with resonant vibration of the motor/machine by avoiding continuous operation in predefined frequency ranges. The drive accelerates and decelerates the motor through the prohibited frequency ranges.
d3-02	Jump Frequency 2	
d3-03	Jump Frequency 3	
d3-04	Jump Frequency Width	Sets the dead-band width around each selected prohibited frequency reference point.
d4-01	Frequency Reference Hold Function Selection	**0: Disabled. Drive starts from zero when the power is switched on.** 1: Enabled. At power up, the drive starts the motor at the Hold frequency that was saved.
d4-03	Frequency Reference Bias Step (Up/Down 2)	Sets the bias added to the frequency reference when the Up 2 and Down 2 digital inputs are enabled (H1-□□ = 75, 76).
d4-05	Frequency Reference Bias Operation Mode Selection (Up/Down 2)	**0: Bias value is held if no input Up 2 or Down 2 is active.** 1: When the Up 2 reference and Down 2 reference are both on or both off, the applied bias becomes 0. The specified accel/decel times are used for acceleration or deceleration.

No.	Name	Description
d4-06	Frequency Reference Bias (Up/Down 2)	The Up/Down 2 bias value is saved in d4-06 when the frequency reference is not input by the digital operator. Set as a percentage of the maximum output frequency.
d4-07	Analog Frequency Reference Fluctuation Limit (Up/Down 2)	Limits how much the frequency reference is allowed to change while an input terminal set for Up 2 or Down 2 is enabled.
d4-08	Frequency Reference Bias Upper Limit (Up/Down 2)	Sets the upper limit for the bias and the value that can be saved in d4-06. Set as a percentage of the maximum output frequency.
d4-09	Frequency Reference Bias Lower Limit (Up/Down 2)	Sets the lower limit for the bias and the value that can be saved in d4-06. Set as a percentage of the maximum output frequency.
d4-10	Up/Down Frequency Reference Limit Selection	**0: The lower limit is determined by d2-02 or an analog input.** 1: The lower limit is determined by d2-02.
E1-01	Input Voltage Setting	This parameter must be set to the power supply voltage. **WARNING!***Electrical Shock Hazard. Drive input voltage (not motor voltage) must be set in E1-01 for the protective features of the drive to function properly. Failure to do so may result in equipment damage and/or death or personal injury.*
E1-03	V/f Pattern Selection	0: 50 Hz, Constant torque 1 1: 60 Hz, Constant torque 2 2: 60 Hz, Constant torque 3 (50 Hz base) 3: 72 Hz, Constant torque 4 (60 Hz base) 4: 50 Hz, Variable torque 1 5: 50 Hz, Variable torque 2 6: 60 Hz, Variable torque 3 7: 60 Hz, Variable torque 4 8: 50 Hz, High starting torque 1 9: 50 Hz, High starting torque 2 A: 60 Hz, High starting torque 3 B: 60 Hz, High starting torque 4 C: 90 Hz (60 Hz base) D: 120 Hz (60 Hz base) E: 180 Hz (60 Hz base) **F: Custom V/f, E1-04 through E1-13 settings define the V/f pattern**
E1-04	Maximum Output Frequency	These parameters are only applicable when E1-03 is set to F. To set linear V/f characteristics, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Ensure that the four frequencies are set according to these rules: E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04 Setting E1-11 to 0 disables both E1-11 and E1-12 and the above conditions do not apply. 
E1-05	Maximum Voltage	
E1-06	Base Frequency	
E1-07	Middle Output Frequency	
E1-08	Middle Output Frequency Voltage	
E1-09	Minimum Output Frequency	
E1-10	Minimum Output Frequency Voltage	
E1-11	Middle Output Frequency 2	
E1-12	Middle Output Frequency Voltage 2	
E1-13	Base Voltage	
E2-01	Motor Rated Current	Sets the motor nameplate full load current in amps. Automatically set during Auto-Tuning.
E2-02	Motor Rated Slip	Sets the motor rated slip. Automatically set during Auto-Tuning.
E2-03	Motor No-Load Current	Sets the no-load current for the motor. Automatically set during Auto-Tuning.

No.	Name	Description
E2-04	Number of Motor Poles	Sets the number of motor poles. Automatically set during Auto-Tuning.
E2-05	Motor Line-to-Line Resistance	Sets the phase-to-phase motor resistance. Automatically set during Auto-Tuning.
E2-06	Motor Leakage Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. Automatically set during Auto-Tuning.
E2-10	Motor Iron Loss for Torque Compensation	Sets the motor iron loss.
E2-11	Motor Rated Power	Sets the motor rated power in kilowatts (1 HP = 0.746 kW). Automatically set during Auto-Tuning.
H1-01 to H1-07	Multi-Function Digital Input Terminal S1 to S7 Function Selection	Selects the function of terminals S1 to S7.
H1-21	External Fault 1 Delay Time	Sets the amount of time delay applied to the EF1 fault. (20 ≤ H1-01 ≤ 2F)
H1-22	External Fault 2 Delay Time	Sets the amount of time delay applied to the EF2 fault. (20 ≤ H1-02 ≤ 2F)
H1-23	External Fault 3 Delay Time	Sets the amount of time delay applied to the EF3 fault. (20 ≤ H1-03 ≤ 2F)
H1-24	External Fault 4 Delay Time	Sets the amount of time delay applied to the EF4 fault. (20 ≤ H1-04 ≤ 2F)
H1-25	External Fault 5 Delay Time	Sets the amount of time delay applied to the EF5 fault. (20 ≤ H1-05 ≤ 2F)
H1-26	External Fault 6 Delay Time	Sets the amount of time delay applied to the EF6 fault. (20 ≤ H1-06 ≤ 2F)
H1-27	External Fault 7 Delay Time	Sets the amount of time delay applied to the EF7 fault. (20 ≤ H1-07 ≤ 2F)
H2-01	Terminal MA, MB, and MC function selection (relay)	Sets the function for terminals MA/MB/MC.
H2-02	Terminal P1 function selection (open-collector)	Sets the function for the terminal P1.
H2-03	Terminal P2 function selection (open-collector)	Sets the function for terminal P2.
H2-06	Power Consumption Output Unit Selection	**0: 0.1 kWh units** 1: 1 kWh units 2: 10 kWh units 3: 100 kWh units 4: 1000 kWh units
H3-01	Terminal A1 Signal Level Selection	**0: 0 to 10 V** 1: -10 to 10 V
H3-02	Terminal A1 Function Selection	Sets the function of terminal A1.
H3-03	Terminal A1 Gain Setting	Sets the level of the input value selected in H3-02 when 10 V is input at terminal A1.
H3-04	Terminal A1 Bias Setting	Sets the level of the input value selected in H3-02 when 0 V is input at terminal A1.
H3-09	Terminal A2 Signal Level Selection	0: 0 to 10 V 1: -10 to 10 V **2: 4 to 20 mA** 3: 0 to 20 mA **Note:** Use DIP Switch S1-2 to set input terminal A2 for a current or voltage input signal.
H3-10	Terminal A2 Function Selection	Sets the function of terminal A2.
H3-11	Terminal A2 Gain Setting	Sets the level of the input value selected in H3-10 when 10 V (20 mA) is input at terminal A2.

No.	Name	Description
H3-12	Terminal A2 Bias Setting	Sets the level of the input value selected in H3-10 when 0 V (0 or 4 mA) is input at terminal A2.
H3-13	Analog Input Filter Time Constant	Sets a primary delay filter time constant for terminals A1 and A2. Used for noise filtering.
H3-14	Analog Input Terminal Enable Selection	1: Terminal A1 only 2: Terminal A2 only **7: All terminals enabled**
H3-16	Terminal A1 Offset	Adds an offset when the analog signal to terminal A1 is at 0 V.
H3-17	Terminal A2 Offset	Adds an offset when the analog signal to terminal A2 is at 0 V.
H4-01	Multi-Function Analog Output Terminal AM Monitor Selection	Selects the data to be output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter “103” for U1-03.
H4-02	Multi-Function Analog Output Terminal AM Gain	Sets the signal level at terminal AM that is equal to 100% of the selected monitor value.
H4-03	Multi-Function Analog Output Terminal AM Bias	Sets the signal level at terminal AM that is equal to 0% of the selected monitor value.
H5-01	Drive Node Address	Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.
H5-02	Communication Speed Selection	0: 1200 bps 1: 2400 bps 2: 4800 bps **3: 9600 bps** 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps Cycle power for the setting to take effect.
H5-03	Communication Parity Selection	**0: No parity** 1: Even parity 2: Odd parity Cycle power for the setting to take effect.
H5-04	Stopping Method After Communication Error (CE)	0: Ramp to stop 1: Coast to stop 2: Fast Stop **3: Alarm only**
H5-05	Communication Fault Detection Selection	0: Disabled **1: Enabled. If communication is lost for more than two seconds, a CE fault will occur.**
H5-06	Drive Transmit Wait Time	Set the wait time between receiving and sending data.
H5-07	RTS Control Selection	0: Disabled. RTS is always on. **1: Enabled. RTS turns on only when sending.**
H5-09	CE Detection Time	Sets the time required to detect a communications error.
H5-10	Unit Selection for MEMOBUS/Modbus Register 0025H	**0: 0.1 V units** 1: 1 V units
H5-11	Communications ENTER Function Selection	**0: Drive requires an Enter command before accepting any changes to parameter settings.** 1: Parameter changes are activated immediately without the Enter command.
H5-12	Run Command Method Selection	**0: FWD/Stop, REV/Stop** 1: Run/Stop, FWD/REV

No.	Name	Description
H6-01	Pulse Train Input Terminal RP Function Selection	**0: Frequency reference** 1: PID feedback value 2: PID setpoint value
H6-02	Pulse Train Input Scaling	Sets the terminal RP input signal frequency that is equal to 100% of the value selected in H6-01.
H6-03	Pulse Train Input Gain	Sets the level of the value selected in H6-01 when a frequency with the value set in H6-02 is input.
H6-04	Pulse Train Input Bias	Sets the level of the value selected in H6-01 when 0 Hz is input.
H6-05	Pulse Train Input Filter Time	Sets the pulse train input filter time constant.
H6-06	Pulse Train Monitor Terminal MP Selection	Select the pulse train monitor output function (value of the □-□□ part of U□-□□). Example: Select "501" for monitor U5-01. Select "0" when not using this parameter or when using in the through mode.
H6-07	Pulse Train Monitor Scaling	Sets the terminal MP output signal frequency when the monitor value is 100%. For example, to have the pulse train monitor output equal the output frequency, set H6-06 to 102 and H6-07 to 0.
H6-08	Pulse Train Input Minimum Frequency	Sets the minimum frequency for the pulse train input to be detected. Enabled when H6-01 = 0, 1, or 2.
L1-01	Motor Overload Protection Selection	0: Disabled **1: General purpose motor (standard fan cooled)** 2: Drive dedicated motor with a speed range of 1:10 3: Vector motor with a speed range of 1:100 6: General purpose motor (50 Hz)
L1-02	Motor Overload Protection Time	Sets the motor thermal overload protection (oL1) time.
L1-03	Motor Overheat Alarm Operation Selection (PTC input)	0: Ramp to stop 1: Coast to stop 2: Fast Stop (decelerate to stop using the deceleration time in C1-09) **3: Alarm only ("oH3" will flash)**
L1-04	Motor Overheat Fault Operation Selection (PTC input)	0: Ramp to stop **1: Coast to stop** 2: Fast Stop (decelerate to stop using the deceleration time in C1-09)
L1-05	Motor Temperature Input Filter Time (PTC input)	Adjusts the filter for the motor temperature analog input (H3-02 or H3-10 = E).
L1-13	Continuous Electrothermal Operation Selection	0: Disabled **1: Enabled** 2: Enabled (RTC)
L1-22	Leakage Current Filter Time Constant 1	Sets the time constant for reducing the sensitivity level when detecting leakage current. Set in seconds and used when operating at constant speed.
L1-23	Leakage Current Filter Time Constant 2	Sets the time constant for reducing the sensitivity level when detecting leakage current. Set in seconds and used during acceleration and deceleration operation.
L2-01	Momentary Power Loss Operation Selection	0: Disabled. Drive trips on Uv1 fault when power is lost. 1: Recover within the time set in L2-02. Uv1 will be detected if power loss is longer than L2-02. **2: Recover as long as CPU has power. Uv1 is not detected.**
L2-02	Momentary Power Loss Ride-Thru Time	Sets the Power Loss Ride-Thru time. Enabled only when L2-01 = 1 or 3.
L2-03	Momentary Power Loss Minimum Baseblock Time	Sets the minimum wait time for residual motor voltage decay before the drive output reenergizes after performing Power Loss Ride-Thru.
L2-04	Momentary Power Loss Voltage Recovery Ramp Time	Sets the time for the output voltage to return to the preset V/f pattern during Speed Search.
L2-05	Undervoltage Detection Level (Uv1)	Sets the DC bus undervoltage trip level.
L2-06	KEB Deceleration Time	Sets the time required to decelerate from the speed when KEB was activated to zero speed.
L2-07	KEB Acceleration Time	Sets the time to accelerate to the frequency reference when momentary power loss is over. If set to 0.0, the active acceleration time is used.
L2-08	Frequency Gain at KEB Start	Sets the percentage of output frequency reduction at the beginning of deceleration when the KEB Ride-Thru function is started.
L2-11	DC Bus Voltage Setpoint during KEB	Sets the desired value of the DC bus voltage during KEB Ride-Thru.
L3-01	Stall Prevention Selection during Acceleration	0: Disabled. **1: General purpose. Acceleration is paused as long as the current is above the L3-02 setting.** 2: Intelligent. Accelerate in the shortest possible time without exceeding the L3-02 level.
L3-02	Stall Prevention Level during Acceleration	Used when L3-01 = 1 or 2. 100% is equal to the drive rated current.
L3-03	Stall Prevention Limit during Acceleration	Sets Stall Prevention lower limit during acceleration when operating in the constant power range. Set as a percentage of drive rated current.
L3-04	Stall Prevention Selection during Deceleration	**0: Disabled. Deceleration at the active deceleration rate. An ov fault may occur.** 1: General purpose. Deceleration is paused when the DC bus voltage exceeds the Stall Prevention level. 2: Intelligent. Decelerate as fast as possible while avoiding ov faults. 3: Stall Prevention with braking resistor. Stall Prevention during deceleration is enabled in coordination with dynamic braking. 4: Overexcitation Deceleration. Decelerates while increasing the motor flux. 7: Overexcitation Deceleration 3. Applies more braking power than normal overexcitation deceleration. Yaskawa recommends extra caution due to the heavy load on the motor.
L3-05	Stall Prevention Selection during Run	**0: Disabled. Drive runs at a set frequency. A heavy load may cause speed loss.** 1: Decel time 1. Uses the deceleration time set to C1-02 while Stall Prevention is performed. 2: Decel time 2. Uses the deceleration time set to C1-04 while Stall Prevention is performed.
L3-06	Stall Prevention Level during Run	Enabled when L3-05 is set to 1 or 2. 100% is equal to the drive rated current.
L3-11	Overvoltage Suppression Function Selection	**0: Disabled** 1: Enabled
L3-17	Target DC Bus Voltage for Overvoltage Suppression and Stall Prevention	Sets the desired value for the DC bus voltage during overvoltage suppression and Stall Prevention during deceleration.

No.	Name	Description
L3-20	DC Bus Voltage Adjustment Gain	Sets the proportional gain for KEB Ride-Thru, Stall Prevention, and overvoltage suppression.
L3-21	Accel/Decel Rate Calculation Gain	Sets the proportional gain used to calculate the deceleration rate during KEB Ride-Thru, ov suppression function, and Stall Prevention during deceleration (L3-04 = 2).
L3-23	Automatic Reduction Selection for Stall Prevention during Run	**0: Sets the Stall Prevention level set in L3-06 that is used throughout the entire frequency range.** 1: Automatic Stall Prevention level reduction in the constant output range. The lower limit value is 40% of L3-06.
L3-24	Motor Acceleration Time for Inertia Calculations	Sets the time needed to accelerate the uncoupled motor at rated torque from stop to the maximum frequency.
L3-25	Load Inertia Ratio	Sets the ratio between the motor and machine inertia.
L4-01	Speed Agreement Detection Level	L4-01 sets the frequency detection level for digital output functions H2-□□ = 2, 3, 4, 5.
L4-02	Speed Agreement Detection Width	L4-02 sets the hysteresis or allowable margin for speed detection.
L4-03	Speed Agreement Detection Level (+/-)	L4-03 sets the frequency detection level for digital output functions H2-□□ = 13, 14, 15, 16.
L4-04	Speed Agreement Detection Width (+/-)	L4-04 sets the hysteresis or allowable margin for speed detection.
L4-05	Frequency Reference Loss Detection Selection	**0: Stop. Drive stops when the frequency reference is lost.** 1: Run. Drive runs at a reduced speed when the frequency reference is lost.
L4-06	Frequency Reference at Reference Loss	Sets the percentage of the frequency reference that the drive should run with when the frequency reference is lost.
L4-07	Speed Agreement Detection Selection	**0: No detection during baseblock.** 1: Detection always enabled.
L5-01	Number of Auto Restart Attempts	Sets the number of times the drive may attempt to restart after the following faults occur: GF, LF, oC, oH1, ov, PF, rH, rr, oL1, oL2, oL3, oL4, STo, Uv1.
L5-02	Auto Restart Fault Output Operation Selection	**0: Fault output not active.** 1: Fault output active during restart attempt.
L5-04	Fault Reset Interval Time	Sets the amount of time to wait between performing fault restarts.
L5-40	Low Feedback Fault Retry Selection	**0: No retry** 1: Retry
L5-41	High Feedback Fault Retry Selection	**0: No retry** 1: Retry
L5-42	Feedback Loss Fault Retry Selection	**0: No retry** 1: Retry
L5-50	Setpoint Not Met Retry Selection	**0: No retry** 1: Retry
L5-51	Loss of Prime Fault Retry Selection	**0: No retry** 1: Retry
L5-52	Pump Over Cycle Fault Retry Selection	**0: No retry** 1: Retry
L5-53	Volute-TStat Retry Selection	**0: No retry** 1: Retry **Note:** The drive will restart only after the Volute-Tstat digital input deactivates and the L5-04 timer expires.

No.	Name	Description
L6-01	Torque Detection Selection 1	**0: Disabled** 1: oL3 detection only active during speed agree, operation continues after detection 2: oL3 detection always active during run, operation continues after detection 3: oL3 detection only active during speed agree, output shuts down on an oL3 fault 4: oL3 detection always active during run, output shuts down on an oL3 fault 5: UL3 detection only active during speed agree, operation continues after detection 6: UL3 detection always active during run, operation continues after detection 7: UL3 detection only active during speed agree, output shuts down on an oL3 fault 8: UL3 detection always active during run, output shuts down on an oL3 fault 9: UL6 Alarm at Speed Agree 10: UL6 Alarm during Run 11: UL6 Fault at Speed Agree 12: UL6 Fault during Run
L6-02	Torque Detection Level 1	Sets the overtorque and undertorque detection level.
L6-03	Torque Detection Time 1	Sets the time an overtorque or undertorque condition must exist to trigger torque detection 1.
L6-04	Torque Detection Selection 2	**0: Disabled** 1: oL4 detection only active during speed agree, operation continues after detection 2: oL4 detection always active during run, operation continues after detection 3: oL4 detection only active during speed agree, output shuts down on an oL4 fault 4: oL4 detection always active during run, output shuts down on an oL4 fault 5: UL4 detection only active during speed agree, operation continues after detection 6: UL4 detection always active during run, operation continues after detection 7: UL4 detection only active during speed agree, output shuts down on an oL4 fault 8: UL4 detection always active during run, output shuts down on an oL4 fault
L6-05	Torque Detection Level 2	Sets the overtorque and undertorque detection level.
L6-06	Torque Detection Time 2	Sets the time an overtorque or undertorque condition must exist to trigger torque detection 2.
L6-13	Motor Underload Protection Selection	**0: Base frequency enable** 1: Max frequency enable
L6-14	Motor Underload Protection Level at Minimum Frequency	Sets the UL6 detection level at minimum frequency by percentage of drive rated current.
L8-01	Internal Dynamic Braking Resistor Protection Selection (ERF type)	**0: Resistor overheat protection disabled** 1: Resistor overheat protection enabled
L8-02	Overheat Alarm Level	An overheat alarm occurs when heatsink temperature exceeds the L8-02 level.
L8-03	Overheat Pre-Alarm Operation Selection	0: Ramp to stop. A fault is triggered. 1: Coast to stop. A fault is triggered. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. A fault is triggered. **3: Continue operation. An alarm is triggered.** 4: Continue operation at reduced speed as set in L8-19.
L8-05	Input Phase Loss Protection Selection	0: Disabled **1: Enabled**

No.	Name	Description
L8-07	Output Phase Loss Protection Selection	0: Disabled **1: Enabled (triggered by a single phase loss)** 2: Enabled (triggered when two phases are lost)
L8-09	Output Ground Fault Detection Selection	**0: Disabled** 1: Enabled
L8-10	Heatsink Cooling Fan Operation Selection	**0: During run only. Fan operates only during run for L8-11 seconds after stop.** 1: Fan always on. Cooling fan operates whenever the drive is powered up.
L8-11	Heatsink Cooling Fan Off Delay Time	Sets a delay time to shut off the cooling fan after the Run command is removed when L8-10 = 0.
L8-12	Ambient Temperature Setting	Enter the ambient temperature. This value adjusts the oL2 detection level.
L8-15	oL2 Characteristics Selection at Low Speeds	0: No oL2 level reduction below 6 Hz. **1: oL2 level is reduced linearly below 6 Hz. It is halved at 0 Hz.**
L8-18	Software Current Limit Selection	**0: Disabled** 1: Enabled
L8-19	Frequency Reduction Rate during Overheat Pre-Alarm	Specifies the frequency reference reduction gain at overheat pre-alarm when L8-03 = 4.
L8-35	Installation Method Selection	0: IP00/Open-Chassis enclosure 1: Side-by-Side mounting 2: IP20/NEMA 1, UL Type 1 enclosure 3: Finless model drive or external heatsink installation
L8-38	Carrier Frequency Reduction	0: Disabled **1: Enabled below 6 Hz** 2: Enabled for the entire speed range
L8-40	Carrier Frequency Reduction Off Delay Time	Sets the time that the drive continues running with reduced carrier frequency after the carrier reduction condition is gone. Setting 0.00 s disables the carrier frequency reduction time.
L8-41	High Current Alarm Selection	**0: Disabled** 1: Enabled. An alarm is triggered at output currents above 150% of drive rated current.
n1-01	Hunting Prevention Selection	0: Disabled **1: Enabled**
n1-02	Hunting Prevention Gain Setting	If the motor vibrates while lightly loaded, increase the gain by 0.1 until vibration ceases. If the motor stalls, decrease the gain by 0.1 until the stalling ceases.
n1-03	Hunting Prevention Time Constant	Sets the time constant used for Hunting Prevention.
n1-05	Hunting Prevention Gain while in Reverse	Sets the gain used for Hunting Prevention. If set to 0, the gain set to n1-02 is used for operation in reverse.
n3-13	Overexcitation Deceleration Gain	Applies a gain to the V/f pattern during deceleration (L3-04 = 4). Returns to normal values after ramp to stop or at re-acceleration.
n3-21	High-Slip Suppression Current Level	Sets output current level at which the drive will start reducing the overexcitation gain in order to prevent a too high motor slip during Overexcitation Deceleration. Set as a percentage of the drive rated current.
n3-23	Overexcitation Operation Selection	**0: Enabled in both directions** 1: Enabled only when rotating forward 2: Enabled only when in reverse
o1-01	Drive Mode Unit Monitor Selection	Selects the content of the last monitor that is shown when scrolling through Drive Mode display. Enter the last three digits of the monitor parameter number to be displayed: U☐-☐☐.

No.	Name	Description
o1-02	User Monitor Selection after Power Up	**1: Frequency reference (U1-01)** 2: Direction 3: Output frequency (U1-02) 4: Output current (U1-03) 5: User-selected monitor (set by o1-01)
o1-03	Digital Operator Display Selection	**0: 0.01 Hz** 1: 0.01% (100% = E1-04) 2: r/min (calculated using the number of motor poles setting in E2-04) 3: User-selected units (set by o1-09, o1-10 and o1-11)
o1-05	LCD Contrast Control	Sets the brightness of the optional LCD operator.
o1-06	User Monitor Selection Mode	0: 3 Monitor Sequential (displays the next two sequential monitors) **1: 3 Monitor Selectable (set by o1-07 and o1-08)**
o1-07	Second Line Monitor Selection	Selects the monitor that is shown in the second line. Enter the last three digits of the monitor parameter number to be displayed: U☐-☐☐. For example, set "403" to display monitor parameter U4-03. **Note:** Parameter is effective only when o1-06 is set to 1.
o1-08	Third Line Monitor Selection	Selects the monitor that is shown in the third line. Enter the last three digits of the monitor parameter number to be displayed: U☐-☐☐. For example, set "403" to display monitor parameter U4-03. **Note:** Parameter is effective only when o1-06 is set to 1.
o1-09	Frequency Reference Display Units	Sets unit display for the frequency reference parameters and frequency related monitors when o1-03 = 3. 0: WC (Inch of water) 1: PSI (Pounds per square inch) 2: GPM (Gallons per minute) 3: F (Degrees Fahrenheit) 4: CFM (Cubic feet per minute) 5: CMH (Cubic meters per hour) 6: LPH (Liters per hour) 7: LPS (Liters per second) 8: Bar (Bar) 9: Pa (Pascal) 10: C (Degrees Celsius) 11: Mtr (Meters) 12: Ft (Feet) 13: LPM (Liters per minute) 14: CMM (Cubic meters per minute) 15: “Hg (inches of mercury) **25: None**
o1-10	User-Set Display Units Maximum Value	These settings define the display values when o1-03 is set to 3. o1-10 sets the display value that is equal to the maximum output frequency. o1-11 sets the position of the decimal position.
o1-11	User-Set Display Units Decimal Display	
o1-12	Home Help Text	0: Disabled **1: Enabled**
o2-02	STOP Key Function Selection	0: Disabled. STOP key is disabled in REMOTE operation. **1: Enabled. STOP key is always enabled.**
o2-03	User Parameter Default Value	**0: No change.** 1: Set defaults. Saves parameter settings as default values for a User Initialization. 2: Clear all. Clears the default settings that have been saved for a User Initialization.
o2-04	Drive Model Selection	Enter the drive model. Setting required only if installing a new control board.

No.	Name	Description
o2-05	Frequency Reference Setting Method Selection	**0: ENTER key must be pressed to enter a frequency reference.** 1: ENTER key is not required. The frequency reference can be adjusted using the up and down arrow keys only.
o2-06	Operation Selection when Digital Operator is Disconnected	**0: The drive continues operating if the digital operator is disconnected.** 1: An oPr fault is triggered and the motor coasts to stop.
o2-07	Motor Direction at Power Up when Using Operator	This parameter requires assigning drive operation to the digital operator. **0: Forward** 1: Reverse
o2-30	Monitor Position Save	Saves the monitor position and Home Screen quick monitor selection. **0: Disabled** 1: Enabled
o3-01	Copy Function Selection	**0: No action** 1: Read parameters from the drive, saving them onto the digital operator. 2: Copy parameters from the digital operator, writing them to the drive. 3: Verify parameter settings on the drive to check if they match the data saved on the operator.
o3-02	Copy Allowed Selection	**0: Read operation prohibited** 1: Read operation allowed
o4-01	Cumulative Operation Time Setting	Sets the value for the cumulative operation time of the drive in units of 10 h.
o4-02	Cumulative Operation Time Selection	0: Logs power-on time **1: Logs operation time when the drive output is active (output operation time).**
o4-03	Cooling Fan Operation Time Setting	Sets the value of the fan operation time monitor U4-03 in units of 10 h.
o4-05	Capacitor Maintenance Setting	Sets the value of the Maintenance Monitor for the capacitors. See U4-05 to check when the capacitors may need to be replaced.
o4-07	DC Bus Pre-Charge Relay Maintenance Setting	Sets the value of the Maintenance Monitor for the soft charge bypass relay. See U4-06 to check when the bypass relay may need to be replaced.
o4-09	IGBT Maintenance Setting	Sets the value of the Maintenance Monitor for the IGBTs. See U4-07 for IGBT replacement times.
o4-11	U2, U3 Initialization	**0: U2-□□ and U3-□□ monitor data is not reset when the drive is initialized (A1-03).** 1: U2-□□ and U3-□□ monitor data is reset when the drive is initialized (A1-03).
o4-12	kWh Monitor Initialization	**0: U4-10 and U4-11 monitor data is not reset when the drive is initialized (A1-03).** 1: U4-10 and U4-11 monitor data is reset when the drive is initialized (A1-03).
o4-13	Number of Run Commands Counter Initialization	**0: Number of Run commands counter is not reset when the drive is initialized (A1-03).** 1: Number of Run commands counter is reset when the drive is initialized (A1-03).
o4-17	Set/Reset Real-Time Clock	**0: - -** 1: Set 2: Reset
o4-20	Time Display Format	**0: 12-hour** 1: 24-hour
P1-01	Pump Mode	**0: Drive only** 3: MEMOBUS network

No.	Name	Description
P1-02	System Units	0: No unit **1: PSI: Pounds per square inch** 2: Pa: Pascals 3: Bar: Bar 4: ”WC: Inch of water 5: ”Hg: Inch of Mercury 6: ft: feet 7: m: meters 8: °F: Degrees Fahrenheit 9: °C: Degrees Celsius 10: Percent
P1-03	Feedback Device Scaling	Sets the scaling of feedback device in user-set units.
P1-04	Start / Draw Down Level	The system starts when the feedback level drops below the start level for the time set in P1-05. This level also specifies the wake-up level when the drive is in Sleep Mode. **Note:** When PID operates in reverse mode, the system will start when the feedback has risen above the start level for the time set to P1-05.
P1-05	Start Level Delay Time	The system starts when the feedback level drops below the start level for the time set in this parameter.
P1-06	Minimum Pump Speed	Minimum frequency at which the drive will run. Applies to both HAND and AUTO Modes. **Note:** For minimum pump frequency, the drive will use the highest setting from among P1-06, P4-12 (Thrust Bearing Frequency), or d2-02 (Reference Lower Limit).
P1-07	Minimum Pump Speed Units	**0: Hz** 1: RPM **Note:** Changing this parameter will reset the P1-06 default value.
P1-08	Low Feedback Level	Sets the lower detection level for the PID feedback.
P1-09	Low Feedback Level Fault Delay Time	Sets the amount of delay time from when the low feedback is detected until the drive faults on an “LFB Low Feedback” fault. **Note:** This parameter is effective only when P1-10 is set to 0 (Fault).
P1-10	Low Feedback Selection	**0: Fault** 1: Alarm 2: Digital out only
P1-11	High Feedback Level	Sets the upper detection level for the PID feedback. **Note:** When P1-03 is set to 3, parameter P9-18 uses the value set here to calculate quick de-stage feedback level.
P1-12	High Feedback Level Fault Delay Time	Sets the amount of delay time from when the high feedback is detected until the drive faults on a “HFB High Feedback” fault. **Note:** This parameter is effective only when P1-13 is set to 0 (Fault (and digital out)).
P1-13	High Feedback Selection	**0: Fault** 1: Alarm 2: Digital out only
P1-14	Hysteresis Level	Sets the hysteresis level used for low and high level feedback detection.
P1-15	Maximum Setpoint Difference	Sets the level that the difference between the setpoint and the feedback must exceed for the time set in P1-16 to trigger the drive response set in P1-17.
P1-16	Not Maintaining Setpoint Time	Sets the delay time before a “Setpoint Not Met” condition occurs. The pump protection criteria set in P1-15 must be met before the timer will start.
P1-17	Not Maintaining Setpoint Selection	**0: Fault** 1: Alarm 2: Digital out only

No.	Name	Description
P1-18	Prime Loss Detection Method	**0: Current (A)** 1: Power (kW) 2: Torque (%)
P1-19	Prime Loss Level	Detects loss of prime in the pump when in Auto or Sleep Boost Mode.
P1-20	Loss of Prime Time	Sets the delay time before a "Loss of Prime" condition occurs. The pump protection criteria set in P1-18 and P1-19 must be met before the timer will start.
P1-21	Loss of Prime Frequency	Sets the frequency level above which the "Loss of Prime" detection is enabled when set to a value other than 0.
P1-22	Loss of Prime Selection	**0: Fault** 1: Alarm 2: Digital out only
P1-23	Loss of Prime Maximum Restart Time after Fault	Sets the time in minutes that the drive will wait before attempting another restart when the restart fails or is not attempted due to a continuing fault condition.
P1-30	Low Water Digital Input Configuration	**0: Normally open** 1: Normally closed
P1-31	High Water Digital Input Configuration	**0: Normally open** 1: Normally closed
P2-01	Sleep Level Type	**0: Output frequency** 1: Output current 2: Feedback 3: Output speed (RPM) **Note:** Feedback depends on PID direction operation.
P2-02	Sleep Level	Sleep activates when the selected level type (P2-01 setting) reaches the programmed sleep level for the time set in P2-03.
P2-03	Sleep Delay Time	Sets the delay time before the drive enters Sleep Mode when the sleep level set in P2-02 is reached.
P2-04	Sleep Activate Level	Sets the level above which the output frequency must rise to activate the sleep function when P2-01, Sleep Level Type, is set to 0 (Output Frequency / Speed).
P2-05	Sleep Boost Level	Sets the amount of boost applied to the setpoint before going to sleep. Setting this parameter to 0.0 disables the function.
P2-06	Sleep Boost Hold Time	Sets the amount of time that the boosted pressure will be maintained before the drive goes to sleep.
P2-07	Sleep Boost Maximum Time	Sets the amount of time that the system (feedback) has to reach the boosted setpoint. The drive will go to sleep when the amount of time set in this parameter has been exceeded.
P2-08	Delta Sleep Feedback Drop Level	If the PID Error (setpoint minus feedback) exceeds the level programmed in this parameter within the time window set in P2-09 and the output frequency is greater than the level set in P1-06, the sleep operation deactivates and the drive returns to normal operation.
P2-09	Feedback Detection Drop Time	Defines the time window in which the software monitors the feedback to detect a flow/no-flow condition.
P2-10	Sleep Mode: Cycling Protection	Sets the maximum number of cycles that are allowed within the time specified in P2-11 before tripping the PoC "Pump Over Cycle" fault.
P2-11	Sleep Mode: Maximum Cycling Protection Time	Sets the maximum time allowed between cycles. When no cycling occurs within the programmed time, the drive will decrease the internal cycle register.

No.	Name	Description
P2-12	Over Cycling Mode	**0: Disabled** 1: Alarm 2: Fault 3: Auto SP Compensation
P2-13	Setpoint Compensation	Allows for the software to automatically compensate the setpoint in the event of excessive cycling.
P2-14	Maximum Setpoint Compensation	Sets the maximum allowed setpoint compensation for over-cycling function.
P2-23	Anti-No-Flow Bandwidth	Sets the amount of PI error bandwidth used to detect the Anti-No-Flow condition.
P2-24	Anti-No-Flow Detection Time	Sets the time delay before the drive starts the increased deceleration rate after Anti-No-Flow is detected.
P2-25	Anti-No-Flow Release Level	Sets the amount below the setpoint which the feedback must drop to disengage the Anti-No-Flow and return to normal PI operation.
P4-01	Pre-Charge Level	Runs the drive at the frequency set in P4-02.
P4-02	Pre-Charge Frequency	Sets the frequency reference used when the Pre-Charge function is active.
P4-03	Pre-Charge Time	Sets the time at which the drive will spend at the Pre-Charge Frequency 1 during pre-charge. Maximum pre-charge time is P4-03 + P4-07.
P4-05	Pre-Charge Loss of Prime Level	Detects loss of prime in the pump during Pre-charge 1. When the measured quantity determined by P1-18 drops below this level for the time set in P1-20 and the output frequency is at the level set in P4-02, a "Loss of Prime" condition occurs. The drive responds to the "Loss of Prime" condition depending on the setting of P1-22, Loss of Prime Selection.
P4-06	Pre-Charge Frequency 2	Sets the frequency reference used when the Pre-Charge function 2 is active. Setting this parameter to 0.0 disables the function.
P4-07	Pre-Charge Time 2	Sets the time at which the drive will spend at the Pre-Charge frequency 2 during pre-charge. Maximum pre-charge time is P4-03 + P4-07.
P4-08	Pre-Charge Loss of Prime Level 2	Detects loss of prime in the pump. When the measured quantity determined by P1-18 drops below this level for the time set in P1-20 and the output frequency is at the level set in P4-06, a "Loss of Prime" condition occurs. The drive responds to the "Loss of Prime" condition depending on the setting of P1-22, Loss of Prime Selection.
P4-10	AUTO Mode Operator Run Power Down Storage	**0: Disabled** 1: Enabled **WARNING!***Sudden Movement Hazard. If the drive is powered down while running, it will automatically initiate an internal Run command upon power-up.*
P4-11	Thrust Bearing Acceleration Time	Sets the time at which the drive output frequency will ramp up to the reference frequency set in P4-12.
P4-12	Thrust Bearing Frequency	The drive will accelerate to this frequency in the time set to P4-11. The drive will decelerate from the frequency in the time set to P4-13.

No.	Name	Description
P4-13	Thrust Bearing Deceleration Time	Sets the amount of time it takes to bring the drive from the Thrust Frequency set in P4-12 to stop when Thrust Mode is active. When the Run command is removed while the drive is operating in Thrust Mode above the Thrust Frequency, the time set in this parameter is used when the frequency reference is at or below the thrust frequency.
P4-17	Utility Start Delay	Sets the amount of time that the drive will delay starting if a Run command is present at power-up. When P1-01, Pump Mode, is set to 3 (MEMOBUS network), the drive is unavailable to the network (Pump Off Network) when the function is active. Setting this parameter to 0.0 disables the function.
P4-21	Low City Input Select	0: Normally open (closed indicates the Low City Pressure condition) **1: Normally closed (open indicates the Low City Pressure condition)**
P4-22	Low City On-Delay Time	Sets the amount of time a Low City Pressure condition needs to be present before the drive will stop.
P4-23	Low City Off-Delay Time	Sets the amount of time a Low City Pressure condition needs to be absent before the drive will restart.
P4-24	Low City Alarm Text	**0: Low city pressure** 1: Low suction pressure 2: Low water in tank
P4-25	Remote Drive Disable Selection	0: Normally open (closed indicates the Remote Drive Disable condition) **1: Normally closed (open indicates the Remote Drive Disable condition)**
P4-26	Remote Drive Disable On-Delay	Sets the amount of time a Remote Drive Disable condition must be present before the drive will stop.
P4-27	Remote Drive Disable Off-Delay	Sets the amount of time a Remote Drive Disable condition must be absent before the drive will run.
P4-29	Lube Pump Message Text	**0: Lube Pump** 1: Digital Out Delay
P4-30	Lube Pump Active During Run	**0: Disabled** 1: Active During Run
P4-31	Lube Pump / Digital Output Delay Timer	Sets the amount of time to delay the drive output and to energize the digital output (H2-□□ = 8B) before the drive is allowed to run.
P4-32	Pre-charge Level 2	For normal PI operation during Pre-charge 2, if the PI Feedback signal rises above the P4-32 level, Pre-charge 2 is cancelled and the drive resumes normal operation.
P5-01	HAND Mode Ref Source	Sets the HAND Mode reference. 0: Analog input **1: P5-02 (HAND reference)**
P5-02	HAND Reference 1	Sets the frequency reference used when HAND Mode is active and P5-01 is set to 1.
P5-03	HAND/AUTO During Run Selection	**0: Disabled** 1: Enabled
P5-04	HAND Key Function Selection	0: Disabled **1: Enabled**
P5-05	HAND Reference 2	Sets the frequency reference used when HAND Mode 2 is active.
P5-06	HAND Ref. 1 Loss of Prime Level	Detects loss of prime in the pump when in HAND Mode.
P5-07	HAND Ref. 2 Loss of Prime Level	Detects loss of prime in the pump when in HAND Mode 2.
P5-09	HAND References Set via Motor Operated Pot Selection	**0: Disabled** 1: Enabled
P7-01	Anti-Jam Operation Selection	**0: Disabled** 1: Enabled
P7-02	Anti-Jam Cycle Count	Sets the maximum number of cycles that will be attempted before triggering and Anti-Jam fault.
P7-03	Anti-Jam Detection Current Level	Sets the current level at start that will trigger the anti-jam function. Set as a percentage of the motor rated current.
P7-04	Anti-Jam Detection Time at Start	Sets the length of time that current must rise above the level set in P7-03 to trigger the anti-jam function.
P7-05	Anti-Jam During Run Current	Sets the current level during run that will trigger the anti-jam function. Set as a percentage of motor rated current. Setting this parameter to 0 will disable anti-jam during run.
P7-06	Anti-Jam During Run Time	Sets the length of time that the current must rise above the level set in P7-05 to trigger the anti-jam function. Restricted to simplex only.
P7-07	Anti-Jam Frequency Reference	Sets the maximum speed allowed when the anti-jam function is active.
P7-08	Anti-Jam Release Time	Sets the length of time that the current must fall below the level set in P7-03 to resume normal operation.
P9-01	Lead Drive Selection	0: Next available **1: Lowest runtime** 2: Stop history
P9-02	Feedback Source	**0: Analog only** 1: Ana->Net, No Alrm 2: Ana->Net, Alarm 3: Network only
P9-03	Alternation Time	Specifies the time for a drive to request alternation. Setting this parameter to 0 disables the function.
P9-04	Alternation Mode	**0: FIFO auto** 1: FIFO forced 2: LIFO 3: FIFO @sleep
P9-05	Lag Drive Mode	**0: Fixed speed. The drive runs at the P9-06 setting after the time set in P9-07 expires.** 2: Turn off. The drive stops running when it switches to a lag drive after the time set in P9-07 expires. 3: Follow Lead Speed. The drive will follow the speed of the current lead drive, applying P9-30 gain and P9-31 bias.
P9-06	Lag Fixed Speed	Sets the speed at which the drive will run when the drive changes from a lead to a lag and the time set in P9-07 has expired.
P9-07	Lag Fixed Speed Delay	Specifies how long speed is latched before performing the function specified in P9-05 when the drive changes from a lead to a lag.
P9-08	Add Pump Mode	0: Output frequency 1: Feedback **2: Feedback + Fout**

No.	Name	Description
P9-09	Add Frequency Level	When P9-08 is set to 0, this parameter sets the level above which the output frequency needs to rise for the time set in P9-11 before the lead drive will send a request for a new lead drive via the iQPump MEMOBUS network. When P9-08 is set to 2 and the delta feedback (setpoint minus feedback) has exceeded the level set in P9-10 for the time set in P9-11, this parameter sets the level above which the output frequency needs to rise before the lead drive will send a request for a new lead drive via the iQPump MEMOBUS network.
P9-10	Add Delta Level	When P9-08 is set to 1, this parameter sets the level above which the delta feedback (setpoint minus feedback) must rise for the time set in P9-11 before the lead drive will send a request for a new lead drive via the iQPump MEMOBUS network. When P9-08 is set to 2 and the output frequency has exceeded the level set in P9-09 for the time set in P9-11, this parameter sets the level above which the delta feedback (setpoint minus feedback) needs to rise before the lead drive will send a request for a new lead drive via the iQPump MEMOBUS network.
P9-11	Add Delay Time	Sets the delay time before a new lead drive is added to the system.
P9-12	Remove Pump Mode	**0: Output frequency** 1: Feedback 2: Feedback + Fout
P9-13	Remove Frequency Level	When P9-12 is set to 0, this parameter sets the level below which the output frequency must fall for the time set in P9-15 before the lead drive will send a request to be removed from the system via the iQPump MEMOBUS network. When P9-12 is set to 2 and the delta feedback (feedback minus setpoint) has exceeded the level set in P9-14 for the time set in P9-15, this parameter sets the level below which the output frequency must fall before the lead drive will request to be removed from the system via the iQPump MEMOBUS network.
P9-14	Remove Delta Level	When P9-12 is set to 1, this parameter sets the level above which the delta feedback (feedback minus setpoint) must rise for the time set in P9-15 before the lead drive will request to be removed from the system via the iQPump MEMOBUS network. When P9-12 is set to 2 and the output frequency has exceeded the level set in P9-13 for the time set in P9-15, this parameter sets the level above which the delta feedback (feedback minus setpoint) frequency must rise before the lead drive will request to be removed from the system via the iQPump MEMOBUS network.
P9-15	Remove Delay Time	Sets the delay time before the lead drive is removed from the system.
P9-16	Stabilization Time	Sets the time used to stabilize the system when a pump is staged or de-staged. Lead/lag control and pump protection are suspended during this time.
P9-17	Setpoint Modifier	Sets the value by which the system setpoint is incremented depending on the number of pumps that are running. Pump 1: Setpoint Pump 2: Setpoint + ((X-1) (P9-17))

No.	Name	Description
P9-18	High Feedback Quick De-Stage	Sets the feedback level that will trigger a quick de-stage. Set as a percentage of the P1-11 value. The quick de-stage ignores parameters P9-12 to P9-15 and uses an internal 2 second delay. Setting this parameter to 0.0 disables the feature.
P9-19	Alternation Unit	Sets the units used in P9-03. **0: Hours (H)** 1: Minutes (min)
P9-20	Allow Network Run	**0: Always** 1: First/alternation 2: First only 3: Alternation only
P9-21	Run Priority	Sets the lead drive selection priority overriding the P9-01 selection. Lower value = Higher priority. If multiple drives have the lowest P9-21 value, then P9-01 determines which drive becomes the lead.
P9-22	System Fault Retry	Sets the number of times that the iQPump MEMOBUS network will allow automatic restarts of system faults. The drive uses L5-04, Fault Reset Interval Time, to determine when to attempt a system fault restart. Set this parameter to the same value for all drives on the network.
P9-23	Maximum Number of Running Pumps	Sets the maximum number of pumps that can run on the system.
P9-24	Lead Swap at Sleep	Sets the length of time for which the lead drive will be in Sleep Mode before this drive will request a swap when there is another drive available with a lower P9-21 setting. Setting this parameter to 0 will disable the function.
P9-25	Highest Node Address	Sets the highest possible node address in the MEMOBUS network. For optimal network performance, set the serial communication address H5-01 beginning with 01h consecutively up to the last drive and then set this parameter to that H5-01 address.
P9-26	Master Time-out	Sets the minimum amount of time that the slave drives will wait for a message from the master before performing the action set in P9-27.
P9-27	Network Recovery	**0: Automatic. The drive will attempt to assume master functionality.** 1: Slave/Resume. The drive will continue running when the master is lost and will wait for a master to come online. 2: Slave/Stop. The drive will stop running when the master is lost and will wait for a master to come online. 3: Fault MSL. Fault the drive with an MSL (Master Lost).
P9-28	NETSCAN Alarm Time	Sets the amount of time that the slave drives will wait for a message from the master before displaying a NETSCAN alarm.
P9-29	Net Start Delay	Sets the amount of time that the network will wait before selecting and starting the lead drive after the first drive on the network has been put on AUTO Mode.
P9-30	Lag Drive Speed Follower Gain	Sets the gain to be applied to the speed of the current lead drive when P9-05 is set to 3. The bias to be applied is set in P9-31.
P9-31	Lag Drive Speed Follower Bias	Sets the bias to be applied to the speed of the current lead drive when P9-05 is set to 3. The gain to be applied is set in P9-30.

No.	Name	Description
P9-32	Lag Follower Deceleration Time	Sets the deceleration time when the P9-33 timer is running and the drive is running as Lag Drive Speed Follower (P9-05 is set to 3).
P9-33	Lag Follower Deceleration Time Active Time	Sets the time during which the deceleration time set in P9-32 is effective. The drive will use the standard deceleration rate when it expires. Setting this parameter to 0.0 disables the function.
P9-34	Low Feedback Quick De-Stage	Sets the low feedback level that will trigger a quick de-stage. The quick de-stage ignores parameters P9-12 and P9-15 and only uses an internal 2 second delay. Setting this parameter to 0.0 disables the function.
P9-99	Network Compatibility Selection	0: A-Ver: 30034 1: B-Ver: 30035/36 **2: iQ SmartNetwork**
Q1-01	PID Controller Setpoint 1	Sets the PID Setpoint when b1-01 is set to 0.
Q1-02	PID Controller Setpoint 2	Sets the PID Setpoint when the “Multi Setpoint 1” or "Alternate Multi Setpoint 1" multi-function digital input is closed.
Q1-03	PID Controller Setpoint 3	Sets the PID Setpoint when the “Multi Setpoint 2” or "Alternate Multi Setpoint 2" digital input is closed.
Q1-04	PID Controller Setpoint 4	Sets the PID Setpoint when the “Multi Setpoint 1” and “Multi Setpoint 2” or “Alternate Multi Setpoint 3” multi-function digital inputs are closed.

No.	Name	Description
Q1-09	PID Setpoint Set via Motor Operated Pot	Selects whether parameters Q1-01 to Q1-04 are changed via MOP from the home screen. **0: Disabled** 1: Enabled
Q3-01	Output Current Limit Select	**0: Disabled** 1: Enabled
Q3-02	Current Limit	Sets the current limit. Value is internally limited to 300% of the drive rated current.
Q3-10	Ripple Regulator Selection	0: Disabled **1: Enabled** 2: Enabled w/ Line Reactor
Q3-11	Ripple Regulator Setpoint	Set as a percentage of the maximum amount of ripple allowed before triggering an input phase loss fault.
S6-01	Emergency Override Speed	Sets the speed command used in emergency override mode when S6-02 = 0.
S6-02	Emergency Override Reference Selection	**0: Use S6-01 Reference** 1: Use Frequency Reference
T1-01	Auto-Tuning Mode Selection	**2: Stationary Auto-Tuning for Line-to-Line Resistance**
T1-02	Motor Rated Power	Sets the motor rated power as specified on the motor nameplate.
T1-04	Motor Rated Current	Sets the motor rated current as specified on the motor nameplate.

i.10 Standards Compliance

◆ UL Standards Compliance

The UL/cUL mark applies to products in the United States and Canada and indicates that UL has performed product testing and evaluation and determined that their stringent standards for product safety have been met. For a product to receive UL certification, all components inside that product must also receive UL certification.

Figure i.42 UL/cUL Mark

This drive is tested in accordance with UL standard UL508C and complies with UL requirements. The following conditions must be met to maintain compliance when using this drive in combination with other equipment:

■ Installation Area

Do not install the drive to an area greater than pollution degree 2 (UL standard).

■ Ambient Temperature

IP20/NEMA 1, UL Type 1 enclosure: -10 °C to +40 °C (14 °F to 104 °F)

IP66/NEMA 4X, UL Type 4X enclosure: -10 °C to +40 °C (14 °F to 104 °F)

◆ IP66/NEMA 4X, UL Type 4X Conditions of Acceptability

Adhere to the installation conditions specified in this manual to take full advantage of the IP66/NEMA 4X, UL Type 4X design of this drive.

■ Resistance Against Chemicals and Solvents

Table i.27 lists the information on chemical and solvent tolerability of the drive. The drive enclosure meets these requirements:

- UL50E: Enclosures for Electrical Equipment, Environmental Considerations **NEMA 4X, UL Type 4X**
- International Standard IEC 60529 Degrees of protection provided by enclosures (IP Code) **IP66**

Refer to the appropriate enclosure specification for more details on the enclosures resistance to chemicals and solvents.

Table i.27 Chemical and Solvent Tolerability

Reagent	Solvent
• Hydrochloric acid (10%) • Sulfuric acid (10%) • Nitric acid (10%) • Ammonia water • Sodium chloride	• Methanol • Ethanol

NOTICE: *Do not allow a stream of chemicals or solvents to be sprayed directly onto the drive enclosure. Failure to do so can damage the drive.*

NOTICE: *Prevent moisture and other solvents from entering the drive enclosure when removing the front cover. Failing to do so can damage the drive or considerably shorten its expected performance life.*

■ Main Circuit Terminal Wiring

Yaskawa recommends using closed-loop crimp terminals on all drive models. UL/cUL approval requires the use of UL Listed closed-loop crimp terminals when wiring the drive main circuit terminals. Use only the tools recommended by the terminal manufacturer for crimping. The wire gauges listed below are Yaskawa recommendations. Refer to local codes for proper wire gauge selections.

Wire Gauges and Tightening Torques

Refer to Wire Gauges and Tightening Torques on page 55 for details.

■ Factory Recommended Branch Circuit Protection for UL Compliance

Yaskawa recommends installing one of the following types of branch circuit protection to maintain compliance with UL508C. Semiconductor protective type fuses are preferred.

Branch circuit protection shall be provided by any of the following according to *Table i.28*.

- Non-time Delay Class J, T, or CC fuses.
- Time Delay Class J, T, CC, or RK5 fuses.
- Semiconductor fuses.
- Molded Case Circuit Breakers (MCCB).

Table i.28 Factory Recommended Drive Branch Circuit Protection

Drive Model	Non-time Delay Fuse Rating (A) <1>	Time Delay Fuses		Bussmann Semiconductor Fuse Part Number (Fuse Ampere) <4>	MCCB <5>	
		Class J, T, or CC Fuse Rating (A) <2>	Class RK5 Fuse Rating (A) <3>		Rating (A)	Minimum Enclosure Volume (in^3)
200 V Class Single-Phase Drives						
BV0006	40	20	30	FWH-80B (80)	30	1152
BV0010	40	35	45	FWH-100B (100)	50	1152
BV0012	50	40	50	FWH-125B (125)	60	1152
BV0018	80	60	70	FWH-175B (175)	80	1152
200 V Class Three-Phase Drives						
2V0006	20	10	15	FWH-25A14F (25)	15	1152
2V0010	25	15	20	FWH-70B (70)	25	1152
2V0012	25	20	30	FWH-70B (70)	30	1152
2V0020	40	40	50	FWH-90B (90)	60	1152
2V0030	–	60	80	FWH-100B (100)	90	1152
2V0040	–	90	110	FWH-200B (200)	125	1152
2V0056	–	110	150	FWH-200B (200)	150	2560
2V0069	–	125	175	FWH-200B (200)	200	2560
400 V Class Three-Phase Drives						
4V0002	6	3.5	3	FWH-40B (40)	15	1152
4V0004	15 <6>	7	8	FWH-50B (50)	15	1152
4V0005	20 <7>	10	10	FWH-70B (70)	15	1152
4V0007	25 <8>	12	15	FWH-70B (70)	20	1152
4V0009	25	15	20	FWH-90B (90)	20	1152
4V0011	30	20	30	FWH-90B (90)	35	1152
4V0018	–	35	45	FWH-80B (80)	50	1152
4V0023	–	40	50	FWH-100B (100)	60	1152
4V0031	–	60	80	FWH-125B (125)	90	1152
4V0038	–	70	90	FWH-200B (200)	110	1152

<1> Maximum 300% of drive input current rating for any Class J, T, or CC fuse except for models 4V0004, 4V0005, and 4V0007.

<2> Maximum 175% of drive input current rating for any Class J, T, or CC fuse.

<3> Maximum 225% of drive input current rating for any Class RK5 fuse.

<4> When using semiconductor fuses, Bussmann FWH are required for UL compliance.

<5> Maximum MCCB Rating is 15 A or 200% of drive input current rating, whichever is larger. MCCB voltage rating must be 600 Vac or greater. Additionally, when using MCCBs for protection, the drive must be installed in a ventilated enclosure with minimum volume according the "Minimum Enclosure Volume" column.

<6> Model 4V0004 requires Mersen (Ferraz) part number A6T15 for compliance.

<7> Model 4V0005 requires Mersen (Ferraz) part number A6T20 for compliance.

<8> Model 4V0007 requires Mersen (Ferraz) part number A6T25 for compliance.

■ Low Voltage Wiring for Control Circuit Terminals

Wire low voltage wires with NEC Class 1 circuit conductors. Refer to national state or local codes for wiring. The external power supply shall be a UL-Listed Class 2 power source or equivalent.

Table i.29 Control Circuit Terminal Power Supply

Input / Output	Terminal Signal	Power Supply Specifications
Multi-function photocoupler output	P1, P2, PC	Requires class 2 power supply
Multi-function digital inputs	S1, S2, S3, S4, S5, S6, S7, SC	Use the internal power supply of the drive. Use class 2 for external power supply.
Multi-function analog inputs	A1, A2, AC	Use the internal power supply of the drive. Use class 2 for external power supply.
Pulse train input	RP	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.
Pulse train output	MP	Use the internal LVLC power supply of the drive. Use class 2 for external power supply.

■ Drive Short-Circuit Rating

This drive has undergone the UL short-circuit test, which certifies that during a short circuit in the power supply the current flow will not rise above 31,000 amps maximum at 240 V for 200 V class drives and 480 V for 400 V class drives.

- The MCCB and breaker protection and fuse ratings shall be equal to or greater than the short-circuit tolerance of the power supply being used.
- Suitable for use on a circuit capable of delivering not more than 31,000 RMS symmetrical amperes for 240 V in 200 V class drives (up to 480 V for 400 V class drives) motor overload protection.

◆ Drive Motor Overload Protection

Set parameter E2-01 (motor rated current) to the appropriate value to enable motor overload protection. The internal motor overload protection is UL Listed and in accordance with the NEC and CEC.

■ E2-01: Motor Rated Current

Setting Range: Model Dependent

Default Setting: Model Dependent

Parameter E2-01 (motor rated current) protects the motor if parameter L1-01 is not set to 0 (default is 1, standard induction motor protection enabled).

If Auto-Tuning has been performed successfully, the motor data that was entered in T1-04 is automatically written into parameter E2-01. If Auto-Tuning has not been performed, manually enter the correct motor rated current in parameter E2-01.

■ L1-01: Motor Overload Protection Selection

The drive has an electronic overload protection function (oL1) based on time, output current and output frequency, which protects the motor from overheating. The electronic thermal overload function is UL-recognized, so it does not require an external thermal overload relay for single motor operation.

This parameter selects the motor overload curve used according to the type of motor applied.

Table i.30 Overload Protection Settings

Setting	Description
0	Disabled
1	Standard Fan-Cooled Motor (Default)
2	Drive Duty Motor with a Speed Range of 1:10
3	Vector Motor with a Speed Range of 1:100
6	Standard Fan-Cooled Motor (50 Hz)

Disable the electronic overload protection (L1-01 = 0: Disabled) and wire each motor with its own motor thermal overload when connecting the drive to more than one motor for simultaneous operation.

Enable the motor overload protection (L1-01 = “1”, “2”, or “3”) when connecting the drive to a single motor unless there is another means of preventing motor thermal overload. The electronic thermal overload function causes an oL1 fault, which shuts off the output of the drive and prevents additional overheating of the motor. The motor temperature is continually calculated as long as the drive is powered up.

■ L1-02: Motor Overload Protection Time

Setting Range: 0.1 to 5.0 Minutes

Factory Default: 1.0 Minutes

The L1-02 parameter sets the allowed operation time before the oL1 fault occurs when the drive is running at 60 Hz and 150% of the full load amp rating (E2-01) of the motor. Adjusting the value of L1-02 can shift the set of oL1 curves up the Y-axis of the diagram below but will not change the shape of the curves.

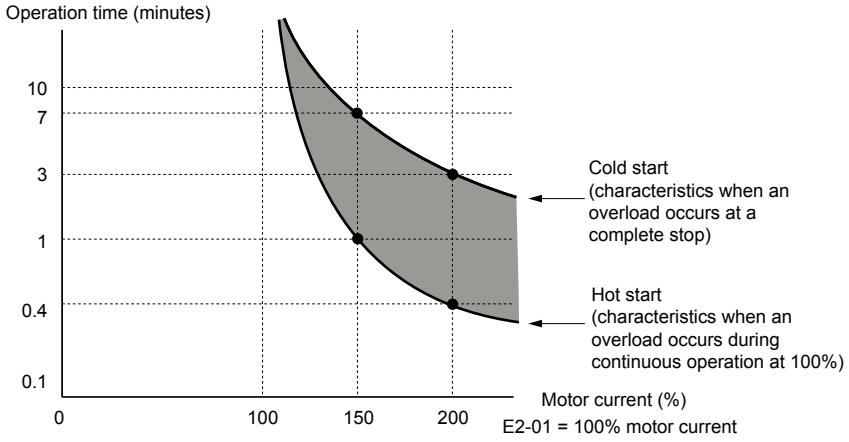


Figure i.43 Motor Overload Protection Time

Revision History

The revision dates and the numbers of the revised manuals appear on the bottom of the back cover.

Example:
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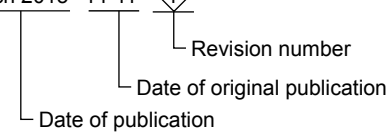

Date of Publication	Revision Number	Section	Revised Content
September 2015	<2>	All	Revision: NEMA/UL nomenclature to conform with UL standards
		Preface	Revision: Quick Start Procedure
		Troubleshooting	Addition: LED and LCD operator codes
March 2015	<1>	Standards Compliance	Addition: Factory Recommended Branch Circuit Protection for UL Compliance
November 2014	–	–	First Edition. This manual supports drive software version PRG: 0100.

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Quick Start Guide

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