YASKAWA

YASKAWA AC Drive - V1000

Compact Vector Control Drive

Programming Manual

Type: CIMR-VU

Model: 200 V Class, Three-Phase Input: 0.1 to 18.5 kW
200 V Class, Single-Phase Input: 0.1 to 5.5 kW
400 V Class, Three-Phase Input: 0.2 to 18.5 kW

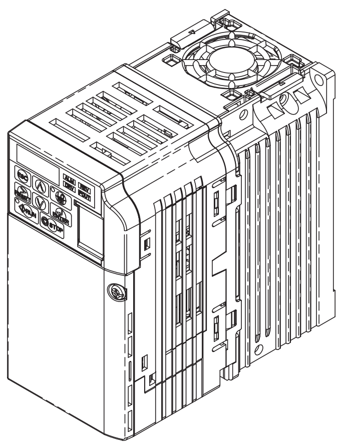
To properly use the product, read this manual thoroughly and retain for easy reference, inspection, and maintenance. Ensure the end user receives this manual.

Parameter Details 1

MEMOBUS/Modbus Communications 2

Parameter List A

PRELIMINARY
05-30-2007



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Preface & General Safety

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

I.1 PREFACE 10
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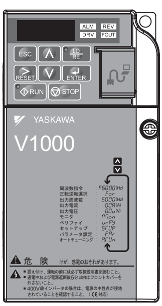
i.1 Preface

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

◆ Applicable Documentation

The following manuals are available for V1000 series drives:

	V1000 Series AC Drive Installation & Start-Up Manual
	Read this manual first. This manual describes installation, wiring, operation procedures, functions, troubleshooting, maintenance, and inspections to perform before operation.
	V1000 Series AC Drive Programming Manual
	Read this manual for detailed information about parameter usage. Contact a Yaskawa representative to order this manual.
	V1000 Series AC Drive Quick Start Guide
	This guide is packaged together with the product. It contains basic information required to install and wire the drive. This guide provides basic programming and simple set-up and adjustment. Refere to the V1000 Technical Manual for complete descriptions of drive features and functions.

◆ Symbols

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

Indicates a term or definition used in this manual.

◆ Terms and Abbreviations

TERMS

Drive: Yaskawa V1000 Series Drive
PM motor: Synchronous motor (an abbreviation for IPM motor or SPM motor)
IPM motor: SSR1 Series
SPM motor: Pico motor (SMRA Series)

i.2 General Safety

◆ Supplemental Safety Information

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

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

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

WARNING

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

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

CAUTION

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

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

NOTICE

Indicates a property damage message.

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

◆ Safety Messages

DANGER

Heed the safety messages in this manual.

Failure to comply will result in death or serious injury.

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

Electrical Shock Hazard

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

Failure to comply will result in death or serious injury.

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

WARNING

Sudden Movement Hazard

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

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

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

Unpredictable equipment operation may result in death or serious injury.

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

WARNING

Electrical Shock Hazard

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

Failure to comply could result in death or serious injury.

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

Do not allow unqualified personnel to use equipment.

Failure to comply could result in death or serious injury.

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

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

Failure to comply could result in death or serious injury.

Fire Hazard

Do not use an improper voltage source.

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

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

CAUTION

Crush Hazard

Do not carry the drive by the front cover.

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

NOTICE

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

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

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

Improper equipment sequencing could result in damage to the drive.

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

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

Do not operate damaged equipment.

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

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

Install adequate branch circuit short circuit protection per applicable codes.

Failure to comply could result in damage to the drive.

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

Do not expose the drive to halogen group disinfectants.

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

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

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

◆ Drive Label Warnings

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

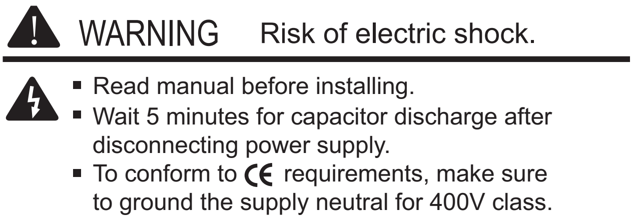


Figure i.1 Warning Information

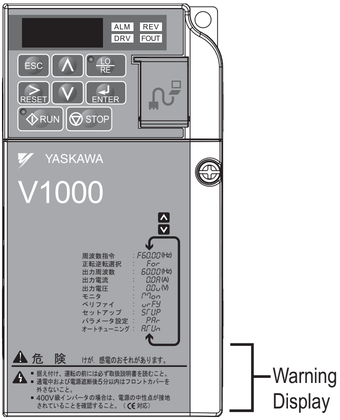


Figure i.2 Warning Information Position

◆ Warranty Information

■ Restrictions

The V1000 was not designed or manufactured for use in devices or systems that may directly affect or threaten human lives or health.

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

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

1

Parameter Details

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1.1 A: Initialization

The initialization group contains parameters associated with initial setup of the drive. Parameters involving the display language, access levels, initialization, and password are located in this group.

◆ A1: Initialization

■ A1-01: Parameter Access Level

Allows or restricts access to drive parameters.

No.	Parameter Name	Setting Range	Default
A1-01	Access Level Selection	0: Operation only 1: Preferred Parameters 2: Advanced Access Level (A) and Setup Access Level (S)	2

Detailed Description

0: Operation Only

Access is restricted to parameters A1-01, A1-04, A1-06, and all U monitor parameters.

1: Preferred Parameters

Access to only a specific list of parameters set to A2-01 through A2-32.

2: Advanced Access Level (A) and Setup Access Level (S)

All parameters can be viewed and edited.

- The drive parameters are password protected (A1-04), which prevents access to A1-00 through A1-03, A1-06, and all A2 parameters.
- A digital input is enabled that has been configured as a Program Lockout (H1-☐☐ = 1B).
- The display will show “bUSY” when attempting to change a parameter while writing to the drive via serial communications. Access will be restricted from the operator keypad until an enter command is received via the serial communication to finish the serial writing process.

■ A1-02: Control Mode Selection

Selects the Control Method of the drive.

No.	Parameter Name	Setting Range	Default
A1-02	Control Method Selection	0: V/f Control without PG 2: Open Loop Vector 5: PM Open Loop Vector	0

Detailed Description

0: V/f Control without PG

- For general-purpose and multiple motor applications.
- For use when the parameter settings are unknown in the drive.

2: Open Loop Vector

- For general, variable-speed applications.
- For applications requiring precise speed control, quick response, and higher torque at low speeds.

5: PM Open Loop Vector

For operating SPM, IPM, and various permanent magnet motors. Takes advantage of Energy Saving features when operating with derated torque.

■ A1-03: Initialization

Resets parameter settings back to their original default values.

No.	Parameter Name	Setting Range	Default
A1-03	Initialize Parameters	0: No Initialize 1110: User Initialize 2220: 2-Wire Initialization 3330: 3-Wire Initialization 5550: OPE04 Reset	0

Detailed Description

1110: User Initialize

The modified Drive parameters are returned to the values selected as user settings. User settings are stored when parameter o2-03 = “1: Set Defaults”.

Note: A “user-initialization” resets all parameters to a user-defined set of default values that were previously saved to the drive. To clear the user-defined default values, set parameter o2-03 to “2”.

2220: 2-Wire Initialization

Resets all parameters back to their original default settings with digital inputs S1 and S2 configured as forward run and reverse run, respectively.

3330: 3-Wire Initialization

The drive parameters are returned to factory default values with digital inputs S1, S2, and S5 configured as run, stop, and forward/reverse respectively.

5550: oPE04 Reset

If parameters on a certain drive have been edited and then a different terminal block is installed with different settings saved in its built-in memory, an oPE04 error will appear on the display screen. To use the parameter settings saved to the terminal block memory, set A1-02 to “5550”.

Note: After initializing the drive, the setting for parameter A1-03 automatically returns to 0.

No.	Parameter Name
A1-02*	Control Method Selection
C6-01	Duty Selection
E1-03	V/f Pattern Selection
E5-01	Motor Code Selection (for PM motors)
E5-02	Motor Rated Capacity (for PM motors)
E5-03	Motor Rated Current (for PM motors)
E5-04	Motor Poles (for PM motors)
E5-05	Motor Armature Resistance (for PM motors)
E5-06	Motor d Axis Inductance (for PM motors)
E5-07	Motor q Axis Inductance (for PM motors)
E5-09	Motor Induction Voltage Constant 1 (for PM motors)
E5-24	Motor Induction Voltage Parameter 2 (for PM motors)
o2-04	Drive/kVA Selection

Note: *Some parameters are unaffected by either the 2-wire or 3-wire initialization. The following parameters will not be reset when parameter A1-03 = 2220 or 3330. Although the control mode in A1-02 is initialized when A1-03 is set to 2220 or 3330, it may change when an application preset is selected. At that time, “APPL” will appear on the display screen, and the most appropriate control mode will be automatically set for the application selected with A1-06.

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

A1-04 is for entering the password when the drive is locked. A1-05 is a hidden parameter used to set the password.

No.	Parameter Name	Setting Range	Default
A1-04	Password	0 to 9999	0
A1-05	Password Setting		

Detailed Explanation

The user can set a password for the drive to restrict access. The password is set to A1-05 and must be entered to A1-04 to unlock parameter access. Until the correct password is entered, the following parameters cannot be viewed or edited: A1-01, A1-02, A1-03, A1-06, and A2-01 through A2-33.

The instructions below demonstrate how to set a new password. Here, the password set is “1234”. An explanation follows on how to enter the password to unlock the parameters.

Step		Display/Result
Setting the Password for the Drive		

Step			Display/Result
1.	Turn on the power to the drive. The initial display appears.	⇒	F 0.00 ALM REV DRV FOUT
2.	Scroll to the Parameter Setup screen and press ∧ .	⇒	PAr
3.	Scroll to the right by pressing ENTER .	⇒	A1-01
4.	Select the flashing digits by pressing > RESET .	⇒	A1-01
5.	Select A1-04 by pressing ∧ .	⇒	A1-04
6.	Press the STOP key while holding down ∧ at the same time. A1-05 will appear. **Note:** A1-05 is normally hidden, but can be displayed by following the directions listed here.	⇒	A1-05 “05” flashes
7.	Press the ENTER key.	⇒	0000
8.	Use > RESET , ∨ and ∧ to enter the password.	⇒	1234
9.	Press ENTER to save what was entered.	⇒	End
10.	The display automatically returns to the screen shown in step 5.	⇒	A1-04

Step			Display/Result
	Check to see if A1-02 is locked. Follow the procedure above from step 10.		
1.	Press ∨ to display A1-02.	⇒	A1-02 “02” flashes
2.	Press ENTER to display the value set to A1-02.	⇒	00

1.1 A: Initialization

Step		Display/Result
3. Press ∨ and ∧, making sure that the setting values cannot be changed.		
4. Press ESC to return to the first screen.	⇒	PAr

Step		Display/Result
The following procedure shows how to displays the password, continuing from step 4 above.		
1. Press ENTER to display the screen for parameter setup.	⇒	A1-01
2. Press RESET to select the flashing digits as shown.	⇒	A1-01 “01 flashes
3. Press ∧ to scroll to A1-04.	⇒	A1-04
4. Enter the password “1234”.	⇒	1234
5. Press ENTER to save the new password.	⇒	End
6. Screen returns to the parameter display.	⇒	A1-04
7. Press ∨ and scroll to A1-02.	⇒	A1-02
8. Press ENTER to display the value set to A1-02.	⇒	00 “0” flashes
9. Use RESET and ∧ to set the desired value.	⇒	02 Open Loop Vector Control
10. Press ENTER to save the setting.	⇒	End

Step		Display/Result
11. The display automatically returns to the parameter display.	⇒	A1-02

Note: **1.** Parameter settings may be edited after entering the correct password. Performing a 2-wire or 3-wire initialization resets the password to “0000”. Re-enter the password after drive initialization.
2. To change the password, enter the new password to parameter A1-05.

■ A1-06: Application Presets

To make it easier to set up the drive for commonly used applications, there are several Application Presets available. By selecting one of these presets, the drive automatically sets the required parameters to their optimal values for that specific application. To further customize these settings, the user can still make changes using the Setup Mode.

No.	Parameter Name	Setting Range	Default
A1-06	Application Presets	0: Disabled 1: Water supply pump 2: Conveyor 3: Exhaust fan 4: HVAC fan 5: Compressor 6: Crane (hoist) 7: Crane (traverse)	0

The next procedure sets the drive for a water supply pump application

A1-06 = 1

- By selecting one of the application presets, I/O terminal settings are changed from their default values and assigned functions appropriate for the application that was selected. Verify all I/O signals and external sequences before operating the motor.
- When A1-06 = 0, all general-use parameters are accessible.
- Perform a 2-wire or 3-wire initialization (A1-03 = 2220 or 3330) on the drive before selecting an Application Preset.

Note: Do not switch between Application Presets without performing a 2-wire or 3-wire initialization

(A1-03 = 2220 or 3330) prior to changing the application selected. Drive parameters should be fully reset by the initialization process before using one of the Application Presets.

Note: Parameters edited by the user can be saved to a list by setting o2-03 to 1. This allows for more immediate access a specific list of relevant parameters, and saves time scrolling through the parameter menu items.

Note: To allow only the Setup Parameters to be displayed, set the parameter access level for Preferred Parameters (A1-01 = 1).

The parameters listed in the table below are unaffected when the drive is initialized:

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

*Although the control method set to A1-02 is unaffected when performing a 2-wire or 3-wire initialization, the drive will automatically change A1-02 according to the value set to parameter A1-06.

Related Parameters

No.	Parameter Name	Setting Range	Default	Page
A1-01	Access Level Selection	0: Operation only 1: Preferred Parameters (access to a set of parameters selected by the user) 2: Advanced Access Level (A) and Setup Access Level (S)	2	-
A1-03	Initialize Parameter	0: No Initialize 1110: User Initialize 2220: 2-Wire Initialization 3330: 3-Wire Initialization 5550: oPE04 Reset	0	-
A2-01 to A2-32	Preferred Parameters 1 to 32	b1-01 to 02-08	Determined by A1-06	-
o2-03	User Parameter Default Value	Allows storing of parameter settings as a User Initialization Selection. 0: No Change 1: Set Defaults - Saves current parameter settings as user initialization. 2: Clear All - Clears the currently saved user initialization.	0	-

Application Presets

Below is a list of Application Presets and the settings automatically assigned to the parameters.

1: Water Supply Pump Application: Parameters and Settings

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

Parameters below are automatically saved as Preferred Parameters (A2-01 to A2-16):

No.	Parameter Name	No.	Parameter Name
b1-01	Frequency Reference Selection	E1-08	Mid Output Frequency Voltage (VC)
b1-02	Run Command Selection	E2-01	Motor Rated Current
b1-04	Reverse Operation Selection	H1-05	Multi-Function Digital Input Terminal S5 Function Selection
C1-01	Acceleration Time 1	H1-06	Multi-Function Digital Input Terminal S6 Function Selection
C1-02	Deceleration Time 1	H1-07	Multi-Function Digital Input Terminal S7 Function Selection
E1-03	V/f Pattern Selection	L5-01	Number of Auto Restart Attempts
E1-07	Mid Output Frequency (FB)	–	–

2: Conveyor Application Parameters and Settings

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

Parameters below are automatically saved as Preferred Parameters (A2-01 to A2-16):

No.	Parameter Name	No.	Parameter Name
A1-02	Control Method Selection	C1-02	Deceleration Time 1
b1-01	Frequency Reference Selection	E2-01	Motor Rated Current

1.1 A: Initialization

No.	Parameter Name	No.	Parameter Name
b1-02	Run Command Selection	L3-04	Stall Prevention Selection during Deceleration
C1-01	Acceleration Time 1	–	–

3: Exhaust Fan Application: Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Method Selection	0: Open Loop Vector
b1-04	Reverse Operation Selection	1: Reverse Prohibited
C6-01	Duty Selection	1: Normal Duty
E1-03	V/f Pattern Selection	0FH
E1-07	Mid Output Frequency (FB)	30.0
E1-08	Mid Output Frequency Voltage (VC)	50.0
L2-01	Momentary Power Loss Operation Selection	1: Enabled
L3-04	Stall Prevention Selection during Deceleration	1: Enabled

Parameters below are automatically saved as Preferred Parameters (A2-01 to A2-16):

No.	Parameter Name	No.	Parameter Name
b1-01	Frequency Reference Selection	E1-07	Mid Output Frequency (FB)
b1-02	Run Command Selection	E1-08	Mid Output Frequency Voltage (VC)
b1-04	Reverse Operation Selection	E2-01	Motor Rated Current
b3-01	Speed Search Selection at Start	H1-05	Multi-Function Digital Input Terminal S5 Function Selection
C1-01	Acceleration Time 1	H1-06	Multi-Function Digital Input Terminal S6 Function Selection
C1-02	Deceleration Time 1	H1-07	Multi-Function Digital Input Terminal S7 Function Selection
E1-03	V/f Pattern Selection	L5-01	Number of Auto Restart Attempts

4: HVAC Fan Application: Parameters and Settings

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

No.	Parameter Name	Optimum Setting
L8-38	Carrier Frequency Reduction	2: Carrier frequency derating across entire frequency range.

Parameters below are automatically saved as Preferred Parameters (A2-01 to A2-16):

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

5: Compressor Application: Parameters and Settings

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

Parameters below are automatically saved as Preferred Parameters (A2-01 to A2-16):

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

6: Hoist Application: Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Method Selection	2: Open Loop Vector Control
b1-01	Frequency Reference Selection	0: Operator
b6-01	Dwell Reference at Start	3.0 Hz
b6-02	Dwell Time at Start	0.3 s
C1-01	Acceleration Time 1	3.0 s
C1-02	Deceleration Time 1	3.0 s
C6-01	Duty Rating	0: Heavy Duty
C6-02	Carrier Frequency Selection	2: 5 kHz
d1-01	Frequency Reference 1	6.0 Hz
d1-02	Frequency Reference 2	30.0 Hz
d1-03	Frequency Reference 3	60.0 Hz
E1-03	V/f Pattern Selection	0FH
H2-02	Terminals P1 Function Selection (open-collector)	37: During frequency output
H2-03	Terminals P2 Function Selection (open-collector)	5: Frequency Detection 2 (FOUT)
L2-03	Momentary Power Loss Minimum Baseblock Time	0.3 s
L3-04	Momentary Power Loss Voltage Recovery Ramp Time	0: Disabled
L4-01	Speed Agreement Detection Level	2.0 Hz
L4-02	Speed Agreement Detection Width	0.0 Hz
L6-01	Torque Detection Selection 1	8: UL3 at RUN - Fault
L6-02	Torque Detection Level 1	5%
L6-03	Torque Detection Time 1	0.5 s
L8-05	Input Phase Loss Protection Selection	1: Enabled
L8-07	Output Phase Loss Protection	1: Enabled
L8-38	Carrier Frequency Reduction	0: Derated when operating at 6 Hz or less
L8-41	Current Alarm Selection	1: Enabled (alarm is output)

Note: **1.** A sequence to release the hold brake is needed for when the multi-function output photocoupler P2-PC closes.
2. Perform Auto-Tuning after selecting the Hoist Application Preset.

Parameters below are automatically saved as Preferred Parameters (A2-01 to A2-16):

No.	Parameter Name	No.	Parameter Name
A1-02	Control Method Selection	d1-02	Frequency Reference 2

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

7: Crane Application: Parameters and Settings

No.	Parameter Name	Optimum Setting
A1-02	Control Mode	0: V/f Control
b1-01	Frequency Reference Selection	0: Operator
C1-01	Acceleration Time 1	3.0 s
C1-02	Deceleration Time 1	3.0 s
C6-01	Duty Cycle	0: Heavy Duty
C6-02	Carrier Frequency Selection	2: 5 kHz
d1-01	Frequency Reference 1	6.0 Hz
d1-02	Frequency Reference 2	30.0 Hz
d1-03	Frequency Reference 3	60.0 Hz
H1-05	Multi-Function Digital Input Terminal S5 Function	3: Multi-Step Speed 1
H1-06	Multi-Function Digital Input Terminal S6 Function	4: Multi-Step Speed 2
H2-02	Terminals P1 Function Selection (open-collector)	37: During frequency output
L3-04	Stall Prevention Selection during Decel	0: Disabled
L8-05	Input Phase Loss Protection Selection	1: Enabled
L8-07	Output Phase Loss Protection	1: Triggered when a single phase is lost
L8-38	Carrier Frequency Reduction	1: Always derated
L8-41	Current Alarm Selection	1: Enabled (alarm output)

Parameters below are automatically saved as Preferred Parameters (A2-01 to A2-16):

No.	Parameter Name	No.	Parameter Name
b1-01	Frequency Reference Selection	d1-03	Frequency Reference 3
C1-01	Acceleration Time 1	E2-01	Motor Rated Current
C1-02	Deceleration Time 1	H1-05	Multi-Function Digital Input Terminal S5 Function
C6-02	Carrier Frequency Selection	H1-06	Multi-Function Digital Input Terminal S6 Function

No.	Parameter Name	No.	Parameter Name
d1-01	Frequency Reference 1	H2-01	Terminals MA, MB, and MC Function Selection
d1-02	Frequency Reference 2	L1-01	Motor Overload Protection Selection

Note: A sequence to release the hold brake is needed for when the multi-function output photocoupler P2-PC closes.

■ Notes on Using the Hoist Application Preset

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

Opening and Closing the Holding Brake

Conditions

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

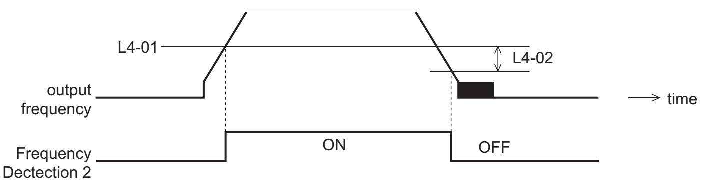
- Set frequency detection so it does not operate during baseblock (L4-07 = 0). Even when an external baseblock command is present, the output frequency will rise when a run command is entered. If frequency detection were to be enabled during baseblock (i.e., if L4-07 = 1), then the brake would be improperly released.

To activate and release the brake using the multi-function output terminals P1-PC, program the drive as shown in the table below:

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

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

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



Sequence Circuit Design

The braking sequence should be designed as follows:

- The brake should release when terminal P2-PC closes in response to the run conditions on the sequence side
- When a fault signal is output, the brake should close. When an Up or Down command is entered, the brake should release.

Timechart

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

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

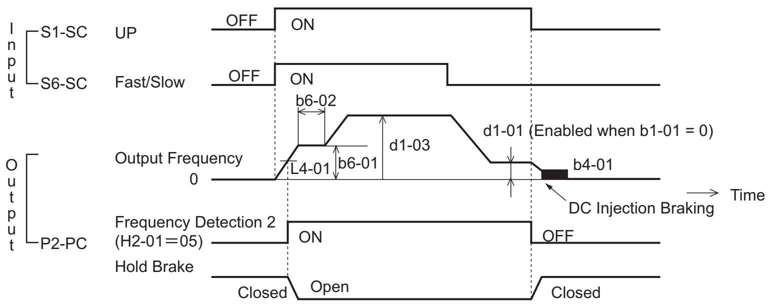


Figure 1.1 Holding Brake Timechart

■ A1-07: DriveWorksEZ Function Selection

DriveWorksEZ is an independent software package that can be used to operate and monitor the drive with a 2 ms scan. It is fully compatible with all types of serial communication software available on the market.

Setting A1-07 to 1 allows the drive to connect to the DriveWorksEZ software package. When using DriveWorksEZ, be sure to set one of the multi-function terminal inputs for DrivesWorksEZ (H1-☐☐ = 9F). The drive is ready to communicate with the software when the terminal is open. Set A1-07 to “0” when DriveWorksEZ is not used.

Please remember that if DriveWorksEZ assigned functions to the multi-function output terminals (both analog and digital), that the terminals will still be set to those functions even after DriveWorksEZ is disabled or disconnected.

Note: For more information on DriveWorksEZ, contact a Yaskawa representative or the Yaskawa sales department directly.

No.	Parameter Name	Setting Range	Default
A1-07	DriveWorksEZ Function Selection	0: Disabled 1: Enabled 2: Terminal input switch (requires that H1-☐☐ = 9F)	0

◆ A2: Preferred Parameters

■ A2-01 to A2-32: Preferred Parameters

The user can select 32 parameters and set them to A2-01 through A2-32. This saves time later scrolling through the parameter menu. The list of Preferred Parameters can also be used to keep track of the most recently edited settings, saving those parameters to this list.

No.	Parameter Name	Setting Range	Default
A2-01 to A2-32	Preferred Parameters 1 to 32	b1-01 to o2-08	A1-06

Detailed Description

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

■ A2-33: Preferred Parameter Automatic Selection

A2-33 determines whether or not parameters that have been edited are saved to the Preferred Parameters (A2-17 to A2-32) for quick, easy access.

No.	Parameter Name	Setting Range	Default
A2-33	Preferred Parameter Automatic Selection	0: Do not save list of recently view parameters. 1: Save history of recently view parameters.	0, 1

Detailed Description

0: Do not save list of recently view parameters.

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

1: Save history of recently view parameters.

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

1.2 b: Setup

Application parameters configure the source of the run command, DC Injection Braking, Speed Search, various timer functions, PID control, the Dwell function, Energy Savings and a variety of other application-related settings.

◆ b1: Mode of Operation

■ b1-01: Frequency Reference Selection 1

Use parameter b1-01 to select the source of the frequency reference.

Press ENTER to set the drive to LOCAL and use the operator keypad to enter the frequency reference.

No.	Parameter Name	Setting Range	Default
b1-01	Frequency Reference Selection 1	0: Operator keypad 1: Analog input terminal A1 2: Serial Com - Modbus 3: Option PCB 4: Pulse Input (Terminal RP)	1

Note: If a run command is input to the drive but no corresponding frequency reference is entered, the RUN indicator LED on the digital operator will light and the STOP indicator will flash.

Detailed Description

Setting	Description
0	Operator: Digital preset speed U1-01 or d1-01 to d1-17.
1	Terminals: Analog input terminal A1 (or terminal A2 based on parameter H3-09).
2	Serial Com - Modbus RS-422/485 terminals R+, R-, S+ and S-.
3	Option PCB
4	Pulse Train Input (terminal RP)

0: Operator Keypad

Use the operator keypad to enter the frequency reference. .

Switch between LOCAL and REMOTE modes by pressing ENTER on the operator keypad or by setting b1-01 to “0”. The frequency reference can be viewed from monitor U1-01.

1: Terminals (analog input terminals)

When b1-01 is set to 1, the frequency reference is entered from either control circuit terminal A1 or A2. Terminal A1 is designed to take a voltage input, while terminal A2 can accept either a voltage or current input. Set parameter H3-02 or H3-09 according to how the frequency reference is to be supplied to the drive. For a voltage input, connect a 0 to 10 V source between terminals A1 and AC. For a current input, connect a 4 to 20 mA source between terminals A2 and AC.

- Entering only the main frequency reference:
  Control circuit terminal A1 (voltage input)
  When entering the main frequency reference with a voltage signal, use the voltage input set up in control circuit terminal A1.

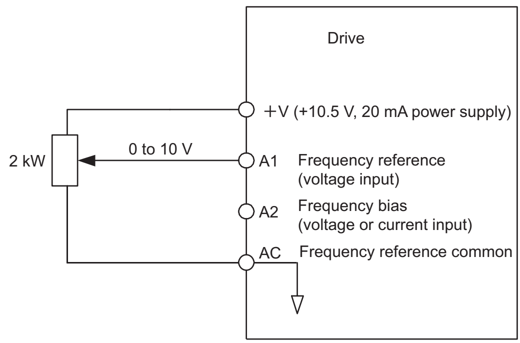


Figure 1.2 Main Frequency Reference Supplied by Voltage Input

Control Circuit Terminal A2 (voltage or current input)

Use control circuit terminal A2 when supplying the frequency reference with a current signal between 4 to 20 mA. To input 0 V to terminal A1, make the following setting changes:

- Set the signal level for multi-function analog input terminal A2 to accept a 4 to 20 mA signal (H3-09 = 2), and the gain for input terminal A2 to 0 (H3-10 = 0)
- For a current signal input, DIP switch S1 must be set to the “I” position. For a voltage signal input, DIP switch S1 must be set to the “V” position.

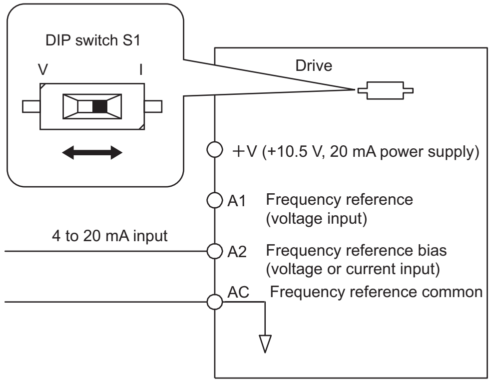
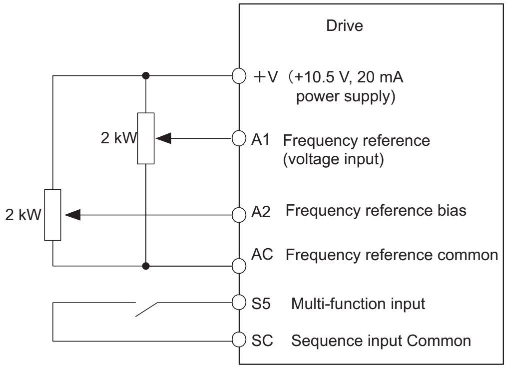


Figure 1.3 Supplying the Frequency Reference with a Current Input

- Switching between Main/Aux Frequency References

  When using the main/aux frequency reference for a two-step speed sequence, input the main frequency reference to terminal A1 and the auxiliary frequency reference to terminal A2. When the multi-function input terminal that has been set for Multi-Step Speed Reference 1 (the default setting for terminal S5) is open, the frequency reference for the drive is supplied by terminal A1. When the contact closes, the frequency reference for the drive changes to terminal A2. When using terminal A2 for an auxiliary frequency reference, set the multi-function analog input terminal A2 function for “Aux Frequency Reference 1” (H3-10 = 2).



Switching between Frequency References

Note: When using multi-function analog input terminal A2 to enter the frequency reference with a voltage signal, the current/voltage DIP switch on the drive needs to be set to voltage. Parameter H3-09 also needs to be set to “1”, which will allows terminal A2 to accept a voltage signal of 0 to 10 V.

2: MEMOBUS Communications

To supply the frequency reference via serial communications, set b1-01 to “2” (Serial Com), and connect the RS-485/422 serial communications cable to terminals R+, R-, S+, and S- on the control I/O terminal block.

3: Option card

Set b1-01 to “3” (Option PCB) and plug a communication option board into the 2CN port on the drive control PCB. Consult the manual supplied with the option board for instructions on integrating the drive with the communication system.

Note: If the frequency reference source is set for an option PCB (b1-01 = 3), but an option board is not installed in 2CN, an OPE05 Operator Programming Error will be displayed on the digital operator and the drive will not run.

4: Pulse Train Input

Setting b1-01 to 4 tells the drive that the frequency reference will be provided by the Pulse Train input, located at control circuit terminal RP.

Verifying Pulse Train is Working Properly

- With H6-02 (Pulse Train Input Scaling) at its default setting of 1440 Hz, manually rotate the pulse generator and see how much the frequency reference increases.
- If the frequency reference does not reach 60 Hz, check the value of H6-02 (Pulse Train Input Scaling).

- Set the Pulse Train to provide the frequency reference (H6-01 = 0) and put the Pulse Train scaling (H6-02) at 100%.

Pulse Train Input Specifications	
Response Frequency	0.5 to 33 kHz
Heavy Duty	30 to 70%
High Level Voltage	3.5 to 13.2 V
Low Level Voltage	0.0 to 0.8 V
Input Impedance	3 kΩ

■ b1-02: Run Command Selection 1

Parameter b1-02 determines where the run command and stop command are input from.

Note: The run command and the frequency reference can be supplied to the drive using various sources that include the operator, the control circuit terminals, option cards, serial communications, and Pulse Train input. The settings required by the drive to accept each one of these input sources can vary. Be sure to read the directions carefully and make the all appropriate settings.

No.	Name	Description	Default
b1-02	Run Command Selection 1	Selects the run command input source. 0: Operator - RUN and STOP keys on the digital operator. 1: Terminals - Contact closure on terminals S1 or S2. 2: Serial Com - Modbus RS-422/485 terminals R+, R-, S+ and S-. 3: Option PCB.	1

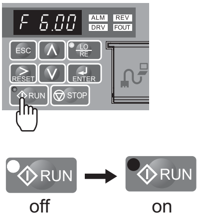
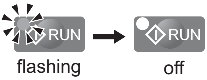
Detailed Description

Available selections for b1-02 include:

Setting	Description
0	Operator: RUN and STOP keys on the LED or LCD operator
1	Terminals: Contact closure on terminals S1 or S2
2	Serial Communications: Modbus RS-422/485 terminals R+, R-, S+ and S-
3	Option PCB

0: Operator

To use the operator to control the drive, press LO/RE or set b1-02 to “0”. This puts the drive in LOCAL mode. In this setting, use the RUN and STOP keys to start and stop the motor.

1.	Turn on the power to the drive. The initial display appears.	⇒	
2.	Set the frequency reference to F6.00 (6 Hz).	⇒	
3.	Press the  key to start the motor. The RUN indicator LED will light and the motor will begin rotating at 6 Hz..	⇒	
4.	Press the  key to stop the motor. The RUN light will flash until the motor comes to a complete stop.	⇒	

1: Control Circuit Terminal

To issue the run command from the terminals, set b1-02 to “1” and select between 2-wire and 3-wire control operation. The default setting is for 2-wire control.

2-Wire Control

The drive is defaulted for 2-wire operation. In the 2-wire configuration, a closure between S1 and SN is interpreted as a forward run command by the drive. A closure between S2 and SN is interpreted as a reverse run command. If both S1 and S2 are closed, the drive will stop (decelerate to zero speed) and the digital operator will display an external fault alarm (“EF” flashes).

Control Circuit Terminal	ON	OFF
S1	Forward run	Stop
S2	Reverse run	Stop

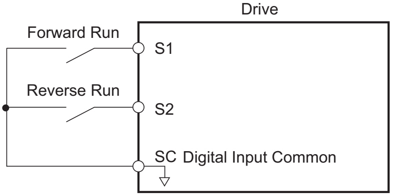
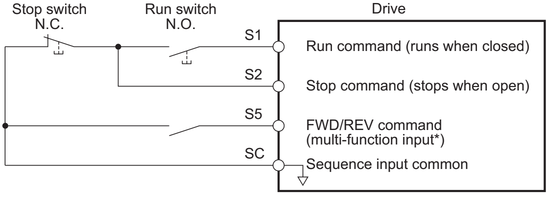


Figure 1.4 2-Wire Control

3-Wire Control

When any of the multi-function digital input parameters (H1-01 through H1-05) are set to 0, terminals S1 and S2 become run and stop, respectively. The multi-function digital input that was set to 0 will function as a forward/reverse input for the drive. When the forward/reverse input is open the drive will run in the forward direction and when the input is closed, the drive will run in reverse.

In 3-wire operation, a momentary closure (> 50 ms) of S1 will cause the drive to run provided that S2 is held closed. The drive will stop any time the S2-SN connection is broken. If the 3-wire configuration is implemented via a 3-wire initialization (A1-03= 3330), then terminal S3 becomes the forward/reverse input.



Note: Forward operation results when S5 is open; Reverse operation results when S5 is closed.

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

Note: When a 3-Wire Initialization is performed using parameter A1-03, the function set to terminal S5 will be automatically reset so that it is assigned the FWD/REV run command.

WARNING! *Sudden Movement Hazard. The motor will begin rotating immediately after the power is switched on. Clear all personnel from rotating machinery and electrical connections prior to switching drive power on. Failure to comply may result in death or serious injury.*

Note: The drive is initially set up not to accept a run command at power up (b1-17 = 0). If a run command is issued at power up, the RUN indicator LED will flash quickly. For the drive to issue the run command, change b1-17 = “1”.

3: Option Card

To issue the run command via the communication option board, set b1-02 to “3” and plug a communication option board into the 2CN port on the control PCB. Consult the manual supplied with the option board for instructions on integrating the drive into the communication system.

Note: If b1-01 is set to 3, but an option board is not installed in 2CN, an OPE05 operator programming error will be displayed on the digital operator and the drive will not run.

4: MEMOBUS Communications

To issue a run command via serial communications, set b1-02 to “2” and connect the RS-485/422 serial communication cable to R+, R-, S+, and S- on the removable terminal block.

■ b1-03: Stopping Method Selection

Select how the drive stops the motor when a stop command is entered or when the run command is removed. There are four ways to stop.

No.	Name	Description	Setting Range
b1-03	Stopping Method Selection	Selects the stopping method when the run command is removed. 0: Ramp to Stop 1: Coast to Stop 2: DC Injection Braking to Stop 3: Coast with Timer (A new run command is ignored if received before the timer expires)	0 to 3

Note: DC Injection Braking cannot be used to stop the motor in PM Open Loop Vector Control.

Detailed Description

0: Ramp to Stop

When the run command is removed, the drive will decelerate the motor to 0 r/min. The rate of deceleration is determined by the active deceleration time. The default deceleration time is set to parameter C1-02.

When the output frequency has dropped below the DC Injection Start Frequency in b2-01 (default = 0.5 Hz), DC current will be injected in the motor at a level determined by b2-02 (default = 50%). The DC Injection condition will occur for the time specified by b2-04 (default = 0.0) to establish the end point of the ramp. DC Injection can be used to ensure the motor is at 0 r/min prior to the drive shutting off.

The deceleration time is calculated using the following formula:

Stop time = output frequency at stop command/max frequency (E1-04) x deceleration time setting (C1-02, C1-04, C1-06, C1-08)

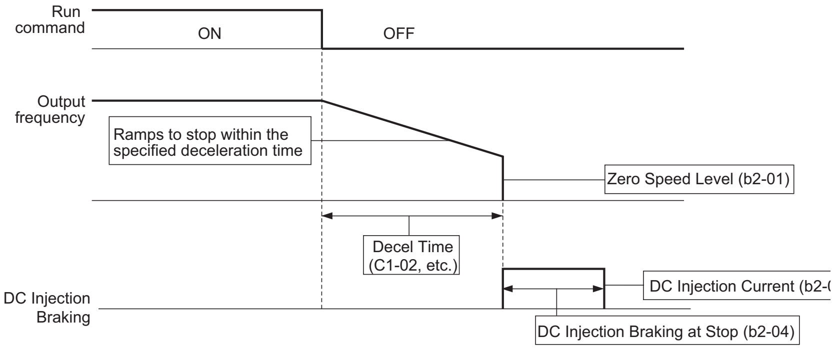


Figure 1.5 Ramp to Stop

Note: If S-curve characteristics are specified by the drive programming, they will add to the total time to stop. Parameter b2-04 is not available if using PM Open Loop Vector. Instead, set the Short Circuit Braking time to b2-13.

1: Coast to Stop

When the run command is removed, the drive will shut off its output and the motor will coast (uncontrolled deceleration). The friction of the driven equipment will eventually overcome any residual inertia of the system and the rotation will stop.

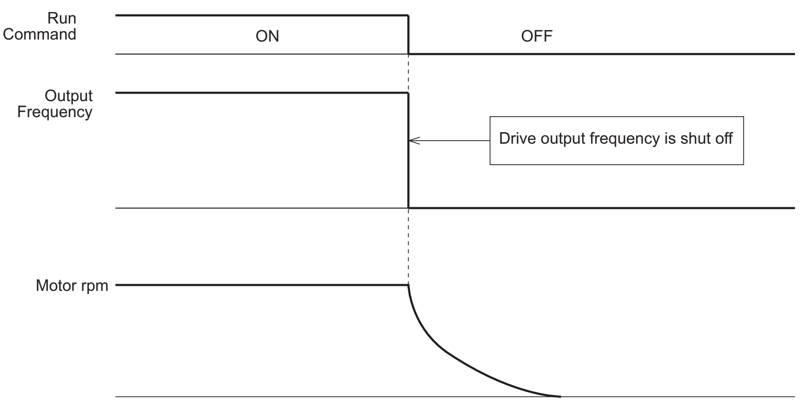


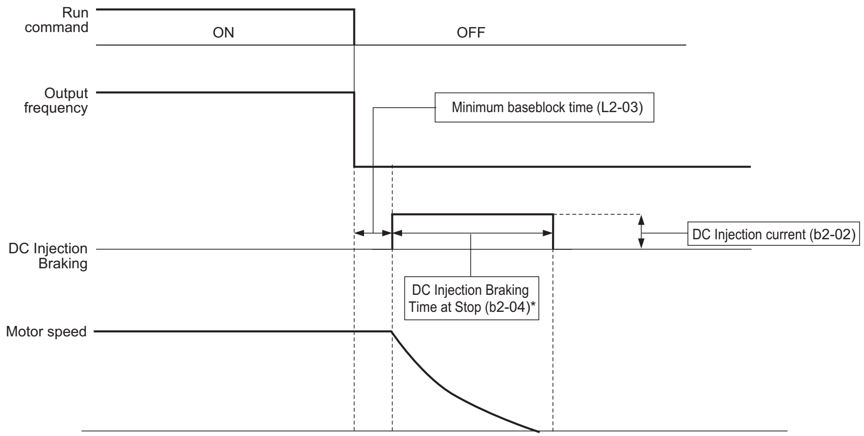
Figure 1.6 Coast to Stop

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 attempt to start the motor up again until it has come to a complete stop. To start the motor back up before it has stopped completely, use DC Injection at start.

2: DC Injection Braking to Stop

When the run command is removed, the drive will baseblock (turn off its output) for the minimum baseblock time (L2-03). Once the minimum baseblock time has expired, the drive will inject DC current into the motor windings to lock the motor shaft. The stopping time will be reduced as compared to coast to stop. The level of DC Injection current is set by parameter b2-02 (default = 50%). The time for DC Injection Braking is determined by the value set to b2-04 and by the output frequency at the time the run command is removed.

Note: This function is not available when using PM Open Loop Vector.
DC Injection Brake Time = (b2-04) x 10 x Output Frequency / max frequency (E1-04)



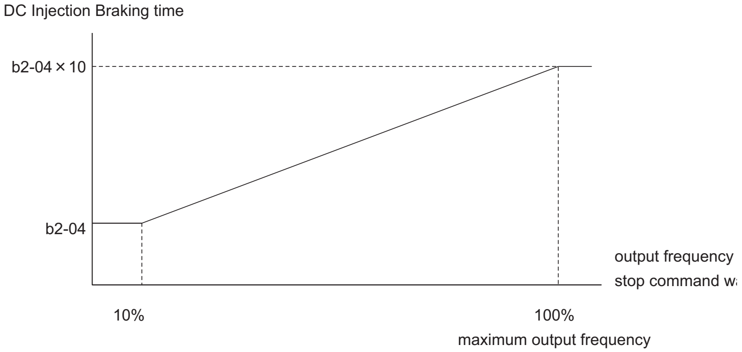
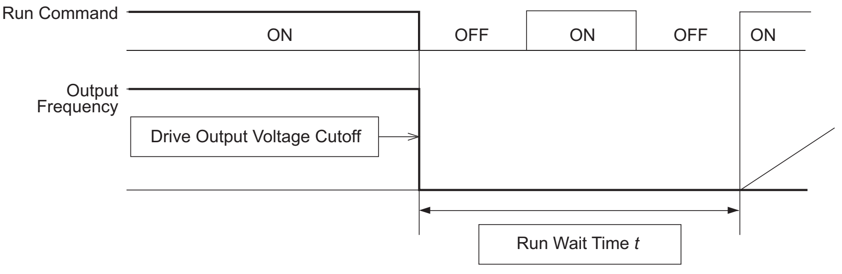


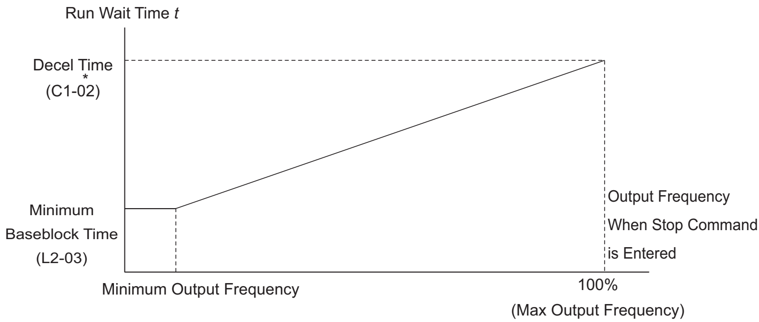
Figure 1.7 DC Injection Braking to Stop

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

3: Coast to Stop with Timer

When the run command is removed, the drive will turn off its output and the motor will coast to stop. If a run command is input before time t (value of C1-02) expires, the drive will not run and the run command will need to be cycled before operation can occur. The time t (value of C1-02) is determined by the output frequency when the run command is removed and by the active deceleration time.





*This value is C1-02 or the selected deceleration time.

■ b1-04: Reverse Operation Selection

For some applications, reverse motor rotation is not appropriate and may even cause problems (e.g., air handling units, pumps, etc.). Setting parameter b1-04 to 1 will cause the drive to ignore any inputs for reverse operation. .

No.	Name	Setting Range	Default
b1-04	Reverse Operation Selection	Sets the forward rotation of the motor, and if reverse operation is disabled. 0: Reverse enabled. 1: Reverse disabled.	0

Note: The default setting for b1-04 is 0, which allows reverse operation. To prohibit the drive from operating in reverse, set b1-04 to “1”.

■ b1-07: LOCAL/REMOTE Run Selection

When the drive is switched between the LOCAL (operation using the digital operator) to REMOTE (these settings are determined by b1-01 and b1-02), there is the possibility that a run command is already present (i.e., a switch closure between S1 and SN when b1-02 = 1). Parameter b1-07 determines what the drive will do if a run command is still present when switching between LOCAL and REMOTE.

No.	Name	Setting Range	Default
b1-07	LOCAL/REMOTE Run Selection	Determines how the drive will interlock when the source of the run command switches from LOCAL to REMOTE. Note that one of the H1 parameters be set to 2 in order to use this function. 0: Cycle External RUN - If the run command is closed when switching from LOCAL to REMOTE, the drive will not run. The run command must first be shut off and then entered again in order to operate the motor. 1: Accept External Run - If the run command is closed when switching from LOCAL to REMOTE, the drive will run.	0

Detailed Description

0: If the run command is closed when switching from LOCAL or alternative reference to REMOTE, the drive will not run.

The drive ignores an external run command until it is removed and re-instated.

1: If the run command is closed when switching from LOCAL or alternative reference to REMOTE, the drive will run.

The drive accepts a run command if it is already present and immediately begins accelerating to the specified frequency reference.

WARNING! *The drive may start unexpectedly if switching from LOCAL to REMOTE when b1-17 = 1. Clear all personnel away from rotating machinery and electrical connections prior to switching between LOCAL and REMOTE. Failure to comply may cause death or serious injury.*

■ b1-08: Run Command Selection while in Programming Mode

As a safety precaution, the drive will not normally respond to a run input when the digital operator is being used to adjust parameters. If it is necessary to recognize external run commands while programming the drive, set b1-08 to “1”.

No.	Name	Setting Range	Default
b1-08	Run Command Selection while in Programming Mode	0: Disabled - Run command accepted only in the operation menu. 1: Enabled - Run command accepted in all menus. 2. Prohibit entering programming mode during run.	0

Note: Refers collectively to the Verify Menu, the Setup Mode, Parameter Settings Mode, and Auto-Tuning.

■ b1-14: Phase Order Selection

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

No.	Name	Setting Range	Default
b1-14	Phase Order Selection	Sets the phase order for drive output terminals U/T1, V/T2 and W/T3. 0: Standard 1: Switch phase order	0

■ b1-15: Frequency Reference Selection 2

Refer to the detailed description for parameter b1-01.

No.	Parameter Name	Setting Range	Default
b1-15	Frequency Reference 2	Selects the frequency reference input source. 0: Operator - Digital preset speed U1-01 or d1-01 to d1-17. 1: Terminals - Analog input terminal A1 (or terminal A2 based on parameter H3-09). 2: Serial Com - Modbus RS-422/485 terminals R+, R-, S+ and S-. 3: Option PCB 4: Pulse Input (Terminal RP)	0

■ b1-16: Run Command Source 2

Refer to the detailed description for parameter b1-02.

No.	Parameter Name	Setting Range	Default
b1-16	Run Command Source 2	Selects the run command input source. 0: Operator - RUN and STOP keys on the digital operator. 1: Terminals - Contact closure on terminals S1 or S2. 2: Serial Com - Modbus RS-422/485 terminals R+, R-, S+ and S-. 3: Option PCB	0

■ b1-17: Run Command at Power Up

Determines whether a run command is given as soon as the power to the drive is switched on.

No.	Parameter Name	Setting Range	Default
b1-17	Run Command at Power Up	0: No run command issued at power up 1: Run command given when power is switched on	0

CAUTION! *The motor will begin rotating immediately after the power is switched on. Take proper precautions to ensure the area around the motor is safe prior to powering up the drive. Failure to comply may cause injury.*

Note: The drive is initially set up not to accept a run command at power up (b1-17 = 0). If a run command is issued at power up, the RUN indicator LED will flash quickly. For the drive to issue the run command, change b1-17 = “1”.

◆ b2: DC Injection Braking

These parameters determine how the DC Injection Braking feature operates. Parameters involving the starting frequency, current level, braking time, and motor pre-heat current level are located here.

■ b2-01: DC Injection Braking Start Frequency

Sets the frequency at which DC Injection Braking starts when “Ramp to Stop” is selected as the stopping method (b1-03 = 0). Set in Hz.

No.	Name	Setting Range	Default
b2-01	DC Injection Braking Start Frequency	0.0 to 10.0	0.5

Detailed Description

Parameter b2-01 sets the output frequency at which the drive begins DC Injection during ramp to stop in order to lock the rotor of the motor and established the end point of the ramp. If b2-01 < E1-09 (Minimum Frequency), then DC Injection begins at at the frequency set to E1-09.

No.	Name	Setting Range	Default
E1-09	Minimum Output Frequency (FMIN)	0.0 to 400.0*	Determined by A1-02 and C1-03. OLV for PM relies on E5-01.

*The upper limit for the setting range is determined by E1-04. E5-01 determines the default value when using PM Open Loop Vector.

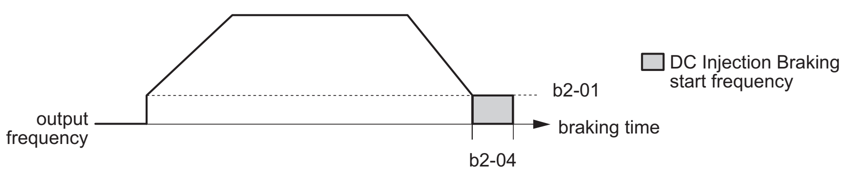


Figure 1.8 DC Injection Braking during Deceleration

■ b2-02: DC Injection Braking Current

Sets the DC Injection Braking current as a percentage of the drive rated current. If set to larger than 50%, the carrier frequency is automatically reduced to 1 kHz.

No.	Parameter Name	Setting Range	Default
b2-02	DC Injection Braking Current	0 to 75	50

Detailed Description

The level of DC Injection Braking current affects the strength of the magnetic field attempting to lock the motor shaft. Increasing the level of current will increase the amount of heat generated by the motor windings, and should only be increased to the level necessary to hold the motor shaft. DC Injection current is set as a percentage of drive rated output current. Find the drive rated output current by looking at the information listed on the drive nameplate.

■ b2-03: DC Injection Braking Time at Start

Sets the time of DC Injection Braking at start in units of 0.01 s, and is used to stop a coasting motor. Disabled when set to 0.00 s.

No.	Parameter Name	Setting Range	Default
b2-03	DC Injection Braking Time at Start	0.00 to 10.00	0.50

Note: When DC Injection Braking cannot be used at start, the motor will likely fault out if Speed Search is not enabled and the motor is allowed to continue rotating.

■ b2-04: DC Injection Braking Time at Stop

This parameter works in combination with b2-01, and sets the DC Injection Braking time at stop in units of 0.01 s. Used to bring the motor to a stop when inertia is causing it to rotate.

No.	Parameter Name	Setting Range	Default
b2-04	DC Injection Braking Time at Stop	0.00 to 10.00	0.50

■ b2-08: Magnetic Flux Compensation Capacity

Sets the magnetic flux compensation as a percentage of the no-load current value (E2-03).

Increases the motor flux when the motor is started up.

No.	Name	Setting Range	Default
b2-08	Magnetic Flux Compensation Capacity	0 to 1000	0

This parameter allows the magnetizing motor flux to be boosted when starting the motor. This parameter will facilitate a quick ramp-up of the torque reference and magnetizing current reference to reduce motor slip during start. A setting of 100% equals motor no-load current E2-03. This flux level will be applied below the minimum output frequency set to

E1-09 until the DC Injection time at start (b2-03) expires. This parameter is useful when starting motors that are relatively larger than the drive, due to the requirement for increased magnetizing current. This parameter may also compensate for reduced starting torque due to motor circuit inefficiencies.

■ b2-12: Short Circuit Brake Time at Start

Sets the time for Short-Circuit Brake operation at start in units of 0.01 s. Used when restarting a coasting motor once it has stopped. Disabled when set to 0.00.

No.	Name	Setting Range	Default
b2-12	Short Circuit Brake Time at Start	0.00 to 25.50	0.00

■ b2-13: Short Circuit Brake Time at Stop

Sets the time for Short-Circuit Brake operation at stop in units of 0.01 s. Used to stop a motor rotating due to inertia. Disabled when set to 0.00.

No.	Name	Setting Range	Default
b2-13	Short Circuit Brake Time at Stop	0.00 to 25.50	0.50

■ b2-15: DC Injection Braking Current 2

Allows the DC Injection Current 1 to flow for the switch time set to b2-16, then switches to DC Injection Current 2. Disabled when set to 0%.

No.	Name	Setting Range	Default
b2-15	DC Injection Braking Current 2	0 to 100	50

◆ b3: Speed Search

The Speed Search function allows the drive to determine the speed of a motor shaft that is being driven by rotational inertia. Speed Search allows the drive to determine the speed of the already rotating motor and begin to ramp the motor to a set speed without first having to bring it to a complete stop. When a momentary loss of supply power occurs, the drive output is turned off. This results in a coasting motor. When power returns, the drive can determine the speed of the coasting motor and start without requiring it to be brought to minimum speed.

Speed Search is performed as follows:

- Enable Power Loss Ride-Thru selection by setting L2-01 to “1” (enabled) or “2” (enabled during CPU operation).
- L5-01 determines the number of times the drive can attempt to restart after a fault occurs.

- To perform Speed Search whenever a run command is entered, set on of the multi-function inputs to External Search Reference 1 or 2 (H1-☐☐ = 61 or 62 respectively). Here, Speed Search is performed only when the run command is first entered, and an external command to perform Speed Search is disregarded. Wait at least 2 ms before entering another external Speed Search command.
- To perform Speed Search when baseblock is released, set on of the multi-function inputs to for the baseblock command (H1-☐☐ = 8 or 9, N.O. and N.C., respectively).

Note: There are two types of Speed Search available in parameter b3-24: Current Detection Speed Search and Speed Estimation Speed Search. When the Speed Search command is entered through one of the multi-function terminals, the type of Speed Search performed is determined by b3-01. If b3-01 is disabled, then Current Detection Speed Search is performed via one of the remote terminal inputs. If b3-01 is enabled, then Speed Estimation Speed Search is executed. The minimum baseblock time and voltage restoration time (L2-03 and L2-04 respectively) both influence how Speed Search works.

■ b3-01: Speed Search Selection at Start

Enables, disables, and selects the speed search function at start.

No.	Name	Setting Range	Default
b3-01	Speed Search Selection at Start	0: Disabled 1: Enabled	0

The type of Speed Search performed is set to b3-24, while the action to take when a momentary power loss occurs is set to L2-01. When the drive is starting back up after power is restored, the run command needs to be maintained for at least the time set to L2-02 (Momentary Power Loss Ride-Thru Time).

No.	Name	Setting Range	Default
b3-24	Speed Search Method Selection	0: Current Detection Speed Search 1: Speed Estimation Type Speed Search	0
L2-01	Momentary Power Loss Operation Selection	0: Disabled - Drive trips on (UV1) fault when power is lost. 1: Power Loss Ride-Thru Time - Drive will restart if power returns within the time set in L2-02. 2: CPU Power Active - Drive will restart if power returns prior to control power supply shut down.	0

The table below lists the Speed Search methods available.

Speed Search Method	Speed Estimation (b3-01=2, 3)	Current Detection (b3-01=0, 1)
Search Method	Estimates motor speed, then accelerates from that speed up to the specified frequency. Works for both forwards and reverse rotation.	Outputs the frequency when momentary power loss occurs, as well as the maximum frequency and the frequency reference. Caculates the current level relative to those values when Speed Search begins.
External Speed Search	Both External Speed Search 1 and 2 perform the same action, estimating the speed of the motor and then searching for the speed based on that estimated value.	External Speed Search 1: Searches for the speed based on the maximum output frequency. External Speed Search 2: Searches for the motor speed based on the most recent frequency reference.
Application Notes	Not for use when running multiple motors from a single drive or when the drive is a frame size larger than the motor. Cannot be used at speeds greater than 130 Hz.	Sudden acceleration may occur with relatively light loads.

Multi-Function Input Selections (H1-01 to H1-07)

Setting	Description
61	External Search Command 1 Closed: Executes Speed Search from the maximum output frequency (E1-04).
62	External Search Command 2 Closed: Executes Speed Search from the frequency reference.

Detailed Description

Speed Estimation (b3-24 = 1)

In Speed Estimation, the drive first estimates the speed of the motor, then accelerates (or decelerates) to that frequency. To enable Speed Estimation at start, set b3-24 to “1”. To also allow Speed Estimation in reverse, set b3-26 to “1”.

Note: Perform Auto-Tuning before using Speed Estimation Speed Search. Perform Auto-Tuning again if the there is change in the cable length between the drive and motor. Speed Estimation should not be used to search for speeds beyond 130 Hz if the application is running multiple motors from the same drive, or if the motor is considerably smaller than the capacity of the drive. Yaskawa recommends using Current Detection Speed Search instead. Speed Estimation may have trouble finding the actual speed if the motor cable is longer than 50 m. We recommend using Current Detection Speed Search in such situations. Use Current Detection Speed Search instead of Speed Estimation when operating motors small than 0.75 kW. Speed Estimation can end up stopping smaller motors as it attempts to find the speed or figure out what direction the motor is rotating in. When using PM Open Loop Vector Control along with a fairly long motor cable, Yaskawa recommends using Short Circuit Braking instead of Speed Estimation. If attempting to find the speed of a motor coasting faster than 120 Hz when using PM Open Loop Vector Control, Yaskawa recommends using Short Circuit Braking instead of Speed Estimation.

Speed Search at Start (b3-24 = 1)

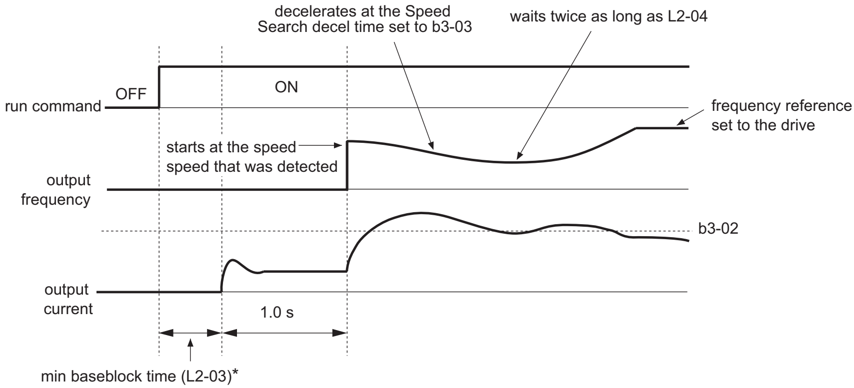


Figure 1.9 Speed Search at Start

*The wait time for Speed Search (b3-05) determines the lower limit.

Note: If the run command is quickly switched off and then back on again when the drive is set to coast to stop following a stop command, Speed Search will operate as shown in the second diagram.

The timechart below demonstrates how the drive operates when power is restored after a momentary power loss.

- Momentary power loss is shorter than the minimum baseblock time (L2-03):

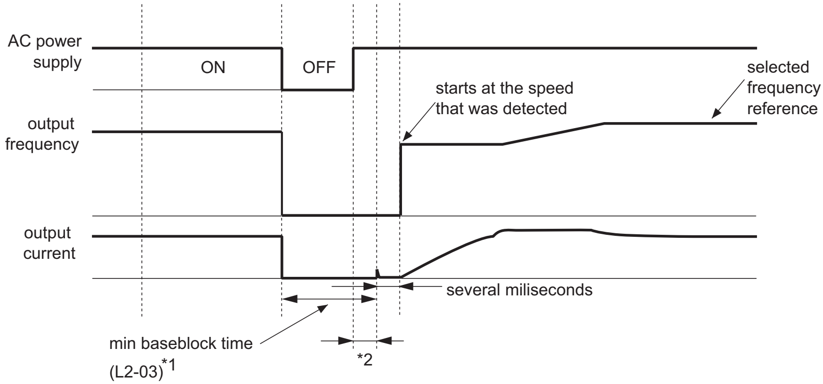


Figure 1.10 Duration of Power Loss < L2-03: Speed Search after Baseblock

* 1. Baseblock time may be shortened on account of the output frequency prior to baseblock.
* 2. Once AC power is restored, the drive will wait for at least the time set to b3-05.

- Momentary power loss is longer than the minimum baseblock time (L2-03):

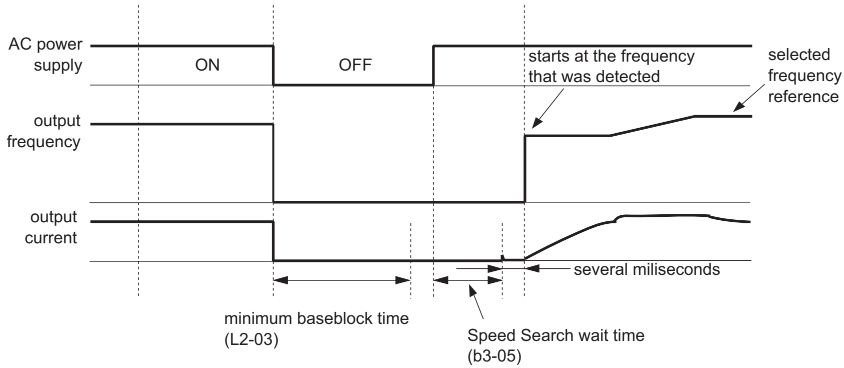


Figure 1.11 Duration of Power Loss > L2-03: Speed Estimation after Baseblock

Note: Speed Search will sometimes operate as shown in the first diagram if the frequency is relatively low just before baseblock or if the duration of power loss is relatively long.

Current Detection Speed Search (b3-24 = 0)

Searches for the motor speed from the maximum frequency and by using the frequency when momentary power loss occurred. Detects speed with the motor current level. Current Detection Speed Search works only in one direction. To enable Current Detection Speed Search, set b3-24 to 0 and b3-01 to 1.

Set the multi-function inputs for “External Speed Search Command 1” or “External Speed Search Command 2” (H1-☐☐ = 61 or 62). External Speed Search Command 1 looks for the motor speed from the maximum frequency set to E1-04. External Speed Search Command 2 looks for the motor speed by starting from the set frequency and decelerating until the speed of the rotor and the output frequency match.

Note: Increase the voltage recovery ramp time set to L2-04 if a UV1 fault occurs when performing Current Detection Speed Search. Shorten the Speed Search deceleration time set to b3-03 if an OL1 fault occurs while performing Current Detection Speed Search. Increase the minimum baseblock time set to L2-03 if an overcurrent fault occurs when performing Speed Search after power is restored following a momentary power loss. Current Detection Speed Search is not available when using PM Open Loop Vector Control.

The timechart below demonstrates how Speed Serach at start and an external Speed Search command operate.

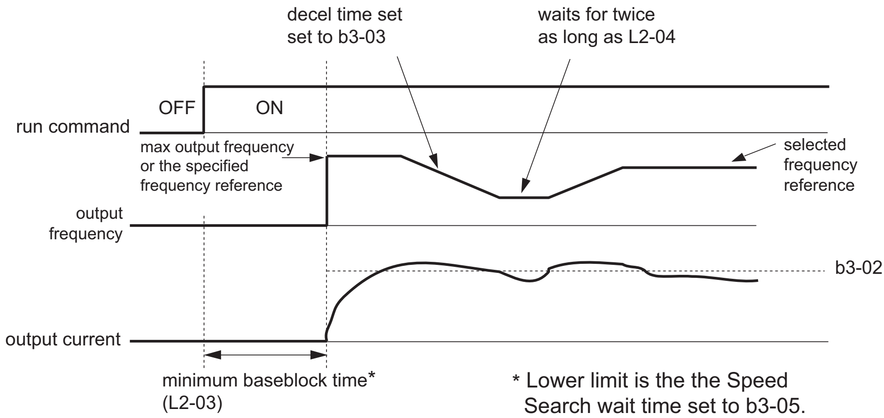
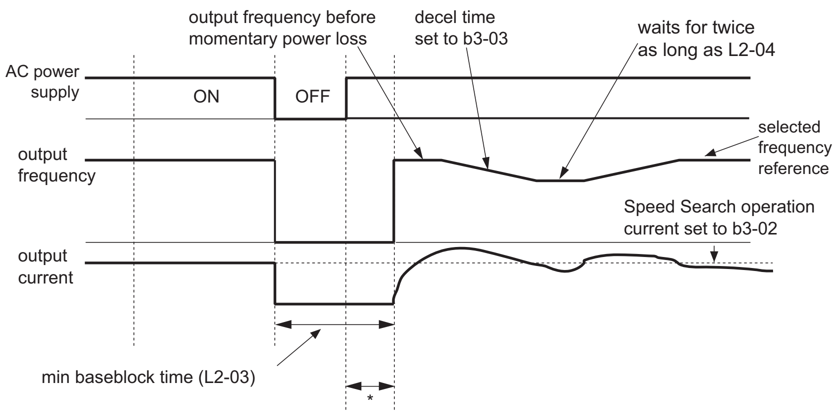


Figure 1.12 Current Detection Speed Search at Start

Speed Search for Momentary Power Loss Ride-Thru: Minimum Baseblock Time (b3-01 = 2)

The following timecharts illustrate how Speed Search operates during Momentary Power Loss Ride-Thru.

- If momentary power loss is shorter than the minimum baseblock time



After power is restored, the drive waits to perform Speed Search until the time set to b3-05 has passed.

Note: Power loss is shorter than L2-03: Current Detection Speed Search after Baseblock.

- If momentary power loss is longer than the minimum baseblock time:

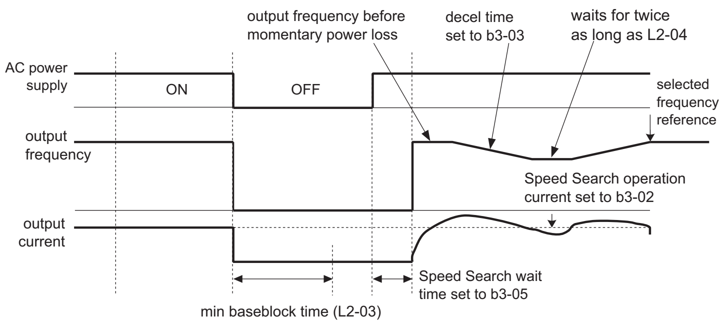


Figure 1.13 Power Loss is Longert than L2-03: Current Detection Speed after Baseblock

Speed Search Settings and Methods		
Settings for b3-01	Speed Search is performed automatically whenever the run command is entered.	Speed Search is performed after a fault restart, external baseblock release command, external Speed Search command, and after momentary power loss.
0	Not possible	Possible
1	Possible	Possible

Note: Default setting is 0.

L2-01 needs to be set to 1 or 2 to enable Speed Search following momentary power loss. To enable Speed Search when performing a fault restart, set L5-01 to any value besides 0.

■ b3-02: Speed Search Deactivation Current

Sets speed search operating current in units of percent with the drive rated current as 100%. Normally there is no need to change this setting. If the drive won’t run after a restart, lower this value.

No.	Parameter Name	Setting Range	Default
b3-02	Speed Search Deactivation Current	0 to 200	Determined by A1-02

Detailed Description

When using the current detection method of Speed Search (b3-01 = 2 or 3), parameter b3-02 sets the current level that will determine when the search is complete and the rotor and output speeds match. When the output frequency is higher than the actual rotor speed the slip causes the current to be high. As the output frequency is lowered, the closer it comes to the rotor speed, the lower the current draw will be. When the output current drops below the level as set in b3-02 (100% = drive rated current) the output frequency stops decreasing and normal operation resumes.

Note: When parameter A1-02 = 0 (V/f control without PG) the factory default setting is 120. When parameter A1-02 = 2 (Open Loop Vector) the factory default setting is 100.

■ b3-03: Speed Search Deceleration Time

Parameter b3-03 sets the deceleration ramp used by the current detection method of Speed Search (b3-01 = 2 or 3) when searching for the motor's rotor speed. Even if Speed Search 2 is selected, for Speed Search at start, the time entered into b3-03 will be the time to decelerate from maximum frequency (E1-04) to minimum frequency (E1-09).

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

Note: Even if Speed Estimation is selected, the drive will still decelerate for as long as it takes to go from the maximum frequency set to E1-04 to the mimimum frequency set to E1-09.

■ b3-05: Speed Search Delay Time

In cases where an output contactor is used between the drive and the motor, extra waiting time is provided after power returns and before Speed Search is performed. This extra time allows for the contactor to operate. When Speed Search at start is used, b3-05 will serve as the lower limit of the minimum baseblock time (L2-03).

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

Note: When using Speed Search at start, the minimum value for the Speed Search Delay Time becomes the same value as the minimum baseblock time set to L2-03.

■ b3-06: Output Current 1 During Speed Search

Sets the coefficients related to motor current for the size of the output current during the beginning of speed search. Rated motor current is set in E2-01 and E4-01. If search speeds are extremely low in the beginning of Speed Search following a long period of baseblock, then increase the setting value (used only in exciatiton search). The output current during Speed Search is automatically limited by the drive rated current. This function is available only when Speed Estimation Speed Search is enabled (b3-24 = 1).

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

Note: If Speed Estimation is not working correctly even after adjusting b3-06, try using Current Detection Speed Search instead.

■ b3-10: Speed Search Detection Compensation Gain

This parameter sets the gain for the frequency at which the drive starts Speed Estimation Speed Search. The drive then starts the motor at this compensated frequency. Available only when Speed Estimation is enabled (b3-24 = 1).

No.	Name	Setting Range	Default
b3-10	Speed Search Detection Compensation Gain	1.00 to 1.20	1.10

Note: Increase this value if overvoltage occurs when performing Speed Search at start after a relatively long period of baseblock.

■ b3-14: Bi-Directional Speed Search Selection

The b3-14 parameter can be used to turn off the bi-directional capabilities of the Speed Estimation form of Speed Search. By turning off the bi-directional capability, the speed search will only try to match the speed in the last known direction.

No.	Parameter Name	Setting Range	Default
b3-14	Bi-Directional Speed Search Selection	0: Disabled. Drive uses frequency reference direction. 1: Enable. Drive uses detected direction.	0

■ b3-17: Speed Search Restart Current Level

A large amount of current can end up flowing through the drive if there is a fairly large difference between the estimated frequency and the actual motor speed when performing Speed Estimation. This parameter sets the current level at which Speed Estimation should be retried, thus avoiding overucrrent and overvoltage problems.

Sets the speed search restart operation detection current level as a percentage of the drive rated current.

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

■ b3-18: Speed Search Restart Detection Time

Sets the time in seconds for how long it takes for speed search restart to be detected.

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

■ b3-19: Number of Speed Search Restarts

Sets the number of restarts possible for speed search restart operations.

No.	Parameter 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 used at start up and after momentary power loss occurs.

No.	Parameter Name	Setting Range	Default
b3-24	Speed Search Method Selection	0: Current Detection Speed Search 1: Speed Estimation Speed Search	0

Detailed Description

0: Current Detection Speed Search

Current Detection Speed Search looks for the speed of the motor by using the frequency when momentary power loss occured and by using the maximum current. While searching for the speed, it adjusts the output frequency with the current the level, accelerating up to the specified frequency reference.

1: Speed Estimation Speed Search

Speed Estimation starts by first estimating the speed of the motor. Based on that speed, it adjust the frequency with the current level, accelerating up to the specified frequency reference. Speed Estimation works both forwards and in reverse.

■ b3-25: Speed Search Wait Time

Sets the wait time in units of 0.1 s bewteen Speed Search attempts when using a PM motor.

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

◆ b4: Delay Timers

The drive has an internal timer function that operates independently from the drive. Delay times can function to get rid of chattering switch noise from sensors.

■ b4-01: Timer Function On-Delay Time

■ b4-02: Timer Function Off-Delay Time

Sets the switching delay for the output in 0.1 s.

No.	Parameter Name	Setting Range	Default
b4-01*	Timer Function On-Delay Time	0.0 to 300.0	0.0
b4-02*	Timer Function Off-Delay Time	0.0 to 300.0	0.0

Enabled when the timer function is set to one of the multi-function inputs (H1-☐☐) and multi-function outputs (H2-☐☐).

Detailed Description

A digital input must be programmed to be a timer start input by setting H1-☐☐ = 18. A digital output must be programmed as a timer output by setting H2-☐☐ = 12. This should not to be confused with the “Wait to Run Time” in b1-11.

Multi-Function Inputs H1-01 through H1-07

Setting	Function Name	Page
18	Timer Function Input	–

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

Setting	Function Name	Page
12	Timer Function Output	–

When the timer function input closes for longer than the value set in b4-01, the timer output switches on. When the timer function input is open for longer than the value set in b4-02, the timer output function switches off. The following diagram demonstrates the timer function operation.

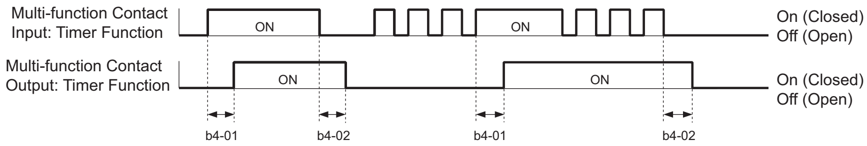


Figure 1.14 Timer Operation

◆ b5: PID Control

The capability to accept an analog signal as feedback for a PID (Proportional + Integral + Derivative) control function is built into the drive. The PID control function provides closed-loop control and regulation of a system variable such as temperature or pressure. A control signal based on the difference (or proportion) between a feedback signal and a desired setpoint is produced. Integration and derivative calculations are then performed on this signal, based upon the PID parameter settings (b5-01 to b5-19), to minimize deviation, for more precise control.

■ P Control

PID refers to the type of action used to control modulating equipment such as valves or dampers. With proportional control, a control signal based on the difference between an actual condition and a desired condition is produced. The difference, such as that between an actual temperature and setpoint is the “error”. The inverter adjusts its output signal related directly to the error magnitude.

■ I Control

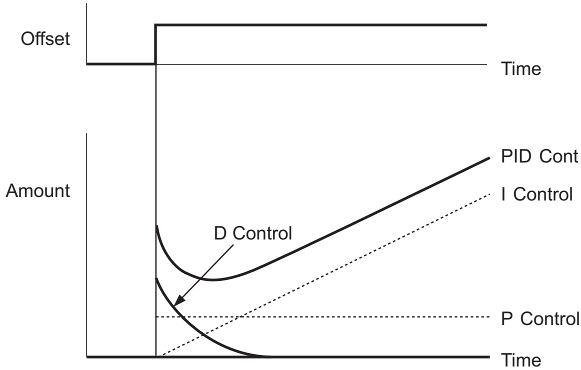
The integral action is designed to minimize offset. An integrating term is used to observe how long the error condition has existed, summing the error over time. Once the system has stabilized, the offset would be minimized.

■ D Control

Overshoot refers to a control loop tendency to overcompensate for an error condition, causing a new error in the opposite direction. Derivative action provides an anticipatory function that exerts a “braking” action on the control loop. When combined, the proportional integral, and derivative actions provide quick response to error, close adherence to the setpoint, and control stability.

■ PID Operation

To better demonstrate how PID input works, the diagram below shows how the output changes as the deviation between the target value and the feedback level are kept constant.

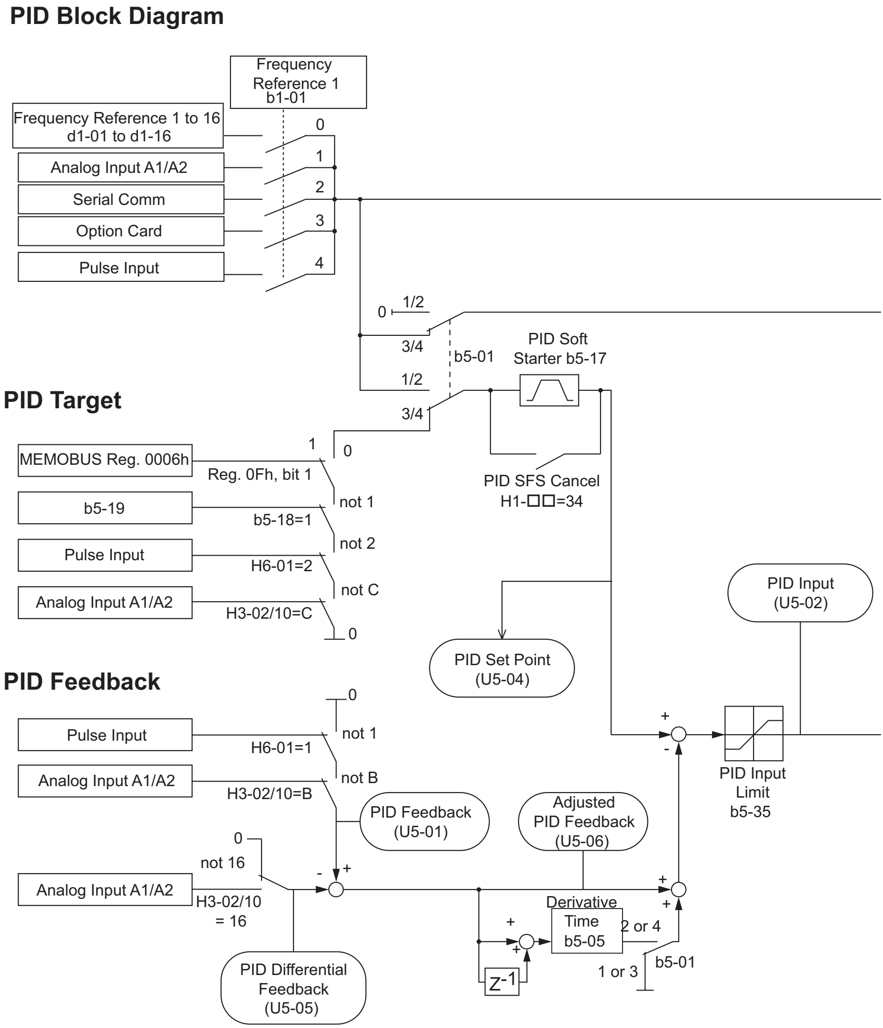


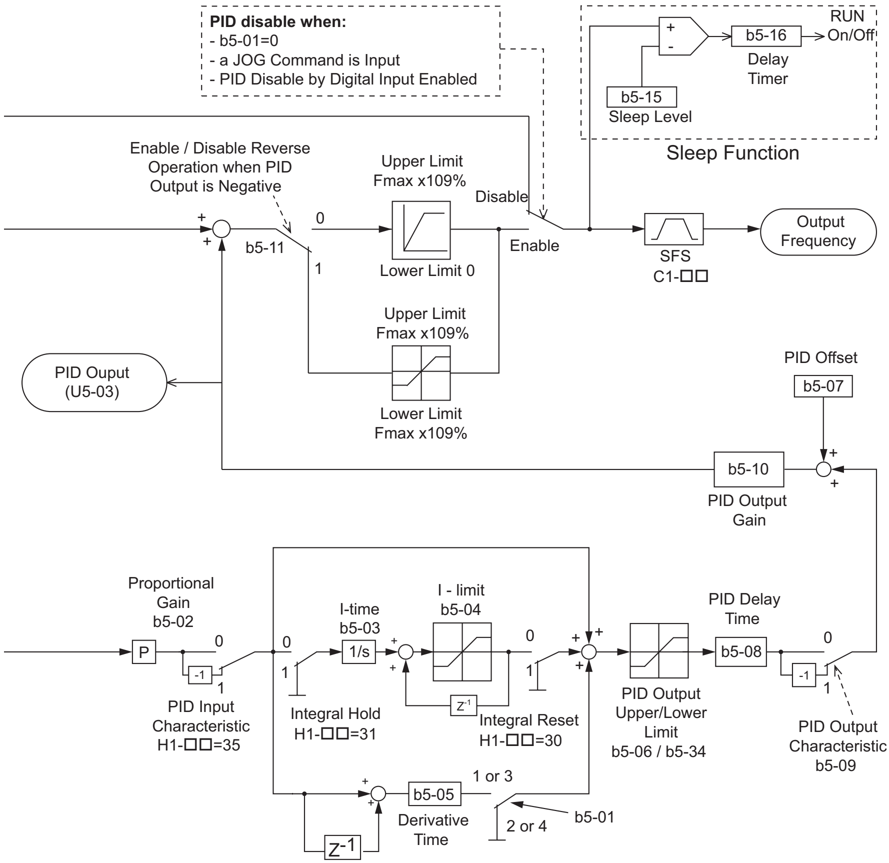
■ Using PID Control

Applications for PID control are listed in the table below.

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 Block Diagram




PID disable when:
- b5-01=0
- a JOG Command is Input
- PID Disable by Digital Input Enabled
RUN On/Off
b5-16
Delay Timer
b5-15
Sleep Level
Sleep Function
Enable / Disable Reverse Operation when PID Output is Negative
Upper Limit Fmax x109%
Lower Limit 0
Disable
Enable
b5-11
SFS
C1-□□
Output Frequency
Upper Limit Fmax x109%
Lower Limit Fmax x109%
PID Ouput (U5-03)
PID Offset
b5-07
b5-10
PID Output Gain
Proportional Gain b5-02
P
PID Input Characteristic H1-□□=35
I-time b5-03
1/s
I - limit b5-04
Integral Hold H1-□□=31
Integral Reset H1-□□=30
PID Output Upper/Lower Limit b5-06 / b5-34
PID Delay Time
b5-08
PID Output Characteristic b5-09
b5-05
Derivative Time
1 or 3
2 or 4
b5-01

■ b5-01: PID Function Setting

To enable PID control, select from settings 1 through 4.

No.	Parameter Name	Setting Range	Default
b5-01	PID Function Setting	0: Disabled	0
		1: D = Feedback	
		2: D = Feed-Forward	
		3: Frequency reference + PID output (D = Feedback)	
		4: Frequency reference + PID output (D = Feed-Forward)	

■ b5-02: Proportional Gain Setting (P)

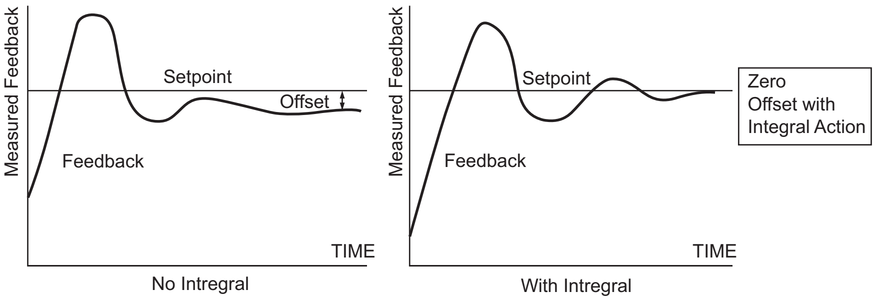
The proportional gain will apply a straight multiplier to the calculated difference (error) between the PID Setpoint and the measured transmitter feedback at terminal A2. A large value will tend to reduce the error but may cause instability (oscillations) if too high. A small value may allow too much offset between the setpoint and feedback.

No.	Parameter Name	Setting Range	Default
b5-02	Proportional Gain Setting (P)	0.00 to 25.00	1.00

■ b5-03: Integral Time Setting (I)

The Integral factor of PID functionality is a time-based gain that can be used to eliminate the error (difference between the setpoint and feedback at steady state). The smaller the integral time set into b5-03, the more aggressive the integral factor will be. To turn off the integral time, set b5-03 = 0.00.

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



■ b5-04: Integral Limit Setting

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

No.	Parameter 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. To suppress this oscillation, a limit can be applied to the intrigue factor by programming b5-04.

■ b5-05: Derivative Time (D)

Adjust this parameter to increase the reponsiveness of the system.

No.	Parameter Name	Setting Range	Default
b5-05	Derivative Time	0.00 to 10.00	0.00

Note: Try reducing this derivative time if overshoot occurs. Increase the derivative time to achieve stability faster even if overshoot occurs. Derivative control is disabled when this value is set to 0.00.

■ b5-06: PID Output Limit

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

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

■ b5-07: PID Offset Adjustment

Sets the amount of offset of the output of the PID controller. Set as a percentage of the maximum frequency. The offset is summed with the PID output.

No.	Parameter 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 amount of time for the filter on the output of the PID controller.

Normally, change is not required.

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

Note: Effective in preventing oscillation 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 reduces the drives responsiveness.

■ b5-09: PID Output Level Selection

Normally, the output of the PID function causes an increase in motor speed whenever the measured feedback is below the setpoint. This is referred to as “direct acting response.” However, if b5-09 = “1: Reverse Output”, the output of the PID function causes the motor to slow down when the feedback is below the setpoint. This is referred to as “reverse acting response.

No.	Parameter Name	Setting Range	Default
b5-09	PID Output Level Selection	0: Normal Output (direct acting) 1: Reverse Output (reverse acting)	0

■ b5-10: PID Output Gain Setting

Applies a multiplier to the output of the PID function. Using the gain can be helpful when the PID function is used to trim the frequency reference. Increasing b5-10 causes the PID function to have a greater regulating affect on the frequency reference.

No.	Parameter 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 reverse operation is allowed while using PID control (b5-01does not = 0) and the PID output goes negative.

No.	Parameter Name	Setting Range	Default
b5-11	PID Output Reverse Selection	0: Zero Limit (when PID output goes negative, the drive stops) 1: Drive reverses when PID turns negative	0

Note: When reverse operation is prohibited (b1-04 = 1), PID output is limited to 0.

PID Feedback Loss Detection

■ b5-12: PID Feedback Reference Missing Detection Selection

■ b5-13: PID Feedback Loss Detection Level

■ b5-14: PID Feedback Loss Detection Time

The PID Feedback Loss Detection function should be used whenever PID control is enabled. If the feedback signal is lost, the output frequency will rise up to the maximum output frequency.

No.	Parameter Name	Setting Range	Default
b5-12	PID Feedback Reference Missing Detection Selection	0 to 5	0
b5-13	PID Feedback Loss Detection Level	0 to 100	0%
b5-14	PID Feedback Loss Detection Time	0.0 to 25.5	1.0 s

When PID feedback is lost, the following operations may be selected:

Setting	Description
0	Disabled. No detection PID feedback loss.
1	Alarm. Detection PID feedback loss. Continues operating during detection without triggering a fault contact.
2	Fault. A fault is output and the drive coasts to stop.
3	PID Feedback error detection disabled. Multi-function output only, detected during PID control cancel input only.
4	PID Feedback error detection enabled. An alarm is triggered and the drive continues running. Detected only when PID control is canceled.
5	PID Feedback error detection enabled. Fault is triggered and output is shut off. Detected only when PID control is canceled.

Note: Drive continues operating when an alarm is issued. A stop command is automatically issued when fault situation is detected. To cancel PID, set one of the multi-function inputs H1-01through H1-07 to 19.

Detailed Description

- b5-12 = 0: An output will be triggered if the PID feedback value is below the detection level set to b5-13 for the time set in b5-14 when H2-☐☐ = 3E.

- b5-12 = 1: If the PID feedback value falls below the PID feedback loss detection level (b5-13) for longer than the PID feedback loss detection time (b5-14), a “FBL - Feedback Loss” alarm will be displayed drive will continue operation.
- b5-12 = 2: In the same situation described above, a “FBL - Feedback Loss” fault will be displayed and a stop command executed. The motor will coast to stop and a fault relay triggered.
- b5-12 = 3: If the PID feedback value exceeds the PID feedback loss detection level (b5-13) for longer than the PID feedback loss detection time (b5-14), a “FBL - Feedback Loss” alarm will be displayed and the drive will continue operation.
- b5-12 = 4: In the same situation described above, a “FBL - Feedback Loss” fault will be displayed and a stop command executed. The motor will coast to stop and a fault relay triggered.
- b5-12 = 5: When PID feedback loss is detected, “FbH” appears on the operator to indicate excessive PID feedback, and fault output is triggered. The drive will coast to stop.

The following time chart shows what happens when PID feedback is lost.

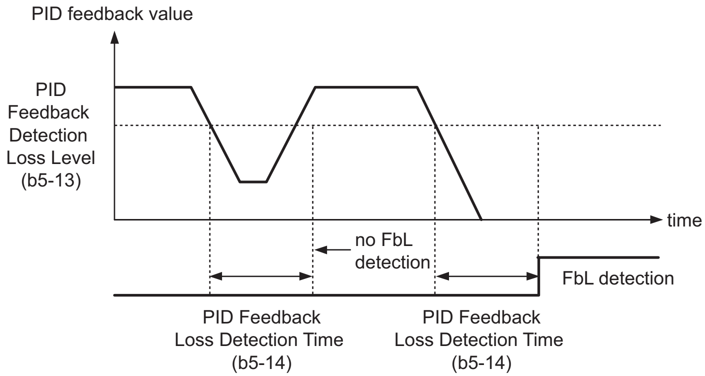


Figure 1.15 PID Feedback Loss Detection

PID Sleep

■ b5-15: PID Sleep Function Start Level

■ b5-16: PID Sleep Delay Time

The PID Sleep function stops the drive when the PID output value falls below the PID Sleep operation level. The drive will resume operating once the PID output value rises above the PID Sleep operation level for the specified time.

No.	Parameter Name	Setting Range	Default
b5-15	PID Sleep Function Start Level	0.0 to 400.0	0.0
b5-16	PID Sleep Delay Time	0.0 to 25.5	0.0

Detailed Description

- If the conditions that triggered the PID Sleep function continue and output fails to rise above the PID Sleep level, the drive will coast to stop.
- If the PID output rises above the PID Sleep level, the drive will automatically be restarted even though the PID Sleep delay time has not fully passed.
- PID Sleep is always enabled, even when PID control is disabled.

Note: Select the stopping method for the drive when PID Sleep is activated.

The figure below illustrates what happens when PID Sleep is triggered.

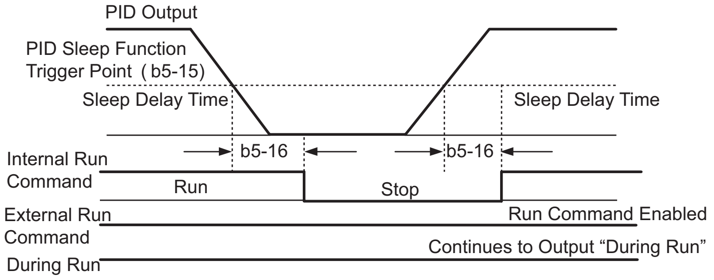


Figure 1.16 PID Sleep

■ b5-17: PID Accel/Decel Time

This is a soft start function that is applied to the PID setpoint analog input. Instead of having nearly instantaneous changes in signal levels, there is a programmed ramp applied to level changes. When changing setpoints the error can be limited by gradually ramping the setpoint through the use of parameter b5-17.

No.	Parameter Name	Setting Range	Default
b5-17	PID Accel/Decel Time	0 to 255	0

Note: Depending on the settings, resonance with the PID control and hunting in the machinery may occur because the acceleration and deceleration times set to the C1 parameters are allocated after PID control. Parameter b5-17 can be use to prevent such problems. The PID Soft Starter function can also be disabled or enabled by setting one of the multi-function digital inputs to 34.

■ b5-18: PID Setpoint Selection

■ b5-19: PID Setpoint Value

No.	Parameter Name	Setting Range	Default
b5-18	PID Setpoint Selection	0: Disabled 1: Enabled	0
b5-19	PID Setpoint Value	0.00 to 100.00	0.00

Sets the PID target value. Use only when b5-18 = 1.

If b5-18 = “0: Disabled”, then the PID Setpoint will either be the Modbus register 06H (provided register 0FH bit 1 is high), or the active frequency reference.

■ b5-20: PID Setpoint Scaling

Determines the units that the PID setpoint (b5-19) is set in and displayed. Also determines the units for monitors U5-01 and U5-04.

No.	Parameter Name	Setting Range	Default
b5-20	PID Setpoint Scaling	0: 0.01 Hz units 1: 0.01% units (100% of max output frequency) 2: r/min (set the motor poles) 3: User-set display (set using b5-38 and b5-39)	1

■ b5-34: PID Output Lower Limit

Sets the minimum output possible from the entire PID controller.

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

- Set as a percentage of the maximum frequency (E1-04).
- The lower limit is disabled when set to 0.0%.

■ b5-35: PID Input Limit

If the input value for PID control is high, the output will also be high. This parameter limits the input value.

No.	Parameter Name	Setting Range	Default
b5-35	PID Input Limit	0 to 1000.0	1000.0

- Set as a percentage of the maximum output frequency (E1-04).
  Acts as a bipolar limit.

■ b5-36: PID Feedback High Detection Level

Determines the level at which a PID feedback alarm occurs. The alarm is triggered when PID feedback exceeds the level specified in b5-36 for longer than the time designated in b5-37. When the alarm is triggered, “FbH” will appear on the operator and the drive will continue running. If the drive is set to trigger a fault, then a fault will be output through one of the multi-function output terminals and a stop command will be issued.

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

- Set as a percentage of the maximum frequency output (E1-04).

■ b5-37: PID Feedback High Detection Time

Determines the time in seconds for the PID feedback level to trigger PID Feedback High detection.

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

■ b5-38: PID Setpoint / User Display

Determines whether or not the PID value is shown when the maximum output frequency is reached. Enabled when b5-20 = 3.

No.	Parameter Name	Setting Range	Default
b5-38	PID Setpoint / User Display	0 to 60000	Determined by b5-20

■ b5-39: PID Setpoint and Display Digits

Determines the number of digits for setting and displaying the PID setpoint. Enabled when b5-20 = 3.

No.	Parameter Name	Setting Range	Default
b5-39	PID Setpoint and Display Digits	0: Integer 1: One decimal places 2: Two decimal places 3: Three decimal places	Determined by b5-20

◆ b6: Dwell Function

■ b6-01/b6-02: Dwell Reference/Time at Start

■ b6-03/b6-04: Dwell Reference/Time at Stop

The reference hold or Dwell function is used to temporarily hold the output frequency at a set reference, for a set time, and then continue to ramp up. This function can be used when driving a permanent magnet motor, or a motor with a heavy starting load. This pause in acceleration allows the magnets in a permanent magnet motor to synchronize with the stator field of the motor, thus reducing traditionally high starting current.

Note: Using the Dwell function requires that the stopping method for the drive be set to “Ramp to Stop” (b1-03 = 0).

No.	Parameter Name	Setting Range	Default
b6-01	Dwell Reference at Start	0.0 to 400.0	0.0 Hz
b6-02	Dwell Time at Start	0.0 to 10.0	0.0 s
b6-03	Dwell Reference at Stop	0.0 to 400.0	0.0 Hz
b6-04	Dwell Time at Stop	0.0 to 10.0	0.0 s

Detailed Description

The figure below illustrates how the Dwell function works.

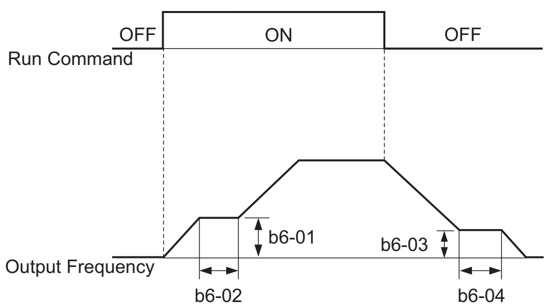


Figure 1.17 Dwell Function at Start and Stop

◆ b8: Energy Saving

The Energy Saving feature improves overall system operating efficiency by operating the motor at its most efficient level. This is accomplished by continuously monitoring the motor load and adjusting the motor terminal voltage so that the motor always operates near its rated slip frequency. A motor is most efficient when operating near rated slip conditions.

Note: Energy Saving is not appropriate for applications where the load may suddenly increase. Such applications should use derated torque.

■ b8-01: Energy Saving Control Selection

Enables the Energy Saving feature.

No.	Parameter Name	Setting Range	Default
b8-01	Energy Saving Control Selection	0: Disabled 1: Enabled	0

■ b8-02: Energy Saving Gain (requires Open Loop Vector)

The output voltage during Energy Saving operation is the product of the normal V/f settings (E1-03 to E1-13) and the Energy Saving gain. The output voltage decreases and recovers according to the Energy Saving control filter time constant b8-03. As the Energy Saving gain increases, the output voltage increases also.

No.	Parameter Name	Setting Range	Default
b8-02	Energy Saving Gain	0.00 to 10.0	0.7

■ b8-03: Energy Saving Control Filter Time Constant (requires Open Loop Vector)

Parameter b8-03 sets the response time for Energy Saving. Although lowering this value allows for a quicker response, instability may result if it is too low.

No.	Parameter Name	Setting Range	Default
b8-03	Energy Saving Control Filter Time Constant	0.00 to 10.00	Determined by o2-04

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

Parameter b8-04 is used to maximize motor efficiency. The default setting depends on the capacity of the drive, but can be adjusted in small amounts while viewing the kW monitor (U1-08) and running the drive to minimize the output kW.

A larger value typically results in less voltage to the motor and less energy consumption, but too large a value will cause the motor to stall.

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

Note: This default value changes if the motor rated capacity set to E2-11 is changed. The Energy

Saving coefficient is set automatically when Energy Saving Auto-Tuning is performed (see the section on Auto-Tuning).

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

The Energy Saving function will search out the lowest output voltage in order to achieve minimum output power usage. Parameter b8-05 determines how often the output power (kW) is measured and the output voltage is adjusted.

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

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

Once Energy Savings is enabled and the optimal energy saving coefficient value has been set, the programmer can have the drive further search out the proper voltage to achieve the lowest output power by measuring the output power and making minute changes to the output voltage.

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

Detailed Description

Limits the output voltage to make sure that the output power stays just above the minimum value.

Note: If set too high, the motor may stall with a sudden increase to the load. Disabled when b8-06 = 0. Setting this value to 0 does not disable Energy Saving.

Related Parameters

No.	Parameter Name	Setting Range	Default
E2-02*3	Motor Rated Slip	0.00 to 20.00	*1
E2-11*2	Motor Rated Capacity	0.00 to 650.00 kW	*1

* 1. Default setting is determined by drive capacity (o2-04).
* 2. Automatically set when Auto-Tuning is performed.
* 3. Automatically set when Rotational Auto-Tuning is performed.

Parameter Details 1

1.3 C: Tuning

C parameters control various aspects of how the drive accelerates and decelerates the motor. This includes S-curve, slip compensation, torque compensation and carrier frequency.

◆ C1: Acceleration and Deceleration Times

■ C1-01 to C1-08: Accel/Decel Times 1 to 4

C1-01 (Acceleration Time 1) sets the time to accelerate from 0 to the maximum output frequency (E1-04). C1-02 (Deceleration Time 1) sets the time to decelerate from maximum output frequency to 0. C1-01 and C1-02 are the default active accel/decel settings.

No.	Parameter Name	Setting Range	Default
C1-01	Acceleration Time 1	0.0 to 6000.0*	10.0 s
C1-02	Deceleration Time 1		
C1-03	Acceleration Time 2		
C1-04	Deceleration Time 2		
C1-05	Acceleration Time 3 (Motor 2 Accel Time 1)		
C1-06	Deceleration Time 3 (Motor 2 Decel Time 1)		
C1-07	Acceleration Time 4 (Motor 2 Accel Time 2)		
C1-08	Deceleration Time 4 (Motor 2 Accel Time 2)		

*The setting range for the acceleration and deceleration times is determined by C1-10 (Accel/Decel Time Setting Units). For example, if the time is set in units of 0.01 s (C1-10 = 0), the setting range becomes 0.00 to 600.00 s.

Detailed Description

C1-01 and C1-02 are the factory default active accel/decel “pair”. Other accel/decel pairs (C1-03 to C1-08) exist that can be activated by a multi-function digital input (H1-☐☐= 7 and 1A). Alternatively, the active accel/decel pair can be switched from accel/decel pair 1 (C1-01 and C1-02) to accel/decel pair 4 (C1-07 and C1-08) by a switch over frequency as programmed in parameter C1-11.

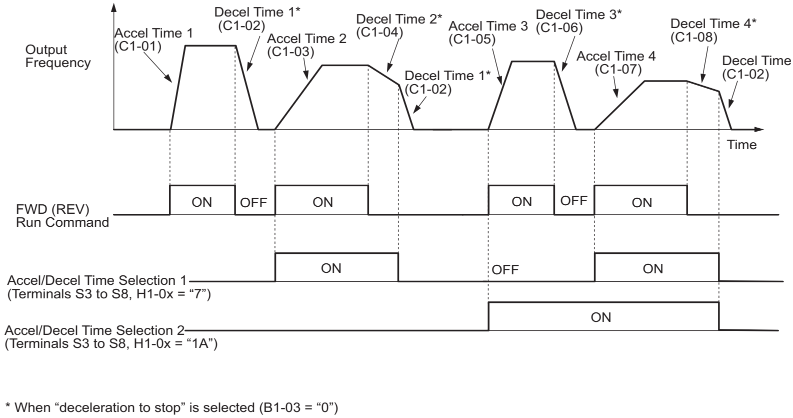


Figure 1.18 Timing Diagram of Accel/Decel Time Change

Ramp to Stop (b1-03 = 0)

Accel/Decel Time Selection 1 Multi-Function Input Setting = "7"	Accel/Decel Time Selection 2 Multi-Function Input Setting = "1A"	Acceleration Time	Deceleration Time
Open or not set	Open or not set	C1-01	C1-02
Closed	Open or not set	C1-03	C1-04
Open or not set	Closed	C1-05	C1-06
Closed	Closed	C1-07	C1-08

■ C1-09: Fast Stop Time

A special deceleration parameter is available for use with emergency or fault operations. Parameter C1-09 will set a special deceleration that can be operated by closing a digital input configured as H1-☐☐ = 15 or H1-☐☐ = 17. A digital input configured as H1-☐☐ = 15 will look for a switch closure before initiating the Fast Stop operation. A digital input configured as H1-☐☐ = 17 will look for the switch opening before initiating the Fast Stop operation.

No.	Parameter Name	Setting Range	Default
C1-09	Fast Stop Time	0.0 to 6000.0*	10.0 s

*Unlike a standard deceleration time, once the Fast Stop operation is initiated even momentarily, the drive cannot be re-operated until the deceleration is complete, the Fast Stop input is cleared, and the run command is cycled.

■ C1-10: Accel/Decel Time Setting Units

Determines the units for the acceleration and deceleration times set to C1-01 through C1-09 using parameter C1-10. If any of the parameters C1-01 to C1-09 are set to 600.1 seconds or more, then C1-10 cannot be set to 0.

No.	Parameter Name	Setting Range	Default
C1-10	Accel/Decel Time Setting Units	0: Sets the accel/decel times in units of 0.01 s, making the setting range 0.00 to 600.00 s. 1: Sets the accel/decel times in units of 0.1 s, making the setting range 0.0 to 6000.0 s.	1

■ C1-11 Accel/Decel Switch Frequency

C1-11 allows the drive to switch automatically between the acceleration and deceleration times set to C1-01/C1-02 and C1-07/C1-08.

No.	Parameter Name	Setting Range	Default
C1-11	Accel/Decel Switch Frequency	0.0 to 400.0	0.0 Hz

Detailed Description

When the output frequency reaches the value set to C1-11, the drive will switch acceleration and deceleration times as shown in the graph below.

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

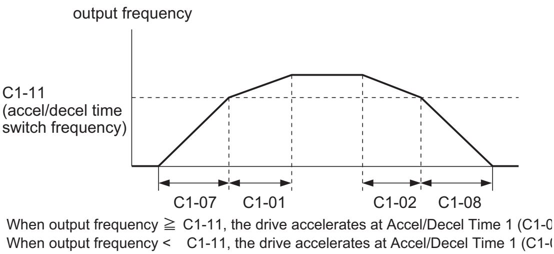


Figure 1.19 Accel/Decel Time Switching Frequency

Acceleration time sets the time necessary for the output frequency to accelerate from 0Hz to maximum output frequency (E1-04). Deceleration time sets the time necessary for the output frequency to decelerate from the maximum output frequency (E1-04) to 0 Hz.

C1-01 and C1-02 make up the default active accel/decel “pair”. Other accel/decel pairs (C1-03 to C1-08) exist that can be activated by a multi-function digital input (H1-☐☐ = 7 and 1A). Alternatively, the active accel/decel pair can be switched from first accel/decel pair (C1-01 and C1-02) to the fourth accel/decel pair (C1-07 and C1-08) by a switch over frequency as programmed in parameter C1-11.

Motor 1 and 2 combinations with Accel/Decel Time 1 are shown in the table below. It is not possible to combine Accel/Decel Time 2 and motor switching at the same time (this would trigger an oPE03 error, indicating a contradictory multi-function input settings).

Table 1.1 Motor Switching and Accel/Decel Time Combinations

Accel/Decel Time 1 (H1-oo = 7)	Output Frequency	Status	Motor 1 Selection	Motor 2 Selection
Open	C1-11 or above	Accel	C1-01	C1-05
Open	C1-11 or above	Decel	C1-02	C1-06
Open	less than C1-11	Accel	C1-07	C1-07
Open	less than C1-11	Decel	C1-08	C1-08
Closed	C1-11 or above	Accel	C1-03	C1-07
Closed	C1-11 or above	Decel	C1-04	C1-08
Closed	less than C1-11	Accel	C1-03	C1-07
Closed	less than C1-11	Decel	C1-04	C1-08

◆ C2: S-Curve Characteristics

Using S-curve characteristics to smooth acceleration and deceleration minimizes abrupt shock to the load. If a STo fault (Hunting Detection 2) occurs when starting a PM motor, try increasing the value set to C2-01.

■ C2-01 to C2-04: S-Curve Characters

C2-01 through C2-04 set each part of the S-curve.

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
C2-03	S-Curve Characteristic at Decel Start		
C2-04	S-Curve Characteristic at Decel End		0.00 s

The S-curve transition into and out of the active acceleration rate can be programmed independently.

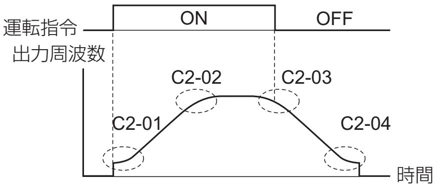


Figure 1.20 S-Curve Characteristics Timing Diagram

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

Detailed Description

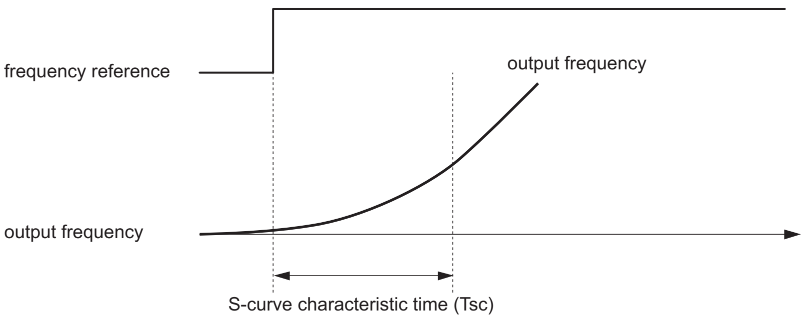


Figure 1.21 S-Curve Characteristic Timing Diagram

Acceleration and deceleration times increase with S-curve characteristics:

- Actual accel = accel time setting + (C2-01 + C2-02)/2
- Actual decel = decel time setting + (C2-03 + C2-04)/2

S-curve characteristics when switching between forward and reverse are shown in the illustration below.

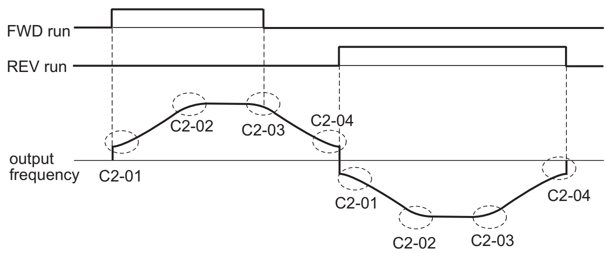


Figure 1.22 S-Curve Timing Diagram - FWD/REV Operation

◆ C3: Slip Compensation

■ C3-01: Slip Compensation Gain

This parameter is used to increase motor speed to account for motor slip by boosting the output frequency. If the speed is lower than the frequency reference, increase C3-01. If the speed is higher than the frequency reference, decrease C3-01. Although this parameter rarely needs to be changed, adjustments might be needed under the following situations:

- If the speed is lower than the frequency reference, increase C3-01.
- If the speed is higher than the frequency reference, decrease C3-01.

No.	Parameter Name	Setting Range	Default
C3-01	Slip Compensation Gain	0.0 to 2.5	Determined by A1-02

Note: Default setting is 0.0 in V/f Control (A1-02 = 0). Default setting is 1.0 in Open Loop Vector Control (A1-02 = 2). This parameter is disabled when using Simple PG in V/f (H6-01 = 3).

■ C3-02: Slip Compensation Primary Delay Time

Adjusts the filter on the output of the slip compensation function. Increase to add stability, decrease to improve response. This parameter rarely needs to be changed from its default setting.

- Decrease the setting when the slip compensation response is too slow.
- Increase this setting when the speed is not stable.

No.	Parameter Name	Setting Range	Default
C3-02	Slip Compensation Primary Delay Time	0 to 10000	Determined by A1-02

Note: When using V/f Control (A1-02 = 0), the default setting becomes 2000 ms. When using Open Loop Vector Control (A1-02 = 2), the default setting becomes 200 ms. This function is not available when using Simple PG in V/f.

■ C3-03: Slip Compensation Limit

Sets the upper limit for the slip compensation function as a percentage of the motor rated slip (E2-02).

No.	Parameter Name	Setting Range	Default
C3-03	Slip Compensation Limit	0 to 250	200%

Although the slip compensation limit is constant throughout the torque range, the following diagram shows how it works with constant torque.

Note: This parameter is disabled when using Simple PG in V/f Control (H6-01 = 3).

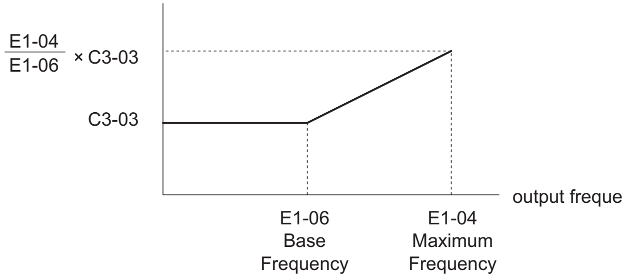


Figure 1.23 Slip Compensation Limit

■ C3-04: Slip Compensation Selection during Regeneration

When the slip compensation during regeneration function has been activated and regeneration capacity increases momentarily, it might be necessary to use a braking option (braking resistor, braking resistor unit or braking unit.)

Even if enabled, this function does not operate when output frequency is too low.

No.	Parameter Name	Setting Range	Default
C3-04	Slip Compensation Selection during Regeneration	0: Disabled 1: Enabled	0

■ C3-05: Output Voltage Limit Operation Selection

Determines if the motor flux is automatically reduced when output voltage saturation occurs.

No.	Parameter Name	Setting Range	Default
C3-05	Output Voltage Limit Operation Selection	0: Disabled 1: Enabled	0

◆ C4: Torque Compensation

■ C4-01: Torque Compensation Gain

■ C4-02: Torque Compensation Primary Delay Time

The Torque Compensation function compensates for insufficient torque production at start-up and during low speed operation. The drive will detect increases in the motor load by monitoring the output current and compensate by increasing the output voltage. The increased output voltage leads to an increase in usable torque.

Torque Compensation in V/f Control:

The drive calculates the motor primary loss voltage using the terminal resistance value (E2-05) and adjusts the output voltage to compensate insufficient torque at start and during low-speed operation. The compensation voltage is calculated by multiplying the motor primary voltage loss times parameter C4-01.

Torque Compensation in Open Loop Vector Control:

The drive calculates motor excitation current and torque producing current, controlling them separately. Torque compensation affects the torque producing current only. Torque producing current is calculated by multiplying the torque reference times C4-01.

No.	Parameter Name	Setting Range	Default
C4-01	Torque Compensation Gain	0.00 to 2.50	Determined by A1-02
C4-02	Torque Compensation Primary Delay Time	0 to 60000	Determined by A1-02

Detailed Description

Sets amount of gain for torque compensation. This parameter rarely needs to be changed, but adjustment may help in the following situations:

- Increase this setting when using a long motor cable.
- Increase when the motor is significantly smaller than the drive capacity.
- Decrease this setting when motor oscillation occurs.

Note: Adjust the range so that the output current does not exceed the drive's current rating when operating at low speeds.

C4-02 is used to the primary delay time in milliseconds for torque compensation. Although C4-02 rarely needs to be changed, adjustments can be made as follows:

- If the motor vibrates, increase C4-02
- If the motor response is sluggish (and possibly stalls), decrease C4-02.

Note: Auto-Tuning significantly improves drive performance at low speeds.

■ C4-03: Torque Compensation at Forward Start (OLV only)

Sets the amount of torque at start (when rotating forward) as a percentage of the motor rated torque. This parameter may improve the motor performance during start. This feature functions only when starting a motor in the forward direction. Torque reference and motor flux can be ramped up quickly to improve speed response during start. A setting of 0.0 disables this feature.

No.	Parameter Name	Setting Range	Default
C4-03	Torque Compensation at Forward Start	0.0 to 200.0	0.0%

■ C4-04: Torque Compensation at Reverse Start (V/f Control)

This parameter may improve the motor performance during start. This feature functions only when starting a motor in the reverse direction. Torque reference and motor flux can be ramped up quickly to improve speed response during start. A setting of 0.0 disables this feature.

No.	Parameter Name	Setting Range	Default
C4-04	Torque Compensation at Reverse Start	-200.0 to 0.0	0.0%

■ C4-05: Torque Compensation Time Constant (OLV only)

This parameter is the time delay that will be applied to the torque compensation parameters C4-03 and C4-04.

No.	Parameter Name	Setting Range	Default
C4-05	Torque Compensation Time Constant	0 to 200	10 ms

■ C4-06: Torque Compensation Primary Delay Time 2 (V/f Control)

Increase settings when acceleration is complete, or if an overvoltage fault or error occurs with sudden changes in the load. Adjustment is not normally required.

No.	Parameter Name	Setting Range	Default
C4-06	Torque Compensation Primary Delay Time 2	0 to 10000	150 ms

Note: If C4-06 is set to a relatively large value, be sure to also increase the setting in n2-03 (AFR Time Constant 2) proportionally.

◆ C5: ASR

The automatic speed regulator (ASR) provides optimum performance during changes in motor speed or load by using speed feedback.

Note: C5 parameters will appear only when using V/f Conrol (A1-02 = 0) and the Pulse Train function is set to allow Simple PG in V/f (H6-01 = 3).

No.	Parameter Name	Setting Range	Default	Page
A1-02	Control Method Selection	0: V/f Control 2: Open Loop Vector 5: PM Open Loop Vector	0	–
H6-01	Terminal RP Pulse Train Input Function Selection	Selects the function of pulse train terminal RP. 0: Frequency reference 1: PID feedback value 2: PID setpoint value 3: Motor speed when using Simple PG V/f Control (can be set only when using motor 1 in V/f Control)	0	–

The figure below illustrates how speed control works when using Simple PG in V/f.

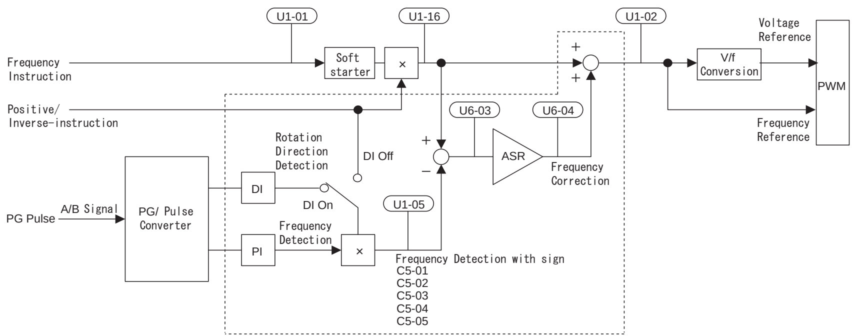


Figure 1.24 Speed Control Using Simple V/f with PG

■ C5-01/C5-03: ASR Proportional Gain 1/2 (Simple PG in V/f)

■ C5-02/C5-04:ASR Integral Time 1/2 (Simple PG in V/f)

C5-01 adjusts the speed in response to speed deviation, and softens the effect of changes in load. Speed response increases as the proportional gain is increased. However, the load may become unstable if the ASR proportional gain is set too high. ASR Proportional Gain 2 is an additional proportional gain adjustment that can be enabled by either a multi-function contact input (H1-□□ = 77) or the ASR switching frequency (C5-07).

C5-02 adjusts the drive’s response time to changes in load. Speed response increases as the integral time is decreased. However, the load may become unstable if the ASR integral time is set too low. ASR Integral Time 2 is an additional integral time adjustment that can be enabled by the ASR switching frequency (C5-07).

No.	Parameter Name	Setting Range	Default
C5-01	ASR Proportional Gain 1 (for Simple PG in V/f)	0.00 to 300.00	0.20
C5-02	ASR Integral Time 1 (for Simple PG in V/f)	0.000 to 10.000	0.200
C5-03	ASR Proportional Gain 2 (for Simple PG in V/f)	0.00 to 300.00	0.02
C5-04	ASR Integral Time 2 (for Simple PG in V/f)	0.000 to 10.000	0.050

Detailed Description

Both the proportional gain P and integral time I for ASR should be set in accordance with the minimum output frequency and the maximum output frequency.

The figure below illustrates how the proportional gain P and integral time I change linearly with motor speed.

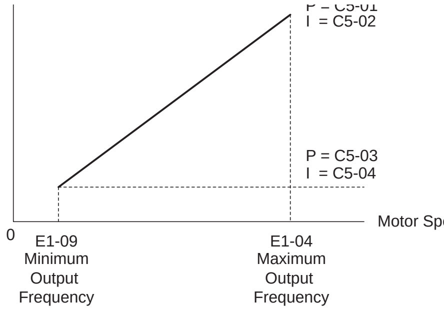


Figure 1.25 Adjusting ASR Proportional Gain and Integral Time

■ C5-05: ASR Limit

Sets ASR frequency compensation limit as a percentage of maximum output frequency (E1-04).

No.	Parameter Name	Setting Range	Default
C5-05	ASR Limit	0.0 to 20.0	5.0%

◆ C6: Carrier Frequency

■ C6-01: Drive Duty Mode Selection

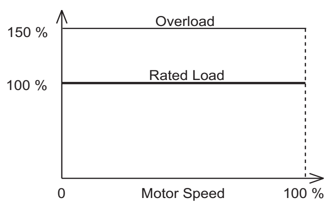
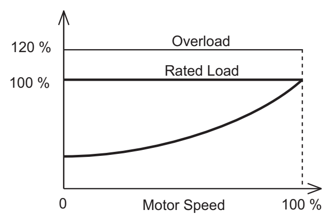
The drive has two different duty modes which must be selected based on the load characteristics. The drives rated current, overload capability and the stall prevention levels during acceleration will change depending on the duty mode selection. Heavy Duty allows over load up to 150% for 1 min, Normal Duty allows up to 120% for 1 min. but therefore the drives rated current is higher. Refer to the Specifications section in this manual for details about the rated current.

No.	Parameter Name	Setting Range	Default
C6-01	Duty Cycle	Selects the load rating for the drive. 0: Heavy Duty, HD (low carrier frequency and constant torque) 1: Normal Duty, ND (high carreir frequency and derated torque)	1

Detailed Description

Set the drive for the type of load using parameter C6-01 (Duty Cycle). The factory setting is Normal Duty

Heavy Duty (HD) vs. Normal Duty (ND) Mode Selections

Mode	Heavy Duty Rating (HD)	Normal Duty Rating (ND)
C6-01	0	1
Characteristics		
Application	Use Heavy Duty Rating is designed applications requiring a high overload tolerance with constant load torque. Such applications include extruders, conveyors and cranes.	Use Normal Duty Rating for applications in which the torque requirements drop along with the speed. Examples include fans or pumps where a high overload tolerance is not required.
Over load capability (OL2)	150% of drive rated current for 60 s	120% of drive rated current for 60 s
L3-02 Stall Prevention during Acceleration	150%	120%
L3-06 Stall Prevention during Run	150%	120%

Setting varies based on the carrier frequency selection (L8-38).

■ C6-02: Carrier Frequency Selection

Parameter C6-02 sets the switching frequency of the drive's output transistors. It can be changed in order to reduce audible noise and also reduce leakage current.

No.	Parameter Name	Setting Range	Default
C6-02	Carrier Frequency Selection	1: 2.0 kHz 2: 5.0 kHz 3: 8.0 kHz 4: 10.0 kHz 5: 12.5 kHz 6: 15.0 kHz 7: Swing PWM1 8: Swing PWM2 9: Swing PWM3 A: Swing PWM4 F: User defined (C6-03 to C6-05)	Determined by the control method (A1-02) and drive capacity (o2-04). Reset when C6-01 is changed.

Note: Swing PWM uses low carrier frequency but by applying special PWM patterns the audible noise of the motor is kept low.

Detailed Description

Use the following guideline to set up the carrier frequency:

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

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

Wiring Distance	Up to 50 m	Up to 100 m	Greater than 100 m
C6-02 (Carrier Frequency Selection)	0 to 6 (15 kHz)	0 to 4 (10 kHz)	1, 7 to A (2 kHz)

Note: If the motor cable is fairly long when using PM Open Loop Vector, set the carrier frequency to 2 kHz (C6-02 = 1). Switch to V/f Control if the cable is longer than 100 m.

Note: Settings 7 through A use “Swing PWM”, equivalent to setting 2 kHz. This function turns the motor noise into less obtrusive white noise. The upper limit for the carrier frequency is determined by drive capacity. A high carrier frequency is fine when using the drive is set for Normal Duty. When setting the carrier frequency higher than the default value with the drive set for Normal Duty, be sure to lower the setting for the drive's output current. For more details on how to lower this setting, please contact Yaskawa.

■ C6-03: Carrier Frequency Upper Limit

■ C6-04: Carrier Frequency Lower Limit

■ C6-05: Carrier Frequency Proportional Gain

The upper and lower limits for the carrier frequency can be set when using V/f Control to operate the drive. To set the upper and lower limits, first make sure that C6-02 = F.

Note: The carrier frequency is can be adjusted only when using V/f Control.

No.	Parameter Name	Setting Range	Default
C6-03*	Carrier Frequency Upper Limit	1.0 kHz to 15.0 kHz	Determined by C6-02
C6-04*	Carrier Frequency Lower Limit	1.0 kHz to 15.0 kHz	
C6-05	Carrier Frequency Proportional Gain	0 to 99	

The default value is determined by the control method (A1-02) as well as the drive capacity (o2-04), and is reinitialized when the value set to C6-01 is changed.

Detailed Description

In V/f Control the carrier frequency can be set up to change linearly with the output frequency. In this case the upper and lower limits for the carrier frequency and the carrier frequency proportional gain (C6-03, C6-04, C6-05) have to be set up like shown *Figure 1.27*.

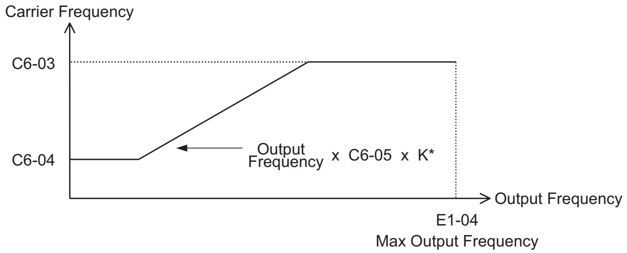


Figure 1.26 Carrier Frequency Changes Relative to Output Frequency

K is a coefficient determined by the value of C6-03.
C6-03 greater than or equal to 10.0 kHz: K=3
10.0 kHz > C6-03 greater than or equal to 5.0 kHz: K=2
5.0 kHz > C6-03: K=1

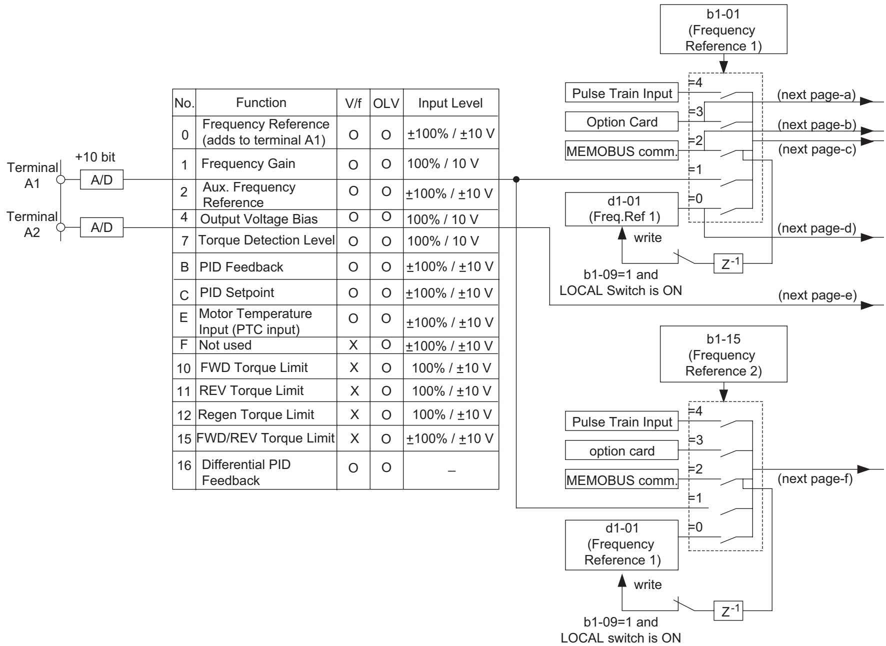
Note: A carrier frequency error (oPE11) will occur when the carrier frequency proportional gain is greater than 6 while C6-03 is less than C6-04.

Table 1.2 Carrier Frequency Default Values

CIMR-V□	C6-02: Carrier Frequency Selection	C6-03: Carrier Frequency Upper Limit (kHz)
Single-Phase 200 V Class: Normal Duty Rating (ND)		
B0001	7 (Swing PWM1)	2.0
B0002	7 (Swing PWM1)	2.0
B0003	7 (Swing PWM1)	2.0
B0006	7 (Swing PWM1)	2.0
B0010	7 (Swing PWM1)	2.0
B0012	7 (Swing PWM1)	2.0
B0020	7 (Swing PWM1)	2.0
Single-Phase 200 V Class: Heavy Duty Rating (HD)		
B0001	4 (10.0 kHz)	10.0

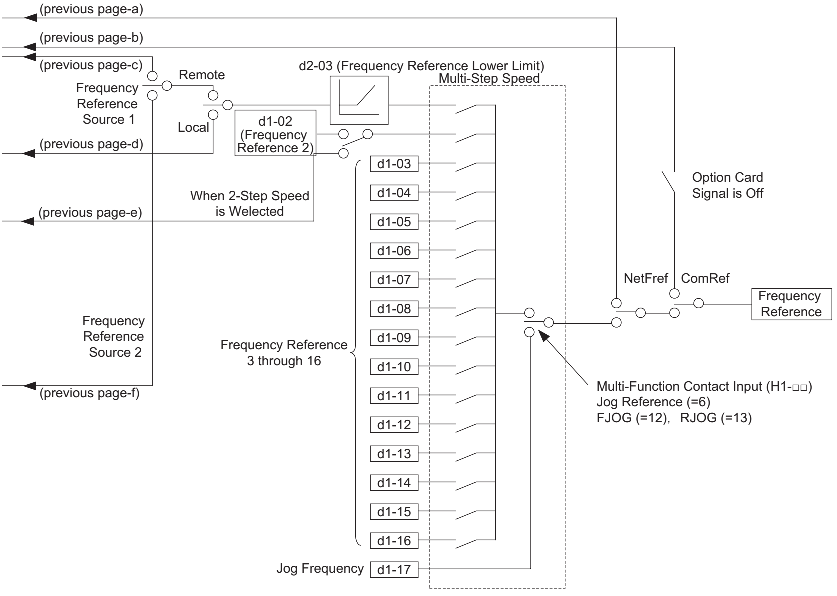
1.4 d: Reference Settings

Sets the various references the drive uses to control the motor. The following figure shows how the various frequency references work.



No.	Function	V/f	OLV	Input Level
0	Frequency Reference (adds to terminal A1)	O	O	±100% / ±10 V
1	Frequency Gain	O	O	100% / 10 V
2	Aux. Frequency Reference	O	O	±100% / ±10 V
4	Output Voltage Bias	O	O	100% / 10 V
7	Torque Detection Level	O	O	100% / 10 V
B	PID Feedback	O	O	±100% / ±10 V
C	PID Setpoint	O	O	±100% / ±10 V
E	Motor Temperature Input (PTC input)	O	O	±100% / ±10 V
F	Not used	X	O	±100% / ±10 V
10	FWD Torque Limit	X	O	100% / ±10 V
11	REV Torque Limit	X	O	100% / ±10 V
12	Regen Torque Limit	X	O	100% / ±10 V
15	FWD/REV Torque Limit	X	O	±100% / ±10 V
16	Differential PID Feedback	O	O	–

Figure 1.27 Frequency Reference Setting Hierarchy



◆ d1: Frequency Reference

■ d1-01 to d1-16: Frequency Reference 1 to 16

■ d1-17: Jog Frequency Reference

Up to 17 preset references (including Jog Reference) can be set through multi-function inputs S3 to S8.

No.	Parameter Name	Setting Range	Default
d1-01 to d1-16	Frequency Reference 1 to 16	0.00 to 400.00*	0.00 Hz
d1-17	Jog Frequency Reference	0.00 to 400.00*	6.00 Hz

Note: The upper limit is determined by the maximum outupt frequency (E1-04) and upper limit for the frequency reference (d2-01).

Detailed Description

To set up 17 separate steps for the speed reference, assign Multi-Step Speed functions to H1-01 to H1-07 (these parameters control the functions set to terminals S1 to S7).

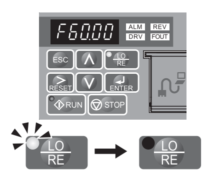
Note: Terminal S5 needs to be set for Multi-Step Speed 1 (H1-05 = 3), and terminal S6 needs to be set for Multi-Speed Step 2 (H1-06 = 4). To have the drive accelerate as shown in the Multi-Step Speed operation shown in this section, parameters need to be changed from their default values as described. Because the Jog Frequency is already assigned to terminal S7 as a default (H1-07 = 6), this setting does not need to be changed.

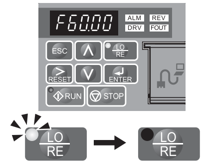
The drive is defaulted for a 2-step speed operation via the analog input terminals. To enable Multi-Step Speed 1 and 2, set the drive as shown below.

No.	Parameter Name	Setting Range	Default	Page
b1-01	Frequency Reference Selection	0 to 4	1	–
H3-10	Terminal A2 Function Selection	0 to 31	0	–

Procedure

Follow the directions below to set the drive up for Multi-Step Speed operation (allows 17 steps). The example assumes the drive is operating in REMOTE mode using an analog signal.

Step			Display/Result
1.	Power up the drive. Assign the source of the frequency reference to the LED operator (b1-02 = 1). The run command should already be defaulted to the control circuit terminal (b1-02 = 1) Set multi-function analog input terminal A2 to “Not Used” (H3-10 = F)	⇒	
2.	Set the desired frequencies to d1-01 through d1-16.		
3.	Set the desired Jog Frequency value to d1-17.		
4.	Set multi-function input terminals S3 through S6 for Multi-Step Speed 1 to 4 (H1-03 = 3, H1-04 = 4, H1-05 = 5, H1-06 = 32)..		
5.	After setting frequency refrences, press ESC to scroll back to the main screen. The DRV LED should light.	⇒	
6.	Press LO/RE to select REMOTE. The LO/RE light will come on.	⇒	

Step			Display/Result
7.	The drive will run the motor at the frequencies set to parameters d1-01 through d1-17, selecting each frequency reference according to the switching combination of multi-function input terminals S3 through S7. This allows for 17 separate speed steps (including the Jog Frequency).	⇒	

Different frequency references can be given to the drive through various switching combinations of multi-function input terminals S3 through S7. Below is a list of the possible combinations.

Table 1.3 Multi-Step Speed Reference and Terminal Switch Combinations

d1-01 to d1-17	Multi-Step Speed	Multi-Step Speed 2	Multi-Step Speed 3	Multi-Step Speed 4	Jog Reference	Reference
1	OFF	OFF	OFF	OFF	OFF	Frequency Reference 1 (d1-01)
2	ON	OFF	OFF	OFF	OFF	Frequency Reference 2 (d1-02)
3	OFF	ON	OFF	OFF	OFF	Frequency Reference 3 (d1-03)
4	ON	ON	OFF	OFF	OFF	Frequency Reference 4 (d1-04)
5	OFF	OFF	ON	OFF	OFF	Frequency Reference 5 (d1-05)
6	ON	OFF	ON	OFF	OFF	Frequency Reference 6 (d1-06)
7	OFF	ON	ON	OFF	OFF	Frequency Reference 7 (d1-07)
8	ON	ON	ON	OFF	OFF	Frequency Reference 8 (d1-08)
9	OFF	OFF	OFF	ON	OFF	Frequency Reference 9 (d1-09)
10	ON	OFF	OFF	ON	OFF	Frequency Reference 10 (d1-10)
11	OFF	ON	OFF	ON	OFF	Frequency Reference 11 (d1-11)
12	ON	ON	OFF	ON	OFF	Frequency Reference 12 (d1-12)
13	OFF	OFF	ON	ON	OFF	Frequency Reference 13 (d1-13)
14	ON	OFF	ON	ON	OFF	Frequency Reference 14 (d1-14)

d1-01 to d1-17	Multi-Step Speed	Multi-Step Speed 2	Multi-Step Speed 3	Multi-Step Speed 4	Jog Reference	Reference
15	OFF	ON	ON	ON	OFF	Frequency Reference 15 (d1-15)
16	ON	ON	ON	ON	OFF	Frequency Reference 16 (d1-16)
17 Jog	–	–	–	–	ON	Jog Frequency Reference (d1-17)*

Note: The Jog Frequency overrides whatever frequency reference is being used.

Note the following when using the Multi-Step Speed function:

- As shown in the table above, it is possible to use analog inputs in place of Frequency Reference 1 and 2.
- If b1-01 = 1, then the analog input A1 will be used instead of Frequency Reference 1 (d1-01) for the first preset speed.
- If b1-01 = 0 then Frequency Reference 1 (d1-01) will be used.
- When H3-10 = 2, then the value input to terminal A2 will be used as the Multi-Step Speed 2 instead of the value set to parameter d1-02. When H3-10 does not equal 2, then d1-02 becomes the reference for Multi-Step Speed 2.

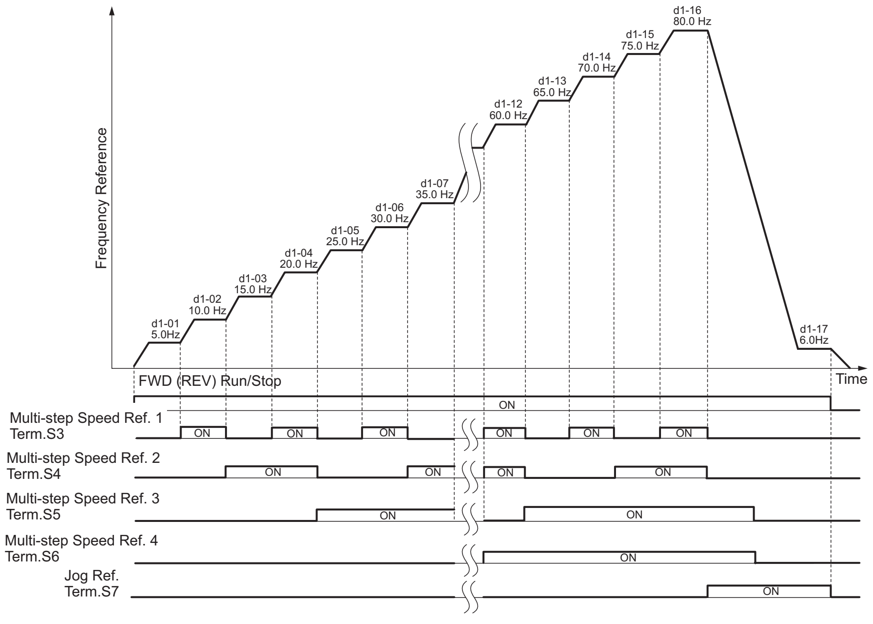


Figure 1.28 Preset Reference Timing Diagram

◆ d2: Frequency Upper/Lower Limits

By entering upper or lower frequency limits, the drive programmer can prevent operation of the Drive above or below levels that may cause resonance and or equipment damage.

■ d2-01: Frequency Reference Upper Limit

Sets the highest frequency that the motor is able to rotate at. This limit applies to all frequency references.

Parameter d2-01 is set as a percentage of the maximum output frequency. 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 lowest frequency that the motor is able to rotate at. This limit applies to all frequency references.

Determines the minimum frequency that the drive can output as a percentage of the maximum output frequency.

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

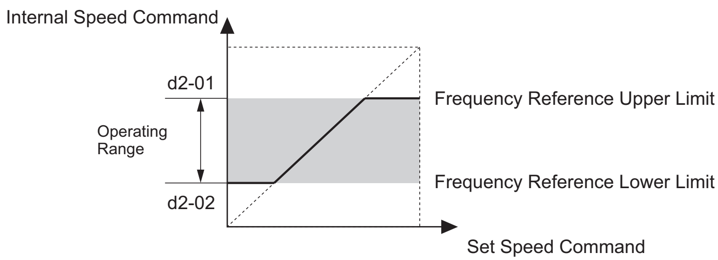


Figure 1.29 Frequency Reference: Upper and Lower Limits

■ d2-03: Master Speed Reference Lower Limit

Unlike frequency reference lower limit (d2-02) which will affect the frequency reference no matter where it is sourced from (i.e., analog input, preset speed, Jog speed, etc.), the frequency reference lower limit (d2-03) sets a low speed threshold that will only affect the analog input (terminals A1 and A2) that is the active master speed frequency.

Set as a percentage of the maximum output frequency.

Note: The lower limits for the Jog frequency, multi-step speed settings, and 2-step speed settings do not change. When lower limits are set to both the frequency reference (d2-02) and the main frequency reference (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

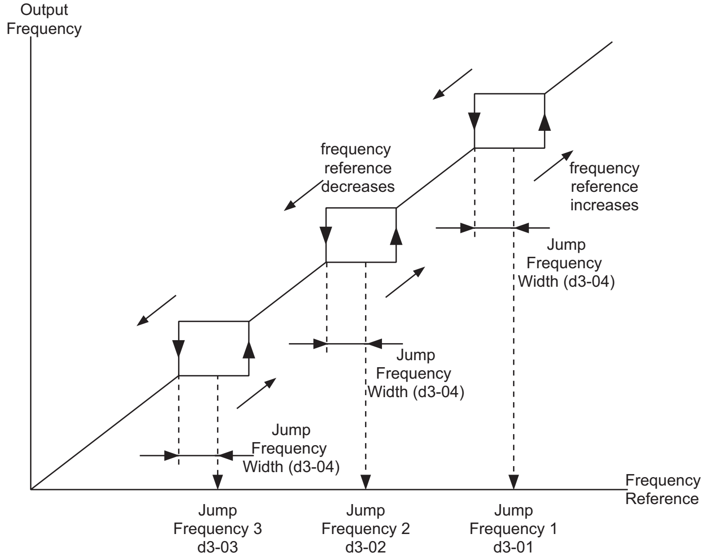
■ d3-04: Jump Frequency Width

In order to avoid continuous operation at a speed that causes resonance in driven machinery, the drive can be programmed with Jump Frequencies that will not allow continued operation within specific frequency ranges. If a speed is commanded that falls within a dead band, or Jump Frequency, the drive will clamp the frequency reference just below the dead band and only accelerate past it when the commanded speed rises above the upper end of the dead band, for increasing references.

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

Detailed Description

The figure below shows the relationship between the Jump Frequency and the output frequency.



Note: The drive will not operate within the specified deadband range for the Jump Frequency. Although the drive quickly accelerates (or decelerates) the motor through the Jump Frequency frequency range, it still maintains the accel/decel times sets to C1-01 and C1-02. When using more than one Jump Frequency, make sure that d3-01 is greater than or equal to d3-02 is greater than or equal to d3-03. Setting parameters d3-01 to d3-03 to 0 essentially disables the Jump Frequency.

◆ d4: Frequency Reference Hold

Determines how bias values affect the frequency reference, and also whether or not the frequency reference is saved when the power is shut off.

■ d4-01: Frequency Reference Hold Function Selection

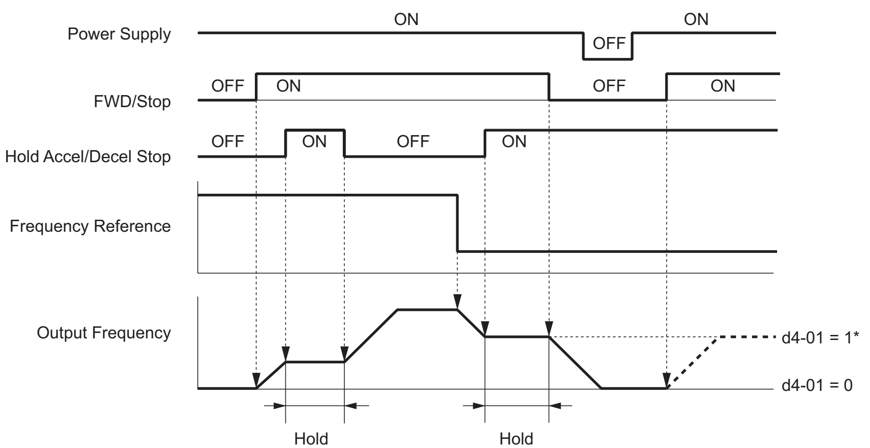
This function is available when the multi-function inputs “accel/decel ramp hold” or “Up/ Down” commands are selected (H1-☐☐ = A or 10 and 11). Determines whether or not the frequency reference is saved when the power supply is shut off.

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

Detailed Description

0	Disabled: Starts the motor from 0.
1	Enabled: Starts the motor from the last frequency reference the drive was given before the power was shut off.

Note: Enabled when the multi-function inputs are assigned for “Accel/Decel Ramp Hold” or "Up/Down" (H1-☐☐ = A or 10 and 11). When d4-01 = 1, the drive will save the frequency reference if the power goes out and then start back up and at that frequency reference as soon as the next Run command is entered. When d4-01 = 1 when the drive is shut off, it will save the frequency reference at that time, then accelerate back up to that frequency the next time the drive is turned back on and a new Run command is issued. To clear the frequency reference that was saved, an Up command or Down command must be entered while the Run command is still off. When d4-01 = 1, the drive will accelerate up to the Up 2 or Down 2 Hold Frequency that was saved befeore the power supply was interrupted the next time the Run command is entered. To reset this frequency, enter a new UP 2 or Down 2 reference while the Run command is still off. Both the Up/Down and Up 2 / Down 2 commands cannot be assigned to the multi-function input terminals at the same time. Doing so will trigger an oPE03 error, which indicates a contradiction set to the multi-function terminals. The drive will no longer be able to decelerate the motor if a Accel/Decel Ramp Hold command is entered during deceleration.



■ d4-03: Frequency Reference Bias Step (Up/Down 2)

Sets the amount to add or subtract from the frequency reference.

No.	Parameter Name	Setting Range	Default
d4-03	Frequency Reference Bias Step (Up/Down 2)	0.00 to 99.99	0.00 Hz

Detailed Description

d4-03 = 0.00

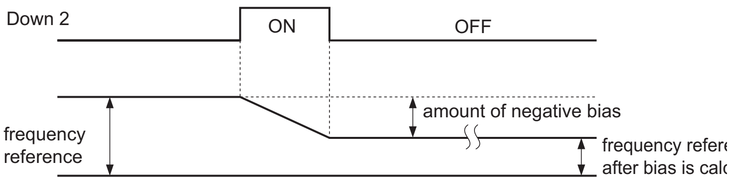
While the Up 2 or Down 2 command is enabled, the bias set to d4-04 will be added (or subtracted) to the frequency reference. Here, the accel/decel times set to the C1 parameters are disregarded.

If d4-03 is set to any value higher than 0.00:

While the terminal assigned to Up 2 or Down 2 is closed, the value set to d4-03 will be added to the speed. After five seconds, the bias value is added (or subtracted) to the frequency reference. This new frequency reference is kept even after the Up 2 or Down 2 command is released. Parameter d4-04 determines the rate at which the drive accelerates or decelerates after the Up 2 or Down 2 command has been added to the frequency reference.

Note: To add a positive bias, when the Up 2 command is enabled (i.e., the switch is closed), it is added to the acceleration rate.

To add a negative bias:



Note: Down 2 is enabled as long as the terminal to which it is assigned is closed. During this time, the value set for Down 2 will be added to the deceleration rate.

■ d4-04: Frequency Reference Accel/Decel(Up/Down 2)

Determines the bias added to the acceleration and deceleration times.

No.	Parameter Name	Setting Range	Default
d4-04	Frequency Reference Accel/Decel (Up/Down 2)	0, 1	0

Detailed Description

0	Adjusts the bias value according to the currently select accel/decel time.
1	Adjusts the bias value by Accel/Decel Time 4 (C1-07 and C1-08).

■ d4-05: Frequency Reference Bias Operation Mode Selection (Up/Down 2)

Determines the frequency reference bias operation when d4-03 is set to 0.00.

No.	Parameter Name	Setting Range	Default
d4-05	Frequency Reference Bias Operation Mode Selection (Up/Down 2)	0, 1	0

Detailed Description

0	Holds the bias value when Up/Down 2 reference is on or off.
1	When the Up 2 reference and Down 2 reference are both on or both off, the frequency reference bias becomes 0. Final reference accelerates or decelerates at the time selected.

Note: Enabled only when d4-03 = 0.

■ d4-06: Frequency Reference Bias (Up/Down 2)

Sets the bias to add or subtract to the frequency reference.

No.	Parameter Name	Setting Range	Default
d4-06	Frequency Reference Bias (Up/Down 2)	-99.9 to 100.0	0.0%

Detailed Description

Set d4-06 as a percentage of the maximum output frequency (E1-04).

The conditions below will disable d4-06:

- When the Up/Down 2 function has not been assigned to the multi-function terminals
- When the frequency reference has been changed (this includes any changes made using the multi-function terminals)
- If d4-03 = 0 Hz and d4-05 = 1 at the same time, then terminals set for the Up 2 and Down 2 functions will both open or both close
- Any changes to the maximum frequency set to E1-04
- Any changes to the digital frequency reference value

■ d4-07: Analog Frequency Reference Fluctuation Limit (Up/Down 2)

This parameter is for handling excessive fluctuation in the frequency reference while the terminal set for Up 2 or Down 2 is closed. If the frequency reference fluctuates passed the level set to d4-07, then the bias value will be held, and the drive will accelerate or decelerate back to the frequency reference. Once Speed Agree is achieved, the bias will be applied again to the frequency reference. Parameter d4-07 is applicable for both an analog frequency reference and when the frequency reference is provided via the Pulse Train input.

No.	Parameter Name	Setting Range	Default
d4-07	Analog Frequency Reference Fluctuation Limit (Up/Down 2)	0.1 to 100.0	1.0%

■ d4-08: Frequency Reference Upper Limit (Up/Down 2)

Parameter d4-08 becomes the upper limit for the bias when d4-08 is greater than d4-06. Set as a percentage of the maximum output frequency (E1-04).

No.	Parameter Name	Setting Range	Default
d4-08	Frequency Reference Upper Limit (Up/Down 2)	0.0 to 100.0	0.0%

■ d4-09: Frequency Reference Lower Limit (Up/Down 2)

Parameter d4-09 becomes the lower limit for the bias when d4-09 is less than d4-06.

No.	Parameter Name	Setting Range	Default
d4-09	Frequency Reference Lower Limit (Up/Down 2)	-99.9 to 0.0	0.0%

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

Parameter Overview

No.	Name	Description	Range	Default
d4-10	Up/Down Frequency Reference Limit Selection	Selects which value is used as frequency reference lower limit if the Up/Down function is used. 0: The lower limit is determined by d2-02 or analog input (H3-02/10 = 0). The higher of both values becomes the reference limit. 1: The lower limit is determined by d2-02.	0 or 1	0

■ d4-11: Bi-Directional Output Selection (YEG Only)

Parameter Overview

No.	Name	Description	Range	Default
d4-11	Bi-directional Output Selection	Enables or disables conversion of frequency reference or PID output value into bi-directional internal frequency reference. 0: Disabled - 0 to 100% reference or PID output: Operation in selected direction 1: Enabled - < 50% reference or PID output: Reverse operation > 50% reference or PID output: Operation in selected direction	0 or 1	0

■ d4-12: Stop Position Gain

Parameter Overview

No.	Name	Description	Range	Default
d4-12	Stop Position Gain	Sets the gain used by the simple positioning stop function to fine adjust the position.	0.50 to 2.55	1.00

◆ d7: Offset Frequencies

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

These parameters are for fine-tuning the frequency reference as needed by machine tool applications. When a multi-function input terminal programmed for an Offset Frequency closes, a bias is added to the frequency reference.

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%

Setting	Function Name	Page
44	Offset Frequency 1 Calculations	-
45	Offset Frequency 2 Calculations	-
46	Offset Frequency 3 Calculations	-

Multi-Function Inputs H1-01 to H1-07

Detailed Description

The figure below illustrates how multi-function input terminal settings operate.

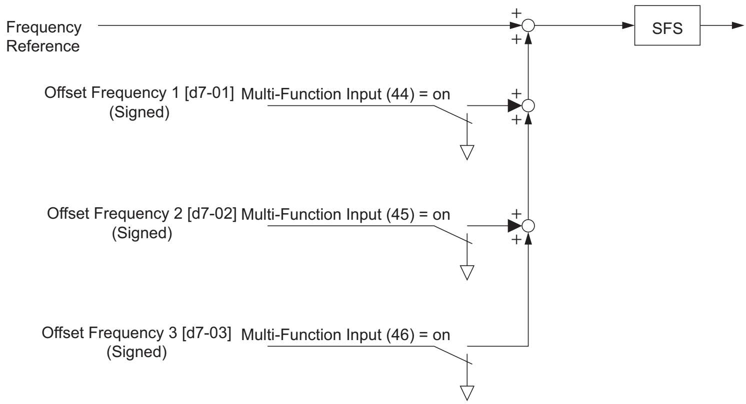


Figure 1.30 Offset Frequency Operation

When two signals from d7-01 through d7-03 differ in sign, the +/- Speed function can be used.

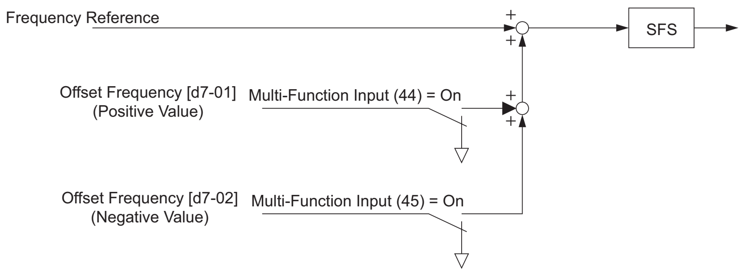


Figure 1.31 Offset Frequency and ± Speed Timing

1.5 E: Motor Parameters

E parameters cover motor related settings.

◆ E1: V/f Characteristics

■ E1-01: Input Voltage Setting

Set the input voltage parameter to the nominal voltage of the connected AC power supply. This parameter adjusts the levels of some protective features of the drive (i.e., overvoltage, Stall Prevention, etc.).

No.	Parameter Name	Setting Range	Default
E1-01	Input Voltage Setting	155 to 255	200 V

Note: The setting range shown here is for 200 V class drives. Double this value when working with 400 V class units.

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

Detailed Description

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

Voltage	Setting Value of E1-01	OV Detection Level (approx.)	BTR Operation Level (approx.)	UV Detection Level (L2-05)	Desired DC Bus Voltage during KEB (L2-11)	Voltage Level for OV Suppression, Stall Prevention (L2-17)
200 V Class	all settings	410 V	394 V	190 V (single phase = 160 V)	240 V	370 V
400 V Class	setting greater than or equal to 400 V	820 V	788 V	380 V	480 V	740 V
	setting < 400 V	740 V	708 V	350 V	440 V	660 V

Note: This data is for an internal dynamic braking resistor of 0.1 to 18.5 kW. For larger units, see “Dynamic Braking Resistor Unit for VARISPEED-600 Series, TOBPC720600000”

■ E1-03: V/f Pattern Selection

■ E1-04 to E1-13

This parameter is only available when using V/f Control. It allows the user to set the V/f pattern and drive input voltage as needed. When running a high-speed or other type of special-purpose motor, this function can be used to fine-tune the amount of torque needed for the load.

No.	Parameter Name	Setting Range	Default
E1-03	V/f Pattern Selection	0 to F	F (user-set)*

*This parameter is not reset when the drive is initialized with A1-03.

Table 1.4 V/f Pattern

Setting	Specification	Characteristic	Application
0	50 Hz	Constant torque	For general purpose applications. Torque remains constant regardless of changes to speed.
1 (F)	60 Hz		
2	60 Hz (with 50 Hz base)		
3	72 Hz (with 60 Hz base)		
4	50 Hz, Heavy Duty 2	Derated torque	For fans, pumps, and other applications that require torque derating relative to the load.
5	50 Hz, Heavy Duty 1		
6	50 Hz, Heavy Duty 1		
7	50 Hz, Heavy Duty 2		
8	50 Hz, mid starting torque	High starting torque	Select high starting torque when: Wiring between the drive an motor exceeds 150 m A large amount of starting torque is required AC Reactor is installed The motor exceeds the largest recommended motor for the drive.
9	50 Hz, high starting torque		
A	60 Hz, mid starting torque		
B	60 Hz, high starting torque		
C	90 Hz (with 60 Hz base)	Constant output	When operating at greater than 60 Hz. This requires that constant voltage be application.
D	120 Hz (with 60 Hz base)		
E	180 Hz (with 60 Hz base)		

Detailed Description

The drive operates utilizing a set V/f pattern to determine the appropriate output voltage level for each commanded speed. There are 15 different preset V/f patterns to select from with varying voltage profiles, saturation levels (frequency at which maximum voltage is reached), and maximum frequencies. There are also settings for custom V/f patterns that will allow the programmer to manually set the V/f pattern using parameters E1-04 through E1-10.

Using parameter E1-03, the programmer can select one of the preset V/f patterns or chose between a custom V/f pattern with an upper voltage limit (E1-03 = “F: Custom V/f”).

No.	Name	Setting Range	Default
E1-04	Max Output Frequency (FMAX)	40.0 to 400.0	*2, *3, *4

1.5 E: Motor Parameters

No.	Name	Setting Range	Default
E1-05	Max Voltage (VMAX)	0.0 to 255.0*1	*2, *3, *4
E1-06	Bass Frequency (FA)	0.0 to 400.0	*2, *3, *4
E1-07	Mid Output Frequency (FB)	0.0 to 400.0	*2, *3
E1-08	Mid Output Frequency Voltage (VC)	0.0 to 255.0 *1	*2, *3
E1-09	Minimum Output Frequency (FMIN)	0.0 to 400.0	*2, *3, *4
E1-10	Minimum Output Frequency Voltage (VMIN)	0.0 to 255.0 *1	*2, *3
E1-11	Mid Output Frequency 2	0.0 to 400.0	0.0 Hz
E1-12	Mid Output Frequency Voltage 2	0.0 to 255.0 *1	0.0 V
E1-13	Base Voltage (VBASE)	0.0 to 255.0 *1	0.0 V

* 1. Values shown here are for 200 V class drives. Double the value when using a 400 V class unit.
* 2. Default setting is determined by the control mode (value shown here is for V/f Control).
* 3. Default setting varies based on the V/f pattern set to E1-03.
* 4. When using PM Open Loop Vector, the default setting is determined by the motor code set to E5-01.

Setting Instructions

1. Set the input voltage for the drive. For instructions, see page 133.
2. Choose one of the two following V/f patterns:

   Select one of the 15 preset V/f patterns (setting = 0 through E)

   Custom V/f pattern (setting = F)
3. When using one of the preset patterns, the parameters listed below are set automatically. When using a custom V/f pattern, set these parameters as desired:
   E1-04 (Max Output Frequency), E1-05 (Max Voltage), E1-06 (Base Frequency), E1-07 (Mid Output Frequency, E1-08 (Mid Output Frequency Voltage), E1-09 (Min Output Frequency), E1-10 (Min Output Frequency Voltage)
4. Settings for the E1 parameters are determined by drive capacity. Drive capacities are divided into the two following ranges:

   V/f pattern for 0.1 to 3.7 kW drives

   V/f pattern for 5.5 to 18.5 kW drives

The user can select one of 15 preset V/f patterns (setting = 0 through E) or decide to set a customized V/f pattern (setting = F). By selecting one of the 15 presets (settings 0 through E), the drive will automatically set the parameters listed in the table below.

E1-09 less than or equal to E1-07 less than or equal to E1-06 less than or equal to E1-11 less than or equal to E1-04

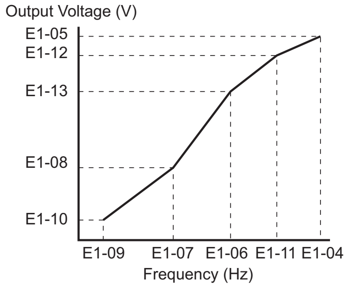


Figure 1.32 V/f Pattern

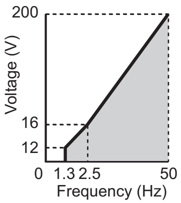
Note: When the drive is initialized using parameter A1-03, the setting of E1-03 is unaffected but the settings of E1-04 through E1-13 are returned to their default settings.

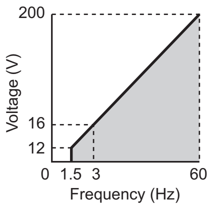
V/f Patterns for 0.1 to 3.7 kW Drives

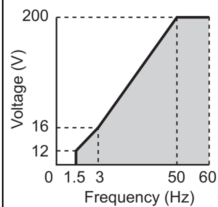
The following graphs are for 200 V class drives. Double values when using a 400 V class unit.

Table 1.5 Constant Torque Characteristics, Settings 0 to 3

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







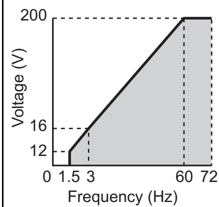
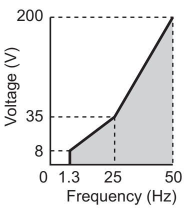
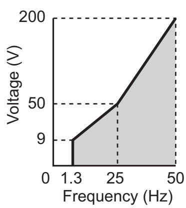
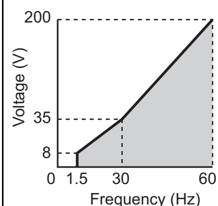


Table 1.6 Derated Torque Characteristics, Settings 4 to 7

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







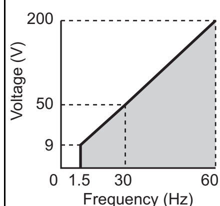
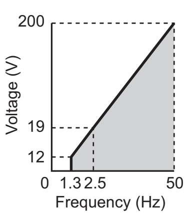
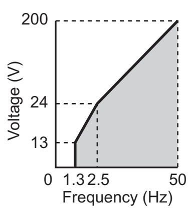
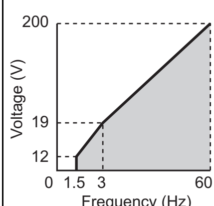


Table 1.7 High Starting Torque, Settings 8 to B

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







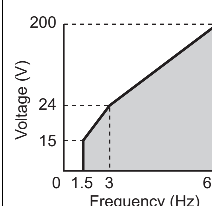
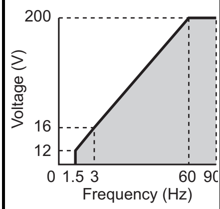
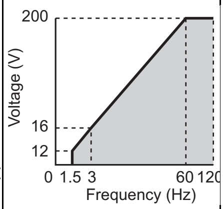
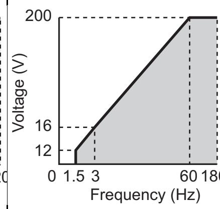
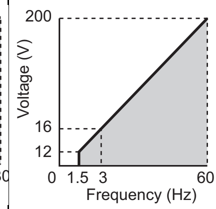


Table 1.8 Rated Output Operation, Settings C to F

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

V/f Patterns for 5.5 to 18.5 kW Drives

The following graphs are for 200 V class drives. Double values when using a 400 V class drive.

Table 1.9 Rated Torque Characteristics, Settings 0 to 3

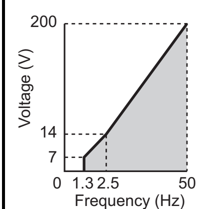
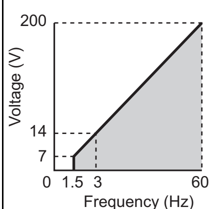
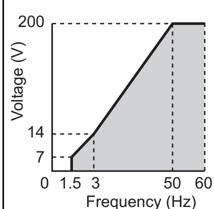
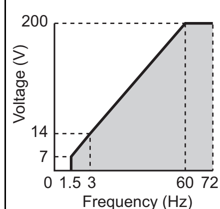
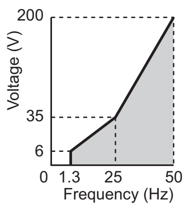
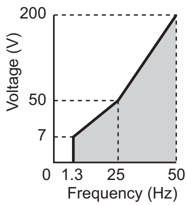
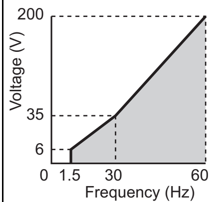
Setting = 0	50 Hz	Setting = 1	60 Hz	Setting = 2	60 Hz	Setting = 3	72 Hz
							

Table 1.10 Derated Torque Characteristics, Settings 4 to 7

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







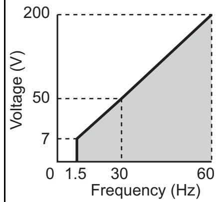
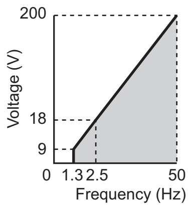
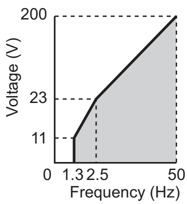
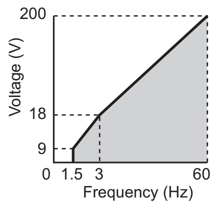


Table 1.11 High Starting Torque, Settings 8 to B

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







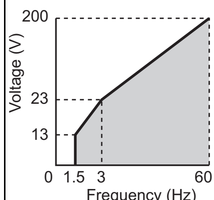
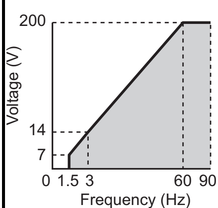
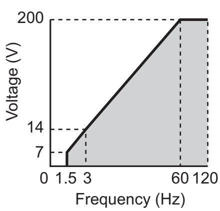
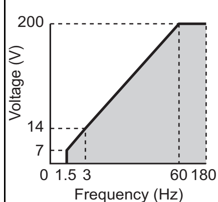


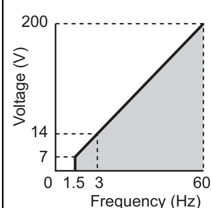
Table 1.12 Constant Output, Settings C to F

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









Note: Increasing the voltage in the V/f pattern increases the available motor torque. However, when setting a custom V/f pattern,increase the voltage gradually while monitoring the motor current, to prevent drive faults as a result of motor over-excitation and motor overheating or excessive vibration

◆ E2: Motor Parameters

These parameters are set automatically when Auto-Tuning is performed for Open Loop Vector Control. If Auto-Tuning is possible, then these parameters can also be set manually.

■ E2-01: Motor Rated Current

The motor rated current parameter E2-01 is used by the drive to protect the motor for proper performance of Open Loop Vector Control (A1-02 = 2). Set E2-01 to the full load amps (FLA) stamped on the motor nameplate. During Auto-Tuning, the technician must enter the motor rated current to parameter T1-04. If Auto-Tuning completes successfully, the value entered into T1-04 will automatically be saved to E2-01.

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

Note: Set the lower and higher digits to the value corresponds to the capacity of the drive: 11 kW or less: Sets the lower 2 digits, 11 kW or higher: Set to the lowest digit

■ E2-02: Motor Rated Slip

Sets the motor rated slip in Hz. This value is automatically set during rotational Auto-Tuning.

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

Calculate the motor rated slip using the information written on the motor nameplate and the formula below:

fs = f - (N x P) / 120

fs: slip frequency (Hz)

f: rated frequency (Hz)

N: rated motor speed (r/min)

P: number of motor poles

■ E2-03: Motor No-Load Current

Set E2-03 to the motor no-load current at rated voltage and rated frequency. If Rotational Auto-Tuning completes successfully, this value is automatically calculated. Consult with the motor manufacturer for the proper value if the no-load current is not stated on the motor nameplate.

No.	Name	Setting Range	Default
E2-03	Motor No-Load Current	Between 0 and [E2-01]	Determined by o2-04

Note: Set the lower and higher digits to the value corresponds to the capacity of the drive: 11 kW or less: Sets the lower 2 digits, 11 kW or higher: Set to the lowest digit

■ E2-04: Number of Motor Poles

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

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

■ E2-05: Motor Line-to-Line Resistance

Sets the line-to-line resistance of the motor's stator winding. If the Auto-tuning completes successfully, this value is automatically calculated. Remember this value must be entered as line-line and not line-neutral.

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

Note: The setting range becomes 0.00 to 130.00 when using less than a 0.2 kW motor.

If Auto-Tuning is not possible, then contact the motor manufacturer to find out the line-to-line resistance. The resistance between lines can also be calculated using the formula below. This data can be obtained from the Motor Test Report.

- E-type insulation: Multiply 0.92 times the resistance value (W) listed on the Test Report at 75°C
- B-type insulation: Multiply 0.92 times the resistance value (W) listed on the Test Report at 75°C.
- F-type insulation: Multiply 0.87 times the resistance value (W) listed on the Test Report at 115°C.

■ E2-06: Motor Leakage Inductance

Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. If Rotational Auto-Tuning completes successfully, then this value is automatically calculated.

No.	Parameter Name	Setting Range	Default
E2-06	Motor Leakage Inductance	0.0 to 40.0	Determined by o2-04

■ E2-07: Motor Iron-Core Saturation Coefficient 1

This parameter sets the motor iron saturation coefficient at 50% of the magnetic flux. If Rotational Auto-Tuning completes successfully, then this value is automatically calculated.

No.	Parameter Name	Setting Range	Default
E2-07	Motor Iron-Core Saturation Coefficient 1	0.00 to 0.50	0.50

■ E2-08: Motor Iron-Core Saturation Coefficient 2

This parameter sets the motor iron saturation coefficient at 75% of the magnetic flux. If Rotational Auto-Tuning completes successfully, then this value is automatically calculated.

No.	Parameter Name	Setting Range	Default
E2-08	Motor Iron-Core Saturation Coefficient 2	E2-07 to 0.75	0.75

■ E2-09: Motor Mechanical Loss

This parameter sets to the motor mechanical loss as a percentage of motor rated power (kW) capacity.

No.	Parameter Name	Setting Range	Default
E2-09	Motor Mechanical Loss	0.0 to 10.0	0.0%

Adjust this setting in the following circumstances:

- When torque loss is large due to motor bearing friction.
- When the torque loss in the load is large.

The setting for the mechanical loss is added to the torque.

■ E2-10: Motor Iron Loss for Torque Compensation

This parameter sets the motor iron loss in watts.

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

■ E2-11: Motor Rated Output

This parameter sets the motor rated power in kW. If rotational Auto-Tuning completes successfully, this value is automatically calculated. Remember that 1 hp = 0.746 kilowatts.

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

■ E2-12: Motor Iron-Core Saturation Coefficient 3

This parameter sets the motor rated power in kW. If rotational Auto-Tuning completes successfully, this value is automatically calculated. Remember that 1 hp = 0.746 kilowatts.

No.	Parameter Name	Setting Range	Default
E2-12	Motor Iron-Core Saturation Coefficient 3	1.30 to 5.00	1.30

◆ E3: V/f Characteristics for Motor 2

The drive has the capability to control two motors independently. A second motor may be selected using a multi-function contact input (H1-☐☐ = 16). This parameter select the control method for motor 2. The control method for motor 1 is selected via parameter A1-02.

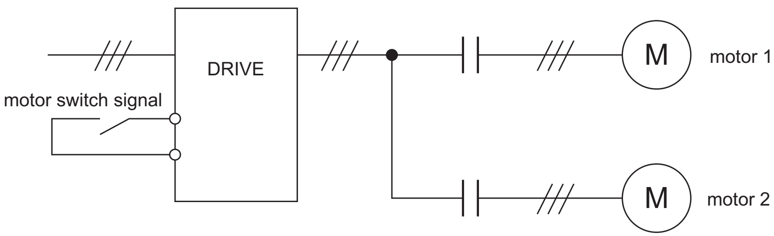


Figure 1.33 Motor Selection

When motor 2 is selected, the following parameters become available:

Table 1.13 Parameters for Motor 2

V/f Pattern 2			
E3-01	Motor 2 Control Method Selection	E3-07	Motor 2 Minimum Output Frequency (FB)
E3-04	Motor 2 Max Voltage (VMAX)	E3-08	Motor 2 Mid Output Frequency Voltage (VC)
E3-05	Motor 2 Max Frequency (FMAX)	E3-09	Motor 2 Minimum Output Frequency (FMIN)
E3-06	Motor 2 Base Frequency (FA)	E3-10	Motor 2 Mid Output Frequency Voltage 2
Motor 2 Settings			
E4-01	Motor 2 Rated Current	E4-08	Motor 2 Motor Iron-Core Saturation Coefficient 2
E4-02	Motor 2 Rated Slip	E4-09	Motor 2 Mechanical Loss

V/f Pattern 2			
E4-03	Motor 2 Rated No-Load Current	E4-10	Motor 2 Iron Loss
E4-04	Motor 2 Motor Poles	E4-11	Motor 2 Rated Capacity
E4-05	Motor 2 Line-to-Line Resistance	E4-12	Motor 2 Iron-Core Saturation Coefficient 3
E4-06	Motor 2 Leakage Inductance	E4-14	Motor 2 Slip Compensation Gain
E4-07	Motor 2 Motor Iron-Core Saturation Coefficient 1	E4-15	Torque Compensation Gain - Motor 2

■ E3-01: Motor 2 Control Method Selection

Selects the control method for motor 2.

No.	Parameter Name	Setting Range	Default
E3-01	Motor 2 Control Method Selection	0: V/f Control 2: Open Loop Vector Control	0

Note: Motor 2 cannot be a permanent magnet motor. The OL1 operation selection set to L1-01 applies to both motor 1 and motor 2.

■ E3-04 to E3-10

The default settings for parameters E3-04 through E3-10 change according to the control method used. The values shown in the table below are the defaults when operating in V/f Control.

No.	Parameter Name	Setting Range	Default
E3-04	Motor 2 Max Output Frequency	40.0 to 400.0	60.0 Hz*2
E3-05	Motor 2 Max Voltage (VMAX)	0.0 to 255.0*1	200.0 V*2
E3-06	Motor 2 Base Frequency (FA)	0.0 to 400.0	60.0 Hz*2
E3-07	Motor 2 Mid Output Frequency (FB)	0.0 to 400.0	3.0 Hz*2
E3-08	Motor 2 Mid Output Frequency Voltage (VC)	0.0 to 255.0 *1	16.0 V*2
E3-09	Motor 2 Minimum Output Frequency (FMIN)	0.0 to 400.0	1.5 Hz*2
E3-10	Motor 2 Minimum Output Frequency Voltage (VMIN)	0.0 to 255.0 *1	9.0 V*2

* 1. These values are for 200 V class drives. Double these values when using a 400 V class unit.
* 2. The default value is determined by the control method (A1-02). Values listed here are for V/f Control.

To set V/f characteristics in a straight line, set the same values for E3-07 and E3-09. In this case, the setting for E3-08 will be disregarded. Be sure that the four frequencies are set in the following manner or else a fault will occur:

E3-04 (FMAX) greater than or equal to E3-06 (FA) > E3-07 (FB) > E3-09 (FMIN)

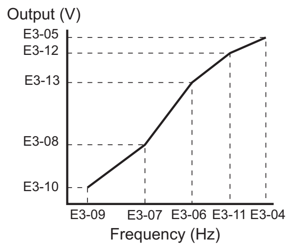


Figure 1.34 V/f Pattern for Motor 2

■ E3-11 to E3-13

These parameters rarely need to be changed. Adjust only when fine-tuning the V/f pattern to maintain constant output.

No.	Parameter Name	Setting Range	Default
E3-11	Motor 2 Mid Output Frequency 2	0.0 to 400.0	0.0 Hz
E3-12	Motor 2 Mid Output Frequency Voltage 2	0.0 to 255.0*1	0.0 Vac
E3-13	Motor 2 Base Voltage (VBASE)	0.0 to 255.0*1	0.0 Vac*2

* 1. These values are for 200 V class drives. Double these values when using a 400 V class unit.
* 2. This value will be the same as the motor rated voltage set to T1-03 after Auto-Tuning is performed.

◆ E4: Motor 2 Parameters

A single drive is capable of operating two separate motors with different capacities and different V/f characteristics. E4 parameters are for setting up motor 2. In Open Loop Vector Control, E4 parameters are set automatically during the Auto-Tuning process. These parameters may need to be set manually if there is a problem performing Auto-Tuning.

■ E4-01: Motor 2 Rated Current

The motor rated current is used by the drive to protect the motor and for proper control when using Open Loop Vector. The drive calculates this value automatically during the Auto-Tuning process.

No.	Parameter Name	Setting Range	Default
E4-01	Motor 2 Rated Current	Between 10 and 200% of the drive rated current.	Determined by o2-04

Note: Set the lower and higher digits to the value corresponds to the capacity of the drive: 11 kW or less: Sets the lower 2 digits, 11 kW or higher: Set to the lowest digit

■ E4-02: Motor 2 Rated Slip

This parameter sets the motor rated slip frequency in units of 0.01 Hz. The drive calculates this value is automatically during Rotational Auto-Tuning.

For information on calculating the motor rated slip, see the description on E2-02.

No.	Parameter Name	Setting Range	Default
E4-02	Motor 2 Rated Slip	0.00 to 20.00	Determined by o2-04

■ E4-03: Motor 2 Rated No-Load Current

Sets the magnetizing current of motor 2 as a percentage of the full load current. This value is automatically set during Rotational Auto-Tuning. If Auto-Tuning cannot be performed, contact the motor manufacturer for this information so that it can be entered manually.

No.	Parameter Name	Setting Range	Default
E4-03	Motor 2 Rated No-Load Current	0 to [E4-01]	Determined by o2-04

Note: Set the lower and higher digits to the value corresponds to the capacity of the drive: 11 kW or less: Sets the lower 2 digits, 11 kW or higher: Set to the lowest digit

■ E4-04: Motor 2 Motor Poles

Sets the number of motor poles for motor 2. This value should be entered during the Auto-Tuning process, after which this parameter will be automatically set.

No.	Parameter Name	Setting Range	Default
E4-04	Motor 2 Motor Poles	2 to 48	4

■ E4-05: Motor 2 Line-to-Line Resistance

Sets the phase-to-phase resistance of motor 2 in ohms. This value is automatically set when Auto-Tuning is executed.

No.	Parameter Name	Setting Range	Default
E4-05	Motor 2 Line-to-Line Resistance	0.000 to 65.000	Determined by o2-04

Note: The setting range is 0.00 to 130.00 when using a drive capacity of 0.2 kW or less.

E4-05 is the only parameter that is automatically set when Stationary Auto-Tuning is performed (also called, “Auto-Tuning for resistance between lines”). If Auto-Tuning is not possible for some reason, contact the motor manufacturer to find out what the line-to-line resistance is for the motor, then calculate this E4-05 using the appropriate formula below.

- E-type insulation: Multiply 0.92 times the resistance value (W) listed on the Test Report at 75°C.

- B-type insulation: Multiply 0.92 times the resistance value (W) listed on the Test Report at 75°C.
- E-type insulation: Multiply 0.87 times the resistance value (W) listed on the Test Report at 115°C.

■ E4-06: Motor 2 Leakage Inductance

Sets the voltage drop due to motor leakage inductance as a percentage of rated voltage of motor 2. This value is automatically set during Auto-Tuning.

No.	Parameter Name	Setting Range	Default
E4-06	Motor 2 Leakage Inductance	0.0 to 40.0	Determined by o2-04

■ E4-07: Motor 2 Motor Iron-Core Saturation Coefficient 1

Set to the motor iron saturation coefficient at 50% of magnetic flux. This value is automatically set during Rotational Auto-Tuning.

No.	Parameter Name	Setting Range	Default
E4-07	Motor 2 Motor Iron-Core Saturation Coefficient 1	0.00 to 0.50	0.50

■ E4-08: Motor 2 Motor Iron-Core Saturation Coefficient 2

Set to the motor iron saturation coefficient at 75% of magnetic flux. This value is automatically set during Rotational Auto-Tuning.

No.	Parameter Name	Setting Range	Default
E4-08	Motor 2 Motor Iron-Core Saturation Coefficient 2	[E4-07] to 0.75	0.75

■ E4-09: Motor 2 Mechanical Loss

Sets the motor mechanical loss as a percentage of motor rated power (kW).

No.	Parameter Name	Setting Range	Default
E4-09	Motor 2 Mechanical Loss	0.00 to 10.0	0.0

This parameter seldom needs to be changed, but may need to be adjusted in the following circumstances:

- When there is a large amount of torque loss due to motor bearing friction.
- When there is a large amount of torque loss in a fan or pump application.

■ E4-10: Motor 2 Iron Loss

Sets the motor iron loss in watts for motor 2.

No.	Parameter Name	Setting Range	Default
E4-10	Motor 2 Iron Loss	0 to 65535	Determined by o2-04

■ E4-11: Motor 2 Rated Capacity

Sets the motor rated capacity in units of 0.01 kW. This value is automatically set when Auto-Tuning is performed.

No.	Parameter Name	Setting Range	Default
E4-11	Motor 2 Rated Capacity	0.00 to 650.00 kW	Determined by o2-04

■ E4-12: Motor 2 Iron-Core Saturation Coefficient 3

Set to the motor iron saturation coefficient at 130% of magnetic flux. This value is automatically set during Rotational Auto-Tuning.

No.	Parameter Name	Setting Range	Default
E4-12	Motor 2 Iron-Core Saturation Coefficient 3	1.30 to 5.00	1.30

■ E4-14: Motor 2 Slip Compensation Gain

Matches the slip compensation gain for motor 1 set to C3-01. Used to increase motor speed to account for motor slip by boosting the output frequency.

No.	Parameter Name	Setting Range	Default
E4-14	Motor 2 Slip Compensation Gain	0.0 to 2.50	Determined by E3-01

Note: The control mode determines the default setting. The value shown here is for V/f Control.

This setting rarely needs to be changed, but adjustment may help under the following conditions:

- Increase this setting if the motor speed is below the desired value.
- Decrease this setting if the motor rotates faster than the desire speed.

■ E4-15: Motor 2 Torque Compensation Gain

Matches the torque compensation gain for motor 1 set to C4-01. This function magnifies the torque compensation to increase output torque.

No.	Parameter Name	Setting Range	Default
E4-15	Motor 2 Torque Compensation Gain	0.0 to 2.50	1.00

Note: Adjust this parameter so the output current does not exceed the drive rated output currren when operating at low speeds.

- Increase the setting when using a long motor cable.
- When using a motor with a smaller capacity than the drive, increase this setting.
- If the motor begins to vibrate, adjust the value set so that the output current doesn't exceed the drive rated output current when operating at low speeds.

◆ E5: PM Motor Settings

■ E5-01: PM Motor Code Selection

Set the motor code appropriate for the PM motor being used. Depending on the motor code entered, the drive may be able to automatically set several motor parameters.

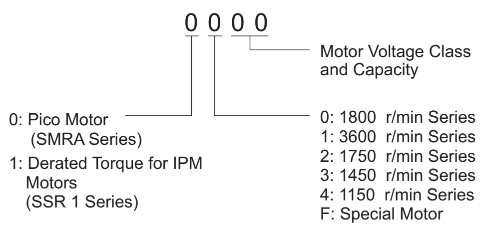
No.	Parameter Name	Setting Range	Default
E5-01	PM Motor Code Selection	0000 to FFFF	Determined by o2-04

Note: This parameter is not reset when the drive is initialized using parameter A1-03. Depending on the motor code, the drive may be able to automatically set several motor parameters. The default setting is for a Yaskawa pico motor with a speed rating of 1800 r/min. Set to "FFFF" when using a specialized or custom motor.

Detailed Description

According to the motor code, the value set for the maximum output frequency becomes the upper limit. Because changing E5-01 will reset all motor parameters according to the new motor code, refrain from making frequent changes to E5-01

Note: Set to "FFFF" when using a specialized or custom motor.



■ E5-02: Motor Rated Capacity (PM OLV)

Sets the rated capacity of the motor.

No.	Parameter Name	Setting Range	Default
E5-02	Motor Rated Capacity (PM OLV)	0.10 to 18.50	Determined by E5-01

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

■ E5-03: Motor Rated Current (PM OLV)

Sets the motor rated current in amps.

No.	Parameter Name	Setting Range	Default
E5-03	Motor Rated Current (PM OLV)	10 to 200% of drive rated current	Determined by E5-01

Note: The default value is determined by the motor code set to E5-01. Setting units are determined by drive capacity. 7.5 kW or less: 0.01 A, 11 kW or greater: 0.1 A

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

Sets the number of motor poles.

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

Note: The default value is determined by the motor code set to E5-01. This parameter is not reset when the drive is initialized using A1-03.

■ E5-05: Motor Armature Resistance (PM OLV)

Set the resistance for each motor phase in units of 0.001 W.

No.	Parameter Name	Setting Range	Default
E5-05	Motor Armature Resistance (PM OLV)	0.000 to 65.000	Determined by E5-01

Note: The default value is determined by the motor code set to E5-01. This parameter is not reset when the drive is initialized using A1-03.

■ E5-06: Motor d Axis Inductance (PM OLV)

Sets the d axis inductance in units of 0.01 mH.

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

Note: The default value is determined by the motor code set to E5-01. This parameter is not reset when the drive is initialized using A1-03.

■ E5-07: Motor q Axis Inductance (PM OLV)

Sets the q axis inductance in units of 0.01 mH.

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

Note: The default value is determined by the motor code set to E5-01. This parameter is not reset when the drive is initialized using A1-03.

■ E5-09: Motor Induction Voltage Constant 1 (PM OLV)

Set the inductance voltage for each motor phase in units of 0.1 mV/(rad/min) [electrical angle]. Set this parameter when using an SSR1 series IPM motor with derated torque or an SST4 series motor with constant torque.

■ E5-24: Motor Induction Voltage Parameter 2 (PM OLV)

Set the inductance voltage for each motor phase in units of 0.1 mV/(r/min) [mechanical angle]. Set this parameter when using an SMRA series pico motor.

Note: Ensure that E5-09 = 0 when setting parameter E5-24.

An alarm will be triggered, however, if both E5-09 and E5-24 are set 0, or if neither parameter is set to 0.

No.	Parameter Name	Setting Range	Default
E5-09	Motor Induction Voltage Constant 1 (PM OLV)	0.0 to 2000.0	Determined by E5-01
E5-24	Motor Induction Voltage Parameter 2 (PM OLV)	0.0 to 2000.0	Determined by E5-01

Note: The default value is determined by the motor code set to E5-01. This parameter is not reset when the drive is initialized using A1-03.

1.6 F: Option Settings

◆ F1: Settings for Simple PG with V/f Control

Although a pulse generator encoder (PG) is not available for V1000, it is equipped with a Pulse Train Input that can be used to improve speed control accuracy. To take advantage of this feature, first set the drive for V/f Control (A1-02 = 0) and then set terminal RP for Simple PG in V/f (H6-01 = 3). For applications operating more than one motor from a single drive, please note that this function is only available for motor 1.

■ F1-02: Operation Selection at PG Open Circuit (PGo)

Sets the stopping method when a PG open circuit fault (PGo) occurs.

No.	Parameter Name	Setting Range	Default
F1-02	Operation Selection at PG Open Circuit (PGO)	0 to 3	1

NOTICE: *Setting = 3: Alarm only. This setting offers limited protection to the motor and machinery. Take proper precautions when selecting this setting.*

■ F1-03: Operation Selection at Overspeed

Sets the stopping method when an overspeed (oS) fault occurs.

No.	Parameter Name	Setting Range	Default
F1-03	Operation Selection at Overspeed (for Simple PG V/f)	0 to 3	1

NOTICE: *Setting = 3: Alarm only. This setting offers limited protection to the motor and machinery. Take proper precautions when selecting this setting.*

■ F1-04: Operation Selection at Deviation

Sets the stopping method when a speed deviation (dEv) fault occurs.

No.	Parameter Name	Setting Range	Default
F1-04	Operation Selection at Deviation (for Simple PG V/f Control)	0 to 3	3

Note: The drive is set to continue operating when dEv is detected (F1-04 = 3).

Table 1.14 Stopping Methods for PGo, oS, dEv Detection

Setting	Description
0	Ramp to Stop (uses the decleration time set to C1-02)
1	Coast to Stop
2	Fast Stop (uses the Fast Stop time set to C1-09)

Setting	Description
3	Alarm only

■ F1-08: Overspeed Detection Level

■ F1-09: Overspeed Detection Delay Time

F1-08 is set as a percentage of the maximum output frequency and determines the level at which oS is detected.

F1-09 determines the time it takes for oS to be detected after the motor speed exceeds the detection level set to F1-08.

No.	Parameter Name	Setting Range	Default
F1-08	Overspeed Detection Level	0 to 120	115%
F1-09	Overspeed Detection Delay Time	0.0 to 2.0	1.0

■ F1-10: Excessive Speed Deviation Detection Level

■ F1-11: Excessive Speed Deviation Detection Delay Time

Configures the speed deviation fault (dEv) detection. dEv fault will occur if the speed deviation is greater than the F1-10 setting for a time longer than F1-11. F1-10 is set as a percentage of the maximum output frequency (E1-04). Speed deviation is the difference between actual motor speed and the frequency reference command.

No.	Parameter Name	Setting Range	Default
F1-10	Excessive Speed Deviation Detection Level	0 to 50	10%
F1-11	Excessive Speed Deviation Detection Delay Time	0.0 to 10.0	0.5 s

■ F1-14: PG Open-Circuit Detection Time

Sets the time required to detect PGo.

No.	Parameter Name	Setting Range	Default
F1-14	PG Open-Circuit Detection Time	0.0 to 10.0	2.0 s

◆ F6 and F7: Serial Communications Option Card Settings

■ F6-01: Communications Error Option Selection

Parameter Overview

No.	Name	Description	Range	Default
F6-01	Communications Error operation Selection	Selects the operation after a communications error occurred. 0: Ramp to stop using current accel/decel time 1: Coast to stop 2: Fast Stop using C1-09 3: Alarm only	0 to 3	1

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

Parameter Overview

No.	Name	Description	Range	Default
F6-02	External Fault from Comm. Option Selection	Sets when an external fault from a comm option is detected. 0: Always detected 1: Detection during Run only	0 or 1	0

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

Parameter Overview

No.	Name	Description	Range	Default
F6-03	External Fault from Comm. Option Operation Selection	Selects the operation after an external fault set by a communications option (EF0). 0: Ramp to stop using current accel/decel time 1: Coast to stop 2: Fast Stop using C1-09 3: Alarm only	0 to 3	1

■ F6-04: Trace Sampling Rate

Parameter Overview

No.	Name	Description	Range	Default
F6-04	Trace Sampling Rate	-	0.0 to 5.0	2.0 s

■ F6-10: CC-Link Node Address

Parameter Overview

No.	Name	Description	Range	Default
F6-10	CC-Link Node Address	Sets the node address if a CC-Link option card is installed	0 to 63	0

F6-11: CC-Link Communication Speed

Parameter Overview

No.	Name	Description	Range	Default
F6-11	CC-Link Communication Speed	0: 156 Kbps 1: 625 Kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps	0 to 4	0

F6-14: BUS Error Auto Reset

Parameter Overview

No.	Name	Description	Range	Default
F6-14	BUS Error Auto Reset	Selects if a BUS fault can be automatically reset.	0 or 1	0

F6-20: DeviceNet MAC Address

Parameter Overview

No.	Name	Description	Range	Default
F6-20	DeviceNet MAC Address	Selects the drives MAC address for DeviceNet	0 to 63	0

F6-21: DeviceNet Communication Speed

Parameter Overview

No.	Name	Description	Range	Default
F6-21	DeviceNet Communication Speed	0: 125 kbps 1: 250 kbps 2: 500 kbps 3: Detect automatically	0 to 3	3

F6-22: DeviceNet PCA Setting

Parameter Overview

No.	Name	Description	Range	Default
F6-22	DeviceNet PCA Setting	I/O Polled Consuming Assembly Data Instance	0 to 255	0

F6-23: DeviceNet PPA Setting

Parameter Overview

No.	Name	Description	Range	Default
F6-23	DeviceNet PPA Setting	I/O Polled Producing Assembly Data Instance	0 to 255	0

F6-24: DeviceNet Idle Mode Fault Detection

Parameter Overview

No.	Name	Description	Range	Default
F6-24	DeviceNet Idle Mode Fault Detection	Selects if a fault s is detected during communication idle mode. 0: Disabled 1: Enabled	0 or 1	0

F6-30: PROFIBUS Node Address

Parameter Overview

No.	Name	Description	Range	Default
F6-30	PROFIBUS Node Address	Sets the node address for a PROFIBUS option.	0 to 125	0

F6-31: PROFIBUS Clear Mode Selection

Parameter Overview

No.	Name	Description	Range	Default
F6-31	PROFIBUS Clear Mode Selection	Selects the operation when a "Clear Mode" command is received. 0: Resets back to zero. 1: Maintains the previous value.	0 or 1	0

F6-32: PROFIBUS Map Selection

Parameter Overview

No.	Name	Description	Range	Default
F6-32	PROFIBUS Map Selection	0: PPO Type 1: Conventional	0 or 1	0

■ F6-36: CANopen Node ID Selection

Parameter Overview

No.	Name	Description	Range	Default
F6-36	CANopen Node ID Selection	Sets the Node ID for a CANopen option	0 to 127	99

■ F6-37: CANopen Communication Speed

Parameter Overview

No.	Name	Description	Range	Default
F6-37	CANopen Communication Speed	0: Auto-adjust 1: 10kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1 Mbps	0 to 8	6

■ F6-40: CompoNet Node ID

Parameter Overview

No.	Name	Description	Range	Default
F6-40	CompoNet Node ID	Sets the Node ID for a CompoNet option.	0 to 63	0

■ F6-41: CompoNet Speed

Parameter Overview

No.	Name	Description	Range	Default
F6-41	CompoNet Speed	0: 93.75 kbit/s 1: Reserved 2: 1.5 Mbit/s 3: 3 Mbit/s 4: 4 Mbit/s 5-255: Reserved	0 to 255	0

■ F7-01 to F7-04: Ethernet IP Address 1 to 4

Parameter Overview

No.	Name	Description	Range	Default
F7-01	Ethernet IP Address 1	Combining these parameters like F7-01.F7-02.F7-03.F7-04 sets the Ethernet IP address. Example: (192.168.1.10)	0 to 255	0
F7-02	Ethernet IP Address 2		0 to 255	0
F7-03	Ethernet IP Address 3		0 to 255	0
F7-04	Ethernet IP Address 4		0 to 255	0

■ F7-05 to F7-08: Subnet Mask 1 to 4

Parameter Overview

No.	Name	Description	Range	Default
F7-05	Subnet Mask 1	Combining these parameters like F7-05.F7-06.F7-07.F7-08 sets the Ethernet Subnet Mask.Example: (255.255.255.0)	0 to 255	0
F7-06	Subnet Mask 2		0 to 255	0
F7-07	Subnet Mask 3		0 to 255	0
F7-08	Subnet Mask 4		0 to 255	0

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

Parameter Overview

No.	Name	Description	Range	Default
F7-09	Gateway Address 1	Combining these parameters like F7-09.F7-10.F7-11.F7-12 sets the Ethernet Gateway Address.Example: (192.168.1.1)	0 to 255	0
F7-10	Gateway Address 2		0 to 255	0
F7-11	Gateway Address 3		0 to 255	0
F7-12	Gateway Address 4		0 to 255	0

■ F7-13: Dress Mode at Startup

Parameter Overview

No.	Name	Description	Range	Default
F7-13	Dress Mode at Startup	Selects how the Ethernet IP address is set. 0:User defined 1:BOOTP 2:DHCP	0 to 2	0

■ F7-14: Security Password

Parameter Overview

No.	Name	Description	Range	Default
F7-14	Security Password	Sets the password required for setup changes via the network. 0: No password required 1 - 9999: 4 digit password	0 to 9999	0

■ F7-15: Duplex Mode Selection

Parameter Overview

No.	Name	Description	Range	Default
F7-15	Duplex Mode Selection	0:Auto Negotiate 1:Half Duplex forced 2:Full Duplex forced	0 to 2	0

■ F7-18: Communication Speed Selection

Parameter Overview

No.	Name	Description	Range	Default
F7-18	Communication Speed Selection	0:Auto Negotiate 10:10 Mbps speed setting 100:100Mbps Speed Setting	0, 10, 100	0

■ F7-19: Web Page Access

Parameter Overview

No.	Name	Description	Range	Default
F7-19	Web Page Access	Selects the mode for modification on the Ethernet option board Web page settings 0: All access 1: Only during stop 2: Never	0 to 2	0

■ F7-20: Gateway Selection

Parameter Overview

No.	Name	Description	Range	Default
F7-20	Gateway Selection	0: Gateway not used 1: Use Gateway	0 or 1	1

■ F7-21: Communication Loss Time Out

Parameter Overview

No.	Name	Description	Range	Default
F7-21	Communication Loss Time Out	Multiplier for communication loss detection timeout value.	0 to 300	0

1.7 H: Terminal Functions

H parameters are used to assign functions to the external terminals.

◆ H1: Multi-Function Contact Inputs

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

These parameters assign functions to the seven multi-function contact inputs located at terminals S1 through S7. Settings 0 to 9F determine the type of input for each terminal.

Note: If not using an input terminal or if using the through-mode, set that terminal to “F”.

No.	Parameter Name	Setting Range	Default
H1-01	Multi-Function Digital Input Terminal S1 Function Selection	1 to 9F	40: Forward Run Command (2-wire sequence)
H1-02	Multi-Function Digital Input Terminal S2 Function Selection	1 to 9F	41:Reverse Run Command (2-wire sequence)
H1-03	Multi-Function Digital Input Terminal S3 Function Selection	0 to 9F	24: External Fault (user selection possible)
H1-04	Multi-Function Digital Input Terminal S4 Function Selection	0 to 9F	14: Fault Reset Closed: Allows the drive to run again after the fault is cleared and the run command is removed
H1-05	Multi-Function Digital Input Terminal S5 Function Selection	0 to 9F	3 (0)*: Multi-Step Speed Reference 1
H1-06	Multi-Function Digital Input Terminal S6 Function Selection	0 to 9F	4 (3)*: Multi-Step Speed Reference 2
H1-07	Multi-Function Digital Input Terminal S7 Function Selection	0 to 9F	6 (4)*: Jog Reference SelectionTakes priority over other multi-step speed references 1 through 16

*Number appearing in parenthesis is the default value after performing a 3-wire initialization.

Table 1.15 Multi-Function Contact Input Settings

Setting	Function	Page	Setting	Function	Page
0	3-Wire Sequence	–	4	Multi-Step Speed Reference 2	–
1	LOCAL/REMOTE Selection	–	5	Multi-Step Speed Reference 2	–
2	Option/Drive Selection	–	6	Jog Reference Selection	–
3	Multi-Step Speed Reference 1	–	7	Accel/Decel Time 1	–
8	Baseblock Command (N.O.)	–	40	Forward Run Command (2-wire sequence)	–
9	Baseblock Command (N.C.)	–	41	Reverse Run Command (2-wire sequence)	–

Setting	Function	Page	Setting	Function	Page
A	Accel/Decel Ramp Hold	–	42	Run Command (2-wire sequence 2)	–
B	Drive Overheat Alarm (OH2)	–	43	FWD/REV Command (2-wire sequence 2)	–
C	Terminal A2 Enable	–	44	Offset Frequency 1 Addition	–
F	Not used	–	45	Offset Frequency 2 Addition	–
10	Up Command	–	46	Offset Frequency 3 Addition	–
11	Down Command	–	60	DC Injection Braking Command	–
12	Forward Jog	–	61	External Search Command 1	–
13	Reverse Jog	–	62	External Search Command 2	–
14	Fault Reset	–	65	KEB Ride-Thru (N.C.)	–
15	Fast-Stop (N.O.)	–	66	KEB Ride-Thru (N.O.)	–
16	Motor 2 Selection	–	67	Communications Test Mode	–
17	Fast-stop (N.C.)	–	68	High-Slip Braking	–
18	Timer Function	–	6A	Drive Enable	–
19	PID Disable	–	75	Up 2 Command	–
1A	Accel/Decel Time Selection 2	–	76	Down 2 Command	–
1B	Program Lockout	–	7A	KEB Ride-Thru 2 (N.C.)	–
1E	Reference Sample Hold	–	7B	KEB Ride-Thru 2 (N.O.)	–
20 to 2F	External Fault	–	7C	Short-Circuit Braking (N.O.)	–
30	PID Integral Reset	–	7D	Short-Circuit Braking (N.C.)	–
31	PID Integral Hold	–	7E	Forward/Reverse Detection (Simple PG in V/f)	–
32	Multi-Step Speed Reference 4	–	90 to 96	DriveWorksEZ Digital Input 1 to 7	–
34	PID Soft Starter	–	9F	DriveWorksEZ Digital Input 9F	–
35	PID Input Switch	–			

Detailed Description

Setting 0: 3-Wire Sequence

When one of the digital inputs (S3 to S7) is programmed for 3-wire control, that input becomes a forward/reverse directional input. Whenever the input is open, the drive will be set for forward rotation of the motor shaft. If the input it closed, then the motor shaft will rotate in the reverse direction whenever a there is a run command entered.

Note: The run and stop commands are allotted to terminals S1 and S2.

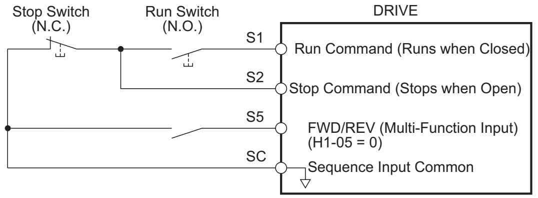


Figure 1.35 3-Wire Sequence Wiring Diagram

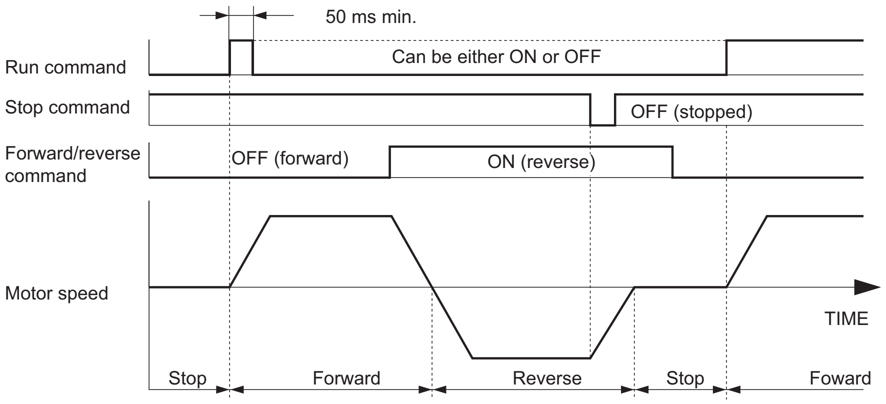


Figure 1.36 3-Wire Sequence

WARNING! *Sudden Movement Hazard. The drive may start unexpectedly if the run command is already applied when programming 3-wire control. Set b1-17 to "0" and set terminal S5 for a 3-wire sequence (H1-05 = 0). Failure to comply could result in death or serious injury from moving equipment.*

WARNING! *Sudden Movement Hazard. The motor will begin rotating when the power is turne on. may start unexpectedly if the run command is already applied when programming 3-wire control. Set b1-17 to "0" and set terminal S5 for a 3-wire sequence (H1-05 = 0). Failure to comply could result in death or serious injury from moving equipment.*

Note: When terminal S1 set for the run command closes, the drive will start operating the motor after 50 ms. If the Run command is not given at power up (b1-17 = 0), the LED will flash briefly when the power supply is cycled to indicate that protective functions are operating. Set b1-17to 1 to allow for the Run command to be given when the drive is first powered on.

Setting 1: LOCAL/REMOTE Selection

When the Run command is assigned to the LED operator, this setting is called LOCAL. When the Run command is entered from one of the control circuit terminals or from an upper controller sequence, this is referred to as REMOTE. This setting allows the input terminal to determine if the drive will run in LOCAL mode or REMOTE mode.

Status	Description
Open	LOCAL: Operation according to frequency reference and Run command from digital operator.
Closed	REMOTE: Operation according to frequency reference and Run command set by parameters b1-01 and b1-02, respectively.

Note: If one of the multi-function input terminals is set to for LOCAL/REMOTE, then the LO/RE key on the operator will be disabled. The drive cannot switch between LOCAL and REMOTE during run. When the drive is set to LOCAL, the LO/RE LED will light.

Setting 2: Option/Drive Selection

The Option/Drive Selection function allows the user to select the source for the Run command and frequency references between either the drive’s terminals or an optional communication board. When a digital input is programmed for the Option/Drive Selection function (H1-☐☐ = 2), that input will function as shown in the following table:.

Input Selection Status	Source of Run Command and Frequency Reference
Open	b1-01, b1-02
Closed	b1-15, b1-16

Setting 3 to 5: Multi-Speed Reference 1 to 3

Setting 6: Jog Frequency Reference Selection

The drive can be programmed to utilize digital inputs to change between 16 presets speeds and a Jog speed. It is a two-step process to set the drive up for preset speeds.

No.	Parameter Name	Setting Range	Default
d1-01	Frequency Reference 1 (when the source of the frequency reference is assigned to the operator)	0.00 to 400.00	0.00 Hz
d1-02 to d1-16	Frequency Reference 2 to 16		0.00 Hz
d1-17	Jog Frequency Reference		6.00 Hz

When a digital input configured as Jog Frequency Reference (H1-☐☐ = 6) is closed, the active frequency reference will be the setting of parameter d1-17 (Jog Frequency Reference). Closure of this digital input alone will not initiate a Jog motion, it will only change the frequency reference. An active Run command is necessary for the drive to operate at the Jog frequency reference. To change to the Jog frequency reference and provide a Run command with a single input, refer to digital input settings 12 and 13.

Note: The Jog frequency reference overrides other frequency references.

Setting 7: Accel/Decel Time Selection 1

When any of the multi-function contact input selections (H1-01 to H1-06) are set to 7 and 1A, up to four acceleration and deceleration times can then be selected by opening and closing the appropriate accel/decel time selection commands (terminals 3 to 8). .

Setting 8: External Baseblock, N.O.

Setting 9: External Baseblock, N.C.

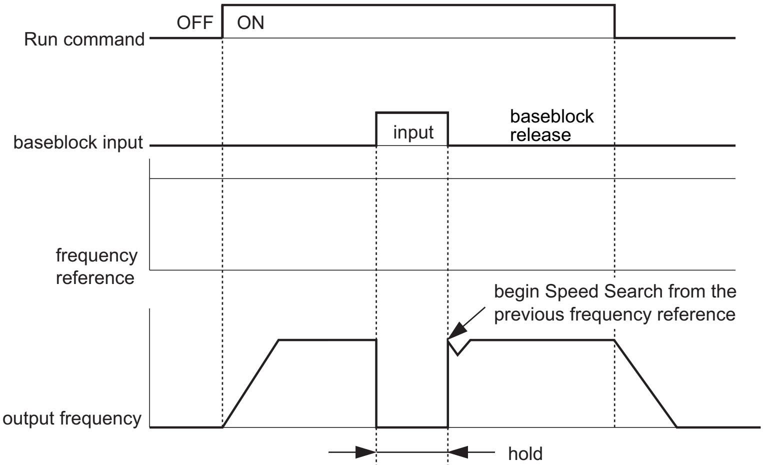
Settings of 8 and 9 assign the baseblock command to the external terminals. When the drive is commanded into baseblock, gating of the output transistor stops and output voltage/ frequency drops to 0 (i.e., the motor coasts). During this time, the alarm “bb” flashes will flash on the LED operator to indicate baseblock. When baseblock ends, the drive performs Speed Search to get the motor running again.

Status	Description
Open	Normal operation
Closed	Interrupt output (baseblock)

Setting 9 (instead of 8) reverses the table above: baseblock will execute when the terminal is open.

The drive has two ways to find the speed of the motor: Current Detection Speed Search and Speed Estimation. The method used when the baseblock input is removed is determined by b3-24.

NOTICE: *Do not use the baseblock excessively with hoist-type applications. Failure to comply will result in sudden motor coasting when the baseblock command is entered, causing the load to slip.*



External Baseblock Characteristics

Function A: Accel/Decel Ramp Hold

The Accel/Decel Ramp Hold function will clamp (“hold”) the speed of the output frequency whenever a digital input that has been programmed for it (H1-☐☐ = A) is closed. All acceleration or deceleration will cease, and the drive will hold the current speed. Once the input is opened again, acceleration or deceleration resumes.

If the Accel/Decel Ramp Hold function is enabled (d4-01 = 1), the drive will save the output frequency to memory whenever the Ramp Hold input is closed. When the interrupted power is restored and a new Run command is entered, the frequency reference becomes the frequency reference that was saved (provided that the Accel/Decel Ramp Hold input is still closed).

No.	Parameter Name	Setting Range	Default
d4-01	Frequency Reference Hold Function Selection	0: Disabled. Drive starts the motor with a frequency reference of 0 if the power is interrupted. 1: Enabled. Drive starts the motor at the frequency reference that was saved just before the power went out.	0

Function B: Drive Overheat Alarm (OH2)

Triggers an OH2 alarm when the contact closes. Because this is an alarm, drive operation is not affected.

Function C: Terminal A2 Enable

Causes the input to analog input terminals A1 and A2 to be ignored unless the contact is closed.

Status	Description
Open	Disables terminals A1, A2
Closed	Enables terminals A1, A2

No.	Parameter Name	Setting Range	Default
H3-09*	Terminal A2 Signal Level Selection	0: 0 to +10 V (with lower limit) 1: 10 to 10 V (no lower limit) 2: 4 to 20 mA (9 bit input) 3: 0 to 20 mA	2
H3-11	Terminal A2 Gain Setting	-999.9 to 999.9	100.0%

* 1. When using terminal A2, make sure DIP switch S1 is set appropriately for the type of input used (current or voltage).
* 2. By tuning the gain and bias levels, an input of less than 5 V can be treated as a negative value.

Function F: Not Used

Any digital input that is not used or is used as through-put should be set to F. This way drive operation will not be affected by the switch, whether it is open or closed.

Setting 10: Up Command

Setting 11: Down Command

Using two digital inputs, the drive can operate with the same type of functionality as a motor operated potentiometer (MOP). One digital input can be programmed as the Up input (H1-0x= 10) to increase the frequency reference, and another digital input can be programmed as the Down input (H1-0x= 11) to decrease the frequency reference. To use these functions, the source of the frequencyr reference must be assigned to the terminals (b1-02 = 1).

Status	Description
Open	Maintain the present frequency reference (no effect)
Closed	Increase or decrease the frequency reference

An opE03 error will occur under the following conditions, indicating that there is a contradictory setting among the functions assigned to terminals S1 to S7:

- The Up function cannot be programmed without also programming the Down function (or vice-versa)

- UP/DOWN function is assigned to the terminals while the Accel/Decel Ramp Hold function is also programmed into other digital inputs

No.	Parameter Name	Setting Range	Default	Page
d2-01	Frequency Reference Upper Limit	0.0 to 110.0	100.0%	–
d2-02	Frequency Reference Lower Limit	0.0 to 110.0	0.0%	–
d2-03	Master Speed Reference Lower Limit	0.0 to 110.0	0.0%	–
E1-04	Max Output Frequency (FMAX)	40.0 to 400.0*	60.0 Hz*	–

When using PM Open Loop Vector Control, these settings will change according to the motor code set to E5-01.

Note: Once the Up/Down functions are programmed, the preset speeds are disabled and the analog frequency reference input becomes a potential frequency reference lower limit. The lower limits for Up/Down are the greater of the analog frequency reference and the programmed frequency reference lower limit (d2-03). The upper limit will be d2-01 (Frequency Reference Upper Limit).

Note: Once a Run command is issued the drive will accelerate immediately to the lower limit.

Note: When Up/Down functions are not used, the upper limit is the maximum output frequency (E1-04).

Note: The status of the d4-01 parameter will affect the performance of the drive after power is cycled to the drive and a fresh Run command is issued. If d4-01= “0: Disabled”, the Run command will cause the drive to ramp to the frequency reference lower limit. However, if d4-01= “1: Enabled”, the Run command will cause the drive to ramp to the last frequency referenced by the Up/Down function before the Run command was removed and the power cycled. Even if d4-01= “1: Enabled”, the previous frequency reference can be reset to the frequency reference lower limit automatically by closing either the Up or Down input without having a Run command active.

No.	Parameter Name	Setting Range	Default	Page
d4-01	Frequency Reference Hold Function Selection	0: Disabled. Drive starts the motor with a frequency reference of 0 if the power is interrupted. 1: Enabled. Drive starts the motor at the frequency reference that was saved just before the power went out.	0	–

Below is an example of drive operation when the Up function is assigned to terminal S3 and the Down function to terminal S4.

No.	Parameter Name	Setting
H1-03	Multi-Function Digital Input Terminal S3 Function Selection	10: Up Command
H1-04	Multi-Function Digital Input Terminal S3 Function Selection	11: Down Command

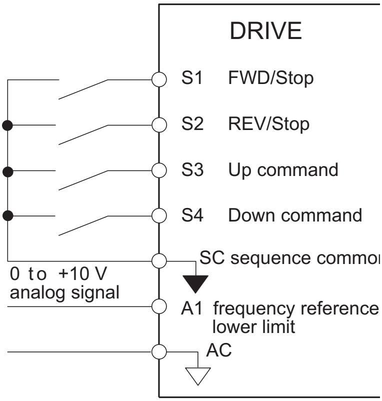
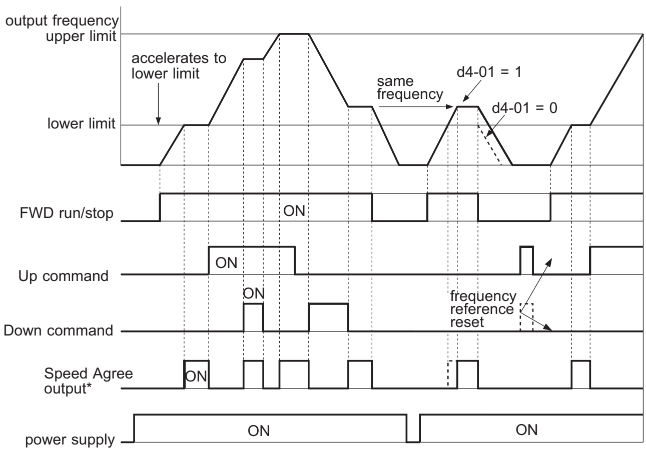


Figure 1.37 Up/Down Functions and Terminal Assignments



*The Speed Agree signal switches on when the motor is not accelerating/ decelerating while the Run command is present.

* 1. The frequency matching signal (Speed Agree) turns on when the motor is not accelerating/ decelerating while the Run command is on.
* 2. The frequency reference can be reset by entering the Up or Down commands while the drive is stopped.

Up/Down Command Operation

Setting 12: FJOG Reference

Setting 13: RJOG Reference

Overview

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

Setting	Description
12	Forward Jog (Closed: Forward run at the frequency reference set to d1-17)
13	Reverse Jog (Closed: Reverse run at the frequency reference set to d1-17)

No.	Parameter Name	Setting Range	Default	Page
d1-17	Jog Frequency Reference	0.00 to 400.00*	6.00 Hz	–

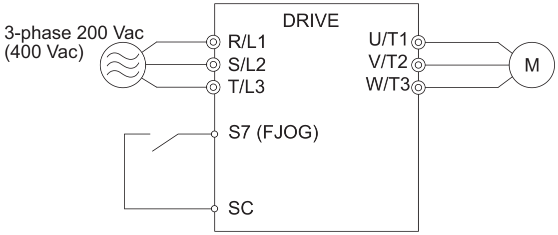
*Parameter d1-17 becomes the frequency reference when Jog is activated.

The setting range for E5-01 changes if using PM Open Loop Vector.

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), then activating Reverse Jog will have no effect. If both the Forward Jog and Reverse Jog are input simultaneously for 500 ms or more, an external fault will occur and the drive will stop using the method set by b1-03.

Detailed Description

Below is an example of the Jog function when H1-07 = 12 and d1-17 = 6.00 Hz.



Jog Operation Using Terminals

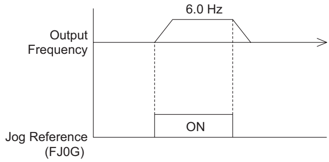
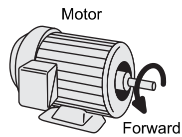


Figure 1.38 Jog Sequence

Setting Up the Jog Function

This example shows how terminal S7 (H1-07) activates the Forward Jog function.

Procedure		Display/Result
1. Turn on the power to the drive.	⇒	F 0.00 ALM REV DRV OUT
2. Press V until the parameter setting screen is displayed.	⇒	PAr
3. Press ENTER to enter the list of parameters.	⇒	A1-01
4. Press ENTER to enter the list of parameters.	⇒	A1-01
5. Use the > RESET and Λ keys to scroll to parameter H1-07 (Multi-Function Digital Input Terminal S7 Function Selection). **Note:** selecting any parameter between H1-01 to H1-07 will produce the same result.	⇒	H1-07
6. Press ENTER to display the setting value for H1-07.	⇒	06
7. Use the Λ and > RESET keys to set 12 (the setting value for Forward Jog.) **Note:** set 13 for Reverse Jog.	⇒	12
8. Press ENTER to save the settings.	⇒	End

	Procedure		Display/Result
1.	Turn on the power to the drive, making sure the drive is set to REMOTE	⇒	 F00.00
2.	Close terminal S7 and run the drive at 6.00 Hz. **Note:** when the Jog reference is input, there is no need to enter a run command..	⇒	
3.	Open terminal S7 to stop the drive.		

Setting 14: Fault Reset

Whenever the drive detects a fault condition, the fault output contact will close and the drive's output will shut off. The motor then coasts to stop (specific stopping methods can be selected for some faults such as L1-04 for motor overheat). Once the run command is removed, the fault can be cleared by either the RESET key on the digital operator or by closing a digital input configured as a Fault Reset (H1-☐☐ = 14).

Note: Fault reset commands are ignored as long as the Run command is present. To reset a fault, first remove the Run command.

Setting 15: Fast Stop, N.O.

Setting 17: Fast Stop, N.C.

The Fast Stop function operates much like an emergency stop input to the drive. While in the run mode, if a Fast Stop is input to the drive, the drive will decelerate to a stop with the deceleration time determined by C1-09 (Fast Stop Time).

- To trigger the Fast Stop function with a N.O. switch, set 15
- To trigger the Fast Stop function with a N.C. switch, set 16

The drive will not run from either the terminals or the digital operator while the Fast Stop is being input. To restart the drive, the Fast Stop input must be removed and the Run command must be cycled.

No.	Parameter Name	Setting Range	Default	Page
C1-09	Fast Stop Time	0.0 to 6000.0	10.0 s	–

The Fast Stop feature is also available as one of the stopping methods for when a fault is detected.

Therefore, be sure to set an acceptable deceleration time in parameter C1-09 when using the Fast Stop feature.

Note: The setting range of C1-09 is dependent on C1-10 Accel/Decel Time Setting Unit.

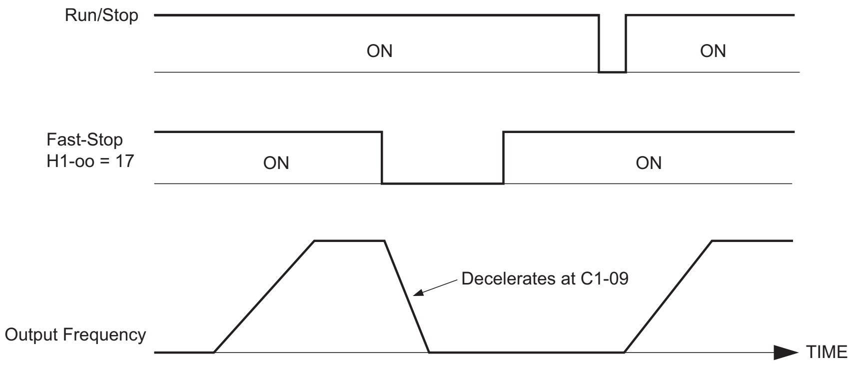


Figure 1.39 Fast Stop Sequence

NOTICE: *Rapid deceleration can trigger an overvoltage fault. When faulted, the drive output shuts off, allowing the motor to coast. The result is an uncontrolled motor state. Therefore, be sure to set an acceptable deceleration time in parameter C1-09 when using the Fast Stop feature*

Setting 16: Motor 2 Selection

The drive has the capability to control 2 different motors independently. Motor 2 may be selected by closing the multi-function contact input programmed for motor 2 selection (H1-☐☐ = 16). When motor 2 is selected, E3 and E4 parameters set the V/f pattern, control method, and motor specifications.

Acceleration and deceleration times for motor 2 can be set to parameters C1-05 through C1-08.

Setting 18: Timer Function

The Timer Function works independently from the drive. For Timer operation, a digital input must be configured for a Timer Function start (H1-☐☐ = 18), a digital output must be configured as a Timer Function output (H2-☐☐ = 12), and the Timer Function On-Delay and Off-Delay parameters (b4-01 and b4-02, respectively) must be programmed.

Table 1.16 Related Parameters

No.	Name	Setting Range	Default	Page
b4-01	Timer Function On-Delay Time	0.0 to 300.0	0.0 s	–
b4-02	Timer Function Off-Delay Time	0.0 to 300.0	0.0 s	–

Once the applicable parameter are programmed the Timer Function start digital input must be closed at least as long as the setting of b4-01 before the Timer Function output will close. The Timer Function input must be open for at least as long as the setting of b4-02 before the Timer Function output will re-open.

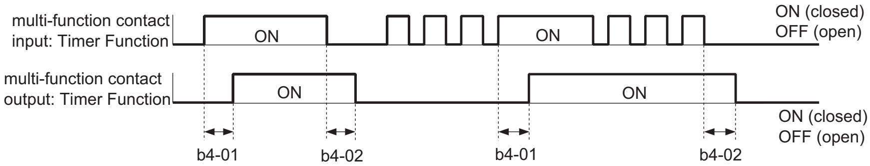


Figure 1.40 Timer Function Timechart

Setting 19: PID Control Cancel

When the PID Function has been enabled by b5-01 (PID Mode Selection), it can be indefinitely disabled by closing a digital input configured as a PID Disable (H1-☐☐ = 19). When disabled, the drive operates as a standard drive that does not have PID enabled.

No.	Parameter Name	Setting Range	Default	Page
b5-01	PID Function Setting	0: Disabled 1: D = Feedback 2: D = Feed-Forward 3: Freq. Ref. + PID output (D = Feedback) 4: Freq. Ref. + PID output (D = Feed-Forward)	0	–

Setting 1A: Multi-Acceleration/Deceleration

When any of the multi-function contact input selections (H1-01 to H1-07) are set to “7” and “1A”, up to four accel/decel times can then be selected by opening or closing the appropriate accel/decel time selection commands (terminals S1 to S7).

Setting 1B: Program Lockout

A Program Lockout digital input will allow changing of parameter values when the input is closed but prevent changing of any drive parameter value except the frequency reference when it is open. Parameter values can be viewed even when a Program Lockout is active.

Status	Description
Open	Parameters settings are locked and cannot be changed.
Closed	Parameter settings can be changed.

Setting 1E: Analog Frequency Reference Sample / Hold

This function allows the user to sample an analog signal being input to A1, A2, or A3 and change the frequency reference to the sampled level. Once the digital input that is configured for 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.

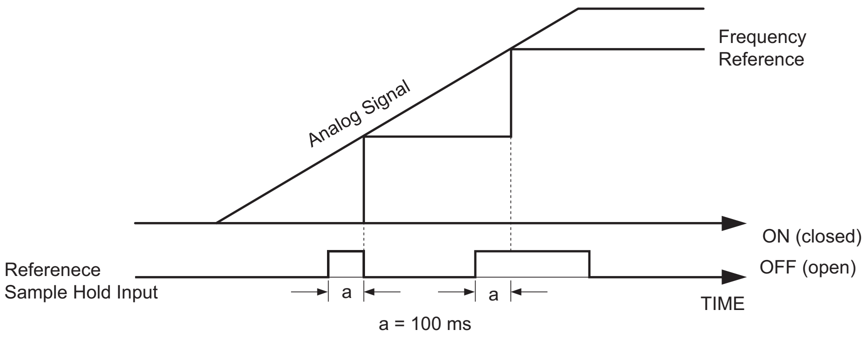


Figure 1.41 Analog Frequency Reference Sample/Hold

- The following functions cannot be programmed to a multi-function input terminal the same time as the Analog Frequency Reference Sample / Hold function. Doing so will cause an oPE03 error.
  - Hold Accel/Decel Stop (setting: A)
  - Up command, Down command (setting: 10, 11)
  - Offset Frequency (setting: 44 to 46)
  - Up or Down functions (setting: 75, 76)
- The analog frequency reference that has been sampled by this function will be cleared if the power is shut off.
- When the power is shut off and the sampled analog frequency reference is cleared, the frequency reference is reset to 0.
- Remember that the digital input must be held for at least 100 ms. If the digital input is not held for at least 100 ms, the analog input will not be sampled.

Setting 20 to 2F: External Fault

By using the External Fault function, the drive can be stopped when problems occur with external devices.

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

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

Select the value to be set in H1-01 to H1-06 from a combination of any of the following three conditions:

- Signal input level from peripheral devices
- External fault detection method
- Operation after external fault detection

The table below shows the relationship between the conditions and the value set to H1-☐☐:

Setting	Terminal Status*1		Detection Method*2		Stopping Method			
	N.O.	N.C.	Always Detected	Detected during Run	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: 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.

- Always Detected: Detection enabled as soon as the drive is powered up
- Detection during Run: Detection enabled only during run.

Setting 30: PID Integral Reset

By configuring one of the digital inputs as an Integral Reset Input, (H1-0☐ = 30), the value of the integral component of PID control can be reset to 0 whenever the configured input is closed. The integral component of PID control will be held at 0 as long as the configured digital input is held closed.

Setting 31: PID Integral Hold

By configuring a digital input for Integral Hold (H1-0☐ = 31), the value of the integral component of the PID control can be forced to clamp at the value it was at when the input is closed. The integral component of the PID control returns to accumulating the error when the digital input is open again.

Holding the integral value can be useful during periods when the error can build up naturally, such

Function 32: Multi-Step Speed 4

For more details, see the descriptions for setting functions 3, 4, and 5 on page ***139***.

Function 34: PID SFS Cancel

By configuring a digital input as a PID SFS Cancel input (H1-0☐ = 34), the operator will be able to use a contact closure to remove the acceleration and deceleration times that are applied to changes in the PID setpoint by the b5-17 parameter. If the digital input configured as PID SFS Cancel is closed, the PID setpoint accel/decel set to b5-17 will be disregarded.

Function 35: PID Input Level Selection

When using the PID Function built into the drive, the set point that has been selected is compared with the feedback that was measured. The difference is called the error. The proportional and integral function are applied to this error. For some applications it may be appropriate to invert the input to the PID block. This can be accomplished by setting one of the digital inputs up as an Input Level Selection (H1-0☐ = 35). When the terminal for the input level is closed, the error will be inverted before it is passed to the PID block.

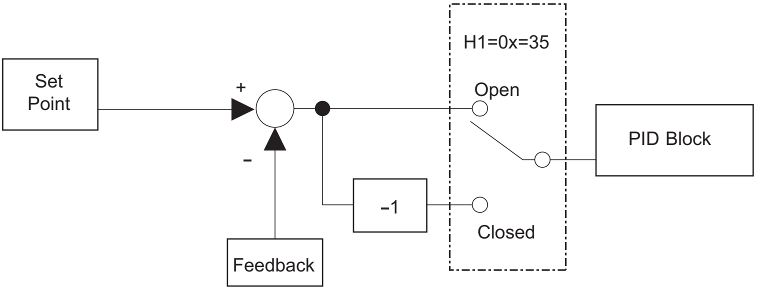


Figure 1.42 PID Input Characteristics

Setting 40: Forward Run Command (2-Wire Sequence)

Setting 41: Reverse Run Command (2-Wire Sequence)

Assigns a 2-wire sequence to the input terminals so that a forward or reverse Run command is issued when the contacts close.

Control Circuit Terminal	Closed	Open
S1	Forward Run	Stop
S2	Reverse Run	Stop

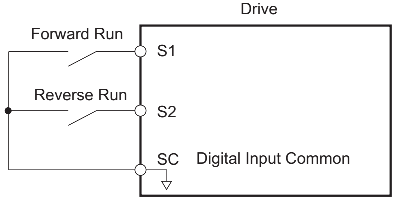


Figure 1.43 2-Wire Sequence Wiring Diagram

Note: Settings 42 and 43 cannot be simultaneously set to the multi-function input terminals.

Setting 42: 2-Wire Sequence 2 (Run Command)

Setting 43: 2-Wire Sequence 2 (Forward/Reverse Command 2)

Sets up a 2-wire sequence to the input terminals. One of the terminals executes the Run command when closed, while the other determines the direction of the Run command: forward when closed, reverse when open.

Note: Settings 40 and 41 cannot be simultaneously set to the multi-function input terminals.

Setting 44: Offset Frequency 1 Addition

Setting 45: Offset Frequency 2 Addition

Setting 46: Offset Frequency 3 Addition

Operates much the same as a bias. When the input is switched on, the value set to d7-01, d7-02, and d7-03 are added to the frequency reference.

Setting 60: DC Injection Braking

When a DC Injection Braking command is input while the drive is stopped, DC Injection Braking operation is activated. When a Run command or a Jog command is input, DC Injection Braking is released to start operation (Jog operation has priority).

The diagram below illustrates the DC Injection Braking function.

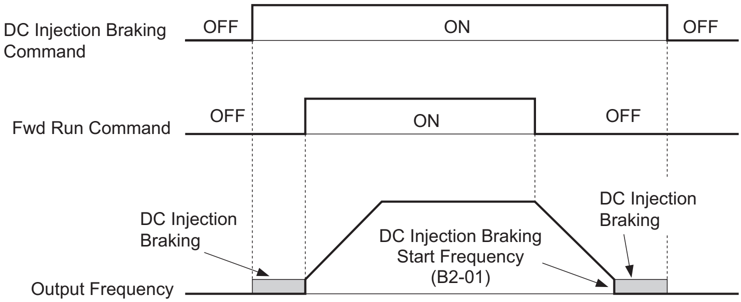


Figure 1.44 DC Injection Braking Input Timing Diagram

Setting 61: Speed Search 1

Setting 62: Speed Search 2

The speed search function detects the actual speed of a coasting motor and restarts it smoothly from that speed. It is useful for getting the application going after momentary power loss, and finding the speed of an idling fan.

No.	Parameter Name	Setting Range	Default	Page
b3-01	Speed Search Selection at Start	0: Enabled 1: Disabled	Determined by A1-02	–
b3-24	Speed Search Method Selection	0: Current Detection Type 1: Speed Estimation	0	–

When the Speed Search method is set for Current Detection Speed Search (b3-24 = 0), then the input terminal set for Speed Search 1 (H1-☐☐ = 60) will begin looking for the motor speed from the maximum output frequency when enabled. Speed Search 2 (H1-☐☐ = 61) instead starts looking for the motor speed starting at the frequency reference. When an input terminal set to 60 or 61 closes, Speed Search is performed regardless of whether b3-01 is enabled or not.

Note: Operator error oPE03 will result if both Speed Search 1 and Speed Search 2 are set to the input terminals at the same time. Only one may be selected. If baseblock occurs, Speed Search cannot begin until the minimum baseblock time set to L2-03 passes. Speed Search 1 and Speed Search 2 will function the same when using Current Detection Speed Search (b21-24 = 1).

Setting 65: KEB Ride-Thru 1, N.C.

Setting 66: KEB Ride-Thru 2, N.O.

The Kinetic Energy Braking (KEB) control circuit attempts to maintain the DC bus voltage at an optimum level [1.35 x ~ input voltage (E1-01)] during momentary power loss, by using load inertia to regenerate voltage back to the DC bus. The drive decelerates at the Fast Stop rate set to C1-09 until power is restored, or until the time runs out and an undervoltage fault (UV) occurs. The larger the inertia, the longer the deceleration rate can be extended. If the inertia is small, then the drive must decelerate quickly to regenerate voltage back to the DC bus, and thus the ride-through time is shorter.

No.	Parameter Name	Setting Range	Default	Page
E1-01	Input Voltage Setting	155 to 255*1	200 V*1	–
L2-06	KEB Deceleration Time	0.0 to 200.0	0.0 s	–
L2-07	Momentary Power Loss Ride-Thru Time	0.0 to 25.5	0.0 s*2	–

* 1. This value is for a 200 V class drive. Double the value when using 400 V class units.
* 2. When set to 0.0, the drive accelerates up to speed at the acceleration rate set to C1-01 to 08.

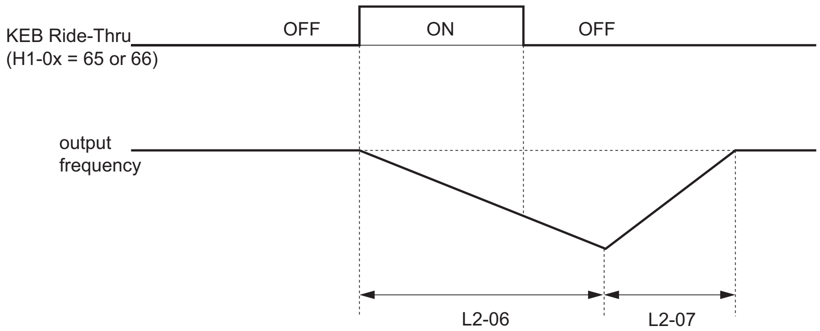


Figure 1.45 KEB Ride-Thru Timing Diagram

Setting 67: Communication Test Mode

The drive has a built-in function for self-diagnosing the serial communications operation. The test involves wiring the send and receive terminals of the RS-485/422 port together. The drive transmits data and then confirms the communications are received normally.

Setting 68: High Slip Braking

If the load inertia is large the High Slip Braking function can be used to shorten the deceleration time compared to simply coasting to stop. The High Slip Braking function manipulates the output frequency while monitoring the output current and DC bus to create a large slip condition. It consumes regenerative energy created as the motor slows, and this energy is consumed in the motor windings. This slip is then used to slow the motor until it stops.

The result is a relatively quick way of stopping the motor.

Setting 6A: Drive Enable

A digital input configured as a Drive Enable input (H1-0□ = 6A) will prevent the drive from executing a Run command until the input is closed. When the Drive Enable input is open, the digital operator will display “dnE to indicate that the drive is disabled.

If a Run command is closed prior to the Drive Enable input being closed, then the drive will not run until the Run command is cycled. If the Drive Enable input is opened while the drive is running, the drive will stop using the method set by parameter b1-03.”

No.	Parameter Name	Setting Range	Default	Page
b1-03	Stopping Method Selection	0: Ramp to Stop 1: Coast to Stop 2: DC Injection Braking to Stop 3: Coast with Timer	0	–

Note: DC Injection Braking is not possible in PM Open Loop Vector.

Setting 75: Up 2

Setting 76: Down 2

These functions raise or lower the frequency reference when the terminals close.

Settings for Terminals S1 to S7	Closed	Open
75: Up 2	Increases or decreases the frequency reference	No change (maintains present speed)
76: Down 2		

Note: Set the Up 2 and Down 2 functions as a pair. This function requires that the source of the Run command be assigned to the control circuit terminals (b1-02 = 1).

Table 1.17 Up 2 and Down 2 (Continued)

Function	Frequency Reference	d4-03 Frequency Reference BiasStep (Up/Down 2)	d4-05 Frequency Reference Bias Operation Mode Selection (Up/Down 2)	d4-01 Frequency Hold Function	Operation	Frequency Saved
1	Multi-Step Speed Reference	0	0	0	Accelerates while the Up 2 function is closed, decelerates while Down 2 is closed, holds the output frequency from the Up 2 or Down 2 functions until the frequency reference is changed. Operates with the frequency reference in all other situations	Not saved
2				1		After the output frequency is held for 5 s, the value sampled with the Multi-Step Speed reference during Hold is set as the frequency reference, and d4-06 is reset to 0.
3			1	--	Accelerates while the Up 2 function is closed, decelerates while Down 2 is closed. Otherwise operates by the frequency reference	Not saved
4	Multi-Step Speed Reference	¼0	--	0	When the Up 2 is enabled, drive accelerates up to the frequency reference plus d4-03. When Down 2 is enabled, drive decelerates down to the frequency reference minus d4-03. Holds the frequency after Speed Agree is reached, otherwise follows the frequency reference.	Not saved
5				1		After the output frequency is held for 5 s, the value sampled with the Multi-Step Speed reference during Hold is set as the frequency reference, and d4-06 is reset to 0.

Function	Frequency Reference	d4-03 Frequency Reference BiasStep (Up/Down 2)	d4-05 Frequency Reference Bias Operation Mode Selection (Up/Down 2)	d4-01 Frequency Hold Function	Operation	Frequency Saved
6	Other (analog communications, etc.)	0	0	0	While Up 2 is closed, drive accelerates. While Down 2 is closed, the drive decelerates. In both situations, though, the drive will hold the bias until Speed Agree is reached if the change in the frequency during accel/decel is greater than the analog frequency fluctuation limit. ,When Up 2 or Down 2 is enabled, drive holds the bias until the frequency reference changes. Otherwise uses the frequency reference.	Not saved
7				1		After the output frequency is held for 5 s, the value sampled during Hold is set to d4-06. The frequency reference cannot be overwritten, so only the bias is saved.

Function	Frequency Reference	d4-03 Frequency Reference BiasStep (Up/Down 2)	d4-05 Frequency Reference Bias Operation Mode Selection (Up/Down 2)	d4-01 Frequency Hold Function	Operation	Frequency Saved
8	Other: Analog, Comm., etc.	0	1	--	When the Up 2 is enabled, drive accelerates up to the frequency reference plus d4-03. When Down 2 is enabled, drive decelerates down to the frequency reference minus d4-03. In both situations, though, the drive will clear the bias until Speed Agree is reached if the change in the frequency during accel/decel is greater than d4-07.	Not saved
9		¼0	--	0	When the Up 2 is enabled, drive accelerates up to the frequency reference plus d4-03. When Down 2 is enabled, drive decelerates down to the frequency reference minus d4-03. Holds the frequency after Speed Agree is reached, otherwise follows the frequency reference.	Not saved
10				1		After the output frequency is held for 5 s, the value sampled during Hold is set to d4-06. The frequency reference cannot be overwritten, so only the bias is saved.

Setting 7A: KEB Ride-Thru 2, (N.C.)

Setting 7B: KEB Ride-Thru 2, (N.O.)

KEB Ride-Thru 2 adjusts the deceleration rate using load inertia data and regenerative power for smooth deceleration. This requires that the motor and load inertia ration be set to

L3-25, as well as the motor acceleration time caculated from inertia calculations be set to L3-24.

Setting 7C: Short Circuit Braking, N.O.

Setting 7D: Short Circuit Braking, N.C.

Short Circuit Braking commands (both the N.O. and N.C. terminal settings) are for use with PM Open Loop Vector only.

Status	Description
Open	Normal operation
Closed	Short-Circuit Braking

Setting 7E: Forward Reverse Detection (Simple PG in V/f)

Status	Description
Open	Forward
Closed	Reverse

Assigns the direction of speed feedback to one of the multi-function terminals using the Pulse Train Input.

Setting 90 to 96: DriveWorksEZ Digital Input 1 to 7

Setting 9F: DriveWorksEZ Function Disable (requires A1-07 = 2)

This function is for use with DriveWorksEZ. Contact Yaskawa for more information on DriveWorksEZ.

◆ H2: Multi-Function Outputs

■ H2-01: Terminal MA, MB, and MC Function Selection

■ H2-02: Terminal P1 Function Selection

■ H2-03: Terminal P2 Function Selection

The drive has three multi-function output terminals. Set parameters H2-01 to H2-03 between 0 and 192 to assign functions to these terminals. Default values are listed in the table below.

No.	Parameter Name	Setting Range	Default
H2-01	Terminal MA, MB and MC Function Selection (relay)	0 to 192	E: Fault Closes when a fault occurs (excluding CPF00, CPF01).

No.	Parameter Name	Setting Range	Default
H2-02	Terminal P1 Function Selection (open-collector)	0 to 192	0: During Run Closes when the Run command is present or when there is voltage output.
H2-03	Terminal P2 Function Selection (open-collector)	0 to 192	2: Speed Agree 1 (detection width set to L4-02)

Note: If not using an input terminal or if using it in the through-mode, be sure to set that terminal to "F".

Below is a circuit diagram for the multi-function output terminals.

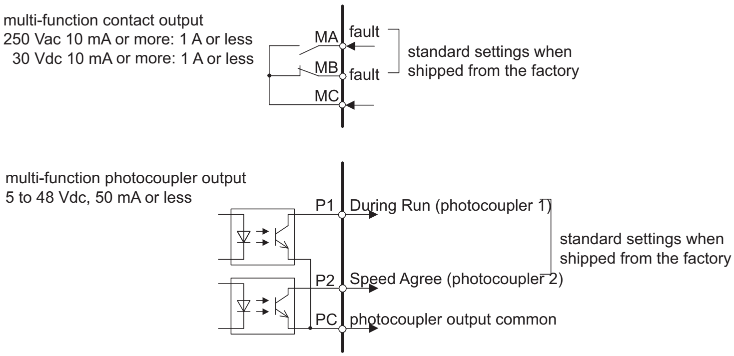


Figure 1.46 Multi-Function Output Circuit Diagram

Table 1.18 Multi-Function Output Terminal Settings

Setting	Function	Page	Setting	Function	Page
0	During Run	–	19	Torque Detection 2 (N.C.)	–
1	Zero Speed	–	1A	Reverse Direction	–
2	Fref/Fout Agree 1	–	1B	Baseblock 2	–
3	Fref/Fset Agree 1	–	1C	Motor 2 Selection	–
4	Frequency (FOUT) Detection 1	–	1E	Restart Enabled	–
5	Frequency (FOUT) Detection 2	–	1F	Overload OL1 (OL1 Alarm)	–
6	Drive Ready	–	20	OH Pre alarm	–
7	DC Bus Undervoltage	–	22	Mechanical Weakening (N.O.)	–
8	During Baseblock	–	30	During Torque Limit	–
9	Option Reference	–	37	During Frequency Output	–

1.7 H: Terminal Functions

Setting	Function	Page	Setting	Function	Page
A	Local/Remote	–	38	Drive Enable	–
B	Torque Detection 1 (N.O.)	–	39	Watt Hour Pulse Output	–
C	Loss of Reference	–	3C	Drive Mode	–
D	Braking Resistor Fault	–	3D	Speed Search	–
E	Fault	–	3E	PID Feedback Loss	–
F	Not used	–	3F	PID Feedback Fault	–
10	Alarm	–	4A	KEB Operation	–
11	Reset Command Active	–	4B	Short-Circuit Brake	–
12	Timer Output	–	4C	During Fast-stop	–
13	Fref/Fout Agree 2	–	4D	OH Pre-alarm Time Limit	–
14	Fref/Fset Agree 2	–	90	DriveWorksEZ Digital Output 1	–
15	Frequency Detection 3	–	91	DriveWorksEZ Digital Output 2	–
16	Frequency Detection 4	–	92	DriveWorksEZ Digital Output 3	–
17	Torque Detection 1 (N.C.)	–	100 to 192H	H2 Parameter Functions Reversed Output Switching of 0 to 92	–
18	Torque Detection 2 (N.O.)	–	–	–	–

Detailed Description

Setting 0: During Run

Closes whenever the Run command is provided and the drive is outputting voltage. This includes deceleration and DC Injection Braking.

Status	Description
Open	Drive is stopped
Closed	During run (which includes anytime their is a voltage output)

Setting 37: During Frequency Output

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

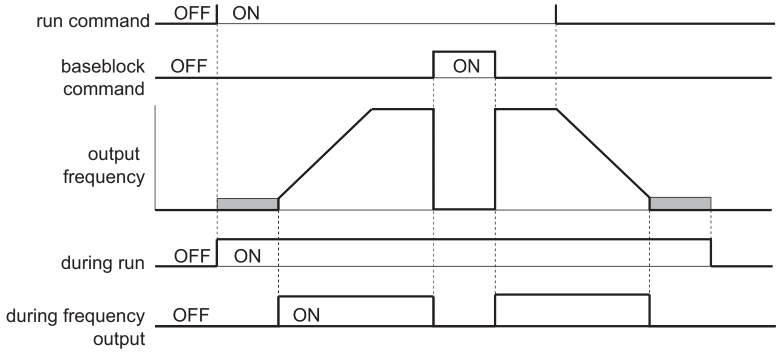


Figure 1.47 During Run Timing Diagram

Setting 1: Zero Speed

Terminal closes whenever the output frequency falls below the minimum output frequency set to E1-09.

Status	Description
Open	Output frequency is above the minimum output frequency set to E1-09
Closed	Output frequency is less than the minimum output frequency set to E1-09

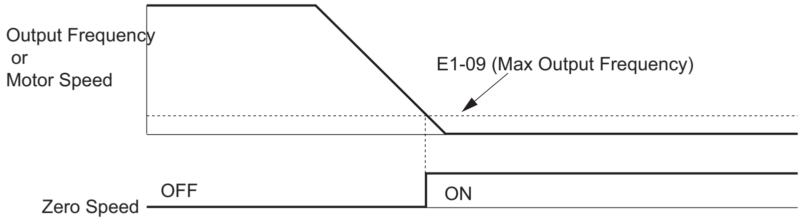


Figure 1.48 Zero-Speed Timechart

Setting 2: Speed Agree 1

Closes whenever 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 Speed Agree Width (L4-02) set for the frequency reference

Setting 3: User-Set Speed Agree 1

Closes whenever 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 does not match the frequency reference while the drive is running
Closed	Output frequency and the frequency reference are both equal to L4-01 ± hysteresis for L4-02

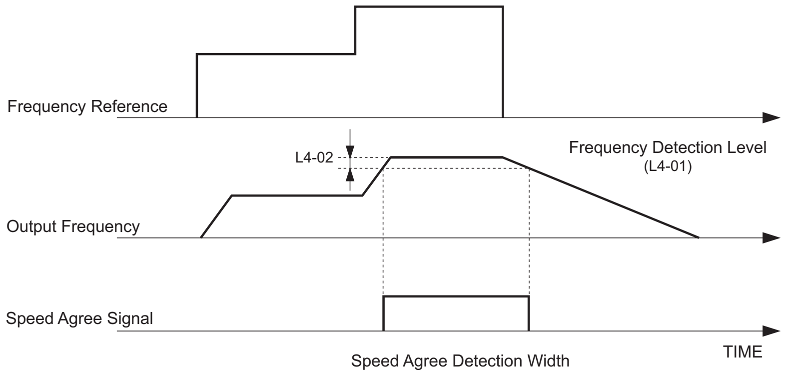


Figure 1.49 User-Set Speed Agree Timing Diagram

Setting 4: Frequency Detection 1

Output closes whenever the output frequency is equal to or below the value of the programmed Speed Agreement Level (L4-01). The Speed Agreement Width (L4-02) is the hysteresis to Frequency Detection 1.

Status	Description
Open	Drive is stopped or the condition described below is not true
Closed	Frequency Detection 1 > (+L4-01 greater than or equal to output frequency greater than or equal to -L4-01, L4-02)

Note: The terminal opens when the output for Frequency Detection 1 reaches the level set to L4-01. Frequency Detection 1 can also be used when the motor is rotating in reverse.

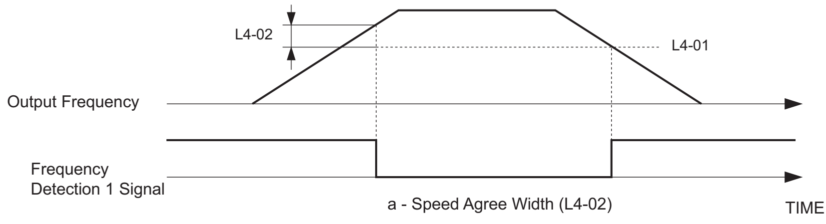


Figure 1.50 Frequency Detection 1 Timing Diagram

Setting 5: Frequency Detection 2

Output closes whenever the output frequency is equal to or above the value of the programmed Speed Agreement Level (L4-01). The Speed Agreement Width (L4-02) is the hysteresis to Frequency Detection 2.

Status	Description
Open	Drive is stopped or the condition described below is not true
Closed	Frequency Detection 1 > (+L4-01 greater than or equal to output frequency greater than or equal to -L4-01, L4-02)

No.	Parameter Name	Setting Range	Default	Page
L4-01	Frequency Detection Level	0.0 to 400.0	0.0 Hz	–
L4-02	Frequency Detection Width	0.0 to 20.0	2.0 Hz	–

Note: The output terminal set for Frequency Detection 2 will close when the output frequency falls below the level set to L4-01 minus the Speed Agree detection width set to L4-02. Frequency Detection 2 can also be used when the motor is rotating in reverse.

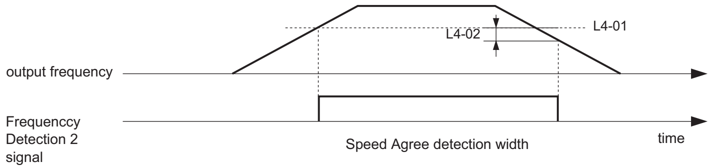


Figure 1.51 Frequency Detection 2 Timing Diagram

Setting 6: Drive Ready

Output closes whenever the drive is not in a fault state and not being programmed. If b1-08 = 1: Enabled", a drive that is in an active Run state that is also being programmed will have the Drive Ready output closed.

Status	Description
Open	Processing: Drive is powering up, initializing parameter settings, dealing with a fault situation, or in the Programming Mode.
Closed	Drive ready: In the Drive Mode with no fault situation. Drive can begin running the motor.

No.	Parameter Name	Setting Range	Default	Page
b1-08	Run Command Selection during Program*	0: Disabled - Run command accepted only in the operation menu. 1: Enabled - Run command accepted in all menus (except when b1-02 = 0). 2: Operation not possible. Cannot enter the Programming mode* because the Programming Mode cannot be accessed during run.	0	–

*“Programming mode” refers to when the drive is in the Setup mode, the Parameter Settings mode, performing Auto-Tuning, or the user is viewing the Verify Menu.

Setting 7: DC Bus Undervoltage

Output closes whenever the main circuit DC bus voltage or control circuit power supply drop below their respective trip level. The undervoltage trip level is determined by L2-05. An open soft charge contactor answer back signal will also cause the DC Bus Undervoltage output to close.

Status	Description
Open	DC bus voltage is above the level set to L2-05
Closed	DC bus voltage has fallen below the trip level set to L2-05.

No.	Parameter Name	Setting Range	Default	Page
L2-05	Undervoltage Detection Level (UV)	150 to 210 *2	*1 **Note:** Reset when E1-01 is changed	–

* 1. Default setting is determined by the drive capacity set to o2-04.
* 2. This value is for a 200 V class drive. Double this value when using a 400 V class unit.

Setting 8: During Baseblock

Output closes to indicate that the drive is in baseblocked state. While baseblock is executed, output transistors are prevented from firing.

Status	Description
Open	Drive is not in a baseblock state.

Status	Description
Closed	Baseblock is being executed (there is no output voltage at this time).

Setting 9: Operator Reference

Output closes when the frequency reference is being sourced from the operator.

Status	Description
Open	Frequency reference is provided from the control circuit terminals or via serial communications.
Closed	Frequency reference is being sourced from the digital operator.

Setting A: LOCAL/REMOTE Operation

Output closes when the Run command is being sourced from the operator.

Status	Description
Open	Run command is provided from the control circuit terminals or via serial communications.
Closed	Run command is being sourced from the digital operator.

Setting B: Torque Detection 1, N.O.

Setting 17: Torque Detection 1, N.C.

Setting 18: Torque Detection 2, N.O.

Setting 19: Torque Detection 2, N.C.

Theses functions tie a digital output to the overtorque/undertorque sensing capabilities of the drive. The digital output switches whenever the output current falls above or below the specified levels for the specified time period.

Select the type of torque detection and assign it to one of the multi-function output terminals (H2-01 to H2-03 = B, 17, 18, 19). Set the torque detection level to L6-01 for Torque Detection 1 or to L6-04 for Torque Detection 2.

Setting	Status	Description
B	Closed	Output current/torque exceeds the torque value set in parameter L6-02 for longer than the time specified in parameter L6-03.
17	Open	Output current/torque exceeds the value set in parameter L6-02 for more time than is set in parameter L6-03.
18	Closed	Output current/torque exceeds the value set in parameter L6-05 for more time than is set in parameter L6-06.
19	Open	Output current/torque exceeds the value set in parameter L6-05 for more time than is set in parameter L6-06.

Note: The torque detection function has a built-in hysteresis of 10% of the drive rated output current. The torque detection function is based on 100% of the drive rated output current when using V/f Control or PM Open Loop Vector. In general Open Loop Vector Control, torque detection is based on 100% of the motor rated torque.

Parameters related to torque detection appear in the table below.

No.	Parameter Name	Setting Range	Default	Page
L6-01 L6-04	Torque Detection Selection 1, 2	0: Disabled 1: OL4 at Speed Agree - Alarm (Overtorque Detection only active during Speed Agree and Operation continues after detection). 2: OL4 at RUN - Alarm (Overtorque Detection is always active and operation continues after detection). 3: OL4 at Speed Agree - Fault (Overtorque Detection only active during Speed Agree and drive output will shut down on an OL4 fault). 4: OL4 at RUN - Fault (Overtorque Detection is always active and drive output will shut down on an OL4 fault). 5: UL4 at Speed Agree - Alarm (Undertorque Detection is only active during Speed Agree and operation continues after detection). 6: UL4 at RUN - Alarm (Undertorque Detection is always active and operation continues after detection). 7: UL4 at Speed Agree - Fault (Undertorque Detection only active during Speed Agree and drive output will shut down on an OL4 fault). 8: UL4 at RUN - Fault (Undertorque Detection is always active and drive output will shut down on an OL4 fault).	0	–
L6-02	Torque Detection Level 1	0 to 300	150%	–
L6-03	Torque Detection Time 1	0.0 to 10.0	0.1 s	–

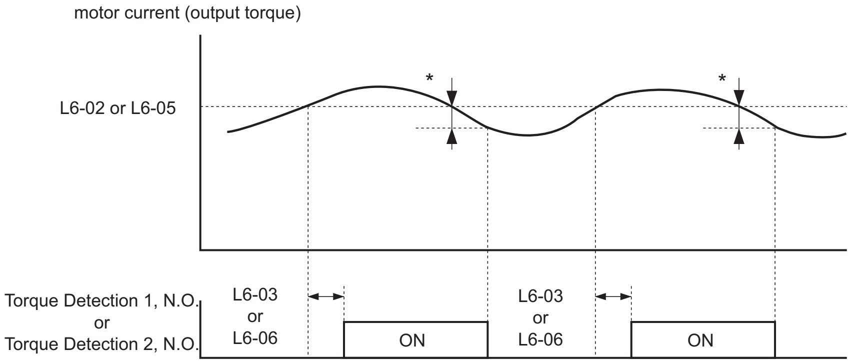


Figure 1.52 Overtorque Detection Timing Diagram

To cancel an overtorque situation, the current level must fall below about 10% of drive rated output torque (or motor rated torque).

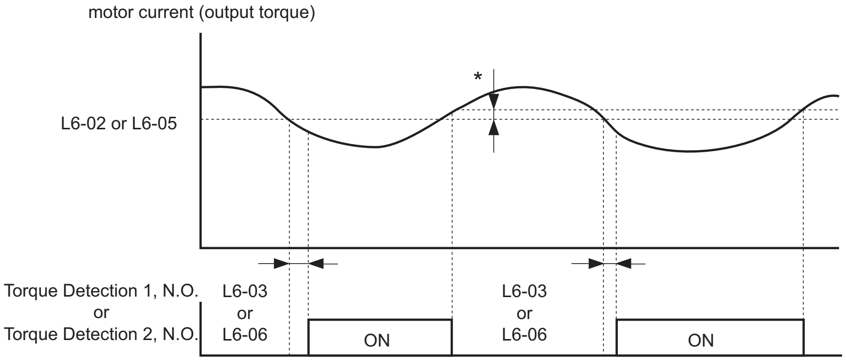


Figure 1.53 Undertorque Detection Timing Diagram

To cancel an undertorque situation, the current level must rise above about 10% of drive minimum output torque (or motor minimum torque).

Setting C: Loss of Reference

The Loss of Reference configured digital output will close when the drive has detected a loss of the analog frequency reference. The frequency reference is considered lost when the voltage level drops 90% in 0.4 seconds. Parameter L4-05 determines the drive's reaction to a loss of reference state in addition to turning on the Loss of Reference digital output.

The frequency references to which the Loss of Reference function applies are:

- Analog frequency reference input via terminal A1
- Analog frequency reference input via terminal A2

No.	Parameter Name	Setting Range	Default	Page
L4-05	Frequency Reference Loss Detection Selection	0: Stop - Drive will stop. 1: Run at the value saved to L4-06	0	–
L4-06	Frequency Reference at Reference Loss	0.0 to 100.0	80.0%	–

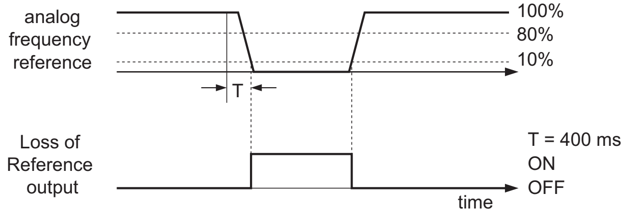


Figure 1.54 Loss of Reference Function

Setting D: Dynamic Braking Resistor Overheat

When the dynamic braking resistor (DB) overheats or the braking transistor is in a fault condition, the DB Overheat configured digital output will close.

Setting E: Fault

The Fault configured digital output will close whenever the drive experiences a fault (this excludes faults CPF00 and CPF01).

Setting F: Not Used

Use this setting when the terminal is not used or when using the terminal as a through-put.

Setting 10: Minor Fault

Output closes when a minor fault condition is present.

Setting 11: During Fault Reset

Output closes whenever 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

Used in conjunction with a multi-function digital input programmed for the timer function. Output closes after the input closes and the time set to b1-04 pass.

Setting 13: Speed Agree 2

Output closes whenever the output frequency is equal to or below the value of the programmed Speed Agree Level. The Speed Agree Width (L4-04) is the hysteresis to Frequency Detection 2.

Status	Description
Closed	Output currents matches the frequency reference +/- L4-04

No.	Parameter Name	Setting Range	Default	Page
L4-04	Speed Agreement Detection Width (+/-)	0.0 to 20.0	2.0 Hz	–

Setting 14: User Speed Agree 2

Output closes whenever the actual output frequency and the frequency reference are within the Speed Agree Width (L4-04) of the specified Speed Agree Level (L4-03). User Speed Agree 2 output is direction sensitive according to the direction programmed in L4-03.

Status	Description
Open	Output frequency and the frequency reference do not match (or the drive is stopped).
Closed	Output currents matches the frequency reference +/- L4-04

No.	Parameter Name	Setting Range	Default	Page
L4-04	Speed Agreement Detection Width (+/-)	0.0 to 20.0	2.0 Hz	–

Setting 15: Frequency Detection 3

Output will be closed whenever the output frequency is equal to or below the value of the specified Speed Agree Level (L4-03). The Speed Agree Width (L4-04) is the hysteresis to the Frequency Detection 3 function. Whenever the output frequency approaches the Speed Agree Level while accelerating, it will need to be equal to or exceed the Speed Agree Level (L4-03) plus the Speed Agree Width (L4-04) before the Frequency Detection 3 output will be activated.

No.	Parameter Name	Setting Range	Default	Page
L4-03	Speed Agreement Detection Level (+/-)	-400.0 to 400.0	0.0 Hz	–
L4-04	Speed Agreement Detection Width (+/-)	0.0 to 20.0	2.0 Hz	–

Note: During acceleration, the terminal set for Frequency Detection 3 will close if the output frequency is greater than the frequency detection level (L4-03) and the frequency detection width (L4-04). During deceleration, the terminal set for Frequency Detection 3 will close as long as the output frequency is less than the frequency detection level (L4-03). The output for Frequency Detection 3 is direction sensitive according to the direction programmed in L4-03.

Setting 16: Frequency Detection 4

Output closes whenever the output frequency is equal to or above the value of the specified Speed Agree Level (L4-03). The Speed Agree Width (L4-04) is the hysteresis to the Frequency Detection 4 function.

No.	Parameter Name	Setting Range	Default	Page
L4-03	Speed Agreement Detection Level (+/-)	-400.0 to 400.0	0.0 Hz	–
L4-04	Speed Agreement Detection Width (+/-)	0.0 to 20.0	2.0 Hz	–

Note: During acceleration, the terminal set for Frequency Detection 4 will close if the output frequency is greater than the frequency detection level (L4-03) and the frequency detection width (L4-04). During deceleration, the terminal set for Frequency Detection 4 will close as long as the output frequency is less than the frequency detection level (L4-03). The output for Frequency Detection 4 is direction sensitive according to the direction programmed in L4-03. .

Setting 1A: During Reverse

The During Reverse digital output will close and remain closed whenever the drive is turning the motor in the reverse direction.

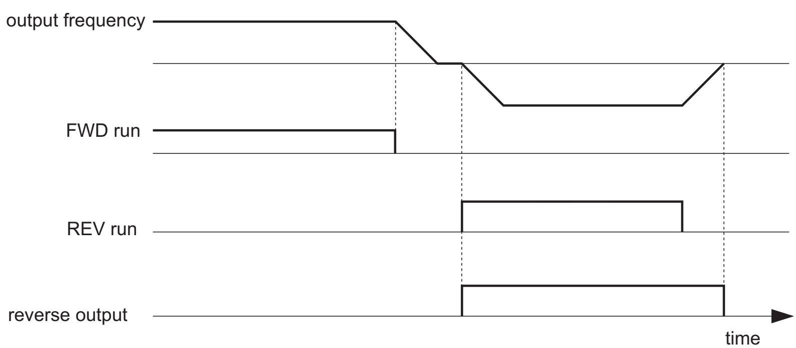


Figure 1.55 Reverse Direction Timing Diagram

Setting 1B: Baseblock, N.C.

Output opens only when the drive is in a baseblocked state.

Setting 1C: Motor 2 Selected

Output closes whenever a multi-function input programmed for motor 2 selection (H1-0x = 16) is closed.

Setting 1E: Restart Enabled

Depending on the setting of parameter L5-01, the drive may be configured to automatically attempt to restart itself after certain faults. The Restart Enabled output will be closed once the restarts begin and will remain closed until a successful restart is accomplished or the number of Auto Restart attempts as specified by L5-01 is reached.

No.	Parameter Name	Setting Range	Default	Page
L5-01	Number of Auto Restart Attempts	0 to 10	0 times	–

Setting 1F: Overload Alarm oL1

The oL1 fault function is designed to protect the motor. It estimates the motor’s winding temperature based on the output current, output frequency, and time. An Overload Alarm oL1 digital output will close whenever 90% of the programmed oL1 time is exceeded.

Status	Description
Open	Motor winding temperature is less than 90% of the specified temperature.
Closed	Motor winding temperature has exceeded 90% of the protection level.

Setting 20: OH Prealarm

Output closes whenever the heatsink temperature reaches the level specified by parameter L8-02. Parameter L8-03 will determine how the drive responds when it reaches the OH Prealarm level, in addition to closing the configured digital output.

Status	Description
Open	Heatsink is cooler than the overheat temperature.
Closed	Heatsink has exceeded the overheat level set to L8-02.

No.	Parameter Name	Setting Range	Default	Page
L8-02	Overheat Alarm Level	50 to 130	Determined by o2-04	–

Setting 22: Mechanical Weakening Detection

Output closes when mechanical weakening is detected.

Setting 30: During Torque Limit (Current Limit)

When the torque reference reaches the torque limit set in L7-01 to L7-04, the output programmed for During Torque Limit closes. This setting is only valid when using Open Loop Vector Control (A1-02 = 2).

No.	Parameter Name	Setting Range	Default	Page
L7-01	Forward Torque Limit	0 to 300	200%	–
L7-02	Reverse Torque Limit			–
L7-03	Forward Regenerative Torque Limit			–
L7-04	Reverse Regenerative Torque Limit			–

Setting 37: During Frequency Output

Output closes whenever the Run command is provided and the drive is outputting frequency. This does not include baseblock, DC Injection, Short Circuit Braking, and Initial Excitation.

Status	Description
Open	Drive is stopped or is performing DC Injection, Short Circuit Braking, or Initial Excitation.
Closed	Drive is producing a frequency output

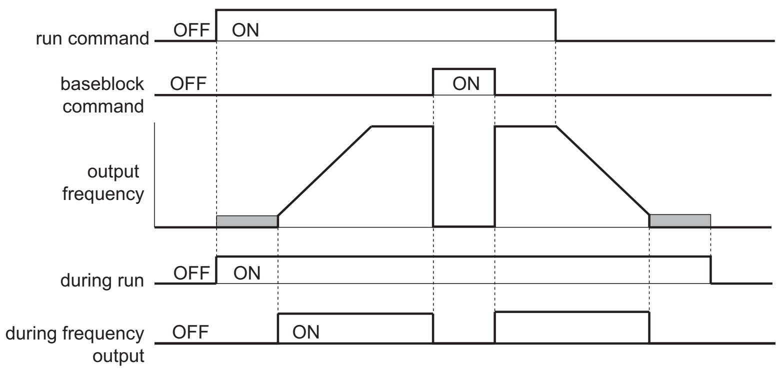


Figure 1.56 Timing Diagram During Frequency Output

Setting 38: Drive Enabled

A Drive Enable digital output will reflect the status of a digital input configured as a Drive Enable input (H1-0x = 6A). If the Drive Enable digital input is closed then the Drive Enabled digital output will also close.

Setting 39: Watt Hour Pulse Output

Outputs a pulse to indicate the watt hour. Set H2-06 to specify the units. Output terminal closes every 200 ms.

No.	Parameter Name	Setting Range	Default	Page
H2-06	Watt Hour Output Unit Selection	0: 0.1 kWH units 1: 1 kWH units 2: 10 kWH units 3: 100 kWH units 4: 1000 kWH units	0	–

Setting 3C: REMOTE/LOCAL Switch

Output terminal closes while the drive is set for LOCAL, and opens when in REMOTE.

Status	Description
Open	REMOTE
Closed	LOCAL

Setting 3D: During Speed Search

Output terminal closes while Speed Search is being performed.

Setting 3E: PID Feedback Loss

Output terminal closes when a the PID feedback signal is lost. Works for both pulse input and analog input PID signals. For PID loss to be detected, set the loss level to b5-13 and the detection time to b5-14.

No.	Parameter Name	Setting Range	Default	Page
b5-13	PID Feedback Loss Detection Level	0 to 100	0%	–
b5-14	PID Feedback Loss Detection Time	0.0 to 25.5	1.0 s	–

Setting 3F: PID Feedback High Fault

Output terminal closes when a the PID feedback signal is too high for too long. Works for both pulse input and analog input PID signals. To detect an excessively high PID signal, set the detection level to b5-36 and the detection time to b5-37.

No.	Parameter Name	Setting Range	Default	Page
b5-36	PID Feedback High Detection Level	0 to 100	100%	–
b5-37	PID Feedback High Level Detection Time	0.0 to 25.5	1.0 s	–

Setting 4A: During KEB Operation

Output terminals closes while KEB is being performed.

Setting 4B: During Short Circuit Braking

Closes the output terminal while Short Circuit Braking is being executed.

Setting 4C: During Fast Stop

Output terminal closes when a Fast Stop is being executed.

Setting 4D: oH Pre-Alarm Time Limit

Output terminals closes when then overheat prealarm continues passed the allowable time.

Setting 90 to 92: DriveWorksEZ Digital Output 1 to 3

For use with DriveWorksEZ.

Setting 100 to 192: Reverse Switching for Functions 0 to 92

Reverses the switching status of the specified terminal and function. Set as 1☐☐, where the last to digits specify the setting number of the function to be reversed.

Example: To reverse the output for “8: During Baseblock”, set “108”. To reverse the output for “14A: During KEB,” set 14A.

■ H2-06: Watt Hour Output Unit Selection

When one of the multi-function terminals is set output the number of watt hours (H2-01 to H2-03 = 39), parameter H2-06 determines the units for the output signal. Outputs a signal every 200 ms.

No.	Parameter Name	Setting Range	Default	Page
H2-06	Watt Hour Output Unit Selection	0: 0.1 kWH units 1: 1 kWH units 2: 10 kWH units 3: 100 kWH units 4: 1000 kWH units	0	–

◆ H3: Multi-Function Analog Input Terminals

V1000 is equipped with 2 multi-function analog input terminals, A1 and A2. The user can assign functions to these terminals by setting parameters H3-02 and H3-10 between 0 and 31.

No.	Parameter Name	Setting Range	Default
H3-02	Terminal A1 Function Selection	0 to 31	0
H3-10	Terminal A2 Function Selection	0 to 31	0

Multi-Function Analog Input Terminal Settings

Setting	Function	Page	Setting	Function	Page
0	Frequency Bias (A1)	–	F	Not used (use this setting if the terminal is not used or is used as a pass-through terminal)	–
1	Frequency Gain	–	10	FWD Torque Limit	–
2	Auxiliary Frequency Reference (used as a second frequency reference)	–	11	REV Torque Limit	–
4	Output Voltage Bias	–	12	Regenerative Torque Limit	–
7	Overtorque/Undertorque Detection Level	–	15	FWD/REV Torque Limit	–
B	PID Feedback	–	16	Differential PID Feedback	–
C	PID Set Point	–	30	DriveWorksEZ Analog Input 1	–
E	Motor Temperature (PTC input)	–	31	DriveWorksEZ Analog Input 2	–

Analog input levels are set using the H3 parameters described below.

H3-01: Terminal A1 Signal Level Selection

The A1 analog input can accept either a 0 to 10 Vdc or -10 to +10 Vdc signal as a reference.

No.	Parameter Name	Setting Range	Default
H3-01	Terminal A1 Signal Level Selection	0 to 1	0

Note: When set to “1”, the user can have an input of less than 5 V can be treated as a negative value by tuning the gain and bias levels.

H3-02: Terminal A1 Function Selection

Determines the function assigned to analog output terminal A1.

No.	Parameter Name	Setting Range	Default
H3-02	Terminal A1 Function Selection	0 to 31	0

Note: If not using an input terminal or if using it in the through-mode, be sure to set that terminal to “F”.

H3-03: Terminal A1 Gain Setting

H3-04: Terminal A1 Bias Setting

In order to have the drive properly interpret an analog input, it may be necessary to apply a gain and/or a bias to the signal. The analog inputs have a resolution of 10 bits (1024 steps).

No.	Parameter 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%

Detailed Description

Using the factory default settings for the analog input's gain and bias, the 0 to 10 Vdc or the -10 to +10 Vdc signal at the analog input will yield a 0 to 100% frequency reference span.

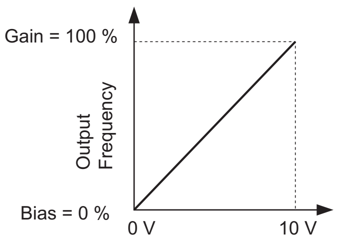


Figure 1.57 Output Frequency as Commanded via Analog Input

If a different span of analog input signal is desirable, it will be necessary to adjust the gain, the bias, or both to allow the analog input level to generate the desired frequency command. Adjustment of the gain setting will change the frequency reference that is equivalent to the maximum analog input (10 Vdc). If, for instance, the gain is increased to 200%, then 10 Vdc will be equivalent to a 200% frequency reference and 5 Vac will be equivalent to a 100% frequency reference. Since the drive output is limited by the maximum frequency parameter (E1-04), 0 to 5 Vdc will now be equivalent to 0 - 100% frequency reference span.

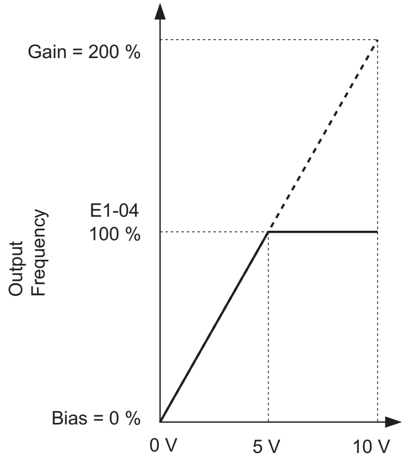


Figure 1.58 Output Frequency Using Analog Input with Increased Gain

Adjustment of the bias setting will likewise adjust the frequency reference that is equivalent to the minimum analog input level (0 Vdc). If, for instance, the bias is set to -25%, then 0 Vdc will be equivalent to a -25% frequency reference. Since the minimum frequency reference is 0% an analog input of 2.5 to 10 Vdc will now be equivalent to 0 - 100% speed command span.

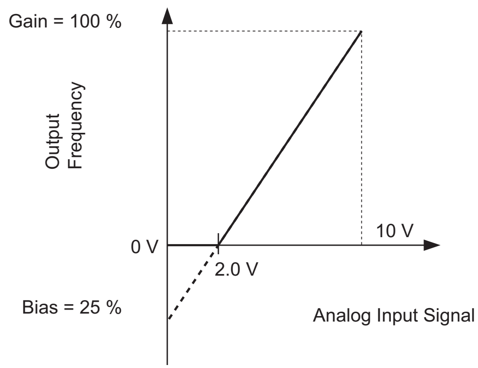


Figure 1.59 Output Frequency Using Analog Input with Reduced Gain

As a further example, for an inverse-acting frequency reference, set the bias= 100% and the gain = 0%. The minimum analog input level (0 Vdc) will produce a 100% frequency reference and the maximum analog input level (10 Vdc) will produce a 0% frequency reference.

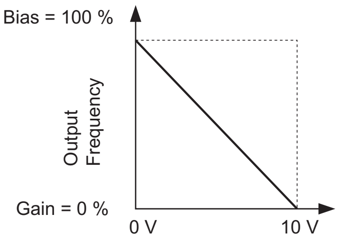


Figure 1.60 Output Frequency with Inverted Gain and Bias Settings

■ H3-09: Terminal A2 Signal Level Selection

Parameter H3-09 assigns the signal level for input signal connected to multi-function analog input terminal A2. Below is a list of settings and corresponding signal levels. Be sure to also set DIP switch S1 accordingly for a voltage input or current input.

0: 0 to +10 V, with lower limit

1: 0 to +10 V, no lower limit

2: 4 to 20 mA

3: 0 to 20 mA

For instructions on how to set DIP switch S1, review section 3.9 in the V1000 Basic Manual.

No.	Parameter Name	Setting Range	Default
H3-09	Terminal A2 Signal Level Selection	0 to 3	2

■ H3-10: Terminal A2 Function Selection

Determines which function is assigned to multi-function analog input terminal A2.

No.	Parameter Name	Setting Range	Default
H3-10	Terminal A2 Function Selection	0 to 31	0

■ Multi-Function Analog Input Terminal Settings and Functions

This section describes the various functions that can be assigned to terminal A2 by setting H3-10.

Setting 0: Adds to Terminal A1

By setting analog input to 0, the level of the analog input will be summed with the level of the frequency reference analog input A1.

Setting 1: Frequency Gain

The analog output level will correspond to the chosen frequency reference input, whether it is input via the operator keypad, analog input, serial communication, option board, or pulse input. Setting 100% will be equivalent to the maximum output frequency of the drive.

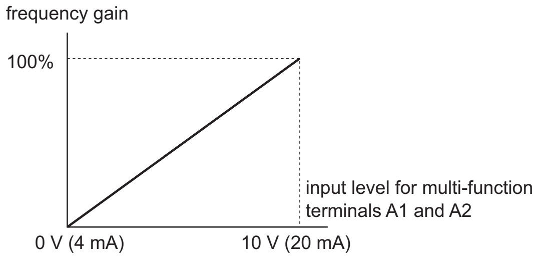


Figure 1.61 Input for Frequency Reference Gain 1

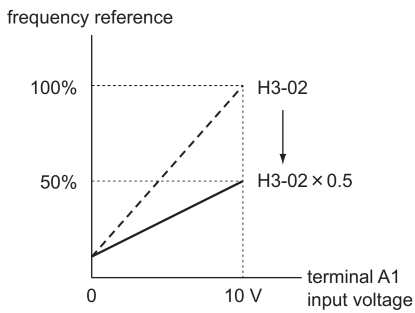


Figure 1.62 Setting Bias Levels for the Output Frequency

Setting 2: Aux Reference

Sets the analog input toe act as an auxiliary speed reference. Input level is a percentage of the drive’s maximum output frequency set to E1-04.

Setting 4: Voltage Bias

Voltage bias boosts the output voltage of the V/f curve as a percentage of motor rated voltage (E1-05). Available only when using V/f Control.

Setting 7: Overtorque Level

Overtorque level sets the overtorque/undertorque detection level using the analog input. This works with Torque Detection Selection 1 (L6-01) and will take the place of the torque detection level set to L6-02. For general OpenLoop Vector Control, this function is based on 100% of the motor rated torque. For V/f Control and PM Open Loop Vector, this function is based on 100% of the drive rated current.

Setting B: PID Feedback

Configuring the analog input as PID feedback is a requirement of setting the drive up for PID operation.

Setting C: PID Set Point

Setting the analog input to PID set point allows the analog input level to be the PID set point as a percentage of maximum output frequency (E1-04). The frequency reference selected in parameter b1-01 no long becomes the PID set point.

Setting E: Motor Temperature

In addition to or in place of the oL1 (motor overload) fault of the drive, it is possible to use a PTC (Positive Temperature Coefficient) thermistor for motor insulation protection. The PTC thermistors are built into the windings of some motors and will vary their resistance based on temperature. For details, see .

Setting F: Not Used

Use this setting when the terminal is not used or when using the terminal as a through-put.

Setting 10: Forward Torque Limit

Setting 11: Reverse Torque Limit

Setting 12: Regeneration Torque Limit

Torque limit can be independently set by the analog input programmed for the proper motoring condition (quadrants 1, 2, 3, and 4) as a percentage of motor rated torque. Available only when using Open Loop Vector Control.

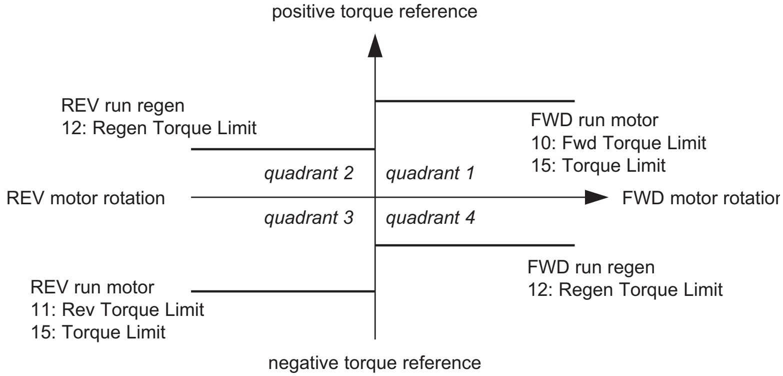


Figure 1.63 Analog Input Torque Limit

Setting 15: Torque Limit

Torque limit can be set by the analog input programmed torque limit for forward and reverse motoring conditions (quadrants 1 and 3) as a percentage of motor rated torque. This function is available only when using Open Loop Vector Control.

Setting 16: Differential PID Feedback

Setting 30: DriveWorksEZ Analog Input 1

Setting 31: DriveWorksEZ Analog Input 2

■ H3-11: Terminal A2 Gain Setting

■ H3-12: Frequency Reference (Current) Terminal A2 Input Bias

An analog input filter can be used to prevent erratic drive control when a “noisy” analog reference is used. Parameter H3-12 sets the time constant for a first order filter that will be applied to both the A1, A2, and A3 analog inputs. The drive operation becomes more stable the longer the time programmed, but it becomes less responsive to rapidly changing analog signals.

No.	Parameter Name	Setting Range	Default
H3-11	Terminal A2 Gain Setting	-999.9 to 999.9	100.0%
H3-12	Frequency Reference (Current) Terminal A2 Input Bias	-999.9 to 999.9	0.0%

■ H3-13: Analog Input Filter Time Constant

Sets the primary delay filter time constant for terminals A1 and A2.

No.	Parameter Name	Setting Range	Default
H3-13	Analog Input Filter Time Constant	0.00 to 2.00	0.03 s

◆ H4: Multi-Function Analog Output Terminals

These parameters assign an output to multi-function analog output terminal AM for monitoring a specific aspect of drive performance.

■ H4-01: Multi-Function Analog 1 (Terminal AM Monitor Selection)

Select the data to be output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U□-□□.

Example: Enter “103” for U1-03.

No.	Parameter Name	Setting Range	Default
H4-01	Multi-Function Analog 1 (Terminal AM Monitor Selection)	000 to 999	102

Note: If terminal AM is not used or is used as a through-put, then set H4-01 to 000 or 031.

■ H4-02: Multi-Function Analog 1 (Terminal AM Output Gain)

■ H4-03: Multi-Function Analog 1 (Terminal AM Output Bias)

Sets the gain and bias of the voltage level output from terminal AM.

No.	Parameter Name	Setting Range	Default
H4-02	Multi-Function Analog 1 (Terminal AM Output Gain)	-999.9 to 999.9	100.0%
H4-03	Multi-Function Analog 1 (Terminal AM Output Bias)	-999.9 to 999.9	0.0%

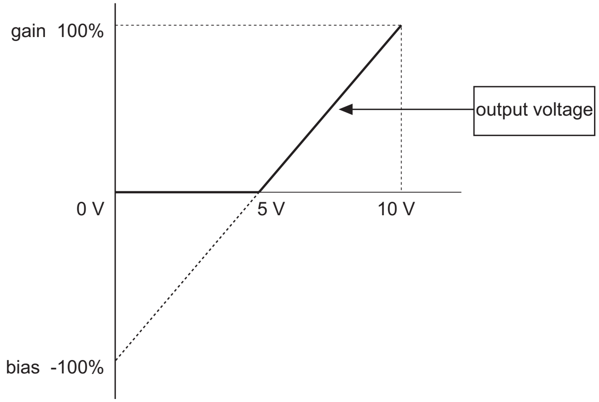


Figure 1.64 Analog Output Gain/Bias Setting

◆ H5: MEMOBUS/Modbus Serial Communication

Serial communication can be performed with programmable logic controllers (PLCs) or similar devices using the MEMOBUS/Modbus protocol.

■ H5-01: Drive Node Address

Parameter Overview

No.	Name	Description	Range	Default
H5-01	Drive Node Address	Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.	0 to 20 H	1F

■ H5-02: Communication Speed Selection

Parameter Overview

No.	Name	Description	Range	Default
H5-02	Communication Speed Selection	Selects the baud rate for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps	0 to 8	3

■ H5-03: Communication Parity Selection

Parameter Overview

No.	Name	Description	Range	Default
H5-03	Communication Parity Selection	Selects the communication parity for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0

■ H5-04: Stopping Method after Communication Error

Parameter Overview

No.	Name	Description	Range	Default
H5-04	Stopping Method after Communication Error	Selects the stopping method when a communication time-out fault (CE) is detected. 0: Ramp to stop 1: Coast to stop 2: Fast-stop 3: Alarm only	0 to 3	3

■ H5-05: Communication Fault Detection Selection

Parameter Overview

No.	Name	Description	Range	Default
H5-05	Communication Fault Detection Selection	Enables or disables the communications time-out fault (CE) detection. 0: Disabled 1: Enabled - If communication is lost for more than two seconds, a CE fault will occur.	0,1	1

■ H5-06: Drive Transmit Wait Time

Parameter Overview

No.	Name	Description	Range	Default
H5-06	Drive Transmit Wait Time	Set the wait time between receiving and sending data.	5 to 65	5

■ H5-07: RTS Control Selection

Parameter Overview

No.	Name	Description	Range	Default
H5-07	RTS Control Selection	Selects "request to send" (RTS) control: 0: Disabled - RTS is always on. 1: Enabled - RTS turns on only when sending.	0,1	1

■ H5-09: CE Detection Time

Parameter Overview

No.	Name	Description	Range	Default
H5-09	CE Detection Time	Sets the time required to detect a communications error. Adjustment may be need when networking several drives.	0.0 to 10.0 s	2.0

■ H5-10: Unit Selection for MEMOBUS/Modbus Register 0025H

Parameter Overview

No.	Name	Description	Range	Default
H5-10	Unit Selection for MEMOBUS/ Modbus Register 0025H	Selects the units used for MEMOBUS/ Modbus register 0025H (Output Voltage Reference Monitor). 0: 0.1 V units 1: 1 V units	0, 1	0

■ H5-11: Communications ENTER Function Selection

Parameter Overview

No.	Name	Description	Range	Default
H5-11	Communications ENTER Function Selection	Select the function for the enter command that saves parameter data to the drive. 0: Parameter changes are activated when ENTER command is entered. 1: Parameter changes are activated immediately without ENTER command (compatible with Varispeed VS606-V7).	0, 1	1

■ H5-12: Run Command Method Selection

Parameter Overview

No.	Name	Description	Range	Default
H5-12	Run Command Method Selection	0: FWD/STOP, REV/STOP Method 1: RUN/STOP, FWD/REV Method	0, 1	0

◆ H6: Pulse Train Input/Output

The drive has the ability to receive and output a single-ended pulse train. The pulse train input and output is not quadrature and therefore cannot be used to sense or transmit direction (phase) information. Please pay attention to the wiring diagrams in the Basic Manual to avoid potential damage to the drive and external circuitry. Proper circuit impedance must be used to avoid either an unrecognizable pulse train signal or a high current condition that could damage equipment.

The input, which can handle up to a 32 kHz signal, is scalable and can be programmed for frequency reference and PID functions. To use the pulse input as the frequency reference, set b1-01 = 4 and H6-01 = 0. For PID functions, set H6-01 = 1 for PID feedback or H6-01 = 2 for PID setpoint.

Speed feedback control is possible when using V/f Control by setting H6-01 to 3.

The output monitor, which can be used in sinking or sourcing installations, is also scalable up to a 32 kHz frequency and can be programmed to be proportional to the drive’s monitors relating to frequency, speed, and the PID functions. To program the output, set the appropriate U1 monitor number in H6-06. The monitor can also be sychronized in phase with the drive’s T1-phase output frequency by setting H6-06 = 2 and H6-07 = 0.

■ H6-01: (Terminal RP) Pulse Train Input Function Selection

Selects the function of pulse train (terminal RP).

This parameter selects the function of the pulse train terminal RP. If pulse train is to be used as the frequency reference (H6-01 = 0) parameter b1-01 must be set to “4: Pulse Input.”

No.	Parameter Name	Setting Range	Default
H6-01	(Terminal RP) Pulse Train Input Function Selection	0: Frequency reference 1: PID feedback value 2: PID setpoint value 3: Simple PG V/f control mode (can be set only when using motor 1 in the V/f control mode)	0

■ H6-02: Pulse Train Input Scaling

Pulse train input scaling parameter sets the number of pulses (in Hz) that is equal to the maximum output frequency E1-04.

No.	Parameter Name	Setting Range	Default
H6-02	Pulse Train Input Scaling	1000 to 32000	1440 Hz

■ H6-03: Pulse Train Input Gain

Pulse train input gain sets the output level with the pulse train input is at 100% as a percentage of maximum output frequency (E1-04).

No.	Parameter Name	Setting Range	Default
H6-03	Pulse Train Input Gain	0.0 to 1000.0	100.0%

■ H6-04: Pulse Train Input Bias

Pulse train input bias sets the output level when the pulse train input is 0 Hz as a percentage of maximum output frequency (E1-04).

No.	Parameter Name	Setting Range	Default
H6-04	Pulse Train Input Bias	-100.0 to 100.0	0.0%

■ H6-05: Pulse Train Input Filter Time

Sets the pulse train input filter time constant in seconds.

No.	Parameter Name	Setting Range	Default
H6-05	Pulse Train Input Filter Time	0.00 to 2.00	0.10 s

■ H6-06: Pulse Train Input Monitor Selection

Selects the pulse train monitor output terminal MP function (value of the □□ part of monitor U1-□□). See Appendix A for a complete list of monitors.

No.	Parameter Name	Setting Range	Default
H6-06	Pulse Train Input Monitor Selection	000, 031, 101, 102, 105, 116, 501, 502, 801 to 809	102

■ H6-07: Pulse Train Input Monitor Scaling

Pulse train monitor scaling sets the number of output pulses when the monitor is 100% (in Hz). Set H6-06 to 102 and H6-07 to 0 to make the pulse train monitor output synchronous to the output frequency.

No.	Parameter Name	Setting Range	Default
H6-07	Pulse Train Input Monitor Scaling	0 to 32000	1440 Hz

1.8 L: Protection Functions

◆ L1: Motor Protection Functions

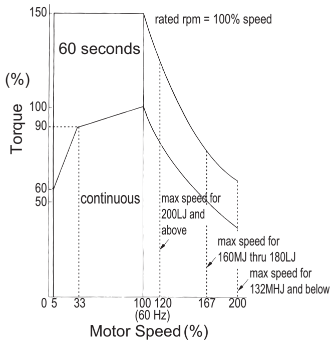
The drive has an electronic overload protection function that protects the motor from overheating.

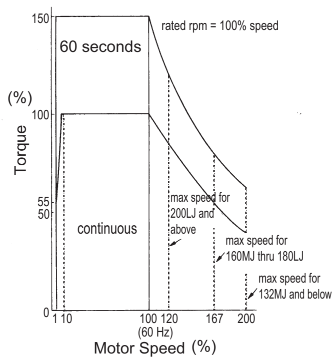
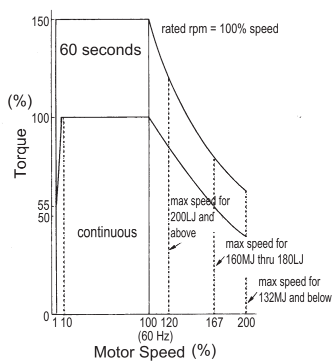
■ L1-01: Motor Protection Function Selection

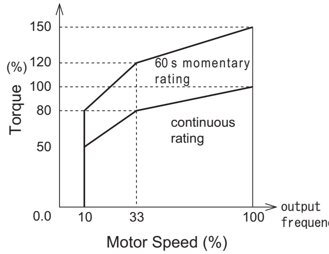
Set the overload protection function in L1-01 according to the motor being used. The cooling ability of an induction motor varies with the motor type, so the electronic thermal protection characteristics must be consequently adjusted.

No.	Name	Setting Range	Default	Page
L1-01	Motor Overload Protection Selection	0 to 4	Determined by A1-02.	–

The table below shows the overload characteristics for each type of motor.

L1-01 Setting	Motor Type	Overload Characteristics	Cooling Ability	Eletrothermal Operation (100% motor OL
1	General-purpose motor (standard motor)		Motor designed to operate from line power. Most effective at cooling the motor when running at line power specifications (check the specifications for line power in your area).	Operating continuously at less then frequency provided by line power can trigger motor overload protection (OL1). A fault is then output and the motor will coast to stop.

L1-01 Setting	Motor Type	Overload Characteristics	Cooling Ability	Eletrothermal Operation (100% motor OL
2	Inverter-Drive Dedicated Motor (constant torque, 1:10)		Motor is designed to effectively cool itself even at low speeds (as lower as 6 Hz).	Continuous operation at 6 Hz to 50/60 Hz.
3	Vector Motor (1:100)		Motor is designed to effectively cool itself at ultra-low speeds (about 0.6 Hz).	Continuous operation at 0.6 Hz to 50/60 Hz.

L1-01 Setting	Motor Type	Overload Characteristics	Cooling Ability	Eletrothermal Operation (100% motor OL
4	PM Derated Torque Motor		Pico motor is designed with a heatsink running from the flange to the enclosure. IPM motors for derated torque have the most effective cooling design.	Because this motor is designed for derated torque applications, the load needs to be limited at low speeds.

Setting Descriptions

- L1-01 = 1
  Set to “1” when using a general-purpose motor (standard motor). Because the motor is self-cooled, this setting lowers the overload tolerance as the motor speeds up. The drive appropriately adjusts the electrothermal trigger point according to the motor overload characteristics, protecting the motor from overheat throughout the entire speed range.
- L1-01 = 2
  Use this setting when operating a inverter drive dedicated motor with a torque ratio of 1:10. Here, the drive runs the motor so that it produces constant torque from 10% up to 100% speed. Slower speeds require torque derating.
- L1-01 = 3
  Use this setting when operating a inverter drive dedicated motor with a torque ratio of 1:100. Here, the drive runs the motor so that is produces constant torque from 1% up to 100% speed. Slower speeds require torque derating.
- L1-01 = 4
  This setting is for operating a PM motor. IPM motors for derated torque have a self-cooling design, so the overload tolerance drops as motor slows. Electrothermal operation is triggered in accordance with the motor overload characteristics, providing overheat protection across the entire speed range.

Note: **1.** Select a method to protect the motor from overheat by setting L1-01 between 1 and 4 when running a single motor from the drive. An external thermal relay is not needed.

NOTICE: *Protect each motor with individual thermal overloads when multiple motors are connected to one drive. Failure to comply could result in improper drive operation. Disable the electronic overload protection of the drive (L1-01= “0: Disabled”) and protect each motor with its own motor thermal overload.*

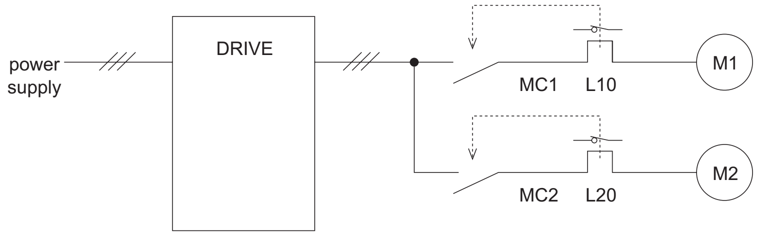


Figure 1.65 Example of Protection Circuit Design for Multiple Motors)

■ L1-02: Motor Overload Protection Time

Sets the time it takes the drive to detect motor overheat due to overload. This setting rarely requires adjustment, but should correlate with the motor overload tolerance protection time for performing a hot start.

No.	Name	Setting Range	Default	Page
L1-02	Motor Overload Protection Time	0.1 to 5.0	1.0 min	–

- Sets the operation time for electrothermal protection. This setting rarely needs to be changed.
- Defaulted to operate allow 150% overload operation for one minute.
- Below is an example of the electrothermal protection operation time using a general-purpose motor operating at 60 Hz with L1-02 set to 1 minute.

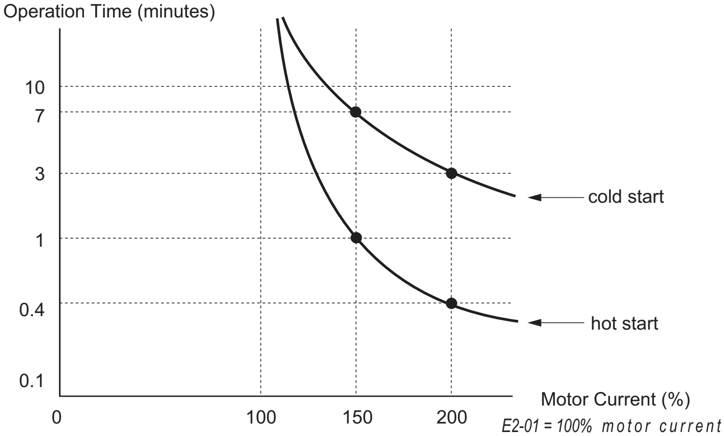


Figure 1.66 Motor Protection Operation Time

Note: When the motor protection function is enabled (L1-01 is not set to 0), an OL1 alarm can be output through one of the multi-function outputs by setting H2-01 to 1F. The output will close when the alarm is triggered at 90% overload.

■ L1-03: Motor Overheat Alarm Operation Selection L1-04: Motor Overheat Fault Operation Selection L1-05: Motor Temperature Input Filter Time

The motor is protected from overheat by using a PTC thermistor embedded in the motor stator windings.

No.	Name	Setting Range	Default	Page
L1-03	Motor Overheat Alarm Operation Selection	0 to 3	3	–
L1-04	Motor Overheat Fault Operation Selection	0 to 2	1	–
L1-05	Motor Temperature Input Filter Time	0.00 to 10.00	0.20 sec	–

Detailed Description

L1-03 and L1-04 determine how the motor is protected from overheat. Alarm OH3 and fault OH4 can be set to appear on the LED or LCD operator by setting the motor temperature input filter time constant to parameter L1-04.

- L1-03 Settings

Setting	Description
0	Ramp to Stop
1	Coast to Stop
2	Fast Stop (stops at the deceleration time set to C1-09)
3	Alarm Only (“oH3” flashes on the operator)

• L1-04 Settings

Setting	Description
0	Ramp to Stop
1	Coast to Stop
2	Fast Stop (stops at the deceleration time set to C1-09)

• Example Using PTC Thermistor

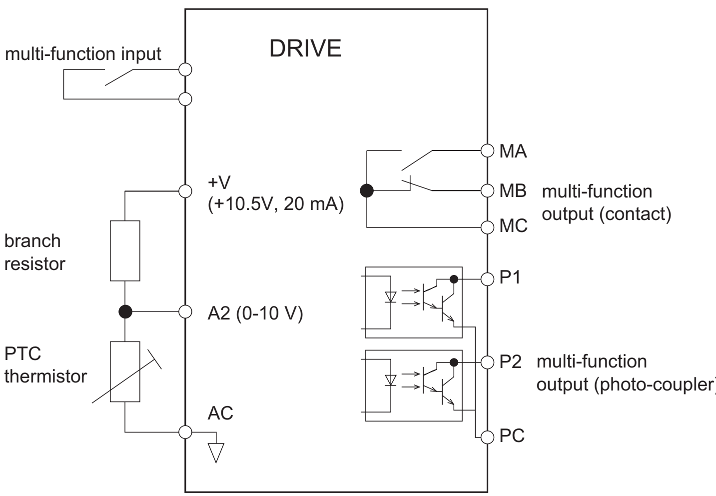


Figure 1.67 Setting Up Motor Overheat Protection

Note: When using terminal A2, set DIP switch S1 to the voltage side.

PTC Thermistor Characteristics

The following diagram shows the characteristics of temperature and resistance on the PTC thermistor.

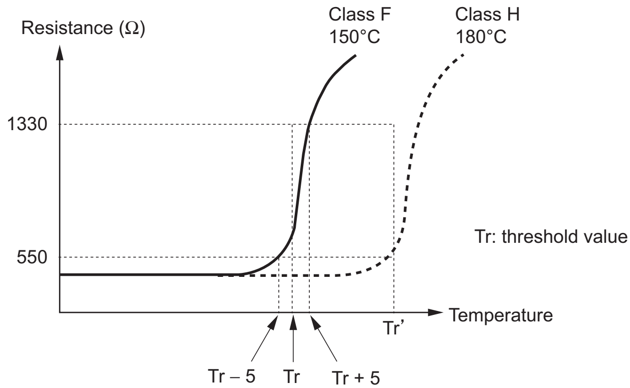


Figure 1.68 PTC Thermistor Temperature: Resistance

- Operation Selection and Setting Method
  Set the analog input terminal for motor temperature input (H3-1 = E), and connect a PTC thermistor as shown in Fig 6.42. Although OH3 or OH4 will appear on the operator when the motor overheats, the drive is defaulted to continue running when OH3 occurs, and to not output a fault. If OH4 occurs, a fault signal will be output and the drive will come to a stop. Depending on the application, the conditions for OH3 can be set to L1-03, and the conditions for OH4 to L1-04.
  When protection operation produces abnormal amounts of noise, try increasing the value set to parameter L1-05.

■ L1-13: Continuous Electrothermal Operation Selection

Parameter Overview

No.	Name	Description	Range	Default
L1-13	Continuous Electrothermal Operation Selection	Determines whether or not to hold the electrothermal value when the power supply is interrupted. 0: Disabled 1: Enabled	0 to 1	1

◆ L2: Momentary Power Loss Ridethru

■ L2-01: Momentary Power Loss Operation Selection

■ L2-02: Momentary Power Loss Ridethru Time

When a momentary power loss occurs, the drive can be set to automatically return to the operation it was performing when the power went out based on certain conditions.

No.	Name	Setting Range	Default	Page
L2-01	Momentary Power Loss Operation Selection	0 to 2	0	–
L2-02	Momentary Power Loss Ride-Thru Time	0.0 to 25.5	Determined by o2-04.	–

Detailed Description

Three operations are possible when a momentary power loss occurs. The table below lists the selections available for parameter L2-01.

Setting	Description
0*	Disabled - Drive trips on (UV1) fault when power is lost.
1	Power Loss Ride-Thru Time: Drive will restart if power returns within the time set in L2-02.*
2	CPU Power Active: Drive will restart if power returns prior to control power supply shut down.

*Default Setting

- L2-01 = 0 (disabled)
  If power is not restored within 15 ms, a UV1 alarm will result and the drive will come to stop.
- L2-01 = 1 (enabled)
  When a momentary power loss occurs, the drive will attempt to restart and perform Speed Search if power is restored within the period of time set to L2-02. If power is not restored within the time set to L2-02, then a UV1 alarm will result.

  Note: The amount of time the drive is capable of recovering after a power loss is determined by the capacity of the drive. Drive capacity determines the upper limit for L2-02. A Momentary Power Loss Unit is available to allow for a longer momentary power loss ride through time in a 0.4 to 7.5 kW drive (200 or 400 V class). This option makes it possible to continue running after up to 2 seconds of power loss.
- L2-01 = 2
  Drive will restart as long as the CPU still has power. This allows for a longer ride-thru time than setting L2-01 to 1.

  Note: When L2-01 is set to 1 or 2, be sure that the magnetic contactor to the power supply as well as the control signal is still maintained even when the power goes out. “UV1” will flash on the operator while the drive is attempting to recover from a momentary power loss. A fault signal is not output at this time.

■ 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 is takes for the leftover voltage in the motor to dissipate. Increase this setting if overcurrent or overvoltage occur at the beginning of Speed Search. If L2-03 > L2-02, then the drive will restart after the time set to L2-03 passes following a momentary loss in power.

No.	Name	Setting Range	Default	Page
L2-03	Momentary Power Loss Minimum Baseblock Time	0.1 to 5.0	Determined by o2-04	–

Note: Increase this setting if overcurrent occurs at the beginning of Speed Search or DC Injection Braking.

■ L2-04: Momentary Power Loss Voltage Recovery Ramp Time

No.	Name	Setting Range	Default	Page
L2-04	Momentary Power Loss Voltage Recovery Ramp Time	0.0 to 5.0 s	Determined by o2-04	–

- Sets the time it takes for the output voltage to be restored from 0 to the maximum voltage.

■ L2-05: Undervoltage Detection Level

No.	Name	Setting Range	Default	Page
L2-05	Undervoltage Detection Level	150 to 210 V/200 V class 300 to 420 V/400 V class	190 V 380 V* Determined by o2-04	–

*This value is initialized when E1-01 is changed.

- This setting rarely needs to be changed.
- Determines the voltage level in the DC bus that is considered to be UV. Uses externals terminal +1 and -.
- When setting L2-05 lower than the default setting, be sure to install an AC reactor option to the input side of the power supply to prevent damage to drive circuitry.

■ KEB Function

KEB (Kinetic Energy Back-Up) decelerates the motor using regenerative energy when power loss has been detected. By keeping the DC bus voltage at a constant level, KEB Ride-Thru allows the drive to continue running without interrupting the output power during momentary power loss. Once power is restored, the drive smoothly returns to the same operational state before the power loss occurred.

Operation Selection and Setting Method

To set KEB Ride-Thru the input terminals, enter 65 or 66 (N.C. and N.O. respectively) to one of the H1 parameters. To set KEB Ride-Thru 2, enter 7A or 7B (again, N.C. and N.O.

respectively) to one of the H1 parameters. As shown in Figure 1.69 , an auxiliary switch for the magnetic contactor should be set between the power supply and the terminal set to KEB Ride-Thru. The drive can be set to trigger KEB when the magnetic contactor opens or closes. Depending on the specifications, set the input auxiliary switch to be N.O. or N.C.

Note: To properly use the KEB function, make sure that the drive is set so that the run command does not switch off when momentary power loss occurs. If the run command is switched off, the drive will not accelerate back to speed when the power is restored.

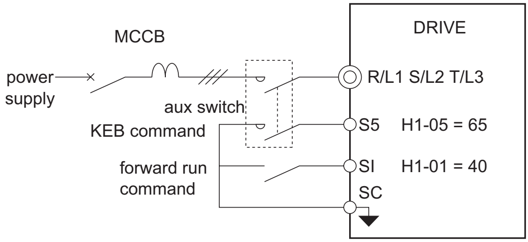


Figure 1.69 KEB Function

KEB Ride-Thru 1

When KEB Ride-Thru 1 has been set to one of the multi-function input terminals, the drive will decelerate at the time set to L2-06. If KEB Ride-Thru is switched off after about 50 ms, the drive will then begin to accelerate again for the time set to L2-07. Use this function to enable KEB Ride-Thru with multiple motors running from the same drive.

Note: Although KEB operation will still begin even if the voltage level in the DC bus is below the value specified in L2-05 prior to KEB Ride-Thru 1, the drive will accelerate back up to speed if the KEB is switched off after approximately 50 ms. Make sure the KEB Ride-Thru 1 is operating properly. This function requires a breaking resistor.

KEB Ride-Thru 2

When KEB Ride-Thru 2 is entered through one of the multi-function input terminals, the drive will decelerate while maintaining the DC bus voltage at the level specified in L3-16. If KEB Ride-Thru 2 is switched off after about 50 ms, then once power is restored the drive will accelerate back up to the speed it was at prior to the power loss. Use this function to have the drive decelerate by KEB only.

Note: Although KEB operation will still begin even if the voltage level in the DC bus is below the value specified in L2-05 prior to KEB Ride-Thru 2, the drive will accelerate back up to speed if the KEB is switched off after approximately 50 ms. Make sure the KEB Ride-Thru 2 is operating properly.

■ L2-06: KEB Deceleration Time

No.	Name	Setting Range	Default	Page
L2-06	KEB Deceleration Time	0.0 to 200.0	0.0 s	–

Sets the time to decelerate from the maximum frequency down to zero speed after KEB Ride-Thru 1 has been entered to one of the multi-function input.

■ L2-07: Momentary Power Loss Ride-Thru Time

No.	Name	Setting Range	Default	Page
L2-07	Momentary Power Loss Ride-Thru Time	0.0 to 25.5	0.0 s	–

Sets the acceleration time to reaccelerate back up to the specified frequency following the momentary power loss occurs that triggered the KEB function. When set to 0, the drive will accelerate back up to speed according to parameters C1-01 through C1-08.

■ L2-08: Minimum Frequency Gain at KEB Start

No.	Name	Setting Range	Default	Page
L2-08	Minimum Frequency Gain at KEB Start	0 to 300	100%	–

The output frequency is reduced in steps when KEB Ride-Thru 1 begins. Set the rate of this decrease as a percentage using the following formula:

Amount of reduction = Slip frequency prior to KEB x (L_2-08) x 2

■ L2-11: Desired DC Bus Voltage during KEB

Sets the desired voltage in the DC bus when KEB is operating.

No.	Name	Setting Range	Default	Page
L2-11	Desired DC Bus Voltage during KEB	150 to 400 *1	240%*3	–

* 1. Double this value when using a 400 V class unit.
* 2. This value is initialized when E1-01 is changed.
* 3. This value is reset its default setting when the control mode is changed (A1-02). The value shown here is for Open Loop Vector Control.

- This setting rarely needs to be changed.
- Sets the level of voltage suppression in the DC bus when KEB Ride-Thru 2 is operating.

Adjustment to KEB Ride-Thru 2 can be made by changing the gain in the DC bus voltage (L3-20), gain calculations for deceleration (L3-21), inertia calculations for the motor acceleration time (L3-24), and the load inertia ratio (L3-25).

◆ L3: Stall Prevention

"Stalling" occurs when the motor is unable to keep up with the frequency reference, and falls too far behind the normal the amount of slip. This makes it impossible to decelerate or accelerate. The drive can prevent the motor from stalling and still reach the desired speed without the user needing to change the acceleration or deceleration time settings.

■ L3-01: Stall Prevention Selection during Acceleration

■ L3-02: Stall Prevention Level during Acceleration

■ L3-03: Stall Prevention Limit during Acceleration

No.	Name	Setting Range	Default	Page
L3-01	Stall Prevention Selection during Acceleration	0 to 2*1	1	–
L3-02	Stall Prevention Level during Acceleration	0 to 150*2	*2	–
L3-03	Stall Prevention Limit during Acceleration	0 to 100	50%	–
L3-22	Deceleration Time at Stall Prevention during Acceleration	0.0 to 6000.0	0.0 s	–

* 1. Setting range in PM Open Loop Vector is 0 and 1. When enabled, the drive will stop accelerating if the level set to L3-02 is reached, then decelerate briefly for 100 ms. Acceleration begins again after the current value is restored.
* 2. The upper limit is determined by the duty rating and the carrier frequency derating selection (C6-01 and L8-38 respectively).

Overview

Stall Prevention during acceleration is used when the motor loses speed during acceleration due to a relatively large load. It prevents overcurrent and motor overload (OL1) from resulting.

Detailed Description

Setting	Description
0	Disabled: Motor accelerates at active acceleration rate.
1	General Purpose: When output current exceeds L3-02 level, acceleration stops. Acceleration will continue when the output current level falls below the L3-02 level.
2	Intelligent: The active acceleration rate is ignored. Acceleration is completed in the shortest amount of time without exceeding the current value set in L3-02.

- L3-01 = 0
  The drive may not be able to perform acceleration within the specified time if the acceleration time setting is too short.
- L3-01 = 1
  Enables Stall Prevention during acceleration.

■ Timechart

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

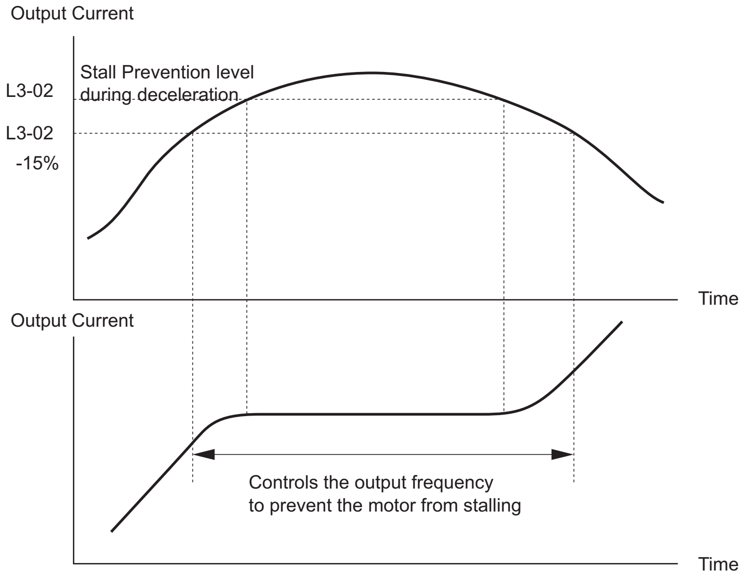


Figure 1.70 Timechart for Stall Prevention during Acceleration

■ Setting Notes

- If stalling occurs with L3-02 set to its default value when using a motor that is relatively small compared to the drive, try lowering L3-02.
- When operating the motor within a constant output range, L3-02 is automatically reduced to prevent speed loss. L3-03 limits the degree to which L3-02 is reduced while attempting to maintain constant output.
- Set as a percentage of the drive rated current.

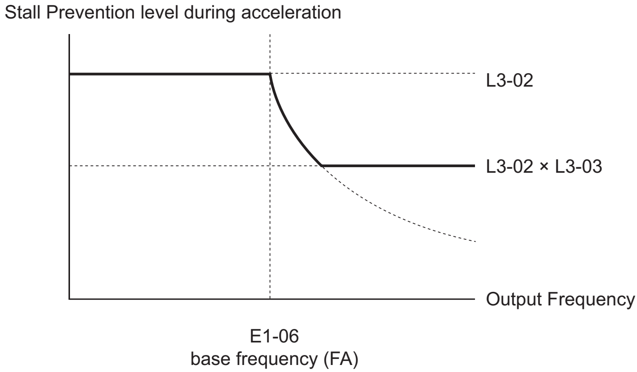
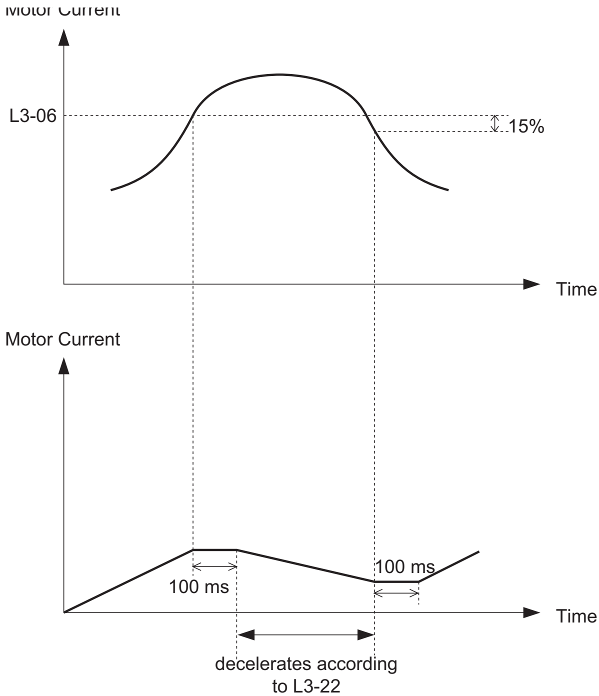


Figure 1.71 Stall Prevention Level and Limit during Acceleration

- If operation exceeds the Stall Prevention level set to L3-02 for more than 100 ms when using PM Open Loop Vector Control, then the drive will respond by briefly decelerating for the time specified in L3-22. Acceleration will resume once the Stall Prevention level falls below L3-02 for 100 ms.



■ L3-22: Deceleration Time at Stall Prevention during Acceleration

Sets the brief deceleration time for when stalling occurs while accelerating a PM motor. When set to 0, this function is disabled and the drive will decelerate at a normal rate when stalling occurs.

Note: The function is available only in Open Loop Vector Control Mode for PM motors.

- L3-01 = 2

  Ignores the acceleration time that has been set and instead accelerates as quickly as possible without the motor stalling.

  Accelerates at the optimal level without exceeding the Stall Prevention level set for acceleration (L3-02).

■ L3-04: Stall Prevention Selection during Deceleration

No.	Name	Setting Range	Default	Page
L3-04	Stall Prevention Selection during Deceleration	0 to 4	1	–

Stall Prevention during deceleration keeps the deceleration rate smooth while keeping the voltage in the DC bus from tripping an OV fault.

Detailed Description

Settings for L3-04 and their meanings appear in the table below.

Setting	Description
0	Disabled (drive decelerates at the active deceleration rate)
1*	General Purpose (no braking resistor)
2	Intelligent
3	Stall Prevention with Braking Resistor
4	Overexciation Deceleration

*Default Setting

Note: Settings 3 and 4 are not available when using a PM motor.

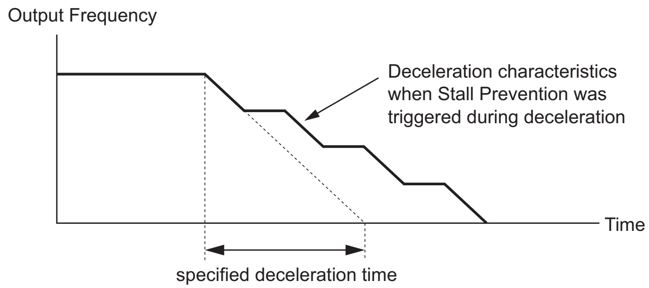
- L3-04 = 1
  This setting enables Stall Prevention during deceleration.

Briefly stops deceleration and maintains the output frequency when the DC bus voltage exceeds the Stall Prevention level listed on the previous page. Begins decelerating again at the specified deceleration time once the voltage in the DC bus drops below the Stall Prevention level. Stall Prevention may be triggered repeatedly to avoid an overvoltage fault, and is useful when attempting to decelerate a load at a rate beyond what the drive is capable of.

Drive Voltage		Stall Prevention Level during Deceleration
200 V class		VDC = 380 V
400 V class	E1-01 greater than or equal to 400 V	VDC = 760 V
	E1-01 < 400 V	VDC = 660 V

Note: Set L3-04 to “0” or “3” when using a Dynamic Braking Resistor or some other braking option. If Stall Prevention during deceleration is enabled, it will be triggered before the braking resistor option can operate.

- The figure below illustrates how Stall Prevention works during deceleration.



Note: When Stall Prevention is activated during deceleration, it might take slightly longer to decelerate than the specified deceleration time. As this may not be appropriate in conveyors or other such applications where positioning is a concern, you may want to consider using a braking resistor option instead.

- L3-04 = 2

  Drive automatically adjusts Stall Prevention levels for optimum performance.

  It suppresses the DC bus voltage, preventing the motor from stalling during deceleration while still maintaining the desired voltage levels specified in L3-17. Here, the deceleration time is disregarded. When the frequency is relatively high, the drive will decelerate the motor slowly, increasing the speed only as the frequency level drops. This function is affected by other parameters that include the DC bus voltage adjustment gain (L3-20), the deceleration rate calculations gain (L3-21), inertia calculations for the motor deceleration time (L3-24), and the load inertia ratio (L3-25).

Note: Refrain from using this function in conveyors and other applications in which the stopping position is a concern. Yaskawa recommends using a braking option instead.

- L3-04 = 3

  Enables the Stall Prevention function while using a braking resistor.

  Use this setting if overvoltage occurs with L3-04 disabled when using a braking resistor. This makes it possible to reduce the deceleration time.
- L3-04 = 4

  Enables Overexcitation Deceleration.

  Overexcitation (increasing the motor flux) can shorten the deceleration time faster than disabling Stall Prevention during deceleration (L3-04 = 0). Repetitive overexcitation, however, can result in motor overload (OL1). In such situations, either shorten the deceleration time setting or consider using a braking resistor.

Note: Because the flux level that allows for overexcitation varies based on the flux saturation characteristics of the motor, set the proper overexcitation level by adjusting the excitation gain in parameter n3-13. Motor characteristics and inertia of the machine influence the deceleration time during overexcitation deceleration.

■ L3-05: Stall Prevention Selection during Run

■ L3-06: Stall Prevention Level during Run

Stall Prevention during run allows the drive to operate at a continuous speed with a constant frequency output. It prevents speed loss or overload (OL1) that would otherwise occur due to an increase in the load.

No.	Name	Setting Range	Default	Page
L3-05	Stall Prevention Selection during Run	0 to 2	1	–
L3-06	Stall Prevention Level during Run	30 to 150*	Determined by C6-01 and L8-38.	–

*The upper limit for this setting is determined by C6-01 and L8-38. This setting rarely needs to be changed.

Note: This function is not available in V/f Control. When used in Open Loop Vector for PG motors, it functions much the same as the torque limit.

Detailed Description

Settings for L3-05 appear in the table below:

Setting	Description
0	Disabled: Drive runs a set frequency. A heavy load may cause a fault.
1	Decelerates at Decel Time 1 (C1-02)
2	Decelerates at Decel Time 2 (C1-04)

- L3-05 = 0
  Disabled. Drive runs a set frequency. A heavy load may cause the drive to trip on an OC or OL fault.
- L3-05 = 1
  In order to avoid stalling during heavy loading, the drive will decelerate at Decel Time 1 (C1-02) if the output current exceeds the level set by L3-06. Once the current level drops below the L3-06 level for 100 ms, the drive will accelerate back to its frequency reference at the active acceleration rate.
- L3-05 = 2
  Same as setting 1 except the drive decelerates at Decel Time 2 (C1-04). When output frequency is 6Hz or less, stall prevention during run is disabled regardless of the setting in L3-05.

■ L3-23: Automatic Reduction Function Selection for Stall Prevention

during Run

No.	Name	Setting Range	Default	Page
L3-23	Automatic Reduction Function Selection for Stall Prevention during Run	0: Disabled 1: Enabled	0	–

Note: When L3-23 = 0, the Stall Prevention level during run becomes the value set to L3-06. When L3-23 = 1, the Stall Prevention level during run is automatically reduced in the constant output range. The lower limit value becomes 40% of L3-06.

■ L3-11: OV Suppression Function Selection

Suppresses voltage in the DC bus to prevent an OV fault from occurring when a regenerative load is added.

No.	Name	Setting Range	Default	Page
L3-11	OV Suppression Function Selection	0: Disabled 1: Enabled*	0	–

*Motor speed will exceed the frequency reference when overvoltage suppression is triggered from an increase in a regenerative load. Consequently, overvoltage suppression is not appropriate in applications that require a perfect match between the frequency reference and the actual motor speed. Disable overvoltage suppression when using a braking resistor. Overvoltage may still occur if there is a sudden increase to a regenerative load.

- L3-11 = 1 (enabled)
  When there in an increase to a regenerative load, this function prevents overvoltage from resulting by increasing the output frequency. It suppresses the DC bus voltage as well as keeps it within the desired level set to L3-17. Be aware that the motor can speed up while OV suppression is operating. This function is helpful in punch press applications, in addition to motoring and regenerative applications that involve repetitive crank movement. Overvoltage suppression is adjusted with other parameters, including DC bus voltage gain (L3-20), deceleration rate calculations gain (L3-21), inertia calculations for motor acceleration time (L3-24), and the load inertia ratio (L3-25).

Note: Not for use with applications in where the motor speed and frequency reference must be exactly the same. Disable this settings when using a braking resistor. Overvoltage may occur even when this function is enabled if there is a sudden increase to a regenerative load. This function is enabled only when operating just below the maximum frequency reference and there is an increase to a regenerative load.

■ L3-17: Overvoltage Suppression and Deceleration Stall and Desired DC Bus Voltage during Motor Stall

No.	Name	Setting Range	Default	Page
L3-17	Overvoltage Suppression and Deceleration Stall and Desired DC Bus Voltage during Motor Stall	150 to 400*1	370 V*1*2	–

* 1. Double this value when using a 400 V class unit.
* 2. This value is initialized when E1-01 is changed.

Note: This parameter is enabled when overvoltage suppression selection is also enabled (L3-11 = 1), and also when Stall Prevention during deceleration is set for automatic adjustment (L3-04 = 2). This setting rarely needs to be changed.

■ L3-20: Main Circuit Voltage Adjustment Gain

Determines the proportional gain for suppressing DC voltage to the desire levels (L3-11 = 1) when KEB Ride-Thru 2 or automatic adjustments for Stall Prevention during deceleration is enabled.

No.	Name	Setting Range	Default	Page
L3-20	Main Circuit Voltage Adjustment Gain	0.00 to 5.00	1.00	–

Note: If overvoltage or undervoltage (UV1) occurs at the beginning of deceleration while KEB Ride-Thru 2 is enabled or while intelligent, automatic adjustment is set for Stall Prevention during deceleration, try increasing this setting slowly in incrememtns of 0.1. If this setting is too high, then a fair amount of speed or torque ripple can result. If overvoltage supression is enabled (L3-11 = 1) and there is a sudden increase in a regenerative load, overvoltage may still result. To counteract this problem, try increasing this setting in increments of 0.1. Note that a fair amount of speed or current ripple may result if set too high.

■ L3-21: Accel/Decel Rate Calculation Gain

Determines the proportional gain used in calculating acceleration and deceleration in order to keep DC bus voltage within the desired range when overvoltage supression is enabled (L3-11 = 1) for KEB Ride-Thru 2 and intelligent Stall Prevention during deceleration (L3-04 = 2).

No.	Name	Setting Range	Default	Page
L3-21	Accel/Decel Rate Calculation Gain	0.00 to 200.00	1.00*	–

*Reset to its default value when the control mode is changed (A1-02). The value shown here is for Open Loop Vector Control.

Note: The gain for the acceleration calculations may need to be reduced in small increments of 0.05 if there is a fairly large speed or current ripple during KEB Ride-Thru 2 or when using the automatic, intelligent adjustment feature in Stall Prevention during deceleration. Small reductions in the acceleration gain can also help solve problems with overvoltage and overcurrent. Be careful not to decrease this setting too much, as that may result in too slow of a response in controlling DC bus voltage and may also slow deceleration times beyond optimal levels. Increase this setting in small increments of 0.1 if overvoltage occurs as a result of a regenerative load when overvoltage supression is enabled (L3-11 = 1). If there is a fairly large speed ripple when overvoltage supression is enabled, then slowly decrease L3-21 in increments of 0.05.

■ L3-24: Motor Acceleration Time for Inertia Calculations

Sets the time it takes to accelerate the motor from stop to the maximum speed at motor rated torque.

This parameter should be set when using KEB Ride-Thru 2, automatic adjustment for optimal Stall Prevention during deceleration (L2-04 = 2), or the overvoltage suppression function (L3-11 = 1).

No.	Name	Setting Range	Default	Page
L3-24	Motor Acceleration Time for Inertia Calculations	0.001 to 10.000	Determined by o2-04, E2-11, and E5-01	–

Note: Parameter o2-04 is defaulted for a Yaskawa standard 4-pole motor. During Auto-Tuning, o2-04 will be initialized to a Yaskawa standard 4-pole motor if parameter E2-11 is changed. This value changes based on the motor code set to E5-01 when using the Open Loop Vector Control Mode for PM motors.

Calculations are made as follows:

J: GD2/4

P: Rated output

$ta = 2\pi \cdot J\ [Kgm^2] \cdot Nr\ [r/min]\ /\ [60 \cdot T_{100} (Nm)]$

To solve for T_{100}:

$T_{100} = 60 \cdot P[kW] \times 103\ /\ [2\pi \cdot Nr\ (r/min)]$

■ L3-25: Load Inertia Ratio

Determines the ratio between the rotor inertia and the load. Set this parameter when using KEB Ride-Thru 2, when optimizing Stall Prevention during deceleration (L2-04 = 2), and when using the overvoltage suppression function (L3-11 = 1).

No.	Name	Setting Range	Default	Page
L3-25	Load Inertia Ratio	0.0 to 1000.0	1.0	–

Note: When set incorrectly, a fairly large current ripple can result during KEB Ride-Thru 2 and while automatic adjustments are made for Stall Prevention during deceleration (L3-11 = 1). Other possible faults such as OV, UV1, and OC may also occur.
load inertia = machine inertia (motor shaft calculated value) / rotor inertia

◆ L4: Frequency Detection

Sets the output signal for a series of functions assigned to the multi-function output terminals that determine frequency agree, user-set frequency agree, frequency detection, and so on.

■ L4-01: Speed Agreement Detection Level

■ L4-02: Speed Agreement Detection Width

L4-01 and L4-02 allow the user to set the Speed Agreement specifications when Frequency Detection 1, Frequency Detection 2, or User-Selected Frequency Agree 1 are assigned to the multi-function terminals.

■ L4-03: Speed Agreement Detection Level (+/-)

■ L4-04: Speed Agreement Detection Width (+/-)

L4-03 and L4-04 allow the user to set the Speed Agreement specifications when Frequency Agree 2, Frequency Detection 3, Frequency Detection 4, or User-Selected Frequency Agree 2 are assigned to the multi-function terminals.

■ L4-05: Frequency Reference Loss Detection Selection

■ L4-06: Frequency Reference at Reference Loss

No.	Name	Setting Range	Default	Page
L4-05	Frequency Reference Loss Detection Selection	0: Drive will stop. 1: Continue running at L4-06.	0	–
L4-06	Frequency Reference at Reference Loss	0.0 to 100.0	80.0 %	–

- The frequency reference is considered “lost” when it is entered from an external source, and suddenly falls below 90% for more than 400 ms.
- If L4-05 = 1, the drive will not stop when the frequency reference is lost, but will instead operate at the value set to L4-06. The drive will switch back to the main frequency reference once it is restored.
- To have a fault output trigger when the frequency reference is lose, set H2-01, H2-02, or H2-03 to “C”.

Note: Frequency reference loss detection: analog reference supplied via terminal A1 can be supplied from terminal A2 by setting H3-10 to 0.

■ L4-07: Frequency Detection Conditions

Parameter Overview

No.	Name	Description	Range	Default
L4-07	Frequency Detection Conditions	0: No detection during baseblock. 1: Detection always enabled.	0 to 1	0

◆ L5: Fault Restart

The drive performs a self-diagnostic check if a fault occurs during operation. If the problem has been taken care of, the drive performs Speed Search (b3-24) and starts back up again. This is referred to as a Fault Restart.

■ L5-01: Number of Auto Restart Attempts

■ L5-02: Auto Restart Operation Selection

No.	Name	Setting Range	Default	Page
L5-01	Number of Auto Restart Attempts	0 to 10	0	–
L5-02	Auto Restart Operation Selection	0: No output 1: Output	0	–

The user can set the number of times that the drive may attempt to restart itself. When the drive faults out, it can attempt to restart after the minimum baseblock time has passed plus 5 ms. Each time that the drive clears the fault and attempts to restart is counted in the number of fault restarts. Even if the number of fault restarts is set to L5-01, protection operation will be triggered if the fault situation continues as the drive attempts to restart itself.
The drive can attempt to restart itself following the faults listed below. Other protection functions are available for other faults not included in this list.

- OC (Overcurrent)RH (Braking Resistor)
- GF (Ground Fault)RR (Braking Transistor)
- PUF (DC Bus Fuse)OL1 (Motor Overload)
- OV (DC Bus Overvoltage)OL2 (Drive Overload)
- UV1 (DC Bus Undervoltage)OH1 (Overheat)
- PF (Input Phase Loss)OL3 (Overtorque 1)
- LF (Output Open Phase)OL4 (Overtorque 2)

When undervoltage in the DC bus is set to allow for Power Loss Ride-Thru (L2-01 = 1 or 2).

Note: To output a signal during fault restart, set H2-01, H2-02, or H2-03 to 1E. The number of fault restarts is reset back to 0 when: The drive operates normally for ten minutes following a fault restart. A fault is cleared manually after protective functions were triggered. The power supply is cycled.

NOTICE: *Do not use the fault restart function in hoist applications.*

■ L5-04: Fault Reset Interval Time

Determines the amount of time to wait between attempts to restart the drive.

This function is enabled by setting L5-05 to 1.

No.	Name	Setting Range	Default	Page
L5-04	Fault Reset Interval Time	0.5 to 600.0	10.0 s	-

■ L5-05: Fault Reset Operation Selection

No.	Name	Setting Range	Default	Page
L5-05	Fault Reset Operation Selection	Keeps track of how many times the drive attempted to restart after a fault occurred. 0: Uses the method available in G7. 1: Uses the method available in V7.	0	–

◆ L6: Torque Detection

This function outputs an alarm signal using multi-function output terminals MA-MC, P1-PC, and P2-PC when the load is too heavy (overtorque) on the machine side, or suddenly becomes too light (undertorque).

■ L6-01/L6-04: Torque Detection Selection 1/2

■ L6-02/L6-05: Torque Detection Level 1/2

■ L6-03/L6-06: Torque Detection Time 1/2

No.	Name	Setting Range	Default	Page
L6-01	Torque Detection Selection 1	0: Disabled 1: OL3 at Speed Agree - Alarm (Overtorque Detection only active during Speed Agree and Operation continues after detection). 2: OL3 at RUN - Alarm (Overtorque Detection is always active and operation continues after detection). 3: OL3 at Speed Agree - Fault (Overtorque Detection only active during Speed Agree and drive output will shut down on an OL3 fault). 4: OL3 at RUN - Fault (Overtorque Detection is always active and drive output will shut down on an OL3 fault). 5: UL3 at Speed Agree - Alarm (Undertorque Detection is only active during Speed Agree and operation continues after detection). 6: UL3 at RUN - Alarm (Undertorque Detection is always active and operation continues after detection). 7: UL3 at Speed Agree - Fault (Undertorque Detection only active during Speed Agree and drive output will shut down on an OL3 fault). 8: UL3 at RUN - Fault (Undertorque Detection is always active and drive output will shut down on an OL3 fault).	0	–
L6-02	Torque Detection Level 1	0 to 300	150%	–
L6-03	Torque Detection Time 1	0.0 to 10.0	0.1 s	–
L6-04	Torque Detection Selection 2	Same as L6-01.	0	–

No.	Name	Setting Range	Default	Page
L6-05	Torque Detection Level 2	0 to 300	150%	–
L6-06	Torque Detection Time 2	0.0 to 10.0	0.1 s	–

Detailed Description

This function is used to detect torque levels in order to check for overtorque or undertorque. When enabled, the following selection can be assigned to the multi-function output terminals (H2-01, H2-02, and H2-03).

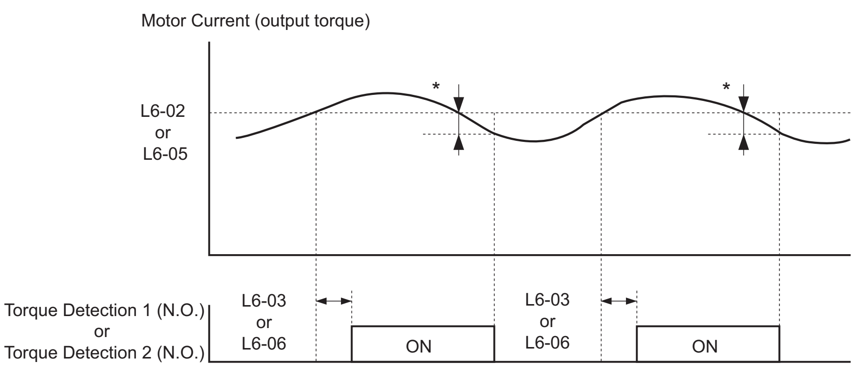
Setting	Status	Description
B	Closed	Output current/torque exceeds the torque value set in parameter L6-02 for longer than the time specified in parameter L6-03.
17	Open	Output current/torque exceeds the value set in parameter L6-02 for more time than is set in parameter L6-03.
18	Closed	Output current/torque exceeds the value set in parameter L6-05 for more time than is set in parameter L6-06.
19	Open	Output current/torque exceeds the value set in parameter L6-05 for more time than is set in parameter L6-06

Note: The torque detection function uses a hysteresis of about 10% of the drive rated output current. The torque detection level in V/f Control is 100% of the drive rated output current. In Open Loop Vector, it is defined as 100% of the motor rated torque.

NOTICE: *When overtorque occurs, the drive may stop due to overcurrent or overload (OL1). To prevent this, the drive should quickly detect overtorque situations. Problems with undertorque can result in a torn belt, a pump shutting off, or other similar trouble.*

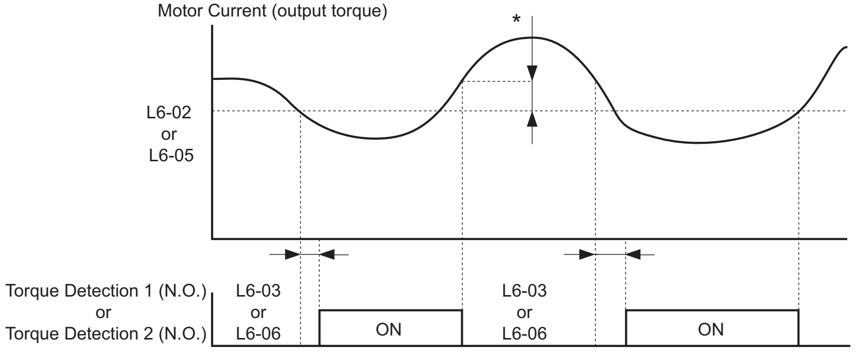
Below is a timechart for overtorque and undertorque detection.

- Overtorque Detection



Note: Torque detection is not active in about 10% of the drive rated output current (or motor rated torque).

- Undertorque Detection



*The range where undertorque is not detected is approx. 10% of the drive rated output current (or the motor rated torque).

Note: Torque detection is not active in about 10% of the drive rated output current (or motor rated torque).

■ L6-08: Mechanical Weakening Detection Operation

The following settings are available for L6-08:

0: Mechanical Weakening Detection disabled.

1: Continue running if the speed (signed) is greater than L6-09 (alarm only).

2: Continue running if the speed (not signed) is greater than L6-09 (alarm only).

3: Interrupt drive output when the motor speed (signed) is greater than L6-09 (protection operation).

4: Interrupt drive output when the motor speed (not signed) is greater than L6-09 (protection operation).

5: Continue running if the speed (signed) is less than L6-09 (alarm only).

6: Continue running if the speed (not signed) is less than L6-09 (alarm only).

7: Interrupt drive output when the motor speed (signed) is less than L6-09 (protection operation).

8: Interrupt drive output when the motor speed (not signed) is less than L6-09 (protection operation).

Note: This output signal is switched on when one of the multi-function outputs is set for mechanical weakening detection (H2-☐☐ = 22).

■ L6-09: Mechanical Weakening Detection Speed Level

Sets the speed at which mechanical weakening operates. Uses Torque Detection 1 when determining the torque (L6-01 to L6-03). If the absolute value selection is set to L6-08, then negative numbers are treated as positive numbers.

■ L6-10: Mechanical Weakening Detection Time

Sets the time permitted for the situation selected in parameter L6-08 to arise before mechanical weakening is detected.

■ L6-11: Mechanical Weakening Detection Start Time

Mechanical weakening detection is triggered when the cumulative operation time (U4-01) exceeds this value.

◆ L7: Torque Limit

The torque limit function is available only when in the Open Loop Vector Mode. Set torque limit to protect the connect machinery.

■ L7-01/L7-02: Forward/Reverse Torque Limit

■ L7-03/L7-04: Forward/Reverse Regenerative Torque Limit

No.	Name	Setting Range	Default	Page
L7-01	Forward Torque Limit	0 to 300	200	–
L7-02	Reverse Torque Limit	0 to 300	200	–
L7-03	Forward Regenerative Torque Limit	0 to 300	200	–
L7-04	Reverse Regenerative Torque Limit	0 to 300	200	–

Note: If the multi-function analog input is programmed for “10: Forward Torque Limit”, “11: Reverse Torque Limit”, “12: Regen Torque Limit”, or “15: FWD/REV Torque Limit”, the drive uses the lower value of either L7-01 through L7-04, or analog input torque limit.

■ L7-06: Torque Limit Integral Time Constant

Sets the integral time constant for the torque limit.

No.	Name	Setting Range	Default	Page
L7-06	Torque Limit Integral Time Constant	5 to 10000	200 ms	–

Note: Reduce this setting in order to allow for a large change in frequency as determined by the torque limit when using integral control with the torque limit.

■ L7-07: Torque Limit Control Method Selection during Accel/Decel

Selects the method of torque limit controls during acceleration and deceleration.

No.	Name	Setting Range	Default	Page
L7-07	Torque Limit Control Method Selection during Accel/ Decel	0: Proportional Control (uses integral control at fixed speeds). 1: Integral Control	0	–

Note: This setting rarely needs to be changed. Set this parameter to 1 (Integral Control) to give torque control priority when accelerating in applications using the torque limit feature. Be aware that when the torque limit is triggered, the acceleration time may increase and motor speed may differ slightly more than usual from the exact frequency reference.

◆ L8: Hardware Protection

■ L8-01: Internal Dynamic Braking Resistor Protection Selection (ERF type)

This parameter selects the dynamic braking resistor protection only when using the 3% duty cycle heatsink mount Yaskawa braking resistor. This parameter does not enable or disable the general dynamic braking function of the Drive. Do not adjust this parameter when using any other braking resistors.

■ L8-02: Overheat Alarm Level

■ L8-03: Overheat Pre-Alarm Operation Selection

The drive is capable of warning the operator of an impending heatsink over-temperature fault via an OH pre-alarm. The level at which the pre-alarm will activate is determined by the setting of parameter L8-02. Measurement of the heatsink temperature is done with several strategically mounted thermistors. The drive will fault (OH2) if any of the heatsink thermistors measure a temperature in excess of the setting of L8-02. When an OH2 fault occurs, one of the action below can be set to L8-03:

- Ramp to stop at the selected deceleration time (L8-03 = 0)
- Coast to stop (L8-03 = 1)
- Fast Stop (L8-03 = 2: Fast Stop)
- Continue operating but display an OH alarm (L8-03 = 3: Alarm only)
- Continue operating but derate the frequency reference (L8-03 = 4: Derated Operation)

When an output terminal is set to for the OH prealarm (H2-01 = 20), the switch will close when the heatsink temperature rises above L8-02, regardless of the value set to L8-03.

■ L8-05: Input Phase Loss Protection Selection

Selects the detection of input current phase loss, power supply voltage imbalance, or main circuit electrostatic capacitor deterioration.

Phase loss detection for the input power supply is disabled when:

- a stop command has been issued
- the magnetic contactor has interrupted the power supply
- a CPU A/D conversion fault occurs
- the drive is decelerating
- output current is less than or equal to 30% of the drive rated current

■ L8-07: Output Phase Loss Protection

The output phase loss detection circuit monitors the DCCT and is triggered when one or more of the output phases are lost. If an output phase loss (LF) fault occurs, and the motor coasts to stop.

■ L8-09: Output Ground Fault Detection Selection

Enables and disables the drive's output ground fault detection. Drive coasts to stop when a ground fault is detected.

■ L8-10: Heatsink Cooling Fan Operation Selection

■ L8-11: Heatsink Cooling Fan Operation Delay Time

Parameters L8-10 and L8-11 allow the drive programmer to customize the heatsink cooling fan operation. Parameter L8-10 determines whether the cooling fans are always on whenever the drive is powered (L8-10 = "1: Fan Always On") or if the cooling fans are only on when the drive is in a run condition (L8-10 = "0: Fan On-Run Mode").

Parameter L8-11 is a delayed off for the cooling fan if L8-10 = "0: Fan On-Run Mode". When the cooling fans are set to turn off when the run command is removed, parameter L8-11 will cause the fans to continue cooling the drive for the amount of time programmed into L8-11 after the run command is actually removed. The drive can be programmed to allow the cooling fan to run for up to 5 minutes (factory default) after the run command is removed.

Both parameters are intended to extend fan life while still providing sufficient cooling for proper drive operation.

■ L8-12: Ambient Temperature Setting

Set parameter L8-12 to the temperature of the area in which the drive is mounted. This value is used during fault detection and for maintenance.

■ L8-15: OL2 Characteristics Selection at Low Speeds

At very low speeds (6 Hz and below) and very high current levels it can be possible to damage output transistors. Therefore the default setting of L8-15 is set to shorten the time before an OL2 fault will occur when operating at low speed with a relatively heavy load (L8-15 = "1: Enabled").

■ L8-18: Software CLA Selection

The Software CLA (software current limit level) is a drive protection function that will limit the drive's output current. The drive limits the output current by reducing the output frequency whenever the current exceeds 110% of the drive rated current. If the current level drops below the Software CLA level, then normal operation will continue.

If the software current limit is disabled (L8-18 = “0: Disabled”), the drive may trip on an OC fault if the load is prohibitively large or the acceleration is too short. For proper drive protection and operation leave the Software CLA function enabled.

■ L8-19: Frequency Reduction Rate during OH Pre-Alarm

Specifies how much to derate the frequency reference when L8-03 is set to 4 and an OH prealarm is output.

■ L8-29: Current Unbalance Detection (LF2)

This function is available only when using PM Open Loop Vector.

Issues a stop command when the output current becomes unbalanced as a result of a damaged photocoupler or output phase loss. Set to 0 to disable this function.

■ L8-35: Side-by-Side Installation Selection

Sets the type of installation. Default setting is for a standard type of set up. For a fully enclosed motor compliant with NEMA type 1 specifications, set this parameter to “2”. Set to “1” when taking advantage of Yaskawa’s Side-by-Side installation.

■ L8-38: Carrier Frequency Reduction

Specifies the degree of reduction for the carrier frequency at low speeds for IGBT protection. There is no carrier frequency reduction when L8-38 is set to 0. Set to “1” to derate the carrier frequency when operating at less than 6 Hz and during overload.

To always have a derated carrier frequency, set L8-38 to 2.

■ L8-40: Low Carrier Frequency Time

Sets the amount of time the drive will operate with a reduced carrier frequency. The carrier frequency derating function during run is disabled when this parameter is set to 0.00 s.

■ L8-41: Current Alarm Selection

Allows or restricts an alarm from being triggered when the relative output current rises above 150%. Disabled when set to 0 (no output).

1.9 n: Special Adjustments

The n parameters handle a variety of specialized adjustments and functions, including Hunting Prevention, ASR Control, High Slip Braking, resistance between motor lines, and PM motor control functions.

◆ n1: Hunting Prevention

Hunting Prevention keeps the drive from hunting as a result of the carrier frequency, low inertia, and operating with a light load. It is available in V/f Control only.

■ n1-01: Hunting Prevention Selection

Enables or disables the Hunting Prevention function.

Note: This function is available only when using V/f Control. Hunting Prevention should be disabled when drive response is need over suppressing motor oscillation. This function can also be disabled without any problems in applications with high inertia loads or relatively heavy loads.

No.	Parameter Name	Setting Range	Default
n1-01	Hunting Prevention Selection	0: Disabled 1: Enabled	1

■ n1-02: Hunting Prevention Gain Setting

Sets the gain for the Hunting Prevention Function.

No.	Parameter Name	Setting Range	Default
n1-02	Hunting Prevention Gain Setting	0.00 to 2.50	1.00

Normally, n1-02 does not need to be changed, but adjustment may help under the following conditions:

- 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.

Note: An overly large Hunting Prevention Gain (n1-02) may cause the motor to stall.

■ n1-03: Hunting Prevention Time Constant

Determines how responsive the Hunting Prevention function is (affects the primary delay time for Hunting Prevention).

No.	Parameter Name	Setting Range	Default
n1-03	Hunting Prevention Time Constant	0 to 500	Determined by o2-04

■ n1-05: Hunting Prevention Gain while in Reverse

This parameter is the same as n1-02 except that it is for when the motor rotating in reverse. See the description of n1-02 for setting instructions.

Note: When set to 0, n1-02 is enabled even when the drive is operating in reverse.

No.	Parameter Name	Setting Range	Default
n1-05	Hunting Prevention Gain while in Reverse	0.00 to 2.50	0.00

◆ n2: AFR Tuning

These parameter are used to achieve speed stability by calculating changes in the torque current feedback and then compensating the output frequency.

Note: The drive comes equipped with Speed Feedback Detection, and therefore an external device for detecting the speed is not necessary

■ n2-01: Speed Feedback Detection Control (AFR) Gain

Sets the internal speed feedback detection control gain in the AFR. Normally there is no need to adjust n2-01 from the default setting. Make adjustments in the following cases:

- If hunting occurs, increase the set value.
- If response is low, decrease the set value.

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

■ n2-02: Speed Feedback Detection Control (AFR) Time Constant 1

■ n2-03: Speed Feedback Detection Control (AFR) Time Constant 2

Sets the time constant to determine the rate of change for the AFR.

Note: If hunting occurs, increase the set value. If response is low, decrease the set value. Increase the setting of n2-03 if overvoltage (OV) failures occur at the completion of acceleration or when the load changes radically. Parameter n2-02 cannot be set higher than n2-03 or an oPE08 error will result. If you increase the gain for Hunting Prevention (n1-02), be sure to also proportionally increase the torque compensation delay time constant set to C4-02. If you increase the time constant for Hunting Prevention (n1-03), be sure to also proportionally increase the value set to C4-06 (Torque Compensation Delay Time Constant 2).

No.	Parameter Name	Setting Range	Default
n2-02	Speed Feedback Detection Control (AFR) Time Constant 1	0 to 2000	50 ms
n2-03	Speed Feedback Detection Control (AFR) Time Constant 2	0 to 2000	750 ms

◆ n3: High Slip Braking

High Slip Braking (HSB) is a method of decreasing the stopping time of a load without using dynamic braking. The regenerated energy of the decelerating load is dissipated in the motor windings through increased motor slipping. Because of the increased temperature of the motor windings, there is a limitation on the occurrence of HSB usage (~5% duty cycle).

The deceleration time is disregarded during HSB.

Braking time varies based on the load inertia and motor characteristics.

Note: High Slip Braking is only possible when using V/f Control. Due to the increased temperature created in the motor windings, there is a limitation on the occurrence of HSB usage. When a HSB command is given, it is not possible to restart the drive until the motor is stopped and the Run command is cycled.

■ n3-01: High Slip Braking Deceleration Frequency Width

Sets how aggressively the drive decreases the output frequency as it stops the motor using high slip braking (HSB).

No.	Parameter Name	Setting Range	Default
n3-01	High Slip Braking Deceleration Frequency Width	1 to 20	5%

■ n3-02: High Slip Braking Current Limit

Sets the maximum current to be output during an HSB stop as a percentage of motor rated current (E2-01). Make sure that this value does not exceed 150% of the drive's current rating.

No.	Parameter Name	Setting Range	Default
n3-02	High Slip Braking Current Limit	100 to 200	150%

■ n3-03: High Slip Braking Dwell Time at Stop

Sets the time that the output frequency should remain constant with the minimum output frequency set to E1-09.

Note: Possible only when using V/f Control. Enabled only during High Slip Braking.

No.	Parameter Name	Setting Range	Default
n3-03	High Slip Braking Dwell Time at Stop	0.0 to 10.0	1.0 s

■ n3-04: High Slip Braking Overload Time

Sets the time required for an HSB overload fault (OL7) to occur when the drive output frequency does not change for some reason during an HSB stop.

The overload fault oL1 is not affected by n3-04.

No.	Parameter Name	Setting Range	Default
n3-04	High Slip Braking Overload Time	30 to 1200	40 s

■ n3-13: Overexcitation Deceleration Gain

Improves the ability of the drive to perform linear deceleration when L3-04 = 4. Increase the gain to shorten the deceleration time.

- Returns to the normal values after ramp to stop, re-acceleration, and stop (DB, BB).
- To improve the breaking power of overexcitation, increase the gain by 1.25 to 1.30.

The optimum setting for n3-04 depends on the motor flux saturation characteristics.

Parameters n3-13, n3-21, and n3-23 are enabled only when using V/f Control or Open Loop Vector Control.

The drive decelerates at the specified time.

This function allows the drive to abandoned deceleration and start accelerating back up to a specified speed.

No.	Parameter Name	Setting Range	Default
n3-13	Overexcitation Deceleration Gain	1.00 to 1.40	1.10

■ n3-21: Overslip Suppression Current Level

If overcurrent, OL1, or OL2 occur during overslip deceleration, reduce the overslip suppression current level. Set as a percentage of the drive rated current.

No.	Parameter Name	Setting Range	Default
n3-21	Overslip Suppression Current Level	0 to 150	100%

Note: If the motor current exceeds the overexcitation supression current level set to n3-21 during overexcitation deceleration, then try returning the setting to what they were before. The problem is the result of flux saturation in the motor. Another possible solution is to try reducing the overexcitation gain set to n3-13.

■ n3-23: Overexcitation Operation Selection

Set this parameter to determine whether overexcitation can work in only one direction or not. This is helpful for having overexcitation apply only when motoring or only during regeneration. Because the flux level increases by the gain set by n3-13 during the overexcitation operation, regenerative energy is consumed in the motor. This allows enough regen torque to be output that a braking resistor is not needed.

Note: Operating the drive with overexcitation can trigger oL1. If overvoltage continues to occur even with this function enabled, try using a braking resistor instead. Disabled this function when using a braking resistor.

No.	Parameter Name	Setting Range	Default
n3-23	Overexcitation Operation Selection	0 to 2	0

0	Disabled

1	Enabled only when rotating forwards
2	Enabled only when rotating in reverse

◆ n6: Line-to-Line Motor Resistance Online Tuning

For tuning the line-to-line motor resistance online.

No.	Parameter Name	Setting Range	Default
n6-01	Line-to-Line Motor Resistance Online Tuning	0: Disabled 1: Enabled	1

◆ n8: PM Motor Control

These parameters are available when using the special Open Loop Vector Control designed for permanent magnet motors.

■ n8-45: Speed Feedback Detection Control Gain (PM OLV)

Sets the gain for internal speed feedback detection control. Although this setting rarely needs to be changed, adjustment may be necessary under the following conditions:

- Increase this setting if motor oscillation occurs.
- Decrease this setting when there is a fair amount of speed fluctuation due to the load.
- Lower this setting in increments of 0.05 to decrease how responsive the drive is.

No.	Parameter Name	Setting Range	Default
n8-45	Speed Feedback Detection Control Gain (PM OLV)	0.00 to 10.00	0.80

■ n8-47: Pull-In Current Compensation Time Constant (PM OLV)

Sets the gain in units of 0.1 seconds to compensate for the phase margin.

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 for the Pull-In Current to match the target value.
- Decrease this setting if motor oscillation occurs.

No.	Parameter Name	Setting Range	Default
n8-47	Pull-In Current Compensation Time Constant (PM OLV)	0.0 to 100.0 s	5.0 s

■ n8-48: Pull-In Current (PM OLV)

Tells the drive the amount of current to be provided to the motor during no load operation at a constant speed. Set as a percentage of the motor rated current.

Increase this setting when hunting occurs while running at a constant speed.

- If the motor is unstable when operating at constant speeds, then slightly increase this setting.
- If there is too much current when drive a light load at a constant speed, then raise this level slightly.

No.	Parameter Name	Setting Range	Default
n8-48	Pull-In Current (PM OLV)	20 to 200%	Determined by E5-01

■ n8-49: d Axis Current for High Efficiency Control (for PM)

Sets the amount of d axis current when using Energy Saving control as a percentage of the motor rated current. For IPM motors only.

Although this setting seldom needs to be changed, please note the following:

- If motor operation is unstable when driving heavy loads, try lowering this setting.
- If motor parameters (E5) have been changed, this value will be reset to 0.

No.	Parameter Name	Setting Range	Default
n8-49	d Axis Current for High Efficiency Control (for PM)	-200.0 to 0.0%	Determined by E5-01

■ n8-51: Acceleration Time Pull-In Current (for PM OLV)

Sets the pull-in current during acceleration as a percentage of the motor rated current (E5-03). Set to a high value when more starting torque is needed.

Adjustments to this setting may help in the following situations:

- Increase this setting when a large amount of starting torque is required.
- Lower this setting if there is excessive current during acceleration.

No.	Parameter Name	Setting Range	Default
n8-51	Acceleration Time Pull-In Current	0 to 200%	Determined by E5-01

■ n8-54: Voltage Error Compensation Time Constant

Parameter Overview

No.	Name	Description	Range	Default
n8-54	Voltage Error compensation time constant	Sets the time constant for voltage error compesation. Adjust the value when: • hunting occurs at low speed • hunting occurs with sudden load changes. Increase in steps of 0.1 or disable the compensation by setting n8-45 to 0. • oscillations occur ar start. Increase the value in steps of 0.1.	0.00 to 10.00	1.00

■ n8-55: Load Inertia (PM OLV)

Adjust appropriately for the inertia of the connected machinery. If this value is set too low, the motor may not start very smoothly, and a STo fault (Pull-Out Detection 2) might occur. Try adjusting this parameter from the beginning.

0: The inertia ratio between the motor and the load just less than 1:10.
There is a sizable current ripple.

1: The inertia ratio between the motor and the load is 1:10 to 1:30.
When set to 0, STo occurs as a result of the load impact and sudden acceleration or deceleration.

2: The inertia ratio between the motor and the load is 1:30 to 1:50.
When set to 1, STo occurs as a result of the load impact and sudden acceleration or deceleration.

3: The inertia ratio between the motor and the load is greater than 1:50.
When set to 1, STo occurs as a result of the load impact and sudden acceleration or deceleration.

No.	Parameter Name	Setting Range	Default
n8-55	Load Inertia (PM OLV)	0 to 3	0

■ n8-62: Output Voltage Limit

Parameter Overview

No.	Name	Description	Range	Default
n8-62	Output voltage limit	Sets the limit for the output voltage. Adjustment is normally needed only if the input voltage is below the n8-62 set value. In this case set n8-62 to the input voltage.	0.0 to 230.0	200 Vac

1.10 o: Operator Related Settings

These parameters concern the various functions and features of the operator.

◆ o1: Display Settings and Selections

There parameters determine how data is displayed on the operator screen.

■ o1-01: Drive Mode Unit Monitor Selection

Selects which monitor will be displayed in the operation menu upon power-up when o1-02 = 4. Press the up arrow key four times and select the desired monitor.

No.	Parameter Name	Setting Range	Default
o1-01	Drive Mode Unit Monitor Selection	104 to 621 (U1-04 to U6-21*)	106 (U1-06)

*U2-□□ and U3-□□ parameters cannot be selected.

Detailed Description

To select a monitor, set the three numeric digits that make up that monitor, in other words, enter the □-□□ part of U□-□□.

The following example explains how to set U4-03 (Cooling Fan Operation Time) to be displayed when the drive is first powered up.

Step		Display/Result
1. Power up the drive.	⇒	F 0.00 ALM REV DRV FOUT
2. Press the V key until the parameter settings screen appears.	⇒	PAr
3. Press ENTER to enter the parameter settings menu.	⇒	A1-01
4. Scroll to o1-01 by pressing > RESET and Λ .	⇒	o1-01
5. Press > RESET and Λ to set “403”.	⇒	403
6. Press ENTER to save the setting.	⇒	End

Step		Display/Result
7. The screen display will automatically return to step 4.	⇒	
8. Press  until the display returns to the first screen.	⇒	

■ o1-02: User Monitor Selection After Power Up

Selects which monitor will be displayed upon power-up. Defaulted to show the frequency reference when the drive is first turned on.

No.	Parameter Name	Setting Range	Default
o1-02	User Monitor Selection After Power Up	1: Frequency Reference (U1-01) 2: Forward/Reverse 3: Output Frequency (U1-02) 4: Output Current (U1-03) 5: User Monitor (set by o1-01)	1

■ o1-03: Digital Operator Display Selection

Parameter o1-03 allows the programmer to change the units used in the speed monitors and when some speed parameters are displayed.

No.	Parameter Name	Setting Range	Default
o1-03	Digital Operator Display Selection	0: 0.01 Hz 1: 0.01% (100% = E1-04) 2: r/min (enter the number of motor poles) 3: User-set	0

The o1-03 parameter will change the units of the following parameters along with o1-10 and o1-11.

No.	Parameter Name
U1-01	Frequency Reference
U1-02	Output Frequency
U1-05	Motor Speed
U1-16	Output Frequency after Soft Start
d1-01 to d1-17	Frequency Reference 1 to 17

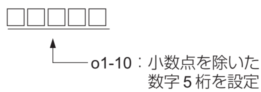
Detailed Description

- To display the frequency reference as a percent rather than hertz, set o1-03 to 1.

- To display the reference in r/min, set o1-03 to 2. The drive will calculate the revolutions per minute from the maximum output frequency and the number of motor poles. Motor pole data should be set to parameters E2-04, E4-04, and E5-04.
- To display the revolutions of the machine (r/min) or the line speed (m/min), set o1-03 to 3, and then set parameters o1-10 and o1-11.

■ o1-10: Frequency Reference Setting and User-Set Display

Determines how values are set and displayed when operating at the max output frequency.

No.	Parameter Name	Setting Range	Default
o1-10	Frequency Reference Setting and User-Set Display	1 to 60000: User-set display 	Determined by o1-03

■ o1-11: Frequency Reference Setting / Decimal Display

Sets the number of digits for setting and displaying the frequency reference.

No.	Parameter Name	Setting Range	Default
o1-11	Frequency Reference Setting / Decimal Display	0: No decimal point. 1: Set to one decimal point. 2: Set to the second decimal point. 3: Set to the third decimal point.	Determined by o1-03

◆ o2: Operator Key Selections

These parameters determine the functions assigned to the operator keys.

■ o2-01: LOCAL/REMOTE Key Function Selection

Parameter o2-01 determines whether the LOCAL/REMOTE switch on the digital operator will be enabled and will switch between keypad operation and the sources specified by the b1-01 and b1-02 parameters when the drive is stopped.

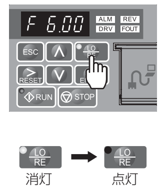
No.	Parameter Name	Setting Range	Default
o2-01	LOCAL/REMOTE Key Function Selection	0: Disabled 1: Enabled	1

Note: When LOCAL has been selected, the LO/RE indicator light is on. The user cannot switch between LOCAL/REMOTE while the drive is running the motor.

Detailed Description

There are three different ways to switch between LOCAL and REMOTE.

- Switching between LOCAL and REMOTE using the LO/RE key:

	Step		Display/Result
1.	Power up the drive. DRV should be lit.	⇒	
2.	If DRV is not lit, press the LO/RE key. Press LO/RE again to put the drive back into REMOTE mode.	⇒	

- Switching between LOCAL and REMOTE with an input terminal (S1 through S7):

Note: Taking the steps described here will disable the LO/RE key on the operator keypad.

	Step		Display/Result
1.	Power up the drive.	⇒	
2.	Press the ∨ key until the parameter settings screen appears.	⇒	
3.	Press ENTER to enter the parameter settings menu.	⇒	
4.	Scroll to H1-05 (or any parameter between H1-05 and H1-07) by pressing ∧ and RESET.	⇒	
5.	Press ENTER to display the value set to H1-05	⇒	
6.	Press RESET to select the flashing digit.	⇒	
7.	Press ∨ to set “01” (LOCAL/REMOTE).	⇒	

Step		Display/Result
8. Press  to save the setting.	⇒	
9. The display will return to the screen shown in step 4.	⇒	
10. Press  until the display returns to the first screen.	⇒	

- Switch between LOCAL and REMOTE using parameters b1-01 and b1-02:
  This method can be used to issue the frequency reference from the operator keypad and the Run command from the control terminals.

■ o2-02: STOP Key Function Selection

The STOP key is enabled during Auto Run as a default, which enables the STOP key on the digital operator even if b1-02 has assigned the Run command to be given from a remote source (i.e., not from the operator). In effect, the STOP key becomes an alternative stop input. Once the drive has been stopped by the STOP key, it can be restarted by cycling the external Run command. If o2-02 = “0: Disabled”, then pressing the STOP key while the drive is set for REMOTE will have no effect.

No.	Parameter Name	Setting Range	Default
o2-02	STOP Key Function Selection	0: Disabled 1: Enabled	1

■ o2-03: User Parameter Default Value

The drive gives the option of configuring any and all of the programming parameters and then saving the parameters as “User Initialization Values”. After configuring the drive, set parameter o2-03 = “1: Set Defaults” to save the parameters to the User Initialization memory. Once this has been done, the “Initialize Parameters” parameter (A1-03) will offer the choice of “1110: User Initialize”. Choosing A1-03 = “1110: User Initialized”, will reset all modified parameters back to what they were the last time they were saved using o2-03.

No.	Parameter Name	Setting Range	Default
o2-03	User Parameter Default Value	0: No Change 1: Set Defaults - Saves current parameter settings as user initialization. A1-03 now allows selecting <1110> for user initialization and returns o2-03 to 0. 2: Clear All - Clears the currently saved user initialization. A1-03 no longer allows selecting <1110> and returns o2-03 to 0.	0

■ o2-04: Drive/kVA Selection

Parameter o2-04 matches the control board to the drive hardware. Proper setting of o2-04 is important so that the control board can provide proper protection for the drive hardware. This parameter is configured at the factory and does not normally require adjustment in the field. It is available primarily to accommodate control board replacement in the event of damage.

No.	Parameter Name	Setting Range	Default
o2-04	Drive/kVA Selection	Sets the kVA of the drive. This parameter only needs to be set when installing a new control board. Do not change for any other reason.	Determined by o2-04

Note: The default settings for some parameters are determined by the capacity of the drive set to o2-04.

An oPE04 error will occur if someone attempts to install a removable terminal board and control board to drive that has a different capacity from the capacity saved to memory of those boards. The oPE04 error indicates that the terminal board doesn't match the control board. To reset oPE04, the drive needs to be initialized by using parameter A1-03. To reset the oPE04 error without initializing any parameter settings, set 5550 to A1-03. Otherwise, initialize the entire drive with a 2-wire or a 3-wire initialization (settings 2220 and 3330 respectively).

Note: Drive performance will suffer If the correct drive capacity is not set to o2-04, and protective functions will fail to operate properly.

■ o2-05: Frequency Reference Setting Method Selection

Determines if the ENTER key must be used to input a frequency reference from the digital operator.

No.	Parameter Name	Setting Range	Default
o2-05	Frequency Reference Setting Method Selection	0: ENTER key required. 1: ENTER not required.	0

The default setting of the Frequency Reference Setting Method parameter (o2-05 = “1: Enabled”) dictates that when setting a frequency reference via the digital operator (LOCAL), it is not necessary to press the “ENTER” key before the drive will begin to accelerate or decelerate to the new set speed. When o2-05 = “1: Enabled”, the frequency reference is stored to memory five seconds after the up arrow or down arrow keys are released.

■ o2-06: Operation Selection when Digital Operator is Disconnected

Determines if the drive will stop when the LCD operator is removed in LOCAL mode or with b1-02 set to 0.

No.	Parameter Name	Setting Range	Default
o2-06	Operator is Disconnect Operation	0: Disabled. Drive does not stop when the digital operator is removed. 1: Enabled. The drive will fault (OPR) and coast to stop when the digital operator is removed.	0

Note: An LCD operator is available as an option. This setting is not applicable to the standard LED operator that comes with the drive.

■ o2-07: Motor Direction at Power Up when Using Operator

Determines the direction the motor will rotate after the drive is powered up when the Run command is set to be given from the LED operator.

No.	Parameter Name	Setting Range	Default
o2-07	Motor Direction at Power Up when Using Operator	0: Forward 1: Reverse	0

Note: This parameter is available only when the Run command is set to be given from the LED operator (b1-02 = 0).

■ o2-09: Initialization Specification Selection

This parameter sets the regional specifications for the drive and should not be changed.

◆ o4: Maintenance Period

■ o4-01: Accumulated Operation Time Setting

■ o4-02: Accumulated Operation Time Selection

Displays the cummlative operation time of the drive and allows the user to set when the drive should indicate the need for maintenance. Specify in o4-01 whether the drive should keep track of how long it is powered up, or if it should only keep track of the time that it is running the motor. If any parts are replaced, be sure to reset o4-01 back to 0. The user can monitor the amount of time passed by viewing U4-01.

No.	Parameter Name	Setting Range	Default	Page
o4-01	Accumulated Operation Time Setting	Sets the starting value for the cumulative operation time of the drive.	0 H	–
o4-02	Accumulated Operation Time Selection	0: Logs operation time from power-on 1: Logs operation time from the point the run command is issued	0	–
U4-01	Accumulated Operation Time	0 to 99999	–	–

Note: It is considered to be “during run” whenever the run command is present (even if the motor is not rotating) and also whenever there is voltage output from the drive.

■ o4-03: Cooling Fan Maintenance Setting

Sets the units to be used when keeping track of how long the cooling fan has been operating. The user can check the amount of time passed by viewing U4-04. Be sure to reset this parameter back to 0 if the cooling fan is replaced.

No.	Parameter Name	Setting Range	Default	Page
o4-03	Cooling Fan Maintenance Setting (Operation Time)	0 to 9999	0H	–
U4-03	Cooling Fan Operation Time	0 to 99999 (value resets if time exceeds 99999)	–	–
U4-04	Cooling Fan Maintenance	Display units: % 90% = Maintenance Period	–	–

Note: Required maintenance times will depend on the environment the drive is used in.

■ o4-05: Capacitor Maintenance Setting

Sets the units to be used when keeping track of how long the electrolytic capacitors have been operating. The user can check the amount of time passed by viewing U4-05. This paramaeter is set as a percentage of the total expected performance life. Be sure to reset this value back to 0 if the main circuit is replaced.

No.	Parameter Name	Setting Range	Default	Page
o4-05	Capacitor Maintenance Setting	0 to 150	0%	–
U4-05	Capacitor Maintenance	Display units: % 90% = Maintenance Period	–	–

Note: Required maintenance times will depend on the environment the drive is used in.

■ o4-07: Inrush Prevention Relay Maintenance Setting

Resets the counter used for parameter U4-06 back 0.

No.	Parameter Name	Setting Range	Default	Page
o4-07	Inrush Prevention Relay Maintenance Setting	0 to 150	0%	–
U4-06	Inrush Prevention Relay Maintenance	Display units: % 90% = Maintenance Period	–	–

Note: Required maintenance times will depend on the environment the drive is used in.

■ o4-09: IGBT Maintenance Setting

Resets the counter used for parameter U4-07 back to 0.

No.	Parameter Name	Setting Range	Default	Page
o4-09	IGBT Maintenance Setting	0 to 150	0%	–
U4-07	IGBT Maintenance	Display units: % 50% = Maintenance Period	–	–

Note: Required maintenance times will depend on the environment the drive is used in.

■ o4-11: U2, U3 Initial Value Selection

This parameter is used to reset the values for the fault history and fault trace (U2-☐☐ and U3-☐☐).

No.	Parameter Name	Setting Range	Default	Page
o4-11	U2, U3 Initial Value Selection	0: Saves the value for U2-☐☐ (Fault Trace) and U3-☐☐ (Fault History). 1: Resets the values for U2-☐☐ (Fault Trace) and U3-☐☐ (Fault History).	0	–

■ o4-12: kWH Monitor Initial Value Selection

Saves the values of monitor parameters U4-10 and U4-11. This value is not reset when the power to the drive is cycled. To manually set this value back to 0, set o4-12 to 1.

Below is an example of how o4-12 displays kilowatt hours when viewing U4-10 and U4-11.

Example: “12345678.9 KWH” indicates that U4-10: 678.9 KWH U4-11: 12345 MWH

Note: No analog monitor output is available.

No.	Parameter Name	Setting Range	Default	Page
o4-12	kWH Monitor Initial Value Selection	0: Saves the values of monitor parameters U4-10 and U4-11. 1: Resets monitor parameters U4-10 and U4-11 back to default settings.	0	–
U4-10	kWH, Lower 4 Digits	Display units: kWH	–	–
U4-11	kWH, Upper 5 Digits	Display units: kWH	–	–

■ o4-13: Motor rpm Reset

Resets the value displayed in U4-02, which keeps track of the number of motor revolutions per minute. This count is not reset when the power is shut off, but can be manually reset to 0 by setting o4-13 to 1.

No.	Parameter Name	Setting Range	Default	Page
o4-13	Motor rpm Reset	0: Maintain the current r/min. 1: Reset the number of motor revolutions to 0.	0	–

No.	Parameter Name	Setting Range	Default	Page
U4-02	Number of Run Commands	Displays the number of times the run command was entered. Reset the number of run commands using parameter o4-13. A maximum of 65535 run commands are counted, after which the value is reset to 0.	–	–

◆ q: DriveWorksEZ Parameters

■ q1-01 to q6-07: Reserve for use by DriveWorksEZ

These parameters are reserved for use with DriveWorksEZ. Refer to the DriveWorksEZ manual for more information.

◆ r: DriveWorksEZ Connection Parameters

■ r1-01 to r1-40: DriveWorksEZ Connection Parameters

These parameters are reserved for use with DriveWorksEZ. Refer to the DriveWorksEZ manual for more information.

1.11 Auto-Tuning

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

◆ Types of Auto-Tuning

There are three types of Auto-Tuning.

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

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

◆ Auto-Tuning Selection

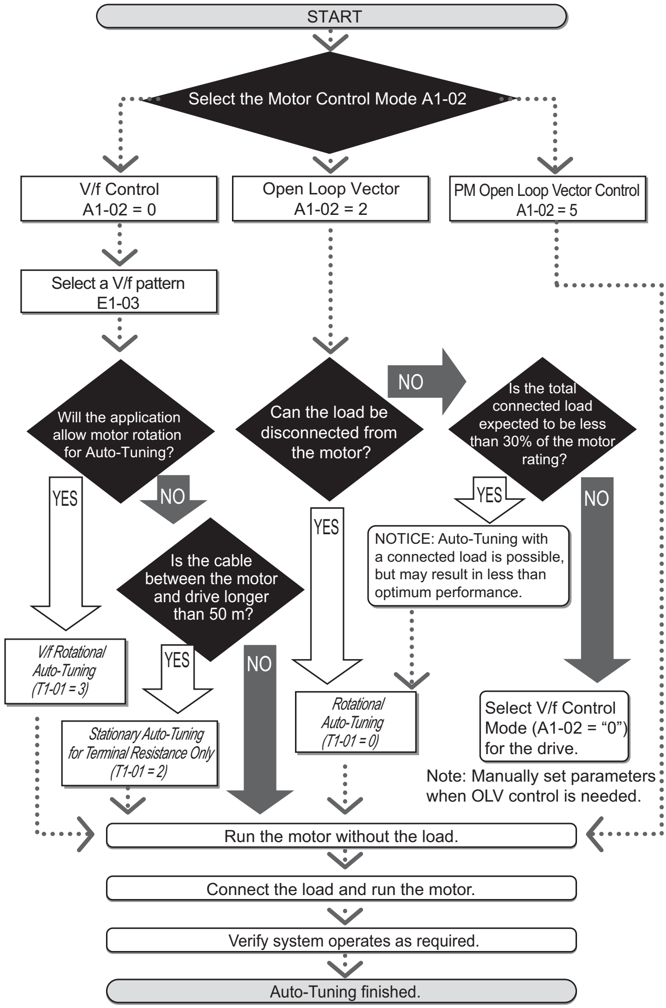


Figure 1.72

◆ Before Auto-Tuning the Drive

Check the items below before Auto-Tuning the drive:

■ Basic Auto-Tuning Preparations

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

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

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

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

■ Rotational Auto-Tuning for V/f Control

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

■ Rotational Auto-Tuning for Open Loop Vector Control

- Used only when in Open Loop Vector Control.
- Perform only with the motor uncoupled from the load for applications requiring high performance over a wide speed range.
- Disconnect the load before Auto-Tuning the drive and motor. Performing Rotational Auto-Tuning with the load connected will set motor parameters incorrectly, and also be dangerous because irregular motor rotation will occur.

- It is possible to perform Rotational Auto-Tuning with a connected load if the load is less than 30% of the rated load.
- Ensure a motor-mounted brake is fully released.
- Connected machinery should not produce enough power to rotate the motor.

■ Stationary Auto-Tuning for Terminal Resistance Only

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

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

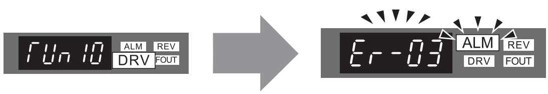
Note: When auto-tuning a motor that is used on an application in conjunction with a brake, take special precaution to ensure the brake stays applied.

◆ Auto-Tuning Fault Codes

Calculation of abnormal measurements or pressing 

before completion will interrupt Auto-Tuning.

A B



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

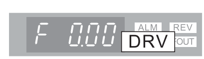
Figure 1.73 Auto-Tuning Interruption Display

◆ Performing Auto-Tuning

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

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

■ Selecting the Type of Auto-Tuning

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

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

■ Enter Data from the Motor Nameplate

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

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

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

Step		Display/Result
6. The display automatically returns to the screen shown in Step 1.	⇒	T1-02
7. Repeat Steps 1 through 5 to set the following parameters:T1-03, Motor Rated Voltage T1-04, Motor Rated CurrentT1-05, Motor Base FrequencyT1-06, Motor Poles; T1-07, Motor Base Frequency	⇒	T1-03 ⋮ T1-07

Note: For stationary Auto-Tuning for line-to-line resistance only, set T1-02 and T1-04.

■ Starting Auto-Tuning

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

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

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

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

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

Step		Display/Result
1. After setting T1-07 as illustrated in the previous section, press  and confirm the display is as follows:	⇒	Tun10
2. Press RUN to activate Auto-Tuning. DRV flashes. **Note:** The first digit indicates which motor is undergoing Auto-Tuning (motor 1 or motor 2). The second digit indicates the type of Auto-Tuning being performed.	⇒	Tun10 ALM REV DRV FOUT
3. Auto-Tuning finishes in approximately one to two minutes.	⇒	End

◆ Motor Data for Auto-Tuning

Table 1.19 Parameters Set During Auto-Tuning

No.	Name	Description	Range	Def.
T1-00	Motor Selection 1/2	Selects which set of motor parameters are set during Auto-Tuning. If motor 2 selection (H1-□□=16) is not selected, this parameter will not be displayed. 1: Motor 1 - E1 to E2 2: Motor 2 - E3 to E4. Enabled when motors 1 and 2 are switched to each other (H1-□□=16). Displayed only when either multi-function contact output H1-01 through H1-07 is set to 16.	1, 2	1
T1-	Auto-Tuning Mode Selection	Selects the Auto-Tuning mode. 0: OLV Rotational Auto-Tuning 2: Terminal resistance only, Stationary Auto-Tuning 3: V/f Rotational Auto-Tuning. Only settings 2 and 3 are available when using V/f Control. Only setting 2 is available when using motor 2. Settings 0 and 2 are available when using OLV Control.	0, 2, 3	0 (“2” in V/f mode)
T1-02	Motor Rated Power	Sets the motor rated output power. A set value that can provide stable control in the open loop control mode ranges from 50 to 100% of the drive rating. In case of motors that operate above base speed, set the value at base speed.	0.00 to 650.00	0.40 kW
T1-03	Motor Rated Voltage	Set the motor base voltage according to the information printed on the motor nameplate. In case of motors that operate above base speed, set the value at base speed.	0.0 to 255.5	200.0 V
T1-04	Motor Rated Current	Enter the motor-rated current as specified on the motor nameplate. For best performance when using OLV select the drive so that the motor represents 50 to 100% of the drive rated current. Enter the current required at base speed for motors with extended speed ranges.	10 to 200% of drive rated current	Det. by o2-04 and C6-01
T1-05	Motor Base Frequency	Enter the motor base frequency as specified on the motor nameplate. Enter the motor base frequency for extended speed range motors.	0.0 to 400.0	60.0 Hz
T1-06	Number of Motor Poles	Enter number of motor poles indicated on motor nameplate.	2 to 48	4
T1-07	Motor Base Speed	Sets the base speed of the motor in revolutions per minute r/min (RPM). Enter the motor base speed for extended speed range motors.	0 to 24000	1750. r/min
T1-11	Motor Iron Loss	Provides iron loss for determining Energy Saving coefficient. When power is cycled, the value set to E2-10 will appear (the motor iron loss). If T1-02 is changed, an initial value for the motor capacity will appear that is close to the capacity that was changed.	0 to 65535	14W

◆ Precision Settings for Auto-Tuning

Basic motor nameplate data can be used to auto-tune a motor. However, improved performance can be achieved by using precise data for base voltage and base frequency. If the base no-load voltage and frequency are known, enter this data when executing auto-tuning to improve performance.

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

◆ No-Load Operation

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

■ Before Starting the Motor

Check the following items before operation:

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

■ During Operation

Check the following items during operation:

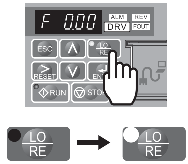
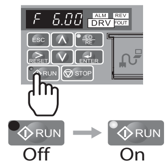
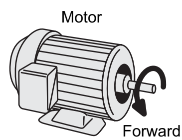
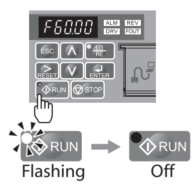
- The motor should rotate smoothly (i.e., no abnormal noise or oscillation).
- The motor should accelerate and decelerate smoothly.

■ Operation Instructions

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

Note: Before starting the motor, set the frequency reference to 6 Hz.

Step		Display/Result
1. Turn on the power to the drive. The initial display appears.	⇒	

Step			Display/Result
2.	Press the  key to select LOCAL. The LO/RE LED will turn on.	⇒	
3.	Press  to give the drive a run command. RUN will light and the motor will rotate at 6 Hz.	⇒	
4.	Ensure the motor is rotating in the correct direction and no faults or alarms occur.	⇒	
5.	If there is no error in step 4, press  to increase the frequency reference. Increase the frequency in 10 Hz increments verifying smooth operation results at all speeds. For each frequency monitor the drive output current (U1-03) through the LED operator to confirm the current is well below the motor rated current. Example: 6 Hz → 50 Hz/60 Hz		
6.	The drive should operate normally. Press  to stop the motor. RUN flashes until the motor comes to a complete stop.	⇒	

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

◆ Operating with the Load Connected

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

■ Notes on Connected Machinery

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

■ Checklist Before Operation

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

If the application permits running the load in the reverse direction, try changing motor direction and the frequency reference and watch for abnormal motor oscillation or vibration. Correct the problem if hunting or oscillation occurs or if there are control-related problems.

■ Operating the Motor under Loaded Conditions

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

1.12 U: Monitor Parameters

Monitor parameters let the user view various aspects of drive performance as it is displayed on the operator screen.

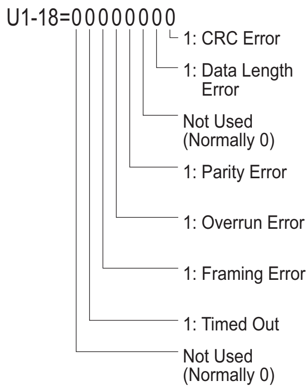
◆ U1: Status Monitors

The following monitors display drive status. The data displayed when viewing the parameters below can also be output from terminal AM by assigning the specific monitor parameter number to H4-01. This is done by setting the numeric parts of U☐-☐☐ to H4-01.

No.	Name	Description	Analog Output Level	Unit
U1-01	Frequency Reference	Monitors the frequency	10 V: Max frequency	0.01Hz
U1-02	Output Frequency	Displays the output voltage. Display units are determined by o1-03.	10 V: Max frequency	0.01Hz
U1-03	Output Current	Displays the output current.	10 V: Drive rated current	0.01A
U1-04	Control Mode	Control method set in A1-02. 0: V/f without PG 2: Open Loop Vector (OLV) 5: PM Open Loop Vector (PM)	No output signal available	–
U1-05	Motor Speed	Displays the motor speed feedback. Display units are determined by o1-03.	10 V: Maximum speed	0.01Hz
U1-06	Output Voltage Reference	Displays the output voltage.	10 V: 200 Vrms (400 Vrms)	0.1 V
U1-07	DC Bus Voltage	Displays the DC bus voltage.	10 V: 400 V (800 V)	1 V
U1-08	Output Power	Displays the output voltage (this value is determined internally).	10 V: Drive capacity (kW) (max. motor capacity allowed)	–
U1-09	Torque Reference	Monitor of internal torque reference value for Open Loop Vector (OLV) control	10 V: Motor rated torque	–

No.	Name	Description	Analog Output Level	Unit
U1-10	Input Terminal Status	Displays the input terminal status. U1-09=0000000 1: FWD run command (terminal S1 enabled) 1: REV run command (terminal S2 enabled) 1: Multi-Function Digital Input 1 (terminal S3 enabled) 1: Multi-Function Digital Input 2 (terminal S4 enabled) 1: Multi-Function Digital Input 3 (terminal S5 enabled) 1: Multi-Function Digital Input 4 (terminal S6 enabled) 1: Multi-Function Digital Input 5 (terminal S7 enabled)	No output signal available	–
U1-11	Output Terminal Status	Displays the output terminal status. U1-11=000 1: Multi-Function Digital Output (fault) (terminal MA/MB-MC) 1: Multi-Function Digital Output 1 (terminal P1) enabled 1: Multi-Function Digital Output 2 (terminal P2) enabled	No output signal available	–

No.	Name	Description	Analog Output Level	Unit
U1-12	Drive Status	Verifies the drive operation status. U1-12=00000000 1: During run 1: During zero-speed 1: During REV 1: During fault reset signal input 1: During speed agree 1: Drive ready 1: During alarm detection 1: During fault detection	No output signal available	–
U1-13	Terminal A1 Input Voltage	Displays the analog input A1 input level. 100% when the input is 10 V	10 V: 100%	0.1%
U1-14	Terminal A2 Input Voltage	Displays the analog input A2 input level. 100% when the input is 10 V / 20 mA	10 V: 100%	0.1%
U1-16	Output Frequency after Soft Start	Displays the output frequency including ramp times, S-curves. Units are determined by o1-03.	10 V: Max frequency	0.01Hz
U1-18	OPE Fault Parameter	Displays the parameter number for oPE□□ or Err (operator error) where the error occurred.	No output signal available	–

No.	Name	Description	Analog Output Level	Unit
U1-19	MEMOBUS/Modbus Error Code	Displays the contents of a MEMOBUS/ Modbus error. 	No output signal available	–
U1-24	Input Pulse Monitor	Displays the Pulse Train input RP frequency.	32000	–
U1-25	Software No. (Flash)	Yaskawa Flash ID	No signal output available	–
U1-26	Software No. (ROM)	Yaskawa ROM ID	No signal output available	–

Set the lower and higher digits to the value corresponds to the capacity of the drive:

11 kW or less: Sets the lower 2 digits

11 kW or higher: Set to the lowest digit

◆ U2: Fault Trace

These monitor parameters are used to view the status of various drive aspects when a fault occurs. This information is helpful for finding out why a fault occurred.

No.	Name	Description	Analog Output Level	Unit
U2-01	Current Fault	Display of the current fault.	No signal output avail.	–
U2-02	Previous Fault	Display of the previous fault.	No signal output avail.	–
U2-03	Frequency Reference at Previous Fault	Displays the frequency reference at the previous fault.	No signal output avail.	0.01Hz

No.	Name	Description	Analog Output Level	Unit
U2-04	Output Frequency at Previous Fault	Displays the output frequency at the previous fault.	No signal output avail.	0.01Hz
U2-05	Output Current at Previous Fault	Displays the output current at the previous fault.	No signal output avail.	
U2-06	Motor Speed at Previous Fault	Displays the motor speed at the previous fault.	No signal output avail.	0.01 Hz
U2-07	Output Voltage at Previous Fault	Displays the output voltage at the previous fault.	No signal output avail.	0.1 V
U2-08	DC Bus Voltage at Previous Fault	Displays the DC bus voltage at the previous fault.	No signal output avail.	1 V
U2-09	Output Power at Previous Fault	Displays the output power at the previous fault.	No signal output avail.	0.1 kW
U2-10	Torque Reference at Previous Fault	Displays the torque reference at the previous fault.	No signal output avail.	0.1%
U2-11	Input Terminal Status at Previous Fault	Displays the input terminal status at the previous fault. Displayed as in U1-10.	No signal output avail.	–
U2-12	Output Terminal Status at Previous Fault	Displays the output status at the previous fault. Displays the same status displayed in U1-11.	No signal output available	–
U2-13	Drive Operation Status at Previous Fault	Displays the operation status of the drive at the previous fault. Displays the same status displayed in U1-12.	No signal output available	–
U2-14	Cumulative Operation Time at Previous Fault	Displays the cumulative operation time at the previous fault.	No signal output available	1 H
U2-15	Soft Starter Speed Reference at Previous Fault	Displays the speed reference for the soft starter at the previous fault.	No signal output available	0.01%
U2-16	Motor q-Axis Current at Previous Fault	Displays the q-axis current for the motor at the previous fault.	No signal output avail.	0.10%
U2-17	Motor d-Axis Current at Previous Fault	Displays the d-axis current for the motor at the previous fault.	No signal output avail.	0.10%

Note: Two digits for 11kW or less, one digit for larger units.

◆ U3: Fault History

These parameters display faults that have a occurred during operation and when they occurred.

No.	Name	Description	Analog Output Level	Unit
U3-01	Most Recent Fault	Displays the most recent fault.	No signal output avail.	–
U3-02	2nd Most Recent Fault	Displays the second most recent fault.	No signal output avail.	–
U3-03	3rd Most Recent Fault	Displays the third most recent fault.	No signal output avail.	–
U3-04	4th Most Recent Fault	Displays the fourth most recent fault.	No signal output available	–
U3-05	5th Most Recent Fault	Displays the fifth most recent fault.	No signal output available	–
U3-06	6th Most Recent Fault	Displays the sixth most recent fault.	No signal output available	–
U3-07	7th Most Recent Fault	Displays the seventh most recent fault.	No signal output available	–
U3-08	8th Most Recent Fault	Displays the eighth most recent fault.	No signal output available	–
U3-09	9th Most Recent Fault	Displays the ninth most recent fault.	No signal output available	–
U3-10	10th Most Recent Fault	Displays the tenth most recent fault.	No signal output available	–
U3-11	Cumulative Operation Time at Most Recent Fault	Displays the cumulative operation time at the most recent fault.	No signal output available	1 h
U3-12	Cumulative Operation Time at 2nd Most Recent Fault	Displays the cumulative operation time at the second most recent fault.	No signal output available	1 h
U3-13	Cumulative Operation Time at 3rd Most Recent Fault	Displays the cumulative operation time at the third most recent fault.	No signal output available	1 h
U3-14	Cumulative Operation Time at 4th Most Recent Fault	Displays the cumulative operation time at the fourth most recent fault.	No signal output available	1 h
U3-15	Cumulative Operation Time at 5th Most Recent Fault	Displays the cumulative operation time at the fifth most recent fault.	No signal output available	1 h
U3-16	Cumulative Operation Time at 6th Most Recent Fault	Displays the cumulative operation time at the sixth most recent fault.	No signal output available	1 h
U3-17	Cumulative Operation Time at 7th Most Recent Fault	Displays the cumulative operation time at the seventh most recent fault.	No signal output available	1 h
U3-18	Cumulative Operation Time at 8th Most Recent Fault	Displays the cumulative operation time at the eighth most recent fault.	No signal output available	1 h

No.	Name	Description	Analog Output Level	Unit
U3-19	Cumulative Operation Time at 9th Most Recent Fault	Displays the cumulative operation time at the ninth most recent fault.	No signal output available	1 h
U3-20	Cumulative Operation Time at 10th Most Recent Fault	Displays the cumulative operation time at the tenth most recent fault.	No signal output available	1 h

◆ U4: Maintenance Monitors

Maintenance monitors are used to indicate when various components require replacement.

No.	Name	Description	Analog Output Level	Unit
U4-01	Accumulated Operation Time	Displays the cumulative operation time of the drive. The value for the cumulative operation time counter can be set in parameter o4-01. Use parameter o4-02 to determine if the operation time should start as soon as the power is switched on or only while the run command is present. The maximum number displayed is 99999, after which the value is reset to 0.	No signal output avail.	1 h
U4-02	Number of Run Commands	Displays the number of times the run command is entered. Reset the number of run commands using parameter o4-13. This value will reset to 0 and start counting again after reaching 65535.	No signal output avail.	
U4-03	Cooling Fan Operation Time	Displays the cumulative operation time of the cooling fan. The default value for the fan operation time is set to parameter o4-03. This value will reset to 0 and start counting again after reaching 65535.	No signal output avail.	1H
U4-05	Capacitor Maintenance	Displays main circuit capacitor usage time in in percent of their expected performance life. Parameter o4-06 resets this monitor.	No signal output avail.	1%
U4-07	IGBT Maintenance	Displays IGBT usage time as a percent of expected performance life. One of the multi-function contact outputs can be set to close when the value reaches 50% (H2-☐☐ = 2F), triggering an alarm. One of the multi-function contact outputs can be set to close when the value reaches 90% (H2-☐☐ = 10), triggering an alarm. Parameter o4-09 resets this monitor.	No signal output avail.	1%

No.	Name	Description	Analog Output Level	Unit
U4-09	LED Check	Lights all segments of the LED to verify that the display is working properly.	No signal output avail.	–
U4-10	kWH, Lower 4 Digits	Monitors the drive output power. The value is shown as a 9 digit number displayed across two monitor parameters, U4-10 and U4-11. Example: 12345678.9 kWh is displayed as: U4-10: 678.9 kWh U4-11: 12345 MWh Analog monitor: No output signal available.	No signal output avail.	kWh
U4-11	kWH, Upper 5 Digits			MWh
U4-13	Peak Hold Current	Displays the peak hold current during run.	10 V: Motor rated current	0.01A
U4-14	Peak Hold Output Frequency	Displays the output frequency when operating at the peak hold current.	10 V: Max frequency	0.01Hz
U4-16	Motor Overload Estimate (OL1)	100% = OL1 detection level	100% = OL1 detection level	0.1%
U4-18	Frequency Reference Source Selection	Displays the source for the frequency reference as XY-nn. X: indicates which reference is used: 1 = Reference 1 (b1-01) 2 = Reference 2 (b1-15) Y-nn: indicates the reference source 0-01 = Operator (d1-01) 1-01 = Analog (terminal A1) 1-02 = Analog (terminal A2) 2-02 to 17 = Multi-step speed (d1-02 to 17) 3-01 = MEMOBUS/Modbus comm. 4-01 = Option 5-01 = Pulse Input 6-01 = CASE 7-01 = DWEZ		–
U4-19	Frequency Reference from MEMOBUS/ Modbus Comm.	Displays the frequency reference provided by MEMOBUS/Modbus (decimal)		–
U4-20	Option Frequency Reference	Displays the frequency reference input by an option card (decimal).		–

No.	Name	Description	Analog Output Level	Unit
U4-21	Run Command Source Selection	Displays the source for the Run command as XY-nn. X: Indicates which Run source is used: 1 = Reference 1 (b1-02) 2 = Reference 2 (b1-16) Y: Input power supply data 0 = Operator 1 = External terminals 2 = Not used 3 = MEMOBUS/Modbus communications 4 = Option 5 = Not used 6 = CASE 7 = DWEZ nn: Run command limit status data 00: No limit status. 01: Run command was left on when stopped in the PRG mode. 02: Run command was left on when switching from local to remote operation. 03: Waiting for the soft charge bypass contactor after the power is switched on (UV or UV1 flashes after 10 seconds). 04: Waiting for “Run Command Prohibited” time period to end. 05: Fast-stop (digital input (H1-☐☐ = 15), operator) 06: b1-17 (run command given at power-up). 07: During Baseblock while coast to stop with timer 08: Frequency reference is below minimal reference during base block 09: Waiting for Enter command		–
U4-22	MEMOBUS/Modbus Communications Reference	Displays the drive control data set by MEMOBUS/Modbus communications register No. 0001H as a 4 digit hexadecimal number.		–
U4-23	Option Card Reference	Displays drive control data set by an option card as a 4 digit hexadecimal number.		–

◆ U5: Application Monitors

These monitors display various aspects of PID control, and can output data via analog output terminal AM. Set the monitor parameter data to be output by entering the last two digits of U5-☐☐ to H4-01.

No.	Name	Description	Analog Output Level	Unit
U5-01	PID Feedback	Displays the PID feedback value in.	10V: 100% (max. freq.)	0.01%
U5-02	PID Input	Displays the amount of PID input (deviation between PID target and feedback).		0.01%
U5-03	PID Output	Displays PID control output.		0.01%
U5-04	PID Setpoint	Displays the PID setpoint.		0.01%
U5-05	PID differential feedback	Displays the 2nd PID feedback value if differential feedback is used.		0.01%
U5-06	PID Adjusted Feedback	Displays the subtraction value of both feedback values if differential feedback is used.		0.01%

◆ U6: Control Monitors

The drive can U6 monitor parameters via multi-function analog output terminal AM. Select the monitor for output to H4-01. Enter 6☐☐, where the last two digits of U6-☐☐ indicate the U6 monitor parameter for output.

No.	Name	Description	Analog Output Level	Unit
U6-01	Motor Secondary Current (Iq)	Displays the value of the motor secondary current (Iq).	10 V: Motor rated secondary current	0.1%
U6-02	Motor Excitation Current (ld)	Displays the value calculated for the motor excitation current (Id) as a percentage of the motor rated secondary current (Iq).	10 V: Motor rated secondary current	0.1%
U6-03	ASR Input	Displays the ASR input value if Simple PG is used in V/f control.	10V: 100% (max. freq.)	0.1%
U6-04	ASR Output	Displays the ASR output value if Simple PG is used in V/f control.	10V: 100% (max. freq.)	0.1%
U6-05	Output voltage reference (Vq)	Output voltage reference (Vq). (q-axis)	10 V: 200 V (400 V)	0.1 Vac
U6-06	Output Voltage Reference (Vd)	Output voltage reference (Vd). (d-axis)	10 V: 200 V (400 V)	0.1 Vac
U6-07	q-axis ACR Output	Displays the current control (ACR) output of for the motor secondary current (Iq).	10 V: 100%	0.1%
U6-08	d-Axis ACR Output	Displays the current control (ACR) output of for the motor excitation current (Id).	10 V: 100%	0.1%
U6-20	Frequency Reference Bias (Up/Down 2)	Displays the bias value used to adjust the frequency reference.	10 V: max. frequency	0.1%
U6-21	Offset Frequency	Displays the frequency added to the main frequency reference.	10 V: max. frequency	0.1%

◆ U8: DriveWorksEZ Monitors

These parameters are reserved for use with DriveWorksEZ.

No.	Name	Description	Analog Output Level	Unit
U8-01	–	Reserved for DriveWorksEZ, Monitor 1.	–	0.01%
U8-02	–	Reserved for DriveWorksEZ, Monitor 2.	–	0.01%
U8-03	–	Reserved for DriveWorksEZ, Monitor 3.	–	0.01%
U8-04	–	Reserved for DriveWorksEZ, Monitor 4.	–	0.01%
U8-05	–	Reserved for DriveWorksEZ, Monitor 5.	–	0.01%
U8-06	–	Reserved for DriveWorksEZ, Monitor 6.	–	0.01%
U8-07	–	Reserved for DriveWorksEZ, Monitor 7.	–	0.01%
U8-08	–	Reserved for DriveWorksEZ, Monitor 8.	–	0.01%
U8-09	–	Reserved for DriveWorksEZ, Monitor 9.	–	0.01%
U8-10	–	Reserved for DriveWorksEZ, Monitor 10.	–	0.01%

2

MEMOBUS/Modbus Communications

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2.1 MEMOBUS/Modbus Configuration

Yaskawa drives can be controlled with a PLC using the MEMOBUS/Modbus protocol to conduct serial communications.

MEMOBUS/Modbus communication can be configured using one master (PLC) and a maximum of 31 slaves. Serial communication between master and slave are normally started by the master and the slaves respond.

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 perform serial communications using that address. A slave that receives a command from the master performs the specified function and sends a response back to the master.

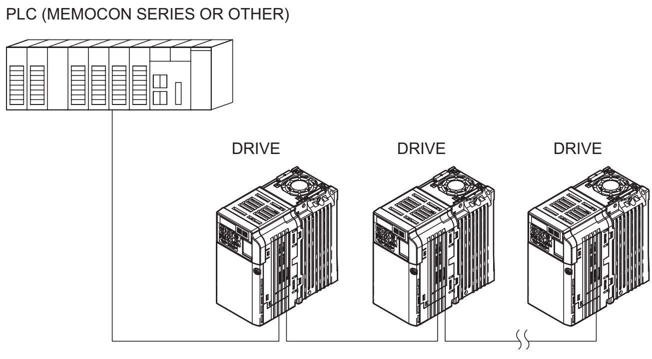


Figure 2.1 Connecting Multiple Drives to a PLC

2.2 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	12, 24, 48, 96, 192, 384, 576, 768, 1152 kbps
	Data length	8 bits (fixed)
	Parity	Select even, odd, or none.
	Stop bit	1 bit (fixed)
Protocol	MEMOBUS/Modbus (using RTU mode only)	
Max Number of Connections	31 drives (using RS-485)	

2.3 Communication Terminal Resistance

The MEMOBUS communication uses the following terminals: S+, S-, R+, and R-. Enable the terminating resistance by setting pin 1 of DIP switch S2 to the ON position.

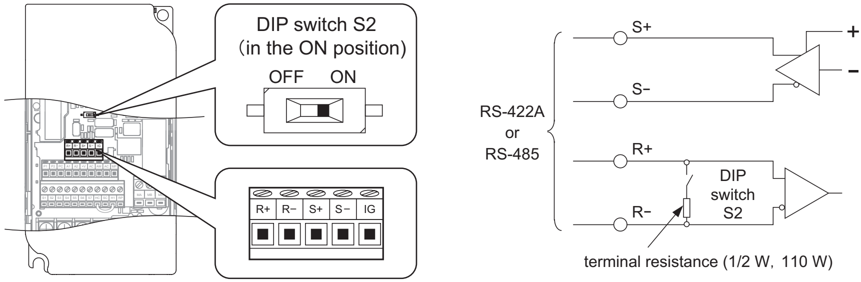


Figure 2.2 Serial Communications Terminal and DIP Switch S2

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.

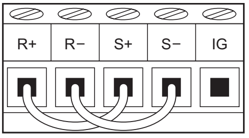


Figure 2.3 RS-485 Terminal Wiring

2.4 Connecting a PLC

Follow the instructions below to connect the drive to a PLC.

1. With the power shut off, connect the communications cable to the drive and PLC.
2. Switch the power on.
3. Set the parameters need for serial communications (H5-01 through H5-12) using the LED operator.
4. Shut the power off, waiting until the display on the LED operator goes out completely.
5. Turn the power back on.
6. The drive is now ready to begin communicating with the PLC.

   Note: A timer should be set to watch how long it takes for the slave drive(s) to respond to the master. If no response is received with in a certain amount of time, the master should try resending the message.

2.5 MEMOBUS/Modbus Parameters

◆ MEMOBUS/Modbus Parameters

■ H5-01: Drive Node Address

This parameter tells the PLC what the node address is for the individual drive.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-01	Drive Node Address	Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.	0 to 20 H*	1F	425H

*If the address is set to 0, no response will be provided during communications.

For serial communciations to work, each individual slave drive must be assigned a unique node address. Setting H5-01 to any value besides 0 assigns the drive its address in the network. Slave address don't need to be assigned in sequential order, but each address needs to be unique so that no two drives have the same address. The power to the drive needs to be cycled after setting the address for the node address to take affect.

■ H5-02: Communication Speed Selection

■ H5-03: Communication Parity Selection

These parameters set the communication speed and the parity.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-02	Communication Speed Selection	Selects the baud rate for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps	0 to 8	3	426H

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-03	Communication Parity Selection	Selects the communication parity for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0	427H

Detailed Description

Parameters H5-02 and H5-03 should be set according to the network specifications run by the master controller. Because the power to the drive needs to be cycled in order for these parameter settings to take affect, the application will have to be stopped to change these settings.

■ H5-04: Stopping Method After Communication Error

Tells the drive how it should stop the motor when a communication error occurs.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-04	Stopping Method After Communication Error	0: Ramp to stop (decelerates according to C1-02) 1: Coast to stop 2: Fast-Stop 3: Alarm only	0 to 3	3	428H

■ H5-05: Communication Fault Detection Selection

Enables or disables the communications time-out fault (CE).

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-05	Communication Fault Detection Selection	0: Disabled - A communication loss will not cause a communication fault. 1: Enabled - If communication is lost for more than two seconds, a CE fault will occur.	0, 1	1	429H

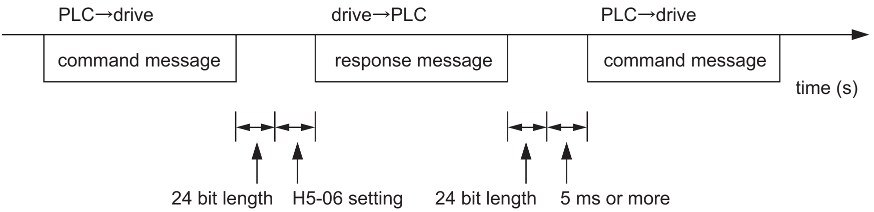
If H5-05 is set to 1, a fault will occur if the master controller does not receive a response from the drive after two seconds. The power to the drive needs to be cycled for the setting in H5-05 to take affect.

■ H5-06: Drive Transmit Wait Time

Sets how long the drive should wait to send a response after it receives data.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-06	Drive Transmit Wait Time	Set the delay time from when the drive receives data to when the drive sends data.	5 to 65	5 ms	42AH

Drive power needs to be cycled for the setting in H5-06 to take effect.



■ H5-07: RTS Control Selection

Enables ore disables RTS (“request-to-send”).

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-07	RTS Control Selection	0: Disabled - RTS is always on. 1: Enabled - RTS turns on only when sending.	0, 1	1	42BH

Disable when using RS-485, and enable this setting when using RS-422. Power to the drive needs to be cycled for any setting changes to take affect.

■ H5-09: CE Detection Time

Sets the time required to detect a communications error. Adjustment may be need when networking several drives.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-09	CE Detection Time	Sets the time required to detect a communications error. Adjustment may be need when networking several drives.	0.0 to 10.0 s	2.0 s	435H

■ H5-10: Unit Selection for MEMOBUS/Modbus Register 0025H

Selects the units used for MEMOBUS/Modbus registry 0025H (Output Voltage Reference Monitor).

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-10	Unit Selection for MEMOBUS/Modbus Register 0025H	0: 0.1 V units 1: 1 V units	0, 1	0	436H

■ H5-11: Communications ENTER Function Selection

Select the function for the enter command that saves parameter data to the drive.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-11	Communications ENTER Function Selection	0: Save parameter data that was edited to the drive when the enter command is given. 1: Parameter data that has been edited is saved when the enter command is given (compatible with the V7).	0, 1	1	43CH

■ H5-12: Run Command Method Selection

Determines how the Run command works when given via serial communications.

No.	Name	Description	Setting Range	Default	MEMOBUS Address
H5-12	Run Command Method Selection	0: FWD/STOP, REV/STOP Method 1: RUN/STOP, FWD/REV Method	0, 1	0	43DH

2.6 Related Parameters

The user can perform the following actions with MEMOBUS/Modbus communications regardless of how b1-01, b1-02, b1-15, and b1-16 are set.

- Observe drive operation from a PLC
- Reference and set parameters
- Reset faults
- Multi-function input commands

When commands are issued from the PLC to the multi-function input terminals S1 through S7, they become OR commands.

No.	Name	Description	Setting Range	Default	MEMOBUS Address	Page
b1-01	Frequency Reference Selection 1	Selects the frequency reference input source. 0: Operator 1: Terminals - Analog input terminal A1 (or terminal A2 based on parameter H3-09). 2: Serial Com 3: Option PCB 4: Pulse Input (Terminal RP)	0 to 4	1	180H	
b1-02	Run Command Selection 1	Selects the run command input source. 0: Operator - RUN and STOP keys on the operator. 1: Terminals - Contact closure on terminals S1 or S2. 2: Serial Com 3: Option PCB.	0 to 3	1	181H	
b1-15	Frequency Reference Selection 2	Selects the frequency reference input source. 0: Operator - Digital preset speed U1-01 or d1-01 to d1-17. 1: Terminals - Analog input terminal A1 (or terminal A2 based on parameter H3-09). 2: Serial Com 3: Option PCB 4: Pulse Input (Terminal RP)	0 to 4	0	1C4H	–
b1-16	Run Command Selection 2	Selects the run command input source. 0: Operator - RUN and STOP keys on the operator. 1: Terminals - Contact closure on terminals S1 or S2. 2: Serial Com 3: Option PCB	0 to 3	0	1C5H	–

2.7 Message Format

In MEMOBUS communications, the master sends commands to the slave, and the slave responds. The message format is configured for both sending and receiving as shown below, and the length of data packets depends on the command (function) content.

SLAVE ADDRESS
FUNCTION CODE
DATA
ERROR CHECK

Some space is required between messages as shown below:

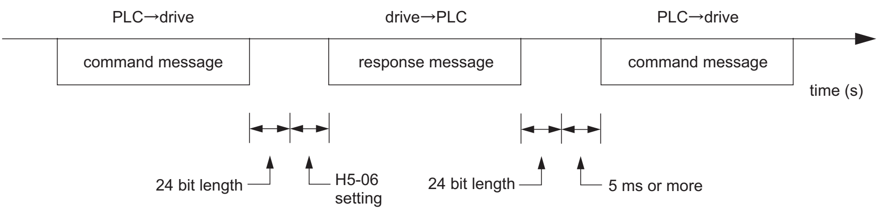


Figure 2.4 Space Between Messages

◆ Slave Address

Set the drive address between 0 and 20 in hexadecimal. If set to 0, commands from the master will be received by all slaves (the drive does not provide a response when a command has been broadcast to all slave devices).

◆ Function Code

The three types of function codes are shown in the table below.

Function Code (Hexadecimal)	Function Name	Command Message Minimum (bytes)	Command Message Maximum (bytes)	Response Message Minimum (bytes)	Response Message Maximum (bytes)
03H	Read memory contents	8	8	7	37
08H	Loopback test	8	8	8	8
10H	Write to multiple memory registers	11	41	8	8

◆ Data

Configure consecutive data by combining the memory register address (test code for a loopback address) and the data the register contains. The data length changes depending on the command details.

◆ Error Check

Errors during communication are detected using CRC-16 (cyclic redundancy check, checksum method). Calculations are performed in the following order:

1. Although the general default setting for CRC-16 calculations is 0, the default for the MEMOBUS/Modbus protocol should be set to -1 (i.e., all 16 bits equal 1).
2. Calculate CRC-16 with MSB for the final data as LSB, and the LSB for the slave address as MSB.
3. Be sure to also calculate CRC-16 relative to the response messages, and refer to that CRC-16 value in the response message.

2.8 Command/Response Message Format

Below are some examples of command and response messages.

◆ Reading Drive Memory Register Contents

The contents of the memory register are separated into higher 8 bits and lower 8 bits. A maximum of 16 drive memory 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

Slave Address		02H
Function Code		03H
Starting No.	Upper	00H
	Lower	20H
Quantity	Upper	00H
	Lower	04H
CRC-16	Upper	45H
	Lower	F0H

Response Message (normal)

Slave Address		02H
Function Code		03H
Data Quantity		08H
1st storage register	Upper	00H
	Lower	65H
Next storage register	Upper	00H
	Lower	00H
Next storage register	Upper	00H
	Lower	00H
Next storage register	Upper	01H
	Lower	F4H
CRC-16	Upper	AFH
	Lower	82H

Response Message (fault)

Slave Address		02H
Function Code		83H
Error Code		03H
CRC-16	Upper	F1H
	Lower	31H

◆ Loop Back Test

The loopback test returns command messages directly as response messages without changing the contents to check the communications between the master and slave. User-defined test code and data values can be set.

The following table shows a message example when performing a loop back test with the slave 1 drive.

Command Message

Slave Address		01H
Function Code		08H
Test Code	Upper	00H
	Lower	00H
Data	Upper	A5H
	Lower	37H
CRC-16	Upper	DAH
	Lower	8DH

Response Message (normal)

Slave Address		01H
Function Code		08H
Test Code	Upper	00H
	Lower	00H
Data	Upper	A5H
	Lower	37H
CRC-16	Upper	DAH
	Lower	8DH

Response Message (fault)

Slave Address		01H
Function Code		89H
Error Code		01H
CRC-16	Upper	86H
	Lower	50H

◆ Writing to Multiple Registers

The writing of drive memory registers works similar to the reading process, i.e., the address of the first register that is to be written and the quantity of to be written registers must be set in the command message. The data to be written must be consecutive, starting from the specified address in the command message. The data order must be higher 8 bits, then lower 8 bits. The data must be in memory register address order.

The following table shows an example of a message where a forward operation has been set with a frequency reference of 60.0 Hz for the slave 1 drive.

Command Message

Slave Address		01H
Function Code		10H
Starting No.	Upper	00H
	Lower	01H
Quantity	Upper	00H
	Lower	02H

Response Message (normal)

Slave Address		01H
Function Code		10H
Starting No.	Upper	00H
	Lower	01H
Quantity	Upper	00H
	Lower	02H

Response Message (fault)

Slave Address		01H
Function Code		90H
Error Code		02H
CRC-16	Upper	CDH
	Lower	C1H

Data Quantity		04H
Starting Data	Upper	00H
	Lower	01H
Next Data	Upper	02H
	Lower	58H
CRC-16	Upper	63H
	Lower	39H

CRC-16	Upper	10H
	Lower	08H

Note: For the number of data value in the command message, take double the number of the data value.

2.9 MEMOBUS/Modbus Data Table

Table below lists all MEMOBUS/Modbus data. There are three types of data: command data, monitor data, and broadcast data.

◆ Command Data

It is possible to both read and write command data.

Note: Bits that are not used should be written as 0. Refrain from writing to reserved registers.

<table>
<tr><th>Register No.</th><th colspan="2">Contents</th></tr>
<tr><td>0000H</td><td colspan="2">Reserved</td></tr>
<tr><td rowspan="14">0001H</td><td colspan="2">Operation Signals</td></tr>
<tr><td>bit 0</td><td>H5-12 = 0: Forward Run Command (0 = Stop, 1 = Run)
H5-12 = 1: Run Command (0 = Stop, 1 = Forward Run)</td></tr>
<tr><td>bit 1</td><td>H5-12 = 0: Reverse Run Command (0 = Stop, 1 = Run)
H5-12 = 1: Forward/Reverse (0 = Stop, 1 = Reverse Run)</td></tr>
<tr><td>bit 2</td><td>External Fault (EF0)</td></tr>
<tr><td>bit 3</td><td>Fault Reset</td></tr>
<tr><td>bit 4</td><td>Multi-Function Input Command 1 ComRef when set for Forward/Stop
Note: If H1-01 = 40, then bit 4 becomes ComRef.</td></tr>
<tr><td>bit 5</td><td>Multi-Function Input Command 2 ComCtrl when set for Reverse/Stop
Note: If H1-02 = 42, then bit 5 becomes ComCtrl.</td></tr>
<tr><td>bit 6</td><td>Multi-Function Input 3</td></tr>
<tr><td>bit 7</td><td>Multi-Function Input 4</td></tr>
<tr><td>bit 8</td><td>Multi-Function Input 5</td></tr>
<tr><td>bit 9</td><td>Multi-Function Input 6</td></tr>
<tr><td>bit A</td><td>Multi-Function Input 7</td></tr>
<tr><td>bit B to bit F</td><td>Reserved</td></tr>
<tr><td>0002H</td><td>Frequency Reference</td><td>Varies by the setting units set to o1-03.</td></tr>
<tr><td>0003H</td><td colspan="2">V/f Gain</td></tr>
<tr><td>0004H-0005H</td><td colspan="2">Reserved</td></tr>
<tr><td>0006H</td><td colspan="2">PID Target (0.01% signed)</td></tr>
<tr><td>0007H</td><td colspan="2">Analog Output 1 setting (10 V / 4000 H)</td></tr>
<tr><td>0008H</td><td colspan="2">Analog Output 2 setting (10 V / 4000 H)</td></tr>
</table>

Register No.	Contents	
0009H	Settings for Multi-Function Digital Outputs	
	bit 0	Contact Output (terminal MA/MB-MC)
	bit 1	Photocoupler Output 1 (terminal P1-PC)
	bit 2	Photocoupler Output 2 (terminal P2-PC)
	bit 3 to bit 5	Reserved
	bit 6	Fault Contact Output Enabled (1 = enabled by bit 7)
	bit 7	Fault contact (terminal MA/MB-MC)
	bit 8 to bit F	Reserved
000AH	PO Output	1/1 Hz Setting Range: 0 to 32000
000BH-000EH	Reserved	
000FH	Control Selection Setting	
	bit 0	Reserved
	bit 1	PID Target Input
	bit 2 to bit B	Reserved
	bit C	Broadcast Data Terminal S5 Input
	bit D	Broadcast Data Terminal S6 Input
	bit E	Broadcast Data Terminal S7 Input
	bit F	Reserved

◆ Monitor Data

Monitor data is read only.

Register No.	Contents	
0020H	Drive Status	
	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 (terminal MA/MB-MC)
	bit 6	Multi-Function Photocoupler Output 1 (terminal P1 - PC)
	bit 7	Multi-Function Photocoupler Output 2 (terminal P2 - PC)
	bit 8 to bit D	Reserved
	bit E	ComRef status
	bit F	ComCtrl status

2.9 MEMOBUS/Modbus Data Table

Register No.	Contents	
0021H	Fault Contents 1	
	bit 0	oC, GF: Overcurrent or Ground Fault
	bit 1	oV: DC Bus Overvoltage
	bit 2	oL2: Drive Overload
	bit 3	oH1, oH2: Overheat Fault
	bit 4	rH, rr: Braking Resistor Fault
	bit 5	Reserved
	bit 6	FbL, FbH: PID Feedback Fault
	bit 7	EF0 to 7: External Fault
	bit 8	CPF☐☐: Hardware Fault (includes OFx)
	bit 9	oL1, oL3, oL4, UL3, UL4: Motor Overload/Overtorque 1 or 2, Undertorque 1 or 2
	bit A	PGo, oS, dEv: PG Disconnect, Overspeed, Speed Deviation
	bit B	Uv1: DC Bus Undervoltage
	bit C	Uv1, Uv2, Uv3: DC Bus Undervoltage, Control Power Supply Fault, Inrush Prevention Circuit Fault
	bit D	PF, LF: Input/Output Phase Loss
	bit E	CE, bUS: Communication Loss
	bit F	oPr: Operator Disconnected
0022H	Data Link Status	
	bit 0	Writing Data
	bit 1	Reserved
	bit 2	Reserved
	bit 3	Upper/Lower Limit Error
	bit 4	Data Integrity Error
	bit 5	Writing to EEPROM
	bit 6 to bit F	Reserved
0023H	Frequency Reference (U1-01)	
0024H	Output Frequency (U1-02)	
0025H	Output Voltage Reference (U1-06), units: 1/0.1 V Note: Switch between setting units using parameter H5-10.	
0026H	Output Current (U1-03), units: 10/1 A	
0027H	Output Power (U1-08)	
0028H	Torque Reference (U1-09)	

Register No.	Contents	
0029H	Fault Contents 2	
	bit 0	SC: Load Short Circuit
	bit 1	GF: Ground Fault
	bit 2	PF: DC Bus Voltage Fault
	bit 3	LF: Output Phase Loss
	bit 4	rH: Braking Resistor Overheat
	bit 5 to bit F	Reserved
002AH	Alarm Contents1	
	bit 0 to bit 1	Reserved
	bit 2	EF: Simultaneous Forward and Reverse Run Commands
	bit 3	bb: Drive Baseblock
	bit 4	oL3: Overtorque 1
	bit 5	oH: Heatsink Overheat
	bit 6	oV: DC Bus Overvoltage
	bit 7	Uv: DC Bus Undervoltage
	bit 8	Reserved
	bit 9	CE: Communications Error
	bit A	bUS: Option Error
	bit B	UL3: Undertorque 1
	bit C	oH2: Drive Overheat Prealarm
	bit D	FbL, FbH: PID Feeback Alarm
	bit E	Reserved
	bit F	CALL: Waiting for Communications
002BH	Input Terminal Status (U1-10)	
	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 to bit F	Reserved

2.9 MEMOBUS/Modbus Data Table

Register No.	Contents	
002CH	Drive Status 2	
	bit 0	During Run
	bit 1	Zero Speed
	bit 2	Speed Agree
	bit 3	User 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 1, 2
	bit C	Frequency Reference Loss
	bit D	During Fault Restart
	bit E	Fault
	bit F	Communication Timeout
002DH	Output Terminal Status (U1-11)	
	bit 0	Multi-Function Contact Output (terminal MA/MB-MC)
	bit 1	Multi-Function Photocoupler Output 1 (terminal P1 - PC)
	bit 2	Multi-Function Photocoupler Output 2 (terminal P2 - PC)
	bit 3 - 6	Reserved
	bit 7	Fault Contact (terminal MA/MB-MC)
	bit 8 to bit F	Reserved
002EH	Reserved	
002FH	Frequency Reference Bias (UP2, DOWN2) 1000/100%	
0030H	Reserved	
0031H	DC Bus Voltage (U1-07)	
0032H	Torque Monitor (units: 1/1%)	
0033H	Reserved	
0034H	Product Code 1 [ASCII] V O	
0035H	Product Code 2 [ASCII] A O	
0036H	Reserved	
0037H	Reserved	
0038H	PID Feedback (100% / max. output frequency; 1/0.1% resolution; not signed)	
0039H	PID Input (100% / max. output frequency; 1/0.1% resolution; signed)	
003AH	PID Output (100% / max. output frequency; 1/0.1% resolution; signed)	

Register No.	Contents	
003B to 003CH	Reserved	
003DH	Communications Error Contents*	
	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	Revolutions per Minute
003FH	Output Frequency	0.01% Units

*The contents of a communication error are saved until fault is reset.

◆ Broadcast Messages

Data can be written from the controller 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 (set by H1-01)
	bit 5	Fault Reset (set by H1-02)
	bit 6 to bit B	Reserved
	bit C	Multi-Function Contact Input S5
	bit D	Multi-Function Contact Input S6
	bit E	Multi-Function Contact Input S7
	bit F	Reserved
0002H	Frequency Reference	30000/100%

Note: See the following page for information on Enter Command Data (0900H, 0910H).

2.10 Enter Command

When writing parameters to the drive from the PLC using MEMOBUS/Modbus communication, the parameters are temporarily stored in the parameter data area of the drive. To enable these parameters in the parameter data area, the Enter command must be used.

There are two types of Enter commands: Enter commands that enable parameter data in RAM only (changes are lost when the drive is shut off), and Enter commands that write data into the EEPROM (non-volatile memory) of the drive and enable the data in RAM at the same time.

The following table shows the Enter command data. The Enter command is enabled by writing 0 to register number 0900H or 0910H.

Register No.	Description
0900H	Saves parameter data to EEPROM
0910H	Updates parameter data to RAM without saving to EEPROM

Note: Because the EEPROM can be written to a maximum of 100,000 times, refrain from writing to the EEPROM too often. The ENTER command registers are write-only. Consequently, if these registers are read, then the register address will be invalid (Error code: 02H). An ENTER command is not required if reference or broadcast data are sent to the drive.

◆ ENTER Command Settings when Upgrading the Drive

To transfer parameter settings from an earlier Yaskawa model drive to V1000, parameter H5-11 needs to be set in accordance with how the Enter command functions in the older drive.

If upgrading from a G7 or F7 series drive to V1000, set parameter H5-11 to 0.

If upgrading from a V7 series drive to V1000, set parameter H5-11 to 1.

No.	Name	Description	Setting	Default	Control Mode			Addr. Hex
					VF	OLV	PM	
H5-11	Communications ENTER Function Selection	Select the function for the enter command that saves parameter data to the drive. 0: Save parameter data that was edited to the drive when the enter command is given. 1: Parameter data that has been edited is saved when the enter command is given (compatible with the V7).	0.1	1	▯	▯	▯	43CH

Note: Option cards are designed for a specific model, and are not compatible between drives.

■ H5-11 and the Enter Command

H5-11 Settings	H5-11 = 0	H5-11 = 1
Drive being replaced	G7, F7	V7
How parameter settings are enabled	When the ENTER key is pressed	As soon as the value is changed
Upper/Lower limit check	Determined by related parameters	Single upper/lower limit
Default value of related parameters	Not affected	Determines the default values of related parameters
Error when setting multiple parameters	Data is accepted even if one setting is invalid	Error occurs if one setting is invalid
Operation when saving several parameter settings at once	Allows all valid settings to be saved	No data is written if a single piece of data is invalid

2.11 Error Codes

A list of MEMOBUS/Modbus errors appears below.

When an error occurs, remove whatever it was that caused the error and restart communications.

Error Code	Error Name / Cause
01H	Function Code Error
	• Attempted to set a function code from a PLC other than 03H, 08H, and 10H.
02H	Register Number Error
	• None of the register numbers exist. • Attempted to send a broadcast message that did not start with 0001H or 0002H.
03H	Bit Count Error
	• Read data or write data is greater than 16 bits. • While the number of bits in the write data message is not ???
21H	Data Setting Error
	• Control data or parameter write data is outside the allowable setting range. • Attempted to write a contradictory parameter setting.
22H	Write Mode Error
	• Attempted to write while the drive was operating to a parameter that cannot be written to during run. • During an EEPROM data error (CPF06), the PLC attempted to write to a parameter other than A1-00 to -05, E1-03, or o2-04. • Attempted to write to read-only data.
23H	DC Bus Undervoltage Write Error
	• Attempted to write from the PLC during an undervoltage fault (Uv1). • Attempted to execute and Enter command from the PLC during Uv1.
24H	Write Error During Parameter Process
	• PLC attempted writing to the drive while the drive was processing parameter data.

2.12 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.

◆ Application Notes

Set the time that the master device should wait for the slave to respond after a command message has been sent. If a response is not received within the specified time, the message can be sent again.

2.13 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.

1. Turn on the power to the drive.
2. Set terminal S7 for the communications test mode (H1-07 = 67).
3. Turn off the power to the drive.
4. With the power off, wire the drive as shown in the illustration below.

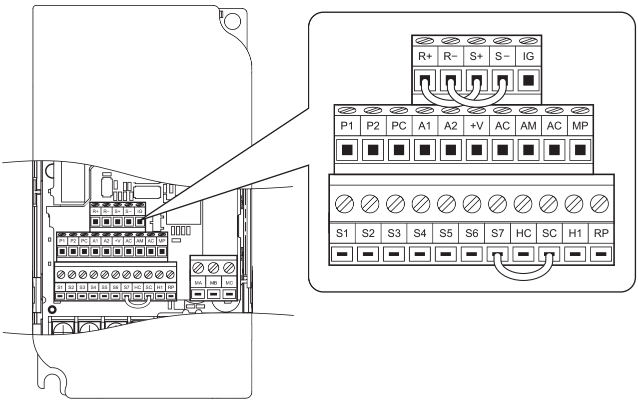


Figure 2.5 Terminal Connections for Communication Self-Diagnostics

5. The last slave in the series should have DIP switch 2 placed to the ON position in order to enable terminal resistance.
6. Turn the power to the drive back on.
   The DIP switch setting takes affect after the drive is turned on again.

During normal operation, the drive will display PASS. This indicates that the communications test mode is operating normally.
When a fault occurs, the drive will display CE on the keypad screen. Once the output contact closes, the “Drive Ready” signal will open.

A

Parameter List

This appendix contains a full listing of all parameters and settings available in the drive

A.1 PARAMETER GROUPS 286
A.2 PARAMETER TABLE 287

A.1 Parameter Groups

Parameter Group	Name	Page	Parameter Group	Name	Page
A1	Initialization	287	H4	Analog Outputs	324
A2	User Parameters	288	H5	Serial Communications Setup	324
b1	Sequence	289	H6	Pulse Train I/O Setup	326
b2	DC Injection Braking	290	L1	Motor Overload	327
b3	Speed Search	291	L2	Power Loss Ride-Thru	328
b4	Delay Timer	292	L3	Stall Prevention	329
b5	PID Control	292	L4	Reference Detection	332
b6	Dwell Function	294	L5	Fault Restart	332
b8	Energy Saving	295	L6	Overtorque Detection	334
C1	Acceleration/Deceleration Time	296	L7	Torque Limit	337
C2	S-Curve Accel/Decel	297	L8	Hardware Protection	337
C3	Motor Slip Compensation	297	n1	Hunting Prevention	340
C4	Motor Torque Compensation	298	n2	Speed Feedback Protection	341
C5	Speed Control (ASR)	298	n3	High-Slip Braking	341
C6	Carrier Frequency	299	n6	Motor Line-to-Line Resistance Online Tuning	342
d1	Frequency Reference	301	n8	PM Motor Control	342
d2	Reference Limits	302	o1	Monitor Display Selection	344
d3	Jump Frequencies	303	o2	Operator Keypad Functions	345
d4	Frequency Reference Hold	303	o4	Maintenance Functions	346
d7	Off-Set Frequency	304	q	DriveWorksEZ Parameters	347
E1	V/f Pattern	305	r	DriveWorksEZ Connection	347
E2	Motor Setup	307	T1	Auto-Tuning	349
E3	Motor 2 V/f Pattern	308	U1	Status Monitor	350
E4	Motor Setup 2	309	U2	Fault Trace	354
E5	PM Motor Setup	310	U3	Fault History	355
F1	Fault Detection during PG Speed Control	311	U4	Maintenance Monitor	357
F6	Network Communications	313	U5	Application Monitor	360
F7	Network Communications	313			
H1	Digital Inputs	316	U6	Control Monitor	360
H2	Digital Outputs	320	U8	Custom Monitors for DriveWorksEZ	361
H3	Analog Inputs	323			

A.2 Parameter Table

◆ A: Initialization Parameters

The A parameter group creates the operating environment for the drive. This includes the parameter Access Level, Motor Control Method, Password, User Parameters and more.

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Name</th><th rowspan="2">Description</th><th rowspan="2">Range</th><th rowspan="2">Def.</th><th colspan="3">Control Mode</th><th rowspan="2">Addr. Hex</th></tr>
<tr><th>V/f</th><th>OLV</th><th>PM</th></tr>
<tr><td colspan="9">A1: Initialization Parameters
Use A1 parameters to configure the basic environment for drive operation.</td></tr>
<tr><td>A1-01
<22>
<16></td><td>Access Level Selection</td><td>Selects which parameters are accessible via the digital operator.
0: Operation only
1: User Parameters (access to a set of parameters selected by the user)
2: Advanced Access Level</td><td>0 to 2</td><td>2</td><td>A</td><td>A</td><td>A</td><td>101H</td></tr>
<tr><td>A1-02</td><td>Control Method Selection</td><td>Selects the Control Method of the drive.
0: V/f Control without PG
2: Open Loop Vector (OLV)
5: PM Open Loop Vector (PM)Note: Does not return to the default setting when the drive is initialized.</td><td>0, 2, 5</td><td>0</td><td>S</td><td>S</td><td>S</td><td>102</td></tr>
<tr><td rowspan="2">A1-03</td><td rowspan="2">Initialize Parameters</td><td rowspan="2">Resets all parameters to factory default settings. (Initializes the drive then returns A1-03 to 0)
0: No Initialize
1110: User Initialize (First set user parameter values must be stored using parameter o2-03)
2220: 2-Wire Initialization
3330: 3-Wire Initialization
5550: OPE04 Error Reset</td><td>0 to 3330</td><td>0</td><td>A</td><td>A</td><td>A</td><td>103</td></tr>
<tr><td colspan="6">The following parameters are not reset when the performing initialization:
A1-00, A1-02, A1-07, and all U2 and U3 monitors.</td></tr>
<tr><td>A1-04</td><td>Password 1</td><td rowspan="3">When the value set into A1-04 does not match the value set into A1-05, parameters A1-01 thru A1-03, A1-06, and A2-01 thru A2-32 cannot be changed.</td><td>0 to 9999</td><td>0</td><td>A</td><td>A</td><td>A</td><td>104</td></tr>
<tr><td rowspan="2">A1-05</td><td rowspan="2">Password 2</td><td>0 to 9999</td><td>0</td><td>A</td><td>A</td><td>A</td><td>105</td></tr>
<tr><td colspan="6">This parameter is hidden from view. To access A1-05, first display A1-04. Then press the STOP key while holding down the up arrow key. Parameter A1-05 will appear.</td></tr>
</table>

Parameter List
A

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
A1-06	Application Preset	Sets parameters that are commonly used in certain applications to A2-01 through A2-16 for easier access. 0: General-purpose (A2 parameters are not affected) 1: Water supply pump 2: Conveyor 3: Exhaust fan 4: HVAC fan 5: Air compressor 6: Crane (Hoist) 7: Crane (Travelling)	0 to 7	0	A	A	A	127
A1-07	DriveWorksEZ Function Selection	0: Disabled 1: Enabled 2: Multi-function input (enabled when H1-□□ = 9F)	0 to 2	0	A	A	A	
A2: User Parameters Use A2 parameters to program the drive.								
A2-01 to A2-32	User Parameters, 1 to 32	Parameters that were recently edited are listed here. The user can also select parameters to appear here for quick access. Parameters will be stored here for quick access when A1-01 = 1.	b1-01 to o2-08	-- <16>	A	A	A	106 to 125
A2-33	User Parameter Automatic Selection	0: Parameters A2-01 through A2-32 are reserved for the user to create a list of User Parameters. 1: Save history of recently viewed parameters. Recently edited parameters will be saved to A2-17 through A2-32 for quick access.	0,1	1 <4>	A	A	A	126

<4> Default setting value is dependent on parameter A1-06. This setting value is 0 when A1-06 = 0, and 1 when A1-06 does not = 0.
<16> Default setting value is dependent on parameter A1-06, Application Selection.
<22> Parameter can be changed during run.

◆ b: Application

Application parameters configure the Run Command Source, DC Injection Braking, Speed Search, Timer functions, PID control, the Dwell function, Energy Savings and a variety of other application-related settings.

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Name</th><th rowspan="2">Description</th><th rowspan="2">Range</th><th rowspan="2">Def.</th><th colspan="3">Control Mode</th><th rowspan="2">Addr. Hex</th></tr>
<tr><th>V/f</th><th>OLV</th><th>PM</th></tr>
<tr><td colspan="9">b1: Operation Mode Selection
Use b1 parameters to configure the operation mode.</td></tr>
<tr><td>b1-01</td><td>Frequency Reference Selection 1</td><td>Selects the frequency reference input source.
0: Operator - Digital preset speed d1-01 to d1-17.
1: Terminals - Analog input terminal A1 or A2.
2: Memobus communications
3: Option PCB
4: Pulse Input (Terminal RP)</td><td>0 to 4</td><td>1</td><td>S</td><td>S</td><td>S</td><td>180</td></tr>
<tr><td>b1-02</td><td>Run Command Selection 1</td><td>Selects the run command input source.
0: Operator - RUN and STOP keys on the digital operator.
1: Digital input terminals S1 to S7
2: Memobus communications
3: Option PCB.</td><td>0 to 3</td><td>1</td><td>S</td><td>S</td><td>S</td><td>181</td></tr>
<tr><td rowspan="2">b1-03</td><td rowspan="2">Stopping Method Selection</td><td rowspan="2">Selects the stopping method when the run command is removed.
0: Ramp to Stop
1: Coast to Stop
2: DC Injection Braking to Stop
3: Coast with Timer (A new run command is ignored if received before the timer expires)</td><td>0 to 3</td><td>0</td><td>S</td><td>S</td><td>S</td><td>182</td></tr>
<tr><td colspan="6">DC Injection Braking at Stop cannot be selected when using Open Loop Vector for PM motors.</td></tr>
<tr><td>b1-04</td><td>Reverse Operation Selection</td><td>Permits or prohibits reverse operation.
0: Reverse enabled.
1: Reverse disabled.</td><td>0,1</td><td>0</td><td>A</td><td>A</td><td>A</td><td>183</td></tr>
<tr><td>b1-07</td><td>Local/Remote Run Selection</td><td>Determines the operation when the Run command source is switched from LOCAL to REMOTE or between Run source 1 and 2 while an external Run command is active at the new source.
0: External Run command has to be cycled at the new source to be activated.
1: External Run command at new source is accepted immediately.</td><td>0,1</td><td>0</td><td>A</td><td>A</td><td>A</td><td>186</td></tr>
<tr><td>b1-08</td><td>Run Command Selection while in Programming Mode</td><td>0: Run command accepted only in the operation menu.
1: Run command accepted in all menus.
2: Prohibit entering programming mode during Run</td><td>0 to 2</td><td>0</td><td>A</td><td>A</td><td>A</td><td>187</td></tr>
<tr><td>b1-14</td><td>Phase Order Selection</td><td>Sets the phase order for drive output terminals U/T1, V/T2 and W/T3.
0: Standard
1: Switch phase order</td><td>0,1</td><td>0</td><td>A</td><td>A</td><td>A</td><td>1C3</td></tr>
</table>

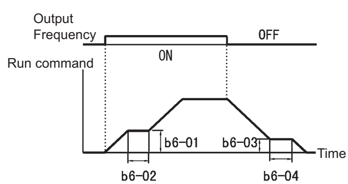
A.2 Parameter Table

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
b1-15	Frequency Reference 2	Selects the frequency reference input source. 0: Operator - Digital preset speed d1-01 to d1-17. 1: Terminals - Analog input terminal A1 or A2 2: Memobus communications 3: Option PCB 4: Pulse Input (Terminal RP)	0 to 4	0	A	A	A	1C4
b1-16	Run Command Source 2	Selects the run command input source. 0: Operator - RUN and STOP keys on the digital operator. 1: Digital input terminals S1 to S7 2: Memobus communications 3: Option PCB	0 to 3	0	A	A	A	1C5
b1-17	Run Command at Power Up	Determines the operation when a Run command is active at power up of the drive. 0: Run command not issued, needs to be cycled 1: Run command issued, motor operation start	0,1	0	A	A	A	1C6
b2: DC Injection Braking Use b2 parameters to configure DC Injection Braking operation								
b2-01	DC Injection Braking Start Frequency	Sets the frequency at which DC Injection Braking starts when Ramp to Stop (b1-03 = 0) is selected. If b2-01< E1-09, DC Injection Braking starts at E1-09.	0.0 to 10.0	0.5 Hz	A	A	A	189
b2-02	DC Injection Braking Current	Sets the DC Injection Braking current as a percentage of the drive rated current.	0 to 75	50%	A	A	–	18A
b2-03	DC Injection Braking Time/DC Excitation Time at Start	Sets DC Injection Braking time at start. Disabled when set to 0.00 seconds.	0.00 to 10.00	0.00 s <1>	A	A	–	18B
b2-04	DC Injection Braking Time at Stop	Sets DC Injection Braking time at stop.When b1-03 = 2, actual DC Injection time is calculated as follows: (b2-04) x 10 x (Output Freq) / (E1-04). When b1-03 = 0, this parameter sets the amount of DC Injection time applied to the motor at the end of the decel ramp or High Slip Braking. Disabled when set to 0.00.	0.00 to 10.00	0.50 s	A	A	–	18C
b2-08	Magnetic Flux Compensation Capacity	Sets the magnetic flux compensation as a percentage of the no-load current value (E2-03).	0 to 1000	0%	–	A	–	190
b2-12	Short Circuit Brake Time at Start	Sets the time for Short-Circuit Brake operation at start. Disabled when set to 0.00. <32>	0.00 to 25.50	0.00 s	–	–	A	1BA

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
b2-13	Short Circuit Brake Time at Stop	Sets Short-Circuit Brake operation time at stop. Used to stop a motor rotating due to inertia. Disabled when set to 0.00 seconds. <32>	0.00 to 25.50	0.50 s	–	–	A	1BB
b3: Speed Search Use B3 parameters to configure Speed Search function operation.								
b3-01	Speed Search Selection	Enables/disables speed search function at start. 0: Disabled - Speed Search is not automatically performed at start. 1: Enabled - Speed Search is automatically performed at start.	0 to 1	0	A	A	A	191
b3-02	Speed Search Deactivation Current	Sets the current level at which the speed is assumed to be detected and Speed Search is ended. Set in percent of the drive rated current.	0 to 200	120 <2>	A	A	–	192
b3-03	Speed Search Deceleration Time	Sets the time constant used to reduce the output frequency during speed search. Related to a change from max. output frequency to 0.	0.1 to 10.0	2.0 s	A	A	–	193
b3-05	Speed Search Delay Time	Delays the speed search operation after a momentary power loss to allow time for an external output contactor to close.	0.0 to 100	0.2 s	A	A	A	195
b3-06	Output Current 1 during Speed Search	Sets the current injected to the motor at the beginning of Esitmation type Speed Search. Set as a factor to the motor rated current.	0.0 to 2.0	<12>	A	A	–	196
b3-10	Speed Search Detection Compensation Gain	Sets the gain which is applied to the speed detected by Speed Estimation Speed Search before the motor is reaccelerated.Increase this setting if OV occurs when performing speed search.	1.00 to 1.20	1.05	A	A	–	19A
b3-14	Bi-Directional Speed Search Selection	Selects if Speed Search detects the motor rotation direction during speed search. 0: Disabled–Frequency reference direction used 1: Enabled–Detected direction used	0,1	0	A	A	–	19E
b3-17	Speed Search Restart Current Level	Sets the speed search restart current level in percentag of the drive rated current.	0 to 200	150 %	A	A	–	1F0
b3-18	Speed Search Restart Detection Time	Sets the time in seconds for speed search restart to be detected.	0.00 to 1.00	0.10 s	A	A	–	1F1
b3-19	Number of Speed Search Restarts	Sets the number of restarts possible for speed search restart operations.	0 to 10	3	A	A	–	1F2
b3-24	Speed Search Method Selection	Sets the Speed Search detection mode. 0: Current Detection Type 1: Speed Estimation Type	0,1	0	A	A	–	1C0
b3-25	Speed Search Retry Interval Time	Sets the wait time before Speed Search restarts.	0 to 30.0	0.5 s	A	A	A	1C8

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
b4: Timer Function Use b4 parameters to configure timer function operation.								
b4-01	Timer Function On-Delay Time	Used in conjunction with a multi-function digital input (H1-☐☐ = 18) and a multi-function digital output (H2-☐☐ = 12) programmed for the timer function. This sets the amount of time between digital input closure and digital output activation.	0.0 to 300.0	0.0 s	A	A	A	1A3
b4-02	Timer Function Off-Delay Time	Used in conjunction with a multi-function digital input (H1-☐☐ = 18) and a multi-function digital output programmed for the timer function. This sets the amount of time the output remains activated after the digital input is opened.	0.0 to 300.0	0.0 s	A	A	A	1A4
b5: PID Control Use b5 parameters to configure the PID control drive function.								
b5-01	PID Function Setting	Sets the PID control mode. 0: Disabled 1: Enable (Deviation is D-controlled) 2: Enable (Feedback is D-controlled) 3: Enable (Deviation is D-controlled, PID outut added to Freq. Ref.) 4: Enable (Feedback is D-controlled, PID outut added to Freq. Ref.)	0 to 4	0	A	A	A	1A5
b5-02 <22>	Proportional Gain Setting (P)	Sets the proportional gain of the PID controller. A setting of 0.00 disables P control.	0.00 to 25.00	1.00	A	A	A	1A6
b5-03 <22>	Integral Time Setting (I)	Sets the integral time for the PID controller. A setting of 0.0 s disables integral control.	0.0 to 360.0	1.0 s	A	A	A	1A7
b5-04 <22>	Integral Limit Setting	Sets the maximum output possible from the integrator.	0.0 to 100.0	100.0%	A	A	A	1A8
b5-05 <22>	Derivative Time (D)	Sets D control derivative time. A setting of 0.00 s disables derivative control.	0.00 to 10.00	0.00 s	A	A	A	1A9
b5-06 <22>	PID Output Limit	Sets the maximum output possible from the entire PID controller.	0.0 to 100.0	100.0%	A	A	A	1AA
b5-07 <22>	PID Offset Adjustment	Applies an offset to the PID controller output.	-100.0 to +100.0	0.0 %	A	A	A	1AB
b5-08 <22>	PID Primary Delay Time Constant	Sets the amount of time for the filter on the output of the PID controller.	0.00 to 10.00	0.00 s	A	A	A	1AC
b5-09	PID Output Level Selection	Sets the PID controller output direction. 0: Normal Output (direct acting) 1: Reverse Output (reverse acting)	0,1	0	A	A	A	1AD

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
b5-10	PID Output Gain Setting	Sets the gain applied to the PID output.	0.00 to 25.00	1.00	A	A	A	1AE
b5-11	PID Output Reverse Selection	Sets the drive operation with negative PID output. 0: Drive stops with negative PID output 1: Rotation direction reverses with negative PID output. When using setting 1 make sure, reverse operation is permitted by parameter b1-04.	0,1	0	A	A	A	1AF
b5-12	PID Feedback Reference Missing Detection Selection	Configures the PID feedback loss detection. 0: Disabled. 1: Feedback loss detected when PID enabled. Alarm output, operation is continued without triggering a fault contact. 2: Feedback loss detected when PID enabled. Fault output, operation is stopped and a fault contact is triggered. 3: Feedback loss detection even when PID is disabled by digital input. No alarm/fault output. “PID feedback loss” digital output is switched, 4: PID Feedback error detection even when PID is disabled by digital input. An alarm is triggered and the drive continues to run. 5: PID Feedback error detection even when PID is disabled by digital input. Fault is triggered and output is shut off.	0 to 5	0	A	A	A	1B0
b5-13	PID Feedback Loss Detection Level	Sets the PID feedback loss detection level.	0 to 100	0%	A	A	A	1B1
b5-14	PID Feedback Loss Detection Time	Sets the PID feedback loss detection delay time in terms of seconds.	0.0 to 25.5	1.0 s	A	A	A	1B2
b5-15	PID Sleep Function Start Level	Sets the sleep function start frequency. **Note:** Also enabled when PID is not active.	0.0 to 400.0	0.0 Hz	A	A	A	1B3
b5-16	PID Sleep Delay Time	Sets the sleep function delay time in units of 0.1 seconds.	0.0 to 25.5	0.0 s	A	A	A	1B4
b5-17	PID Accel/Decel Time	Applies an accel/decel time to the PID setpoint reference.	0 to 255	0 s	A	A	A	1B5
b5-18	PID Setpoint Selection	Selects b5-19 as PID setpoint value. 0: Disabled 1: Enabled, b5-19 becomes PID target	0,1	0	A	A	A	1DC
b5-19	PID Setpoint Value	Sets the PID target value when b5-18 = 1.	0.00 to 100.00	0.00 %	A	A	A	1DD

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
b5-20	PID Setpoint Scaling	Sets the units for b5-19, and for parameter monitors U5-01 (PID Feedback) and U5-04 (PID Setpoint). 0: 0.01Hz units 1: 0.01% units (100% = max output frequency) 2: r/min (motor pole number must be set up) 3: User-set (set to b5-38 and b5-39)	0 to 3	1	A	A	A	1E2
b5-34 <22>	PID Output Lower Limit	Sets the minimum output possible from the PID controller.	-100.0 to +100.0	0.00 %	A	A	A	19F
b5-35 <22>	PID Input Limit	Limits the PID control input (deviation signal). Acts as a bipolar limit.	0 to 1000.0	1000.0%	A	A	A	1A0
b5-36	PID Feedback High Detection Level	Sets the PID feedback high detection level.	0 to 100	100 %	A	A	A	1A1
b5-37	PID Feedback High Level Detection Time	Sets the PID feedback high level detection delay time.	0.0 to 25.5	1.0 s	A	A	A	1A2
b5-38	PID Setpoint / User Display	0 to 60000: User-Set Display if b5-20=3 Set the numbers displayed by designating the maximum PID target.	1 to 60000	<5>	A	A	A	1FE
b5-39	PID Setpoint Display Digits	Sets the number of digits the PID setpoint. 0: No decimal places 1: One decimal places 2: Two decimal places 3: Three decimal places	0 to 3	<5>	A	A	A	1FF
b6: Dwell Function Use b6 parameters to configure dwell function operation.								
b6-01	Dwell Reference at Start	The Dwell function is used to temporarily hold the frequency when driving a motor with a heavy load. Parameters b6-01 and b6-02 set the frequency to hold and the time to maintain that frequency at start. Parameters b6-03 and b6-04 set the frequency to hold and the time to maintain that frequency at stop.	0.0 to 400.0	0.0 Hz	A	A	A	1B6
b6-02	Dwell Time at Start		0.0 to 10.0	0.0 s	A	A	A	1B7
b6-03	Dwell Frequency at Stop		0.0 to 400.0	0.0 Hz	A	A	A	1B8
b6-04	Dwell Time at Stop		0.0 to 10.0	0.0 s	A	A	A	1B9

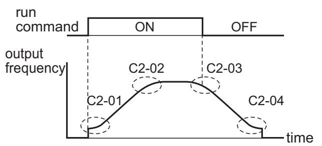
No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
b8: Energy Saving Use b8 parameters to configure the energy saving/conservation drive function.								
b8-01	Energy Saving Control Selection	Selects the Energy Savings function. 0: Disabled 1: Enabled (set b8-04)	0,1	0	A	A	–	1CC
b8-02 <22>	Energy Saving Gain	Sets energy savings control gain when in Open Loop Vector (OLV) control mode.	0.0 to 10.0	0.7	–	A	–	1CD
b8-03 <22>	Energy Saving Control Filter Time Constant	Sets energy saving control filter time constant when in Open Loop Vector control.	0.00 to 10.00	0.50	–	A	–	1CE
b8-04	Energy Saving Coefficient Value	Sets the Energy Saving coefficient and is used to fine adjustments in V/f Control.	0.0 to 655.00	<57>	A	–	–	1CF
b8-05	Power Detection Filter Time	Sets a filter time for the Power Detection used by Energy Savings in V/f Control.	0 to 2000	20 ms	A	–	–	1D0
b8-06	Search Operation Voltage Limit	Sets the limit for the voltage search operation performed by Energy Savings in V/f Control. Set as a percentage of the motor base voltage. Disabled when set to 0%.	0 to 100	0%	A	–	–	1D1

<1> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 2-OLV control.
<2> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 0-V/f Control.
<5> Default setting is dependent on parameter b5-20, PID Setpoint Scaling.
<12> Default setting value is dependent on parameter o2-04, Drive/kVA Selection.
<14> Default setting value is dependent on parameter o2-09, Initialization Spec. Selection.
<22> Parameter can be changed during run.
<32> A coasting motor may require a braking resistor circuit to bring the motor to a stop in the required time.
<33> Increase the setting value in increments of 0.1 when estimating the minimum output frequency for a motor coasting at high speed while attempting Speed-Estimation Type Speed Search.
<34> Increase this value if an OV overvoltage fault occurs when performing Speed Search at start.
<57> Default setting value is dependent on parameter o2-04, Drive/kVA Selection and C6-01, Drive Duty Selection.

◆ C: Tuning

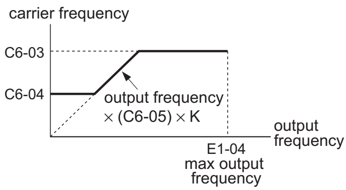
C parameters are used to adjust the acceleration and deceleration times, S-curves, slip- and torque compensation functions and carrier frequency selections.

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
C1: Acceleration and Deceleration Times Use C1 parameters to configure motor acceleration and deceleration.								
C1-01 <22>	Acceleration Time 1	Sets the time to accelerate from 0 to maximum frequency.	0.0 to 6000.0 <6>	10.0 s	S	S	S	200
C1-02 <22>	Deceleration Time 1	Sets the time to decelerate from maximum frequency to 0.	0.0 to 6000.0 <6>	10.0 s	S	S	S	201
C1-03 <22>	Acceleration Time 2	Sets the time to accelerate from 0 to maximum frequency when Accel/Decel times 2 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	202
C1-04 <22>	Deceleration Time 2	Sets the time to decelerate from maximum frequency to 0 when Accel/Decel times 2 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	203
C1-05 <22>	Acceleration Time 3 (Motor 2 Accel Time 1)	Sets the time to accelerate from 0 to maximum frequency when Accel/Decel times 3 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	204
C1-06 <22>	Deceleration Time 3 (Motor 2 Decel Time 1)	Sets the time to decelerate from maximum frequency to 0 when Accel/Decel times 3 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	205
C1-07 <22>	Acceleration Time 4 (Motor 2 Accel Time 2)	Sets the time to accelerate from 0 to maximum frequency when Accel/Decel times 4 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	206
C1-08	Deceleration Time 4 (Motor 2 Decel Time 2)	Sets the time to decelerate from maximum frequency to 0 when Accel/Decel times 4 are selected by a digital input.	0.0 to 6000.0 <6>	10.0 s	A	A	A	207
C1-09	Fast-Stop Time	Sets the time to decelerate from maximum frequency to 0 for the multi-function input fast-stop function. **Note:** This parameter is also used by selecting “Fast-Stop” as a Stop Method when a fault is detected.	0.0 to 6000.0 <6>	10.0 s	A	A	A	208
C1-10	Accel/Decel Time Setting Units	Sets the resolution of C1-01 to C1-09. 0: 0.01 s (0.00 to 600.00 s) 1: 0.1 s (0.0 to 6000.0 s)	0,1	1	A	A	A	209
C1-11	Accel/Decel Time Switching Frequency	Sets the frequency for automatic acceleration/ deceleration switching. Below set frequency: Accel/Decel Time 4 Above set frequency: Accel/Decel Time 1 The multi-function input “Accel/Decel Time 1” or “Accel/Decel Time 2” take priority.	0.0 to 400.0 Hz	0.0 Hz	A	A	A	20A

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
C2: S-Curve Characteristics Use C2 parameters to configure S-curve operation.								
C2-01	S-Curve Characteristic at Accel Start	The S-curve can be controlled in the four points shown below. S-curve is used to further soften  the starting and stopping ramp. The longer the S-curve time, the softer the starting and stopping ramp.	0.00 to 10.00	0.20 s <2>	A	A	A	20B
C2-02	S-Curve Characteristic at Accel End		0.00 to 10.0	0.20 s	A	A	A	20C
C2-03	S-Curve Characteristic at Decel Start		0.00 to 10.0	0.20 s	A	A	A	20D
C2-04	S-Curve Characteristic at Decel End		0.00 to 10.0	0.00 s	A	A	A	20E
C3: Slip Compensation Use C3 parameters to configure the slip compensation function.								
C3-01 <22>	Slip Compensation Gain	Sets the slip compensation gain. Decides for what amount the output frequency is boosted in order to compensate the slip. **Note:** Adjustment is not normally required.	0.0 to 2.5	0.0 <2>	A	A	–	20F
C3-02	Slip Compensation Primary Delay Time	Adjusts the slip compensation function delay time. Decrease the setting when the slip compensation response is too slow, increase it when the speed is not stable. Disabled when Simple V/f Control with PG (H6-01 = 3) is used.	0 to 10000	2000 ms <2>	A	A	–	210
C3-03	Slip Compensation Limit	Sets the slip compensation upper limit. Set as a percentage of motor rated slip (E2-02). Disabled when Simple V/f Control with PG (H6-01 = 3) is used.	0 to 250	200%	A	A	–	211
C3-04	Slip Compensation Selection during Regeneration	Selects slip compensation during regenerative operation. 0: Disabled 1: EnabledUsing the Slip Compensation function during regeneration may require a braking option to handle momentary increasing regenerative energy.	0,1	0	A	A	–	212
C3-05	Output Voltage Limit Operation Selection	Selects if the motor magnetic flux is reduced during output voltage saturation. 0: Disabled 1: Enabled	0,1	0 <2>	–	A	–	213

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
C4: Torque Compensation Use C4 parameters to configure Torque Compensation function.								
C4-01 <23>	Torque Compensation Gain	V/f control: Sets the gain for the automatic torque (voltage) boost function and helps to produce better starting torque. Increase this setting when using a long motor cable or when the motor is significantly smaller than the drive capacity. Decrease this setting when motor oscillation occurs. Set the value so that the current at low speed does not exceeds the drives rated current. Open Loop Vector: Sets the torque compensation function gain. Normally no change is required.	0.00 to 2.50	1.00	A	A	A	215
C4-02	Torque Compensation Primary Delay Time	Sets the torque compensation filter time. Increase this setting when motor oscillation occurs. Reduce the setting if there is not enough response from the motor.	0 to 60000	200 ms <1>	A	A	A	216
C4-03	Torque Compensation at Forward Start	Sets torque compensation at forward start as a percentage of motor torque.	0.0 to 200.0	0.0%	–	A	–	217
C4-04	Torque Compensation at Reverse Start	Sets torque compensation at reverse start as a percentage of motor torque.	-200.0 to 0.0	0.0%	–	A	–	218
C4-05	Torque Compensation Time Constant	Sets the time constant for torque compensation at forward start and reverse start (C4-03 and C4-04). The filter is disabled if the time is set to 4 ms or less.	0 to 200	10 ms	–	A	–	219
C4-06	Torque Compensation Primary Delay Time 2	Sets the torque compensation time 2. When an OV fault occurs with sudden load changes or at the and of an acceleration, increase the setting. Note: Adjustment is not normally required. If adjusted then AFR time 2 (n2-03) should be adjusted too.	0 to 10000	150 ms	–	A	–	21AH
C5: Speed Control (ASR) Use C5 parameters to configure the Automatic Speed Regulator (ASR). C5 parameters are available only when using V/f with Simple PG (H6-01 = 3).								
C5-01 <22>	ASR Proportional Gain 1	Sets the proportional gain of the speed control loop (ASR).	0.00 to 300.00	0.20	A	–	–	21B
C5-02 <22>	ASR Integral Time 1	Sets the integral time of the speed control loop (ASR).	0.000 to 10.000	0.200	A	–	–	21C
C5-03 <22>	ASR Proportional Gain 2	Sets the speed control gain 2 of the speed control loop (ASR).	0.00 to 300.00	0.02	A	–	–	21D

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
C5-04 <22>	ASR Integral Time 2	Sets the integral time 2 of the speed control loop (ASR).	0.000 to 10.000	0.050 s	A	–	–	21E
C5-05 <22>	ASR Limit	Sets the upper limit for the speed control loop (ASR) as a percentage of the maximum output frequency (E1-04).	0.0 to 20.0	5.0%	A	–	–	21F
C6: Carrier Frequency Use C6 parameters to configure the carrier frequency drive settings.								
C6-01	Normal/Heavy Duty Selection	Selects the load rating for the drive. 0: Heavy Duty (HD) for constant torque applications. 1: Normal Duty (ND) for variable torque applications. This setting affects the Rated output current and overload tolerance of the drive.	0,1	1	S	S	S	223
C6-02	Carrier Frequency Selection	Selects the carrier frequency 1: 2.0 kHz 2: 5.0 kHz 3: 8.0 kHz 4: 10.0 kHz 5: 12.5 kHz 6: 15.0 kHz 7: Swing PWM1 (Audible sound 1) 8: Swing PWM2 (Audible sound 2) 9: Swing PWM3 (Audible sound 3) A: Swing PWM4 (Audible sound 4) B to E: No setting possible F: User defined (determined by C6-03 through C6-05)	1 to F	<3>	S	S	S	224

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Name</th><th rowspan="2">Description</th><th rowspan="2">Range</th><th rowspan="2">Def.</th><th colspan="3">Control Mode</th><th rowspan="2">Addr. Hex</th></tr>
<tr><th>V/f</th><th>OLV</th><th>PM</th></tr>
<tr><td>C6-03</td><td>Carrier Frequency Upper Limit</td><td rowspan="2">Open Loop Vector: C6-03 defines the fixed carrier frequency if C6-02 = F.
V/f control: C6-03 and C6-04 set upper and lower limits for the carrier frequency.


The coefficient K depends on C6-03:
C6-03 ≥ 10.0 kHz: K = 3
10.0 kHz > C6-03 ≥ 5.0 kHz: K = 2
5.0 kHz > C6-03: K = 1
When C6-05 ≤ 6, C6-04 is disabled (makes the carrier frequency C6-03 value).</td><td>1.0 to 15.0</td><td><8></td><td>A</td><td>A</td><td>A</td><td>225</td></tr>
<tr><td>C6-04</td><td>Carrier Frequency Lower Limit</td><td>0.4 to 15.0</td><td><8></td><td>A</td><td>-</td><td>-</td><td>226</td></tr>
<tr><td>C6-05</td><td>Carrier Frequency Proportional Gain</td><td>Sets the relationship of output frequency to carrier frequency when C6-02 = F.</td><td>00 to 99</td><td><8></td><td>A</td><td>-</td><td>-</td><td>227</td></tr>
</table>

<1> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 2-OLV control.
<2> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 0-V/f Control.
<3> Default setting value is dependent on parameters o2-04, Drive/kVA Selection, A1-02, Control Method Selection and C6-01, Normal/Heavy Duty selection. 351.
<6> Setting range value is dependent on parameter C1-10, Accel/Decel Time Setting Units. When C1-10 = 0 (units of 0.01 seconds), the setting range becomes 0.00 to 600.00 seconds.
<8> Default setting value is dependent on parameter C6-02, Carrier Frequency Selection.
<22> Parameter can be changed during run.
<23> Parameter cannot be changed during run when parameter A1-02 = 5-PM OLV Control.

◆ d: References

Reference parameters are used to set the various frequency reference values during operation.

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
d1: Frequency Reference Use d1 parameters to configure the drive frequency reference.								
d1-01 <22>	Frequency Reference 1	Frequency reference	0.00 to 400.00 Hz <11> <19>	0.00 Hz	S	S	S	280
d1-02 <22>	Frequency Reference 2	Frequency reference when digital input "Multi-Step Speed Reference 1" (H1-☐☐ = 3) is on.		0.00 Hz	S	S	S	281
d1-03 <22>	Frequency Reference 3	Frequency reference when digital input "Multi-Step Speed Reference 2” (H1-☐☐ = 4) is on.		0.00 Hz	S	S	S	282
d1-04 <22>	Frequency Reference 4	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 2" (H1-☐☐ = 3 and 4) are on.		0.00 Hz	S	S	S	283
d1-05 <22>	Frequency Reference 5	Frequency reference when digital input "Multi-Step Speed Reference 3" (H1-☐☐ = 5) is on.		0.00 Hz	A	A	A	284
d1-06 <22>	Frequency Reference 6	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 3 " (H1-☐☐ = 3 and 5) are on.		0.00 Hz	A	A	A	285
d1-07 <22>	Frequency Reference 7	Frequency reference when digital inputs "Multi-Step Speed Reference 2, 3" (H1-☐☐ = 4 and 5) are on.		0.00 Hz	A	A	A	286
d1-08 <22>	Frequency Reference 8	Frequency reference when multi-function input "Multi-Step speed reference 1, 2, 3" (H1-☐☐ = 3, 4, 5) are on.		0.00 Hz	A	A	A	287
d1-09 <22>	Frequency Reference 9	Frequency reference when multi-function input "Multi-Step Speed Reference 4" (H1-☐☐ = 32) is on.		0.00 Hz	A	A	A	288
d1-10 <22>	Frequency Reference 10	Frequency reference when digital input "Multi-Step Speed Reference 1, 4" (H1-☐☐ = 3 and 32) are on.		0.00 Hz	A	A	A	28B

A.2 Parameter Table

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
d1-11 <22>	Frequency Reference 11	Frequency reference when digital inputs "Multi-Step Speed Reference 2, 4" (H1-☐☐ = 4 and 32) are on.	0.00 to 400.00 Hz <11> <19>	0.00 Hz	A	A	A	28C
d1-13 <22>	Frequency Reference 13	Frequency reference when digital inputs "Multi-Step Speed Reference 3, 4" (H1-☐☐ = 5 and 32) are on.		0.00 Hz	A	A	A	28E
d1-14 <22>	Frequency Reference 14	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 3, 4" (H1-☐☐ = 3, 5, 32) are on.		0.00 Hz	A	A	A	28F
d1-15 <22>	Frequency Reference 15	Frequency reference when digital inputs "Multi-Step Speed Reference 2, 3, 4" (H1-☐☐ = 4, 5, 32) are on.		0.00 Hz	A	A	A	290
d1-16 <22>	Frequency Reference 16	Frequency reference when digital inputs "Multi-Step Speed Reference 1, 2, 3, 4" (H1-☐☐ = 3, 4, 5, 32) are on.		0.00 Hz	A	A	A	291
d1-17 <22>	Jog Frequency Reference	Frequency reference when digital inputs "Jog Frequency Reference", "Forward Jog" or "Reverse Jog." are on. "Jog Frequency Reference" has priority over "Multi-Step Speed Reference 1 to 16".		6.00 Hz	S	S	S	292
d2: Frequency Upper and Lower Limits Use d2 parameters to configure the frequency reference limits.								
d2-01	Frequency Reference Upper Limit	Sets the frequency reference upper limit as a percentage of maximum output frequency (E1-04). Output speed is limited to this value even if the frequency reference is higher. This limit applies to all frequency reference sources.	0.0 to 110.0	100.0%	A	A	A	289
d2-02	Frequency Reference Lower Limit	Sets the frequency reference lower limit as a percentage of maximum output frequency (E1-04). Output speed is limitedto this value even if the frequency reference is lower. This limit applies to all frequency reference sources.	0.0 to 110.0	0.0 %	A	A	A	28A
d2-03	Master Speed Reference Lower Limit	Sets the minimum frequency reference lower limit if the frequency reference is input using an analog input. Set as a percentage of maximum output frequency (E1-04). The higher of both values d2-01 and d2-03 will be the lower limit.	0.0 to 110.0	0.0 %	A	A	A	293

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
d3: Jump Frequency Use d3 parameters to configure the drive Jump Frequency settings.								
d3-01	Jump Frequency 1	d3-01 to d3-04 allow programming of three prohibited frequency reference points for eliminating problems with resonant vibration of the motor / machine. This feature does not eliminate the selected frequency values, but accelerates and decelerates the motor through the prohibited bandwidth. The parameters must be according to the rule; d3-01 ≥ d3-02 ≥ d3-03.	0.0 to 400.0	0.0 Hz	A	A	A	294
d3-02	Jump Frequency 2			0.0 Hz	A	A	A	295
d3-03	Jump Frequency 3			0.0 Hz	A	A	A	296
d3-04	Jump Frequency Width	This parameter sets the dead-band width around each selected prohibited frequency reference point. The bandwidth becomes the designated Jump frequency, plus or minus d3-04.	0.0 to 20.0	1.0 Hz	A	A	A	297
d4: Frequency Reference Hold Use d4 parameters to configure the drive frequency reference hold function.								
d4-01	Frequency Reference Hold Function Selection	This parameter is used to hold the last frequency reference in U1-01 (d1-01) when power is removed. 0: Disabled 1: Enabled This function is available when the multi-function inputs “accel/decel ramp hold” or “up/down” commands are selected (H1-☐☐ = A or 10 and 11).	0,1	0	A	A	A	298
d4-03 <22>	Frequency Reference Bias Step (Up/Down 2)	Sets the bias added to the frequency reference when the Up/Down 2 digital inputs are set. When set to 0.00 Hz, the bias value is increased or decreased according to d4-04. When greater than 0.0 Hz, the bias value d4-03 is added or subtracted to/from the frequency reference. The acceleration or deceleration rate is ultimately determined by d4-04.	0.00 to 99.99 Hz	0.00 Hz	A	A	A	2AA
d4-04 <22>	Frequency Reference Accel/ Decel (Up/Down 2)	0: Adjusts the bias value according to the currently selected accel/decel time. 1: Adjusts the bias value by Accel/Decel Time 4 (C1-07 and C1-08).	0,1	0	A	A	A	2AB
d4-05 <22>	Frequency Reference Bias Operation Mode Selection (Up/Down 2)	0: Holds the bias value when Up/Down 2 reference is on or off. 1: When the Up 2 reference and Down 2 reference are both on or both off, the applied bias becomes 0. Currently selected accel/ decel. times are used. Enabled only when d4-03 = 0.	0,1	0	A	A	A	2AC

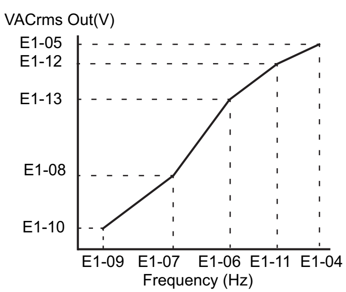
No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
d4-06	Frequency Reference Bias (Up/Down 2)	100% = Max output frequency (E1-04). Saves the bias value once the frequency reference is adjusted.The bias can be set by the user, but will be disabled under the following conditions: When none of the multi-function input terminals are assigned +0 frequency reference bias function. When the frequency reference priority has changed (including multi-step speed). When both d4-03 = 0 and d4-05 = 1 while the Up 2 / Down 2 commands are both on or both off. When the max output frequency has changed (E1-04). When the digital frequency reference has changed.	-99.9 to +100.0	0.0 %	A	A	A	2AD
d4-07 <22>	Analog Frequency Reference Fluctuation Limit (Up/Down 2)	• When the Up 2 and Down 2 commands are enabled, the frequency reference holds the bias value as the levels for the analog frequency reference or pulse train frequency reference change, accelerating or decelerating to the frequency reference. After frequency agree is achieved, the bias process starts again. • Enabled only when the analog or pulse train reference is on.	0.1 to +100.0	1.0 %	A	A	A	2AE
d4-08 <22>	Frequency Reference Bias Upper Limit (Up/ Down 2)	When d4-06 is greater than d4-08, d4-08 becomes the bias for the upper limit. Set as a percentage of the max output frequency.	0.1 to 100.0	0.0 %	A	A	A	2AF
d4-09 <22>	Frequency Reference Bias Lower Limit (Up/ Down 2)	When d4-06 is less than d4-09, d4-09 becomes the bias for the lower limit. Set as a percentage of the max output frequency.	-99.9 to 0.0	0.0 %	A	A	A	2B0
d4-10	Up/Down Frequency Reference Limit Selection	Selects which value is used as frequency reference lower limit if the Up/Down function is used. 0: The lower limit is determined by d2-02 or analog input (H3-02/10 = 0). The higher of both values becomes the reference limit. 1: The lower limit is determined by d2-02.	0 or 1	0	A	A	A	2B6
d4-12	Stop Position Gain	Sets the gain used by the simple positioning stop function to fine adjust the position.	0.50 to 2.55	1.00	A	A	A	2B8
		d7: Offset Frequency Use d7 parameters to set the offset frequency.						
d7-01 <22>	Offset Frequency 1	Added to the frequency reference when the digital input “Frequency Offset 1” (H1-□□ = 44) is switched on.	-100.0 to +100.0	0.0 %	A	A	A	2B2

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
d7-02 <22>	Offset Frequency 2	Added to the frequency reference when the digital input "Frequency Offset 2" (H1-☐☐ = 45) is switched on.	-100.0 to +100.0	0.0 %	A	A	A	2B3
d7-03 <22>	Offset Frequency 3	Added to the frequency reference when the digital input "Frequency Offset 3" (H1-☐☐ = 46) is switched on.	-100.0 to +100.0	0.0 %	A	A	A	2B4

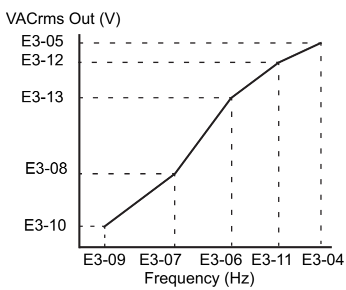
<11> Default setting value is dependent on parameter o1-03, Digital Operator Display Selection.
<19> Range upper limit is dependent on parameters E1-04, Maximum Output Frequency, and d2-01, Frequency Reference Upper Limit.
<22> Parameter can be changed during run.

◆ E: Motor Parameters

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
E1: V/f Pattern Characteristics Use E1 parameters to set V/f characteristics for the motor.								
E1-01 <24>	Input Voltage Setting	This parameter must be set to the power supply voltage. It sets the maximum and base voltage used by preset V/f patterns (E1-03 = 0 to E) and adjusts levels used by certain functions. Refer to page 130 for details **WARNING!** Drive input voltage (not motor voltage) must be set in E1-01 for the protective features of the drive to function properly. failure to do so may result in equipment damage and/or death or personal injury.	155 to 255	200 V	S	S	S	300

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
E1-03	V/f Pattern Selection	Selects a preset V/f pattern. 0: 50 Hz Constant torque 1 1: 60 Hz Constant torque 2 2: 60 Hz Constant torque 3 (50Hz base) 3: 72 Hz Constant torque 4 (60 Hz base) 4: 50 Hz Variable torque 1 5: 50 Hz Variable torque 2 6: 60 Hz Variable torque 3 7: 60 Hz Variable torque 4 8: 50 Hz High starting torque 1 9: 50 Hz High starting torque 2 A: 60 Hz High starting torque 3 B: 60 Hz High starting torque 4 C: 90 Hz (60 Hz base) D: 120 Hz (60 Hz base) E: 180 Hz (60 Hz base) F: Custom V/f. E1-04 through E1-13 settings define the V/f pattern.	0 to F	F	A	A	–	302
E1-04	Max Output Frequency	These parameters are only applicable when E1-03 is set to F. To set linear V/f characteristics, set the same values for E1-07 and E1-09. In this case, the setting for E1-08 will be disregarded. Ensure that the four frequencies are set according to these rules: E1-04 ≥ E1-06> E1-07 ≥ E1-09 	40.0 to 400.0	60 Hz <10>	S	S	S	303
E1-05 <24>	Max Output Voltage		0.0 to 255.0	230 V <10>	S	S	S	304
E1-06	Base Frequency		0.0 to E1-04	60 Hz <10>	S	S	S	305
E1-07	Mid Output Frequency		0.0 to E1-04	3.0 Hz <2>	A	A	A	306
E1-08 <24>	Mid Output Frequency Voltage		0.0 to 255.0	18.4 V <2> <12>	A	A	A	307
E1-09	Minimum Output Freq.		0.0 to E1-04	1.5 Hz <2> <10>	S	S	S	308
E1-10 <24>	Minimum Output Freq. Voltage		0.0 to 255.0	13.8 V <2> <12>	A	A	A	309
E1-11	Mid Output Frequency 2		0.0 to E1-04	0.0 Hz	A	A	A	30A
E1-12 <24>	Mid Output Frequency Voltage 2		0.0 to 255.0	0.0 V	A	A	A	30B
E1-13 <24>	Base Voltage		0.0 to 255.0	0.0 V	A	S	S	30C

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
E2: Motor Parameters Use E2 parameters to set motor-related data.								
E2-01	Motor Rated Current	Sets the motor nameplate full load current in amperes (A). Automatically set during Auto-Tuning.	10 to 200% of drive rated current <27>	<57>	S	S	–	30E
E2-02	Motor Rated Slip	Sets the motor rated slip in Hertz (Hz). Automatically set during rotational Auto-Tuning.	0.00 to 20.00	<57>	A	A	–	30F
E2-03	Motor No-Load Current	Sets the magnetizing current of the motor as a percentage of the motor rated current (E2-01). Automatically set during rotational Auto-Tuning.	0 to less than E2-01	<57>	A	A	–	310
E2-04	Number of Motor Poles	Sets the number of motor poles. Automatically set during Auto-Tuning.	2 to 48	4 poles	A	A	–	311
E2-05	Motor Line-to-Line Resistance	Sets the phase-to-phase motor resistance in ohms. Automatically set during Auto-Tuning.	0.000 to 65.000	<57>	A	A	–	312
E2-06	Motor Leakage Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of motor rated voltage. Automatically set during Auto-Tuning.	0.0 to 40.0	<57>	A	A	–	313
E2-07	Motor Iron-Core Saturation Coefficient 1	Sets the motor iron saturation coefficient at 75% of magnetic flux. Automatically set during Auto-Tuning.	E2-07 to 0.50	0.50	–	A	–	314
E2-08	Motor Iron-Core Saturation Coefficient 2	Sets the motor iron saturation coefficient at 75% of magnetic flux. Automatically set during during Auto-Tuning.	[E2-07] to 0.75	0.75	–	A	–	315
E2-09	Motor Mechanical Loss	Sets the motor mechanical loss as a percentage of motor rated power (kW). Adjust in the following circumstances: When there is a large amount of torque loss due to motor bearing friction. When there is a large amount of torque loss.	0.0 to 10.0	0.0%	–	A	–	316
E2-10	Motor Iron Loss for Torque Compensation	Sets the motor iron loss in watts (W).	0 to 65535	<57>	A	–	–	317

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Name</th><th rowspan="2">Description</th><th rowspan="2">Range</th><th rowspan="2">Def.</th><th colspan="3">Control Mode</th><th rowspan="2">Addr. Hex</th></tr>
<tr><th>V/f</th><th>OLV</th><th>PM</th></tr>
<tr><td>E2-11</td><td>Motor Rated Output</td><td>Sets the motor rated power in kilowatts (kW).
Automatically set during Auto-Tuning.
(1HP = 0.746 kW).</td><td>0.00 to 650.00</td><td>0.40 kW <12></td><td>S</td><td>S</td><td>–</td><td>318</td></tr>
<tr><td>E2-12</td><td>Motor Iron-Core Saturation Coefficient 3</td><td>Set to the motor iron saturation coefficient at 130% of magnetic flux.
Automatically set during rotational Auto-Tuning.</td><td>1.30 to 5.00</td><td>1.30</td><td>–</td><td>A</td><td>–</td><td>328</td></tr>
<tr><td colspan="9">E3: Motor 2 V/f Characteristics
Use E3 parameters to set the V/f pattern for a second motor.</td></tr>
<tr><td>E3-01</td><td>Motor 2 Control Method</td><td>0: V/f Control
2: Open Loop Vector (OLV)</td><td>0 or 2</td><td>0</td><td>A</td><td>A</td><td>–</td><td>319</td></tr>
<tr><td>E3-04</td><td>Motor 2 Max Output Frequency</td><td rowspan="10">These parameters set the V/f pattern for motor 2. To set linear V/f characteristics, set the same values for E3-07 and E3-09. In this case, the setting for E3-08 will be disregarded. Ensure that the four frequencies are set according to these rules or OPE10 fault will occur:
E3-04 ≥ E3-06 > E3-07 > E3-09

</td><td>40.0 to 400.0</td><td>60 Hz</td><td>A</td><td>A</td><td>–</td><td>31A</td></tr>
<tr><td>E3-05 <24></td><td>Motor 2 Max Voltage</td><td>0.0 to 255.0</td><td>230 V</td><td>A</td><td>A</td><td>–</td><td>31B</td></tr>
<tr><td>E3-06</td><td>Motor 2 Base Frequency</td><td>0.0 to E3-04</td><td>60 Hz</td><td>A</td><td>A</td><td>–</td><td>31C</td></tr>
<tr><td>E3-07</td><td>Motor 2 Mid Output Freq.</td><td>0.0 to E3-04</td><td>3.0 Hz</td><td>A</td><td>A</td><td>–</td><td>31D</td></tr>
<tr><td>E3-08 <24></td><td>Motor 2 Mid Output Freq. Voltage</td><td>0.0 to 255.0</td><td>18.4 V <12></td><td>A</td><td>A</td><td>–</td><td>31E</td></tr>
<tr><td>E3-09</td><td>Motor 2 Min. Output Freq.</td><td>0.0 to E3-04</td><td>1.5 Hz</td><td>A</td><td>A</td><td>–</td><td>31F</td></tr>
<tr><td>E3-10 <24></td><td>Motor 2 Min. Output Freq. Voltage</td><td>0.0 to 255.0</td><td>13.8 V <12></td><td>A</td><td>A</td><td>–</td><td>320</td></tr>
<tr><td>E3-11</td><td>Motor 2 Mid Output Frequency 2</td><td>0.0 to E3-04</td><td>0.0 Hz</td><td>A</td><td>A</td><td>–</td><td>345</td></tr>
<tr><td>E3-12 <24></td><td>Motor 2 Mid Output Frequency Voltage 2</td><td>0.0 to 255.0</td><td>0.0 Vac</td><td>A</td><td>A</td><td>–</td><td>346</td></tr>
<tr><td>E3-13 <24></td><td>Motor 2 Base Voltage</td><td>0.0 to 255.0</td><td>0.0 Vac</td><td>A</td><td>S</td><td>–</td><td>347</td></tr>
</table>

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
E4: Motor 2 Parameters Use E4 parameters to control a second motor operating on the same drive.								
E4-01	Motor 2 Rated Current	Sets the motor 2 name plate full load current in amperes (A). This value is automatically set during Auto-Tuning.	10 to 200% of drive rated current	*<57>*	A	A	–	321
E4-02	Motor 2 Rated Slip	Sets the motor 2 name plate full load current in amperes (A). Automatically set during Auto-Tuning.	0.00 to 20.00	*<57>*	A	A	–	322
E4-03	Motor 2 Rated No-Load Current	Sets the magnetizing current of motor 2 in percentage of full load current (E4-01). Automatically set during Rotational Auto-Tuning.	0 to less than [E4-01] *<27>*	*<57>*	A	A	–	323
E4-04	Motor 2 Motor Poles	Sets the number of poles of motor 2. This value is automatically set during Auto-Tuning.	2 to 48	4 poles	A	A	–	324
E4-05	Motor 2 Line-to-Line Resistance	Sets the phase-to-phase resistance of motor 2 in ohms. Automatically during Auto-Tuning.	0.000 to 65.000	*<57>*	A	A	–	325
E4-06	Motor 2 Leakage Inductance	Sets the voltage drop due to motor leakage inductance as a percentage of rated voltage of motor 2. Automatically set during Auto-Tuning.	0.0 to 40.0	*<57>*	A	A	–	326
E4-07	Motor 2 Motor Iron-Core Saturation Coefficient 1	Set to the motor iron saturation coefficient at 50% of magnetic flux. Automatically set during Rotational Auto-Tuning.	0.00 to 0.50	0.50	–	A	–	343
E4-08	Motor 2 Motor Iron-Core Saturation Coefficient 2	Set to the motor iron saturation coefficient at 75% of magnetic flux. This value is automatically set during Rotational Auto-Tuning.	Setting for E4-07 to 0.75	0.75	–	A	–	344
E4-09	Motor 2 Mechanical Loss	Sets the motor mechanical loss as a percentage of motor rated power (kW) capacity. Adjust in the following circumstances: When there is a large amount of torque loss due to motor bearing friction. When there is a large amount of torque loss.	0.00 to 10.0	0.0	–	A	–	33F
E4-10	Motor 2 Iron Loss	Sets the motor iron loss in watts.	0 to 65535	*<57>*	–	A	–	340
E4-11	Motor 2 Rated Capacity	Sets the motor rated capacity in kW. Automatically set during Auto-Tuning.	0.00 to 650.00	*<12>*	A	A	–	327

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
E4-12	Motor 2 Iron-Core Saturation Coefficient 3	Set to the motor iron saturation coefficient at 130% of magnetic flux. Automatically set during Rotational Auto-Tuning.	1.30 to 5.00	1.30	–	A	–	342
E4-14 <22>	Motor 2 Slip Compensation Gain	Sets the slip compensation gain for motor 2. The function is the same as C3-01 for motor 1. Refer to the C3-01 description.	0.0 to 2.5	0.0	A	A	–	341
E4-15	Torque Compensation Gain - Motor 2	Sets the torque compensation gain for motor 2. The function is the same as C4-01 for motor 1. Refer to the C4-01 description.	1.00 to 2.50	1.00	A	A	–	341
E5: PM Motor Parameters								
E5-01 <25>	Motor Code Selection (for PM motor)	Enter the Yaskawa motor code for the PM motor being used. Various motor parameters are automatically set based on the value of this parameter. **Note:** Set to FFFF when using a specialized or custom motor. For all other motors: 0 0 0 0 Motor voltage class and capacity 0: Pico motor (SMRA series) 1: Derated torque IPM motor (SSR1 series) 2: Constant torque IPM motor (SST4 series) 0: 1800 r/min series 1: 3600 r/min series 2: 1750 r/min series 3: 1450 r/min series 4: 1150 r/min series F: Custom motor All motor parameters are re-initialized to factory settings when this parameter is set.	0000 to FFFF	<12>	–	–	S	329
E5-02 <25>	Motor Rated Capacity (for PM motor)	Sets the rated capacity of the motor.	0.10 to 18.5	<10>	–	–	S	32A
E5-03	Motor Rated Current	Sets the motor rated current in amps.	10 to 200% of drive rated current <27>	<4>	–	–	S	32B

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
E5-04 <25>	Motor Poles	Sets the number of motor poles.	2 to 48	<10>	–	–	S	32C
E5-05 <25>	Motor Resistance	Set the resistance for each motor phase in units of 0.001 Ω.	0.000 to 65.000	<10>	–	–	S	32D
E5-06 <25>	Motor d Axis Inductance	Sets the d axis inductance in units of 0.01 mH.	0.00 to 300.00	<10>	–	–	S	32E
E5-07 <25>	Motor q Axis Inductance	Sets the q axis inductance in units of 0.01 mH.	0.00 to 600.00	<10>	–	–	S	32F
E5-09 <25>	Motor Induction Voltage Constant 1	Set the induced phase peak voltage in units of 0.1 mV (rad/min) [electrical angle]. Set this parameter when using a Yaskawa SSR1 series PM motor with derate torque, or a Yaskawa SST4 series motor with constant torque. When setting this parameter, E5-24 should be set to 0. An alarm will be triggered if both E5-09 and E5-24 are set to 0, or if neither parameter is set to 0.	0.0 to 2000.0	<10>	–	–	S	331
E5-24 <25>	Motor Induction Voltage Parameter 2	Set the induced phase-to-phase rms voltage in units of 0.1 mV/(r/min) [mechanical angle]. Set this parameter when using a Yaskawa SMRA series pico motor. When setting this parameter, E5-09 should be set to 0. An alarm will be triggered if both E5-09 and E5-24 are set to 0, or if neither parameter is set to 0. If E5-03 (Motor Rated Current) is set to 0, however, then an alarm will not be triggered when both E5-09 and E5-24 are set to 0.	0.0 to 2000.0	0 <10>	–	–	S	353

◆ F: Options

F parameters are used to program the drive for PG feedback and to function with option cards.

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
F1: Simple PG V/f Parameters								
Use F1 parameters to set up the drive for Simple PG V/f control. These parameters are enabled only when H6-01 = 03								

A.2 Parameter Table

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
F1-02	Operation Selection at PG Open Circuit (PGO)	Sets stopping method when a PG open circuit fault (PGO) occurs. Refer to parameter F1-14. 0: Ramp to Stop - Decelerate to stop using the active deceleration time. 1: Coast to Stop 2: Fast-stop - Decelerate to stop using the deceleration time in C1-09. 3: Alarm only - Drive continues operation.	0 to 3	1	A	–	–	381
F1-03	Operation Selection at Overspeed (OS)	Sets the stopping method when an overspeed (OS) fault occurs. Refer to F1-08 and F1-09. 0: Ramp to stop - Decelerate to stop using the active deceleration time. 1: Coast to stop 2: Fast - Stop - Decelerate to stop using the deceleration time in C1-09. 3: Alarm Only - Drive continues operation.	0 to 3	1	A	–	–	382
F1-04	Operation Selection at Deviation	Sets the stopping method when a speed deviation (DEV) fault occurs. Refer to F1-10 and F1-11. 0: Ramp to stop - Decelerate to stop using the active deceleration time. 1: Coast to stop 2: Fast-stop - Decelerate to stop using the deceleration time in C1-09. 3: Alarm only - Drive continues operation.	0 to 3	3	A	–	–	383
F1-08	Overspeed Detection Level	Sets the speed feedback level which has to be exceeded for the time set in F1-09 before an OS fault will occur. Set as a percentage of the maximum output frequency (E1-04).	0 to 120	115 %	A	–	–	387
F1-09	Overspeed Detection Delay Time	Sets the time in seconds for which the speed feedback has to exceed the overspeed detection level F1-08 before an OS fault will occur.	0.0 to 2.0	1.0	A	–	–	388
F1-10	Excessive Speed Deviation Detection Level	Sets the allowable deviation between motor speed and frequency reference before a speed deviation fault (DEV) is triggered. Set as a percentage of the maximum output frequency (E1-04).	0 to 50	10%	A	–	–	389
F1-11	Excessive Speed Deviation Detection Delay Time	Sets the time in seconds for which a deviation between motor speed and frequency reference has to exceed the speed deviation detection level F1-10 before a DEV fault will occur.	0.0 to 10.0	0.5 s	A	–	–	38A

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
F1-14	PG Open-Circuit Detection Time	Sets the time for which no PG pulses must be detected before a PG Open (PGO) fault is triggered.	0.0 to 10.0	2.0 s	A	–	–	38D
F6 and F7: Serial Communications Option Card Settings Use F6 parameters to program the drive for serial communication.								
F6-01	Communications Error operation Selection	Selects the operation after a communications error occurred. 0: Ramp to stop using current accel/decel time 1: Coast to stop 2: Fast Stop using C1-09 3: Alarm only	0 to 3	1	A	A	A	3A2
F6-02	External fault from comm. option selection	Sets when an external fault from a comm option is detected. 0: Always detected 1: Detection during Run only	0 or 1	0	A	A	A	3A3
F6-03	External fault from comm. option operation selection	Selects the operation after an external fault set by a communications option (EF0). 0: Ramp to stop using current accel/decel time 1: Coast to stop 2: Fast Stop using C1-09 3: Alarm only	0 to 3	1	A	A	A	3A4
F6-04	Trace Sampling Rate	-	0.0 to 5.0	2.0 s	A	A	A	3A5
F6-10	CC-Link Node Address	Sets the node address if a CC-Link option card is installed	0 to 63	0	A	A	A	3E6
F6-11	CC-Link communications speed	0: 156 Kbps 1: 625 Kbps 2: 2.5 Mbps 3: 5 Mbps 4: 10 Mbps	0 to 4	0	A	A	A	3E7
F6-14	BUS Error auto reset	Selects if a BUS fault can be automatically reset.	0 or 1	0	A	A	A	3BB
F6-20	DeviceNet MAC Address	Selects the drives MAC address for DeviceNet	0 to 63	0	A	A	A	3C1
F6-21	Device Net Communications Speed	0: 125 kbps 1: 250 kbps 2: 500 kbps 3: Detect automatically	0 to 3	3	A	A	A	3C2
F6-22	DeciveNet PCA setting	I/O Polled Consuming Assembly Data Instance	0 to 255	0	A	A	A	3C3
F6-23	DeciveNet PPA setting	I/O Polled Producing Assembly Data Instance	0 to 255	0	A	A	A	3C4

Parameter List

A

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
F6-24	DeciveNet Idle mode fault detection	Selects if a fault s is detected during communication idle mode. 0: Disabled 1: Enabled	0 or 1	0	A	A	A	3C5
F6-30	Profibus node address	Sets the node address for a Profibus option.	0 to 125	0	A	A	A	3CB
F6-31	Profibus Clear mode selection	Selects the operation when a "Clear Mode" command is received. 0: Resets back to zero. 1: Maintains the previous value.	0 or 1	0	A	A	A	3CC
F6-32	Profibus Map selections	0: PPO Type 1: Conventional	0 or 1	0	A	A	A	3CD
F6-36	CANopen Node ID selection	Sets the Node ID for a CANopen option	0 to 127	99	A	A	A	3D0
F6-37	CANopen Communications speed	0: Auto-adjust 1: 10kbps 2: 20 kbps 3: 50 kbps 4: 125 kbps 5: 250 kbps 6: 500 kbps 7: 800 kbps 8: 1 Mbps	0 to 8	6	A	A	A	3D1
F6-40	CompoNet Node ID	Sets the Node ID for a CompoNet option.	0 to 63	0	A	A	A	3D5
F6-41	CompoNet Speed	0: 93.75kbit/s 1: Reserved 2: 1.5Mbit/s 3: 3Mbit/s 4: 4Mbit/s 5-255: Reserved	0 to 255	0	A	A	A	3D6
F7-01	Ethernet IP Address 1	Combining these parameters like F7-01.F7-02.F7-03.F7-04 sets the Ethernet IP address. Example: (192.168.1.10)	0 to 255	0	A	A	A	3E5
F7-02	Ethernet IP Address 1		0 to 255	0	A	A	A	3E6
F7-03	Ethernet IP Address 1		0 to 255	0	A	A	A	3E7
F7-04	Ethernet IP Address 1		0 to 255	0	A	A	A	3E8
F7-05	Subnet Mask 1	Combining these parameters like F7-05.F7-06.F7-07.F7-08 sets the Ethernet Subnet Mask.Example: (255.255.255.0)	0 to 255	0	A	A	A	3E9
F7-06	Subnet Mask 2		0 to 255	0	A	A	A	3EA
F7-07	Subnet Mask 3		0 to 255	0	A	A	A	3EB
F7-08	Subnet Mask 4		0 to 255	0	A	A	A	3EC

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
F7-09	Gateway Address 1	Combining these parameters like F7-09.F7-10.F7-11.F7-12 sets the Ethernet Gateway Address.Example: (192.168.1.1)	0 to 255	0	A	A	A	3ED
F7-10	Gateway Address 2		0 to 255	0	A	A	A	3EE
F7-11	Gateway Address 3		0 to 255	0	A	A	A	3EF
F7-12	Gateway Address 4		0 to 255	0	A	A	A	3F0
F7-13	Dress Mode at Startup	Selects how the Ethernet IP address is set. 0:User defined 1:BOOTP 2:DHCP	0 to 2	0	A	A	A	3F1
F7-14	Security password	Sets the password required for setup changes via the network. 0: No password required 1 - 9999: 4 digit password	0 to 9999	0	A	A	A	3F2
F7-15	Duplex Mode Selection	0:Auto Negotiate 1:Half Duplex forced 2:Full Duplex forced	0 to 2	0	A	A	A	3F3
F7-18	Communication Speed Selection	0:Auto Negotiate 10:10 Mbps speed setting 100:100Mbps Speed Setting	0, 10, 100	0	A	A	A	3F6
F7-19	Web Page Access	Selects the mode for modification on the Ethernet option board Web page settings 0: All access 1: Only during stop 2: Never	0 to 2	0	A	A	A	3F7
F7-20	Gateway selection	0: Gateway not used 1: Use Gateway	0 or 1	1	A	A	A	3F8
F7-21	Communication loss time out	Multiplier for communication loss detection timeout value.	0 to 300	0	A	A	A	3F9

◆ H Parameters: Multi-Function Terminals

H parameters assign functions to the multi-function input and output terminals.

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
H1: Multi-Function Digital Input H1 parameters to assign functions to the multi-function digital input terminals. Unused terminals should be set to "F".								
H1-01	Multi-Function Digital Input Terminal S1 Function Selection	Selects the function of terminals S1 to S7 Refer to “Multi-Function Digital Input Selection Table” for a description of setting values.	1 to 9F <40>	40	A	A	A	438
H1-02	Multi-Function Digital Input Terminal S2 Function Selection			41	A	A	A	439
H1-03	Multi-Function Digital Input Terminal S3 Function Selection			24	A	A	A	400
H1-04	Multi-Function Digital Input Terminal S4 Function Selection			14	A	A	A	401
H1-05	Multi-Function Digital Input Terminal S5 Function Selection			3(0) <18>	A	A	A	402
H1-06	Multi-Function Digital Input Terminal S6 Function Selection			4(3) <18>	A	A	A	403
H1-07	Multi-Function Digital Input Terminal S7 Function Selection			6(4) <18>	A	A	A	404

<18> Parenthetical value is the default when parameter A1-03 = 3330 3-Wire Initialization.
<40> The availability of certain functions depends on the control method used.

H1 Multi-Function Digital Input Selections

H1-□□ Setting	Function	Description	Control Mode		
			V/f	OLV	PM
0	3-Wire Sequence	Closed: Reverse rotation (only if the drive is set up for 3-wire sequence)	O	O	O
1	Local/Remote Selection	Open: Remote, Reference 1 or 2 (b1-01/02 or b1-15/16) Closed: Local, LED operator is run and reference source	O	O	O
2	External Reference 1/2	Open: Run and frequency reference source 1 (b1-01/02) Closed: Run and frequency reference source 2 (b1-15/16)	O	O	O
3	Multi-Step Speed Reference 1	Used to select Multi-Step Speeds set in d1-01 to d1-16	O	O	O
4	Multi-Step Speed Reference 2		O	O	O
5	Multi-Step Speed Reference 3		O	O	O
6	Jog Reference Selection	Open: Selected speed reference Closed: Jog Frequency reference (d1-17). Jog has priority over all other reference sources.	O	O	O

H1 Multi-Function Digital Input Selections					
H1-☐☐ Setting	Function	Description	Control Mode		
			V/f	OLV	PM
7	Accel/Decel Time 1	Used to switch between Accel/Decel. Time 1/2	O	O	O
8	Baseblock Command (N.O.)	Open: Normal operation Closed: No drive output	O	O	O
9	Baseblock Command (N.C.)	Open: No drive output Closed: Normal operation	O	O	O
A	Accel/Decel Ramp Hold	Closed: The drive pauses during acceleration or deceleration and maintains the output frequency.	O	O	O
B	Drive Overheat Alarm (OH2)	Closed: Displays an OH2 alarm	O	O	O
C	Terminal A2 Enable	Open: Terminal A2 disabled Closed: Terminal A2 enabled	O	O	O
F	Not used	Select this setting when not using the terminal or when using the terminal in a pass-through mode.	O	O	O
10	Up Command	Open: Maintains the current frequency reference Closed: Increases or decreases the current frequency reference. Ensure that the increase and decrease commands are set in conjunction with one another. The frequency reference source must be set to operator (b1-01 = 0).	O	O	O
11	Down Command		O	O	O
12	Forward Jog	Closed: Runs forward at the Jog Frequency d1-17.	O	O	O
13	Reverse Jog	Closed: Runs reverse at the Jog Frequency d1-17.	O	O	O
14	Fault Reset	Closed: Resets faults if the cause is cleared and the Run command is removed.	O	O	O
15	Fast-Stop (N.O.)	Closed: Decelerates at the Fast-Stop time C1-09. To restart the Fast-Stop input must be released and Run must be cycled.	O	O	O
16	Motor 2 Selection	Open: Motor 1 (E1-☐☐, E2-☐☐) Closed: Motor 2 (E3-☐☐, E4-☐☐)	O	O	O
17	Fast-stop (N.C.)	Open: Decelerates according to C1-09 (Fast-stop Time)	O	O	O
18	Timer Input Function	Set the timer delay using parameters b4-01 and b4-02. Ensure this function is set in conjunction with the multi-function output timer (H2-☐☐ = 12).	O	O	O
19	PID Disable	Closed: PID control disabled	O	O	O
1A	Accel/Decel Time Selection 2	Switches Accel/Decel times.	O	O	O
1B	Program Lockout	Open: Parameters can not be edited. (except U1-01 if reference source is set for operator) Closed: Parameters may be edited and saved.	O	O	O
1E	Reference Sample Hold	Closed: Samples the analog frequency reference and operates the drive at that speed.	O	O	O

H1 Multi-Function Digital Input Selections					
H1-☐☐ Setting	Function	Description	Control Mode		
			V/f	OLV	PM
20 to 2F	External Fault	20: N.O., Always Detected, Ramp To Stop 21: N.C., Always Detected, Ramp To Stop 22: N.O., During Run, Ramp To Stop 23: N.C., During Run, Ramp To Stop 24: N.O., Always Detected, Coast To Stop 25: N.C., Always Detected, Coast To Stop 26: N.O., During Run, Coast To Stop 27: N.C., During Run, Coast To Stop 28: N.O., Always Detected, Fast-stop 29: N.C., Always Detected, Fast-stop 2A: N.O., During Run, Fast-stop 2B: N.C., During Run, Fast-stop 2C: N.O., Always Detected, Alarm Only (continue running) 2D: N.C., Always Detected, Alarm Only (continue running) 2E: N.O., During Run, Alarm Only (continue running) 2F: N.C., During Run, Alarm Only (continue running)	O	O	O
30	PID Integral Reset	Closed: Resets the PID control integral value.	O	O	O
31	PID Integral Hold	Closed: Maintains the current PID control integral value.	O	O	O
32	Multi-Step Speed Reference 4	Used to select Multi-Step Speeds set in d1-01 to d1-16	O	O	O
34	PID Soft Starter	Closed: Disables the PID soft starter b5-17.	O	O	O
35	PID Input Switch	Closed: Inverses the PID input signal	O	O	O
40	Forward Run Command (2-wire sequence)	Open: Stop Closed: Forward run **Note:** Can not be set together with Settings 42 or 43.	O	O	O
41	Reverse Run Command (2-wire sequence)	Open: Stop Closed: Reverse run **Note:** Can not be set together with Settings 42 or 43.	O	O	O
42	Run Command (2-wire sequence 2)	Open: Stop Closed: Run **Note:** Can not be set together with Settings 40 or 41.	O	O	O
43	FWD/REV Command (2-wire sequence 2)	Open: Reverse Closed: Forward **Note:** Can not be set together with Settings 40 or 41.	O	O	O
44	Offset Frequency 1 Addition	Closed: Adds d7-01 to the frequency reference.	O	O	O
45	Offset Frequency 2 Addition	Closed: Adds d7-02 to the frequency reference.	O	O	O
46	Offset Frequency 3 Addition	Closed: Adds d7-03 to the frequency reference.	O	O	O
60	DC Injection Braking Command	Closed: Triggers DC Injection Braking (b2-02)	O	O	-

H1-☐☐ Setting	Function	Description	Control Mode V/f	Control Mode OLV	Control Mode PM
H1 Multi-Function Digital Input Selections					
61	External Search Command 1	Closed: Activates Current Detection Speed Search from the max. output frequency (E1-04) if b3-01=0. Activates Speed Estimation Type Speed search if b3-01 =1.	O	O	O
62	External Search Command 2	Closed: Activates Current Detection Speed Search from the frequency reference b3-01=0. Activates Speed Estimation Type Speed search if b3-01 =1.	O	O	O
65	KEB Ride-Thru 1 (N.C.)	Open: KEB Ride-Thru 1 enabled Closed: Normal operation	O	O	O
66	KEB Ride-Thru 1 (N.O.)	Open: Normal operation Closed: KEB Ride-Thru 1 enabled	O	O	O
67	Communications Test Mode	Tests the MEMOBUS/Modbus RS-485/422 interface.	O	O	O
68	High-Slip Braking	Closed: High-Slip braking is executed. Drive stops.	O	-	-
6A	Drive Enable	Open: Drive disabled. If this input is opened during run, then the drive will stop as specified by parameter b1-03. Closed: Ready for operation.	O	O	O
75	Up 2 Command	Open: Maintains the current frequency reference Closed: Increases or decreases the frequency reference.UP 2 and Down 2 commands must be set in combination with each other. The frequency reference source must be assigned to the operator (b1-01 = “0”).	O	O	O
76	Down 2 Command		O	O	O
7A	KEB Ride-Thru 2 (N.C.)	Open: KEB Ride-Thru 2 enabled Closed: Normal operation	O	O	O
7B	KEB Ride-Thru 2 (N.O.)	Open: Normal operation Closed: KEB Ride-Thru 2 enabled	O	O	O
7C	Short-Circuit Braking (N.O.)	Open: Normal operation Closed: Short-Circuit Braking	-	-	O
7D	Short-Circuit Braking (N.C.)		-	-	O
7E	Forward/Reverse Detection	Direction of rotation detection (for Simple V/f w/PG)	O	-	-
9F	DriveWorksEZ enable	Open: DWEZ enabled Closed: DWEZ disabled	O	O	O

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
H2: Multi-Function Digital Outputs **Use** H2 parameters to assign functions to the multi-function digital outputs.								

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
H2-01	Terminal MA, MB and MC Function Selection (relay)	Refer to “Multi-Function Digital Output Selection Table” for a description of setting values.	0 to 192 *<40>*	E	A	A	A	40B
H2-02	Terminal P1 Function Selection (open-collector)			0	A	A	A	40C
H2-03	Terminal P2 Function Selection (open-collector)			2	A	A	A	40D
H2-06	Watt Hour Output Unit Selection	Sets the display units for one of the multi-function output terminals that is assigned to output the watt hours (H2-□□ = 39) is the value every 200 ms. An output pulse of 200 ms is provided for every kWh that occurs. Intended to drive a counter, meter or PLC for logging kWh. 0: 0.1 kWh units 1: 1 kWh units 2: 10 kWh units 3: 100 kWh units 4: 1000 kWh units	0 to 4	0	A	A	A	437

<40> The availability of certain functions depends on the control method used.

H2 Multi-Function Digital Output Settings

H2-□□ Setting	Function	Description	Control Mode V/f	Control Mode OLV	Control Mode PM
0	During Run	Closed: A Run command is active or voltage is output.	O	O	O
1	Zero Speed	Closed: Output frequency is 0.	O	O	O
2	Fref/Fout Agree 1	Closed: Output frequency equals the speed reference (plus or minus the hysteresis set to L4-02).	O	O	O
3	Fref/Fset Agree 1	Closed: Output frequency and speed reference equal the value in L4-01 (plus or minus the hysteresis of L4-02).	O	O	O
4	Frequency (FOUT) Detection 1	Closed: Output frequency is less than or equal to the value in L4-01 with hysteresis determined by L4-02.	O	O	O
5	Frequency (FOUT) Detection 2	Closed: Output frequency is greater than or equal to the value in L4-01, with hysteresis determined by L4-02.	O	O	O

H2 Multi-Function Digital Output Settings					
H2-□□ Setting	Function	Description	Control Mode		
			V/f	OLV	PM
6	Drive Ready	Closed: Drive Ready. The drive is powered up, not in a fault state, and in the Drive mode.	O	O	O
7	DC Bus Undervoltage	Closed: DC bus voltage is below the UV trip level set in L2-05.	O	O	O
8	During Baseblock	Closed: This is no output voltage	O	O	O
9	Option Reference	Closed: Digital operator supplies the frequency reference.	O	O	O
A	Local/Remote	Open: Reference 1 or 2 are active Closed: Digital operator supplies the run command.	O	O	O
B	Torque Detection 1 (N.O.)	Closed: Output current/torque exceeds the torque value set in parameter L6-02 for longer than the time set in parameter L6-03.	O	O	O
C	Loss of Reference	Closed: Loss of the analog frequency reference detected. Enabled when L4-05 = 1.	O	O	O
D	Braking Resistor Fault	Closed: Braking resistor or transistor is overheated or faulted out. This selection requires that braking resistor protection parameter be set for ERF (L8-01 = “1”).	O	O	O
E	Fault	Closed: Fault occurred (other than CPF00 and CPF01).	O	O	O
F	Not used	Set this value when the terminal is not used, or when using the terminal in the pass-through mode.	O	O	O
10	Alarm	Closed: An alarm is triggered.	O	O	O
11	Reset Command Active	Closed: Reset command to the drive is active.	O	O	O
12	Timer Output	Timer output, controlled by b4-01 and b4-02. Used in conjunction with the digital input (H1-□□ = 18 “timer function”).	O	O	O
13	Fref/Fout Agree 2	Closed: When drive output frequency equals the frequency reference +/- L4-04.	O	O	O
14	Fref/Fset Agree 2	Closed: When the drive output frequency is equal to the value in L4-03 (plus or minus L4-04).	O	O	O
15	Frequency Detection 3	Closed: When the drive output frequency is less than or equal to the value in L4-03 with the hysteresis determined by L4-04.	O	O	O
16	Frequency Detection 4	Closed: When the output frequency is greater than or equal to the value in L4-03 with the hysteresis determined by L4-04.	O	O	O
17	Torque Detection 1 (N.C.)	Open: When the output current/torque exceeds the value set in parameter L6-02 for more time than is set in parameter L6-03.	O	O	O
18	Torque Detection 2 (N.O.)	Closed: When the output current/torque exceeds the value set in parameter L6-05 for more time than is set in parameter L6-06.	O	O	O
19	Torque Detection 2 (N.C.)	Open: Output current/torque exceeds the value set in parameter L6-05 for more time than is set in parameter L6-06.	O	O	O
1A	Reverse Direction	Closed: Drive is running in the reverse direction.	O	O	O

H2-☐☐ Setting	Function	Description	Control Mode V/f	Control Mode OLV	Control Mode PM
H2 Multi-Function Digital Output Settings					
1B	Baseblock 2	Open: Drive is in base block condition. Output is disabled.	O	O	O
1C	Motor 2 Selection	Closed: Motor 2 is selected by a digital input (H1-☐☐ = 16)	O	O	–
1E	Restart Enabled	Closed: An automatic restart is performed	O	O	O
1F	Overload Alarm OL1	Closed: OL1 is at 90% of its trip point or greater.	O	O	O
20	OH Pre alarm	Closed: Heatsink temperature exceeds the parameter L8-02 value.	O	O	O
22	Mechanical Weakening (N.O.)	Closed: Mechanical Weakening detected.	O	O	O
30	During Torque Limit	Closed: When the torque limit has been reached.	–	O	–
37	During Frequency Output	Closed: Frequency is output Open: Operation stopped, Baseblock, DC Injection Braking, or Initial Excitation is being performed.	O	O	O
38	Drive Enable	Closed: Multi-function input closes (H1-☐☐ = 6A)	O	O	O
39	Watt Hour Pulse Output	Output units are determined by H2-06, outputs 200 ms pulse for each incremented kWh count.	O	O	O
3C	Drive Mode	Closed: Local Open: Remote(this signal combines setting values 9 and A).	O	O	O
3D	Speed Search	Closed: Speed search is being executed.	O	O	O
3E	PID Feedback Loss	Closed: PID Feedback Loss. PID feedback value is below the level set to b5-13 for longer than the time set in b5-14.	O	O	O
3F	PID Feedback Fault	Closed: PID Feedback Fault.PID feedback value exceeds the level set to b5-36 for longer than the time set to b5-37.	O	O	O
4A	KEB Operation	Closed: KEB is being performed.	O	O	O
4B	Short-Circuit Brake	Closed: Short-Circuit Braking is active.	–	–	O
4C	During Fast-stop	Closed: Fast-stop command is entered	O	O	O
4D	OH Pre-alarm Time Limit	Closed: OH Pre-alarm time limit is passed.	O	O	O
100 to 14D	H2 Parameter Functions Reversed Output Switching of 0 to 92	Reverse the output switching of the multi-function output functions. Set the last two digits of 1☐☐ to reverse the output signal of that specific function.Examples: Setting “108” reverses the output of “During baseblock,” which is setting value 08. Setting “14A” reverses the output of “During KEB operation”, which is setting “4A”.	O	O	O

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
H3: Analog Inputs Use H3 parameters to set the multi-function analog input terminals.								
H3-01	Terminal A1 Signal Level Selection	Sets the input level for terminal A1. 0: 0 to +10 V (lower limit) 1: 0 to +10 V (no lower limit)	0, 1	0	A	A	A	410
H3-02	Terminal A1 Function Selection	Sets the function of terminal A1. When terminal A1 is not used or is used as a through terminal, this parameter must be set to “F”.	0 to 31 *<40>*	0	A	A	A	434
H3-03 *<22>*	Terminal A1 Gain Setting	Sets the level of the input value selected in H3-02 when 10V is input at terminal A1.	-999.9 to 999.9	100.0%	A	A	A	411
H3-04 *<22>*	Terminal A1 Bias Setting	Sets the level of the input value selected in H3-02 when 0V is input at terminal A1.	-999.9 to 999.9	0.0 %	A	A	A	412
H3-09	Terminal A2 Signal Level Selection	Sets the input signal level for terminal A2. 0: 0 to +10 V (with lower limit) 1: 0 to +10 V (no lower limit) 2: 4 to 20 mA 3: 0 to 20 mA	0 to 3	2	A	A	A	417
			Switch between current or voltage inputs by using DIP switch S1-2 switch on the terminal board..					
H3-10	Terminal A2 Function Selection	Sets the function of terminal A2. When terminal A2 is not used or is used as a through terminal, this parameter must be set to “F”.	0 to 31 *<40>*	0	A	A	A	418
H3-11 *<22>*	Terminal A2 Gain Setting	Sets the level of the input value selected in H3-10 when 10 V (20 mA) is input at terminal A2.	-999.9 to 1000.0	100.0%	A	A	A	419
H3-12 *<22>*	Terminal A2 Input Bias	Sets the level of the input value selected in H3-10 when 0 V (0 or 4 mA) is input at terminal A2.	-999.9 to 999.-	0.0 %	A	A	A	41A
H3-13	Analog Input Filter Time Constant	Sets the primary delay filter time constant for terminals A1 and A2. Used for noise filtering.	0.00 to 2.00	0.03 s	A	A	A	41B

<22> Parameter can be changed during run.
<40> The availability of certain parameters depends on the control method used.

H3 Multi-Function Analog Input Settings					
H3-□□ Setting	Function	Maximum Input Level Possible	Control Mode		
			V/f	OLV	PM
0	Frequency Bias	Max output frequency (E1-04).Same value can be set using H3-02 and H3-10.	O	O	O
1	Frequency Gain	Frequency reference (voltage)	O	O	O

H3 Multi-Function Analog Input Settings					
H3-□□ Setting	**Function**	**Maximum Input Level Possible**	**Control Mode**		
			V/f	**OLV**	**PM**
2	Auxiliary Frequency Reference (used as a multi step speed 2)	Max output frequency (E1-04)	O	O	O
4	Output Voltage Bias	Motor rated voltage (E1-05).	O	–	–
7	Overtorque/Undertorque Detection Level	Open Loop Vector: Motor rated torque V/f control: Drive rated current	O	O	O
B	PID Feedback	10V = 100%	O	O	O
C	PID Set Point	10V = 100%	O	O	O
E	Motor Temperature (PTC input)	10 V = 100.00% Determined by L1-03 and L1-04.	O	O	O
F	Not used / Pass-through mode	–	O	O	O
10	FWD Torque Limit	Motor rated torque	–	O	–
11	REV Torque Limit	Motor rated torque	–	O	–
12	Regenerative Torque Limit	Motor rated torque	–	O	–
15	FWD/REV Torque Limit	Motor rated torque	–	O	–
16	Differential PID Feedback	10 V = 100%	O	O	O

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
H4: Multi-Function Analog Outputs Use H4 parameters to configure the multi-function analog output terminals.								
H4-01	Multi-Function Analog Output Terminal AM)	Selects the data to be output through multi-function analog output terminal AM. Set the desired monitor parameter to the digits available in U□-□□. For example, enter “103” for U1-03. When using this terminal in trough mode or when not using it at all, set “000” or “031”.	000 to 999 <40>	102	A	A	A	41D
H4-02 <22>	Multi-Function Analog Output Terminal AM Gain	Sets terminal AM output level when selected monitor is at 100%. Maximum output voltage is 10 V.	-999.9 to 999.9	100.0%	S	S	S	41E
H4-03 <22>	Multi-Function Analog Output Terminal AM Gain	Sets terminal AM output level when selected monitor is at 0%.	-999.9 to 999.9	0.0 %	A	A	A	41F
H5: MEMOBUS/Modbus Communications **Use** H5 Parameters to connect the drive to a MEMOBUS/Modbus network.								

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
H5-01 <39>	Drive Node Address	Selects drive station node number (address) for MEMOBUS/Modbus terminals R+, R-, S+, S-. Cycle power for the setting to take effect.	0 to 20 H	1F	A	A	A	425
H5-02	Communication Speed Selection	Selects the baud rate for MEMOBUS/Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: 1200 bps 1: 2400 bps 2: 4800 bps 3: 9600 bps 4: 19200 bps 5: 38400 bps 6: 57600 bps 7: 76800 bps 8: 115200 bps	0 to 8	3	A	A	A	426
H5-03	Communication Parity Selection	Selects the communication parity for MEMOBUS/ Modbus terminals R+, R-, S+ and S-. Cycle power for the setting to take effect. 0: No parity 1: Even parity 2: Odd parity	0 to 2	0	A	A	A	427
H5-04	Stopping Method After Communication Error	Selects the stopping method when a communication time-out fault (CE) is detected. 0: Ramp to stop 1: Coast to stop 2: Fast-stop 3: Alarm only	0 to 3	3	A	A	A	428
H5-05	Communication Fault Detection Selection	Enables or disables the communications time-out fault (CE) detection. 0: Disabled 1: Enabled - If communication is lost for more than two seconds, a CE fault will occur.	0,1	1	A	A	A	429
H5-06	Drive Transmit Wait Time	Set the wait time between receiving and sending data.	5 to 65	5 ms	A	A	A	42A
H5-07	RTS Control Selection	Selects "request to send" (RTS) control: 0: Disabled - RTS is always on. 1: Enabled - RTS turns on only when sending.	0,1	1	A	A	A	42B
H5-09	CE Detection Time	Sets the time required to detect a communications error. Adjustment may be need when networking several drives.	0.0 to 10.0 s	2.0 s	A	A	A	435

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
H5-10	Unit Selection for MEMOBUS/Modbus Register 0025H	Selects the units used for MEMOBUS/Modbus register 0025H (Output Voltage Reference Monitor). 0: 0.1 V units 1: 1 V units	0, 1	0	A	A	A	436
H5-11	Communications ENTER Function Selection	Select the function for the enter command that saves parameter data to the drive. 0: Parameter changes are activated when ENTER command is entered. 1: Parameter changes are activated immediately without ENTER command (compatible with Varispeed VS606-V7).	0, 1	1	A	A	A	43C
H5-12	Run Command Method Selection	0: FWD/STOP, REV/STOP Method 1: RUN/STOP, FWD/REV Method	0, 1	0	A	A	A	43D
H6: Pulse Train Input/Output Use H6 parameters to configure Pulse Train I/O operation.								
H6-01	Pulse Train Input Terminal RP Function Selection	Selects pulse train input function. 0: Frequency reference 1: PID feedback value 2: PID setpoint value 3: Simple PG V/f control mode (can be set only when using motor 1 in the V/f control mode)	0 to 3	0	A	A	A	42C
H6-02 <22>	Pulse Train Input Scaling	Sets the number of pulses (Hz) that is equal to 100% of the value selected in H6-01.	1000 to 32000	1440 Hz	A	A	A	42D
H6-03 <22>	Pulse Train Input Gain	Sets the level of the value selected in H6-01 when a frequency with the value set in H6-02 is input.	0.0 to 1000.0	100.0%	A	A	A	42E
H6-04 <22>	Pulse Train Input Bias	Sets the level of the value selected in H6-01 when 0 Hz is input.	-100.0 to +100.0	0.0 %	A	A	A	42F
H6-05 <22>	Pulse Train Input Filter Time	Sets the pulse train input filter time constant.	0.00 to 2.00	0.10 s	A	A	A	430
H6-06 <22>	Pulse Train Monitor Terminal MP Selection	Select the pulse train monitor output function (value of the □-□□ part of U□-□□). Refer to ***U: Monitors on page 350*** for the list of U monitors. Example: To select U5-01, set “501.” When not using this parameter or when using in the through mode, set “000”.	000, 031, 101, 102, 105, 116, 501, 502	102	A	A	A	431

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
H6-07 <22>	Pulse Train Monitor Scaling	Sets the pulse output frequency in Hz when the monitor value is 100%. Set H6-06 to “2” and H6-07 to “0”, to make the pulse train monitor output equal to the output frequency.	0 to 32000	1440 Hz	A	A	A	432

<22> Parameter can be changed during run.
<39> If this parameter is set to 0, the drive will be unable to respond to MEMOBUS/Modbus commands.
<40> The availability of certain functions depends on the control method used.

Note: Cycle power to the drive to enable MEMOBUS/Modbus settings.

◆ L: Protection Function

L parameters provide protection to the drive and motor, such as: control during momentary power loss, stall prevention, frequency detection, fault restarts, overtorque detection, torque limits and other types of hardware protection.

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
L1: Motor Protection Functions Use L1 parameters to configure motor protective functions.								
L1-01	Motor Overload Protection Selection	Sets the motor thermal overload protection (OL1) based on the cooling capacity of the motor. 0: Disabled 1: Standard Fan Cooled (< 10:1 motor) 2: Standard Blower Cooled (≥ 10:1 motor) 3: Vector Motor (100:1 motor) 4: PM motor with variable torque**NOTICE:** The thermal protection is reset when the power is cycled. In applications where the power is frequently cycled, the drive may not be able to provide protection, even if this parameter is set to 1. Set to “0” and ensure each motor has a thermal relay installed.	0 to 4	1 <2>	S	S	S	480
L1-02	Motor Overload Protection Time	Sets the motor thermal overload protection (OL1) time. A larger L1-02 time will increase the time for an OL1 fault to occur. This parameter does not typically require adjustment. Should be set in accordance with the overload tolerance of the motor.	0.1 to 5.0	1.0 min	A	A	A	481

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
L1-03	Motor Overheat Alarm Operation Selection (PTC input)	Sets operation when the motor temperature analog input (H3-02/10 = E) exceeds the OH3 alarm level. 0: Ramp to Stop 1: Coast to Stop 2: Fast-stop using C1-09 3: Alarm Only (“oH3” will flash)	0 to 3	3	A	A	A	482
L1-04	Motor Overheat Fault Operation Selection (PTC input)	Sets stopping method when the motor temperature analog input (H3-02/10 = E) exceeds the OH4 fault level. 0: Ramp to Stop 1: Coast to Stop 2: Fast-stop	0 to 2	1	A	A	A	483
L1-05	Motor Temperature Input Filter Time (PTC input)	This parameter adjusts the filter on the motor temperature analog input (H3-02 or H3-10 = E). Increase to add stability, decrease to improve response.	0.00 to 10.00	0.20 s	A	A	A	484
L1-13	Continuous Electrothermal Operation Selection	Determines whether or not to hold the electrothermal value when the power supply is interrupted. 0: Disabled 1: Enabled	0 to 1	1	A	A	A	46D
L2: Momentary Power Loss Use L2 parameters to configure drive functions for momentary power loss conditions.								
L2-01	Momentary Power Loss Operation Selection	Enables and disables the momentary power loss function. 0: Disabled - Drive trips on (UV1) fault when power is lost. 1: Power Loss Ride-Thru Time - Drive will restart if power returns within the time set in L2-02. 2: CPU Power Active - Drive will restart if power returns as long as the CPU is working.	0 to 2	0	A	A	A	485
			For a restart to occur, the run command must be maintained throughout the ride-thru period.					
L2-02	Momentary Power Loss Ride-Thru Time	Sets the Power Loss Ride-Thru time. Only effective when L2-01 = 1.	0.0 to 25.5	<12>	A	A	A	486
L2-03	Momentary Power Loss Minimum Baseblock Time	Sets the minimum wait time for residual motor voltage decay before the drive output reenergizes after power loss ride-thru. If L2-03 is greater than L2-02, operation resumes after the time set in L2-03.	0.1 to 5.0	<57>	A	A	A	487
L2-04	Momentary Power Loss Voltage Recovery Ramp Time	Sets the time for the output voltage to return to the preset V/f pattern during speed search.	0.0 to 5.0	<12>	A	A	A	488

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
L2-05 <24>	Undervoltage Detection Level (UV)	Sets the DC Bus undervoltage trip level. If this is set lower than the default setting, additional AC input impedance or DC bus reactance may be necessary. Consult with the manufacturer before changing this parameter setting. This value is used for KEB activation if L2-01 > 0.	150 to 210	<9> <12>	A	A	A	489
L2-06	KEB Deceleration Time	Sets the time required to decelerate from the speed when KEB was activated to zero speed.	0.0 to 200.0	0.0 s	A	A	A	48A
L2-07	KEB Acceleration Time	Set the time to accelerate to the set speed after recovery from a momentary power loss. If set to 0.0, the active acceleration time is used.	0.0 to 25.5	0.0 s	A	A	A	48B
L2-08	KEB Start Output Frequency Reduction	Sets the percentage of output frequency reduction at the beginning of deceleration when a KEB command is input from multi-function input. Reduction = (slip frequency before KEB) x L2-08 x 2	0 to 300	100 %	A	A	A	48C
L2-11 <24>	Desired DC Bus Voltage during KEB	Sets the desired value of the DC bus voltage during KEB.	150 to 400 V	E1-01 1.22	A	A	A	461
L3: Stall Prevention Function Use L3 parameters to configure the stall prevention function.								
L3-01	Stall Prevention Selection during Acceleration	Selects the stall prevention method used to prevent excessive current during acceleration. 0: Disabled - Motor accelerates at active acceleration rate. The motor may stall if load is too heavy or accel time is too short. 1: General Purpose - When output current exceeds L3-02 level, acceleration stops. Acceleration will continue when the output current level falls below the L3-02 level. 2: Intelligent - The active acceleration rate is ignored. Acceleration is completed in the shortest amount of time without exceeding the current value set in L3-02.	0 to 2 <29>	1	A	A	A	48F
L3-02	Stall Prevention Level during Acceleration	Used when L3-01 = 1 or 2. 100% is equal to the drive rated current. Decrease the set value if stalling or excessive current occurs with default setting.	0 to 150	<7>	A	A	A	490
L3-03	Stall Prevention Limit during Acceleration	Sets stall prevention lower limit during acceleration when operating in the constant power range. Set as a percentage of the drive's rated current.	0 to 100	50%	A	A	A	491

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
L3-04	Stall Prevention Selection during Deceleration	When using a braking resistor, use setting "0". Setting "3" is used in specific applications. 0: Disabled - The drive decelerates at the active deceleration rate. If the load is too large or the deceleration time is too short, an OV fault may occur. 1: General Purpose - The drive decelerates at the active deceleration rate, but if the main circuit DC bus voltage reaches the stall prevention level (380/ 760 VDC), deceleration will stop. Deceleration will continue once the DC bus level drops below the stall prevention level. 2: Intelligent - The active deceleration rate is ignored and the drive decelerates as fast as possible without hitting OV fault level. Range: C1-02 / 10. 3: Stall Prevention with Braking Resistor - Stall prevention during deceleration is enabled in coordination with dynamic braking. 4: Overexcitation Deceleration - Decelerates with the flux level determined by n3-13 (Overexcitation Gain).	0 to 4 <50>	1	S	S	S	492
L3-05	Stall Prevention Selection during Run	Selects the stall prevention method to use to prevent drive faults during run. 0: Disabled - Drive runs a set frequency. A heavy load may cause the drive to trip on an OC or OL fault. 1: Decel Time 1 - The drive will decelerate at Decel Time 1 (C1-02) if the output current exceeds the level set by L3-06. Once the current level drops below the L3-06 level, the drive will accelerate back to its frequency reference at the active acceleration rate. 2: Decel Time 2 - Same as setting 1 except the drive decelerates at Decel Time 2 (C1-04). When output frequency is 6 Hz or less, stall prevention during run is disabled regardless of the setting in L3-05.	0 to 2	1	A	–	A	493
L3-06	Stall Prevention Level during Run	Enabled when L3-05 is set to "1" or "2". 100% is equal to the drive rated current.Decrease the set value if stalling or excessive current occurs with the default settings.	30 to 200	<7>	A	–	A	494

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
L3-11	OV Suppression Function Selection	Enables or disables OV suppression function, which allows the drive to change the output frequency as the load changes, thus preventing an OV fault. 0: Disabled 1: Enabled **Note:** The frequency reference and motor speed diverge as the regenerative energy begins to flow back into the DC bus and triggers the OV suppression function. Disable this function when using a braking resistor.	0, 1	0	A	A	-	4C7
L3-17 <24>	Overvoltage Suppression and Stall Prevention Desired DC Bus Voltage	Sets the desired value for the DC bus voltage during overvoltage suppression and stall prevention during deceleration. Enabled only when L3-04 = 2.	150 to 400 V	370 V <9>	A	A	A	462
L3-20	Main Power Circuit Voltage Adjustment Gain	Sets the proportional gain used by KEB, Stall prevention and overvoltage suppression. If OV or UV1 occurs at the beginning of KEB deceleration, slowly increase this setting by 0.1.	0.00 to 5.00	1.00	A	A	A	465
L3-21	Accel/Decel Rate Calculation Gain	Sets the proportional gain used to calculate the deceleration rate during KEB, OV suppression function and stall prevention during deceleration (L3-04 = 2). This parameter does not typically require adjustment. Increase the value in steps of 1.0 if overcurrent and overvoltage occur.	0.00 to 200.00	1.00	A	A	A	466
L3-22	Deceleration Time at Stall Prevention during Acceleration	Sets the deceleration time used for stall prevention during acceleration in Open Loop Vector control for PM motors. When set to 0, the drive decelerates at the normal deceleration time.	0.0 to 6000.0	0.0 s	–	–	A	4F9
L3-23	Automatic Reduction Selection for Stall Prevention during Run	0: Sets the stall prevention level throughout the entire frequency range to the value in parameter L3-06. 1: Automatically lowers the stall prevention level in the constant output range. The lower limit value is 40% of L3-06.	0, 1	0	A	A	A	4FD
L3-24	Motor Acceleration Time for Inertia Calculations	Sets the time needed to accelerate the uncoupled motor at rated torque from stop to the maximum frequency. Setting the drive capacity to parameter o2-04 or changing E2-11 will automatically set this parameter for a 4-pole motor.	0.001 to 10.000	<57>	A	A	A	46E

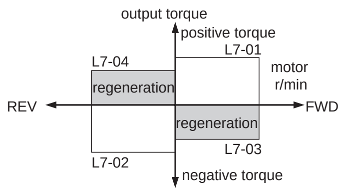
No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
L3-25	Load Inertia Ratio	Sets the ratio between the motor and machine inertia.	0.0 to 1000.0	1.0	A	A	A	46F
L4: Frequency Detection Use L4 parameters to configure frequency detection operation.								
L4-01	Speed Agreement Detection Level	These parameters configure the multi-function output (H2-☐☐ = 2, 3, 4, 5) settings "Fref/Fout Agree 1", "Fref/Set Agree 1", "Frequency Detection 1," and "Frequency detection 2". Parameter L4-01 sets the level while parameter L4-02 sets the hysteresis for the Speed Detection Output Function.	0.0 to 400.0	0.0 Hz	A	A	A	499
L4-02	Speed Agreement Detection Width		0.0 to 20.0	2.0 Hz	A	A	A	49A
L4-03	Speed Agreement Detection Level (+/-)	These parameters configure the Multi-Function Output (H2-☐☐ = 13, 14, 15, 16) settings "Fref/Fout Agree 2", "Fref/Set Agree 2", "Frequency Detection 3," or "Frequency Detection 4". Parameter L4-03 sets the level while parameter L4-04 sets the hysteresis for the Speed Detection Output Function.	-400.0 to +400.0	0.0 Hz	A	A	A	49B
L4-04	Speed Agreement Detection Width (+/-)		0.0 to 20.0	2.0 Hz	A	A	A	49C
L4-05	Frequency Reference Loss Detection Selection	Sets operation when the frequency reference is lost (reference drops 90% or more of within 400 ms). 0: Stop - Drive will stop. 1: Run at L4-06 PrevRef - Drive will run at the percentage set in L4-06 of the frequency reference before loss.	0,1	0	A	A	A	49D
L4-06	Frequency Reference at Reference Loss	Sets the frequency reference when a reference loss was detected and L4-05 = 1. Reference will be: Fref = Fref at time of loss L4-06.	0.0 to 100.0	80.0 %	A	A	A	4C2
L4-07	Frequency Detection Conditions	0: No detection during baseblock. 1: Detection always enabled.	0 to 1	0	A	A	A	470H
L5: Fault Reset Use L5 parameters to configure Automatic Restart after fault.								
L5-01	Number of Auto Restart Attempts	Sets the counter for the number of times the drive attempts to restart when the following faults occur: GF, LF, OC, OV, PF, PUF, RH, RR, OL1, OL2, OL3, OL4, UV1. If the drive faults after an auto restart attempt, the counter is incremented. When the drive operates without fault for 10 minutes, the counter will be reset.	0 to 10	0	A	A	A	49E

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
L5-02	Auto Restart Operation Selection	Sets fault contact activation during automatic restart attempts. 0: Fault output (H2-oo = E) not active. 1: Fault output (H2-oo = E) active during restart attempt.	0,1	0	A	A	A	49F
L5-04	Fault Reset Interval Time	Sets the amount of time to wait between performing fault restarts. Enabled when L5-05 is set to 1.	0.5 to 600.0 s	10.0 s	A	A	A	46C
L5-05	Fault Reset Operation Selection	Selects the method of incrementing the restart counter. 0: Continuously attempt to restart and increment counter after successful restart (like Varispeed VS616-F7/G7) 1: Attempt to restart with the interval time set in L5-04. Every trial increments the counter. (like Varispeed VS606-V7)	0 to 1	0	A	A	A	467

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
L6: Overtorque Detection Use L6 parameters to configure overtorque detection.								
L6-01	Torque Detection Selection 1	Selects the overtorque/undertorque operation. overtorque and undertorque are determined by the settings in parameters L6-02 and L6-03. The multi-function output settings (H2-☐☐ = B and 17) are also active if programmed. 0: Disabled 1: OL3 at Speed Agree - Alarm (overtorque detection only active during Speed Agree and operation continues after detection). 2: OL3 at RUN - Alarm (overtorque detection is always active and operation continues after detection). 3: OL3 at Speed Agree - Fault (overtorque detection only active during Speed Agree and drive output will shut down on an OL3 fault). 4: OL3 at RUN - Fault (overtorque detection is always active and drive output will shut down on an OL3 fault). 5: UL3 at Speed Agree - Alarm (undertorque detection is only active during Speed Agree and operation continues after detection). 6: UL3 at RUN - Alarm (undertorque detection is always active and operation continues after detection). 7: UL3 at Speed Agree - Fault (undertorque detection only active during Speed Agree and drive output will shut down on an OL3 fault). 8: UL3 at RUN - Fault (undertorque detection is always active and drive output will shut down on an OL3 fault).	0 to 8	0	A	A	A	4A1
L6-02	Torque Detection Level 1	Sets the overtorque/undertorque detection level. 100% is equal to the motor rated current in V/f control and the motor rated torque in Open Loop Vector control.	0 to 300	150 %	A	A	A	4A2
L6-03	Torque Detection Time 1	Sets the length of time an overtorque/undertorque condition must exist before Torque Detection 1 is triggered.	0.0 to 10.0	0.1 s	A	A	A	4A3

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
L6-04	Torque Detection Selection 2	Sets the response to an overtorque/undertorque condition. overtorque and undertorque are determined by the settings in parameters L6-05 and L6-06. The multi-function output settings (H2-☐☐ = 18 and 19). 0: Disabled 1: OL4 at Speed Agree - Alarm (overtorque Detection only active during Speed Agree and Operation continues after detection). 2: OL4 at RUN - Alarm (overtorque Detection is always active and operation continues after detection). 3: OL4 at Speed Agree - Fault (overtorque Detection only active during Speed Agree and drive output will shut down on an OL4 fault). 4: OL4 at RUN - Fault (overtorque Detection is always active and drive output will shut down on an OL4 fault). 5: UL4 at Speed Agree - Alarm (undertorque Detection is only active during Speed Agree and operation continues after detection). 6: UL4 at RUN - Alarm (undertorque Detection is always active and operation continues after detection). 7: UL4 at Speed Agree - Fault (undertorque Detection only active during Speed Agree and drive output will shut down on an OL4 fault). 8: UL4 at RUN - Fault (undertorque Detection is always active and drive output will shut down on an OL4 fault).	0 to 8	0	A	A	A	4A4
L6-05	Torque Detection Level 2	Sets the overtorque/undertorque detection level. 100% is equal to the motor rated current in V/f control and the motor rated torque in Open Loop Vector control.	0 to 300	150 %	A	A	A	4A5
L6-06	Torque Detection Time 2	Sets the length of time an overtorque/undertorque condition must exist before torque detection 2 is recognized by the drive.	0.0 to 10.0	0.1 s	A	A	A	4A6

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
L6-08	Mechanical Weakening (OL5) Detection Operation	This function can detect an over/undertorque in a certain speed range as a result of machine fatigue. It is triggered by a certain operation time and uses the OL1 detection settings (L6-01 to L6-03) 0: Mechanical Weakening Detection disabled. 1: Continue running if the speed (signed) is greater than L6-09 (alarm only). 2: Continue running if the speed (not signed) is greater than L6-09 (alarm only). 3: Interrupt drive output when the motor speed (signed) is greater than L6-09 (protection operation). 4: Interrupt drive output when the motor speed (not signed) is greater than L6-09 (protection operation). 5: Continue running if the speed (signed) is less than L6-09 (alarm only). 6: Continue running if the speed (not signed) is less than L6-09 (alarm only). 7: Interrupt drive output when the motor speed (signed) is less than L6-09 (protection operation). 8: Interrupt drive output when the motor speed (not signed) is less than L6-09 (protection operation).	0 to 8	0	A	A	A	468
L6-09	Mechanical Weakening Detection Speed Level	• Sets the speed that triggers mechanical weakening detection. • When L6-08 is set for an unsigned value, the absolute value is used even if the setting is negative.	-110.0 to +110.0 %	110 %	A	A	A	469
L6-10	Mechanical Weakening Detection Time	Sets the time a mechanical weakening has to be detected before an Alarm/Fault is triggered.	0.0 to 10.0 s	0.1 s	A	A	A	46A
L6-11	Mechanical Weakening Detection Start Time	Sets the operation time (U1-04) that has to be passed before Mechanical weakening detection is active.	0 to 65535	0	A	A	A	46B

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
L7: Torque Limit Use L7 parameters to configure the torque limit function.								
L7-01	Forward Torque Limit	Sets the torque limit value as a percentage of the motor rated torque. Four individual quadrants can be set.  	0 to 300	200 %	–	A	–	4A7
L7-02	Reverse Torque Limit		0 to 300	200 %	–	A	–	4A8
L7-03	Forward Regenerative Torque Limit		0 to 300	200 %	–	A	–	4A9
L7-04	Reverse Regenerative Torque Limit		0 to 300	200 %	–	A	–	4AA
L7-06	Torque Limit Integral Time Constant	Sets the integral time constant for the torque limit.	5 to 10000	200 ms	–	A	–	4AC
L7-07	Torque Limit Control Method Selection during Accel/Decel	Selects the method of torque limit control during accel/decel. 0: Proportional Control (change to integral controls at fixed speeds). Use this setting when acceleration to the desired speed has priority over torque limitation. 1: Integral Control. Use this setting if the torque limitation has priority. When torque limit is applied to the motor, accel/decel time may increase and motor speed may not meet the speed reference.	0, 1	0	–	A	–	4C9
L8: Hardware Protection Use L8 parameters to configure hardware protection functions.								
L8-01	Internal Dynamic Braking Resistor Protection Selection (ERF type)	Selects the Braking resistor when using a 3% duty cycle heatsink mounted Yaskawa braking resistor. This parameter does not enable or disable the braking transistor of the drive. 0: Resistor overheat protection disabled 1: Resistor overheat protection enabled	0,1	0	A	A	A	4AD
L8-02	Overheat Alarm Level	When the heatsink temperature exceeds the value set in this parameter, an Overheat Alarm (OH) will occur.	50 to 130	<12>	A	A	A	4AE

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
L8-03	Overheat Pre-Alarm Operation Selection	Sets the drive operation when an overheat alarm OH is detected. 0: Ramp to Stop using the active decel time. 1: Coast to Stop. 2: Fast-stop using the time set in C1-09. 3: Alarm Only. Drive continues running, but displays an alarm. 4: Reduced Speed Operation. Drive continues to run with reduced frequency reference as specified in L8-19. Settings 0 through 2 trigger a fault relay if the heatsink becomes too hot.	0 to 4	3	A	A	A	4AF
L8-05	Input Phase Loss Protection Selection	Selects the detection of input current phase loss, power supply voltage imbalance, or main circuit electrolytic capacitor deterioration. 0: Disabled 1: Enabled	0,1	1 <56>	A	A	A	4B1
L8-07	Output Phase Loss Protection	Selects the output phase loss detection. 0: Disabled 1: Enabled (triggered by a single phase loss). 2: Enabled (triggered when two phases are lost).Output phase loss is detected when operating with less than 5% of the drive rated current. Detection can mistakenly occur if the motor is too small relative to the drive capacity rating (this parameter should be disabled in such cases).	0 to 2	0	A	A	A	4B3
L8-09	Output Ground Fault Detection Selection	Selects the output ground fault detection. 0: Disabled 1: Enabled	0,1	<12>	A	A	A	4B5
L8-10	Heatsink Cooling Fan Operation Selection	Controls the heatsink cooling fan operation. 0: Fan On-Run Mode - Fan will operate only when the drive is running and for L8-11 seconds after stop. 1: Fan always on - Cooling fan operates whenever the drive is powered up.	0,1	0	A	A	A	4B6
L8-11	Heatsink Cooling Fan Operation Delay Time	This parameter sets the delay time for the cooling fan to shut off after the run command is removed when L8-10 = 0.	0 to 300	60 s	A	A	A	4B7
L8-12	Ambient Temperature Setting	Used to input the ambient temperature. This value adjusts the drives OL2 detection level.	-10 to 50	40 °C	A	A	A	4B8

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
L8-15	OL2 Characteristics Selection at Low Speeds	Sets the OL2 characteristics at output frequencies below 6 Hz. 0: No OL2 level reduction below 6Hz. 1: OL2 level is reduced linearly below 6 Hz. It is halved at 0 Hz.	0,1	1	A	A	A	4BB
L8-18	Soft CLA Selection	Selects the software current limit function. Typically no adjustment is required. 0: Disabled 1: Enabled	0,1	1	A	A	–	4BE
L8-19	Frequency Reduction Rate during OH Pre-Alarm	Specifies the frequency reference reduction gain at overheat prealarm when L8-03 = 4.	0.1 to 1.0	0.8	A	A	A	4BF
L8-29	Current Unbalance Detection (LF2)	Selects the detection of unbalanced output currents caused by faulty devices in the output circuit. 0: Disabled 1: Enabled	0 to 1	1	–	–	A	4DF
L8-35	Side-by-Side Selection	Selects the installation type: 0: Standard installation of Open Chassis drive 1: Side-by-Side installation with top cover removed 2: Standard Installation of NEMA Type 1 drive	0 to 2	<12> <25>	A	A	A	4ECH
L8-38	Carrier Frequency Reduction	Provides protection to the IGBTs by reducing the carrier frequency at low speeds. 0: Disabled 1: Enabled below 6Hz 2: Enabled for the whole speed range	0 to 2	0	A	A	A	4EF
L8-40	Carrier Frequency Reduction Time	Sets the time for that the drive continues running with reduced carrier frequency after the carrier reduction condition has gone (see also L8-38). A setting of 0.00 s disables the carrier frequency reduction time.	0.00 to 2.00	0.50	A	A	A	4F1
L8-41	Current Alarm Selection	Configures an alarm when the output current exceeds 150% of the drive rated current. 0: Alarm disabled. 1: Alarm enabled (alsarm is output).	0,1	0	A	A	A	4F2

<1> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 2-OLV control.
<2> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 0-V/f Control.
<7> Default setting value is 120% when C6-01 is set to 1 (ND) and 150% when C6-01 is set to 0 (HD).
<9> Default setting value is dependent on parameter E1-01, Input Voltage Setting.
<12> Default setting value is dependent on parameter o2-04, Drive/kVA Selection.
<14> Default setting value is dependent on parameter o2-09, Initialization Spec. Selection.

<15> Default setting value is dependent on parameter A1-02, Control Method Selection. The value shown is for A1-02 = 5-PM OLV Control.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<25> Parameter setting value is not reset to the default value during drive initializaion, A1-03 = 1110, 2220, 3330.
<29> Setting value 2 is not available A1-02 = 5-PM OLV Control. When enabled, the drive stops accelerating when it exceeds the value of L3-02, Stall Prevention Level. The drive decelerates after 100 ms and begins accelerating again after restoring the current level.
<31> Use caution when working with regenerative loads as motor speed can exceed the frequency reference during overvoltage suppression function operation. Set to "Disable" when motor speed needs to accurately match the frequency reference, and also when using a braking resistor. An OV fault may still occur even when this function is enabled if there is a sudden increase in the regenerative load.
<50> The setting range depends on the control mode set in A1-02. For PM OLV Control the setting range is 0 to 2.
<51> Parameter value is changed if E2-11 is manually changed or changed by Auto-Tuning.
<56> The default value is 0 for all 200 V Single-Phase drives.
<57> Default setting value is dependent on parameter o2-04, Drive/kVA Selection and C6-01, Drive Duty Selection.

◆ n: Advanced Performance Set-Up

The n parameters are used to adjust more advanced performance characteristics such as hunting prevention, speed feedback detection, high-slip braking and R1 online tuning.

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
n1: Hunting Prevention Use n1 parameters to configure hunting prevention operation.								
n1-01	Hunting Prevention Selection	If the motor vibrates while lightly loaded, Hunting Prevention may reduce the vibration. 0: Disabled 1: Enabled When quick response is needed disable Hunting Prevention.	0,1	1	A	–	–	580
n1-02	Hunting Prevention Gain Setting	Sets the gain for the Hunting Prevention Function. If the motor vibrates while lightly loaded and n1-01 = 1, increase the gain by 0.1 until vibration ceases. If the motor stalls while n1-01 = 1, decrease the gain by 0.1 until the stalling ceases.	0.00 to 2.50	1.00	A	–	–	581
n1-03	Hunting Prevention Time Constant	Sets the time constant used for hunting prevention.	0 to 500	<12>	A	–	–	582
n1-05	Hunting Prevention Gain while in Reverse	Sets the gain used for Hunting Prevention. When set to 0, the gain n1-02 is used for operation in reverse direction.	0.00 to 2.50	0.00	A	–	–	530

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
n2: Speed Feedback Detection Control Function Use n2 parameters to configure the Speed Feedback Detection Control function operation.								
n2-01	Speed Feedback Detection Control (AFR) Gain	Sets the internal speed feedback detection control gain in the automatic frequency regulator (AFR). This parameter does not typically require adjustment. Adjust this parameter as follows: If hunting occurs, increase the set value. If response is low, decrease the set value.	0.00 to 10.00	1.00	–	A	–	584
			Adjust the setting by 0.05 units at a time, while checking the response.					
n2-02	Speed Feedback Detection Control (AFR) Time Constant	Sets the AFR time constant 1.	0 to 2000	50 ms	–	A	–	585
n2-03	Speed Feedback Detection Control (AFR) Time Constant 2	Sets the AFR time constant 2. Increase the setting if overvoltage occurs during sudden load changes or the speed overshoots during fast acceleration.	0 to 2000	750 ms	–	A	–	586
n3: High-Slip Braking Use n3 parameters to configure the high-slip braking function.								
n3-01	High-Slip Braking Deceleration Frequency Width	Sets the output frequency reduction step width when the drive stops the motor using high-slip braking (HSB). If Overvoltage (OV) faults occur during HSB, this parameter may need to be increased.	1 to 20	5%	A	–	–	588
n3-02	High-Slip Braking Current Limit	Sets the current limit during HSB. Higher n3-02 settings will shorten motor stopping times but increase the motor current, and therefore motor heating.	100 to 200	150 %	A	–	–	589
n3-03	High-Slip Braking Dwell Time at Stop	Sets the time the drive will run with minimum frequency (E1-09) at the end of deceleration. If this time is set too low, the machine inertia can cause the motor to rotate slightly after HSB completion.	0.0 to 10.0	1.0 s	A	–	–	58A
n3-04	High-Slip Braking Overload Time	Sets the time required for an HSB overload fault (OL7) to occur when the drive output frequency does not change during an HSB stop. This parameter does not typically require adjustment.	30 to 1200	40 s	A	–	–	58B
n3-13	Overexcitation Deceleration Gain	Applies a gain to the V/f pattern during deceleration (L3-04=4). Returns to normal values after ramp to stop or at re-acceleration. To improve the braking power of overexcitation, increase the gain by 1.25 to 1.30.	1.00 to 1.40	1.10	A	A	–	531

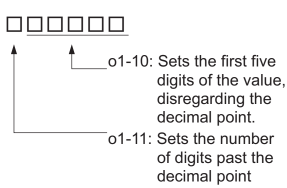
No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
n3-21	High-Slip Suppression Current Level	If overcurrent or overload occur during high-slip deceleration, reduce the high-slip suppression current level. Set as a percentage of the drive rated current.	0 to 150	100 %	A	A	–	579
n3-23	Overexcitation Operation Selection	0: Disabled 1: Enabled only when rotating forward 2: Enabled only when in reverse	0 to 2	0	A	A	–	
n6: Online Tuning of Resistance between Motor Lines Use n6 parameters to adjust the motor line-to-line resistance while the drive is online.								
n6-01	Line-to-Line Motor Resistance Online Tuning	Tunes the line-to-line motor resistance continuously during operation. 0: Disabled 1: Enabled	0,1	1	–	A	–	570
n8: Permanent Magnet (PM) Motor Control Use n8 parameters to control the PM motor control.								
n8-45	Speed Feedback Detection Control Gain	Sets the gain for internal speed feedback detection control. This parameter does not typically require adjustment. Increase this setting if hunting occurs. Decrease to lower the response.	0.0 to 10.0	0.8	–	–	A	538
n8-47	Pull-In Current Compensation Time Constant	Sets the time constant to make the pull-in current and actual current value agree. Decrease the value if the motor begins to oscillate. Increase the value if it takes too long for the current reference to equal the output current.	0.0 to 100.0 s	5.0 s	–	–	A	53A
n8-48	Pull-In Current	Defines the amount of current provided to the motor during no load operation at a constant speed. Set as a percentage of the motor rated current. Increase this setting when hunting occurs while running at a constant speed.	20 to 200%	30%	–	–	A	53B
n8-49	Load Current	Sets the amount of d-axis current when using Energy Saving control.	-200.0 to 0.0%	0%	–	–	A	53C
n8-51	Acceleration Pull-In Current	Sets the pull-in current during acceleration as a percentage of the motor rated current (E5-03). Set to a high value when more starting torque is needed.	0 to 200%	50%	–	–	A	53E

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
n8-54	Voltage Error Compensation Time Constant	Sets the time constant for voltage error compesation. Adjust the value when • hunting occurs at low speed. • hunting occurs with sudden load changes. Increase in steps of 0.1 or disable the compensation by setting n8-45 to 0. • oscillations occur ar start. Increase the value in steps of 0.1.	0.00 to 10.00 s	1.00 s	–	–	A	56D
n8-55	Load Inertia	Sets the ratio between motor and machine inertia. 0: less than 1:10. 1: between 1:10 to 1:30. 2: between 1:30 to 1:50. 3: higher than 1:50.	0 to 3	0	–	–	A	56E
n8-62 <24>	Output Voltage Limit	Sets the limit for the output voltage. Adjustment is normally needed only if the input voltage is below the n8-62 set value. In this case set n8-62 to the input voltage.	0.0 to 230.0	200 Vac	-	-	A	57D

<12> Default setting value is dependent on parameter o2-04, Drive/kVA Selection.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

◆ o: Operator Related Parameters

o parameters are used to set up the LED digital operator displays.

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
o1: Display Settings Use o1 parameters to configure the digital operator display.								
o1-01 <22>	Drive Mode Unit Monitor Selection	Selects which monitor will be displayed in the operation menu upon power-up when o1-02 = 5. The monitor parameter number is entered into the spaces provided: U□-□□. For example, set “403” to display monitor parameter U4-03.	104 to 621 Set to U1-06 as a default (Output Voltage Reference).	106	A	A	A	500
o1-02 <22>	User Monitor Selection After Power Up	Selects the monitor to display upon power-up. 1: Frequency Reference (U1-01) 2: Forward/Reverse 3: Output Frequency (U1-02) 4: Output Current (U1-03) 5: User Monitor (set by o1-01)	1 to 5	1	A	A	A	501
o1-03	Digital Operator Display Selection	Sets the units to display the frequency reference and output frequency. 0: Hz 1: % (100% = E1-04) 2: r/min (enter the number of motor poles into E2-04/E4-04/E5-04) 3: User defined by parameters o1-10 and o1-11	0 to 3	0	A	A	A	502
o1-10	Frequency Reference Setting and User-Set Display	These settings define the display values when o1-03 is set to 3. o1-10 sets display values when operating at the maximum output frequency. o1-11 sets the position of the decimal positions.	1 to 60000	<11>	A	A	A	520
o1-11	Frequency Reference Setting / Decimal Display		0 to 3	<11>	A	A	A	521

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
o2: Operator Keypad Functions Use o2 parameters to configure LED digital operator key functions.								
o2-01	LOCAL/REMOTE Key Function Selection	Enables/Disables the digital operator LOCAL/ REMOTE key. 0: Disabled 1: Enabled	0,1	1	A	A	A	505
o2-02	STOP Key Function Selection	Enables/Disables the operator panel STOP key when the drive is operated form external sources (not operator). 0: Disabled 1: Enabled	0,1	1	A	A	A	506
o2-03	User Parameter Default Value	Allows storing of parameter settings as a User Initialization Selection (value 1110 for A1-03). The value returns to 0 after entering 1 or 2. 0: No Change 1: Set Defaults - Saves current parameter settings as user initialization. 2: Clear All - Clears the currently saved user initialization.	0 to 2	0	A	A	A	507
o2-04	Drive/kVA Selection	Sets the kVA of the drive. This parameter only needs to be set when installing a new control board. Do not change for other reason.	0 to FF	<12>	A	A	A	508
o2-05	Frequency Reference Setting Method Selection	Selects if the ENTER key must be pressed when inputting the frequency reference by the operator keypad. 0: Data/Enter key must be pressed to enter a frequency reference. 1: Data/Enter key is not required. The frequency reference is adjusted by the “up” and “down” arrow keys.	0,1	0	A	A	A	509
o2-06	Operation Selection when Digital Operator is Disconnected	Sets drive action when the digital operator is removed in Local mode or with b1-02 = 0. 0: The drive will continue operation 1: The drive will trigger a fault (OPR) and the motor will coast to stop	0,1	0	A	A	A	50A
o2-07	Motor Direction at Power Up when Using Operator	0: Forward 1: Reverse This parameter requires that drive operation be assigned to the digital operator.	0 to 1	0	A	A	A	527

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
o4: Maintenance Period Use o4 parameters to perform maintenance.								
o4-01	Accumulated Operation Time Setting	Sets the starting value for the cumulative operation time of the drive in units of 10h.	0 to 9999	0	A	A	A	50B
o4-02	Accumulated Operation Time Selection	Sets this parameter to log the cumulative operation time (U4-01). 0: Logs power-on time 1: Logs operation time when the drive output is active (output operation time).	0 to 1	0	A	A	A	50C
o4-03	Cooling Fan Operation Time Setting	Used to resets the Cooling Fan operation time counter U1-04.	0 to 9999	0	A	A	A	50E
o4-05	Capacitor Maintenance Setting	Resets the capacitor maintenance time monitor U4-05.	0 to 150	0%	A	A	A	51D
o4-07	Inrush Prevention Relay Maintenance Setting	Resets the Inrush Prevention Relay Maintenance monitor U4-06.	0 to 150	0%	A	A	A	523
o4-09	IGBT Maintenance Setting	Resets the counter that logs the IGBTs usage time. Refer to U4-07 (IGBT Maintenance).	0 to 150	0%	A	A	A	525
o4-11	U2, U3 Initialize Selection	Selects if U2-oo (Fault Trace) , U3-oo (Fault History) monitors are reset at drive initialization. 0: Saves the fault monitor data 1: Resets the fault monitor data	0 to 1	0	A	A	A	510
o4-12	kWh Monitor Initialize Selection	Selects if U4-10 and U4-11 (kWh monitor) are reset at drive initialization. 0: Saves the U4-10 and U4-11 monitor data. 1: Resets the U4-10 and U4-11 monitor data.	0 to 1	0	A	A	A	512
o4-13	Number of Run Commands Initialize Selection	Selects if the Run command counter (U4-02) is reset at drive initialization. 0: Saves the number of Run commands 1: Resets the number of Run commands	0 to 1	0	A	A	A	528

<9> Default setting value is dependent on parameter E1-01, Input Voltage Setting.
<11> Default setting value is dependent on parameter o1-03, Digital Operator Display Selection.
<12> Default setting value is dependent on parameter o2-04, Drive/kVA Selection.
<22> Parameter can be changed during run.

◆ r: DWEZ Parameters

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
r1-01	DWEZ Connection Parameter 1 (upper)	Parameter 1 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1840
r1-02	DWEZ Connection Parameter 1 (lower)	Parameter 1 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1841
r1-03	DWEZ Connection Parameter 2 (upper)	Parameter 2 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1842
r1-04	DWEZ Connection Parameter 2 (lower)	Parameter 2 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1843
r1-05	DWEZ Connection Parameter 3 (upper)	Parameter 3 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1844
r1-06	DWEZ Connection Parameter 3 (lower)	Parameter 3 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1845
r1-07	DWEZ Connection Parameter 4 (upper)	Parameter 4 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1846
r1-08	DWEZ Connection Parameter 4 (lower)	Parameter 4 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1847
r1-09	DWEZ Connection Parameter 5 (upper)	Parameter 5 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1848
r1-10	DWEZ Connection Parameter 5 (lower)	Parameter 5 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1849
r1-11	DWEZ Connection Parameter 6 (upper)	Parameter 6 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	184A
r1-12	DWEZ Connection Parameter 6 (lower)	Parameter 6 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	184BH
r1-13	DWEZ Connection Parameter 7 (upper)	Parameter 7 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	184C
r1-14	DWEZ Connection Parameter 7 (lower)	Parameter 7 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	184D
r1-15	DWEZ Connection Parameter 8 (upper)	Parameter 8 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	184E
r1-16	DWEZ Connection Parameter 8 (lower)	Parameter 8 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	184F
r1-17	DWEZ Connection Parameter 9 (upper)	Parameter 9 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1850
r1-18	DWEZ Connection Parameter 9 (lower)	Parameter 9 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1851

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
r1-19	DWEZ Connection Parameter 10 (upper)	Parameter 10 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1852
r1-20	DWEZ Connection Parameter 10 (lower)	Parameter 10 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1853
r1-21	DWEZ Connection Parameter 11 (upper)	Parameter 11 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1854
r1-22	DWEZ Connection Parameter 11 (lower)	Parameter 11 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1855
r1-23	DWEZ Connection Parameter 12 (upper)	Parameter 12 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1856
r1-24	DWEZ Connection Parameter 12 (lower)	Parameter 12 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1857
r1-25	DWEZ Connection Parameter 13 (upper)	Parameter 13 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1858
r1-26	DWEZ Connection Parameter 13 (lower)	Parameter 13 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1859
r1-27	DWEZ Connection Parameter 14 (upper)	Parameter 14 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	185A
r1-28	DWEZ Connection Parameter 14 (lower)	Parameter 14 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	185B
r1-29	DWEZ Connection Parameter 15 (upper)	Parameter 15 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	185C
r1-30	DWEZ Connection Parameter 15 (lower)	Parameter 15 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	185D
r1-31	DWEZ Connection Parameter 16 (upper)	Parameter 16 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	185E
r1-32	DWEZ Connection Parameter 16 (lower)	Parameter 16 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	185F
r1-33	DWEZ Connection Parameter 17 (upper)	Parameter 17 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1860
r1-34	DWEZ Connection Parameter 17 (lower)	Parameter 17 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1861
r1-35	DWEZ Connection Parameter 18 (upper)	Parameter 18 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1862
r1-36	DWEZ Connection Parameter 18 (lower)	Parameter 18 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1863
r1-37	DWEZ Connection Parameter 19 (upper)	Parameter 19 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1864

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
r1-38	DWEZ Connection Parameter 19 (lower)	Parameter 19 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1865
r1-39	DWEZ Connection Parameter 20 (upper)	Parameter 20 for connecting DWEZ (upper).	0 to FFFFH	0	–	A	A	1866
r1-40	DWEZ Connection Parameter 20 (lower)	Parameter 20 for connecting DWEZ (lower).	0 to FFFFH	0	–	A	A	1867

◆ T: Motor Tuning

Enter data into the following parameters to tune the motor and drive for optimal performance

No.	Name	Description	Range	Def.	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
T1-00	Motor Selection 1/2	Selects which set of motor parameters are used and set during Auto-Tuning. If Motor 2 selection (H1-□□ = 16) is not selected, this parameter will not be displayed. 1: 1st Motor - E1 to E2 2: 2nd Motor - E3 to E4 (this selection is not displayed if motor 2 has not been selected)	1, 2	1	A	A	–	700
T1-01	Auto-Tuning Mode Selection	Selects the Auto-Tuning mode. 0: Rotational Auto-Tuning 2: Stationary Auto-Tuning, Terminal resistance only, 3: Rotational Auto-Tuning for V/f control (necessary for Energy Savings and Speed Estimation type speed search)	0, 2, 3 <54>	2 or 3 in V/f 0 or 2 in OLV 2 for Motor 2	A	A	–	701
T1-02	Motor Rated Power	Sets the motor rated power in kilowatts (kW). **Note:** If motor power is given in horsepower, power in kW can be calculated using the following formula: kW = HP x 0.746.	0.00 to 650.00	0.40 kW	A	A	–	702
T1-03 <24>	Motor Rated Voltage	Sets the motor rated voltage in volts (V).	0.0 to 255.5	200.0 V	A	A	–	703

No.	Name	Description	Range	Def.	Control Mode			Addr. Hex
					V/f	OLV	PM	
T1-04	Motor Rated Current	Sets the motor rated current in amperes (A).	10 to 200% of drive rated current	<12>	A	A	–	704
T1-05	Motor Base Frequency	Sets the base frequency of the motor in Hertz (Hz).	0.0 to 400.0	60.0 Hz	A	A	–	705
T1-06	Number of Motor Poles	Sets the number of motor poles.	2 to 48	4	A	A	–	706
T1-07	Motor Base Speed	Sets the base speed of the motor in revolutions per minute r/min (RPM).	0 to 24000	1750 r/min	A	A	–	707
T1-11	Motor Iron Loss	Provides the iron loss for determining the Energy Saving coefficient. The value set to E2-10 (motor iron loss) when the power is cycled. If T1-02 is changed, an initial value valid for the selected capacity will be shown.	0 to 65535	14W	A	–	–	70B
				These values differ depending on the motor code value and motor parameter settings.				

<12> Default setting value is dependent on parameter o2-04, Drive/kVA Selection.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<54> The available tuning methods dpend on control mode. Select values 2 or 3 in V/f control, 0 or 2 in OLV control, and 2 for Motor 2 control.

◆ U: Monitors

Monitor parameters allow the user to view drive status, fault information, and other information about drive operation.

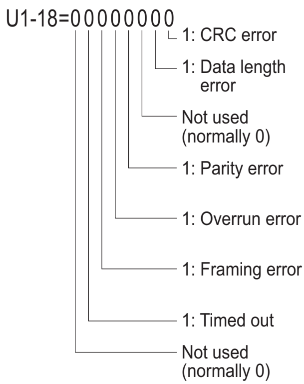
No.	Name	Description	Analog Output Level	Unit	Control Mode			Addr. Hex
					V/f	OLV	PM	
U1: Operation Status Monitors Use U1 monitors to display the operation status of the drive.								
U1-01	Frequency Reference	Monitors the frequency	10 V: Max frequency	0.01 Hz	A	A	A	40

No.	Name	Description	Analog Output Level	Unit	Control Mode			Addr. Hex
					V/f	OLV	PM	
U1-02	Output Frequency	Displays the output voltage. Display units are determined by o1-03.	10 V: Max frequency	0.01 Hz <27>	A	A	A	41
U1-03	Output Current	Displays the output current.	10 V: Drive rated current	0.01 A	A	A	A	42
U1-04	Control Mode	Control method set in A1-02. 0: V/f without PG 2: Open Loop Vector (OLV) 5: PM Open Loop Vector (PM)	No output signal available	–	A	A	A	43
U1-05	Motor Speed	Displays the motor speed feedback. Display units are determined by o1-03.	10 V: Maximum speed	0.01 Hz	–	A	A	44
U1-06	Output Voltage Reference	Displays the output voltage.	10 V: 200 Vrms (400 Vrms)	0.1 V	A	A	A	45
U1-07	DC Bus Voltage	Displays the DC bus voltage.	10 V: 400 V (800 V)	1 V	A	A	A	46
U1-08	Output Power	Displays the output voltage (this value is determined internally).	10 V: Drive capacity (kW) (max. motor capacity allowed)	<27>	A	A	A	47
U1-09	Torque Reference	Monitor of internal torque reference value for Open Loop Vector (OLV) control	10 V: Motor rated torque	–	–	A	–	

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U1-10	Input Terminal Status	Displays the input terminal status. U1-09=0000000 1: FWD run command (terminal S1 enabled) 1: REV run command (terminal S2 enabled) 1: Multi-Function Digital Input 1 (terminal S3 enabled) 1: Multi-Function Digital Input 2 (terminal S4 enabled) 1: Multi-Function Digital Input 3 (terminal S5 enabled) 1: Multi-Function Digital Input 4 (terminal S6 enabled) 1: Multi-Function Digital Input 5 (terminal S7 enabled)	No output signal available	–	A	A	A	49
U1-11	Output Terminal Status	Displays the output terminal status. U1-11=000 1: Multi-Function Digital Output (fault) (terminal MA/MB-MC) 1: Multi-Function Digital Output 1 (terminal P1) enabled 1: Multi-Function Digital Output 2 (terminal P2) enabled	No output signal available	–	A	A	A	4A

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U1-12	Drive Status	Verifies the drive operation status. U1-12=00000000 1: During run 1: During zero-speed 1: During REV 1: During fault reset signal input 1: During speed agree 1: Drive ready 1: During alarm detection 1: During fault detection	No output signal available	–	A	A	A	4B
U1-13	Terminal A1 Input Voltage	Displays the analog input A1 input level. 100% when the input is 10 V	10 V: 100%	0.1 %	A	A	A	4E
U1-14	Terminal A2 Input Voltage	Displays the analog input A2 input level. 100% when the input is 10 V / 20 mA	10 V: 100%	0.1 %	A	A	A	4F
U1-16	Output Frequency after Soft Start	Displays the output frequency including ramp times, S-curves. Units are determined by o1-03.	10 V: Max frequency	0.01 Hz	A	A	A	53
U1-18	OPE Fault Parameter	Displays the parameter number for oPE☐☐ or Err (operator error) where the error occurred.	No output signal available	–	A	A	A	61

A.2 Parameter Table

No.	Name	Description	Analog Output Level	Unit	Control Mode			Addr. Hex
					V/f	OLV	PM	
U1-19	MEMOBUS/Modbus Error Code	Displays the contents of a MEMOBUS/ Modbus error. 	No output signal available	–	A	A	A	66
U1-24	Input Pulse Monitor	Displays the Pulse Train input RP frequency.	32000					7D
U1-25	Software No. (Flash)	Yaskawa Flash ID	No signal output available					4D
U1-26	Software No. (ROM)	Yaskawa ROM ID	No signal output available					5B
U2: Fault Trace Use U2 monitor parameters to view fault trace data.								
U2-01	Current Fault	Display of the current fault.	No signal output avail.	–	A	A	A	80
U2-02	Previous Fault	Display of the previous fault.	No signal output avail.	–	A	A	A	81
U2-03	Frequency Reference at Previous Fault	Displays the frequency reference at the previous fault.	No signal output avail.	0.01 Hz	A	A	A	82
U2-04	Output Frequency at Previous Fault	Displays the output frequency at the previous fault.	No signal output avail.	0.01 Hz	A	A	A	83
U2-05	Output Current at Previous Fault	Displays the output current at the previous fault.	No signal output avail.		A	A	A	84

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U2-06	Motor Speed at Previous Fault	Displays the motor speed at the previous fault.	No signal output avail.	0.01 Hz	–	A	–	85
U2-07	Output Voltage at Previous Fault	Displays the output voltage at the previous fault.	No signal output avail.	0.1 V	A	A	A	86
U2-08	DC Bus Voltage at Previous Fault	Displays the DC bus voltage at the previous fault.	No signal output avail.	1 V	A	A	A	87
U2-09	Output Power at Previous Fault	Displays the output power at the previous fault.	No signal output avail.	0.1 kW	A	A	A	88
U2-10	Torque Reference at Previous Fault	Displays the torque reference at the previous fault.	No signal output avail.	0.1 %	–	A	–	89
U2-11	Input Terminal Status at Previous Fault	Displays the input terminal status at the previous fault. Displayed as in U1-10.	No signal output avail.	–	A	A	A	8A
U2-12	Output Terminal Status at Previous Fault	Displays the output status at the previous fault. Displays the same status displayed in U1-11.	No signal output available	–	A	A	A	8B
U2-13	Drive Operation Status at Previous Fault	Displays the operation status of the drive at the previous fault. Displays the same status displayed in U1-12.	No signal output available	–	A	A	A	8C
U2-14	Cumulative Operation Time at Previous Fault	Displays the cumulative operation time at the previous fault.	No signal output available	1 H	A	A	A	8D
U2-15	Soft Starter Speed Reference at Previous Fault	Displays the speed reference for the soft starter at the previous fault.	No signal output available	0.01 %	A	A	A	7E0
U2-16	Motor q-Axis Current at Previous Fault	Displays the q-axis current for the motor at the previous fault.	No signal output avail.	0.10 %	–	A	A	7E1
U2-17	Motor d-Axis Current at Previous Fault	Displays the d-axis current for the motor at the previous fault.	No signal output avail.	0.10 %	–	A	A	7E2
U3: Fault History Use U3 parameters to display fault data.								
U3-01	Most Recent Fault	Displays the most recent fault.	No signal output avail.	–	A	A	A	90 (800)
U3-02	2nd Most Recent Fault	Displays the second most recent fault.	No signal output avail.	–	A	A	A	91 (801)
U3-03	3rd Most Recent Fault	Displays the third most recent fault.	No signal output avail.	–	A	A	A	92 (802)
U3-04	4th Most Recent Fault	Displays the fourth most recent fault.	No signal output available	–	A	A	A	93 (803)

No.	Name	Description	Analog Output Level	Unit	Control Mode			Addr. Hex
					V/f	OLV	PM	
U3-05	5th Most Recent Fault	Displays the fifth most recent fault.	No signal output available	–	A	A	A	804
U3-06	6th Most Recent Fault	Displays the sixth most recent fault.	No signal output available	–	A	A	A	805
U3-07	7th Most Recent Fault	Displays the seventh most recent fault.	No signal output available	–	A	A	A	806
U3-08	8th Most Recent Fault	Displays the eighth most recent fault.	No signal output available	–	A	A	A	807
U3-09	9th Most Recent Fault	Displays the ninth most recent fault.	No signal output available	–	A	A	A	808
U3-10	10th Most Recent Fault	Displays the tenth most recent fault.	No signal output available	–	A	A	A	809
U3-11	Cumulative Operation Time at Most Recent Fault	Displays the cumulative operation time at the most recent fault.	No signal output available	1 h	A	A	A	94 (80A)
U3-12	Cumulative Operation Time at 2nd Most Recent Fault	Displays the cumulative operation time at the second most recent fault.	No signal output available	1 h	A	A	A	95 (80B)
U3-13	Cumulative Operation Time at 3rd Most Recent Fault	Displays the cumulative operation time at the third most recent fault.	No signal output available	1 h	A	A	A	96 (80C)
U3-14	Cumulative Operation Time at 4th Most Recent Fault	Displays the cumulative operation time at the fourth most recent fault.	No signal output available	1 h	A	A	A	97 (80D)
U3-15	Cumulative Operation Time at 5th Most Recent Fault	Displays the cumulative operation time at the fifth most recent fault.	No signal output available	1 h	A	A	A	80E
U3-16	Cumulative Operation Time at 6th Most Recent Fault	Displays the cumulative operation time at the sixth most recent fault.	No signal output available	1 h	A	A	A	80F
U3-17	Cumulative Operation Time at 7th Most Recent Fault	Displays the cumulative operation time at the seventh most recent fault.	No signal output available	1 h	A	A	A	810E

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U3-18	Cumulative Operation Time at 8th Most Recent Fault	Displays the cumulative operation time at the eighth most recent fault.	No signal output available	1 h	A	A	A	811E
U3-19	Cumulative Operation Time at 9th Most Recent Fault	Displays the cumulative operation time at the ninth most recent fault.	No signal output available	1 h	A	A	A	812
U3-20	Cumulative Operation Time at 10th Most Recent Fault	Displays the cumulative operation time at the tenth most recent fault.	No signal output available	1 h	A	A	A	813
U4: Maintenance Monitors Use U4 parameters to display drive maintenance information.								
U4-01	Accumulated Operation Time	Displays the cumulative operation time of the drive. The value for the cumulative operation time counter can be set in parameter o4-01. Use parameter o4-02 to determine if the operation time should start as soon as the power is switched on or only while the run command is present. The maximum number displayed is 99999, after which the value is reset to 0.	No signal output avail.	1 h	A	A	A	4C
U4-02	Number of Run Commands	Displays the number of times the run command is entered. Reset the number of run commands using parameter o4-13. This value will reset to 0 and start counting again after reaching 65535.	No signal output avail.		A	A	A	76
U4-03	Cooling Fan Operation Time	Displays the cumulative operation time of the cooling fan. The default value for the fan operation time is set to parameter o4-03. This value will reset to 0 and start counting again after reaching 65535.	No signal output avail.	1H	A	A	A	67
U4-05	Capacitor Maintenance	Displays main circuit capacitor usage time in in percent of their expected performance life. Parameter o4-06 resets this monitor.	No signal output avail.	1%	A	A	A	7C
U4-07	IGBT Maintenance	Displays IGBT usage time as a percent of expected performance life. One of the multi-function contact outputs can be set to close when the value reaches 50% (H2-☐☐ = 2F), triggering an alarm. One of the multi-function contact outputs can be set to close when the value reaches 90% (H2-☐☐ = 10), triggering an alarm. Parameter o4-09 resets this monitor.	No signal output avail.	1%	A	A	A	7D7

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U4-09	LED Check	Lights all segments of the LED to verify that the display is working properly.	No signal output avail.	–	A	A	A	3C
U4-10	kWH, Lower 4 Digits	Monitors the drive output power. The value is shown as a 9 digit number displayed across two monitor parameters, U4-10 and U4-11. Example: 12345678.9 kWh is displayed as: U4-10: 678.9 kWh U4-11: 12345 MWh Analog monitor: No output signal available.	No signal output avail.	kWh	A	A	A	5C
U4-11	kWH, Upper 5 Digits			MWh	A	A	A	5D
U4-13	Peak Hold Current	Displays the peak hold current during run.	10 V: Motor rated current	0.01 A	A	A	A	7CF
U4-14	Peak Hold Output Frequency	Displays the output frequency when operating at the peak hold current.	10 V: Max frequency	0.01 Hz	A	A	A	7D0
U4-16	Motor Overload Estimate (OL1)	100% = OL1 detection level	100% = OL1 detection level	0.1 %	A	A	A	7D8
U4-18	Frequency Reference Source Selection	Displays the source for the frequency reference as XY-nn. X: indicates which reference is used: 1 = Reference 1 (b1-01) 2 = Reference 2 (b1-15) Y-nn: indicates the reference source 0-01 = Operator (d1-01) 1-01 = Analog (terminal A1) 1-02 = Analog (terminal A2) 2-02 to 17 = Multi-step speed (d1-02 to 17) 3-01 = MEMOBUS/Modbus comm. 4-01 = Option 5-01 = Pulse Input 6-01 = CASE 7-01 = DWEZ			A	A	A	7DA
U4-19	Frequency Reference from MEMOBUS/ Modbus Comm.	Displays the frequency reference provided by MEMOBUS/Modbus (decimal)			A	A	A	7DB
U4-20	Option Frequency Reference	Displays the frequency reference input by an option card (decimal).			A	A	A	7DD

No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U4-21	Run Command Source Selection	Displays the source for the Run command as XY-nn. \t\t\t\t\t\t\t\t\t\t\tX: Indicates which Run source is used: 1 = Reference 1 (b1-02) 2 = Reference 2 (b1-16) Y: Input power supply data 0 = Operator 1 = External terminals 2 = Not used 3 = MEMOBUS/Modbus communications 4 = Option 5 = Not used 6 = CASE 7 = DWEZ nn: Run command limit status data 00: No limit status. 01: Run command was left on when stopped in the PRG mode. 02: Run command was left on when switching from local to remote operation. 03: Waiting for the soft charge bypass contactor after the power is switched on (UV or UV1 flashes after 10 seconds). 04: Waiting for “Run Command Prohibited” time period to end. 05: Fast-stop (digital input (H1-☐☐ = 15), operator) 06: b1-17 (run command given at power-up). 07: During Baseblock while coast to stop with timer 08: Frequency reference is below minimal reference during base block 09: Waiting for Enter command			A	A	A	7DD
U4-22	MEMOBUS/Modbus Communications Reference	Displays the drive control data set by MEMOBUS/Modbus communications register No. 0001H as a 4 digit hexadecimal number.			A	A	A	7DE
U4-23	Option Card Reference	Displays drive control data set by an option card as a 4 digit hexadecimal number.			A	A	A	7DF

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No.	Name	Description	Analog Output Level	Unit	Control Mode V/f	Control Mode OLV	Control Mode PM	Addr. Hex
U5: Application Monitor Use U5 parameters to view application-specific settings.								
U5-01	PID Feedback	Displays the PID feedback value in.	10V: 100% (max. freq.)	0.01 %	A	A	A	57
U5-02	PID Input	Displays the amount of PID input (deviation between PID target and feedback).		0.01 %	A	A	A	63
U5-03	PID Output	Displays PID control output.		0.01 %	A	A	A	64
U5-04	PID Setpoint	Displays the PID setpoint.		0.01 %	A	A	A	65
U5-05	PID differential feedback	Displays the 2nd PID feedback value if differential feedback is used.		0.01 %	A	A	A	
U5-06	PID Adjusted Feedback	Displays the subtraction value of both feedback values if differential feedback is used.		0.01 %	A	A	A	
U6: Application Monitor Use U6 parameters to display drive control information.								
U6-01	Motor Secondary Current (Iq)	Displays the value of the motor secondary current (Iq).	10 V: Motor rated secondary current	0.1 %	A	A	A	51
U6-02	Motor Excitation Current (ld)	Displays the value calculated for the motor excitation current (Id) as a percentage of the motor rated secondary current (Iq).	10 V: Motor rated secondary current	0.1 %	–	A	A	52
U6-03	ASR Input	Displays the ASR input value if Simple PG is used in V/f control.	10V: 100% (max. freq.)	0.1 %	A	–	–	
U6-04	ASR Output	Displays the ASR output value if Simple PG is used in V/f control.	10V: 100% (max. freq.)	0.1 %	A	–	–	55
U6-05	Output voltage reference (Vq)	Output voltage reference (Vq). (q-axis)	10 V: 200 V (400 V)	0.1 Vac	–	A	A	59
U6-06	Output Voltage Reference (Vd)	Output voltage reference (Vd). (d-axis)	10 V: 200 V (400 V)	0.1 Vac	–	A	A	5A
U6-07	q-axis ACR Output	Displays the current control (ACR) output of for the motor secondary current (Iq).	10 V: 100%	0.1 %	–	A	–	5F
U6-08	d-Axis ACR Output	Displays the current control (ACR) output of for the motor excitation current (Id).	10 V: 100%	0.1 %	–	A	–	60
U6-20	Frequency Reference Bias (Up/Down 2)	Displays the bias value used to adjust the frequency reference.	10 V: max. frequency	0.1 %	A	A	A	7D4

No.	Name	Description	Analog Output Level	Unit	Control Mode			Addr. Hex
					V/f	OLV	PM	
U6-21	Offset Frequency	Displays the frequency added to the main frequency reference.	10 V: max. frequency	0.1 %	A	A	A	7D5
U8: Custom Monitors for DriveWorksEZ U8 parameters are reserved for DriveWorksEZ								
U8-01	–	Reserved for DriveWorksEZ, Monitor 1.	–	0.01 %	A	A	A	1950
U8-02	–	Reserved for DriveWorksEZ, Monitor 2.	–	0.01 %	A	A	A	1951
U8-03	–	Reserved for DriveWorksEZ, Monitor 3.	–	0.01 %	A	A	A	1952
U8-04	–	Reserved for DriveWorksEZ, Monitor 4.	–	0.01 %	A	A	A	1953
U8-05	–	Reserved for DriveWorksEZ, Monitor 5.	–	0.01 %	A	A	A	1954
U8-06	–	Reserved for DriveWorksEZ, Monitor 6.	–	0.01 %	A	A	A	1955
U8-07	–	Reserved for DriveWorksEZ, Monitor 7.	–	0.01 %	A	A	A	1956
U8-08	–	Reserved for DriveWorksEZ, Monitor 8.	–	0.01 %	A	A	A	1957
U8-09	–	Reserved for DriveWorksEZ, Monitor 9.	–	0.01 %	A	A	A	1958
U8-10	–	Reserved for DriveWorksEZ, Monitor 10.	–	0.01 %	A	A	A	1959

<27> Setting units for this parameter are determined by o2-04, Drive/kVA Selection. Less than 11 kW: 2 decimal points, 11 kW and above: 1 decimal point.

◆ Control Mode Dependent Parameter Default Values

The tables below list parameters that depend on the control mode selection (A1-02 for motor 1, E3-01 for motor 2). These parameters are initialized to the shown values if the control mode is changed.

Table A.1 A1-02 (Motor 1 Control Mode) Dependent Parameters and Default Values

No.	Description	Setting Range	Resolution	Control Modes (A1-02)		
				V/f (0)	OLV (2)	PM (5)
b3-02	Speed Search deactivation current	0 to 200	1 %	120	100	–
b8-02	Energy Saving gain	0.0 to 10.0	0.1	–	0.7	–

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No.	Description	Setting Range	Resolution	Control Modes (A1-02)		
				V/f (0)	OLV (2)	PM (5)
C2-01	S-curve time at acceleration start	0.00 to 10.00	0.01 s	0.20	0.20	1.00
C3-01	Slip compensation gain	0.0 to 2.5	0.1	0.0	1.0	–
C3-02	Slip compensation time constant	0 to 10000	1 msec	2000	200	–
C4-01	Torque comp. gain	0.00 to 2.50	0.01	1.00	1.00	0.00
C4-02	Torque comp. primary delay time	0 to 10000	1 msec	200	20	100
C6-02	Carrier frequency	1 to F	1	7 *<12>*	7 *<12>*	2
E1-04	Maximum output frequency	40.0 to 400.0	0.1 Hz	60.0	60.0	*<10>*
E1-05	Maximum output voltage *<24>*	0.0 to 255.0	0.1 V	230.0	230.0	*<10>*
E1-06	Base Frequency	0.0 to 400.0	0.1 Hz	60.0	60.0	*<10>*
E1-07	Middle output frequency	0.0 to 400.0	0.1 Hz	3.0	3.0	–
E1-08	Middle output freq. voltage *<24>*	0.0 to 255.0	0.1 V	18.4	13.8	–
E1-09	Minimum output frequency	0.0 to 400.0	0.1 Hz	1.5	0.5	*<10>*
E1-10	Minimum output voltage *<24>*	0.0 to 255.0	0.1 V	13.8	2.9	–
E1-11	Middle output frequency 2	0.0 to 400.0	0.1 Hz	0.0	0.0	–
E1-12	Middle output freq. voltage 2 *<24>*	0.0 to 255.0	0.1 V	0.0	0.0	–
E1-13	Base voltage *<24>*	0.0 to 255.0	0.1 V	0.0	0.0	–
L1-01	Motor protection selection	0 to 4	-	1	1	4
L3-20	Accel/Decel rate calculation rate	0.00 to 5.00	0.01	1.00	0.30	0.65
L3-21	Decel time at stall prevention during acceleration	0.00 to 200.00	0.01	1.00	1.00	2.50

<10> Default setting value is dependent on parameter E5-01, Motor Code Selection.
<12> Default setting value is dependent on parameter o2-04, Drive/kVA Selection.
<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

Table A.2 E3-01 (Motor 2 Control Mode) Dependent Parameters and Default Values

No.	Description	Setting Range	Resolution	Control Modes (E3-01)	
				V/f (0)	OLV (2)
E3-04	Maximum output frequency	40.0 to 400.0	0.1 Hz	60.0	60.0
E3-05	Maximum output voltage *<24>*	0.0 to 255.0	0.1 V	230.0	230.0
E3-06	Base Frequency	0.0 to 400.0	0.1Hz	60.0	60.0
E3-07	Middle output frequency	0.0 to 400.0	0.1Hz	3.0	3.0
E3-08	Middle output freq. voltage *<24>*	0.0 to 255.0	0.1 V	18.4	13.8
E3-09	Minimum output frequency	0.0 to 400.0	0.1 Hz	1.5	0.5
E3-10	Minimum output voltage *<24>*	0.0 to 255.0	0.1 V	13.8	2.9
E3-11	Middle output frequency 2	0.0 to 400.0	0.1 Hz	0.0	0.0
E3-12	Middle output freq. voltage 2 *<24>*	0.0 to 255.0	0.1 V	0.0	0.0
E3-13	Base voltage *<24>*	0.0 to 255.0	0.1 V	0.0	0.0
E3-14	Motor 2 Slip compensation gain	0.0 to 2.5	0.1	0.0	1.0

<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.

◆ V/f Pattern Default Values

The tables below show the V/f pattern settings default values depending on the control mode (A1-02) and the V/f pattern selection (E1-03 in V/f control).

Table A.3 E1-03 V/f Pattern Settings for Drive Capacity: CIMR-VUBA0001 to CIMR-VUBA0010; CIMR-VU2A0001 to CIMR-VU2A0010; CIMR-VU4A0001 to CIMR-VU4A0005

No.	U	V/f Control																OLV
E1-03	–	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**	<55>	
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120	180	60.0	60.0	60.0
E1-05 <24>	V	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	230	230
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	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	3.0	3.0	3.0
E1-08 <24>	V	16.0	16.0	16.0	16.0	35.0	50.0	35.0	50.0	19.0	24.0	19.0	24.0	16.0	16.0	16.0	16.0	18.4	13.8
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	1.5	0.5
E1-10 <24>	V	12.0	12.0	12.0	12.0	8.0	9.0	8.0	9.0	12.0	13.0	12.0	15.0	12.0	12.0	12.0	12.0	13.8	2.9

<24> Values shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<55> Used as default settings for E1-04 to E1-10 and E2-04 to E2-10

Table A.4 E1-03 V/f Pattern Settings for Drive Capacity: CIMR-VUBA0012 to CIMR-VUBA0020; CIMR-VU2A0012 to CIMR-VU2A0069; CIMR-VU4A0007 to CIMR-VU4A0038

No.	U	V/f Control																OLV
E1-03	–	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**	**D**	**E**	**F**	<55>	
E1-04	Hz	50.0	60.0	60.0	72.0	50.0	50.0	60.0	60.0	50.0	50.0	60.0	60.0	90.0	120	180	60.0	60.0	60.0
E1-05 <24>	V	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	230	230
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	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	3.0	3.0	3.0
E1-08 <24>	V	14.0	14.0	14.0	14.0	35.0	50.0	35.0	50.0	18.0	23.0	18.0	23.0	14.0	14.0	14.0	14.0	16.1	12.7
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	1.5	0.5
E1-10 <24>	V	7.0	7.0	7.0	7.0	6.0	7.0	6.0	7.0	9.0	11.0	9.0	13.0	7.0	7.0	7.0	7.0	8.1	2.3

<24> Vaaaaalues shown here are for 200 V class drives. Double the value when using a 400 V class drive.
<55> Used as default settings for E1-04 to E1-10 and E2-04 to E2-10

◆ Default Settings Determined by Drive Capacity (o2-04) and ND/HD Selection (C6-01)

Default settings for the following parameters will vary based on drive capacity.

Table A.5 Single-Phase, 200 V Class Drives Default Settings by Drive Capacity and ND/HD Settings

No.	Description	Unit	Default Settings					
–	Model CIMR-Vo	–	BA0001		BA0002		BA0003	
C6-01	Normal/Heavy Duty Sel.	–	HD	ND	HD	ND	HD	ND
o2-04	kVA Selection	–	48 (30H)		49 (31H)		50 (32H)	
E2-11 (E4-11, T1-02)	Motor rated power	kW	0.1	0.2	0.2	0.4	0.4	0.75
b3-06	Speed Search current 1	–	1	1	1	1	1	1
b8-04	Energy saving coefficient	–	481.7	356.9	356.9	288.2	288.2	223.7
C6-02	Carrier frequency	–	4	7	4	7	4	7
E2-01 (E4-01, T1-04)	Motor rated current	A	0.6	1.1	1.1	1.9	1.9	3.3
E2-02 (E4-02)	Motor rated slip	Hz	2.5	2.6	2.6	2.9	2.9	2.5
E2-03 (E4-03)	Motor no load current	A	0.4	0.8	0.8	1.2	1.2	1.8
E2-05 (E4-05)	Motor line-to-line resistance	Ω	35.98	20.56	20.56	9.842	9.842	5.156
E2-06 (E4-06)	Motor leakage inductance	%	21.6	20.1	20.1	18.2	18.2	13.8
E2-10 (E4-10)	Motor Iron Loss	W	6	11	11	14	14	26
E5-01	Motor code	hex	FFFF	FFFF	FFFF	FFFF	0002	0002
L2-02	Momentary power loss ride-through time	s	0.1	0.1	0.1	0.1	0.1	0.1
L2-03	Mom. power loss base block time	s	0.2	0.2	0.2	0.2	0.2	0.3
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	160	160	160	160	160	160
L3-24	Motor acceleration time	s	0.178	0.178	0.178	0.178	0.178	0.142
L8-02	Overheat alarm level	×C	115	115	115	115	110	110
L8-09	Ground fault selection	–	0	0	0	0	0	0
L8-38	Carrier freq. reduction sel.	–	1	1	1	1	1	1
n1-03	Hunting Prev. Time Const.	ms	10	10	10	10	10	10

No.	Description	Unit	Default Settings						
–	Model CIMR-Vo	–	BA0006		BA0010		BA0012		BA0018
C6-01	Normal/Heavy Duty	–	HD		HD	ND	HD	ND	HD
o2-04	kVA Selection	–	51 (33H)		52 (34H)		53 (35H)		55 (37H)
E2-11 (E4-11, T1-02)	Motor rated power	kW	0.75	1.1	1.5	2.2	2.2	3.0	3.7
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	223.7	169.4	169.4	156.8	156.8	136.4	122.9
C6-02	Carrier frequency	–	4	7	3	7	3	7	3
E2-01 (E4-01, T1-04)	Motor rated current	A	3.3	6.2	6.2	8.5	8.5	11.4	14.0
E2-02 (E4-02)	Motor rated slip	Hz	2.5	2.6	2.6	2.9	2.9	2.7	2.73
E2-03 (E4-03)	Motor no load current	A	1.8	2.8	2.8	3	3	3.7	4.5
E2-05 (E4-05)	Motor line-to-line resistance	Ω	5.156	1.997	1.997	1.601	1.601	1.034	0.771
E2-06 (E4-06)	Motor leakage inductance	%	13.8	18.5	18.5	18.4	18.4	19	19.6
E2-10 (E4-10)	Motor Iron Loss	W	26	53	53	77	77	91	112
E5-01	Motor Code	hex	0003	0003	0005	0005	0006	0006	0008
L2-02	Momentary power loss ride-through time	s	0.2	0.2	0.3	0.3	0.5	0.5	1.0
L2-03	Momentary power loss base block time	s	0.3	0.4	0.4	0.5	0.5	0.5	0.6
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	160	160	160	160	160	160	160
L3-24	Motor acceleration time	s	0.142	0.142	0.166	0.145	0.145	0.145	0.154
L8-02	Overheat alarm level	°C	105	105	100	100	95	95	100
L8-09	Ground fault selection	–	0	0	0	0	0	0	0
L8-38	Carrier frequency reduction selection	–	1	1	1	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10

No.	Description	Unit	Default Settings							
–	Model CIMR-VA	–	2A0010		2A0012		2A0018		2A0020	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND	HD	ND
o2-04	kVA Selection	–	101 (65H)		102 (66H)		103 (67H)		104 (68H)	
E2-11 (E4-11, T1-02)	Motor rated power	kW	1.5	2.2	2.2	3.0	3.0	3.7	3.7	5.5
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	169.4	156.8	156.8	136.4	136.4	122.9	122.9	94.75
C6-02	Carrier frequency	–	3	7	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	6.2	8.5	8.5	11.4	11.4	14	14	19.6
E2-02 (E4-02)	Motor rated slip	Hz	2.6	2.9	2.9	2.7	2.7	2.73	2.73	1.5
E2-03 (E4-03)	Motor no load current	A	2.8	3.0	3.0	3.7	3.7	4.5	4.5	5.1
E2-05 (E4-05)	Motor line-to-line resistance	Ω	1.997	1.601	1.601	1.034	1.034	0.771	0.771	0.399
E2-06 (E4-06)	Motor leakage inductance	%	18.5	18.4	18.4	19	19	19.6	19.6	18.2
E2-10 (E4-10)	Motor Iron Loss	W	53	77	77	91	91	112	112	172
E5-01	Motor Code	hex	0005	0005	0006	0006	FFFF	FFFF	0008	0008
L2-02	Momentary power loss ride-through time	s	0.3	0.3	0.5	0.5	1	1	1	1
L2-03	Momentary power loss base block time	s	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.7
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	190	190	190	190	190	190	190	190
L3-24	Motor acceleration time	s	0.166	0.145	0.145	0.145	0.145	0.154	0.154	0.168
L8-02	Overheat alarm level	°C	100	100	100	100	110	110	110	110
L8-09	Ground fault selection	–	0	0	0	0	0	0	0	0
L8-35	Enclosure/Mounting selection	–	0	0	0	0	0	0	0	0
L8-38	Carrier frequency reduction selection	–	1	1	1	1	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10	10

No.	Description	Unit	Default Settings							
–	Model CIMR-VA	–	2A0030		2A0040		2A0056		2A0069	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND	HD	ND
o2-04	kVA Selection	–	106 (6AH)		108 (6CH)		109 (6DH)		110 (6EH)	
E2-11 (E4-11, T1-02)	Motor rated power	kW	5.5	7.5	7.5	11.0	11.0	15.0	15.0	18.5
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	94.75	72.69	72.69	70.44	70.44	63.13	63.13	57.87
C6-02	Carrier frequency	–	3	7	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	19.6	26.6	26.6	39.7	39.7	53	53	65.8
E2-02 (E4-02)	Motor rated slip	Hz	1.5	1.3	1.3	1.7	1.7	1.6	1.6	1.67
E2-03 (E4-03, T1-09)	Motor no load current	A	5.1	8.0	8.0	11.2	11.2	15.2	15.2	15.7
E2-05 (E4-05)	Motor line-to-line resistance	Ω	0.399	0.288	0.288	0.230	0.230	0.138	0.138	0.101
E2-06 (E4-06)	Motor leakage inductance	%	18.2	15.5	15.5	19.5	19.5	17.2	17.2	15.7
E2-10 (E4-10)	Motor Iron Loss	W	172	262	262	245	245	272	272	505
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0
L2-03	Momentary power loss base block time	s	0.7	0.8	0.8	0.9	0.9	1.0	1.0	1.0
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.6	0.6
L2-05	UV detection voltage	V dc	190	190	190	190	190	190	190	190
L3-24	Motor acceleration time	s	0.168	0.175	0.175	0.265	0.265	0.244	0.244	0.317
L8-02	Overheat alarm level	°C	115	115	121	121	120	120	120	120
L8-09	Ground fault selection	–	1	1	1	1	1	1	1	1
L8-35	Enclosure/Mounting selection	–	2	2	2	2	2	2	2	2
L8-38	Carrier frequency reduction selection	–	2	2	2	2	2	2	2	2
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10	10

Table A.6 Three-Phase, 200 V Class Drives Default Settings by Drive Capacity and ND/HD Setting

No.	Description	Unit	Default Settings									
–	**Model CIMR-Vo**	–	**2A0001**		**2A0002**		**2A0004**		**2A0006**		**2A0010**	
C6-01	**Normal/Heavy Duty Sel.**	–	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**
o2-04	**kVA Selection**	–	**96 (60H)**		**97 (61H)**		**98 (62H)**		**99 (63H)**		**101 (65H)**	
E2-11 (E4-11, T1-02)	**Motor rated power**	**kW**	**0.1**	**0.2**	**0.2**	**0.4**	**0.4**	**0.75**	**0.75**	**1.1**	**1.5**	**2.2**
b3-06	Speed Search current 1	–	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	481.7	356.9	356.9	288.2	288.2	223.7	223.7	196.6	169.4	156.8
C6-02	Carrier frequency	–	4	7	4	7	4	7	4	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	0.6	1.1	1.1	1.9	1.9	3.3	3.3	4.9	6.2	8.5
E2-02 (E4-02)	Motor rated slip	Hz	2.5	2.6	2.6	2.9	2.9	2.5	2.5	2.6	2.6	2.9
E2-03 (E4-03)	Motor no load current	A	0.4	0.8	0.8	1.2	1.2	1.8	1.8	2.3	2.8	3.0
E2-05 (E4-05)	Motor line-to-line resistance	W	35.98	20.56	20.56	9.842	9.842	5.156	5.156	3.577	1.997	1.601
E2-06 (E4-06)	Motor leakage inductance	%	21.6	20.1	20.1	18.2	18.2	13.8	13.8	18.5	18.5	18.4
E2-10 (E4-10)	Motor Iron Loss	W	6	11	11	14	14	26	26	38	53	77
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	0002	0002	0003	0003	0005	0005
L2-02	Momentary power loss ride-through time	s	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3
L2-03	Momentary power loss base block time	s	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	190	190	190	190	190	190	190	190	190	190
L3-24	Motor acceleration time	s	0.178	0.178	0.178	0.178	0.178	0.142	0.142	0.142	0.166	0.145
L8-02	Overheat alarm level	°C	110	110	110	110	115	115	100	100	100	100
L8-09	Ground fault selection	–	0	0	0	0	0	0	0	0	0	0
L8-38	Carrier frequency reduction selection	–	1	1	1	1	1	1	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10	10	10	10

No.	Description	Unit	Default Settings					
–	Model CIMR-Vo	–	2A0012		2A0020		2A0030	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND
o2-04	kVA Selection	–	102 (66H)		104 (68H)		106 (6AH)	
E2-11 (E4-11, T1-02)	Motor rated power	kW	2.2	3.0	3.7	5.5	5.5	7.5
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	156.8	136.4	122.9	94.75	94.75	72.69
C6-02	Carrier frequency	–	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	8.5	11.4	14	19.6	19.6	26.6
E2-02 (E4-02)	Motor rated slip	Hz	2.9	2.7	2.73	1.5	1.5	1.3
E2-03 (E4-03)	Motor no load current	A	3.0	3.7	4.5	5.1	5.1	8.0
E2-05 (E4-05)	Motor line-to-line resistance	Ω	1.601	1.034	0.771	0.399	0.399	0.288
E2-06 (E4-06)	Motor leakage inductance	%	18.4	19	19.6	18.2	18.2	15.5
E2-10 (E4-10)	Motor Iron Loss	W	77	91	112	172	172	262
E5-01	Motor Code	hex	0006	0006	0008	0008	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	0.5	0.5	1	1	1.0	1.0
L2-03	Momentary power loss base block time	s	0.5	0.5	0.6	0.7	0.7	0.8
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	190	190	190	190	190	190
L3-24	Motor acceleration time	s	0.145	0.145	0.154	0.168	0.168	0.175
L8-02	Overheat alarm level	°C	100	100	110	110	115	115
L8-09	Ground fault selection	–	0	0	0	0	1	1
L8-38	Carrier frequency reduction selection	–	1	1	1	1	2	2
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10

A.2 Parameter Table

No.	Description	Unit	Default Settings					
–	Model CIMR-Vo	–	2A0040		2A0056		2A0069	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND
o2-04	kVA Selection	–	108 (6CH)		109 (6DH)		110 (6EH)	
E2-11 (E4-11, T1-02)	Motor rated power	kW	7.5	11.0	11.0	15.0	15.0	18.5
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	72.69	70.44	70.44	63.13	63.13	57.87
C6-02	Carrier frequency	–	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	26.6	39.7	39.7	53	53	65.8
E2-02 (E4-02)	Motor rated slip	Hz	1.3	1.7	1.7	1.6	1.6	1.67
E2-03 (E4-03)	Motor no load current	A	8.0	11.2	11.2	15.2	15.2	15.7
E2-05 (E4-05)	Motor line-to-line resistance	Ω	0.288	0.230	0.230	0.138	0.138	0.101
E2-06 (E4-06)	Motor leakage inductance	%	15.5	19.5	19.5	17.2	17.2	15.7
E2-10 (E4-10)	Motor Iron Loss	W	262	245	245	272	272	505
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	1.0	1.0	2.0	2.0	2.0	2.0
L2-03	Momentary power loss base block time	s	0.8	0.9	0.9	1.0	1.0	1.0
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.6	0.6
L2-05	UV detection voltage	V dc	190	190	190	190	190	190
L3-24	Motor acceleration time	s	0.175	0.265	0.265	0.244	0.244	0.317
L8-02	Overheat alarm level	°C	121	121	120	120	120	120
L8-09	Ground fault selection	–	1	1	1	1	1	1
L8-38	Carrier frequency reduction selection	–	2	2	2	2	2	2
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10

Table A.7 Three-Phase 400V Class Drives
Default Settings by Drive Capacity and ND/HD Setting

No.	Description	Unit	Default Settings							
–	Model CIMR-Vo	–	4A0001		4A0002		4A0004		4A0005	
C6-01	Normal/Heavy Duty	–	HD	ND	HD	ND	HD	ND	HD	ND
o2-04	kVA Selection	–	145 (91H)		146 (92H)		147 (93H)		148 (94H)	
E2-11 (E4-11, T1-02)	Motor rated power	kW	0.2	0.4	0.4	0.75	0.75	1.5	1.5	2.2
b3-06	Speed Search current 1	–	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	713.8	576.4	576.4	447.4	447.4	338.8	338.8	313.6
C6-02	Carrier frequency	–	3	7	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	0.6	1	1	1.6	1.6	3.1	3.1	4.2
E2-02 (E4-02)	Motor rated slip	Hz	2.5	2.9	2.9	2.6	2.6	2.5	2.5	3
E2-03 (E4-03)	Motor no load current	A	0.4	0.6	0.6	0.8	0.8	1.4	1.4	1.5
E2-05 (E4-05)	Motor line-to-line resistance	Ω	83.94	38.198	38.198	22.459	22.459	10.1	10.1	6.495
E2-06 (E4-06)	Motor leakage inductance	%	21.9	18.2	18.2	14.3	14.3	18.3	18.3	18.7
E2-10 (E4-10)	Motor Iron Loss	W	12	14	14	26	26	53	53	77
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3
L2-03	Momentary power loss base block time	s	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.5
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	380	380	380	380	380	380	380	380
L3-24	Motor acceleration time	s	0.178	0.178	0.178	0.142	0.142	0.166	0.166	0.145
L8-02	Overheat alarm level	°C	110	110	110	110	110	110	90	90
L8-09	Ground fault selection	–	0	0	0	0	0	0	0	0
L8-38	Carrier frequency reduction selection	–	1	1	1	1	1	1	1	1
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10	10

No.	Description	Unit	Setting Range							
–	**Model CIMR-Vo**	–	**4A0007**		**4A0009**		**4A0011**		**4A0018**	
C6-01	**Normal/Heavy Duty Sel.**	–	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**	**HD**	**ND**
o2-04	**kVA Selection**	–	**149 (95H)**		**150 (96H)**		**151 (97H)**		**153 (99H)**	
E2-11 (E4-11, T1-02)	**Motor rated power**	**kW**	**2.2**	**3.0**	**3.0**	**3.7**	**4.0**	**5.5**	**5.5**	**7.5**
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	313.6	265.7	265.7	245.8	245.8	189.5	189.5	145.38
C6-02	Carrier frequency	–	3	7	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	4.2	5.7	5.7	7	7	9.8	9.8	13.38
E2-02 (E4-02)	Motor rated slip	Hz	3	2.7	2.7	2.7	2.7	1.5	1.5	1.3
E2-03 (E4-03)	Motor no load current	A	1.5	1.9	1.9	2.3	2.3	2.6	2.6	4.0
E2-05 (E4-05)	Motor line-to-line resistance	Ω	6.495	4.360	4.360	3.333	3.333	1.595	1.595	1.152
E2-06 (E4-06)	Motor leakage inductance	%	18.7	19	19	19.3	19.3	18.2	18.2	15.5
E2-10 (E4-10)	Motor Iron Loss	W	77	105	105	130	130	193	193	263
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	0.5	0.5	0.5	0.5	0.5	0.5	0.8	0.8
L2-03	Momentary power loss base block time	s	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
L2-05	UV detection voltage	V dc	380	380	380	380	380	380	380	380
L3-24	Motor acceleration time	s	0.145	0.145	0.145	0.154	0.154	0.154	0.168	0.175
L8-02	Overheat alarm level	°C	100	100	100	100	100	100	110	110
L8-09	Ground fault selection	–	0	0	0	0	0	0	1	1
L8-38	Carrier frequency reduction selection	–	1	1	1	1	1	1	2	2
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10	10	10

No.	Description	Unit	Setting Range					
–	Model CIMR-Vo	–	4A0023		4A0031		4A0038	
C6-01	Normal/Heavy Duty Sel.	–	HD	ND	HD	ND	HD	ND
o2-04	kVA Selection	–	154 (9AH)		156 (9CH)		157 (9DH)	
E2-11 (E4-11, T1-02)	Motor rated power	kW	7.5	11.0	11.0	15.0	15.0	18.5
b3-06	Speed Search current 1	–	0.5	0.5	0.5	0.5	0.5	0.5
b8-04	Energy saving coefficient	–	145.38	140.88	140.88	126.26	126.26	115.74
C6-02	Carrier frequency	–	3	7	3	7	3	7
E2-01 (E4-01, T1-04)	Motor rated current	A	13.3	19.9	19.9	26.5	26.5	32.9
E2-02 (E4-02)	Motor rated slip	Hz	1.30	1.70	1.70	1.60	1.60	1.67
E2-03 (E4-03)	Motor no load current	A	4.0	5.6	5.6	7.6	7.6	7.8
E2-05 (E4-05)	Motor line-to-line resistance	Ω	1.152	0.922	0.922	0.550	0.550	0.403
E2-06 (E4-06)	Motor leakage inductance	%	15.5	19.6	19.6	17.2	17.2	20.1
E2-10 (E4-10)	Motor Iron Loss	W	263	385	385	440	440	508
E5-01	Motor Code	hex	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF
L2-02	Momentary power loss ride-through time	s	1	1	2	2	2	2
L2-03	Momentary power loss base block time	s	0.8	0.9	0.9	1.0	1.0	1.0
L2-04	Momentary power loss voltage recovery time	s	0.3	0.3	0.3	0.6	0.6	0.6
L2-05	UV detection voltage	V dc	380	380	380	380	380	380
L3-24	Motor acceleration time	s	0.175	0.265	0.265	0.244	0.244	0.317
L8-02	Overheat alarm level	°C	110	110	110	110	110	110
L8-09	Ground fault selection	–	1	1	1	1	1	1
L8-38	Carrier frequency reduction selection	–	2	2	2	2	2	2
n1-03	Hunting Prevention Time Constant	ms	10	10	10	10	10	10

◆ Parameters that Change with the Motor Code Selection

The following tables show parameters and default settings that change with the motor code selection E5-01 when Open Loop Vector for PM motors is used.

■ Yaskawa Pico Motor (SPM motor)

Table A.8 1800 rpm Type Yaskawa Pico Motor Settings

Par.	Description	Unit	Default Settings				
E5-01	Motor Code	–	0002	0003	0005	0006	0008
	Voltage class Rated power	–	200 Vac 0.4 kW	200 Vac 0.75 kW	200 Vac 1.5 kW	200 Vac 2.2 kW	200 Vac 3.7 kW
	Rated speed	min-1	1800	1800	1800	1800	1800
E5-02	Motor rated power	kW	0.4	0.75	1.5	2.2	3.7
E5-03	Motor rated current	A	2.1	4.0	6.9	10.8	17.4
E5-04	Motor pole number	–	8	8	8	8	8
E5-05	Motor winding resistance	W	2.47	1.02	0.679	0.291	0.169
E5-06	d-axis inductance	mH	12.7	4.8	3.9	3.6	2.5
E5-07	q-axis inductance	mH	12.7	4.8	3.9	3.6	2.5
E5-09	Induction voltage constant 1	mVsec/rad	0	0	0	0	0
E5-24	Induction voltage constant 2	mV/min-1	62.0	64.1	73.4	69.6	72.2
E1-04	Maximum output frequency	Hz	120	120	120	120	120
E1-05	Maximum output voltage	V	200.0	200.0	200.0	200.0	200.0
E1-06	Base voltage	Hz	120	120	120	120	120
E1-09	Minimum output voltage	Hz	6	6	6	6	6
L3-24	Motor acceleration time	s	0.064	0.066	0.049	0.051	0.044
n8-49	Pull-in current	%	0	0	0	0	0

Table A.9 3600 rpm Type Yaskawa Pico Motor Settings

Par.	Description	Unit	Default Settings			
E5-01	Motor Code	–	0103	0105	0106	0108
	Voltage class Rated power	–	200 Vac 0.75 kW	200 Vac 1.5 kW	200 Vac 2.2 kW	200 Vac 3.7 kW
	Rated speed	min-1	3600	3600	3600	3600
E5-02	Motor rated power	kW	0.75	1.5	2.2	3.7
E5-03	Motor rated current	A	4.1	8.0	10.5	16.5
E5-04	Motor pole number	–	8	8	8	8
E5-05	Motor winding resistance	W	0.538	0.20	0.15	0.097
E5-06	d-axis inductance	mH	3.2	1.3	1.1	1.1
E5-07	q-axis inductance	mH	3.2	1.3	1.1	1.1
E5-09	Induction voltage constant 1	mVsec/rad	0	0	0	0
E5-24	Induction voltage constant 2	mV/min-1	32.4	32.7	36.7	39.7
E1-04	Maximum output frequency	Hz	240	240	240	240

Par.	Description	Unit	Default Settings			
E1-05	Maximum output voltage	V	200.0	200.0	200.0	200.0
E1-06	Base voltage	Hz	240	240	240	240
E1-09	Minimum output voltage	Hz	12	12	12	12
L3-24	Motor acceleration time	s	0.064	0.066	0.049	0.051
n8-49	Pull-in current	%	0	0	0	0

■ SS5 Motor: Yaskawa SSR1 Series IPM Motor

Table A.10 200 V, 1750 rpm Type Yaskawa SSR1 Series Motor

Par.	Description	Unit	Default Settings				
E5-01	Motor Code	–	1202	1203	1205	1206	1208
	Voltage class Rated power	–	200 Vac 0.4 kW	200 Vac 0.75 kW	200 Vac 1.5 kW	200 Vac 2.2 kW	200 Vac 3.7 kW
	Rated speed	min-1	1750	1750	1750	1750	1750
E5-02	Motor rated power	kW	0.4	0.75	1.5	2.2	3.7
E5-03	Motor rated current	A	1.65	2.97	5.50	8.10	13.40
E5-04	Motor pole number	–	6	6	6	6	6
E5-05	Motor winding resistance	W	8.233	2.284	1.501	0.827	0.455
E5-06	d-axis inductance	mH	54.84	23.02	17.08	8.61	7.20
E5-07	q-axis inductance	mH	64.10	29.89	21.39	13.50	10.02
E5-09	Induction voltage constant 1	mVsec/rad	233.0	229.5	250.9	247.9	248.6
E5-24	Induction voltage constant 2	mV/min-1	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum output frequency	Hz	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum output voltage	V	190.0	190.0	190.0	190.0	190.0
E1-06	Base voltage	Hz	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum output voltage	Hz	4.4	4.4	4.4	4.4	4.4
L3-24	Motor acceleration time	s	0.092	0.076	0.051	0.066	0.075
n8-49	Pull-in current	%	–7.2	–10.8	–11.1	–17.8	–17.5

Par.	Description	Unit	Default Settings			
E5-01	Motor Code	–	120A	120B	120D	120E
	Voltage class Rated power	–	200 Vac 5.5 kW	200 Vac 7.5 kW	200 Vac 11 kW	200 Vac 15 kW
	Rated speed	min-1	1750	1750	1750	1750
E5-02	Motor rated power	kW	5.5	7.5	11.0	15
E5-03	Motor rated current	A	19.80	27.00	39.7	53.2
E5-04	Motor pole number	–	6	6	6	6
E5-05	Motor winding resistance	W	0.246	0.198	0.094	0.066

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Par.	Description	Unit	Default Settings			
E5-06	d-axis inductance	mH	4.86	4.15	3.40	2.65
E5-07	q-axis inductance	mH	7.43	5.91	3.91	3.11
E5-09	Induction voltage constant 1	mVsec/rad	249.6	269.0	249.3	266.6
E5-24	Induction voltage constant 2	mV/min-1	0.0	0.0	0.0	0.0
E1-04	Maximum output frequency	Hz	87.5	87.5	87.5	87.5
E1-05	Maximum output voltage	V	190.0	190.0	190.0	190.0
E1-06	Base voltage	Hz	87.5	87.5	87.5	87.5
E1-09	Minimum output voltage	Hz	4.4	4.4	4.4	4.4
L3-24	Motor acceleration time	s	0.083	0.077	0.084	0.102
n8-49	Pull-in current	%	–22.0	–17.3	–10.1	–10.3

Table A.11 400 V, 1750 rpm Type Yaskawa SSR1 Series Motor

Par.	Description	Unit	Default Settings				
E5-01	Motor Code	–	1232	1233	1235	1236	1238
	Voltage class Rated power	–	400 Vac 0.4 kW	400 Vac 0.75 kW	400 Vac 1.5 kW	400 Vac 2.2 kW	400 Vac 3.7 kW
	Rated speed	min-1	1750	1750	1750	1750	1750
E5-02	Motor rated power	kW	0.4	0.75	1.5	2.2	3.7
E5-03	Motor rated current	A	0.83	1.49	2.75	4.05	6.80
E5-04	Motor pole number	–	6	6	6	6	6
E5-05	Motor winding resistance	W	32.932	9.136	6.004	3.297	1.798
E5-06	d-axis inductance	mH	219.36	92.08	68.32	40.39	32.93
E5-07	q-axis inductance	mH	256.40	119.56	85.56	48.82	37.70
E5-09	Induction voltage constant 1	mVsec/rad	466.0	459.0	501.8	485.7	498.7
E5-24	Induction voltage constant 2	mV/min-1	0.0	0.0	0.0	0.0	0.0
E1-04	Maximum output frequency	Hz	87.5	87.5	87.5	87.5	87.5
E1-05	Maximum output voltage	V	380.0	380.0	380.0	380.0	380.0
E1-06	Base voltage	Hz	87.5	87.5	87.5	87.5	87.5
E1-09	Minimum output voltage	Hz	4.4	4.4	4.4	4.4	4.4
L3-24	Motor acceleration time	s	0.092	0.076	0.051	0.066	0.075
n8-49	Pull-in current	%	–7.2	–10.7	–11.1	–8.9	–7.9

Par.	Description	Unit	Default Settings			
E5-01	Motor Code	–	123A	123B	123D	123E
	Voltage class Rated power	–	400 Vac 5.5 kW	400 Vac 7.5 kW	400 Vac 11 kW	400 Vac 15 kW
	Rated speed	min-1	1750	1750	1750	1750
E5-02	Motor rated power	kW	5.5	7.5	11.0	15
E5-03	Motor rated current	A	9.90	13.10	19.9	26.4
E5-04	Motor pole number	–	6	6	6	6
E5-05	Motor winding resistance	W	0.982	0.786	0.368	0.263
E5-06	d-axis inductance	mH	22.7	16.49	13.38	10.51
E5-07	q-axis inductance	mH	26.80	23.46	16.99	12.77
E5-09	Induction voltage constant 1	mVsec/rad	498.0	541.7	508.7	531.9
E5-24	Induction voltage constant 2	mV/min-1	0.0	0.0	0.0	0.0
E1-04	Maximum output frequency	Hz	87.5	87.5	87.5	87.5
E1-05	Maximum output voltage	V	380.0	380.0	380.0	380.0
E1-06	Base voltage	Hz	87.5	87.5	87.5	87.5
E1-09	Minimum output voltage	Hz	4.4	4.4	4.4	4.4
L3-24	Motor acceleration time	s	0.083	0.077	0.084	0.102
n8-49	Pull-in current	%	–10.2	–17.4	–15.8	–12.6

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YASKAWA AC Drive - V1000
Compact Vector Control Drive
PRELIM. Programming Manual

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