YASKAWA

Low Harmonic Drive for HVAC Applications

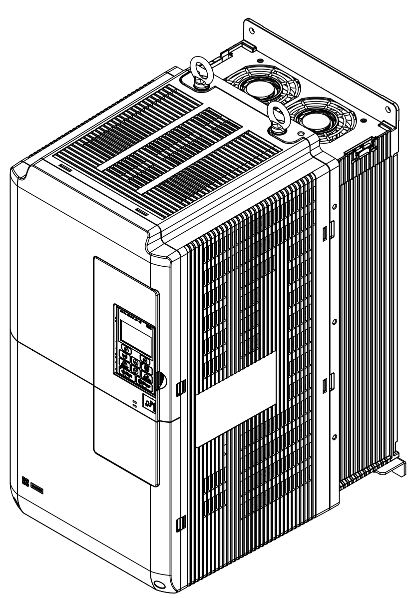
Z1000U HVAC MATRIX Drive

Programming Manual

Type: CIMR-ZU☐

Models: 200 V Class: 7.5 to 75 kW (10 to 100 HP ND)
400 V Class: 5.5 to 260 kW (7.5 to 350 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. SIEP C710636 10D

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Parameter Details

1.1 A: Initialization

The initialization group contains parameters associated with initial drive setup, including parameters involving the display language, access levels, initialization, and password.

◆ A1: Initialization

■ A1-00: Language Selection

Selects the display language for the HOA keypad.

Note: This parameter is not reset when the drive is initialized using parameter A1-03.

No.	Parameter Name	Setting Range	Default
A1-00	Language Selection	0, 1, 3, 5, 6	0

Setting 0: English

Setting 1: Japanese

Setting 3: French

Setting 5: Spanish

Setting 6: Portuguese

■ A1-01: Access Level Selection

Allows or restricts access to drive parameters.

No.	Parameter Name	Setting Range	Default
A1-01	Access Level Selection	0 to 2	2

Setting 0: Operation Only

A1-01, A1-04, and Drive Mode can be accessed and set. All U monitor parameters can be accessed. Parameters that are set in A2-01 to A2-32 can be accessed in Setup Mode. Verify Mode, Setup Mode, and Auto-Tuning Mode cannot be accessed.

Setting 1: User Parameters

A1-00, A1-01, A1-04, and Drive Mode can be accessed and set. All U monitor parameters can be accessed. Parameters that are set in A2-01 through A2-32 can be accessed in Setup Mode. Verify Mode and Auto-Tuning Mode cannot be accessed.

Setting 2: Advanced Access Level (A)

All parameters can be viewed and edited.

Notes on Parameter Access

- If the drive parameters are password protected by A1-04 and A1-05, parameters A1-01 through A1-03, A1-06, and A2-01 through A2-32 cannot be modified.
- If a digital input terminal programmed for “Program lockout” (H1-☐☐ = 1B) is enabled, parameter values cannot be modified, even if A1-01 is set to 1 or 2.
- If parameters are changed via serial communication, it will not be possible to edit or change parameter settings with the HOA keypad until an Enter command is issued to the drive from the serial communication.

■ A1-02: Control Method Selection

Selects the Control Method (also referred to as the control mode) that the drive uses to operate the motor. Parameter A1-02 determines the control mode for the motor.

Note: When changing control modes, all parameter settings depending upon the setting of A1-02 will be reset to the default.

No.	Parameter Name	Setting Range	Default
A1-02	Control Method Selection	0, 5	0

Setting 0: V/f Control for Induction Motors

Use this mode for simple speed control and for multiple motor applications with low demands to dynamic response or speed accuracy. The speed control range is 1:40.

Setting 5: Open Loop Vector Control for PM

Use this mode when running a PM motor in variable torque applications that benefit from energy efficiency. The drive can control an SPM or IPM motor with a speed range of 1:20 in this control mode.

■ A1-03: Initialize Parameters

Resets parameters to default values. 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, 3410, 3420	0

Setting 0: No Initialize

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 except parameters listed in *Table 1.1* to default settings with digital inputs S1 and S2 configured as Forward run and Reverse run, respectively. *Refer to Setting 40, 41: Forward Run, Reverse Run Command for 2-Wire Sequence on page 84* for more information on digital input functions.

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. *Refer to Setting 0: 3-Wire Sequence on page 78* for more information on digital input functions.

Setting 3410: HVAC Initialization

Resets parameters to default settings. The following parameters are not reset:

H1-03: b1 (Customer Safeties)

H1-04: b2 (BAS Interlock)

H1-05: AF (Emergency Override Forward Run)

H2-03: b2 (BAS Interlock Relay Contact)

Note: After performing an HVAC Initialization, H1-03 to H1-05 and H2-03 will be displayed in the Modified Parameters list.

Setting 3420: OEM Bypass Initialization

Resets parameters to default settings. The following parameters are not reset:

H1-03: A7 (BP Customer Safeties)

H1-04: A6 (BP BAS Interlock)

H1-05: A4 (Emergency Override)

H1-06: AE (BP Bypass Run)

H2-01: A4 (BP Drive Relay)

H2-02: A5 (BP Bypass Relay)

H2-03: A6 (BP BAS Interlock)

o1-16: 2 (Drive/Bypass)

Note: After performing an OEM Bypass Initialization, H1-03 to H1-05, H2-01 to H2-03, and o1-16 will be displayed in the Modified Parameters list.

Notes on Parameter Initialization

The parameters shown in *Table 1.1* will not be reset when the drive is initialized by setting A1-03 = 2220 or 3330. Although the control mode in A1-02 is not reset when A1-03 is set to 2220 or 3330, it may change when an application preset is selected.

Table 1.1 Parameters Not Changed by Drive Initialization

No.	Parameter Name
A1-00	Language Selection
A1-02	Control Method Selection
E1-03	V/f Pattern Selection
F6-08	Communication Parameter Reset
L8-35	Installation Selection
o2-04	Drive Model Selection

■ A1-04, A1-05: Password and Password Setting

Parameter A1-04 enters the password when the drive is locked; parameter A1-05 is a hidden parameter that sets the password.

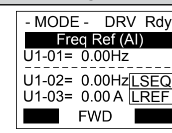
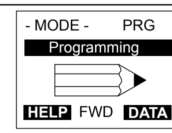
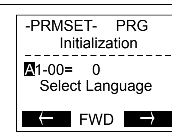
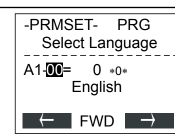
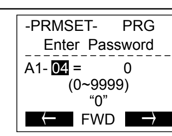
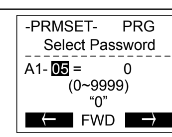
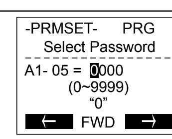
No.	Parameter Name	Setting Range	Default
A1-04	Password	0000 to 9999	0000
A1-05	Password Setting		

How to Use the Password

The user can set a password in parameter A1-05 to restrict access to the drive. The password must be entered to A1-04 to unlock parameter access (i.e., parameter setting A1-04 must match the value programmed into A1-05). The following parameters cannot be viewed or edited until the value entered to A1-04 correctly matches the value set to A1-05: A1-01, A1-02, A1-03, A1-06, and A2-01 through A2-32.

The instructions below demonstrate how to set password “1234”. An explanation follows on how to enter that password to unlock the parameters.

Table 1.2 Setting the Password for Parameter Lock

	Step		Display/Result
1.	Turn on the power to the drive. The initial display appears.	➡	
2.	Press ∧ or ∨ until the Parameter Setting Mode screen appears.	➡	
3.	Press ENTER to enter the parameter menu tree.	➡	
4.	Select the flashing digits by pressing F1, F2, or RESET.	➡	
5.	Select A1-04 by pressing ∧ .	➡	
6.	Press ∧ while holding down OFF at the same time. A1-05 will appear. **Note:** A1-05 is hidden and will not display by pressing only ∧ .	➡	
7.	Press ENTER.	➡	

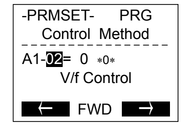
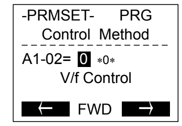
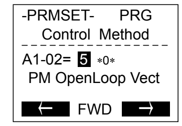
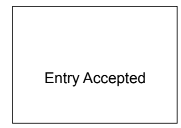
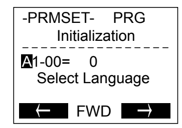
	Step		Display/Result
8.	Use F1, F2, RESET, ∨ and ∧ to enter the password.	➡	-PRMSET- PRG Select Password A1- 05 = 1234 (0~9999) "0" ← FWD →
9.	Press ENTER to save what was entered.	➡	Entry Accepted
10.	The display automatically returns to the display shown in step 6.	➡	-PRMSET- PRG Select Password A1- 05 = 0 (0~9999) "0" ← FWD →

Table 1.3 Check if A1-02 is Locked (continuing from step 10 above)

	Step		Display/Result
1.	Press ∨ to display A1-02.	➡	-PRMSET- PRG Control Method A1-02= 0 *0* V/f Control ← FWD →
2.	Press ENTER, making sure that the setting values cannot be changed.		
3.	Press ESC to return to the first display.	➡	- MODE - PRG Programming HELP FWD DATA

Table 1.4 Enter the Password to Unlock Parameters (continuing from step 3 above)

	Step		Display/Result
1.	Press ENTER to enter the parameter setup display.	➡	-PRMSET- PRG Initialization A1-00= 0 Select Language ← FWD →
2.	Press F1, F2, RESET to select the flashing digits as shown.	➡	-PRMSET- PRG Select Language A1-00= 0 *0* English ← FWD →
3.	Press ∧ to scroll to A1-04 and ENTER.	➡	-PRMSET- PRG Enter Password A1- 04 = 0 (0~9999) "0" ← FWD →
4.	Enter the password "1234".	➡	-PRMSET- PRG Enter Password A1-04= 1234 V/f Control ← FWD →
5.	Press ENTER to save the new password.	➡	Entry Accepted
6.	Drive returns to the parameter display.	➡	-PRMSET- PRG Enter Password A1- 04 = 0 (0~9999) "0" ← FWD →

Step			Display/Result
7.	Press ∨ and scroll to A1-02.	➡	
8.	Press ENTER to display the value set to A1-02. If the first “0” blinks, parameter settings are unlocked.	➡	
9.	Use RESET and ∧ to change the value if desired (though changing the control mode at this point is not typically done).	➡	
10.	Press ENTER to save the setting, or press ESC to return to the previous display without saving changes.	➡	
11.	The display automatically returns to the parameter display.	➡	

Note:
1. Parameter settings can be edited after entering the correct password.
2. Performing a 2-Wire or 3-Wire initialization resets the password to “0000”.

■ A1-06: Application Preset

Several 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.

◆ A2: User Parameters

■ A2-01 to A2-32: User Parameters 1 to 32

The user can select up to 32 parameters and assign them to parameters A2-01 through A2-32 to provide quicker access by eliminating the need to scroll through multiple menus. The User Parameter list can also save the most recently edited parameters.

No.	Parameter Name	Setting Range	Default
A2-01 to A2-32	User Parameters 1 to 32	A1-00 to S6-07	Determined by A1-06 <1> <2>

<1> This setting is the default setting of the Setup Mode parameters. Refer to TOEPC71063610 User Manual Section 4 for details.

<2> A1-06 determines how the setting of user parameters A2-01 through A2-32 are changed.

Saving User Parameters

To save specific parameters to A2-01 through A2-32, set parameter A1-01 to 2 to allow access to all parameters, then enter the parameter number to one of the A2-□□ parameters to assign it to the list of User Parameters. Finally, set A1-01 to 1 to restrict access so users can only set and refer to the parameters saved as User Parameters.

■ A2-33: User Parameter Automatic Selection

Determines whether recently edited parameters are saved to the second half of the User Parameters (A2-17 to A2-32) for quicker access.

No.	Parameter Name	Setting Range	Default
A2-33	User Parameter Automatic Selection	0, 1	Determined by A1-06

Setting 0: Do not save list of recently edited parameters

Set A2-33 to 0 to manually select the parameters listed in the User Parameter group.

Setting 1: Save list of recently edited parameters

Set A2-33 to 1 to automatically save recently edited parameters to A2-17 through A2-32. A total of 16 parameters are saved with the most recently edited parameter set to A2-17, the second most recently to A2-18, and so on. Access the User Parameters using the Setup Mode of the HOA keypad.

Note: User parameters are listed from A2-27 to A2-32. Parameters A2-01 to A2-26 are already listed as defined by default when in Setup Mode.

1.2 b: Application

◆ b1: Operation Mode Selection

■ b1-01: Frequency Reference Selection for AUTO Mode

Selects the frequency reference source 1.

Note: If a Run command is input to the drive, but the frequency reference entered is 0 or below the minimum frequency, the AUTO or HAND indicator LED on the HOA keypad will light and the OFF indicator will flash.

No.	Parameter Name	Setting Range	Default
b1-01	Frequency Reference Selection for AUTO Mode	0 to 3	1

Setting 0: HOA Keypad

Using this setting, the frequency reference can be input using the HOA keypad.

Setting 1: Terminals (analog input terminals)

Using this setting, an analog frequency reference can be entered as a voltage or current signal from terminals A1, A2, or A3.

Voltage Input

Voltage input can be used at any of the three analog input terminals. Make the settings as described in ***Table 1.5*** for the input used.

Table 1.5 Analog Input Settings for Frequency Reference Using Voltage Signals

Terminal	Signal Level	Parameter Settings				Notes
		Signal Level Selection	Function Selection	Gain	Bias	
A1	0 to 10 Vdc	H3-01 = 0	H3-02 = 0 (Frequency Reference Bias)	H3-03	H3-04	–
	-10 to +10 Vdc	H3-01 = 1				
A2	0 to 10 Vdc	H3-09 = 0	H3-10 = 0 (Frequency Reference Bias)	H3-11	H3-12	Set jumper S1 on the terminal board to "V" for voltage input.
	-10 to +10 Vdc	H3-09 = 1				
A3	0 to 10 Vdc	H3-05 = 0	H3-06 = 0 (Frequency Reference Bias)	H3-07	H3-08	Set DIP switch S4 on the terminal board to "AI".
	-10 to +10 Vdc	H3-05 = 1				

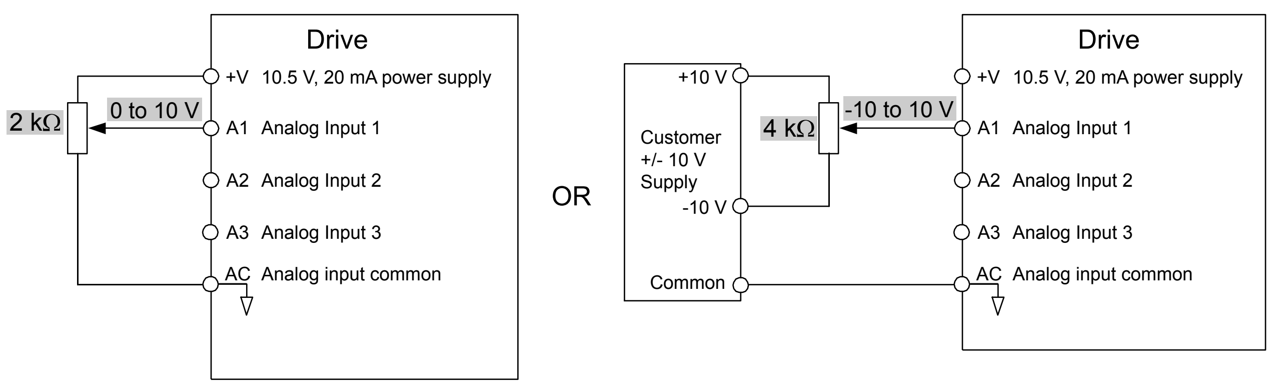


Figure 1.1 Setting the Frequency Reference as a Voltage Signal at Terminal A1

Current Input

Input terminals, A1, A2, and A3 can accept a current input signal. Refer to ***Table 1.6*** for an example to set terminal A2 for current input.

Table 1.6 Analog Input Settings for Frequency Reference Using a Current Signal

Terminal	Signal Level	Parameter Settings				Notes
		Signal Level Selection	Function Selection	Gain	Bias	
A2	4 to 20 mA	H3-09 = 2	H3-10 = 0 (Frequency Bias)	H3-11	H3-12	Make sure to set jumper S1 on the terminal board to "I" for current input.
	0 to 20 mA	H3-09 = 3				

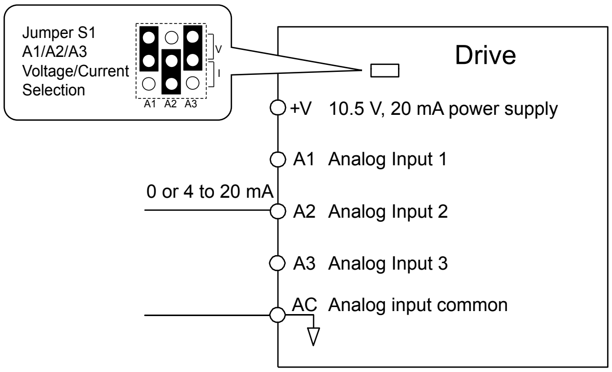


Figure 1.2 Setting the Frequency Reference as a Current Signal to Terminal A2

Switching between Main/Auxiliary Frequency References

The frequency reference input can be switched between the analog terminals A1, A2, and A3 using multi-speed inputs. *Refer to Multi-Step Speed Selection on page 52* for details on using this function.

Setting 2: Serial Communication (APOGEE FLN, BACnet, MEMOBUS/Modbus, Metasys N2)

This setting requires entering the frequency reference via the RS-422/RS-485 serial communications port (control terminals R+, R-, S+, and S-). *Refer to MEMOBUS/Modbus Configuration on page 280* for instructions.

Setting 3: Option card

This setting requires entering the frequency reference via an option board plugged into connector CN5-A 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 operation error will be displayed on the digital operator and the drive will not run.

■ b1-02: Run Command Selection for AUTO Mode

Determines the Run command selection for AUTO mode.

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

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. *Refer to Setting 40, 41: Forward Run, Reverse Run Command for 2-Wire Sequence on page 84*.
- 2-Wire sequence 2:

  Two inputs (Start/Stop-FWD/REV). *Refer to Setting 42, 43: Run and Direction Command for 2-Wire Sequence 2 on page 84*.
- 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. *Refer to Setting 0: 3-Wire Sequence on page 78*.

Setting 2: Serial Communication (APOGEE FLN, BACnet, MEMOBUS/Modbus, Metasys N2)

This setting requires entering the Run command via serial communications by connecting the RS-422/RS-485 serial communication cable to control terminals R+, R-, S+, and S- on the terminal block. *Refer to MEMOBUS/Modbus Configuration on page 280* for instructions.

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 card manual for instructions on integrating the drive into the communication system.

Note: If b1-02 is set to 3, but an option card is not installed in CN5, an oPE05 operation error will be displayed on the HOA keypad 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.

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 or Zero Speed Control depending on the selected control mode.

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.

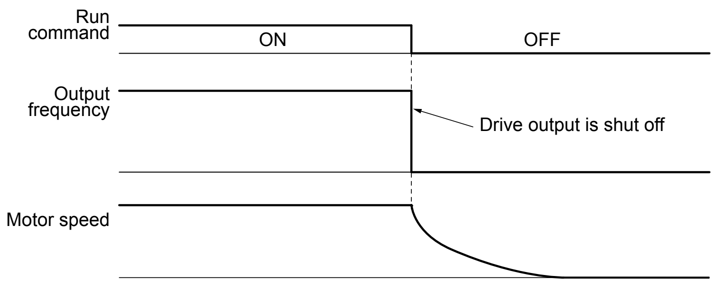


Figure 1.3 Coast to Stop

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 (***Refer to b2-03: DC Injection Braking Time at Start on page 22***) or Speed Search (***Refer to b3: Speed Search on page 23***) 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 current 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.

Note: This function is not available in OLV/PM control mode (A1-02 = 5).

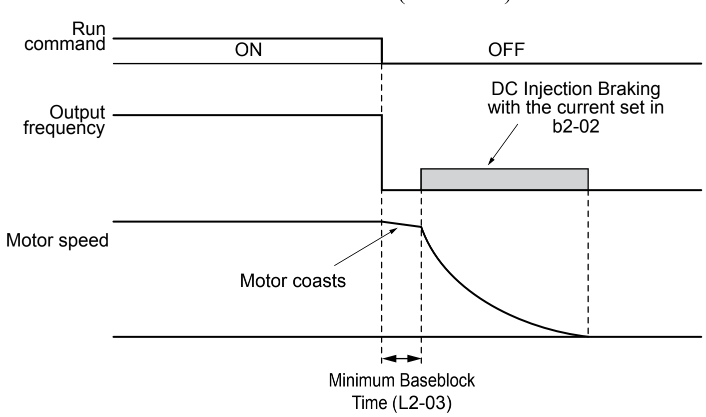


Figure 1.4 DC Injection Braking to Stop

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:

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

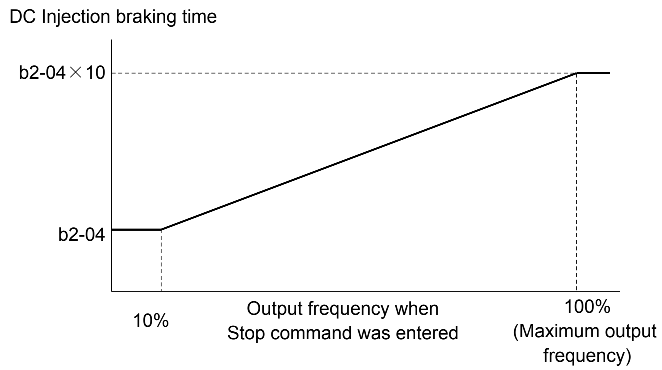


Figure 1.5 DC Injection Braking Time Depending on Output Frequency

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

Setting 3: Coast with Timer

When the Run command is removed, the drive will turn off its output and the motor will coast to stop. The drive will not start if a Run command is input before the time *t* (C1-02) has expired. Cycle the Run command that was activated during time *t* after *t* has expired to start the drive.

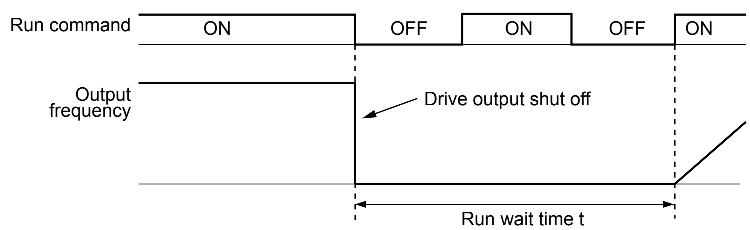


Figure 1.6 Coast with Timer

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

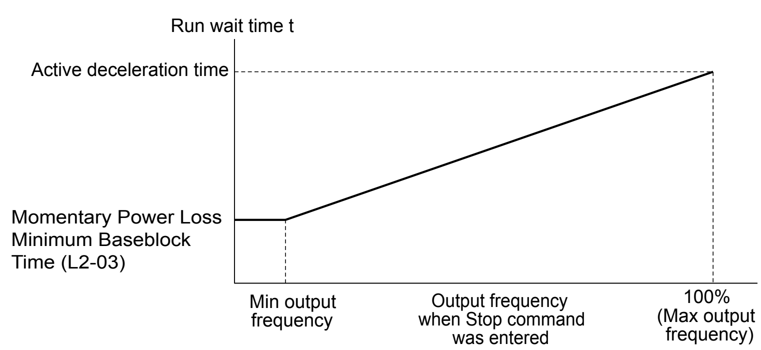


Figure 1.7 Run Wait Time Depending on Output Frequency

■ b1-04: Reverse Operation Selection

Enables and disables Reverse operation. For some applications, reverse motor rotation is not appropriate and may cause problems (e.g., air handling units, pumps, etc.).

No.	Parameter Name	Setting Range	Default
b1-04	Reverse Operation Selection	0, 1	1

Setting 0: Reverse Enabled

Possible to operate the motor in both forward and reverse directions.

Setting 1: Reverse Disabled

Drive disregards a Reverse run command or a negative frequency reference.

■ b1-06: Digital Input Reading

Defines how the digital inputs are read. The inputs are acted upon every 1 ms or 2 ms depending upon the setting.

No.	Name	Setting Range	Default
b1-06	Digital Input Reading	0, 1	1

Setting 0: Read once (1 ms scan)

The state of a digital input is read once. If the state has changed, the input command is immediately processed. With this setting the drive responds more quickly to digital inputs, but a noisy signal could cause erroneous operation.

Setting 1: Read twice (2 ms scan)

The state of a digital input is read twice. The input command is processed only if the state does not change during the double reading. This reading process is slower than the "Read once" process, but it is more resistant to noisy signals.

■ b1-08: Run Command Selection in Programming Mode

As a safety precaution, the drive will not normally respond to a Run command input when the HOA keypad is being used to adjust parameters in Programming Mode (Verify Menu, Setup Mode, Parameter Settings Mode, and Auto-Tuning Mode). If required by the application, set b1-08 to allow the drive to run while in Programming Mode.

No.	Parameter Name	Setting Range	Default
b1-08	Run Command Selection in Programming Mode	0 to 2	0

Setting 0: Run Command Is Not Accepted in Programming Mode

A Run command is not accepted while the HOA keypad is in Programming Mode.

Setting 1: Run Command Is Accepted in Programming Mode

A Run command is accepted in any HOA keypad mode.

Setting 2: Prohibit Entering Programming Mode during Run

It is not possible to enter the Programming Mode as long as the drive output is active. The Programming Mode cannot be displayed during Run.

■ b1-11: Drive Delay Time Setting

If a time is set to b1-11, the drive will delay executing a Run command until the set time has expired. During Drive Delay Time execution, the HOA keypad will display "WrUn". Both Alarm and Run indicators will blink while the drive waits to execute the Run command.

No.	Parameter Name	Setting Range	Default
b1-11	Drive Delay Time Setting	0 to 600 s	0

■ b1-14: Phase Order Selection

Sets the phase order for drive output terminals U/T1, V/T2, and W/T3.

Switching motor phases will reverse the direction of the motor.

No.	Parameter Name	Setting Range	Default
b1-14	Phase Order Selection	0, 1	0

Setting 0: Standard

Setting 1: Switch Phase Order

The direction of the motor is reversed.

■ b1-17: Run Command at Power Up

Determines whether an external Run command that is active during power up will start the drive.

No.	Parameter Name	Setting Range	Default
b1-17	Run Command at Power Up	0, 1	1

Setting 0: Disregarded

A new Run command must be issued after power up. Cycle the Run command to start the drive.

Note: For safety reasons, the drive is initially programmed not to accept a Run command at power up (b1-17 = 0). If a Run command is issued at power up, the RUN indicator LED will flash quickly.

Setting 1: Allowed

The motor will start immediately after a power up if a Run command is already enabled.

WARNING! *Sudden Movement Hazard. If b1-17 is set to 1 and an external Run command is active during power up, the motor will begin rotating as soon as the power is switched on. Proper precautions must be taken to ensure that the area around the motor is safe prior to powering up the drive. Failure to comply may cause serious injury.*

■ b1-24: Commercial Power Operation Switching Selection

When the output frequency matches the power supply frequency (60 Hz), the PWM switching operation stops and switches to operation with a direct commercial power supply connection.

Note:
1. Switching can be enabled when an inductive motor is being driven in V/f control mode.
2. Current value may change when a switch is made.
3. Verify that the induction motor can be driven with the commercial power supply (e.g., the rated voltage and rated speed) prior to enabling the commercial power switching selection.

No.	Parameter Name	Setting Range	Default
b1-24	Commercial Power Switching Selection	0, 1	0

Setting 0: Disabled

A voltage will be output with PWM switching operation regardless of the output frequency.

Setting 1: Enabled

When the deviation between the output frequency and the power supply frequency is less than or equal to the commercial power switching output frequency coincidence level (b1-26), the PWM switching operation stops and switches to operation with a direct commercial power supply connection.

Operation with a direct commercial power supply continues until the deviation between the output frequency and the power supply frequency is greater than or equal to the commercial power switching output frequency coincidence/non-coincidence level (b1-25 + b1-26).

■ b1-25/b1-26: Commercial Power Supply Operation Cancellation Level/Switching Level

These parameters set the value in 0.1 Hz increments at which commercial power supply switching selection is enabled and disabled.

Entering Eco Mode

When the deviation between the output frequency and the power supply frequency becomes equal to or less than the setting values of b1-26, an output frequency coincidence condition exists. The drive will operate in commercial power switching mode. If the drive will not switch to commercial power supply switching mode, set b1-26.

Exiting Eco Mode

When the deviation between the output frequency and the power supply frequency becomes equal to or greater than the setting value of b1-25 + b1-26, the drive will operate in PWM switching mode. If commercial power switching mode and PWM switching mode are repeated frequently, increase the setting value of b1-25.

Note: The drive will not switch to commercial power switching mode when L3-06, Stall Prevention Level during Run, is exceeded and L3-05, Stall Prevention Selection during Run, is enabled.

No.	Parameter Name	Setting Range	Default
b1-25	Commercial Power Supply Operation Cancellation Level	0.4 to 6.0 Hz	1.0 Hz
b1-26	Commercial Power Supply Operation Switching Level	0.0 to 3.0 Hz	0.2 Hz

◆ b2: DC Injection Braking

These parameters determine operation of the DC Injection Braking and Zero Speed Control features.

■ b2-01: Zero Speed Level (DC Injection Braking Start Frequency)

Active when "Ramp to Stop" is selected as the stopping method (b1-03 = 0).

No.	Name	Setting Range	Default
b2-01	Zero Speed Level (DC Injection Braking Start Frequency)	0.0 to 10.0 Hz	Determined by A1-02

The function triggered by parameter b2-01 depends on the control mode that has been selected.

V/f and OLV/PM (A1-02 = 0, 5)

For these control modes, parameter b2-01 sets the starting frequency for DC Injection Braking at Stop. When the output frequency falls below the setting of b2-01, DC Injection Braking is enabled for the time set in parameter b2-04.

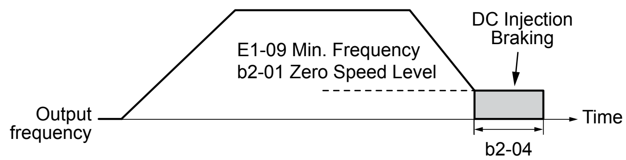


Figure 1.8 DC Injection Braking at Stop for V/f

Note: If b2-01 is set to a smaller value than E1-09 (Minimum Output Frequency), then DC Injection Braking will begin when the frequency falls to the E1-09 value.

■ b2-02: DC Injection Braking Current

Sets the DC Injection Braking current as a percentage of the drive rated current.

No.	Name	Setting Range	Default
b2-02	DC Injection Braking Current	0 to 100%	50%

The level of DC Injection Braking current affects the strength of the magnetic field attempting to lock the motor shaft. Increasing the current level will increase the amount of heat generated by the motor windings. Do not set this parameter higher than the level necessary to hold the motor shaft.

■ b2-03: DC Injection Braking Time at Start

Sets the time of DC Injection Braking at start. Used to stop a coasting motor before restarting it or to apply braking torque at start. Disabled when set to 0.00 s.

No.	Name	Setting Range	Default
b2-03	DC Injection Braking Time at Start	0.00 to 10.00 s	0.00 s

Note: Before starting an uncontrolled rotating motor (e.g., a fan motor driven by windmill effect), use DC Injection or Speed Search to stop the motor or detect motor speed before starting it. Otherwise, motor stalling and other faults can occur.

■ b2-04: DC Injection Braking Time at Stop

Sets the time of DC Injection Braking at stop. Used to completely stop a motor with high inertia load after ramp down. Increase the value if the motor still coasts by inertia after it should have stopped. Disabled when set to 0.00 s.

No.	Name	Setting Range	Default
b2-04	DC Injection Braking Time at Stop	0.00 to 10.00 s	0.00 s

■ b2-09: Motor Pre-Heat Current 2

Determines the percentage of motor rated output current that will be used for the motor pre-heat function. This function can be useful in applications where the motor sits for extended periods of time in humid conditions. Motor pre-heating can only be initiated by closing a digital input programmed as a Motor Pre-Heat 2 (H1-□□ = 50).

No.	Name	Setting Range	Default
b2-09	Motor Pre-Heat Current 2	0 to 100%	5%

◆ b3: Speed Search

The Speed Search function allows the drive to detect the speed of a rotating motor shaft that is driven by external forces and start the motor operation directly from the detected speed without first stopping the machine.

Example: When a momentary loss of power occurs, the drive output shuts off and the motor coasts. When power returns, the drive can find the speed of the coasting motor and restart it directly.

Enabling Speed Search for PM motors only requires setting parameter b3-01 to 1. The drive offers current detection and speed estimation Speed Search for induction motors. Parameter b3-24 selects the speed search method for induction motors. Both methods and relevant parameters are explained below.

Speed Search start timing differs depending on whether operation is after a momentary power loss (L2-01 = 1 or 2) or after the Speed Search at start (b3-01 = 1). The operation timing of the Speed Search after a momentary power loss is shown in *Figure 1.9*. The operation timing after the Speed Search at start is shown in *Figure 1.10*.

After restoring power, the Speed Search operation remains in baseblock status for at least the time set in b3-05. However, Speed Search will not start if the time set in L2-03, Minimum Baseblock Time, does not pass after the power stops. When induced voltage remains in the motor, the Speed Search operation starts after the time set in b3-05 without waiting for the time set in L2-03.

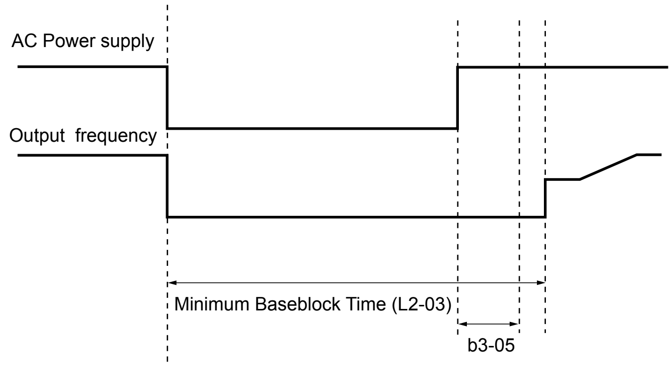


Figure 1.9 Timing Chart for Speed Search after Recovery from Momentary Power Loss

When performing a speed search operation at start, the speed search operation will start after waiting for the longer of the times set in b3-05 and L2-03 after the Run command input is received. When induced voltage remains in the motor, the Speed Search operation starts after the time set in b3-05 without waiting for the time set in L2-03.

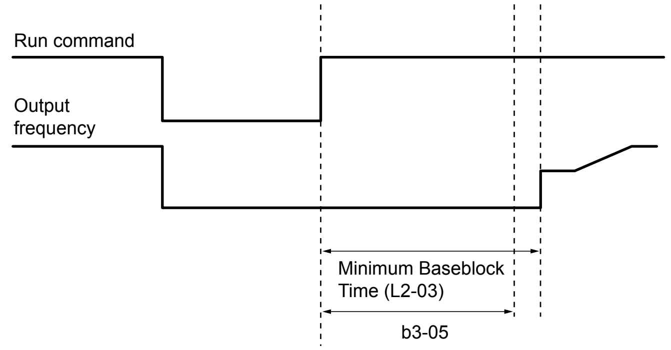


Figure 1.10 Timing Chart for Speed Search at Start

■ Current Detection Speed Search 2 (b3-24 = 2)

Current Detection Speed Search 2 is for use with IM motors. The current set in b3-31 is applied and the speed is detected based on the current flow to the motor. The speed then accelerates or decelerates to the frequency reference after completing Speed Search. If the output current during the Speed Search operation is larger than the setting value of b3-32, reduce the frequency for the deceleration time set in b3-03. After motor speed estimation is completed, the speed is accelerated or decelerated to the frequency reference.

Parameter Details

1

■ Speed Estimation Speed Search (b3-24 = 1)

A Speed Estimation Speed Search estimates the motor speed while the motor is coasting and then restarts operation. The speed then accelerates or decelerates to the frequency reference after completing Speed Search.

This method can be used for a single induction motor connected to a drive. Do not use this method if the motor is one or more frame size smaller than the drive, at motor speeds above 200 Hz, or when using a single drive to operate more than one motor.

■ Speed Search Activation

Speed Search can be activated using any of the methods 1 through 5 described below. Select the Speed Search type in parameter b3-24 independent of the activation method.

Method 1. Automatically activate Speed Search with every Run command. Set b3-01, Speed Search Selection at Start, to 1 (Enabled). External Speed Search commands are ignored.

Method 2. Activate Speed Search using the digital input terminals.

Use the input functions for H1-☐☐ in *Table 1.7*.

Table 1.7 Speed Search Activation by Digital Inputs

Setting	Description	b3-24 = 1	b3-24 = 2
61	External Search Command 1	Activate Speed Estimation Speed Search	Closed: Activate Current Detection Speed Search from the maximum output frequency (E1-04).
62	External Search Command 2		Closed: Activate Current Detection Speed Search from the frequency reference.

To activate Speed Search by a digital input, the input must be set together with the Run command or the Run command must be entered after giving the Speed Search command.

Method 3. After automatic fault restart.

When the number of maximum fault restarts in parameter L5-01 is set higher than 0, the drive will automatically perform Speed Search as specified by b3-24 following a fault.

Method 4. After momentary power loss.

This mode requires that the Power Loss Ride-Thru function is enabled during CPU operation (L2-01 = 1 or 2). *Refer to L2-01: Momentary Power Loss Operation Selection on page 109*.

Method 5. After external baseblock is released.

The drive will resume the operation starting with Speed Search if the Run command is present and the output frequency is above the minimum frequency when the Baseblock command (H1-☐☐ = 8 or 9) is released.

■ Rotation Direction Detection Conditions for Backspin

Backspin occurs when the motor rotates in the opposite direction from the rotation direction command. Specify the speed search direction when power is recovered after a momentary power loss in applications in which backspin can occur, such as for an oil pump when backspin may occur due to the weight of the oil after a momentary power loss. The search starts from the rotation direction specified in the direction command when the momentary power loss time is short. The search starts from the opposite direction of the direction specified in the direction command when the momentary power loss time is long. The rotation for the Speed Search is determined as follows:

[t] is the time from the momentary power loss to recovery.

- 0 ≤ t < b3-50: The search is started in the direction specified by the direction command.
- b3-50 ≥ t < b3-51: The motor is not restarted and the baseblock continues.

  The search starts from the opposite direction of the direction command when the momentary power loss time exceeds the setting value of b3-51.
- b3-51 ≤ t: The search is started in the direction opposite to the direction command.

Refer to b3-50/b3-51: Backspin Search Direction Judgment Time 1/2 on page 28 for details on the backspin direction judgment time.

Note:
1. Set b3-50 to the required time to enable rotation direction detection for backspin.
2. When setting b3-50, be sure to also set the following parameters to the values specified. Setting these parameters to any other values will trigger an oPE08 fault.
   b3-50 ≤ b3-51
   b3-14 = 0
   b3-24 = 2
3. Backspin detection is not necessary with a PM motor.

■ 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	Determined by A1-02

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.

■ b3-03: Speed Search Deceleration Time

Sets the output frequency reduction ramp used by the Current Injection Method of Speed Estimation (b3-24 = 1). The time entered into b3-03 will be the time to decelerate from maximum frequency (E1-04) to minimum frequency (E1-09).

No.	Name	Setting Range	Default
b3-03	Speed Search Deceleration Time	0.1 to 10.0 s	2.0 s

■ b3-04: V/f Gain during Speed Search (Speed Estimation Type)

During Speed Search, the output voltage calculated from the V/f pattern is multiplied with this value. Changing this value can help reduce the output current during Speed Search.

No.	Name	Setting Range	Default
b3-04	V/f Gain during Speed Search	10 to 100%	Determined by o2-04

■ b3-05: Speed Search Delay Time

In cases where an output contactor is used between the drive and the motor, the contactor must be closed before Speed Search can be performed. This parameter can be used to delay the Speed Search operation, giving the contactor enough time to close completely.

No.	Name	Setting Range	Default
b3-05	Speed Search Delay Time	0.0 to 100.0 s	0.2 s

■ b3-06: Output Current 1 during Speed Search (Speed Estimation Type)

Sets the current injected to the motor at the beginning of Speed Estimation Speed Search as a factor of the motor rated current set in E2-01. If the motor speed is relatively slow when the drive starts to perform Speed Search after a long period of baseblock, it may be helpful to increase the setting value. The output current during Speed Search is automatically limited by the drive rated current.

No.	Name	Setting Range	Default
b3-06	Output Current 1 during Speed Search	0.0 to 2.0	Determined by o2-04

Note: Use Current Detection Speed Search if Speed Estimation is not working correctly even after adjusting b3-06.

■ b3-07: Output Current 2 during Speed Search (Speed Estimation Type)

Sets the amount of output current during Speed Estimation Speed Search as a coefficient for the no-load current (output current during Speed Search is automatically limited by the drive rated current).

Increase this setting value in increments of 0.1 if the drive fails to perform Speed Estimation.

No.	Name	Setting Range	Default
b3-07	Output Current 2 during Speed Search (Speed Estimation Type)	0.0 to 5.0	1.0

■ b3-08: Current Control Gain during Speed Search (Speed Estimation Type)

Sets the proportional gain for the current controller during Speed Search.

No.	Name	Setting Range	Default
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	0.00 to 6.00	Determined by A1-02 and o2-04

■ b3-09: Current Control Integral Time during Speed Search (Speed Estimation Type)

Sets the Integral Time for the current controller during Speed Search.

No.	Name	Setting Range	Default
b3-09	Current Control Integral Time during Speed Search (Speed Estimation Type)	0.0 to 1000.0 ms	Determined by A1-02

■ b3-10: Speed Search Detection Compensation Gain (Speed Estimation Type)

Sets the gain for the detected motor speed of the Speed Estimation Speed Search. Increase the setting only if an overvoltage fault occurs when the drive restarts the motor.

No.	Name	Setting Range	Default
b3-10	Speed Search Detection Compensation Gain	1.00 to 1.20	1.05

■ b3-11: Speed Search Method Switching Level (Speed Estimation Type)

Within the type of the speed measurement, the search method can be switched automatically by the amount of remaining voltage in the motor. This parameter sets the switching level. (200 V class at 100% = 200 V, and 400 V class at 100% = 400 V).

No.	Name	Setting Range	Default
b3-11	Speed Search Method Switching Level (Speed Estimation Type)	0.5 to 100.0%	5.0%

■ b3-12: Minimum Current Detection Level during Speed Search

Sets the minimum current detection level during Speed Search. Increase this setting value in increments of 0.1 if the drive fails to perform Speed Estimation.

No.	Name	Setting Range	Default
b3-12	Minimum Current Detection Level during Speed Search	2.0 to 10.0	Determined by o2-04

■ b3-14: Bi-Directional Speed Search Selection (Speed Estimation Type)

Sets how the drive determines the motor rotation direction when performing Speed Estimation Speed Search.

No.	Parameter Name	Setting Range	Default
b3-14	Bi-Directional Speed Search Selection	0, 1	1

Setting 0: Disabled

The drive uses the frequency reference to determine the direction of motor rotation to restart the motor.

Setting 1: Enabled

The drive detects the motor rotation direction to restart the motor.

■ b3-17: Speed Search Restart Current Level (Speed Estimation Type)

Sets the current level at which Speed Estimation is restarted as a percentage of drive rated current to avoid overcurrent and overvoltage problems since a large current can flow into the drive if the difference between the estimated frequency and the actual motor speed is too big when performing Speed Estimation.

No.	Name	Setting Range	Default
b3-17	Speed Search Restart Current Level	0 to 200%	150%

■ b3-18: Speed Search Restart Detection Time (Speed Estimation Type)

Sets the time for which the current must be above the level set in b3-17 before restarting Speed Search.

No.	Name	Setting Range	Default
b3-18	Speed Search Restart Detection Time	0.00 to 1.00 s	0.10 s

■ b3-19: Number of Speed Search Restarts (Speed Estimation Type)

Sets the number of times the drive should attempt to find the speed and restart the motor. If the number of restart attempts exceeds the value set to b3-19, the SEr fault will occur and the drive will stop.

No.	Name	Setting Range	Default
b3-19	Number of Speed Search Restarts	0 to 10	3

■ b3-24: Speed Search Method Selection

Sets the Speed Search method.

In V/f control mode, set this parameter to 2 (Current Detection Type Speed Search 2) when b3-50 is 0.1 or longer.

No.	Parameter Name	Setting Range	Default
b3-24	Speed Search Method Selection	1, 2	Determined by A1-02 and o2-04

Setting 1: Speed Estimation

Setting 2: Current Detection 2

Note:
1. Enable or disable Speed Search at start with b3-01 and Speed Search after momentary power loss with L2-01.
2. *Refer to Current Detection Speed Search 2 (b3-24 = 2) on page 23* and *Refer to Speed Estimation Speed Search (b3-24 = 1) on page 24* for details on the Speed Search direction.

■ b3-25: Speed Search Wait Time

Sets the wait time between Speed Search restarts. Increase the wait time if problems occur with overcurrent, overvoltage, or if an SEr fault occurs.

No.	Name	Setting Range	Default
b3-25	Speed Search Wait Time	0.0 to 30.0 s	0.5 s

■ b3-27: Start Speed Search Select

Selects a condition to activate Speed Search Selection at Start (b3-01) or External Speed Search Command 1 or 2 from the multi-function input.

No.	Name	Setting Range	Default
b3-27	Start Speed Search Select	0, 1	0

Setting 0: Triggered when a Run Command Is Issued (Normal)

Setting 1: Triggered when an External Baseblock Is Released

■ b3-29: Speed Search Induced Voltage Level

Lower this value in small increments if changes are necessary. Setting this value too low will prevent the drive from performing Speed Search. There is normally no need to change this parameter from the default value.

No.	Name	Setting Range	Default
b3-29	Speed Search Induced Voltage Level	0 to 10%	10%

■ b3-31: Speed Search Operation Current Level 1 (Current Detection Type 2)

Sets the current level used to limit the output current during Current Detection Type Speed Search 2 as a ratio to E2-03, Motor No-Load Current.

The current level is determined for a no-load current that is 30% of the rated motor current when the setting value of E2-03 is less than or equal to 30% of the rated motor current.

Note: If the setting value is too large, a stopped inductive motor may accelerate too quickly. In such cases, set this parameter to a value that is smaller than the rated motor current.

No.	Name	Setting Range	Default
b3-31	Speed Search Operation Current Level 1 (Current Detection Type 2)	1.50 to 3.50	1.50

■ b3-32: Speed Search Operation Current Level 2 (Current Detection 2)

Sets the current level at which to end the Speed Search for Current Detection Type Speed Search 2 as a ratio to E2-03, Motor No-Load Current.

The current level is determined for a no-load current that is 30% of the rated motor current when the setting value of E2-03 is less than or equal to 30% of the rated motor current.

No.	Name	Setting Range	Default
b3-32	Speed Search Operation Current Level 2 (Current Detection 2)	0.00 to 1.49	1.20

■ b3-33: Speed Search Selection when Run Command is Given during Uv

Activates and deactivates Speed Search at start in accordance with whether a Run command was issued during an undervoltage (Uv) condition. Function is active when a momentary power loss (L2-01 = 1 or 2), Speed Search at start (b3-01 = 1), and coasting to a stop (b1-03 = 1) are enabled.

No.	Name	Setting Range	Default
b3-33	Speed Search Selection when Run Command is Given during Uv	0, 1	0

Setting 0: Disabled

Setting 1: Enabled

■ b3-50/b3-51: Backspin Search Direction Judgment Time 1/2

The direction of the Speed Search is adjusted to allow for backspin.

When momentary power loss time t is shorter than the time set in b3-50, the search operates according to the direction command. When momentary power loss time t is equal to or longer than the time set in b3-51, the search operates from the opposite direction of the direction command. When momentary power loss time t is equal to or longer than the time set in b3-50 and shorter than b3-15, baseblock continues until momentary power loss time t exceeds the time set in b3-51. The search then operates from the opposite direction of the direction command.

Note:
1. Use these parameters only in applications in which backspin can occur
2. Be sure to set b3-50 < b3-51.
3. Backspin detection is not necessary with a PM motor.

No.	Name	Setting Range	Default
b3-50	Backspin Search Direction Judgment Time 1	0.0 to 10.0	Determined by A1-02
b3-51	Backspin Search Direction Judgment Time 2	0.0 to 10.0	0.0

Speed Search from the Direction Command (0.0 ≤ Momentary Power Loss Time t < b3-50)

When time t from the momentary power loss to recovery is shorter than the setting value of b3-50, Speed Search is performed in the direction specified by the direction command. The deceleration time set in b3-52 is used for the search frequency and the setting value of the frequency reference is used as the starting search frequency.

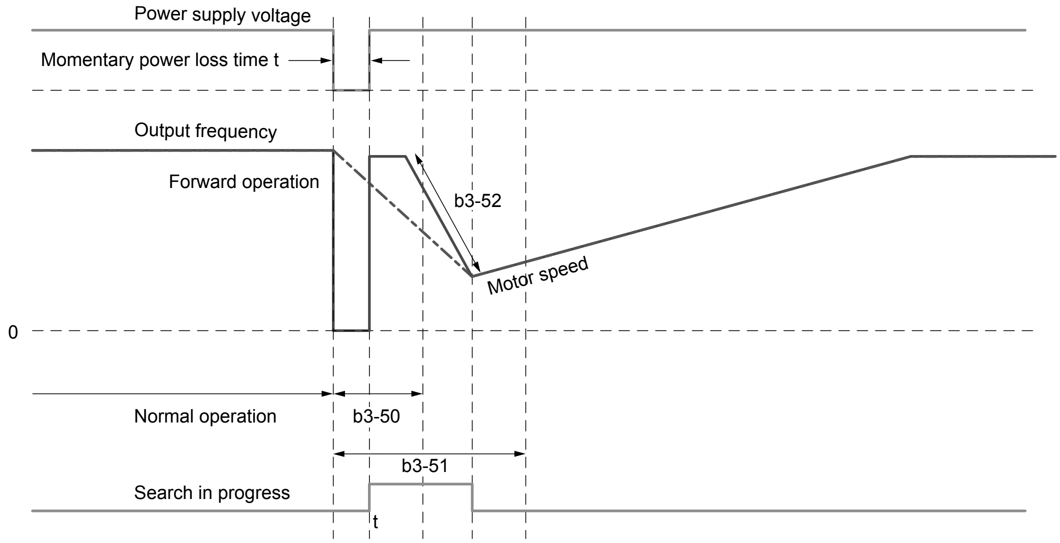


Figure 1.11 Speed Search from Forward Run Command (0 ≤ t < b3-50)

Continuous Baseblock (b3-50 ≤ t < b3-51)

When time t from the momentary power loss to recovery is between the times set for b3-50 and b3-51, operation will not be restarted and the baseblock will continue. The drive will stay in baseblock for the time set in b3-51 even after restoring power. After the time set in b3-51 passes, Speed Search starts in the opposite direction of the direction command. The deceleration time in b3-53 is used for the search frequency and the setting value of the frequency reference is used as the starting search frequency.

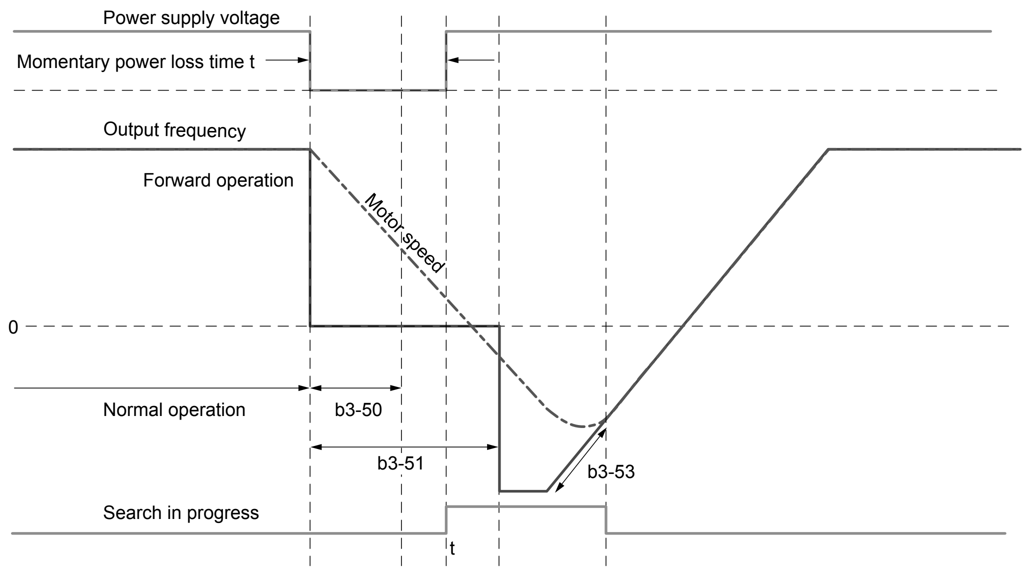


Figure 1.12 Continuous Baseblock (b3-50 ≤ t < b3-51)

Speed Search in Direction Opposite to Direction Command (b3-51 ≤ t)

When time t from the momentary power loss to recovery exceeds the setting value of b3-51, Speed Search is performed in the opposite direction of the direction command. The deceleration time in b3-53 is used for the search frequency and the setting value of the frequency reference is used as the starting search frequency.

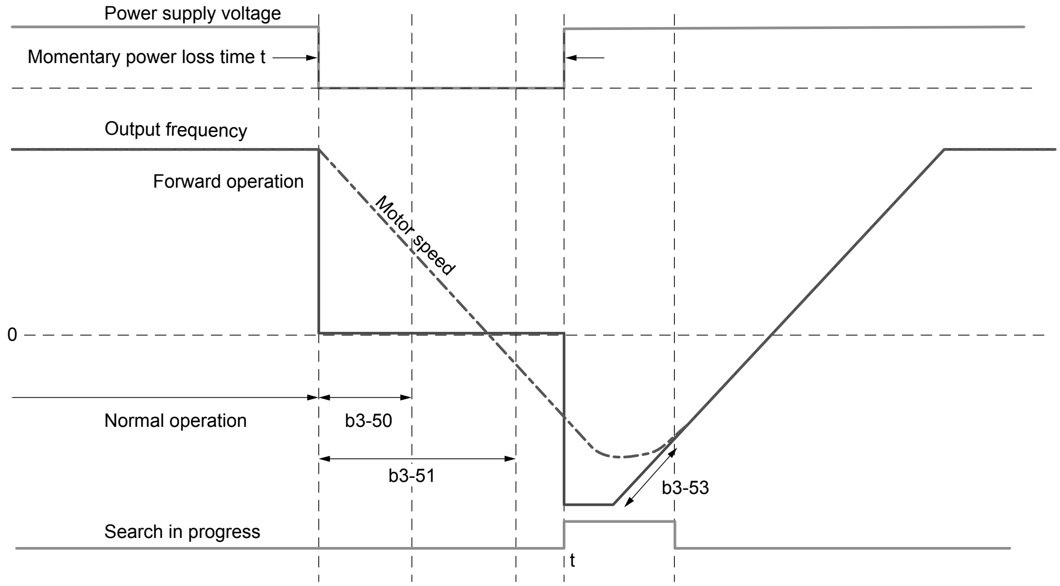


Figure 1.13 Speed Search in Direction Opposite to Direction Command (b3-51 ≤ t)

■ b3-52: Backspin Search Deceleration Time 1

Sets the search frequency deceleration rate when searching from the direction command when momentary power loss time t is shorter than the time set in b3-50.

Set the value lower than the motor deceleration rate during coasting.

No.	Name	Setting Range	Default
b3-52	Backspin Search Deceleration Time 1	0.1 to 10.0 s	2.0 s

■ b3-53: Backspin Search Deceleration Time 2

Sets the search frequency deceleration rate for a Speed Search from the opposite direction of the direction command when momentary power loss time t is equal to or longer than the time set in b3-51.

No.	Name	Setting Range	Default
b3-53	Backspin Search Deceleration Time 2	0.1 to 10.0 s	2.0 s

■ b3-59: PM Speed Search DC Injection Braking Time at Low Speed

Sets the DC Injection Braking time at low speed PM motor Speed Search. It is the time in which DC Injection Braking is done to initiate stopping the motor fully when the PM motor is coasting at approximately 5% or less. If the moment of inertia of the machine is large and the motor will not stop, increase the setting value.

The DC Injection Braking current at low speed PM motor Speed Search will be b3-02 (Speed Search Deactivation Current).

Note: This parameter is available in drive software versions PRG: 6115 or later and 5201 and later.

No.	Name	Setting Range	Default
b3-59	PM Speed Search DC Injection Braking Time at Low Speed	0.50 to 10.00 s	1.00 s

◆ b4: Timer Function

The timer function is independent of drive operation and can delay the switching of a digital output triggered by a digital input signal and help eliminate chattering switch noise from sensors. An on-delay and off-delay can be set separately.

To enable the timer function, set a multi-function input to “Timer Function Input” (H1-□□ = 18) and set a multi-function output to “Timer output” (H2-□□ = 12). Only one timer can be used.

■ b4-01, b4-02: Timer Function On-Delay, Off-Delay Time

b4-01 sets the on-delay time for switching the timer output. b4-02 sets the off-delay time for switching the timer output.

No.	Name	Setting Range	Default
b4-01	Timer Function On-Delay Time	0.0 to 3000.0 s	0.0 s
b4-02	Timer Function Off-Delay Time	0.0 to 3000.0 s	0.0 s

■ Timer Function Operation

The timer function switches on when the timer function input closes for longer than the value set to b4-01. The timer function switches off when the timer function input is open for longer than the value set to b4-02. *Figure 1.14* illustrates the timer function operation:

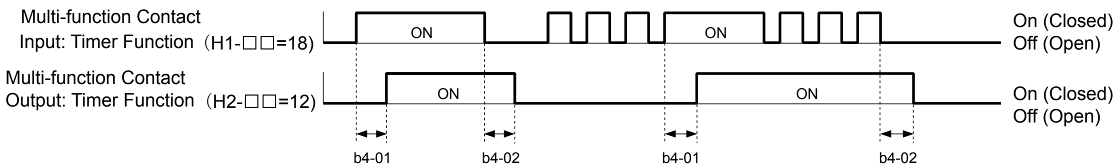
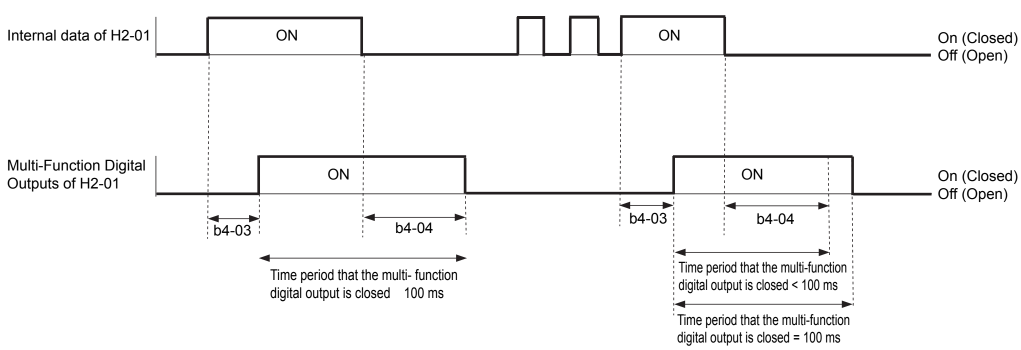


Figure 1.14 Timer Operation

■ b4-03 to b4-08: H2-□□ ON-Delay and OFF-Delay Time

Sets the length of the delay time for contact outputs to open or close for the related functions set in H2-□□.

No.	Name	Setting Range	Default
b4-03	H2-01 ON Delay Time	0 to 65000 ms	0 ms
b4-04	H2-01 OFF Delay Time	0 to 65000 ms	0 ms
b4-05	H2-02 ON Delay Time	0 to 65000 ms	0 ms
b4-06	H2-02 OFF Delay Time	0 to 65000 ms	0 ms
b4-07	H2-03 ON Delay Time	0 to 65000 ms	0 ms
b4-08	H2-03 OFF Delay Time	0 to 65000 ms	0 ms



Note: The multi-function digital output closes for at least 100 ms even when the length of the off-delay time and on-delay time for multi-function digital output are each shorter than 100 ms,

◆ b5: PID Control

The drive has a built-in Proportional + Integral + Derivative (PID) controller that uses the difference between the target value and the feedback value to adjust the drive output frequency to minimize deviation and provide accurate closed loop control of system variables such as pressure or temperature.

■ P Control

The output of P control is the product of the deviation and the P gain so that it follows the deviation directly and linearly. With P control, only an offset between the target and feedback remains.

■ I Control

The output of I control is the integral of the deviation. It minimizes the offset between target and feedback value that typically remains when pure P control is used. The integral time (I time) constant determines how fast the offset is eliminated.

■ D Control

D control predicts the deviation signal by multiplying its derivative (slope of the deviation) with a time constant, then adds this value to the PID input. This way the D portion of a PID controller provides a braking action to the controller response and can reduce the tendency to oscillate and overshoot.

D control tends to amplify noise on the deviation signal, which can result in control instability. Only use D control when absolutely necessary.

■ PID Operation

To better demonstrate PID functionality, ***Figure 1.15*** illustrates the PID output when the PID input (deviation) is at a constant level.

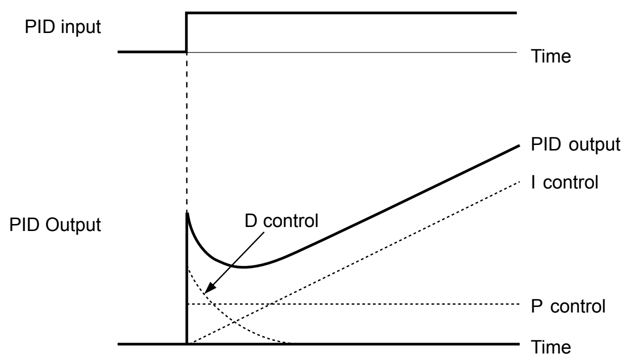


Figure 1.15 PID Operation

■ Using PID Control

Applications for PID control are listed in ***Table 1.8***.

Table 1.8 Using PID Control

Application	Description	Sensors Used
Speed Control	Machinery speed is fed back and adjusted to meet the target value. Synchronous control is performed using speed data from other machinery as the target value	Tachometer
Pressure	Maintains constant pressure using pressure feedback.	Pressure sensor
Fluid Control	Keeps flow at a constant level by feeding back flow data.	Flow rate sensor
Temperature Control	Maintains a constant temperature by controlling a fan with a thermostat.	Thermocoupler, Thermistor

■ PID Setpoint Input Methods

The PID setpoint input can be input from one of the sources listed in ***Table 1.9***.

If none of the sources listed in ***Table 1.9*** are used, the frequency reference source in b1-01 (or b1-15) or one of the inputs listed in ***Table 1.9*** becomes the PID setpoint.

Table 1.9 PID Setpoint Sources

PID Setpoint Source	Settings
Analog Input A1	Set H3-02 = C
Analog Input A2	Set H3-10 = C
Analog Input A3	Set H3-06 = C
MEMOBUS/Modbus Register 0006 H	Set bit 1 in register 000F H to 1 and input the setpoint to register 0006 H
Pulse Input RP	Set H6-01 = 2
Parameter b5-19	Set parameter b5-18 = 1 and input the PID setpoint to b5-19

Note: A duplicate allocation of the PID setpoint input will cause an oPE07 (Multi-Function Analog Input Selection Error) alarm.

■ PID Feedback Input Methods

Input one feedback signal for normal PID control or input two feedback signals can for controlling a differential process value.

Normal PID Feedback

Input the PID feedback signal from one of the sources listed in *Table 1.10*:

Table 1.10 PID Feedback Sources

PID Feedback Source	Settings
Analog Input A1	Set H3-02 = B
Analog Input A2	Set H3-10 = B
Analog Input A3	Set H3-06 = B
Pulse Input RP	Set H6-01 = 1

Note: A duplicate allocation of the PID feedback input will cause an oPE07 (Multi-Function Analog Input Selection Error) alarm.

Differential Feedback

The second PID feedback signal for differential feedback can come from the sources listed in *Table 1.11*. The differential feedback function is automatically enabled when a differential feedback input is assigned.

Table 1.11 PID Differential Feedback Sources

PID Differential Feedback Source	Settings
Analog Input A1	Set H3-02 = 16 (Differential PID Feedback)
Analog Input A2	Set H3-10 = 16 (Differential PID Feedback)
Analog Input A3	Set H3-06 = 16 (Differential PID Feedback)

Note: A duplicate allocation of the PID differential feedback input will cause an oPE07 (Multi-Function Analog Input Selection Error) alarm.

■ PID Block Diagram

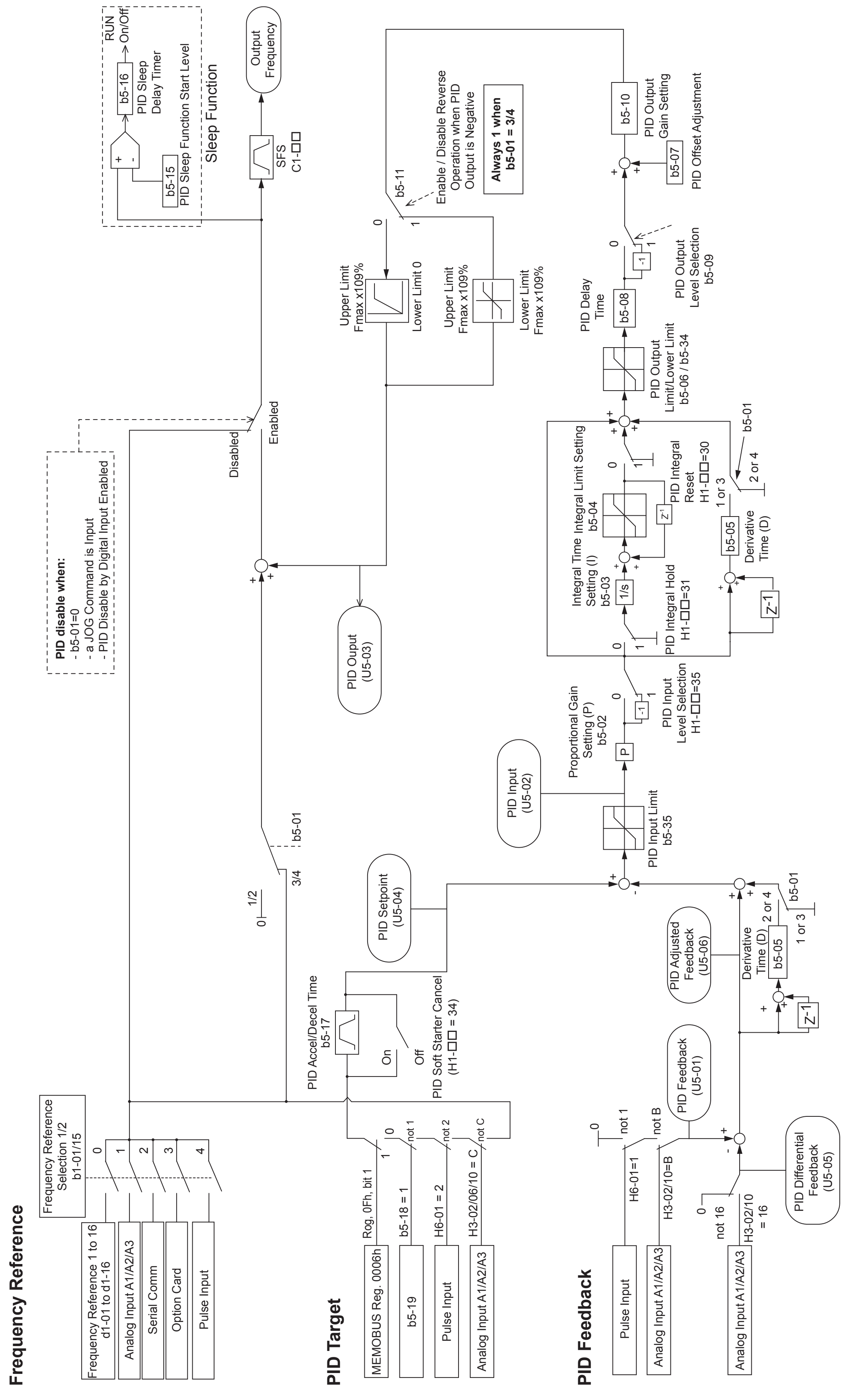


Figure 1.16 PID Block Diagram

b5-01: PID Function Setting

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

No.	Parameter Name	Setting Range	Default
b5-01	PID Function Setting	0, 1, 3	0

Setting 0: PID Disabled

Setting 1: Output Frequency = PID Output 1

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

Setting 3: Output Frequency = Frequency Reference + PID Output 1

The PID controller is enabled and the PID output is added to the frequency reference.

b5-02: Proportional Gain Setting (P)

Sets the P gain applied to the PID input. Larger values will tend to reduce the error but may cause oscillations if set too high, while lower values may allow too much offset between the setpoint and feedback.

No.	Name	Setting Range	Default
b5-02	Proportional Gain Setting (P)	0.00 to 25.00	2.00

b5-03: Integral Time Setting (I)

Sets the time constant used to calculate the integral of the PID input. The shorter the integral time set to b5-03, the faster the offset will be eliminated. If the integral time is set too short, however, overshoot or oscillation may occur. To turn off the integral time, set b5-03 to 0.00.

No.	Name	Setting Range	Default
b5-03	Integral Time Setting (I)	0.0 to 360.0 s	1.0 s

b5-04: Integral Limit Setting

Sets the maximum output possible from the integral block as a percentage of the maximum frequency (E1-04).

No.	Name	Setting Range	Default
b5-04	Integral Limit Setting	0.0 to 100.0%	100.0%

Note: On some applications, especially those with rapidly varying loads, the output of the PID function may show a fair amount of oscillation. Program b5-04 to apply a limit to the integral output and suppress this oscillation.

b5-05: Derivative Time (D)

Sets the time the drive predicts the PID input/PID feedback signal based on the derivative of the PID input/PID feedback. Longer time settings improve the response but can cause instability, while shorter time settings reduce the overshoot but reduce controller responsiveness. D control is disabled by setting b5-05 to zero seconds.

No.	Name	Setting Range	Default
b5-05	Derivative Time (D)	0.00 to 10.00 s	0.00 s

b5-06: PID Output Limit

Sets the maximum output possible from the entire PID controller as a percentage of the maximum frequency (E1-04).

No.	Name	Setting Range	Default
b5-06	PID Output Limit	0.0 to 100.0%	100.0%

b5-07: PID Offset Adjustment

Sets the offset added to the PID controller output as a percentage of the maximum frequency (E1-04).

No.	Name	Setting Range	Default
b5-07	PID Offset Adjustment	-100.0 to 100.0%	0.0%

b5-08: PID Primary Delay Time Constant

Sets the time constant for the filter applied to the output of the PID controller. Normally, change is not required.

No.	Name	Setting Range	Default
b5-08	PID Primary Delay Time Constant	0.00 to 10.00 s	0.00 s

Note: Useful when there is a fair amount of oscillation or when rigidity is low. Set to a value larger than the cycle of the resonant frequency. Increasing this time constant may reduce the responsiveness of the drive.

■ b5-09: PID Output Level Selection

Reverses the sign of the PID controller output signal. Normally a positive PID input (feedback smaller than setpoint) leads to positive PID output.

No.	Parameter Name	Setting Range	Default
b5-09	PID Output Level Selection	0, 1	0

Setting 0: Normal Output

A positive PID input causes an increase in the PID output (direct acting).

Setting 1: Reverse Output

A positive PID input causes a decrease in the PID output (reverse acting).

■ b5-10: PID Output Gain Setting

Applies a gain to the PID output and can be helpful when the PID function is used to trim the frequency reference (b5-01 = 3 or 4).

No.	Name	Setting Range	Default
b5-10	PID Output Gain Setting	0.00 to 25.00	1.00

■ b5-11: PID Output Reverse Selection

Determines whether a negative PID output reverses the direction of drive operation. This parameter has no effect when the PID function trims the frequency reference (b5-01 = 3 or 4) and the PID output will not be limited (same as b5-11 = 1).

No.	Parameter Name	Setting Range	Default
b5-11	PID Output Reverse Selection	0, 1	0

Setting 0: Reverse Disabled

Negative PID output will be limited to 0 and the drive output will be stopped.

Setting 1: Reverse Enabled

Negative PID output will cause the drive to run in the opposite direction.

■ PID Feedback Loss Detection

The PID feedback loss detection function detects broken sensors or broken sensor wiring. It should be used when PID control is enabled to prevent critical machine conditions (e.g., acceleration to max. frequency) caused by a feedback loss.

Feedback loss can be detected in two ways:

- **Feedback Low Detection**

  Detected when the feedback falls below a certain level for longer than the specified time. This function is set up using parameters b5-12 to b5-14.
- **Feedback High Detection**

  Detected when the feedback rises above a certain level for longer than the specified time. This function is set up using parameters b5-12, b5-36, and b5-37.

The following figure illustrates the working principle of feedback loss detection when the feedback signal is too low. Feedback high detection works in the same way.

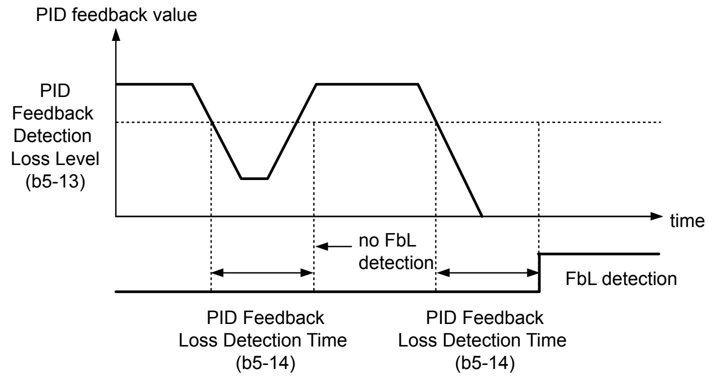


Figure 1.17 PID Feedback Loss Detection

■ b5-12: PID Feedback Loss Detection Selection

Enables or disables the feedback loss detection and sets the operation when a feedback loss is detected.

No.	Parameter Name	Setting Range	Default
b5-12	PID Feedback Loss Detection Selection	0 to 5	0

Setting 0: Multi-Function Digital Outputs Only

Multi-function digital outputs set for “PID feedback low” (H2-☐☐ = 3E) will be triggered if the PID feedback value is below the detection level set to b5-13 for the time set to b5-14 or longer. Multi-function digital outputs set for “PID feedback high” (H2-☐☐ = 3F) will be triggered if the PID feedback value is beyond the detection level set to b5-36 for longer than the time set to b5-37. Neither a fault nor an alarm is displayed on the digital operator and the drive will continue operation. The multi-function digital outputs reset when the feedback value leaves the loss detection range.

Setting 1: Feedback Loss Alarm

If the PID feedback value falls below the level set to b5-13 for longer than the time set to b5-14, a “FBL - Feedback Low” alarm will be displayed and a digital output set for “PID feedback low” (H2-☐☐ = 3E) will be triggered. If the PID feedback value exceeds the level set to b5-36 for longer than the time set to b5-37, a “FBH - Feedback High” alarm will be displayed and a digital output set for “PID feedback high” (H2-☐☐ = 3F) will be triggered. Both events trigger an alarm output (H2-☐☐ = 10). The drive will continue operation. The alarm and multi-function digital outputs reset when the feedback value leaves the loss detection range.

Setting 2: Feedback Loss Fault

If the PID feedback value falls below the level set to b5-13 for longer than the time set to b5-14, a “FbL - Feedback Low” fault will be displayed. If the PID feedback value exceeds the level set to b5-36 for longer than the time set to b5-37, a “FbH - Feedback High” fault will be displayed. Both events trigger a fault output (H2-☐☐ = E) and cause the drive to stop the motor.

Setting 3: Digital Output Only, even if PID Is Disabled by Digital Input

Same as b5-12 = 0. Detection remains active when PID is disabled by a digital input (H1-☐☐ = 19).

Setting 4: Feedback Loss Alarm, even if PID Is Disabled by Digital Input

Same as b5-12 = 1. Detection remains active when PID is disabled by a digital input (H1-☐☐ = 19).

Setting 5: Feedback Loss fault, even if PID Is Disabled by Digital Input

Same as b5-12 = 2. Detection remains active when PID is disabled by a digital input (H1-☐☐ = 19).

■ b5-13: PID Feedback Low Detection Level

Sets the PID feedback detection low level as a percentage of E1-04 (Maximum Output Frequency). The PID feedback must fall below this level for longer than the time set to b5-14 before feedback loss is detected.

No.	Name	Setting Range	Default
b5-13	PID Feedback Low Detection Level	0 to 100%	0%

■ b5-14: PID Feedback Low Detection Time

Sets the time that the PID feedback has to fall below b5-13 before feedback loss is detected.

No.	Name	Setting Range	Default
b5-14	PID Feedback Low Detection Time	0.0 to 25.5 s	1.0 s

■ PID Sleep

The PID Sleep function stops the drive when the PID output or the frequency reference falls below the PID Sleep operation level for a certain time. The drive will resume operating when the PID output or frequency reference rise above the PID Sleep operation level for the specified time. An example of PID Sleep operation appears in the figure below.

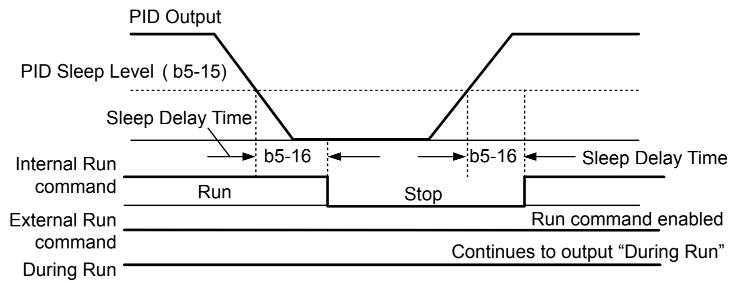


Figure 1.18 PID Sleep Operation

Notes on using the PID Sleep function

- The PID Sleep function is active even when PID control is disabled.
- The PID Sleep function stops the motor according to the stopping method set to b1-03.

The parameters necessary to control the PID Sleep function are explained below.

■ b5-15: PID Sleep Function Start Level

Sets the level that triggers PID Sleep.

The drive goes into Sleep mode if the PID output or frequency reference is smaller than b5-15 for longer than the time set to b5-16. The drive resumes operation when the PID output or frequency reference is above b5-15 for longer than the time set to b5-16.

No.	Name	Setting Range	Default
b5-15	PID Sleep Function Start Level	0.0 to 400.0 Hz	0.0 Hz

■ b5-16: PID Sleep Delay Time

Sets the delay time to activate or deactivate the PID Sleep function.

No.	Name	Setting Range	Default
b5-16	PID Sleep Delay Time	0.0 to 25.5 s	0.0 s

■ b5-17: PID Accel/Decel Time

The PID acceleration/deceleration time is applied on the PID setpoint value.

When the setpoint changes quickly, the normal C1-□□ acceleration times reduce the responsiveness of the system as they are applied after the PID output. The PID accel/decel time helps avoid the hunting and overshoot and undershoot that can result from the reduced responsiveness.

The PID acceleration/deceleration time can be canceled using a digital input programmed for "PID SFS cancel" (H1-□□ = 34).

No.	Name	Setting Range	Default
b5-17	PID Accel/Decel Time	0.0 to 6000.0 s	0.0 s

■ b5-18: PID Setpoint Selection

Enables or disables parameter b5-19 for PID setpoint.

No.	Parameter Name	Setting Range	Default
b5-18	PID Setpoint Selection	0, 1	0

Setting 0: Disabled

Parameter b5-19 is not used as the PID setpoint.

Setting 1: Enabled

Parameter b5-19 is used as PID setpoint.

■ b5-19: PID Setpoint Value

Used as the PID setpoint if parameter b5-18 = 1.

No.	Name	Setting Range	Default
b5-19	PID Setpoint Value	0.00 to 100.00%	0.00%

■ b5-20: PID Setpoint Scaling

Determines the units for the PID Setpoint Value (b5-19) and monitors U5-01 and U5-04. The units for setting and display can be changed with b5-20.

No.	Parameter Name	Setting Range	Default
b5-20	PID Setpoint Scaling	0 to 3	1

Setting 0: 0.01 Hz

The setpoint and PID monitors are displayed in Hz with a resolution of 0.01 Hz.

Setting 1: 0.01% (100.00%: Maximum PID Feedback)

The setpoint and PID monitors are displayed as a percentage with a resolution of 0.01%.

Setting 2: r/min (Set the Motor Poles)

The setpoint and PID monitors are displayed in r/min with a resolution of 1 r/min.

Setting 3: User Defined (Determined by b5-38 and b5-39)

Parameters b5-38 and b5-39 determine the units and resolution used to display the values the setpoint in b5-19, and PID monitors U1-01 and U1-04.

■ b5-21: PID Sleep Input Source

Selects the Sleep Function characteristic action. When b5-21 is set to 1, the Sleep Function Start Level (b5-15) is compared to the output of the drive (Speed Command after PID Block). Use this setting for open loop control.

The Sleep Function Start Level (b5-15) can be compared to the drive input or setpoint by setting b5-21 to 0.

When b5-21 is set to 2, a variation of the Sleep Function called “Snooze” is enabled. See parameters b5-22 to b5-27 for details.

No.	Parameter Name	Setting Range	Default
b5-21	PID Sleep Input Source	0 to 2	1

Setting 0: PID Setpoint

Setting 1: SFS Input

Setting 2: Snooze

■ b5-22: PID Snooze Level

Sets the PID Snooze function start level as a percentage of maximum frequency.

No.	Parameter Name	Setting Range	Default
b5-22	PID Snooze Level	0 to 100%	0%

■ b5-23: PID Snooze Delay Time

Sets the PID Snooze function delay time in seconds.

No.	Parameter Name	Setting Range	Default
b5-23	PID Snooze Delay Time	0 to 2600 s	0 s

■ b5-24: PID Snooze Deactivation Level

When the PID feedback drops below this level, normal operation starts again. Sets as a percentage of maximum frequency.

No.	Parameter Name	Setting Range	Default
b5-24	PID Snooze Deactivation Level	0 to 100%	0%

■ b5-25: PID Setpoint Boost Setting

Temporary increase of PID setpoint to create an overshoot of the intended PID setpoint.

No.	Parameter Name	Setting Range	Default
b5-25	PID Setpoint Boost Setting	0 to 100%	0%

■ b5-26: PID Maximum Boost Time

Associated with the Snooze Function. In cases where the temporary PID Setpoint (intended PID setpoint + PID Setpoint Boost) cannot be reached within the PID Maximum Boost Time (b5-26), the Setpoint Boost is interrupted and the Drive output is turned off.

No.	Parameter Name	Setting Range	Default
b5-26	PID Maximum Boost Time	0 to 2600 s	0 s

■ b5-27: PID Snooze Feedback Level

The second method of initiating the Snooze Function. The drive output shuts off when the PID feedback level exceeds the PID Snooze Feedback Level (b5-27).

Normal drive and PID operation return after the PID feedback drops below the PID Snooze Deactivation Level (b5-24). Snooze activates when both b5-22 and b5-27 conditions are met. There is no time delay for deactivation.

Sets as a percentage of maximum frequency.

No.	Parameter Name	Setting Range	Default
b5-27	PID Snooze Feedback Level	0 to 100%	60%

■ b5-28: PID Feedback Function Selection

When b5-28 is set to 1, the square root of the PID feedback is compared to the PID Setpoint to determine appropriate drive output to properly regulate the system.

This is helpful in cases where the measured feedback is pressure, but the PID loop needs to regulate flow.

No.	Parameter Name	Setting Range	Default
b5-28	PID Feedback Function Selection	0, 1	0

0: Disabled

1: Square Root

■ b5-29: PID Square Root Gain

A multiplier applied to the square root of the feedback. If the PID Function is regulating the flow of a closed loop system by using a pressure feedback, it may be convenient to view the square root of the PID output using monitor U1-37.

No.	Parameter Name	Setting Range	Default
b5-29	PID Square Root Gain	0.00 to 2.00	0.00

■ b5-30: PID Feedback Offset

Sets PID feedback Offset as a percentage of maximum frequency.

No.	Parameter Name	Setting Range	Default
b5-30	PID Feedback Offset	0.00 to 100.00%	0.00%

b5-34: PID Output Lower Limit

Sets the minimum possible PID controller output as a percentage of the maximum output frequency (E1-04). The lower limit is disabled when set to 0.00%

No.	Name	Setting Range	Default
b5-34	PID Output Lower Limit	-100.0 to 100.0%	0.00%

b5-35: PID Input Limit

Sets the maximum allowed PID input as a percentage of the maximum output frequency (E1-04). Parameter b5-35 acts as a bipolar limit.

No.	Name	Setting Range	Default
b5-35	PID Input Limit	0.0 to 1000.0%	1000.0%

b5-36: PID Feedback High Detection Level

Sets the excessive PID feedback detection high level as a percentage of E1-04 (Maximum Output Frequency). The PID feedback must exceed this level for longer than the time set to b5-37 before feedback loss is detected.

No.	Name	Setting Range	Default
b5-36	PID Feedback High Detection Level	0 to 100%	100%

b5-37: PID Feedback High Detection Time

Sets the time that the PID feedback must exceed the value set to b5-36 before feedback loss is detected.

No.	Name	Setting Range	Default
b5-37	PID Feedback High Detection Time	0.0 to 25.5 s	1.0 s

b5-38, b5-39: PID Setpoint User Display, PID Setpoint Display Digits

When parameter b5-20 is set to 3, parameters b5-38 and b5-39 set a user-defined display for the PID setpoint (b5-19) and PID feedback monitors (U5-01, U5-04).

Parameter b5-38 determines the display value when the maximum frequency is output and parameter b5-39 determines the number of digits. The setting value is equal to the number of decimal places.

No.	Name	Setting Range	Default
b5-38	PID Setpoint User Display	1 to 60000	Determined by b5-20
b5-39	PID Setpoint Display Digits	0 to 3	Determined by b5-20

Setting 0: No Decimal Places

Setting 1: One Decimal Place

Setting 2: Two Decimal Places

Setting 3: Three Decimal Places

b5-40: Frequency Reference Monitor Content During PID

Sets the content of the frequency reference monitor display (U1-01) when PID control is active.

No.	Name	Setting Range	Default
b5-40	Frequency Reference Monitor Content During PID	0, 1	0

Setting 0: Frequency Reference after PID

Monitor U1-01 displays the frequency reference increased or reduced for the PID output.

Setting 1: Frequency Reference

Monitor U1-01 displays the frequency reference value.

b5-41: PID Unit Selection

Sets the display units in U5-14 and U5-15.

No.	Name	Setting Range	Default
b5-41	PID Unit Selection	0 to 14	0

Setting 0: WC (Inch of Water)
Setting 1: PSI (Pounds per Square Inch)
Setting 2: GPM (Gallons per Minute)
Setting 3: F (Degrees Fahrenheit)
Setting 4: CFM (Cubic Feet per Minute)
Setting 5: CMH (Cubic Meters per Hour)
Setting 6: LPH (Liters per Hour)
Setting 7: LPS (Liters per Second)
Setting 8: Bar (Bar)
Setting 9: Pa (Pascal)
Setting 10: C (Degrees Celsius)
Setting 11: Mtr (Meters)
Setting 12: Ft (Feet)
Setting 13: LPM (Liters per Minute)
Setting 14: CMM (Cubic Meters per Minute)

■ b5-42: PID Output Monitor Calculation Method

No.	Name	Setting Range	Default
b5-42	PID Output Monitor Calculation Method	0 to 3	0

Setting 0: Linear

The monitor displays PID output.

Setting 1: Square Root

The monitor displays square root PID output.

Setting 2: Quadratic

The monitor displays $1/(\text{PID output})^2$

Setting 3: Cubic

The monitor displays $1/(\text{PID output})^3$

■ b5-43/b5-44: PID Output 2 Monitor Max Upper/Lower 4 Digits

Set the maximum monitor value at maximum frequency. U5-14 and U5-15 show Custom PID output. U5-14 shows the upper 4 digits and U5-15 shows the lower 4 digits. It shows 999999.99 maximum.

No.	Name	Setting Range	Default
b5-43	Custom PID Output Monitor Setting 2	0 to 9999	0
b5-44	Custom PID Output Monitor Setting 2	0.00 to 99.99	0.00

■ b5-45: PID Output 2 Monitor Minimum

b5-14 shows Custom PID Output. b5-45 sets the minimum display value at zero speed. This function is effective when b5-42 is set to 0 (Linear).

No.	Name	Setting Range	Default
b5-45	PID Output 2 Monitor Minimum	0 to 999.9	999.9

■ b5-46: PID Setpoint Monitor Unit Selection

Sets the HOA keypad display units in U5-01 and U5-04 when b5-20 is set to 3.

No.	Name	Setting Range	Default
b5-46	PID Setpoint Monitor Unit Selection	0 to 14	0

Setting 0: WC (Inch of Water)
Setting 1: PSI (Pounds per Square Inch)
Setting 2: GPM (Gallons per Minute)
Setting 3: F (Degrees Fahrenheit)
Setting 4: CFM (Cubic Feet per Minute)
Setting 5: CMH (Cubic Meters per Hour)
Setting 6: LPH (Liters per Hour)
Setting 7: LPS (Liters per Second)
Setting 8: Bar (Bar)
Setting 9: Pa (Pascal)
Setting 10: C (Degrees Celsius)
Setting 11: Mtr (Meters)
Setting 12: Ft (Feet)
Setting 13: LPM (Liters per Minute)
Setting 14: CMM (Cubic Meters per Minute)

■ b5-47: PID Output Reverse Selection 2

Determines whether a negative PID output reverses the direction of drive operation. When the PID function is used to trim the frequency reference (b5-01 = 3 or 4), this parameter has no effect and the PID output will not be limited (same as b5-11 = 1).

No.	Name	Setting Range	Default
b5-47	PID Output Reverse Selection 2	0, 1	1

Setting 0: Reverse Disabled

Negative PID output will be limited to 0 and the drive output will be stopped.

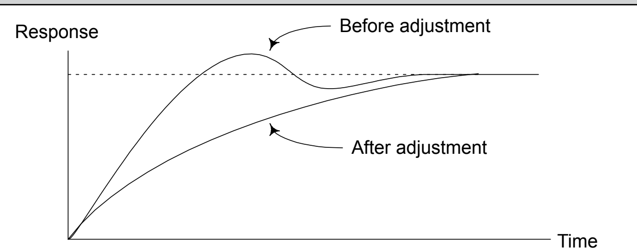
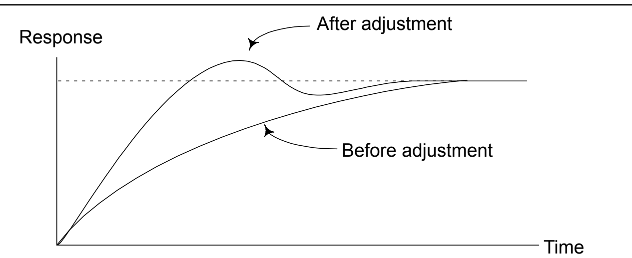
Setting 1: Reverse Enabled

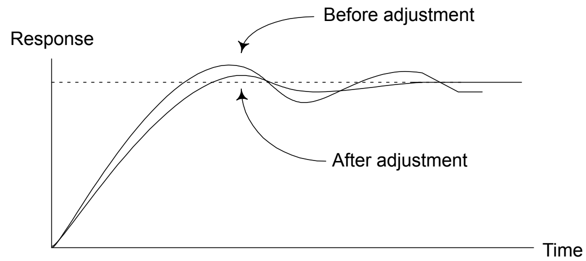
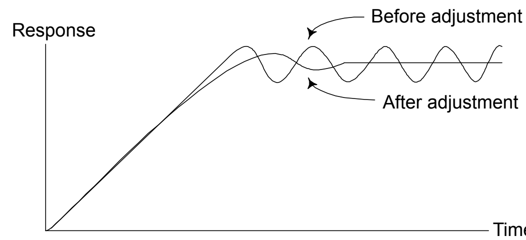
Negative PID output will cause the drive to run in the opposite direction.

■ Fine-Tuning PID

Follow the directions below to fine tune PID control parameters:

Table 1.12 PID Fine Tuning

Goal	Tuning Procedure	Result
Suppress overshoot	• Reduce the derivative time (b5-05) • Increase the integral time (b5-03)	
Achieve stability quickly while allowing some overshoot	• Decrease the integral time (b5-03) • Increase the derivative time (b5-05)	

Goal	Tuning Procedure	Result
Suppress long cycle oscillations (longer than the integral time setting)	Increase the integral time (b5-03)	
Suppress short cycle oscillations	• If oscillation cycle time is close to the derivative time, reduce the derivative time (b5-05). • If the derivative time is set to 0.00 s and oscillations are still a problem, reduce the proportional gain (b5-02) or increase the PID primary delay time (b5-08)	

◆ b8: Energy Saving

The Energy Saving feature improves overall system operating efficiency by operating the motor at its most efficient level.

Note:
1. Energy Saving is not designed for applications that experience instantaneous heavy loads or applications that rarely operate with light load conditions.
2. Energy Saving is mainly designed for applications with variable torque, however Energy Saving is not appropriate for applications where the load may suddenly increase.
3. The performance of the Energy Saving function depends on the accuracy of the motor data. Always perform Auto-Tuning and correctly enter the motor data before using this function.

■ b8-01: Energy Saving Control Selection

Enables or disables the Energy Saving function.

Note: Enabling the Energy Saving function when using a PM motor may adversely affect motor efficiency depending on the type of PM motor. Disable the Energy Saving function in such cases.

No.	Parameter Name	Setting Range	Default
b8-01	Energy Saving Control Selection	0, 1	Determined by A1-02

Setting 0: Disabled

Setting 1: Enabled

■ b8-04: Energy Saving Coefficient Value (V/f)

Fine tunes Energy Saving control. Adjust this setting while viewing the output power monitor (U1-08) and running the drive with a light load.

A low setting results in less output voltage and less energy consumption. If the value is set too low the motor may stall. The default setting depends on the capacity of the drive.

No.	Name	Setting Range	Default
b8-04	Energy Saving Coefficient Value	0.00 to 655.00	Determined by E2-11, and o2-04

Note: The default value changes if the motor rated capacity set to E2-11 is changed. The Energy Saving coefficient is set automatically when Auto-Tuning for Energy Saving is performed.

■ b8-05: Power Detection Filter Time (V/f)

Determines how often in milliseconds the output power is measured. The Energy Saving function continuously searches out the lowest output voltage to achieve minimum output power.

Reducing this setting increases the response time. If the filter time is too short, the motor may become unstable with a lighter load.

No.	Name	Setting Range	Default
b8-05	Power Detection Filter Time	0 to 2000 ms	20 ms

■ b8-06: Search Operation Voltage Limit (V/f)

Sets the voltage limit for the Speed Search optimal output voltage detection as a percentage of the maximum output voltage. The drive will keep the output voltage above this level during the search operation to prevent motor stalling.

Note: If set too low, the motor may stall when the load is suddenly increased. Disabled when set to 0. Setting this value to 0 does not disable Energy Saving.

No.	Name	Setting Range	Default
b8-06	Search Operation Voltage Limit	0 to 100%	0%

1.3 C: Tuning

C parameters set the characteristics for acceleration, deceleration, and S-curves. Other parameters in the C group cover settings for slip compensation, torque compensation, and carrier frequency.

◆ C1: Acceleration and Deceleration Times

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

Four 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	0.1 to 6000.0 s	30.0 s
C1-02	Deceleration Time 1		
C1-03	Acceleration Time 2		
C1-04	Deceleration Time 2		

Switching Acceleration Times by Digital Input

Accel/decel time 1 is active by default if no input is set.

Table 1.13 Accel/Decel Time Selection by Digital Input

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

Figure 1.19 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).

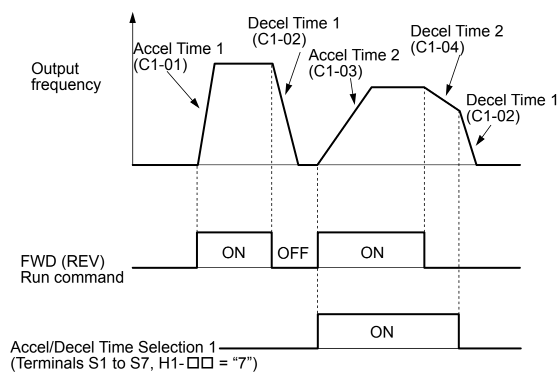


Figure 1.19 Timing Diagram of Accel/Decel Time Change

Switching Accel/Decel Times by a Frequency Level

The drive can switch between different acceleration and deceleration times automatically. The drive will switch from accel/decel time 2 in C1-03 and C1-04 to the default accel/decel time in C1-01 and C1-02 when the output frequency exceeds the frequency level set in parameter C1-11. When the frequency falls below this level, the accel/decel times are switched back. *Figure 1.20* shows an operation example.

Note: Acceleration and deceleration times selected by digital inputs have priority over the automatic switching by the frequency level set to C1-11. For example, if accel/decel time 2 is selected, the drive will use only accel/decel time 2; it will not switch from accel/decel time 2 to the selected time.

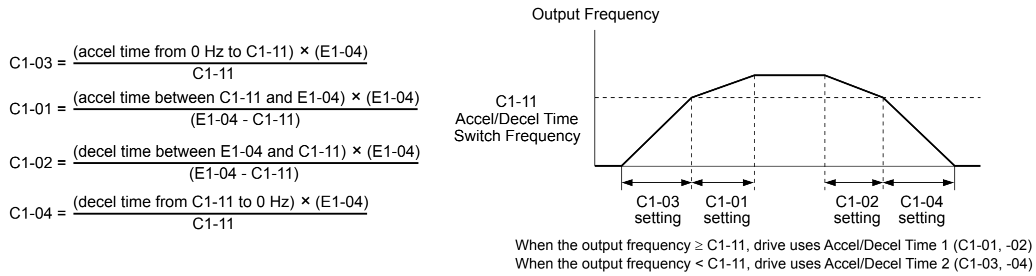


Figure 1.20 Accel/Decel Time Switching Frequency

■ C1-09: Fast Stop Time

Sets a special deceleration used when a select group of faults occur or when closing a digital input configured as H1-□□ = 15 (N.O. input) or 17 (N.C. input). A momentary closure of the digital input will trigger the Fast Stop operation; it does not have to be closed continuously.

The drive cannot be restarted after initiating a Fast Stop operation until after completing deceleration, clearing the Fast Stop input, and cycling the Run command.

A digital output programmed for “During Fast Stop” (H2-□□ = 4C) will be closed as long as Fast Stop is active.

No.	Parameter Name	Setting Range	Default
C1-09	Fast Stop Time	0.1 to 6000.0 s	10.0 s

NOTICE: *Rapid deceleration can trigger an overvoltage fault. The drive output shuts off when faulted and the motor coasts. Set an appropriate Fast Stop time to C1-09 to avoid this uncontrolled motor state and to ensure that the motor stops quickly and safely.*

■ C1-11: Accel/Decel Time Switching Frequency

Sets the frequency at which the drive switches between accel/decel time settings. See ***Refer to Switching Accel/Decel Times by a Frequency Level on page 46***.

No.	Parameter Name	Setting Range	Default
C1-11	Accel/Decel Time Switching Frequency	0.0 to 400.0 Hz	Determined by A1-02

Note: Setting C1-11 to 0.0 disables this function.

◆ C2: S-Curve Characteristics

Use S-curve characteristics to smooth acceleration and deceleration and minimize abrupt shock to the load. Set S-curve characteristic time during acceleration/deceleration at start and acceleration/deceleration at stop. Increase the value set to C2-01 if the STo fault (Step Out Detection) occurs when starting a PM motor.

■ C2-01 and C2-02: S-Curve Characteristics

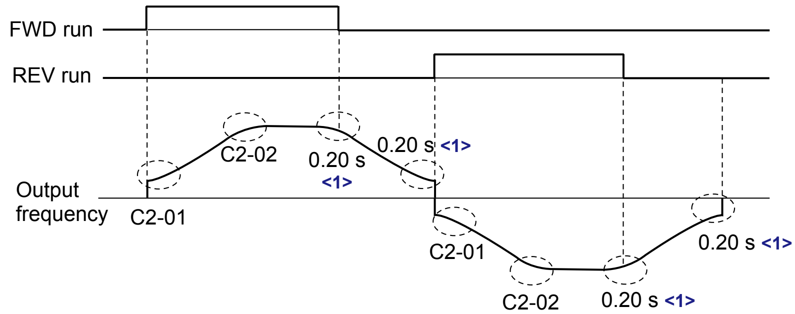
C2-01 and C2-02 set separate S-curves for each section of the acceleration or deceleration.

No.	Parameter Name	Setting Range	Default
C2-01	S-Curve Characteristic at Accel Start	0.00 to 10.00 s	Determined by A1-02
C2-02	S-Curve Characteristic at Accel End		0.20 s

Figure 1.21 illustrates S-curve application.

Parameter Details

1



<1> S-Curve characteristic at Decel Start/End is fixed to 0.20 s.

Figure 1.21 S-Curve Timing Diagram - FWD/REV Operation

Setting the S-curve will increase the acceleration and deceleration times.

Actual accel time = accel time setting + (C2-01 + C2-02) / 2

◆ C4: Torque Compensation

The torque compensation function compensates for insufficient torque production at start-up or when a load is applied.

Note: Set the motor parameters and V/f pattern properly before setting torque compensation parameters.

■ C4-01: Torque Compensation Gain

Sets the gain for the torque compensation function.

No.	Parameter Name	Setting Range	Default
C4-01	Torque Compensation Gain	0.00 to 2.50	Determined by A1-02

Torque Compensation in V/f and OLV/PM:

The drive calculates the motor primary voltage loss using the output current and the termination resistor value (E2-05 for IM motors, E5-05 for PM motors) and adjusts the output voltage to compensate insufficient torque at start or when load is applied. The effects of this voltage compensation can be increased or decreased using parameter C4-01.

Adjustment

Although this parameter rarely needs to be changed, it may be necessary to adjust the torque compensation gain in small steps of 0.05 in the following situations:

- Increase this setting when using a long motor cable.
- Decrease this setting when motor oscillation occurs.

Adjust C4-01 so the output current does not exceed the drive rated current.

Note: Refrain from adjusting this parameter in OLV/PM. Setting this value too high can cause overcompensation and motor oscillation.

■ C4-02: Torque Compensation Primary Delay Time

Sets the delay time used for applying torque compensation.

No.	Parameter Name	Setting Range	Default
C4-02	Torque Compensation Primary Delay Time	0 to 60000 ms	Determined by A1-02 and o2-04

Adjustment

Although C4-02 rarely needs to be changed, adjustments may be necessary in the following situations:

- Increase this setting if the motor vibrates.
- Decrease this setting if the motor responds too slowly to changes in the load.

◆ C6: Carrier Frequency

■ C6-02: Carrier Frequency Selection

Sets the switching frequency of the drive output transistors. Changes to the switching frequency lower audible noise and reduce leakage current.

Note: Increasing the carrier frequency above the default value automatically lowers the drive current rating. *Refer to Rated Current Depending on Carrier Frequency on page 50*.

No.	Parameter Name	Setting Range	Default
C6-02	Carrier Frequency Selection	1 to 4, F	Determined by A1-02 and o2-04.

Setting 1: 4.0 kHz

Setting 2: 6.0 kHz

Setting 3: 8.0 kHz

Setting 4: 10.0 kHz

Setting F: User defined (C6-03 to C6-05)

Guidelines for Carrier Frequency Parameter Setup

Symptom	Remedy
Speed and torque are unstable at low speeds	Lower the carrier frequency.
Noise from the drive affects peripheral devices	
Excessive leakage current from the drive	
Wiring between the drive and motor is too long <1>	
Audible motor noise is too loud	Increase the carrier frequency.

<1> The carrier frequency may need to be lowered if the motor cable is too long. Refer to *Table 1.14*.

Table 1.14 Wiring Distance and Carrier Frequency

Wiring Distance	Up to 50 m	Greater than 50 m
Recommended setting value for C6-02	1 to 4 (up to 10 kHz)	1 (up to 4 kHz)

Note: The maximum cable length is 100 m when using OLV/PM (A1-02 = 5).

■ C6-03, C6-04, C6-05: Carrier Frequency Upper Limit, Lower Limit, Proportional Gain

Note: C6-04 and C6-05 are available in V/f Control mode only.

These parameters set a user-defined or a variable carrier frequency. Set C6-02 to F to set the upper and lower limits and the carrier frequency proportional gain.

No.	Parameter Name	Setting Range	Default
C6-03	Carrier Frequency Upper Limit	4.0 to 10.0 kHz <1>	Determined by C6-02 and o2-04
C6-04	Carrier Frequency Lower Limit (V/f Control only)	4.0 to 10.0 kHz <1>	
C6-05	Carrier Frequency Proportional Gain (V/f Control only)	0 to 99 <1>	

<1> Available only when C6-02 is set to F.

The upper limit of the carrier frequency varies by the drive model. *Refer to Rated Current Depending on Carrier Frequency on page 50* for details.

Setting a Fixed User-Defined Carrier Frequency

A carrier frequency between the fixed selectable values can be entered in parameter C6-03 when C6-02 is set to F.
In V/f Control, adjust parameter C6-04 to the same value as C6-03.

Setting a Variable Carrier Frequency (V/f Control)

In V/f Control, the carrier frequency can be set up to change linearly with the output frequency by setting the upper and lower limits for the carrier frequency and the carrier frequency proportional gain (C6-03, C6-04, C6-05) as shown in *Figure 1.22*.

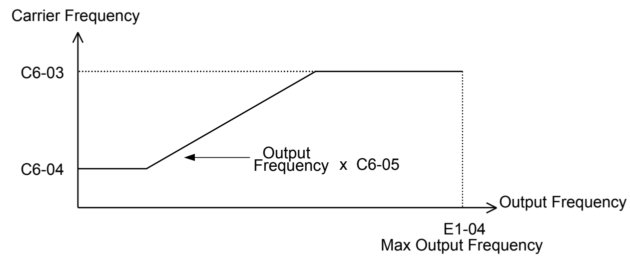


Figure 1.22 Carrier Frequency Changes Relative to Output Frequency

Note: When C6-05 is set lower than 7, C6-04 is disabled and the carrier frequency will be fixed to the value set in C6-03.

■ C6-09: Carrier Frequency during Rotational Auto-Tuning

Determines the carrier frequency while performing Rotational Auto-Tuning. Although this parameter rarely needs to be changed, when overcurrent problems occur when Auto-Tuning a high frequency motor or low impedance motor, it may be helpful to set C6-03 to a high value before setting C6-09 to 1.

No.	Parameter Name	Setting Range	Default
C6-09	Carrier Frequency during Rotational Auto-Tuning	0, 1	0

Setting 0: Carrier frequency = 4 kHz

Setting 1: Same value set to C6-03

◆ Rated Current Depending on Carrier Frequency

The tables below show the drive output current depending on the carrier frequency settings.

Use the data in the following tables to linearly calculate output current values for carrier frequencies not listed.

Table 1.15 Three-Phase 200 V Class Carrier Frequency and Current Derating

Drive Model	Setting Range	Rated Current [A]			
		4 kHz	6 kHz	8 kHz	10 kHz
2□0028	4 to 10 kHz	28	25	22	20
2□0042	4 to 10 kHz	42	38	34	29
2□0054	4 to 10 kHz	54	49	43	38
2□0068	4 to 10 kHz	68	61	54	48
2□0081	4 to 10 kHz	81	73	65	57
2□0104	4 to 8 kHz	104	94	83	—
2□0130	4 to 8 kHz	130	117	104	—
2□0154	4 to 6 kHz	154	139	—	—
2□0192	4 to 6 kHz	192	173	—	—
2□0248	4 kHz	248	—	—	—

Table 1.16 Three-Phase 400 V Class Carrier Frequency and Current Derating

Drive Model	Setting Range	Rated Current [A]			
		4 kHz	6 kHz	8 kHz	10 kHz
4□0011	4 to 10 kHz	11	9.9	8.8	7.7
4□0014	4 to 10 kHz	14	13	11	9.8
4□0021	4 to 10 kHz	21	19	17	15
4□0027	4 to 10 kHz	27	24	22	19
4□0034	4 to 10 kHz	34	31	27	24
4□0040	4 to 10 kHz	40	36	32	28
4□0052	4 to 10 kHz	52	47	42	36
4□0065	4 to 10 kHz	65	59	52	46
4□0077	4 to 10 kHz	77	69	62	54
4□0096	4 to 8 kHz	96	86	77	—

Drive Model	Setting Range	Rated Current [A]			
		4 kHz	6 kHz	8 kHz	10 kHz
4□0124	4 to 8 kHz	124	112	99	—
4□0156	4 to 6 kHz	156	140	—	—
4□0180	4 to 6 kHz	180	162	—	—
4□0216	4 kHz	216	—	—	—
4□0240	4 kHz	240	—	—	—
4□0302	4 kHz	302	—	—	—
4□0361	4 kHz	361	—	—	—
4□0414	4 kHz	414	—	—	—

◆ C7: Voltage Adjustment

■ C7-43: Input Voltage Offset Adjustment

Note: Adjustment is completed at the factory. Do not change the setting of this parameter.

Enables adjustment of the offset for the input voltage circuit when the control board is replaced.

Changing the value of o2-04 will trigger an oPE30 error. The input voltage offset must be adjusted when the error occurs. If the combination of the control board and drive does not change, set this parameter to 0002 (offset adjustment not required).

Contact Yaskawa or a Yaskawa representative if it becomes necessary to replace the control board.

No.	Parameter Name	Setting Range	Default
C7-43	Input Voltage Offset Adjustment	0000 to 9999	0000

Setting 0000: Standard

Setting 0002: Offset Adjustment Not Required

■ C7-56: Power Factor Control Selection

Power factor control improves the input power supply power factor according to the operating conditions.

This parameter rarely requires adjustment, but may be enabled to improve the power factor in the low output region. Power factor control is not suitable for applications with frequent load fluctuations.

This function is disabled in High Output Voltage Mode (C7-60 = 1).

No.	Parameter Name	Setting Range	Default
C7-56	Power Factor Control Selection	0, 1	0

Setting 0: Power Factor Control Disabled

Setting 1: Power Factor Control Enabled

■ C7-60: Output Voltage Limit Mode Selection

Sets the mode to limit the output voltage.

Set this parameter to 0 (Harmonic suppression priority mode) to give priority to harmonic suppression. The maximum output voltage is automatically limited to suppress harmonics.

Set this parameter to 1 (High output voltage mode) to give priority to the output voltage over harmonic suppression. The effectiveness of harmonic suppression will be reduced because the maximum output voltage will be used.

No.	Parameter Name	Setting Range	Default
C7-60	Output Voltage Limit Mode Selection	0, 1	Determined by A1–02

Setting 0: Harmonic Suppression Priority Mode

Setting 1: High Output Voltage Mode

1.4 d: Reference Settings

Figure 1.23 gives an overview of the reference input, selections, and priorities.

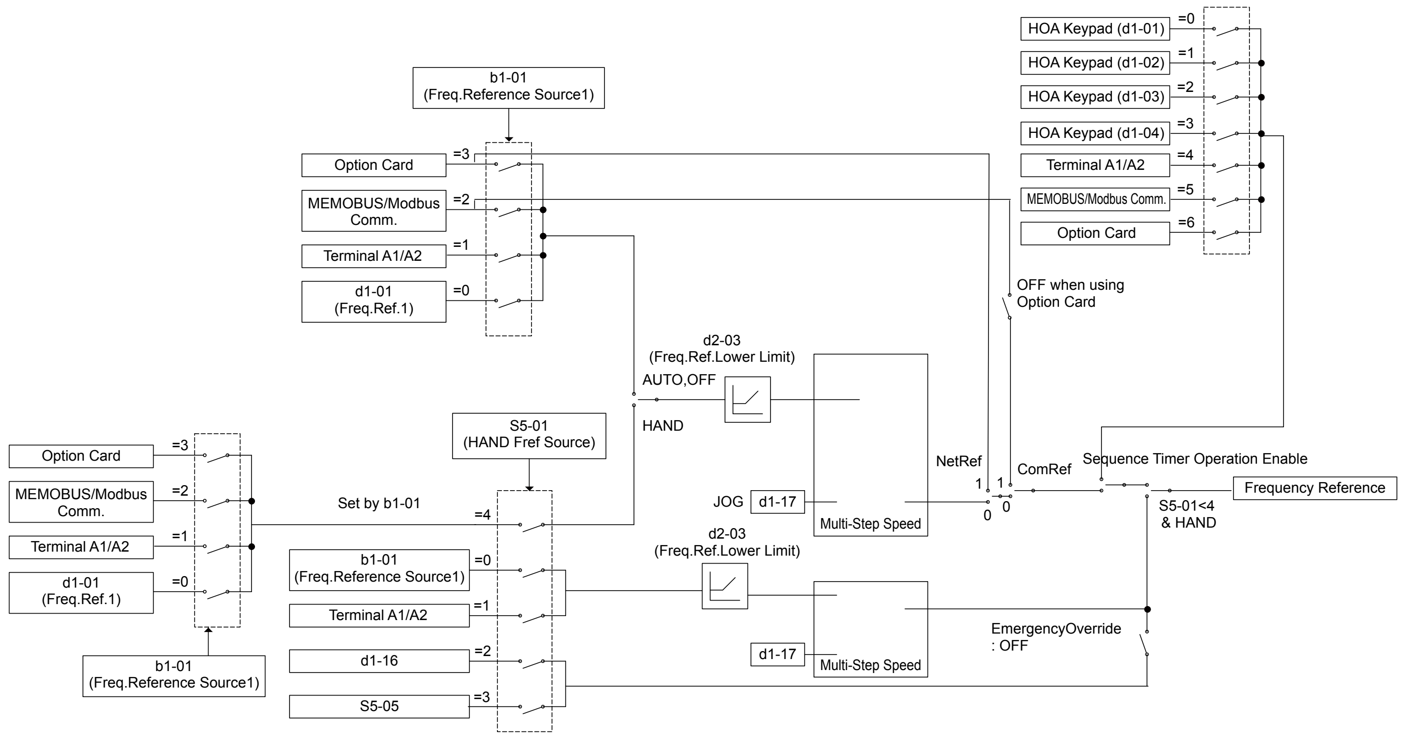


Figure 1.23 Frequency Reference Setting Hierarchy

◆ d1: Frequency Reference

■ d1-01 to d1-04, d1-16, and d1-17: Frequency References 1 to 4, 16, and Jog Frequency Reference

The drive lets the user switch between up to 5 preset frequency references during run (including the Jog reference) through the digital input terminals. The drive uses the acceleration and deceleration times that have been selected when switching between each frequency reference.

The Jog Frequency overrides all other frequency references and must be selected by a separate digital input.

The multi-speed references 1 and 2 can be provided by analog inputs.

No.	Parameter Name	Setting Range	Default
d1-01 to d1-04	Frequency Reference 1 to 4	0.00 to 400.00 Hz <1> <2>	0.00 Hz <2>
d1-16	Frequency Reference 16	0.00 to 400.00 Hz <1> <2>	0.00 Hz <2>
d1-17	Jog Frequency Reference	0.00 to 400.00 Hz <1> <2>	6.00 Hz <2>

<1> The upper limit is determined by the maximum output frequency (E1-04) and upper limit for the frequency reference (d2-01).

<2> Setting units are determined by parameter o1-03. The default is “Hz” (o1-03 = 0).

Multi-Step Speed Selection

To use several speed references for a multi-step speed sequence, set the H1-□□ parameters to 3 and 4. To assign the Jog reference to a digital input, set H1-□□ to 6.

Notes on using analog inputs as Multi-Speed 1 and 2:

- The first frequency reference (Multi-Speed 1) comes from the source specified in b1-01. When using an analog input terminal to supply the frequency reference, assign the frequency reference source to the control terminals (b1-01 = 1).
- When an analog input is set to “Auxiliary frequency 1” (H3-02 or H2-06 = 2), the value set to this input will be used as the Multi-Step Speed 2 instead of the value set to parameter d1-02. If no analog inputs are set for “Auxiliary frequency 1”, then d1-02 becomes the reference for Multi-Step Speed 2.

Select the different speed references as shown in *Table 1.17*. *Figure 1.24* illustrates the multi-step speed selection.

Table 1.17 Multi-Step Speed Reference and Terminal Switch Combinations

Reference	Multi-Step Speed H1-☐☐ = 3	Multi-Step Speed 2 H1-☐☐ = 4	Jog Reference H1-☐☐ = 6
Frequency Reference 1 (set in b1-01)	OFF	OFF	OFF
Frequency Reference 2 (d1-02 or input terminal A1, A2)	ON	OFF	OFF
Frequency Reference 3 (d1-03 or input terminal A1, A2)	OFF	ON	OFF
Frequency Reference 4 (d1-04)	ON	ON	OFF
Jog Frequency Reference (d1-17) <1>	–	–	ON

<1> The Jog frequency overrides all other frequency references.

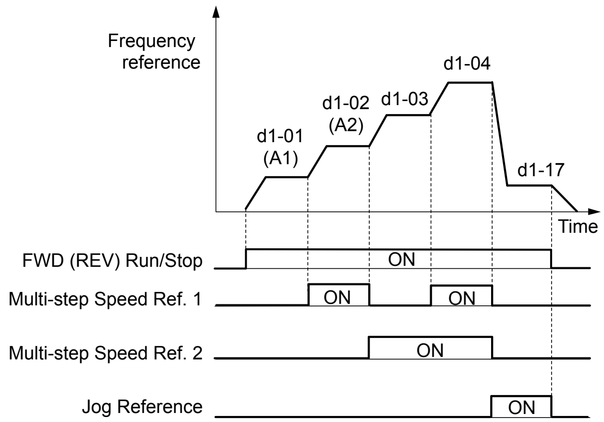


Figure 1.24 Preset Reference Timing Diagram

◆ d2: Frequency Upper/Lower Limits

Upper and lower frequency limits prevent motor speed from going above or below levels that may cause resonance or equipment damage.

■ d2-01: Frequency Reference Upper Limit

Sets the maximum frequency reference as a percentage of the maximum output frequency. This limit applies to all frequency references.

Even if the frequency reference is set to a higher value, the drive internal frequency reference will not exceed this value.

No.	Parameter Name	Setting Range	Default
d2-01	Frequency Reference Upper Limit	0.0 to 110.0%	100.0%

■ d2-02: Frequency Reference Lower Limit

Sets the minimum frequency reference as a percentage of the maximum output frequency. This limit applies to all frequency references.

If a lower reference than this value is entered, the drive will run at the limit set to d2-02. If the drive is started with a lower reference than d2-02, it will accelerate up to d2-02.

No.	Parameter Name	Setting Range	Default
d2-02	Frequency Reference Lower Limit	0.0 to 110.0%	0.0%

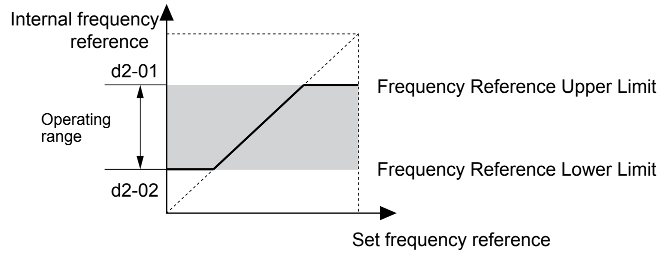


Figure 1.25 Frequency Reference: Upper and Lower Limits

■ d2-03: Master Speed Reference Lower Limit

Sets a lower limit as a percentage of the maximum output frequency that will only affect a frequency reference entered from the analog input terminals (A1, A2, or A3) as the master speed reference. This is unlike parameter d2-02, which affects all frequency references regardless of their source.

Note: When lower limits are set to both parameters d2-02 and d2-03, the drive uses the greater of those two values as the lower limit.

No.	Parameter Name	Setting Range	Default
d2-03	Master Speed Reference Lower Limit	0.0 to 110.0%	0.0%

◆ d3: Jump Frequency

■ d3-01 to d3-04: Jump Frequencies 1, 2, 3 and Jump Frequency Width

Jump frequencies are frequency ranges at which the drive will not operate. The drive can be programmed with three separate Jump Frequencies to avoid operating at speeds that cause resonance in driven machinery. If the speed reference falls within a Jump Frequency dead band, the drive will clamp the frequency reference just below the dead band and only accelerate past it when the frequency reference rises above the upper end of the dead band.

Setting parameters d3-01 through d3-03 to 0.0 Hz disables the Jump Frequency function.

No.	Parameter Name	Setting Range	Default
d3-01	Jump Frequency 1	0.0 to 400.0 Hz	0.0 Hz
d3-02	Jump Frequency 2	0.0 to 400.0 Hz	0.0 Hz
d3-03	Jump Frequency 3	0.0 to 400.0 Hz	0.0 Hz
d3-04	Jump Frequency Width	0.0 to 20.0 Hz	1.0 Hz

Figure 1.26 shows the relationship between the Jump Frequency and the frequency reference.

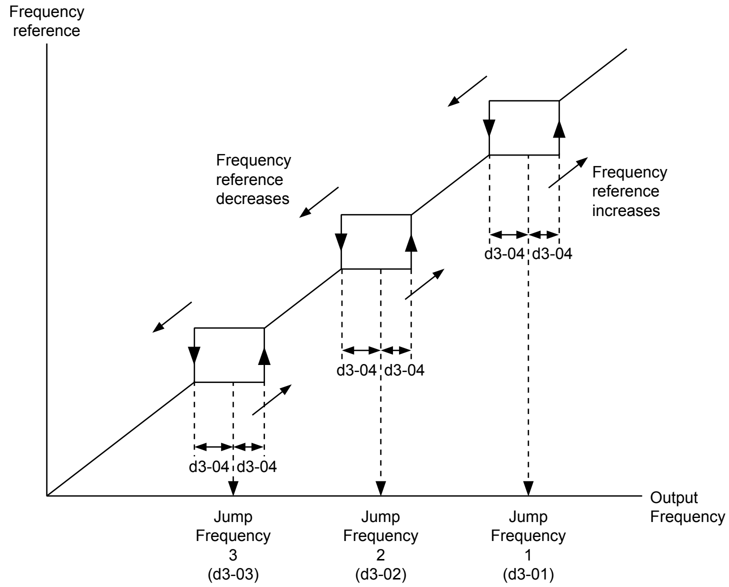


Figure 1.26 Jump Frequency Operation

Note:
1. The drive will use the active accel/decel time to pass through the specified dead band range, but will not allow continuous operation in that range.
2. When setting more than one Jump Frequency, make sure that the parameters do not overlap.

◆ d4: Frequency Reference Hold and Up/Down 2 Function

■ d4-01: Frequency Reference Hold Function Selection

This parameter is effective when either of the digital input functions listed below are used:
- Accel/decel ramp hold function (H1-□□= A)
- Up/Down function (H1-□□ = 10 and 11)

No.	Parameter Name	Setting Range	Default
d4-01	Frequency Reference Hold Function Selection	0, 1	0

The operation depends on the function used with parameter d4-01.

Setting 0: Disabled
- Acceleration hold

  The hold value will be reset to 0 Hz when the Stop command is entered or the drive power is switched off. The active frequency reference will be the value the drive uses when it restarts.
- Up/Down

  The frequency reference value will be reset to 0 Hz when the Stop command is entered or the drive power is switched off. The drive will start from 0 Hz when it is restarted.

Setting 1: Enabled
- Acceleration hold

  The last hold value will be saved when the Run command or the drive power is switched off and the drive will use the saved value as the frequency reference when it restarts. Make sure to continuously enable the multi-function input terminal set for "Accel/decel ramp hold" (H1-□□ = A) or the hold value will be cleared when the power is switched on.

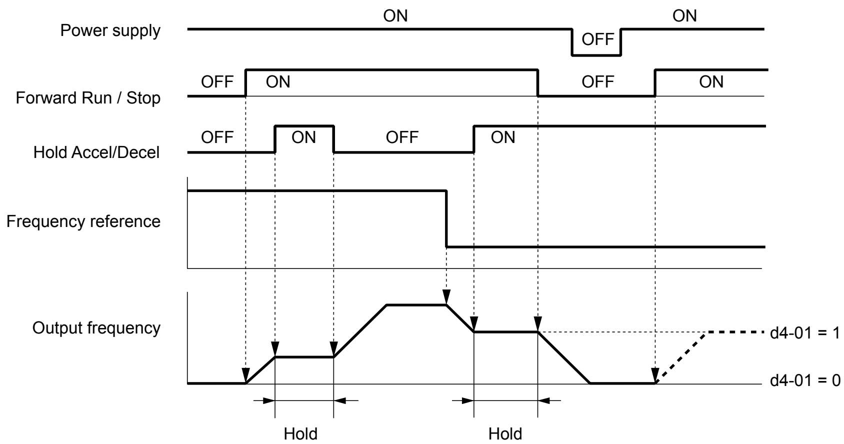


Figure 1.27 Frequency Reference Hold with Accel/Decel Hold Function

- Up/Down

  The frequency reference value will be saved when the Run command or the drive power is switched off. The drive will use the frequency reference that was saved when it restarts.

Clearing the Saved Value

Depending on which function is used, it is possible to clear the saved frequency reference value by:

- Releasing the input programmed for Acceleration hold.
- Setting an Up or Down command while no Run command is active.

■ d4-10: Up/Down Frequency Reference Limit Selection

Selects how the lower frequency limit is set when using the Up/Down function. ***Refer to Settings 10 and 11: Up/Down Function on page 80*** for details on the Up/Down function in combination with frequency reference limits.

No.	Parameter Name	Setting Range	Default
d4-10	Up/Down Frequency Reference Limit Selection	0, 1	0

Setting 0: Lower Limit is Determined by d2-02 or Analog Input

The lower frequency reference limit is determined by the higher value of either parameter d2-02 or an analog input (A1, and A2) that is programmed for “Frequency bias”.

Note: For example, if the command to switch the external reference (H1-☐☐ = 2) is used to switch between the Up/Down function and an analog input as the reference source, the analog value becomes the lower reference limit when the Up/Down command is active. Change d4-10 to 1 to make the Up/Down function independent of the analog input value.

Setting 1: Lower Limit is Determined by Parameter d2-02

Only parameter d2-02 sets the lower frequency reference limit.

◆ d6: Field Weakening

■ d6-01: Field Weakening Level

Sets the drive output voltage for the Field Weakening function as a percentage of the maximum output voltage. Enabled when a multi-function input is set for Field Weakening (H1-☐☐ = 63).

No.	Parameter Name	Setting Range	Default
d6-01	Field Weakening Level	0 to 100%	80%

■ d6-02: Field Weakening Frequency Limit

Sets the minimum output frequency at which field weakening can be activated. Field Weakening cannot be activated for frequencies below d6-02.

No.	Parameter Name	Setting Range	Default
d6-02	Field Weakening Frequency Limit	0 to 400.0 Hz	0.0 Hz

◆ d7: Offset Frequency

■ d7-01 to d7-03: Offset Frequency 1 to 3

Three different offset values can be added to the frequency reference. They can be selected using digital inputs programmed for Offset frequency 1, 2, and 3 (H1-□□ = 44, 45, 46). The selected offset values are added together if multiple inputs are closed simultaneously.

No.	Parameter Name	Setting Range	Default
d7-01	Offset Frequency 1	-100.0 to 100.0%	0%
d7-02	Offset Frequency 2	-100.0 to 100.0%	0%
d7-03	Offset Frequency 3	-100.0 to 100.0%	0%

Figure 1.28 illustrates the Offset frequency function.

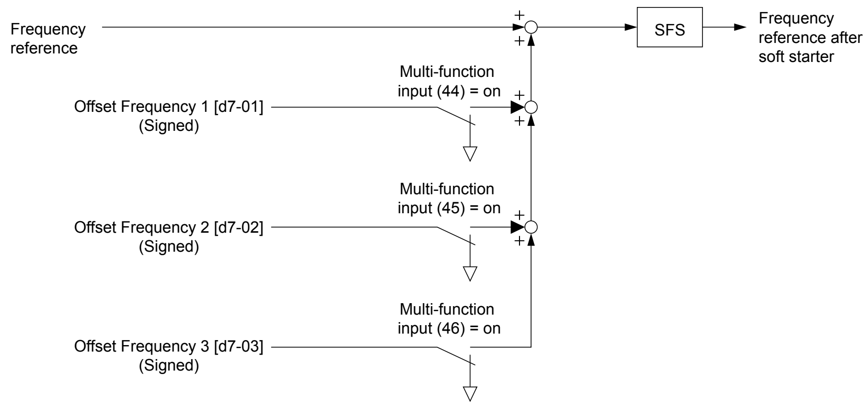


Figure 1.28 Offset Frequency Operation

Parameter Details

1

1.5 E: Motor Parameters

E parameters cover V/f pattern and motor data settings.

◆ E1: V/f Pattern for Motor 1

■ V/f Pattern Settings (E1-03)

The drive uses a V/f pattern to adjust the output voltage relative to the frequency reference. There are 15 different predefined V/f patterns (setting 0 to E) from which to select, each with varying voltage profiles, saturation levels (frequency at which maximum voltage is reached), and maximum frequencies. Additionally, one custom V/f pattern is available (setting F) that requires the user to create the pattern using parameters E1-04 through E1-10.

■ E1-03: V/f Pattern Selection

Selects the V/f pattern for the drive and motor from 15 predefined patterns or creates a custom V/f pattern.

No.	Parameter Name	Setting Range	Default
E1-03	V/f Pattern Selection	0 to F <1>	F <2>

<1> Settings 0 through E are not available in OLV/PM (A1-02 = 5).

<2> Parameter is not reset to the default value when the drive is initialized using A1-03.

Setting a Predefined V/f Pattern (Setting 0 to E)

Choose the V/f pattern that best meets the application demands from ***Table 1.18***. These settings are available only in V/f Control modes. Set the correct value to E1-03. Parameters E1-04 to E1-13 can only be monitored, not changed.

Note: **1.** Setting an improper V/f pattern may result in low motor torque or increased current due to overexcitation.
2. Drive initialization does not reset parameter E1-03.

Table 1.18 Predefined V/f Patterns

Setting	Specification	Characteristic	Application
0	50 Hz	Constant torque	For general purpose applications. Torque remains constant regardless of changes to speed.
1	60 Hz		
2	60 Hz (with 50 Hz base)		
3	72 Hz (with 60 Hz base)		
4	50 Hz, Variable torque 1	Variable torque	For fans, pumps, and other applications where the required torque changes as a function of the speed.
5	50 Hz, Variable torque 2		
6	60 Hz, Variable torque 1		
7	60 Hz, Variable torque 2		
8	50 Hz, mid starting torque	High starting torque	Select high starting torque when: • Wiring between the drive and motor exceeds 150 m. • A large amount of starting torque is required.
9	50 Hz, high starting torque		
A	60 Hz, mid starting torque		
B	60 Hz, high starting torque		
C	90 Hz (with 60 Hz base)	Constant output	Output voltage is constant when operating at greater than 60 Hz.
D	120 Hz (with 60 Hz base)		
E	180 Hz (with 60 Hz base)		
F <1>	60 Hz	Constant torque	For general purpose applications. Torque remains constant regardless of changes to speed.

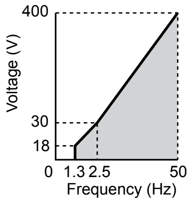
<1> Setting F enables a custom V/f pattern by changing parameters E1-04 to E1-13. When the drive is shipped, the default values for parameters E1-04 to E1-13 are the same as those of setting 1.

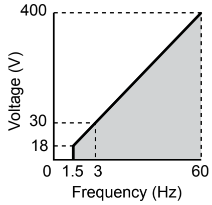
The following tables show details on predefined V/f patterns.

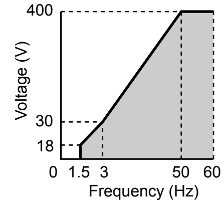
Predefined V/f Patterns for Models 4□0011 and 4□0014

Table 1.19 Constant Torque Characteristics, Settings 0 to 3

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







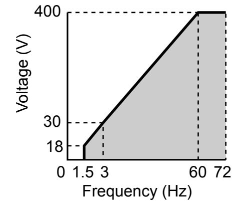
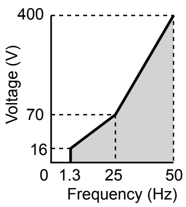
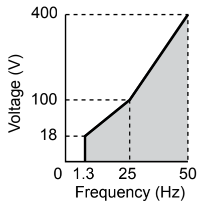
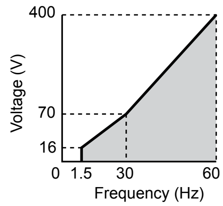


Table 1.20 Derated Torque Characteristics, Settings 4 to 7

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







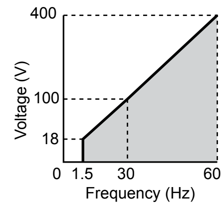
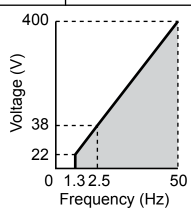
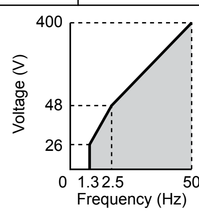
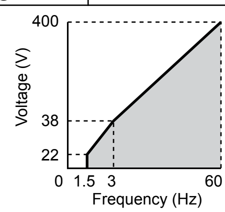


Table 1.21 High Starting Torque, Settings 8 to B

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







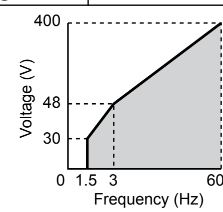
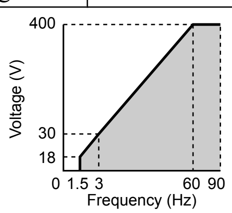
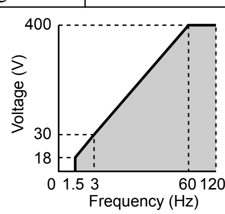
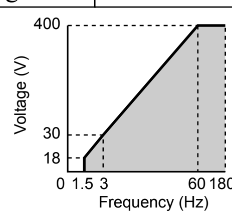


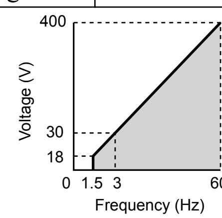
Table 1.22 Rated Output Operation, Settings C to F

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz	Setting = F	60 Hz







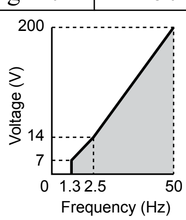


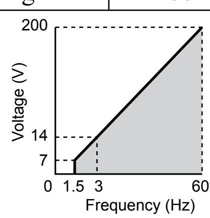
Predefined V/f Patterns for Models 2□0028 to 2□0192 and 4□0021 to 4□0124

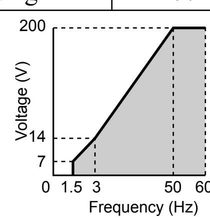
The values in the following graphs are specific to 200 V class drives. Double the values for 400 V class drives.

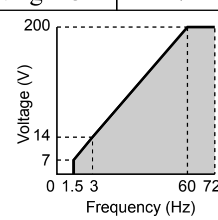
Table 1.23 Rated Torque Characteristics, Settings 0 to 3

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









Parameter Details

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Table 1.24 Derated Torque Characteristics, Settings 4 to 7

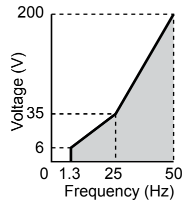
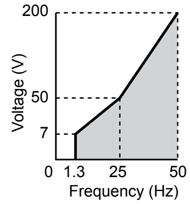
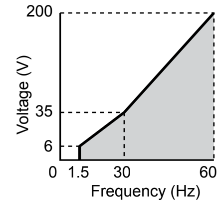
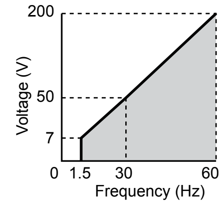
Setting = 4	50 Hz	Setting = 5	50 Hz	Setting = 6	60 Hz	Setting = 7	60 Hz
							

Table 1.25 High Starting Torque, Settings 8 to B

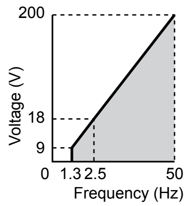
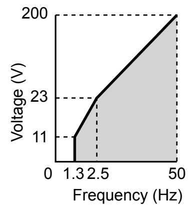
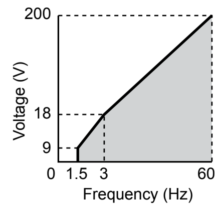
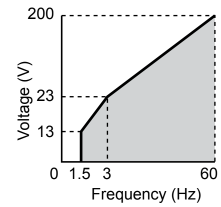
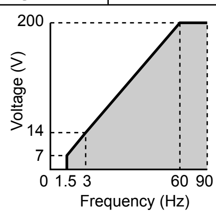
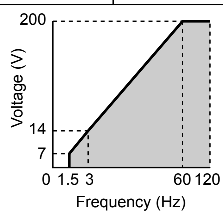
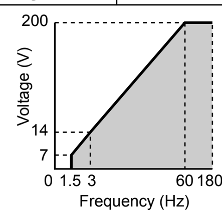
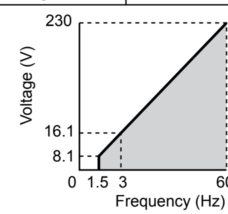
Setting = 8	50 Hz	Setting = 9	50 Hz	Setting = A	60 Hz	Setting = B	60 Hz
							

Table 1.26 Constant Output, Settings C to F

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz	Setting = F	60 Hz
							

Predefined V/f Patterns for Models 2□0216 and 4□0156 to 4□0414

The values in the following graphs are specific to 200 V class drives. Double the values for 400 V class drives.

Table 1.27 Rated Torque Characteristics, Settings 0 to 3

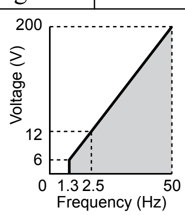
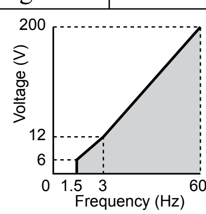
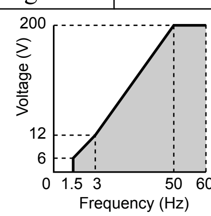
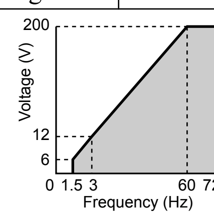
Setting = 0	50 Hz	Setting = 1	60 Hz	Setting = 2	60 Hz	Setting = 3	72 Hz
							

Table 1.28 Derated Torque Characteristics, Settings 4 to 7

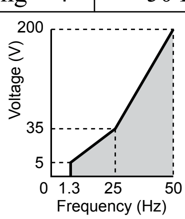
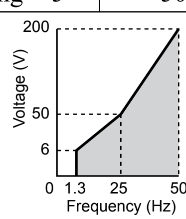
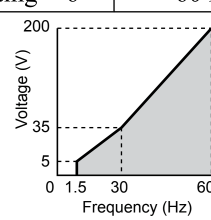
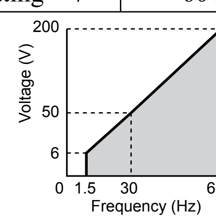
Setting = 4	50 Hz	Setting = 5	50 Hz	Setting = 6	60 Hz	Setting = 7	60 Hz
							

Table 1.29 High Starting Torque, Settings 8 to B

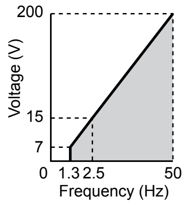
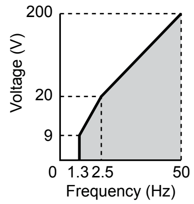
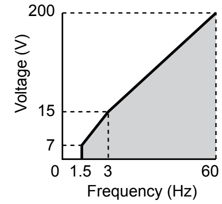
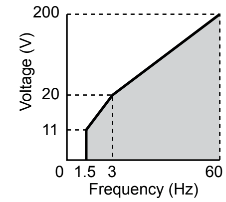
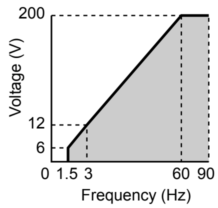
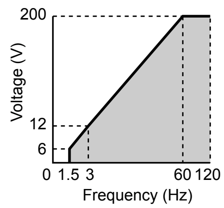
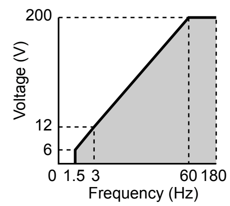
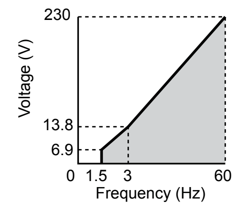
Setting = 8	50 Hz	Setting = 9	50 Hz	Setting = A	60 Hz	Setting = B	60 Hz
							

Table 1.30 Constant Output, Settings C to F

Setting = C	90 Hz	Setting = D	120 Hz	Setting = E	180 Hz	Setting = F	60 Hz
							

Setting a Custom V/f Pattern (Setting F: Default)

Setting parameter E1-03 to F allows the user to set up a custom V/f pattern by changing parameters E1-04 to E1-13.

■ V/f Pattern Settings E1-04 to E1-13

If E1-03 is set to a preset V/f pattern (i.e., a value other than F), the user can monitor the V/f pattern in parameters E1-04 through E1-13. To create a new V/f pattern, set E1-03 to F. *Refer to V/f Pattern on page 62* for an example custom V/f pattern.

Note: Certain E1-□□ parameters might not be visible depending on the control mode. *Refer to Parameter List on page 191* for details.

No.	Parameter Name	Setting Range	Default
E1-04	Maximum Output Frequency	40.0 to 400.0 Hz <1>	<2> <3>
E1-05	Maximum Voltage	0.0 to 255.0 V <4>	<2> <5>
E1-06	Base Frequency	0.0 to [E1-04] <1>	<2> <3> <5>
E1-07	Middle Output Frequency	0.0 to [E1-04]	<2>
E1-08	Middle Output Frequency Voltage	0.0 to 255.0 V <4>	<2>
E1-09	Minimum Output Frequency	0.0 to [E1-04] <1>	<2> <3> <5>
E1-10	Minimum Output Frequency Voltage	0.0 to 255.0 V <4>	<2>
E1-11 <6>	Middle Output Frequency 2	0.0 to [E1-04]	0.0 Hz
E1-12 <6>	Middle Output Frequency Voltage 2	0.0 to 255.0 V <4>	0.0 V <7>
E1-13 <8>	Base Voltage	0.0 to 255.0 V <4>	0.0 V <7>

<1> Default setting is determined by E5-01 in OLV/PM. When E5-01 is set to FFFFH, the setting range for E1-04 and E1-06 is 10.0 to 400.0 Hz and the setting range for E1-09 is 0.0 to 400.0 Hz.

<2> Default setting is dependent on parameters A1-02, Control Mode Selection, and o2-04, and Drive Model Selection.

<3> When using PM motors, the default setting is determined by the motor code set to E5-01.

<4> Values shown are specific to 200 V class drives. Double the value for 400 V class drives.

<5> Default setting is determined by parameter A1-02, Control Mode Selection.

<6> Parameter ignored when E1-11 (Motor 1 Mid Output Frequency 2) and E1-12 (Motor 1 Mid Output Frequency Voltage 2) are set to 0.0.

<7> The drive changes these settings when Auto-Tuning is performed.

<8> When Auto-Tuning is performed, E1-13 and E1-05 will be set to the same value.

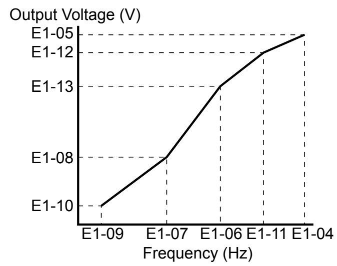


Figure 1.29 V/f Pattern

Note:
1. The following condition must be true when setting up the V/f pattern: E1-09 ≤ E1-07 < E1-06 ≤ E1-11 ≤ E1-04
2. To make the V/f pattern a straight line below E1-06, set E1-09 equal to E1-07. In this case the E1-08 setting is disregarded.
3. E1-03 is unaffected when the drive is initialized, but E1-04 through E1-13 return to their default values.
4. Only use E1-11, E1-12, and E1-13 to fine-tune the V/f pattern in the constant output range. These parameters rarely need to be changed.

◆ E2: Motor 1 Parameters

These parameters contain the motor data needed for motor 1. Enter the motor data into these parameters when Auto-Tuning cannot be performed.

Note: The function for switching between two motors cannot be used with a PM motor. E2-□□ parameters are hidden when OLV/PM control mode is selected (A1-02 = 5).

■ 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 150% of the drive rated current <1>	Determined by o2-04

<1> Display is in the following units:
2□0028, 2□0042, and 4□0011 to 4□0027: 0.01 A units
2□0054 to 2□0248 and 4□0034 to 4□0414: 0.1 A units

Note: Setting E2-01 ≤ E2-03 will trigger an oPE02 error. Set E2-03 correctly to prevent this error.

■ E2-02: Motor Rated Slip

Sets the motor rated slip in Hz to provide motor control, protect the motor, and calculate torque limits.

No.	Parameter Name	Setting Range	Default
E2-02	Motor Rated Slip	0.00 to 20.00 Hz	Determined by o2-04

If Auto-Tuning cannot be performed, calculate the motor rated slip using the information written on the motor nameplate and the formula below:

E2-02 = f - (n × p)/120

(f: rated frequency (Hz), n: rated motor speed (r/min), p: number of motor poles)

■ E2-03: Motor No-Load Current

Set the no-load current for the motor in amperes when operating at the rated frequency and the no-load voltage. The drive sets E2-03 during the Auto-Tuning process (Rotational Auto-Tuning and Stationary Auto-Tuning 2, 3). The motor no-load current listed in the motor test report can also be entered to E2-03 manually. Contact the motor manufacturer to receive a copy of the motor test report.

No.	Parameter Name	Setting Range	Default
E2-03	Motor No-Load Current	0.00 A to [E2-01] <1>	Determined by o2-04

<1> Display is in the following units:
2□0028, 2□0042, and 4□0011 to 4□0027: 0.01 A units

2□0054 to 2□0248 and 4□0034 to 4□0414: 0.1 A units

■ E2-04: Number of Motor Poles

Set the number of motor poles to E2-04. If Auto-Tuning completes successfully, the value entered to T1-06 will automatically be saved to E2-04.

No.	Parameter Name	Setting Range	Default
E2-04	Number of Motor Poles	2 to 48	4

■ E2-05:Motor Line-to-Line Resistance

Sets the line-to-line resistance of the motor stator winding. If Auto-Tuning completes successfully, this value is automatically calculated. Enter this value as line-to-line and not for each motor phase.

If Auto-Tuning is not possible, contact the motor manufacturer to find out the line-to-line resistance or measure it manually. When using the manufacturer motor test report, calculate E2-05 by one of the formulas below:

- E-type insulation: Multiply 0.822 times the resistance value (Ω) listed on the test report at 75 °C (167 °F).
- B-type insulation: Multiply 0.822 times the resistance value (Ω) listed on the test report at 75 °C (167 °F).
- F-type insulation: Multiply 0.728 times the resistance value (Ω) listed on the test report at 115 °C (239 °F).

No.	Parameter Name	Setting Range	Default
E2-05	Motor Line-to-Line Resistance	0.000 to 65.000 Ω	Determined by o2-04

■ E2-10: Motor Iron Loss for Torque Compensation

Sets the motor iron loss in watts.

No.	Parameter Name	Setting Range	Default
E2-10	Motor Iron Loss for Torque Compensation	0 to 65535 W	Determined by o2-04

■ E2-11: Motor Rated Power

Sets the motor rated power in kW. If Auto-Tuning completes successfully, the value entered to T1-02 will automatically be saved to E2-11.

No.	Parameter Name	Setting Range	Default
E2-11	Motor Rated Power	0.00 to 650.00 kW	Determined by o2-04

■ Setting Motor Parameters Manually

Follow the instructions below when setting motor-related parameters manually instead of Auto-Tuning. Refer to the motor test report included with the motor to ensure the correct data is entered into the drive.

Set the Motor Rated Current

Enter the motor rated current listed on the nameplate of the motor to E2-01.

Set the Motor Rated Slip

Calculate the motor rated slip using the base speed listed on the motor nameplate. Refer to the formula below, then enter that value to E2-02.

Motor rated slip = rated frequency [Hz] – base speed [r/min] × (no. of motor poles) / 120

Set the No-Load Current

Enter the no-load current at rated frequency and rated voltage to E2-03. This information is not usually listed on the nameplate. Contact the motor manufacturer if the data cannot be found.

The default setting of the no-load current is for performance with a 4-pole Yaskawa motor.

Set the Line-to-Line Resistance

E2-05 is normally set during Auto-Tuning. If Auto-Tuning cannot be performed, contact the motor manufacturer to determine the correct resistance between motor lines. The motor test report can also be used to calculate this value using the formulas below:

- E-type insulation: Multiply 0.822 times the resistance value (Ω) listed on the test report at 75 °C (167 °F).
- B-type insulation: Multiply 0.822 times the resistance value (Ω) listed on the test report at 75 °C (167 °F).
- F-type insulation: Multiply 0.728 times the resistance value (Ω) listed on the test report at 115 °C (239 °F).

Set the Motor Iron Loss for Torque Compensation

Only required when using V/f Control. Enter this value in watts to E2-10. The drive uses this setting to improve the precision of torque compensation.

◆ E5: PM Motor Settings

These parameters set the motor data of a PM motor.

Perform Auto-Tuning for PM motors. The motor data can be entered manually, if known.

Note:
1. E5-□□ parameters are visible only when a OLV/PM motor control mode is selected (A1-02 = 5).
2. E5-□□ parameters are not reset when the drive is initialized using parameter A1-03.

■ E5-01: Motor Code Selection (for PM Motors)

When using Yaskawa motors, set the motor code for the PM motor being used. The drive automatically sets several parameters to appropriate values depending on the motor code.

Setting parameter E5-01 to FFFF allows the motor data to be manually set using the E5-□□ parameters.

No.	Parameter Name	Setting Range	Default
E5-01	Motor Code Selection (for PM Motors)	0000 to FFFF	Determined by A1-02 and o2-04

Note:
1. E5-□□ parameters are not reset when the drive is initialized using parameter A1-03.
2. When E5-01 is set to a value other than FFFF, the drive will not initialize using parameter A1-03
3. Changing E5-01 to FFFF from value other than FFFF will not change the values of parameters E5-02 through E5-24.
4. Set E5-01 to FFFF when using a motor other than a Yaskawa SMRA, SSR1, or SST4 series.
5. Default settings is Yaskawa SSR1 Series (1750 r/min)
6. Selection may vary depending on the motor code entered to E5-01.
7. If an alarm or hunting occurs despite using a motor code, enter the value indicated on the nameplate.

Figure 1.30 explains the motor code setting.

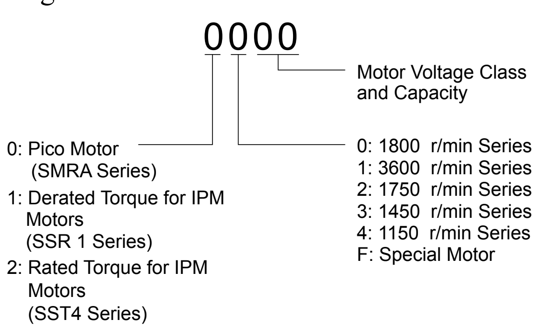


Figure 1.30 PM Motor Code

■ E5-02: Motor Rated Power (for PM Motors)

Sets the rated power of the motor. Determined by the value set to T2-04 during Stationary Auto-Tuning for PM motors.

No.	Parameter Name	Setting Range	Default
E5-02	Motor Rated Power (for PM Motors)	0.10 to 650.00 kW	Determined by E5-01

■ E5-03: Motor Rated Current (for PM Motors)

Sets the motor rated current in amps. Automatically set when the value is entered to T2-06 during Auto-Tuning.

No.	Parameter Name	Setting Range	Default
E5-03	Motor Rated Current (for PM Motors)	10 to 150% of drive rated current <1>	Determined by E5-01

<1> Display is in the following units:
2☐0028, 2☐0042, and 4☐0011 to 4☐0027: 0.01 A units
2☐0054 to 2☐0248 and 4☐0034 to 4☐0414: 0.1 A units

■ E5-04: Number of Motor Poles (for PM Motors)

Sets the number of motor poles. Automatically set when the value is entered to T2-08 during Auto-Tuning.

No.	Parameter Name	Setting Range	Default
E5-04	Number of Motor Poles (for PM Motors)	2 to 48	Determined by E5-01

■ E5-05: Motor Stator Resistance (r1) (for PM Motors)

Set the resistance for one motor phase. Do not enter the line-to-line resistance into E5-05 when measuring the resistance manually.

No.	Parameter Name	Setting Range	Default
E5-05	Motor Stator Resistance (for PM Motors)	0.000 to 65.000 Ω	Determined by E5-01

■ E5-06: Motor d-Axis Inductance (Ld) (for PM Motors)

Sets the d-Axis inductance in 0.01 mH units.

No.	Parameter Name	Setting Range	Default
E5-06	Motor d-Axis Inductance (for PM Motors)	0.00 to 300.00 mH	Determined by E5-01

■ E5-07: Motor q-Axis Inductance (Lq) (for PM Motors)

Sets the q-Axis inductance in 0.01 mH units.

No.	Parameter Name	Setting Range	Default
E5-07	Motor q-Axis Inductance (for PM Motors)	0.00 to 600.00 mH	Determined by E5-01

■ E5-09: Motor Induction Voltage Constant 1 (Ke) (for PM Motors)

Sets the induced peak voltage per phase in units of 0.1 mV/(rad/s) [electrical angle]. Set this parameter when using an IPM motor with derated torque (SSR1 series or equivalent) or an IPM motor with constant torque (SST4 series or equivalent).

Set the voltage constant with E5-09 or E5-24 when E5-01 is set to FFFF. This parameter is set during Auto-Tuning for PM motors.

No.	Parameter Name	Setting Range	Default
E5-09	Motor Induction Voltage Constant 1 (for PM Motors)	0.0 to 2000.0 mV/(rad/s)	Determined by E5-01

Note: Set E5-24 to 0 when setting E5-09. However, setting both E5-09 and E5-24 to 0 will trigger an alarm. An alarm will also be triggered if neither E5-09 nor E5-24 are set to 0. When E5-01 is set to FFFF, then E5-09 = 0.0.

■ E5-24: Motor Induction Voltage Constant 2 (Ke) (for PM Motors)

Set the induced phase-to-phase rms voltage in units of 0.1 mV/(r/min) [mechanical angle]. Set this parameter when using an SPM Motor (SMRA Series or equivalent).

When E5-01 is set to FFFF, use either E5-09 or E5-24 for setting the voltage constant. This parameter is set during Parameter Auto-Tuning for PM motors.

No.	Parameter Name	Setting Range	Default
E5-24	Motor Induction Voltage Constant 2 (for PM Motors)	0.0 to 6500.0 mV/(r/min)	Determined by E5-01

Note: Set E5-24 to 0.0 when setting E5-09. However, setting both E5-09 and E5-24 to 0.0 will trigger an alarm. An alarm will also be triggered if neither E5-09 nor E5-24 are set to 0.0. When E5-01 is set to FFFF, then E5-09 should be set to 0.0.

1.6 F: Option Settings

◆ F2: Analog Input Card Settings

These parameters set the drive for operation with the analog input option card AI-A3. If no AI-A3 card is connected, drive terminals A1 to A3 are enabled regardless of the F2-01 setting. This section describes parameters that govern operation with an input option card. Refer to the option card instruction manual for specific details on installation, wiring, input signal level selection, and parameter setup.

■ F2-01: Analog Input Option Card Operation Selection

Determines how the input terminals on the AI-A3 option card are used.

No.	Parameter Name	Setting Range	Default
F2-01	Analog Input Option Card Operation Selection	0, 1	0

Setting 0: Separate functions for each terminal (V1, V2, V3 replace terminals A1, A2, A3)

Use the H3-☐☐ parameters described in *H3-03, H3-04: Terminal A1 Gain and Bias Settings* on page 98 to set the functions and gain and bias levels for an analog reference supplied by AI-A3.

Note: Setting option card terminals for separate input functions (F2-01 = 0) while b1-01 = 3 will trigger an oPE05 error.

Setting 1: Combine input terminal values to create frequency reference (V1, V2, V3 are combined)

This setting adds all three input signals on the AI-A3 option card to create the frequency reference. Set b1-01 to 3 when the option card is the source of the frequency reference for the drive. Set the gain and bias settings for the frequency reference supplied from AI-A3 with F2-02 and F2-03.

■ F2-02, F2-03: Analog Input Option Card Gain, Bias

Parameter F2-02 sets the gain and parameter F2-03 sets the bias for the AI-A3 input signal when the card is used in the combined input signals mode (F2-01 = 1). Both gain and bias are set as a percentage of the maximum output frequency.

No.	Parameter Name	Setting Range	Default
F2-02	Analog Input Option Card Gain	-999.9 to 999.9%	100.0%
F2-03	Analog Input Option Card Bias	-999.9 to 999.9%	0.0%

Note: Enabled only when F2-01 = 1.

◆ F3: Digital Input Card Settings

These parameters set the drive for operation with the option card DI-A3. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

■ F3-01: Digital Input Option Card Input Selection

Determines the type of input for digital option card DI-A3 when o1-03 is set to 0 or 1.

No.	Parameter Name	Setting Range	Default
F3-01	Digital Input Option Card Input Selection	0 to 7	0

Note: BCD input when o1-03 = 2 or 3. Units are determined by o1-03.

Setting 0: BCD, 1% units

Setting 1: BCD, 0.1% units

Setting 2: BCD, 0.01% units

Setting 3: BCD, 1 Hz units

Setting 4: BCD, 0.1 Hz units

Setting 5: BCD, 0.01 Hz units

Setting 6: BCD, special setting (5 digit input), 0.02 Hz units

Setting 7: Binary

The unit and the setting range are determined by F3-03.

F3-03 = 0: 255/100% (-255 to +255)

F3-03 = 1: 4095/100% (-4095 to +4095)

F3-03 = 2: 30000/100% (-33000 to +33000)

Note: BCD input when o1-03 = 2 or 3. Units are determined by o1-03.

■ F3-03: Digital Input Option DI-A3 Data Length Selection

Determines the number of bits for the option card input that sets the frequency reference.

No.	Parameter Name	Setting Range	Default
F3-03	Digital Input Option DI-A3 Data Length Selection	0 to 2	2

Setting 0: 8 bit

Setting 1: 12 bit

Setting 2: 16 bit

◆ F4: Analog Monitor Card Settings

These parameters set the drive for operation with the analog output option card AO-A3. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

■ F4-01, F4-03: Terminal V1, V2 Monitor Selection

Selects the data to output from analog terminal V1. Enter the final three digits of U□-□□ to determine which monitor data is output from the option card. Some monitors are only available in certain control modes.

No.	Parameter Name	Setting Range	Default
F4-01	Terminal V1 Monitor Selection	000 to 999	102
F4-03	Terminal V2 Monitor Selection	000 to 999	103

Note: Set “000” or “031” when using the terminal in through mode. This setting can adjust the V1 and V2 terminal output from PLC via MEMOBUS/Modbus communications or a communications option.

■ F4-02, F4-04, F4-05, F4-06: Terminal V1, V2 Monitor Gain and Bias

Parameters F4-02 and F4-04 determine the gain, while parameters F4-05 and F4-06 set the bias. These parameters are set as a percentage of the output signal from V1 and V2 where 100% equals 10 V output. The terminal output voltage is limited to 10 V.

No.	Parameter Name	Setting Range	Default
F4-02	Terminal V1 Monitor Gain	-999.9 to 999.9%	100.0%
F4-04	Terminal V2 Monitor Gain	-999.9 to 999.9%	50.0%
F4-05	Terminal V1 Monitor Bias	-999.9 to 999.9%	0.0%
F4-06	Terminal V2 Monitor Bias	-999.9 to 999.9%	0.0%

Using Gain and Bias to Adjust Output Signal Level

The output signal is adjustable while the drive is stopped.

Terminal V1

1. View the value set to F4-02 (Terminal V1 Monitor Gain) on the digital operator. A voltage equal to 100% of the parameter being set in F4-01 will be output from terminal V1.
2. Adjust F4-02 viewing the monitor connected to the terminal V1.
3. View the value set to F4-05 on the digital operator, terminal V1 will output a voltage equal to 0% of the parameter being set in F4-01.
4. Adjust F4-05 viewing the output signal on the terminal V1.

Terminal V2

1. View the value set to F4-02 (Terminal V2 Monitor Gain) on the digital operator. A voltage equal to 100% of the parameter being viewed in F4-03 will be output from terminal V2.
2. Adjust F4-04 viewing the monitor connected to the terminal V2.
3. View the value set to F4-06 on the digital operator, terminal V2 will output a voltage equal to 0% of the parameter being set in F4-03.
4. Adjust F4-06 viewing the output signal on the terminal V2.

■ F4-07, F4-08: Terminal V1, V2 Signal Level

Sets the output signal level for terminals V1 and V2.

No.	Parameter Name	Setting Range	Default
F4-07	Terminal V1 Signal Level	0, 1	0
F4-08	Terminal V2 Signal Level	0, 1	0

Setting 0: 0 to 10 V

Setting 1: -10 to 10 V

◆ F5: Digital Output Card Settings

These parameters set the drive for operation with the digital output option card DO-A3. Refer to the instruction manual packaged with the option card for specific details on installation, wiring, input signal level selection, and parameter setup.

■ F5-01 through F5-08: Digital Output Option Card Terminal Function Selection

When F5-09 = 2, the parameters listed in the table below assign functions to the output terminals on the option card.

No.	Name	Setting Range	Default
F5-01	Terminal P1-PC Output Selection	0 to 1B6	0: During run
F5-02	Terminal P2-PC Output Selection	0 to 1B6	1: Zero speed
F5-03	Terminal P3-PC Output Selection	0 to 1B6	2: Speed agree
F5-04	Terminal P4-PC Output Selection	0 to 1B6	4: Frequency detection 1
F5-05	Terminal P5-PC Output Selection	0 to 1B6	6: Drive ready
F5-06	Terminal P6-PC Output Selection	0 to 1B6	37: During frequency output
F5-07	Terminal M1-M2 Output Selection	0 to 1B6	F: Not used
F5-08	Terminal M3-M4 Output Selection	0 to 1B6	F: Not used

■ F5-09: DO-A3 Output Mode Selection

Determines how the DO-A3 option card works with the drive.

No.	Parameter Name	Setting Range	Default
F5-09	DO-A3 Output Mode Selection	0 to 2	0

Note: Refer to TOBP C730600 41 Yaskawa AC Drive-Option DO-A3 Installation Manual for more details on F5-09 settings.

Setting 0: Separate Output Functions for Each of 8 Terminals

Setting 1: Binary Output

Setting 2: Output Functions Assigned by F5-01 through F5-08

◆ F6 and F7: Communication Option Card

These parameters configure communication option cards and communication fault detection methods.

■ F6-01: Communications Error Operation Selection

Determines drive operation when a communication error occurs.

No.	Parameter Name	Setting Range	Default
F6-01	Communications Error Operation Selection	0 to 5	1

Setting 0: Ramp to Stop (Use the Deceleration Time Set to C1-02)

Setting 1: Coast to Stop

Setting 2: Fast Stop (Use the Fast Stop Time Set to C1-09)

Setting 3: Alarm Only (Continue Operation)

Setting 4: Alarm Only (Continue Operation Using the Frequency Reference Set in d1-04)

Setting 5: Alarm Ramp to Stop

■ F6-02: External Fault from Comm. Option Detection Selection

Determines the detection method of an external fault initiated by a communication option (EF0).

No.	Parameter Name	Setting Range	Default
F6-02	External Fault from Comm. Option Detection Selection	0, 1	0

Setting 0: Always Detected

Setting 1: Detection during Run Only

■ F6-03: External Fault from Comm. Option Operation Selection

Determines drive operation when an external fault is initiated by a communication option (EF0).

No.	Parameter Name	Setting Range	Default
F6-03	External Fault from Comm. Option Operation Selection	0 to 3	1

Setting 0: Ramp to Stop

Setting 1: Coast to Stop

Setting 2: Fast Stop

Setting 3: Alarm Only (Continue Operation)

■ F6-07: NetRef/ComRef Function Selection

Selects the treatment of multi-step speed inputs when the NetRef command is set.

No.	Parameter Name	Setting Range	Default
F6-07	NetRef/ComRef Function Selection	0, 1	0

Setting 0: Multi-step Speed Operation Disabled
Multi-step speed input frequency references are disabled when the NetRef command is selected.

Setting 1: Multi-step Speed Operation Enabled
Multi-step speed inputs are still active and can override the frequency reference from the communications option even when the NetRef command is selected.

■ F6-08: Reset Communication Parameters

Determines whether F6-□□/F7-□□ communication-related parameters are reset after initialization.

No.	Parameter Name	Setting Range	Default
F6-08	Reset Communication Parameters	0, 1	0

Setting 0: Do Not Reset F6-□□/F7-□□ Parameters after Initialization Using A1-03

Setting 1: Reset F6-□□/F7-□□ Parameters after Initialization Using A1-03

Note: F6-08 is not reset when the drive is initialized.

◆ CC-Link Parameters

Parameters F6-04, F6-10, F6-11, and F6-14 set the drive to operate on a CC-Link network.

■ F6-04: bUS Error Detection Time

Sets the delay time for bUS error detection.

No.	Parameter Name	Setting Range	Default
F6-04	bUS Error Detection Time	0.0 to 5.0 s	2.0 s

■ F6-10: CC-Link Node Address

Sets the node address of a CC-Link option board.

No.	Parameter Name	Setting Range	Default
F6-10	CC-Link Node Address	0 to 64	0

■ F6-11: CC-Link Communication Speed

Sets the communication speed for a CC-Link option card.

No.	Parameter Name	Setting Range	Default
F6-11	CC-Link Communication Speed	0 to 4	0

Setting 0: 156 kbps

Setting 1: 625 kbps

Setting 2: 2.5 Mbps

Setting 3: 5 Mbps

Setting 4: 10 Mbps

■ F6-14: bUS Error Auto Reset

Selects whether a bUS error can be automatically reset if automatic fault retry is enabled.

No.	Parameter Name	Setting Range	Default
F6-14	bUS Error Auto Reset	0, 1	0

Setting 0: Disabled, Auto Reset Not Possible

Setting 1: Enabled, Auto Reset Possible

◆ MECHATROLINK Parameters

■ F6-20: MECHATROLINK Station Address

Sets the station address when the MECHATROLINK option is installed.

Note: All station addresses must be unique. Setting this parameter to 20 or 3F will trigger a Station Address Error (AEr) and turn on the “ERR” light.

No.	Parameter Name	Setting Range	Default
F6-20	MECHATROLINK Station Address	20 to 3F <1>	21

<1> Range shown is for the MECHATROLINK-II option (SI-T3). Range for MECHATROLINK-III option (SI-ET3) is: 03 to EF.

■ F6-21: MECHATROLINK Frame Size

Sets the frame size.

No.	Parameter Name	Setting Range	Default
F6-21	MECHATROLINK Frame Size	0, 1	0

Setting 0: 32-byte (MECHATROLINK-II option setting)

Value for MECHATROLINK-III option is: 64-byte

Setting 1: 17-byte (MECHATROLINK-II option setting)

Value for MECHATROLINK-III option is: 32-byte

■ F6-22: MECHATROLINK Link Speed

Sets the communication speed for a MECHATROLINK-II option card.

Note: This parameter is only available with a MECHATROLINK-II option card.

No.	Parameter Name	Setting Range	Default
F6-22	MECHATROLINK Link Speed	0, 1	0

Setting 0: 10 Mbps

Setting 1: 4 Mbps

■ F6-23: MECHATROLINK Monitor Selection (Code 0EH)

Sets MEMOBUS/Modbus register to monitor SEL_MON of INV_CTL and INV_CTL.

Setting byte 10 of INV_CTL to “0EH” enables the register set by F6-23.

Bytes 11 and 12 of the response data enable the register content set by F6-23.

No.	Parameter Name	Setting Range	Default
F6-23	MECHATROLINK Monitor Selection (Code 0EH)	0 to FFFFH	0H

■ F6-24: MECHATROLINK Monitor Selection (Code 0FH)

Sets MEMOBUS/Modbus register to monitor SEL_MON of INV_CTL and INV_CTL.

Setting byte 10 of INV_CTL to 0FH enables the register set by F6-24.

Bytes 11 and 12 of the response data enable the register content set by F6-24.

No.	Parameter Name	Setting Range	Default
F6-24	MECHATROLINK Monitor Selection (Code 0FH)	0 to FFFFH	0H

■ F6-25: Operation Selection at Watchdog Error (E5)

No.	Parameter Name	Setting Range	Default
F6-25	Operation Selection at Watchdog Error (E5)	0 to 3	1

Setting 0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02.

Setting 1: Coast to stop

Setting 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09.

Setting 3: Alarm only

■ F6-26: MECHATROLINK bUS Errors Detected

No.	Parameter Name	Setting Range	Default
F6-26	MECHATROLINK bUS Errors Detected	2 to 10	2

◆ PROFIBUS-DP Parameters

Parameters F6-30 through F6-32 set the drive to run on a PROFIBUS-DP network.

■ F6-30: PROFIBUS-DP Node Address

Sets the node address of a PROFIBUS-DP option card.

No.	Parameter Name	Setting Range	Default
F6-30	PROFIBUS-DP Node Address	0 to 125	0

■ F6-31: PROFIBUS-DP Clear Mode Selection

Determines the operation when a Clear Mode command is received.

No.	Parameter Name	Setting Range	Default
F6-31	PROFIBUS-DP Clear Mode Selection	0, 1	0

Setting 0: Reset

Resets the drive operation (frequency reference, inputs, outputs etc.).

Setting 1: Maintain the Previous State

Returns the drive status to the state prior to receiving the command.

■ F6-32: PROFIBUS-DP Data Format Selection

Selects the data format used for PROFIBUS-DP communication.

No.	Parameter Name	Setting Range	Default
F6-32	PROFIBUS-DP Data Format Selection	0, 1	0

Setting 0: PPO-type Data Format

Setting 1: Conventional Data Format

◆ CANopen Parameters

Parameters F6-35 and F6-36 set the drive to operate on a CANopen network.

■ F6-35: CANopen Node ID Selection

Selects the node ID of a CANopen option board.

No.	Parameter Name	Setting Range	Default
F6-35	CANopen Node ID Selection	0 to 126	0

■ F6-36: CANopen Communication Speed

Sets the communication speed for a CANopen option card.

No.	Parameter Name	Setting Range	Default
F6-36	CANopen Communication Speed	0 to 8	6

Setting 0: Auto detection
Setting 1: 10 kbps
Setting 2: 20 kbps
Setting 3: 50 kbps
Setting 4: 125 kbps
Setting 5: 250 kbps
Setting 6: 500 kbps
Setting 7: 800 kbps
Setting 8: 1 Mbps

◆ BACnet Parameters

When using an SI-B3 option card, parameters F6-45 to F6-49 set the drive to operate on a BACnet MS/TP network.

When using a JOHB-SMP3 option card, parameters F6-48, F6-49, and F7-01 to F7-57 set the drive to operate on a BACnet/IP network. The BACnet/IP network is available in drive software versions PRG: 6117 and later.

■ F6-45: BACnet Node Address

Sets the node address for a BACnet option card.

No.	Parameter Name	Setting Range	Default
F6-45	BACnet Node Address	0 to 127	1

■ F6-46: BACnet Baud Rate

Sets the node address for a BACnet option card.

No.	Parameter Name	Setting Range	Default
F6-46	BACnet Baud Rate	0 to 8	3

Setting 0: 1200
Setting 1: 2400
Setting 2: 4800
Setting 3: 9600
Setting 4: 19200
Setting 5: 38400
Setting 6: 57600
Setting 7: 76800
Setting 8: 115200

■ F6-47: Rx to Tx Wait Time

Sets the wait time between receiving and sending for BACnet MS/TP.

No.	Parameter Name	Setting Range	Default
F6-47	Rx to Tx Wait Time	5 to 65 ms	5 ms

■ F6-48: BACnet Device Object Identifier 0

Sets the least significant word for BACnet/IP when using the JOHB-SMP3 option and BACnet MS/TP when using the SI-B3 option.

No.	Parameter Name	Setting Range	Default
F6-48	BACnet Device Object Identifier 0	0 to FFFF	0

■ F6-49: BACnet Device Object Identifier 1

Sets the most significant word for BACnet/IP when using the JOHB-SMP3 option and BACnet MS/TP when using the SI-B3 option.

No.	Parameter Name	Setting Range	Default
F6-49	BACnet Device Object Identifier 1	0 to 3F	0

◆ DeviceNet Parameters

Parameters F6-50 through F6-63 set the drive to operate on a DeviceNet network.

■ F6-50: DeviceNet MAC Address

Sets the MAC address for a DeviceNet option card.

No.	Parameter Name	Setting Range	Default
F6-50	DeviceNet MAC Address	0 to 64	64

■ F6-51: DeviceNet Communication Speed

Sets the communication speed for a DeviceNet option card.

To assign the baud rate for the drive from the upper controller, set F6-51 = 3.

To make the drive detect the network speed, set F6-51 = 4. The drive will automatically adjust itself after detecting the network speed.

No.	Parameter Name	Setting Range	Default
F6-51	DeviceNet Communication Speed	0 to 4	4

Setting 0: 125 kbps
Setting 1: 250 kbps
Setting 2: 500 kbps
Setting 3: Adjustable from network
Setting 4: Auto detection

■ F6-52: DeviceNet PCA Setting

Defines the format for data the drive receives from the DeviceNet master.

No.	Parameter Name	Setting Range	Default
F6-52	DeviceNet PCA Setting	0 to 255	21

■ F6-53: DeviceNet PPA Setting

Defines the format for data sent from the drive to the DeviceNet master.

No.	Parameter Name	Setting Range	Default
F6-53	DeviceNet PPA Setting	0 to 255	71

■ F6-54: DeviceNet Idle Mode Fault Detection

Determines whether the drive triggers an EF0 fault when no data is received from the master (e.g., when the master is idling).

No.	Parameter Name	Setting Range	Default
F6-54	DeviceNet Idle Mode Fault Detection	0, 1	0

Setting 0: Enabled

Setting 1: Disabled, No Fault Detection

■ F6-55: DeviceNet Baud Rate Monitor

Displays the baud rate currently being used for network communications. F6-55 is used only as a monitor.

No.	Parameter Name	Setting Range	Default
F6-55	DeviceNet Baud Rate Monitor	0 to 2 (read only)	0

Setting 0: 125 kbps
Setting 1: 250 kbps
Setting 2: 500 kbps

■ F6-56 to F6-61: DeviceNet Scaling Factors

These parameters define scaling factors for drive monitors in the DeviceNet Class ID 2AH - AC/DC Drive Object.

No.	Parameter Name	Setting Range	Default
F6-56	DeviceNet Speed Scaling	-15 to 15	0
F6-57	DeviceNet Current Scaling	-15 to 15	0
F6-58	DeviceNet Torque Scaling	-15 to 15	0
F6-59	DeviceNet Power Scaling	-15 to 15	0
F6-60	DeviceNet Voltage Scaling	-15 to 15	0
F6-61	DeviceNet Time Scaling	-15 to 15	0

Setting

The monitor value in the AC/DC Drive Object 2AH is calculated by:
AC/DC Drive Object 2AH Monitor = Drive Value × 2^{Scaling}

Example:

If the drive output frequency monitor (U1-02) is 5.00 and the scaling is set to F6-56 = 6, then the value in the AC/DC Drive Object 2AH, Instance 1, Attribute 7 would be 500 × 2^6 = 32000.

■ F6-62: DeviceNet Heartbeat Interval

Sets the heartbeat interval for DeviceNet communications. A setting of 0 disables the heartbeat function.

No.	Parameter Name	Setting Range	Default
F6-62	DeviceNet Heartbeat Interval	0 to 10	0

■ F6-63: DeviceNet Network MAC ID

Displays the MAC ID assigned to the drive. F6-63 is used only as a monitor.

No.	Parameter Name	Setting Range	Default
F6-63	DeviceNet Network MAC ID	0 to 63 (read only)	63

■ F6-64 to F6-71: Dynamic Assembly Parameters (Reserved)

■ F7-01 to F7-04: IP Address 1 to 4

Sets the significant octet of network static IP address.

■ F7-05 to F7-08: Subnet Mask 1 to 4

Sets the significant octet of network static Subnet Mask.

■ F7-09 to F7-12: Gateway Address 1 to 4

Sets the significant octet of network Gateway address.

◆ Modbus TCP/IP Parameters

Parameters F7-01 through F7-16, U6-80 through U6-93, U6-98, and U6-99 set up the drive to operate on a Modbus TCP/IP network.

For details on parameter settings, refer to the YASKAWA AC Drive 1000-Series Option Modbus TCP/IP Installation Manual and Technical Manual.

◆ PROFINET Parameters

Parameters F7-01 through F7-15, F7-17 through F7-42, U6-80 through U6-93, U6-98, and U6-99 set up the drive to operate on a PROFINET network.

For details on parameter settings, refer to the YASKAWA AC Drive 1000-Series Option PROFINET Installation Manual and Technical Manual.

◆ EtherNet/IP Parameters

Parameters F7-01 through F7-15, F7-17 through F7-42, U6-80 through U6-93, U6-98, and U6-99 set up the drive to operate on an EtherNet/IP network.

For details on parameter settings, refer to the YASKAWA AC Drive 1000-Series Option EtherNet/IP Installation Manual and Technical Manual.

1.7 H: Terminal Functions

H parameters assign functions to the external terminals.

◆ H1: Multi-Function Digital Inputs

■ H1-01 to H1-08: Functions for Terminals S1 to S8

These parameters assign functions to the multi-function digital inputs. The various functions and settings are listed in ***Table 1.31***.

No.	Parameter Name	Setting Range	Default
H1-01	Multi-Function Digital Input Terminal S1 Function Selection	1 to B2	40 (F) <1> : Forward Run Command (2-Wire sequence)
H1-02	Multi-Function Digital Input Terminal S2 Function Selection	1 to B2	41 (F) <1> : Reverse Run Command (2-Wire sequence)
H1-03	Multi-Function Digital Input Terminal S3 Function Selection	0 to B2	24: External Fault (N.O., always detected, coast to stop)
H1-04	Multi-Function Digital Input Terminal S4 Function Selection	0 to B2	14: Fault Reset
H1-05	Multi-Function Digital Input Terminal S5 Function Selection	0 to B2	3 (0) <1> : Multi-Step Speed Reference 1
H1-06	Multi-Function Digital Input Terminal S6 Function Selection	0 to B2	4 (3) <1> : Multi-Step Speed Reference 2
H1-07	Multi-Function Digital Input Terminal S7 Function Selection	0 to B2	6 (4) <1> : Jog Reference Selection
H1-08	Multi-Function Digital Input Terminal S8 Function Selection	0 to B2	8: External Baseblock Command

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

Table 1.31 Multi-Function Digital Input Terminal Settings

Setting	Function	Page	Setting	Function	Page
0	3-Wire Sequence	*78*	42	Run Command (2-Wire sequence 2)	*84*
3	Multi-Step Speed Reference 1	*78*	43	FWD/REV Command (2-Wire sequence 2)	
4	Multi-Step Speed Reference 2		44	Offset Frequency 1	*84*
6	Jog reference Selection	*78*	45	Offset Frequency 2	
7	Accel/Decel Time Selection 1	*79*	46	Offset Frequency 3	
8	Baseblock Command (N.O.)	*79*	47	Node Setup	*84*
9	Baseblock Command (N.C.)		50	Motor Pre-Heat 2	*84*
A	Accel/Decel Ramp Hold	*79*	51	Sequence Timer Disable	*84*
B	Drive Overheat Alarm (oH2)	*79*	52	Sequence Timer Cancel	*84*
C	Analog Terminal Input Selection	*79*	60	Motor Pre-Heat 1	*84*
F	Through Mode	*79*	61	External Speed Search Command 1	*85*
10	Up Command	*80*	62	External Speed Search Command 2	*85*
11	Down Command		63	Field Weakening	*85*
12	Forward Jog	*81*	67	Communications Test Mode	*85*
13	Reverse Jog		69	Jog 2	*85*
14	Fault Reset	*81*	6A	Drive Enabled	*85*
15	Fast Stop (N.O.)	*81*	6D	AUTO Mode Select	*85*
17	Fast Stop (N.C.)	*81*	6E	HAND Mode Select	*85*
18	Timer Function Input	*82*	70	Drive Enable2	*86*
19	PID Disable	*82*	A4	BP Emergency Override	*86*
1B	Program Lockout	*82*	A5	BP Drive/Bypass Selection	*86*
1E	Reference Sample Hold	*82*	A6	BP BAS Interlock	*86*
20 to 2F	External Fault	*83*	A7	BP Customer Safeties	*86*
30	PID Integral Reset	*83*	A8	PI2 Disable (N.O.)	*86*
31	PID Integral Hold	*83*	A9	PI2 Disable (N.C.)	*86*
34	PID Soft Starter Cancel	*83*	AA	PI2 Inverse Operation	*86*
35	PID Input Level Selection	*83*	AB	PI2 Integral Reset	*86*
40	Forward Run Command (2-Wire sequence)	*84*	AC	PI2 Integral Hold	*86*
41	Reverse Run Command (2-Wire sequence)		AD	Select PI2 Parameters	*86*

Setting	Function	Page
AE	BP Bypass Run	86
AF	Emergency Override Forward Run	87
B0	Emergency Override Reverse Run	87
B1	Customer Safeties	87
B2	BAS Interlock	87

Setting 0: 3-Wire Sequence

The digital input programmed for 3-Wire control becomes the forward/reverse directional input, S1 becomes the Run command input, and S2 becomes the Stop command input.

The drive starts the motor when the input S1 set for the Run command closes for longer than 2 ms. The drive stops the operation when the Stop input S2 is released. When the digital input programmed for a forward/reverse operation is open, the drive is set for forward operation. When the digital input is closed, the drive is set for reverse operation.

Note: Input the Run and Stop commands via S1 and S2 when selecting a 3-Wire sequence.

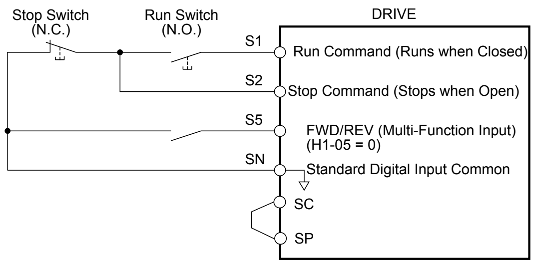


Figure 1.31 3-Wire Sequence Wiring Diagram

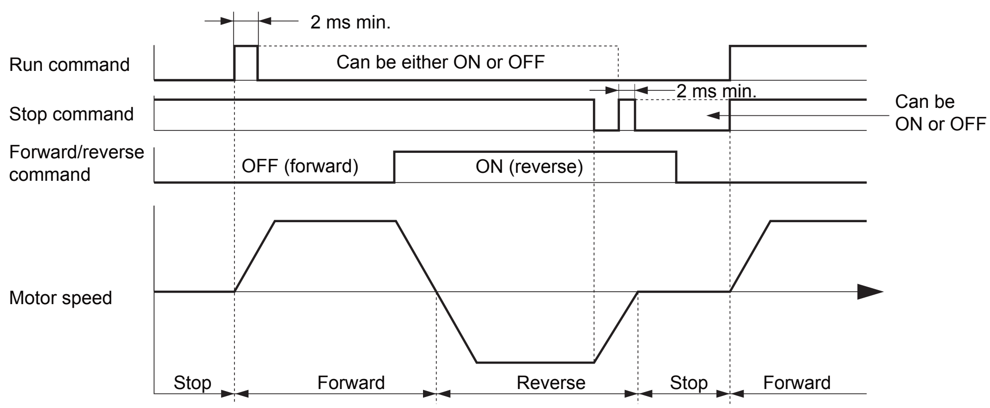


Figure 1.32 3-Wire Sequence

Note:
1. The Run command must be closed for more than 2 ms.
2. If the Run command is active at power up and b1-17 = 0 (Run command at power up not accepted), the AUTO LED will flash to indicate that protective functions are operating. If required by the application, set b1-17 to 1 to automatically issue the Run command upon drive power up.

WARNING! *Sudden Movement Hazard. Ensure start/stop and safety circuits are wired properly and in the correct state before applying power to the drive. Failure to comply could result in death or serious injury from moving equipment.*

WARNING! *Sudden Movement Hazard. The drive may start unexpectedly in reverse direction after power up if it is wired for 3-Wire sequence but set up for 2-Wire sequence (default). Make sure b1-17 is set to "0" (drive does not accept a Run command active at power up). When initializing the drive use 3-Wire initialization. Failure to comply could result in death or serious injury from moving equipment.*

Settings 3 and 4: Multi-Step Speed Reference 1 and 2

Switches multi-step speed frequency references d1-01 to d1-04 by digital inputs. ***Refer to d1: Frequency Reference on page 52*** for details.

Setting 6: Jog Reference Selection

The Jog frequency set in parameter d1-17 becomes the frequency reference when the input terminal closes. ***Refer to d1: Frequency Reference on page 52*** for details.

Setting 7: Accel/Decel Time Selection 1

Switches between accel/decel times 1 (C1-01 and C1-02) and 2 (C1-03 and C1-04). ***Refer to C1-01 to C1-04: Accel, Decel Times 1 and 2 on page 46*** for details.

Settings 8 and 9: Baseblock Command (N.O., N.C.)

When the drive receives a baseblock command, the output transistors stop switching, the motor coasts to stop, and a bb alarm flashes on the HOA keypad to indicate baseblock. When baseblock ends while a Run command is active, the drive performs Speed Search to restart the motor.

DIgital Input Function	Drive Operation	
	Input Open	Input Closed
Setting 8 (N.O.)	Normal operation	Baseblock (Interrupt output)
Setting 9 (N.C.)	Baseblock (Interrupt output)	Normal operation

WARNING! *Sudden Movement Hazard. When using a mechanical holding brake with the drive in a lifting application, close the brake when the drive output is cut off by a baseblock command triggered by one of the input terminals. Failure to comply will result in a slipping load from the motor suddenly coasting when the baseblock command is entered and may cause serious injury or death.*

WARNING! *Incorrect Operation. Yaskawa recommends that you use H1-□□ = 9 (Baseblock Command (N.C.)). If a circuit error occurs in the MFDI, the drive cannot stop the output when the terminal set to H1-□□ = 8 (Baseblock Command (N.O.)) turns ON.*

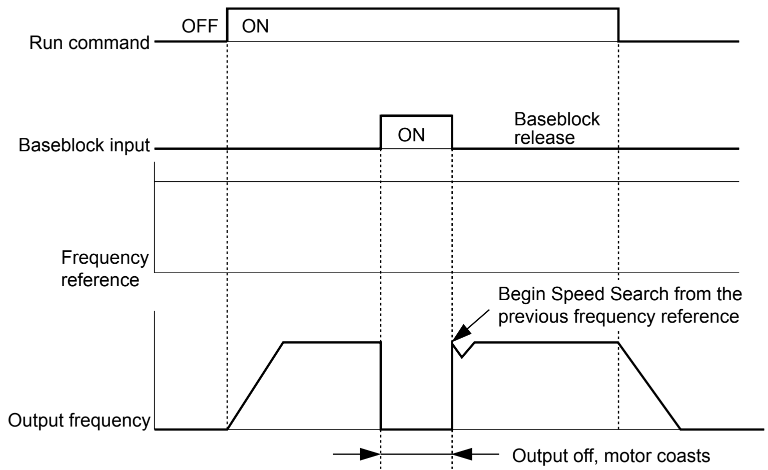


Figure 1.33 Baseblock Operation During Run

Setting A: Accel/Decel Ramp Hold

When the digital input programmed for the Accel/decel ramp hold function closes, the drive locks (holds) the output frequency. Acceleration or deceleration resumes when the input is reopened.

If the Accel/decel ramp hold function is enabled (d4-01 = 1), the drive saves the output frequency to memory when the Ramp Hold input is closed. When the drive is restarted after stop or after power supply interruption, the saved output frequency becomes the frequency reference (provided that the Accel/decel ramp hold input is still closed). ***Refer to d4-01: Frequency Reference Hold Function Selection on page 55*** for details.

Setting B: Drive Overheat Alarm (oH2)

Closed: An external device has triggered an oH2 alarm. Sets Drive Overheat Pre-alarm Multi-Function Digital Output 20H. Triggers an oH2 alarm when the contact closes. Drive operation is not affected because this is an alarm.

Setting C: Analog Terminal Input Selection (Terminals A1 and A2)

When closed, the terminals specified in H3-14 are enabled. When open, the drive disregards the input signal to the analog terminals.

Setting F: 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 to be read out by a PLC via a communication option or APOGEE FLN, BACnet, MEMOBUS/Modbus, or Metasys N2 communications.

Settings 10 and 11: Up/Down Function

The Up/Down function allows the frequency reference to be set by two push buttons when one digital input is programmed as the Up input (H1-□□= 10) to increase the frequency reference and the other digital input is programmed as the Down input (H1-□□= 11) to decrease the frequency reference.

The Up/Down function takes priority over the frequency references from the HOA keypad and the analog inputs (b1-01 = 0, 1). When using the Up/Down function, references provided by these sources will be disregarded.

The inputs operate as shown in the table below:

Status		Drive Operation
Up (10)	Down (11)	
Open	Open	Hold current frequency reference
Closed	Open	Increase frequency reference
Open	Closed	Decrease frequency reference
Closed	Closed	Hold current frequency reference

Note:
1. An oPE03 alarm occurs when only one of the Up/Down functions is programmed to a digital input.
2. An oPE03 alarm occurs when the Up/Down function is assigned to the terminals and a different digital input is programmed for the Accel/decel ramp hold function. Refer to the Troubleshooting chapter in the User Manual packaged with the drive for more information on alarms.
3. The Up/Down function can only be used for External reference 1. Consider this when using Up/Down and the external reference switching command (H1-□□ = 2).

Using the Up/Down Function with Frequency Reference Hold (d4-01)

- If the frequency reference hold function is disabled (d4-01 = 0), the Up/Down frequency reference will be reset to 0 when the Run command is cleared or the power is cycled.
- When d4-01 = 1, the drive will save the frequency reference set by the Up/Down function. When the Run command or the power is cycled, the drive will restart with the saved reference value. Close the Up or Down input without an active Run command to reset the saved value. *Refer to d4-01: Frequency Reference Hold Function Selection on page 55*.

Using the Up/Down Function with Frequency Reference Limits

Parameter d2-01 determines the upper frequency reference limit.

The value for the lower frequency reference limit depends on the parameter d4-10 setting. This value can be set by an analog input or parameter d2-02. When a Run command is applied, the lower limits function as follows:

- If the lower limit is set by d2-02 only, the drive accelerates to this limit as soon as a Run command is entered.
- If the lower limit is determined by an analog input only (d2-02 = 0), the drive accelerates when both the Run command and an Up command are active and decelerates to the limit when a Down command is active. The drive will not start running if only the Run command is active.
- If the lower limit is set by both an analog input and d2-02, the drive accelerates to the d2-02 value when a Run command is input even if an Up or Down command is not entered. (The drive will not run with the default setting: d2-02 = 0). The drive accelerates if an Up command is active, and decelerates to the higher limit of the analog input and d2-02 if a Down command is active.

Figure 1.34 shows an Up/Down function example with a lower frequency reference limit set by d2-02, and the frequency reference hold function both enabled and disabled.

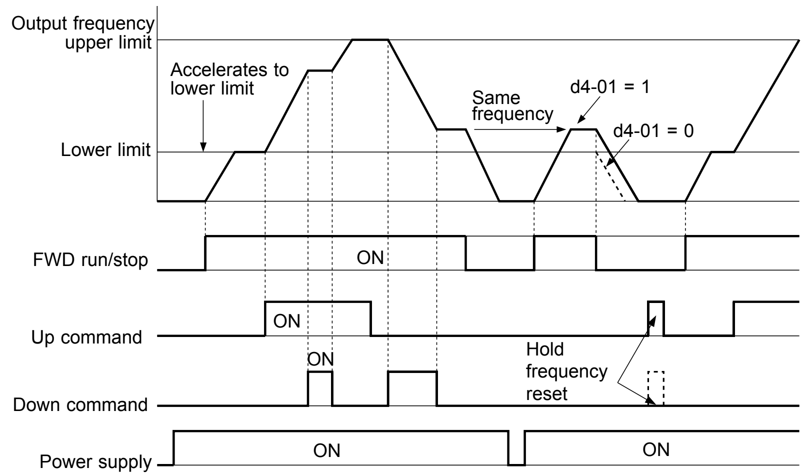


Figure 1.34 Up/Down Command Operation

Settings 12 and 13: Forward Jog, Reverse Jog

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

Note: The Forward Jog and Reverse Jog commands override all other frequency references. However, if the drive is set to prohibit reverse rotation (b1-04 = 1), activating Reverse Jog will have no effect. Inputting both the Forward Jog and Reverse Jog are simultaneously for 500 ms or longer will trigger an alarm will and the drive will ramp to stop.

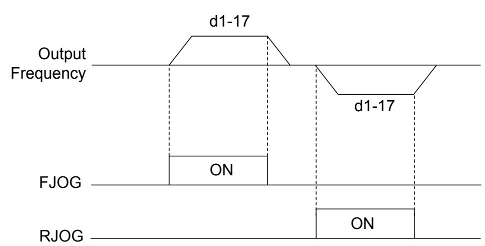


Figure 1.35 FJOG/RJOG Operation

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 HOA keypad 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.

Settings 15 and 17: Fast Stop (N.O., N.C.)

The Fast Stop function operates similar to an emergency stop input to the drive. If a Fast Stop command is input while the drive is running, the drive decelerates to a stop in the deceleration time set to C1-09 (*Refer to C1-09: Fast Stop Time on page 47*). The drive can only be restarted after bringing the drive to a complete stop, turning off the Fast Stop input, and switching off the Run command.

- To trigger the Fast Stop function with an N.O. switch, set H1-□□ = 15.
- To trigger the Fast Stop function with an N.C. switch, set H1-□□ = 17.

Figure 1.36 shows an operation example of Fast Stop.

Parameter Details

1

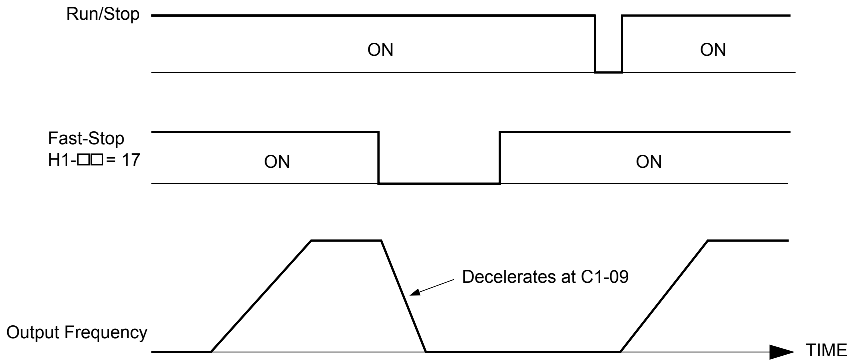


Figure 1.36 Fast Stop Sequence

WARNING! *Incorrect Operation. Yaskawa recommends that you use H1-□□ = 17 (Fast Stop (N.C.)). If a circuit error occurs in the MFDI, the drive cannot stop the output when the terminal set to H1-□□ = 15 (Fast Stop (N.O.)) turns ON.*

NOTICE: *Rapid deceleration can trigger an overvoltage fault. When faulted, the drive output shuts off, and the motor coasts. To avoid this uncontrolled motor state and to ensure that the motor stops quickly and safely, set an appropriate Fast Stop time to C1-09.*

Setting 18: Timer Function Input

This setting configures a digital input terminal as the input for the timer function. Use this setting combination with the timer function output (H2-□□ = 12). ***Refer to b4: Timer Function on page 30*** for details.

Setting 19: PID Disable

Close a digital input to indefinitely disable the PID function. When the input is released, the drive resumes PID operation. ***Refer to PID Block Diagram on page 34***.

Setting 1B: Program Lockout

Parameter values cannot be changed when an input is programmed for Program Lockout and the input is open. It is still possible, however, to view and monitor parameter settings.

Setting 1E: Reference Sample Hold

This function allows the user to sample an analog frequency reference signal being input to terminal A1 or A2 and hold the frequency reference at the sampled level. When the Analog Frequency Reference Sample/Hold function is held for at least 100 ms, the drive reads the analog input and changes the frequency reference to the newly sampled speed as illustrated in ***Figure 1.37***.

When the power is shut off and the sampled analog frequency reference is cleared, the frequency reference is reset to 0.

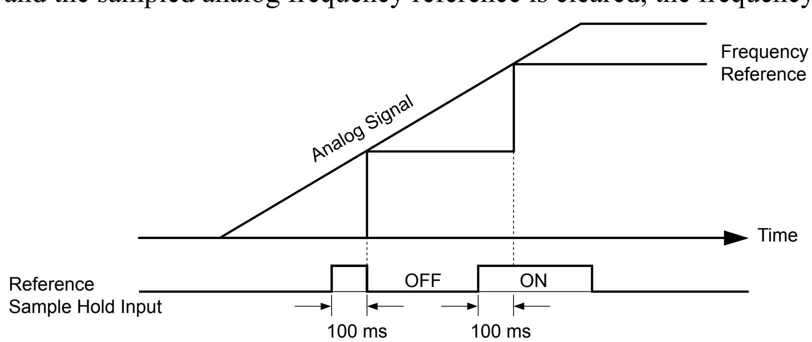


Figure 1.37 Analog Frequency Reference Sample/Hold

An oPE03 error will occur when one of the following functions is used simultaneously with the Analog frequency reference sample/hold command:

- Hold accel/decel stop (Setting: A)
- Up command, Down command (Setting: 10, 11)
- Offset frequency (Setting: 44 to 46)

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 HOA keypad will display EF□ where □ is the number of the terminal to which the external fault signal is assigned.

WARNING! *Incorrect Operation. Yaskawa recommends that you use H1-□□ = 21, 23, 25, 27, 29, 2B, 2D, 2F (External Fault (N.C.)). If a circuit error occurs in the MFDI, the drive cannot stop the output when the terminal set to H1-□□ = 20, 22, 24, 26, 28, 2A, 2C, 2E (External Fault (N.O.)) turns ON.*

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

The following table 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.

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.

Setting 30: PID Integral Reset

Configuring one of the digital inputs for PID integral reset (H1-□□ = 30) resets the value of the integral component in PID control to 0 when the terminal is closed. ***Refer to PID Block Diagram on page 34*** for more details.

Setting 31: PID Integral Hold

Configuring a digital input for Integral Hold (H1-□□ = 31) locks the value of the integral component of the PID control as long as the input is active. The PID controller resumes integral operation from the hold value as soon as the integral hold input is released. ***Refer to PID Block Diagram on page 34*** for more information on this function.

Setting 34: PID Soft Starter Cancel

A digital input configured as a PID soft starter cancel input (H1-□□ = 34) enables or disables the PID soft starter and cancels the PID accel/decel time (b5-17). ***Refer to PID Block Diagram on page 34***.

Setting 35: PID Input Level Selection

Allows an input terminal to switch the sign of the PID input. ***Refer to PID Block Diagram on page 34*** for details.

Setting 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.

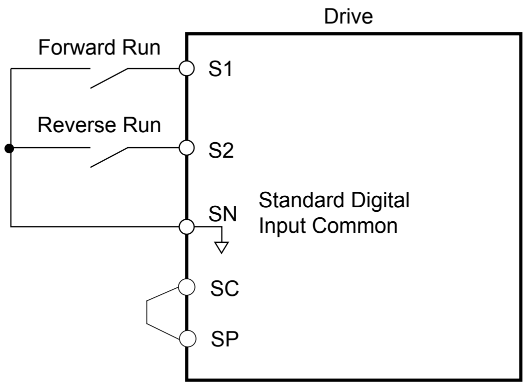


Figure 1.38 Example Wiring Diagram for 2-Wire Sequence

Setting 42, 43: Run and Direction Command for 2-Wire Sequence 2

Sets the drive for 2-Wire sequence 2.

When an input terminal programmed for 42 closes, the drive will operate in the selected direction. The drive will stop when the input opens.

The input programmed for 43 selects the direction. If the input is open, forward direction is selected. If the input is closed, reverse direction is selected.

Note: This function cannot be used simultaneously with settings 40 and 41.

Settings 44, 45, and 46: Offset Frequency 1, 2, 3

These inputs add offset frequencies d7-01, d7-02, and d7-03 to the frequency reference. ***Refer to d7-01 to d7-03: Offset Frequency 1 to 3 on page 57*** for details.

Setting 47: Node Setup

If the SI-S3 option card is connected, closing this terminal sets a node address for operation on a CANopen network.

Setting 50: Motor Pre-Heat 2

Sets the DC preheat current as a percentage of motor rated current (E2-01). ***Refer to Setting 60: Motor Pre-Heat 1 on page 84*** details.

Setting 51: Sequence Timer Disable

Drive ignores sequence timers and runs normally (based on b1-02 source).

Setting 52: Sequence Timer Cancel

The sequence timers are canceled.

Setting 60: Motor Pre-Heat 1

A DC current can be circulated through the motor windings to create heat and prevent moisture from condensing on the wire.

Motor Pre-Heating can only be initiated by closing a digital input programmed as a Motor Pre-Heat input (H1-□□ = 60). The level of the DC current used by the Motor Pre-Heat function is determined by b2-09.

A Run input will be given priority over a Motor Pre-Heat input and when the Run command is removed, the motor pre-heating will resume if the Motor Pre-Heat input is still closed.

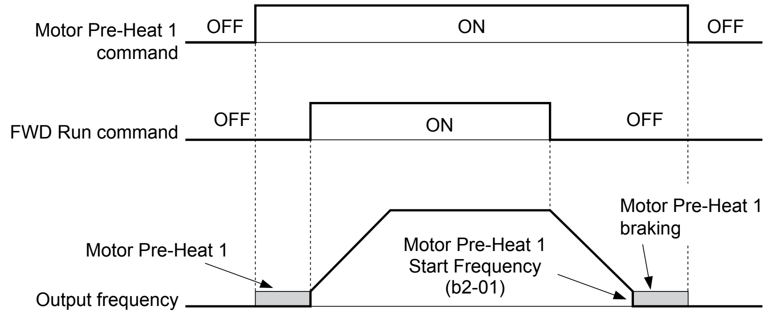


Figure 1.39 Motor Pre-Heat 1 Input Timing Diagram

Setting 61, 62: External Speed Search Command 1, 2

These input functions enable Speed Search even if parameter b3-01 = 0 (no Speed Search at start). *Refer to Speed Search Activation on page 24* for details on how to use the input signals. *Refer to b3: Speed Search on page 23* for more about Speed Search.

Note: Simultaneously assigning Speed Search 1 and Speed Search 2 to the input terminals will trigger an oPE03 error.

Setting 63: Field Weakening

Enabled in V/f Control. When this input is closed, Field Weakening is performed.

Setting 67: Communication Test Mode

The drive has a built-in function to self-diagnose serial communications operation. The test involves wiring the send and receive terminals of the RS-422/RS-485 port together. The drive transmits data and then confirms that the communications are received normally. *Refer to Self-Diagnostics on page 313* for details on how to use this function.

Setting 69: Jog 2

The Jog 2 function applies to 3-Wire control only. If a digital input is configured as Jog 2 (H1-□□ = 69) when the drive is not in 3-Wire Control, an oPE03 fault will occur.

The Jog 2 input causes the drive to ramp to the Jog Frequency Reference (d1-17) in the direction dictated by the Fwd/Rev input of the 3-Wire Control mode. Acceleration to and from the Jog Frequency Reference is determined by the active Accel/ Decel parameters.

Setting 6A: Drive Enable

A digital input configured as a “Drive enable” (H1-□□ = 6A) will prevent the drive from executing a Run command until the input is closed. When the input is open, the HOA keypad will display “dnE” to indicate that the drive is disabled.

If a Run command is enabled before the terminal set for “Drive enable” closes, then the drive will not run until the Run command is cycled (i.e., a new Run command is required). If the input is opened while the drive is running, the drive will stop according to the stop method set to b1-03 (*Refer to b1-03: Stopping Method Selection on page 18*).

Setting 6D: AUTO Mode Select

Sets the behavior when AUTO Mode is selected.

Legacy Operation Mode (S5-04 = 0)	
Open	Drive is in OFF or HAND mode
Closed	Drive is in AUTO mode (when HAND Mode Select input is open)
Normal Operation Mode (S5-04 = 1)	
Open	HAND reference is selected (based on S5-01)
Closed	AUTO reference is selected (based on b1-01)

Setting 6E: HAND Mode Select

Sets the behavior when HAND Mode is selected.

Legacy Operation Mode (S5-04 = 0)	
Open	Drive is in OFF or AUTO mode
Closed	Drive is in HAND mode (when AUTO Mode Select input is open)
Normal Operation Mode (S5-04 = 1)	
Open	HAND reference is selected (based on S5-01)
Closed	AUTO reference is selected (based on b1-01)

Setting 70: Drive Enable2

A digital input configured as a Drive Enable2 input (H1-☐☐ = 70) prevents the drive from executing a Run command until the Drive Enable2 input is closed. When the Drive Enable2 input is open and a Run command is closed, the digital operator will display “dnE”.

The Run command does not need to be cycled after the Drive Enable2 input is closed. The drive will run when both the Run and Drive Enable2 inputs are closed. If the Drive Enable2 input is opened while the drive is running, the drive will stop using the method set by parameter b1-03.

Setting A4: BP Emergency Override

When this input is closed the drive will switch into override. If the drive is running the drive will stop running and the motor will be switched to line voltage. If the drive is not running and dampers are present, they will be actuated. Upon completion of damper actuation the motor will be run on line voltage.

Setting A5: BP Drive/Bypass Select

Note: An oPE27 (BP Program Error) will occur if one of the digital inputs is set to A5 and parameter o1-13 or o1-14 is set to 2 (Drive/Bypass).

Status	Description
Open	Bypass mode
Closed	Drive mode

Setting A6: BP BAS Interlock

Indicates that the dampers are open.

Setting A7: BP Customer Safeties

Indicates that customer safeties are in place.

Setting A8: PI2 Disable (N.O.)

Disables the secondary PI controller. Output behavior depends on the setting of S3-12

Setting A9: PI2 Disable (N.C.)

Enables the secondary PI controller (when open, output behavior depends on the setting of S3-12).

Setting AA: PI2 Inverse Operation

Changes the sign of the secondary PI controller input (reverse acting PI control).

Setting AB: PI2 Integral Reset

Resets the secondary PI controller integral value.

Setting AC: PI2 Integral Hold

Locks the value of the secondary PI controller integral value.

Setting AD: Select PI2 Parameters

Uses the secondary PI controller Proportional and Integral adjustments (S3-06 and S3-07) instead of the primary PID controller Proportional and Integral adjustments (b5-02 and b5-03). Only valid when S3-01 = 0 (secondary PI controller disabled).

Note: This multi-function input has no effect on the secondary PI controller. It is only used for the primary PID controller (b5-☐☐).

Setting AE: BP Bypass Run

Commands a Run in Bypass mode via closing the BP Bypass Relay multi-function output.

Setting AF: Emergency Override Forward Run

Enables Emergency Override Forward Run.

Setting B0: Emergency Override Reverse Run

Enables Emergency Override Reverse Run.

Setting B1: Customer Safeties

The Customer Safeties multi-function input functionality is identical to Bypass Drive Enable (Setting 70: Drive Enable 2), except for the following:

- When the input is open, the stopping method is forced to Coast to Stop
- If the input is open when the Run command is present, a “SAFE” alarm is displayed instead of the “dnE” alarm.

Setting B2: BAS Interlock

The BAS Interlock multi-function input is used in a damper interlock circuit to keep the drive from running until the damper control relay is closed.

- When the input is open, the drive output is shut off (baseblocked).
- The drive will display an “inTLK” message if the input is open and a Run command is present. It will not display “dnE”.
- The state of the BAS Interlock multi-function input has no effect on the Emergency Override multi-function inputs (H1-□□ = AF, B0). The Emergency Override command will be accepted if the BAS Interlock digital input is open or closed.

◆ H2: Multi-Function Digital Outputs

■ H2-01 to H2-03: Terminal M1-M2, M3-M4, and MD-ME-MF Function Selection

The drive has three multi-function output terminals. *Table 1.32* lists the functions available for theses terminals using H2-01, H2-02, and H2-03.

No.	Parameter Name	Setting Range	Default
H2-01	Terminal M1-M2 Function Selection (relay)	0 to 1B6	0: During Run
H2-02	Terminal M3-M4 Function Selection (relay)	0 to 1B6	1: Zero Speed
H2-03	Terminal MD-ME-MF Function Selection (relay)	0 to 1B6	2: Speed Agree 1

Table 1.32 Multi-Function Digital Output Terminal Settings

Setting	Function	Page	Setting	Function	Page
0	During Run	88	16	Frequency Detection 4	93
1	Zero Speed	88	17	Torque Detection 1 (N.C.)	91
2	Speed Agree 1	88	1B	During Baseblock (N.C.)	94
3	User-Set Speed Agree 1	89	1E	Restart Enabled	94
4	Frequency Detection 1	89	1F	Motor Overload Alarm (oL1)	94
5	Frequency Detection 2	90	20	Drive Overheat Pre-Alarm (oH)	94
6	Drive Ready	90	2F	Maintenance Period	94
7	During Power Supply Voltage Fault	90	37	During Frequency Output	94
8	During Baseblock (N.O.)	91	38	Drive Enabled	95
9	Frequency Reference Source	91	39	Power Consumption Pulse Output	95
A	Run Command Source	91	3A	Regenerated Power Pulse Output	95
B	Torque Detection 1 (N.O.)	91	3D	During Speed Search	95
C	Frequency Reference Loss	91	3E	PID Feedback Low	95
E	Fault	91	3F	PID Feedback High	95
F	Through Mode	91	4C	During Fast Stop	95
10	Minor Fault	91	4D	oH Pre-Alarm Time Limit	95
11	Fault Reset Command Active	92	50	Waiting for Run	95
12	Timer Output	92	51	Sequence Timer 1 Active	95
13	Speed Agree 2	92	52	Sequence Timer 2 Active	95
14	User-Set Speed Agree 2	92	53	Sequence Timer 3 Active	95
15	Frequency Detection 3	93	54	Sequence Timer 41 Active	96

Setting	Function	Page
58	Underload Detection	96
60	Internal Cooling Fan Alarm	96
62	MEMOBUS Register 1	96
63	MEMOBUS Register 2	96
64	During Commercial Power Operation	96
AF	BP Drive Relay Contact	96
B0	BP Bypass Relay Contact	96
B1	BP BAS Interlock Relay Contact	96
B2	BAS Interlock Relay Contact	96
B3	Secondary PI Feedback Low	96
B4	Secondary PI Feedback High	96
B5	Relay Operator Control	96
B6	Drive Overheat Alarm 2	96
100 to 1B6	Functions 0 to B6 with Inverse Output	96

Setting 0: During Run

Output closes when the drive is outputting a voltage.

Status	Description
Open	Drive is stopped.
Closed	A Run command is input or the drive is in deceleration or DC injection.

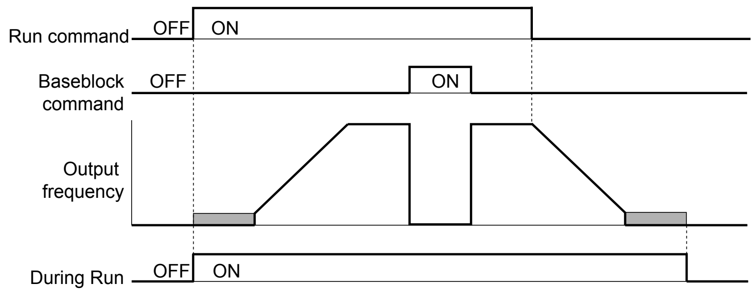


Figure 1.40 During Run Time Chart

Setting 1: Zero Speed

Terminal closes when the output frequency falls below the minimum output frequency set to E1-09 or b2-01.

Status	Description
Open	Output frequency is above the minimum output frequency set to E1-09 or b2-01
Closed	Output frequency is less than the minimum output frequency set to E1-09 or b2-01

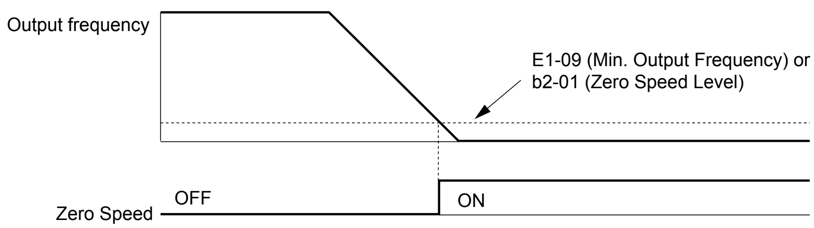


Figure 1.41 Zero-Speed Time Chart

Setting 2: Speed Agree 1 (f_{ref}/f_{out} Agree 1)

Closes when the actual output frequency is within the Speed Agree Width (L4-02) of the current frequency reference regardless of the direction.

Status	Description
Open	Output frequency does not match the frequency reference while the drive is running.
Closed	Output frequency is within the range of frequency reference ±L4-02.

Note: Detection works in forward and reverse.

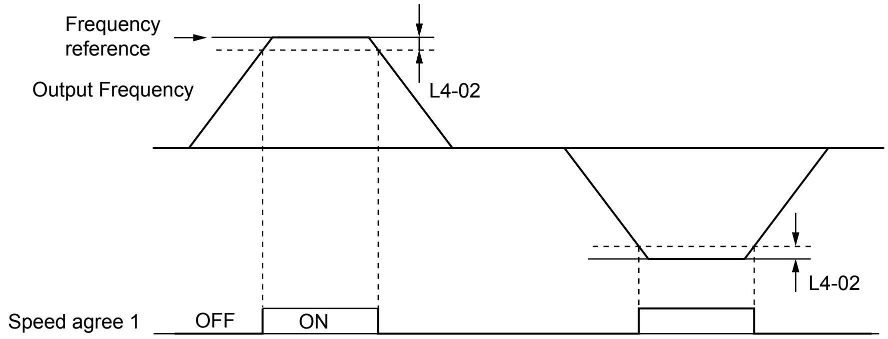


Figure 1.42 Speed Agree 1 Time Chart

Refer to L4-01, L4-02: Speed Agree Detection Level and Detection Width on page 116 for more details.

Setting 3: User-Set Speed Agree 1 (f_{ref}/f_{set} Agree 1)

Closes when the actual output frequency and the frequency reference are within the speed agree width (L4-02) of the programmed speed agree level (L4-01).

Status	Description
Open	Output frequency and frequency reference are not both within the range of L4-01 ±L4-02.
Closed	Output frequency and the frequency reference are both within the range of L4-01 ±L4-02.

Note: Frequency detection works in forward and reverse. The value of L4-01 is used as the detection level for both directions.

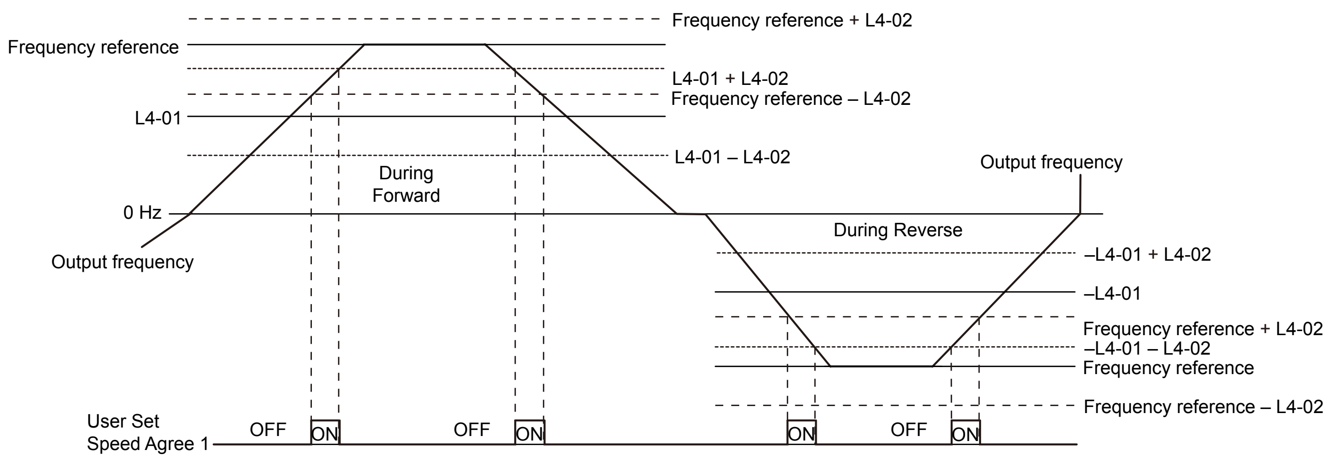


Figure 1.43 User Set Speed Agree 1 Time Chart

Refer to L4-01, L4-02: Speed Agree Detection Level and Detection Width on page 116 for more instructions.

Setting 4: Frequency Detection 1

The output opens when the output frequency rises above the detection level set in L4-01 plus the detection width set in L4-02. The terminal remains open until the output frequency fall below the level set in L4-01.

Status	Description
Open	Output frequency exceeded L4-01 + L4-02.
Closed	Output frequency is below L4-01 or has not exceeded L4-01 + L4-02.

Note: Frequency detection works in forward and reverse. The value of L4-01 is used as the detection level for both directions.

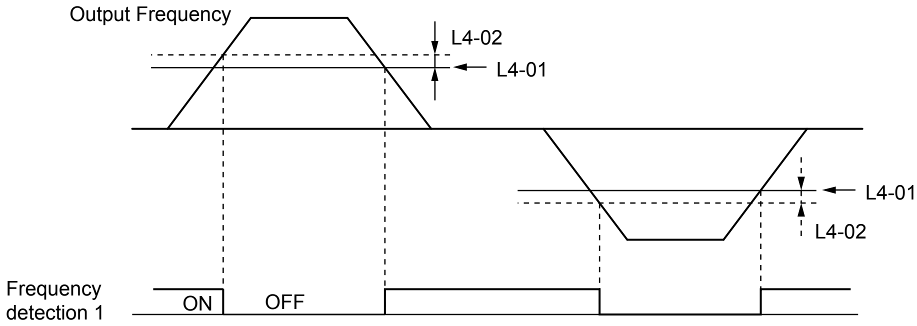


Figure 1.44 Frequency Detection 1 Time Chart

Refer to L4-01, L4-02: Speed Agree Detection Level and Detection Width on page 116 for more details.

Setting 5: Frequency Detection 2

The output closes when the output frequency is above the detection level set in L4-01. The terminal remains closed until the output frequency fall below L4-01 minus the setting of L4-02.

Status	Description
Open	Output frequency is below L4-01 minus L4-02 or has not exceeded L4-01.
Closed	Output frequency exceeded L4-01.

Note: Frequency detection works in forward and reverse. The value of L4-01 is used as the detection level for both directions.

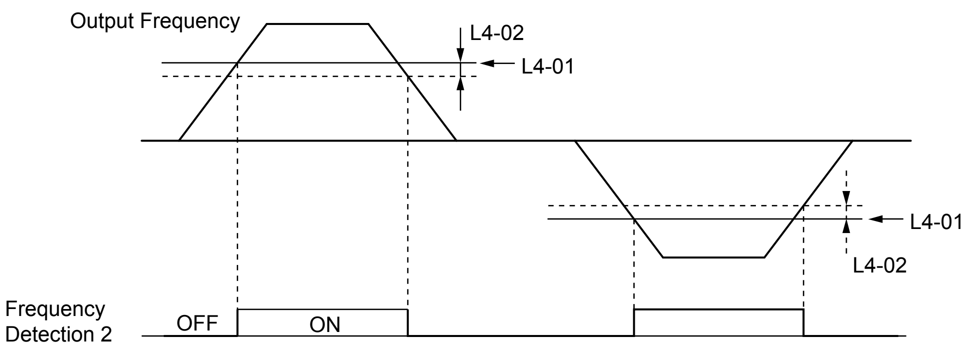


Figure 1.45 Frequency Detection 2 Time Chart

Refer to L4-01, L4-02: Speed Agree Detection Level and Detection Width on page 116 for more details.

Setting 6: Drive Ready

The output closes when the drive is ready to operate the motor. The terminal will not close under the conditions listed below, and any Run commands will be disregarded.

- When the power is shut off
- During a fault
- When the internal power supply of the drive has malfunctioned
- When a parameter setting error makes it impossible to run
- Although stopped, an overvoltage or undervoltage situation occurs
- While editing a parameter in the Programming Mode (when b1-08 = 0)

Setting 7: During Power Supply Voltage Fault

Output closes when the power supply voltage or the control circuit voltage falls below the drive operating voltage or when the power supply frequency is incorrect.

Status	Description
Open	Normal
Closed	One of the following faults will occur: AUv (Power Supply Undervoltage) Uv (Undervoltage) Fdv (Power Supply Frequency Fault)

Setting 8: During Baseblock (N.O.)

The output closes to indicate that the drive is in a baseblock state. While in baseblock, output transistors do not switch and no main circuit voltage is output.

Status	Description
Open	Drive is not in a baseblock state.
Closed	Baseblock is being executed.

Setting 9: Frequency Reference Source

Displays the currently selected frequency reference source.

Status	Description
Open	Frequency reference is provided from External reference 1 (b1-01).
Closed	Frequency reference is being sourced from the HOA keypad.

Setting 9: Minor Fault

The output closes when a minor fault condition is present.

Setting A: Run Command Source

Displays the currently selected Run command source.

Status	Description
Open	Run command is provided from External reference 1 (b1-02).
Closed	Run command is being sourced from the HOA keypad.

Setting B and 17: Torque Detection 1 (N.O., N.C.)

These digital output functions signal an overtorque or undertorque situation to an external device.

Set up the torque detection levels and select the output function from the table below. ***Refer to L6: Torque Detection on page 120*** for details.

Setting	Status	Description
B	Closed	Torque detection 1 (N.O.): Output current/torque exceeds (overtorque detection) or is below (undertorque detection) the torque value set in parameter L6-02 for longer than the time specified in parameter L6-03.
17	Open	Torque detection 1 (N.C.): Output current/torque exceeds (overtorque detection) or is below (undertorque detection) the torque value set in parameter L6-02 for longer than the time specified in parameter L6-03.

Setting C: Frequency Reference Loss

An output set for this function closes when frequency reference loss is detected. ***Refer to L4-05: Frequency Reference Loss Detection Selection on page 117*** for details.

Setting E: Fault

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

Setting F: Through Mode

Select this setting when using the terminal in a pass-through mode. When set to F, an output does not trigger any function in the drive. Setting F, however, still allows the output status to be read by a PLC via a communication option or MEMOBUS/ Modbus communications.

Setting 10: Minor Fault

The output closes when a minor fault condition is present.

Setting 11: Fault Reset Command Active

The output closes when there is an attempt to reset a fault situation from the control circuit terminals, via serial communications, or using a communications option card.

Setting 12: Timer Output

This setting configures a digital output terminal as the output for the timer function. *Refer to b4: Timer Function on page 30* for details.

Setting 13: Speed Agree 2 (f_{ref} /f_{out} Agree 2)

The output closes when the actual output frequency is within the speed agree width (L4-04) of the current frequency reference, regardless of the direction.

Status	Description
Open	Output frequency is outside the range of frequency reference ±L4-04.
Closed	Output frequency is within the range of frequency reference ±L4-04.

Note: Detection works in forward and reverse.

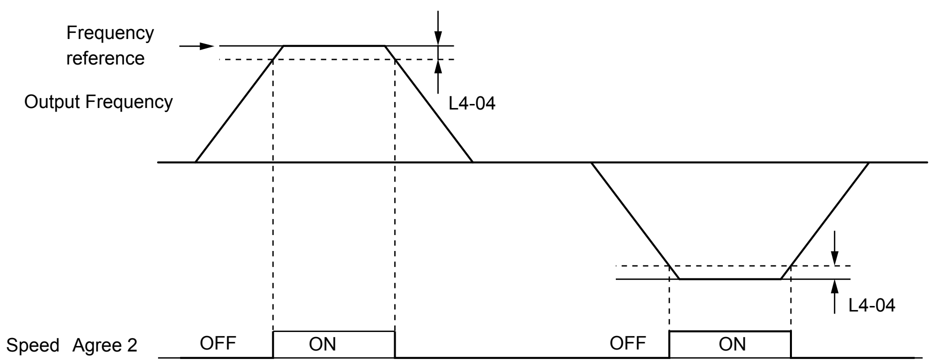


Figure 1.46 Speed Agree 2 Time Chart

Refer to L4-03, L4-04: Speed Agree Detection Level and Detection Width (+/-) on page 116 for more details.

Setting 14: User-Set Speed Agree 2 (f_{ref} /f_{set} Agree 2)

The output closes when the actual output frequency and the frequency reference are within the speed agree width (L4-04) of the programmed speed agree level (L4-03).

Status	Description
Open	Output frequency and frequency reference are both outside the range of L4-03 ±L4-04.
Closed	Output frequency and the frequency reference are both within the range of L4-03 ±L4-04.

Note: The detection level L4-03 is a signed value; detection works in the specified direction only.

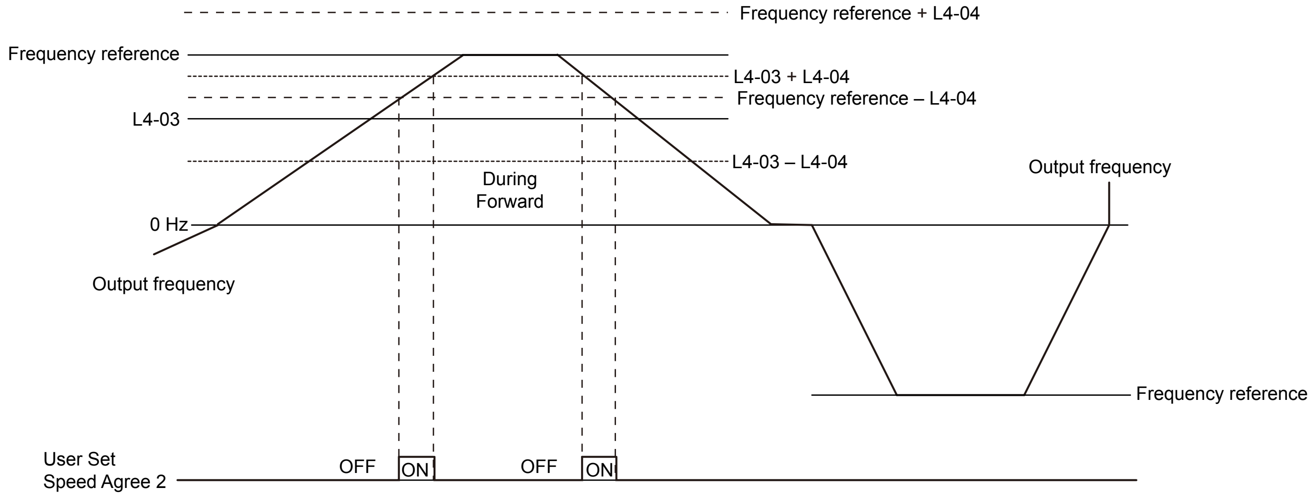


Figure 1.47 User-Set Speed Agree 2 Example with a Positive L3-04 Value

Refer to L4-03, L4-04: Speed Agree Detection Level and Detection Width (+/-) on page 116 for more details.

Setting 15: Frequency Detection 3

The output opens when the output frequency rises above the detection level set in L4-03 plus the detection with set in L4-04. The terminal remains open until the output frequency falls below the level set in L4-03. The detection level L4-03 is a signed value; detection works in the specified direction only.

Status	Description
Open	Output frequency exceeded L4-03 plus L4-04.
Closed	Output frequency is below L4-03 or has not exceeded L4-03 plus L4-04.

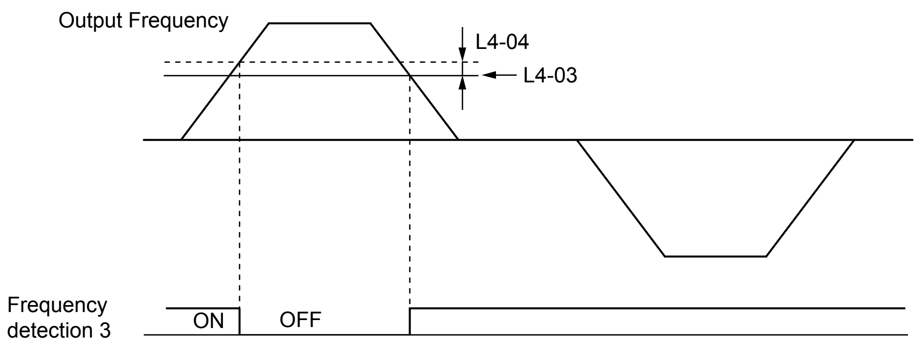


Figure 1.48 Frequency Detection 3 Example with a Positive L3-04 Value

Refer to L4-03, L4-04: Speed Agree Detection Level and Detection Width (+/-) on page 116 for more details.

Setting 16: Frequency Detection 4

The output closes when the output frequency is above the detection level set in L4-03. The terminal remains closed until the output frequency falls below L4-03 minus the setting of L4-04.

Status	Description
Open	Output frequency is below L4-03 minus L4-04 or has not exceeded L4-03.
Closed	Output frequency exceeded L4-03.

Note: The detection level L4-03 is a signed value; detection works in the specified direction only.

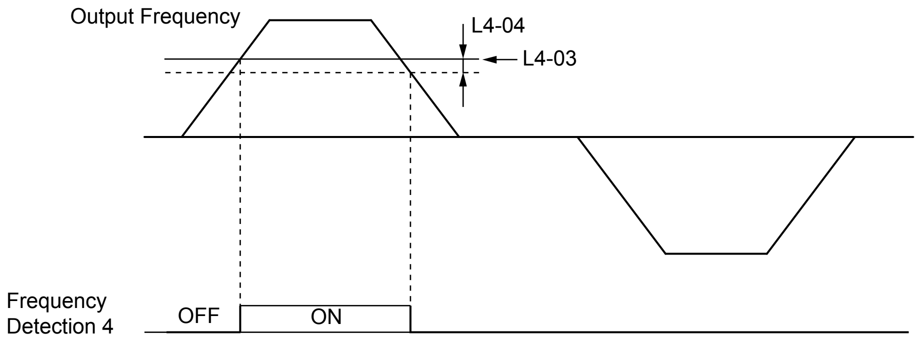


Figure 1.49 Frequency Detection 4 Example with Positive L3-04 Value

Refer to L4-03, L4-04: Speed Agree Detection Level and Detection Width (+/-) on page 116 for more details.

Setting 1B: During Baseblock (N.C.)

The output opens to indicate that the drive is in a baseblock state. While Baseblock is executed, output transistors do not switch and no main circuit voltage is output.

Status	Description
Open	Baseblock is being executed.
Closed	Drive is not in a baseblock state.

Setting 1E: Restart Enabled

An output set for “Restart enabled” closes when the drive attempts to restart after a fault has occurred.

The fault restart function allows the drive to automatically clear a fault. The terminal set to 1E will close after the fault is cleared and the drive has attempted to restart. If the drive cannot successfully restart within the number of attempts permitted by L5-01, a fault will be triggered and the terminal set to 1E will open. *Refer to L5: Fault Restart on page 117* for details on automatic restart.

Setting 1F: Motor Overload Alarm (oL1)

The output closes when the motor overload level estimated by the oL1 fault detection exceeds 90% of the oL1 detection level. *Refer to L1-01: Motor Overload Protection Selection on page 106*.

Setting 20: Drive Overheat Pre-Alarm (oH)

The output closes when the heatsink temperature exceeds the L8-02 level (while L8-03 = 3, 4), or an external device has triggered an oH2 alarm via multi-function input H1-☐☐ = BH. *Refer to L8-02: Overheat Alarm Level on page 123* for details on drive overheat detection.

Setting 2F: Maintenance Period

The output closes when the cooling fan, capacitor for the control power supply, or DC bus pre-charge relay may require maintenance as determined by the estimated performance life span of those components. Components performance life is displayed as a percentage on the HOA keypad screen.

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.
Closed	Drive is outputting frequency.

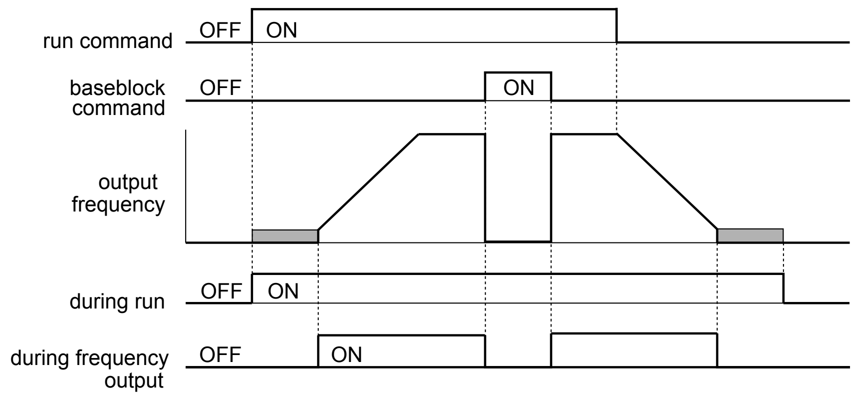


Figure 1.50 During Frequency Output Time Chart

Setting 38: Drive Enable

Reflects the status of a digital input configured as a “Drive enable” input (H1-□□ = 6A). If that digital input closes, then the digital output set for “Drive enable” will also close.

Setting 39: Power Consumption Pulse Output

Outputs a pulse to indicate the watt hours.

Setting 3A: Regenerated Power Pulse Output

Outputs a pulse to indicate the regenerated power.

Setting 3D: During Speed Search

The output terminal closes while Speed Search is being performed. ***Refer to b3: Speed Search on page 23*** for details.

Setting 3E: PID Feedback Low

The output terminal closes when a PID feedback loss is detected. The feedback is considered to be lost if it falls below the level set to b5-13 for longer than the time set to b5-14. ***Refer to PID Feedback Loss Detection on page 36*** for details.

Setting 3F: PID Feedback High

The output terminal closes when a PID feedback loss is detected. The feedback is considered to be lost if it rises beyond the level set to b5-36 for longer than the time set to b5-37. ***Refer to PID Feedback Loss Detection on page 36*** for details.

Setting 4C: During Fast Stop

The output terminal closes when a Fast Stop is being executed. ***Refer to Settings 15 and 17: Fast Stop (N.O., N.C.) on page 81***.

Setting 4D: oH Pre-Alarm Time Limit

The output terminal closes when the drive is reducing the speed due to a drive overheat alarm (L8-03 = 4) and the overheat alarm has not disappeared after 10 frequency reduction operation cycles. ***Refer to L8-03: Overheat Pre-Alarm Operation Selection on page 123*** for a more detailed description.

Setting 50: Waiting to Run (WrUn)

The drive will delay executing a Run command until the time set to b1-11 has expired.

Setting 51: Sequence Timer 1 Active

Sequence Timer 1 is active.

Setting 52: Sequence Timer 2 Active

Sequence Timer 2 is active.

Setting 53: Sequence Timer 3 Active

Sequence Timer 3 is active.

Setting 54: Sequence Timer 4 Active

Sequence Timer 4 is active.

Setting 58: Underload Detection

Underload is detected when the output current falls below the underload detection level defined by L6-14 and L6-02.

Setting 60: Internal Cooling Fan Alarm

The output closes when the drive internal cooling fan has failed.

Setting 62: MEMOBUS Register 1 (Selected with H2-07 and H2-08)

The contact output is closed when any of the bits specified by H2-08 for the MEMOBUS/Modbus register address set in H2-07 turn on.

Setting 63: MEMOBUS Register 2 (Selected with H2-09 and H2-10)

The contact output is closed when any of the bits specified by H2-10 for the MEMOBUS/Modbus register address set in H2-09 turn on.

Setting 64: During Commercial Power Operation

Output closes when operating on commercial power when commercial power switching is selected (b1-24 = 1).

Setting AF: BP Drive Relay

Line voltage is being supplied to the drive, and the motor is being run via the drive.

Note: Available in V/f control mode.

Setting B0: BP Bypass Relay

Line voltage is being supplied directly to the motor.

Note: Available in V/f control mode.

Setting B1: BP BAS Interlock Relay

Actuation signal for options dampers.

Note: Available in V/f control mode.

Setting B2: BAS Interlock Relay Contact

A Run command is active or voltage is output. Actuation signal for damper.

Setting B3: Secondary PI Feedback Low

The PI2 feedback level is too low.

Setting B4: Secondary PI Feedback High

The PI2 feedback level is too high.

Setting B5: Relay Operator Control

F1 (F2) key toggle relay is output.

Setting B6: Drive Overheat Alarm 2 (oH2)

Triggers an oH2 alarm when the contact closes. The drive continues to operate normally because frequency is reduced.

Setting 100 to 1B6: Functions 0 to B6 with Inverse Output

These settings have the same function as settings 0 to B6, but with inverse output. Set as 1☐☐, where the “1” indicates inverse output and the last two digits specify the setting number of the function.

Examples:

- Set 108 for inverse output of “8: During Baseblock (N.O.)”.
- Set 14C for inverse output of “4C: During Fast Stop”.

■ H2-06: Power Consumption Output Unit Selection

When one of the multi-function terminals is set to power consumption pulse output (H2-01, H2-02, or H2-03 = 39) or regenerated power pulse output (H2-01, H2-02, or H2-03 = 3A), parameter H2-06 determines the units for the output signal.

This output function provides a watt hour meter or a PLC input by a 200 ms pulse signal. H2-06 determines the frequency that pulses are issued to keep track of the kWh for the drive.

No.	Parameter Name	Setting Range	Default
H2-06	Power Consumption Output Unit Selection	0 to 4 <1>	1

<1> Setting range is 1 to 4 in drive software versions PRG: 6113 and earlier.

Setting 0: 0.1 kWh Units

Setting 1: 1 kWh Units

Setting 2: 10 kWh Units

Setting 3: 100 kWh Units

Setting 4: 1000 kWh Units

Note:
1. A regenerated power pulse output does not subtract from the total watt hours while power is applied. A power consumption output does not subtract from the total watt hours during regeneration.
2. The drive keeps track of the watt hours as long as the control circuit has power. The value is reset when the power supply is shut off.

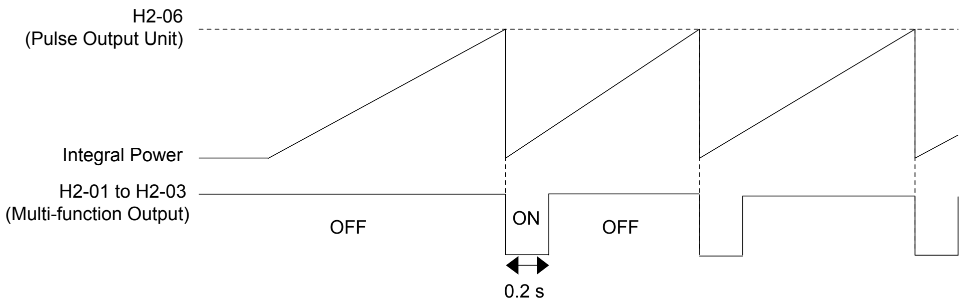


Figure 1.51 Watt Hour Output Example

■ H2-07 to H2-10: MEMOBUS Registers

These parameters specify the MEMOBUS/Modbus registers and bits from which data will be sent to the multi-function contact outputs.

No.	Name	Setting Range	Default
H2-07	MEMOBUS Register 1 Address Select	1 to 1FFFH	1
H2-08	MEMOBUS Register 1 Bit Select	0 to FFFFH	0
H2-09	MEMOBUS Register 2 Address Select	1 to 1FFFH	1
H2-10	MEMOBUS Register 2 Bit Select	0 to FFFFH	0

The MEMOBUS/Modbus register addresses for sending data to multi-function contact outputs 62 and 63 are specified in H2-07 and H2-09, and the bits for the MEMOBUS/Modbus registers are specified in H2-08 and H2-10.

◆ H3: Multi-Function Analog Inputs

The drive is equipped with multi-function analog input terminals A1, A2, and A3. ***Refer to Multi-Function Analog Input Terminal Settings on page 101*** for a listing of the functions that can be set to these terminals.

■ H3-01: Terminal A1 Signal Level Selection

Selects the input signal level for analog input A1. Set jumper S1 on the terminal board accordingly for voltage input or current input.

No.	Name	Setting Range	Default
H3-01	Terminal A1 Signal Level Selection	0 to 3	0

Setting 0: 0 to 10 V with Zero Limit

The input level is 0 to 10 Vdc with zero limit. The minimum input level is limited to 0%, so that a negative input signal due to gain and bias settings will be read as 0%.

Setting 1: 0 to 10 V without Zero Limit

The input level is 0 to 10 Vdc without zero limit. If the resulting voltage is negative after being adjusted by gain and bias settings, then the motor will rotate in reverse.

Setting 2: 4 to 20 mA Current Input

The input level is 4 to 20 mA. Negative input values by negative bias or gain settings are limited to 0%.

Setting 3: 0 to 20 mA Current Input

The input level is 0 to 20 mA. Negative input values by negative bias or gain settings are limited to 0%.

■ H3-02: Terminal A1 Function Selection

Selects the input signal level for analog input A1. ***Refer to Multi-Function Analog Input Terminal Settings on page 101*** for instructions on adjusting the signal level.

No.	Name	Setting Range	Default
H3-02	Terminal A1 Function Selection	0 to 26	0

■ H3-03, H3-04: Terminal A1 Gain and Bias Settings

Parameter H3-03 sets the level of the selected input value that is equal to 10 Vdc (20 mA) input at terminal A1 (gain).

Parameter H3-04 sets the level of the selected input value that is equal to 0 V (4 mA, 0 mA) input at terminal A1 (bias).

Use both parameters to adjust the characteristics of the analog input signal to terminal A1.

No.	Name	Setting Range	Default
H3-03	Terminal A1 Gain Setting	-999.9 to 999.9%	100.0%
H3-04	Terminal A1 Bias Setting	-999.9 to 999.9%	0.0%

Setting Examples

- Gain H3-03 = 200%, bias H3-04 = 0, terminal A1 as frequency reference input (H3-02 = 0):

  A 10 Vdc input is equivalent to a 200% frequency reference and 5 Vdc is equivalent to a 100% frequency reference. Since the drive output is limited by the maximum frequency parameter (E1-04), the frequency reference will be equal to E1-04 above 5 Vdc.

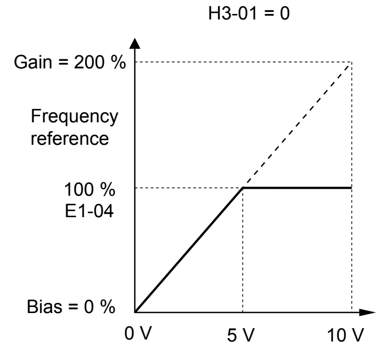


Figure 1.52 Frequency Reference Setting by Analog Input with Increased Gain

- Gain H3-03 = 100%, bias H3-04 = -25%, terminal A1 as frequency reference input:
  An input of 0 Vdc will be equivalent to a -25% frequency reference.
  When parameter H3-01 = 0, the frequency reference is 0% between 0 and 2 Vdc input.

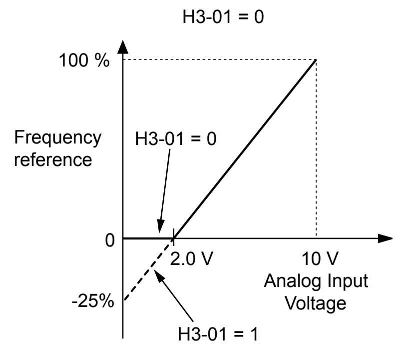


Figure 1.53 Frequency Reference Setting by Analog Input with Negative Bias

■ H3-05: Terminal A3 Signal Level Selection

Selects the input signal level for analog input A3. *Refer to Multi-Function Analog Input Terminal Settings on page 101* for a list of functions and descriptions.

No.	Name	Setting Range	Default
H3-05	Terminal A3 Signal Level Selection	0 to 3	0

Setting 0: 0 to 10 Vdc

The input level is 0 to 10 Vdc. See the explanation provided for H3-01. *Refer to Setting 0: 0 to 10 V with Zero Limit on page 98*.

Setting 1: -10 to 10 Vdc

The input level is -10 to 10 Vdc. See the explanation provided for H3-01. *Refer to Setting 1: 0 to 10 V without Zero Limit on page 98*.

Setting 2: 4 to 20 mA Current Input

The input level is 4 to 20 mA. Negative input values by negative bias or gain settings will be limited to 0%.

Setting 3: 0 to 20 mA Current Input

The input level is 0 to 20 mA. Negative input values by negative bias or gain settings will be limited to 0%.

■ H3-06: Terminal A3 Function Selection

Determines the function assigned to analog input terminal A3. *Refer to Multi-Function Analog Input Terminal Settings on page 101* for a list of functions and descriptions.

No.	Name	Setting Range	Default
H3-06	Terminal A3 Function Selection	0 to 26	2

■ H3-07, H3-08: Terminal A3 Gain and Bias Setting

Parameter H3-07 sets the level of the selected input value that is equal to 10 Vdc input at terminal A3 (gain).

Parameter H3-08 sets the level of the selected input value that is equal to 0 V input at terminal A3 (bias).

No.	Name	Setting Range	Default
H3-07	Terminal A3 Gain Setting	-999.9 to 999.9%	100.0%
H3-08	Terminal A3 Bias Setting	-999.9 to 999.9%	0.0%

■ H3-09: Terminal A2 Signal Level Selection

Selects the input signal level for analog input A2. Set Jumper S1 on the terminal board accordingly for a voltage input or current input.

No.	Name	Setting Range	Default
H3-09	Terminal A2 Signal Level Selection	0 to 3	2

Setting 0: 0 to 10 V with Zero Limit

The input level is 0 to 10 Vdc. Negative input values will be limited to 0. ***Refer to Setting 0: 0 to 10 V with Zero Limit on page 98***.

Setting 1: 0 to 10 V without Zero Limit

The input level is 0 to 10 Vdc. Negative input values will be accepted. ***Refer to Setting 1: 0 to 10 V without Zero Limit on page 98***.

Setting 2: 4 to 20 mA Current Input

The input level is 4 to 20 mA. Negative input values by negative bias or gain settings will be limited to 0%.

Setting 3: 0 to 20 mA Current Input

The input level is 0 to 20 mA. Negative input values by negative bias or gain settings will be limited to 0%.

■ H3-10: Terminal A2 Function Selection

Determines the function assigned to analog input terminal A2. ***Refer to Multi-Function Analog Input Terminal Settings on page 101*** for a list of functions and descriptions.

No.	Name	Setting Range	Default
H3-10	Terminal A2 Function Selection	0 to 26	*<1>*

<1> Default is 0 when b5-01 is set to 0.
Default is B when b5-01 is set to 1 or 3.

■ H3-11, H3-12: Terminal A2 Gain and Bias Setting

Parameter H3-11 sets the level of the input value selected that is equal to 10 Vdc input or 20 mA input to terminal A2.

Parameter H3-12 sets the level of the input value selected that is equal to 0 V, 4 mA or 0 mA input at terminal A2.

Use both parameters to adjust the characteristics of the analog input signal to terminal A2. The setting works in the same way as parameters H3-03 and H3-04 for analog input A1.

No.	Name	Setting Range	Default
H3-11	Terminal A2 Gain Setting	-999.9 to 999.9%	100.0%
H3-12	Terminal A2 Bias Setting	-999.9 to 999.9%	0.0%

■ H3-13: Analog Input Filter Time Constant

Parameter H3-13 sets the time constant for a first order filter that will be applied to the analog inputs.

An analog input filter prevents erratic drive control when using a “noisy” analog reference. Drive operation becomes more stable as the programmed time becomes longer, but it also becomes less responsive to rapidly changing analog signals.

No.	Name	Setting Range	Default
H3-13	Analog Input Filter Time Constant	0.00 to 2.00 s	0.03 s

■ H3-14: Analog Input Terminal Enable Selection

When one of the multi-function digital input parameters is set for “Analog input enable” (H1-☐☐ = C), the value set to H3-14 determines which analog input terminals are enabled when the input is closed. All of the analog input terminals will be enabled all of the time when H1-☐☐≠ C. The terminals not set as the target are not influenced by input signals.

No.	Name	Setting Range	Default
H3-14	Analog Input Terminal Enable Selection	1 to 7	7

Setting 1: A1 Only Enabled

Setting 2: A2 Only Enabled

Setting 3: A1 and A2 Only Enabled

Setting 4: A3 Only Enabled

Setting 5: A1 and A3 Only Enabled

Setting 6: A2 and A3 Only Enabled

Setting 7: All Analog Input Terminals Enabled

■ H3-16 to H3-18: Terminal A1/A2/A3 Offset

Set the offset level of the selected input value to terminals A1, A2, or A3 that is equal to 0 Vdc input. These parameters rarely require adjustment.

No.	Name	Setting Range	Default
H3-16	Terminal A1 Offset	-500 to 500	0
H3-17	Terminal A2 Offset	-500 to 500	0
H3-18	Terminal A3 Offset	-500 to 500	0

■ Multi-Function Analog Input Terminal Settings

See *Table 1.33* for information on how H3-02, H3-10, and H3-06 determine functions for terminals A1, A2, and A3.

Note: The scaling of all input functions depends on the gain and bias settings for the analog inputs. Set these to appropriate values when selecting and adjusting analog input functions.

Table 1.33 Multi-Function Analog Input Terminal Settings

Setting	Function	Page	Setting	Function	Page
0	Frequency Bias	101	9	Output Frequency Lower Limit Level	103
1	Frequency Gain	101	B	PID Feedback	103
2	Auxiliary Frequency Reference 1	102	C	PID Setpoint	103
3	Auxiliary Frequency Reference 2	102	D	Frequency Bias	103
4	Output Voltage Bias	102	E	Motor Temperature (PTC Input)	103
5	Accel/Decel Time Gain	102	F	Through Mode	103
6	DC Injection Braking Current	102	16	Differential PID Feedback	103
7	Overtorque/Undertorque Detection Level	102	25	Secondary PI Setpoint	103
8	Stall Prevention Level During Run	102	26	Secondary PI Feedback	103

Setting 0: Frequency Bias

The input value of an analog input set to this function will be added to the analog frequency reference value. When the frequency reference is supplied by a different source other than the analog inputs, this function will have no effect. Use this setting also when only one of the analog inputs is used to supply the frequency reference.

By default, analog inputs A1 and A2 are set for this function. Simultaneously using A1 and A2 increases the frequency reference by the total of all inputs.

Example: If the analog frequency reference from analog input terminal A1 is 50% and a bias of 20% is applied by analog input terminal A2, the resulting frequency reference will be 70% of the maximum output frequency.

Setting 1: Frequency Gain

The input value of an analog input set to this function will be multiplied with the analog frequency reference value.

Example: If the analog frequency reference from analog input terminal A1 is 80% and a gain of 50% is applied from analog input terminal A2, the resulting frequency reference will be 40% of the maximum output frequency.

Setting 2: Auxiliary Reference 1

Sets the auxiliary frequency reference 1 when multi-step speed operation is selected. ***Refer to Multi-Step Speed Selection on page 52*** for details.

Setting 3: Auxiliary Reference 2

Sets the auxiliary frequency reference 2 when multi-step speed operation is selected. ***Refer to Multi-Step Speed Selection on page 52*** for details.

Setting 4: Output Voltage Bias

Voltage bias boosts the output voltage of the V/f curve as a percentage of the maximum output voltage (E1-05). Available only when using V/f Control.

Setting 5: Accel/Decel Time Gain

Adjusts the gain level for the acceleration and deceleration times set to parameters C1-01 through C1-08.

The drive acceleration time is calculated by multiplying the gain level to C1-□□ as follows:

C1-□□ × Accel/decel time gain = Drive accel/decel time

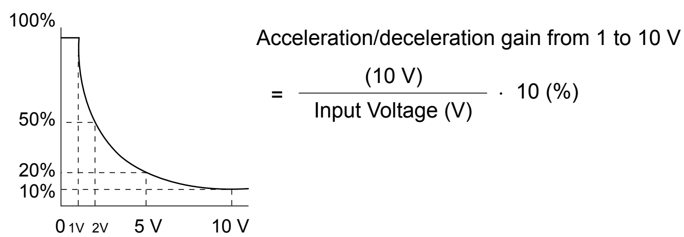


Figure 1.54 Accel/Decel Time Gain with Analog Input Terminal

Setting 6: DC Injection Braking Current

The current level used for DC Injection Braking is set as a percentage of the drive rated current.

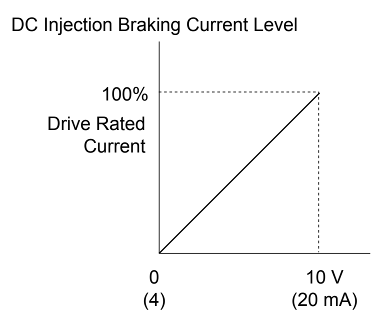


Figure 1.55 DC Injection Braking Current Using an Analog Input Terminal

Setting 7: Torque Detection Level

Using this setting, the overtorque/undertorque detection level for torque detection 1 (L6-01) can be set by an analog input. The analog input replaces the level set to L6-02. An analog input of 100% (10 V or 20 mA) sets a torque detection level equal to 100% drive rated current/motor rated torque. Adjust the analog input gain if higher detection level settings are required. ***Refer to L6: Torque Detection on page 120*** for details on torque detection.

Setting 8: Stall Prevention Level

Allows an analog input signal to adjust the Stall Prevention level. ***Figure 1.56*** shows the setting characteristics. The drive will use the lower value of the Stall Prevention level set to L3-06 or the level coming from the selected analog input terminal.

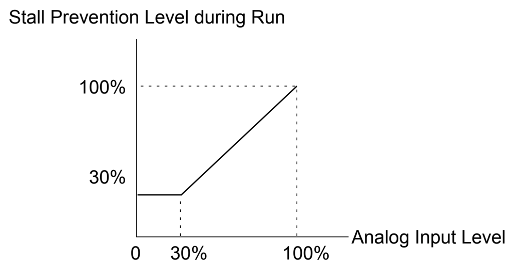


Figure 1.56 Stall Prevention During Run Using an Analog Input Terminal

Setting 9: Output Frequency Lower Limit Level

The user can adjust the lower limit of the output frequency using an analog input signal.

Setting B: PID Feedback

Supplies the PID feedback value. This setting requires PID operation to be enabled in b5-01. *Refer to PID Feedback Input Methods on page 32*.

Setting C: PID Setpoint

Supplies the PID setpoint value and makes the frequency reference selected in parameter b1-01 no longer the PID setpoint. PID operation to be enabled in b5-01 to use this setting. *Refer to PID Setpoint Input Methods on page 32*.

Setting D: Frequency Bias

The input value of an analog input set to this function will be added to the frequency reference. This function can be used with any frequency reference source.

Setting E: Motor Temperature

In addition to motor overload fault detection oL1, it is possible to use a PTC (Positive Temperature Coefficient) thermistor for motor insulation protection.

Setting F: Through Mode

When set to F, an input does not affect any drive function, but the input level can still be read out by a PLC via APOGEE FLN, BACnet, MEMOBUS/Modbus, or Metasys N2 communications.

Setting 16: Differential PID Feedback

If an analog value is set for this function, the PID controller is set for differential feedback. The difference of the PID feedback input value and the differential feedback input value builds the feedback value used to calculate the PID input. *Refer to PID Feedback Input Methods on page 32*.

Setting 25: Secondary PI Setpoint

10 V = S3-02 (Maximum Output Frequency).

Setting 26: Secondary PI Feedback

10 V = S3-02 (Maximum Output Frequency).

◆ H4: Multi-Function Analog Outputs

These parameters assign functions to analog output terminals FM and AM for monitoring a specific aspect of drive performance.

■ H4-01, H4-04: Multi-Function Analog Output Terminal FM, AM Monitor Selection

Sets the desired drive monitor parameter U□-□□ to output as an analog value via terminal FM and AM. *Refer to U: Monitor Parameters on page 164* for a list of all monitors. The “Analog Output Level” column indicates whether a monitor can be used for analog output.

Example: Enter “103” for U1-03.

No.	Name	Setting Range	Default
H4-01	Multi-Function Analog Output Terminal FM Monitor Selection	000 to 655	102
H4-04	Multi-Function Analog Output Terminal AM Monitor Selection	000 to 655	103

A setting of 031 or 000 applies no drive monitor to the analog output. With this setting, terminal functions as well as FM and AM output levels can be set by a PLC via a communication option or MEMOBUS/Modbus (through mode).

■ H4-02, H4-03: Multi-Function Analog Output Terminal FM Gain and Bias H4-05, H4-06: Multi-Function Analog Output Terminal AM Gain and Bias

Parameters H4-02 and H4-05 set the terminal FM and AM output signal level when the value of the selected monitor is at 100%. Parameters H4-03 and H4-06 set the terminal FM and AM output signal level when the value of the selected monitor is at 0%. Both are set as a percentage, where 100% equals 10 Vdc or 20 mA analog output and 0% equals 0 V or 4 mA. The output voltage of both terminals is limited to +/-10 Vdc.

The output signal range can be selected between 0 to +10 Vdc or -10 to +10 Vdc, or 4 to 20 mA using parameter H4-07 and H4-08. *Figure 1.57* illustrates how gain and bias settings work.

No.	Name	Setting Range	Default
H4-02	Multi-Function Analog Output Terminal FM Gain	-999.9 to 999.9%	100.0%
H4-03	Multi-Function Analog Output Terminal FM Bias	-999.9 to 999.9%	0.0%
H4-05	Multi-Function Analog Output Terminal AM Gain	-999.9 to 999.9%	50.0%
H4-06	Multi-Function Analog Output Terminal AM Bias	-999.9 to 999.9%	0.0%

Using Gain and Bias to Adjust Output Signal Level

When viewing a gain setting parameter (H4-02 or H4-05) on the HOA keypad, the analog output will supply a voltage signal equal to 100% of the monitor value (including changes made from bias and gain settings). When viewing a bias setting parameter (H4-03 or H4-06), the analog output voltage will supply a signal equal to 0% monitor value.

Example 1: Set H4-02 to 50% for an output signal of 5 V at terminal FM when the monitored value is at 100%.

Example 2: Set H4-02 to 150% for an output signal of 10 V at terminal FM when the monitored value is at 76.7%.

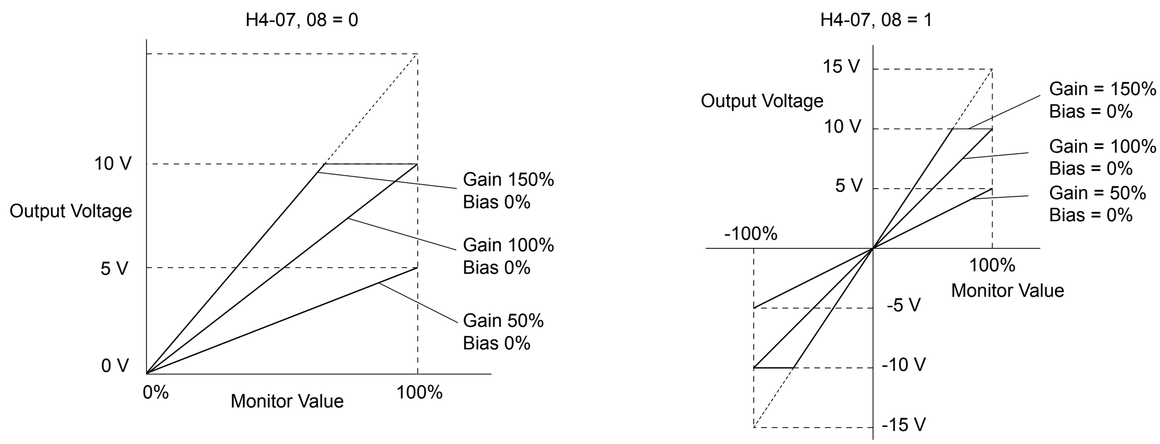


Figure 1.57 Analog Output Gain and Bias Setting Example 1 and 2

Example 3: Set H4-03 to 30% for an output signal of 3 V at terminal FM when the monitored value is at 0%.

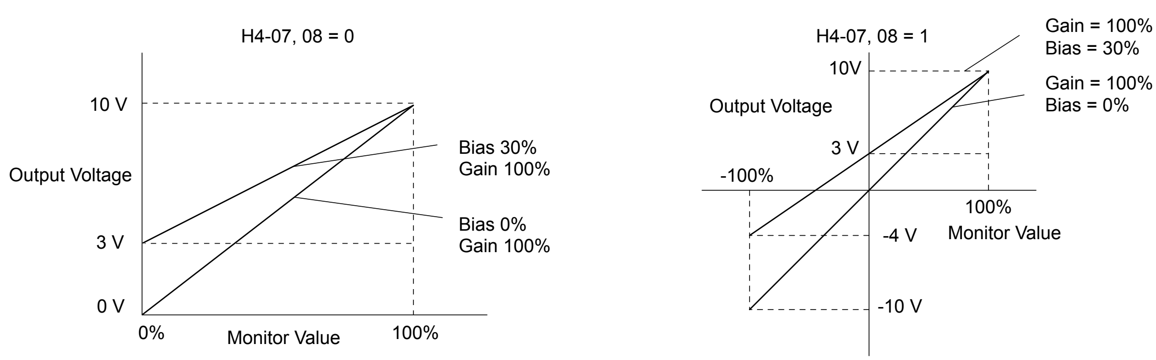


Figure 1.58 Analog Output Gain and Bias Setting Example 3

■ H4-07, H4-08: Multi-Function Analog Output Terminal FM, AM Signal Level Selection

Sets the voltage output level of U parameter (monitor parameter) data to terminal FM and terminal AM using parameters H4-07 and H4-08.

Set jumper S5 on the terminal board accordingly when changing these parameters.

No.	Name	Setting Range	Default
H4-07	Multi-Function Analog Output Terminal FM Signal Level Selection	0 to 2	0
H4-08	Multi-Function Analog Output Terminal AM Signal Level Selection	0 to 2	0

Setting 0: 0 to 10 V

Setting 1: -10 V to 10 V

Setting 2: 4 to 20 mA

◆ H5: Serial Communication (APOGEE FLN, BACnet, MEMOBUS/Modbus, and Metasys N2)

Serial communication is possible in the drive using the built-in RS-422/RS-485 port (terminals R+, R-, S+, S-) and programmable logic controllers (PLCs) or similar devices running the APOGEE FLN, BACnet, MEMOBUS/Modbus, and Metasys N2 protocols.

The H5-□□ parameters set the drive for APOGEE FLN, BACnet, MEMOBUS/Modbus, and Metasys N2 communications. Refer to the different communication protocol chapters for detailed descriptions of the H5-□□ parameters.

1.8 L: Protection Functions

◆ L1: Motor Protection

■ L1-01: Motor Overload Protection Selection

The drive has an electronic overload protection function that estimates the motor overload level based on output current, output frequency, thermal motor characteristics, and time. When the drive detects a motor overload an oL1 fault is triggered and the drive output shuts off.

L1-01 sets the overload protection function characteristics according to the motor being used.

No.	Name	Setting Range	Default
L1-01	Motor Overload Protection Selection	0, 1, 4	Determined by A1-02

Note: 1. When the motor protection function is enabled (L1-01≠ 0), an oL1 alarm can be output through one of the multi-function outputs by setting H2-01 to 1F. The output closes when the motor overload level reaches 90% of the oL1 detection level.

2. Set L1-01 to a value between 1 and 5 when running a single motor from the drive to select a method to protect the motor from overheat. An external thermal relay is not necessary.

Setting 0: Disabled (Motor Overload Protection Is not Provided)

Use this setting if no motor overheat protection is desired or if multiple motors are connected to a single drive. If multiple motors are connected to a single drive, install a thermal relay for each motor as shown in *Figure 1.59*.

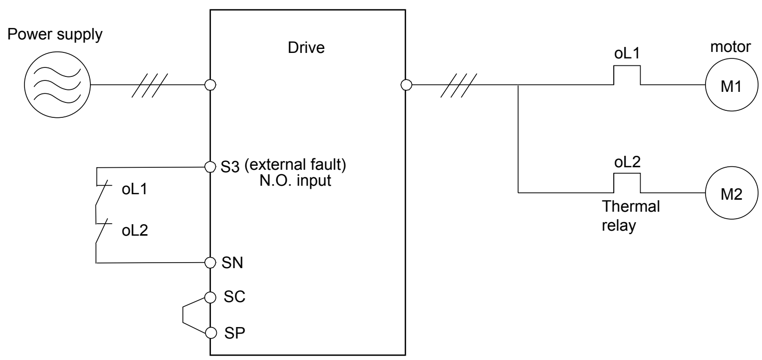
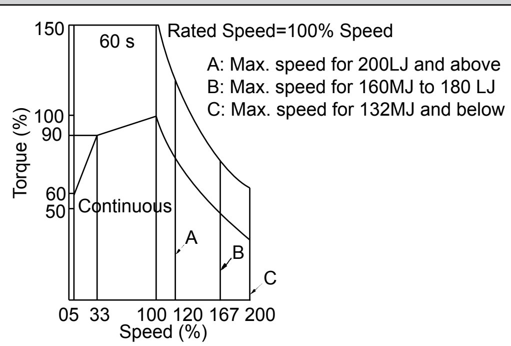


Figure 1.59 Example of Protection Circuit Design for Multiple Motors

NOTICE: *Thermal protection cannot be provided when running multi-motors simultaneously with the same drive, or when using motors with a relatively high current rating compared to other standard motors (such as a submersible motor). Failure to comply could result in motor damage. Disable the electronic overload protection of the drive (L1-01 = “0: Disabled”) and protect each motor with individual motor thermal overloads.*

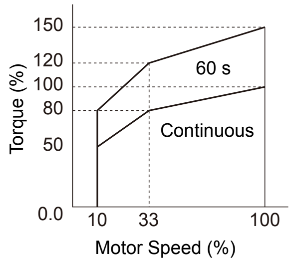
Setting 1: General-Purpose Motor (Standard Self-Cooled)

Because the motor is self-cooled, the maximum load current drops when the motor speed is lowered. The drive appropriately adjusts the electrothermal trigger point according to the motor overload characteristics, protecting the motor from overheat throughout the entire speed range.

Maximum Load Current	Cooling Ability	Overload Characteristics
 	Motor designed to operate from line power. Motor cooling is most effective when running at rated base frequency (check the motor nameplate or specifications).	Continuous operation at less than line power frequency with 100% load can trigger motor overload protection (oL1). A fault is output and the motor will coast to stop.

Setting 4: PM Derated Torque Motor

Use this setting when operating a PM motor. PM motors for derated torque have a self-cooling design and the maximum load current drops as the motor slows. Electronic thermal overload is triggered in accordance with the motor overload characteristics, providing overheat protection across the entire speed range.

Maximum Load Current	Cooling Ability	Overload Characteristics
	Motor is designed to produce 100% torque at base speed. Built with effective cooling capabilities.	Reaching 100% when operating at below the base frequency causes a motor overload fault (oL1). The drive fault output closes and the motor coasts to stop.

■ L1-02: Motor Overload Protection Time

Sets the detection time of motor overheat due to overload. This setting rarely requires adjustment, but should correlate with the motor maximum load current protection time for performing a hot start.

No.	Name	Setting Range	Default
L1-02	Motor Overload Protection Time	0.1 to 50.0 minutes	1.0 minute

Defaulted to operate with an allowance of 150% overload operation for one minute in a hot start.

Figure 1.60 illustrates an example of the electrothermal protection operation time using a general-purpose motor operating at the value of E1-06, Motor Base Speed, with L1-02 set to one minute.

During normal operation, motor overload protection operates in the area between a cold start and a hot start.

- Cold start: Motor protection operation time in response to an overload situation that was suddenly reached when starting a stationary motor.
- Hot start: Motor protection operation time in response to an overload situation that occurred during sustained operation at rated current.

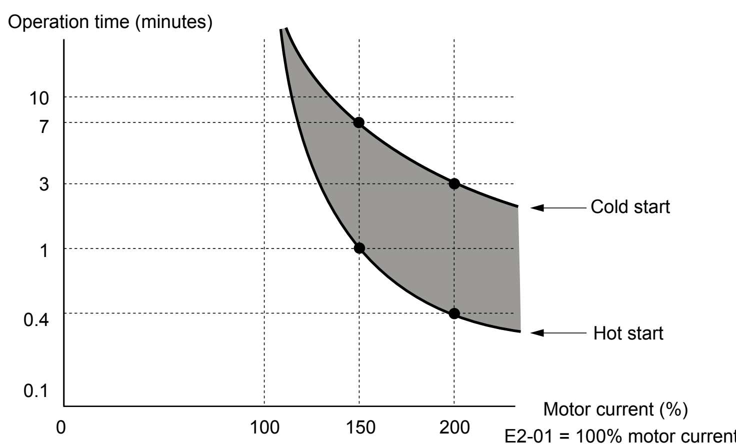


Figure 1.60 Motor Protection Operation Time

■ Motor Protection Using a Positive Temperature Coefficient (PTC) Thermistor

Connect a motor PTC to an analog input of the drive for motor overheat protection.

When the PTC input signal reaches the motor overheat alarm level, an oH3 alarm will be triggered and the drive will continue operation as selected in L1-03. When the PTC input signal reaches the overheat fault level, an oH4 fault will be triggered, a fault signal will be output, and the drive will stop the motor using the stopping method determined in L1-04.

Figure 1.61 shows a PTC connection example for analog input A2. When using analog input A2, be sure to set Jumper S1 on the control board for voltage input when using this function.

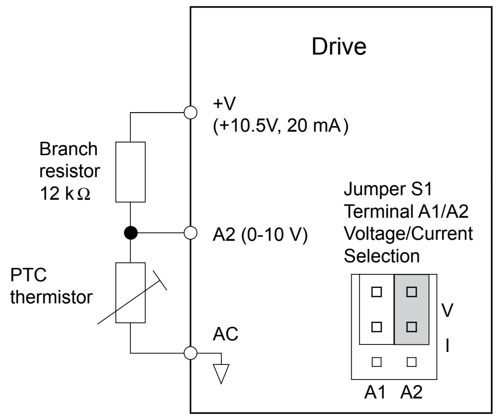


Figure 1.61 Connection of a Motor PTC

The PTC must exhibit the characteristics shown in ***Figure 1.62*** for one motor phase. The motor overload protection of the drive expects 3 of these PTCs to be connected in a series.

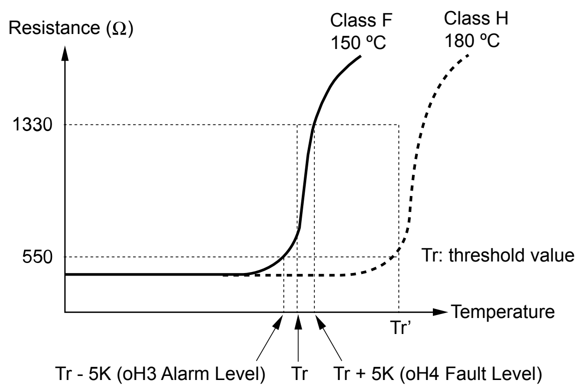


Figure 1.62 Motor PTC Characteristics

Set up overheat detection using a PTC using parameters L1-03, L1-04, and L1-05 as explained in the following sections.

■ L1-03: Motor Overheat Alarm Operation Selection (PTC input)

Sets the drive operation when the PTC input signal reaches the motor overheat alarm level (oH3).

No.	Name	Setting Range	Default
L1-03	Motor Overheat Alarm Operation Selection (PTC input)	0 to 3	3

Setting 0: Ramp to Stop

The drive stops the motor using the deceleration time 1 set in parameter C1-02.

Setting 1: Coast to Stop

The drive output is switched off and the motor coasts to stop.

Setting 2: Fast Stop

The drive stops the motor using the Fast Stop time set in parameter C1-09.

Setting 3: Alarm Only

The operation is continued and an oH3 alarm is displayed on the HOA keypad.

■ L1-04: Motor Overheat Fault Operation Selection (PTC input)

Sets the drive operation when the PTC input signal reaches the motor overheat fault level (oH4).

No.	Name	Setting Range	Default
L1-04	Motor Overheat Fault Operation Selection (PTC input)	0 to 2	1

Setting 0: Ramp to Stop

The drive stops the motor using the deceleration time 1 set in parameter C1-02.

Setting 1: Coast to Stop

The drive output is switched off and the motor coasts to stop.

Setting 2: Fast Stop

The drive stops the motor using the Fast Stop time set in parameter C1-09.

■ L1-05: Motor Temperature Input Filter Time (PTC input)

Sets a filter on the PTC input signal to prevent erroneous detection of a motor overheat fault.

No.	Name	Setting Range	Default
L1-05	Motor Temperature Input Filter Time (PTC input)	0.00 to 10.00 s	0.20 s

■ L1-08: oL1 Current Level

Sets the reference current for motor thermal overload detection for motor 1 in amperes. When L1-08 is set to 0.0 A (default), parameter E2-01 (E5-03 in PM control modes) is used as the reference for motor overload protection. When L1-08 ≠0.0 A, the set value is used as the reference for motor overload protection.

No.	Name	Setting Range	Default
L1-08	oL1 Current Level	0.0 A or 10 to 150% of drive rated current <1> <2>	0.00 A

<1> Display is in the following units:
2□0028, 2□0042, and 4□0011 to 4□0027: 0.01 A units
2□0054 to 2□0248 and 4□0034 to 4□0414: 0.1 A units

<2> Cannot be set to a value smaller than 10% of drive rated current when the current level is set to a value greater than 0.0 A.

■ L1-13: Continuous Electrothermal Operation Selection

Determines whether to hold the current value of the electrothermal motor protection (L1-01) when the power supply is interrupted.

No.	Name	Setting Range	Default
L1-13	Continuous Electrothermal Operation Selection	0 to 2	1

Setting 0: Disabled

Setting 1: Enabled

Setting 2: Enable Using Real Time Clock (HOA Keypad)

Stores value and integrates (resets) down the oL value based on real time.

◆ L2: Momentary Power Loss Ride-Thru

■ L2-01: Momentary Power Loss Operation Selection

When a momentary power loss occurs, the drive can automatically return to the operation it was performing prior to the power loss based on certain conditions.

No.	Name	Setting Range	Default
L2-01	Momentary Power Loss Operation Selection	0 to 2	0

Setting 0: Disabled

If a momentary power loss occurs, a power supply frequency fault (Fdv) is detected and the drive output is turned OFF. The motor coasts to stop.

Setting 1: Recover within L2-02

When a momentary power loss occurs, the drive output will be shut off. If the power returns within the time set to parameter L2-02, the drive will perform Speed Search and attempt to resume operation. If power is not restored within this time, then an Fdv fault is triggered and the drive will stop.

Setting 2: Recover as long as CPU Has Power

When a momentary power loss occurs, the drive output will be shut off. If the power returns and the drive control circuit has power, the drive will attempt to perform Speed Search and resume the operation. This will not trigger an Fdv fault.

Notes on Settings 1 and 2:

- "Uv" flashes on the operator while the drive attempts to recover from a momentary power loss. A fault signal is not output at this time.
- When using a magnetic contactor between the motor and the drive, keep the magnetic contactor closed while the drive attempts to restart with Speed Search.

■ L2-02: Momentary Power Loss Ride-Thru Time

Sets the length of time that the drive will wait if the control circuit voltage is less than the detection level of the Uv1 after a momentary power loss before the drive detects a control circuit undervoltage fault (Uv1). This function is applicable when L2-01 = 1 (Recover within L2-02). After a power loss, if all of these conditions are satisfied, the drive detects a Uv1 fault, shuts off the output, and the motor coasts to stop:

- The control circuit voltage is less than the detection level of Uv1.
- The time set in L2-02 is expired.
- The drive does not detect a control power supply voltage fault (Uv2). Depending on use conditions, if the time set in L2-02 is long, the drive can detect Uv2 before it detects Uv1. If this is a problem, decrease the time set in L2-02 to prevent Uv2.

Note:
1. The length of time that the drive can recover after a power loss changes when drive capacity changes.
2. The upper limit of the possible momentary power loss Ride-Thru time changes when drive capacity changes.

No.	Name	Setting Range	Default
L2-02	Momentary Power Loss Ride-Thru Time	0.0 to 2.5 s	0.5 s

■ L2-03: Momentary Power Loss Minimum Baseblock Time

Sets the minimum baseblock time when power is restored following a momentary power loss. This determines the time the drive waits for the residual voltage in the motor to dissipate. Increase this setting if overcurrent or overvoltage occurs at the beginning of Speed Search, after a power loss, or during DC Injection Braking.

No.	Name	Setting Range	Default
L2-03	Momentary Power Loss Minimum Baseblock Time	0.1 to 5.0 s	Determined by o2-04

■ L2-04: Momentary Power Loss Voltage Recovery Ramp Time

Sets the time for the drive to restore the output voltage to the level specified by the V/f pattern after Speed Search. The setting value determines the time for the voltage to go from 0 V to the maximum voltage.

No.	Name	Setting Range	Default
L2-04	Momentary Power Loss Voltage Recovery Ramp Time	0.0 to 5.0 s	Determined by o2-04

■ L2-07: Momentary Power Loss Voltage Recovery Acceleration Time

Sets the time to reaccelerate from the deceleration frequency to the frequency set in frequency reference (frequency before before power loss) after momentary power loss.

When set to 0.0 s, the drive will accelerate to speed according to the active acceleration time set by C1-01, C1-03, C1-05, or C1-07.

No.	Name	Setting Range	Default
L2-07	Momentary Power Loss Voltage Recovery Acceleration Time	0.00 to 6000.0 s <1>	0.00 s

<1> Setting range is determined by the accel/decel time units set in C1-10. If the time is set in units of 0.01 s (C1-10 = 0), the setting range becomes 0.00 to 600.00 s.

■ L2-13: Input Power Frequency Fault Detection Gain

Sets the gain used to detect a power supply frequency fault (Fdv). If an Fdv fault occurs with no momentary power loss, reduce the setting value in 0.1 increments.

No.	Name	Setting Range	Default
L2-13	Input Power Frequency Fault Detection Gain	0.1 to 2.0	1.0

■ L2-21: Low Input Voltage Detection Level

Sets the low input voltage detection level.

No.	Name	Setting Range	Default
L2-21	Low Input Voltage Detection Level	100 to 230 V <1>	150 V <1>

<1> Values are specific to 200 V class drives. Double the value for 400 V class drives.

■ L2-27: Power Supply Frequency Fault Detection Width

Sets the frequency width used to detect a power supply frequency fault (Fdv) in Hz. There is normally no need to change this parameter from the default value.

No.	Name	Setting Range	Default
L2-27	Power Supply Frequency Fault Detection Width	3.0 to 20.0 Hz	6.0 Hz

◆ L3: Stall Prevention

The motor may experience excessive slip because it cannot keep up with the frequency reference when the load is too high or acceleration and deceleration times are too short. If the motor slips during acceleration, it usually causes an overcurrent fault (oC), drive overload (oL2), or motor overload (oL1). If the motor slips during deceleration, it can cause excessive regenerative power to flow back into the DC bus capacitors, and eventually cause the drive to fault out from overvoltage (ov). The Stall Prevention Function prevents the motor from stalling and while allowing the motor to reach the desired speed without requiring the user to change the acceleration or deceleration time settings. The Stall Prevention function can be set separately for acceleration, operating at constant speeds, and deceleration.

■ L3-01: Stall Prevention Selection during Acceleration

Stall Prevention during acceleration prevents tripping with overcurrent (oC), motor overload (oL1), or drive overload (oL2) faults common when accelerating with heavy loads.

L3-01 determines the type of Stall prevention the drive should use during acceleration.

No.	Name	Setting Range	Default
L3-01	Stall Prevention Selection during Acceleration	0, 1, 3 <1>	1

<1> Setting 3 is not available for OLV/PM.

Setting 0: Disabled

No Stall Prevention is provided. If the acceleration time is too short, the drive may not be able to get the motor up to speed fast enough, causing an overload fault.

Setting 1: Enabled

Enables Stall Prevention during acceleration. Operation varies depending on the control mode.

- V/f Control, V/f Control with PG, and Open Loop Vector Control:

  Acceleration is reduced when the output current value exceeds 85% of the level set to parameter L3-02 for a longer than the time set to L3-27. The acceleration stops when the current exceeds L3-02. Acceleration continues when the current falls below L3-02 for longer than the time set to L3-27.

  The Stall Prevention level is automatically reduced in the constant power range. ***Refer to L3-03: Stall Prevention Limit during Acceleration on page 113***.

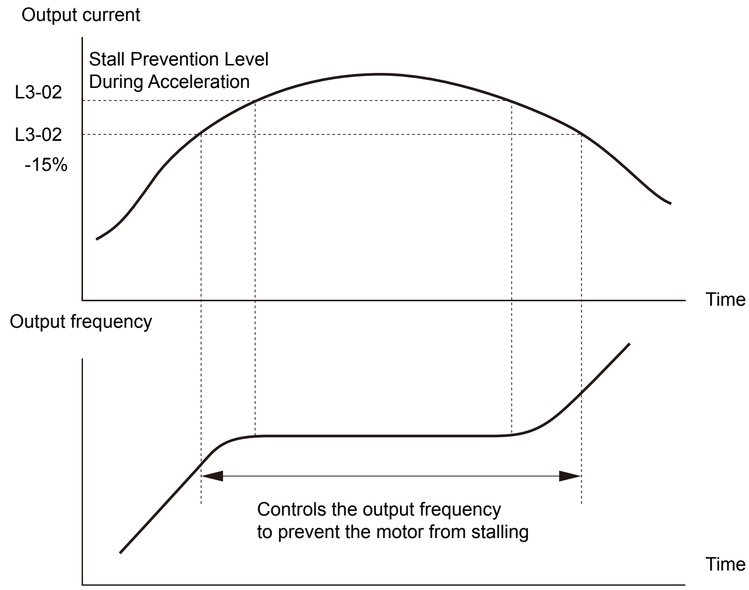


Figure 1.63 Stall Prevention During Acceleration for Induction Motors

- Open Loop Vector Control for PM:

  Acceleration stops when the output current reaches the level set to parameter L3-02. When the time set to parameter L3-27 passes, the drive decelerates using the deceleration time set to L3-22 (*Refer to L3-22: Deceleration Time at Stall Prevention during Acceleration on page 115*). Deceleration stops when the current falls below 85% of L3-02,. The drive will attempt to reaccelerate after the time set to L3-27.

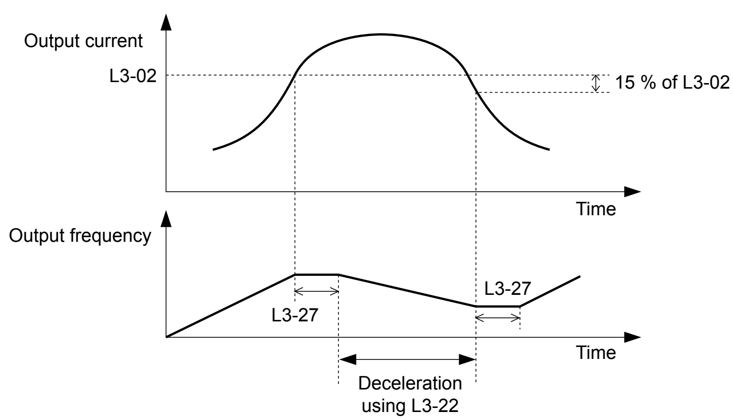


Figure 1.64 Stall Prevention During Acceleration for Permanent Magnet Motors

Setting 3: Enabled (Current Limit)

The acceleration rate is automatically adjusted while limiting the output current at the value set to L3-02, Stall Prevention Level during Acceleration.

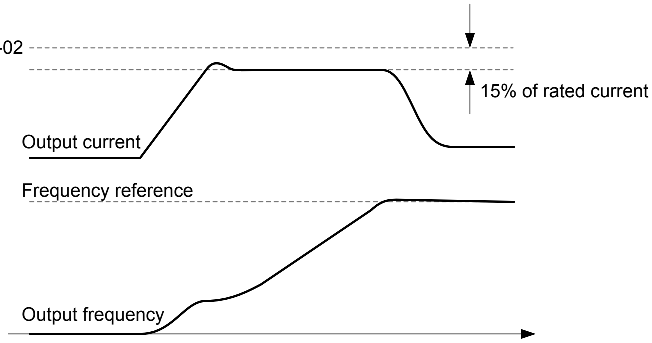


Figure 1.65 Current-Limited Acceleration

■ L3-02/L3-14: Stall Prevention Level during Acceleration/Deceleration

Set the output voltage level at which to enable stall prevention during acceleration and deceleration as a percentage of drive rated current. L3-02 is valid when stall prevention is selected during acceleration (L3-01 = 1, 3). L3-14 is valid when stall prevention is selected during deceleration (L3-04 = 1, 6). Decrease the setting values if stalling occurs when parameters are set to default. There is normally no need to change these parameters from their default values.

No.	Name	Setting Range	Default
L3-02	Stall Prevention Level during Acceleration	0 to 150% <1>	<1>
L3-14	Stall Prevention Level during Deceleration	80 to 150% <1>	<1>

<1> The upper limit and default value are determined by C6-01, Drive Duty Selection, and L8-38, Carrier Frequency Reduction Selection.

- Stalling may occur when the motor is rated at a smaller current than the drive rated output current and the stall prevention default settings are used. Set L3-02/L3-14 appropriately if stalling occurs.
- Also set parameter L3-03 when operating the motor in the constant power range.

■ L3-03: Stall Prevention Limit during Acceleration

The Stall Prevention level is automatically reduced when the motor is operated in the constant power range. L3-03 sets the lower limit for this reduction as a percentage of the drive rated current.

No.	Name	Setting Range	Default
L3-03	Stall Prevention Limit during Acceleration	0 to 100%	50%

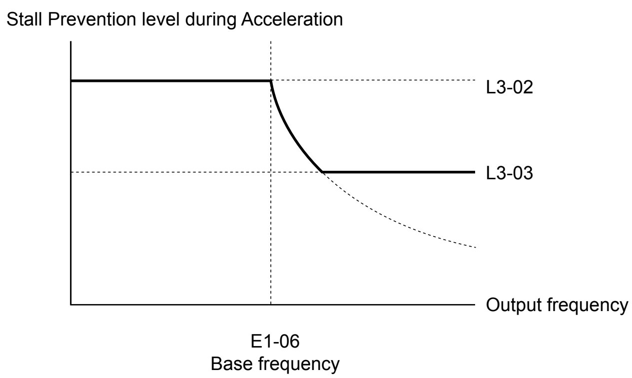


Figure 1.66 Stall Prevention Level and Limit During Acceleration

■ L3-04: Stall Prevention Selection during Deceleration

Stall prevention during deceleration prevents the motor from stalling when a large load is imposed on the motor or rapid deceleration is performed.

No.	Name	Setting Range	Default
L3-04	Stall Prevention Selection During Deceleration	0, 1, 4, 6 <1>	1

<1> Setting 4 is not available in OLV/PM.

Setting 0: Disabled

The drive decelerates according to the set deceleration time. High inertia loads or rapid deceleration may trigger an overcurrent (oC) fault. Switch to another L3-04 selection if an oC fault occurs.

Setting 1: General-purpose Stall Prevention

The drive tries to decelerate within the set deceleration time. The drive pauses deceleration when the output current exceeds the Stall Prevention level and then continues deceleration when the output current drops below that level. Stall Prevention may be triggered repeatedly to avoid an overcurrent (oC) fault.

Figure 1.67 illustrates the function of Stall Prevention during deceleration.

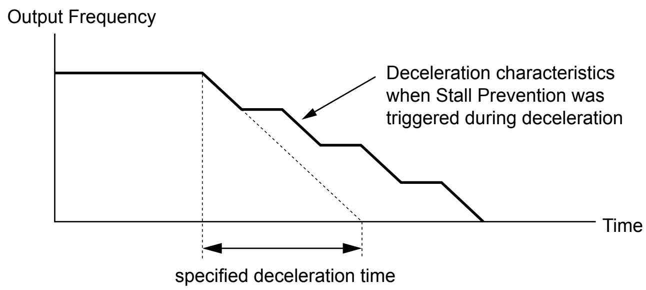


Figure 1.67 Stall Prevention During Deceleration

Setting 4: Overexcitation Deceleration

Overexcitation Deceleration (increasing the motor flux) is faster than deceleration with no Stall Prevention (L3-04 = 0). Setting 4 changes the selected decel time and functions to provide protection from an overvoltage trip. ***Refer to Overexcitation Deceleration (Induction Motors) on page 130*** for details.

Setting 6: Enable (Current Limit)

The deceleration rate is automatically adjusted during deceleration of the load while limiting the regeneration current at the setting value of the stall prevention level during deceleration (L3-14).

The stall prevention level may be reached if an external force is applied in the regeneration direction, dramatically decreasing the possibility of stopping the motor.

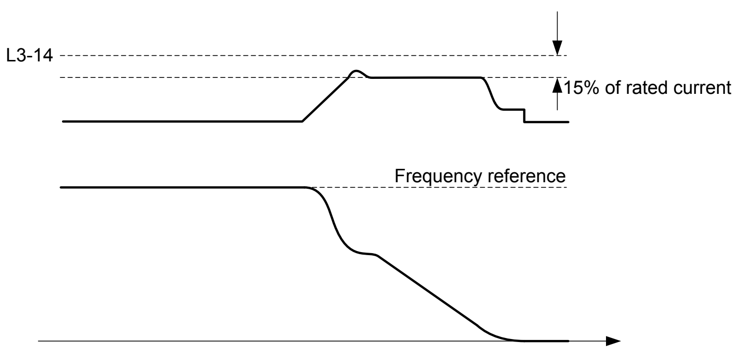


Figure 1.68 Deceleration for Current Limit

■ L3-05: Stall Prevention Selection during Run

Determines how Stall Prevention works during Run. Stall Prevention during run prevents the motor from stalling by automatically reducing the speed when a transient overload occurs while the motor is running at constant speed.

No.	Name	Setting Range	Default
L3-05	Stall Prevention Selection During Run	0 to 2	1

Note: Stall Prevention during run is disabled when the output frequency is 6 Hz or lower regardless of the L3-05 and L3-06 settings.

Setting 0: Disabled

Drive runs at the set frequency reference. A heavy load may cause the motor to stall and trip the drive with an oC or oL fault.

Setting 1: Decelerate Using C1-02

If the current exceeds the Stall Prevention level set in parameter L3-06, the drive will decelerate at decel time 1 (C1-02). When the current level drops below the value of L3-06 minus 2% for 100 ms, the drive accelerates back to the frequency reference at the active acceleration time.

Setting 2: Decelerate Using C1-04

Same as setting 1 except the drive decelerates at decel time 2 (C1-04).

■ L3-06: Stall Prevention Level during Run

Sets the current level to trigger Stall Prevention during run. Depending on the setting of parameter L3-23, the level is automatically reduced in the constant power range (speed beyond base speed).

The Stall Prevention level can be adjusted using an analog input. ***Refer to Multi-Function Analog Input Terminal Settings on page 101*** for details.

No.	Name	Setting Range	Default
L3-06	Stall Prevention Level During Run	30 to 150 <1>	<1>

<1> The upper limit and default values are determined by parameter L8-38, Carrier Frequency Derating Selection.

■ L3-22: Deceleration Time at Stall Prevention during Acceleration

Sets the brief deceleration time used when stalling occurs while accelerating a PM motor. When set to 0, this function is disabled and the drive decelerates at the selected deceleration time when stalling occurs.

The function is effective only in OLV/ PM control and when parameter L3-01 is set to 1.

No.	Name	Setting Range	Default
L3-22	Deceleration Time at Stall Prevention During Acceleration	0.0 to 6000.0 s	0.0 s

■ L3-23: Automatic Reduction Selection for Stall Prevention during Run

Reduces the Stall Prevention during run level in the constant power range.

No.	Name	Setting Range	Default
L3-23	Automatic Reduction Selection for Stall Prevention During Run	0, 1	0

Setting 0: Disabled

The level set in L3-06 is used throughout the entire speed range.

Setting 1: Enabled

The Stall Prevention level during run is reduced in the constant power range. The lower limit will be 40% of L3-06.

■ Overvoltage Suppression Function

Suppresses overvoltage faults by decreasing the regenerative torque limit and slightly increasing the output frequency when the DC bus voltage rises.

The regenerative torque limit and the output frequency are adjusted during ov suppression so that the DC bus voltage does not exceed the level set to parameter L3-17. In addition to the parameters explained below, ov suppression also uses these settings for frequency adjustment:

- Inertia calculations for motor acceleration time (L3-24)
- Load inertia ratio (L3-25)

Note:
1. The motor speed will exceed the frequency reference when overvoltage suppression is triggered. Consequently, overvoltage suppression is not appropriate in applications that require a perfect match between the frequency reference and the motor speed.
2. Overvoltage may still occur if there is a sudden increase to a regenerative load.
3. This function is enabled only when operating just below the maximum frequency. Overvoltage suppression does not increase the output frequency beyond the maximum frequency. If the application requires this, increase the maximum frequency and change the base frequency setting.

■ L3-27: Stall Prevention Detection Time

Sets a delay time from when the Stall Prevention level is reached and the actual Stall Prevention function is activated.

No.	Name	Setting Range	Default
L3-27	Stall Prevention Detection Time	0 to 5000 ms	50 ms

■ L3-36/L3-41: Vibration Suppression Gain during Acceleration/Deceleration (with Current Limit)

There is normally no need to change these parameters from their default values. These parameters are valid when acceleration stall prevention (with current limit) is enabled (L3-01 = 3), or when current-limited deceleration is selected for stall prevention during deceleration (L3-04 = 6). Increase the setting values if oscillation occurs in the output current during acceleration/ deceleration.

No.	Name	Setting Range	Default
L3-36	Vibration Suppression Gain during Acceleration (with Current Limit)	0.0 to 100.0	Determined by A1-02
L3-41	Vibration Suppression Gain during Deceleration (with Current Limit)	1.0 to 1000.0	Determined by A1-02

■ L3-39/L3-44: Current-Limited Integral Time Constant during Acceleration/Deceleration

Set the time constant for acceleration/deceleration rate adjustment for current-limited acceleration/deceleration. There is normally no need to change these parameters from their default values. These parameters are valid when acceleration or deceleration stall prevention (with current limit) is enabled (L3-01 = 3 or 6).

No.	Name	Setting Range	Default
L3-39	Current-Limited Integral Time Constant during Acceleration	1.0 to 1000.0 ms	100.0 ms
L3-44	Current-Limited Integral Time Constant during Deceleration	1.0 to 1000.0 ms	100.0 ms

■ L3-40/L3-45: Current-Limited Maximum S-curve Selection during Acceleration/ Deceleration

Enable or disable the maximum S-curve for current-limited acceleration/deceleration (acceleration: L3-40, deceleration: L3-45). Because it is optimized, the actual acceleration/deceleration time may exceed the setting.

Enable this function when an overcurrent (oC) or other error occurs immediately after starting acceleration or deceleration.

No.	Name	Setting Range	Default
L3-40	Current-Limited Maximum S-curve Selection during Acceleration	0, 1	0
L3-45	Current-Limited Maximum S-curve Selection during Deceleration	0, 1	0

Setting 0: Disabled

Setting 1: Enabled

◆ L4: Speed Detection

These parameters set up the speed agree and speed detection functions that can be assigned to the multi-function output terminals.

The speed is detected using the motor speed when A1-02 = 3 or 7.

■ L4-01, L4-02: Speed Agree Detection Level and Detection Width

Parameter L4-01 sets the detection level for the digital output functions Speed agree 1, User-set speed agree 1, Frequency detection 1, and Frequency detection 2.

Parameter L4-02 sets the hysteresis level for these functions.

No.	Name	Setting Range	Default
L4-01	Speed Agree Detection Level	0.0 to 400.0 Hz	0.0 Hz
L4-02	Speed Agree Detection Width	0.0 to 20.0 Hz	Determined by A1-02

Refer to H2-01 to H2-03: Terminal M1-M2, M3-M4, and MD-ME-MF Function Selection on page 87, Settings 2, 3, 4, and 5.

■ L4-03, L4-04: Speed Agree Detection Level and Detection Width (+/-)

Parameter L4-03 sets the detection level for the digital output functions Speed agree 2, User-set speed agree 2, Frequency detection 3, and Frequency detection 4.

Parameter L4-04 sets the hysteresis level for these functions.

No.	Name	Setting Range	Default
L4-03	Speed Agree Detection Level (+/-)	-400.0 to 400.0 Hz	0.0 Hz
L4-04	Speed Agree Detection Width (+/-)	0.0 to 20.0 Hz	Determined by A1-02

Refer to H2-01 to H2-03: Terminal M1-M2, M3-M4, and MD-ME-MF Function Selection on page 87, Settings 13, 14, 15, and 16.

■ L4-05: Frequency Reference Loss Detection Selection

The drive can detect a loss of an analog frequency reference from input A1, A2, or A3. Frequency reference loss is detected when the frequency reference drops below 10% of the reference or below 5% of the maximum output frequency within 400 ms.

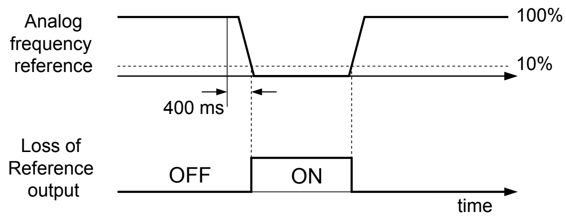


Figure 1.69 Loss of Reference Function

Set H2-01 or H2-02 to C for a digital output to trigger when frequency reference loss occurs. *Refer to Setting C: Frequency Reference Loss on page 91* for details on setting the output function.

Parameter L4-05 selects the operation when a frequency reference loss is detected.

No.	Name	Setting Range	Default
L4-05	Frequency Reference Loss Detection Selection	0, 1	1

Setting 0: Stop. Drive stops when the frequency reference is lost.

Setting 1: Run. Drive continues operation according to the setting of L4-06.

The drive will continue operation at the percent of the previous frequency value set to parameter L4-06. When the external frequency reference value is restored, the operation is continued with the frequency reference.

■ L4-06: Frequency Reference at Reference Loss

Sets the frequency reference level at which the drive runs when L4-05 = 1 and when detecting a reference loss. The value is set as a percentage of the frequency reference before the loss was detected.

No.	Name	Setting Range	Default
L4-06	Frequency Reference at Reference Loss	0.0 to 100.0%	80.0%

■ L4-07: Speed Agree Detection Selection

Determines when frequency detection is active using parameters L4-01 through L4-04.

No.	Name	Setting Range	Default
L4-07	Speed Agree Detection Selection	0, 1	0

Setting 0: No Detection during baseblock

Setting 1: Detection always enabled

◆ L5: Fault Restart

After a fault has occurred, Fault Restart attempts to automatically restart the motor and continue operation instead of stopping.

The drive can perform a self-diagnostic check and resume the operation after a fault has occurred. If the self-check is successful and the cause of the fault has disappeared, the drive restarts by first performing Speed Search (*Refer to b3: Speed Search on page 23* for details).

Note: **1.** The wiring sequence should remove the Forward/Reverse command when a fault is triggered and output is shut off.

2. When the Forward/Reverse command is removed, the drive can perform a self-diagnostic check and attempt to restart the fault automatically.

WARNING! *Sudden Movement Hazard. Do not use the fault restart function in lifting applications. Fault restart may cause the machine to drop the load, which could result in death or serious injury.*

The drive can attempt to restart itself following the faults listed below.

Fault	Name	Fault	Name
GF	Ground Fault	oL3	Overtorque 1
LF	Output Open Phase	oL4	Overtorque 2
oC	Overcurrent	ov	DC Bus Overvoltage
oH1	Drive Overheat	PF	Input Phase Loss
oL1	Motor Overload	STo	Pull-Out Detection
oL2	Drive Overload		

Use parameters L5-01 to L5-05 to set up automatic fault restart.

Set H2-01, H2-02, or H2-03 to 1E. to output a signal during fault restart.

■ L5-01: Number of Auto Restart Attempts

Sets the number of times that the drive may attempt to restart itself.

Parameter L5-05 determines the method of incrementing the restart counter. When the counter reaches the number set to L5-01, the operation stops and the fault must be manually cleared and reset.

The restart counter is incremented at each restart attempt, regardless of whether the attempt was successful. When the counter reaches the number set to L5-01, the operation stops and the fault must be manually cleared and reset.

The number of fault restarts is reset to zero when:

- The drive operates normally for 10 minutes following a fault restart.
- A fault is cleared manually after protective functions are triggered.
- The power supply is cycled.

No.	Name	Setting Range	Default
L5-01	Number of Auto Restart Attempts	0 to 10 Times	0 Times

■ L5-02: Auto Restart Fault Output Operation Selection

Determines if a fault output is triggered (H2-□□ = E) when the drive attempts to restart.

No.	Name	Setting Range	Default
L5-02	Auto Restart Fault Output Operation Selection	0, 1	0

Setting 0: No Fault Output

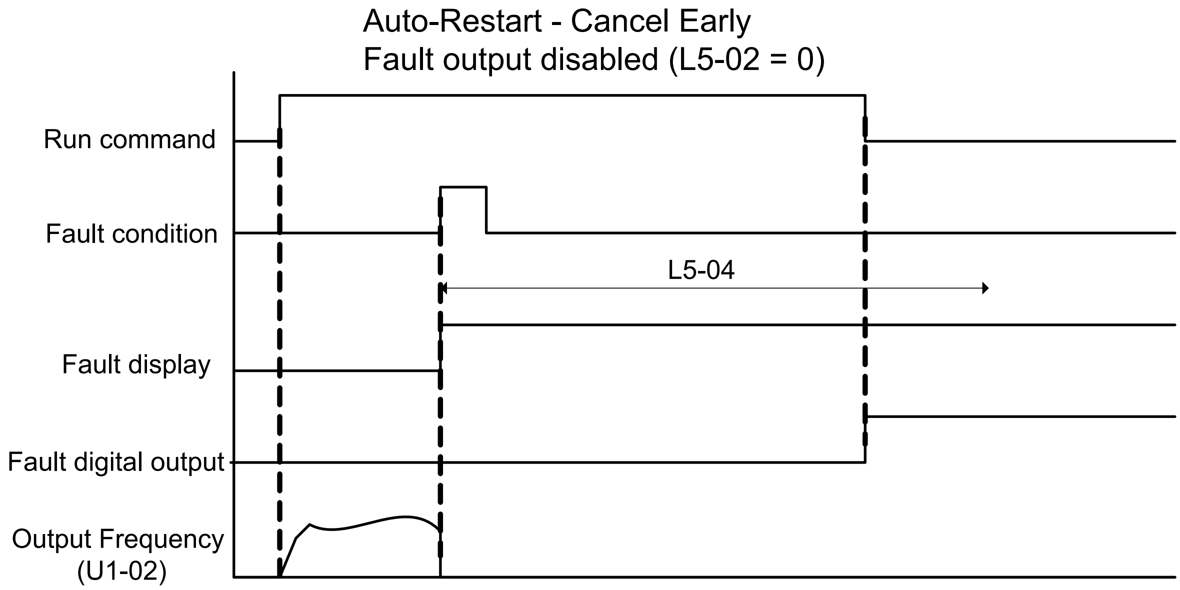


Figure 1.70 Auto Restart Cancel Early

Setting 1: Fault Output Is Set

■ L5-03: Time to Continue Making Fault Restarts (enabled only when L5-05 = 0)

Although the drive will continue to execute fault restarts, this parameter will cause a fault if a fault restart cannot occur after the time set to L5-03 passes.

All major faults will cause the drive to stop. For some faults it is possible to configure the drive to attempt a restart automatically. After the fault occurs, the drive baseblocks for L2-03 seconds. After the baseblock is removed, the drive checks if a fault condition still exists. If no fault condition exists, the drive will attempt to restart the motor. If the restart is successful, the drive performs a Speed Search (Regardless of the status of b3-01 "Speed Search Selection") from the set speed command and the Auto Restart Attempts count is increased by one. Even if the restart fails, the restart count is increased by one as long as the drive attempted to rotate the motor. The restart count will not be incremented if the restart is not attempted due to a continuing fault condition, (i.e., an ov fault). The drive waits L5-03 seconds before attempting another restart.

No.	Name	Setting Range	Default
L5-03	Time to Continue Making Fault Restarts	0.1 to 600.0 s	180.0 s

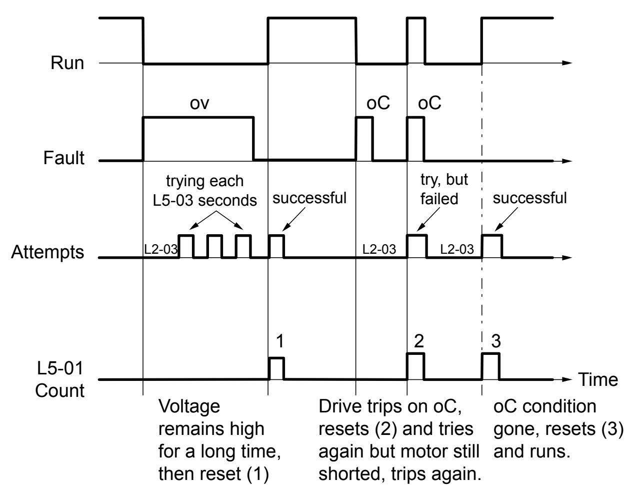


Figure 1.71 Automatic Restart Timing Diagram

The auto restart count is reset back to 0 if any of the following occur:

- No further faults for 10 minutes after the last retry.
- The drive power is turned off (the drive must be without power long enough to let control power dissipate).

- The RESET key is pushed after the last reset attempt.

The setting of parameter L5-02 determines whether the fault output (MA-MB) will be closed during an auto restart attempt.

The setting of L5-02 can be important when using the drive with other equipment.

The following faults will allow the Auto Restart function to initiate:

- oC (Overcurrent)
- LF (Output Phase Loss)
- PF (Input Phase Loss)
- oL1 (Motor Overload)
- oL3 (Overtorque Detection 1)
- oL2 (Drive Overload)
- ov (Overvoltage)
- GF (Ground Fault)
- Uv1 (Undervoltage)
- oH1 (Heatsink Overheat)

In order for auto restart after a Uv1 fault, Momentary Power Loss Ride-thru must be enabled (L2-01= 1: "Power Loss Ridethru Time"). Setting H2-01, H2-02 or H2-03 to 1E configures a digital output as "Restart Enabled" to signal if an impending auto restart is possible.

■ L5-04: Fault Reset Interval Time

Determines the amount of time to wait between restart attempts when parameter L5-05 is set to 1.

No.	Name	Setting Range	Default
L5-04	Fault Reset Interval Time	0.5 to 600.0 s	10.0 s

■ L5-05: Fault Reset Operation Selection

No.	Name	Setting Range	Default
L5-05	Fault Reset Operation Selection	0, 1	1

Setting 0: Count Successful Restarts

The drive will continuously attempt to restart. If it restarts successfully, the restart counter is increased. This operation is repeated each time a fault occurs until the counter reaches the value set to L5-01.

Setting 1: Count Restart Attempts

The drive will attempt to restart using the time interval set to parameter L5-04. A record is kept of the number of attempts to restart to the drive, regardless of whether those attempts were successful. When the number of attempted restarts exceeds the value set to L5-01, the drive stops attempting to restart.

◆ L6: Torque Detection

The drive provides two independent torque detection functions that trigger an alarm or fault signal when the load is too heavy (oL), or suddenly drops (UL). These functions are set up using the L6-☐☐ parameters. Program the digital outputs as shown below to indicate the underload or overload condition to an external device:

Note: When overtorque occurs in the application, the drive may stop due to overcurrent (oC) or overload (oL1). To prevent the drive from stopping, use torque detection to indicate an overload situation to the controller before oC or oL1 occur. Use undertorque detection to discover application problems like a torn belt, a pump shutting off, or other similar trouble.

H2-01, H2-02, H2-03 Setting	Description
B	Torque detection 1, N.O. (output closes when overload or underload is detected)
17	Torque detection 1, N.C. (output opens when overload or underload is detected)
18	Torque detection 2, N.O. (output closes when overload or underload is detected)
19	Torque detection 2, N.C. (output opens when overload or underload is detected)

Figure 1.72 and *Figure 1.73* illustrate the functions of overtorque and undertorque detection.

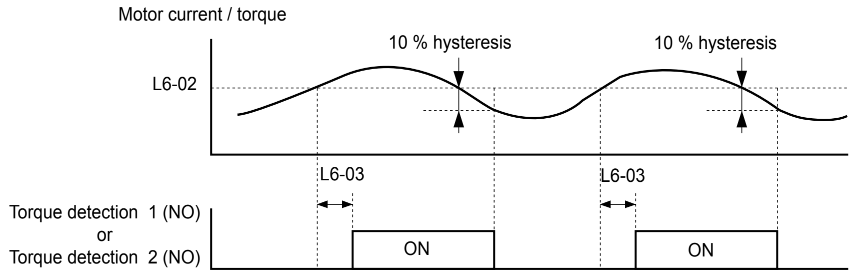


Figure 1.72 Overtorque Detection Operation

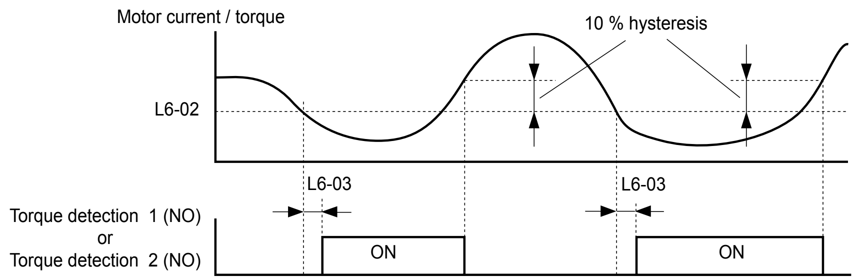


Figure 1.73 Undertorque Detection Operation

Note:
1. The torque detection function uses a hysteresis of 10% of the drive rated output current and motor rated torque.
2. The level is set as a percentage of the drive rated output current.

■ L6-01: Torque Detection Selection 1

The torque detection function is triggered when the current or torque exceed the levels set to L6-02 for longer than the time set to L6-03. L6-01 selects the conditions for detection and the operation that follows.

No.	Name	Setting Range	Default
L6-01	Torque Detection Selection 1	0 to 12	0

Setting 0: Disabled

Setting 1: oL3 at Speed Agree (Alarm)

Overtorque detection is active only when the output speed is equal to the frequency reference (i.e., no detection during acceleration and deceleration). The operation continues after detecting overtorque and triggering an oL3 alarm.

Setting 2: oL3 at Run (Alarm)

Overtorque detection works as long as the Run command is active. The operation continues after detecting overtorque and triggering an oL3 alarm.

Setting 3: oL3 at Speed Agree (Fault)

Overtorque detection is active only when the output speed is equal to the frequency reference (i.e., no detection during acceleration and deceleration). The operation stops and triggers an oL3 fault.

Setting 4: oL3 at Run (Fault)

Overtorque detection works as long as a Run command is active. The operation stops and triggers an oL3 fault.

Setting 5: UL3 at Speed Agree (Alarm)

Undertorque detection is active only when the output speed is equal to the frequency reference (i.e., no detection during acceleration and deceleration). The operation continues after detecting overtorque and triggering a UL3 alarm.

Setting 6: UL3 at Run (Alarm)

Undertorque detection works as long as the Run command is active. The operation continues after detecting overtorque and triggering a UL3 alarm.

Setting 7: UL3 at Speed Agree (Fault)

Undertorque detection is active only when the output speed is equal to the frequency reference (i.e., no detection during acceleration and deceleration). The operation stops and triggers a UL3 fault.

Setting 8: UL3 at Run (Fault)

Undertorque detection works as long as a Run command is active. The operation stops and triggers a UL3 fault.

Setting 9: UL6 at Speed Agree (Alarm)

Motor Underload detection is active only when the output speed is equal to the frequency reference (i.e., no detection during acceleration and deceleration). The operation continues after detection and triggers a UL6 alarm.

Setting 10: UL6 at Run (Alarm)

Motor Underload detection works as long as the Run command is active. The operation continues after detection and triggers a UL6 alarm.

Setting 11: UL6 at Speed Agree (Fault)

Motor Underload detection is active only when the output speed is equal to the frequency reference (i.e., no detection during acceleration and deceleration). The operation stops and triggers a UL6 fault.

Setting 12: UL6 at Run (Fault)

Motor Underload detection works as long as a Run command is active. The operation stops and triggers a UL6 fault.

■ L6-02: Torque Detection Level 1

Sets the detection levels for torque detection function 1 as a percentage of the drive rated output current.

No.	Name	Setting Range	Default
L6-02	Torque Detection Level 1	0 to 300%	15%

Note: The torque detection level 1 (L6-02) can also be supplied by an analog input terminal set to H3-☐☐ = 7. Here, the analog value has priority and the setting in L6-02 is disregarded.

■ L6-03: Torque Detection Time 1

Determines the time required to trigger an alarm or fault after exceeding the level in L6-02.

No.	Name	Setting Range	Default
L6-03	Torque Detection Time 1	0.0 to 10.0 s	10.0 s

■ L6-13: Motor Underload Protection Selection

Sets Motor Underload Protection (UL6) based on motor load and determines whether the level of L6-02 refers to fbase or fmax.

Selects the operation of underload detection UL6. Underload is detected when the output current falls below the underload detection level defined by L6-14 and L2-02.

No.	Name	Setting Range	Default
L6-13	Motor Underload Protection Selection	0, 1	0

Setting 0: Enabled (Base Frequency)

Setting 1: Enabled (Max Frequency)

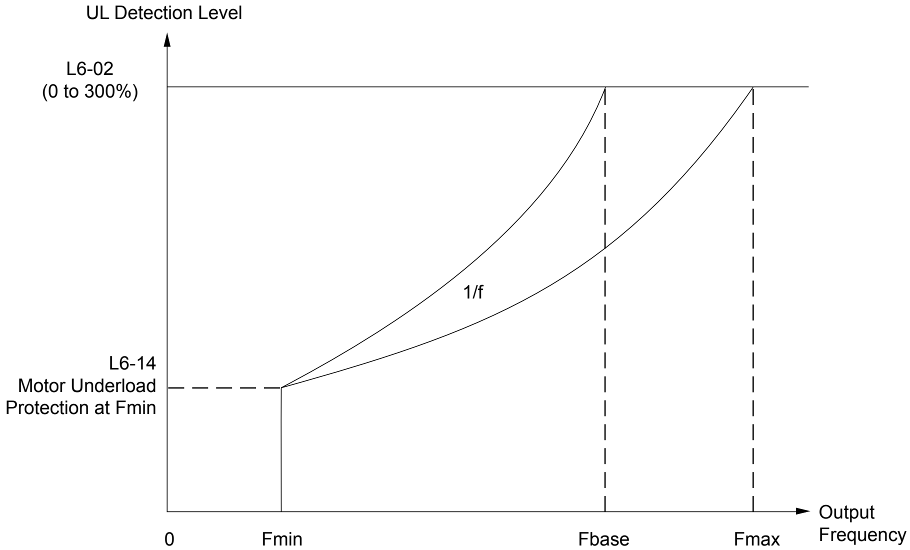


Figure 1.74 Motor Underload Protection

■ L6-14: Motor Underload Protection Level at Minimum Frequency

Sets the UL6 detection level at minimum frequency by percentage of drive rated current

No.	Name	Setting Range	Default
L6-14	Motor Underload Protection Level at Minimum Frequency	0 to 300%	15%

◆ L8: Drive Protection

■ L8-02: Overheat Alarm Level

Sets the overheat alarm (oH) detection level.

The drive outputs an alarm when the heatsink temperature exceeds the overheat alarm level. If the drive is set to continue operation after this alarm occurs (L8-03 = 4) and the temperature reaches the overheat fault level, the drive will trigger an oH1 fault and stop operation.

When an output terminal is set for the oH pre-alarm (H2-☐☐ = 20), the switch will close when the heatsink temperature rises above L8-02.

No.	Name	Setting Range	Default
L8-02	Overheat Alarm Level	50 to 150 °C	Determined by o2-04

■ L8-03: Overheat Pre-Alarm Operation Selection

Sets the operation when an overheat pre-alarm is detected.

Note: Change L8-03 setting only when necessary.

No.	Name	Setting Range	Default
L8-03	Overheat Pre-Alarm Operation Selection	0 to 4	4

Setting 0: Ramp to Stop

If an overheat alarm occurs, the drive decelerates to stop using the currently selected deceleration time. If a digital output is programmed for “fault” (H2-☐☐ = E), this output will be triggered.

Setting 1: Coast to Stop

If an overheat alarm occurs, the drive switches off the output and the motor coasts to stop. If a digital output is programmed for “fault” (H2-☐☐ = E), this output will be triggered.

Setting 2: Fast Stop

If an overheat alarm occurs, the drive decelerates to stop using the Fast Stop time (C1-09). If a digital output is programmed for “fault” (H2-☐☐ = E), this output will be triggered.

Setting 3: Alarm Only

If an overheat alarm occurs, an alarm is output and the drive continues operation.

Setting 4: Operation with Reduced Speed

If an overheat alarm occurs, the operation continues with the speed reduced to the level set to parameter L8-19. If the oH alarm is still present after 10 s, the speed is reduced again. The amount of speed reduction depends on how often the alarm repeats. If the oH alarm disappears while the drive is operating at a reduced speed, the drive will switch to the previous speed in 10 s increments until reaching base frequency. *Figure 1.75* explains the operation with reduced speed during an oH alarm. A digital output programmed for 4D is switched when the oH alarm is still active after ten reduction cycles.

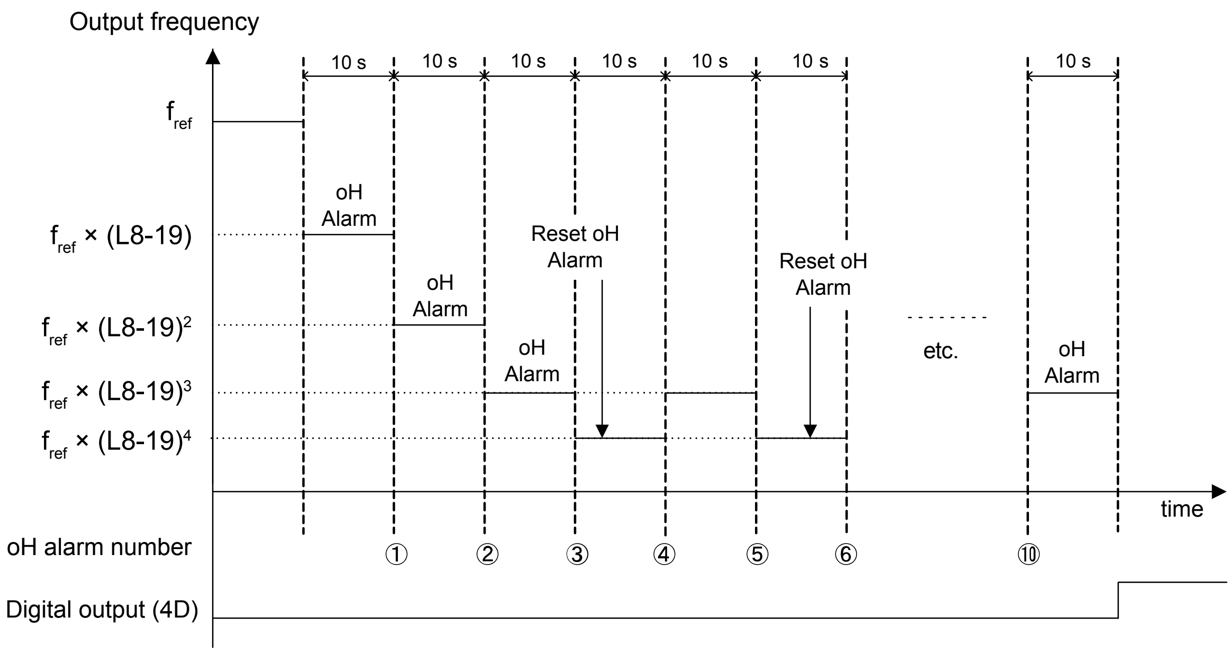


Figure 1.75 Output Frequency Reduction During Overheat Alarm

■ L8-06: Input Phase Loss Detection Level

Sets the Input Phase Loss Detection (PF) Level.

Triggers PF fault when there is an imbalance larger than the value set to L8-06 in the drive input power voltage.

Detection Level = 100% = Voltage Class × $\sqrt{2}$

No.	Name	Setting Range	Default
L8-06	Input Phase Loss Detection Level	0.0 to 50.0%	Determined by o2-04

■ L8-07: Output Phase Loss Protection Selection

Enables or disables the output phase loss detection.

Note: 1. Output phase loss detection can mistakenly be triggered if the motor rated current is very small compared to the drive rating. Disable this parameter in such cases.
2. Output phase loss detection is not possible when the drive is running a PM motor with light load.

No.	Name	Setting Range	Default
L8-07	Output Phase Loss Protection Selection	0 to 2	1

Setting 0: Disabled

Setting 1: Fault when One Phase Is Lost

An output phase loss fault (LF) is triggered when the output current for any phase U, V, or W drops to 5% or less of the drive rated current.

When using a PM motor, this is applicable when the output current is 30% or higher of the drive rated current.

When using an IM motor, this is applicable when the output current is 5% or higher of the drive rated current.

Setting 2: Fault when Two Phases Are Lost

An output phase loss fault (LF) is triggered when the output current for phases U, V, and W all drop to 5% or less of the drive rated current.

The output shuts off and the motor coasts to stop.

■ L8-09: Output Ground Fault Detection Selection

Enables or disables the output ground fault detection.

No.	Name	Setting Range	Default
L8-09	Output Ground Fault Detection Selection	0, 1	Determined by o2-04

Setting 0: Disabled

Ground faults are not detected.

Setting 1: Enabled

A ground fault (GF) is triggered when high leakage current or a ground short circuit occurs in one or two output phases.

■ L8-10: Heatsink Cooling Fan Operation Selection

Selects the heatsink cooling fan operation.

No.	Name	Setting Range	Default
L8-10	Heatsink Cooling Fan Operation Selection	0, 1	0

Setting 0: Run with Timer

The fan is switched on when a Run command is active and switched off with the delay set to parameter L8-11 after releasing the Run command. This setting extends the fan lifetime.

Setting 1: Run Always

The fan runs when power is supplied to the drive.

■ L8-11: Heatsink Cooling Fan Off-Delay Time

Sets the cooling fan switch off-delay time if parameter L8-10 is set to 0.

No.	Name	Setting Range	Default
L8-11	Heatsink Cooling Fan Off-Delay Time	0 to 300 s	60 s

■ L8-12: Ambient Temperature Setting

Automatically adapts the drive rated current to safe values when used with parameter L8-35. This eliminates the need to reduce the drive rated current when the temperature where the drive is mounted is above the specified values.

No.	Name	Setting Range	Default
L8-12	Ambient Temperature Setting	-10 to +50 °C	40 °C

■ L8-15: oL2 Characteristics Selection at Low Speeds

Selects whether the drive overload capability (oL fault detection level) is reduced at low speeds to prevent premature output transistor failures. Set this parameter to 0 (Protection disabled at low speed) when protection is activated for an oL2 fault for a light load at low speed.

Note:
1. Contact Yaskawa before using the drive for applications for which the setting is 0 (disabled).
2. Do not set this parameter to 0 (disabled) in V/f or OLV control.
3. Do not set this parameter to 0 (disabled) in models 4□0302 to 4□0414.

No.	Name	Setting Range	Default
L8-15	oL2 Characteristics Selection at Low Speed	0, 1	1

Setting 0: oL2 (Drive Overload) Characteristics Disabled at Low Speed

The overload protection level is not reduced. Frequently operating the drive with high output current at low speed can lead to premature drive faults.

Setting 1: oL2 (Drive Overload) Characteristics Enabled at Low Speed

The overload protection level (oL2 fault detection level) is automatically reduced at speeds below 6 Hz. At zero speed, the overload is derated by 50%.

■ L8-18: Software Current Limit Selection

Enables and disables the Software Current Limit (CLA) protection function to prevent main circuit transistor failures caused by high current.

Note: Do not change this setting unless absolutely necessary.

No.	Name	Setting Range	Default
L8-18	Software Current Limit Selection	0, 1	Determined by A1-02

Setting 0: Software CLA Disabled

The drive may trip on an oC fault if the load is too heavy or the acceleration is too short.

Setting 1: Software CLA Enabled

When the Software CLA current level is reached, the drive reduces the output voltage to reduce the current. Normal operation continues when the current level drops below the Software CLA level.

■ L8-19: Frequency Reduction Rate during Overheat Pre-Alarm

Specifies the output frequency reduction when L8-03 is set to 4 and an oH alarm is present. Set as a factor of the maximum output frequency.

No.	Name	Setting Range	Default
L8-19	Frequency Reduction Rate During Overheat Pre-Alarm	10.0 to 100.0%	20.0%

■ L8-27: Overcurrent Detection Gain

Adjusts the overcurrent detection level in OLV/PM control mode. A setting of 100% is equal to the motor rated current. When the drive rated current is considerably higher than the motor rated current, use this parameter to decrease the overcurrent level and prevent motor demagnetization from high current.

Overcurrent detection uses the lower value between the overcurrent level for the drive and the motor rated current multiplied by L8-27.

Note: The drive detects the lowest overcurrent from the overcurrent level of the drive, the setting value of this parameter, and the overcurrent level determined from the motor rated current.

No.	Name	Setting Range	Default
L8-27	Overcurrent Detection Gain	0.0 to 400.0%	300.0%

■ L8-29: Current Unbalance Detection (LF2)

Enables and disables output current unbalance detection in OLV/PM. Current unbalance can heat a PM motor and demagnetize the magnets. The current unbalance detection function monitors output current and triggers the LF2 fault to prevent such motor damage.

No.	Name	Setting Range	Default
L8-29	Current Unbalance Detection (LF2)	0, 2	2

Setting 0: Disabled

Motor protection with LF2 is disabled.

Setting 2: Current Det Type

LF2 fault is triggered when an output current imbalance is detected. Drive output shuts off and the motor coasts to stop.

■ L8-32: Cooling Fan Failure Selection

Determines drive operation when a FAn fault occurs.

No.	Name	Setting Range	Default
L8-32	Cooling Fan Failure Selection	0 to 2	1

Setting 0: Ramp to Stop

The drive stops the motor using the deceleration time 1 set in parameter C1-02.

Setting 1: Coast to Stop

The drive output is switched off and the motor coasts to a stop.

Setting 2: Fast Stop

The drive stops the motor using the Fast stop time set in parameter C1-09.

■ L8-35: Installation Method Selection

Selects the type of installation for the drive and changes the drive overload (oL2) limits accordingly.

Note:
1. Initialization does not reset this parameter.
2. The value is preset to the appropriate value when the drive is shipped. Change the value only when mounting a standard drive with the heatsink outside the cabinet.

No.	Name	Setting Range	Default
L8-35	Installation Method Selection	0, 2, 3	Determined by o2-04

Setting 0: IP00/Open-Chassis Enclosure

For an Open Type enclosure drive installed with at a minimum of 30 mm space to the next drive or a cabinet wall.

Setting 2: IP20/UL Type 1 Enclosure

For drives compliant with IP20/UL Type 1 enclosure specifications.

Setting 3: External Heatsink Installation

For a standard drive mounted with the heatsink outside the cabinet or enclosure panel.

■ L8-38: Carrier Frequency Reduction Selection

Selects the operation of the carrier frequency reduction function. Reduces the carrier frequency when the output current exceeds a certain level. This temporarily increases the overload capability (oL2 detection), allowing the drive to run through transient load peaks without tripping.

No.	Name	Setting Range	Default
L8-38	Carrier Frequency Reduction Selection	0 to 2	Determined by A1-02 and o2-04

Setting 0: Disabled

No carrier frequency reduction at high current.

Setting 1: Enabled for Output Frequencies below 6 Hz

The carrier frequency is reduced at speeds below 6 Hz when the current exceeds 100% of the drive rated current. The drive returns to the normal carrier frequency when the current falls below 88% or the output frequency exceeds 7 Hz.

Setting 2: Enabled for Entire Frequency Range

The carrier frequency is reduced at the following speeds:

- Below 6 Hz when the current exceeds 100% of the drive rated current.
- Above 7 Hz when the current exceeds 112% of the drive rated current.

The drive uses the delay time set in parameter L8-40 and a hysteresis of 12% when switching the carrier frequency back to the set value.

■ L8-40: Carrier Frequency Reduction Off-Delay Time

Sets a hold time before returning to the original carrier frequency setting after the carrier frequency has been temporarily derated as determined by L8-38. The carrier frequency reduction function is disabled when this value is 0.00 s.

No.	Name	Setting Range	Default
L8-40	Carrier Frequency Reduction Off-Delay Time	0.00 to 2.00 s	0.50 s

■ L8-41: High Current Alarm Selection

Triggers a high current alarm (HCA) when the output current exceeds 150% of the drive rated current.

No.	Name	Setting Range	Default
L8-41	High Current Alarm Selection	0, 1	0

Setting 0: Disabled

No alarm is detected.

Setting 1: Enabled

An alarm is triggered when the output current exceeds 150% of the drive rated current. A digital output set for an alarm (H2-☐☐ = 10) will close.

■ L8-97: Carrier Frequency Reduction Rate during oH Pre-Alarm

Derates the carrier frequency to the level set to L8-39 during oH pre-alarm.

No.	Name	Setting Range	Default
L8-97	Carrier Frequency Reduction Rate during oH Pre-Alarm	0, 1	0

Setting 0: Disabled

Setting 1: Enabled

◆ L9: Drive Protection 2

■ L9-03: Carrier Frequency Reduction Level Selection

Selects start or clear current level for automatic carrier frequency reduction. There is normally no need to change this parameter from the default value.

No.	Name	Setting Range	Default
L9-03	Carrier Frequency Reduction Level Selection	0, 1	0

Setting 0: Reduces the Carrier Frequency Based on the Drive Rated Current that Is Not Derated

Setting 1: Reduces the Carrier Frequency Based on the Drive Rated Current that Is Derated by the Carrier Frequency and Temperature with C6-02 Selection

■ L9-12: SoH Alarm Selection during bb

Sets the SoH (Snubber Discharge Resistor Overheat) alarm to output a fault or a minor fault during baseblock (bb). There is normally no need to change this parameter from the default value.

Note: This parameter is available in drive software versions PRG: 6113 and later.

No.	Name	Setting Range	Default
L9-12	SoH Alarm Selection during bb	0, 1	0

Setting 0: Outputs a Fault for an SoH Alarm during Baseblock (bb)

Setting 1: Outputs a Minor Fault for an SoH Alarm during Baseblock (bb)

1.9 n: Special Adjustments

These parameters control a variety of specialized adjustments and functions, including Hunting Prevention, High Slip Braking, resistance between motor lines, and PM motor control functions.

◆ n1: Hunting Prevention

Hunting Prevention prevents the drive from hunting as a result of low inertia and operating with light load. Hunting often occurs with a high carrier frequency and an output frequency below 30 Hz.

■ n1-01: Hunting Prevention Selection

Enables or disables the Hunting Prevention function.

Note: This function is available only when using V/f Control. Disable Hunting Prevention when drive response is more important than suppressing motor oscillation. This function may be disabled without problems in applications with high inertia loads or relatively heavy loads.

No.	Name	Setting Range	Default
n1-01	Hunting Prevention Selection	0, 1	1

Setting 0: Disabled

Setting 1: Enabled

■ n1-02: Hunting Prevention Gain Setting

Sets the gain for the Hunting Prevention Function.

No.	Name	Setting Range	Default
n1-02	Hunting Prevention Gain Setting	0.00 to 2.50	1.00

Although this parameter rarely needs to be changed, it may require adjustment in the following situations:
- If the motor vibrates while lightly loaded and n1-01 = 1, increase the gain by 0.1 until vibration ceases.
- If the motor stalls while n1-01 = 1, decrease the gain by 0.1 until the stalling ceases.

■ n1-03: Hunting Prevention Time Constant

Determines the responsiveness of the Hunting Prevention function (affects the primary delay time for Hunting Prevention).

No.	Name	Setting Range	Default
n1-03	Hunting Prevention Time Constant	0 to 500 ms	Determined by o2-04

Although this parameter rarely needs to be changed, it may require adjustment in the following situations:
- Increase this value for applications with a large load inertia. A higher setting leads to slower response, which can result in oscillation at lower frequencies.
- Lower this setting if oscillation occurs at low speed.

■ n1-05: Hunting Prevention Gain while in Reverse

This parameter functions the same as n1-02, except it is used when rotating in reverse. See the explanation for n1-02.

Note: n1-02 is enabled for forward and reverse operation when n1-05 = 0.0 ms.

No.	Name	Setting Range	Default
n1-05	Hunting Prevention Gain while in Reverse	0.00 to 2.50	0.00

◆ n3: High Slip Braking (HSB) and Overexcitation Braking

■ High Slip Braking (V/f)

HSB works in V/f Control only and decreases the stopping time compared to normal deceleration without using dynamic braking options. HSB reduces the output frequency in large steps to stop the motor and produce a high slip, which dissipates the regenerative energy created from decelerating the load in the motor windings. Due to the increased temperature of the motor windings, do not use HSB to frequently stop the motor. The duty cycle should be around 5% or lower.

Notes on Using High Slip Braking

- The set deceleration time is ignored during HSB. Use Overexcitation Deceleration 1 (L3-04 = 4) to stop the motor within a specified time.
- Braking time varies based on the load inertia and motor characteristics.
- Enabling HSB and KEB Ride-Thru simultaneously will trigger an oPE03 error.
- HSB must be triggered by a digital input set to H1-□□ = 68. After the HSB command is given, the drive will not restart until the motor is completely stopped and the Run command is cycled.
- Use parameters n3-01 through n3-04 to adjust HSB.

■ Overexcitation Deceleration (Induction Motors)

Increases the flux during deceleration and allows shorter deceleration time settings. Enabled by setting L3-04 to 4 or 5. ***Refer to L3-04: Stall Prevention Selection during Deceleration on page 113***.

Notes on Overexcitation Deceleration

- Frequently applying Overexcitation Deceleration raises the motor temperature because regenerative energy is mainly dissipated as heat in the motor. In cases where frequent application is required, make sure the motor temperature does not exceed the maximum allowable value of Overexcitation Deceleration.
- During Overexcitation Deceleration 2, Hunting Prevention in V/f Control is disabled.
- Overexcitation Deceleration can be most efficiently used in a V/f Control.
- Overexcitation Deceleration cannot be used with PM motors.

Parameter Adjustments

- Use parameters n3-13 through n3-23 to adjust Overexcitation Deceleration.
- When repetitive or long Overexcitation Deceleration causes motor overheat, lower the overexcitation gain (n3-13) and reduce the overslip suppression current level (n3-21).
- During Overexcitation Deceleration 1 (L3-04 = 4), the drive decelerates at the active deceleration time (C1-02 or C1-04). Set this time so no overvoltage (ov) fault occurs.
- During Overexcitation Deceleration 2 (L3-04 = 5), the drive decelerates using the active deceleration time while adjusting the deceleration rate to keep the DC bus voltage at the level set to L3-17. The actual stopping time will be longer or shorter than the set deceleration time depending on the motor characteristics and the load inertia. Increase the deceleration time if overvoltage occurs (ov).
- Entering a Run command during Overexcitation Deceleration cancels overexcitation operation and the drive reaccelerates to the specified speed.

■ n3-13: Overexcitation Deceleration Gain

Multiplies a gain to the V/f pattern output value during Overexcitation Deceleration to determine the level of overexcitation. The drive returns to the normal V/f value after the motor has stopped or when it is accelerating to the frequency reference.

No.	Name	Setting Range	Default
n3-13	Overexcitation Deceleration Gain	1.00 to 2.00	1.10

The optimum setting for n3-13 depends on the motor flux saturation characteristics.

- Gradually increase the gain to 1.25 or 1.90 to improve the braking power of Overexcitation Deceleration.
- Lower n3-13 when flux saturation characteristics cause overcurrent. A high setting sometimes causes overcurrent (oC), motor overload (oL1), or drive overload (oL2).

◆ n8: PM Motor Control Tuning

These parameters adjust the control performance in the vector control modes for permanent magnet motors.

■ n8-45: Speed Feedback Detection Control Gain (OLV/PM)

Sets the gain for internal speed feedback detection control. Although this parameter rarely needs to be changed, adjustment may be necessary under the following conditions:

- Increase this setting if motor oscillation or hunting occurs.
- Decrease this setting in increments of 0.05 to decrease drive responsiveness.

No.	Name	Setting Range	Default
n8-45	Speed Feedback Detection Control Gain	0.00 to 10.00	0.80

■ n8-47: Pull-In Current Compensation Time Constant (OLV/PM)

Sets the time constant for pull-in current to match the actual current.

Although this setting rarely needs to be changed, adjustment may be necessary under the following conditions:

- Increase this setting when it takes too long for the reference value of the pull-in current to match the target value.
- Decrease this setting if motor oscillation occurs.

No.	Name	Setting Range	Default
n8-47	Pull-In Current Compensation Time Constant	0.0 to 100.0 s	5.0 s

■ n8-48: Pull-In Current (OLV/PM)

Sets the d-Axis current during no-load operation at a constant speed. Set as a percentage of the motor rated current.

- Increase this setting when hunting occurs or the motor speed is unstable while running at a constant speed.
- Slightly reduce this value if there is too much current when driving a light load at a constant speed.

No.	Name	Setting Range	Default
n8-48	Pull-In Current	20 to 200%	30%

■ n8-49: d-Axis Current for High Efficiency Control (OLV/PM)

Sets the d-Axis current reference when running with high load at constant speed. When using an IPM motor, this parameter uses the reluctance torque to increase the efficiency and reduce energy consumption. Set this parameter to 0 when using an SPM motor.

Although this setting rarely needs to be changed, adjustment may be necessary under the following conditions:

- Lower the setting if motor operation is unstable when driving heavy loads.
- If motor parameters (E5-□□) have been changed, this value will be reset to 0 and will require readjustment.

No.	Name	Setting Range	Default
n8-49	d Axis Current for High Efficiency Control	-200.0 to 0.0%	Determined by o2-04

■ n8-51: Acceleration/Deceleration Pull-In Current (OLV/PM)

Sets the pull-in current during acceleration and deceleration as a percentage of the motor rated current (E5-03).

Adjustment may be necessary under the following conditions:

- Increase this setting when a large amount of starting torque is required.
- Lower this setting if there is excessive current during acceleration.

No.	Name	Setting Range	Default
n8-51	Acceleration/Deceleration Pull-In Current	0 to 200%	50%

■ n8-54: Voltage Error Compensation Time Constant (OLV/PM)

Sets the time constant for voltage error compensation.

Adjustment may be necessary under the following conditions:

- Adjust the value when hunting occurs at low speed.
- Increase the value in steps of 0.1 when hunting occurs with sudden load changes. Set n8-51 to 0 to disable the compensation if increasing n8-54 does not help.
- Increase the value when oscillations occur at start.

No.	Name	Setting Range	Default
n8-54	Voltage Error Compensation Time Constant	0.00 to 10.00	1.00

■ n8-55: Load Inertia (OLV/PM)

Sets the ratio between motor inertia and the inertia of the connected machinery. If this value is set too low, the motor may not start very smoothly and trigger an STo (Motor Step-Out) fault.

Increase this setting for large inertia loads or to improve speed control response. A high setting with low inertia load may cause oscillation.

No.	Name	Setting Range	Default
n8-55	Load Inertia	0 to 3	0

Setting 0: Below 1:10

The inertia ratio between the motor and the load is lower than 1:10.

Setting 1: Between 1:10 and 1:30

The inertia ratio between the motor and the load is between 1:10 and 1:30. Set n8-55 to 1 if an STo fault occurs as a result of impact load or sudden acceleration/deceleration when n8-55 = 0.

Setting 2: Between 1:30 and 1:50

The inertia ratio between the motor and the load is between 1:30 and 1:50. Set n8-55 to 2 if an STo fault occurs as a result of impact load or sudden acceleration/deceleration when n8-55 = 1.

Setting 3: Beyond 1:50

The inertia ratio between the motor and the load is higher than 1:50. Set n8-55 to 3 if an STo fault occurs as a result of impact load or sudden acceleration/deceleration when n8-55 = 2.

■ n8-62: Output Voltage Limit

Sets the output voltage limit to prevent voltage saturation. Do not set this value higher than the actual input voltage.

No.	Name	Setting Range	Default
n8-62	Output Voltage Limit	0.0 to 230.0 Vac <1>	200 Vac <1>

<1> Values shown are specific to 200 V class drives. Double value for 400 V class drives.

■ n8-63: Output Voltage Limit Proportional Gain (for PM Motors)

Stabilizes constant output.

There is normally no need to change this parameter from the default value.

Note:
1. This parameter is only available in OLV/PM.
2. This parameter is available in drive software versions PRG: 6114 and later.

No.	Name	Setting Range	Default
n8-63	Output Voltage Limit Proportional Gain (for PM Motors)	0.00 to 100.00	1.00

■ n8-64: Output Voltage Limit Integral Time (for PM Motors)

There is normally no need to change this parameter from the default value.

Note:
1. This parameter is only available in OLV/PM.
2. This parameter is available in drive software versions PRG: 6114 and later.

No.	Name	Setting Range	Default
n8-64	Output Voltage Limit Integral Time (for PM Motors)	0.000 to 5.000 s	0.040 s

■ n8-66: Output Voltage Limit Output Filter Time Constant (for PM Motors)

There is normally no need to change this parameter from the default value.

Note:
1. This parameter is only available in OLV/PM.
2. This parameter is available in drive software versions PRG: 6114 and later.

No.	Name	Setting Range	Default
n8-66	Output Voltage Limit Output Filter Time Constant (for PM Motors)	0.000 to 5.000 s	0.001 s

1.10 o: Operator-Related Settings

These parameters control the various functions, features, and display of the HOA keypad.

◆ o1: HOA Keypad Display Selection

These parameters determine the data display on the HOA keypad.

■ o1-01: Drive Mode Unit Monitor Selection

When o1-02 is set to 5, any U monitors can be displayed. This parameter will select the monitors. Pressing the up arrow key will display the following data: frequency reference → rotational direction → output frequency → output current → o1-01 selection.

Parameter o1-01 selects the content of the last monitor in this sequence. This is done by entering the “1□□” part of “U1-□□”. Certain monitors are not available in some control modes. There is no effect like this on an LCD operator.

No.	Name	Setting Range	Default
o1-01	Drive Mode Unit Monitor Selection	104 to 914 U1-04 (Control Mode) to U9-14 (Power Monitor) <1>	106 (U1-06)

<1> U2-□□ and U3-□□ parameters cannot be selected.

■ o1-02: User Monitor Selection after Power Up

Selects which monitor parameter is displayed upon power up by entering the 1- □□ part of U1-□□. Certain monitors are not available in some control modes. *Refer to U: Monitor Parameters on page 164* for a list of monitors.

No.	Name	Setting Range	Default
o1-02	User Monitor Selection after Power Up	1 to 5	<1>

<1> Default is 1 when b5-01 is set to 0.
Default is 3 when b5-01 is set to 1 or 3.

Setting 1: Frequency Reference (U1-01)

Setting 2: Motor Direction

Setting 3: Output Frequency (U1-02)

Setting 4: Output Current (U1-03)

Setting 5: User Monitor

The monitor value selected by o1-01 will be displayed.

■ o1-03: HOA Keypad Display Selection

Sets the units used to display the frequency reference and output frequency. Set o1-03 to 3 for user-set units before setting parameters o1-10 and o1-11.

No.	Name	Setting Range	Default
o1-03	HOA Keypad Display Selection	0 to 3	0

Setting 0: 0.01 Hz Units

Setting 1: 0.01% Units (100% = Max Output Frequency)

Setting 2: r/min Units (Calculated by the Max Output Frequency and the Number of Motor Poles)

Setting 3: User-set Units (Use o1-10, o1-11)

Set the value used for the maximum frequency reference to o1-10. Set the placement of the decimal point in this number to o1-11.

For example, to have the maximum output frequency displayed as “100.00”, set o1-10 = 1000 and o1-11 = 2 (i.e., 1000 with 2 decimal points).

Note: **1.** Parameter o1-03 allows the programmer to change the units used in the following parameters and monitors:
U1-01: frequency reference
U1-02: output frequency
U1-16: output frequency after softstarter (accel/decel ramp generator)
d1-01 to d1-17: frequency references

2. Setting o1-03 to 2 requires entering the number of motor poles to E2-04 and E5-04.

■ o1-05: LCD Contrast Control

Sets the brightness of the digital operator. The lower the setting, the brighter the LCD contrast. The higher the setting, the darker the LCD contrast.

No.	Name	Setting Range	Default
o1-05	LCD Contrast Control	0 to 5	3

■ o1-06: User Monitor Selection Mode

Normally the monitors shown directly below the active monitor are the next two sequential monitors. If o1-06 (User Monitor Selection Mode) is set to 1: "3 Mon Selectable", those two monitors are locked as specified by parameters o1-07 and o1-08 and will not change as the top parameter is scrolled with the Up/Down Arrow keys.

No.	Name	Setting Range	Default
o1-06	User Monitor Selection Mode	0, 1	<1>

<1> Default is 0 when b5-01 is set to 0.
Default is 1 when b5-01 is set to 1 or 3.

Setting 0: 3 Monitor Sequential (Displays the Next 2 Sequential Monitors)

Setting 1: 3 Monitor Selectable (o1-07, and o1-08 Selected Monitor Is Shown)

■ o1-07: Second Line Monitor Selection

Selects which monitor will be displayed in the second line. The monitor parameter number is entered into the spaces provided: U□-□□.

For example, set "403" to display monitor parameter U4-03.

No.	Name	Setting Range	Default
o1-07	Second Line Monitor Selection	101 to 699	<1>

<1> Default is 102 when b5-01 is set to 0.
Default is 504 when b5-01 is set to 1 or 3.

■ o1-08: Third Line Monitor Selection

Selects which monitor will be displayed in the third line. The monitor parameter number is entered into the spaces provided: U□-□□.

For example, set "403" to display monitor parameter U4-03.

No.	Name	Setting Range	Default
o1-08	Third Line Monitor Selection	101 to 699	<1>

<1> Default is 102 when b5-01 is set to 0.
Default is 501 when b5-01 is set to 1 or 3.

■ o1-09: Frequency Reference Display Units

Sets unit display for the frequency reference parameters and frequency related monitors when o1-03 = 3.

No.	Name	Setting Range	Default
o1-09	Frequency Reference Display Units	0 to 16	16

Setting 0: Inch of Water (“WC)
Setting 1: Pounds per Square Inch (PSI)
Setting 2: Gallons per Minute (GPM)
Setting 3: Degrees Fahrenheit (F)
Setting 4: Cubic Feet per Minute (CFM)
Setting 5: Cubic Meters per Hour (CMH)
Setting 6: Liters per Hour (LPH)
Setting 7: Liters per Second (LPS)
Setting 8: Bar (Bar)
Setting 9: Pascals (Pa)
Setting 10: Degrees Celsius (C)
Setting 11: Meters (Mtr)
Setting 12: Ft (Feet)
Setting 13: Liters per Minute (LPM)
Setting 14: Cubic Meters per Minute (CMM) No unit
Setting 15: Custom Units (Determined by o1-12)
Setting 16: None

■ o1-10: User-Set Display Units Maximum Value

Determines the display value that is equal to the maximum output frequency.

No.	Name	Setting Range	Default
o1-10	User-Set Display Units Maximum Value	1 to 60000	Determined by o1-03

■ o1-11: User-Set Display Units Decimal Display

Determines how many decimal points should be used to set and display the frequency reference.

No.	Name	Setting Range	Default
o1-11	User-Set Display Units Decimal Display	0 to 3	Determined by o1-03

Setting 0: No Decimal Point
Setting 1: One Decimal Point
Setting 2: Two Decimal Points
Setting 3: Three Decimal Points

■ o1-13 to o1-15: Frequency Reference and Frequency Related Monitor Custom Units 1 to 3

Sets the customer specified unit display for the frequency reference parameters and frequency related monitors when o1-03 is set to 3 and o1-09 is set to 15 as custom units.

The custom units consist of three characters selected from o1-13 to o1-15. Each character is selected by ASCII code from 30Hex to 7AHex.

No.	Name	Setting Range	Default
o1-13	Frequency Reference and Frequency Related Monitor Custom Units 1	30H to 7AH	41H
o1-14	Frequency Reference and Frequency Related Monitor Custom Units 2		
o1-15	Frequency Reference and Frequency Related Monitor Custom Units 3		

■ o1-16, o1-17: F1/F2 Key Function Selection

The HOA Keypad multi-function keys F1 and F2 can be set for different HVAC specific functions. Selects the functions of the F1/F2 keys and the LCD display text above the F1/F2 keys.

Note: Parameters o1-16 and o1-17 cannot be set to the same value (except for setting 0).

No.	Name	Setting Range	Default
o1-16	F1 Key Function Selection	0 to 4	0
o1-17	F2 Key Function Selection		0

Setting 0: Standard

Setting 1: Monitor

Setting 2: Drive/Bypass (DRV/BYP)

Setting 3: Bypass Run (RUN BYP)

Setting 4: Toggle Relay Output (RLY)

■ o1-18, o1-19: User-Defined Parameter Upper/Lower

Allows the user to set values that can be used as reference information.

No.	Name	Setting Range	Default
o1-18	User-Defined Parameter Upper	0 to 999	0
o1-19	User-Defined Parameter Lower		

◆ o2: HOA Keypad Functions

These parameters determine the functions assigned to the operator keys.

■ o2-02: OFF Key Function Selection

Determines if the OFF key on the HOA keypad will stop drive operation when the drive is controlled from a remote source (i.e., not from HOA keypad).

Note: The keypad OFF key is not functional when the drive is in Emergency Override.

No.	Name	Setting Range	Default
o2-02	OFF Key Function Selection	0, 1	1

Setting 0: Disabled

Setting 1: Enabled

The OFF key will terminate drive operation even if the Run command source is not assigned to the HOA keypad. Cycle the Run command to restart the drive if the drive has been stopped by pressing the OFF key.

■ o2-03: User Parameter Default Value

After completely setting up drive parameters, save the values as user-set defaults with parameter o2-03. After saving the values, parameter A1-03 (Initialize Parameters) will offer the choice of "1110: User Initialize". Selecting 1110 resets all parameters to the user-set default values. *Refer to A1-03: Initialize Parameters on page 11* for details on drive initialization.

No.	Name	Setting Range	Default
o2-03	User Parameter Default Value	0 to 2	0

Setting 0: No Change (Awaiting Command)

Setting 1: Set User Initialize Values

The current parameter settings are saved as user-set default for a later User Initialization. Setting o2-03 to 1 and pressing the ENTER key saves the values and returns the display to 0.

Setting 2: Clear User Initialize Values

All user-set defaults for “User Initialize” are cleared. Setting o2-03 to 2 and pressing the ENTER key erases the values and returns the display to 0.

■ o2-04: Drive Model Selection

Set this parameter when replacing the control board or the terminal board. *Refer to Defaults by Drive Model on page 259* for information on drive model selection.

NOTICE: *Drive performance will suffer and protective functions will not operate properly if the correct drive capacity is not set to o2-04.*

No.	Name	Setting Range	Default
o2-04	Drive Model Selection	-	Determined by drive capacity

Note: Change o2-04 setting only when necessary.

■ o2-05: Frequency Reference Setting Method Selection

Determines if the ENTER key must be pressed after changing the frequency reference using the HOA keypad while in Drive Mode.

No.	Name	Setting Range	Default
o2-05	Frequency Reference Setting Method Selection	0, 1	0

Setting 0: ENTER Key Required

The ENTER key must be pressed every time the frequency reference is changed using the HOA keypad for the drive to accept the change.

Setting 1: ENTER Key not Required

The output frequency changes immediately when the reference is changed by the up or down arrow keys on the HOA keypad. The ENTER key does not need to be pressed. The frequency reference (Fref) is saved to memory after remaining unchanged for 5 seconds.

■ o2-06: Operation Selection when HOA Keypad is Disconnected

Determines whether the drive will stop when the remote control extension cable of the HOA keypad is removed in HAND mode or when b1-02 or b1-16 is set to 0. When the operator is reconnected, the display will indicate that it was disconnected.

No.	Name	Setting Range	Default
o2-06	Operation Selection when HOA Keypad is Disconnected	0, 1	1

Setting 0: Continue Operation

The operation continues.

Setting 1: Trigger a Fault

The operation stops and triggers an oPr fault. The motor coasts to stop.

■ o2-07: Motor Direction at Power Up when Using Operator

Determines the direction the motor will rotate after the drive is powered up and the Run command is given from the HOA keypad.

Note: This parameter is effective only when the Run command is set to be given from the HOA keypad (b1-02 = 0).

No.	Name	Setting Range	Default
o2-07	Motor Direction at Power Up when Using Operator	0, 1	0

Setting 0: Forward

Setting 1: Reverse

■ o2-19: Selection of Parameter Write during Uv

Determines whether parameter settings can be changed during a control circuit undervoltage condition. To be used with 24 V Power Supply Unit Built-in model.

No.	Name	Setting Range	Default
o2-19	Selection of Parameter Write during Uv	0, 1	0

Setting 0: Disabled

Setting 1: Enabled

◆ o3: Copy Function

These parameters control the Copy function of the HOA keypad. The Copy function stores parameter settings into the memory of the HOA keypad to facilitate the transfer of those settings to other drives that are the same model, capacity, and same control mode setting.

■ o3-01: Copy Function Selection

Instructs the drive to Read, Write, or Verify parameter settings.

No.	Name	Setting Range	Default
o3-01	Copy Function Selection	0 to 3	0

Setting 0: Copy Select (No Function)

Setting 1: INV --> OP READ

Copies all parameters from the drive to the HOA keypad.

Note: The copy protection for the HOA keypad is enabled by default. Set o3-01 to 1 to unlock copy protection.

Setting 2: OP --> INV WRITE

Copies all parameters from the HOA keypad to the drive.

Setting 3: OP<-->INV VERIFY

Compares the parameters in the drive with the parameter settings saved on the HOA keypad for matches.

■ o3-02: Copy Allowed Selection

Allows and restricts the use of the Copy function.

No.	Name	Setting Range	Default
o3-02	Copy Allowed Selection	0, 1	0

Setting 0: Disabled

Setting 1: Enabled

◆ o4: Maintenance Monitor Settings

■ o4-01: Cumulative Operation Time Setting

Sets the cumulative operation time of the drive. The user can also manually set this parameter to begin keeping track of operation time from some desired value. Total operation time can be viewed in monitor U4-01.

Note: The value in o4-01 is set in 10 h units. For example, a setting of 30 will set the cumulative operation time counter to 300 h. 300 h will also be displayed in monitor U4-01.

No.	Name	Setting Range	Default
o4-01	Cumulative Operation Time Setting	0 to 9999 h	0 h

■ o4-02: Cumulative Operation Time Selection

Selects the conditions for how the drive keeps track of its total operation time. This time log can be viewed in monitor U4-01.

No.	Name	Setting Range	Default
o4-02	Cumulative Operation Time Selection	0, 1	1

Setting 0: Power on Time

The drive logs the time it is connected to a power supply, regardless of whether the motor is running.

Setting 1: Run Time

The drive logs the time that the output is active including when the Run command is active (even if the motor is not rotating) and when there is voltage output.

■ o4-03: Cooling Fan Operation Time Setting

Sets the value for how long the cooling fan has been operating. This value can be viewed in monitor U4-03. Parameter o4-03 also sets the base value used for the cooling fan maintenance, which is displayed in U4-04. Reset this parameter to 0 after replacing the cooling fan.

Note:
1. The value in o4-03 increases after every 10 hours of use. A setting of 30 will set the cooling fan operation time counter to 300 h. “300” will be displayed in monitor U4-03.
2. The cooling fan may require maintenance at an earlier date in harsher environments.

No.	Name	Setting Range	Default
o4-03	Cooling Fan Operation Time Setting	0 to 9999 h	0 h

■ o4-05: Capacitor Maintenance Setting

Starts estimates for capacitor maintenance times from this setting value. This value should be reset to 0 when the capacitors have been replaced.

Note: The actual maintenance time will depend on the environment where the drive is used.

No.	Name	Setting Range	Default
o4-05	Capacitor Maintenance Setting	0 to 150%	0%

■ o4-07: DC Bus Pre-Charge Relay Maintenance Setting

Starts estimates for soft charge bypass relay maintenance times from this setting value. This value should be reset to 0 when the bypass relay has been replaced.

Note: The actual maintenance time will depend on the environment where the drive is used.

No.	Name	Setting Range	Default
o4-07	DC Bus Pre-charge Relay Maintenance Setting	0 to 150%	0%

■ o4-11: U2, U3 Initialization

Resets the fault trace and fault history monitors (U2-□□ and U3-□□).

Note: Initializing the drive using A1-03 does not reset these monitors.

No.	Name	Setting Range	Default
o4-11	U2, U3 Initialization	0, 1	0

Setting 0: No Action

The drive keeps the previously saved record concerning fault trace and fault history.

Setting 1: Reset Fault Data

Resets the data for the U2-□□ and U3-□□ monitors. Setting o4-11 to 1 and pressing the ENTER key erases fault data and returns the display to 0.

■ o4-12: kWh Monitor Initialization

Manually resets kWh monitors U4-10, U4-11, and U9-□□. Initializing the drive or cycling the power will not reset these monitors.

No.	Name	Setting Range	Default
o4-12	kWh Monitor Initialization	0, 1	0

Setting 0: No Action

The kWh data are maintained.

Setting 1: Reset kWh Data

Resets the kWh counter. The monitors U4-10, U4-11, and U9-□□ will display “0” after they are initialized. Setting o4-12 to 1 and pressing the ENTER erases kWh data and returns the display to 0.

■ o4-13: Number of Run Commands Counter Initialization

Resets the Run command counter displayed in U4-02. Initializing the drive or cycling the power does not reset this monitor.

No.	Name	Setting Range	Default
o4-13	Number of Run Commands Counter Initialization	0, 1	0

Setting 0: No Action

The Run command data are kept.

Setting 1: Number of Run Commands Counter

Resets the Run command counter. The monitor U4-02 will show 0. Setting o4-13 to 1 and pressing the ENTER key erases the counter value and returns the display to 0.

■ o4-17: Set/Reset Real Time Clock

The time setting screen will appear.

No.	Name	Setting Range	Default
o4-17	Set/Reset Real Time Clock	0 to 2	0

Setting 0: — —

No Setting

Setting 1: Set

The HOA keypad shows 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 TIM fault will occur until o4-17 is set to 1 to set the Real Time Clock.

■ o4-19: Power Unit Price

Sets the price per 1 kWh to calculate the power rate displayed for total consumed power (U9-07 to U9-10) and total regenerated power (U9-11 to U9-14).

No.	Name	Setting Range	Default
o4-19	Power Unit Price	0.00 to 650.00	000.00

1.11 S: Special Parameters

◆ S1: Dynamic Audible Noise Control Function

The Dynamic Audible Noise Control Function reduces audible noise by suppressing the output voltage.

This function is available when using V/f Control mode and can help to quickly restore output voltage after an impact has caused a sudden increase in the time constant. Dynamic Audible Noise Control is useful in applications where load impact is common.

Energy Saving (b8-01 = 1) and Dynamic Audible Noise Control (S1-01 = 1) cannot be used simultaneously.

Procedure

1. Set S1-01 to 1 to enable Dynamic Audible Noise Control.

Note:
1. When S1-01 is set to 1, the tolerance to impact loading is reduced when compared to V/f Control (without Energy Saving).
2. Disable Dynamic Audible Noise Control for applications without an impact load.

2. Responsiveness is increased because the addition of a load causes the level of the current to rise.

   Increase the value of S1-02. The flux will become stronger and the torque will rise, but load movement will be minimized by the Dynamic Audible Noise Control function.

   Set S1-03 and S1-04 to a small value. Voltage is recovered quicker during impact load conditions. Under certain conditions voltage stability may become poor.

   Lower the value of S1-05. The voltage level will drop and speed up voltage restoration when the load is increased.
3. Increase the value of S1-03 to increase the effectiveness of Dynamic Audible Noise Control if the output voltage remains high.
4. Decrease the value of S1-06 to increase drive response to an impact load.
5. When the output voltage is unstable, increase the difference between S1-03 and S1-04 and increase S1-05 and S1-06 to slow the load response.

■ S1-01: Dynamic Audible Noise Control Selection

Reduces audible noise by decreasing the output voltage in variable torque applications with light loads.

Note: Setting b8-01 to 1 and S1-01 to 1 will trigger an oPE16 error.

No.	Name	Setting Range	Default
S1-01	Dynamic Audible Noise Control Selection	0 or 1	0

Setting 0: Disabled

Setting 1: Enabled

■ S1-02: Voltage Reduction Rate

Sets the rate at which the output voltage will be reduced as a percentage of the V/f pattern when operating with no load.

No.	Name	Setting Range	Default
S1-02	Voltage Reduction Rate	50.0 to 100.0%	50.0%

■ S1-03: Voltage Restoration Level

Sets the level when the drive should start restoring the voltage as a percentage of the drive rated torque.

The voltage is reduced when the torque output has decreased to the level set in S1-03.

The method used to reduce the voltage level is selected in accordance with the characteristics of the voltage reduction rate defined by the S1-03 and S1-04 settings.

Note: Setting S1-04 to a value less than that of S1-03 + 10.0 will trigger an oPE02 error.

No.	Name	Setting Range	Default
S1-03	Voltage Restoration Level	0.0 to 90.0%	20.0%

■ S1-04: Voltage Restoration Complete Level

Sets the level at which voltage restoration for the V/f pattern is complete as a percentage of the drive rated torque. If the output torque rises above the value of S1-04, then the voltage will be controlled in a manner specified by the V/f pattern setting.

Note: Setting S1-04 to a value less than that of S1-03 + 10.0 will trigger an oPE02 error.

No.	Name	Setting Range	Default
S1-04	Voltage Restoration Complete Level	S1-03 + 10.0 to 100.0%	50.0%

■ S1-05: Voltage Restoration Sensitivity Time Constant

Sets the level of sensitivity of the output torque as well as that of the LPF time constant for the voltage reduction rate. The level of sensitivity can be adjusted in accordance with the load response.

The LPF time constant is used to calculate the value of the output torque sensitivity time constant.

The voltage reduction rate is based on the torque output. Select LPF to prevent voltage fluctuation.

The Dynamic Audible Noise Control Function outputs the rate of voltage reduction as a percentage within the allowable range (Max: 100%, Min: S1-02 value).

No.	Name	Setting Range	Default
S1-05	Voltage Restoration Sensitivity Time Constant	0.000 to 3.000 s	1.000 s

■ S1-06: Voltage Restoration Time Constant at Impact

Sets the voltage restoration time constant if an impact load is added.

Sets the time constant that enables the voltage level to rise if the speed suddenly changes upon impact.

No.	Name	Setting Range	Default
S1-06	Voltage Restoration Time Constant at Impact	0.000 to 1.000 s	0.050 s

◆ S2: Sequence Timers

■ Programmable Run Timers for Real Time Clock (RTC)

Programmable run timers allow the drive to start and stop automatically at specified times. The timers can be configured to run daily, on weekdays, on weekends, or only on specific days of the week.

Sequence Timer 1

When the current time reaches the value set in parameter S2-01 (Sequence Timer 1 Start Time), the drive will execute the action set in parameter S2-04 (Sequence Timer 1 Selection), provided the current day is selected via S2-03 (Sequence Timer 1 Day Selection). The drive will stop executing the S2-04 action when the S2-02 (Sequence Timer 1 Stop Time) is reached.

When S2-04 = 0 or the Disable Sequence Timers multi-function input (H1-□□= 50) is closed, Sequence Timer 1 has no effect on the drive Run command. The drive runs normally based on the status of the selected run source (b1-02). If S2-04 = 1 or 2 and the Disable Sequence Timers input is open, the drive will run during the Sequence Timer 1 active time, provided the drive has a valid Run command. The frequency reference that is used is set by S2-05 (Sequence Timer 1 Reference Source). When S2-04 = 2, PID control is disabled.

If the Cancel Active Sequence Timer multi-function input (H1-□□ = 51) transitions from open to closed while Sequence Timer 1 is active, the timer will be disabled until the next scheduled sequence timer occurrence. Sequence Timer 1 can be re-enabled by cycling the drive Run command. The Sequence Timer 1 multi-function output (H2-□□ = 50) will close while Sequence Timer 1 is active regardless of the S2-04 selection.

When S2-01 = S2-02, Sequence Timer 1 is active continuously for the days selected in S2-03. The timer will start at the S2-01/S2-02 time on the first day and stop at the same time on the last day. If only one day is selected in S2-03, the timer will stop at 11:59 on that day.

When S2-04 = 1 or 2, Sequence Timer 1 is active and the drive is running, the HOA Keypad will display “Sequence Timer 1 RUN”. When the drive has a run command, S2-04 = 1 or 2 and Sequence Timer 1 is not active, the HOA Keypad will display “Sequence Timer OFF”.

When the drive has a run command, S2-04 = 1 or 2 and Sequence Timer 1 is not active, the drive should not fault on undervoltage or overvoltage conditions (should be Alarm only).

Note: When S2-03 > 0 and the HOA keypad is disconnected, an oPr fault will be triggered, regardless of the setting of o2-06 (Operation Selection when Digital Operator is Disconnected).

Sequence Timers 2 to 4

These timers operate identically to Sequence Timer 1. Parameters S2-06 to S2-20 configure Sequence Timers 2 to 4.

Priority

If multiple sequence timers overlap, the timer with the lowest number has priority.

Sequence Timer 1 = highest priority

Sequence Timer 4 = lowest priority

Examples of Sequence Timers

If multiple sequence timers overlap, the timer with the lowest number has priority.

Sequence Timer 1 = highest priority

Sequence Timer 4 = lowest priority

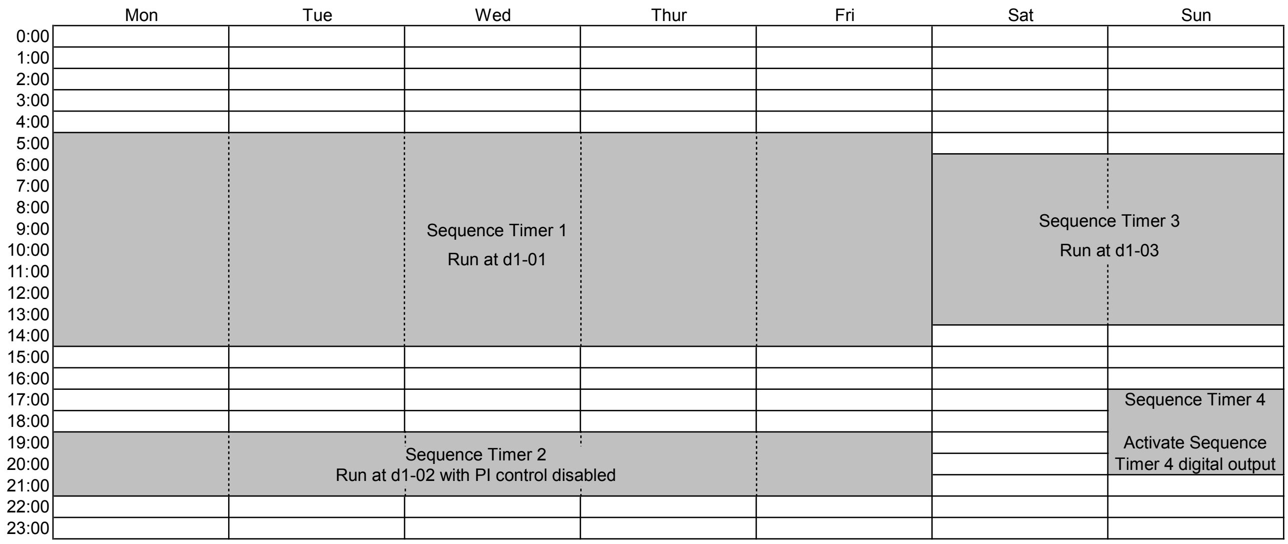


Figure 1.76 Sequence Timer Example 1

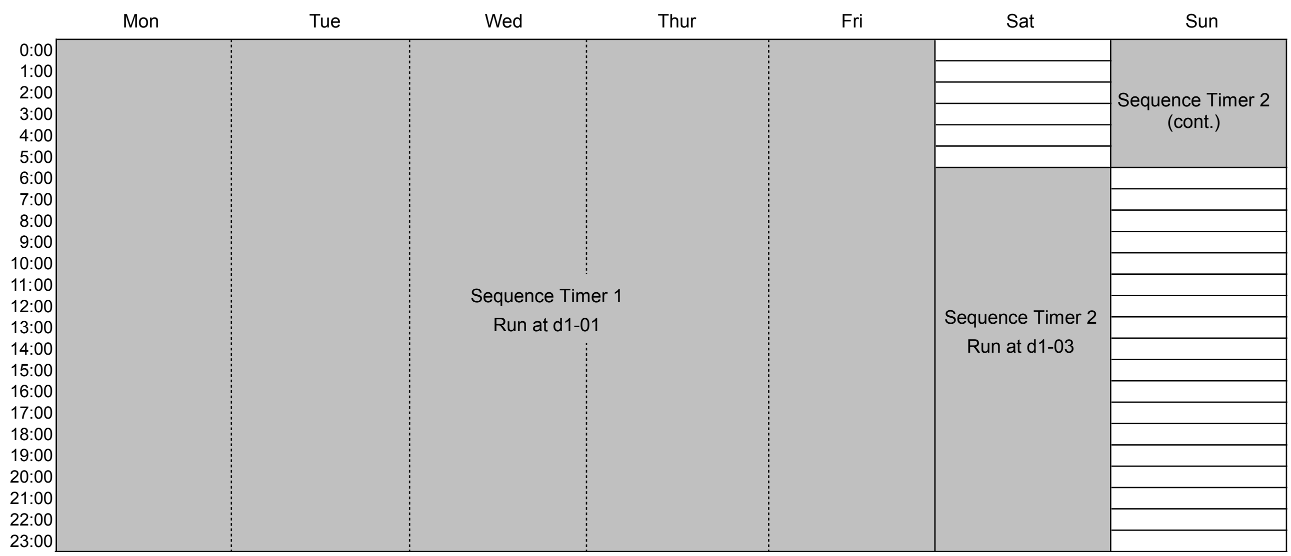


Figure 1.77 Sequence Timer Example 2

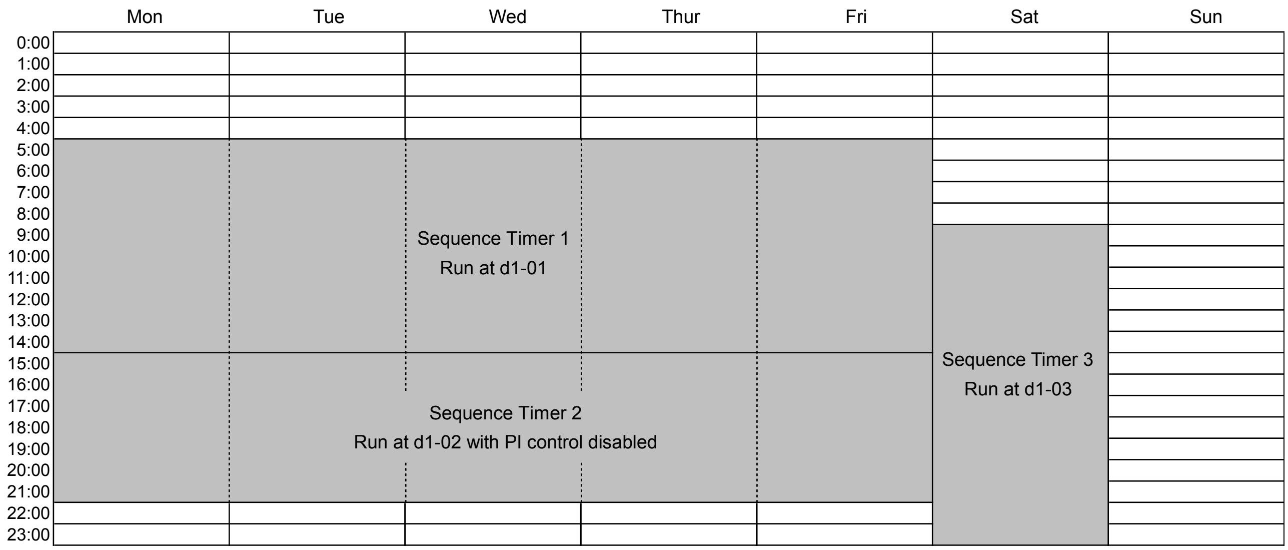


Figure 1.78 Sequence Timer Example 3

■ S2-01/S2-06/S2-11/S2-16: Sequence Timers 1 to 4 Start Time

Sets the start times for timers 1 to 4.

If the Stop Time is set to a higher value than the Start Time, the Sequence Timers will be active starting from the set Start Time, run through midnight, and stop the following day at the set Stop Time.

Note: Setting the sequence timer start time to a higher value than the sequence timer stop time disables that sequence timer in drive software versions PRG: 8551 and earlier.

No.	Name	Setting Range	Default
S2-01	Sequence Timer 1 Start Time	12:00AM to 11:59PM <1>	12:00AM <1>
S2-06	Sequence Timer 2 Start Time	12:00AM to 11:59PM <1>	12:00AM <1>
S2-11	Sequence Timer 3 Start Time	12:00AM to 11:59PM <1>	12:00AM <1>
S2-16	Sequence Timer 4 Start Time	12:00AM to 11:59PM <1>	12:00AM <1>

<1> Default is 00:00 and range is 00:00 to 24:00 when o4-20 is set to 1 (24-hour).

■ S2-02/S2-07/S2-12/S2-17: Sequence Timers 1 to 4 Stop Time

Sets the stop times for timers 1 to 4. The values must be set greater than or equal to S2-01/S2-06/S2-11/S2-16.

No.	Name	Setting Range	Default
S2-02	Sequence Timer 1 Stop Time	00:00 to 24:00	00:00
S2-07	Sequence Timer 2 Stop Time	00:00 to 24:00	00:00
S2-12	Sequence Timer 3 Stop Time	00:00 to 24:00	00:00
S2-17	Sequence Timer 4 Stop Time	00:00 to 24:00	00:00

■ S2-03/S2-08/S2-13/S2-18: Sequence Timers 1 to 4 Day Selection

Sets the days for which sequence timers 1 to 4 are active.

No.	Name	Setting Range	Default
S2-03	Sequence Timer 1 Day Selection	0 to 10	0
S2-08	Sequence Timer 2 Day Selection	0 to 10	0
S2-13	Sequence Timer 3 Day Selection	0 to 10	0
S2-18	Sequence Timer 4 Day Selection	0 to 10	0

Setting 0: Timer Disabled

Setting 1: Daily

Setting 2: Mon - Fri

Setting 3: Sat - Sun

Setting 4: Monday

Setting 5: Tuesday

Setting 6: Wednesday

Setting 7: Thursday

Setting 8: Friday

Setting 9: Saturday

Setting 10: Sunday

■ S2-04/S2-09/S2-14/S2-19: Sequence Timers 1/2/3/4 Selection

Sets the action that occurs when sequence timers 1 to 4 are active.

No.	Name	Setting Range	Default
S2-04	Sequence Timer 1 Selection	0 to 2	0
S2-09	Sequence Timer 2 Selection	0 to 2	0
S2-14	Sequence Timer 3 Selection	0 to 2	0
S2-19	Sequence Timer 4 Selection	0 to 2	0

Setting 0: Digital Output Only

Setting 1: Run

Setting 2: Run - PID Disable

■ S2-05/S2-10/S2-15/S2-20: Sequence Timers 1/2/3/4 Reference Source

Selects the frequency reference source used for running the drive when sequence timers 1 to 4 are active (only applicable when S2-04/S2-09/S2-14/S2-19 are set to 1 or 2).

Note: H1-☐☐ = 12/13 overrides these sequence timer run sources in drive software versions PRG: 1018 and later.

No.	Name	Setting Range	Default
S2-05	Sequence Timer 1 Reference Source	0 to 6	0
S2-10	Sequence Timer 2 Reference Source	0 to 6	0
S2-15	Sequence Timer 3 Reference Source	0 to 6	0
S2-20	Sequence Timer 4 Reference Source	0 to 6	0

Setting 0: Operator (d1-01)

Setting 1: Operator (d1-02)

Setting 2: Operator (d1-03)

Setting 3: Operator (d1-04)

Setting 4: Terminals

Setting 5: Serial Communication

Setting 6: Option Card

◆ S3: Secondary PI (PI2) Control

The drive has a built in PI (Proportional + Integral) controller that can be used for closed loop control of system variables such as pressure or temperature. The difference between the target and the feedback value (deviation) is fed into the PI controller and the PI controller outputs the frequency to U5-□□ for monitoring. *Refer to b5: PID Control on page 31* for details.

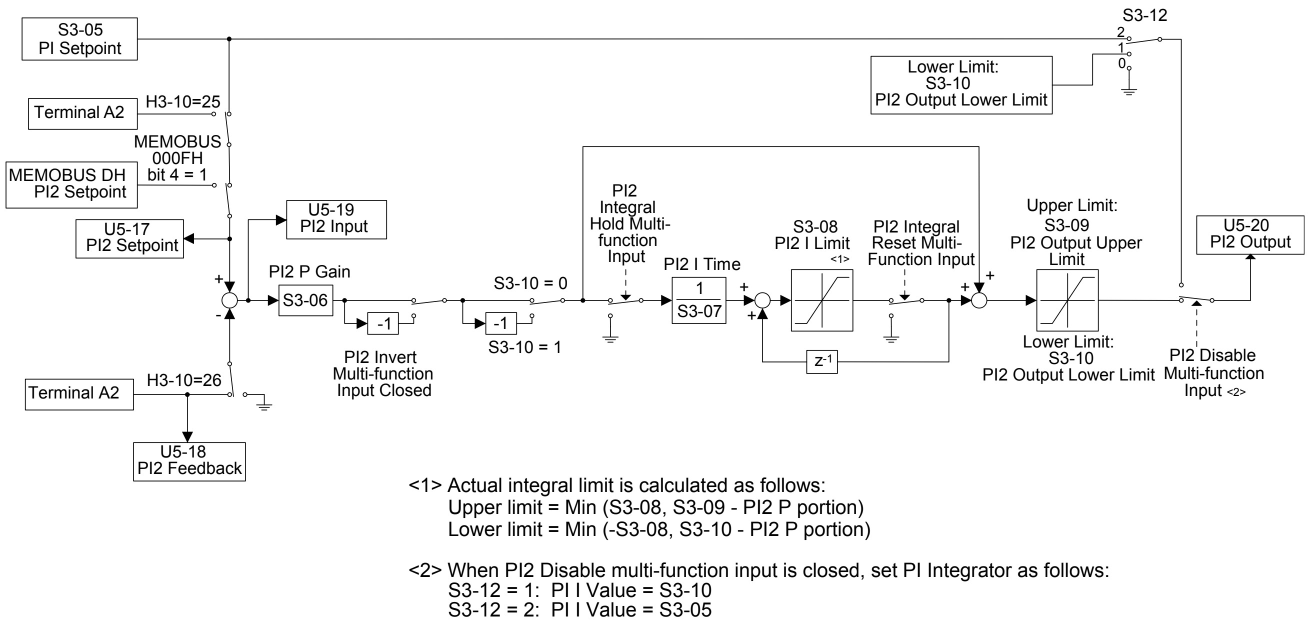


Figure 1.79 PI2 Block Diagram

■ S3-01: Secondary PI Enable Selection

Determines when the secondary PI controller is enabled.

No.	Name	Setting Range	Default
S3-01	Secondary PI Enable Selection	0 to 3	0

Setting 0: Secondary PI Disabled

Setting 1: Always

Setting 2: Drive Running

Setting 3: Motor Running

Available when the drive is not at zero speed, not in base block, and not in DC injection.

■ S3-02: Secondary PI User Display

Sets the scale value of 100% PI input. The decimal place shifts based on S3-03.

No.	Name	Setting Range	Default
S3-02	Secondary PI User Display	0 to 60000	1000 <1>

<1> Unit is determined by S3-03.

■ S3-03: Secondary PI Display Digits

Sets the decimal place display for secondary PI units.

No.	Name	Setting Range	Default
S3-03	Secondary PI Display Digits	0 to 3	2

Setting 0: No Decimal Places

Setting 1: One Decimal Place

Setting 2: Two Decimal Places

Setting 3: Three Decimal Places

■ S3-04: Secondary PI Unit Selection

Sets units for secondary PI control function.

No.	Name	Setting Range	Default
S3-04	Secondary PI Unit Selection	0 to 15	15

Setting 0: Inch of Water (WC)

Setting 1: Pounds per Square Inch (PSI)

Setting 2: Gallons per Minute (GPM)

Setting 3: Degrees Fahrenheit (F)

Setting 4: Cubic Feet per Minute (CFM)

Setting 5: Cubic Meters per Hour (CMH)

Setting 6: Liters per Hour (LPH)

Setting 7: Liters per Second (LPS)

Setting 8: Bar (Bar)

Setting 9: Pascals (Pa)

Setting 10: Degrees Celsius (C)

Setting 11: Meters (Mtr) (Ft: Feet)

Setting 12: Liters per Minute (LPM)

Setting 13: Cubic Meters per Minute (CMM)

Setting 14: No Unit

Setting 15: Percentage (%)

■ S3-05: Secondary PI Setpoint Value

Sets the secondary PI controller target value

No.	Name	Setting Range	Default
S3-05	Secondary PI Setpoint Value	0.00 to 600.00 <1>	0.00 <2>

<1> Upper limit is S3-02, decimal place holder is determined by S3-03.

<2> Unit is determined by S3-04.

■ S3-06: Secondary PI Proportional Gain Setting

Sets the proportional gain of the secondary PI controller. A setting of 0.00 disables P control.

No.	Name	Setting Range	Default
S3-06	Secondary PI Proportional Gain Setting	0.00 to 25.00	1.00

■ S3-07: Secondary PI Integral Time Setting

Sets the integral time for the secondary PI controller. A setting of 0.0s disables integral control.

No.	Name	Setting Range	Default
S3-07	Secondary PI Integral Time Setting	0.0 to 360.0 s	1.0 s

■ S3-08: Secondary PI Integral Limit Setting

Sets the maximum output possible from the integrator.

No.	Name	Setting Range	Default
S3-08	Secondary PI Integral Limit Setting	0.0 to 100.0%	100.0%

■ S3-09: Secondary PI Output Upper Limit

Sets the maximum output possible from the secondary PI controller.

No.	Name	Setting Range	Default
S3-09	Secondary PI Output Upper Limit	0 to 100.0%	100.0%

■ S3-10: Secondary PI Output Lower Limit

Sets the minimum output possible from the secondary PI controller.

No.	Name	Setting Range	Default
S3-10	Secondary PI Output Lower Limit	-100.00 to 100.00	0.00%

■ S3-11: Secondary PI Output Level Selection

Sets the secondary PI controller output direction.

No.	Name	Setting Range	Default
S3-11	Secondary PI Output Level Selection	0 or 1	0

Setting 0: Normal Output (Direct Acting)

Setting 1: Reverse Output (Reverse Acting)

■ S3-12: Secondary PI Disable Mode

Selects the secondary PI controller output when disabled.

No.	Name	Setting Range	Default
S3-12	Secondary PI Disable Mode	0 to 2	0

Setting 0: No Output (0%)

Setting 1: Lower Limit (S3-10)

Setting 2: Setpoint

■ S3-13: Secondary PI Low Feedback Detection Level

Sets the secondary PI low feedback detection level.

No.	Name	Setting Range	Default
S3-13	Secondary PI Low Feedback Detection Level	0.00 to 600.00 <1>	0.00 <2>

<1> Upper limit is S3-02, decimal place holder is determined by S3-03.

<2> Unit is determined by S3-04.

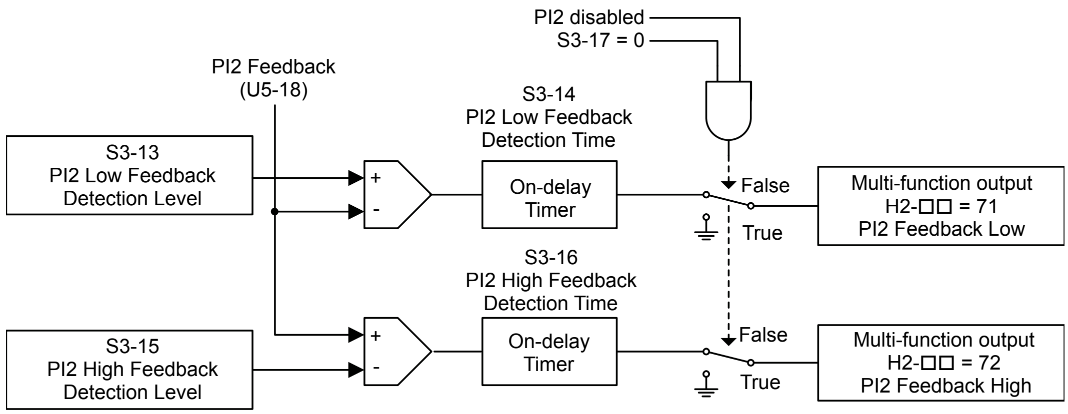


Figure 1.80 PI Low Feedback Detection Level

■ S3-14: Secondary PI Low Feedback Detection Time

Sets the secondary PI low feedback detection delay time in seconds.

No.	Name	Setting Range	Default
S3-14	Secondary PI Low Feedback Detection Time	0.0 to 25.5 s	1.0 s

■ S3-15: Secondary PI High Feedback Level

Sets the secondary PI high feedback detection level.

No.	Name	Setting Range	Default
S3-15	Secondary PI High Feedback Level	0.00 to 600.00 <1>	300.0 <2>

<1> Upper limit is S3-02, decimal place holder is determined by S3-03.

<2> Unit is determined by S3-04.

■ S3-16: Secondary PI High Feedback Detection Time

Sets the secondary PI high feedback detection delay time in seconds.

No.	Name	Setting Range	Default
S3-16	Secondary PI High Feedback Detection Time	0.0 to 25.5 s	1.0 s

■ S3-17: Secondary PI Feedback Detection Selection

Selects when secondary PI controller low and high feedback detection is active.

No.	Name	Setting Range	Default
S3-17	Secondary PI Feedback Detection Selection	0 or 1	0

Setting 0: Secondary PI Enabled

Setting 1: Always

◆ S4: Bypass Operation

The Drive/Bypass functionality allows the drive to control contactors that switch the motor voltage source between the drive and line voltage. A digital input can force the drive to go into Bypass mode and cause the motor to run on line voltage (full speed).

A second digital input (override) will run the motor on line voltage provided that dampers open feedback is present. The drive can switch to running the motor on line voltage if a fault occurs in the drive and also be configured to switch to Bypass for energy saving purposes if it is running near full speed for a set amount of time.

■ Enabling Programmable Bypass Logic

The programmable bypass logic is enabled when the following digital inputs are assigned: A4 (Emergency Override), A5 (BP Drive/Bypass Select), and A7 (BP Customer Safeties), and the following digital outputs are assigned:
A4 (BP Drive Relay Contact), and A5 (BP Bypass Relay Contact)

Note:
1. If o1-16 or o1-17 are set to 2 (Drive/Bypass), it is not necessary to set digital output A5.
2. If o1-16 or o1-17 are set to 3 (Bypass Run Command), it is not necessary to set digital output 84.

When Bypass functionality is enabled, the drive can allow the motor to run off of line voltage instead of the drive output. The drive will only run in Drive or Bypass mode if a Run command is entered. The drive must also be configured to 2-Wire control to enable Bypass functionality. Each time the drive performs a switch from Drive mode to Bypass mode it will follow the procedure outlined below.

Immediate Transfer to Bypass

Three conditions: Emergency Override (Smoke Purge), Transfer on Fault Required, and Energy Saving Transfer, require the drive to perform an immediate transfer to bypass.

To protect system hardware, this transfer cannot happen instantly. When an immediate transfer is required, the drive will block the output. After the L2-03 time (Minimum Baseblock Time) elapses, the BP Drive Relay Contact opens to disconnect the drive from the motor. The drive then allows the Minimum Baseblock Time (L2-03) to elapse before closing the BP Bypass Relay Contact. This causes the motor to operate on line voltage.

This process ensures that any residual field present in the motor is allowed to dissipate before the voltage source is changed.

Transfer to Drive Operation

When this occurs, the drive will open the BP Bypass Relay Contact, wait until the Minimum Baseblock Time (L2-03) elapses, close the BP Drive Relay Contact and wait for the L2-03 time to elapse again. After the drive is connected to the motor, it will remove the Baseblock condition, perform a speed search, catch the spinning motor, and ramp to the desired output frequency.

■ Programmable Bypass Logic

When the Drive/Bypass MFDI (H1-☐☐ = A5) is closed and a Run command is entered, the drive switches to Drive mode and allows the drive to run the motor. ***Refer to Transfer to Drive Operation on page 150*** for details.

If the Drive/Bypass Select digital input is opened and the Bypass Run command is given, the drive switches to Bypass mode and allows the motor to run on line voltage. ***Refer to Immediate Transfer to Bypass on page 150*** for details.

When Drive/Bypass MFDI (H1-☐☐ = A5) is open, but no Run command is present, the HOA keypad displays “Bypass Select Off”.

When Drive/Bypass MFDI (H1-☐☐ = A5) is open and the BP Bypass Relay Contact is closed, the HOA keypad displays “Bypass Select Run”.

When o1-16 or o1-17 is set to 2 (Drive/Bypass), the HOA keypad DRV/BYP multi-function key selects the bypass operating mode instead of the Drive/Bypass MFDI.

When o1-16 or o1-17 is set to 3 (Bypass Run Command), the HOA keypad RUN BYP multi-function key is used to run in Bypass mode instead of the Bypass Run Command MFDI.

Safety Circuit

The Customer Safeties Relay must to be closed for drive or bypass operation to be functional. If the Customer Safeties Relay is open, the drive will not run in Drive or Bypass mode.

The Customer Safeties Alarm “SAFE Customer Safety” displays when the BP Customer Safeties MFDI (H1-☐☐ = A7) is open.

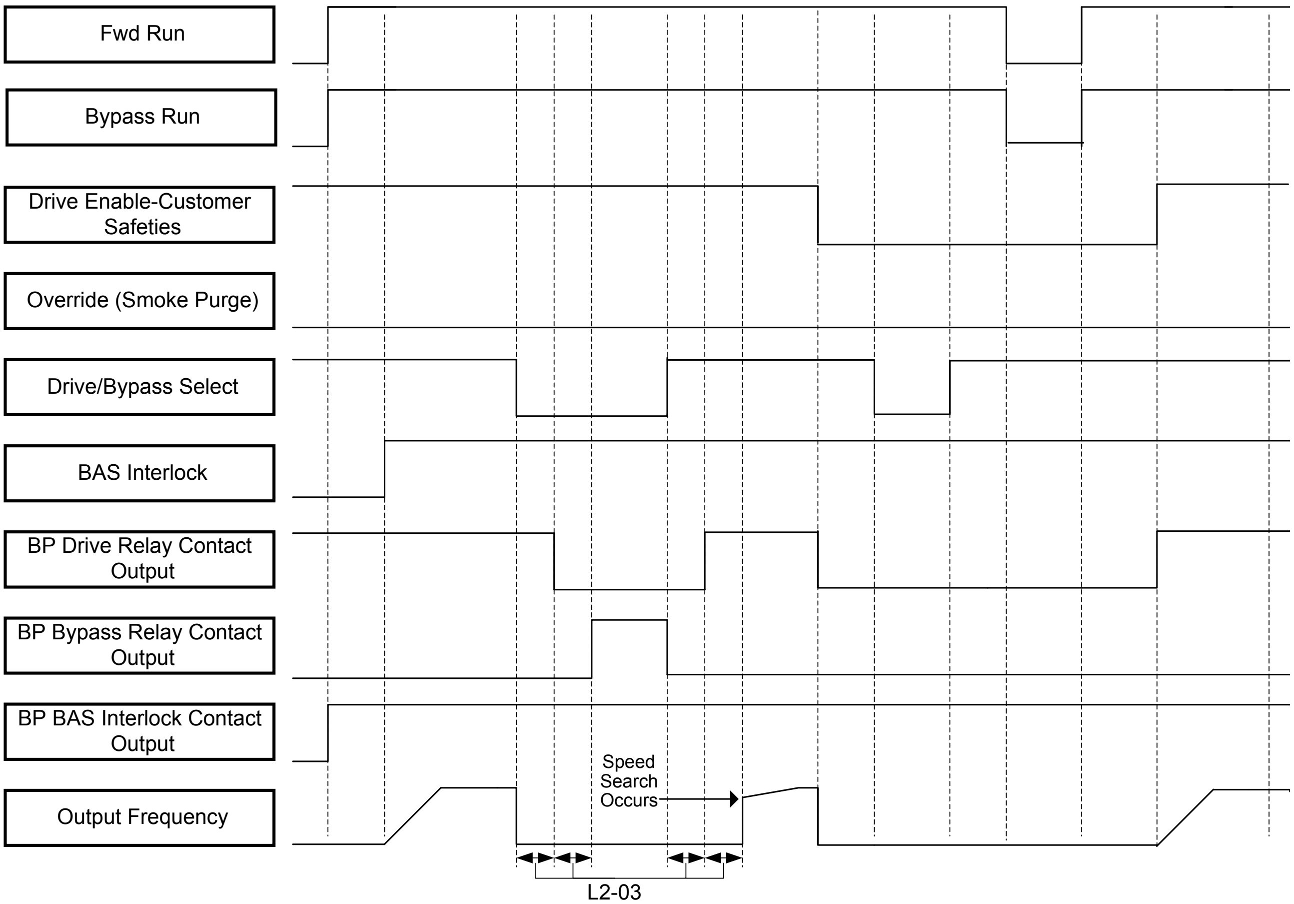


Figure 1.81 Transfer to Bypass and Safety Circuit

Emergency Override

When the Emergency Override (Smoke Purge) digital input is closed, the drive will perform the transfer. ***Refer to Immediate Transfer to Bypass on page 150*** for details.

If programmed, the BP BAS Interlock Relay Contact will close before the transfer occurs. During the transfer process, and if BAS Interlocks are present, the BAS Interlock Input MFDI must be closed before the drive will close the bypass contactor to run the motor on line voltage.

When the Emergency Override MFDI is closed, the state of BP Drive/Bypass Select MFDI, Run command, Bypass Run command and BP Customer Safeties MFDI have no impact on the operation of the system. When Emergency Override opens, the drive operates based on the other digital input commands. If the drive is commanded to run, the drive will perform the switch. ***Refer to Transfer to Drive Operation on page 150*** for details.

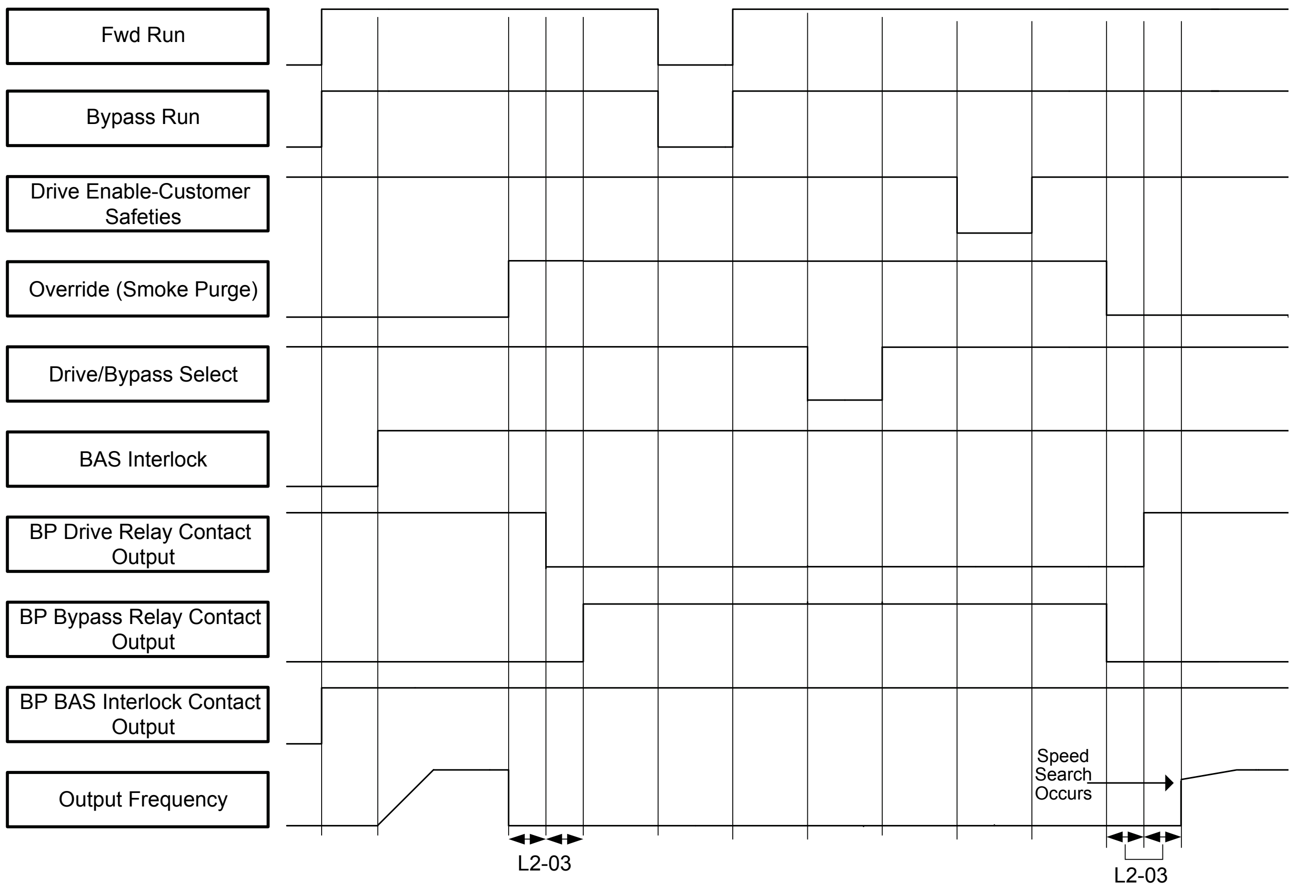


Figure 1.82 Emergency Override

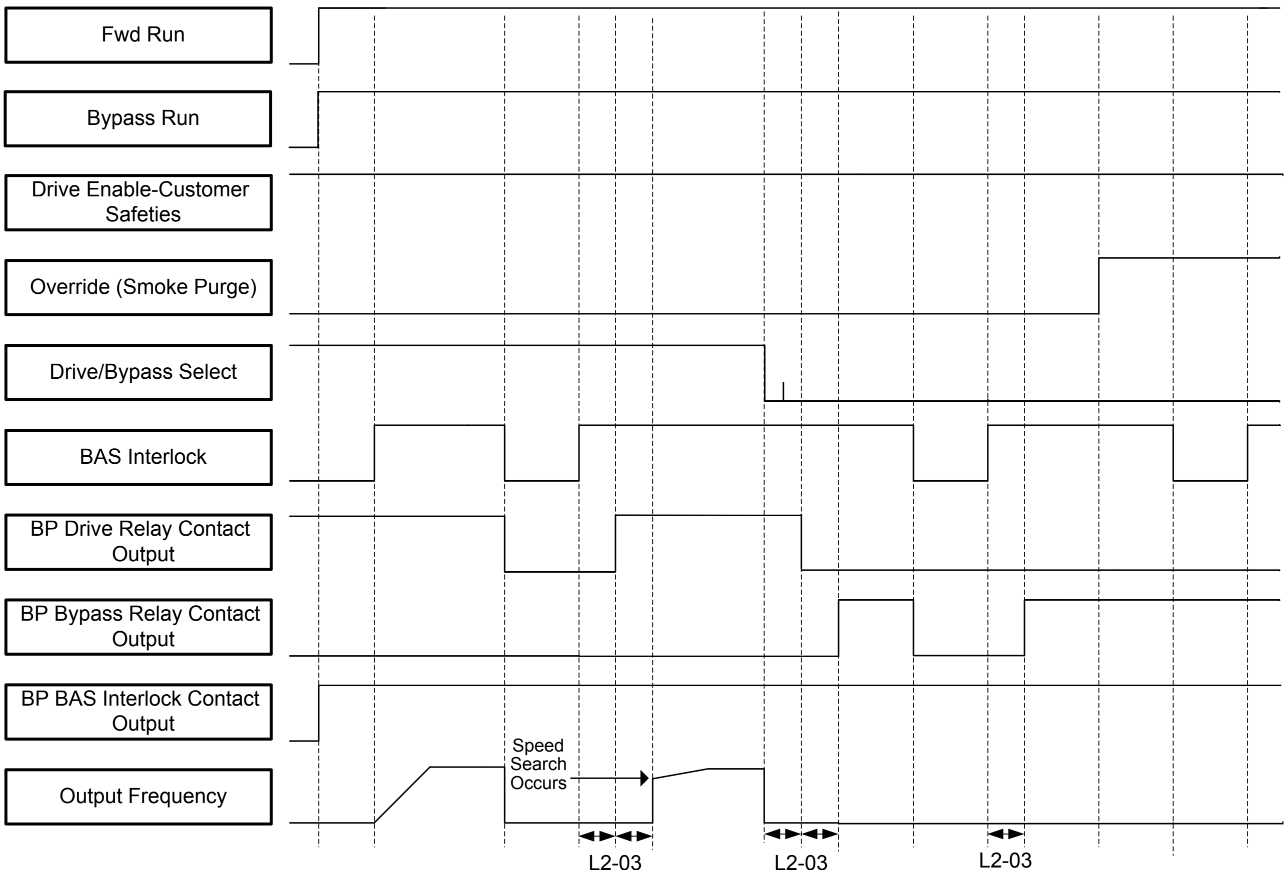


Figure 1.83 BAS Interlock

Transfer on Fault

When the bypass functionality is enabled and the BP Auto Transfer on Fault Enable (S4-01) is enabled, the drive can perform a transfer to bypass upon a drive fault. If the drive is running when a fault occurs, an immediate transfer to bypass will occur. *Refer to Immediate Transfer to Bypass on page 150* for details.

The drive will keep the BP Bypass Relay Contact closed until the run command is removed, the BP Customer Safeties is opened, or the BAS Interlock Input MFDI is programmed and opens. When the fault is manually reset, the drive performs the switch. *Refer to Transfer to Drive Operation on page 150* for details.

This functionality also requires that Auto-Restart Retries is set to zero (L5-01 = 0) to ensure that the drive does not attempt an automatic fault retry.

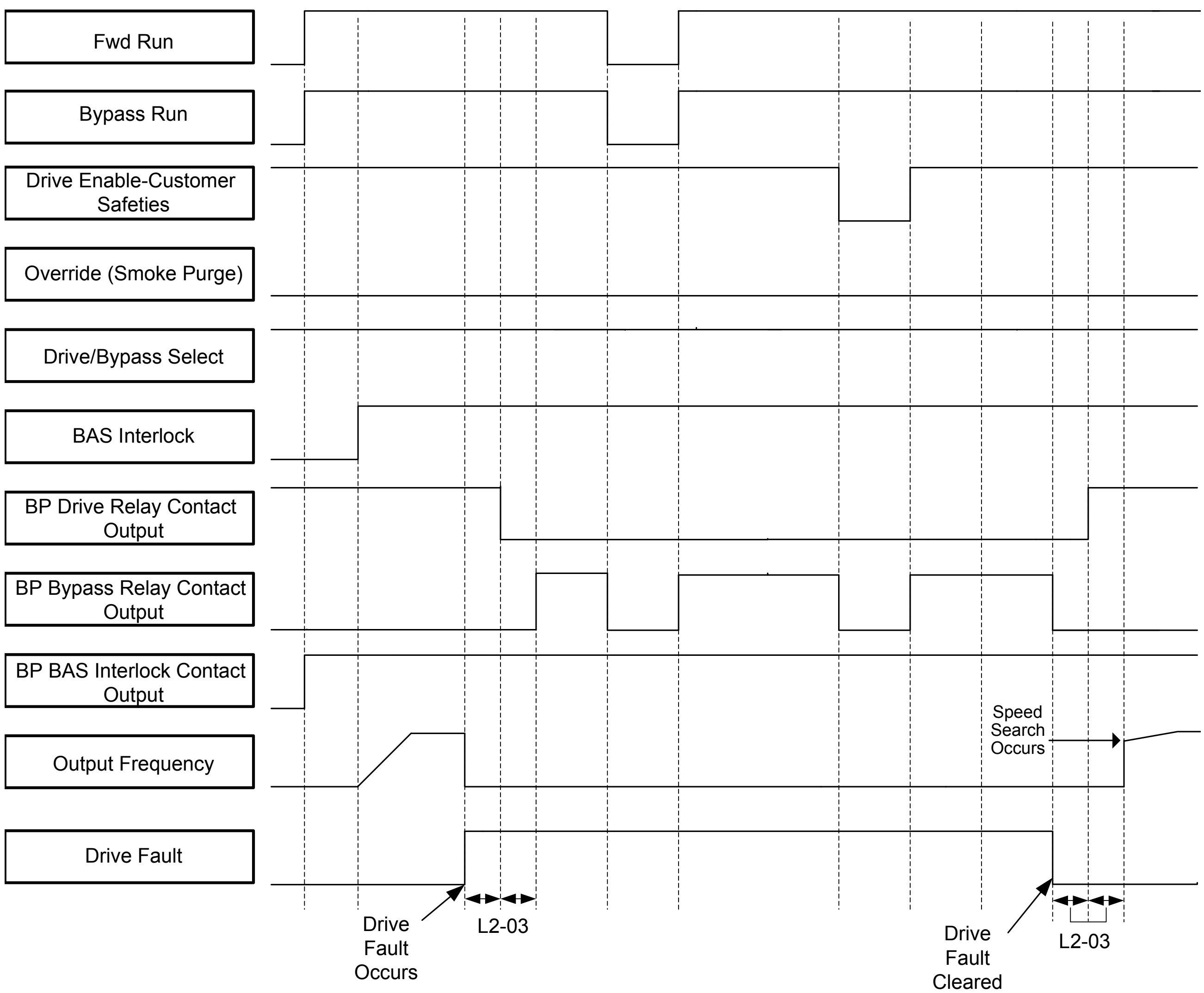


Figure 1.84 Transfer on Fault

Energy Savings Mode

When the BP Energy Save Bypass Trigger Level (S4-02) is greater than 0, the Energy Savings Mode is enabled. If the drive is running at a speed, as determined by SFS output equal to or greater than Maximum Output Frequency minus BP Energy Save Bypass Trigger Level (E1-04 - S4-02) for the time specified in BP Energy Save Bypass Timer (S4-03), the drive output frequency ramps to Maximum Output Frequency plus BP Energy Save Bypass Speed Increase (E1-04 + S4-04).

When the SFS output frequency is equal to Maximum Output Frequency plus BP Energy Save Bypass Speed Increase (E1-04 + S4-04), the drive will perform an immediate transfer to bypass. ***Refer to Immediate Transfer to Bypass on page 150*** for details.

The drive will continue to run on line voltage until the frequency command drops below E1-04 - S4-02 (Maximum Output Frequency minus BP Energy Save Bypass Trigger Level). When this occurs, the drive performs the switch. ***Refer to Transfer to Drive Operation on page 150*** for details.

The BP BAS Interlock Open message will display when the drive is waiting for the BAS feedback before issuing an internal Run command or closing the BP Bypass Relay Contact.

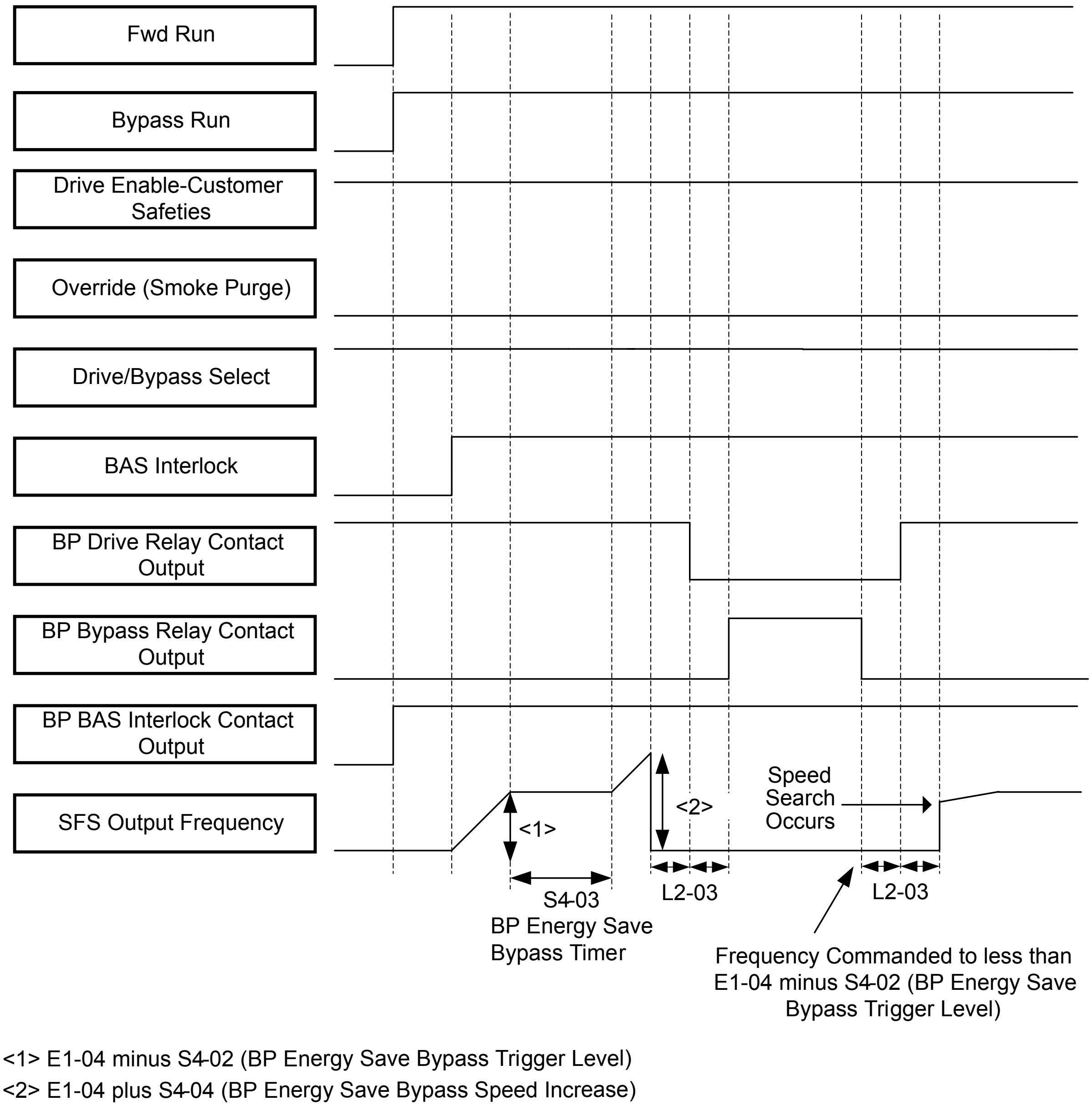


Figure 1.85 Energy Savings Mode

■ S4-01: BP Auto Transfer on Fault Enable

Enables Auto-Transfer when a fault occurs.

No.	Name	Setting Range	Default
S4-01	BP Auto Transfer on Fault Enable	0 or 1	0

Setting 0: No Transfer after Fault

Setting 1: Transfer to Bypass after Fault

■ S4-02: BP Energy Save Bypass Trigger Level

Delta used to determine when to switch into Energy Save Bypass. This allows for lower frequency output values to also trigger Energy Save Bypass functionality. A transfer to bypass occurs after the drive reaches the programmed output frequency (E1-04 to S4-02) for the time specified in the BP Energy Save Bypass Timer (S4-03). Additionally, if frequency input is set below E1-04 to S4-02, the drive exits Energy Save Bypass. Setting S4-02 to 0 disables Energy Save Bypass functionality.

Parameter Details

1

No.	Name	Setting Range	Default
S4-02	BP Energy Save Bypass Trigger Level	0 to 20 Hz	0 Hz

■ S4-03: BP Energy Save Bypass Timer

Sets the time in seconds that the drive should run at the specified speed before entering Energy Save Bypass mode.

No.	Name	Setting Range	Default
S4-03	BP Energy Save Bypass Timer	10 to 60000 s	60 s

■ S4-04: BP Energy Save Bypass Speed Increase

Sets the value in Hz that the drive will increase the output frequency above E1-04 before performing an Energy Save transfer to bypass.

No.	Name	Setting Range	Default
S4-04	BP Energy Save Bypass Speed Increase	0 to 10 Hz	6 Hz

◆ S5: HOA Keypad Parameters

■ S5-01: HAND Frequency Reference Selection

Selects the speed command input source in HAND mode.

No.	Name	Setting Range	Default
S5-01	HAND Frequency Reference Selection	0 to 4	0

Setting 0: HOA Keypad

Setting 1: Terminals

Setting 2: d1-16

Setting 3: S5-05

Setting 4: Determined by b1-01

■ S5-02: HAND/AUTO During Run Selection

Selects if drive will permit switching between HAND and AUTO modes while running.

No.	Name	Setting Range	Default
S5-02	HAND/AUTO During Run Selection	0 or 1	1

Setting 0: Disabled

Setting 1: Enabled

■ S5-03: HAND Mode PID Selection

Selects whether PID control is enabled or disabled when in HAND mode.

No.	Name	Setting Range	Default
S5-03	HAND Mode PID Selection	0 or 1	1

Setting 0: Disabled

Setting 1: Enabled

■ S5-04: HAND Mode Behavior Selection

Selects the behavior of HAND mode.

No.	Name	Setting Range	Default
S5-04	HAND Mode Behavior Selection	0 to 2	1

Setting 0: Legacy Operation Mode

When S5-04 = 0 (Legacy operation mode), the HAND/OFF/AUTO functionality for both the HOA keypad and multifunction inputs.

Setting 1: Normal Operation Mode

When S5-04 = 1 (Normal operation mode), the functionality is as follows:

- AUTO mode: Drive frequency reference and run command are based on b1-01/b1-02.
- OFF mode: Drive is stopped and cannot run (except via Emergency Override multi-function input). Frequency reference is based on b1-01.
- HAND mode: Drive runs at frequency reference selected via S5-01.

The AUTO, OFF and HAND states are selected either via the HOA keypad or multi-function inputs.

Parameter S5-01 selects the HAND mode frequency reference source. When S5-01 is set to 2, d1-16 is used as the HAND mode reference. When S5-01 is set to 3, S5-05 is used. When S5-01 is set to 4, the frequency reference selected via b1-01 is used as the HAND mode reference.

The only difference between d1-16 and S5-05 is that the unit for d1-16 changes based on o1-03, o1-10 and o1-11. However, the unit for S5-05 is fixed at Hz.

Parameter S5-03 selects whether PID control is enabled or disabled in HAND mode.

Note: The drive will always be in AUTO mode at power up with S5-04 = 1.

Table 1.34 HAND/AUTO Multi-Function Inputs, Standard Behavior (S5-04 = 1 or 2)

AUTO Mode Selection (H1-☐☐ = 6D)	HAND Mode Selection (H1-☐☐ = 6E)	Operation Mode	Frequency Reference	Run Command
Open	Open	OFF	Based on b1-01	OFF
Open	Closed	HAND	Based on S5-01	OFF
Closed	Open	AUTO	Based on b1-01	Based on b1-02
Closed	Closed	OFF	Based on b1-01	OFF

When the AUTO and HAND multi-function inputs (setting 6D and 6E) are used, the HAND and AUTO keys on the HOA keypad do not function.

If S5-04 is set to 1 or 2, the AUTO and HAND multi-function inputs (setting 6D and 6E) can only be used together or an oPE03 error will occur.

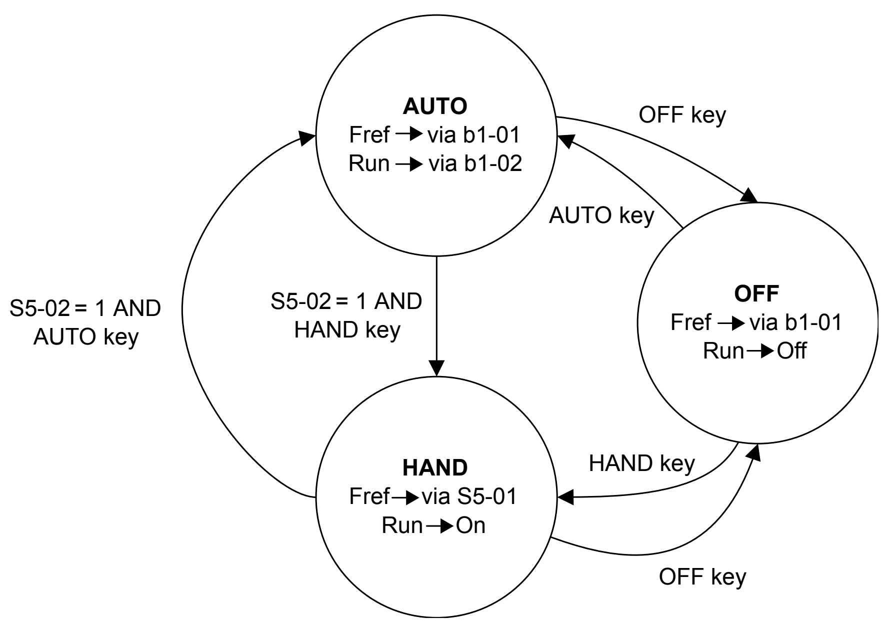


Figure 1.86 Standard Behavior (S5-04 = 1 or 2)

Table 1.35 HAND/AUTO Multi-Function Inputs, Legacy Behavior (S5-04 = 0)

AUTO Mode Selection (H1-□□ = 6D)	HAND Mode Selection (H1-□□ = 6E)	Frequency Reference	Run Command
Open	-	Based on S5-01	Based on b1-02
Closed	-	Based on b1-02	
-	Open	Based on b1-02	
-	Closed	Based on S5-01	

If S5-04 is set to 0, the AUTO and HAND multi-function inputs (setting 6D and 6E) can only be used individually or an oPE03 error will occur.

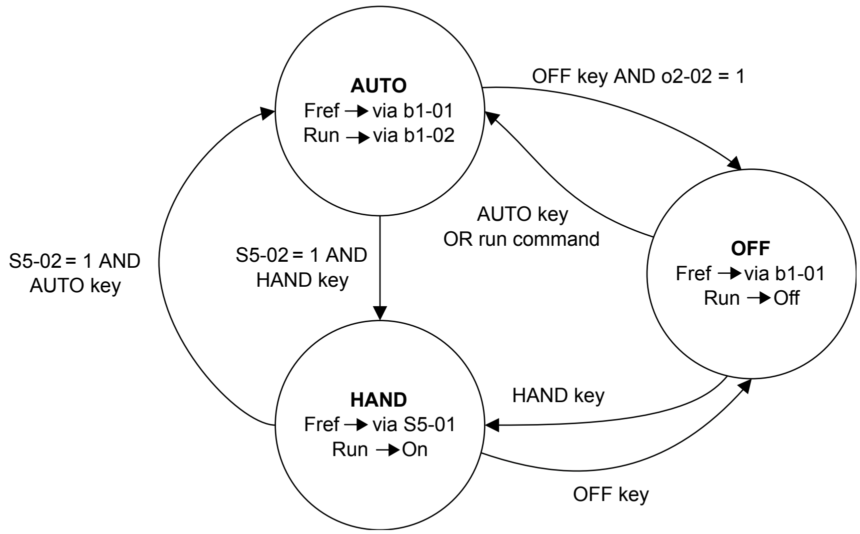


Figure 1.87 Legacy Behavior (S5-04 = 0)

Setting 2: Normal Operation Mode with Memory

When switching AUTO/HAND modes from the HOA keypad, the drive will memorize the operation mode when the power to the drive is shut off. This will be the initial operating mode when power is reapplied.

When switching AUTO/HAND modes from a Multi-Function Input, the drive will start with the Multi-Function Input setting.

HAND mode: The drive starts with the OFF mode when cycling the power to the drive.

AUTO mode: The drive starts with the AUTO mode when cycling the power to the drive.

OFF mode: The drive starts with the OFF mode when cycling the power to the drive.

■ S5-05: HAND Frequency Reference 1

Sets the frequency reference used in HAND mode when S5-01 is set to 3.

Note: Setting units and range are determined by parameters o1-03, o1-10, and o1-11.

No.	Name	Setting Range	Default
S5-05	HAND Frequency Reference 1	0.00 to [E1-04]	0.00 Hz

■ S5-07: HAND Key Function Selection (HOA Keypad)

Determines whether the HAND key on the HOA keypad will be enabled for switching between HAND and AUTO.

No.	Name	Setting Range	Default
S5-07	HAND Key Function Selection (HOA Keypad)	0, 1	1

Setting 0: Disabled

Setting 1: Enabled

◆ S6: Phase Order Selections

■ S6-01: Emergency Override Speed

Sets the speed command used in emergency override mode when S6-02 = 0.

No.	Name	Setting Range	Default
S6-01	Emergency Override Speed	0.00 to [E1-04]	0.00 Hz

■ S6-02: Emergency Override Reference Selection

Selects the frequency reference source for the Emergency Override function (H1-☐☐= AF or B0). Emergency Override ignores faults such as oL2, oH1, oL1/oL2/oL3, EF☐☐, oH1/oH3/oH4, LL3, rH, oPr, CPF, PID faults, LF/LF2, UL3, PF, and any other faults, if possible.

No.	Name	Setting Range	Default
S6-02	Emergency Override Reference Selection	0, 1	0

Setting 0: Use S6-01 Reference

Setting 1: Use AUTO Reference

■ S6-07: Output Phase Loss Detection Level for Dynamic Audible Noise Control

Sets the output phase loss detection level for Dynamic Audible Noise Control. Decrease the setting in steps of 10% when output phase loss is detected erroneously. This setting rarely needs to be changed.

No.	Name	Setting Range	Default
S6-07	Output Phase Loss Detection Level for Dynamic Audible Noise Control	10.0 to 100.0%	100.0%

1.12 T: Motor Tuning

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

◆ T1: Parameter Settings during Induction Motor Auto-Tuning

The T1-☐☐ parameters set the Auto-Tuning input data for induction motor tuning.

Note: For motors operating in the field weakening range, first perform the Auto-Tuning with the base data. After Auto-Tuning is complete, change E1-04, Maximum Output Frequency, to the desired value.

■ T1-01: Auto-Tuning Mode Selection

Sets the type of Auto-Tuning to be used. Refer to the User Manual packaged with the drive for details on the different types of Auto-Tuning.

No.	Name	Setting Range	Default
T1-01	Auto-Tuning Mode Selection	2, 3	2

Setting 2: Stationary Auto-Tuning for Line-to-Line Resistance

Setting 3: Rotational Auto-Tuning for V/f Control Energy Saving

■ T1-02: Motor Rated Power

Sets the motor rated power according to the motor nameplate value.

Note: Use the following formula to convert HP to kW: kW = HP x 0.746.

No.	Name	Setting Range	Default
T1-02	Motor Rated Power	0.00 to 650.00 kW	Determined by o2-04

■ T1-03: Motor Rated Voltage

Sets the motor rated voltage according to the motor nameplate value. Enter the voltage base speed when the motor operates above base speed. Enter the voltage needed to operate the motor under no-load conditions at rated speed to T1-03.

No.	Name	Setting Range	Default
T1-03	Motor Rated Voltage	0.0 to 255.0 V <1>	200.0 V <1>

<1> Values shown are specific to 200 V class drives. Double value for 400 V class drives.

■ T1-04: Motor Rated Current

Sets the motor rated current according to the motor nameplate value. Enter the current at the motor base speed.

No.	Name	Setting Range	Default
T1-04	Motor Rated Current	10.0 to 150.0% of drive rated current	Determined by o2-04

■ T1-05: Motor Base Frequency

Sets the motor rated frequency according to the motor nameplate value. If a motor with an extended speed range is used or the motor is used in the field weakening area, enter the maximum frequency to E1-04 after Auto-Tuning is complete.

No.	Name	Setting Range	Default
T1-05	Motor Base Frequency	0.0 to 400.0 Hz	60.0 Hz

■ T1-06: Number of Motor Poles

Sets the number of motor poles according to the motor nameplate value.

No.	Name	Setting Range	Default
T1-06	Number of Motor Poles	2 to 48	4

■ T1-07: Motor Base Speed

Sets the motor rated speed according to the motor nameplate value. Enter the speed at base frequency when using a motor with an extended speed range or if using the motor in the field weakening area.

No.	Name	Setting Range	Default
T1-07	Motor Base Speed	0 to 24000 r/min	1750 r/min

T1-11: Motor Iron Loss

Provides iron loss information to determine the Energy Saving coefficient. T1-11 will first display the value for the motor iron loss that the drive automatically calculated when the motor capacity was entered to T1-02. Enter the motor iron loss value listed to T1-11 if the motor test report is available.

No.	Name	Setting Range	Default
T1-11	Motor Iron Loss	0 to 65535 W	Determined by E2-11

T1-12: T1 Tuning Start

Set T1-12 to 0 to start IM Auto-Tuning.

No.	Name	Setting Range	Default
T1-12	T1 Tuning Start	0	–

T2: Parameter Settings during PM Motor Auto-Tuning

The T2-□□ parameters are used to set the Auto-Tuning input data for PM motor tuning.

T2-01: PM Motor Auto-Tuning Mode Selection

No.	Name	Setting Range	Default
T2-01	PM Motor Auto-Tuning Mode Selection	0 to 2; 14	0

Setting 0: PM Motor Parameter Settings

Setting 1: PM Stationary Auto-Tuning

Setting 2: PM Stationary Auto-Tuning for Stator Resistance

Setting 14: PM Rotational Auto-Tuning

T2-02: PM Motor Code Selection

If the drive is operating a Yaskawa PM motor from the SMRA, SSR1, or SST4 series, enter the motor code in T2-02 to automatically set parameters T2-03 through T2-09. Use the motor nameplate or motor test report values to set parameters T2-10 to T2-14. If the drive is operating a specialized motor or a motor designed by a manufacturer other than Yaskawa, set T2-02 to FFFF and enter the data from the motor nameplate or the motor test report as prompted.

Only the designated PM motor codes may be entered. The PM motor codes accepted by the drive will differ depending on the selected control mode. *Refer to E5: PM Motor Settings on page 64* for motor codes.

No.	Name	Setting Range	Default
T2-02	PM Motor Code Selection	0000 to FFFF	Determined by o2-04

T2-03: PM Motor Type

Selects the type of PM motor the drive will operate.

No.	Name	Setting Range	Default
T2-03	PM Motor Type	0, 1	1

Setting 0: IPM motor

Setting 1: SPM motor

T2-04: PM Motor Rated Power

Specifies the motor rated power in kilowatts.

No.	Name	Setting Range	Default
T2-04	PM Motor Rated Power	0.00 to 650.00 kW	Determined by o2-04

■ T2-05: PM Motor Rated Voltage

Sets the motor rated voltage.

No.	Name	Setting Range	Default
T2-05	PM Motor Rated Voltage	0.0 to 255.0 V <1>	200.0 V <1>

<1> Value shown is specific to 200 V class drives. Double value for 400 V class drives.

■ T2-06: PM Motor Rated Current

Enter the motor rated current in amps.

No.	Name	Setting Range	Default
T2-06	PM Motor Rated Current	0.0% to 300.0% of the drive rated current.	Determined by o2-04

■ T2-07: PM Motor Base Frequency

Enter the motor base frequency in Hz.

Note: T2-07 will be displayed when in OLV/PM.

No.	Name	Setting Range	Default
T2-07	PM Motor Base Frequency	0.0 to 400.0 Hz	87.5 Hz

■ T2-08: Number of PM Motor Poles

Enter the number of motor poles.

No.	Name	Setting Range	Default
T2-08	Number of PM Motor Poles	2 to 48	6

■ T2-10: PM Motor Stator Resistance

Enter the motor stator resistance per motor phase.

No.	Name	Setting Range	Default
T2-10	PM Motor Stator Resistance	0.000 to 65.000 Ω	Determined by T2-02

■ T2-11: PM Motor d-Axis Inductance

Enter the d-Axis inductance per motor phase.

No.	Name	Setting Range	Default
T2-11	PM Motor d-Axis Inductance	0.00 to 600.00 mH	Determined by T2-02

■ T2-12: PM Motor q-Axis Inductance

Enter the q-Axis inductance per motor phase.

No.	Name	Setting Range	Default
T2-12	PM Motor q-Axis Inductance	0.00 to 600.00 mH	Determined by T2-02

■ T2-13: Induced Voltage Constant Unit Selection

Selects the units used for setting the induced voltage coefficient.

No.	Name	Setting Range	Default
T2-13	Induced Voltage Constant Unit Selection	0, 1	1

Setting 0: mV (r/min)

Setting 1: mV (rad/sec)

Note: If T2-13 is set to 0, then the drive will use E5-24 (Motor Induction Voltage Constant 2), and will automatically set E5-09 (Motor Induction Voltage Constant 1 (Ke)) to 0.0. If T2-13 is set to 1, then the drive will use E5-09 and will automatically set E5-25 to 0.0.

■ T2-14: PM Motor Induced Voltage Constant (Ke)

Enter the motor induced voltage constant (Ke).

No.	Name	Setting Range	Default
T2-14	PM Motor Induced Voltage Constant (Ke)	0.0 to 2000.0	Determined by T2-02

■ T2-15: Pull-In Current Level for PM Motor Tuning

Sets the amount of pull-in current. Set as a percentage of the motor rated current.

No.	Name	Setting Range	Default
T2-15	Pull-In Current Level for PM Motor Tuning	0 to 120%	30%

1.13 U: Monitor Parameters

Monitor parameters let the user view various aspects of drive performance using the HOA keypad display. Some monitors can be output from terminals FM and AM by assigning the specific monitor parameter number (U☐-☐☐) to H4-01 and H4-04. *Refer to H4-01, H4-04: Multi-Function Analog Output Terminal FM, AM Monitor Selection on page 103* for details on assigning functions to an analog output.

◆ U1: Operation Status Monitors

Status monitors display drive status data such as output frequency and output current. *Refer to U1: Operation Status Monitors on page 248* for a complete list of U1-☐☐ monitors and descriptions.

◆ U2: Fault Trace

Use these monitor parameters to view the status of various drive aspects when a fault occurs.

This information is helpful for determining the cause of a fault. *Refer to U2: Fault Trace on page 250* for a complete list of U2-☐☐ monitors and descriptions.

U2-☐☐ monitors are not reset when the drive is initialized. *Refer to o4-11: U2, U3 Initialization on page 139* for instructions on how to reset these monitor values.

Note: Fault histories are not kept when CPF00, CPF01, CPF06, CPF24, oFA00, oFb00, oFC00, Uv1, Uv2, or Uv3 occur.

◆ U3: Fault History

These parameters display faults that have occurred during operation as well as the drive operation time when those faults occurred. *Refer to U3: Fault History on page 251* for a complete list of U3-☐☐ monitors and descriptions.

U3-☐☐ monitors are not reset when the drive is initialized. *Refer to o4-11: U2, U3 Initialization on page 139* for instructions on how to reset these monitor values.

Note: Fault histories are not kept when CPF00, CPF01, CPF06, CPF24, oFA00, oFb00, oFC00, Uv1, Uv2, or Uv3 occur.

◆ U4: Maintenance Monitors

Maintenance monitors show:

- Runtime data of the drive and cooling fans and number of Run commands issued
- Maintenance data and replacement information for various drive components
- kWh data
- Highest peak current that has occurred and output frequency at the time the peak current occurred
- Motor overload status information
- Detailed information about the present Run command and frequency reference source selection

Refer to U4: Maintenance Monitors on page 253 for a complete list of U4-☐☐ monitors and descriptions.

◆ U5: PID Monitors

These monitors display various aspects of PID control. *Refer to PID Block Diagram on page 34* for details on how these monitors display PID data.

Refer to U5: PID Monitors on page 254 for a complete list of U5-☐☐ monitors and descriptions.

◆ U6: Operation Status Monitors

These monitors display reference data for the output voltage and vector control and the offset value added to the frequency reference by the frequency offset function. *Refer to Settings 44, 45, and 46: Offset Frequency 1, 2, 3 on page 84* for details.

Refer to U6: Operation Status Monitors on page 255 for a complete list of U6-☐☐ monitors and descriptions.

◆ U9: Power Monitors

The total consumed power and regenerated power are displayed for these parameters. *Refer to U9: Power Monitors on page 256* for a complete list of U9-☐☐ monitors and descriptions.

2

Periodic Inspection & Maintenance

This chapter describes the periodic inspection and maintenance of the drive to ensure that it receives the proper care to maintain overall performance.

2.1 Section Safety

⚠ WARNING

Arc Flash Hazard

It is possible that there is more than one source of power for the equipment.

Obey the requirements for Electrical Safety in the Workplace and local codes for safe work procedures and applicable personal protective equipment (PPE).

Failure to obey can cause serious injury or death.

Electrical Shock Hazard

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

Failure to comply could result in death or serious injury.

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

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

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

Always ground the motor-side grounding terminal.

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

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

Failure to comply could result in death or serious injury.

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

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait for at least the time specified on the warning label; after all indicators are OFF, measure the DC bus voltage level to confirm it has reached a safe level.

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

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

Do not use an improper voltage source.

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

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

WARNING

Do not use improper combustible materials in drive installation.

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

Attach the drive to metal or other noncombustible material.

NOTICE

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

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

Follow cooling fan replacement instructions. The cooling fan cannot operate properly when it is installed incorrectly and could seriously damage the drive.

Follow the instructions in this manual to replace the cooling fan, making sure that the label is on top before inserting the cooling fan into the drive. To ensure maximum useful product life, replace both cooling fans when performing maintenance.

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

Improper equipment sequencing could result in damage to the drive.

Do not use unshielded cable for control wiring.

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

Do not allow unqualified personnel to use the product.

Failure to comply could result in damage to the drive.

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

Do not modify the drive circuitry.

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

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

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

Failure to comply could result in damage to the drive.

Comply with proper wiring practices.

The motor may run in reverse if the phase order is backward.

Connect motor input terminals U, V and W to drive output terminals U/T1, V/T2, and W/T3. The phase order for the drive and motor should match.

Frequently switching the drive power supply to stop and start the motor can damage the drive.

To get the full performance life out of the capacitor for the control power supply 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.

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.

2.2 Inspection

Power electronics have limited life and may exhibit changes in characteristics or performance deterioration after years of use under normal conditions. To help avoid such problems, it is important to perform preventive maintenance and periodic inspection on the drive.

Drives contain a variety of power electronics such as power transistors, semiconductors, capacitors, resistors, fans, and relays. The electronics in the drive serve a critical role in maintaining proper motor control.

Follow the inspection lists provided in this chapter as a part of a regular maintenance program.

Note: The drive will require more frequent inspection if it is placed in harsh environments, such as:

- High ambient temperatures
- Frequent starting and stopping
- Fluctuations in the AC supply or load
- Excessive vibrations or shock loading
- Dust, metal dust, salt, sulfuric acid, chlorine atmospheres
- Poor storage conditions.

Perform the first equipment inspection one to two years after installation.

◆ Recommended Daily Inspection

Table 2.1 outlines the recommended daily inspection for Yaskawa drives. Check the following items on a daily basis to avoid premature deterioration in performance or product failure. Copy this checklist and mark the “Checked” column after each inspection.

Table 2.1 General Recommended Daily Inspection Checklist

Inspection Category	Inspection Points	Corrective Action	Checked
Motor	Inspect for abnormal oscillation or noise coming from the motor.	• Check the load coupling. • Measure motor vibration. • Tighten all loose components.	
Cooling	Inspect for abnormal heat generated from the drive or motor and visible discoloration.	Check for the following: • Excessive load. • Loose connections. • Dirty heatsink or motor. • Ambient temperature.	
	Inspect drive cooling fan and circulation fan operation.	Check for the following: • Clogged or dirty fan. • Correct Fan operation parameter setting.	
Environment	Verify the drive environment complies with the specifications listed in the Specifications chapter in the User Manual packaged with the drive.	Eliminate the source of contaminants or correct poor environment.	
Load	The drive output current should not be higher than the motor or drive rating for an extended period of time.	Check for the following: • Excessive load. • Correct motor parameter settings.	
Power Supply Voltage	Check main power supply and control voltages.	• Correct the voltage or power supply to within nameplate specifications. • Verify all main circuit phases.	

◆ Recommended Periodic Inspection

Table 2.2 outlines the recommended periodic inspections for Yaskawa drive installations. Although periodic inspections should generally be performed once a year; the drive may require more frequent inspection in harsh environments or with rigorous use. Operating and environmental conditions, along with experience in each application, will determine the actual inspection frequency for each installation. Periodic inspection will help to avoid premature deterioration in performance or product failure. Copy this checklist and mark the "Checked" column after each inspection.

■ Periodic Inspection

WARNING! *Electrical Shock Hazard. Do not inspect, connect, or disconnect any wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing, disconnect all power to the equipment. The capacitor for the control power supply remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the control power supply voltage is below 50 Vdc. To prevent electric shock, wait for at least the time specified on the warning label; after all indicators are OFF, measure for unsafe voltages to confirm the drive is safe prior to servicing.*

Table 2.2 Periodic Inspection Checklist

Inspection Area	Inspection Points	Corrective Action	Checked
Main Circuit Periodic Inspection			
General	• Inspect equipment for discoloration from overheating or deterioration. • Inspect for damaged or deformed parts.	• Replace damaged components as required. • The drive has few serviceable parts and may require complete drive replacement.	
	Inspect for dirt, foreign particles, or dust collection on components.	• Inspect enclosure door seal if used. • Remove foreign particles and dust with a vacuum cleaner to avoid touching parts. • Replace components if cleaning is not possible.	
Conductors and Wiring	• Inspect wiring and connections for discoloration, damage, or heat stress. • Inspect wire insulation and shielding for wear.	Repair or replace damaged wiring.	
Terminals	Inspect terminals for stripped, damaged, or loose connections.	Tighten loose screws and replace damaged screws or terminals.	
Relays and Contactors	• Inspect contactors and relays for excessive noise during operation. • Inspect coils for signs of overheating such as melted or cracked insulation.	• Check coil voltage for overvoltage or undervoltage conditions. • Replace damaged removable relays, contactors, or circuit board.	
Electrolytic Capacitor	• Inspect for leaking, discoloration, or cracks. • Check if the cap has come off, for any swelling, or if the sides have burst open.	The drive has few serviceable parts and may require complete drive replacement.	
Diode, IGBT (Power Transistor)	Inspect for dust or other foreign material collected on the surface.	Remove foreign particles and dust with a vacuum cleaner to avoid touching parts.	
Motor Periodic Inspection			
Operation Check	Check for increased vibration or abnormal noise.	Stop the motor and contact qualified maintenance personnel as required.	
Control Circuit Periodic Inspection			
General	• Inspect terminals for stripped, damaged, or loose connections. • Make sure all terminals have been properly tightened.	• Tighten loose screws and replace damaged screws or terminals. • If terminals are integral to a circuit board, then board or drive replacement may be required.	
Circuit Boards	Check for any odor, discoloration, and rust. Make sure connections are properly fastened and that no dust or oil mist has accumulated on the surface of the board.	• Fix any loose connections. • If an antistatic cloth or vacuum plunger cannot be used, replace the board. • Do not use any solvents to clean the board. • Remove foreign particles and dust with a vacuum cleaner to avoid touching parts. The drive has few serviceable parts and may require complete drive replacement.	
Cooling System Periodic Inspection			
Cooling Fan, Circulation Fan	• Check for abnormal oscillation or unusual noise. • Check for damaged or missing fan blades.	• Replace as required. • *Refer to Drive Cooling Fans on page 174* for information on cleaning or replacing the fan.	
Heatsink	Inspect for dust or other foreign material collected on the surface.	Remove foreign particles and dust with a vacuum cleaner to avoid touching parts.	

Inspection Area	Inspection Points	Corrective Action	Checked
Display Periodic Inspection			
HOA Keypad	• Make sure data appears on the display properly. • Inspect for dust or other foreign material that may have collected on surrounding components.	• Contact Yaskawa or a Yaskawa representative if there is any trouble with the display or keypad. • Clean the HOA keypad.	

◆ Storage Guidelines

The drive contains electrolytic capacitors and fine electronic parts that undergo chemical changes. Observe the following precautions to help maintain the expected performance life and reliability during long-term storage.

■ Storage Location

Temperature and Humidity

Store the drive in a location that is between -10 and +40 °C with a relative humidity of 95% or less. Do not store the drive in direct sunlight or where condensation or ice will form.

Storage temperatures between -20 to +60 °C are allowed when storing the drive for approximately one month.

Note: Package and store the drive during shipping to protect it from vibration and shock.

Dust and Oil Mist

Do not store the drive in a dusty location or a location subject to oil mist.

Corrosive Gas

Do not store the drive in a location subject to corrosive gas.

Salt Damage

Do not store the drive in a location subject to salt damage, such as near the ocean.

Do not store the drive in adverse environments. Store all drives in storage rooms that are not subjected to adverse environmental elements.

Periodic Power Application

Yaskawa recommends applying power to the drive once per year for at least 30 minutes to prevent the capacitors from deteriorating.

When applying power after power has not been applied for more than two years, Yaskawa recommends using a variable power source and gradually increasing the power from 0 V to the rated drive voltage over a period of 2 to 3 minutes. Apply power for at least 1 hour with no load to age the main circuit electrolytic capacitor.

Wire the drive normally and check for drive faults, overcurrents, motor vibration, speed fluctuations, and other abnormalities during operation after performing the above procedure.

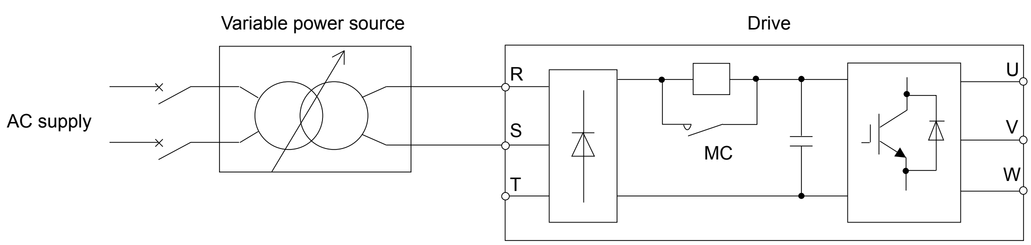


Figure 2.1 Power Distribution Method

2.3 Periodic Maintenance

The drive has Maintenance Monitors that keep track of component wear. This feature provides advance maintenance warning and eliminates the need to shut down the entire system for unexpected problems. The drive allows the user to check predicted maintenance periods for the components listed below.

- Cooling Fan, Circulation Fan
- Capacitors for the Control Power Supply
- Inrush Prevention Circuit

For replacement parts, contact the distributor where the drive was purchased or contact Yaskawa or a Yaskawa representative.

◆ Replacement Parts

Table 2.3 contains the estimated performance life of components that require replacement during the life of the drive. Only use Yaskawa replacement parts for the appropriate drive model and revision.

Table 2.3 Estimated Performance Life

Component	Estimated Performance Life
Cooling Fan, Circulation Fan	10 years
Capacitors for the Control Power Supply	10 years <1>

<1> Capacitors for the control power supply cannot be replaced on some lower capacity models. Complete drive replacement may be required for these models.

NOTICE: *Estimated performance life based on specific usage conditions. These conditions are provided for the purpose of replacing parts to maintain performance. Some parts may require more frequent replacement due to poor environments or rigorous use.*
Usage conditions for estimated performance life:
Ambient temperature: Yearly average of 40 °C (IP00/Open Type enclosure)
Load factor: 80% maximum
Operation time: 24 hours a day

■ Performance Life Monitors Maintenance Monitors

The drive calculates the maintenance period for components that may require replacement during the life of the drive. A percentage of the maintenance period is displayed on the digital operator by viewing the appropriate monitor parameter.

When the maintenance period reaches 100%, there is increased risk that the drive may malfunction. Yaskawa recommends checking the maintenance period regularly to ensure maximum performance life.

Refer to Recommended Periodic Inspection on page 169 for more details.

Table 2.4 Performance Life Monitors Used for Component Replacement

Parameter	Component	Contents
U4-03	Cooling Fan Circulation Fan	Displays the accumulated operation time of the fan from 0 to 99999 hours. The default value is 0. The value counts up from 0. The value is automatically reset to 0 after it reaches 99999.
U4-04		Displays the accumulated fan operation time as a percentage of the specified maintenance period. The default value is 0. The value counts up from 0.
U4-05	DC Bus Capacitors	Displays the accumulated time the capacitors are used as a percentage of the specified maintenance period. The default value is 0. The value counts up from 0.
U4-06	Pre-charge Circuit	Displays the number of times the drive is powered up as a percentage of the performance life of the inrush circuit. The default value is 0. The value counts up from 0.

■ Alarm Outputs for Maintenance Monitors

An output can be set up to inform the user when a specific components has neared its expected performance life.

When one of multi-function digital output terminals has been assigned the maintenance monitor function (H2-□□ = 2F), the terminal will close when the cooling fan, DC bus capacitors, or DC bus pre-charge relay reach 90% of expected performance life. Additionally the digital operator will display an alarm like shown in *Table 2.5* to indicate the specific components that may need maintenance.

Table 2.5 Maintenance Alarms

Display	Function	Corrective Action
LT-1 <1>	The cooling fans have reached 90% of their designated life time.	Replace the cooling fan.
LT-2 <1>	The DC bus capacitors have reached 90% of their designated life time.	Contact Yaskawa or a Yaskawa representative on possible drive replacement.
LT-3 <1>	The pre-charge circuit has reached 90% of its designated life time.	Contact Yaskawa or a Yaskawa representative on possible drive replacement.

<1> This alarm message will be output only if the Maintenance Monitor function is assigned to one of the digital outputs (H2-□□ = 2F). The alarm will also trigger a digital output that is programmed for alarm indication (H2-□□ = 10).

■ Related Drive Parameters

Use parameters o4-03, o4-05, and o4-07, to reset a Maintenance Monitor to zero after replacing a specific component. *Refer to Parameter List on page 191* for details on parameter settings.

NOTICE: *If these parameters are not reset after the corresponding parts have been replaced, the Maintenance Monitor function will continue to count down the performance life from the value that was reached with the old part. If the Maintenance Monitor is not reset, the drive will not have the correct value of the performance life for the new component.*

2.4 HOA Keypad Battery Replacement

The HOA keypad contains a monitor battery that allows the user to check drive functions. The battery requires periodic replacement because the lifespan of the battery is shorter than the performance life of the HOA keypad.

WARNING! *Fire Hazard. Properly handle the HOA keypad battery. Improper use of the battery may cause fire by explosion and injury. Correctly install the battery, paying attention to polarity (+/-). Do not charge the battery or improperly disassemble the HOA keypad.*

When replacing the battery, use a Hitachi Maxell CR1220 Lithium Manganese Dioxide Battery or an equivalent battery with the following specifications:

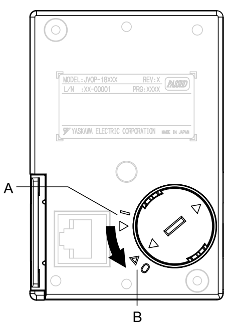
- Nominal Voltage 3 V
- Operating Temperature Range -20 °C to +85 °C
- Nominal battery life of 2 years (ambient temperature of +20 °C).

NOTICE: *Do not heat or throw the battery into fire. The battery remains in use even when power to the drive has been shut off. Be sure to also remove the battery in the HOA keypad when the drive will be shut off for long periods of time.*
A dead battery left inside the HOA keypad may leak and damage the keypad and drive. Replace the battery with a new one immediately after the expected lifespan has passed or when the “bAT” error is displayed on the HOA keypad.

NOTICE: *Observe Perchlorate Best Management Practices (BMPs). BMPs apply to primary lithium (manganese dioxide) coin batteries sold or distributed in California. Perchlorate Material special handling may apply, please refer to: www.dtsc.ca.gov/hazardouswaste/perchlorate.*

◆ Replacing the Battery

1. Shut off the power to the drive and remove the HOA keypad.
2. Insert the tip of a straight-edge screwdriver into the slot in the middle of the battery cover and turn the cover counter-clockwise to remove the cover.



A – Closed **B – Open**

Figure 2.2 Remove the Battery Cover

3. Remove the battery from the HOA keypad.
4. Correctly install the new battery.

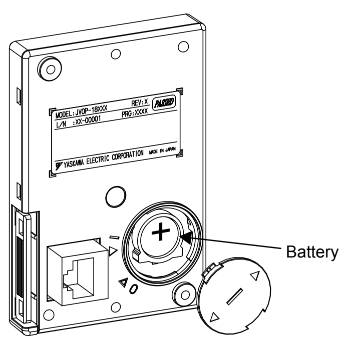


Figure 2.3 Install the Battery

5. Replace the battery cover on the HOA keypad, insert the tip of a straight-edge screwdriver, and turn the cover clockwise to close.
6. Replace the HOA keypad onto the drive.
7. Apply power to the drive and set o4-17 to 1 to set the Real Time Clock (RTC). Refer to the User Manual packaged with the drive for details on setting the RTC.

2.5 Drive Cooling Fans

NOTICE: *Follow cooling fan replacement instructions. The cooling fan cannot operate properly when installed incorrectly and could seriously damage the drive. To ensure maximum useful product life, replace all cooling fans when performing maintenance.*

Contact Yaskawa or a Yaskawa representative to order replacement cooling fans as required.

For drives with multiple cooling fans, replace all the fans when performing maintenance to ensure maximum product performance life.

◆ Number of Cooling Fans

■ Drive Models 2□0028 to 2□0248 and 4□0011 to 4□0414

Drive Model	Cooling Fans	Circulation Fans	Control Board Cooling Fans	Page
Three-Phase 200 V Class				
2□0028	2	–	–	176
2□0042	2	–	–	176
2□0054	2	–	–	176
2□0068	2	–	–	176
2□0081	2	–	–	176
2□0104	2	–	–	176
2□0130	2	–	–	176
2□0154	3	–	–	178
2□0192	3	–	–	178
2□0248	1	2	–	182
Three-Phase 400 V Class				
4□0011	2	–	–	176
4□0014	2	–	–	176
4□0021	2	–	–	176
4□0027	2	–	–	176
4□0034	2	–	–	176
4□0040	2	–	–	176
4□0052	2	–	–	176
4□0065	2	–	–	176
4□0077	2	–	–	176
4□0096	2	–	–	176
4□0124	2	–	–	176
4□0156	3	–	–	178
4□0180	3	–	–	178
4□0216	1	2	–	182
4□0240	1	2	–	182
4□0302	2	2	–	182
4□0361	2	2	–	182
4□0414	2	2	–	182

◆ Cooling Fan Component Names

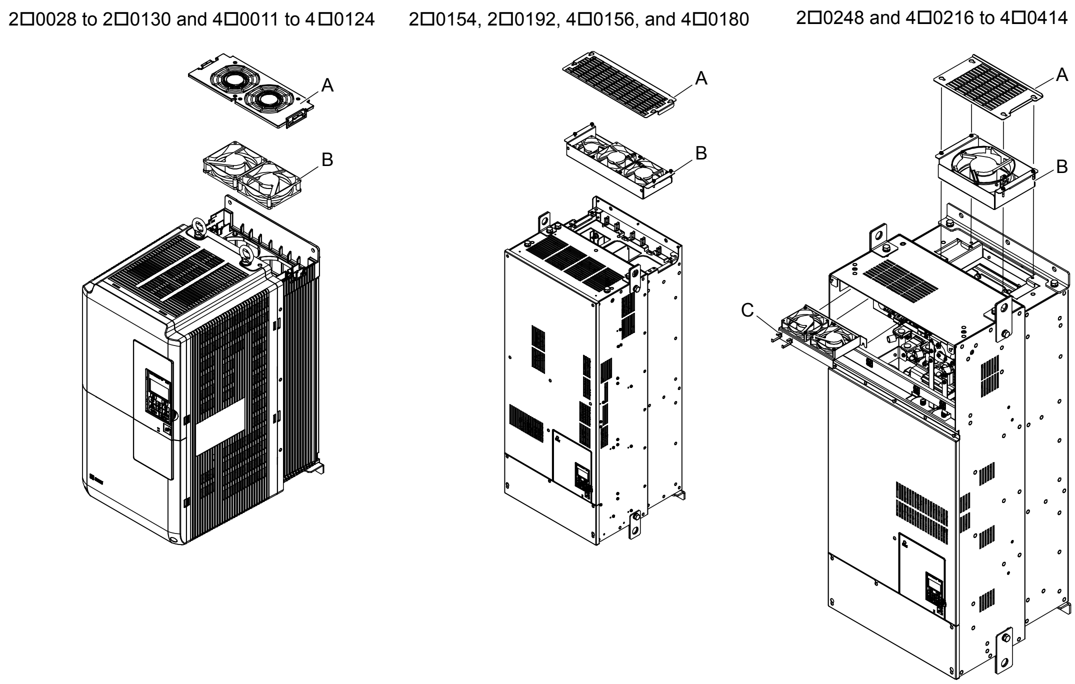
WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The capacitor for the control power supply remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

NOTICE: *Prevent Equipment Damage. Follow cooling fan and circulation fan replacement instructions. Fans cannot operate properly when they are installed incorrectly and can damage the drive. Follow the instructions below to replace the fans, making sure that the label is on top before inserting the fan into the drive. To ensure maximum useful product life, replace all fans when performing maintenance.*

Note: Procedures shown in this section use a representative drive model. Figures in these procedures may differ slightly from the actual model used by the customer.

■ Drive Models 2□0028 to 2□0248 and 4□0011 to 4□0414



A – Fan guard
B – Cooling Fan/Cooling Fan Unit
C – Circulation Fan Unit

Figure 2.4 Drive Cooling Fan Component Names

◆ Drive Cooling Fan Replacement: Models 2□0028 to 2□0130 and 4□0011 to 4□0124

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The capacitor for the control power supply remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

NOTICE: *Prevent Equipment Damage. Follow cooling fan and circulation fan replacement instructions. Improper fan replacement could cause damage to equipment. Make sure the fan is facing upwards when installing the replacement fan into the drive. Replace all fans when performing maintenance to help ensure maximum useful product life.*

■ Removing the Cooling Fan Guard and Cooling Fan

1. Depress the right and left sides of the fan guard tabs and pull upward. Remove the fan guard from the top of the drive.

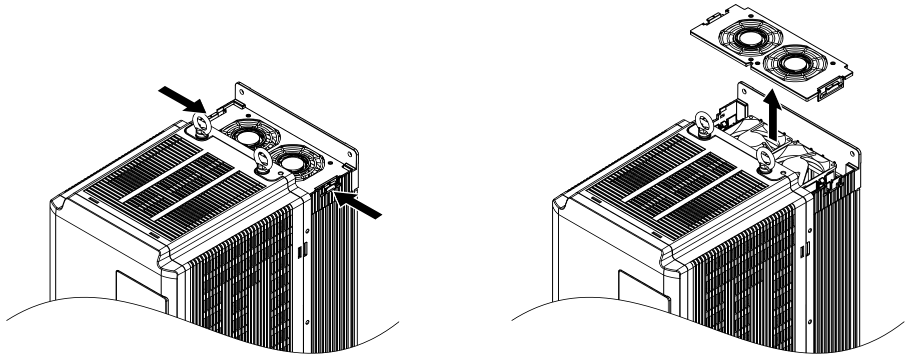


Figure 2.5 Remove the Fan Guard

2. Remove the cooling fan cartridge.

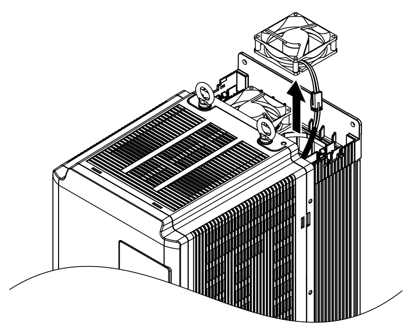


Figure 2.6 Remove the Cooling Fan Cartridge

3. Disconnect the pluggable connector and remove the fan.

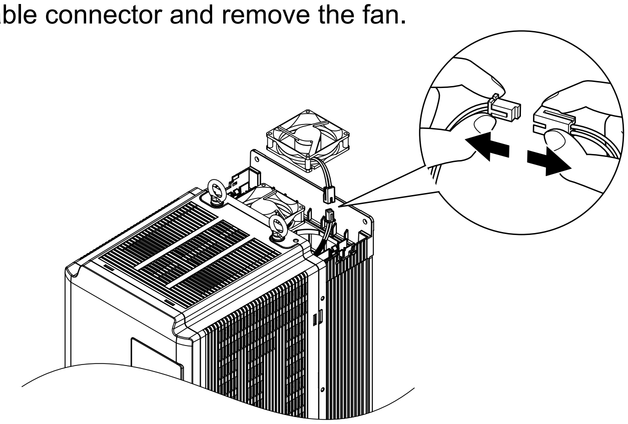


Figure 2.7 Disconnect the Cooling Fan

■ Installing the Cooling Fan

Reverse the procedure described above to reinstall the cooling fan.

1. Properly plug the relay connector.

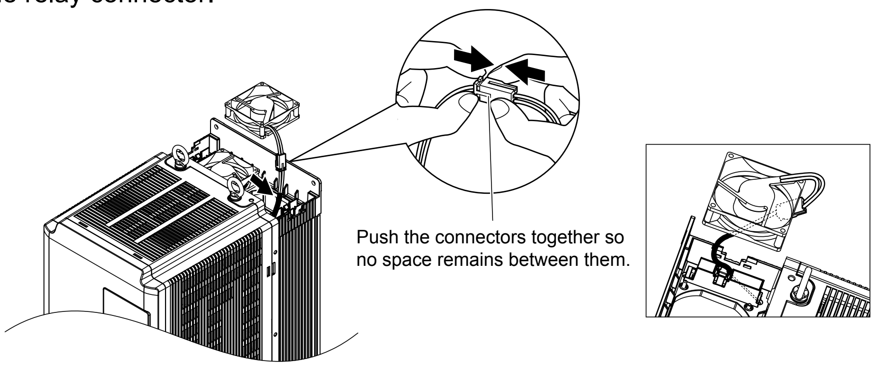
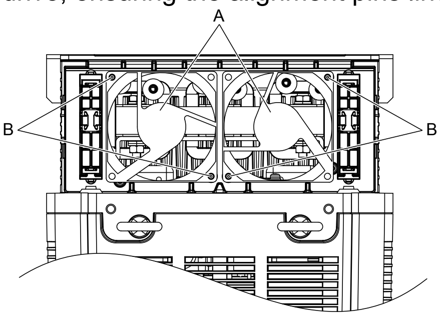


Figure 2.8 Plug the Relay Connector

2. Install the replacement fan into the drive, ensuring the alignment pins line up as shown in ***Figure 2.9***.



A – Label facing up

B – Make sure the alignment pins line up properly.

Figure 2.9 Install the Cooling Fan

3. Properly connect the fan power lines, then place the cable back into the recess of the drive.

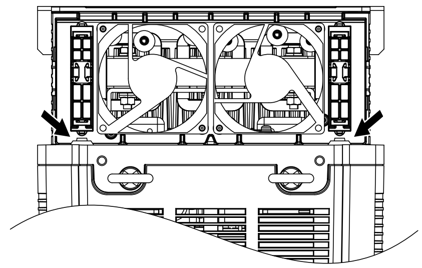


Figure 2.10 Relay Connector Placement

4. While pressing in on the tabs on the left and right sides of the fan guard, guide the fan guard until it clicks back into place.

Note: The fan guard has a cutout on the front side for proper alignment.

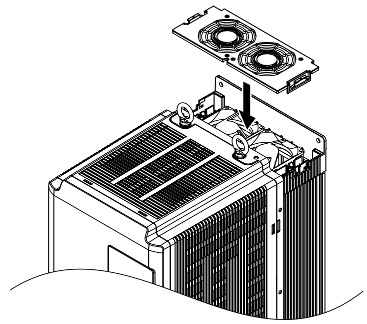


Figure 2.11 Reattach the Fan Guard

5. Turn on the power supply and set o4-03 to 0 to reset the Maintenance Monitor cooling fan operation time.

◆ Drive Cooling Fan Replacement: Models 2□0154, 2□0192, 4□0156, and 4□0180

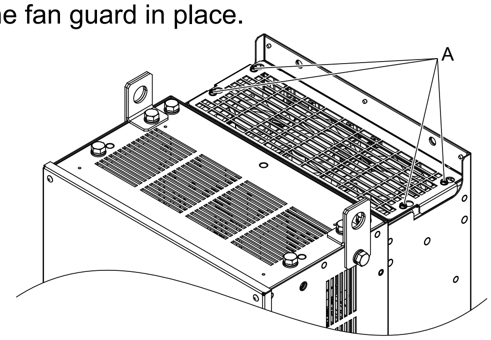
WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The capacitor for the control power supply remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

NOTICE: *Prevent Equipment Damage. Follow cooling fan and circulation fan replacement instructions. Improper fan replacement could cause damage to equipment. Make sure the fan is facing upwards when installing the replacement fan into the drive. Replace all fans when performing maintenance to help ensure maximum useful product life.*

■ Removing the Fan Guard and Cooling Fan

1. Loosen the 4 screws that hold the fan guard in place.



A –Screw locations

Figure 2.12 Loosen the Screws

2. Slide the fan guard toward the front of the drive to remove it from the drive.

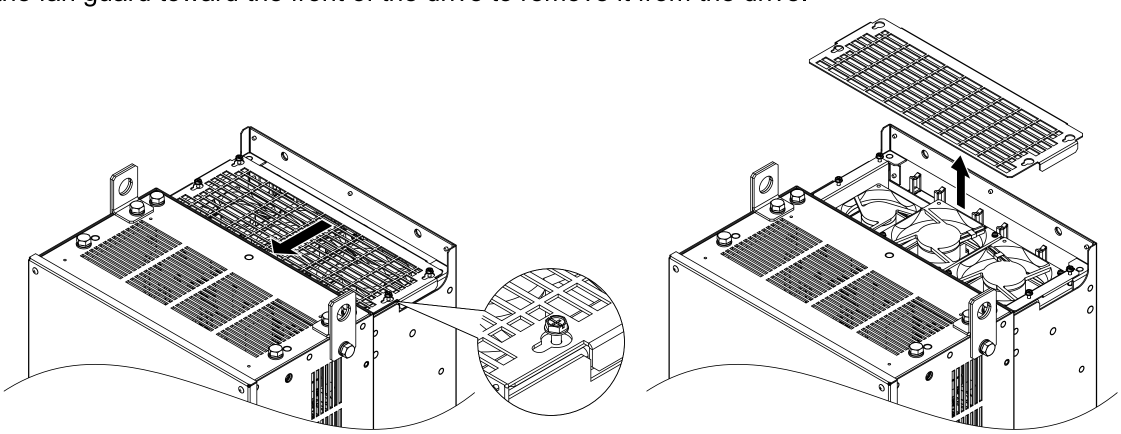
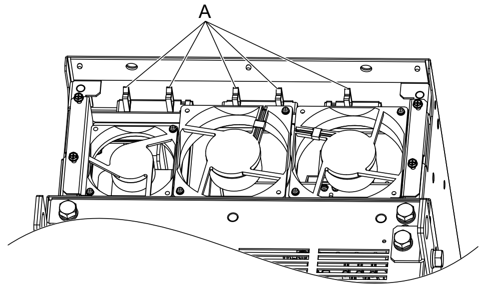


Figure 2.13 Remove the Fan Guard

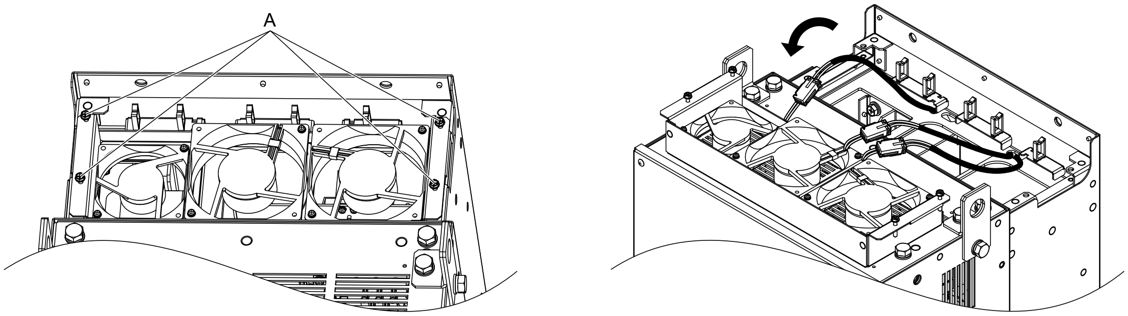
3. Release the cables from the hooks in 5 locations.



A –Hook locations

Figure 2.14 Release the Cables

4. Loosen the 4 screws affixing the cooling fan unit.



A –Screw locations

Figure 2.15 Remove the Cooling Fan Unit

5. Disconnect the 3 pluggable connectors and remove the fan unit from the drive.

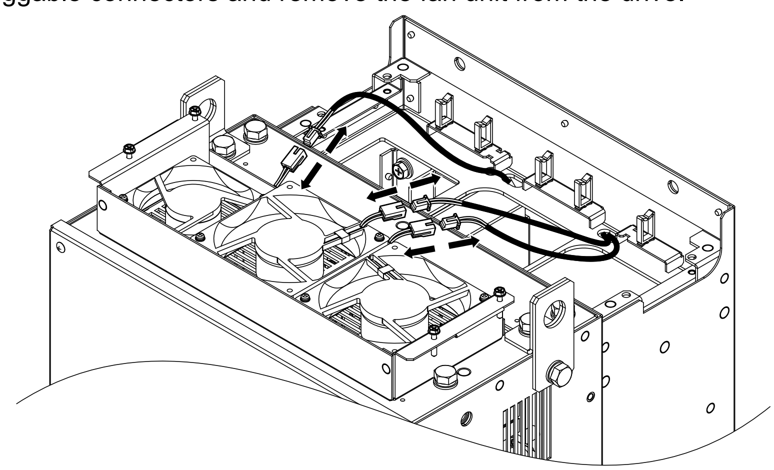


Figure 2.16 Unplug the Relay Connectors

■ Installing the Cooling Fan Unit

1. Connect the relay connectors for the fans in the replacement fan unit.

Note: Replace the whole unit when performing maintenance on the cooling fans.

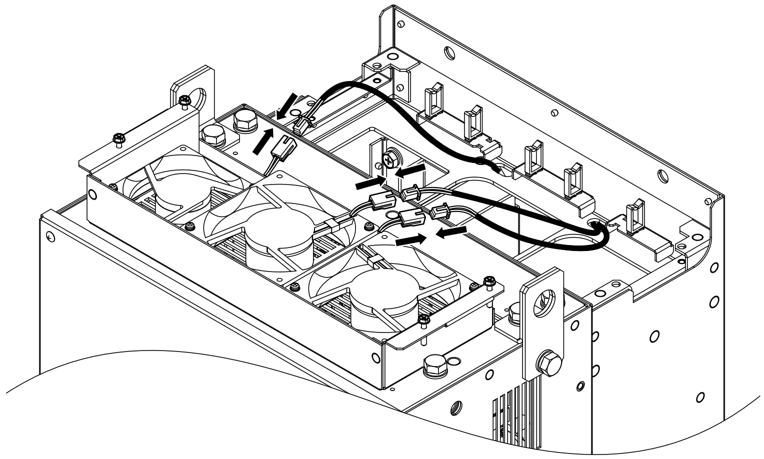


Figure 2.17 Plug the Relay Connectors

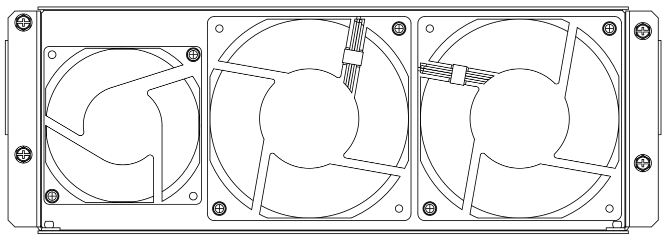
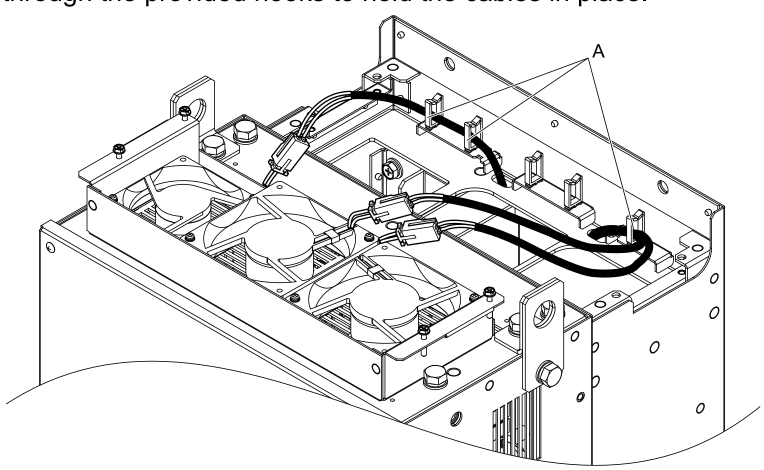


Figure 2.18 Cooling Fan Unit

2. Guide the fan cables through the provided hooks to hold the cables in place.



A –Hook locations

Figure 2.19 Position the Fan Cables

3. Install the cooling fan unit while pulling the cables upward.

Note: Do not pinch the fan cable between parts when reassembling the fan unit.

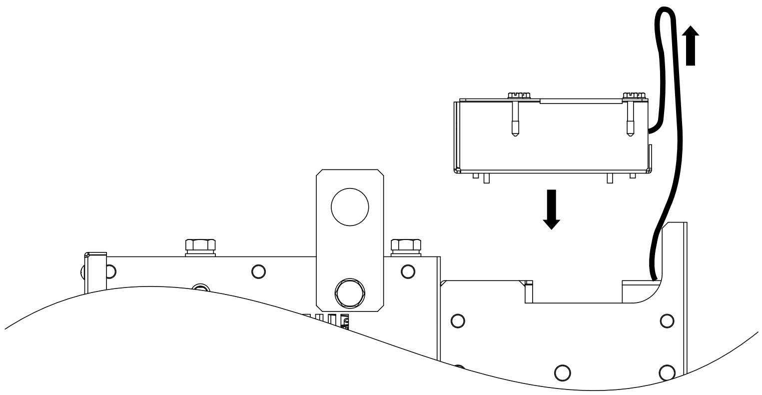
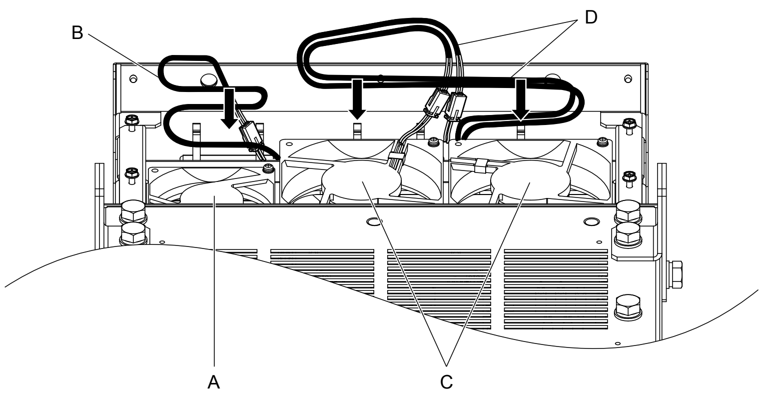


Figure 2.20 Install the Cooling Fan Unit

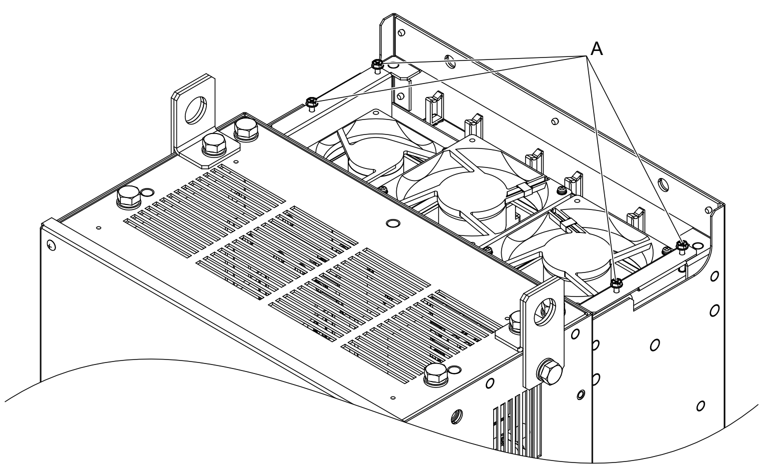
4. Guide the cables through the second set of provided hooks to hold the cables in place.



A – Cooling fan A
B – Bend 3 times
C – Cooling fan B
D – Bend 2 times

Figure 2.21 Cooling Fan Wire Routing

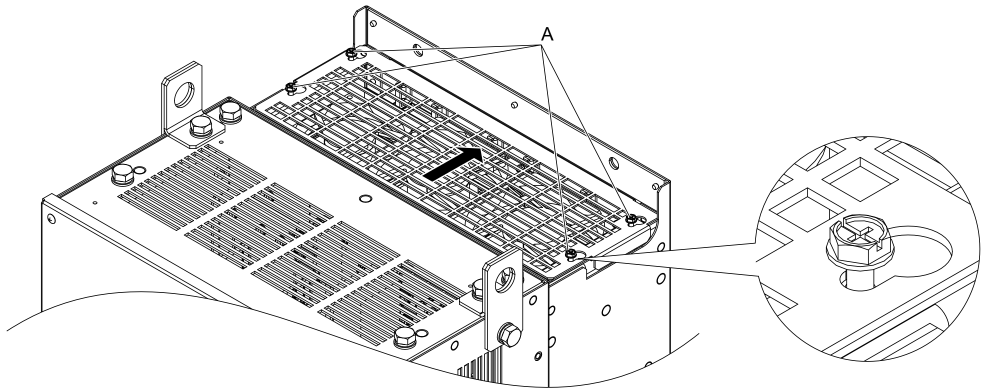
5. Thread the 4 fan unit screws into the proper holes approximately 2/3 of the way. Leave enough space to reinsert the fan guard.



A –Screw locations

Figure 2.22 Insert Cooling Fan Screws

6. Insert the fan guard and firmly tighten the screws so they do not come loose.



A –Screw locations

Figure 2.23 Reattach the Fan Guard

7. Turn on the power supply and set o4-03 to 0 to reset the Maintenance Monitor cooling fan operation time.

◆ Drive Cooling Fan Replacement: Models 2☐0248 and 4☐0216 to 4☐0414

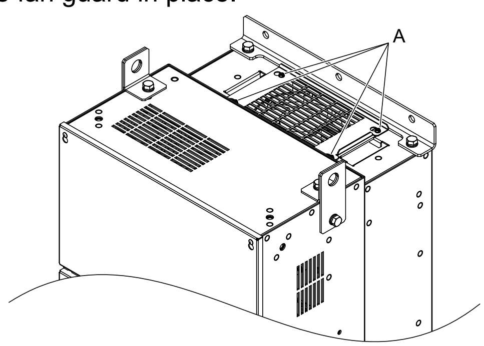
WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

CAUTION! *Burn Hazard. Do not touch a hot drive heatsink. Failure to comply could result in minor or moderate injury. Shut off the power to the drive when replacing the cooling fan. To prevent burns, wait at least 15 minutes and ensure the heatsink has cooled down.*

NOTICE: *Prevent Equipment Damage. Follow cooling fan and circulation fan replacement instructions. Improper fan replacement could cause damage to equipment. Follow the instructions and replace the entire unit when replacing the cooling fan.*

■ Removing the Fan Guard and Cooling Fan

1. Loosen the 4 screws that hold the fan guard in place.



A –Screw locations

Figure 2.24 Loosen the Screws

2. Slide the fan guard toward the right to remove it from the drive.

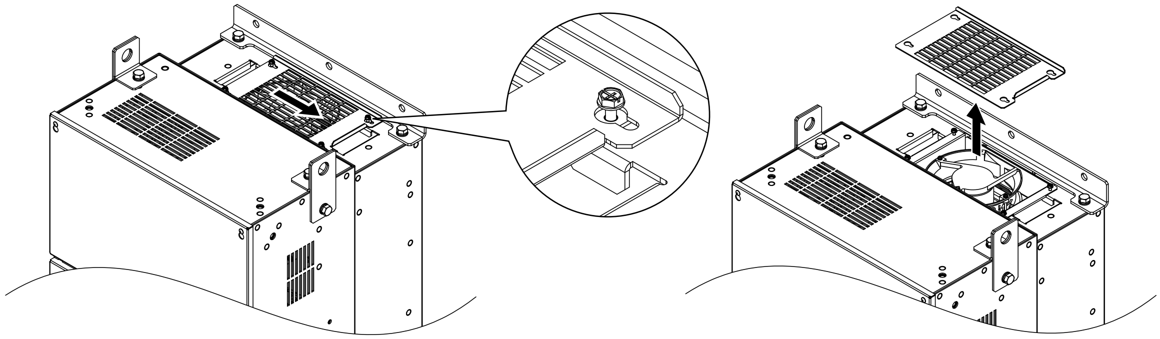
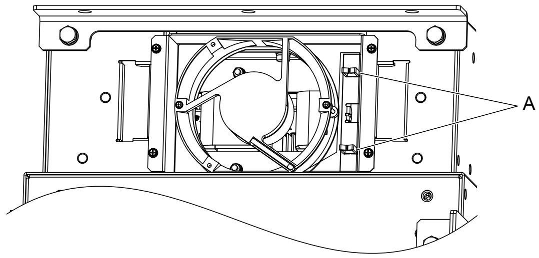


Figure 2.25 Remove the Fan Guard

3. Release the cable from the hooks.

Note: Models 4☐0302 to 4☐0414 have 4 hooks.



A –Hook locations

Figure 2.26 Release the Cable

4. Loosen the 2 screws affixing the cooling fan unit.

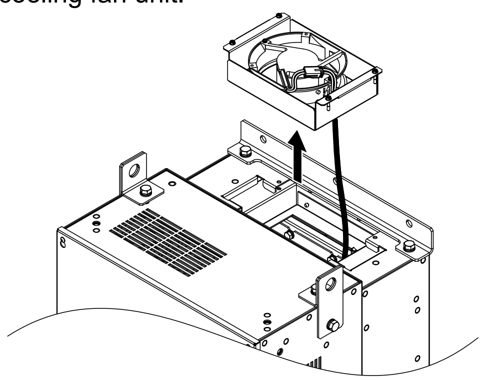


Figure 2.27 Remove the Cooling Fan Unit

5. Unplug the relay connector and release the fan from the drive.

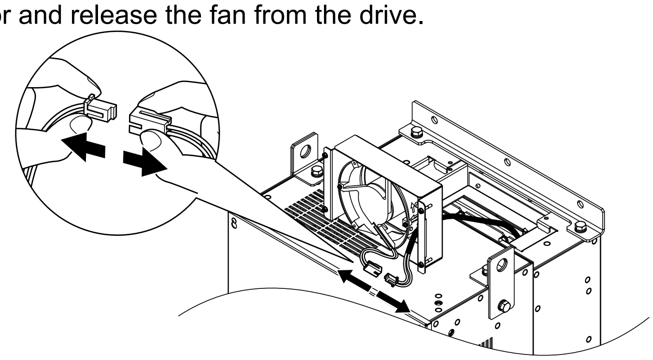
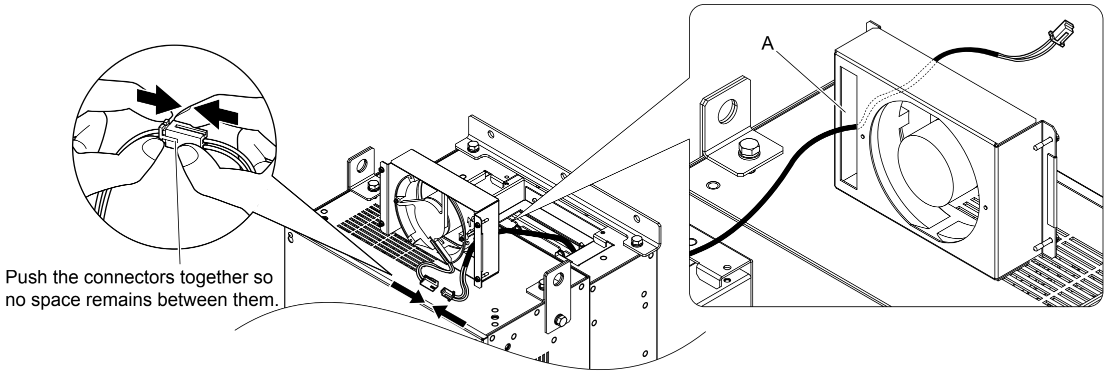


Figure 2.28 Unplug the Relay Connector

◆ Installing the Cooling Fan

1. Pass the cable through the opening of the replacement cooling fan unit from the back side, then plug the relay connector.



A –Opening

Figure 2.29 Attach the Relay Connector

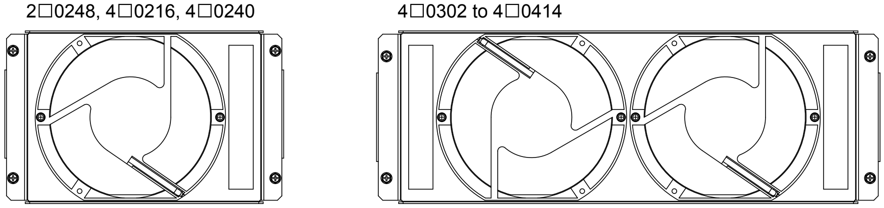
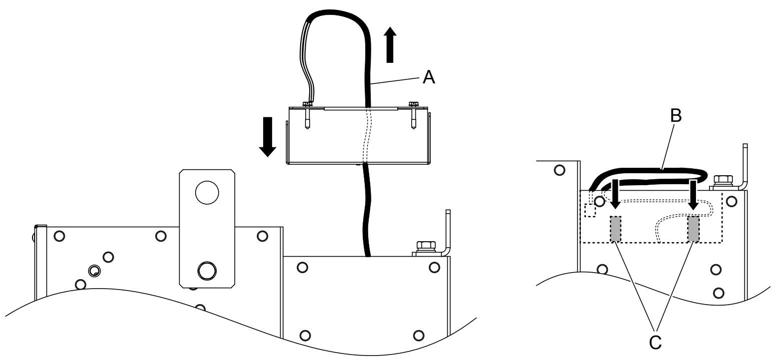


Figure 2.30 Cooling Fan Unit

2. Install the cooling fan unit and place the cable back into position.

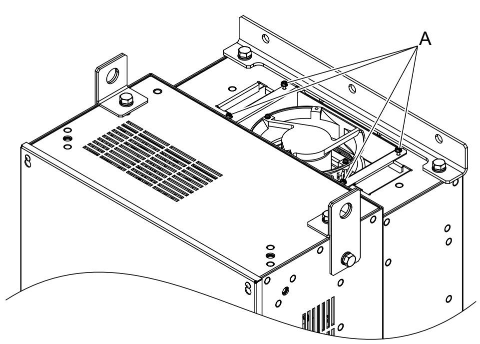
Note:
1. Replace the whole unit when performing maintenance on the cooling fans.
2. Install the cooling fan unit while pulling the cable upward so that the cable does not get pinched between parts.



A – Pull the cable upwards
B – Bend 3 times
C – Hook

Figure 2.31 Install the Cooling Fan

3. Thread the 4 fan unit screws into the proper holes approximately 2/3 of the way. Leave enough space to reinsert the fan guard.



A –Screw locations

Figure 2.32 Attach the Cooling Fan Unit

4. Reattach the fan guard and then tighten the screws firmly so that the screws do not come loose.

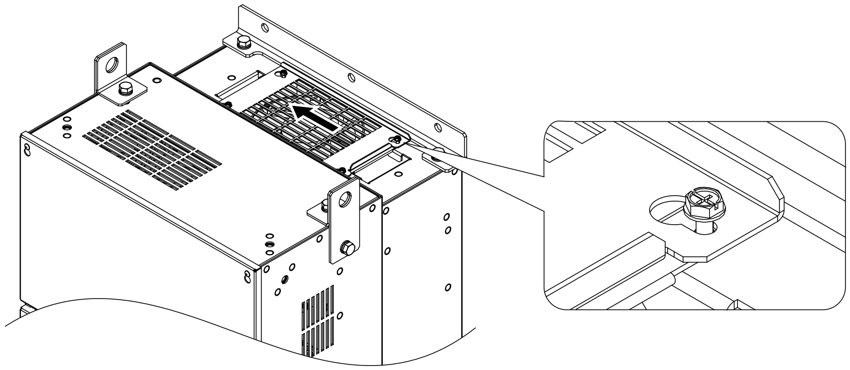
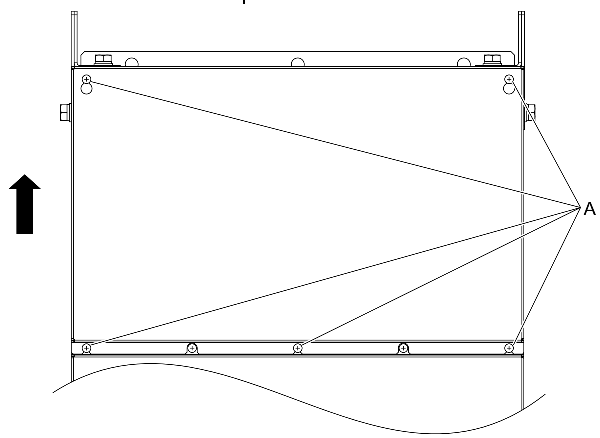


Figure 2.33 Reattach the Fan Cover

■ Removing the Circulation Fan

CAUTION! *Crush Hazard. Do not completely remove the cover screws, just loosen them. If the cover screws are removed completely, the terminal cover may fall off causing an injury. Take special care when removing/reattaching the terminal covers for larger drives.*

1. Loosen the 5 screws that hold the drive cover in place.



A –Screw locations

Figure 2.34 Remove the Drive Cover

2. Unlock the 2 cable hooks.

Note: The circulation fan unit on models 4☐0302 to 4☐0414 is located on the right side of the drive.

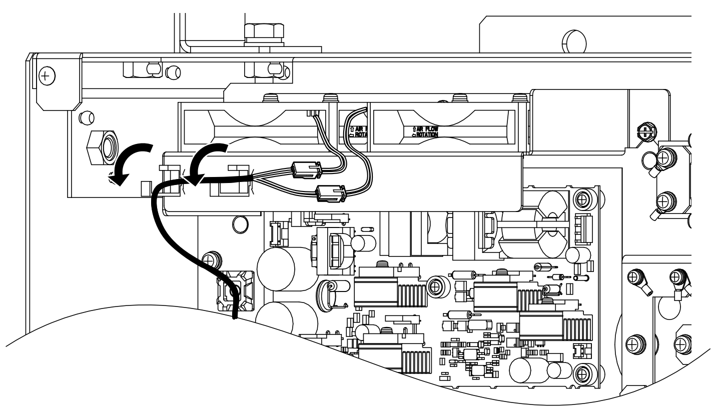


Figure 2.35 Unlock the Cable Hooks

3. Unplug the relay connectors and release the cable from the hooks.

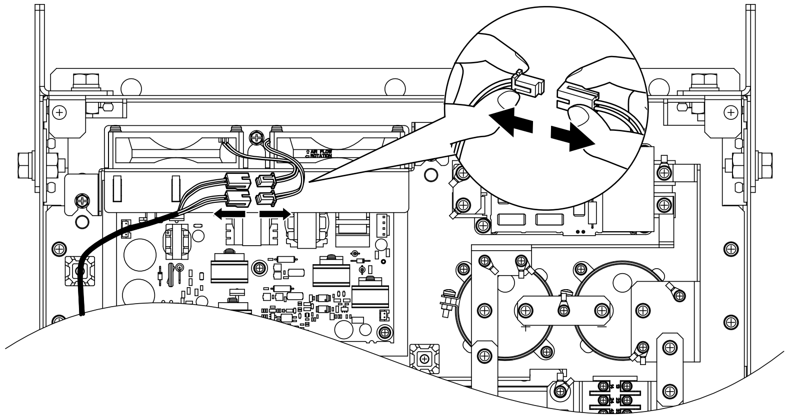
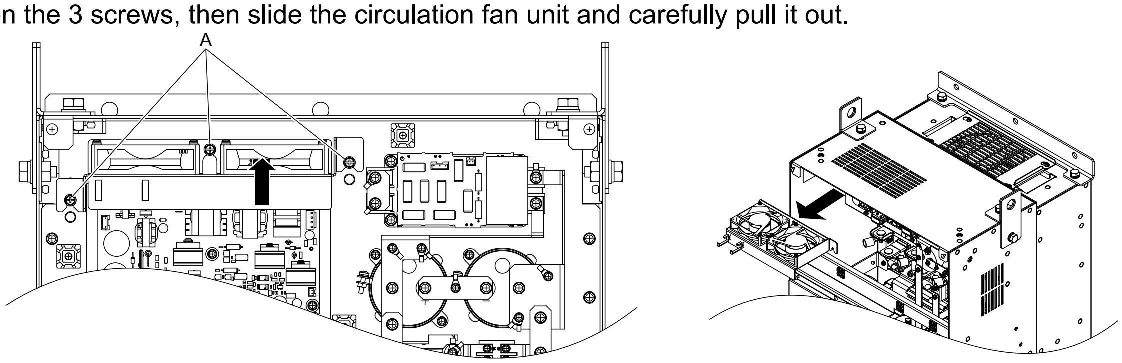


Figure 2.36 Unplug the Relay Connector

4. Loosen the 3 screws, then slide the circulation fan unit and carefully pull it out.



A –Screw locations

Figure 2.37 Remove the Circulation Fan

■ Installing the Circulation Fan

CAUTION! *Crush Hazard. Do not completely remove the cover screws, just loosen them. If the cover screws are removed completely, the terminal cover may fall off causing an injury. Take special care when removing/reattaching the terminal covers for larger drives.*

1. Reverse the procedure described above to install the replacement circulation fan unit.

Note:
1. Replace the whole unit when performing maintenance on the circulation fans.
2. Place the cables back into the hooks to secure.
3. Do not pinch the fan cable between parts when reassembling the fan unit.
4. Tighten the screws firmly so they do not come loose.

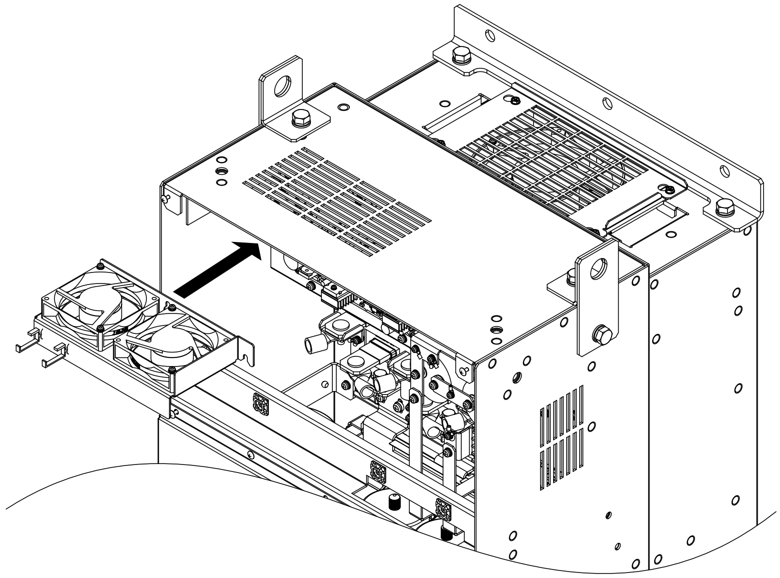


Figure 2.38 Installing the Circulation Fan

2. Turn on the power supply and set o4-03 to 0 to reset the Maintenance Monitor circulation fan operation time.

2.6 Drive Replacement

◆ Serviceable Parts

The drive contains some serviceable parts. The following parts can be replaced over the life span of the drive:

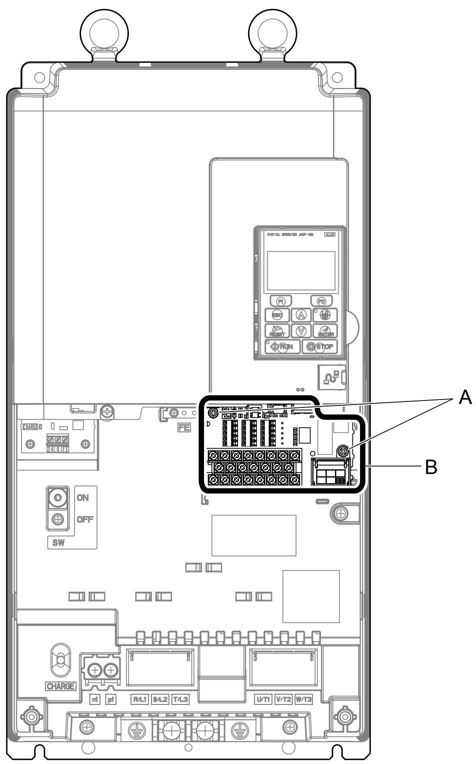
- Terminal board I/O PCBs
- Cooling fan(s)
- Front cover

Replace the drive if the main power circuitry is damaged. Contact Yaskawa or a Yaskawa representative before replacing parts if the drive is still under warranty. Yaskawa reserves the right to replace or repair the drive according to Yaskawa warranty policy.

◆ Terminal Board

The drive has a modular I/O terminal block that facilitates quick drive replacement. The terminal board contains on-board memory that stores all drive parameter settings and allows the parameters to be saved and transferred to the replacement drive. To transfer the terminal board, disconnect the terminal board from the damaged drive and reconnect it to the replacement drive. There is no need to manually reprogram the replacement drive after transferring the terminal board.

Note: If the damaged drive and the new replacement drive are have different capacities, the data stored in the terminal board cannot be transferred to the new drive and an oPE01 error will appear on the display. The terminal board can still be used, but parameter setting from the old drive cannot be transferred. The replacement drive must be initialized and manually programmed.



A – Terminal board locking screws **B – Removable terminal board**

Figure 2.39 Terminal Board

◆ Replacing the Drive

WARNING! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply can result in serious personal injury. Before servicing the drive, disconnect all power to the equipment. The capacitor for the control power supply remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the drive before touching any components.*

WARNING! *Electrical Shock Hazard. Do not allow unqualified personnel to perform work on the drive. Failure to comply could result in serious injury. Installation, maintenance, inspection, and service must be performed only by authorized personnel familiar installation, adjustment, and maintenance of drives.*

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.*

The following procedure explains how to replace a drive.

This section provides instructions for drive replacement only.

To install option boards or other types of options, refer to the specific manuals for those options.

NOTICE: *When transferring a braking transistor, braking resistor, or other type of option from a damaged drive to a new replacement drive, make sure it is working properly before reconnecting it to the new drive. Replace broken options to prevent immediate breakdown of the replacement drive.*

1. Remove the terminal cover.

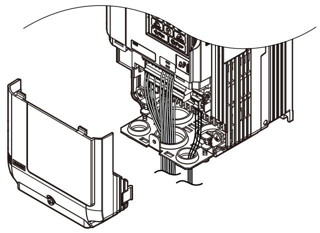


Figure 2.40 Remove the Terminal Cover

2. Loosen the screws holding the terminal board in place. Remove the screw securing the bottom cover and remove the bottom cover from the drive.

Note: IP00/Open Type enclosure drives do not have a bottom cover.

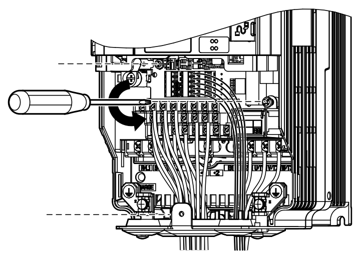


Figure 2.41 Unscrew the Terminal Board

3. Slide the terminal board as illustrated by the arrows in *Figure 2.42* to remove it from the drive along with the bottom cover.

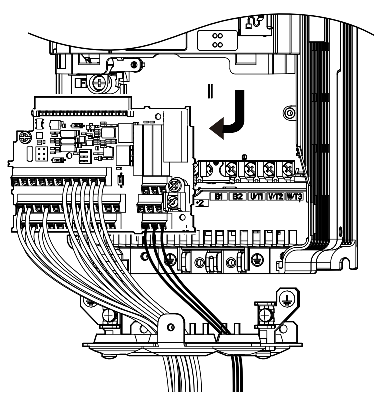


Figure 2.42 Remove the Terminal Board

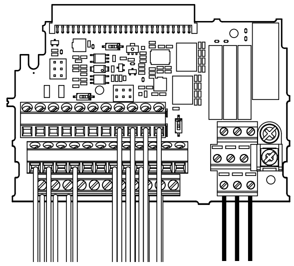


Figure 2.43 Disconnected Removable Terminal Board

4. Disconnect all option cards and options, making sure they are intact before reusing.
5. Replace the drive and wire the main circuit.

■ Installing the Drive

1. After wiring the main circuit, connect the terminal block to the drive as shown in *Figure 2.44*. Use the installation screw (M3: 0.49 - 0.73 N·m) to fasten the terminal block into place.

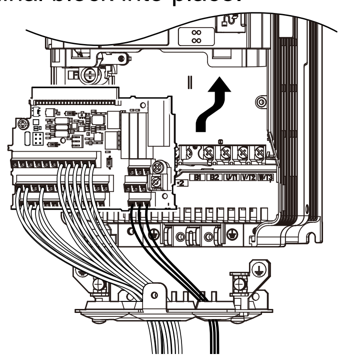


Figure 2.44 Install the Terminal Board

2. Reconnect options for the new drive the same way the options were connected in the old drive. Connect option boards to the same option ports in the new drive that were used in the old drive.
3. Replace the terminal cover.
4. After powering on the drive, all parameter settings are transferred from the terminal board to the drive memory. If an oPE04 error occurs, load the parameter settings saved on the terminal board to the new drive by setting parameter A1-03 to 5550. Reset the Maintenance Monitor function timers by setting parameters o4-01 through o4-12 to 0, and parameter o4-13 to 1.

Note:
1. When replacing a previous generation product with U1000, do not use the previous generation terminal board.
2. Set the correct value in o2-04. *Refer to Defaults by Drive Model on page 259* for details.
3. Contact Yaskawa or a Yaskawa representative for instructions on replacing the terminal board. Improperly replacing the terminal board will result in drive malfunction.

Appendix: A

Parameter List

This appendix contains a full listing of all parameters and settings available in the drive.

A.1 Understanding Parameter Descriptions

◆ Control Modes, Symbols, and Terms

The table below lists terms and symbols used in this section to indicate parameter availability and control.

Table A.1 Symbols and Icons Used in Parameter Descriptions

Symbol	Description
OLV/PM	Parameter is ONLY available when operating the drive with Open Loop Vector for PM motors.
RUN	Parameter can be changed during run.

A.2 Parameter Groups

Table A.2 Parameter Groups

Parameter Group	Name	Page
A1	Initialization Parameters	194
A2	User Parameters	194
b1	Operation Mode Selection	195
b2	DC Injection Braking	196
b3	Speed Search	196
b4	Timer Function	198
b5	PID Control	198
b8	Energy Saving	201
C1	Acceleration and Deceleration Times	202
C2	S-Curve Characteristics	202
C4	Torque Compensation	202
C6	Carrier Frequency	203
d1	Frequency Reference	204
d2	Frequency Upper/Lower Limits	204
d3	Jump Frequency	205
d4	Frequency Reference Hold and Up/Down 2 Function	205
d6	Field Weakening	205
d7	Offset Frequency	206
E1	V/f Pattern for Motor 1	207
E2	Motor 1 Parameters	208
E5	PM Motor Settings	208
F6, F7	Communication Option Card	211
H1	Multi-Function Digital Inputs	217
H2	Multi-Function Digital Outputs	221
H3	Multi-Function Analog Inputs	223
H4	Multi-Function Analog Outputs	225
H5	MEMOBUS/Modbus Serial Communication	226
L1	Motor Protection	228
L2	Momentary Power Loss Ride-Thru	229
L3	Stall Prevention	229
L4	Speed Detection	230
L5	Fault Restart	231
L6	Torque Detection	231
L8	Drive Protection	232
n1	Hunting Prevention	234
n3	High Slip Braking (HSB) and Overexcitation Braking	234
n8	PM Motor Control Tuning	234
o1	HOA Keypad Display Selection	236
o2	HOA Keypad Functions	237
o3	Copy Function	238
o4	Maintenance Monitor Settings	238
S1	Stillness Control	239
S2	Sequence Timer Operation	239
S3	Secondary PI Control	241
S4	Bypass Functions	243
S5	HAND Key Functions	243
S6	Phase Order Selection	243
T1	Induction Motor Auto-Tuning	245
T2	PM Motor Auto-Tuning	246
U1	Operation Status Monitors	248
U2	Fault Trace	250
U3	Fault History	251
U4	Maintenance Monitors	253
U5	PID Monitors	254
U6	Operation Status Monitors	255

A.3 A: Initialization Parameters

The A parameter group creates the operating environment for the drive. This includes the parameter Access Level, Motor Control Method, Password, User Parameters and more.

◆ A1: Initialization

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
A1-00 (0100) RUN <1>	Language Selection	Select Language 0: English 1: ニホンゴ (Japanese) 3: Français 5: Español 6: Portuguêse	0: English 1: Japanese 3: French 5: Spanish 6: Portuguese	Default: 0 Range: 0 to 6	10
A1-01 (0101) RUN <2>	Access Level Selection	Access Level 0: Operation Only 1: User Parameters 2: Advanced Level	0: View and set A1-01 and A1-04. U□-□□ parameters can also be viewed. 1: User Parameters (access to a set of parameters selected by the user, A2-01 to A2-32) 2: Advanced Access (access to view and set all parameters)	Default: 2 Range: 0 to 2	10
A1-02 (0102) <1>	Control Method Selection	Control Method 0: V/F Control 5: PM OpenLoop Vect	0: V/f Control 5: Open Loop Vector Control for PM	Default: 0 Range: 0, 5	10
A1-03 (0103)	Initialize Parameters	Init Parameters 0: No Initialize 1110: User Initialize 2220: 2-Wire Initial 3330: 3-Wire Initial 3410: SELVAL HVAC Initialize 3420: SELVAL OEM Bypass Init	0: No initialization 1110: User Initialize (parameter values must be stored using parameter o2-03) 2220: 2-Wire Initialization 3330: 3-Wire Initialization 3410: HVAC Initialization 3420: OEM Bypass Initialization	Default: 0 Range: 0 to 3420	11
A1-04 (0104)	Password	Enter Password	When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 through A1-03, A1-06, and A2-01 through A2-32 cannot be changed.	Default: 0000 Min.: 0000 Max.: 9999	12
A1-05 (0105)	Password Setting	Select Password	When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 through A1-03, A1-06, and A2-01 through A2-32 cannot be changed.	Default: 0000 Min.: 0000 Max.: 9999	12
A1-06 (0127)	Application Preset	Application Sel 0: General 1: Fan General 2: Fan PID 3: Fan ReturnAir/PID 4: Cooling Tower 5: CoolingTower/PID 6: Pump Secondary 7: Pump PID	0: Standard 1: Fan 2: Fan with PID Control 3: Return Fan with PID Control 4: Cooling Tower Fan 5: Cooling Tower Fan with PID Control 6: Pump (Secondary) 7: Pump with PID Control	Default: 0 Range: 0 to 7	14

<1> Parameter setting value is not reset to the default value when the drive is initialized.

<2> Default setting value is dependent on the Application Preset selected with parameter A1-06.

◆ A2: User Parameters

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
A2-01 to A2-32 (0106 to 0125)	User Parameters 1 to 32	User Param 1 - 32	Recently edited parameters are listed here. The user can also select parameters to appear here for quicker access.	Default: <1> <2> Range: A1-00 to S6-07	14
A2-33 (0126)	User Parameter Automatic Selection	User Parms Sel 0: Disabled 1: Enabled	0: Parameters 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.	Default: 1 <3> Range: 0, 1	15

<1> Default setting value is dependent on the Application Preset selected with parameter A1-06.

<2> This setting is the default setting of the Setup Group parameters. Refer to TOEPC71063610 User Manual Section 4 for details.

<3> Default setting value is determined by parameter A1-06. Default is 0 when A1-06 = 0, and 1 when A1-06 ≠ 0.

A.4 b: Application

Application parameters configure the source of the Run command, DC Injection Braking, Speed Search, timer functions, PID control, Energy Savings, and a variety of other application-related settings.

◆ b1: Operation Mode Selection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b1-01 (0180)	Frequency Reference Selection for AUTO mode	Ref Source 1 0: Operator 1: Analog Input 2: Serial Com 3: Option PCB	0: HOA keypad 1: Terminals (Analog Input Terminals) 2: Serial communications (APOGEE FLN, BACnet, MEMOBUS/Modbus, or Metasys N2) 3: Option card	Default: 1 Range: 0 to 3	16
b1-02 (0181)	Run Command Selection for AUTO mode	Run Source 1 1: Digital Inputs 2: Communication 3: Option PCB	1: Control Circuit Terminal 2: Serial communications (APOGEE FLN, BACnet, MEMOBUS/Modbus, or Metasys N2) 3: Option card	Default: 1 Range: 1 to 3	17
b1-03 (0182)	Stopping Method Selection	Stopping Method 0: Ramp to Stop 1: Coast to Stop 2: DCInj to Stop 3: Coast w/Timer	0: Ramp to stop 1: Coast to stop 2: DC Injection Braking to stop 3: Coast with timer	Default: 1 Range: 0 to 3	18
b1-04 (0183)	Reverse Operation Selection	Reverse Oper 0: Reverse Enabled 1: Reverse Disabled	0: Reverse enabled 1: Reverse disabled	Default: 1 Range: 0, 1	19
b1-06 (0185)	Digital Input Reading	Cntl Input Scans 0: 1 Scan 1: 2 Scans	0: Input status is read once and processed immediately (for quicker response) 1: Input is read twice and processed only if the status is the same in both readings (robust against noisy signals)	Default: 1 Range: 0, 1	20
b1-08 (0187)	Run Command Selection in Programming Mode	RUN dur PRG Mode 0: Run Disabled@PRG 1: ModeRun Enabled@PRG 2: Prg only @ Stop	0: Run command is not accepted while in Programming Mode 1: Run command is accepted while in Programming 2: Prohibit entering Programming Mode during Run	Default: 0 Range: 0 to 2	20
b1-11 (01DF)	Drive Delay Time Setting	Run Delay Time	After a Run command is entered, the drive output waits until this delay time has passed before starting.	Default: 0 s Min.: 0 Max.: 600	20
b1-14 (01C3)	Phase Order Selection	Rotation Sel 0: Standard 1: SwitchPhaseOrder	0: Standard 1: Switch phase order (reverses the direction of the motor)	Default: 0 Range: 0, 1	20
b1-17 (01C6)	Run Command at Power Up	Run Cmd @ Pwr On 0: Cycle Ext Run 1: Accept Ext Run	0: Disregarded. A new Run command must be issued after power up. 1: Allowed. Motor will start immediately after power up if a Run command is already enabled.	Default: 1 Range: 0, 1	20
b1-24 (0B2C)	Commercial Power Operation Switching Selection	CommerclPwrSwSel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	21
b1-25 (0B2D)	Commercial Power Supply Operation Cancellation Level	Freq Deviate Lvl	Sets the judgement value of the hysteresis comparator in the judgment section for the commercial power switching function in increments of 0.1 Hz.	Default: 1.0 Hz Min.: 0.4 Max.: 6.0	21
b1-26 (0B2E)	Commercial Power Supply Operation Switching Level	Freq Accept Lvl		Default: 0.2 Hz Min.: 3.0 Max.: 6.0	21

◆ b2: DC Injection Braking

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b2-01 (0189)	DC Injection Braking Start Frequency	DCInj Start Freq	Sets the frequency at which DC Injection Braking starts when "Ramp to stop" (b1-03 = 0) is selected.	Default: <1> Min.: 0.0 Hz Max.: 10.0 Hz	22
b2-02 (018A)	DC Injection Braking Current	DCInj Current	Sets the DC Injection Braking current as a percentage of the drive rated current.	Default: 50% Min.: 0 Max.: 100	22
b2-03 (018B)	DC Injection Braking Time at Start	DCInj Time@Start	Sets DC Injection Braking time at start. Disabled when set to 0.00 seconds.	Default: 0.00 s Min.: 0.00 Max.: 10.00	22
b2-04 (018C)	DC Injection Braking Time at Stop	DCInj Time@Stop	Sets DC Injection Braking time at stop.	Default: 0.00 s Min.: 0.00 Max.: 10.00	22
b2-09 (01E1)	Motor Pre-Heat Current 2	Preheat Current	Determines the percentage of motor rated output current used for the motor pre-heat function.	Default: 5% Min.: 0 Max.: 100	22

<1> Default setting is determined by parameter A1-02, Control Method Selection.

◆ b3: Speed Search

No. (Addr Hex.)	Name	LCD Display	Description	Values	Page
b3-01 (0191)	Speed Search Selection at Start	SpdSrch at Start 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	25
b3-03 (0193)	Speed Search Deceleration Time	SpdSrch Dec Time	Sets output frequency reduction time during Speed Search.	Default: 2.0 s Min.: 0.1 Max.: 10.0	25
b3-04 (0194)	V/f Gain during Speed Search (Speed Estimation Type)	SpdSrch V/f	Determines how much to lower the V/f ratio during Speed Search. Output voltage during Speed Search equals the V/f setting multiplied by b3-04.	Default: <1> Min.: 10% Max.: 100%	25
b3-05 (0195)	Speed Search Delay Time	Search Delay	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.	Default: 0.2 s Min.: 0.0 Max.: 100.0	25
b3-06 (0196)	Output Current 1 during Speed Search (Speed Estimation Type)	Srch Im Lvl1	Sets the current injected to the motor at the beginning of Speed Estimation Speed Search. Set as a coefficient for the motor rated current.	Default: <1> Min.: 0.0 Max.: 2.0	25
b3-07 (0197)	Output Current 2 during Speed Search (Speed Estimation Type)	Srch Im Lvl2	Sets the amount of output current during Speed Estimation Speed Search as a coefficient for the no-load current (output current during Speed Search is automatically limited by the drive rated current). Increase this setting value in increments of 0.1 if the drive fails to perform Speed Estimation.	Default: 1.0 Min.: 0.0 Max.: 5.0	25
b3-08 (198)	Current Control Gain during Speed Search (Speed Estimation Type)	Srch ACR P Gain	Sets the proportional gain for the current controller during Speed Search.	Default: <1> <2> Min.: 0.00 Max.: 6.00	26
b3-09 (0199)	Current Control Integral Time during Speed Search (Speed Estimation Type)	Srch ACR I Time	Sets the Integral Time for the current controller during Speed Search.	Default: <2> Min.: 0.0 ms Max.: 1000.0 ms	26
b3-10 (019A)	Speed Search Detection Compensation Gain (Speed Estimation Type)	Srch Detect Comp	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.	Default: 1.05 Min.: 1.00 Max.: 1.20	26
b3-11 (19B)	Speed Search Method Switching Level (Speed Estimation Type)	Srch Mthd Sw Lvl	Uses the amount of voltage remaining in the motor to automatically switch the search method within the type of speed measurement. (200 V class at 100% = 200 V; 400 V class at 100% = 400 V)	Default: 5.0% Min.: 0.5 Max.: 100.0	26

No. (Addr Hex.)	Name	LCD Display	Description	Values	Page
b3-12 (019C)	Minimum Current Detection Level during Speed Search	Srch I Deadband	Sets the minimum current detection level during Speed Search. Increase this setting value in increments of 0.1 if the drive fails to perform Speed Estimation.	Default: <1> Min.: 2.0 Max.: 10.0	26
b3-14 (019E)	Bi-Directional Speed Search Selection (Speed Estimation Type)	Bidir Search Sel 0: Disabled 1: Enabled	0: Disabled (uses the direction of the frequency reference) 1: Enabled (drive detects which way the motor is rotating)	Default: 1 Range: 0, 1	26
b3-17 (01F0)	Speed Search Restart Current Level (Speed Estimation Type)	SrchRestart Lvl	Sets the Speed Search restart current level as a percentage of the drive rated current.	Default: 150% Min.: 0 Max.: 200	26
b3-18 (01F1)	Speed Search Restart Detection Time (Speed Estimation Type)	SrchRestart Time	Sets the time to detect Speed Search restart.	Default: 0.10 s Min.: 0.00 Max.: 1.00	27
b3-19 (01F2)	Number of Speed Search Restarts (Speed Estimation Type)	Num of SrchRestr	Sets the number of times the drive can attempt to restart when performing Speed Search.	Default: 3 Min.: 0 Max.: 10	27
b3-24 (01C0)	Speed Search Method Selection	SpdSrch Method 1: Speed Estimation 2: CurrentDetection2	1: Speed Estimation 2: Current Detection 2	Default: <3> Range: 1, 2	27
b3-25 (01C8)	Speed Search Wait Time (Speed Estimation Type)	SpdSrch WaitTime	Sets the time the drive must wait between each Speed Search restart attempt.	Default: 0.5 s Min.: 0.0 Max.: 300.0	27
b3-27 (01C9)	Start Speed Search Select	SPD Search By AI 0: start from 0 1: start SPD	Selects a condition to activate Speed Search Selection at Start (b3-01) or External Speed Search Command 1 or 2 from the multi-function input. 0: Triggered when a Run command is issued (normal). 1: Triggered when an external baseblock is released.	Default: 0 Range: 0, 1	27
b3-29 (077C)	Speed Search Induced Voltage Level	SpdSrch Ind Vlvl	OLV/PM Performs Speed Search when the motor induced voltage exceeds the set level. There is normally no need to change this parameter from the default value, but if changes are necessary, try lowering this value in small increments. When set too low, the drive will not perform Speed Search.	Default: 10% Min.: 0 Max.: 10	27
b3-31 (0BC0)	Speed Search Operation Current Level 1 (Current Detection 1)	Search (I2) Lvl1	Set the current level to use to limit the output current during a Speed Search.	Default: 1.50 Min.: 1.50 Max.: 3.50	27
b3-32 (0BC1)	Speed Search Operation Current Level 2 (Current Detection 2)	Search (I2) Lvl2	Set the current level at which to end the Speed Search for Current Detection Type Speed Search 2.	Default: 1.20 Min.: 0.00 Max.: 1.49	28
b3-33 (0B3F)	Speed Search Selection when Run Command is Given during Uv	SpdSrch Start UV 0: Disabled 1: Enabled	Activates and deactivates Speed Search at start in accordance with whether a Run command was issued during an undervoltage (Uv) condition. Function is active when a momentary power loss (L2-01 = 1 or 2), Speed Search at start (b3-01 = 1), and coasting to a stop (b1-03 = 1) are enabled. 0: Disabled 1: Enabled	Default: 0 Range: 0, 1	28
b3-50 (0BC7)	Backspin Search Direction Judgment Time 1	Bkspin Srch Time1	Adjusts the direction of Speed Search to allow for backspin.	Default: 0.0 s Min.: 0.0 Max.: 10.0	28
b3-51 (0BC8)	Backspin Search Direction Judgment Time 2	Bkspin Srch Time2		Default: 0.0 s Min.: 0.0 Max.: 10.0	28
b3-52 (0BC9)	Backspin Search Deceleration Time 1	BkspinSrchDecel1	Sets the search frequency deceleration rate when searching from the direction command when the momentary power loss time is shorter than the time set in b3-50.	Default: 2.0 s Min.: 0.0 Max.: 10.0	30
b3-53 (0BCA)	Backspin Search Deceleration Time 2	BkspinSrchDecel2	Sets the search frequency deceleration rate for a Speed Search from the opposite direction of the direction command when the momentary power loss time is equal to or longer than the time set in b3-51.	Default: 2.0 s Min.: 0.0 Max.: 10.0	30
b3-59 (1B44)	PM Speed Search DC Injection Braking Time at Low Speed	Srch DCInj Time	OLV/PM Sets the DC Injection Braking time at low speed PM motor Speed Search.	Default: 1.00 s Min.: 0.50 Max.: 10.00	30

<1> Default setting is dependent on parameter o2-04, Drive Model Selection.

<2> Default setting is determined by parameter A1-02, Control Method Selection.
<3> Default setting is determined by parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

◆ b4: Timer Function

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b4-01 (01A3)	Timer Function On-Delay Time	Delay-ON Timer	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).	Default: 0.0 s Min.: 0.0 Max.: 3000.0	30
b4-02 (01A4)	Timer Function Off-Delay Time	Delay-OFF Timer		Default: 0.0 s Min.: 0.0 Max.: 3000.0	30
b4-03 (0B30)	H2-01 ON Delay Time	H2-01 ON Delay	Sets the length of the delay time for contact outputs to open or close for the related functions set in H2-□□.	Default: 0 ms Min.: 0 Max.: 65000	31
b4-04 (0B31)	H2-01 OFF Delay Time	H2-01 OFF Delay			
b4-05 (0B32)	H2-02 ON Delay Time	H2-02 ON Delay			
b4-06 (0B33)	H2-02 OFF Delay Time	H2-02 OFF Delay			
b4-07 (0B34)	H2-03 ON Delay Time	H2-03 ON Delay			
b4-08 (0B35)	H2-03 OFF Delay Time	H2-03 OFF Delay			

◆ b5: PID Control

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b5-01 (01A5)	PID Function Setting	PID Mode 0: Disabled 1: Enabled D=Fdbk 3: Fref+PID D=Fdbk	0: Disabled 1: Enabled (PID output becomes output frequency reference) 3: Enabled (PID output added to frequency reference)	Default: 0 Range: 0, 1, 3	35
b5-02 (01A6) RUN	Proportional Gain Setting (P)	PID Gain	Sets the proportional gain of the PID controller.	Default: 2.00 Min.: 0.00 Max.: 25.00	35
b5-03 (01A7) RUN	Integral Time Setting (I)	PID I Time	Sets the integral time for the PID controller.	Default: 0.5 s Min.: 0.0 Max.: 360.0	35
b5-04 (01A8) RUN	Integral Limit Setting	PID I Limit	Sets the maximum output possible from the integrator as a percentage of the maximum output frequency.	Default: 100.0% Min.: 0.0 Max.: 100.0	35
b5-05 (01A9) RUN	Derivative Time (D)	PID D Time	Sets D control derivative time.	Default: 0.00 s Min.: 0.00 Max.: 10.00	35
b5-06 (01AA) RUN	PID Output Limit	PID Limit	Sets the maximum output possible from the entire PID controller as a percentage of the maximum output frequency.	Default: 100.0% Min.: 0.0 Max.: 100.0	35
b5-07 (01AB) RUN	PID Offset Adjustment	PID Offset	Applies an offset to the PID controller output. Set as a percentage of the maximum output frequency.	Default: 0.0% Min.: -100.0 Max.: 100.0	35
b5-08 (01AC) RUN	PID Primary Delay Time Constant	PID Delay Time	Sets a low pass filter time constant on the output of the PID controller.	Default: 0.00 s Min.: 0.00 Max.: 10.00	35
b5-09 (01AD)	PID Output Level Selection	Output Level Sel 0: Normal Character 1: Rev Character	0: Normal output (direct acting) 1: Reverse output (reverse acting)	Default: 0 Range: 0, 1	36

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b5-10 (01AE)	PID Output Gain Setting	Output Gain	Sets the gain applied to the PID output.	Default: 1.00 Min.: 0.00 Max.: 25.00	36
b5-11 (01AF)	PID Output Reverse Selection	Output Rev Sel 0: 0 limit 1: Reverse	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.	Default: 0 Range: 0, 1	36
b5-12 (01B0)	PID Feedback Loss Detection Selection	Fb loss Det Sel 0: Disabled 1: Alarm @ PID Enbl 2: Fault @ PID Enbl 3: DO Only@PID Enbl 4: Alarm – Always 5: Fault – Alwaysl	0: Digital Output Only (Remains active when PID is disabled by digital input) 1: Alarm output, drive continues operation (Remains active when PID is disabled by digital input) 2: Fault output, drive output is shut off (Remains active when PID is disabled by digital input) 3: Digital output only. No detection when PID is disabled by digital input. 4: Alarm detection. No detection when PID is disabled by digital input. 5: Fault detection. No detection when PID is disabled by digital input.	Default: 0 Range: 0 to 5	37
b5-13 (01B1)	PID Feedback Loss Detection Level	Fb loss Det Lvl	Sets the PID feedback loss detection level as a percentage of the maximum output frequency.	Default: 0% Min.: 0 Max.: 100	37
b5-14 (01B2)	PID Feedback Loss Detection Time	Fb loss Det Time	Sets a delay time for PID feedback loss.	Default: 1.0 s Min.: 0.0 Max.: 25.5	37
b5-15 (01B3)	PID Sleep Function Start Level	PID Sleep Level	Sets the frequency level that triggers the sleep/snooze function.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	38
b5-16 (01B4)	PID Sleep Delay Time	PID Sleep Time	Sets a delay time before the sleep/snooze function is triggered.	Default: 0.0 s Min.: 0.0 Max.: 25.5	38
b5-17 (01B5)	PID Accel/Decel Time	PID Acc/Dec Time	Sets the acceleration and deceleration time to PID setpoint.	Default: 0.0 s Min.: 0.0 Max.: 6000.0	38
b5-18 (01DC)	PID Setpoint Selection	PID Setpoint Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	38
b5-19 (01DD) RUN	PID Setpoint Value	PID Setpoint	Sets the PID target value when b5-18 = 1. Set as a percentage of the maximum output frequency.	Default: 0.00% Min.: 0.00 Max.: 100.00 <1>	39
b5-20 (01E2)	PID Setpoint Scaling	PID Disp Scaling 0: 0.01Hz units 1: 0.01% units 2: r/min 3: User Units	0: 0.01 Hz units 1: 0.01% units (100% = max output frequency) 2: r/min (number of motor poles must entered) 3: User-set (set scaling to b5-38 and b5-39)	Default: 1 Range: 0 to 3	39
b5-21 (01E3)	PID Sleep Input Source	PID Sleep Ref 0: PID Setpoint 1: Frequency Ref 2: Snooze Func	Input source selection for Sleep Function mode. 0: PID Setpoint 1: SFS Input 2: Snooze	Default: 1 Range: 0 to 2	39
b5-22 (01E4)	PID Snooze Level	Snooze Level	Sets the PID Snooze Function start level as a percentage of the maximum frequency.	Default: 0% Min.: 0 Max.: 100	39
b5-23 (01E5)	PID Snooze Delay Time	Snooze DelayTime	Sets the PID Snooze Function delay time in seconds.	Default: 0s Min.: 0 Max.: 2600	39
b5-24 (01E6)	PID Snooze Deactivation Level	SnoozeRestartLvl	When the PID feedback level drops below this level, the drive returns to normal operation. Set as a percentage of the maximum frequency.	Default: 0% Min.: 0 Max.: 100	40
b5-25 (01E7)	PID Setpoint Boost Setting	SetpointBoostLvl	Temporarily increases the PID setpoint to create an overshoot of the intended PID setpoint.	Default: 0% Min.: 0 Max.: 100	40

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b5-26 (01E8)	PID Maximum Boost Time	SetpointBoostTim	Sets the maximum boost time when PID feedback does not reach boost level. The Snooze Function starts when the PID feedback exceeds the boost setting level or when the boost time expires.	Default: 0s Min.: 0 Max.: 2600	40
b5-27 (01E9)	PID Snooze Feedback Level	Snooze Reset Lvl	Sets the PID feedback level above which Snooze mode is activated. Set as a percentage of the maximum frequency.	Default: 60% Min.: 0 Max.: 100	40
b5-28 (01EA)	PID Feedback Function Selection	PID FdbkSqrt Sel 0: Disabled 1: Enabled	0: Disabled 1: Square root	Default: 0 Range: 0, 1	40
b5-29 (01EB)	PID Square Root Gain	PID FdbkSqrtGain	A multiplier applied to the square root of the feedback.	Default: 0.00 Min.: 0.00 Max.: 2.00	40
b5-30 (01EC)	PID Feedback Offset	PID Fdbk Offset	PID feedback offset set as a percentage of the maximum frequency.	Default: 0.00 Min.: 0.00 Max.: 100.00	40
b5-34 (019F) RUN	PID Output Lower Limit	PID Out Low Lim	Sets the minimum output possible from the PID controller as a percentage of the maximum output frequency.	Default: 0.0% Min.: -100.0 Max.: 100.0	41
b5-35 (01A0) RUN	PID Input Limit	PID Input Limit	Limits the PID control input (deviation signal) as a percentage of the maximum output frequency. Acts as a bipolar limit.	Default: 1000.0% Min.: 0.0 Max.: 1000.0	41
b5-36 (01A1)	PID Feedback High Detection Level	Fb High Det Lvl	Sets the PID feedback high detection level as a percentage of the maximum output frequency.	Default: 100% Min.: 0 Max.: 100	41
b5-37 (01A2)	PID Feedback High Detection Time	Fb High Dly Time	Sets the PID feedback high level detection delay time.	Default: 1.0 s Min.: 0.0 Max.: 25.5	41
b5-38 (01FE)	PID Setpoint User Display	PID UsrDspMaxVal	Sets the display value of U5-01 and U5-04 when the maximum frequency is output.	Default: <2> Min.: 1 Max.: 60000	41
b5-39 (01FF)	PID Setpoint Display Digits	PID UsrDspDigits 0: No Dec (XXXXX) 1: 1 Dec (XXXX.X) 2: 2 Dec (XXX.XX) 3: 3 Dec (XX.XXX)	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	Default: <2> Range: 0 to 3	41
b5-40 (017F)	Frequency Reference Monitor Content during PID	Fref Mon Sel@PID 0: Fref Mon w PID 1: Fref Mon w/o 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.	Default: 0 Range: 0, 1	41
b5-41 (0160)	PID Unit Selection	PID Mon Unit Sel 0: WC 1: PSI 2: GPM 3: °F 4: CFM 5: CMH 6: LPH 7: LPS 8: Bar 9: Pa 10: °C 11: Mtr 12: Ft 13: LPM 14: CMM	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)	Default: 0 Range: 0 to 14	41
b5-42 (0161) RUN	PID Output Monitor Calculation Method	PID Out Calc Mode 0: Linear 1: Square root 2: 1/f2 3: 1/f3	0: Linear - the monitor displays PID output 1: Square root - the monitor displays square root PID output 2: Quadratic - the monitor displays 1/(PID output) 3: Cubic - the monitor displays 1/(PID output)	Default: 0 Range: 0 to 3	42

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b5-43 (0162) RUN	PID Output 2 Monitor Max Upper 4 Digits	PID Out MonMax U4	Sets the upper 4 digits of the maximum monitor value. Used with b5-44 to set maximum monitor value of U5-14 and U5-15 at maximum frequency. **Note:** Used for U5-14 and U5-15 only.	Default: 0 Min.: 0 Max.: 9999	42
b5-44 (0163) RUN	PID Output 2 Monitor Max Lower 4 Digits	PID Out MonMax L4	Sets the lower 4 digits of the maximum monitor value. Used with b5-43 to set maximum monitor value of U5-14 and U5-15 at maximum frequency. **Note:** Used for U5-14 and U5-15 only.	Default: 0 Min.: 0 Max.: 99.99	42
b5-45 (0164) RUN	PID Output 2 Monitor Minimum	PID Out MonMin	Sets the minimum display value at zero speed. This function is effective when b5-42 is set to 0 (Linear output mode). **Note:** Used for U5-14 and U5-15 only.	Default: 0 Min.: 0 Max.: 999.9	42
b5-46 (0165)	PID Setpoint Monitor Unit Selection	PID Mon Unit Sel 0: WC 1: PSI 2: GPM 3: °F 4: CFM 5: CMH 6: LPH 7: LPS 8: bar 9: Pa 10: °C 11: Mtr 12: Ft 13: LPM 14: CMM	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)	Default: 0 Range: 0 to 14	42
b5-47 (017D)	Reverse Operation Selection 2 by PID Output	Output Rev Sel2 0: 0 limit 1: Reverse	Reverse operation selection when b5-01 = 3 0: Reverse Disabled 1: Reverse Enabled	Default: 1 Range: 0, 1	43

<1> Internally limited to the value of b5-38. Changing b5-20, b5-38, and b5-39 will not automatically update the value of this parameter.

<2> Default setting is dependent on parameter b5-20, PID Setpoint Scaling.

◆ b8: Energy Saving

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
b8-01 (01CC)	Energy Saving Control Selection	Energy Save Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: <1> Range: 0, 1	44
b8-04 (01CF)	Energy Saving Coefficient Value	Energy Save COEF	Determines the level of maximum motor efficiency. Setting range is 0.0 to 2000.0 for drives 3.7 kW and smaller.	Default: <2> <3> Min.: 0.00 Max.: 655.00	44
b8-05 (01D0)	Power Detection Filter Time	kW Filter Time	Sets a time constant filter for output power detection.	Default: 20 ms Min.: 0 Max.: 2000	44
b8-06 (01D1)	Search Operation Voltage Limit	Search V Limit	Sets the limit for the voltage search operation as a percentage of the motor rated voltage.	Default: 0% Min.: 0 Max.: 100	45

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<2> Default setting is determined by parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

<3> Parameter value changes automatically if E2-11 is manually changed or changed by Auto-Tuning.

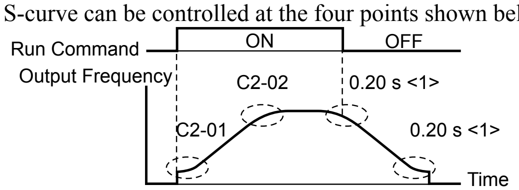
A.5 C: Tuning

C parameters are used to adjust the acceleration and deceleration times, S-curves, torque compensation, and carrier frequency selections.

◆ C1: Acceleration and Deceleration Times

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C1-01 (0200) RUN	Acceleration Time 1	Accel Time 1	Sets the time to accelerate from 0 to maximum frequency.	Default: 30.0 s Min.: 0.1 Max.: 6000.0	46
C1-02 (0201) RUN	Deceleration Time 1	Decel Time 1	Sets the time to decelerate from maximum frequency to 0.		46
C1-03 (0202) RUN	Acceleration Time 2	Accel Time 2	Sets the time to accelerate from 0 to maximum frequency.	Default: 30.0 s Min.: 0.1 Max.: 6000.0	46
C1-04 (0203) RUN	Deceleration Time 2	Decel Time 2	Sets the time to decelerate from maximum frequency to 0.		46
C1-09 (0208)	Fast Stop Time	Fast Stop Time	Sets the time for the Fast Stop function.	Default: 10.0 s Min.: 0.1 Max.: 6000.0	47
C1-11 (020A)	Accel/Decel Time Switching Frequency	Acc/Dec SW Freq	Sets the frequency to switch between accel/decel time settings. Setting units are determined by parameter A1-02, Control Method Selection.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	47

◆ C2: S-Curve Characteristics

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C2-01 (020B)	S-Curve Characteristic at Accel Start	SCrv Acc @ Start	The S-curve can be controlled at the four points shown below. 	Default: <1> Min.: 0.00 s Max.: 10.00 s	47
C2-02 (020C)	S-Curve Characteristic at Accel End	SCrv Acc @ End		Default: 0.20 s Min.: 0.00 Max.: 10.00	47

<1> Default setting is determined by parameter A1-02, Control Method Selection.

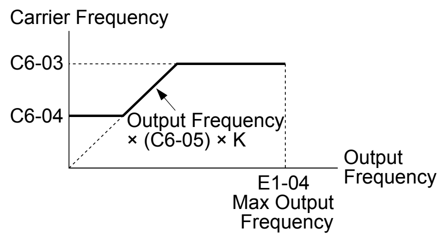
◆ C4: Torque Compensation

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C4-01 (0215) RUN	Torque Compensation Gain	Torq Comp Gain	Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque. Used for motor 1.	Default: <1> Min.: 0.00 Max.: 2.50	48
C4-02 (0216) RUN	Torque Compensation Primary Delay Time 1	Torq Comp Time	Sets the torque compensation filter time.	Default: <2> Min.: 0 ms Max.: 60000 ms	48

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<2> Default setting is determined by parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

◆ C6: Carrier Frequency

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C6-02 (0224)	Carrier Frequency Selection	CarrierFreq Sel 1: Fc=4.0 kHz 2: Fc=6.0 kHz 3: Fc=8.0 kHz 4: Fc=10.0 kHz F: Program	1: 4.0 kHz 2: 6.0 kHz 3: 8.0 kHz 4: 10.0 kHz F: User-defined (determined by C6-03 through C6-05)	Default: <1> Range: 1 to 4; F	49
C6-03 (0225)	Carrier Frequency Upper Limit	CarrierFreq Max	Determines the upper and lower limits for the carrier frequency. 	Default: <2> Min.: 4.0 kHz Max.: 10.0 kHz	49
C6-04 (0226)	Carrier Frequency Lower Limit	CarrierFreq Min		Default: <2> Min.: 4.0 kHz Max.: 10.0 kHz	49
C6-05 (0227)	Carrier Frequency Proportional Gain	CarrierFreq Gain		Default: <2> Min.: 0 Max.: 99	49
C6-09 (022B)	Carrier Frequency during Rotational Auto-Tuning	Carrier in tune 0: Fc = 5kHz 1: Fc = C6-03	OLV/PM 0: Carrier Frequency = 4 kHz. 1: Setting value for C6-03.	Default: 0 Range: 0, 1	50

<1> Default setting value is dependent on parameters A1-02, Control Method Selection and o2-04, Drive Model Selection.

<2> Default setting value is dependent on parameter C6-02, Carrier Frequency Selection and o2-04, Drive Model Selection.

◆ C7: Voltage Adjustment

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
C7-43 (112A)	Input Voltage Offset Adjustment	InputVolt Offset	Adjusts the offset for the input voltage circuit when the control board is replaced. 0000: Standard 0002: Offset adjustment not required	Default: 0000 Range: 0000 to 9999	51
C7-56 (1107)	Power Factor Control Selection	PF Control Sel 0: PF Ctrl Disabled 1: PF Ctrl Enabled	0: Power factor control disabled 1: Power factor control enabled	Default: 0 Range: 0, 1	51
C7-60 (0B1C)	Output Voltage Limit Mode Selection	V Out Limit Sel 0: Limit Harmonics 1: Improve PF	0: Harmonic suppression priority mode 1: High output voltage mode	Default: 1 Range: 0, 1	51

A.6 d: References

Reference parameters set the various frequency reference values during operation.

◆ d1: Frequency Reference

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d1-01 (0280) RUN	Frequency Reference 1	Reference 1	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 <1>	52
d1-02 (0281) RUN	Frequency Reference 2	Reference 2	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 <1>	52
d1-03 (0282) RUN	Frequency Reference 3	Reference 3	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 <1>	52
d1-04 (0283) RUN	Frequency Reference 4	Reference 4	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 <1>	52
d1-16 (0291) RUN	Frequency Reference 16	Reference 16	Sets the frequency reference for the drive. Setting units are determined by parameter o1-03.	Default: 0.00 Hz Min.: 0.00 Max.: 400.00 <1>	52
d1-17 (0292) RUN	Jog Frequency Reference	Jog Reference	Sets the Jog frequency reference. Setting units are determined by parameter o1-03.	Default: 6.00 Hz Min.: 0.00 Max.: 400.00 <1>	52

<1> Range upper limit is determined by parameters d2-01, Frequency Reference Upper Limit, and E1-04, Maximum Output Frequency.

◆ d2: Frequency Upper/Lower Limits

No. (Addr. Hex.)	Name	LCD Display	Description	Setting	Page
d2-01 (0289)	Frequency Reference Upper Limit	Ref Upper Limit	Sets the frequency reference upper limit as a percentage of the maximum output frequency.	Default: 100.0% Min.: 0.0 Max.: 110.0	53
d2-02 (028A)	Frequency Reference Lower Limit	Ref Lower Limit	Sets the frequency reference lower limit as a percentage of the maximum output frequency.	Default: 0.0% Min.: 0.0 Max.: 110.0	53
d2-03 (0293)	Master Speed Reference Lower Limit	Ref1 Lower Limit	Sets the lower limit for frequency references from analog inputs as a percentage of the maximum output frequency.	Default: 0.0% Min.: 0.0 Max.: 110.0	54

◆ d3: Jump Frequency

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d3-01 (0294)	Jump Frequency 1	Jump Freq 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. Setting 0.0 disables this function. Parameters must be set so that d3-01 ≥ d3-02 ≥ d3-03.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	54
d3-02 (0295)	Jump Frequency 2	Jump Freq 2	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. Setting 0.0 disables this function. Parameters must be set so that d3-01 ≥ d3-02 ≥ d3-03.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	54
d3-03 (0296)	Jump Frequency 3	Jump Freq 3	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. Setting 0.0 disables this function. Parameters must be set so that d3-01 ≥ d3-02 ≥ d3-03.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	54
d3-04 (0297)	Jump Frequency Width	Jump Bandwidth	Sets the dead-band width around each selected prohibited frequency reference point.	Default: 1.0 Hz Min.: 0.0 Max.: 20.0	54

◆ d4: Frequency Reference Hold Function

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d4-01 (0298)	Frequency Reference Hold Function Selection	Fref Hold Sel 0: Disabled 1: Enabled	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.	Default: 0 Range: 0, 1	55
d4-10 (02B6)	Up/Down Frequency Reference Limit Selection	Up/Dn LowLim Sel 0: D2-02 or Analog 1: D2-02 Only	0: The lower limit is determined by d2-02 or an analog input. 1: The lower limit is determined by d2-02.	Default: 0 Range: 0, 1	56

◆ d6: Field Weakening

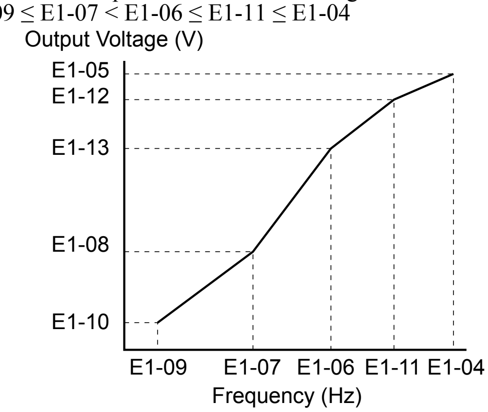
No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
d6-01 (02A0)	Field Weakening Level	Field-Weak Lvl	Sets the drive output voltage for the Field Weakening function as a percentage of the maximum output voltage. Enabled when a multi-function input is set for Field Weakening (H1-☐☐ = 63).	Default: 80% Min.: 0 Max.: 100	56
d6-02 (02A1)	Field Weakening Frequency Limit	Field-Weak Freq	Sets the lower limit of the frequency range where Field Weakening control is valid. The Field Weakening command is valid only at frequencies above this setting and only when the output frequency matches the frequency reference (speed agree).	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	56

◆ d7: Offset Frequency

No. (Addr. Hex)	Name	LCD Display	Description	Setting	Page
d7-01 (02B2) RUN	Offset Frequency 1	Offset Freq 1	Added to the frequency reference when the digital input “Frequency offset 1” (H1-□□ = 44) is switched on.	Default: 0.0% Min.: -100.0 Max.: 100.0	57
d7-02 (02B3) RUN	Offset Frequency 2	Offset Freq 2	Added to the frequency reference when the digital input “Frequency offset 2” (H1-□□ = 45) is switched on.	Default: 0.0% Min.: -100.0 Max.: 100.0	57
d7-03 (02B4) RUN	Offset Frequency 3	Offset Freq 3	Added to the frequency reference when the digital input “Frequency offset 3” (H1-□□ = 46) is switched on.	Default: 0.0% Min.: -100.0 Max.: 100.0	57

A.7 E: Motor Parameters

◆ E1: V/f Pattern for Motor 1

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E1-03 (0302)	V/f Pattern Selection	V/F Selection 0: 50 Hz 1: 60 Hz Saturation 2: 60 Hz Saturation 3: 72 Hz 4: 50 Hz VT1 5: 50 Hz VT2 6: 60 Hz VT1 7: 60 Hz VT2 8: 50 Hz HST1 9: 50 Hz HST2 A: 60 Hz HST1 B: 60 Hz HST2 C: 90 Hz D: 120 Hz E: 180 Hz F: Custom V/F	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	Default: F <1> Range: 0 to 9; A to F	58
E1-04 (0303)	Maximum Output Frequency	Max 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  **Note:** E1-07, E1-08, and E1-10 to E1-13 are not available in OLV/PM control mode.	Default: <2> <8> Min.: 40.0 Hz Max.: 400.0 Hz <3>	61
E1-05 (0304) <7>	Maximum Voltage	Max Voltage		Default: <2> <4> Min.: 0.0 V Max.: 255.0 V <5>	61
E1-06 (0305)	Base Frequency	Base Frequency		Default: <2> <4> <8> Min.: 0.0 Hz Max.: E1-04 <3>	61
E1-07 (0306)	Middle Output Frequency	Mid Frequency A		Default: <2> Min.: 0.0 Hz Max.: E1-04	61
E1-08 (0307)	Middle Output Frequency Voltage	Mid Voltage A		Default: <2> Min.: 0.0 V Max.: 255.0 V <5>	61
E1-09 (0308)	Minimum Output Frequency	Min Frequency		Default: <2> <4> <8> Min.: 0.0 Hz Max.: E1-04 <3>	61
E1-10 (0309)	Minimum Output Frequency Voltage	Min Voltage		Default: <2> Min.: 0.0 V Max.: 255.0 V <5>	61
E1-11 (030A) <6>	Middle Output Frequency 2	Mid Frequency B		Default: 0.0 Hz Min.: 0.0 Max.: E1-04	61
E1-12 (030B) <6> <9>	Middle Output Frequency Voltage 2	Mid Voltage B		Default: 0.0 V Min.: 0.0 Max.: 255.0 <5>	61
E1-13 (030C) <7> <9>	Base Voltage	Base Voltage		Default: 0.0 V Min.: 0.0 Max.: 255.0 <5>	61

<1> Parameter setting value is not reset to the default value when the drive is initialized.

<2> Default setting is dependent on parameters A1-02, Control Mode Selection and o2-04, Drive Model Selection.

<3> Default setting is determined by E5-01 in OLV/PM.
When E5-01 is set to FFFFH, the setting range for E1-04 and E1-06 is 10.0 to 400.0 Hz and the setting range for E1-09 is 0.0 to 400.0 Hz.

<4> Default setting is dependent on parameter A1-02, Control Mode Selection.

<5> Values shown are specific to 200 V class drives. Double the value for 400 V class drives.

<6> Parameter ignored when E1-11 (Motor 1 Mid Output Frequency 2) and E1-12 (Motor 1 Mid Output Frequency Voltage 2) are set to 0.0.

<7> When Auto-Tuning is performed, E1-13 and E1-05 will be set to the same value.

<8> When using PM motors, the default setting is determined by the motor code set to E5-01.

<9> The drive changes these settings when Auto-Tuning is performed.

◆ E2: Motor 1 Parameters

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E2-01 (030E)	Motor Rated Current	Motor Rated FLA	Sets the motor nameplate full load current in amps. Automatically set during Auto-Tuning.	Default: <1> Min.: 10% of drive rated current Max.: 150% of drive rated current <2>	62
E2-02 (030F)	Motor Rated Slip	Motor Rated Slip	Sets the motor rated slip. Automatically set during Auto-Tuning.	Default: <1> Min.: 0.00 Hz Max.: 20.00 Hz	62
E2-03 (0310)	Motor No-Load Current	No-Load Current	Sets the no-load current for the motor. Automatically set during Auto-Tuning.	Default: <1> Min.: 0.00 A Max.: E2-01 <2>	62
E2-04 (0311)	Number of Motor Poles	Number of Poles	Sets the number of motor poles. Automatically set during Auto-Tuning.	Default: 4 Min.: 2 Max.: 48	63
E2-05 (0312)	Motor Line-to-Line Resistance	Term Resistance	Sets the phase-to-phase motor resistance. Automatically set during Auto-Tuning.	Default: <1> Min.: 0.000 Ω Max.: 65.000 Ω	63
E2-10 (0317)	Motor Iron Loss for Torque Compensation	Motor Iron Loss	Sets the motor iron loss.	Default: <1> Min.: 0 W Max.: 65535 W	63
E2-11 (0318)	Motor Rated Power	Mtr Rated Power	Sets the motor rated power in kilowatts (1 HP = 0.746 kW). Automatically set during Auto-Tuning.	Default: <1> Min.: 0.00 kW Max.: 650.00 kW	63

<1> Default setting is dependent on parameter o2-04, Drive Model Selection.

<2> Display is in the following units:
2□0028, 2□0042, and 4□0011 to 4□0027: 0.01 A units
2□0054 to 2□0248 and 4□0034 to 4□0414: 0.1 A units

◆ E5: PM Motor Settings

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E5-01 (0329) <1>	Motor Code Selection (for PM Motors)	PM Mtr Code Sel	**OLV/PM** Enter the Yaskawa motor code for the PM motor being used. Various motor parameters are automatically set based on the value of this parameter. Settings that were changed manually will be overwritten by the defaults of the selected motor code. **Note:** 1. Set to FFFF when using a non-Yaskawa PM motor or a special motor. 2. If an alarm or hunting occurs despite using a motor code, enter the value indicated on the nameplate.	Default: <2> Min.: 0000 Max.: FFFF <4>	64
E5-02 (032A) <1>	Motor Rated Power (for PM Motors)	PM Mtr Capacity	**OLV/PM** Sets the rated capacity of the motor.	Default: <3> Min.: 0.10 kW Max.: 650.00 kW	64

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
E5-03 (032B) <1>	Motor Rated Current (for PM Motors)	PM Mtr Rated FLA	OLV/PM Sets the motor rated current.	Default: <3> Min: 10% of drive rated current Max: 150% of drive rated current <5>	64
E5-04 (032C) <1>	Number of Motor Poles (for PM Motors)	PM Motor Poles	OLV/PM Sets the number of motor poles.	Default: <3> Min.: 2 Max.: 48	65
E5-05 (032D) <1>	Motor Stator Resistance (for PM Motors)	PM Mtr Arm Ohms	OLV/PM Set the resistance for each motor phase.	Default: <3> Min.: 0.000 Ω Max.: 65.000 Ω	65
E5-06 (032E) <1>	Motor d-Axis Inductance (for PM Motors)	PM Mtr d Induct	OLV/PM Sets the d-Axis inductance for the PM motor.	Default: <3> Min.: 0.00 mH Max.: 300.00 mH	65
E5-07 (032F) <1>	Motor q-Axis Inductance (for PM Motors)	PM Mtr q Induct	OLV/PM Sets the q-Axis inductance for the PM motor.	Default: <3> Min.: 0.00 mH Max.: 600.00 mH	65
E5-09 (0331) <1>	Motor Induction Voltage Constant 1 (for PM Motors)	PM Mtr Ind V 1	OLV/PM Sets the induced peak voltage per phase in units of 0.1 mV/(rad/s) [electrical angle]. Set this parameter when using an IPM motor with variable torque. Set E5-24 to 0 when setting this parameter.	Default: <3> Min.: 0.0 mV/(rad/s) Max.: 2000.0 mV/(rad/s)	65
E5-24 (0353) <1>	Motor Induction Voltage Constant 2 (for PM Motors)	PM Mtr Ind V 2	OLV/PM Sets the induced phase-to-phase rms voltage in units of 0.1 mV/(r/min) [mechanical angle].	Default: <3> Min.: 0.0 mV/(r/min) Max.: 6500.0 mV/(r/min)	65

<1> Setting value is not reset to the default when drive is initialized.

<2> Default setting is determined by parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

<3> Default setting is dependent on parameter E5-01, Motor Code Selection.

<4> Selection may vary depending on the motor code entered to E5-01.

<5> Display is in the following units:
2☐0028, 2☐0042, and 4☐0011 to 4☐0027: 0.01 A units
2☐0054 to 2☐0248 and 4☐0034 to 4☐0414: 0.1 A units

Parameter List

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A.8 F: Option Settings

◆ F2: Analog Input Card Settings (AI-A3)

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F2-01 (038F)	Analog Input Option Card Operation Selection	AI Function Sel 0: 3ch Individual 1: 3ch Addition	0: Option card input terminals V1, V2, and V3 replace drive input terminals A1, A2, and A3. 1: Input signals to terminals V1, V2, and V3 are added together to create the frequency reference.	Default: 0 Range: 0, 1	67
F2-02 (0368) RUN	Analog Input Option Card Gain	AI Input Gain	Sets the gain for the input signal to the analog card.	Default: 100.0% Min.: -999.9 Max.: 999.9	67
F2-03 (0369) RUN	Analog Input Option Card Bias	AI Input Bias	Sets the bias for the input signal to the analog card.	Default: 0.0% Min.: -999.9 Max.: 999.9	67

◆ F3: Digital Input Card Settings (DI-A3)

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F3-01 (0390)	Digital Input Option Card Input Selection	DI Function Sel 0: BCD 1% 1: BCD 0.1% 2: BCD 0.01% 3: BCD 1 Hz 4: BCD 0.1 Hz 5: BCD 0.01 Hz 6: BCD(5DG) 0.01 Hz 7: Binary	0: BCD, 1% units 1: BCD, 0.1% units 2: BCD, 0.01% units 3: BCD, 1 Hz units 4: BCD, 0.1 Hz units 5: BCD, 0.01 Hz units 6: BCD customized setting (5-digit), 0.02 Hz units 7: Binary input The unit and the setting range are determined by F3-03. F3-03 = 0: 255/100% (-255 to +255) F3-03 = 1: 40961/100% (-4095 to +4095) F3-03 = 2: 30000/100% (-33000 to +33000) When the digital operator units are set to be displayed in Hz or user-set units (o1-03 = 2 or 3), the units for F3-01 are determined by parameter o1-03.	Default: 0 Range: 0 to 7	67
F3-03 (03B9)	Digital Input Option DI-A3 Data Length Selection	Data length Sel 0: 8bit 1: 12bit 2: 16bit	0: 8 bit 1: 12 bit 2: 16 bit	Default: 2 Range: 0 to 2	68

◆ F4: Analog Monitor Card Settings (AO-A3)

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F4-01 (0391)	Terminal V1 Monitor Selection	AO Ch1 Select	Sets the monitor signal for output from terminal V1. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes.	Default: 102 Range: 000 to 999	68
F4-02 (0392) RUN	Terminal V1 Monitor Gain	AO Ch1 Gain	Sets the gain for voltage output via terminal V1.	Default: 100.0% Min.: -999.9 Max.: 999.9	68
F4-03 (0393)	Terminal V2 Monitor Selection	AO Ch2 Select	Sets the monitor signal for output from terminal V2. Set this parameter to the last three digits of the desired U□-□□ monitor. Some U parameters are available only in certain control modes.	Default: 103 Range: 000 to 999	68
F4-04 (0394) RUN	Terminal V2 Monitor Gain	AO Ch2 Gain	Sets the gain for voltage output via terminal V2.	Default: 50.0% Min.: -999.9 Max.: 999.9	68

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F4-05 (0395) RUN	Terminal V1 Monitor Bias	AO Ch1 Bias	Sets the amount of bias added to the voltage output via terminal V1.	Default: 0.0% Min.: -999.9 Max.: 999.9	68
F4-06 (0396) RUN	Terminal V2 Monitor Bias	AO Ch2 Bias	Sets the amount of bias added to the voltage output via terminal V2.	Default: 0.0% Min.: -999.9 Max.: 999.9	68
F4-07 (0397)	Terminal V1 Signal Level	AO Opt Level Ch1 0: 0-10 VDC 1: -10 +10 VDC	0: 0 to 10 V 1: -10 to 10 V	Default: 0 Range: 0, 1	69
F4-08 (0398)	Terminal V2 Signal Level	AO Opt Level Ch2 0: 0-10 VDC 1: -10 +10 VDC	0: 0 to 10 V 1: -10 to 10 V	Default: 0 Range: 0, 1	69

◆ F5: Digital Output Card Settings (DO-A3)

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F5-01 (0399)	Terminal P1-PC Output Selection	DO Ch1 Select	Sets the function for contact output terminals M1-M2, M3-M4, and photocoupler output terminals P1 through P6.	Default: 0 Range: 0 to 1B6	69
F5-02 (039A)	Terminal P2-PC Output Selection	DO Ch2 Select		Default: 1 Range: 0 to 1B6	69
F5-03 (039B)	Terminal P3-PC Output Selection	DO Ch3 Select		Default: 2 Range: 0 to 1B6	69
F5-04 (039C)	Terminal P4-PC Output Selection	DO Ch4 Select		Default: 4 Range: 0 to 1B6	69
F5-05 (039D)	Terminal P5-PC Output Selection	DO Ch5 Select		Default: 6 Range: 0 to 1B6	69
F5-06 (039E)	Terminal P6-PC Output Selection	DO Ch6 Select		Default: 37 Range: 0 to 1B6	69
F5-07 (039F)	Terminal M1-M2 Output Selection	DO Ch7 Select		Default: F Range: 0 to 1B6	69
F5-08 (03A0)	Terminal M3-M4 Output Selection	DO Ch8 Select		Default: F Range: 0 to 1B6	69
F5-09 (03A1)	DO-A3 Output Mode Selection	DO Function Sel	0: Output terminals are each assigned separate output functions. 1: Binary code output. 2: Use output terminal functions selected by parameters F5-01 through F5-08.	Default: 0 Range: 0 to 2	69

◆ F6, F7: Communication Option Card Settings

Parameters F6-01 through F6-03, F6-07, and F6-08 are used for BACnet/IP, EtherNet/IP, Modbus TCP/IP, and LONWORKS options. F7 parameters are used for the BACnet/IP, EtherNet/IP, and Modbus TCP/IP options.

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F6-01 (03A2)	Communications Error Operation Selection	Comm Bus Flt Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only 4: Alarm (d1-04) 5: Alm – Ramp Stop	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only. <1> 4: Alarm only. Continue operation using the frequency reference set in d1-04. <1> 5: Alarm. Ramp to stop.	Default: 1 Range: 0 to 5	69
F6-02 (03A3)	External Fault from Comm. Option Detection Selection	EF0 Detection 0: Always Detected 1: Only During Run	0: Always detected. 1: Detection during run only.	Default: 0 Range: 0, 1	70

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No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F6-03 (03A4)	External Fault from Comm. Option Operation Selection	EF0 Fault Action 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0: Ramp to stop. Decelerate to stop using the deceleration time in C1-02. 1: Coast to stop. 2: Fast Stop. Decelerate to stop using the deceleration time in C1-09. 3: Alarm only. <1>	Default: 1 Range: 0 to 3	70
F6-04 (03A5)	bUS Error Detection Time	BUS Err Det Time	Sets the delay time for error detection if a bus error occurs.	Default: 2.0 s Min.: 0.0 Max.: 5.0	71
F6-07 (03A8)	Multi-Step Speed Enable/Disable Selection when NefRef/ ComRef is Selected	Fref PrioritySel 0: Net/Com REF 1: MultiStep Speed	0: Multi-step reference disabled (same as F7) 1: Multi-step reference enabled (same as V7)	Default: 0 Range: 0, 1	70
F6-08 (036A) <3>	Reset Communication Parameters	Com Prm Init Sel 0: No Init Com Prms 1: Init Com Prms	0: Communication-related parameters (F6-□□) are not reset when the drive is initialized using A1-03. 1: Reset all communication-related parameters (F6-□□) when the drive is initialized using A1-03.	Default: 0 Range: 0, 1	70
F6-10 (03B6)	CC-Link Node Address	CC-Link Node Add	Sets the node address if a CC-Link option is installed.	Default: 0 Min.: 0 Max.: 64	71
F6-11 (03B7)	CC-Link Communication Speed	CC-Link Baud 0: 156 kbps 1: 625 kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps	0: 156 Kbps 1: 625 Kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps	Default: 0 Range: 0 to 4	71
F6-14 (03BB)	CC-Link bUS Error Auto Reset	Bus Err Auto Rst 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 0 Range: 0, 1	71
F6-20 (036B)	MECHATROLINK Station Address	Station Address	Sets the station address when the MECHATROLINK option has been installed.	Default: 21 Min.: 20 <2> Max.: 3F <2>	71
F6-21 (036C)	MECHATROLINK Frame Size	Frame length	MECHATROLINK-II (SI-T3) 0: 32-byte 1: 17-byte MECHATROLINK-III (SI-ET3) 0: 64-byte 1: 32-byte	Default: 0 Range: 0, 1	71
F6-22 (036D)	MECHATROLINK Link Speed	Link Speed 0: 10MHz 1: 4MHz	0: 10 Mbps 1: 4 Mbps	Default: 0 Range: 0, 1	72
F6-23 (036E)	MECHATROLINK Monitor Selection (E)	Mon E register	Sets the MECHATROLINK monitor (E).	Default: 0 Min.: 0 Max.: FFFF	72
F6-24 (036F)	MECHATROLINK Monitor Selection (F)	Mon F register	Sets the MECHATROLINK monitor (F).	Default: 0 Min.: 0 Max.: FFFF	72
F6-25 (03C9)	Operation Selection at MECHATROLINK Watchdog Timer Error (E5)	SI-T WDTErr Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only	0: Ramp to stop. Decelerate using the deceleration time in C1-02. 1: Coast to stop 2: Fast stop. Decelerate using the deceleration time in C1-09. 3: Alarm only	Default: 1 Range: 0 to 3	72
F6-26 (03CA)	MECHATROLINK bUS Errors Detected	Num of SI-T BUS	Sets the number of option communication errors (bUS).	Default: 2 Min.: 2 Max.: 10	72
F6-30 (03CB)	PROFIBUS-DP Node Address	PB Node Address	Sets the node address.	Default: 0 Min.: 0 Max.: 125	72
F6-31 (03CC)	PROFIBUS-DP Clear Mode Selection	PB Clear Select 0: Reset to Zero 1: Hold Prev Value	0: Resets drive operation with a Clear mode command. 1: Maintains the previous operation state when Clear mode command is given.	Default: 0 Range: 0, 1	73
F6-32 (03CD)	PROFIBUS-DP Data Format Selection	PB Map Select 0: PPO Type 1: Conventional	0: PPO Type 1: Conventional	Default: 0 Range: 0, 1	73

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F6-35 (03D0)	CANopen Node ID Selection	CO Node Address	Sets the node address.	Default: 0 Min.: 0 Max.: 126	73
F6-36 (03D1)	CANopen Communication Speed	CO Baud Rate 0: Auto Detect 1: 10 kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1Mbps	0: Auto-detection 1: 10 kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1 Mbps	Default: 6 Range: 0 to 8	73
F6-40 (03D5)	CompoNet Node Address	CN Node Adress	Reserved.	–	–
F6-41 (03D6)	CompoNet Communication Speed	CN Baud Rate	Reserved.	–	–
F6-45 (02FB)	BACnet Node Address	BAC Node Address	Sets BACnet physical node address.	Default: 1 Min.: 0 Max.: 127	73
F6-46 (02FC)	BACnet Baud Rate	BAC Baud Rate 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19.2 kbps 5: 38.4 kbps 6: 57.6 kbps 7: 76.8 kbps 8: 115.2 kbps	0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400 6: 57600 7: 76800 8: 115200	Default: 3 Range: 0 to 8	74
F6-47 (02FD)	Rx to Tx Wait Time	Rx to Tx Wait T	Sets the wait time between receiving and sending for BACnet MS/TP.	Default: 5 ms Min.: 5 Max.: 65	74
F6-48 (02FE)	BACnet Device Object Identifier 0	BAC Dev Obj Id 0	Sets the least significant word for BACnet/IP when using the JOHB-SMP3 option and BACnet MS/TP when using the SI-B3 option.	Default: 0 Min.: 0 Max.: FFFF	74
F6-49 (02FF)	BACnet Device Object Identifier 1	BAC Dev Obj Id 1	Sets the most significant word for BACnet/IP when using the JOHB-SMP3 option and BACnet MS/TP when using the SI-B3 option.	Default: 0 Min.: 0 Max.: 3F	74
F6-50 (03C1)	DeviceNet MAC Address	DN MAC Address	Selects the drive MAC address.	Default: 64 Min.: 0 Max.: 64	74
F6-51 (03C2)	DeviceNet Communication Speed	DN Baud Rate 0: 125 kbps 1: 250 kbps 2: 500 kbps 3: Set from Network 4: Auto Detect	0: 125 kbps 1: 250 kbps 2: 500 kbps 3: Adjustable from network 4: Detect automatically	Default: 4 Range: 0 to 4	74
F6-52 (03C3)	DeviceNet PCA Setting	PCA Selection	Sets the format of the data set from the DeviceNet master to the drive.	Default: 21 Min.: 0 Max.: 255	75
F6-53 (03C4)	DeviceNet PPA Setting	PPA Selection	Sets the format of the data set from the drive to the DeviceNet master.	Default: 71 Min.: 0 Max.: 255	75
F6-54 (03C5)	DeviceNet Idle Mode Fault Detection	DN Idle Flt Det 0: Stop 1: Ignore	0: Enabled 1: Disabled, no fault detection	Default: 0 Range: 0, 1	75
F6-55 (03C6)	DeviceNet Baud Rate Monitor	DN BAUD RATE MEM 0: 125 kbps 1: 250 kbps 2: 500 kbps	Verifies the baud rate running on the network. 0: 125 kbps 1: 250 kbps 2: 500 kbps	Default: 0 Range: 0 to 2	75
F6-56 (03D7)	DeviceNet Speed Scaling	Speed Scale	Sets the scaling factor for the speed monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	75

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F6-57 (03D8)	DeviceNet Current Scaling	Current Scale	Sets the scaling factor for the output current monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	75
F6-58 (03D9)	DeviceNet Torque Scaling	Torque Scale	Sets the scaling factor for the torque monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	75
F6-59 (03DA)	DeviceNet Power Scaling	Power Scale	Sets the scaling factor for the power monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	75
F6-60 (03DB)	DeviceNet Voltage Scaling	Voltage Scale	Sets the scaling factor for the voltage monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	75
F6-61 (03DC)	DeviceNet Time Scaling	Time Scale	Sets the scaling factor for the time monitor in DeviceNet.	Default: 0 Min.: -15 Max.: 15	75
F6-62 (03DD)	DeviceNet Heartbeat Interval	DN Heart Beat	Sets the heartbeat interval for DeviceNet communications.	Default: 0 Min.: 0 Max.: 10	75
F6-63 (03DE)	DeviceNet Network MAC ID	DN MAC ID MEM	Saves and monitors settings 0 to 63 of F6-50 (DeviceNet MAC Address).	Default: 63 Min.: 0 Max.: 63	76
F6-64 to F6-71 (03DF to 03C8)	Reserved	–	Reserved for Dynamic I/O Assembly Parameters.	–	–
F6-72 (03DE)	PowerLink Node Address	PowerLink NodeID	Reserved.	–	–
F7-01 (03E5) <4> <5> <6>	IP Address 1	IP Address 1	Sets the most significant octet of network static IP address.	Default: 192 Min.: 0 Max.: 255	–
F7-02 (03E6) <4> <5> <6>	IP Address 2	IP Address 2	Sets the second most significant octet of network static IP address.	Default: 168 Min.: 0 Max.: 255	–
F7-03 (03E7) <4> <5> <6>	IP Address 3	IP Address 3	Sets the third most significant octet of network static IP address.	Default: 1 Min.: 0 Max.: 255	–
F7-04 (03E8) <4> <5> <6>	IP Address 4	IP Address 4	Sets the fourth most significant octet of network static IP address.	Default: 20 Min.: 0 Max.: 255	–
F7-05 (03E9) <6>	Subnet Mask 1	Subnet Mask 1	Sets the most significant octet of network static Subnet Mask.	Default: 255 Min.: 0 Max.: 255	–
F7-06 (03EA) <6>	Subnet Mask 2	Subnet Mask 2	Sets the second most significant octet of network static Subnet Mask.	Default: 255 Min.: 0 Max.: 255	–
F7-07 (03EB) <6>	Subnet Mask 3	Subnet Mask 3	Sets the third most significant octet of network static Subnet Mask.	Default: 255 Min.: 0 Max.: 255	–
F7-08 (03EC) <6>	Subnet Mask 4	Subnet Mask 4	Sets the fourth most significant octet of network static Subnet Mask.	Default: 0 Min.: 0 Max.: 255	–
F7-09 (03ED) <6>	Gateway Address 1	Gateway IP Add 1	Sets the most significant octet of network Gateway address.	Default: 192 Min.: 0 Max.: 255	–
F7-10 (03EE) <6>	Gateway Address 2	Gateway IP Add 2	Sets the second most significant octet of network Gateway address.	Default: 168 Min.: 0 Max.: 255	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F7-11 (03EF) <6>	Gateway Address 3	Gateway IP Add 3	Sets the third most significant octet of network Gateway address.	Default: 1 Min.: 0 Max.: 255	–
F7-12 (03E0) <6>	Gateway Address 4	Gateway IP Add 4	Sets the fourth most significant octet of network Gateway address.	Default: 1 Min.: 0 Max.: 255	–
F7-13 (03F1)	Address Mode at Startup	IP Add Mode Sel 0: User Defined 1: BOOTP 2: DHCP	Select the option address setting method 0: Static <5> <6> 1: BOOTP 2: DHCP	Default: 2 Range: 0 to 2	–
F7-14 (03F2)	Duplex Mode Selection	Duplex Select 0: Half/Half 1: Auto/Auto 2: Full/Full	Selects duplex mode setting. 0: Half duplex forced <7> 1: Auto-negotiate duplex mode and communication speed 2: Full duplex forced <7>	Default: 1 Range: 0 to 2	–
F7-15 (03F3) <7>	Communication Speed Selection	Baud Rate 10: 10/10 Mbps 100: 100/100 Mbps	Sets the communication speed 10: 10 Mbps 100: 100 Mbps	Default: 10 Range: 10, 100	–
F7-16 (03F4)	Communication Loss Timeout	CommLoss Tout	Sets the timeout value in tenths of a second for communication loss detection. Example: Setting this parameter to 100 represents 10.0 seconds. Setting this parameter to 0 disables the connection timeout.	Default: 0.0 s Min.: 0.0 Max.: 30.0	–
F7-17 (03F5)	EtherNet/IP Speed Scaling Factor	EN Speed Scale	Sets the scaling factor for the speed monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-18 (03F6)	EtherNet/IP Current Scaling Factor	EN Current Scale	Sets the scaling factor for the output current monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-19 (03F7)	EtherNet/IP Torque Scaling Factor	EN Torque Scale	Sets the scaling factor for the torque monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-20 (03F8)	EtherNet/IP Power Scaling Factor	EN Power Scale	Sets the scaling factor for the power monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-21 (03F9)	EtherNet/IP Voltage Scaling Factor	EN Voltage Scale	Sets the scaling factor for the voltage monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-22 (03FA)	EtherNet/IP Time Scaling	EN Time Scale	Sets the scaling factor for the time monitor in EtherNet/IP Class ID 2AH Object.	Default: 0 Min.: -15 Max.: 15	–
F7-23 to F7-32 (03FB to 0374)	Dynamic Output Assembly Parameters	–	Parameters used in Output Assembly 116. Each parameter contains a MEMOBUS/Modbus address. The value received for Output Assembly 116 will be written to this corresponding MEMOBUS/Modbus address. A MEMOBUS/Modbus address value of 0 means that the value received for Output Assembly 116 will not be written to any MEMOBUS/Modbus register.	Default: 0	–
F7-33 to F7-42 (0375 to 037E)	Dynamic Input Assembly Parameters	–	Parameters used in Input Assembly 166. Each parameter contains a MEMOBUS/Modbus address. The value sent for Input Assembly 166 will be read from this corresponding MEMOBUS/Modbus address. A MEMOBUS/Modbus address value of 0 means that the value sent for Input Assembly 166 is not defined by the user, therefore the option default register value will be returned.	Default: 0	–
F7-50 (1BC1) <8>	BACnet/IP Port	BACnet/IP Port	Sets the UDP port on which the drive will receive incoming BACnet/IP messages.	Default: 47808 Min.: 1024 Max.: 65535	–
F7-51 (1BE9) <8>	BBMD Foreign Register Addr 1	BBMD IP Addr 1	Sets first octet of the IP Address of the BBMD device to which this unit will register as a foreign device.	Default: 0 Min.: 0 Max.: 255	–
F7-52 (1BEA) <8>	BBMD Foreign Register Addr 2	BBMD IP Addr 2	Sets second octet of the IP Address of the BBMD device to which this unit will register as a foreign device.	Default: 0 Min.: 0 Max.: 255	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
F7-53 (1BEB) <8>	BBMD Foreign Register Addr 3	BBMD IP Addr 3	Sets third octet of the IP Address of the BBMD device to which this unit will register as a foreign device.	Default: 0 Min.: 0 Max.: 255	–
F7-54 (1BEC) <8>	BBMD Foreign Register Addr 4	BBMD IP Addr 4	Sets fourth octet of the IP Address of the BBMD device to which this unit will register as a foreign device.	Default: 0 Min.: 0 Max.: 255	–
F7-55 (1BED) <8>	BBMD Foreign Register Port #	BBMD Port #	Sets the UDP port of the BBMD device to which this unit will register.	Default: 47808 Min.: 1024 Max.: 65535	–
F7-56 (1BEE) <8>	BBMD Foreign Register Time	BBMD Register Tm	Sets the time interval in which this unit will repeat BBMD foreign registration.	Default: 3600 Min.: 0 Max.: 65535	–
F7-57 (1BEF) <8>	BACnet/IP bUS Timeout Value	B/IP bUS Flt Tim	Sets the length of time that this unit will wait after it receives Run command or frequency reference command before it will detect a bUS fault.	Default: 3600 Min.: 0 Max.: 65535	–

<1> When using this setting, be sure to take safety measures, such as installing an emergency stop switch. The drive will continue to operate when a fault is detected.

<2> Values shown are for the MECHATROLINK-II option (SI-T3). Values for MECHATROLINK-III option (SI-ET3) are:
Min: 03
Max.: EF

<3> Parameter setting value is not reset to the default value when the drive is initialized.

<4> Cycle power for setting changes to take effect.

<5> When setting F7-13 to 0, all IP addresses (F7-01 to F7-04) must be unique.

<6> When setting F7-13 to 0, also set parameters F7-01 to F7-12.

<7> When F7-14 is set to 0 or 2, be sure to also set F7-15.

<8> Available in drive software versions PRG: 6117 and later.

A.9 H Parameters: Multi-Function Terminals

H parameters assign functions to the multi-function input and output terminals.

◆ H1: Multi-Function Digital Inputs

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H1-01 (0438)	Multi-Function Digital Input Terminal S1 Function Selection	Term S1 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *217* to *220* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 40 (F) <1> Min.: 1 Max.: B2	*77*
H1-02 (0439)	Multi-Function Digital Input Terminal S2 Function Selection	Term S2 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *217* to *220* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 41 (F) <1> Min.: 1 Max.: B2	*77*
H1-03 (0400)	Multi-Function Digital Input Terminal S3 Function Selection	Term S3 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *217* to *220* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 24 Min.: 0 Max.: B2	*77*
H1-04 (0401)	Multi-Function Digital Input Terminal S4 Function Selection	Term S4 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *217* to *220* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 14 Min.: 0 Max.: B2	*77*
H1-05 (0402)	Multi-Function Digital Input Terminal S5 Function Selection	Term S5 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *217* to *220* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 3 (0) <1> Min.: 0 Max.: B2	*77*
H1-06 (0403)	Multi-Function Digital Input Terminal S6 Function Selection	Term S6 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *217* to *220* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 4 (3) <1> Min.: 0 Max.: B2	*77*
H1-07 (0404)	Multi-Function Digital Input Terminal S7 Function Selection	Term S7 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *217* to *220* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 6 (4) <1> Min.: 0 Max.: B2	*77*
H1-08 (0405)	Multi-Function Digital Input Terminal S8 Function Selection	Term S8 Func Sel	Assigns a function to the multi-function digital inputs. Refer to pages *217* to *220* for descriptions of setting values. **Note:** Set unused terminals to F.	Default: 8 Min.: 0 Max.: B2	*77*

<1> Value in parenthesis is the default setting when a 3-Wire initialization is performed (A1-03 = 3330).

H1 Multi-Function Digital Input Selections				
H1-□□ Setting	**Function**	**LCD Display**	**Description**	**Page**
0	3-Wire sequence	3-Wire Control	Closed: Reverse rotation (only if the drive is set up for 3-Wire sequence) Terminals S1 and S2 are automatically set up for the Run command and Stop command.	*78*
3	Multi-Step Speed Reference 1	Multi-Step Ref 1	When input terminals are set to Multi-Step Speed References 1 through 3, switching combinations of those terminals will create a multi-step speed sequence using the frequency references set in d1-01 through d1-08.	*78*
4	Multi-Step Speed Reference 2	Multi-Step Ref 2	When input terminals are set to Multi-Step Speed References 1 through 3, switching combinations of those terminals will create a multi-step speed sequence using the frequency references set in d1-01 through d1-08.	*78*
6	Jog reference selection	jog Freq Ref	Closed: Jog frequency reference (d1-17) selected. Jog has priority over all other reference sources.	*78*
7	Accel/decel time selection 1	Multi-Acc/Dec 1	Used to switch between accel/decel time 1 (set in C1-01, C1-02) and accel/decel time 2 (set in C1-03, C1-04).	*79*
8	Baseblock command (N.O.)	Ext BaseBlk N.O.	Closed: No drive output	*79*
9	Baseblock command (N.C.)	Ext BaseBlk N.C.	Open: No drive output	*79*
A	Accel/decel ramp hold	Acc/Dec RampHold	Open: Accel/decel is not held Closed: The drive pauses during acceleration or deceleration and maintains the output frequency.	*79*

H1 Multi-Function Digital Input Selections				
H1-☐☐ Setting	Function	LCD Display	Description	Page
B	Drive overheat alarm (oH2)	OH2 Alarm Signal	Closed: Closes when an oH2 alarm occurs. An external device has triggered an oH2 alarm. Sets Drive Overheat Pre-alarm Multi-Function Digital Output 20H.	79
C	Analog terminal input selection	Term A2 Enable	Open: Function assigned by H3-14 is disabled. Closed: Function assigned by H3-14 is enabled.	79
F	Through mode	Term Not Used	Select this setting when using the terminal in a pass-through mode. The terminal does not trigger a drive function, but it can be used as digital input for the controller to which the drive is connected.	79
10	Up command	Up Command 1	The drive accelerates when the Up command terminal closes, and decelerates when the Down command closes. When both terminals are closed or both are open, the drive holds the frequency reference. The Up and Down commands must always be used in conjunction with one another.	80
11	Down command	Down Command 1	The drive accelerates when the Up command terminal closes, and decelerates when the Down command closes. When both terminals are closed or both are open, the drive holds the frequency reference. The Up and Down commands must always be used in conjunction with one another.	80
12	Forward Jog	Forward Jog	Closed: Runs forward at the Jog frequency d1-17.	81
13	Reverse Jog	Reverse Jog	Closed: Runs reverse at the Jog frequency d1-17.	81
14	Fault reset	Fault Reset	Closed: Resets faults if the cause is cleared and the Run command is removed.	81
15	Fast Stop (N.O.)	Fast-Stop N.O.	Closed: Decelerates at the Fast Stop time set to C1-09.	81
17	Fast Stop (N.C.)	Fast-Stop N.C.	Open: Decelerates to stop at the Fast Stop time set to C1-09.	81
18	Timer function input	Timer function	Triggers the timer set up by parameters b4-01 and b4-02. Must be set in conjunction with the timer function output (H2-☐☐ = 12).	82
19	PID disable	PID Disable	Open: PID control enabled Closed: PID control disabled	82
1B	Program lockout	Program Lockout	Open: Parameters cannot be edited (except for U1-01 if the reference source is assigned to the HOA keypad). Closed: Parameters can be edited and saved.	82
1E	Reference sample hold	Ref Sample Hold	Closed: Samples the analog frequency reference and operates the drive at that speed.	82
20 to 2F	External fault	External fault 20: NO/Always Det, Ramp to Stop 21: NC/Always Det, Ramp to Stop 22: NO/During RUN, Ramp to Stop 23: N.C., During run, ramp to stop 24: NO/ Always Det, Coast to Stop 25: NC/Always Det, Coast to Stop 26: NO/During RUN, Coast to Stop 27: NC/During RUN, Coast to Stop 28: NO/Always Det, Fast-Stop 29: NC/Always Det, Fast-Stop 2A: NO/During RUN, Fast-Stop 2B: NC/During RUN, Fast- Stop 2C: NO/Always Det, Alarm Only 2D: NC/Always Det, Alarm Only 2E: NO/ During RUN, Alarm Only 2F: NC/During RUN, Alarm Only	20: N.O., Always detected, ramp to stop 21: N.C., Always detected, ramp to stop 22: N.O., During run, ramp to stop 23: N.C., During run, ramp to stop 24: N.O., Always detected, coast to stop 25: N.C., Always detected, coast to stop 26: N.O., During run, coast to stop 27: N.C., During run, coast to stop 28: N.O., Always detected, Fast Stop 29: N.C., Always detected, Fast Stop 2A: N.O., During run, Fast Stop 2B: N.C., During run, Fast Stop 2C: N.O., Always detected, alarm only (continue running) 2D: N.C., Always detected, alarm only (continue running) 2E: N.O., During run, alarm only (continue running) 2F: N.C., During run, alarm only (continue running)	83
30	PID integral reset	PID Intgrl Reset	Closed: Resets the PID control integral value.	83

H1 Multi-Function Digital Input Selections				
H1-□□ Setting	Function	LCD Display	Description	Page
31	PID integral hold	PID Intgrl Hold	Open: Performs integral operation. Closed: Maintains the current PID control integral value.	83
34	PID soft starter cancel	PID SFS Cancel	Open: PID soft starter is enabled. Closed: Disables the PID soft starter b5-17.	83
35	PID input level selection	PID Input Invert	Closed: Inverts the PID input signal.	83
40	Forward run command (2-Wire sequence)	FwdRun 2Wire Seq	Open: Stop Closed: Forward run **Note:** Cannot be set together with settings 42 or 43.	84
41	Reverse run command (2-Wire sequence)	RevRun 2WireSeq	Open: Stop Closed: Reverse run **Note:** Cannot be set together with settings 42 or 43.	84
42	Run command (2-Wire sequence 2)	Run/Stp 2WireSeq	Open: Stop Closed: Run **Note:** Cannot be set together with settings 40 or 41.	84
43	FWD/REV command (2-Wire sequence 2)	FWD/REV 2WireSeq	Open: Forward Closed: Reverse **Note:** Determines motor direction, but does not issue a Run command. Cannot be set together with settings 40 or 41.	84
44	Offset frequency 1	Offset Freq 1	Closed: Adds d7-01 to the frequency reference.	84
45	Offset frequency 2	Offset Freq 2	Closed: Adds d7-02 to the frequency reference.	84
46	Offset frequency 3	Offset Freq 3	Closed: Adds d7-03 to the frequency reference.	84
47	Node setup	CanOpenNID Setup	Closed: Node setup for SI-S3 enabled.	84
50	Motor Pre-Heat 2	Motor Preheat 2	Closed: Triggers Motor Pre-Heat 2.	84
51	Sequence Timer Disable	SeqTimer Disable	Closed: Drive ignores sequence timers and runs normally.	84
52	Sequence Timer Cancel	SeqTimer Cancel	Closed: Sequence Timer Cancel .	84
60	Motor pre-heat 1	DCInj Activate	Closed: Triggers Motor pre-heat 1.	84
61	External Speed Search command 1	Speed Search 1	Closed: Activates Current Detection Speed Search from the maximum output frequency (E1-04).	85
62	External Speed Search command 2	Speed Search 2	Closed: Activates Current Detection Speed Search from the frequency reference.	85
63	Field weakening	Field Weak	Closed: The drive performs Field Weakening control as set for d6-01 and d6-02.	85
67	Communications test mode	Comm Test Mode	Tests the MEMOBUS/Modbus RS-422/RS-485 interface. Displays “PASS” if the test completes successfully.	85
69	Jog 2	Jog 2	Cause the drive to ramp to the jog frequency (d1-17).	85
6A	Drive enable	Drive Enable	Open: Drive disabled. If this input is opened during run, the drive will stop as specified by b1-03. Closed: Ready for operation.	85
6D	AUTO mode select	AUTO Mode Sel	Legacy Operation Mode (S5-04 = 0) • Open: HAND reference is selected (based on S5-01) • Closed: AUTO reference is selected (based on b1-01) Normal Operation Mode (S5-04 ≠ 0) **Note:** The drive will always be in AUTO mode at power up when S5-04 is set to 1. • Open: Drive is in OFF or HAND mode. • Closed: Drive is in AUTO mode (when HAND mode select input is open)	85
6E	HAND mode select	HAND Mode Se	Legacy Operation Mode (S5-04 = 0) • Open: AUTO reference is selected (based on b1-01) • Closed: HAND reference is selected (based on S5-01) Normal Operation Mode (S5-04 ≠ 0) **Note:** The drive will always be in AUTO mode at power up when S5-04 is set to 1. • Open: Drive is in OFF or AUTO mode. • Closed: Drive is in HAND mode. (when AUTO mode select input is open)	85

H1 Multi-Function Digital Input Selections				
H1-□□ Setting	**Function**	**LCD Display**	**Description**	**Page**
70	Drive Enable2	Drive Enable 2	Prevents the Drive from executing a Run command until the Drive Enable2 input is closed. When the Drive Enable2 input is open and a Run command is closed, the drive LCD will display “dnE”. The drive will run when the Run and Drive Enable2 inputs are both closed. If the Drive Enable2 input is opened while the drive is running, the drive will stop using the method set by parameter b1-03.	86
A4	BP Customer Safeties	BP Emg Override	Closed: Indicates that customer safeties are in place.	86
A5	BP Drive/Bypass Select	BP Drv/Bypss Sel	Open: Bypass mode. Closed: Drive mode.	86
A6	BP BAS Interlock Input	BP BAS Interlock	Closed: Indicates that the dampers are open	86
A7	BP Customer Safeties	BP Cust Safeties	Closed: Indicates that customer safeties are in place.	86
A8	Secondary PI Disable (N.O.)	PI2 Disable N.O.	Closed: Disables the secondary PI controller. Output behavior depends on the setting of S3-12.	86
A9	Secondary PI Disable (N.C.)	PI2 Disable N.C.	Closed: Enables the secondary PI controller. Output behavior depends on the setting of S3-12 when open.	86
AA	Secondary PI Inverse Operation	PI2 Invert	Closed: Changes the sign of the secondary PI controller input (reverse acting PID control).	86
AB	Secondary PI Integral Reset	PI2 Intgrl Reset	Closed: Resets the secondary PI controller integral value.	86
AC	Secondary PI Integral Hold	PI2 Intgrl Hold	Closed: Locks the value of the secondary PI controller integral value.	86
AD	Select Secondary PI Parameters	Select PI2 Parms	Closed: Uses the secondary PI controller Proportional and Integral adjustments (S3-06 and S3-07) instead of the primary PID controller Proportional and Integral adjustments (b5-02 and b5-03). Only valid when S3-01 = 0 (secondary PI controller disabled). **Note:** This multi-function input has no effect on the secondary PI controller. It is only used for the primary PID controller (b5-□□).	86
AE	BP Bypass Run	BP Bypass Run	Closed: Commands a Run (via closing the BP Bypass Relay multi-function output) when in Bypass mode.	86
AF	Emergency Override Forward Run	EmergOverrideFWD	Closed: Emergency Override Forward Run	87
B0	Emergency Override Reverse Run	EmergOverrideREV	Closed: Emergency Override Reverse Run	87
B1	Customer Safeties	CustomerSafeties	The functionality is identical to Drive Enable 2 (H1-□□ = 70), except for the following characteristics: • The stopping method is forced to Coast to Stop when the input is open • The drive will display a “SAFE” alarm if the input is open when a Run command is present. It will not display “dnE”. Open: Customer Safeties are open. Drive will not run. Stopping method is Coast to Stop. Closed: Customer Safeties are in place.	87
B2	BAS Interlock	BAS Interlock	Open: Damper interlock is not closed. Drive output is shut off (baseblocked). The drive displays an "inTLK" message if a Run command is present. It will not display "dnE". Closed: Damper interlock is closed. Drive operates normally. **Note:** The state of the BAS Interlock multi-function input has no effect on the Emergency Override multi-function inputs (H1-□□ = AF, B0). The Emergency Override command is accepted when the BAS Interlock digital input is open or closed.	87

◆ H2: Multi-Function Digital Outputs

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H2-01 (040B)	Terminal M1-M2 function selection (relay)	M1-M2 Func Sel	Refer to H2 Multi-Function Digital Output Settings on pages 221 to 223 for descriptions of setting values.	Default: 0 Range: 0 to 1B6	87
H2-02 (040C)	Terminal M3-M4 function selection (relay)	M3/M4 Func Sel		Default: 1 Range: 0 to 1B6	87
H2-03 (040D)	Terminal MD-ME-MF function selection (relay)	MD/ME/MF FuncSel		Default: 2 Range: 0 to 1B6	87
H2-06 (0437)	Power Consumption Output Unit Selection	Pwr Mon Unit Sel	Sets the units for the output signal when Power Consumption Pulse Output or Regenerated Power Pulse Output are selected as the digital output (H2-01, H2-02, or H2-03 = 39 or 3A). 0: 0.1 kWh units <1> 1: 1 kWh units 2: 10 kWh units 3: 100 kWh units 4: 1000 kWh units	Default: 1 Range: 0 to 4	96
H2-07 (0B3A)	MEMOBUS Register 1 Address Select	MFDO Regs1 Addr	Sets the addresses of the MEMOBUS/Modbus registers from which data will be sent to contact outputs 62 and 162.	Default: 1 Range: 1 to 1FFFH	97
H2-08 (0B3B)	MEMOBUS Register 1 Bit Select	MFDO Regs1 Bit	Sets the bits for the MEMOBUS/Modbus registers from which data will be sent to contact outputs 62 and 162.	Default: 0 Range: 0 to FFFFH	97
H2-09 (0B3C)	MEMOBUS Register 2 Address Select	MFDO Regs2 Addr	Sets the addresses of the MEMOBUS/Modbus registers from which data will be sent to contact outputs 63 and 163.	Default: 1 Range: 1 to 1FFFH	97
H2-10 (0B3D)	MEMOBUS Register 2 Bit Select	MFDO Regs2 Bit	Sets the bits for the MEMOBUS/Modbus registers from which data will be sent to contact outputs 63 and 163.	Default: 0 Range: 0 to FFFFH	97

<1> Available in drive software versions PRG: 6113 and later.

H2 Multi-Function Digital Output Settings				
H2-□□ Setting	Function	LCD Display	Description	Page
0	During run	During RUN 1	Closed: A Run command is active or voltage is output.	88
1	Zero speed	Zero Speed	Open: Output frequency is above the minimum output frequency set in E1-09. Closed: Output frequency is below the minimum output frequency set in E1-09.	88
2	Speed agree 1	Fref/Fout Agree1	Closed: Output frequency equals the speed reference (plus or minus the hysteresis set to L4-02).	88
3	User-set speed agree 1	Fref/Set Agree 1	Closed: Output frequency and speed reference equal L4-01 (plus or minus the hysteresis set to L4-02).	89
4	Frequency detection 1	Freq Detect 1	Closed: Output frequency is less than or equal to the value in L4-01 with hysteresis determined by L4-02.	89
5	Frequency detection 2	Freq Detect 2	Closed: Output frequency is greater than or equal to the value in L4-01 with hysteresis determined by L4-02.	90
6	Drive ready	Drive Ready	Closed: Power up is complete and the drive is ready to accept a Run command.	90
7	During Power Supply Voltage Fault	Power Supply Err	Closed: One of the following faults will occur: AUv (Power Supply Undervoltage), Uv (Undervoltage). or Fdv (Power Supply Frequency Fault).	90
8	During baseblock (N.O.)	BaseBlk 1	Closed: Drive has entered the baseblock state (no output voltage).	91
9	Frequency reference source	Ref Source	Open: External Reference 1 or 2 supplies the frequency reference (set in b1-01). Closed: HOA keypad supplies the frequency reference.	91
A	Run command source	Run Cmd Source	Open: External Reference 1 or 2 supplies the Run command (set in b1-02). Closed: HOA keypad supplies the Run command.	91
B	Torque detection 1 (N.O.)	Trq Det 1 N.O.	Closed: An overtorque or undertorque situation has been detected.	91
C	Frequency reference loss	Loss of Ref	Closed: Analog frequency reference has been lost.	91
E	Fault	Fault	Closed: Fault occurred.	91

H2 Multi-Function Digital Output Settings				
H2-□□ Setting	Function	LCD Display	Description	Page
F	Through mode	Not Used	Set this value when using the terminal in the pass-through mode.	91
10	Minor Fault	Minor Fault	Closed: An alarm has been triggered.	91
11	Fault reset command active	Reset Cmd Active	Closed: A command has been entered to clear a fault via the input terminals or from the serial network.	92
12	Timer output	Timer Output	Closed: Timer output.	92
13	Speed agree 2	Fref/Fout Agree2	Closed: When drive output frequency equals the frequency reference ±L4-04.	92
14	User-set speed agree 2	Fref/Set Agree 2	Closed: When the drive output frequency is equal to the value in L4-03 ±L4-04.	92
15	Frequency detection 3	Freq Detect 3	Closed: When the drive output frequency is less than or equal to the value in L4-03 ±L4-04.	93
16	Frequency detection 4	Freq Detect 4	Closed: When the output frequency is greater than or equal to the value in L4-03 ±L4-04.	93
17	Torque detection 1 (N.C.)	Trq Det 1 N.C.	Open: Overtorque or undertorque has been detected.	91
1B	During baseblock (N.C.)	BaseBlk 2	Open: Drive has entered the baseblock state (no output voltage).	94
1E	Restart enabled	Dur Flt Restart	Closed: An automatic restart is performed	94
1F	Motor overload alarm (oL1)	Overload (OL1)	Closed: oL1 is at 90% of its trip point or greater. An oH3 situation also triggers this alarm.	94
20	Drive overheat pre-alarm (oH)	OH Prealarm	Closed: The heatsink temperature exceeds the L8-02 level (while L8-03 = 3, 4), or an external device has triggered an oH2 alarm via multi-function input H1-□□ = BH.	94
2F	Maintenance period	Maintenance	Closed: Cooling fan, capacitor for the control power supply, or the soft charge bypass relay may require maintenance.	94
37	During frequency output	During RUN 2	Open: Either the drive has stopped or baseblock, DC Injection Braking, or Initial Excitation is being performed. Closed: Drive is running the motor (not in a baseblock state and DC Injection is not being performed).	94
38	Drive enabled	Drive Enable	Closed: Multi-function input set for “Drive enable” is closed (H1-□□ = 6A)	95
39	Power consumption pulse output	Energy Pulse Out	Outputs a pulse to indicate the power consumed. Output units are determined by H2-06. Outputs a pulse every 200 ms to indicate the kWh count.	95
3A	Regenerated power pulse output	RegEn Pulse Out	Outputs a pulse to indicate the regenerated power. Output units are determined by H2-06. Outputs a pule every 200 ms to indicate kWh count.	95
3D	During speed search	During SpdSrch	Closed: Speed Search is being executed.	95
3E	PID feedback low	PID Feedback Low	Closed: PID feedback level is too low.	95
3F	PID feedback high	PID FeedbackHigh	Closed: The PID feedback level is too high.	95
4C	During fast stop	During Fast Stop	Closed: A Fast Stop command has been entered from the operator or input terminals.	95
4D	oH Pre-alarm time limit	OH Pre-Alarm	Closed: oH pre-alarm time limit has passed. An oH pre-alarm is present after 10 output frequency reduction cycles have passed (L8-03 = 4).	95
50	Waiting for run	Waiting for Run	Closed: Delay executing any run command until the time set to b1-11 has expired.	95
51	Sequence timer 1 active	SeqTimer Disable	Closed: Sequence timer 1 is active.	95
52	Sequence timer 2 active	SeqTimer Cancel	Closed: Sequence timer 2 is active.	95
53	Sequence timer 3 active	Sequence timer 3	Closed: Sequence timer 3 is active.	95
54	Sequence timer 4 active	Sequence Timer 4	Closed: Sequence timer 4 is active.	95
58	Underload detection	UL6	Closed: Underload is detected.	95
60	Internal cooling fan alarm	Fan Alrm Det	Closed: Internal cooling fan alarm	96
62	MEMOBUS Register 1 (Selected with H2-07 and H2-08)	Memobus Regs1	The contact output is closed when any of the bits specified by H2-08 for the MEMOBUS/Modbus register address set in H2-07 turn on.	96
63	MEMOBUS Register 2 (Selected with H2-09 and H2-10)	Memobus Regs2	The contact output is closed when any of the bits specified by H2-10 for the MEMOBUS/Modbus register address set in H2-09 turn on.	96
64	During Commercial Power Operation	CommerclPwr Mode	Closed: Operating on commercial power.	96
AF	BP Drive Relay Contact	BP Drive Relay	Closed: Line voltage is being supplied to the dive, and the motor is being run via the drive.	96

H2 Multi-Function Digital Output Settings				
H2-□□ Setting	Function	LCD Display	Description	Page
B0	BP Bypass Relay Contact	BP Bypass Relay	Closed: Line voltage is being supplied directly to the motor.	96
B1	BP BAS Interlock Relay Contact	BP BAS Interlock	Closed: Actuation signal for options dampers.	96
B2	BAS Interlock Relay Contact	BAS Interlock	A Run command is active or voltage is output. Actuation signal for damper.	96
B3	Secondary PI Feedback Low	PI2 Feedback Low	Closed: PI2 feedback level is too low.	96
B4	Secondary PI Feedback High	PI2 FeedbackHigh	Closed: The PI2 feedback level is too high.	96
B5	Relay Operator Control	PI2 Disable N.C.	Closed: F1 (F2) key toggle relay output.	96
B6	Drive overheat alarm 2	OH Alarm 2	Closed: An external device triggered an overheat warning in the drive.	96
100 to 1B6	Function 0 to B6 with inverse output Note: A prefix of "!" is added to represent inverse functions on the LCD keypad display. Example: “!Zero speed”	–	Inverts the output switching of the multi-function output functions. Set the last two digits of 1□□ to reverse the output signal of that specific function.	96

◆ H3: Multi-Function Analog Inputs

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H3-01 (0410)	Terminal A1 Signal Level Selection	Term A1 Level 0: 0-10V, (LowLim=0) 1: 0-10V, (BipolRef) 2: 4-20 mA 3: 0-20 mA	0: 0 to 10 V with zero limit 1: 0 to 10 V without zero limit 2: 4-20 mA 3: 0-20 mA **Note:** Use jumper switch S1 to set input terminal A1 for current or voltage.	Default: 0 Range: 0 to 3	98
H3-02 (0434)	Terminal A1 Function Selection	Term A1 FuncSel	Sets the function of terminal A1.	Default: 0 Range: 0 to 26	98
H3-03 (0411) RUN	Terminal A1 Gain Setting	Terminal A1 Gain	Sets the level of the input value selected in H3-02 when 10 V is input at terminal A1.	Default: 100.0% Min.: -999.9 Max.: 999.9	98
H3-04 (0412) RUN	Terminal A1 Bias Setting	Terminal A1 Bias	Sets the level of the input value selected in H3-02 when 0 V is input at terminal A1.	Default: 0.0% Min.: -999.9 Max.: 999.9	98
H3-05 (0413)	Terminal A3 Signal Level Selection	Term A3 Signal 0: 0-10V (LowLim=0) 1: 0-10V, (BipolRef) 2: 4-20mA 3: 0-20mA	0: 0 to 10 V 1: -10 to 10 V 2: 4 to 20 mA 3: 0 to 20 mA **Note:** Use jumper switch S1 to set input terminal A3 for current or voltage input signal.	Default: 0 Range: 0 to 3	99
H3-06 (0414)	Terminal A3 Function Selection	Terminal A3 Sel	Sets the function of terminal A3.	Default: 2 Range: 0 to 26	99
H3-07 (0415) RUN	Terminal A3 Gain Setting	Terminal A3 Gain	Sets the level of the input value selected in H3-06 when 10 V is input at terminal A3.	Default: 100.0% Min.: -999.9 Max.: 999.9	100
H3-08 (0416) RUN	Terminal A3 Bias Setting	Terminal A3 Bias	Sets the level of the input value selected in H3-06 when 0 V is input at terminal A3.	Default: 0.0% Min.: -999.9 Max.: 999.9	100
H3-09 (0417)	Terminal A2 Signal Level Selection	Term A2 Level 0: 0-10V, (LowLim=0) 1: 0-10V, (BipolRef) 2: 4-20 mA 3: 0-20 mA	0: 0 to 10 V with zero limit 1: 0 to 10 V without zero limit 2: 4 to 20 mA 3: 0 to 20 mA **Note:** Use jumper switch S1 to set input terminal A2 for current or voltage input signal.	Default: 2 Range: 0 to 3	100

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H3-10 (0418)	Terminal A2 Function Selection	Term A2 FuncSel	Sets the function of terminal A2.	Default: <1> Range: 0 to 26	100
H3-11 (0419) RUN	Terminal A2 Gain Setting	Terminal A2 Gain	Sets the level of the input value selected in H3-10 when 10 V (20 mA) is input at terminal A2.	Default: 100.0% Min.: -999.9 Max.: 999.9	100
H3-12 (041A) RUN	Terminal A2 Bias Setting	Terminal A2 Bias	Sets the level of the input value selected in H3-10 when 0 V (0 or 4 mA) is input at terminal A2.	Default: 0.0% Min.: -999.9 Max.: 999.9	100
H3-13 (041B)	Analog Input Filter Time Constant	A1/A2 Filter T	Sets a primary delay filter time constant for terminals A1 and A2. Used for noise filtering.	Default: 0.03 s Min.: 0.00 Max.: 2.00	100
H3-14 (041C)	Analog Input Terminal Enable Selection	A1/A2/A3 Sel 1: A1 Available 2: A2 Available 3: A1/A2 Available 4: A3 Available 5: A1/A3 Available 6: A2/A3 Available 7: All Available	Determines which analog input terminals will be enabled or disabled when a digital input programmed for “Analog input enable” (H1-□□ = C) is activated. The terminals not set as the target are not influenced by input signals. 1: Terminal A1 only 2: Terminal A2 only 3: Terminals A1 and A2 only 4: Terminal A3 only 5: Terminals A1 and A3 6: Terminals A2 and A3 7: All terminals enabled	Default: 7 Range: 1 to 7	101
H3-16 (02F0)	Terminal A1 Offset	TerminalA1Offset	Adds an offset when the analog signal to terminal A1 is at 0 V.	Default: 0 Min.: -500 Max.: 500	101
H3-17 (02F1)	Terminal A2 Offset	TerminalA2Offset	Adds an offset when the analog signal to terminal A2 is at 0 V.	Default: 0 Min.: -500 Max.: 500	101
H3-18 (02F2)	Terminal A3 Offset	TerminalA3Offset	Adds an offset when the analog signal to terminal A3 is at 0 V.	Default: 0 Min.: -500 Max.: 500	101

<1> Default is 0 when b5-01 is set to 0.
Default is B when b5-01 is set to 1 or 3.

H3 Multi-Function Analog Input Settings				
H3-□□ Setting	Function	LCD Display	Description	Page
0	Frequency bias	Freq Ref Bias	10 V = E1-04 (maximum output frequency)	101
1	Frequency gain	Freq Ref Gain	0 to 10 V signal allows a setting of 0 to 100%. -10 to 0 V signal allows a setting of -100 to 0%.	101
2	Auxiliary frequency reference 1 (used as a Multi-Step Speed 2)	Aux Reference1	10 V = E1-04 (maximum output frequency)	102
3	Auxiliary frequency reference 2 (3rd step analog)	Aux Reference2	10 V = E1-04 (maximum output frequency)	102
4	Output voltage bias	Voltage Bias	10 V = E1-05 (motor rated voltage)	102
5	Accel/decel time gain	Acc/Dec Change	10 V = 100%	102
6	DC Injection Braking current	DC Brake Current	10 V = Drive rated current	102
7	Overtorque/undertorque detection level	Torque Det Level	10 V = Drive rated current (V/f) 10 V = Motor rated torque (OLV/PM)	102
8	Stall Prevention level during run	Stall Prev Level	10 V = Drive rated current	102
9	Output frequency lower limit level	Ref Lower Limit	10 V = E1-04 (maximum output frequency)	103
B	PID feedback	PID Feedback1	10 V = 100%	103
C	PID setpoint	PID Set Point	10 V = 100%	103

H3 Multi-Function Analog Input Settings				
H3-□□ Setting	Function	LCD Display	Description	Page
D	Frequency bias	Freq Ref Bias 2	10 V = E1-04 (maximum output frequency)	103
E	Motor temperature (PTC input)	Motor PTC	10 V = 100%	103
F	Through mode	Not Used	Set this value when using the terminal in the pass-through mode.	103
16	Differential PID feedback	PID Feedback 2	10 V = 100%	103
25	Secondary PI Setpoint	PI2 Setpoint	10 V = S3-02 (maximum output frequency)	103
26	Secondary PI Feedback	PI2 Feedback	10 V = S3-02 (maximum output frequency)	103

◆ H4: Analog Outputs

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H4-01 (041D)	Multi-Function Analog Output Terminal FM Monitor Selection	Term FM FuncSel	Selects the data to be output through multi-function analog output terminal FM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter "103" for U1-03.	Default: 102 Range: 000 to 655	103
H4-02 (041E) RUN	Multi-Function Analog Output Terminal FM Gain	Terminal FM Gain	Sets the signal level at terminal FM that is equal to 100% of the selected monitor value.	Default: 100.0% Min.: -999.9 Max.: 999.9	104
H4-03 (041F) RUN	Multi-Function Analog Output Terminal FM Bias	Terminal FM Bias	Sets the signal level at terminal FM that is equal to 0% of the selected monitor value.	Default: 0.0% Min.: -999.9 Max.: 999.9	104
H4-04 (0420)	Multi-Function Analog Output Terminal AM Monitor Selection	Terminal AM Sel	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.	Default: 103 Range: 000 to 655	103
H4-05 (0421) RUN	Multi-Function Analog Output Terminal AM Gain	Terminal AM Gain	Sets the signal level at terminal AM that is equal to 100% of the selected monitor value.	Default: 50.0% Min.: -999.9 Max.: 999.9	104
H4-06 (0422) RUN	Multi-Function Analog Output Terminal AM Bias	Terminal AM Bias	Sets the signal level at terminal AM that is equal to 0% of the selected monitor value.	Default: 0.0% Min.: -999.9 Max.: 999.9	104
H4-07 (0423)	Multi-Function Analog Output Terminal FM Signal Level Selection	Level Select1 0: 0-10 VDC 1: -10 +10 VDC 2: 4-20 mA	0: 0 to 10 V 1: -10 to +10 V 2: 4 to 20 mA	Default: 0 Range: 0 to 2	104
H4-08 (0424)	Multi-Function Analog Output Terminal AM Signal Level Selection	AO Level Select2 0: 0-10 VDC 1: -10 +10 VDC 2: 4-20 mA	0: 0 to 10 V 1: -10 to +10 V 2: 4 to 20 mA	Default: 0 Range: 0 to 2	104

◆ H5: MEMOBUS/Modbus Serial Communication

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H5-01 (0425) <1>	Drive Slave Address	Serial Comm Adr	Selects drive station slave number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. **Note:** Cycle power for the setting to take effect.	Default: 1F (Hex) Min.: 0 Max.: FF	285
H5-02 (426)	Communication Speed Selection	Serial Baud Rate 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19.2 kbps 5: 38.4 kbps 6: 57.6 kbps 7: 76.8 kbps 8: 115.2 kbps	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 **Note:** Cycle power for the setting to take effect.	Default: 3 Range: 0 to 8	285
H5-03 (0427)	Communication Parity Selection	Serial Com Sel 0: No parity 1: Even parity 2: Odd parity	0: No parity 1: Even parity 2: Odd parity **Note:** Cycle power for the setting to take effect.	Default: 0 Range: 0 to 2	285
H5-04 (0428)	Stopping Method after Communication Error (CE)	Serial Fault Sel 0: Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm Only 4: Alarm(d1-04)	0: Ramp to stop 1: Coast to stop 2: Fast Stop 3: Alarm only 4: Run at d1-04	Default: 3 Range: 0 to 4	285
H5-05 (0429)	Communication Fault Detection Selection	Serial Flt Dtct 0: Disabled 1: Enabled	0: Disabled 1: Enabled If communication is lost for more than two seconds, a CE fault will occur.	Default: 1 Range: 0, 1	286
H5-06 (042A)	Drive Transmit Wait Time	Transmit WaitTIM	Set the wait time between receiving and sending data. **Note:** Cycle power for the setting to take effect.	Default: 5 ms Min.: 5 Max.: 65	286
H5-07 (042B)	RTS Control Selection	RTS Control Sel 0: Disabled 1: Enabled	0: Disabled. RTS is always on. 1: Enabled. RTS turns on only when sending. **Note:** Cycle power for the setting to take effect.	Default: 1 Range: 0, 1	286
H5-08 (062D)	Communication Protocol Selection	Protocol Select 0: MEMOBUS 1: N2 2: P1 3: BACnet	Selects the communication protocol. 0: MEMOBUS/Modbus 1: N2 (Metasys) 2: P1 (APOGEE FLN) 3: BACnet	Default: 0 Range: 0 to 3	286
H5-09 (0435)	CE Detection Time	CE Detect Time	Sets the time required to detect a communications error. Adjustment may be needed when networking several drives.	Default: 2.0 s Min.: 0.0 Max.: 10.0	287
H5-10 (0436)	Unit Selection for MEMOBUS/Modbus Register 0025H	CommReg 25h Unit 0: 0.1 V 1: 1 V	0: 0.1 V units 1: 1 V units	Default: 0 Range: 0, 1	287
H5-11 (043C)	Communications ENTER Function Selection	Enter CommandSel 0: Enter Required 1: No EnterRequired	0: Drive requires an Enter command before accepting any changes to parameter settings. 1: Parameter changes are activated immediately without the Enter command (same as V7).	Default: 0 Range: 0, 1	287
H5-12 (043D)	Run Command Method Selection	Run CommandSel 0: FWD Run &REV Run 1: Run & FWD/REV	0: FWD/Stop, REV/Stop 1: Run/Stop, FWD/REV	Default: 0 Range: 0, 1	287
H5-14 (310D)	BAC Dev Obj ID 0	BAC Dev Obj Id 0	BACnet device object ID	Default: 1 Range: 0 to FFFF	–
H5-15 (310E)	BAC Dev Obj ID 1	BAC Dev Obj Id 1	BACnet device object ID	Default: 0 Range: 0 to 3F	–

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
H5-17 (11A1)	Operation Selection when Unable to Write into EEPROM	Busy Enter Sel 0: No ROM Enter 1: RAM Enter	Selects operation when an attempt is made to write data into EEPROM via MEMOBUS/Modbus communications and writing into EEPROM is not possible. There is normally no need to change this parameter from the default value 0: Cannot write into EEPROM 1: Write in RAM only	Default: 0 Range: 0, 1	*287*
H5-18 (11A2)	Filter Time Constant for Motor Speed Monitoring	MtrSpd Monitor T	Sets the filter time constant for monitoring the motor speed from MEMOBUS/Modbus communications and communication options. Applicable MEMOBUS/Modbus registers are: 3EH, 3FH, 44H, ACH, and ADH	Default: 0 ms Min.: 0 Max.: 100	*287*

<1> If this parameter is set to 0, the drive will be unable to respond to MEMOBUS/Modbus commands.

Parameter List

A

A.10 L: Protection Function

L parameters provide protection to the drive and motor, including control during momentary power loss, Stall Prevention, frequency detection, fault restarts, overtorque detection, and other types of hardware protection.

◆ L1: Motor Protection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L1-01 (0480)	Motor Overload Protection Selection	Mtr OL Charact 0: OL1 Disabled 1: VT Motor 4: PM Motor	0: Disabled 1: General purpose motor (standard fan cooled) 4: PM motor with variable torque The drive may not be able to provide protection when using multiple motors, even if overload is enabled in L1-01. Set L1-01 to 0 and install separate thermal relays to each motor.	Default: <1> Range: 0, 1, 4	106
L1-02 (0481)	Motor Overload Protection Time	MOL Time Const	Sets the motor thermal overload protection (oL1) time.	Default: 1.0 min Min.: 1.0 Max.: 5.0	107
L1-03 (0482)	Motor Overheat Alarm Operation Selection (PTC input)	Mtr OH Alarm Sel 0 : Ramp to Stop 1: Coast to Stop 2: Fast-Stop 3: Alarm only	Sets operation when the motor temperature analog input (H3-02 or H3-10 = E) exceeds the alarm level. 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)	Default: 3 Range: 0 to 3	108
L1-04 (0483)	Motor Overheat Fault Operation Selection (PTC input)	Mtr OH Fault Sel 0 : Ramp to Stop 1: Coast to Stop 2: Fast-Stop	Sets stopping method when the motor temperature analog input (H3-02, or H3-10 = E) exceeds the oH4 fault level. 0: Ramp to stop 1: Coast to stop 2: Fast Stop (decelerate to stop using the deceleration time in C1-09)	Default: 1 Range: 0 to 2	108
L1-05 (0484)	Motor Temperature Input Filter Time (PTC input)	Mtr Temp Filter	Adjusts the filter for the motor temperature analog input (H3-02, or H3-10 = E).	Default: 0.20 s Min.: 0.00 Max.: 10.00	109
L1-08 (1103)	oL1 Current Level	oL1 Current Lvl	Sets the reference current for motor thermal overload detection for the motor in amperes.	Default: <3> Min.: 10% of drive rated current Max.: 150% of drive rated current <4>	109
L1-13 (046D)	Continuous Electrothermal Operation Selection	Mtr OL Mem Sel 0: Disabled 1: Enabled 2: Enabled(RTC)	0: Disabled 1: Enabled 2: Enable using Real Time Clock	Default: 1 Range: 0 to 2	109

<1> Default setting is determined by parameter A1-02, Control Method Selection.

<3> Default setting is determined by parameter o2-04, Drive Model Selection.

<4> Display is in the following units:
2□0028, 2□0042, and 4□0011 to 4□0027: 0.01 A units
2□0054 to 2□0248 and 4□0034 to 4□0414: 0.1 A units

◆ L2: Momentary Power Loss Ride-Thru

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L2-01 (0485)	Momentary Power Loss Operation Selection	PwrL Selection 0: Disabled 1: Enbl with Timer 2: Enbl whl CPU act	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. Fdv is not detected.	Default: 0 Range: 0 to 2	109
L2-02 (0486)	Momentary Power Loss Ride-Thru Time	PwrL Ridethru t	Sets the Power Loss Ride-Thru time. Enabled only when L2-01 = 1.	Default: 0.5 s Min.: 0.0 Max.: 2.5	110
L2-03 (0487)	Momentary Power Loss Minimum Baseblock Time	PwrL Baseblock t	Sets the minimum wait time for residual motor voltage decay before the drive output reenergizes after performing Power Loss Ride-Thru. Increasing the time set to L2-03 may help if overcurrent or overvoltage occur during Speed Search or during DC Injection Braking.	Default: <1> Min.: 0.1 s Max.: 5.0 s	110
L2-04 (0488)	Momentary Power Loss Voltage Recovery Ramp Time	PwrL V/F Ramp t	Sets the time for the output voltage to return to the preset V/f pattern during Speed Search.	Default: <1> Min.: 0.0 s Max.: 5.0 s	110
L2-07 (048B)	Momentary Power Loss Voltage Recovery Acceleration Time	KEB Accel 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.	Default: 0.00 s Min.: 0.00 Max.: 6000.0 <2>	110
L2-13 (04CD)	Input Power Frequency Fault Detection Gain	FDV Detect Gain	Set the gain to use to detect power supply frequency fault (Fdv).	Default: 1.0 Min.: 0.1 Max.: 2.0	110
L2-21 (04D5)	Low Input Voltage Detection Level	AVV Detect evel	Set the level at which to detect a low input voltage.	Default: 150 V Min.: 100 V <3> Max.: 230 V <3>	111
L2-27 (04F7)	Power Supply Frequency Fault Detection Width	FDV Detect Width	Sets the frequency width to use to detect power supply frequency fault (Fdv).	Default: 6.0 Hz Min.: 3.0 Hz Max.: 20.0 Hz	111

<1> Default setting is dependent on parameter o2-04, Drive Model Selection.

<2> Setting range value is dependent on parameter C1-10, Accel/Decel Time Setting Units. When C1-10 = 0 (units of 0.01 seconds), the setting range becomes 0.00 to 600.00 seconds.

<3> Values shown are specific to 200 V class drives. Double the value for 400 V class drives.

◆ L3: Stall Prevention

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L3-01 (048F)	Stall Prevention Selection during Acceleration	StallP Accel Sel 0: Disabled 1: General purpose 3: iLim Mode	0: Disabled. 1: General purpose. Acceleration is paused as long as the current is above the L3-02 setting. 3: Enabled (Current Limit). The acceleration rate is automatically adjusted while limiting the output current at the setting value of the stall prevention level (L3-02).	Default: 1 Range: 0, 1, 3 <1>	111
L3-02 (0490)	Stall Prevention Level during Acceleration	StallP Accel Lvl	Used when L3-01 = 1 or 3. 100% is equal to the drive rated current.	Default: <2> Min.: 0% Max.: 150% <2>	113
L3-03 (0491)	Stall Prevention Limit during Acceleration	StallPAccDecLim	Sets Stall Prevention lower limit during acceleration when operating in the constant power range. Set as a percentage of drive rated current.	Default: 50% Min.: 0 Max.: 100	113
L3-04 (0492)	Stall Prevention Selection during Deceleration	StallP Decel Sel 0: Disabled 1: General purpose 4: High Flux Brake 6: iLim Mode	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. 4: Overexcitation Deceleration. Decelerates while increasing the motor flux 6: Enable (Current Limit). The deceleration rate is automatically adjusted while limiting the regeneration current at the setting value of the stall prevention level (L3-14).	Default: 1 Range: 0, 1, 4, 6 <1>	113

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L3-05 (0493)	Stall Prevention Selection during Run	StallP Run Sel 0: Disabled 1: Decel time 2: Decel time 2	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.	Default: 1 Range: 0 to 2	114
L3-06 (0494)	Stall Prevention Level during Run	StallP Run Level	Enabled when L3-05 is set to 1 or 2. 100% is equal to the drive rated current.	Default: <2> Min.: 30% Max.: 150% <2>	115
L3-14 (04E9)	Stall Prevention Level during Deceleration	StallP Decel Lvl	Used when L3-04 = 1. 100% is equal to the drive rated current.	Default: 120% Min.: 80 Max.: 120 <2>	113
L3-22 (04F9)	Deceleration Time at Stall Prevention during Acceleration	PM Acc Stall P T	Sets the deceleration time used for Stall Prevention during acceleration in OLV/PM.	Default: 0.0 s Min.: 0.0 Max.: 6000	115
L3-23 (04FD)	Automatic Reduction Selection for Stall Prevention during Run	CHP Stall P Sel 0: Lvl set in L3-06 1: Autom. Reduction	0: Sets the Stall Prevention level set in L3-04 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.	Default: 0 Range: 0, 1	115
L3-27 (0456)	Stall Prevention Detection Time	Stl Prev DetTime	Sets the time the current must exceed the Stall Prevention level to activate Stall Prevention.	Default: 50 ms Min.: 0 Max.: 5000	115
L3-36 (11D0)	Vibration Suppression Gain during Acceleration (with Current Limit)	ILim Acc Gain	Increase the setting value if oscillation occurs in the output current during acceleration.	Default: 10.0 Min.: 0.0 Max.: 100.0	116
L3-39 (11D3)	Current-limited Integral Time Constant during Acceleration	ILim Acc I Time	Sets the time constant for acceleration rate adjustment for current-limited acceleration.	Default: 100.0 ms Min.: 1.0 Max.: 1000.0	116
L3-40 (11D6)	Current-limited Maximum S-curve Selection during Acceleration	ILimAcc S-Curve 0: Disable 1: Enable	0: Disable 1: Enable	Default: 0 Range: 0, 1	116
L3-41 (11D7)	Vibration Suppression Gain during Deceleration (with Current Limit)	ILim Dec Gain	Increase the setting value if oscillation occurs in the output current during deceleration.	Default: 10.0 Min.: 1.0 Max.: 100.0	116
L3-44 (11D8)	Current-limited Integral Time Constant during Deceleration	ILim Dec I Time	Sets the time constant for deceleration rate adjustment for current-limited deceleration.	Default: 100.0 ms Min.: 1.0 Max.: 1000.0	116
L3-45 (11D9)	Current-limited Maximum S-curve Selection during Deceleration	ILimDec S-Curve 0: Disable 1: Enable	0: Disable 1: Enable Available when L3-04 = 6.	Default: 0 Range: 0, 1	116

<1> The setting range is 0, 1 in OLV/PM control mode.

<2> Upper limit is dependent on parameter L8-38, Frequency Reduction Selection.

◆ L4: Speed Detection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L4-01 (0499)	Speed Agreement Detection Level	Spd Agree Level	Sets the frequency detection level for digital output functions H2-□□ = 2, 3, 4, 5.	Default: 0.0 Hz Min.: 0.0 Max.: 400.0	116
L4-02 (049A)	Speed Agreement Detection Width	Spd Agree Width	Sets the hysteresis or allowable margin for speed detection.	Default: 2.0 Hz Min.: 0.0 Max.: 20.0	116
L4-03 (049B)	Speed Agreement Detection Level (+/-)	Spd Agree Lvl+-	Sets the frequency detection level for digital output functions H2-□□ = 13, 14, 15, 16.	Default: 0.0 Hz Min.: -400.0 Max.: 400.0	116

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L4-04 (049C)	Speed Agreement Detection Width (+/-)	Spd Agree Wdth+-	Sets the hysteresis or allowable margin for speed detection.	Default: 2.0 kHz Min.: 0.0 Max.: 20.0	116
L4-05 (049D)	Frequency Reference Loss Detection Selection	Ref Loss Sel 0: Stop 1: Run@L4-06PrevRef	0: Stop. Drive stops when the frequency reference is lost. 1: Run. Drive continues operation according to the setting of L4-06.	Default: 1 Range: 0, 1	117
L4-06 (04C2)	Frequency Reference at Reference Loss	Fref at Floss	Sets the percentage of the frequency reference that the drive should run with when the frequency reference is lost.	Default: 80.0% Min.: 0.0 Max.: 100.0	117
L4-07 (0470)	Speed Agreement Detection Selection	Freq Detect Sel 0: No Detection @BB 1: Always Detected	0: No detection during baseblock. 1: Detection always enabled.	Default: 0 Range: 0, 1	117

◆ L5: Fault Restart

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L5-01 (049E)	Number of Auto Restart Attempts	Num of Restarts	Sets the number of times the drive may attempt to restart after the following faults occur: GF, LF, oC, ov, PF, oL1, oL2, oL3, STo, Uv1.	Default: 0 Min.: 0 Max.: 10	118
L5-02 (049F)	Auto Restart Fault Output Operation Selection	Restart Sel 0: Flt Outp Disabld 1: Flt Outp Enabled	0: Fault output not active. 1: Fault output active during restart attempt.	Default: 0 Range: 0, 1	118
L5-03 (04A0)	Time to Continue Making Fault Restarts	Max Restart Time	Enabled only when L5-05 is set to 0. Causes a fault if a fault restart cannot occur after the set time passes.	Default: 180.0 s Min.: 0.1 Max.: 600.0	118
L5-04 (046C)	Fault Reset Interval Time	Flt Reset Wait T	Sets the amount of time to wait between performing fault restarts.	Default: 10.0 s Min.: 0.5 Max.: 600.0	120
L5-05 (0467)	Fault Reset Operation Selection	Fault Reset Sel 0: Continuous 1: Use L5-04 Time	0: Continuously attempt to restart while incrementing restart counter only at a successful restart (same as F7 and G7). 1: Attempt to restart with the interval time set in L5-04 and increment the restart counter with each attempt (same as V7).	Default: 1 Range: 0, 1	120

◆ L6: Torque Detection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L6-01 (04A1)	Torque Detection Selection 1	Torq Det 1 Sel 0: Disabled 1: OL Alm at SpdAgr 2: OL Alm dur RUN 3: OL Flt at SpdAgr 4: OL Flt dur RUN 5: UL Alm at SpdAgr 6: UL Alm dur RUN 7: UL Flt at SpdAgr 8: UL Flt dur RUN 9: UL6Alm at SpdAgr 10: UL6Alm dur RUN 11: UL6Flt at SpdAgr 12: UL6Flt dur RUN	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 at speed agree (alarm) 10: UL6 at run (alarm) 11: UL6 at speed agree (fault) 12: UL6 at run (fault)	Default: 0 Range: 0 to 12	121
L6-02 (04A2)	Torque Detection Level 1	Torq Det 1 Lvl	Sets the overtorque and undertorque detection level.	Default: 15% Min.: 0 Max.: 300	122

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L6-03 (04A3)	Torque Detection Time 1	Torq Det 1 Time	Sets the time an overtorque or undertorque condition must exist to trigger torque detection 1.	Default: 10.0 s Min.: 0.0 Max.: 10.0	122
L6-13 (062E)	Motor Underload Protection Selection	Underload Select 0: Base Freq Enable 1: Max Freq Enable	Sets the motor underload protection (UL□) based on motor load. 0: Overtorque/undertorque detection enabled 1: Base frequency motor load enabled	Default: 0 Range: 0, 1	121
L6-14 (062F)	Motor Underload Protection Level at Minimum Frequency	Underload Level	Sets the UL6 detection level at minimum frequency by percentage of drive rated current.	Default: 15% Min.: 0 Max.: 300	121

◆ L8: Drive Protection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L8-02 (04AE)	Overheat Alarm Level	OH Pre-Alarm Lvl	An overheat alarm occurs when heatsink temperature exceeds the L8-02 level.	Default: <1> Min.: 50 °C Max.: 150 °C	123
L8-03 (04AF)	Overheat Pre-Alarm Operation Selection	OH Pre-Alarm Sel 0: Ramp to stop 1: Coast to stop 2: Fast-Stop 3: Alarm only 4: Run@L8-19 Rate	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.	Default: 4 Range: 0 to 4	123
L8-06 (04B2)	Input Phase Detection Level	Inp Ph Loss Lvl	When ripple is observed in the DC bus, expansion of the input bias is calculated. This value becomes the input phase if the difference between the maximum and minimum values of the ripple is greater than the value set to L8-06. Detection Level = 100% = Voltage class x $\sqrt{2}$	Default: <1> Min.: 0.0% Max.: 50.0%	124
L8-07 (04B3)	Output Phase Loss Protection Selection	Outp Ph Loss Det 0: Disabled 1: 1PH Loss Det 2: 2/3PH Loss Det	0: Disabled 1: Enabled (triggered by a single phase loss) 2: Enabled (triggered when two phases are lost)	Default: 1 Range: 0 to 2	124
L8-09 (04B5)	Output Ground Fault Detection Selection	Grnd Flt Det Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: <1> Range: 0, 1	125
L8-10 (04B6)	Heatsink Cooling Fan Operation Selection	Fan On/Off Sel 0: Dur Run (OffDly) 1: Always On	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.	Default: 0 Range: 0, 1	125
L8-11 (04B7)	Heatsink Cooling Fan Off Delay Time	Fan Delay Time	Sets a delay time to shut off the cooling fan after the Run command is removed when L8-10 = 0.	Default: 60 s Min.: 0 Max.: 300	125
L8-12 (04B8)	Ambient Temperature Setting	Ambient Temp	Enter the ambient temperature. This value adjusts the oL2 detection level.	Default: 40 °C Min.: -10 Max.: 50	125
L8-15 (04BB)	oL2 Characteristics Selection at Low Speeds	OL2 Sel @ L-Spd 0: Disabled 1: Enabled	0: No oL2 level reduction below 6 Hz. 1: oL2 level is reduced linearly below 6 Hz. It is reduced to 70% at 0 Hz.	Default: 1 Range: 0, 1	125
L8-18 (04BE)	Software Current Limit Selection	Soft CLA Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: <2> Range: 0, 1	126
L8-19 (04BF)	Frequency Reduction Rate during Overheat Pre-Alarm	Fc Red dur OHAlm	Specifies the frequency reference reduction gain at overheat pre-alarm when L8-03 = 4.	Default: 20.0% Min.: 10.0 Max.: 100.0	126
L8-27 (04DD)	Overcurrent Detection Gain	OC Level	Sets the gain for overcurrent detection as a percentage of the motor rated current. Overcurrent is detected using the lower value between the overcurrent level of the drive or the value set to L8-27.	Default: 300.0% Min.: 0.0 Max.: 400.0	126

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L8-29 (04DF)	Current Unbalance Detection (LF2)	LF2 Flt Det Sel 0: Disabled 2: Current Det Type	OLV/PM 0: Disabled 2: Enabled (current detection)	Default: 2 Range: 0, 2	126
L8-32 (04E2)	Main Contactor and Cooling Fan Power Supply Failure Selection	FAN Fault Sel 0: Ramp to stop 1: Coast to stop 2: Fast-Stop	Determines drive response when a fault occurs with the internal cooling fan. 0: Ramp to stop 1: Coast to stop 2: Fast stop (Decelerate to stop using the deceleration time set to C1-09)	Default: 1 Range: 0 to 2	126
L8-35 (04EC)	Installation Method Selection	Installation Sel 0: IP00/OpenChassis 2: IP20/Nema Type 1 3: Finless/Fin Ext	0: IP00/Open-Chassis enclosure 2: IP20/UL Type 1 enclosure 3: External heatsink installation	Default: <1> <3> <4> Range: 0, 2, 3	127
L8-38 (04EF)	Carrier Frequency Reduction	Fc Reduct dur OL 0: Disabled 1: Active below 6Hz 2: Active @ any Spd	0: Disabled 1: Enabled below 6 Hz 2: Enabled for the entire speed range	Default: <5> Range: 0 to 2	127
L8-40 (04F1)	Carrier Frequency Reduction Off Delay Time	Fc Reduct 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.	Default: 0.50 s Min.: 0.00 Max.: 2.00	127
L8-41 (04F2)	High Current Alarm Selection	High Cur Alm Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled. An alarm is triggered at output currents above 150% of drive rated current.	Default: 0 Range: 0, 1	128
L8-97 (3104)	Carrier Frequency Reduction Selection during oH Pre-Alarm	FC Sel dur OHAlm 0: Disabled 1: Enabled	Carrier frequency reduction protection selection. It is reduced to the carrier frequency at oH pre-alarm. 0: Disabled 1: Enabled	Default: 0 Range: 0, 1	–

<1> Default setting is dependent on parameter o2-04, Drive Model Selection.

<2> Default setting value is determined by the drive software version.
PRG: 6113: 0
PRG: 6114 and later: Default setting is dependent on parameter A1-02, Control Method Selection.

<3> Parameter setting value is not reset to the default value when the drive is initialized.

<4> Default setting is determined by parameter o2-04, Drive Model Selection.

<5> Default setting is dependent on parameters A1-02, Control Method Selection, and o2-04, Drive Model Selection.

◆ L9: Drive Protection 2

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
L9-03 (0819)	Carrier Frequency Reduction Level Selection	Fc ReductLvl Sel 0: Disabled 1: Enabled	Selects the level to start the reduction of the frequency or to clear the current frequency level for the automatic reduction of the carrier frequency. There is normally no need to change this parameter from the default value. 0: Reduces the carrier frequency based on the drive rated current that is not derated. 1: Reduces the carrier frequency based on the drive rated current that is derated by the carrier frequency and the temperature selected for C6-02.	Default: 0 Range: 0, 1	128
L9-12 (0B28) <1>	SoH Alarm Selection during bb	SoH ALM Sel 0: Fault 1: Alarm	Sets the SoH (Snubber Discharge Resistor Overheat) alarm to output a fault or a minor fault during baseblock (bb). 0: Output a fault for an SoH alarm during baseblock (bb). 1: Output a minor fault for an SoH alarm during baseblock (bb).	Default: 0 Range: 0, 1	128

<1> Available in drive software versions PRG: 6113 and later.

A.11 n: Special Adjustment

The n parameters adjust more advanced performance characteristics such as Hunting Prevention, speed feedback detection, High Slip Braking, and Online Tuning for motor line-to-line resistance.

◆ n1: Hunting Prevention

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n1-01 (0580)	Hunting Prevention Selection	Hunt Prev Select 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	129
n1-02 (0581)	Hunting Prevention Gain Setting	Hunt Prev Gain	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.	Default: 1.00 Min.: 0.00 Max.: 2.50	129
n1-03 (0582)	Hunting Prevention Time Constant	Hunt Prev Time	Sets the time constant used for Hunting Prevention.	Default: <1> Min.: 0 ms Max.: 500 ms	129
n1-05 (0530)	Hunting Prevention Gain while in Reverse	Hprev Gain @Rev	Sets the gain used for Hunting Prevention. If set to 0, the gain set to n1-02 is used for operation in reverse.	Default: 0.00 Min.: 0.00 Max.: 2.50	129

<1> Default setting is dependent on parameter o2-04, Drive Model Selection.

◆ n3: Overexcitation Braking

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n3-13 (0531)	Overexcitation Deceleration Gain	Hflux Brake Gain	Sets the gain applied to the V/f pattern during Overexcitation Deceleration (L3-04 = 4).	Default: 1.10 Min.: 1.00 Max.: 2.00	130

◆ n8: PM Motor Control Tuning

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n8-45 (0538)	Speed Feedback Detection Control Gain	PM Spd Fdbk Gain	OLV/PM Increase this setting if hunting occurs. Decrease to lower the response.	Default: 0.80 Min.: 0.00 Max.: 10.00	131
n8-47 (053A)	Pull-In Current Compensation Time Constant	PM Pull-in I Tc	OLV/PM Sets the time constant to make the pull-in current reference and actual current value agree. Decrease the value if the motor begins to oscillate, and increase the value if it takes too long for the current reference to equal the output current.	Default: 5.0 s Min.: 0.0 Max.: 100.0	131
n8-48 (053B)	Pull-In Current	PM No-load Curr	OLV/PM Defines the d-Axis current reference during no-load operation at a constant speed. Set as a percentage of the motor rated current. Increase this setting if hunting occurs while running at constant speed.	Default: 30% Min.: 20 Max.: 200	131
n8-49 (053C)	d-Axis Current for High Efficiency Control	EnergySav ID Lvl	OLV/PM Sets the d-Axis current reference when running a high load at constant speed. Set as a percentage of the motor rated current.	Default: <1> Min.: -200.0% Max.: 0.0%	131
n8-51 (053E)	Acceleration/ Deceleration Pull-In Current	PM Pull-in I@Acc	OLV/PM Sets the d-Axis current reference during acceleration/ deceleration as a percentage of the motor rated current. Set to a high value when more starting torque is needed.	Default: 50% Min.: 0 Max.: 200	131
n8-54 (056D)	Voltage Error Compensation Time Constant	PM V Error CompT	OLV/PM Adjusts the value when hunting occurs at low speed. If hunting occurs with sudden load changes, increase n8-54 in increments of 0.1. Reduce this setting if oscillation occurs at start.	Default: 1.00 s Min.: 0.00 Max.: 10.00	131

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
n8-55 (056E)	Load Inertia	PMLoad wk2 Ratio 0: Less than 1:10 1: 1:10 to 1:30 2: 1:30 to 1:50 3: More than 1:50	OLV/PM Sets the ratio between motor and machine inertia. 0: Lower than 1:10 1: Between 1:10 to 1:30 2: Between 1:30 to 1:50 3: Higher than 1:50	Default: 0 Min.: 0 Max.: 3	132
n8-62 (057D)	Output Voltage Limit	PM Vout Limit	OLV/PM Prevents output voltage saturation. Should be set just below the voltage provided by the input power supply.	Default: 200.0 V <2> Min.: 0.0 Max.: 230.0 <2>	132
n8-63 (057E) <3>	Output Voltage Limit Proportional Gain (for PM Motors)	PM Vout P Gain	OLV/PM Stabilizes constant output. There is normally no need to change this parameter from the default value.	Default: 1.00 Min.: 0.00 Max.: 100.00	132
n8-64 (057F) <3>	Output Voltage Limit Integral Time (for PM Motors)	PM Vout I Time	OLV/PM There is normally no need to change this parameter from the default value.	Default: 0.040 s Min.: 0.000 Max.: 5.000	132
n8-66 (0235) <3>	Output Voltage Limit Output Filter Time Constant (for PM Motors)	VlimFilterTime	OLV/PM There is normally no need to change this parameter from the default value.	Default: 0.001 s Min.: 0.000 Max.: 5.000	132

<1> Default setting is dependent on parameter o2-04, Drive Model Selection.

<2> Values shown are specific to 200 V class drives. Double the value for 400 V class drives.

<3> Available in drive software versions PRG: 6114 and later.

Parameter List

A

A.12 o: Operator-Related Settings

The o parameters set up the HOA keypad displays.

◆ o1: HOA Keypad Display Selection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o1-01 (0500) RUN	Drive Mode Unit Monitor Selection	User Monitor Sel	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□-□□.	Default: 106 Range: 104 to 914	133
o1-02 (0501) RUN	User Monitor Selection after Power Up	Power-On Monitor 1: Frequency Ref 2: FWD/REV 3: Output Freq 4: Output Current 5: User Monitor	1: Frequency reference (U1-01) 2: Direction 3: Output frequency (U1-02) 4: Output current (U1-03) 5: User Monitor	Default: <1> Range: 1 to 5	133
o1-03 (0502)	HOA Keypad Display Selection	Display Unit Sel 0: 0.01 Hz 1: 0.01% 2: r/min 3: User Units	Sets the units the drive should use to display the frequency reference and motor speed monitors. 0: 0.01 Hz 1: 0.01% (100% = E1-04) 2: r/min (calculated using the number of motor poles setting in E2-04 or E5-04) 3: User-selected units (set by o1-10 and o1-11)	Default: 0 Range: 0 to 3	133
o1-05 (0504) RUN	LCD Contrast Control	LCD Contrast	Sets the contrast of the LCD operator.	Default: 3 Min.: 0 Max.: 5	134
o1-06 (0517)	User Monitor Selection Mode	Monitor Mode Sel 0: 3 Mon Sequential 1: 3 Mon Selectable	0: 3 Monitor Sequential (Displays the next two sequential monitors) 1: 3 Monitor Selectable (o1-07 and o1-08 selected monitor are shown)	Default: <2> Range: 0, 1	133
o1-07 (0518)	Second Line Monitor Selection	2nd Monitor Sel	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.	Default: <3> Range: 101 to 699	133
o1-08 (0519)	Third Line Monitor Selection	3rd Monitor Sel	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.	Default: <4> Range: 101 to 699	133
o1-09 (051C)	Frequency Reference Display Units	Fref Disp Unit 0: WC 1: PSI 2: GPM 3: °F 4: CFM 5: CMH 6: LPH 7: LPS 8: Bar 9: Pa 10: °C 11: Mtr 12: Ft 13: LPM 14: CMM 15: Custom unit 16: No Unit	Sets unit display for the frequency reference parameters and frequency related monitors when o1-03 > 40. 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: Custom units (Determined by o1-12) 16: None	Default: 16 Range: 0 to 16	133
o1-10 (0520)	User-Set Display Units Maximum Value	UserDisp Scaling	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.	Default: <5> Range: 1 to 60000	135
o1-11 (0521)	User-Set Display Units Decimal Display	UserDisp Dec		Default: <5> Range: 0 to 3	135
o1-13 (3105)	Frequency Reference and Frequency Related Monitor Custom Units 1	Fref Cust Unit 1	Sets the customer-specified unit display for the frequency reference parameters and frequency related monitors when o1-03 = 3 and o1-09 = 15 as custom units.	Default: 41 Range: 30 to 7A	135

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o1-14 (3106)	Frequency Reference and Frequency Related Monitor Custom Units 2	Fref Cust Unit 2	Sets the customer-specified unit display for the frequency reference parameters and frequency related monitors when o1-03 = 3 and o1-09 = 15 as custom units	Default: 41 Range: 30 to 7A	135
o1-15 (3107)	Frequency Reference and Frequency Related Monitor Custom Units 3	Fref Cust Unit 3	Sets the customer-specified unit display for the frequency reference parameters and frequency related monitors when o1-03 = 3 and o1-09 = 15 as custom units	Default: 41 Range: 30 to 7A	135
o1-16 (3108)	F1 Key Function Selection	F1 Key Func Sel 0: Standard 1: Mon 2: DRV/BYP 3: RUN BYP 4: RLY	Selects the function of the F1 key and the LCD display text above the F1 key. 0: Standard 1: Monitor 2: Drive/Bypass (DRV/BYP) 3: Bypass Run Command (RUN BYP) 4: Toggle Relay Output (RLY)	Default: 0 Range: 0 to 4	135
o1-17 (3109)	F2 Key Function Selection	F2 Key Func Sel 0: Standard 1: Mon 2: DRV/BYP 3: RUN BYP 4: RLY	Selects the function of the F1 key and the LCD display text above the F1 key. 0: Standard 1: Monitor 2: Drive/Bypass (DRV/BYP) 3: Bypass Run Command (RUN BYP) 4: Toggle Relay Output (RLY)	Default: 0 Range: 0 to 4	135
o1-18 (310A)	User Defined Parameter Upper	Userdefined par1	Allows the user to set values that can be used as reference information.	Default: 0 Range: 0 to 999	135
o1-19 (310B)	User Defined Parameter Lower	Userdefined par2	Allows the user to set values that can be used as reference information.	Default: 0 Range: 0 to 999	135

<1> Default is 1 when b5-01 is set to 0.
Default is 3 when b5-01 is set to 1 or 3.

<2> Default is 0 when b5-01 is set to 0.
Default is 1 when b5-01 is set to 1 or 3.

<3> Default is 102 when b5-01 is set to 0.
Default is 504 when b5-01 is set to 1 or 3.

<4> Default is 102 when b5-01 is set to 0.
Default is 501 when b5-01 is set to 1 or 3.

<5> Default setting is dependent on parameter o1-03, HOA Keypad Display Selection.

◆ o2: HOA Keypad Functions

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o2-02 (0506)	OFF Key Function Selection	Oper STOP Key 0: Disabled 1: Enabled	0: Disabled. OFF key is disabled in REMOTE operation. 1: Enabled. OFF key is always enabled.	Default: 1 Range: 0, 1	136
o2-03 (0507)	User Parameter Default Value	User Default Sel 0: No Change 1: Save User Init 2: Clear User Init	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.	Default: 0 Range: 0 to 2	136
o2-04 (0508)	Drive Model Selection	Inverter Model #	Enter the drive model. Setting required only if installing a new control board.	Default: Determined by drive capacity	136
o2-05 (0509)	Frequency Reference Setting Method Selection	Oper Ref Method 0: Disabled 1: Enabled	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.	Default: 0 Range: 0, 1	137
o2-06 (050A)	Operation Selection when HOA Keypad is Disconnected	Oper Discon Det 0: Disabled 1: Enabled	0: The drive continues operating if the HOA keypad is disconnected. 1: An oPr fault is triggered and the motor coasts to stop.	Default: 1 Range: 0, 1	137
o2-07 (0527)	Motor Direction at Power Up when Using Operator	For/RevSel@PwrUp 0: Forward 1: Reverse	0: Forward 1: Reverse This parameter requires assigning drive operation to the HOA keypad.	Default: 0 Range: 0, 1	137

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o2-19 (061F)	Selection of Parameter Write during Uv	ParameterSet Sel 0: Disabled 1: Enabled	Determines whether parameter settings can be changed during a control circuit undervoltage condition. To be used with 24 V Power Supply Unit Built-in model. 0: Disabled 1: Enabled	Default: 0 Range: 0, 1	137

◆ o3: Copy Function

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o3-01 (0515)	Copy Function Selection	COPY SELECT 0: COPY SELECT 1: INV→OP READ 2: OP→INV WRITE 3: OP←→INV VERIFY	0: No action 1: Read parameters from the drive, saving them onto the HOA keypad. 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 HOA keypad.	Default: 0 Range: 0 to 3	138
o3-02 (0516)	Copy Allowed Selection	Read Allowable 0: Disabled 1: Enabled	0: Read operation prohibited 1: Read operation allowed	Default: 0 Range: 0, 1	138

◆ o4: Maintenance Monitor Settings

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
o4-01 (050B)	Cumulative Operation Time Setting	DrvElapsTimeCnt	Sets the value for the cumulative operation time of the drive in units of 10 h.	Default: 0 h Min.: 0 Max.: 9999	138
o4-02 (050C)	Cumulative Operation Time Selection	ElapsTimeCntSet 0: Power-On Time 1: Running Time	0: Logs power-on time 1: Logs operation time when the drive output is active (output operation time).	Default: 1 Range: 0, 1	138
o4-03 (050E)	Cooling Fan Operation Time Setting	FanElapsTimeCn	Sets the value of the fan operation time monitor U4-03 in units of 10 h.	Default: 0 h Min.: 0 Max.: 9999	138
o4-05 (051D)	Capacitor Maintenance Setting	BusCap Maint Set	Starts estimates for capacitor maintenance times from this setting value. See U4-05 to check when the capacitors may need to be replaced.	Default: 0% Min.: 0 Max.: 150	139
o4-07 (0523)	DC Bus Pre-Charge Relay Maintenance Setting	ChrgCircMaintSet	Starts estimates for soft charge bypass relay maintenance times from this setting value. See U4-06 to check when the bypass relay may need to be replaced.	Default: 0% Min.: 0 Max.: 150	139
o4-11 (0510)	U2, U3 Initialization	Fault Data Init 0: No Reset 1: Reset	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).	Default: 0 Range: 0, 1	139
o4-12 (0512)	kWh Monitor Initialization	kWh Monitor Init 0: No Reset 1: Reset	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).	Default: 0 Range: 0, 1	139
o4-13 (0528)	Number of Run Commands Counter Initialization	Run Counter Init 0: No Reset 1: Reset	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).	Default: 0 Range: 0, 1	139
o4-17 (3100)	Set/Reset Real Time Clock	Set Time 0: — — 1: Set 2: Reset	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	139
o4-19 (113A)	Power Unit Price	Energy Price/kWh	Sets the price per 1 kWh to calculate the power rate displayed for total consumed power (U9-07 to U9-10) and total regenerated power (U9-11 to U9-14).	Default: 000.00 Min.: 000.00 Max.: 650.00	140

A.13 S: Special Application

◆ S1: Dynamic Noise Control Function

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S1-01 (3200)	Dynamic Audible Noise Control Function Selection	Dyn Noise Ctrl 0: Disabled 1: Enabled	Reduces audible noise by decreasing the output voltage in variable torque applications with light loads. 0: Disabled 1: Enabled	Default: 1 Range: 0, 1	141
S1-02 (3201)	Voltage Reduction Rate	Volt Reduce Amt	Sets the rate at which the output voltage will be reduced as a percentage of the V/f pattern when operating with no load.	Default: 50.0% Min.: 50.0 Max.: 100.0	141
S1-03 (3202)	Voltage Restoration Level	V Reduce On Lvl	Sets the level when the drive should start restoring the voltage as a percentage of the drive rated torque.	Default: 20.0% Min.: 0.0 Max.: 90.0	141
S1-04 (3203)	Voltage Restoration Complete Level	V Reduce Off Lvl	Sets the level at which voltage restoration for the V/f pattern is complete as a percentage of the drive rated torque. If the output torque rises above the value of S1-04, then the voltage will be controlled in a manner specified by the V/f pattern setting.	Default: 50.0% Min.: S1-03 + 10.0 Max.: 100.0	142
S1-05 (3204)	Voltage Restoration Sensitivity Time Constant	Sensitivity Time	Sets the level of sensitivity of the output torque and LPF time constant for the voltage reduction rate. The level of sensitivity can be adjusted in accordance with the load response.	Default: 1.000 s Min.: 0.000 Max.: 3.000	142
S1-06 (3205)	Voltage Restoration Time Constant at Impact	Impact Load Time	Sets the voltage restoration time constant if an impact load is added.	Default: 0.050 s Min.: 0.000 Max.: 1.000	142

◆ S2: Sequence Timers

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S2-01 (3206)	Sequence Timer 1 Start Time	Tmr 1 Start Time	Sets the start time for timer 1. The value must be set less than or equal to S2-02.	Default: 00:00 Min.: 00:00 Max.: 24:00	144
S2-02 (3207)	Sequence Timer 1 Stop Time	Tmr 1 Stop Time	Sets the stop time for timer 1. The value must be set greater than or equal to S2-01.	Default: 00:00 Min.: 00:00 Max.: 24:00	144
S2-03 (3208)	Sequence Timer 1 Day Selection	Tmr 1 Day Sel 0: Timer disabled 1: Daily 2: Mon - Fri 3: Sat - Sun 4: Monday 5: Tuesday 6: Wednesday 7: Thursday 8: Friday 9: Saturday 10: Sunday	Sets the days for which sequence timer 1 is active. 0: Timer disabled 1: Daily 2: Mon - Fri 3: Sat - Sun 4: Monday 5: Tuesday 6: Wednesday 7: Thursday 8: Friday 9: Saturday 10: Sunday	Default: 0 Range: 0 to 10	145
S2-04 (3209)	Sequence Timer 1 Selection	Tmr 1 Seq Sel 0: Digital out only 1: Run 2: Run - PID Disable	Sets the action that occurs when sequence timers 1 is active. 0: Digital output only 1: Run 2: Run - PID disable	Default: 0 Range: 0 to 2	145
S2-05 (320A)	Sequence Timer 1 Reference Source	Tmr 1 Ref Source 0: Operator (d1-01) 1: Operator (d1-02) 2: Operator (d1-03) 3: Operator (d1-04) 4: Terminals 5: Serial com 6: Option PCB	Selects the frequency reference source used for running the drive when sequence timer 1 is active (only applicable when S2-04 is set to 1 or 2). 0: Operator (d1-01) 1: Operator (d1-02) 2: Operator (d1-03) 3: Operator (d1-04) 4: Terminals 5: Serial communication 6: Option card	Default: 0 Range: 0 to 6	145

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S2-06 (320B)	Sequence Timer 2 Start Time	Tmr 2 Start Time	Sets the start time for timer 2. The value must be set less than or equal to S2-07.	Default: 00:00 Min.: 00:00 Max.: 24:00	144
S2-07 (320C)	Sequence Timer 2 Stop Time	Tmr 2 Stop Time	Sets the stop time for timer 2. The value must be set greater than or equal to S2-06.	Default: 00:00 Min.: 00:00 Max.: 24:00	144
S2-08 (320D)	Sequence Timer 2 Day Selection	Tmr 2 Day Sel 0: Timer disabled 1: Daily 2: Mon - Fri 3: Sat - Sun 4: Monday 5: Tuesday 6: Wednesday 7: Thursday 8: Friday 9: Saturday 10: Sunday	Sets the days for which sequence timer 2 is active. 0: Timer disabled 1: Daily 2: Mon - Fri 3: Sat - Sun 4: Monday 5: Tuesday 6: Wednesday 7: Thursday 8: Friday 9: Saturday 10: Sunday	Default: 0 Range: 0 to 10	145
S2-09 (320E)	Sequence Timer 2 Selection	Tmr 2 Seq Sel 0: Digital out only 1: Run 2: Run - PID Disable	Sets the action that occurs when sequence timers 2 is active. 0: Digital output only 1: Run 2: Run - PID disable	Default: 0 Range: 0 to 2	145
S2-10 (320F)	Sequence Timer 2 Reference Source	Tmr 2 Ref Source 0: Operator (d1-01) 1: Operator (d1-02) 2: Operator (d1-03) 3: Operator (d1-04) 4: Terminals 5: Serial com 6: Option PCB	Selects the frequency reference source used for running the drive when sequence timer 2 is active (only applicable when S2-09 is set to 1 or 2). 0: Operator (d1-01) 1: Operator (d1-02) 2: Operator (d1-03) 3: Operator (d1-04) 4: Terminals 5: Serial communication 6: Option card	Default: 0 Range: 0 to 6	145
S2-11 (3210)	Sequence Timer 3 Start Time	Tmr 3 Start Time	Sets the start time for timer 3. The value must be set less than or equal to S2-12.	Default: 00:00 Min.: 00:00 Max.: 24:00	144
S2-12 (3211)	Sequence Timer 3 Stop Time	Tmr 3 Stop Time	Sets the stop time for timer 3. The value must be set greater than or equal to S2-11.	Default: 00:00 Min.: 00:00 Max.: 24:00	144
S2-13 (3212)	Sequence Timer 3 Day Selection	Tmr 3 Day Sel 0: Timer disabled 1: Daily 2: Mon - Fri 3: Sat - Sun 4: Monday 5: Tuesday 6: Wednesday 7: Thursday 8: Friday 9: Saturday 10: Sunday	Sets the days for which sequence timer 3 is active. 0: Timer disabled 1: Daily 2: Mon - Fri 3: Sat - Sun 4: Monday 5: Tuesday 6: Wednesday 7: Thursday 8: Friday 9: Saturday 10: Sunday	Default: 0 Range: 0 to 10	145
S2-14 (3213)	Sequence Timer 3 Selection	Tmr 3 Seq Sel 0: Digital out only 1: Run 2: Run - PID Disable	Sets the action that occurs when sequence timer 3 is active. 0: Digital output only 1: Run 2: Run - PID disable	Default: 0 Range: 0 to 2	145
S2-15 (3214)	Sequence Timer 3 Reference Source	Tmr 3 Ref Source 0: Operator (d1-01) 1: Operator (d1-02) 2: Operator (d1-03) 3: Operator (d1-04) 4: Terminals 5: Serial com 6: Option PCB	Selects the frequency reference source used for running the drive when sequence timer 3 is active (only applicable when S2-14 is set to 1 or 2). 0: Operator (d1-01) 1: Operator (d1-02) 2: Operator (d1-03) 3: Operator (d1-04) 4: Terminals 5: Serial communication 6: Option card	Default: 0 Range: 0 to 6	145
S2-16 (3215)	Sequence Timer 4 Start Time	Tmr 4 Start Time	Sets the start time for timer 4. The value must be set less than or equal to S2-17.	Default: 00:00 Min.: 00:00 Max.: 24:00	144

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S2-17 (3216)	Sequence Timer 4 Stop Time	Tmr 4 Stop Time	Sets the stop time for timer 4. The value must be set greater than or equal to S2-16.	Default: 00:00 Min.: 00:00 Max.: 24:00	144
S2-18 (3217)	Sequence Timer 4 Day Selection	Tmr 4 Day Sel 0: Timer disabled 1: Daily 2: Mon - Fri 3: Sat - Sun 4: Monday 5: Tuesday 6: Wednesday 7: Thursday 8: Friday 9: Saturday 10: Sunday	Sets the days for which sequence timer 4 is active. 0: Timer disabled 1: Daily 2: Mon - Fri 3: Sat - Sun 4: Monday 5: Tuesday 6: Wednesday 7: Thursday 8: Friday 9: Saturday 10: Sunday	Default: 0 Range: 0 to 10	145
S2-19 (3218)	Sequence Timer 4 Selection	Tmr 4 Seq Sel 0: Digital out only 1: Run 2: Run - PID Disable	Sets the action that occurs when sequence timer 4 is active. 0: Digital output only 1: Run 2: Run - PID disable	Default: 0 Range: 0 to 2	145
S2-20 (3219)	Sequence Timer 4 Reference Source	Tmr 4 Ref Source 0: Operator (d1-01) 1: Operator (d1-02) 2: Operator (d1-03) 3: Operator (d1-04) 4: Terminals 5: Serial com 6: Option PCB	Selects the frequency reference source used for running the drive when sequence timer 4 is active (only applicable when S2-19 is set to 1 or 2). 0: Operator (d1-01) 1: Operator (d1-02) 2: Operator (d1-03) 3: Operator (d1-04) 4: Terminals 5: Serial communication 6: Option card	Default: 0 Range: 0 to 6	145

◆ S3: Secondary PI (PI2) Control

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S3-01 (321A) RUN	Secondary PI Enable Selection	PI2 Enable Sel 0: Disabled 1: Always 2: Drive running 3: Motor running	0: Secondary PI disabled 1: Always 2: Drive running 3: Motor running	Default: 0 Range: 0 to 3	146
S3-02 (321B) RUN	Secondary PI User Display	PI2 UsrDspMaxVal	Sets the scale value of 100% PI input.	Default: 10000 Min.: 0 Max.: 60000	146
S3-03 (321C) RUN	Secondary PI Display Digits	PI2 UsrDspDigits 0: No Dec (XXXXX) 1: 1 Dec (XXXX.X) 2. 2 Dec (XXX.XX) 3: 3 Dec (XX.XXX)	0: No decimal places 1: One decimal place 2: Two decimal places 3: Three decimal places	Default: 2 Range: 0 to 3	147
S3-04 (321D) RUN	Secondary PI Unit Selection	PI2 Unit Sel 0: WC 1: PSI 2: GPM 3: °F 4: CFM 5: CMH 6: LPH 7: LPS 8: Bar 9: Pa 10: °C 11: Mtr 12: LPM 13: CMM 14: No unit 15: %	0: Inch of water (WC) 1: Pounds per square inch (PSI) 2: Gallons per minute (GPM) 3: Degrees Fahrenheit (F) 4: Cubic feet per minute (CFM) 5: Cubic meters per hour (CMH) 6: Liters per hour (LPH) 7: Liters per second (LPS) 8: Bar (Bar) 9: Pascals (Pa) 10: Degrees Celsius (C) 11: Meters (Mtr) (Ft: Feet) 12: Liters per minute (LPM) 13: Cubic meters per minute (CMM) 14: No unit 15: Percentage (%)	Default: 15 Range: 0 to 15	147

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S3-05 (321E) RUN	Secondary PI Setpoint Value	PI2 Setpoint	Sets the secondary PI controller target value	Default: 0.00 <1> Min.: 0.00 Max.: 600.00 <2>	147
S3-06 (321F) RUN	Secondary PI Proportional Gain Setting	PI2 Gain	Sets the proportional gain of the secondary PI controller. A setting of 0.00 disables P control.	Default: 1.00 Min.: 0.00 Max.: 25.00	147
S3-07 (3220) RUN	Secondary PI Integral Time Setting	PI2 I Time	Sets the integral time for the secondary PI controller. A setting of 0.0s disables integral control.	Default: 1.0 s Min.: 0.0 Max.: 360.0	147
S3-08 (3221) RUN	Secondary PI Integral Limit Setting	PI2 I Limit	Sets the maximum output possible from the integrator.	Default: 100.0% Min.: 0.0 Max.: 100.0	148
S3-09 (3222) RUN	Secondary PI Output Upper Limit	PI2 Upper Limit	Sets the maximum output possible from the secondary PI controller.	Default: 100.0% Min.: 0.0 Max.: 100.0	148
S3-10 (3223) RUN	Secondary PI Output Lower Limit	PI2 Lower Lim	Sets the minimum output possible from the secondary PI controller.	Default: 0.00% Min.: -100.00 Max.: 100.00	148
S3-11 (3224) RUN	Secondary PI Output Level Selection	PI2 Out Lvl Sel 0: Normal Character 1: Rev Character	0: Normal Output (direct acting) 1: Reverse Output (reverse acting)	Default: 0 Range: 0, 1	148
S3-12 (3225) RUN	Secondary PI Disable Mode	PI2 Disable Mode 0: No output 1: Lower Limit (S3-10) 2: Setpoint	0: No output (0%) 1: Lower Limit (S3-10) 2: Setpoint	Default: 0 Range: 0 to 2	148
S3-13 (3226) RUN	Secondary PI Low Feedback Detection Level	PI2 Low FB Lvl	Sets the secondary PI low feedback detection level.	Default: 0.00 <1> Min.: 0.00 Max.: 600.00 <2>	148
S3-14 (3227) RUN	Secondary PI Low Feedback Detection Time	PI2 Low FB Time	Sets the secondary PI low feedback detection delay time in seconds.	Default: 1.0 s Min.: 0.0 Max.: 25.5	149
S3-15 (3228) RUN	Secondary PI High Feedback Level	PI2 High FB Lvl	Sets the secondary PI high feedback detection level.	Default: 100.00 <1> Min.: 0.00 Max.: 600.00 <2>	149
S3-16 (3229) RUN	Secondary PI High Feedback Detection Time	PI2 High FB Tim	Sets the secondary PI high feedback detection delay time in seconds.	Default: 1.0 s Min.: 0.0 Max.: 25.5	149
S3-17 (322A) RUN	Secondary PI Feedback Detection Selection	PI2 FB Det Sel 0: PI2 Enabled 1: Always	0: Secondary PI enabled 1: Always	Default: 0 Range: 0, 1	149

<1> Unit is determined by S3-04.

<2> Upper limit is S3-02, decimal placeholder is determined by S3-03.

◆ S4: Bypass Operation

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S4-01 (322B) RUN	BP Auto Transfer on Fault Enable	BP Fault Trnsfer 0: Disabled 1: Enabled	0: No transfer after fault 1: Transfer to bypass after fault	Default: 1 Range: 0, 1	155
S4-02 (322C) RUN	Secondary PI User Display	BP Enrgy Sav Lvl	Delta used to determine when to switch into Energy Save Bypass. This allows for lower frequency output values to also trigger Energy Save Bypass functionality.	Default: 0 Hz Min.: 0 Max.: 20	155
S4-03 (322D) RUN	BP Energy Save Bypass Timer	BP Enrgy Sav TMR	Sets the time in seconds that the drive should run at the specified speed before entering Energy Save Bypass mode.	Default: 60 s Min.: 10 Max.: 60000	156
S4-04 (322E) RUN	BP Energy Save Bypass Speed Increase	BP Enrgy Sav Inc	Sets the value in Hz that the drive will increase the output frequency above E1-04 before performing an Energy Save transfer to bypass.	Default: 6 Hz Min.: 0 Max.: 10	156

◆ S5: HOA Keypad Parameters

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S5-01 (322F)	HAND Frequency Reference Selection	HAND Fref Source 0: Operator 1: Terminals 2: d1-16 3: S5-05 4: Set by b1-01	0: HOA keypad 1: Terminals 2: d1-16 3: S5-05 4: Determined by b1-01	Default: 0 Range: 0 to 4	156
S5-02 (3230)	HAND/AUTO During Run Selection	HAND/AUTO @Run 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	156
S5-03 (3231) RUN	HAND Mode PI Selection	HAND Mode PI Sel 0: Disabled 1: Enabled	0: Disabled 1: Enabled	Default: 1 Range: 0, 1	156
S5-04 (3232)	HAND Mode Behavior Selection	HAND BehaviorSel 0: Legacy 1: Normal 2: Normal w/ Memory	0: Legacy operation mode 1: Normal operation mode 2: Normal with memory **Note:** The drive will always be in AUTO mode at power up with S5-04 = 1.	Default: 1 Range: 0 to 2	156
S5-05 (3233) RUN	HAND Frequency Reference 1	HAND Freq Ref 2	Sets the frequency reference used in HAND mode when S5-01 is set to 2.	Default: 0.00 Hz Min.: 0.00 Max.: E1-04	158
S5-07 (3235)	HAND Key Function Selection (HOA Keypad)	Oper HAND Key 0: Disabled 1: Enabled	Determines whether the HAND key on the HOA keypad will be enabled for switching between HAND and AUTO. 0: Disabled 1: Enabled	Default: 1 Range: 0, 1	158

◆ S6: Z1000U Protection

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S6-01 (3236)	Emergency Override Speed	E Override Speed	Sets the speed command used in Emergency Override mode when S6-02 = 0.	Default: 0.00 Hz Min.: 0.00 Max.: E1-04	159
S6-02 (3237)	Emergency Override Reference Selection	E OverrideRefSel 0: Use S6-01 Ref 1: Use AUTO Ref	Selects the frequency reference source for the Emergency Override function (H1-☐☐= AF or B0). 0: Use S6-01 Reference 1: Use AUTO Reference	Default: 0 Range: 0, 1	159

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
S6-07 (323C)	Output Phase Loss Detection Level for Dynamic Audible Noise Control	Outp Ph Loss Lv1	Sets the output phase loss detection level for Dynamic Audible Noise Control. Decrease the setting in steps of 10% when output phase loss is detected erroneously. This setting rarely needs to be changed.	Default: 100.0% Min.: 10.0 Max.: 100.0	*159*

A.14 T: Motor Tuning

Enter data into the following parameters to tune the motor and drive for optimal performance.

◆ T1: Induction Motor Auto-Tuning

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
T1-01 (0701) <1>	Auto-Tuning Mode Selection	Tuning Mode Sel 2: Term Resistance 3: On-DelayCompTune	2: Stationary Auto-Tuning for Line-to-Line Resistance 3: Rotational Auto-Tuning for V/f Control Energy Saving	Default: 2 Range: 2, 3	160
T1-02 (0702)	Motor Rated Power	Mtr Rated Power	Sets the motor rated power as specified on the motor nameplate. **Note:** Use the following formula to convert horsepower into kilowatts: 1HP = 0.746 kW.	Default: <2> Min.: 0.00 kW Max.: 650.00 kW	160
T1-03 (0703)	Motor Rated Voltage	Rated Voltage	Sets the motor rated voltage as specified on the motor nameplate.	Default: 200.0 V <3> Min: 0.0 Max: 255.0 <3>	160
T1-04 (0704)	Motor Rated Current	Rated Current	Sets the motor rated current as specified on the motor nameplate.	Default: <2> Min.: 10% of drive rated current Max.: 200% of drive rated current	160
T1-05 (0705)	Motor Base Frequency	Rated Frequency	Sets the rated frequency of the motor as specified on the motor nameplate.	Default: 60.0 Hz Min.: 0.0 Max.: 400.0	160
T1-06 (0706)	Number of Motor Poles	Number of Poles	Sets the number of motor poles as specified on the motor nameplate.	Default: 4 Min.: 2 Max.: 48	160
T1-07 (0707)	Motor Base Speed	Rated Speed	Sets the rated speed of the motor as specified on the motor nameplate.	Default: 1750 r/min Min.: 0 Max.: 14400	160
T1-11 (070B)	Motor Iron Loss	Mtr Iron Loss(W)	Sets the iron loss for determining the Energy Saving coefficient. The value is set to E2-10 (motor iron loss) set when the power is cycled. If T1-02 is changed, a default value appropriate for the motor capacity that was entered will appear.	Default: <4> Min.: 0 Max.: 65535	161
T1-12 (FFF0)	T1 Tuning Start	Tuning Ready	The drive starts tuning.	No setting available	161

<1> The availability of certain Auto-Tuning methods depends on the control mode selected for the drive.

<2> Default setting is dependent on parameter o2-04, Drive Model Selection.

<3> Values shown are specific to 200 V class drives. Double the value for 400 V class drives.

<4> Default setting value differs depending on the motor code value, motor parameter settings, and E2-11, Motor Rated Power.

◆ T2: PM Motor Auto-Tuning

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
T2-01 (0750)	PM Motor Auto-Tuning Mode Selection	PM Tuning Mode 0: Standard Tuning 1: Tune-No Rotate 2: Term Resistance 14: PM Rotation Tune	OLV/PM 0: PM Motor Parameter Settings 1: PM Stationary Auto-Tuning 2: PM Stationary Auto-Tuning for Stator Resistance 14: PM Rotational Auto-Tuning	Default: 0 Range: 0 to 2; 14	161
T2-02 (0751)	PM Motor Code Selection	PM Mtr Code Sel	OLV/PM Enter the motor code when using a Yaskawa PM motor. After entering the motor code, the drive automatically sets parameters T2-03 through T2-09. Set parameters T2-10 to T2-14 according the motor nameplate or the motor test report. When using a motor without a supported motor code or a non-Yaskawa motor, set FFFF and adjust the other T2 parameters according to the motor nameplate or the motor test report.	Default: <1> Min: 0000 Max: FFFF	161
T2-03 (0752)	PM Motor Type	PM Motor Type 0: IPM motor 1: SPM motor	OLV/PM 0: IPM motor 1: SPM motor	Default: 1 Range: 0, 1	161
T2-04 (0730)	PM Motor Rated Power	Mtr Rated Power	OLV/PM Sets the motor rated power. **Note:** Use the following formula to convert horsepower into kilowatts: 1HP = 0.746 kW.	Default: <1> Min.: 0.00 kW Max.: 650.00 kW	161
T2-05 (0732)	PM Motor Rated Voltage	Rated Voltage	OLV/PM Enter the motor rated voltage as indicated on the motor nameplate.	Default: 200.0 V <2> Min.: 0.0 Max.: 255.0 <2>	162
T2-06 (0733)	PM Motor Rated Current	Rated Current	OLV/PM Enter the motor rated current as indicated on the motor nameplate.	Default: <1> Min.: 10% of drive rated current Max.: 150% of drive rated current	162
T2-07 (0753)	PM Motor Base Frequency	Base Frequency	OLV/PM Enter the motor base frequency as indicated on the motor nameplate.	Default: 87.5 Hz Min.: 0.0 Max.: 400.0	162
T2-08 (0734)	Number of PM Motor Poles	Number of Poles	OLV/PM Enter the number of motor poles for the PM motor as indicated on the motor nameplate.	Default: 6 Min.: 2 Max.: 48	162
T2-10 (0754)	PM Motor Stator Resistance	Arm Resistance	OLV/PM Enter the rotor resistance for the PM motor as indicated on the motor nameplate.	Default: <3> Min.: 0.000 Ω Max.: 65.000 Ω	162
T2-11 (0735)	PM Motor d-Axis Inductance	d-Axis Induct	OLV/PM Enter the d-axis inductance for the PM motor as indicated on the motor nameplate.	Default: <3> Min.: 0.00 mH Max.: 600.00 mH	162
T2-12 (0736)	PM Motor q-Axis Inductance	q-Axis Induct	OLV/PM Enter the q-axis inductance for the PM motor as indicated on the motor nameplate.	Default: <3> Min.: 0.00 mH Max.: 600.00 mH	162
T2-13 (0755)	Induced Voltage Constant Unit Selection	Iduct Volt Unit 0: mV/RPM 1: mV/(rad/sec)	OLV/PM 0: mV/(r/min). E5-09 will automatically be set to 0.0, and E5-24 will be used. 1: mV/(rad/sec). E5-24 will automatically be set to 0.0, and E5-09 will be used.	Default: 1 Range: 0, 1	162

No. (Addr. Hex)	Name	LCD Display	Description	Values	Page
T2-14 (0737)	PM Motor Induced Voltage Constant	Induct Volt Coef	OLV/PM Enter the induced voltage coefficient for the PM motor as indicated on the motor nameplate. Setting units are determined by parameter T2-13, Induced Voltage Constant Unit Selection.	Default: <3> Min.: 0.1 Max.: 2000.0	163
T2-15 (0756)	Pull-In Current Level for PM Motor Tuning	Pull-In I Lvl	OLV/PM Sets the amount of pull-in current to use for Auto-Tuning as a percentage of the motor rated current. Increase this setting for high inertia loads.	Default: 30% Min.: 0 Max.: 120	163

<1> Default setting is determined by parameter o2-04, Drive Model Selection.

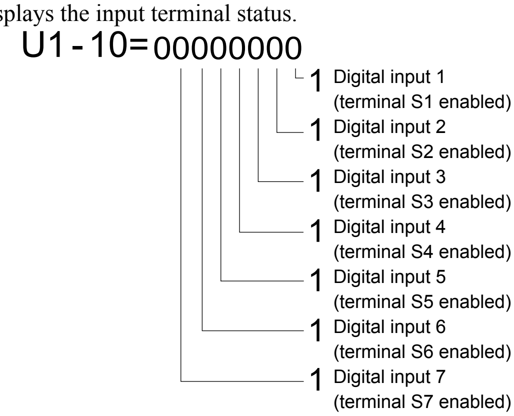
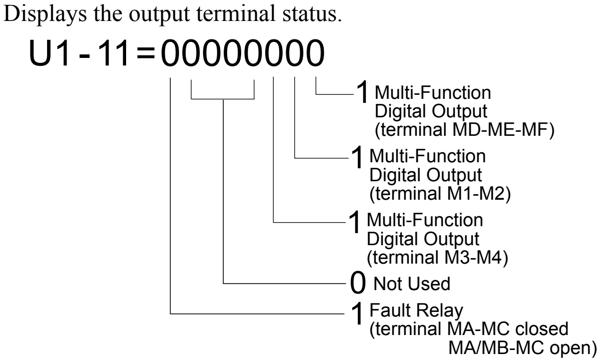
<2> Values shown are specific to 200 V class drives. Double the value for 400 V class drives.

<3> Default setting is dependent on parameter T2-02, PM Motor Code Selection, and the drive capacity.

A.15 U: Monitors

Monitor parameters allow the user to view drive status, fault information, and other data concerning drive operation.

◆ U1: Operation Status Monitors

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U1-01 (0040)	Frequency Reference	Frequency Ref	Monitors the frequency reference. Display units are determined by o1-03.	10 V: Max frequency	0.01 Hz
U1-02 (0041)	Output Frequency	Output Freq	Displays the output frequency. Display units are determined by o1-03.	10 V: Max frequency	0.01 Hz
U1-03 (0042)	Output Current	Output Current	Displays the output current.	10 V: Drive rated current	<1> <2>
U1-04 (0043)	Control Method	Control Method	0: V/f Control	No signal output available	–
U1-06 (0045)	Output Voltage Reference	Output Voltage	Displays the output voltage.	10 V: 200 Vrms <3>	0.1 Vac
U1-07 (0046)	DC Bus Voltage	DC Bus Voltage	Displays the DC bus voltage.	10 V: 400 V <3>	1 Vdc
U1-08 (0047)	Output Power	Output kWatts	Displays the output power (this value is calculated internally).	10 V: Drive rated power (kW)	<4>
U1-10 (0049)	Input Terminal Status	Input Term Sts	Displays the input terminal status. 	No signal output available	–
U1-11 (004A)	Output Terminal Status	Output Term Sts	Displays the output terminal status. 	No signal output available	–

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U1-12 (004B)	Drive Status	Int Ctl Sts 1	Verifies the drive operation status. U1-12=00000000 1 During run 1 During zero-speed 1 During REV 1 During fault reset signal input 1 During speed agree 1 Drive ready 1 During alarm detection 1 During fault detection	No signal output available	–
U1-13 (004E)	Terminal A1 Input Level	Term A1 Level	Displays the signal level to analog input terminal A1.	10 V: 100%	0.1%
U1-14 (004F)	Terminal A2 Input Level	Term A2 Level	Displays the signal level to analog input terminal A2.	10 V: 100%	0.1%
U1-15 (0050)	Terminal A3 Input Level	Term A3 Level	Displays the signal level to analog input terminal A3.	10 V: 100% (-10 to +10 V)	0.1%
U1-16 (0053)	Output Frequency after Soft Starter	SFS Output	Displays output frequency with ramp time and S-curves. Units determined by o1-03.	10 V: Max frequency	0.01 Hz
U1-17 (0058)	DI-A3 Input Status	DI Opt Status	Displays the reference value input from the DI-A3 option card. Display will appear in hexadecimal as determined by the digital card input selection in F3-01. 3FFFF: Set (1 bit) + sign (1 bit) + 16 bit	No signal output available	–
U1-18 (0061)	oPE Fault Parameter	OPE Error Code	Displays the parameter number that caused the oPE□□ or Err (EEPROM write error) error.	No signal output available	–
U1-19 (0066)	MEMOBUS/Modbus Error Code	Transmit Err	Displays the contents of a MEMOBUS/Modbus error. U1-19=00000000 1 CRC Error 1 Data Length Error 0 Not Used 1 Parity Error 1 Overrun Error 1 Framing Error 1 Timed Out 0 Not Used	No signal output available	–
U1-21 (0077)	AI-A3 Terminal V1 Input Voltage Monitor	AI Opt Ch1 Level	Displays the input voltage to terminal V1 on analog input card AI-A3.	10 V: 100% (-10 to +10 V)	0.1%
U1-22 (072A)	AI-A3 Terminal V2 Input Voltage Monitor	AI Opt Ch2 Level	Displays the input voltage to terminal V2 on analog input card AI-A3.	10 V: 100% (-10 to +10 V)	0.1%
U1-23 (072B)	AI-A3 Terminal V3 Input Voltage Monitor	AI Opt Ch3 Level	Displays the input voltage to terminal V3 on analog input card AI-A3.	10 V: 100% (-10 to +10 V)	0.1%
U1-25 (004D)	Software Number (Flash)	CPU 1 SW Number	FLASH ID	No signal output available	–
U1-26 (005B)	Software No. (ROM)	CPU 2 SW Number	ROM ID	No signal output available	–
U1-27 (07A8)	Message ID (OPR)	MessageID(OPR)	OPR ID	No signal output available	–
U1-28 (07A9)	Message ID (INV)	MessageID(DRV)	INV ID	No signal output available	–
U1-54 (1083)	Drive Input Power Voltage Effective Value	PowerSupply Volt	Displays the effective value of the drive input power voltage.	200 V class 10 V: 400 V 400 V class 10 V: 800 V	1 V
U1-58 (1087)	Power Supply Frequency	PoweSupply Freq	Displays the frequency of the drive input power supply.	10 V: Rated frequency	0.1 Hz

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U1-72 (1095)	Input Power Supply Information	Power Supply Sts	Displays information on the input power supply. U1-72=00000000 Bit 0: AUv reset. (0: Not completed, 1: Reset) Bit 1: PF reset (0: Not completed, 1: Reset) Bit 2: Rated frequency detection (0: Not completed, 1: Completed) Bit 3: Phase order detection (0: Not completed, 1: Completed) Bit 4: Power supply established (0: Not completed, 1: Completed) Bit 5: Fdv detection (0: Not detected, 1: Detected) Bit 6: PF detection (0: Not detected, 1: Detected) Bit 7: Reserved.	No signal output available	–

<1> Display is in the following units:
2□0028, 2□0042, and 4□0011 to 4□0027: 0.01 A units
2□0054 to 2□0248 and 4□0034 to 4□0414: 0.1 A units

<2> When reading the value of this monitor via MEMOBUS/Modbus, a value of 8192 is equal to 100% of the drive rated output current.

<3> Values shown are specific to 200 V class drives. Double the value for 400 V class drives.

<4> Display is in the following units:
2□0028, 2□0042, and 4□0011 to 4□0027: 0.01 kW units
2□0054 to 2□0248 and 4□0034 to 4□0414: 0.1 kW units

◆ U2: Fault Trace

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U2-01 (0080)	Current Fault	Current Fault	Displays the current fault.	No signal output available	–
U2-02 (0081)	Previous Fault	Last Fault	Displays the previous fault.	No signal output available	–
U2-03 (0082)	Frequency Reference at Previous Fault	Frequency Ref	Displays the frequency reference at the previous fault.	No signal output available	0.01 Hz
U2-04 (0083)	Output Frequency at Previous Fault	Output Freq	Displays the output frequency at the previous fault.	No signal output available	0.01 Hz
U2-05 (0084)	Output Current at Previous Fault	Output Current	Displays the output current at the previous fault.	No signal output available	<1> <2>
U2-07 (0086)	Output Voltage at Previous Fault	Output Voltage	Displays the output voltage at the previous fault.	No signal output available	0.1 Vac
U2-08 (0087)	Control Circuit DC Voltage at Previous Fault	DC Bus Voltage	Displays the control circuit DC voltage at the previous fault.	No signal output available	1 Vdc
U2-09 (0088)	Output Power at Previous Fault	Output kWatts	Displays the output power at the previous fault.	No signal output available	0.1 kW
U2-11 (008A)	Input Terminal Status at Previous Fault	Input Term Sts	Displays the input terminal status at the previous fault. Displayed as in U1-10.	No signal output available	–
U2-12 (008B)	Output Terminal Status at Previous Fault	Output Term Sts	Displays the output status at the previous fault. Displays the same status displayed in U1-11.	No signal output available	–
U2-13 (008C)	Drive Operation Status at Previous Fault	Inverter Status	Displays the operation status of the drive at the previous fault. Displays the same status displayed in U1-12.	No signal output available	–
U2-14 (008D)	Cumulative Operation Time at Previous Fault	Elapsed time	Displays the cumulative operation time at the previous fault.	No signal output available	1 h
U2-15 (07E0)	Soft Starter Speed Reference at Previous Fault	SFS Output	Displays the speed reference for the soft starter at the previous fault.	No signal output available	0.01 Hz
U2-16 (07E1)	Motor q-Axis Current at Previous Fault	Motor Iq Current	Displays the q-axis current for the motor at the previous fault.	No signal output available	0.10%
U2-17 (07E2)	Motor d-Axis Current at Previous Fault	Motor Id Current	OLV/PM Displays the d-axis current for the motor at the previous fault.	No signal output available	0.10%
U2-20 (008E)	Heatsink Temperature at Previous Fault	Actual Fin Temp	Displays the temperature of the heatsink when the most recent fault occurred.	No signal output available	1 °C

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U2-30 (3008)	Date Year at Previous Fault	Date Year YYYY	Displays the year when the most recent fault occurred.	No signal output available	–
U2-31 (3009)	Date Month and Day at Previous Fault	Date Mo Day MMDD	Displays the date and day when the most recent fault occurred.	No signal output available	–
U2-32 (300A)	Time Hours and Minutes at Previous Fault	Time Hr Min HHMM	Displays the time when the most recent fault occurred.	No signal output available	–
U2-50 (085C)	Input Power Supply	Power Supply Sts	Information at Previous Fault Displays the input power supply information at the previous fault. Displayed as in U1-72.	No signal output available	–
U2-54 (0843)	Power Supply Voltage at Previous Fault	PowerSupply Volt	Displays the power supply voltage at the previous fault. Displayed as in U1-54.	No signal output available	1 V
U2-58 (0847)	Power Supply Frequency at Previous Fault	PowerSupply Freq	Displays the power supply frequency at the previous fault. Displayed as in U1-58.	No signal output available	0.1 Hz

<1> Display is in the following units:
2□0028, 2□0042, and 4□0011 to 4□0027: 0.01 A units
2□0054 to 2□0248 and 4□0034 to 4□0414: 0.1 A units

<2> When reading the value of this monitor via MEMOBUS/Modbus, a value of 8192 is equal to 100% of the drive rated output current.

◆ U3: Fault History

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U3-01 to U3-04 (0090 to 0093 (0800 to 0803))	First to 4th Most Recent Fault	Fault Message □	Displays the first to the fourth most recent faults.	No signal output available	–
U3-05 to U3-10 (0804 to 0809)	5th to 10th Most Recent Fault	Fault Message □	Displays the fifth to the tenth most recent faults. After ten faults, data for the oldest fault is deleted. The most recent fault appears in U3-01, with the next most recent fault appearing in U3-02. The data is moved to the next monitor parameter each time a fault occurs.	No signal output available	–
U3-11 to U3-14 (0094 to 0097 (080A to 080D))	Cumulative Operation Time at 1st to 4th Most Recent Fault	Elapsed Time □	Displays the cumulative operation time when the first to the fourth most recent faults occurred.	No signal output available	1 h
U3-15 to U3-20 (080E to 0813)	Cumulative Operation Time at 5th to 10th Most Recent Fault	Elapsed Time □	Displays the cumulative operation time when the fifth to the tenth most recent faults occurred.	No signal output available	1 h
U3-21 (300B)	Date Year at Most Recent Fault	Fault 1 YYYY	Displays the year when the most recent fault occurred.	No signal output available	–
U3-22 (300C)	Date Month and Day at Most Recent Fault	Fault 1 MMDD	Displays the date and day when the most recent faults occurred.	No signal output available	–
U3-23 (300D)	Time Hours and Minutes at Most Recent Fault	Fault 1 HHMM	Displays the time when the most recent fault occurred.	No signal output available	–
U3-24 (300E)	Date Year at 2nd Most Recent Fault	Fault 2 YYYY	Displays the year when the second most recent fault occurred.	No signal output available	–
U3-25 (300F)	Date Month and Day at 2nd Most Recent Fault	Fault 2 MMDD	Displays the date and day when the second most recent fault occurred.	No signal output available	–
U3-26 (3010)	Time Hours and Minutes at 2nd Most Recent Fault	Fault 2 HHMM	Displays the time when the second most recent fault occurred.	No signal output available	–
U3-27 (3011)	Date Year at 3rd Most Recent Fault	Fault 3 YYYY	Displays the year when the most third recent fault occurred.	No signal output available	–
U3-28 (3012)	Date Month and Day at 3rd Most Recent Fault	Fault 3 MMDD	Displays the date and day when the third most recent fault occurred.	No signal output available	–

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U3-29 (3013)	Time Hours and Minutes at 3rd Most Recent Fault	Fault 3 HHMM	Displays the time when the third most recent fault occurred.	No signal output available	–
U3-30 (3014)	Date Year at 4th Most Recent Fault	Fault 4 YYYY	Displays the year when the fourth most recent fault occurred.	No signal output available	–
U3-31 (3015)	Date Month and Day at 4th Most Recent Fault	Fault 4 MMDD	Displays the date and day when the fourth most recent fault occurred.	No signal output available	–
U3-32 (3016)	Time Hours and Minutes at 4th Most Recent Fault	Fault 4 HHMM	Displays the time when the fourth most recent fault occurred.	No signal output available	–
U3-33 (3017)	Date Year at 5th Most Recent Fault	Fault 5 YYYY	Displays the year when the fifth most recent fault occurred.	No signal output available	–
U3-34 (3018)	Date Month and Day at 5th Most Recent Fault	Fault 5 MMDD	Displays the date and day when the fifth most recent fault occurred.	No signal output available	–
U3-35 (3019)	Time Hours and Minutes at 5th Most Recent Fault	Fault 5 HHMM	Displays the time when the fifth most recent fault occurred.	No signal output available	–
U3-36 (301A)	Date Year at 6th Most Recent Fault	Fault 6 YYYY	Displays the year when the sixth most recent fault occurred.	No signal output available	–
U3-37 (301B)	Date Month and Day a 6th Most Recent Fault	Fault 6 MMDD	Displays the date and day when the sixth most recent fault occurred.	No signal output available	–
U3-38 (301C)	Time Hours and Minutes at 6th Most Recent Fault	Fault 6 HHMM	Displays the time when the most sixth recent fault occurred.	No signal output available	–
U3-39 (301D)	Date Year at 7th Most Recent Fault	Fault 7 YYYY	Displays the year when the most seventh recent fault occurred.	No signal output available	–
U3-40 (301E)	Date Month and Day at 7th Most Recent Fault	Fault 7 MMDD	Displays the date and day when the seventh most recent fault occurred.	No signal output available	–
U3-41 (301F)	Time Hours and Minutes at 7th Most Recent Fault	Fault 7 HHMM	Displays the time when the seventh most recent fault occurred.	No signal output available	–
U3-42 (3020)	Date Year at 8th Most Recent Fault	Fault 8 YYYY	Displays the year when the eighth most recent fault occurred.	No signal output available	–
U3-43 (3021)	Date Month and Day 8th at Most Recent Fault	Fault 8 MMDD	Displays the date and day when the eighth most recent fault occurred.	No signal output available	–
U3-44 (3022)	Time Hours and Minutes at 8th Most Recent Fault	Fault 8 HHMM	Displays the time when the eighth most recent fault occurred.	No signal output available	–
U3-45 (3023)	Date Year at 9th Most Recent Fault	Fault 9 YYYY	Displays the year when the ninth most recent fault occurred.	No signal output available	–
U3-46 (3024)	Date Month and Day at 9th Most Recent Fault	Fault 9 MMDD	Displays the date and day when the ninth most recent fault occurred.	No signal output available	–
U3-47 (3025)	Time Hours and Minutes at 9th Most Recent Fault	Fault 9 HHMM	Displays the time when the ninth most recent fault occurred.	No signal output available	–
U3-48 (3026)	Date Year at 10th Most Recent Fault	Fault 10 YYYY	Displays the year when the tenth most recent fault occurred.	No signal output available	–
U3-49 (3027)	Date Month and Day at 10th Most Recent Fault	Fault 10 MMDD	Displays the date and day when the tenth most recent fault occurred.	No signal output available	–
U3-50 (3028)	Time Hours and Minutes at 10th Most Recent	Fault 10 HHMM	Displays the time when the tenth most recent fault occurred.	No signal output available	–

◆ U4: Maintenance Monitors

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U4-01 (004C)	Cumulative Operation Time	Drv Elapsed Time	Displays the cumulative operation time of the drive. The value for the cumulative operation time counter can be reset in parameter o4-01. Use parameter o4-02 to determine if the operation time should start as soon as the power is switched on or only while the Run command is present. The default value is 0. The value counts up from 0. The maximum number displayed is 99999, after which the value is reset to 0.	No signal output available	1 h
U4-02 (0075)	Number of Run Commands	RUN Cmd Counter	Displays the number of times the Run command is entered. Reset the number of Run commands using parameter o4-13. The default value is 0. The value will reset to 0 and start counting again after reaching 65535.	No signal output available	1 Time
U4-03 (0067)	Cooling Fan Operation Time	Fan Elapsed TIme	Displays the cumulative operation time of the cooling fan. The default value for the fan operation time is reset in parameter o4-03. The default value is 0. The value will reset to 0 and start counting again after reaching 99999.	No signal output available	1 h
U4-04 (007E)	Cooling Fan Maintenance	Fan Life Mon	Displays main cooling fan usage time as a percentage of its expected performance life. The default value is 0. The value counts up from 0. Parameter o4-03 can be used to reset this monitor.	No signal output available	1%
U4-05 (007C)	Capacitor Maintenance	Cap Life Mon	Displays main circuit capacitor usage time as a percentage of their expected performance life. The default value is 0. The value counts up from 0. Parameter o4-05 can be used to reset this monitor.	No signal output available	1%
U4-06 (07D6)	Soft Charge Bypass Relay Maintenance	ChgCirc Life Mon	Displays the soft charge bypass relay maintenance time as a percentage of its estimated performance life. The default value is 0. The value counts up from 0. Parameter o4-07 can be used to reset this monitor.	No signal output available	1%
U4-08 (0068)	Heatsink Temperature	Heatsink Temp	Displays the heatsink temperature.	10 V: 100 °C	1 °C
U4-09 (005E)	LED Check	LED Oper Check	Lights all segments of the LED to verify that the display is working properly.	No signal output available	–
U4-10 (005C)	kWh, Lower 4 Digits	kWh Lower 4 dig	Monitors the drive output power. The value is shown as a 9-digit number displayed across two monitor parameters, U4-10 and U4-11. Example: 12345678.9 kWh is displayed as: U4-10: 678.9 kWh U4-11: 12345 MWh	No signal output available	1 kWh
U4-11 (005D)	kWh, Upper 5 Digits	kWh Upper 5 dig		No signal output available	1 MWh
U4-13 (07CF)	Peak Hold Current	Current PeakHold	Displays the highest current value that occurred during run.	No signal output available	0.01 A <1> <2>
U4-14 (07D0)	Peak Hold Output Frequency	Freq@ I PeakHold	Displays the output frequency when the current value shown in U4-13 occurred.	No signal output available	0.01 Hz
U4-16 (07D8)	Motor Overload Estimate (oL1)	Motor OL1 Level	Shows the value of the motor overload detection accumulator. 100% is equal to the oL1 detection level.	10 V: 100%	0.1%
U4-18 (07DA)	Frequency Reference Source Selection	Reference Source	Displays the source for the frequency reference as XY-nn. **X: indicates which reference is used:** 0 = OFF 1 = AUTO 2 = HAND **Y-nn: indicates the reference source** 0-01 = HOA keypad 1-00 = Analog (not assigned) 1-01 = Analog (terminal A1) 1-02 = Analog (terminal A2) 2-02 to 17 = Multi-step speed (d1-02 to 17) 3-01 = MEMOBUS/Modbus communications 4-01 = Communication option card 9-01 = Up/Down	No signal output available	–
U4-19 (07DB)	Frequency Reference from MEMOBUS/ Modbus Comm.	MEMOBUS Freq Ref	Displays the frequency reference provided by MEMOBUS/ Modbus (decimal).	No signal output available	0.01%
U4-20 (07DC)	Option Frequency Reference	Option Freq Ref	Displays the frequency reference input by an option card (decimal).	No signal output available	–

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U4-21 (07DD)	Run Command Source Selection	Run Cmd Source	Displays the source for the Run command as XY-nn. **X: Indicates which Run source is used:** 0 = OFF 1 = AUTO 2 = HAND **Y: Input power supply data** 0 = HOA keypad 1 = External terminals 3 = Serial communications (APOGEE FLN, BACnet, MEMOBUS/Modbus, or Metasys N2) 4 = Communication option card **nn: Run command limit status data** 00: No limit status. 01: Run command was left on when stopped in the PRG mode 02: Run command was left on when switching from LOCAL to REMOTE operation 03: Waiting for soft charge bypass contactor after power up (Uv or Uv1 flashes after 10 s) 04: Waiting for “Run command prohibited” time period to end 05: Fast Stop (digital input, HOA keypad) 06: b1-17 (Run command given at power-up) 07: During baseblock while coast to stop with timer 08: Frequency reference is below minimal reference during baseblock 09: Waiting for Enter command	No signal output available	–
U4-22 (07DE)	MEMOBUS/Modbus Communications Reference	MEMOBUS Ref Reg	Displays the drive control data set by MEMOBUS/Modbus communications register no. 0001H as a four-digit hexadecimal number.	No signal output available	–
U4-23 (07DF)	Communication Option Card Reference	Option Ref Reg	Displays drive control data set by an option card as a four-digit hexadecimal number.	No signal output available	–

<1> Display is in the following units:
2☐0028, 2☐0042, and 4☐0011 to 4☐0027: 0.01 A units
2☐0054 to 2☐0248 and 4☐0034 to 4☐0414: 0.1 A units

<2> When reading the value of this monitor via MEMOBUS/Modbus, a value of 8192 is equal to 100% of the drive rated output current.

◆ U5: PID Monitors

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U5-01 (0057)	PID Feedback	PID Feedback 1	Displays the PID feedback value.	10 V: 100%	0.01%
U5-02 (0063)	PID Input	PID Input	Displays the amount of PID input (deviation between PID setpoint and feedback).	10 V: 100%	0.01%
U5-03 (0064)	PID Output	PID Output	Displays PID control output.	10 V: 100%	0.01%
U5-04 (0065)	PID Setpoint	PID Setpoint	Displays the PID setpoint.	10 V: 100%	0.01%
U5-05 (07D2)	PID Differential Feedback	PID Feedback 2	Displays the second PID feedback value if differential feedback is used (H3-☐☐ = 16).	10 V: 100%	0.01%
U5-06 (07D3)	PID Adjusted Feedback	PID Diff Fdbk	Displays the difference of both feedback values if Differential Feedback is used (U5-01 - U5-05). If PID Square Root Feedback or Differential Feedback are enabled, U5-01 ≠ U5-06. If PID Square Root Feedback or Differential Feedback are NOT enabled, U5-01= U5-06.	10 V: 100%	0.01%
U5-07 (72)	AUTO Mode Frequency Reference Value	AUTO mode Fref	Displays the Frequency reference value at AUTO Mode.	No signal output available	0.01 Hz
U5-08 (0073)	HAND Mode Frequency Reference Value	HAND mode Fref	Displays the Frequency reference value at HAND Mode.	No signal output available	0.01 Hz
U5-14 (086B)	PID Output Upper 4 Digits	PID Output U4	Displays Custom PID output. U5-14 shows the upper 4 digits.	10V: (b5-43 x 10000) + b5-44 <1>	1

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U5-15 (086C)	PID Output Lower 4 Digits	PID Output L4	Displays Custom PID output. U5-15 shows the lower 4 digits.	No signal output available	0.01
U5-17 (302A)	PI2 Setpoint	PI2 Set-point	Displays the secondary PI setpoint.	10 V: Max frequency	0.01%
U5-18 (302B)	PI2 Feedback	PI2 Feedback	Displays the secondary PI feedback value.	10 V: Max frequency	0.01%
U5-19 (302C)	PI2 Input	PI2 Input	Displays the secondary PI input (deviation between PID target and feedback).	10 V: Max frequency	0.01%
U5-20 (302D)	PI2 Output	PI2 Output	Displays the secondary PI control output.	10 V: Max frequency	0.01%
U5-30 (3000)	Time Hr Min HHMM	Time Hr Min HHMM	Displays the current time (Hours and Minutes).	No signal output available	1
U5-31 (3001)	Date Year	Date Year	Displays the current year.	No signal output available	1
U5-32 (3002)	Date Mo Day MMDD	Date Mo Day MMDD	Displays the current date (Month and Day).	No signal output available	1
U5-33 (3003)	Day of the Week	Date Week 0: Sun 1: Mon 2: Tues 3: Wed 4: Thur 5: Fri 6: Sat	Displays the current day of the week. 0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	No signal output available	1

<1> Analog Output selection text is: “PID Output 2”.

◆ U6: Operation Status Monitors

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U6-01 (0051)	Motor Secondary Current (Iq)	Mot SEC Current	Displays the value of the motor secondary current (Iq). Motor rated secondary current is 100%.	10 V: Motor secondary rated current	0.1%
U6-02 (0052)	Motor Excitation Current (Id)	Mot EXC Current	OLV/PM Displays the value calculated for the motor excitation current (Id). Motor rated secondary current is 100%.	10 V: Motor secondary rated current	0.1%
U6-05 (0059)	Output Voltage Reference (Vq)	Voltage Ref (Vq)	OLV/PM Output voltage reference (Vq) for the q-Axis.	10 V: 200 Vrms <1>	0.1 Vac
U6-06 (005A)	Output Voltage Reference (Vd)	Voltage Ref (Vd)	OLV/PM Output voltage reference (Vd) for the d-Axis.	10 V: 200 Vrms <1>	0.1 Vac
U6-21 (07D5)	Offset Frequency	Offset Frequency	Displays the frequency added to the main frequency reference.	–	0.1%
U6-80 to U6-99 (07B0 to 07F9)	Option Monitors 1 to 20	–	Output monitor for option card. Refer to Option Instruction manual for details	No signal output available.	–

<1> Values shown are specific to 200 V class drives. Double the values for 400 V class drives.

◆ U9: Power Monitors

No. (Addr. Hex)	Name	LCD Display	Description	Analog Output Level	Unit
U9-01 (0820)	Electric Power (GWh)	GWh Consumed	Shows the total amount of electric power. 000 000 000 kWh U9-03 U9-02 U9-01	No signal output available	1 GWh
U9-02 (0821)	Electric Power (MWh)	MWh Consumed		No signal output available	1 MWh
U9-03 (0822)	Electric Power (kWh)	kWh Consumed		No signal output available	1 kWh
U9-04 (0823)	Regenerative Power (GWh)	GWh Produced	Shows the total amount of regenerated power. 000 000 000 kWh U9-06 U9-05 U9-04	No signal output available	1 GWh
U9-05 (0824)	Regenerative Power (MWh)	MWh Produced		No signal output available	1 MWh
U9-06 (0825)	Regenerative Power (kWh)	kWh Produced		No signal output available	1 kWh
U9-07 to U9-10 (0826 to 0829)	Electric Power Rates 1 to 4	Consumed □ ($)	These parameters show the electric power rate in Power Unit Price (o4-19) that is calculated from the total electrical power consumptions in U9-01 to U9-03. U9-10: Digit 1 to digit 3 U9-09: Digit 4 to digit 6 U9-08: Digit 7 to digit 9 U9-07: Digit 10 to digit 12 000 000 000 000 U9-10 U9-09 U9-08 U9-07 The unit price is set in o4-19, and U9-07 to U9-10 are U9-01 to U9-03 x o4-19.	No signal output available	–
U9-11 to U9-14 (082A to 082D)	Regenerative Power Rates 1 to 4	Produced □ ($)	These parameters show the regenerative power rate in Power Unit Price (o4-19) that is calculated from the total electrical power consumptions in U9-04 to U9-06. U9-14: Digit 1 to digit 3 U9-13: Digit 4 to digit 6 U9-12: Digit 7 to digit 9 U9-11: Digit 10 to digit 12 000 000 000 000 U9-14 U9-13 U9-12 U9-11 The unit price is set in o4-19, and U9-11 to U9-14 are U9-04 to U9-06 x o4-19.	No signal output available	–

A.16 Control Mode Dependent Parameter Default Values

The tables below list parameters that depend on the control mode selection. Changing the control mode initializes these parameters to the values shown here.

◆ A1-02 (Control Mode) Dependent Parameters

Table A.3 A1-02 (Control Mode) Dependent Parameters and Default Values

No.	Name	Setting Range	Resolution	Control Modes (A1-02)	
				V/f (0)	OLV/PM (5)
b1-24	Commercial Power Switching Selection	0, 1	–	0	0
b2-01	DC Injection Braking Start Frequency	0.0 to 10.0	0.1 Hz	0.5 Hz	0.5 Hz
b2-04	DC Injection Braking Time at Stop	0.00 to 10.00	0.01 s	0.50 s	0.00 s
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	0.00 to 6.00	–	<1>	0.3
b3-09	Current Control Integral Time during Speed Search (Speed Estimation Type)	0.0 to 1000.0	0.0 ms	2.00 ms	4.00 ms
b3-24	Speed Search Method Selection	1, 2	–	2	2
b8-01	Energy Saving Control Selection	0, 1	–	0	–
C2-01	S-Curve Time at Acceleration Start	0.00 to 10.00	0.01 s	0.20 s	1.00 s
C4-01	Torque Compensation Gain	0.00 to 2.50	0.01	1.00	0.00
C4-02	Torque Compensation Primary Delay Time	0 to 10000	1 ms	200 ms	100 ms
C6-02	Carrier Frequency Selection	1 to 4, F	–	<1>	<1>
E1-04	Maximum Output Frequency	40.0 to 400.0	0.1 Hz	60.0	<2>
E1-05	Maximum Voltage	0.0 to 255.0 <3>	0.1 V	575 <4>	<2>
E1-06	Base Frequency	0.0 to 400.0	0.1 Hz	60.0	<2>
E1-07	Middle Output Frequency	0.0 to 400.0	0.1 Hz	3.0	–
E1-08	Middle Output Frequency Voltage	0.0 to 255.0 <3>	0.1 V	15.0 <4>	–
E1-09	Minimum Output Frequency	0.0 to 400.0	0.1 Hz	1.5	<2>
E1-10	Minimum Output Frequency Voltage	0.0 to 255.0 <3>	0.1 V	9.0	–
L1-01	Motor Overload Protection Selection	0 to 4	–	1	4
L8-18	Software Current Limit Selection	0 to 1	–	<5>	0
L8-38	Carrier Frequency Reduction Selection	0 to 2	–	<1>	0
L8-40	Carrier Frequency Reduction Off Delay Time	0.00 to 2.00	0.01 s	0.50 s	0.00 s

<1> Default setting value is determined by parameter o2-04, Drive Model Selection.

<2> Default setting is dependent on parameter E5-01, Motor Code Selection.

<3> Values shown are specific to 200 V class drives. Double the values for 400 V class drives.

<4> This setting value depends on rated output current and V/f pattern selection in parameter E1-03.

<5> Default setting value is determined by the drive software version.
PRG: 6113 and earlier: 0
PRG: 6114 and later: Default setting is dependent on parameter A1-02, Control Method Selection

A.17 V/f Pattern Default Values

The following tables show the V/f pattern setting default values depending on the control mode (A1-02) and the V/f pattern selection (E1-03 in V/f Control).

Table A.4 E1-03 V/f Pattern Settings for Drive Capacity: Model 4□0011

No.	Unit	V/f Control															
E1-03	-	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F <1>
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	60.0
E1-05 <2>	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	230.0
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	30.0
E1-08 <2>	V	15.0	15.0	15.0	15.0	35.0	50.0	35.0	50.0	19.0	24.0	19.0	24.0	15.0	15.0	15.0	57.5
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.5
E1-10 <2>	V	9.0	9.0	9.0	9.0	8.0	9.0	8.0	9.0	11.0	13.0	11.0	15.0	9.0	9.0	9.0	10.2

<1> This value determines the default values for E1-04 through E1-10.

<2> Values shown here are specific to 200 V class drives. Double the value for 400 V class drives.

Table A.5 E1-03 V/f Pattern Settings for Drive Capacity: Models 2□0028 to 2□0154 and 4□0014 to 4□0096

No.	Unit	V/f Control															
E1-03	-	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F <1>
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	60.0
E1-05 <2>	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	230.0
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	30.0
E1-08 <2>	V	14.0	14.0	14.0	14.0	35.0	50.0	35.0	50.0	18.0	23.0	18.0	23.0	14.0	14.0	14.0	57.5
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.5
E1-10 <2>	V	7.0	7.0	7.0	7.0	6.0	7.0	6.0	7.0	9.0	11.0	9.0	13.0	7.0	7.0	7.0	8.1

<1> This value determines the default values for E1-04 through E1-10.

<2> Values shown here are specific to 200 V class drives. Double the value for 400 V class drives.

Table A.6 E1-03 V/f Pattern Settings for Drive Capacity: Models 2□0192, 2□0248, and 4□0124 to 4□0414

No.	Unit	V/f Control															
E1-03	-	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F <1>
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120.0	180.0	60.0
E1-05 <2>	V	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	230.0
E1-06	Hz	50.0	60.0	50.0	60.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	60.0	60.0	60.0	60.0
E1-07	Hz	2.5	3.0	3.0	3.0	25.0	25.0	30.0	30.0	2.5	2.5	3.0	3.0	3.0	3.0	3.0	30.0
E1-08 <2>	V	12.0	12.0	12.0	12.0	35.0	50.0	35.0	50.0	15.0	20.0	15.0	20.0	12.0	12.0	12.0	57.5
E1-09	Hz	1.3	1.5	1.5	1.5	1.3	1.3	1.5	1.5	1.3	1.3	1.5	1.5	1.5	1.5	1.5	1.5
E1-10 <2>	V	6.0	6.0	6.0	6.0	5.0	6.0	5.0	6.0	7.0	9.0	7.0	11.0	6.0	6.0	6.0	6.9

<1> This value determines the default values for E1-04 through E1-10.

<2> Values shown here are specific to 200 V class drives. Double the value for 400 V class drives.

A.18 Defaults by Drive Model

The following tables show parameters and default settings that change with the drive model selection (o2-04).

Table A.7 200 V Class Drives Default Settings by Drive Model Selection

No.	Name	Unit	Default Settings			
–	Drive Model	–	2□0028	2□0042	2□0054	2□0068
o2-04	Drive Model Selection	Hex.	6A	6B	6D	6E
E2-11	Motor Rated Output	kW (HP)	7.5 (10)	11 (15)	15 (20)	18.5 (25)
b3-04	V/f Gain during Speed Search	%	100	100	100	100
b3-06	Output Current 1 during Speed Search	–	0.5	0.5	0.5	0.5
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	–	0.5	0.5	0.5	0.5
b8-04	Energy Saving Coefficient Value	–	72.69	70.44	63.13	57.87
C6-02	Carrier Frequency Selection	–	1	1	1	1
E2-01	Motor Rated Current	A	26.6	39.7	53	65.8
E2-02	Motor Rated Slip	Hz	1.3	1.7	1.6	1.67
E2-03	Motor No-Load Current	A	8	11.2	15.2	15.7
E2-05	Motor Line-to-Line Resistance	Ω	0.288	0.23	0.138	0.101
E2-06	Motor Leakage Inductance	%	15.5	19.5	17.2	20.1
E2-10	Motor Iron Loss for Torque Compensation	W	262	245	272	505
E5-01	Motor Code Selection (for PM Motors)	Hex.	120A	120B	120D	120E
L2-02	Momentary Power Loss Ride-Thru Time	s	0.8	0.9	1	1
L2-03	Momentary Power Loss Minimum Baseblock Time	s	0.3	0.3	0.6	0.6
L2-04	Momentary Power Loss Voltage Recovery Time	s	150	150	150	150
L8-02	Overheat Alarm Level	°C	130	130	130	130
L8-35	Installation Method Selection	–	0	0	0	0
L8-38	Carrier Frequency Reduction Selection	–	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10

Table A.8 200 V Class Drives Default Settings by Drive Model Selection

No.	Name	Unit	Default Settings					
–	Drive Model	–	2□0081	2□0104	2□0130	2□0154	2□0192	2□0248
o2-04	Drive Model Selection	Hex.	6F	70	72	73	74	75
E2-11	Motor Rated Output	kW (HP)	22 (30)	30 (40)	37 (50)	45 (60)	55 (75)	75 (100)
b3-04	V/f Gain during Speed Search	%	100	80	80	80	80	80
b3-06	Output Current 1 during Speed Search	–	0.5	0.5	0.5	0.5	0.5	0.7
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	–	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy Saving Coefficient Value	–	51.79	46.27	38.16	35.78	31.35	23.1
C6-02	Carrier Frequency Selection	–	1	1	1	1	1	1
E2-01	Motor Rated Current	A	77.2	105	131	160	190	260
E2-02	Motor Rated Slip	Hz	1.7	1.8	1.33	1.6	1.43	1.39
E2-03	Motor No-Load Current	A	18.5	21.9	38.2	44	45.6	72
E2-05	Motor Line-to-Line Resistance	Ω	0.079	0.064	0.039	0.03	0.022	0.023
E2-06	Motor Leakage Inductance	%	19.5	20.8	18.8	20.2	20.5	20
E2-10	Motor Iron Loss for Torque Compensation	W	538	699	823	852	960	1200
E5-01	Motor Code Selection (for PM Motors)	Hex.	120F	1210	1212	1213	1214	1215
L2-02	Momentary Power Loss Ride-Thru Time	s	1	1.1	1.1	1.2	1.3	1.5
L2-03	Momentary Power Loss Minimum Baseblock Time	s	0.6	0.6	0.6	1	1	1

No.	Name	Unit	Default Settings					
–	**Drive Model**	**–**	**2□0081**	**2□0104**	**2□0130**	**2□0154**	**2□0192**	**2□0248**
o2-04	**Drive Model Selection**	**Hex.**	**6F**	**70**	**72**	**73**	**74**	**75**
E2-11	**Motor Rated Output**	**kW (HP)**	**22 (30)**	**30 (40)**	**37 (50)**	**45 (60)**	**55 (75)**	**75 (100)**
L2-04	Momentary Power Loss Voltage Recovery Time	s	150	150	150	150	150	150
L8-02	Overheat Alarm Level	°C	130	136	136	134	134	138
L8-35	Installation Method Selection	–	0	0	0	0	0	0
L8-38	Carrier Frequency Reduction Selection	–	1	1	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10

Table A.9 400 V Class Drives Default Settings by Drive Model Selection

No.	Name	Unit	Default Settings			
–	**Drive Model**	**–**	**4□0011**	**4□0014**	**4□0021**	**4□0027**
o2-04	**Drive Model Selection**	**Hex.**	**95**	**97**	**99**	**9A**
E2-11	**Motor Rated Output**	**kW (HP)**	**5.5 (7.5)**	**7.5 (10)**	**11 (15)**	**15 (20)**
b3-04	V/f Gain during Speed Search	%	100	100	100	100
b3-06	Output Current 1 during Speed Search	–	0.5	0.5	0.5	0.5
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	–	0.5	0.5	0.5	0.5
b8-04	Energy Saving Coefficient Value	–	245.8	189.5	145.38	140.88
C6-02	Carrier Frequency Selection	–	1	1	1	1
E2-01	Motor Rated Current	A	7	9.8	13.3	19.9
E2-02	Motor Rated Slip	Hz	2.7	1.5	1.3	1.7
E2-03	Motor No-Load Current	A	2.3	2.6	4	5.6
E2-05	Motor Line-to-Line Resistance	Ω	3.333	1.595	1.152	0.922
E2-06	Motor Leakage Inductance	%	19.3	18.2	15.5	19.6
E2-10	Motor Iron Loss for Torque Compensation	W	130	193	263	385
E5-01	Motor Code Selection (for PM Motors)	Hex.	1236	1238	123A	123B
L2-02	Momentary Power Loss Ride-Thru Time	s	0.6	0.7	0.8	0.9
L2-03	Momentary Power Loss Minimum Baseblock Time	s	0.3	0.3	0.3	0.3
L2-04	Momentary Power Loss Voltage Recovery Time	s	300	300	300	300
L8-02	Overheat Alarm Level	°C	130	130	130	130
L8-35	Installation Method Selection	–	0	0	0	0
L8-38	Carrier Frequency Reduction Selection	–	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10

Table A.10 400 V Class Drives Default Settings by Drive Model Selection

No.	Name	Unit	Default Settings			
–	**Drive Model**	**–**	**4□0034**	**4□0040**	**4□0052**	**4□0065**
o2-04	**Drive Model Selection**	**Hex.**	**9C**	**9D**	**9E**	**9F**
E2-11	**Motor Rated Output**	**kW (HP)**	**18.5 (25)**	**22 (30)**	**30 (40)**	**37 (50)**
b3-04	V/f Gain during Speed Search	%	100	100	100	100
b3-06	Output Current 1 during Speed Search	–	0.5	0.5	0.5	0.5
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	–	0.5	0.5	0.5	0.5
b8-04	Energy Saving Coefficient Value	–	126.26	115.74	103.58	92.54
C6-02	Carrier Frequency Selection	–	1	1	1	1
E2-01	Motor Rated Current	A	26.5	32.9	38.6	52.3
E2-02	Motor Rated Slip	Hz	1.6	1.67	1.7	1.8
E2-03	Motor No-Load Current	A	7.6	7.8	9.2	10.9
E2-05	Motor Line-to-Line Resistance	Ω	0.55	0.403	0.316	0.269
E2-06	Motor Leakage Inductance	%	17.2	20.1	23.5	20.7

No.	Name	Unit	Default Settings			
–	**Drive Model**	**–**	**4□0034**	**4□0040**	**4□0052**	**4□0065**
o2-04	**Drive Model Selection**	**Hex.**	**9C**	**9D**	**9E**	**9F**
E2-11	**Motor Rated Output**	**kW (HP)**	**18.5 (25)**	**22 (30)**	**30 (40)**	**37 (50)**
E2-10	Motor Iron Loss for Torque Compensation	W	440	508	586	750
E5-01	Motor Code Selection (for PM Motors)	Hex.	123D	123E	123F	1240
L2-02	Momentary Power Loss Ride-Thru Time	s	1	1	1	1.1
L2-03	Momentary Power Loss Minimum Baseblock Time	s	0.6	0.6	0.6	0.6
L2-04	Momentary Power Loss Voltage Recovery Time	s	300	300	300	300
L8-02	Overheat Alarm Level	°C	130	130	130	130
L8-35	Installation Method Selection	–	0	0	0	0
L8-38	Carrier Frequency Reduction Selection	–	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10

Table A.11 400 V Class Drives Default Settings by Drive Model Selection

No.	Name	Unit	Default Settings			
–	**Drive Model**	**–**	**4□0077**	**4□0096**	**4□0124**	**4□0156**
o2-04	**Drive Model Selection**	**Hex.**	**A1**	**A2**	**A3**	**A4**
E2-11	**Motor Rated Output**	**kW (HP)**	**45 (60)**	**55 (75)**	**75 (100)**	**90 (125)**
b3-04	V/f Gain during Speed Search	%	100	100	80	60
b3-06	Output Current 1 during Speed Search	–	0.5	0.5	0.5	0.7
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	–	0.5	0.5	0.5	0.8
b8-04	Energy Saving Coefficient Value	–	76.32	71.56	67.2	46.2
C6-02	Carrier Frequency Selection	–	1	1	1	1
E2-01	Motor Rated Current	A	65.6	79.7	95	130
E2-02	Motor Rated Slip	Hz	1.33	1.6	1.46	1.39
E2-03	Motor No-Load Current	A	19.1	22	24	36
E2-05	Motor Line-to-Line Resistance	Ω	0.155	0.122	0.088	0.092
E2-06	Motor Leakage Inductance	%	18.8	19.9	20	20
E2-10	Motor Iron Loss for Torque Compensation	W	925	1125	1260	1600
E5-01	Motor Code Selection (for PM Motors)	Hex.	1242	1243	1244	1245
L2-02	Momentary Power Loss Ride-Thru Time	s	1.1	1.2	1.2	1.3
L2-03	Momentary Power Loss Minimum Baseblock Time	s	0.6	0.6	1	1
L2-04	Momentary Power Loss Voltage Recovery Time	s	300	300	300	300
L8-02	Overheat Alarm Level	°C	130	136	136	134
L8-35	Installation Method Selection	–	0	0	0	0
L8-38	Carrier Frequency Reduction Selection	–	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	30

Table A.12 400 V Class Drives Default Settings by Drive Model Selection

No.	Name	Unit	Default Settings					
–	**Drive Model**	**–**	**4□0180**	**4□0216**	**4□0240**	**4□0302**	**4□0361**	**4□0414**
o2-04	**Drive Model Selection**	**Hex.**	**A5**	**A6**	**A7**	**A8**	**A9**	**AA**
E2-11	**Motor Rated Output**	**kW (HP)**	**110 (150)**	**132 (175)**	**150 (200)**	**185 (250)**	**220 (300)**	**260 (350)**
b3-04	V/f Gain during Speed Search	%	60	60	60	60	60	60
b3-06	Output Current 1 during Speed Search	–	0.7	0.7	0.7	0.7	0.7	0.7
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	–	0.8	0.8	0.8	0.8	0.8	0.8
b8-04	Energy Saving Coefficient Value	–	38.91	36.23	32.79	30.13	30.57	27.13
C6-02	Carrier Frequency Selection	–	1	1	1	1	1	1

No.	Name	Unit	Default Settings					
–	Drive Model	–	4□0180	4□0216	4□0240	4□0302	4□0361	4□0414
o2-04	Drive Model Selection	Hex.	A5	A6	A7	A8	A9	AA
E2-11	Motor Rated Output	kW (HP)	110 (150)	132 (175)	150 (200)	185 (250)	220 (300)	260 (350)
E2-01	Motor Rated Current	A	156	190	223	270	310	370
E2-02	Motor Rated Slip	Hz	1.4	1.4	1.38	1.35	1.3	1.3
E2-03	Motor No-Load Current	A	40	49	58	70	81	96
E2-05	Motor Line-to-Line Resistance	Ω	0.056	0.046	0.035	0.029	0.025	0.02
E2-06	Motor Leakage Inductance	%	20	20	20	20	20	20
E2-10	Motor Iron Loss for Torque Compensation	W	1760	2150	2350	2850	3200	3700
E5-01	Motor Code Selection (for PM Motors)	Hex.	1246	1247	1248	1249	124A	FFFF
L2-02	Momentary Power Loss Ride-Thru Time	s	1.5	1.7	1.7	1.8	1.9	2
L2-03	Momentary Power Loss Minimum Baseblock Time	s	1	1	1	1	1	1
L2-04	Momentary Power Loss Voltage Recovery Time	s	300	300	300	300	300	300
L8-02	Overheat Alarm Level	°C	134	138	138	130	130	130
L8-35	Installation Method Selection	–	0	0	0	0	0	0
L8-38	Carrier Frequency Reduction Selection	–	1	1	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	30	30	30	30	30	100

Table A.13 400 V Class Drives Default Settings by Drive Model Selection

No.	Name	Unit	Default Settings	
–	Drive Model	–	4□0361	4□0414
o2-04	Drive Model Selection	Hex.	A9	AA
E2-11 (E4-11)	Motor Rated Output	kW (HP)	220 (300)	260 (350)
b3-04	V/f Gain during Speed Search	%	60	60
b3-06	Output Current 1 during Speed Search	–	0.7	0.7
b3-08	Current Control Gain during Speed Search (Speed Estimation Type)	–	0.8	0.8
b8-03	Energy Saving Control Filter Time Constant	s	2.00	2.00
b8-04	Energy Saving Coefficient Value	–	30.57	27.13
C5-17 (C5-37)	Motor Inertia	kgm^2	3.60	4.10
C6-02	Carrier Frequency Selection	–	1	1
E2-01 (E4-01)	Motor Rated Current	A	310	370
E2-02 (E4-02)	Motor Rated Slip	Hz	1.3	1.3
E2-03 (E4-03)	Motor No-Load Current	A	81	96
E2-05 (E4-05)	Motor Line-to-Line Resistance	Ω	0.025	0.02
E2-06 (E4-06)	Motor Leakage Inductance	%	20	20
E2-10 (E4-10)	Motor Iron Loss for Torque Compensation	W	3200	3700
E5-01	Motor Code Selection (for PM Motors)	Hex.	124A	FFFF
L2-02	Momentary Power Loss Ride-Thru Time	s	1.9	2
L2-03	Momentary Power Loss Minimum Baseblock Time	s	1	1
L2-04	Momentary Power Loss Voltage Recovery Time	s	300	300
L2-21	Low Input Voltage Detection Level	V	300	300
L8-02	Overheat Alarm Level	°C	130	130
L8-35	Installation Method Selection	–	0	0
L8-38	Carrier Frequency Reduction Selection	–	1	1
n1-03	Hunting Prevention Time Constant	ms	30	100
n5-02	Motor Acceleration Time	s	0.864	0.91

A.19 Parameters Changed by Motor Code Selection (for PM Motors)

The following tables show parameters and default settings that change with the motor code selection E5-01 when Open Loop Vector for PM motors is used.

◆ Yaskawa SMRA Series SPM Motor

Table A.14 200 V, 1800 r/min Type Yaskawa SMRA Series SPM Motor Settings

No.	Name	Unit	Default Settings				
E5-01	Motor Code Selection (for PM Motors)	–	0002	0003	0005	0006	0008
	Voltage Class	V	200	200	200	200	200
	Rated Power	kW	0.4	0.75	1.5	2.2	3.7
	Rated Speed	r/min	1800	1800	1800	1800	1800
E5-02	Motor Rated Power (for PM Motors)	kW	0.4	0.75	1.5	2.2	3.7
E5-03	Motor Rated Current (for PM Motors)	A	2.1	4.0	6.9	10.8	17.4
E5-04	Number of Motor Poles (for PM Motors)	–	8	8	8	8	8
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	2.47	1.02	0.679	0.291	0.169
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	12.7	4.8	3.9	3.6	2.5
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	12.7	4.8	3.9	3.6	2.5
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	0	0	0	0	0
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	62.0	64.1	73.4	69.6	72.2
E1-04	Maximum Output Frequency	Hz	120	120	120	120	120
E1-05	Maximum Voltage	V	200.0	200.0	200.0	200.0	200.0
E1-06	Base Frequency	Hz	120	120	120	120	120
E1-09	Minimum Output Frequency	Hz	6	6	6	6	6

Table A.15 200 V, 3600 r/min Type Yaskawa SMRA Series SPM Motor Settings

No.	Name	Unit	Default Settings			
E5-01	Motor Code Selection (for PM Motors)	–	0103	0105	0106	0108
	Voltage Class	V	200	200	200	200
	Rated Power	kW	0.75	1.5	2.2	3.7
	Rated Speed	r/min	3600	3600	3600	3600
E5-02	Motor Rated Power (for PM Motors)	kW	0.75	1.5	2.2	3.7
E5-03	Motor Rated Current (for PM Motors)	A	4.1	8.0	10.5	16.5
E5-04	Number of Motor Poles (for PM Motors)	–	8	8	8	8
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.538	0.20	0.15	0.097
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	3.2	1.3	1.1	1.1
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	3.2	1.3	1.1	1.1
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	0	0	0	0
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	32.4	32.7	36.7	39.7
E1-04	Maximum Output Frequency	Hz	240	240	240	240
E1-05	Maximum Voltage	V	200.0	200.0	200.0	200.0
E1-06	Base Frequency	Hz	240	240	240	240
E1-09	Minimum Output Frequency	Hz	12	12	12	12

◆ Yaskawa SSR1 Series IPM Motor (For Derated Torque)

Table A.16 200 V, 1750 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	1202	1203	1205	1206	1208	120A	120B	120D
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
	Rated Speed	r/min	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	Motor Rated Power (for PM Motors)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03	Motor Rated Current (for PM Motors)	A	1.77	3.13	5.73	8.44	13.96	20.63	28.13	41.4
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	8.233	2.284	1.470	0.827	0.455	0.246	0.198	0.094
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	54.84	23.02	17.22	8.61	7.20	4.86	4.15	3.40
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	64.10	29.89	20.41	13.50	10.02	7.43	5.91	3.91
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	223.7	220.3	240.8	238.0	238.7	239.6	258.2	239.3
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4

Table A.17 200 V, 1750 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	120E	120F	1210	1212	1213	1214	1215	1216
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	15	18	22	30	37	45	55	75
	Rated Speed	r/min	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	Motor Rated Power (for PM Motors)	kW	15.0	18.00	22.00	30.00	37.00	45.00	55.00	75.00
E5-03	Motor Rated Current (for PM Motors)	A	55.4	68.2	80.6	105.2	131.3	153.1	185.4	257.3
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.066	0.051	0.037	0.030	0.020	0.014	0.012	0.006
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	2.45	2.18	1.71	1.35	0.99	0.83	0.79	0.44
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	3.11	2.55	2.05	1.82	1.28	1.01	0.97	0.56
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	248.1	253.6	250.0	280.9	264.2	280.4	311.9	268.0
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0

No.	Name	Unit	Default Settings							
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4

Table A.18 400 V, 1750 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	1232	1233	1235	1236	1238	123A	123B	123D
	Voltage Class	V	400	400	400	400	400	400	400	400
	Rated Power	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
	Rated Speed	r/min	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	Motor Rated Power (for PM Motors)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03	Motor Rated Current (for PM Motors)	A	0.89	1.56	2.81	4.27	7.08	10.31	13.65	20.7
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	25.370	9.136	6.010	3.297	1.798	0.982	0.786	0.349
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	169.00	92.08	67.71	34.40	32.93	22.7	16.49	13.17
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	197.50	119.56	81.71	54.00	37.70	26.80	23.46	15.60
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	392.6	440.6	478.3	466.3	478.8	478.1	520.0	481.5
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4

Table A.19 400 V, 1750 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	123E	123F	1240	1242	1243	1244	1245	1246
	Voltage Class	V	400	400	400	400	400	400	400	400
	Rated Power	kW	15	18	22	30	37	45	55	75
	Rated Speed	r/min	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	Motor Rated Power (for PM Motors)	kW	15	18.50	22.00	30.00	37.00	45.00	55.00	75.00
E5-03	Motor Rated Current (for PM Motors)	A	27.5	33.4	39.8	52.0	65.8	77.5	92.7	126.6
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.272	0.207	0.148	0.235	0.079	0.054	0.049	0.029
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	10.30	8.72	6.81	5.4	4.08	3.36	3.16	2.12
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	12.77	11.22	8.47	7.26	5.12	3.94	3.88	2.61
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	498.8	509.5	503.9	561.7	528.5	558.1	623.8	594.5
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0

No.	Name	Unit	Default Settings							
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4

Table A.20 400 V, 1750 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	1247	1248	1249	124A	1302	1303	1305	1306
	Voltage Class	V	400	400	400	400	200	200	200	200
	Rated Power	kW	90	110	132	160	0.4	0.75	1.5	2.2
	Rated Speed	r/min	1750	1750	1750	1750	1450	1450	1450	1450
E5-02	Motor Rated Power (for PM Motors)	kW	90.00	110.00	132.00	160.00	0.4	0.75	1.5	2.2
E5-03	Motor Rated Current (for PM Motors)	A	160.4	183.3	222.9	267.7	1.88	3.13	5.63	8.33
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.019	0.017	0.012	0.008	3.190	1.940	1.206	0.665
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	1.54	1.44	1.21	0.97	32.15	26.12	14.72	12.27
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	2.06	2.21	1.46	1.28	41.74	34.30	20.15	14.77
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	524.1	583.7	563.6	601.2	264.3	269.6	284.3	287.1
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	72.5	72.5	72.5	72.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	72.5	72.5	72.5	72.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	3.6	3.6	3.6	3.6

Table A.21 200 V, 1450 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	1308	130A	130B	130D	130E	130F	1310	1312
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	3.7	5.5	7.5	11	15	18	22	30
	Rated Speed	r/min	1450	1450	1450	1450	1450	1450	1450	1450
E5-02	Motor Rated Power (for PM Motors)	kW	3.7	5.5	7.5	11.0	15.00	18.00	22.00	30.00
E5-03	Motor Rated Current (for PM Motors)	A	14.17	20.63	27.71	39.6	55.5	65.6	75.1	105.2
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.341	0.252	0.184	0.099	0.075	0.057	0.041	0.034
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	8.27	6.49	6.91	4.07	3.29	2.53	1.98	1.75
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	9.81	7.74	7.66	4.65	3.84	3.01	2.60	2.17
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	284.5	298.0	335.0	303.9	311.2	300.9	327.7	354.2
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5

No.	Name	Unit	Default Settings							
E1-09	Minimum Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6

Table A.22 200 V, 1450 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	1313	1314	1315	1332	1333	1335	1336	1338
	Voltage Class	V	200	200	200	400	400	400	400	400
	Rated Power	kW	37	45	55	0.4	0.75	1.5	2.2	3.7
	Rated Speed	r/min	1450	1450	1450	1450	1450	1450	1450	1450
E5-02	Motor Rated Power (for PM Motors)	kW	37.00	45.00	55.00	0.4	0.75	1.5	2.2	3.7
E5-03	Motor Rated Current (for PM Motors)	A	126.0	153.1	186.5	0.94	1.56	2.81	4.27	6.98
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.023	0.015	0.012	12.760	7.421	4.825	2.656	1.353
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	1.48	1.04	0.87	128.60	85.11	58.87	46.42	31.73
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	1.70	1.31	1.10	166.96	113.19	80.59	60.32	40.45
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	369.6	351.6	374.7	528.6	544.2	568.5	572.8	562.9
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Minimum Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6

Table A.23 400 V, 1450 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	133A	133B	133D	133E	133F	1340	1342	1343
	Voltage Class	V	400	400	400	400	400	400	400	400
	Rated Power	kW	5.5	7.5	11	15	18	22	30	37
	Rated Speed	r/min	1450	1450	1450	1450	1450	1450	1450	1450
E5-02	Motor Rated Power (for PM Motors)	kW	5.5	7.5	11.0	15	18.50	22.00	30.00	37.00
E5-03	Motor Rated Current (for PM Motors)	A	10.21	13.85	19.5	27.4	32.9	37.6	52.5	63.2
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.999	0.713	0.393	0.295	0.223	0.164	0.137	0.093
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	26.20	27.06	15.51	12.65	9.87	7.90	7.01	5.93
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	30.94	33.45	19.63	15.87	12.40	10.38	8.68	6.79
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	587.6	670.1	612.7	624.6	610.4	655.4	708.4	739.2
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Minimum Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6

Table A.24 400 V, 1450 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	1344	1345	1346	1347	1348	1349	1402	1403
	Voltage Class	V	400	400	400	400	400	400	200	200
	Rated Power	kW	45	55	75	90	110	132	0.4	0.75
	Rated Speed	r/min	1450	1450	1450	1450	1450	1450	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	45.00	55.00	75.00	90.00	110.00	132.00	0.4	0.75
E5-03	Motor Rated Current (for PM Motors)	A	76.4	96.1	124.0	153.1	186.5	226.0	1.88	3.02
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.059	0.048	0.028	0.024	0.015	0.011	4.832	2.704
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	4.17	3.11	2.32	2.20	1.45	1.23	48.68	32.31
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	5.22	4.55	2.97	3.23	1.88	1.67	63.21	40.24
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	703.0	747.1	639.3	708.0	640.7	677.0	320.4	327.1
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	57.5	57.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	190.0	190.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	2.9	2.9

Table A.25 200 V, 1150 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	1405	1406	1408	140A	140B	140D	140E	140F
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	1.5	2.2	3.7	5.5	7.5	11.0	15	18.00
	Rated Speed	r/min	1150	1150	1150	1150	1150	1150	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	1.5	2.2	3.7	5.5	7.5	11	15	18.5
E5-03	Motor Rated Current (for PM Motors)	A	6.00	8.85	14.27	20.21	26.67	39.9	55.6	63.5
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	1.114	0.511	0.412	0.303	0.165	0.113	0.084	0.066
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	19.22	12.15	7.94	11.13	6.59	4.96	3.83	3.33
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	24.38	15.35	11.86	14.06	8.55	6.12	4.65	4.5
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	364.4	344.4	357.5	430.8	391.5	384.4	372.1	421.3
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9

Table A.26 200 V, 1150 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	1410	1412	1413	1414	1432	1433	1435	1436
	Voltage Class	V	200	200	200	200	400	400	400	400
	Rated Power	kW	22.00	30.00	37.00	45.00	0.4	0.75	1.5	2.2
	Rated Speed	r/min	1150	1150	1150	1150	1150	1150	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	22	30	37	45	0.4	0.75	1.5	2.2
E5-03	Motor Rated Current (for PM Motors)	A	74.4	104.2	129.6	154.2	0.94	1.51	3.00	4.43
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.048	0.035	0.023	0.016	19.320	10.800	4.456	2.044
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	2.38	2.04	1.53	1.16	194.70	129.20	76.88	48.60
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	3.15	2.86	2.27	1.54	252.84	160.90	97.52	61.40
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	410.9	436.1	428.8	433.3	640.9	654.1	728.8	688.9
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9

Table A.27 400 V, 1150 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	1438	143A	143B	143D	143E	143F	1440	1442
	Voltage Class	V	400	400	400	400	400	400	400	400
	Rated Power	kW	3.7	5.5	7.5	11	15	18	22	30
	Rated Speed	r/min	1150	1150	1150	1150	1150	1150	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	3.7	5.5	7.5	11.0	15	18.50	22.00	30.00
E5-03	Motor Rated Current (for PM Motors)	A	7.08	10.10	13.33	19.9	27.8	31.8	37.2	52.1
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	1.483	1.215	0.660	0.443	0.331	0.264	0.192	0.140
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	37.58	44.54	26.36	19.10	15.09	13.32	9.52	8.16
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	47.65	56.26	34.20	24.67	18.56	18.00	12.60	11.40
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	702.0	861.5	783.0	762.2	749.6	842.7	821.8	872.3
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9

Table A.28 400 V, 1150 r/min Type Yaskawa SSR1 Series IPM Motor

No.	Name	Unit	Default Settings					
E5-01	Motor Code Selection (for PM Motors)	–	1443	1444	1445	1446	1447	1448
	Voltage Class	V	400	400	400	400	400	400
	Rated Power	kW	37	45	55	75	90	110
	Rated Speed	r/min	1150	1150	1150	1150	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	37.00	45.00	55.00	75.00	90.00	110.00
E5-03	Motor Rated Current (for PM Motors)	A	64.8	76.6	92.0	127.1	150.5	185.4
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.093	0.063	0.051	0.033	0.027	0.015
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	6.13	4.63	3.96	3.03	2.60	1.89
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	9.10	6.15	5.00	5.14	3.28	2.33
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	857.7	866.6	854.0	823.1	853.4	829.2
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9

◆ Yaskawa SST4 Series IPM Motor (For Constant Torque)

Table A.29 200 V, 1750 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	-	2202	2203	2205	2206	2208	220A	220B	220D
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
	Rated Speed	r/min	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	Motor Rated Power (for PM Motors)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03	Motor Rated Current (for PM Motors)	A	1.77	3.54	6.56	8.96	14.79	20.94	29.58	41.1
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	2.247	1.132	0.774	0.479	0.242	0.275	0.161	0.111
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	22.32	12.38	8.90	7.39	5.06	5.82	3.86	3.59
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	32.50	15.72	11.96	9.63	6.42	6.74	4.66	4.32
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	215.2	203.9	219.3	230.6	235.1	251.7	235.7	252.0
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-9.3	-6.4	-10.0	-9.9	-9.7	-8.4	-11.5	-13.1

Table A.30 200 V, 1750 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	-	220E	220F	2210	2212	2213	2214	2215	2216
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	15	18	22	30	37	45	55	75
	Rated Speed	r/min	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	Motor Rated Power (for PM Motors)	kW	15	18.50	22.00	30.00	37.00	45.00	55.00	75.00
E5-03	Motor Rated Current (for PM Motors)	A	54.2	68.2	78.6	104.2	129.2	153.1	205.2	260.4
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.071	0.049	0.040	0.030	0.020	0.013	0.009	0.006
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	2.67	1.98	1.69	1.31	0.88	0.77	0.55	0.40
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	3.1	2.41	2.12	1.61	1.14	1.04	0.69	0.50
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	253.7	244.6	256.3	283.1	266.3	260	261.5	259.3
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-10.9	-14.3	-15.1	-11.3	-14.1	-18.8	-11.4	-12.2

Table A.31 400 V, 1750 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	-	2232	2233	2235	2236	2238	223A	223B	223D
	Voltage Class	V	400	400	400	400	400	400	400	400
	Rated Power	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
	Rated Speed	r/min	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	Motor Rated Power (for PM Motors)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03	Motor Rated Current (for PM Motors)	A	0.92	1.77	3.33	4.48	7.50	10.42	14.27	20.5
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	8.935	4.570	3.096	1.906	0.972	1.103	0.630	0.429
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	80.14	48.04	35.60	30.31	20.03	23.41	14.86	14.34
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	110.76	64.88	47.84	38.36	24.97	28.70	17.25	17.25
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	416.5	399.4	438.5	475.5	463.7	485.8	470.4	513.4
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4

No.	Name	Unit	Default Settings							
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-7.5	-8.5	-9.8	-8.2	-9.1	-13.1	-9.2	-12.4

Table A.32 400 V, 1750 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	-	223E	223F	2240	2242	2243	2244	2245	2246
	Voltage Class	V	400	400	400	400	400	400	400	400
	Rated Power	kW	15	18	22	30	37	45	55	75
	Rated Speed	r/min	1750	1750	1750	1750	1750	1750	1750	1750
E5-02	Motor Rated Power (for PM Motors)	kW	15	18.50	22.00	30.00	37.00	45.00	55.00	75.00
E5-03	Motor Rated Current (for PM Motors)	A	26.4	34.2	38.8	52.2	65.4	77.6	99.3	130.2
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.275	0.196	0.160	0.120	0.077	0.052	0.036	0.023
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	9.99	7.92	6.82	5.24	3.57	2.98	1.59	1.59
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	12.37	9.64	8.51	6.44	4.65	3.75	2.78	1.97
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	505.3	489.2	509.5	566.2	531.6	530.6	515.2	515.2
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-15.1	-14.3	-15.3	-11.3	-14.5	-13.2	-22.6	-11.9

Table A.33 400 V, 1750 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	-	2247	2248	2249	224A	224C	224D	224E	2302
	Voltage Class	V	400	400	400	400	400	400	400	200
	Rated Power	kW	90.00	110	132	160	200	220	300	0.4
	Rated Speed	r/min	1750	1750	1750	1750	1750	1750	1750	1450
E5-02	Motor Rated Power (for PM Motors)	kW	90.00	110.00	132.00	160.00	200.00	250.00	300.00	0.4
E5-03	Motor Rated Current (for PM Motors)	A	153.1	184.4	229.2	269.8	346.9	421.9	520.8	1.77
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.019	0.017	0.012	0.008	0.005	0.004	0.002	3.154
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	1.51	1.43	1.13	0.96	0.65	0.67	0.40	28.46
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	1.76	1.92	1.54	1.26	0.88	0.74	0.52	39.29
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	538.3	590.9	548.2	603.9	556.8	593.1	495.4	268.8
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

No.	Name	Unit	Default Settings							
E1-04	Maximum Output Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	72.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	190.0
E1-06	Base Frequency	Hz	87.5	87.5	87.5	87.5	87.5	87.5	87.5	72.5
E1-09	Minimum Output Frequency	Hz	4.4	4.4	4.4	4.4	4.4	4.4	4.4	3.6
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-8.6	-14.8	-17.5	-12.5	-14.7	-5.1	-16.3	-7.5

Table A.34 200 V, 1450 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	2302	2303	2305	2306	2308	230A	230B	230D
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
	Rated Speed	r/min	1450	1450	1450	1450	1450	1450	1450	1450
E5-02	Motor Rated Power (for PM Motors)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03	Motor Rated Current (for PM Motors)	A	1.77	3.33	5.94	9.48	14.17	20.42	27.92	39.6
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	3.154	1.835	0.681	0.308	0.405	0.278	0.180	0.098
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	28.46	19.46	10.00	6.88	8.15	5.77	6.32	3.34
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	39.29	25.89	15.20	9.25	10.76	8.60	8.80	4.61
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	268.8	256.9	271.9	260.2	286.8	314.9	300.8	292.3
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Minimum Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-7.5	-9.4	-13.9	-10.0	-15.0	-17.9	-22.7	-20.5

Table A.35 200 V, 1450 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	230E	230F	2310	2312	2313	2314	2315	2316
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	15	18	22	30	37	45	55	75
	Rated Speed	r/min	1450	1450	1450	1450	1450	1450	1450	1450
E5-02	Motor Rated Power (for PM Motors)	kW	15.0	18.50	22.00	30.00	37.00	45.00	55.00	75.00
E5-03	Motor Rated Current (for PM Motors)	A	54.2	68.3	75.2	102.0	131.3	160.4	191.7	257.3
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.073	0.055	0.048	0.034	0.023	0.016	0.012	0.007
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	2.94	2.23	2.08	1.67	1.39	0.94	0.82	0.56
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	3.65	2.85	2.66	2.04	1.73	1.22	1.06	0.76
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	305.1	297.6	355.8	355.4	324.0	302.4	337.2	323.4

No.	Name	Unit	Default Settings							
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Minimum Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-14.6	-16.4	-11.8	-10.5	-14.5	-17.4	-13.9	-17.5

Table A.36 400 V, 1450 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	-	2332	2333	2335	2336	2338	233A	233B	233D
	Voltage Class	V	400	400	400	400	400	400	400	400
	Rated Power	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
	Rated Speed	r/min	1450	1450	1450	1450	1450	1450	1450	1450
E5-02	Motor Rated Power (for PM Motors)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03	Motor Rated Current (for PM Motors)	A	0.91	1.67	3.02	4.74	7.08	10.21	13.96	20.5
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	12.616	7.340	2.724	1.232	1.509	1.112	0.720	0.393
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	113.84	77.84	40.00	27.52	31.73	23.09	25.28	13.36
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	157.16	103.56	60.80	37.00	40.88	34.39	35.20	18.44
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	490.8	513.8	543.7	520.3	580.8	602.7	601.5	584.6
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Minimum Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-9.5	-9.4	-13.7	-10.0	-12.9	-19.9	-22.8	-19.8

Table A.37 400 V, 1450 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	-	233E	233F	2340	2342	2343	2344	2345	2346
	Voltage Class	V	400	400	400	400	400	400	400	400
	Rated Power	kW	15	18	22	30	37	45	55	75
	Rated Speed	r/min	1450	1450	1450	1450	1450	1450	1450	1450
E5-02	Motor Rated Power (for PM Motors)	kW	15	18.50	22.00	30.00	37.00	45.00	55.00	75.00
E5-03	Motor Rated Current (for PM Motors)	A	27.1	34.2	37.6	50.9	65.4	80.2	96.1	129.2
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.291	0.220	0.192	0.136	0.091	0.064	0.048	0.028
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	11.77	8.94	8.32	6.68	5.30	3.76	3.09	2.24

No.	Name	Unit	Default Settings							
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	14.60	11.40	10.64	8.16	6.80	4.88	4.75	3.03
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	610.3	595.2	711.6	710.8	652.7	604.8	669.1	646.8
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Minimum Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-14.5	-16.1	-11.8	-10.5	-15.6	-17.4	-21.7	-17.3

Table A.38 400 V, 1450 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings					
E5-01	Motor Code Selection (for PM Motors)	-	2347	2348	2349	234A	234C	234D
	Voltage Class	V	400	400	400	400	400	400
	Rated Power	kW	90	110	132	160	200	250
	Rated Speed	r/min	1450	1450	1450	1450	1450	1450
E5-02	Motor Rated Power (for PM Motors)	kW	90.00	110.00	132.00	160.00	200.00	250.00
E5-03	Motor Rated Current (for PM Motors)	A	153.1	191.7	226.0	268.8	331.3	422.9
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.024	0.015	0.011	0.007	0.006	0.003
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	2.20	1.34	1.23	0.92	0.84	0.61
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	3.23	2.16	1.67	1.30	1.25	0.89
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	708.0	637.8	677.0	661.7	687.1	655.9
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	72.5	72.5	72.5	72.5	72.5	72.5
E1-09	Minimum Output Frequency	Hz	3.6	3.6	3.6	3.6	3.6	3.6
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-19.6	-24.1	-15.1	-17.0	-19.8	-19.3

Table A.39 200 V, 1150 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	2402	2403	2405	2406	2408	240A	240B	240D
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11
	Rated Speed	r/min	1150	1150	1150	1150	1150	1150	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11.0
E5-03	Motor Rated Current (for PM Motors)	A	1.77	3.44	5.94	9.17	14.79	20.21	27.40	39.0
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	2.680	1.520	1.071	0.542	0.362	0.295	0.162	0.115
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	30.55	15.29	17.48	11.98	8.60	9.54	5.31	4.44

No.	Name	Unit	Default Settings							
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	42.71	24.28	22.51	15.51	10.69	13.84	8.26	5.68
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	313.1	313.1	345.3	342.9	363.8	384.3	379.9	370.2
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-8.4	-11.0	-10.7	-10.7	-9.4	-22.5	-22.2	-16.7

Table A.40 200 V, 1150 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings							
E5-01	Motor Code Selection (for PM Motors)	–	240E	240F	2410	2412	2413	2414	2415	2416
	Voltage Class	V	200	200	200	200	200	200	200	200
	Rated Power	kW	15	18	22	30	37	45	55	75
	Rated Speed	r/min	1150	1150	1150	1150	1150	1150	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	15	18.50	22.00	30.00	37.00	45.00	55.00	75.00
E5-03	Motor Rated Current (for PM Motors)	A	55.9	65.4	77.0	103.5	126.0	153.1	188.5	260.4
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.083	0.065	0.052	0.035	0.026	0.019	0.013	0.009
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	3.50	2.92	2.55	2.03	1.59	1.24	0.98	0.70
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	4.23	3.79	3.22	2.46	1.92	1.64	1.37	0.97
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	364.5	404.5	445.1	444.4	447.3	470.8	422.4	418.3
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Maximum Voltage	V	190.0	190.0	190.0	190.0	190.0	190.0	190.0	190.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-13.7	-15.2	-10.9	-9.8	-9.3	-11.5	-17.7	-17.1

Table A.41 400 V, 1150 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings						
E5-01	Motor Code Selection (for PM Motors)	–	2432	2433	2435	2436	2438	243A	243B
	Voltage Class	V	400	400	400	400	400	400	400
	Rated Power	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5
	Rated Speed	r/min	1150	1150	1150	1150	1150	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	0.4	0.75	1.5	2.2	3.7	5.5	7.5
E5-03	Motor Rated Current (for PM Motors)	A	0.89	1.72	3.02	4.58	7.40	10.21	13.75
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	10.720	6.080	4.336	2.143	1.428	1.199	0.648
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	122.20	61.16	70.24	46.20	33.87	41.67	21.24

No.	Name	Unit	Default Settings						
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	170.80	97.12	90.04	60.28	42.98	69.15	33.04
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	626.1	626.1	703.1	727.6	699.0	861.5	759.7
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-8.4	-11.0	-9.9	-9.0	-11.4	-23.2	-22.1

Table A.42 400 V, 1150 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings						
E5-01	Motor Code Selection (for PM Motors)	–	243D	243E	243F	2440	2442	2443	2444
	Voltage Class	V	400	400	400	400	400	400	400
	Rated Power	kW	11	15	18	22	30	37	45
	Rated Speed	r/min	1150	1150	1150	1150	1150	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	11.0	15	18.50	22.00	30.00	37.00	45.00
E5-03	Motor Rated Current (for PM Motors)	A	19.5	27.7	32.7	39.2	51.8	63.0	76.6
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.460	0.325	0.260	0.209	0.140	0.106	0.076
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	17.76	12.83	11.68	10.09	8.12	6.43	4.96
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	22.72	17.19	15.16	16.25	9.84	7.71	6.56
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	740.4	716.6	809.1	786.2	888.8	857.7	941.6
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-16.7	-20.2	-15.2	-27.7	-9.8	-10.2	-11.5

Table A.43 400 V, 1150 r/min Type Yaskawa SST4 Series IPM Motor

No.	Name	Unit	Default Settings						
E5-01	Motor Code Selection (for PM Motors)	–	2445	2446	2447	2448	2449	244A	244C
	Voltage Class	V	400	400	400	400	400	400	400
	Rated Power	kW	55	75	90k	110	132	160	200
	Rated Speed	r/min	1150	1150	1150	1150	1150	1150	1150
E5-02	Motor Rated Power (for PM Motors)	kW	55.00	75.00	90.00	110.00	132.00	160.00	200.00
E5-03	Motor Rated Current (for PM Motors)	A	93.1	128.1	153.1	186.5	221.9	269.8	336.5
E5-04	Number of Motor Poles (for PM Motors)	–	6	6	6	6	6	6	6
E5-05	Motor Stator Resistance (r1) (for PM Motors)	Ω	0.051	0.032	0.026	0.015	0.012	0.009	0.007

A.19 Parameters Changed by Motor Code Selection (for PM Motors)

No.	Name	Unit	Default Settings						
E5-06	Motor d-Axis Inductance (Ld) (for PM Motors)	mH	3.99	2.97	2.44	1.87	1.49	1.41	1.22
E5-07	Motor q-Axis Inductance (Lq) (for PM Motors)	mH	5.39	3.90	3.23	2.46	2.08	1.88	1.51
E5-09	Motor Induction Voltage Constant 1 (Ke) (for PM Motors)	mVs /rad	853.8	829.6	835.6	833.4	848.6	889.1	915.0
E5-24	Motor Induction Voltage Constant 2 (Ke) (for PM Motors)	mV/ (r/min)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum Output Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-05	Maximum Voltage	V	380.0	380.0	380.0	380.0	380.0	380.0	380.0
E1-06	Base Frequency	Hz	57.5	57.5	57.5	57.5	57.5	57.5	57.5
E1-09	Minimum Output Frequency	Hz	2.9	2.9	2.9	2.9	2.9	2.9	2.9
n8-49	d-Axis Current for High Efficiency Control (for PM Motors) (OLV/PM)	%	-16.0	-15.7	-15.7	-14.7	-16.5	-14.1	-10.4

Appendix: B

MEMOBUS/Modbus Communications

B.1 MEMOBUS/Modbus Configuration

Drives can be controlled from a PLC or other master device via serial communications using the MEMOBUS/Modbus protocol.

MEMOBUS/Modbus communications can be configured using one master (PLC) and up to 31 slaves. The drive has slave functionality only, and serial communication is normally initiated from the master and responded to by the slaves.

The master performs serial communications with only one slave at a time. The address or node for each slave must be set beforehand so that the master can communicate with the slave at that address. A slave that receives a command from the master will perform the specified function and then send a response back to the master.

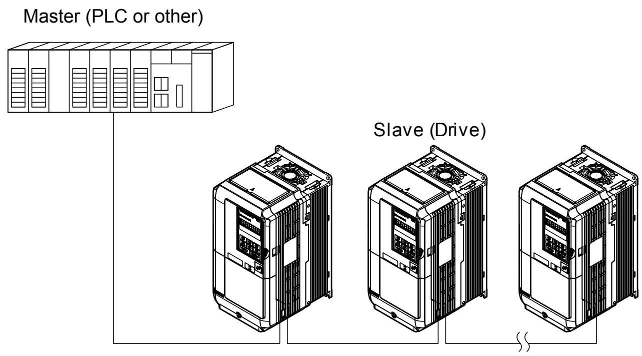


Figure B.1 Connecting Multiple Drives to a PLC

B.2 Communication Specifications

MEMOBUS/Modbus specifications appear in the following table:

Item	Specifications	
Interface	RS-422, RS-485	
Communications Cycle	Asynchronous (Start-stop synchronization)	
Communication Parameters	Communication Speeds Available	1.2; 2.4; 4.8; 9.6; 19.2; 38.4; 57.6; 76.8; 115.2 kbps
	Data length	8-bit (fixed)
	Parity	Select even, odd, or none
	Stop bit	1-bit (fixed)
Protocol	MEMOBUS/Modbus (using RTU mode only)	
Max Number of Slaves	31 drives (using RS-485 only)	

B.3 Connecting to a Network

This section explains how to connect the drive to a MEMOBUS/Modbus network and the network termination required for a connection.

◆ Network Cable Connection

Follow the instructions below to connect the drive to a MEMOBUS/Modbus network.

1. With the power shut off, connect the communications cable to the drive and the master. Use terminal TB4 for MEMOBUS/Modbus.

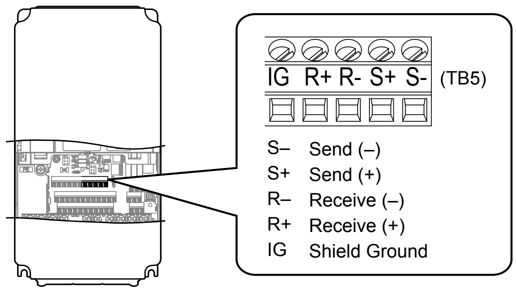


Figure B.2 Serial Communications Cable Connection Terminal (TB4)

Note: Separate the communications cables from the main circuit cables and other wiring and power cables. Use shielded cables for the communications cables, and properly shielded clamps to prevent problems with noise. When using RS-485 communications, connect S+ to R+, and S- to R- as shown in the diagram below.

2. Check or set the termination resistor selection at all slaves. Use the description in ***Network Termination*** on page ***284*** for slaves that are Z1000U drives.
3. Switch the power on.
4. Set the parameters needed for serial communications (H5-01 through H5-12) using the digital operator.
5. Shut the power off and wait until the display on the digital operator goes out completely.
6. Turn the power back on.
7. The drive is now ready to begin communicating with the master.

◆ Wiring Diagram for Multiple Connections

Figure B.3 and *Figure B.4* explain the wiring diagrams for multiple connections using MEMOBUS/Modbus communication.

■ RS-485 Interface

Note: The isolated ground (IG) connection is optional but strongly recommended to improve network immunity to electrical interference.

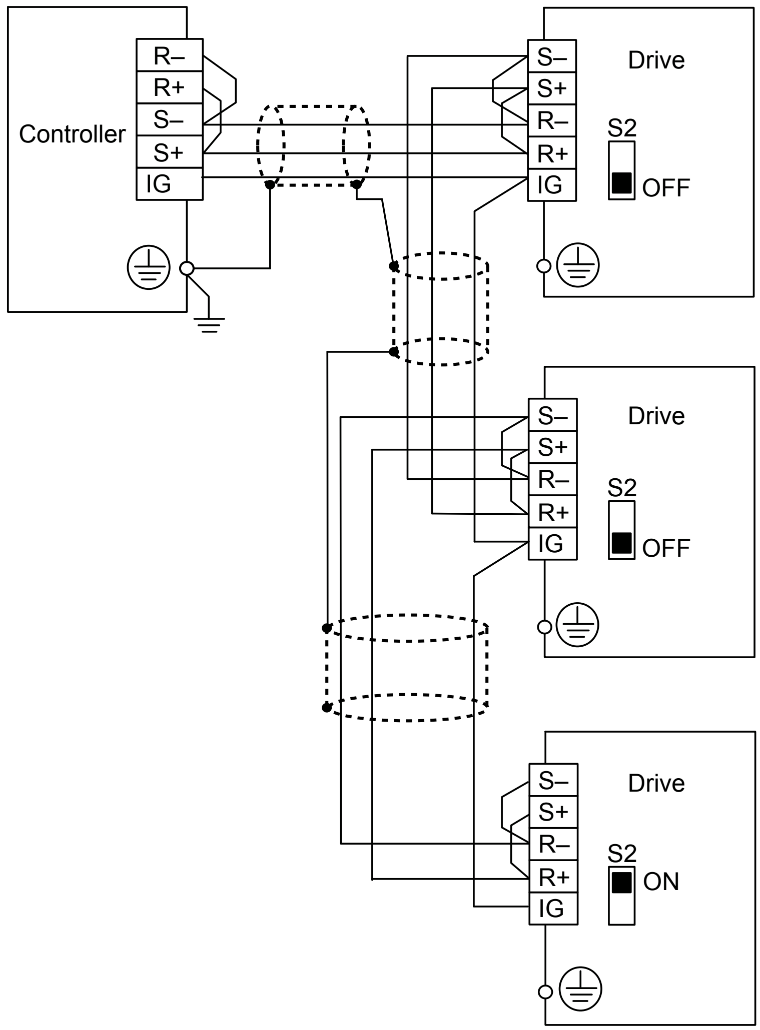


Figure B.3 RS-485 Interface

Note:
1. Set DIP switch S2 to the ON position on the drive located at the end of the network. Set DIP switch S2 to the OFF positions on all other slave devices.
2. Set H5-07 to 1 when using the RS-485 interface.

■ RS-422 Interface

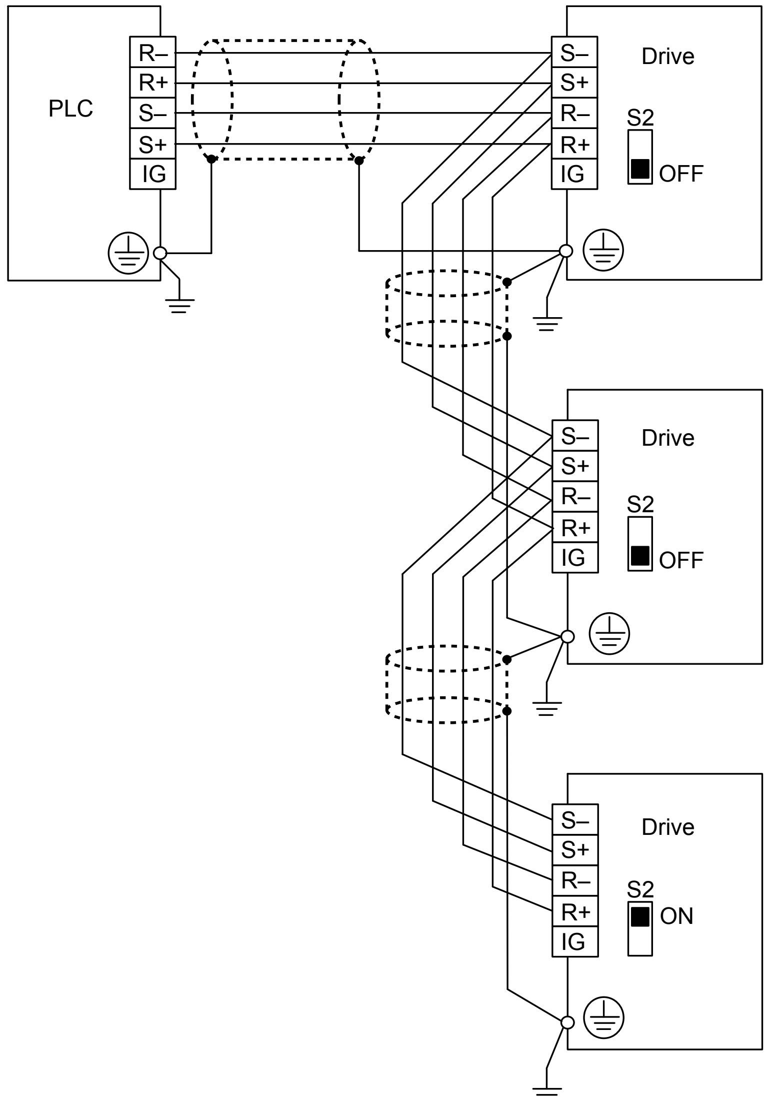


Figure B.4 RS-422 Interface

Note:
1. Set DIP switch S2 to the ON position on the drive located at the end of the network. Set DIP switch S2 to the OFF positions on all other slave devices.
2. Set H5-07 to 1 when using the RS-422 interface in a multi-drop circuit.
   Set H5-07 to 0 when using the RS-422 interface in a point-to-point circuit.

◆ Network Termination

The two ends of the MEMOBUS/Modbus network line have to be terminated. The drive has a built in termination resistor that can be enabled or disabled using DIP switch S2. If a drive is located at the end of a network line, enable the termination resistor by setting DIP switch S2 to the ON position. Disable the termination resistor on all slaves that are not located at the network line end.

B.4 MEMOBUS/Modbus Setup Parameters

◆ MEMOBUS/Modbus Serial Communication

Changes to MEMOBUS/Modbus communications settings become effective after restarting the drive.

■ H5-01: Drive Slave Address

Sets the drive slave address used for communications.

Note: Cycle power for the setting to take effect.

No.	Name	Setting Range	Default
H5-01	Drive Slave Address	0 to FFH	1FH

Each slave drive must be assigned a unique slave address for serial communications to work. Slave addresses do not need to be assigned in sequential order, but no two drives may share the same address.

■ H5-02: Communication Speed Selection

Sets the communications speed for APOGEE FLN, BACnet, MEMOBUS/Modbus, and Metasys N2.

Note:
1. Cycle power for the setting to take effect.
2. When Metasys N2 communications are selected (H5-08 = 1), selecting a baud rate other than 9600 bps will trigger an oPE29 error.
3. When APOGEE FLN (P1) communications are selected (H5-08 = 2), selecting a baud rate other than 4800 bps will trigger an oPE29 error.
4. When BACnet communications are selected (H5-08 = 3), selecting 115200 bps (Setting 8) will trigger an oPE29 error.

No.	Name	Setting Range	Default
H5-02	Communication Speed Selection	0 to 8	<1>

<1> Default depends on H5-08 setting:
H5-08 = 0, MEMOBUS/Modbus; default: 3
H5-08 = 1, N2 (Metasys); default: 3
H5-08 = 2, P1 (APOGEE FLN); default: 2
H5-08 = 3, BACnet; default: 3

H5-02	Communication Speed	H5-02	Communication Speed
0 <1>	1200 bps	5 <1>	38400 bps
1 <1>	2400 bps	6 <1>	57600 bps
2	4800 bps	7 <1>	76800 bps
3 <1>	9600 bps	8 <1> <2>	115200 bps
4 <1>	19200 bps		

<1> Not available when H5-08 is set to 2 P1 (APOGEE FLN).

<2> Not available when H5-08 is set to 0 (MEMOBUS/Modbus) or 1 (Metasys N2).

■ H5-03: Communication Parity Selection

Sets the parity used for communications.

Note: Cycle power for the setting to take effect.

No.	Name	Setting Range	Default
H5-03	Communication Parity Selection	0 to 2	0

Setting 0: No parity

Setting 1: Even parity

Setting 2: Odd parity

■ H5-04: Stopping Method after Communication Error

Selects the stopping method after a communications error (CE) has occurred.

No.	Name	Setting Range	Default
H5-04	Stopping Method after CE	0 to 4	3

Setting 0: Ramp to Stop

Uses the deceleration time currently enabled.

Setting 1: Coast to Stop

Setting 2: Fast Stop

Setting 3: Alarm Only - Operation Continues

Setting 4: Run at d1-04

■ H5-05: Communication Fault Detection Selection

Enables or disables the CE detection for communications.

No.	Name	Setting Range	Default
H5-05	Communication Fault Detection Selection	0 or 1	1

Setting 0: Disabled

No communication error detection. The drive continues operation.

Setting 1: Enabled

If the drive does not receive data from the master for longer than the time set to H5-09, then a CE fault will be triggered and the drive will operate as determined by parameter H5-04.

■ H5-06: Drive Transmit Wait Time

Sets the time the drive waits after receiving data from a master until responding data.

Note: Cycle power for the setting to take effect.

No.	Name	Setting Range	Default
H5-06	Drive Transmit Wait Time	5 to 65 ms	5 ms

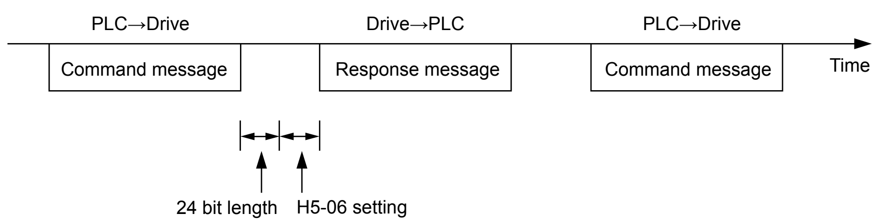


Figure B.5 Drive Transmit Wait Time Setting

■ H5-07: RTS Control Selection

Enables or disables RTS control.

Note: Cycle power for the setting to take effect.

No.	Name	Setting Range	Default
H5-07	RTS Control Selection	0 or 1	1

Setting 0: Disabled. RTS is always on.

Use this setting with point-to-point RS-422 communications.

Setting 1: Enabled. RTS switches while sending.

Use this setting with RS-485 communications or when using multi-drop RS-422 communications.

■ H5-08: Communications Protocol Selection

Selects the communications protocol.

No.	Name	Setting Range	Default
H5-08	Communications Protocol Selection	0 to 3	0

Setting 0: MEMOBUS/Modbus

Setting 1: N2 (Metasys)

Setting 2: P1 (APOGEE FLN)

Setting 3: BACnet

■ H5-09: Communications Fault Detection Time

Sets the time the communications must be lost before the drive triggers a CE fault.

No.	Name	Setting Range	Default
H5-09	Communications Fault Detection Time	0.0 to 10.0 s	2.0 s

■ H5-10: Unit Selection for MEMOBUS/Modbus Register 0025H

Sets the unit for the output voltage monitor value in MEMOBUS/Modbus register 0025H.

No.	Name	Setting Range	Default
H5-10	Unit Selection for MEMOBUS/Modbus Register 0025H	0 or 1	0

Setting 0: 0.1 V units

Setting 1: 1 V units

■ H5-11: Communications Enter Function Selection

Selects whether an Enter command is necessary to change parameter values via MEMOBUS/Modbus communications. ***Refer to Enter Command on page 311***.

No.	Name	Setting Range	Default
H5-11	Communications Enter Function Selection	0 or 1	0

Setting 0: Enter command necessary

Parameter changes become effective after an Enter command. An Enter command must only be sent after the last parameter change, not for each single parameter.

Setting 1: Enter command not necessary

Parameter value changes become effective immediately without the need to send an Enter command.

■ H5-12: Run Command Method Selection

Selects the type of sequence used when the Run command source is set to network communications (b1-02 = 2).

When BACnet protocol is selected (H5-08 = 3), then the value entered for H5-12 will be ignored and the logic will be handled as though “0” was entered (FWD/Stop, REV/Stop method).

No.	Name	Setting Range	Default
H5-12	Run Command Method Selection	0 or 1	0

Setting 0: FWD/Stop, REV/Stop

Setting bit 0 will start and stop the drive in the forward direction. Setting bit 1 will start and stop the drive in reverse.

Setting 1: Run/Stop, FWD/REV

Setting bit 0 will start and stop the drive. Setting bit 1 changes the direction.

■ H5-17: Operation Selection when Unable to Write into EEPROM

Selects the operation to be carried out when attempting to write data into EEPROM by MEMOBUS/Modbus communications but writing into EEPROM is not enabled. There is normally no need to change this parameter from the default value.

No.	Name	Setting Range	Default
H5-17	Operation Selection when Unable to Write into EEPROM	0, 1	0

Setting 0: Cannot write into EEPROM

Setting 1: Write in RAM only

■ H5-18: Filter Time Constant for Motor Speed Monitoring

Sets the filter time constant for monitoring the motor speed from MEMOBUS/Modbus communications and communication options. Applicable MEMOBUS/Modbus registers are: 3EH, 3FH, 44H, ACH, and ADH

No.	Name	Setting Range	Default
H5-18	Filter Time Constant for Motor Speed Monitoring	0 to 100 ms	0 ms

B.5 Drive Operations by MEMOBUS/Modbus

The drive operations that can be performed by MEMOBUS/Modbus communication depend on drive parameter settings. This section explains the functions that can be used and related parameter settings.

◆ Observing the Drive Operation

PLCs can perform the following actions with MEMOBUS/Modbus communications:

- observe drive status and drive control terminal status
- read and write parameters (not H5-□□)
- reset faults
- set multi-function inputs

Note: Input settings from the input terminals (S1 to S8) and from MEMOBUS/Modbus communications are both linked by a logical OR operation.

B.6 Communications Timing

To prevent a communications overrun in the slave drive, the master should wait a certain time between sending messages to the same drive. In the same way, the slave drive must wait before sending response messages to prevent an overrun in the master. This section explains the message timing.

◆ Command Messages from Master to Drive

The master must wait for a specified time between receiving a response and resending the same type of command to the same slave drive to prevent overrun and data loss. The minimum wait time depends on the command as shown in ***Table B.1***.

Table B.1 Minimum Wait Time for Sending Messages

Command Type	Example	Minimum Wait Time
1	• Control command (Run, Stop) • Set inputs/outputs • Read monitors and parameter values	5 ms <1>
2	Write parameters	H5-11 = 0: 50 ms H5-11 = 1: 200 ms <1>
3	Save changes using an Enter command	200 ms to 2 s, depending on the number of parameters that were changed <1>
4	Enter with storage to drive EEPROM after initialization	5 s

<1> If the drive receives command type 1 data during the minimum wait time, it will perform the command and then respond. However, if it receives a command type 2 or 3 during that time, either a communication error will result or the command will be ignored.

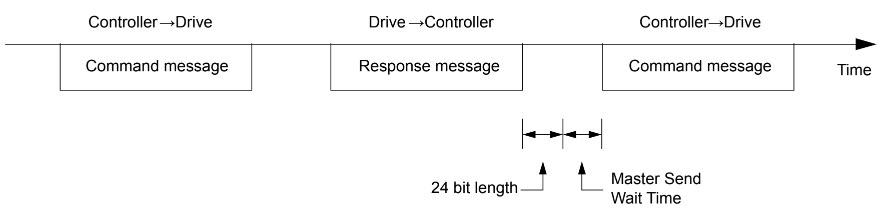


Figure B.6 Minimum Wait Time for Sending Messages

Set a timer in the master to check how long it takes for the slave drive(s) to respond to the master. If no response is received within a certain amount of time, the master should try resending the message.

◆ Response Messages from Drive to Master

If the drive receives a command from the master, it will process the data received and wait for the time set in H5-06 until it responds. Increase H5-06 if the drive response causes overrun in the master.

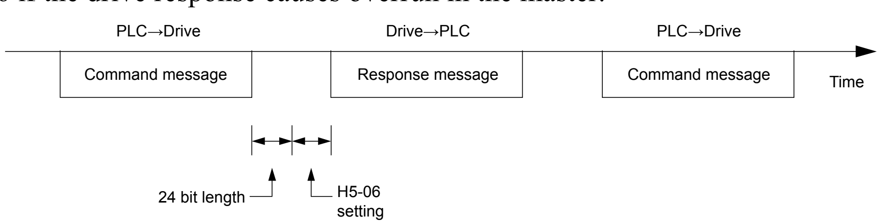


Figure B.7 Minimum Response Wait Time

B.7 Message Format

◆ Message Content

In MEMOBUS/Modbus communications, the master sends commands to the slave, and the slave responds. The message format is configured for both sending and receiving as shown below, and the length of data packets depends on the command (function) content.

SLAVE ADDRESS
FUNCTION CODE
DATA
ERROR CHECK

◆ Slave Address

The slave address in the message defines the note the message is sent to. Use addresses between 0 and FF (hex). If a message with slave address 0 is sent (broadcast), the command from the master will be received by all slaves. The slaves do not provide a response to a broadcast type message.

◆ Function Code

The three types of function codes are shown in the table below.

Function Code	Function Name	Data Length (bytes)			
		Command Message		Response Message	
		Minimum	Maximum	Minimum	Maximum
03H	Read MEMOBUS/Modbus registers	8	8	7	37
08H	Loopback test	8	8	8	8
10H	Write to multiple MEMOBUS/Modbus registers	11	41	8	8

◆ Data

Configure consecutive data by combining the MEMOBUS/Modbus register address (test code in case of a loopback test) and the data the register contains. The data length changes depending on the command details.

A drive MEMOBUS/Modbus register always has a data length of two bytes. Data written into drive registers must also always have a length of two bytes. Register data read out from the drive will always consist of two bytes.

◆ Error Check

The drive uses a CRC-16 (cyclic redundancy check, checksum method) for checking data validity. Use the procedure described below when calculating the CRC-16 checksum for command data or when verifying response data.

■ Command Data

When the drive receives data, it calculates the CRC-16 checksum from the data and compares it to the CRC-16 value received within the message. Both must match before a command is processed.

An initial value of FFFFH (i.e., all 16 bits equal 1) must be used for CRC-16 calculations in the MEMOBUS/Modbus protocol.

Calculate the CRC-16 checksum using the following steps:

1. The starting value is FFFFH.
2. Perform an XOR operation of this value and the slave address.
3. Right shift the result.
4. When the overflow bit of the shift operation becomes 1, perform an XOR operation of the result from step 3 above and the fix value A001H.
5. Repeat steps 3 and 4 until eight shift operations have been performed.
6. After eight shift operations, perform an XOR operation with the result and the next data in the message (function code, register address, data). Continue with steps 3 to 5 until the last data has been processed.
7. The result of the last shift or XOR operation is the checksum.

The example in ***Table B.2*** shows the CRC-16 calculation of the slave address 02H and the function code 03H, yielding the result D140H.

Note: This example does not show the calculation for a complete MEMOBUS/Modbus command. Normally data would follow in the calculation.

Table B.2 CRC-16 Checksum Calculation Example

Description	Calculation	Overflow	Description	Calculation	Overflow
Initial Value (FFFFH)	1111 1111 1111 1111		Function Code 03H	0000 0000 0000 0011	
Address 02H	0000 0000 0000 0010		XOR w result	1000 0001 0011 1101	
XOR w initial value	1111 1111 1111 1101		Shift 1	0100 0000 1001 1110	1
Shift 1	0111 1111 1111 1110	1	XOR w A001H	1010 0000 0000 0001	
XOR w A001H	1010 0000 0000 0001		XOR result	1110 0000 1001 1111	
XOR result	1101 1111 1111 1111		Shift 2	0111 0000 0100 1111	1
Shift 2	0110 1111 1111 1111	1	XOR w A001H	1010 0000 0000 0001	
XOR w A001H	1010 0000 0000 0001		XOR result	1101 0000 0100 1110	
XOR result	1100 1111 1111 1110		Shift 3	0110 1000 0010 0111	0
Shift 3	0110 0111 1111 1111	0	Shift 4	0011 0100 0001 0011	1
Shift 4	0011 0011 1111 1111	1	XOR w A001H	1010 0000 0000 0001	
XOR w A001H	1010 0000 0000 0001		XOR result	1001 0100 0001 0010	
XOR result	1001 0011 1111 1110		Shift 5	0100 1010 0000 1001	0
Shift 5	0100 1001 1111 1111	0	Shift 6	0010 0101 0000 0100	1
Shift 6	0010 0100 1111 1111	1	XOR w A001H	1010 0000 0000 0001	
XOR w A001H	1010 0000 0000 0001		XOR result	1000 0101 0000 0101	
XOR result	1000 0100 1111 1110		Shift 7	0100 0010 1000 0010	1
Shift 7	0100 0010 0111 1111	0	XOR w A001H	1010 0000 0000 0001	
Shift 8	0010 0001 0011 1111	1	XOR result	1110 0010 1000 0011	
XOR w A001H	1010 0000 0000 0001		Shift 8	0111 0001 0100 0001	1
XOR result	1000 0001 0011 1110		XOR w A001H	1010 0000 0000 0001	
Perform operations with next data (function code)			XOR result	1101 0001 0100 0000	
			CRC-16	1101 0001 0100 0000	
				D 1 4 0 (Lower) (Upper)	
			Continue from here with next data.		

■ Response Data

Perform a CRC-16 calculation on the response message data as described above as a validation check. The result should match the CRC-16 checksum received within the response message.

B.8 Message Examples

Below are some examples of command and response messages.

◆ Reading Drive MEMOBUS/Modbus Register Contents

Using the function code 03H (Read), a maximum of 16 MEMOBUS/Modbus registers can be read out at a time.

The following table shows message examples when reading status signals, error details, data link status, and frequency references from the slave 2 drive.

Command Message			Response Message (normal)			Response Message (fault)		
Slave Address		02H	Slave Address		02H	Slave Address		02H
Function Code		03H	Function Code		03H	Function Code		83H
Starting No.	Upper	00H	Data Quantity		08H	Error Code		03H
	Lower	20H	1st storage register	Upper	00H	CRC-16	Upper	F1H
Data Quantity	Upper	00H		Lower	65H		Lower	31H
	Lower	04H	Next storage register	Upper	00H			
CRC-16	Upper	45H		Lower	00H			
	Lower	F0H	Next storage register	Upper	00H			
				Lower	00H			
			Next storage register	Upper	01H			
				Lower	F4H			
			CRC-16	Upper	AFH			
				Lower	82H			

◆ Loopback Test

Function code 08H performs a loopback test that returns a response message with exactly the same content as the command message. The response message can be used to check communications between the master and slave. User-defined test code and data values can also be set.

The following table shows a message example when performing a loopback test with the slave 1 drive.

Command Message			Response Message		
Slave Address		01H	Slave Address		01H
Function Code		08H	Function Code		08H
Test Code	Upper	00H	Test Code	Upper	00H
	Lower	00H		Lower	00H
Data	Upper	A5H	Data	Upper	A5H
	Lower	37H		Lower	37H
CRC-16	Upper	DAH	CRC-16	Upper	DAH
	Lower	8DH		Lower	8DH

◆ Writing to Multiple Registers

Function code 10H allows the user to write multiple drive MEMOBUS/Modbus registers with one message. This process works similar to reading registers, in that the address of the first register to be written and the data quantity are set in the command message. The data to be written must be consecutive so that the register addresses are in order, starting from the specified address in the command message. The data order must be high byte then lower byte.

The following table shows an example of a message where a forward operation has been set with a frequency reference of 60.00 Hz for the slave 1 drive.

If parameter values are changed using the Write command, an Enter command may be necessary to activate or save the data depending on the setting of H5-11. ***Refer to H5-11: Communications Enter Function Selection on page 287*** and ***Refer to Enter Command on page 311*** for detailed descriptions.

Command Message			Response Message (normal)			Response Message (fault)		
Slave Address		01H	Slave Address		01H	Slave Address		01H
Function Code		10H	Function Code		10H	Function Code		90H
Starting No.	Upper	00H	Starting No.	Upper	00H	Error Code		02H
	Lower	01H		Lower	01H	CRC-16	Upper	CDH
Data Quantity	Upper	00H	Data Quantity	Upper	00H		Lower	C1H
	Lower	02H		Lower	02H			
Number of Bytes		04H	CRC-16	Upper	10H			
Starting Data	Upper	00H		Lower	08H			
	Lower	01H						
Next Data	Upper	17H						
	Lower	70H						
CRC-16	Upper	63H						
	Lower	39H						

Note: Double the number of the data quantity for the number of bytes in the command message.

B.9 MEMOBUS/Modbus Data Table

The tables below list all MEMOBUS/Modbus data.

The MEMOBUS register hex addresses for parameters are listed beginning on page 194.

◆ Command Data

It is possible to both read and write command data.

Note: Bits that are not used should be set to 0. Refrain from writing to reserved registers.

Register No.	Contents	
0000H	Reserved	
0001H	Operation Commands and Multi-function Inputs	
	bit 0	H5-12 = 0: Forward Run Command (0 = Stop, 1 = Forward Run) H5-12 = 1: Run Command (0 = Stop, 1 = Run)
	bit 1	H5-12 = 0: Reverse Run Command (0 = Stop, 1 = Reverse Run) H5-12 = 1: Forward/Reverse (0 = Forward, 1 = Reverse)
	bit 2	Option Card External Fault (EF0)
	bit 3	Fault Reset
	bit 4	Multi-Function Input 1 Function is ComRef when H1-01 = 40 (Forward/Stop). **Note:** When the bit at ComCtrl is turned on, commands from MEMOBUS/Modbus communications take control of the operation. However, when a communications option card is connected, that option card is given priority.
	bit 5	Multi-Function Input 2 Function is ComCtrl when H1-02 = 41 (Reverse/Stop).
	bit 6	Multi-Function Input 3
	bit 7	Multi-Function Input 4
	bit 8	Multi-Function Input 5
	bit 9	Multi-Function Input 6
	bit A	Multi-Function Input 7
	bit B	Multi-Function Input 8
	bit C to F	Reserved
0002H	Frequency Reference	Units are determined by parameter o1-03.
0003H	Output voltage gain/ Unit: 0.1% Range: 20 (2.0%) to 2000 (200.0%), Default when power on: 1000 (100.0%)	
0004H	Torque Reference/Torque Limit, 0.1% units, signed (Usable only if Torque Control is enabled)	
0005H	Torque Compensation, 0.1% units, signed (Usable only if Torque Control is enabled)	
0006H	PID Target, 0.01% units, signed	
0007H	Analog Output Terminal FM Setting (10 V / 4000 H)	
0008H	Analog Output Terminal AM Setting (10 V / 4000 H)	
0009H	Settings for Multi-Function Digital Outputs	
	bit 0	Multi-Function Contact Output 1 (terminal M1-M2)
	bit 1	Multi-Function Contact Output 2 (terminal M3-M4)
	bit 2	Multi-Function Contact Output 3 (terminal MD-ME-MF)
	bit 3 to 5	Reserved
	bit 6	Enables the function in bit 7
	bit 7	Fault Contact Output (terminal MA/MB-MC)
	bit 8 to F	Reserved
000AH	Pulse Output Terminal MP Setting, 1 Hz units, Setting Range: 0 to 32000	
000BH to 000EH	Reserved	

Register No.	Contents	
000FH	Control Selection Setting	
	bit 0	Reserved
	bit 1	PID Setpoint Input
	bit 2	Torque reference / torque limit input (enables the setting from MEMOBUS/Modbus)
	bit 3	Torque compensation input (enables the setting from MEMOBUS/Modbus)
	bit 4 to B	Reserved
	bit C	Enable Terminal S5 Input for Broadcast Data
	bit D	Enable Terminal S6 Input for Broadcast Data
	bit E	Enable Terminal S7 Input for Broadcast Data
	bit F	Enable Terminal S8 Input for Broadcast Data
0010H to 001AH	Reserved	
001BH	Analog Monitor Option AO-A3 Analog Output 1 (10 V/4000 H)	
001CH	Analog Monitor Option AO-A3 Analog Output 2 (10 V/4000 H)	
001DH	Digital Output Option DO-A3 Output (Binary)	
001EH to 001FH	Reserved	

◆ Monitor Data

Monitor data can be read only.

Register No.	Contents	
0020H	Drive Status 1	
	bit 0	During Run
	bit 1	During Reverse
	bit 2	Drive Ready
	bit 3	Fault
	bit 4	Data Setting Error
	bit 5	Multi-Function Contact Output 1 (terminal M1-M2)
	bit 6	Multi-Function Contact Output 2 (terminal M3-M4)
	bit 7	Multi-Function Contact Output 3 (terminal MD-ME-MF)
	bit 8 to bit D	Reserved
	bit E	When ComRef has been enabled
	bit F	When ComCtrl has been enabled

Register No.	Contents	
0021H	Fault Contents 1	
	bit 0	Overcurrent (oC), Ground fault (GF)
	bit 1	Control Circuit Overvoltage (ov)
	bit 2	Overload (oL2)
	bit 3	Overheat 1 (oH1), Heatsink Overheat Warning (oH2)
	bit 4, 5	Reserved
	bit 6	PID Feedback Loss/Excessive PID Feedback (FbL / FbH)
	bit 7	EF to EF8: External Fault
	bit 8	CPF□□: Hardware Fault (includes oFx)
	bit 9	Motor Overload (oL1), Overtorque Detection 1/2 (oL3/oL4), Undertorque Detection 1/2 (UL3/ UL4)
	bit A	PG Disconnect (PGo), PG Hardware Fault (PGoH), Overspeed (oS), Speed Deviation (dEv)
	bit B	Control Circuit Undervoltage (Uv), Power Supply Undervoltage (AUv), Power Supply Frequency Fault (Fdv)
	bit C	Control Circuit Undervoltage Fault (Uv1), Control Power Supply Voltage Fault (Uv2), Undervoltage 3 (Uv3), Power Supply Frequency Fault (Fdv), Power Supply Undervoltage (AUv), Phase Order Detection Fault (SrC)
	bit D	Output Phase Loss (LF)
	bit E	MEMOBUS/Modbus Communication Error (CE), Option Communication Error (bUS)
	bit F	External Digital Operator Connection Fault (oPr)
0022H	Data Link Status	
	bit 0	Writing data or switching motors
	bit 1, 2	Reserved
	bit 3	Upper or lower limit error
	bit 4	Data conformity error
	bit 5	Writing to EEPROM
	bit 6	0: Write into EEPROM. 1: Write in RAM only. **Note:** Enabled only when H5-17 = 1.
	bit 7 to bit F	Reserved
0023H	Frequency Reference <1>	
0024H	Output Frequency <1>	
0025H	Output Voltage Reference, 0.1 V units (units are determined by parameter H5-10)	
0026H	Output Current, 0.1 A units <2>	
0027H	Output Power	
0028H	Torque Reference	
0029H	Fault Contents 2	
	bit 0	Reserved
	bit 1	Ground Fault (GF)
	bit 2	Reserved
	bit 3	Output Phase Loss (LF)
	bit 4, 5	Reserved
	bit 6	Motor Overheat 2 (PTC input) (oH4)
	bit 7 to bit F	Reserved

Register No.	Contents	
002AH	Alarm Contents 1	
	bit 0, 1	Reserved
	bit 2	Forward/Reverse Run Command Input Error (EF)
	bit 3	Baseblock (bb)
	bit 4	Overtorque 1 (oL3)
	bit 5	Heatsink Overheat (oH)
	bit 6	Control Circuit Overvoltage (ov)
	bit 7	Control Circuit Undervoltage (Uv)
	bit 8	Fan Fault (FAn)
	bit 9	MEMOBUS/Modbus Communication Error (CE)
	bit A	Option Communication Error (bUS)
	bit B	Undertorque Detection 1/2 (UL3/UL4)
	bit C	Motor Overheat (oH3)
	bit D	PID Feedback Loss, Excessive PID Feedback (FbL, FbH)
	bit E	Reserved
	bit F	Serial Communication Transmission Error (CALL)
002BH	Input Terminal Status	
	bit 0	Terminal S1 Closed
	bit 1	Terminal S2 Closed
	bit 2	Terminal S3 Closed
	bit 3	Terminal S4 Closed
	bit 4	Terminal S5 Closed
	bit 5	Terminal S6 Closed
	bit 6	Terminal S7 Closed
	bit 7	Terminal S8 Closed
	bit 8 to bit F	Reserved
002CH	Drive Status 2	
	bit 0	During Run
	bit 1	Zero Speed
	bit 2	Speed Agree
	bit 3	User-set Speed Agree
	bit 4	Frequency Detection 1
	bit 5	Frequency Detection 2
	bit 6	Drive Ready
	bit 7	During Undervoltage
	bit 8	During Baseblock
	bit 9	Frequency Reference from Operator Keypad
	bit A	Run Command from Operator Keypad
	bit B	Over/Undertorque Detection 1, 2
	bit C	Frequency Reference Loss
	bit D	During Fault Restart
	bit E	Fault
	bit F	Communication Timeout
002DH	Output Terminal Status	
	bit 0	Multi-Function Contact Output 1 (terminal M1-M2)
	bit 1	Multi-Function Contact Output 2 (terminal M3-M4)
	bit 2	Multi-Function Contact Output 3 (terminal MD-ME-MF)
	bit 3 to 6	Reserved
	bit 7	Fault Contact Output (terminal MA/MB-MC)
	bit 8 to F	Reserved

Register No.	Contents	
002EH	Reserved	
002FH	Frequency Reference Bias (from Up/Down 2 Function), 0.1% units	
0030H	Reserved	
0031H	Control Circuit Voltage, 1 Vdc units	
0032H	Torque Reference (U1-09), 0.1% units	
0033H	Reserved	
0034H	Product Code 1 [ASCII], Product Type (U0 for U1000)	
0035H	Product Code 2 [ASCII], Region Code	
0036H, 0037H	Reserved	
0038H	PID Feedback, 0.1% units, unsigned, 100% / max. output frequency	
0039H	PID Input, 0.1% units, signed, 100% / max. output frequency	
003AH	PID Output, 0.1% units, signed, 100% / max. output frequency	
003BH, 003CH	Reserved	
003DH	Communications Error Contents <3>	
	bit 0	CRC Error
	bit 1	Data Length Error
	bit 2	Reserved
	bit 3	Parity Error
	bit 4	Overrun Error
	bit 5	Framing Error
	bit 6	Timeout
	bit 7 to bit F	Reserved
003EH	Output Frequency	r/min <4>
003FH		0.01% units
0040H to 004AH	Used for various monitors U1-☐☐. *Refer to U: Monitors on page 248* for parameter details.	
004BH	Drive status (U1-12)	
	bit 0	During Run
	bit 1	During Zero Speed
	bit 2	During Reverse Run
	bit 3	During Fault Reset Signal Input
	bit 4	During Speed Agree
	bit 5	Drive Ready
	bit 6	Alarm
	bit 7	Fault
	bit 8	During Operation Error (oPE☐☐)
	bit 9	During Momentary Power Loss
	bit A	Motor 2 selected
	bit B	Reserved
	bit E	ComRef status, NetRef status
	bit F	ComCtrl status, NetCtrl status
004CH to 007EH	Used for monitors U1-☐☐, U4-☐☐, U5-☐☐ and U6-☐☐. *Refer to U2: Fault Trace on page 250* and *Refer to U3: Fault History on page 251* for parameter details.	
007FH	Minor Fault Code, *Refer to Alarm Register Contents on page 310* for Minor Fault codes.	
0080H to 0097H	Used for monitors U2-☐☐, U3-☐☐. *Refer to U: Monitors on page 248* for parameter details and *Refer to Fault Trace Contents on page 308* for register value descriptions.	
0098H, 0099H	U4-01 (Cumulative Operation Time) Example: When U4-01 (Cumulative Operation Time) is 12345 hours, then 0098H = 1234 and 0099H = 5.	
009AH, 009BH	U4-03 (Cooling Fan Operation Time) Example: When U4-03 (Cooling Fan Operation Time) is 12345 hours, then 009AH = 1234 and 009BH = 5.	
009CH to 00AAH	Reserved	
00ABH	Drive Rated Current <2>	

Register No.	Contents	
00ACH	Motor Speed (U1-05)	r/min units <4>
00ADH		0.01% units
00AEH, 00AFH	Reserved	
00B0H	Option Code Connected to CN5-A	Register contains ASCII code of the option card. AI-A3 = 0003H AO-A3 = 0004H DI-A3 = 0001H DO-A3 = 0002H PG-B3 = 0011H PG-RT3 = 0023H PG-X3 = 0012H SI-B3 = 1002H SI-C3 = 5343H SI-EM3 = 1005H SI-EN3 = 1006H SI-ES3 = 1001H SI-ET3 = 1004H SI-N3 = 534EH SI-P3 = 5350H SI-S3 = 5353H SI-T3 = 5354H SI-W3 = 1003H
00B1H	Reserved	
00B2H	Option Code Connected to CN5-B	
00B3H	Option Code Connected to CN5-C	
00B4H	Reserved	
00B5H	Frequency Reference After Soft-starter (U1-16)	r/min units <4>
00B6H		0.01% units
00B7H	Frequency Reference	r/min <4>
00B8H		0.01% units
00B9H to 00BEH	Reserved	
00BFH	Lists the last two digits of operation error code oPE□□.	
00C0H	Fault Contents 3	
	bit 1	Control Circuit Undervoltage Fault (Uv1)
	bit 2	Control Power Supply Undervoltage Fault (Uv2)
	bit 3	Undervoltage 3 (Soft-Charge Bypass Circuit Fault) (Uv3)
	bit 4	Reserved
	bit 5	Ground Fault (GF)
	bit 6	Overcurrent (oC)
	bit 7	Control Circuit Overvoltage (ov)
	bit 8	Heatsink Overheat (oH)
	bit 9	Overheat 1 (oH1)
	bit A	Motor Overload (oL1)
	bit B	Overload (oL2)
	bit C	Overtorque Detection 1 (oL3)
	bit D	Overtorque Detection 2 (oL4)
	bit E, F	Reserved

Register No.	Contents	
00C1H	Fault Contents 4	
	bit 0	External Fault at input terminal S3 (EF3)
	bit 1	External Fault at input terminal S4 (EF4)
	bit 2	External Fault at input terminal S5 (EF5)
	bit 3	External Fault at input terminal S6 (EF6)
	bit 4	External Fault at input terminal S7 (EF7)
	bit 5	External Fault at input terminal S8 (EF8)
	bit 6	Fan Fault (FAn)
	bit 7	Overspeed (os)
	bit 8	Excessive Speed Deviation (dEv)
	bit 9	PG Disconnect (PGo)
	bit A	Reserved
	bit B	Output Phase Loss (LF)
	bit C	Motor Overheat (PTC input) (oH3)
	bit D	External Digital Operator Connection Fault (oPr)
	bit E	EEPROM Write Error (Err)
	bit F	Motor Overheat Fault (PTC input) (oH4)
00C2H	Fault Contents 5	
	bit 0	MEMOBUS/Modbus Communication Error (CE)
	bit 1	Option Communication Error (bUS)
	bit 2, 3	Reserved
	bit 4	Control Fault (CF)
	bit 5	Zero Servo Fault (SvE)
	bit 6	Option Card External Fault (EF0)
	bit 7	PID Feedback Loss (FbL)
	bit 8	Undertorque Detection 1 (UL3)
	bit 9	Undertorque Detection 2 (UL4)
	bit A to E	Reserved
	bit F	Hardware Fault (includes oFx)
00C3H	Fault Contents 6	
	bit 0	Reserved
	bit 1	Z Pulse Fault (dv1)
	bit 2	Z Pulse Noise Fault Detection (dv2)
	bit 3	Inversion Detection (dv3)
	bit 4	Inversion Prevention Detection (dv4)
	bit 5	Output Current Imbalance (LF2)
	bit 6	Pull-Out Detection (STo)
	bit 7	PG Hardware Fault (PGoH)
	bit 8	MECHATROLINK Watchdog Timer Error (E5)
	bit 9	Reserved
	bit A	Too Many Speed Search Restarts (SEr)
	bit B to F	Reserved

Register No.	Contents	
00C4H	Fault Contents 7	
	bit 0	PID Feedback Loss (FbH)
	bit 1	External Fault 1, input terminal S1 (EF1)
	bit 2	External Fault 2, input terminal S2 (EF2)
	bit 3	Mechanical Weakening Detection 1 (oL5)
	bit 4	Mechanical Weakening Detection 2 (UL5)
	bit 5	Current Offset Fault (CoF)
	bit 6, 7	Reserved
	bit 8	DriveWorksEZ Fault (dWFL)
	bit 9 to F	Reserved
00C5H	Fault Contents 8	
	bit 0	LSo Fault (LSo)
	bit 1	Node Setup Fault (nSE)
	bit 2 to 9	Reserved
	bit A	Initial Polarity Estimation Timeout (dv7)
	bit B to F	Reserved
00C6H to 00C7H	Reserved	
00C8H	Alarm Contents 2	
	bit 0	Control Circuit Undervoltage (Uv)
	bit 1	Control Circuit Overvoltage (ov)
	bit 2	Heatsink Overheat (oH)
	bit 3	Heatsink Overheat Warning (oH2)
	bit 4	Overtorque Detection 1 (oL3)
	bit 5	Overtorque Detection 2 (oL4)
	bit 6	Forward/Reverse Run Commands Input Error (EF)
	bit 7	Baseblock (bb)
	bit 8	External Fault 3, input terminal S3 (EF3)
	bit 9	External Fault 4, input terminal S4 (EF4)
	bit A	External Fault 5, input terminal S5 (EF5)
	bit B	External Fault 6, input terminal S6 (EF6)
	bit C	External Fault 7, input terminal S7 (EF7)
	bit D	External Fault 8, input terminal S8 (EF8)
	bit E	Fan Fault (FAn)
	bit F	Overspeed (oS)

Register No.	Contents	
00C9H	Alarm Contents 3	
	bit 0	Speed Deviation (dEv)
	bit 1	PG Disconnect (PGo)
	bit 2	External Digital Operator Connection Fault (oPr)
	bit 3	MEMOBUS/Modbus Communication Error (CE)
	bit 4	Option Communication Error (bUS)
	bit 5	Serial Communication Transmission Error (CALL)
	bit 6	Motor Overload (oL1)
	bit 7	Overload (oL2)
	bit 8	Reserved
	bit 9	Option Card External fault (EF0)
	bit A	Motor Switch during Run (rUn)
	bit B	Reserved
	bit C	Serial Communication Transmission Error (CALL)
	bit D	Undertorque Detection 1 (UL3)
	bit E	Undertorque Detection 2 (UL4)
	bit F	MEMOBUS/Modbus Communication Test Mode Error (SE)
00CAH	Alarm Contents 4	
	bit 0	Reserved
	bit 1	Motor Overheat Alarm (PTC Input) (oH3)
	bit 2 to 5	Reserved
	bit 6	PID Feedback Loss (FbL)
	bit 7	Excessive PID Feedback (FbH)
	bit 9	Drive Disabled (dnE)
	bit A	PG Disconnect (PGo)
	bit B to F	Reserved
00CBH	Alarm Contents 5	
	bit 0	MECHATROLINK Watchdog Timer Error (E5)
	bit 1	Station Address Setting Error (AEr)
	bit 2	MECHATROLINK Comm. Cycle Setting Error (CyC)
	bit 3	Current Alarm (HCA)
	bit 4	Cooling Fan Maintenance Time (LT-1)
	bit 5	Maintenance Time (LT-2)
	bit 6	Damping Resistor Overheat (doH)
	bit 7	SI-S EEPROM Error (EEP)
	bit 8	External Fault 1 (input terminal S1) (EF1)
	bit 9	External Fault 2 (input terminal S2) (EF2)
	bit A	Safe Disable Signal Input (HbbF)
	bit B	Safe Disable Signal Input (Hbb)
	bit C	Mechanical Weakening Detection 1 (oL5)
	bit D	Mechanical Weakening Detection 2 (UL5)
	bit E, F	Reserved
00CCH	Alarm Contents 6	
	bit 0, 1	Reserved
	bit 2	Capacitor Maintenance Time (LT-3)
	bit 3 to 7	Reserved
	bit 8	DriveWorksEZ Fault (dWAL)
	bit 9 to F	Reserved

Register No.	Contents	
00CDH	Alarm Contents 7	
	bit 0	Power Supply Frequency Fault Detection (Fdv)
	bit 1	Phase Order Detection Fault (SrC)
	bit 2	Reserved
	bit 3	Power Supply Undervoltage (AUv)
	bit 4 to F	Reserved
00CEH	Alarm Contents 8	
	bit 0 to D	Reserved
	bit E	Snubber Discharge Resistor Overheat (SoH)
	bit F	Reserved
00CFH	Reserved	
00D0H	CPF Contents 1	
	bit 0, 1	Reserved
	bit 2	Control Circuit Error (CPF02)
	bit 3	Control Circuit Error (CPF03)
	bit 4, 5	Reserved
	bit 6	Control Circuit Error (CPF06)
	bit 7	Control Circuit Error (CPF07)
	bit 8	Control Circuit Error (CPF08)
	bit 9, A	Reserved
	bit B	Control Circuit Error (CPF11)
	bit C	Control Circuit Error (CPF12)
	bit D	Control Circuit Error (CPF13)
	bit E	Control Circuit Error (CPF14)
	bit F	Reserved
00D1H	CPF Contents 2	
	bit 0	Control Circuit Error (CPF16)
	bit 1	Control Circuit Error (CPF17)
	bit 2	Control Circuit Error (CPF18)
	bit 3	Control Circuit Error (CPF19)
	bit 4	Control Circuit Error (CPF20)
	bit 5	Control Circuit Error (CPF21)
	bit 6	Control Circuit Error (CPF22)
	bit 7	Control Circuit Error (CPF23)
	bit 8	Control Circuit Error (CPF24)
	bit 9	Terminal Board not Connected (CPF25)
	bit A	Control Circuit Error (CPF26)
	bit B	Control Circuit Error (CPF27)
	bit C	Control Circuit Error (CPF28)
	bit D	Control Circuit Error (CPF29)
	bit E	Control Circuit Error (CPF30)
	bit F	Control Circuit Error (CPF31)

Register No.	Contents	
00D2H	CPF Contents 3	
	bit 0	Control Circuit Error (CPF32)
	bit 1	Control Circuit Error (CPF33)
	bit 2	Control Circuit Error (CPF34)
	bit 3	Control Circuit Error (CPF35)
	bit 4 to 7	Reserved
	bit 8	Control Circuit Error (CPF40)
	bit 9	Control Circuit Error (CPF41)
	bit A	Control Circuit Error (CPF42)
	bit B	Control Circuit Error (CPF43)
	bit C	Control Circuit Error (CPF44)
	bit D	Control Circuit Error (CPF45)
	bit E, F	Reserved
00D3H to 00D7H	Reserved	
00D8H	oFA0□ Contents (CN5-A)	
	bit 0	Option Compatibility Error (oFA00)
	bit 1	Option not properly connected (oFA01)
	bit 2 to 4	Reserved
	bit 5	A/D Conversion Error (oFA05)
	bit 6	Option Response Error (oFA06)
	bit 7 to F	Reserved
00D9H	oFA1□ Contents (CN5-A)	
	bit 0	Option RAM Fault (oFA10)
	bit 1	Option Operation Mode Fault (SLMOD) (oFA11)
	bit 2	Unit Receive CRC Error (oFA12)
	bit 3	Unit Receive Frame Error (oFA13)
	bit 4	Unit Receive Abort Error (oFA14)
	bit 5	Option Receive CRC Error (oFA15)
	bit 6	Option Receive Frame Error (oFA16)
	bit 7	Option Receive Abort Error (oFA17)
	bit 8 to F	Reserved
00DAH to 00DBH	Reserved	
00DBH	oFA3□ Contents (CN5-A)	
	bit 0	Comm. ID Error (oFA30)
	bit 1	Model Code Error (oFA31)
	bit 2	Sumcheck Error (oFA32)
	bit 3	Comm. option timeout waiting for response (oFA33)
	bit 4	MEMOBUS Timeout (oFA34)
	bit 5	Unit timeout waiting for response (oFA35)
	bit 6	CI Check Error (oFA36)
	bit 7	Unit timeout waiting for response (oFA37)
	bit 8	Control Command Selection Error (oFA38)
	bit 9	Unit timeout waiting for response (oFA39)
	bit A	Control Response Selection 1 Error (oFA40)
	bit B	Unit timeout waiting for response (oFA41)
	bit C	Control Response Selection 2 Error (oFA42)
	bit D	Control Response Selection Error (oFA43)
	bit E, F	Reserved

Register No.	Contents	
00DCH	oFb0□ Contents (CN5-B)	
	bit 0	Option compatibility error (oFb00)
	bit 1	Option not properly connected (oFb01)
	bit 2	Same type of option card already connected (oFb02)
	bit 3, 4	Reserved
	bit 5	A/D Conversion Fault (oFb05)
	bit 6	Option Response Error (oFb06)
	bit 7 to F	Reserved
00DDH	oFb1□ Contents (CN5-B)	
	bit 0	Option RAM Fault (oFb10)
	bit 1	Option Operation Mode Fault (SLMOD) (oFb11)
	bit 2	Unit Receive CRC Error (oFb12)
	bit 3	Unit Receive Frame Error (oFb13)
	bit 4	Unit Receive Abort Error (oFb14)
	bit 5	Option Receive CRC Error (oFb15)
	bit 6	Option Receive Frame Error (oFb16)
	bit 7	Option Receive Abort Error (oFb17)
	bit 8 to F	Reserved
00DEH to 00DFH	Reserved	
00E0H	oFb3□ Contents (CN5-B)	
	bit 0	Comm. ID Error (oFb30)
	bit 1	Model Code Error (oFb31)
	bit 2	Sumcheck Error (oFb32)
	bit 3	Comm. option timeout waiting for response (oFb33)
	bit 4	MEMOBUS Timeout (oFb34)
	bit 5	Unit timeout waiting for response (oFb35)
	bit 6	CI Check Error (oFb36)
	bit 7	Unit timeout waiting for response (oFb37)
	bit 8	Control Command Selection Error (oFb38)
	bit 9	Unit timeout waiting for response (oFb39)
	bit A	Control Response Selection 1 Error (oFb40)
	bit B	Unit timeout waiting for response (oFb41)
	bit C	Control Response Selection 2 Error (oFb42)
	bit D	Control Response Selection Error (oFb43)
	bit E, F	Reserved
00E1H	oFC0□ Contents (CN5-C)	
	bit 0	Option compatibility error (oFC00)
	bit 1	Option not properly connected (oFC01)
	bit 2	Same type of option card already connected (oFC02)
	bit 3, 4	Reserved
	bit 5	A/D Conversion Fault (oFC05)
	bit 6	Option Response Error (oFC06)
	bit 7 to F	Reserved

Register No.	Contents	
00E2H	oFC1☐ Contents (CN5-C)	
	bit 0	Option RAM Fault (oFC10)
	bit 1	Option Operation Mode Fault (SLMOD) (oFC11)
	bit 2	Unit Receive CRC Error (oFC12)
	bit 3	Unit Receive Frame Error (oFC13)
	bit 4	Unit Receive Abort Error (oFC14)
	bit 5	Option Receive CRC Error (oFC15)
	bit 6	Option Receive Frame Error (oFC16)
	bit 7	Option Receive Abort Error (oFC17)
	bit 8 to F	Reserved
00E3H	Reserved	
00E4H	oFC5☐ Contents (CN5-C)	
	bit 0	Encoder Option AD Conversion Error (oFC50)
	bit 1	Encoder Option Analog Circuit Error (oFC51)
	bit 2	Encoder Communication Timeout (oFC52)
	bit 3	Encoder Communication Data Error (oFC53)
	bit 4	Encoder Error (oFC54)
	bit 5	Resolver Error (oFC55)
	bit 6 to F	Reserved
00E5H to 00E9H	Reserved	
00EAH	Fault contents 11	
	bit 0 to 6	Reserved
	bit 7	Damping Resistor Overheat (doH)
	bit 8	Snubber Discharge Resistor Overheat (SoH)
	bit 9	Internal Resistance Fault (Srr)
	bit A to D	Reserved
	bit E	Safety Circuit Fault (SCF)
	bit F	Reserved
00EBH to 00FAH	Reserved	
00FBH	Output Current <2>	

<1> Parameter o1-03, Digital Operator Display Selection, determines the units.

<2> Display is in the following units:
2☐0028, 2☐0042, and 4☐0011 to 4☐0027: 0.01 A units
2☐0054 to 2☐0248 and 4☐0034 to 4☐0414: 0.1 A units

<3> Communication error contents are saved until the fault is reset.

<4> Set the number of motor poles to parameter E2-04 or E5-04 depending on the motor being used.

MEMOBUS/Modbus Communications

B

◆ Broadcast Messages

Data can be written from the master to all slave devices at the same time.

The slave address in a broadcast command message must be set to 00H. All slaves will receive the message, but will not respond.

Register No.	Contents	
0001H	Digital Input Command	
	bit 0	Forward Run (0: Stop 1: Run)
	bit 1	Direction Command (0: Forward, 1: Reverse)
	bit 2, 3	Reserved
	bit 4	External Fault
	bit 5	Fault Reset
	bit 6 to B	Reserved
	bit C	Multi-Function Digital Input S5
	bit D	Multi-Function Digital Input S6
	bit E	Multi-Function Digital Input S7
	bit F	Multi-Function Digital Input S8
0002H	Frequency Reference	30000/100%

◆ Fault Trace Contents

The table below shows the fault codes that can be read out by MEMOBUS/Modbus commands from the U2-□□ monitor parameters.

Table B.3 Fault Trace / History Register Contents

Fault Code	Fault Name	Fault Code	Fault Name
0002H	Control Circuit Undervoltage Fault (Uv1)	0021H	MEMOBUS/Modbus Communication Error (CE)
0003H	Control Power Supply Voltage Fault (Uv2)	0022H	Option Communication Error (bUS)
0004H	Undervoltage 3 (Uv3)	0025H	Control Fault (CF)
0006H	Ground Fault (GF)	0026H	Zero-Servo Fault (SvE)
0007H	Overcurrent (oC)	0027H	Option Card External Fault (EF0)
0008H	Control Circuit Overvoltage (ov)	0028H	PID Feedback Loss (FbL)
0009H	Heatsink Overheat (oH)	0029H	Undertorque Detection 1 (UL3)
000AH	Overheat 1 (oH1)	002AH	Undertorque Detection 2 (UL4)
000BH	Motor Overload (oL1)	0030H	Hardware Fault (including oFx)
000CH	Overload (oL2)	0032H	Z Pulse Fault (dv1)
000DH	Overtorque Detection 1 (oL3)	0033H	Z Pulse Noise Fault Detection (dv2)
000EH	Overtorque Detection 2 (oL4)	0034H	Inversion Detection (dv3)
0011H	External Fault at Input Terminal S3 (EF3)	0035H	Inversion Prevention Detection (dv4)
0012H	External Fault at Input Terminal S4 (EF4)	0036H	Output Current Imbalance (LF2)
0013H	External Fault at Input Terminal S5 (EF5)	0037H	Pull-Out Detection (Sto)
0014H	External Fault at Input Terminal S6 (EF6)	0038H	PG Hardware Fault (PGoH)
0015H	External Fault at Input Terminal S7 (EF7)	0039H	MECHATROLINK Watchdog Timer Error (E5)
0016H	External Fault at Input Terminal S8 (EF8)	003BH	Too Many Speed Search Restarts (SEr)
0017H	Fan Fault (FAn)	0041H	Excessive PID Feedback (FbH)
0018H	Overspeed (oS)	0042H	External Fault 1, Input Terminal S1 (EF1)
0019H	Speed Deviation (dEv)	0043H	External Fault 2, Input Terminal S2 (EF2)
001AH	PG Disconnect (PGo)	0044H	Mechanical Weakening Detection 1 (oL5)
001CH	Output Phase Loss (LF)	0045H	Mechanical Weakening Detection 2 (UL5)
001DH	Motor Overheat Alarm (PTC input) (oH3)	0046H	Current Offset Fault (CoF)
001EH	Digital Operator Connection Fault (oPr)	0049H	DriveWorksEZ Fault (dWFL)
001FH	EEPROM Write Error (Err)	004AH	EEPROM Memory DriveWorksEZ Data Error (dWF1)
0020H	Motor Overheat Fault (PTC input) (oH4)		

Fault Code	Fault Name
0051H	LSo Fault (LSo)
0052H	Node Setup Fault (nSE)
005BH	Initial Polarity Estimation Timeout (dv7)
005CH	Ground Fault (GF)
0066H	Power Supply Undervoltage (AUv)
0067H	Power Supply Overvoltage (Aov)
0068H	Power Supply Frequency Fault Detection (Fdv)
0069H	Phase Order Detection Fault (SrC)
0081H	Control Circuit Error (CPF00)
0082H	Control Circuit Error (CPF01)
0083H	Control Circuit Error (CPF02)
0084H	Control Circuit Error (CPF03)
0087H	Control Circuit Error (CPF06)
0088H	Control Circuit Error (CPF07)
0089H	Control Circuit Error (CPF08)
008CH	Control Circuit Error (CPF11)
008DH	Control Circuit Error (CPF12)
008EH	Control Circuit Error (CPF13)
008FH	Control Circuit Error (CPF14)
0091H	Control Circuit Error (CPF16)
0092H	Control Circuit Error (CPF17)
0093H	Control Circuit Error (CPF18)
0094H	Control Circuit Error (CPF19)
0095H	Control Circuit Error (CPF20)
0096H	Control Circuit Error (CPF21)
0097H	Control Circuit Error (CPF22)
0098H	Control Circuit Error (CPF23)
0099H	Control Circuit Error (CPF24)
009AH	Terminal Board not Connected (CPF25)
009BH	Control Circuit Error (CPF26)
009CH	Control Circuit Error (CPF27)
009DH	Control Circuit Error (CPF28)
009EH	Control Circuit Error (CPF29)
009FH	Control Circuit Error (CPF30)
00A0H	Control Circuit Error (CPF31)
00A1H	Control Circuit Error (CPF32)
00A2H	Control Circuit Error (CPF33)
00A3H	Control Circuit Error (CPF34)
00A4H	Control Circuit Error (CPF35)
00A9H	Control Circuit Error (CPF40)
00AAH	Control Circuit Error (CPF41)
00ABH	Control Circuit Error (CPF42)
00ACH	Control Circuit Error (CPF43)
00ADH	Control Circuit Error (CPF44)
00AEH	Control Circuit Error (CPF45)
0101H	Option Compatibility Error (oFA00)
0102H	Option Not Properly Connected (oFA01)
0106H	A/D Conversion Error (oFA05)
0107H	Option Response Error (oFA06)
0111H	Option RAM Fault (oFA10)
0112H	Option Operation Mode Fault (SLMOD) (oFA11)
0113H	Unit Receive CRC Error (oFA12)
0114H	Unit Receive Frame Error (oFA13)
0115H	Unit Receive Abort Error (oFA14)
0116H	Option Receive CRC Error (oFA15)
0117H	Option Receive Frame Error (oFA16)
0118H	Option Receive Abort Error (oFA17)
0131H	Comm. ID Error (oFA30)
0132H	Model Code Error (oFA31)
0133H	Sumcheck Error (oFA32)
0134H	Comm. Option Timeout Waiting for Response (oFA33)
0135H	MEMOBUS Timeout (oFA34)
0136H	Unit Timeout Waiting for Response (oFA35)
0137H	CI Check Error (oFA36)
0138H	Unit Timeout Waiting for Response (oFA37)
0139H	Control Command Selection Error (oFA38)
013AH	Unit Timeout Waiting for Response (oFA39)
013BH	Control Response Selection 1 Error (oFA40)
013CH	Unit Timeout Waiting for Response (oFA41)
013DH	Control Response Selection 2 Error (oFA42)
013EH	Control Response Selection Error (oFA43)
0201H	Option Compatibility Error (oFB00)
0202H	Option Connection Error (oFb01)
0203H	Same Type of Option Card Already Connected (oFb02)
0206H	A/D Conversion Error (oFb05)
0207H	Option Response Error (oFb06)
0211H	Option RAM Fault (oFb10)
0212H	Option Operation Mode Fault (SLMOD) (oFb11)
0213H	Unit Receive CRC Error (oFb12)
0214H	Unit Receive Frame Error (oFb13)
0215H	Unit Receive Abort Error (oFb14)
0216H	Option Receive CRC Error (oFb15)
0217H	Option Receive Frame Error (oFb16)
0218H	Option Receive Abort Error (oFb17)
0232H	Model Code Error (oFb31)
0233H	Sumcheck Error (oFb32)
0234H	Comm. option Timeout Waiting for Response (oFb33)
0235H	MEMOBUS Timeout (oFb34)
0236H	Unit Timeout Waiting for Response (oFb35)
0237H	CI Check Error (oFb36)
0238H	Unit Timeout Waiting for Response (oFb37)
0239H	Control Command Selection Error (oFb38)
023AH	Unit Timeout Waiting for Response (oFb39)
023BH	Control Response Selection 1 Error (oFb40)
023CH	Unit Timeout Waiting for Response (oFb41)
023DH	Control Response Selection 2 Error (oFb42)
023EH	Control Response Selection Error (oFb43)
0301H	Option Compatibility Error (oFC00)
0303H	Option Not Properly Connected (oFC01)

Fault Code	Fault Name
0304H	Same Type of Option Card Already Connected (oFC02)
0306H	A/D Conversion Error (oFC05)
0307H	Option Response Error (oFC06)
0311H	Option RAM Fault (oFC10)
0312H	Option Operation Mode Fault (SLMOD) (oFC11)
0313H	Unit Receive CRC Error (oFC12)
0314H	Unit Receive Frame Error (oFC13)
0315H	Unit Receive Abort Error (oFC14)
0316H	Option Receive CRC Error (oFC15)
0317H	Option Receive Frame Error (oFC16)
0318H	Option Receive Abort Error (oFC17)
0351H	Encoder Option AD Conversion Error (oFC50)
0352H	Encoder Option Analog Circuit Error (oFC51)
0353H	Encoder Communication Timeout (oFC52)
0354H	Encoder Communication Data Error (oFC53)
0355H	Encoder Error (oFC54)
0356H	Resolver Error (oFC55)
0408H	Damping Resistor Overheat (doH)
0409H	Snubber Discharge Resistor Overheat (SoH)
040AH	Internal Resistance Fault (Srr)

◆ Alarm Register Contents

The table below shows the alarm codes that can be read out from MEMOBUS/Modbus register 007FH.

Table B.4 Alarm Register 007FH Contents

Fault Code	Fault Name
0001H	Control Circuit Undervoltage (Uv)
0002H	Control Circuit Overvoltage (ov)
0003H	Heatsink Overheat (oH)
0004H	Heatsink Overheat Warning (oH2)
0005H	Overtorque 1 (oL3)
0006H	Overtorque 2 (oL4)
0007H	Forward/Reverse Run commands input error (EF)
0008H	Baseblock (bb)
0009H	External Fault 3, input terminal S3 (EF3)
000AH	External Fault 4, input terminal S4 (EF4)
000BH	External Fault 5, input terminal S5 (EF5)
000CH	External Fault 6, input terminal S6 (EF6)
000DH	External Fault 7, input terminal S7 (EF7)
000EH	External Fault 8, input terminal S8 (EF8)
000FH	Fan Fault (FAn)
0010H	Overspeed (oS)
0012H	PG Disconnect (PGo)
0014H	MEMOBUS/Modbus Communication Error (CE)
0015H	Option Communication Error (bUS)
0016H	Serial Communication Transmission Error (CALL)
001AH	Option Card External Fault (EF0)
001BH	Motor Switch command input during run (rUn)
001DH	Serial Communication Transmission Error (CALL)
001EH	Undertorque Detection 1 (UL3)
001FH	Undertorque Detection 2 (UL4)
0020H	MEMOBUS/Modbus Communication Test Mode Error (SE)
0022H	Motor Overheat (oH3)
0027H	PID Feedback Loss (FbL)
0028H	Excessive PID Feedback (FbH)
002AH	Drive Disabled (dnE)
002BH	PG Disconnect (PGo)
0031H	MECHATROLINK Watchdog Timer Error (E5)
0032H	Station Address Setting Error (AEr)
0033H	MECHATROLINK Comm. Cycle Setting Error (CyC)
0034H	Current Alarm (HCA)
0035H	Cooling Fan Maintenance Time (LT-1)
0036H	Capacitor Maintenance Time (LT-2)
0037H	Damping Resistor Overheat (doH)
0038H	SI-S EEPROM Error (EEP)
0039H	External Fault (input terminal S1) (EF1)
003AH	External Fault (input terminal S2) (EF2)
003BH	Safe Disable Signal Input (HbbF)
003CH	Safe Disable Signal Input (Hbb)
003DH	Mechanical Weakening Detection 1 (oL5)
003EH	Mechanical Weakening Detection 2 (UL5)
0043H	Soft Charge Bypass Relay Maintenance Time (LT-3)
0049H	DriveWorksEZ Fault (dWAL)
0050H	Power Supply Undervoltage (AUv)

B.10 Enter Command

When writing parameters to the drive from the PLC using MEMOBUS/Modbus communication, parameter H5-11 determines whether an Enter command must be issued to enable these parameters. This section describes the types and functions of the Enter commands.

◆ Enter Command Types

The drive supports two types of Enter commands as shown in *Table B.5*. An Enter command is enabled by writing 0 to register numbers 0900H or 0910H. It is only possible to write to these registers; attempting to read from these registers will cause an error.

Table B.5 Enter Command Types

Register No.	Description
0900H	Simultaneously writes data into the EEPROM (non-volatile memory) of the drive and enables the data in RAM. Parameter changes remain after cycling power.
0910H	Writes data in the RAM only. Parameter changes are lost when the drive is shut off.

Note: The EEPROM can only be written to 100,000 times, so it is recommended to limit the number of times writing to the EEPROM. The Enter command registers are write-only and if these registers are read, the register address will be invalid (Error code: 02H). An Enter command is not required when reference or broadcast data are sent to the drive.

■ H5-11 and the Enter Command

An enter command is not required when writing registers 0000H to 001FH. Changes to those registers take effect immediately, independent of the setting in parameter H5-11.

H5-11 Settings	H5-11 = 0	H5-11 = 1
How parameter settings are enabled	When the Enter command is received from the master.	As soon as the value is changed.
Upper/lower limit check	Upper/lower limit check is performed, taking the settings of related parameters into account.	Checks only the upper/lower limits of the parameters that were changed.
Default value of related parameters	Not affected. The settings of related parameters remain unchanged. They must be changed manually if needed.	Default settings of related parameters are changed automatically.
Error handling when setting multiple parameters	Data is accepted even if one setting is invalid. The invalid setting will be discarded. No error message occurs.	Error occurs if only one setting is invalid. All data that was sent are discarded.

B.11 Communication Errors

◆ MEMOBUS/Modbus Error Codes

A list of MEMOBUS/Modbus errors appears below.

When an error occurs, remove whatever caused the error and restart communications.

<table>
<tr><th rowspan="2">Error Code</th><th>Error Name</th></tr>
<tr><th>Cause</th></tr>
<tr><td rowspan="2">01H</td><td>Function Code Error</td></tr>
<tr><td>Attempted to set a function code from a PLC other than 03H, 08H, and 10H.</td></tr>
<tr><td rowspan="2">02H</td><td>Register Number Error</td></tr>
<tr><td>• A register number specified in the command message does not exist.
• Attempted to send a broadcast message using other register numbers than 0001H or 0002H.</td></tr>
<tr><td rowspan="2">03H</td><td>Bit Count Error</td></tr>
<tr><td>• Read data or write data is greater than 16 bits. Invalid command message quantity.
• In a write message, the “Number of Data Items” contained within the message does not equal twice the amount of data words (i.e., the total of Data 1+ Data 2, etc.).</td></tr>
<tr><td rowspan="2">21H</td><td>Data Setting Error</td></tr>
<tr><td>• Control data or parameter write data is outside the allowable setting range.
• Attempted to write a contradictory parameter setting.</td></tr>
<tr><td rowspan="2">22H</td><td>Write Mode Error</td></tr>
<tr><td>• During run, the user attempted to write a parameter that cannot be written to during run.
• During an EEPROM memory data error (CPF06), the master attempted to write to a parameter other than A1-00 to A1-05, E1-03, or o2-04.
• Attempted to write to read-only data.</td></tr>
<tr><td rowspan="2">23H</td><td>Power Supply Err</td></tr>
<tr><td>During an undervoltage situation, the master attempted to write to parameters that cannot be written to during undervoltage.</td></tr>
<tr><td rowspan="2">24H</td><td>Write Error During Parameter Process</td></tr>
<tr><td>Master attempted writing to the drive while the drive was processing parameter data.</td></tr>
<tr><td rowspan="2">25H</td><td>Writing into EEPROM Disabled</td></tr>
<tr><td>An attempt was made to write data into EEPROM by MEMOBUS/Modbus communications when writing EEPROM is not possible. (When this error code occurs, an error message is displayed and the drive continues operation.)</td></tr>
</table>

◆ Slave Not Responding

In the following situations, the slave drive will ignore the command message sent from the master, and not send a response message:

- When a communications error (overrun, framing, parity, or CRC-16) is detected in the command message.
- When the slave address in the command message and the slave address in the drive do not match (remember to set the slave address for the drive using H5-01).
- When the gap between two blocks (8-bit) of a message exceeds 24 bits.
- When the command message data length is invalid.

Note: If the slave address specified in the command message is 00H, all slaves execute the write function, but do not return response messages to the master.

B.12 Self-Diagnostics

The drive has a built-in self-diagnosing function of the serial communication interface circuits. To perform the self-diagnosis function, use the following procedure.

DANGER! *Electrical Shock Hazard. Do not connect or disconnect wiring while the power is on. Failure to comply will result in death or serious injury. Before servicing, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. The charge indicator LED will extinguish when the DC bus voltage is below 50 Vdc. To prevent electric shock, wait at least one minute after all indicators are OFF and measure the DC bus voltage level to confirm safe level.*

1. Turn on the power to the drive.
2. Note the present terminal S6 function selection setting (H1-06) and set it for the communications test mode (H1-06 = 67).
3. Turn off the power to the drive.
4. With the power off, wire the drive as shown in *Figure B.8*, connecting terminals R+ and S+, R- and S-, and S6 and SN.

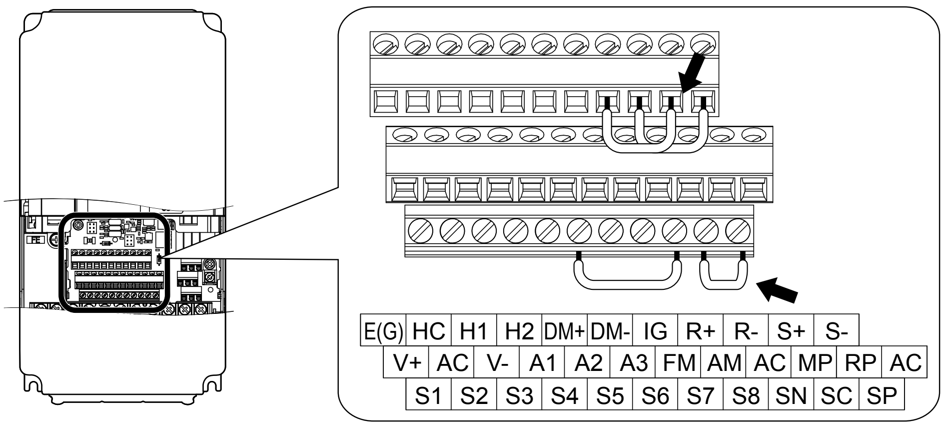


Figure B.8 Terminal Connections for Communication Self-Diagnostics

5. Verify that terminals SC to SP are connected by wire jumper.
6. Turn the power to the drive back on.
7. During normal operation, the drive will display “PASS” to indicate that the communications test mode is operating normally.

   When a fault occurs, the drive will display “CE” on the keypad display.
8. Turn off the power supply.
9. Remove the wire jumpers from terminal R+, R-, S+, S-, and S6-SN. Reset jumper SC to SP to its original position and set terminal S6 to its original function.
10. Return to normal operation.

MEMOBUS/Modbus Communications

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Revision History

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

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Low Harmonic Drive for HVAC Applications

Z1000U HVAC MATRIX Drive

Programming Manual

YASKAWA AMERICA, INC.
2121, Norman Drive South, Waukegan, IL 60085, U.S.A.
Phone: +1-800-YASKAWA (927-5292) or +1-847-887-7000 Fax: +1-847-887-7310
www.yaskawa.com

DRIVE CENTER (INVERTER PLANT)
2-13-1, Nishimiyaichi, Yukuhashi, Fukuoka, 824-8511, Japan
Phone: +81-930-25-2548 Fax: +81-930-25-3431
www.yaskawa.co.jp

YASKAWA ELECTRIC CORPORATION
New Pier Takeshiba South Tower, 1-16-1, Kaigan, Minatoku, Tokyo, 105-6891, Japan
Phone: +81-3-5402-4502 Fax: +81-3-5402-4580
www.yaskawa.co.jp

YASKAWA ELÉTRICO DO BRASIL LTDA.
777, Avenida Piraporinha, Diadema, São Paulo, 09950-000, Brasil
Phone: +55-11-3585-1100 Fax: +55-11-3585-1187
www.yaskawa.com.br

YASKAWA EUROPE GmbH
Hauptstraße 185, 65760 Eschborn, Germany
Phone: +49-6196-569-300 Fax: +49-6196-569-398
www.yaskawa.eu.com E-mail: info@yaskawa.eu.com

YASKAWA ELECTRIC KOREA CORPORATION
6F, 112, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea
Phone: +82-31-8015-4224 Fax: +82-31-8015-5034
www.yaskawa.co.kr

YASKAWA ASIA PACIFIC PTE. LTD.
30A, Kallang Place, #06-01, 339213, Singapore
Phone: +65-6282-3003 Fax: +65-6289-3003
www.yaskawa.com.sg

YASKAWA ELECTRIC (THAILAND) CO., LTD.
59, 1F-5F, Flourish Building, Soi Ratchadapisek 18, Ratchadapisek Road, Huaykwang, Bangkok, 10310, Thailand
Phone: +66-2-017-0099 Fax: +66-2-017-0799
www.yaskawa.co.th

YASKAWA ELECTRIC (CHINA) CO., LTD.
22F, Link Square 1, No.222, Hubin Road, Shanghai, 200021, China
Phone: +86-21-5385-2200 Fax: +86-21-5385-3299
www.yaskawa.com.cn

YASKAWA ELECTRIC (CHINA) CO., LTD. BEIJING OFFICE
Room 1011, Tower W3 Oriental Plaza, No. 1, East Chang An Avenue,
Dong Cheng District, Beijing, 100738, China
Phone: +86-10-8518-4086 Fax: +86-10-8518-4082

YASKAWA ELECTRIC TAIWAN CORPORATION
12F, No. 207, Section 3, Beishin Road, Shindian District, New Taipei City 23143, Taiwan
Phone: +886-2-8913-1333 Fax: +886-2-8913-1513 or +886-2-8913-1519
www.yaskawa.com.tw

YASKAWA INDIA PRIVATE LIMITED
#17/A, Electronics City, Hosur Road, Bengaluru, 560 100 (Karnataka), India
Phone: +91-80-4244-1900 Fax: +91-80-4244-1901
www.yaskawaindia.in

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