YASKAWA

A World of Automation Solutions™

VS-616PS5 Series Programming Manual

Brushless Motor Drive

⚠ WARNING

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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 products designed to incorporate a component part manufactured by YASKAWA must be supplied to the end user with appropriate warnings and instructions as to that part's safe use and operation. Any warnings provided by YASKAWA must be promptly provided to the end user.

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READ THIS ENTIRE MANUAL BEFORE INSTALLING OR OPERATING THE VS-616PS5!

WARNING!

The PS5 motor uses permanent magnets. **HIGH VOLTAGE** is generated by the motor whenever the rotor is turning, with or without a power supply. Make sure the motor is not turning before performing ANY service on the motor or on the inverter.

If there is a possibility that the motor can be turned by the load while inverter power is off, install a contactor or a manual disconnect to open the motor leads while servicing the inverter. Interlock the disconnect with the control circuits of the drive.

ONLY PERSONNEL WHO ARE EXPERIENCED IN WORKING WITH HIGH VOLTAGE, HIGH POWER EQUIPMENT SHOULD INSTALL OR SERVICE THIS EQUIPMENT.

Turn off the supply power to the VS-616PS5 AND make sure the motor is stopped AND the internal capacitors are discharged before connecting or disconnecting wires or touching any internal parts.

The VS-616PS5 internal capacitors remain charged even after the power supply is turned off. Wait at least five minutes after removing power. Make sure all LED's are off before servicing the inverter.

Do not use a Megger or other type of high withstand voltage tester on the VS-616PS5. Higher voltages can damage the semiconductors used in the inverter.

Do not connect or disconnect the operator or a computer while the VS-616PS5 is running.

FAILURE TO OBSERVE THE WARNINGS AND PRECAUTIONS IN THIS MANUAL CAN EXPOSE THE USER TO HIGH VOLTAGES, RESULTING IN DAMAGE TO EQUIPMENT, SERIOUS PERSONAL INJURY, OR EVEN DEATH.

POWER SUPPLY LIMITATIONS

The VS-616PS5 is suitable for use on a circuit capable of delivering not more than 65,000 RMS symmetrical amperes at 480 VAC maximum (for 460 VAC class units) or 240 VAC maximum (for 230 VAC class units).

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Introduction

The Model VS-616PS5 is a series of high quality, general purpose, inverters designed to control the current in a permanent magnet (PM) brushless motor. In the PM motor, current is directly related to torque.
With power outputs ranging from 0.5 to 500 horsepower (HP), the VS-616PS5 series is suitable for any application. The inverters provide full start-up torque, smooth low speed operation, and precise speed control from zero to full speed. The proprietary auto-tuning function allows the inverters to get the best performance from PM motors manufactured worldwide. Some of Yaskawa's proprietary features of the VS-616PS5 inverter include torque control, automatic tuning to the motor characteristics, UL recognized electronic thermal motor overload, energy saving operation, PID loop control, and low noise operation. Also available is a digital operator for simple programming. The design team has used the latest in microprocessor technology to produce the ***ultimate*** drive for ***any*** application.

Use the Parameter Tree on the following page to determine which control mode and access level each parameter is available in.

The VS-616PS585 ships preset to the Quick-start access level. This publication describes all Quick-Start, Basic and Advanced parameters. For installation and simplified Quick-Start parameters, please refer to ***YEA-TOA-S616-10.22***.

VS-616PS5 Parameter Overview

	Group	Function	Parameter No.		
			Quick-start	Basic	Advanced
U Monitor	U1	Monitor	01-03, 05-14	15-19	20-22,27-33,41-47, 49,50,53,54,55
	U2	Fault Trace	01-14	15,16	17-22
	U3	Fault History	01-08		
A Initialize	A1	Initialize	01, 03, 04		
B Application	B1	Sequence	01-03	04	05-06
	B2	Zero Speed Level		01	
	B3	Magnetic Pull-in			02, 04, 05
	B4	Delay Timers			01, 02
	B5	Pid Control			01-08
	B6	Reference Hold			01-04
	B7	Droop Control			01, 02
C Tuning	C1	Accel/decel	01, 02	03, 04, 09	05-08, 10, 11
	C2	PG Origin Pulse Comp.	13		
	C3	Voltage Limit Control			05
	C5	Asr Tuning		01-04	05-07
	C6	Carrier Frequency			02
	C7	S-Curve Characteristics			01-04
D Reference	D1	Preset Reference	01-04, 09	05-08	
	D2	Reference Limit		01, 02	
	D3	Jump Speed			01-04
	D4	Hold Reference Memory			01
	D5	Torque Control			01-06
E Motor	E1	Motor Constant	01-13, 17	15,16	
F Option	F1	PG Option Set-up	01,05	02-04	08-11, 13
	F2	AI-14 Set-up			01
	F3	DI-08, 16 Set-up			01
	F4	AO-08, 12 Set-up			01-06
	F5	DO-02 Set-up			01, 02
	F6	DO-08 Set-up			01
	F8	Speed Feedback Selection	01	02	
	F9	CP-916 Set-up			01-06
H Terminal	H1	Digital Inputs		01-06	
	H2	Digital Outputs		01-03	
	H3	Analog Inputs		01-03	04-12
	H4	Analog Outputs		01-07	
	H5	Serial Communications			01-05
L Protection	L2	Power Loss Ridethrough		01, 02	05
	L3	Stall Prevention		01	
	L4	Reference Detection		01, 02	03-05
	L5	Fault Restart		01, 02	
	L6	Torque Detection		01-03	04-06
	L7	Torque Limit		01-04	
	L8	Hardware Protection			01, 02, 03, 05, 07, 10
O Operator	O1	Monitor Select		01-03	
	O2	Key Select		01, 02, 04	05-08
T Tuning	T1	Auto-tuning	02,03		

* User Selectable

Main Menu:Initialize <ENTER>

A Initialization Parameters

A1 Initialization Set-up

A1-01 Parameter Access Level Q

This parameter allows the “masking” of parameters according to user level. See the following table:

Setting	Description
0	Operation Only
2	Quick Start Level *(factory default)* - For maintenance-level programming.
3	Basic Level - For basic programming in most applications.
4	Advanced Level - For advanced programming in special applications.

A1-03 Operator Status Q

Use this parameter to reset the inverter to its factory default settings. Initialize the inverter after changing the control PCB, or after selecting inverter capacity *(O2-04)*.

Setting	Description
0	No Initialization *(factory default)*.
2220	2-Wire Initialization - terminal 1 becomes FWD run command and terminal 2 becomes REV run command. All other parameters are reset to their original factory default settings.
3330	3-Wire Initialization - terminal 1 becomes run command, terminal 2 becomes stop command and terminal 3 becomes FWD/REV run selection. All other parameters are reset to their original factory default settings.

A1-04 Password Entry Q

This parameter allows password entry to view masked parameters.

Main Menu: Programming <ENTER>
B Application Parameters
B1 Sequence

B1-01 Frequency Reference Selection Q
B1-02 Operation Method Selection Q

Setting Range: 0 to 4
Factory Default: 1

Frequency reference and run command can be set independently as shown below:

Setting	Description
0	Run by digital operator reference
1	Run by external terminal reference *(factory default)*.
2	Run by serial communication
3	Option card (run by CP-916 B/G, 216 I/F references
4	Run by personal computer (CP-717) reference
6	Pulse Train reference (valid for B1-01 only, used with PG-P2)

By depressing the LOCAL/REMOTE key on the digital operator, the operation mode can be selected as shown below:

Local: Frequency reference and run command from digital operator. (Remote SEQ and REF LEDs off)

Remote: Operation according to frequency reference and run command set by *B1-01* & *B1-02,* respectively.

The Control Method is reset to remote operation when power is cycled.

B1-03 Stopping Method Selection Q

Setting Range: 0 to 3
Factory Default: 0

This function selects the stopping method suitable for the application.

Setting	Description
0	Ramp to stop *(factory default)*.
1	Coast to stop.
3	Coast to stop with timer.

- Ramp to Stop (*B1-03* = “0”)

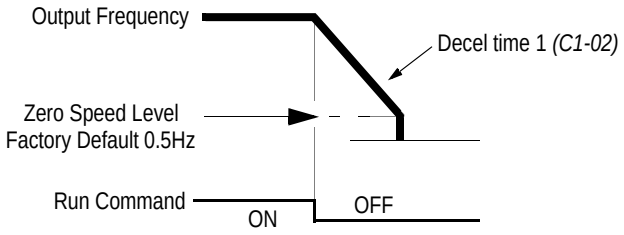


Figure 1 Stopping Method - Ramp to Stop

Upon removal of the FWD (REV) run command, the motor decelerates at a rate determined by the time set in deceleration time 1 *(C1-02)* and baseblocks upon reaching the zero speed level (B2-01) or minimum speed (E1-08), whichever is higher. If the deceleration time setting is too short or the load inertia is large, an overvoltage fault (OV) may occur during deceleration. In this case, increase the deceleration time or install an optional braking transistor and/or braking resistor (braking transistors are provided as standard for units 230V 7.5kW and smaller, 460V 15kW and smaller).
Braking torque: without braking resistor, approximately 5% of motor rated torque
with braking option, approximately 150% of motor rated torque

- Coast to Stop (*B1-03* = “1”)

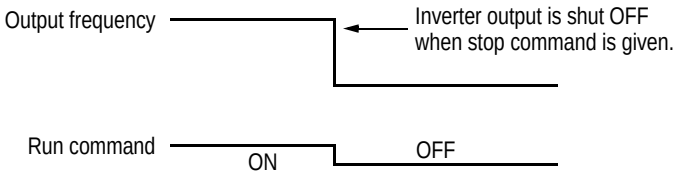


Figure 2 Stopping Method - Coast to Stop

Upon removal of the FWD (REV) run command, the motor starts to coast. Upon reapplying the run command operation will resume after the minimum baseblock time *(L2-03)* elapses.

Coast to Stop with Timer 1 (*B1-03* = “3”) should be used to prohibit the inverter from starting into a rotating motor. When setting B1-03=3, the deceleration time (C1-02) is used as the timer during which operation is prohibited.

- Coast to Stop with Timer 1 (*B1-03* = “3”)

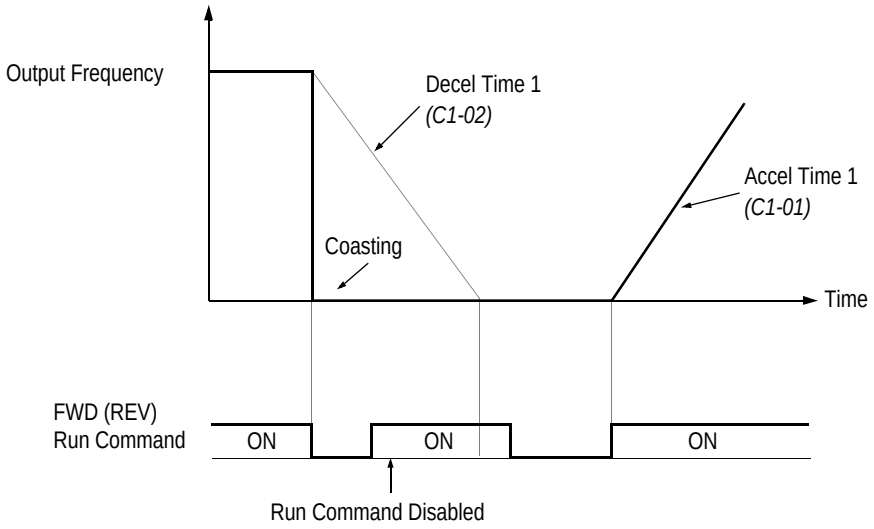


Figure 4 Stopping Method - Coast to Stop w/Timer

Upon removal of the run command, a new run command is blocked until the coast to stop timer has elapsed (same as Decel 1). After the timer elapses, the user must enter another run command for the inverter to begin acceleration. This stopping method is disabled during flux vector control.

B1-04 Reverse Operation Enable/Disable B

Setting Range: 0 to 1
Factory Default: 0

A “reverse run disabled” setting does not allow a reverse run command from the control circuit terminal or the digital operator. This setting is used in applications where a reverse run command is undesirable.

Setting	Description
0	Reverse run is enabled *(factory default).*
1	Reverse run is disabled.

B1-05 Operation Selection at Zero Speed A

Select an operation mode to be used when the speed reference (analog input) drops below the minimum speed setting *(EI -08)*.

Setting	Description
0	E1-08 is ignored, run according to speed reference.

Setting	Description
1	Baseblock *(factory default)*- No output to motor
2	Run at minimum output speed (E1-08).
3	Zero-speed operation (internal speed reference is set to “0”)

B1-06 LOCAL/REMOTE Run Select

A

This parameter determines how the inverter will function when switching from local to remote operation when the external run command is applied.

Selection	Description
0	Operation is disabled if the external run command is applied prior to switching from local to remote. The run command must be removed and re-applied to start operation.
1	Operation is enabled if the external run command is applied prior to switching from local to remote.(factory default).

B2 Zero Speed Level

.

B2-01 Zero-speed Level (Baseblock level) B

Setting Range: 0.0 to 20.0%
Factory Default: 0.5%

Sets the speed at which the inverter baseblocks upon deceleration. 20% equals 20% of the maximum speed setting as entered in parameter E1-06.

The initial value is 0.5%. The units can be changed by O1-03.

B3 Magnetic Pull-in

The magnetic pull-in (Synchronization) feature is used only during the PG orientation auto-tuning process. During normal operation this function is not performed.
During PG Orientation Auto-Tuning, the following parameters are used to gradually ramp up the motor current to a desired level to allow a “soft” rotor pole alignment. Once the magnetic pull-in is completed, the PG Orientation feature is performed.

B3-02 Magnetic Pull-in Current

A

Setting Range: 0 to 150%
Factory Default: 50%

The current level during initial magnetic pull-in is set in units of 1%.
A setting of 100% generates Motor rated current (E1-04). Increasing this value increases the motor torque during the pull-in process.

B3-04 Current Ramp-up Time

A

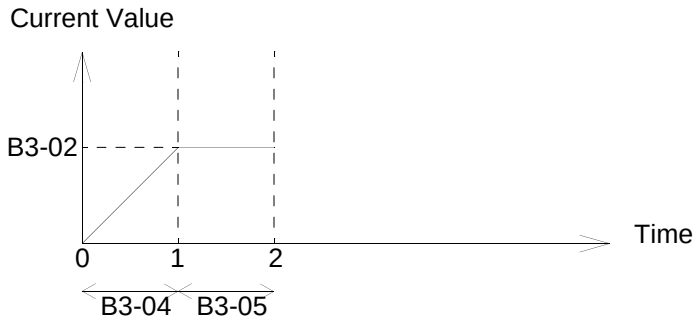
Setting Range: 0.0 to 5.0s
Factory Default: 1.0s.

Sets the rate at which the current is increased during the magnetic pull-in process. Too short a setting will result in abrupt rotor movement.

B3-05 Magnetic Pull-in Time A

Setting Range: 0.0 to 5.0s
Factory Default: 1.0s

This parameter sets the time to allow the rotor to pull in (align) with the magnetic field at initial excitation. Pull-in waiting time is set in units of 0.1s.
The current vs. time plot during the magnetic pull-in process is as follows:



Operation Status	B3-02 Adjustment	B3-04 Adjustment	B3-05Adjustment
Slow Start	-	Decrease set value	Decrease set value
Insufficient torque, and "STO" is output	Increase set value.	-	-

B4 Delay Timers

Use the inverter input (multifunction inputs) and output (multifunction outputs) in place of an external timer. When a multi-function contact input (*H1-XX* = "18") is closed, a multi-function contact output (*H2-XX* = "12") can be set to close after the On-delay time (*B4-01*) has expired. This function operates independently of any concurrent inverter activity.

B4-01 On-delay Timer A

Setting Range: 0.0 to 300.0s
Factory Default: 0.0s

Sets the ON-delay time in units of 0.1 second. The multi-function input must be "closed" for longer than the ON-delay timer for the multi-function output to close.

B4-02 Off-delay Timer A

Setting Range: 0.0 to 300.0s
Factory Default: 0.0s

Sets the OFF-delay time in units of 0.1 second. The multi-function input must be "open" longer than the OFF-delay timer for the multi-function output to open.

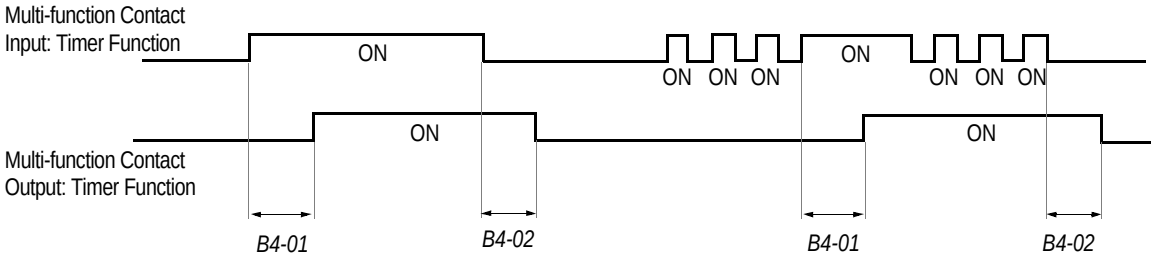


Figure 8 Timing Diagram of Timer Function

B5 PID Control

The Proportional, Integral, and Derivative (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 error) 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 B5-08), to minimize deviation, for precise control.

B5-01 PID Control Mode Selection A

To enable PID control, set PID control mode selection to "1" or "2", according to the description below. Also be sure to set terminal 16 function selection *(H3-05)* to PID feedback (Set Value: "B").

Setting	Description
0	PID is disabled *(factory default).*
1	PID is enabled (deviation signal is put through derivative control).
2	PID operates with feed forward (feedback signal is put through derivative control).

Notes:

1. PID with feed forward applies control much quicker than normal PID, without waiting for the deviation signal to build up.
2. A PID inverse feedback signal can be selected by inverting the settings for terminal 16 gain and bias.

Then select the PID control intended value (setpoint) and detected value (feedback) setpoint as follows:

Detected Value (Feedback)

Set the PID feedback value with the control circuit terminal 16 voltage signal (0 to 10V, -10 to 10V) or multi-step speed parameters *H1-03* to *H1-06*.

Control circuit terminal 16 voltage signal:
Set reference selection *(B1-01)* to "1" and set *H3-05 = "B"*.

Multi-step speed parameters via multifunction inputs (*H1-01* to *H1-06*):
Set reference selection *(B1-01)* to "0."
Set multifunction inputs to (*H1-01* to *H1-06*) set value 3,4 and/or 5.
(allows combination of multi-step speed references and jog frequency reference as entered in parameter *D1-01 thru D1-09*)

Intended Value (Setpoint)

The control circuit terminal 14 current signal (4 to 20mA) or voltage signals (0 to 10V, -10 to +10V) can be used to set the PID setpoint value.

Control circuit terminal 14 accepts 4-20 MA current signal:
Set terminal 14 signal selection *(H3-08)* to "2."

Control circuit terminal 14 accepts voltage signal:

Set terminal 14 signal selection *(H3-08)* to “0” for 0-10 VDC input signal or “1” for -10 to 10 VDC input signal. The J1 jumper must also be cut to set-up terminal 14 to accept a voltage signal.

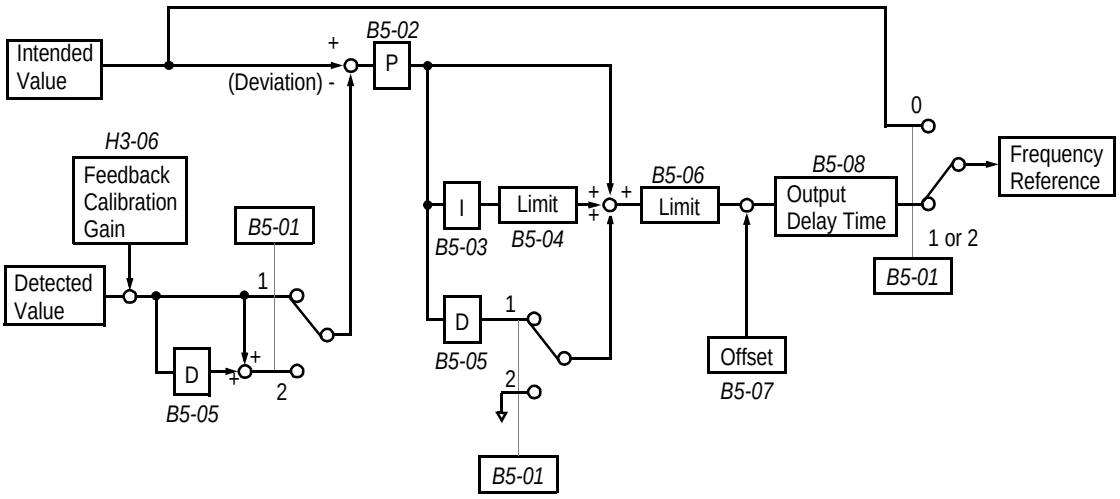


Figure 9 PID Control Block Diagram

Notes:

1. I value is reset to ”0” when operation stops.
2. The upper limit of the I value can be set by parameter *B5-04*. Increase the value of parameter *B5-04* to upgrade control capability by integration. If the control system is unstable and it cannot be stopped by adjusting the integral time, output delay time, etc., decrease the set value of parameter *B5-04*.
3. PID control can be canceled by a multi-function contact input signal. By setting any of parameters *H1-01* to *H1-06* to “19” and by closing the contact during running PID control is disabled and the intended value signal itself is used as a frequency reference signal.

B5-02 PID Control Proportional Gain A

Setting Range: 0.00 to 25.00
Factory Default: 1.00

The proportional gain is the value by which the deviation signal is multiplied to generate a new frequency reference. Too high a setting will result in oscillations (instability).
Too low a setting will result in a sluggish response.

B5-03 PID Control Integral Time A

Setting Range: 0.00 to 360.0s
Factory Default: 1.00s

The integral calculation sums the deviation over time which forces the deviation to become zero. Thus, the feedback will match the desired setpoint. The integral time determines how quickly the integral gain increase is added to the control loop. Too high a setting will result in slow response. Too low a setting may result in rapid oscillations (instability).

B5-04 PID Control Integral Limit A

Setting Range: 0.0 to 100.0%
Factory Default: 100.0%

The integral limit is used to limit the range of the integral term. In some applications it may be desirable to limit the integral term to improve system response. Otherwise, the integral value may become large and overshoots may result when the integral value takes a long time to integrate in the opposite direction. This value is set as a percentage of maximum motor speed *(E1-06)*.

B5-05 PID Control Derivative Time A

Setting Range: 0.00 to 10.00s
Factory Default: 0.00s

The derivative calculation attempts to control the remaining overshoot left over after the proportion and integral calculations. If the system is approaching the intended value very rapidly, the derivative control produces a strong braking action to prevent overshoot. If the system is already stable with very little deviation change, derivative control has very little effect. The derivative time is used to dampen oscillations and reduce overshoot, thus improving stability. Setting the derivative time to a larger number produces more braking action in the control system.

B5-06 PID Control Limit A

Setting Range: 0.0 to 100.0%
Factory Default: 100.0%

The PID limit places a limit on the PID signal output, limiting the output frequency reference. Normally this is set to 100% to allow unrestrained operation of the PID function. This value is set as a percentage of maximum motor speed *(E1-06)*.

B5-07 PID Control Offset A

Setting Range: ±100.0%
Factory Default: 0.0%

The PID offset adds a bias to the calculated PID value.

B5-08 PID Control Output Primary Delay Time A

Setting Range: 0.00 to 10.00s
Factory Default: 0.00s

The output delay time builds in a delay to changes in the calculated PID value, which can prevent oscillations and improve stability. Use the PID Delay Time when transients occur in the system and it is undesirable to have the PID respond.

Parameters *B5-04* thru *B5-08* are preset at the factory to optimum values for most applications, and hence, do not need to be changed.

When tuning a system, first increase the proportional gain until oscillations occur. Then, reduce the proportional gain slightly until the oscillations stop. Next, reduce the integral time slowly until oscillations begin. Then, increase the integral time slowly so that the oscillations cease. Test the system under all conditions, observe the stability and verify that the desired operation is generated. Fine tune the proportional and integral times, along with any other PID parameter as needed.

B6 Reference Hold

The reference hold or dwell function is used to temporarily hold the output frequency at a set reference, for a set time, during the acceleration and deceleration process. Use this function when driving a permanent magnet motor, or a motor with a heavy starting load. The 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.

B6-01 Dwell Reference at Start A

Setting Range: 0.00 to 100.00%
Factory Default: 0.00%

Sets the dwell frequency reference during acceleration in units of 0.01%.

B6-02 Dwell Time at Start A

Setting Range: 0.0 to 10.0s
Factory Default: 0.0s

Sets the amount of time that the frequency reference “dwells” during acceleration in units of 0.1s.

B6-03 Dwell Reference at Stop A

Setting Range: 0.00 to 100.00%
Factory Default: 0.00%

Sets the dwell frequency reference during deceleration in units of 0.01%.

B6-04 Dwell Time at Stop A

Setting Range: 0.0 to 10.0s
Factory Default: 0.0s

Sets the amount of time that the frequency reference “dwells” during deceleration in units of 0.1s.

B7 Droop Control

Droop Control is a function that allows the speed of a motor to decrease in proportion to load torque. This can be used to insure load sharing between drives on multiple drive systems.

B7-01 Droop Capacity

A

Range:0.0 to 100.0%
Factory Default: 0.0%

$$\text{Droop amount (\%)} = \frac{(B7-01)}{100} \times 100\%$$

A setting of 100% allows the speed to drop 100% of the maximum speed value (when the torque is 100%).

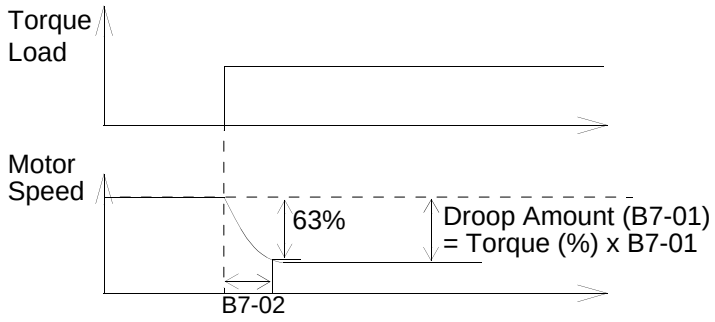
Droop response time is set with parameter B7-02.

B7-02 Droop Delay Time

A

Setting Range: 0.00 to 1.00s
Factory Default: 0.10s

When B7-02 is decreased, drooping response becomes quicker, but the motor hunts more easily.

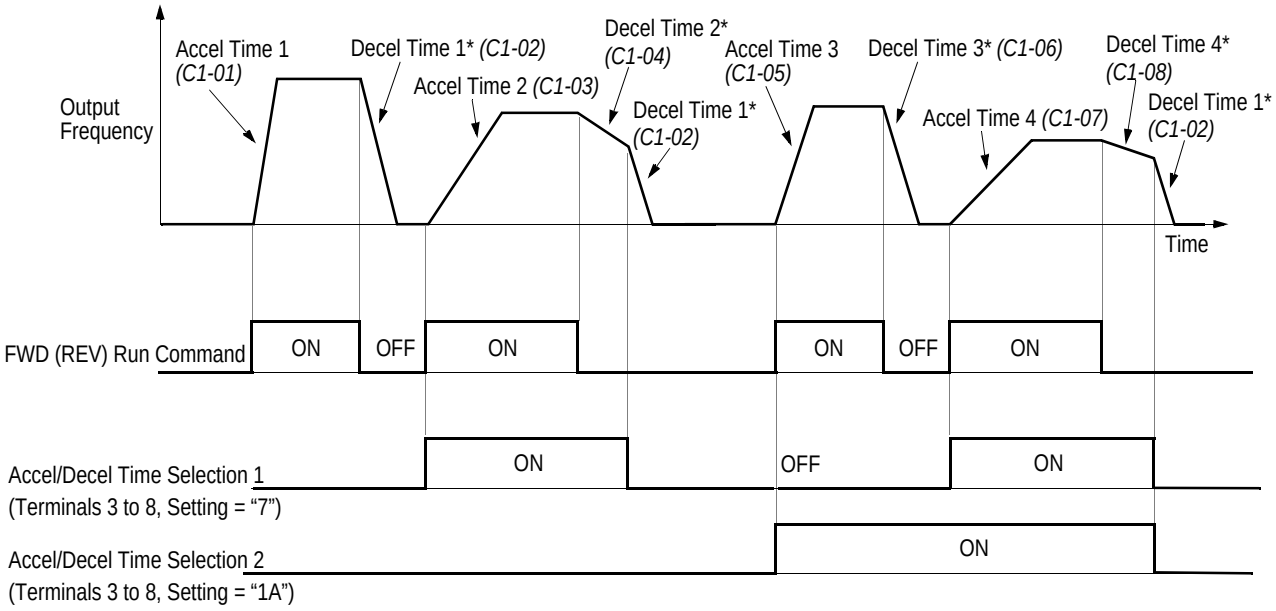


C Tuning Parameters
C1 Accel/Decel

C1-01 Acceleration Time 1	Q
C1-02 Deceleration Time 1	Q
C1-03 Acceleration Time 2	B
C1-04 Deceleration Time 2	B
C1-05 Acceleration Time 3	A
C1-06 Deceleration Time 3	A
C1-07 Acceleration Time 4	A
C1-08 Deceleration Time 4	A

Setting Range: 0.00 to 6000.0s
Factory Default: 10.0s

The acceleration parameters set the time necessary for the output speed to accelerate from 0 to the maximum Speed (E1-06). Deceleration parameters set the time needed for the output Speed to decelerate from the maximum speed to 0. .



* When "ramp to stop" is selected (*B1-03* = "0")

Figure 13 Timing Diagram of Accel/Decel Time Adjustment

Use the multifunction inputs to select up to four accel/decel times. When any of the multi-function contact input selections (*H1-01* to *H1-06*) 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 3 to 8).

Accel/decel Time Selection 1 Multi-function Input Setting = "7"	Accel/decel Time Selection 2 Multi-function Input Setting = "1A"	Accel Time	Decel 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 B

Setting Range: 0.00 to 6000.0s
Factory Default: 10.0s

When a Multi-function contact input is set to fast-stop command (setting = "15"), and the contact closes the fast stop feature is executed.
It may be necessary to install a braking unit to achieve the desired stopping rate and eliminate over-voltage from occurring.

C1-10 Accel/Decel Time Setting Units A

Setting	Description
0	Accel/decel time (C1-01 to C1-09) setting range is in units of 0.01s. Accel/decel time setting range: 0.00 to 600.00s
1	Accel/decel time (C1-01 to C1-09) setting range is in units of 0.1 second. Accel/decel time setting range: 0.0 to 6000.0s *(factory default).*

If any of the parameters *C1-01* to *C1-09* is set to 600.1 seconds or more, *C1-10* cannot be set to "0."

C1-11 Automatic Accel/Decel Time Switching Speed Level A

Setting Range: 0.0 to 100.0%
Factory Default: 0.0%

Accel/decel times can be changed automatically, without using the multi-function contact inputs. This feature is active anytime *C1-11 is not equal to 0.*

Use accel/decel times set in parameters *C1-01* and *C1-02* when output frequency ≥ *C1-11*.

Use accel/decel times set in parameters *C1-07* and *C1-08* when output frequency < *C1-11*.

Multi-function contact inputs which are set for accel/decel selection have priority over

the automatic change of accel/decel.

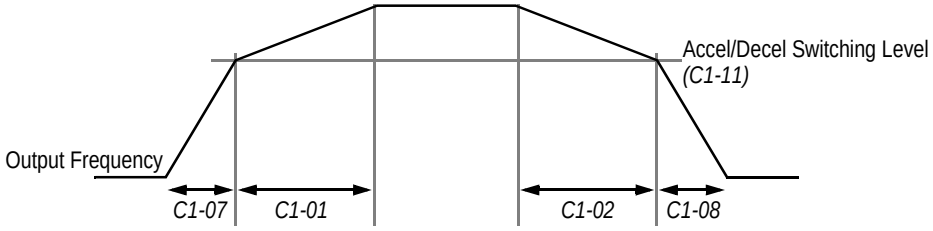


Figure 14 Accel/Decel Switching Level Adjustment

C2 PG Origin Pulse Compensation

C2-13 PG Origin Pulse Compensation Value

Q

Setting Range: ±180°

Indicates the angular displacement between the magnetic pole and the marker pulse from the hall sensor or encoder feedback devices. This value is used to control the commutation to insure optimum performance.

This value is automatically set when performing PG origin auto-tuning.

Do not change after setting.

This value is not initialized at initialization.

C3 Voltage Limit Control

C3-05 Voltage Limit Control Selection

A

This parameter sets the voltage limit control.

Set Value	Description
0	·Voltage limitation control is not performed *(factory default).*
1	·Voltage limitation control is performed limits the output voltage to 230 (460) by reducing the d-axis current level.

C5 ASR Tuning

The Automatic Speed Regulator (ASR) provides closed loop motor speed control so that optimum performance during changes in motor speed or load can be achieved.

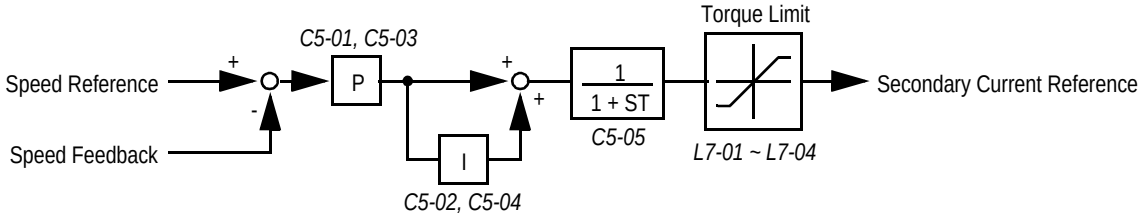


Figure 20 ASR Block Diagram (Flux Vector Control)

C5-01 ASR Proportional Gain 1 B

Setting Range: 0.00 to 300.00
Factory Default: 5.00

The ASR proportional gain 1 adjusts the speed in response to the speed deviation signal. Speed response increases as the proportional gain is increased. However, the load may become unstable if the ASR proportional gain is set too high.

C5-02 ASR Integral Time 1 B

Setting Range: 0.000 to 10.000s
Factory Default: 0.500s

The ASR integral time 1 adjusts the inverter's response time to changes in load. Response increases as the integral time is decreased. However, the load may become unstable if the ASR integral time is set too low.

C5-03 ASR Proportional Gain 2 B

Setting Range: 0.00 to 300.00
Factory Default: 5.00

The ASR proportional gain 2 is an additional proportional gain adjustment that can be enabled by a multi-function contact input (*H1-XX* = "77").

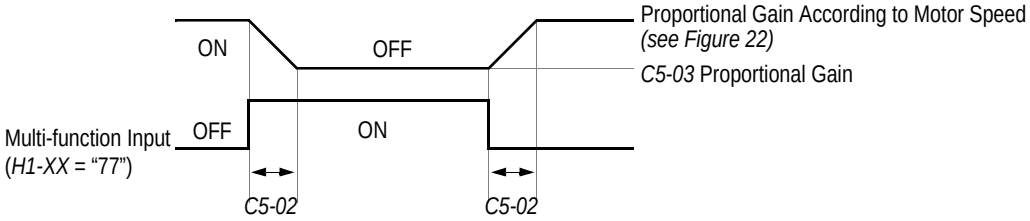


Figure 21 ASR Multi-function Input Timing Diagram

C5-04 ASR Integral Time 2 B

Setting Range: 0.000 to 10.000s
Factory Default: 0.500s

The ASR integral time 2 is an additional integral time adjustment.

C5-05 ASR Output Primary Delay Time A

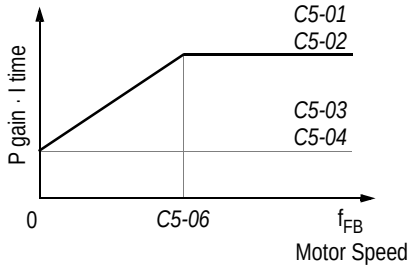
Setting Range: 0.000 to 0.500s
Factory Default: 0.004s

Mechanical backlash in an application causes secondary current (I_2) reference variations in the motor's rotor. This condition can undesirably limit the adjustment of ASR parameters. The output delay time constant is used to control these secondary current (I_2) reference variations.

C5-06 ASR Switching Speed Level A

Setting Range: 0.00 to 100.00%
Factory Default: 0.00%

Sets speed at which *C5-01 and C5-02* are achieved. When C5-06 is set to any setting other than 0, both sets of proportional and integral values are used (See Figure 22).



$$f_{FB} = \frac{P \cdot N}{120}$$

where . . .
P = Number of Motor Poles
N = Motor RPM

* When *C5-06* ="0", proportional gain 1 *(C5-01)* and integral time 1 *(C5-02)* are selected.

Figure 22 ASR Switching Speed Level

Notes:
1. When *C5-06* =" 0", proportional gain 1 *(C5-01)* and integral time 1 *(C5-02)* are selected.

C5-07 ASR P Gain at Start A

Setting Range: 0.00 to 300.00
Factory Default: 5.00

This parameter sets the ASR P gain applied at magnetic pole pull-in. It is set to a unit of 0.01.

C6 Carrier Frequency

This function sets the inverter output transistor switching frequency (carrier frequency). Increase the carrier frequency to reduce motor noise and decrease it to reduce leakage current. When increasing the carrier frequency above the factory default values, current derating is necessary.

C6-02 Carrier Frequency Upper Limit

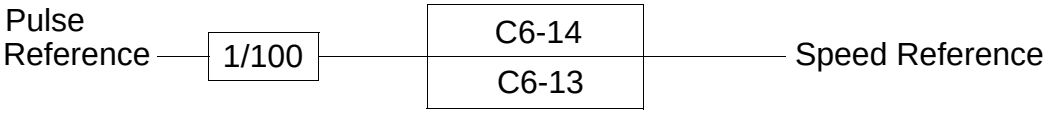
A

Factory Settings:

230 Volt Models	
Model Number	Carrier Frequency
PS5U20P4	8kHz
PS5U20P7	
PS5U21P5	
PS5U22P2	
PS5U23P7	
PS5U25P5	
PS5U27P5	
PS5U2011	
PS5U2015	

460 Volt Models	
Model Number	Carrier Frequency
PS5U40P4	8kHz
PS5U40P7	
PS5U41P5	
PS5U42P2	
PS5U43P7	
PS5U45P5	
PS5U47P5	
PS5U4011	
PS5U4015	
PS5U4018	
PS5U4022	
PS5U4030	
PS5U4037	4kHz
PS5U4045	
PS5U4055	
PS5U4075	
PS5U4110	
PS5U4160	

460 Volt Models	
Model Number	Carrier Frequency
PS5U4185	2kHz
PS5U4220	
PS5U4300	



C6-13 Pulse Reference Ratio Denominator Value A

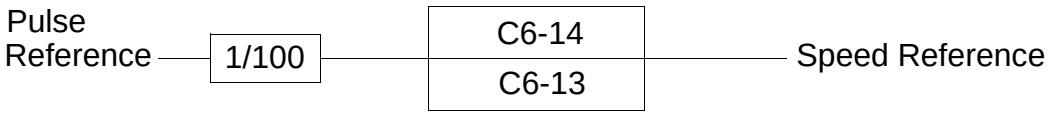
Setting Range: 0 - 1000
Factory Default: 0

Sets the denominator portion of the pulse reference multiplication block. Used when B1-02=6 (Pulse Train reference mode).

C6-14 Pulse Reference Ratio Numerator Value A

Setting Range: 0 - 1000
Factory Default: 0

Sets the numerator portion of the pulse reference multiplication block. Used when B1-02=6 (Pulse Train reference mode).



C7 S-Curve Accel/Decel

An S-curve pattern is used to reduce shock and provide smooth transitions during machine acceleration and deceleration. S-curve characteristic time is the time it takes to reach the set accel/decel rate during a speed change.

C7-01 S-Curve Time at Acceleration Start	A
C7-02 S-Curve Time at Acceleration End	A
C7-03 S-Curve Time at Deceleration Start	A
C7-04 S-Curve Time at Deceleration End	A

Setting Range: 0.00 to 2.50s
Factory Default: 0.00s

.

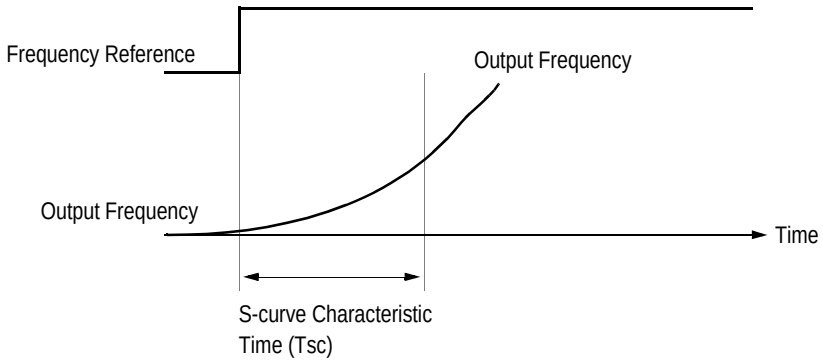


Figure 15 S-curve Characteristic Timing Diagram

The following figure shows FWD/REV run switching with deceleration to stop.

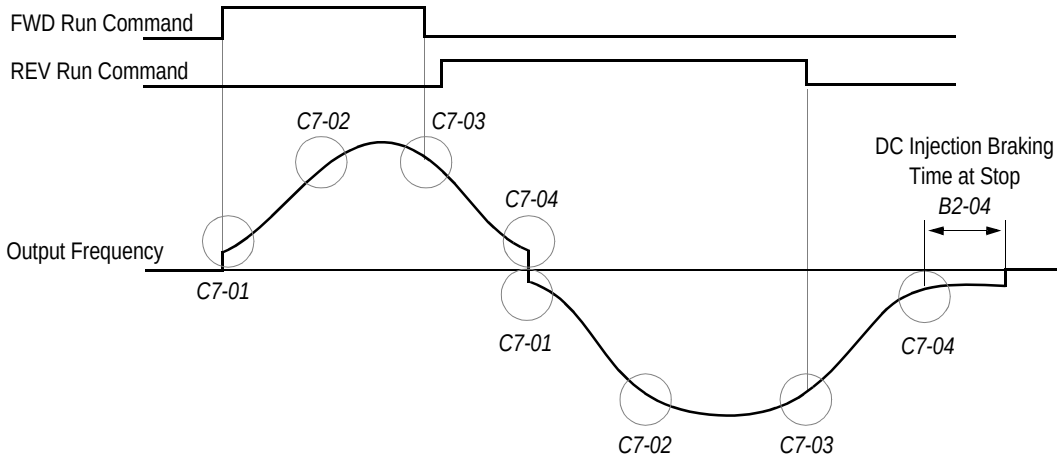


Figure 16 S-curve Characteristics - FWD/REV Operation

Time to accelerate from the minimum frequency to the maximum frequency (total acceleration) = *C1-XX* + (*C7-01* + *C7-02*)/2

D Reference Parameters
D1 Preset References

D1-01 Preset Reference 1 Q
D1-02 Preset Reference 2 Q
D1-03 Preset Reference 3 Q
D1-04 Preset Reference 4 Q
D1-05 Preset Reference 5 B
D1-06 Preset Reference 6 B
D1-07 Preset Reference 7 B
D1-08 Preset Reference 8 B

Setting Range: 0.00 to 100.00%
Factory Default: 0.00%

Up to *9* preset speed references (including jog) with the multi-function contact input function selections. When using the multi-step speed references, set the reference selection *(B1-01)* to "0," and set terminal 16 selection *(H3-05)* to "1F." See the following table for programming preset speed references.

Terminal 5 *H1-03* = "3"	Terminal 6 *H1-04* = "4"	Terminal 7 *H1-05* = "5"	Terminal 8 *H1-06* = "6"	Speed Reference
Open	Open	Open	Open	Speed Reference 1 - Set Reference Source *(B1-01)* to "0."
Closed	Open	Open	Open	Speed Reference 2 - Set Terminal 16 Selection *(H3-05)* to "1F."
Open	Closed	Open	Open	Speed Reference 3
Closed	Closed	Open	Open	Speed Reference 4
Open	Open	Closed	Open	Speed Reference 5
Closed	Open	Closed	Open	Speed Reference 6
Open	Closed	Closed	Open	Speed Reference 7
Closed	Closed	Closed	Open	Speed Reference 8
Closed	Closed	Closed	Closed	Jog Speed Reference

D1-09 Jog Frequency Reference B

Setting Range: 0.00 to 100.00%
Factory Default: 10.00%

The jog frequency reference can be set in this parameter. Depress the JOG key on the digital operator, or close terminal 7 to use this function. The jog command always has priority over other reference commands. When using the multi-step speed references as indicated in the table above, change the jog command from terminal 7 to terminal 8 (*H1-06* = "6"). Selecting the jog frequency reference via a multifunction input selects the jog frequency reference only. A separate run command also needs to be applied to start the unit.

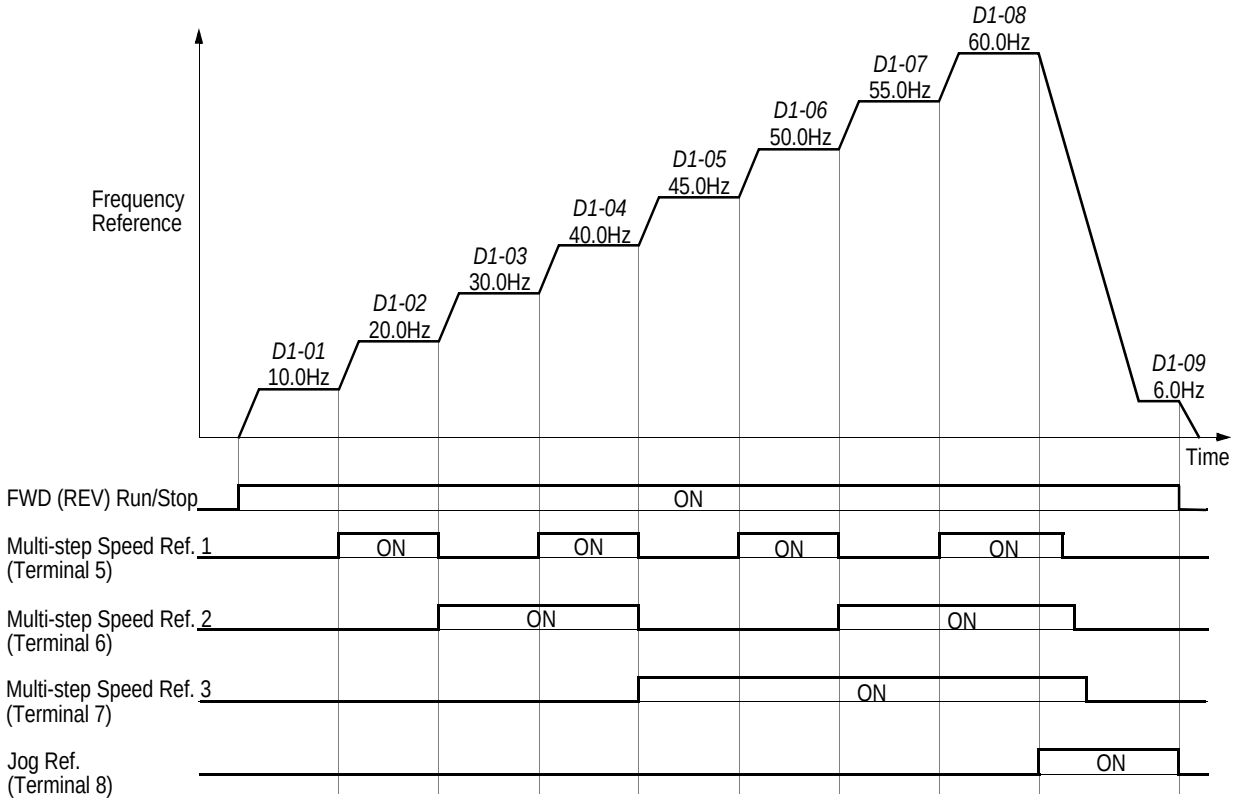


Figure 24 Multi-step Speed Operation - Timing Diagram

Note: Setting units for *D1-01* to *D1-09* are dependent upon the setting of digital operator display mode *(O1-03)*. Possible setting units include Hz, percentage, RPM, or engineering units. See section ***O1***, ***Monitor Selection***, for more details.

D2 Reference Limits

D2-01 Speed Reference Upper Limit B

Setting Range: 0.0 to 110.0%
Factory Default: 100.0%

The speed reference upper limit is set as a percentage of the maximum output speed *(E1-06).* Limits the maximum output speed of the motor.

D2-02 Speed Reference Lower Limit B

Setting Range: 0.0 to 100.0%
Factory Default: 0.0%

The speed reference lower limit is set as a percentage of the maximum output speed *(E1-06)*. When a run command is input and the speed reference is less than the lower limit, operation continues at the speed reference lower limit. However, when the lower limit is set to less than the minimum output speed *(E1-08)*, operation discontinues.

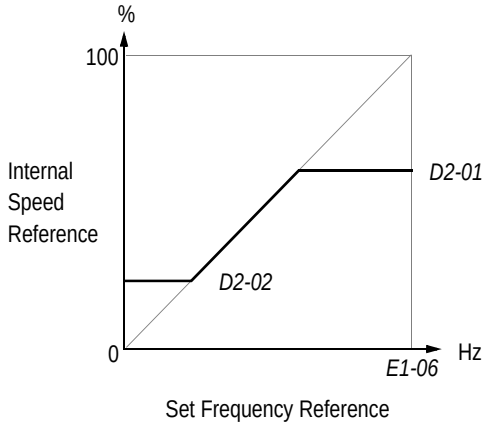


Figure 25 Setting Frequency Upper and Lower Limits

D3 Jump Frequencies

D3-01 Jump Speed Reference 1	A
D3-02 Jump Speed Reference 2	A
D3-03 Jump Speed Reference 3	A

Setting Range: 0.0 to 200.0%
Factory Default: 0.0%

D3-04 Jump Speed Reference Bandwidth	A

Setting Range: 0.0 to 200.0%
Factory Default: 1.0%

These functions allow the prohibition or “jumping” of critical Speeds so that the motor can operate without resonant vibrations caused by some machine systems. They are also used for dead band controls. Setting the value to 0.0% disables each function.

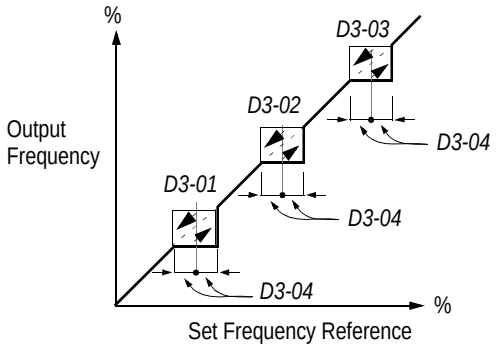


Figure 26 Jump Frequencies

D4 Reference Memory (Memorize Last Reference)

D4-01 Reference Memory Selection - (Up/Down or Accel/ Decel Hold Feature)

A

Selects whether the reference memorization feature during, Up/Down or Accel/Decel Hold operation is stored when operation is stopped (when power is removed or when the run command is cancelled or overridden).

Setting	Description
0	Reference memorization during Up/Down or Accel/Decel Hold operation not retained. If a stop command is given or if power is removed, the frequency reference is reset to 0Hz. If the inverter is decelerating when the run command is restored, operation resumes at the frequency reference which the inverter has ramped down to *(factory default)*.
1	Reference memorization during an Up/Down or Accel/Decel hold operation is retained. If a stop command is given, or if power is removed, operation resumes at the held frequency reference when run command is restored.

Note: Up/Down operation is set using the multi-function contact input function selections (*H1-01* to *H1-06*, setting = “10” and “11”). Accel/Decel Hold operation is set using multi-function contact input function selections (*H1-01 to H1-06*, setting = “A”). See section ***H1, Digital Inputs***, for more information.

D5 Torque Control

D5-01 Torque Control Selection A

Select either speed and torque control.

Setting	Description
0	Speed control enabled with torque limit *(factory default)*
1	Torque control enabled with speed limit

Speed/torque control selection can also be made by using a multi-function contact input function selection (*H1-XX* = "71"). When using a multifunction contact input to switch between speed and torque control, set D5-01 = "0".

D5-02 Torque Limit Primary Delay Time A

Setting Range: 0 to 1000ms
Factory Default: 0ms

Sets delay time constant for torque reference input in the torque control mode, in units of 1ms. This can be used to filter (smooth) a noisy/rapidly fluctuating torque reference signal so that abrupt torque changes do not occur.

D5-03 Speed Limit Input Selection A

Select speed limit location in the torque control mode.

Setting	Description
1	Speed limit is the analog speed reference set by terminal 13 or 14 *(factory default)*.
2	Speed limit is the digital value set by D5-04.

D5-04 Speed Limit Value A

Setting Range: ±120%
Factory Default: 0%

Sets the speed limit value in the torque control mode as a percentage of the maximum output frequency. Used when *D5-03* = "2."

D5-05 Speed Limit Bias A

Setting Range: 0 to 120%
Factory Default: 5%

Sets the speed limit bias value in the torque control mode as a percentage of the maximum output frequency. See "Torque Control Operation" description on following page.

D5-06 Speed/Torque Control Changeover Delay Timer A

Setting Range: 0 to 1000ms
Factory Default: 50ms

When using a multifunction input to switch between speed and torque mode, D5-06 can be used to allow the analog signals to be modified in preparation for the newly selected mode.

Upon a change in command (Speed/Torque) the analog input values are retained for the time set in D5-06 so the analog signals can be changed to accommodate the new mode. After the D5-06 time elapses the new analog signals are accepted.

Torque Control Operation
To select torque control, set torque selection *(D5-01)* to "1," or close the multi-function contact input set to speed/torque control (*H1-XX* = "71") and set terminal 16 function selection to torque reference (*H3-05* = "13").

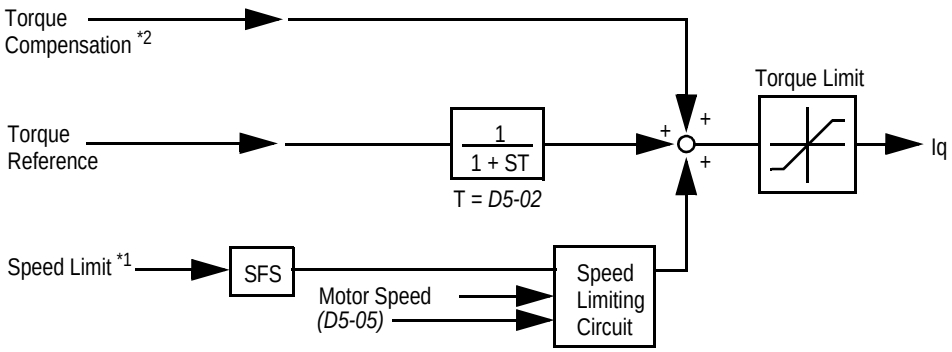


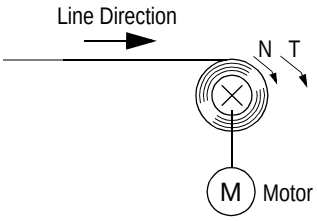
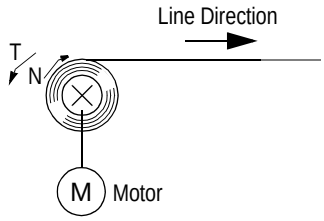
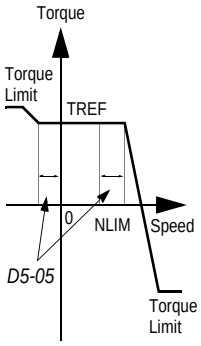
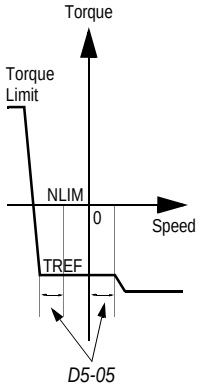
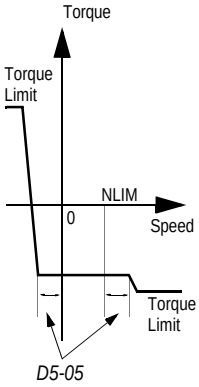
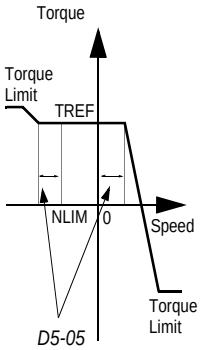
Figure 27 Torque Control Block Diagram

*1: When speed limit selection *(D5-03)* is set to "1," the master frequency reference input from terminal 13 or 14 becomes the speed limit; when speed limit selection *(D5-03)* is set to "2," the set value of *D5-04* becomes the speed limit.
*2: When terminal 14 function selection is set to torque compensation (*H3-09* = "14"), the terminal I4 set value can be used as the torque compensation value.

When torque reference > 0 and speed limit > 0 (winder application sequence), the following sequence is activated:

- When [-1 × speed limit bias *(D5-05)*] < motor speed (%) < [speed limit + *D5-05*], torque control is activated using the set torque reference.
- When motor speed > [speed limit + *D5-05*], speed limiting circuit outputs a negative torque reference to prevent the motor speed from increasing.
- When motor speed < [-I × *D5-05*], the speed limiting circuit outputs a positive torque reference to prevent the motor speed from increasing in the reverse direction.

Therefore, when torque reference > 0 and speed limit (%) > 0, the torque control range is:
[-l × *D5-05*] < motor speed < [speed limit + *D5-05*]
Refer to the following table for more details on the relationship between torque reference, speed limit, and motor speed.

		Winder Control		Unwinder Control	
Configuration					
Direction of Motor Rotation		Forward	Reverse	Forward	Reverse
Reference Polarity	Torque Reference (TREF)	+	-	-	+
	Speed Limit (NLIM)	+	-	+	-
Torque Profile					

Speed/Torque Control Switching

- Speed control or torque control can be selected “on the fly” by using the multi-function input speed/torque control selection command (*H1-XX* = “71”).

Terminal No.	Parameter No.	Setting	Description
8	H1-06	71	Speed/torque control selection
13	B1-01 D5-03	1 1	Frequency reference selection (terminals 13, 14) Speed limit selection (terminals 13, 14)
16	H3-05	13	Torque reference

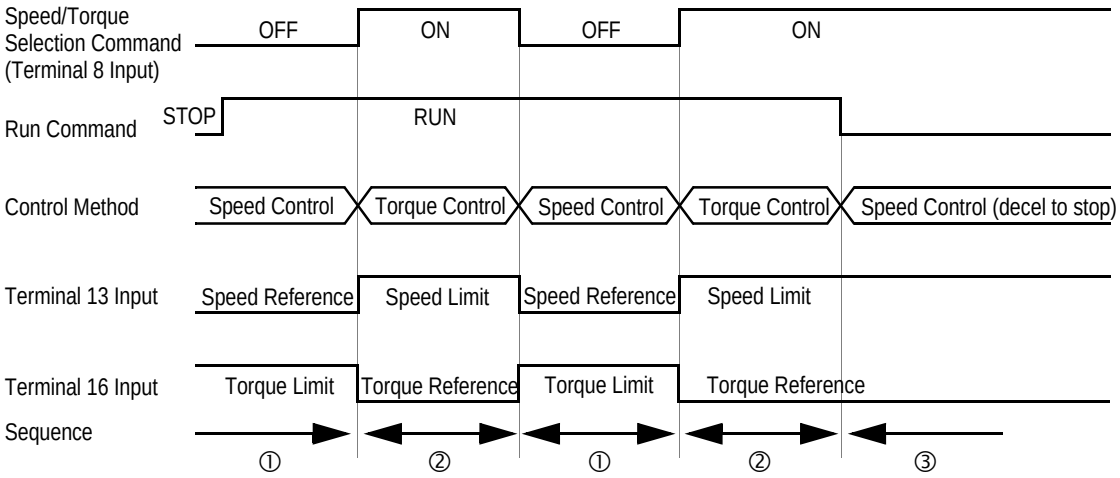


Figure 28 Speed/Torque Control Selection Timing Diagram

Sequence Description

① When the speed/torque control selection contact is OPEN, speed control is activated:

- Speed reference during speed control depends on the frequency reference selection *(B1-01)* setting. To use terminal 13 or 14 as the master frequency reference, set *BI-0l* to "l."
- Torque limit during speed control is the smaller of the absolute value of terminal 16 torque limit *(H3-05 = 13)*, or the values set in the torque limit parameters (*L7-01* to *L7-04*).
- When a stop command is given during speed control, speed control is maintained and the smaller of the absolute value of terminal l6 torque limit, or the values set in the torque limit parameters (*L7-01* to *L7-04*), is used as the torque limit. Then the motor decelerates to stop.

② When the speed/torque control selection contact is CLOSED, torque control is activated:

- Speed limit during torque control is:
- the master frequency reference at terminal 13 or 14 when speed limit selection *(D5-03)* is set to "1"
- the speed limit value *(D5-04)* when *D5-03* = "2," regardless of the frequency reference selection *(B1-01)* setting.
- During torque control, the terminal 16 analog input value becomes the torque reference.

③ By giving a stop command during torque control, operation changes to speed control automatically, and the motor decelerates to stop. The torque limit during deceleration to stop becomes the values set in the torque limit parameters (*L7-01* to *L7-04*).

Note: The control mode actually changes after the speed/torque control selection command changes *and* after the reference delay timer *(D5-06)* elapses. The terminal 13 speed reference/speed limit and the terminal 16 torque limit/torque reference are stored in the inverter until the time set to *D5-06* passes.

E Motor Parameters
E1 Motor Constant

E1-01 Inverter Input Voltage Setting Q

Setting Range: 180 to 230V (360 to 460V)
Factory Default: 230V (460V)

Set E1-01 to the nominal expected line voltage (exact setting is not required)
This setting adjusts the overvoltage level, the braking transistor turn on level, and the stall prevention level during deceleration.

Inverter Voltage	E1-01 Setting	Overvoltage Trip		Braking Transistor		Stall Level
		Trip	Reset	ON	OFF	
230	150 - 255	400V	380V	380V	375V	380V
460	>400	800V	760V	760V	750V	760V
460	<400	720V	680V	660V	650V	670V

Only built-in type braking transistors will be affected, not CDBR units.

E1-02 Motor Capacity Selection Q

Setting Range: 1000 to 1239
Factory Default: 0

Used in conjunction with the motor connection selection (E1-17) to automatically load the motor parameter *(E1-03 thru E1-13)* from a pre-programmed look-up table. When setting E1-02 to any setting other than 1000, be sure to set E1-17 to the proper connection setting first. Then, set E1-03 to the proper motor winding type. When set to 1000, manual entry of parameter E1-03 - E1-13 is required.
Do not change the value after it has been set as the motor parameters will be modified.

E1-03 Motor Rated Voltage Q

Setting Range: 0.0 to 255.0V (0-510.0 V)
Factory Default: 230.0 (460.0)

Sets the motor rated voltage. Set to 230.0 for 320VDC nameplated motors and 460.0 for 640VDC nameplated motors.

E1-04 Motor Rated Current Q

Setting Range: 0.0 to 605.0
Factory Default: 0.00 (E1-02=1000)

Set to the motor rated current as indicated on the motor nameplate for motor capacity 7.5kW or less is set in units of 0.01A, and for motor capacity 11kW or greater, in units of 0.1A.

E1-05 Number of Motor Poles Q

Setting Range: 2, 4, 6, or 8
Factory Default: 4 (E1-02=1000)

Use this parameter to set the number of motor poles.

E1-06 Maximum Motor Speed Q

Setting Range: 0 to 6000rpm
Factory Default: 1 (E1-02=1000)

Set the maximum motor speed with this parameter in units of 1rpm. Avoid the constant horsepower range due to lack of field weakening control in the brushless DC machine.

E1-07 Base Motor Speed Q

Setting Range: 0 to 6000rpm
Factory Default: 1 (E1-02=1000)

Base motor speed is set in units of 1rpm.
.

E1-08 Minimum Motor Speed Q

Setting Range: 0 to 6000rpm
Factory Default: 30 (E1-02=1000)

The minimum motor operating speed is set in units of 1rpm.

E1-09 Motor Terminal to Terminal Resistance Q

Setting Range: 0 to 65.535Ω
Factory Default: 0.000 (E1-02=1000)

Set the terminal to terminal resistance of the motor in units of 0.001Ω.

E1-10 Motor d Axis Inductance Q

Setting Range: 0.00 to 600.00mH
Factory Default: 0.00 (E1-02=1000)

The d Axis inductance is set in units of 0.01mH.

E1-11 Motor q Axis Inductance Q

Setting Range: 0.00 to 600.00mH
Factory Default: 0.00 (E1-02=1000)

This parameter sets the q Axis inductance in units of 0.01mH at the time the motor-rated load is established. Set this value equal to the setting in parameter E1-10 for surface magnet PM motors.

E1-13 Induced Voltage Constant Q

Setting Range: 20.0 to 500.0 V/1000 RPM
Factory Default: 0.0 (E1-02=1000)

This parameter sets the induced voltage RMS value for the motor in units of 0.1V/ 1000 RPM. Enter the induced voltage generated at 1000 RPM motor speed. Make sure the induced voltage at the maximum speed (E1-06 does not exceed the voltage rating of the inverter.
Do not change the value after it has been set.

E1-15 Motor Mechanical Loss A

Setting Range: 0.0 to 10.0%
Factory Default: 0.0

The motor's mechanical loss is set in units of 0.1%. Used to improve torque linearity The motor's rated output is 100%.

E1-16 Motor Feeder Resistance A

Setting Range: 0.0 to 10.0%
Factory Default: 1.0

Wiring resistance between the inverter and the motor is set by a percentage value of the inverter's rated voltage.

$$R_{feed} = \frac{R_f \times I_m}{\frac{V_b}{\sqrt{3}}} \times 100$$

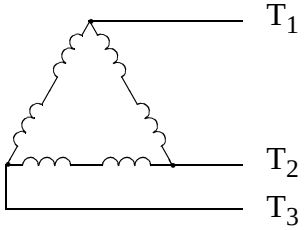
Where:

R_{feed}= Percent wiring resistance between inverter and motor
R_f = Feeder resistance (Ω)
I_m = Rated current (E1-04) (A)
V_b = Inverter rated voltage (E1-03) (V)

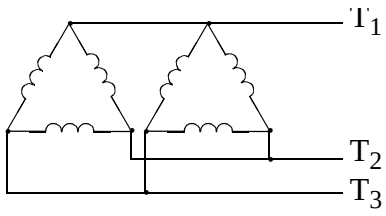
E1-17 Motor Connection Selection A

Setting Range: 0 to 3
Factory Default: 0

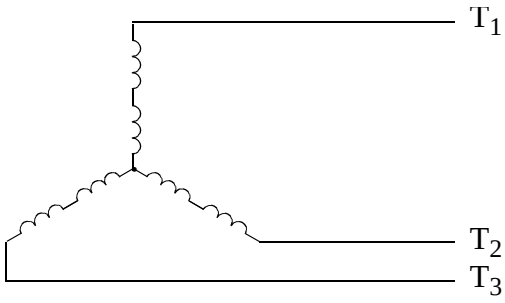
Sets the winding connection configuration for the connected motor. Used only when using the winding data look-up tables, E1-02 is not equal to 1000 (see Installation & Quick Start Manual). Set E1-17 to the proper configuration first, then set E1-02 to the proper winding code. This parameter is not used if E1-02=1000.
0: 1Δ Connection:



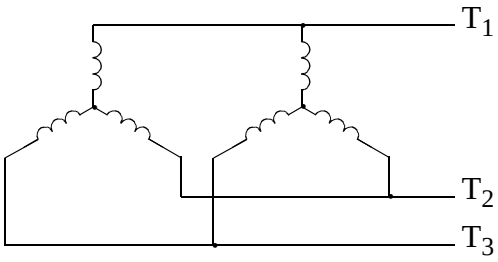
1: 2Δ Connection:



2: 1Y Connection:



3: 2Y Connection:



F Option Parameters

F1 PG Option Set-up

These parameters set up the Speed feedback pulse generator (PG).

F1-01 PG Pulses per Revolution Q

Setting Range: 0 to 10000
Factory Default: 30

This parameter sets the number of PG pulses per motor revolution (pulses/rev). Enter the PPR of the hall sensor signals HS4 & HS5 for Hall sensor only feedback *(F8-01=1).* Use the encoder PPR for motors using encoders *(F8-01=0)*. Consult the factory when using encoders with greater than 4096 PPR.

F1-02 PG Disconnection Detection Stopping Method B

Selects the stopping method when a disconnected PG is detected.

Setting	Description
0	Ramp to stop - according to C1-02. (Declaration time 1).
1	Coast to stop *(factory default)*.
2	Fast-stop - according to C1-09.
3	Alarm flashes, operation continues.

F1-03 Overspeed Detection Stopping Method B

Selects the stopping method when an overspeed condition is detected.

Setting	Description
0	Ramp to stop - according to C1-02 (Declaration time 1).
1	Coast to stop *(factory default)*.
2	Fast-stop - according to C1-09.
3	Alarm flashes, operation continues.

F1-04 PG Deviation Detection Stopping Method B

Selects the stopping method when excessive speed deviation is detected.

Setting	Description
0	Ramp to stop - according to C1-02 (Declaration time 1).
1	Coast to stop.
2	Fast-stop - according to C1-09.
3	Alarm flashes, operation continues *(factory default).*

F1-05 PG Rotation Selection Q

Sets the relationship between the motor rotation direction and PG polarity. (Hall sensor HS4 & HS5 or encoder channel A & B).

Setting	Description
0	HS5 leads HS4 (channel B leads A) in FWD direction.
1	HS4 leads HS5 (A leads B) in FWD direction (*factory default*).

The motor's rotation direction applies when viewing the motor shaft from the load side.

F1-08 Overspeed Detection Level A

Setting Range: 0 to 120%
Factory Default: 115%

This parameter sets the motor overspeed detection level as a percentage of maximum output speed *(E1-06)*. Used in conjunction with parameter *F1-09* to sense an overspeed condition.

F1-09 Overspeed Detection Time A

Setting Range: 0.0 to 2.0s
Factory Default: 0.0s

Sets the elapsed time from when an overspeed condition is detected to when a fault (or alarm) occurs.

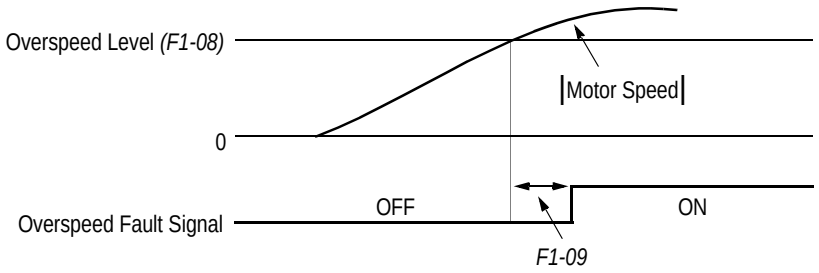


Figure 29 Overspeed Detection Timing Diagram

A fault signal is output to stop operation after the absolute value of the motor speed exceeds the set value of *F1-08* for the time set to *F1-09*. The stopping method is set by *F1-03*.

F1-10 PG Deviation Detection Level A

Setting Range: 0 to 50%
Factory Default: 10%

This sets the excessive speed deviation detection level as a percentage of maximum output speed *(E1-06)*. Used in conjunction with parameter *F1-11* to sense a speed deviation condition.

F1-11 PG Deviation Detection Time A

Setting Range: 0.0 to 10.0s
Factory Default: 0.5s

This parameter sets the elapsed time for which a speed deviation condition must exist, before a fault (or alarm) is generated.

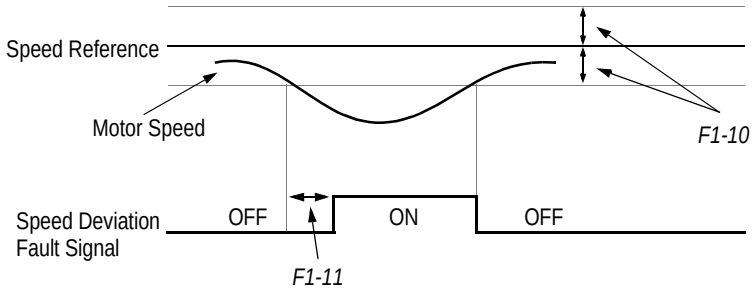


Figure 30 Overspeed Detection Timing Diagram

A fault (or alarm) signal is output after the deviation between speed reference and the actual motor speed exceeds the set value of *F1-10* and after the time set to *F1-11* elapses. The stopping method is set with *F1-04*. Also, detection is not activated while accelerating/decelerating or during torque control.

F1-13 *PG Open Detection Delay Time* A

Setting Range: 0.0 to 10.0s
Factory Default: 3.0s

This sets the time for which a PG open condition must exist, before a fault (or alarm) is generated.

- The stopping method, when a “PGO” condition is detected, is selected by parameter *F1-02*.

F2 AI-14B Set-up

F2-01 AI-14B Function Selection A

Sets CH1 to CH3 input functions when *AI-14B* option is connected.

Setting	Function	CH1 (TC1 to TC4)	CH2 (TC2 to TC4)	CH3 (TC3 to TC4)
0	3-channel individual input *(factory default)*	Substitute for terminals 13 & 17	Substitute for terminals 14 & 17	Substitute for terminals 16 & 17
1	3-channel additional input	Sum of CH1 to CH3 input values is used as the speed reference value. (Reference the AI-14B instruction manual for details).		

When the 3CH individual input selection is used, set parameter *B1-01* to “1” (frequency reference from control circuit terminal). The option/inverter reference selection, which is selected by a multi-function contact input (*H1-XX* = “2”), is disabled when using the AI-14B option.

F3 DI-08/DI-16H Set-up

F3-01 Digital Input Option

A

This parameter selects the setting mode of the frequency reference input from the *DI-08* and *DI-16H* options.

Setting	Frequency Reference Setting Mode
0	BCD 1% unit *(factory default)*
1	BCD 0.1% unit
2	BCD 0.01% unit
3	Not used
4	Not used
5	Not used
6	Not used
7	Binary DI-08: 255/100% DI-16H, 12-bit selection: 4096/100% DI-16H, 16-bit selection: 30000/100%

F4 AO-08/AO-12 Set-up

F4-01 Analog Output Channel 1 Selection A

Setting Range: 1 to 53
Factory Default: 5
Selects the analog output monitors for channel 1 of the *AO-08 and AO-12* options. Possible settings are as follows:

Setting	Description
1	Speed reference
2	Output frequency
3	Inverter output current
5	Motor speed (factory default)
6	Output voltage
7	DC bus voltage
8	Output power
9	Torque reference (internal)
15	External terminal 13 input voltage
16	External terminal 14 input voltage
17	External terminal 16 input voltage
18	Motor secondary current (Iq)
19	Motor excitation current (Id)
20	Primary frequency after SFS
21	Speed controller ASR input
22	Speed controller ASR output
27	qAxis current control reference
28	dAxis current control reference
29	Voltage limit control output
30	qAxis current control output
31	dAxis current control output
32	Output voltage reference (V_q)
33	Output voltage reference (V_d)
45	External torque reference
46	Torque compensation value
49	Control section software number
50	Speed detection PG counter value
53	PID feedback

F4-02 Analog Output Channel 1 Gain A

Setting Range: ±300.0
Factory Default: 1.0

Sets the channel 1 output gain for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in this parameter *(F4-02)*.

F4-03 Analog Output Channel 1Bias A

Setting Range: ±109.2%
Factory Default: 0.0%

Sets the channel 1 output bias for the analog output monitors. To determine the output level, add the bias value set in *F4-03* to the monitor output level.

F4-04 Analog Output Channel 2 Selection A

Setting Range: Same as *F4-01*
Factory Default: Inverter output current (setting = “3”)

Select the analog output monitors for channel 2 of the *AO-08* and *AO-12* options. Select from the table included in parameter *F4-01.*

F4-05 Analog Output Channel 2 Gain A

Setting Range: ±300.0
Factory Default: 1.0

This parameter sets the channel 2 output gain for the analog output monitors. To determine the output level, multiply the monitor output level by the gain value set in this parameter *F4-05*.

F4-06 Analog Output Channel 2 Bias A

Setting Range: ±109.2%
Factory Default: 0.0%

Sets the channel 2 output bias for the analog output monitors. To determine the output level, add the bias value set in *F4-06* to the monitor output level.

F5 DO-02 Set-up

F5-01 DO-02C Digital Output Channel 1 Selection A

Setting Range: 0 to 37
Factory Default: During run 1 (setting = “0”)

Selects the multi-function output selections for channel 1 of the DO-02C option.

Setting	Description	Setting	Description
0	During run 1 *(factory default)*	12	Timer output
1	Zero speed	13	Agree 2
2	Sref/Sout agree 1	14	Agree 2
3	Sref/Sset agree 1	15	Speed detection 3
4	Speed detection 1	16	Speed detection 4
5	Speed detection 2	17	Torque detection 1(N.C.)
6	Inverter ready	18	Torque detection 2 (N.O.)
7	DC bus undervoltage	19	Torque detection 2 (N.C)
8	Baseblock 1	1A	Reverse direction
9	Option reference	1B	Baseblock 2
A	Remote operation	1D	Regenerating
B	Torque detection 1 (N.O.)	1E	Restart enabled
C	Loss of reference	1F	Overload (OL1)
D	DB overheat	20	OH prealarm
E	Fault	30	Current/torque limit
F	Not used	31	Speed limit
10	Minor fault	37	During run 2
11	Reset command active	37	

For detailed information on these settings, refer to section ***H2***, ***Digital Outputs***.

F5-02 DO-02C Digital Output Channel 2 Selection A

Setting Range: Same as *F5-01*
Factory Default: Zero speed (setting = “1”)

Use this function to select the multi-function output selections for channel 2 of the DO-02C option.

F6 DO-08 Set-up

F6-01 DO-08 Digital Output Selection

A

Selects the multi-function output selections for the DO-08 option.

Setting	Terminal No.	Description
0 8-channel individual (factory default)	TD5/TD11	Overcurrent (SC, OC, GF)
	TD6/TD11	Overvoltage (OV)
	TD7/TD11	Inverter overload (OL2)
	TD8/TD11	Fuse blown (PUF)
	TD9/TD11	Not used
	TD10/TD11	Inverter overheat (OH1)
	TD1/TD2	During zero-speed detection
	TD3/TD4	During speed agree
1 binary output	TD5/TD11	Binary output *
	TD6/TD11	
	TD7/TD11	
	TD8/TD11	
	TD9/TD11	During zero-speed detection
	TD10/TD11	During speed agree
	TD1/TD2	During run
	TD3/TD4	Minor fault

* When F6-01 is set to binary output (setting = "1"), use the table below to read the DO-08 terminal 5,6,7 and 8 output.

TD8/TD11 (bit 3)	TD7/TD11 (bit 2)	TD6/TD11 (bit 1)	TD5/TD11 (bit 0)	Description
0	0	0	0	No fault
0	0	0	1	Overcurrent (SC, OC, GF)
0	0	1	0	Overvoltage (OV)
0	0	1	1	Inverter overload (OL2)
0	1	0	0	Inverter overheat (OH)
0	1	0	1	Overspeed (OS)
0	1	1	0	Fuse blown (FU)
0	1	1	1	Not used
1	0	0	0	External fault (EF3 ~ EF8)
1	0	0	1	Controller fault (CPF)
1	0	1	0	Motor overload (OL1)
1	0	1	1	Not used
1	1	0	0	Power loss (UV1, UV2, UV3)
1	1	0	1	Excessive speed deviation (DEV)
1	1	1	0	PG disconnection (PGO)
1	1	1	1	Not used

Note: When the terminal is open, the bit setting is "0"; when the terminal is closed, the bit setting is "1".

F8 PG Option Set-up 2

F8-01 Speed Feedback Detection Method Q

Setting Range: 0,1
Factory Default: 1

Selects the speed feedback method (hall sensor or line drive encoder).

Setting	Description
0	Speed feedback comes from channels A & B on PG-P2 option
1	Speed feedback comes from channels HS4 & HS5 input on PG-P2 option

F8-01 Pulse Train Average Value B

Setting Range: 0 - 50
Factory Default: 0

Sets the number of scans the Pulse Train reference is averaged. A larger number will provide a more stable speed reference signal, however, the inverter response to a rapid change in reference may be slower.
A setting of “0” or “1” means no moving average will be used, and the pulse train reference will be updated every scan.

F9 CP-916 Setup

F9-01 External Fault Input Level from Communication Option A

This parameter selects the initial state for an external fault condition when the inverter is configured for serial communication using the CP-916.

Set Value	Description
0	Detection by N. O. (when closed, the inverter will trip), *(factory default)*.
1	Detection by N. C. (when open, the inverter will trip).

F9-02 External Fault Detection Selection from Communication Option A

This parameter selects the condition of detection for an external fault when using the CP-916 option.

Set Value	Description
0	The fault will always be detected, even when the drive is stopped *(factory default)*.
1	The fault will be detected only when the drive is running.

F9-03 Operation at External Fault Input from Communication Option A

Setting this parameter selects the stopping method when an EFO fault is detected.

Set Value	Description
0	Ramp to stop according to C1-02 set value.
1	Coast to stop *(factory default).*
2	Ramp to stop according to C1-09 set value.
3	Alarm flashes, operation continues.

F9-04 Trace Sampling of Option A

This parameter sets the # of scans per each trace sample when using the CP-916B option card.

Setting Range: 0-6000
Factory Default: 0

Note: Setting F9-04 to zero executes a trace every scan.

F9-05 Torque Reference Selection from Communication Option A

This allows the Communication option card (ex. Device Net) to set the torque limits when the inverter is in the speed control mode and to set the torque reference when operating in the torque control model.

Setting	Description
0	Torque reference by analog input.
1	Torque reference by Communication options *(factory default).*

F9-06 Operation at Bus Error Detection A

Setting this parameter selects the stopping method when a BUS fault is detected.

Setting	Description
0	Ramp to stop according to C1-02 set value.
1	Coast to stop *(factory default)*.
2	Ramp to stop according to C1-09 set value.
3	Alarm flashes, operation continues.

A BUS fault may occur when using the Communication option or the CP-916 communication options. The fault will occur after initial communication has been established, and when the connection has been interrupted.

H Control Circuit Terminal Parameters

H1 Digital Inputs

The VS-616PS5 has six multi-function contact inputs for the set-up of numerous functions, including multi-step speed operation, PID, speed search, speed/torque control selection, and many others. This section includes descriptions of these functions.

H1-01 Multi-function Input Terminal 3 Selection	B
H1-02 Multi-function Input Terminal 4 Selection	B
H1-03 Multi-function Input Terminal 5 Selection	B
H1-04 Multi-function Input Terminal 6 Selection	B
H1-05 Multi-function Input Terminal 7 Selection	B
H1-06 Multi-function Input Terminal 8 Selection	B

The following table lists the function selections for the multi-function contact inputs (terminals 3 to 8), and lists the reference page that provides a more detailed explanation of each.

Setting	Function	Reference Page
0	3-Wire Control	62
1	Local/Remote Selection	62
2	Option/Inverter Selection	62
3	Multi-Step Ref. 1 *(factory default, H1-03)*	35
4	Multi-Step Ref. 2 *(factory default, H1-04)*	35
5	Multi-Step Reference 3	35
6	Jog Speed Ref. *(factory default, H1-05)*	35
7	Multi-Accel/Decel 1	24
8	External Baseblock N.O. *(factory default H1-06)*	62
9	External Baseblock N.C.	62
A	Accel/Decel Hold Command	63
B	Inverter Overheat OH2 Alarm	63
C	Multi-function Analog Input Enable/Disable	63
E	Speed Control Integral Value Reset	63
10	Up Command	63
11	Down Command	63
12	Forward Jog	64
13	Reverse Jog	64
14	Fault Reset *(factory default, H1-02)*	65
15	Fast-Stop	25
18	Timer Function	17
19	PID Disable	19
1A	Multi-Accel/Decel 2	24
1B	Program Lockout	65
1E	Analog Reference Sample/Hold Selection	65
1F	Terminal 13/14 Selection	65
24	External Fault *(factory default H1-01)*	65
71	Speed/Torque Control Change	40
77	ASR Gain Switch	29

- Three-wire Control (setting: “0”)
  Enable 3-wire control when *H1-01* is set to “0”. The terminal set to “0” becomes the FWD/REV run command.

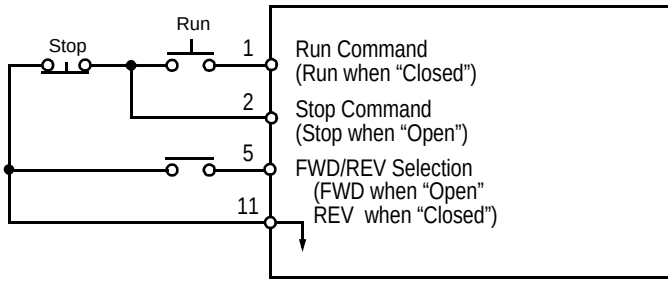


Figure 31 Terminal Function at 3-Wire Sequence Selection (H1-01 = "0")

- Local/Remote Selection (setting: "1")
  Selects the operation mode, only when the inverter is stopped.
  - Local: Operation according to frequency reference and run command as entered from digital operator.
  - Remote: Operation according to frequency reference and run command set by *B1-01* & *B1-02*, respectively.
  - Note: When local/remote selection is set by a multi-function contact input terminal, local/remote selection from the digital operator key is disabled.

- Option/Inverter Selection (setting: "2")
  Selects whether operation is performed using a reference command from an option card or from the inverter. Changeover is effective only when the inverter is stopped.
  - Open: Runs by frequency reference and run command from inverter control circuit terminal or digital operator (B1-01 & B1-02 dependant).
  - Closed: Runs by frequency reference and run command from an option card.

- External Baseblock N.O. (setting: "8")
  Baseblock operation is performed when the contact input is closed. External baseblock operation differs, as described below, depending on the run command input status.
  Inputting an external baseblock signal while the inverter is running, causes a "*bb*" indication on the digital operator display, and the inverter output is shut OFF.
  After removing the external baseblock command, operation restarts at the previously referenced speed.
  Inputting a stop signal along with an external baseblock signal while the inverter is decelerating, causes" *bb*" to blink on the digital operator, the inverter output to shut OFF, and the frequency reference to reset to 0.

- External Baseblock N.C. (setting: "9")
  Baseblock operation is performed similar to setting "8," except that operation is performed when the contact input is open.

- Accel/Decel Hold Command (setting: "A")
  The accel/decel hold command is used to temporarily hold the output speed at its current level at the time the "Hold" command is applied. Upon entry of a stop command, the accel/decel hold condition releases and operation stops.

.

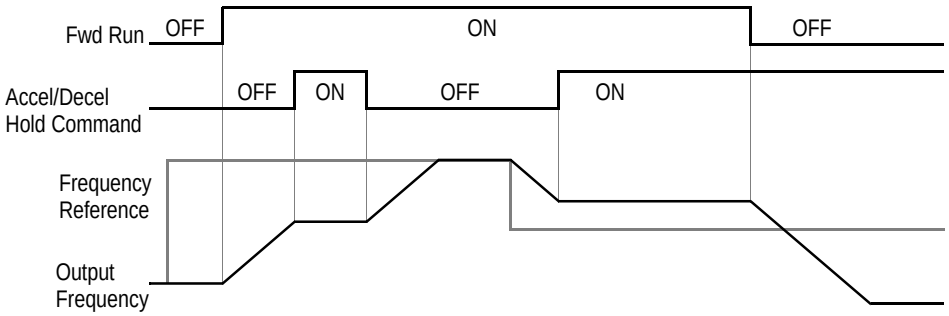


Figure 32 Accel/Decel Hold Command Timing Diagram

Notes:

1. When both a hold reference memory selection (*D4-01* = "1") and an accel/decel hold command are input, a stop command followed by a run command will generate storage of the output frequency data until the accel/decel stop command is released. Operation resumes after the frequency storage.
2. When the power supply is turned OFF after the accel/decel hold command is input, the held output frequency is also stored.
3. When *D4-01* is set to "0," the held output frequency is not stored.

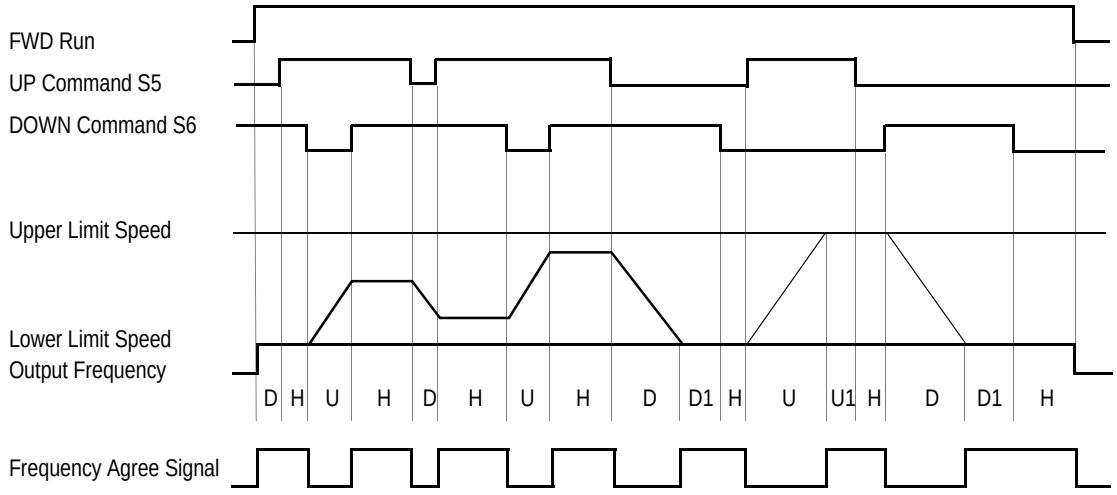
- Inverter Overheat OH2 Alarm (setting: "B")
  Inputting the inverter overheat alarm signal, "*OH2*" blinks on the digital operator display (Alarm condition only). The user can connect the dry contact of an external heat sensor for indication of device over-temperature. To close an output contact under this condition, set a multi-function contact output *(H2-XX)* to "20".

- Multi-function Analog Input Enable/Disable (setting: "C")
  This setting allows terminal 16 multi-function analog input to be enabled (accepted) or disabled (disregarded) via a digital input.
  Open: Terminal 16 command is not accepted.
  Closed: Terminal 16 command is accepted.

- Speed Control Integral Value Reset (setting: "E")
  This function allows the speed control integral value to be reset while the inverter is running.
  Open: PI-control (adds the speed control integral values.)
  Closed: P-control (resets the speed control integral values by the integral time constant).

- Up/Down Command (settings: Up = “10,” Down = “11”)
  Allows the motor speed to be increased (Up command) or decreased (Down command) via contact closures. Requires the run command to be applied.

UP command	Closed	Open	Open	Closed
DOWN command	Open	Closed	Open	Closed
Operation Status	Accel	Decel	Hold	Hold



U: Up (accelerating) status
D: Down (decelerating) status
H: Hold (constant speed) status
U1: Up status, with clamping at upper limit speed
D1: Down status, with clamping at lower limit speed

Figure 33 UP/DOWN Command Timing Diagram

Notes:

1. Be sure to set Speed Reference Selection *(B1-01)* = “1.” When *B1-01* = “0,” Up/Down operation is disabled.
2. Upper limit speed = Maximum output speed *(E1-06)* × Speed Reference Upper Limit *(D2-01)*, if used.
3. The lower limit value is the larger of either the master Speed reference from control circuit terminals 13 or 14, or the Speed Reference Lower Limit *(D2-02)*.
4. With Hold Reference Memory Selection is enabled (*D4-01* = “1”) and a hold command input, the output frequency stored even after the power supply turns OFF. When *D4-01* = “0” the output frequency is *not* stored.
5. If the jog frequency reference is input during Up/Down operation, the jog frequency reference has priority.

- Forward and Reverse JOG commands (settings: Fwd Jog = “12,” Rev Jog = “13”)
  Enables forward and reverse run jog frequency commands.

Setting	Description
12	When closed-run forward at jog frequency reference (D1-09).
13	When closed-run reverse at jog frequency reference (D1-09).

Notes:

1. When either forward or reverse jog command is input during run, this command has priority.
2. When both the forward and reverse jog commands are closed for more than 500ms, the inverter stops according to the stopping method selection *(BI-03)*.
3. The forward and reverse jog commands can be set independently.

- Fault Reset (setting: “14”)
  Closing this contact resets a fault after the fault condition has been removed. The run command must be removed when resetting a fault.

- Program Lockout (setting: “1B”)
  Opening this contact prohibits the changing of VS-616PS5 parameters.

- Analog Reference Sample/Hold Selection (setting: “1E”)
  If the contact input closes for 100ms or longer, the analog speed reference is sampled once, after which the analog speed reference is held.

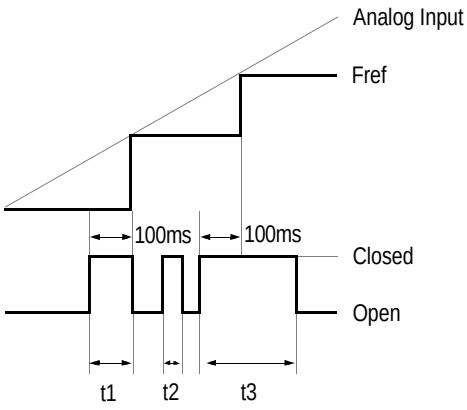


Figure 34 Sample/Hold Selection - Analog Reference

Note:t1, t3 - Each reference is held for 100ms or longer.
t2 - Reference is held for less than 100ms, generating no frequency sampling.

- Terminal 13/14 Selection (setting: “1F”)
  Open: Terminal 13 is used for the master speed reference.
  Closed: Terminal 14 is used for the master speed reference.

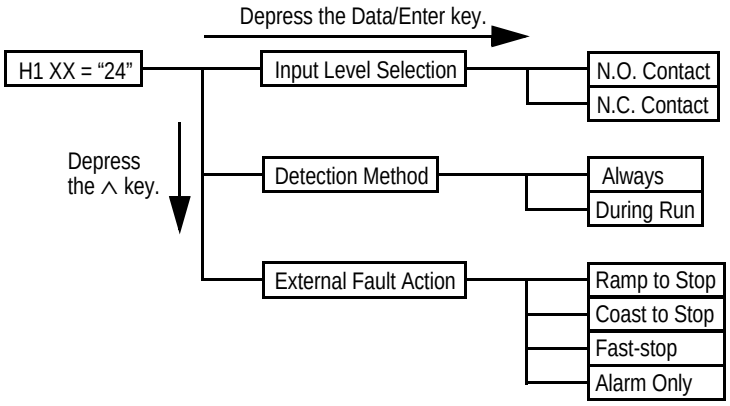
  Note: Terminal 14 Selection, Parameter H3-09, must be set equal to “1F” (not used) when setting a multifunction input to Value “1F”. Otherwise, an OPE3 error occurs.

- External Fault (setting: “24”)
  Closing this contact causes the inverter to indicate an external fault. Use the follow-

ing table to choose the desired response upon inputting an external fault command.

External Fault Selection								Setting Result
Input Level Selection		Detection Method		External Fault Action				
N.O.	N.C.	Always	During Run	Ramp to Stop	Coast to Stop	Fast-stop	Alarm Only	
÷	—	÷	—	÷	—	—	—	20
÷	—	÷	—	—	÷	—	—	24
÷	—	÷	—	—	—	÷	—	28
÷	—	÷	—	—	—	—	÷	2C
÷	—	—	÷	÷	—	—	—	22
÷	—	—	÷	—	÷	—	—	26
÷	—	—	÷	—	—	÷	—	2A
÷	—	—	÷	—	—	—	÷	2E
—	÷	÷	—	÷	—	—	—	21
—	÷	÷	—	—	÷	—	—	25
—	÷	÷	—	—	—	÷	—	29
—	÷	÷	—	—	—	—	÷	2D
—	÷	—	÷	÷	—	—	—	23
—	÷	—	÷	—	÷	—	—	27
—	÷	—	÷	—	—	÷	—	2B
—	÷	—	÷	—	—	—	÷	2F

Notes:
1. N.O. = normally open contact; N.C. = normally closed contact
2. Setting “24” is the factory default.
3. Set up the external fault function according to the following tree.



H2 Digital Outputs

The VS-616PS5 has three multi-function digital outputs for the indication of various conditions, including speed detection, speed agree, zero speed, overtorque detection, and many others. This section includes descriptions of these functions.

H2-01 Multi-function Output 1 Selection (terminal 9, 10)	B
H2-02 Multi-function Output 2 Selection (terminal 25, 27)	B
H2-03 Multi-function Output 3 Selection (terminal 26, 27)	B

The following table lists the function selections for the multi-function digital outputs (terminals 9, 25 & 26), and indicates the control modes during which each function can be enabled.

Setting	Function	Reference Page
0	During Run 1 *(factory default, H2-01)*	68
1	Zero-speed *(factory default, H2-02)*	68
2	Speed Agree 1 *(factory default, H2-03)*	68
3	Desired Speed Agree 1	68
4	Speed Detection 1	69
5	Speed Detection 2	69
6	Inverter Ready	69
7	DC Bus Undervoltage	69
8	Baseblock 1 - N.O.	69
9	Speed Reference Selection	69
A	Run Command Selection	69
B	Overtorque Detection 1 - N.O.	70
C	Loss of Speed Reference	70
D	Dynamic Braking Resistor (DB) Overheat	70
E	Fault	70
F	Not used	-
10	Alarm (Minor fault)	70
11	Fault Reset	70
12	Timer Output	70
13	Speed Agree 2	70
14	Desired Speed Agree 2	71
15	Speed Detection 3	71
16	Speed Detection 4	71
17	Overtorque Detection 1 - N.C.	72
18	Overtorque Detection 2 - N.O.	72
19	Overtorque Detection 2 - N.C.	72
1A	During Reverse Run	72
1B	Baseblock 2 - N.C.	72
1D	Monitoring/ Regenerating Mode	72
1E	Automatic Restart	72
1F	Overload (OL1) Pre-alarm	72
20	OH Pre-alarm	72
30	Current/torque Limit	73
31	Speed Limit	73
37	During Run 2	73

- During Run (setting: “0”)
  Closes after a run command is inputted or when the inverter generates output voltage.

- Zero-speed (setting: “1”)
  Closes when the motor speed is less than the zero-speed level *(B2-01).*

- Speed Agree 1 (setting: “2”)
  Closes whenever the output speed “agrees” with the speed reference plus or minus the speed agree detection width *(L4-02)*. This works in both forward *and* reverse operation.

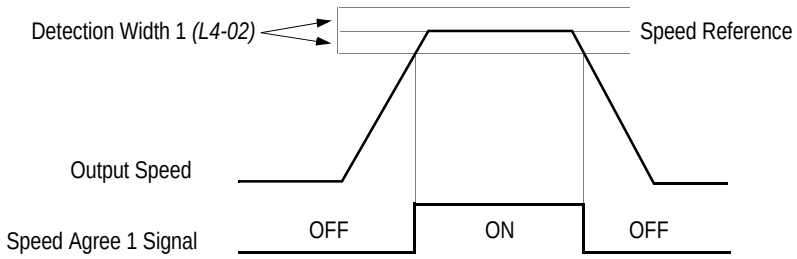


Figure 37 Speed Agree Signal 1 Timing Diagram

- Desired Speed Agree 1 (setting: “3”)
  Closes whenever the output Speed “agrees” with the Speed Agree Detection Level, *(L4-01)*, plus or minus the Speed Agree Detection Width, *(L4-02)*. This works in both forward *and* reverse operation.

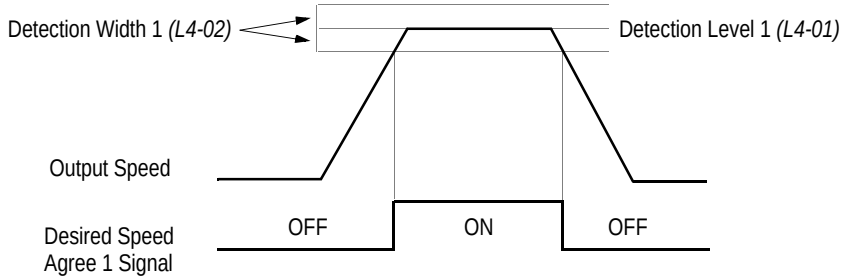


Figure 38 Desired Speed Agree 1 Signal Timing Diagram

- Speed Detection 1 (setting: “4”)
  Closes whenever the output speed is at or below the Speed Agree Detection Level *(L4-01)*. During acceleration from below the detection level, the output speed increases through the Detection Bandwidth *(L4-02)* before the contact opens again. This works in both forward *and* reverse operation.

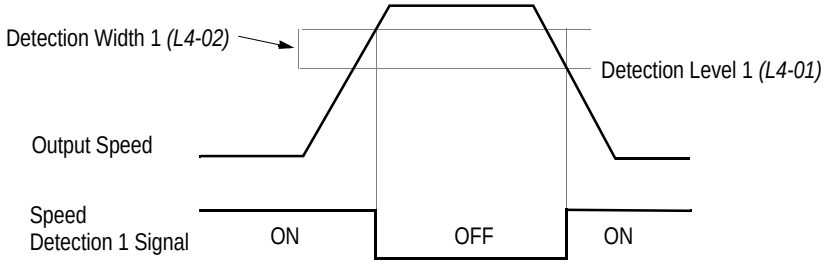


Figure 39 Speed Detection 1 Signal Timing Diagram

- Speed Detection 2 (setting: “5”)
  Closes whenever the output speed is at or above the Speed Agree Detection Level *(L4-01)*. During deceleration from above the detection level, the output Speed decreases through the Detection Bandwidth *(L4-02)* before the contact opens again. This works in both forward *and* reverse operation.

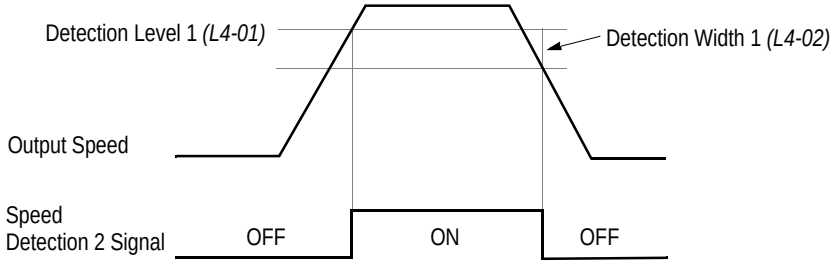


Figure 40 Speed Detection 2 Signal Timing Diagram

- Inverter Ready (setting: “6”)
  Closes when the inverter is ready for operation (no faults or alarms).

- DC Bus Undervoltage (setting: “7”)
  Closes when the main circuit DC bus voltage or control circuit power supply is drops below the trip level, or when the main soft charge contactor (MC) is OPEN.

- Baseblock 1 - N.O. (setting: “8”)
  Closes when the inverter output shuts OFF.

- Speed Reference Selection (setting: “9”)
  Open when the speed reference is entered from the control circuit terminals or option. Closes when the speed reference is input from the digital operator.

- Run Command Selection (setting: “A”)
  Opens when run command is entered from the control circuit terminals or option.

Closes when run command is input from the digital operator.

- Overtorque Detection 1 - N.O. (setting: “B”)
  Closes during overtorque detection 1 (L6-01, see section ***L6***, ***Overtorque Detection***).

- Loss of Speed Reference (setting: “C”)
  Closes when the speed reference is reduced by 90% within 400ms. The inverter will respond according to the setting of reference loss selection *(L4-05)*. After reference loss, if *L4-05* = “1,” then operation continues at 80% of the previous speed reference, and the contact closes.

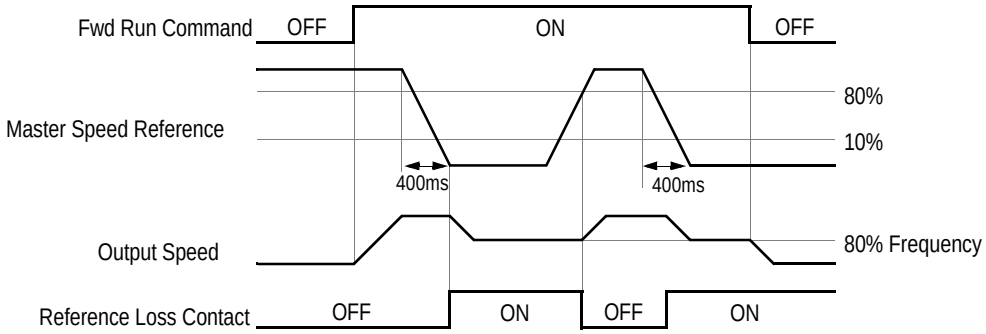


Figure 41 Reference Loss Timing Diagram

- Dynamic Braking Resistor Overheat (setting: “D”)
  Closes during braking resistor overheating or a braking transistor fault.

- Fault (setting: “E”)
  Closes when a fault occurs (except CPF00 and CPF01).

- Alarm (setting: “10”)
  Closes while an alarm is displayed.

- Fault Reset (setting: “11”)
  Closes while a fault is being reset.

- Timer Output (setting: “12”)
  Closes when a timer contact input closes (after On-delay time elapses).
  Opens when a timer contact input opens (after Off-delay time elapses).

- Speed Agree 2 (setting: “13”)
  Closes whenever the output speed “agrees” with the Speed reference plus or minus the Speed Agree Detection Width *(L4-04)*. This is used for setting up an alternate detection width.

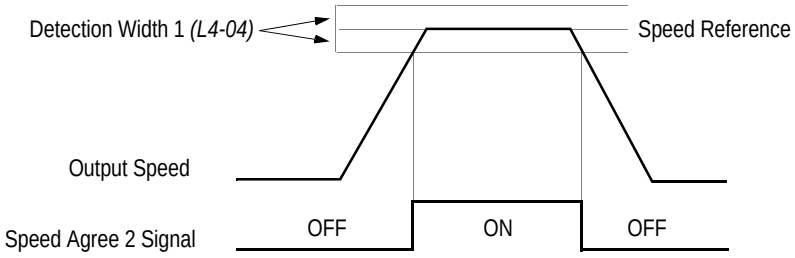


Figure 42 Speed Agree Signal 2 Timing Diagram

- Desired Speed Agree 2 (setting: “14”)
  Closes whenever the output Speed “agrees” with the Speed Agree Detection Level *(L4-03)*, plus or minus the Speed Agree Detection Width *(L4-04)*. Choose forward or reverse operation in *L4-03*.

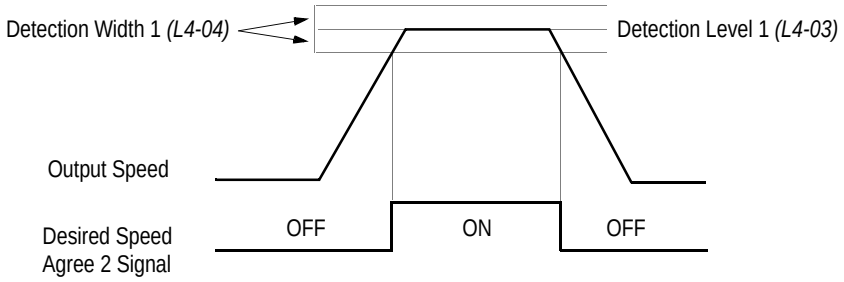


Figure 43 Desired Speed Agree 2 Signal Timing Diagram

- Speed Detection 3 (setting: “15”)
  Closes whenever the output Speed is at or below the Speed Agree Detection Level *(L4-03)*. During acceleration from below the detection level, the output Speed increases through the Detection Bandwidth *(L4-04)* before the contact opens again. Choose forward or reverse operation in *L4-03*.

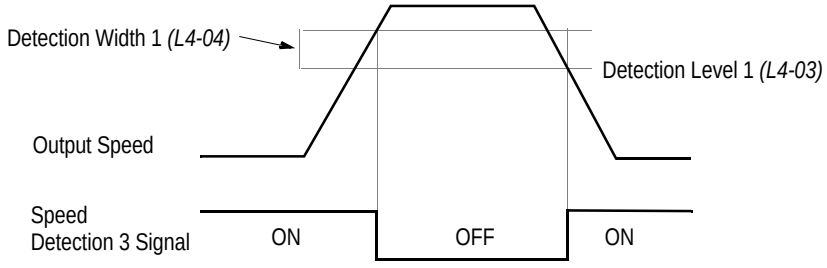


Figure 44 Speed Detection 3 Signal Timing Diagram

- Speed Detection 4 (setting: “16”)
  Closes whenever the output Speed is at or above the Speed Agree Detection Level *(L4-03)*. During deceleration from above the detection level, the output Speed decreases through the Detection Bandwidth *(L4-04)* before the contact opens again. Choose forward or reverse operation in *L4-03*. Choose forward or reverse operation in *L4-03*.

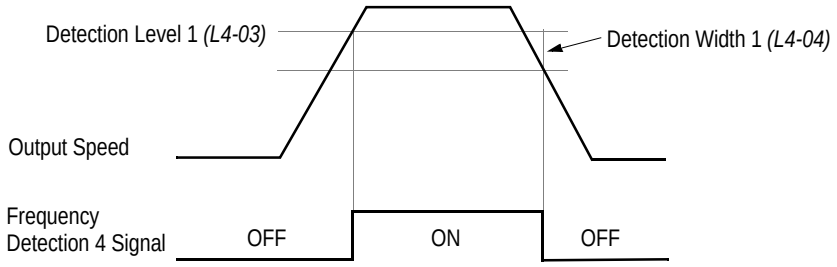


Figure 45 Speed Detection 2 Signal Timing Diagram

- Overtorque Detection 1 - N.C. (setting: “17”)
  Opens during overtorque detection 1 (L6-01, see section ***L6***, ***Overtorque Detection***, on page 81).

- Overtorque Detection 2 - N.O. (setting: “18”)
  Closes during overtorque detection 2 (L6-01, see section ***L6***, ***Overtorque Detection***, on page 81).

- Overtorque Detection 2 - N.C. (setting: “19”)
  Opens during overtorque detection 2 (L6-01, see section ***L6***, ***Overtorque Detection***, on page 81).

- During Reverse Run (setting: “1A”)
  Closes during a reverse run command.

- Baseblock 2 - N.C. (setting: “1B”)
  Opens when the inverter output shuts OFF.

- Monitoring/Regenerating Mode (setting: “1D”)
  Closes during regenerative operation.

- Automatic Restart (setting: “1E”)
  Closes during automatic restart operation.

- OL1 Pre-alarm (setting: “1F”)
  Closes when the motor-calculated electronic thermal overload value increases to 90% of the internal fault detection level.

- OH Pre-alarm (setting: “20”)
  Closes when the heatsink temperature exceeds the Overheat Temperature Level *(L8-02)*, or when a multi-function contact input (*H1-XX* = “B”) closes.

- Current/Torque Limit (setting: “30”)
  Closes during torque limit.

- Speed Limit (setting: “31”)
  Closes when the Speed Limit Level as determined by parameter setting *(D5-03)* is reached during torque control. The speed limit is set by *D5-04* or the analog input.

- During Run 2 (setting: “37”)
  Closes during running (does *not* close during baseblock, injection braking, or initial excitation).

H3 Analog Inputs

The VS-616PS5 has three analog inputs (two multi-function and one fixed), for the external input of numerous references and limits, including speed, torque, PID, and others. This section includes descriptions of these functions.

H3-01 Terminal 13 Signal Selection B

Selects the type of voltage signal input at terminal 13.

Setting	Description
0	0 to 10V input *(factory default)*
1	-10 to +10V input

The resolution of terminal 13 is 11 bit, plus a sign bit.

H3-02 Terminal 13 Reference % Gain B

Setting Range: 0.0 to 1000.0%
Factory Default: 100.0%

Sets the terminal 13 input gain level when the reference voltage is 10V.

H3-03 Terminal 13 Reference ±% Bias B

Setting Range: ±100.0%
Factory Default: 0.0%

Sets the terminal 13 input bias level when the reference voltage is 0V.

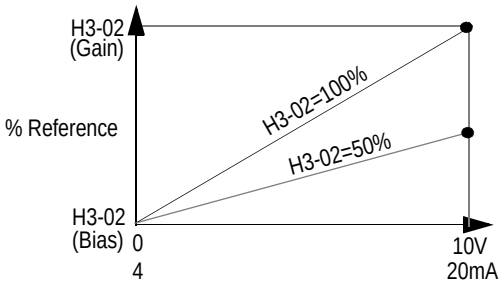


Figure 46 Analog Input Gain and Bias Adjustment

H3-04 Terminal 16 Signal Selection A

Selects the type of voltage signal input at terminal 16.

Setting	Description
0	0 to 10V input *(factory default)*
1	- 10 to + 10V input

The resolution of terminal 16 is 11 bit, plus a sign bit.

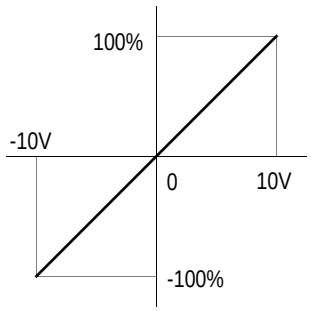
H3-05 Terminal 16 Multi-function Selection

A

The following table lists the function selections for the multi-function analog inputs (terminals 14 & 16).

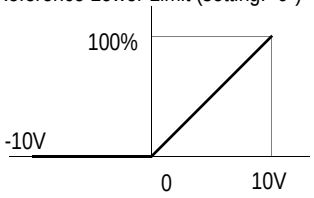
Setting	Function	Setting Level
0	Auxiliary Speed Reference *(factory default)*	±100% / ±10V
1	Speed Gain	100% / 10V
2	Speed Bias	±100% / ±10V
7	Overtorque Level	100% / 10V
9	Reference Lower Limit	100% / 10V
A	Jump Speed	100% / 10V
B	PID Feedback	±100% / ±10V
10	Forward Torque Limit	100% / ±10V
11	Reverse Torque Limit	100% / ±10V
12	Regenerative Torque Limit	100% / ±10V
13	Torque Reference	±100% / ±10V
14	Torque Compensation	±100% / ±10V
15	Forward/Reverse Torque Limit	±100% / 10V
1F	Not Used	-

· Auxiliary Speed Reference (setting: “0”)
· Speed Bias (setting: “2”)
· PID Feedback (setting: “B”)
· Torque Reference (setting: “13”)
· Torque Compensation (setting: “14”)

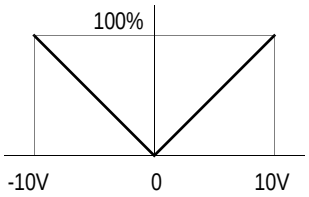


· Speed Gain (setting: “1”)
· Overtorque Level (setting: “7”)

· Jump Speed (setting: “A”)
· Reference Lower Limit (setting: “9”)



· Speed Torque Limit (setting: “10”)
· Reverse Torque Limit (setting: “11”)
· Regenerative Torque Limit (setting: “12”)



· Forward/Reverse Torque Limit (setting: “15”)

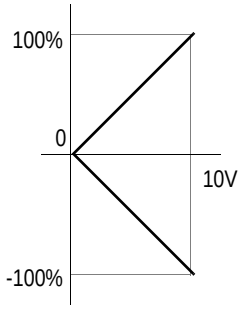


Figure 47 Multi-function Analog Input Selection

H3-06 Terminal 16 Reference % Gain A

Setting Range: 0.0 to 1000.0%
Factory Default: 100.0%

Sets the terminal 16 input gain level when the reference voltage is 10V, (see Figure 46).

H3-07 Terminal 16 Reference ±% Bias A

Setting Range: ±100.0%
Factory Default: 0.0%

Sets the terminal 16 input bias level when the reference voltage is 0V, (see Figure 46).

H3-08 Terminal 14 Signal Selection A

Selects the type of signal input at terminal 14.

Setting	Description
0	0 to 10V input
1	-10V to +10V input
2	4 to 20mA *(factory default)*

The resolution of terminal 14 is 11 bit, plus a sign bit. (10 bit for 4-20mA input).

Note: To enable terminal 14 for a voltage signal (settings: “0” or “1”), cut jumper wire J1 on the control printed circuit board. J1 is located on the bottom left-hand corner of the control board directly behind terminal 13.

H3-09 Terminal 14 Multi-function Selection A

Selects the multi-function analog input function for terminal 14 (see Terminal 16 Multi-function Selection for details).

H3-10 Terminal 14 Reference % Gain A

Setting Range: 0.0 to 1000.0%
Factory Default: 100.0%

Sets the terminal 14 input gain level when the reference current is 20mA, (see Figure 46).

H3-11 Terminal 14 Reference ±% Bias A

Setting Range: ±100.0%
Factory Default: 0.0%

Sets the terminal 14 input bias level when the reference current is 4mA, (see Figure 46).

H3-12 Analog Input Filter Time Constant A

Setting Range: 0.00 to 2.00s
Factory Default: 0.00s

Sets up a filter time constant for terminals 13, 14, and 16. This filter can be used to filter a “noisy” or fluctuating analog signal. The same filter time applies to all 3 analog signals.

H4 Analog Outputs

The VS-616PS5 has two analog outputs, for the external monitoring of drive conditions such as output speed, output current, PID feedback and others.

H4-01 Terminal 21 Analog Output Selection

B

Selects the analog output monitors for terminal 21.

Setting	Description
1	Speed reference
2	Output Speed *(factory default)*
3	Inverter output current
5	Motor speed
6	Output voltage
7	DC bus voltage
8	Output power
9	Torque reference (internal)
15	External terminal 13 input voltage
16	External terminal 14 input voltage
17	External terminal 16 input voltage
18	Motor secondary current (Iq)
19	Motor excitation current (Id)
20	Primary Speed after SFS
21	Speed controller ASR input
22	Speed controller ASR output
27	qAxis current control reference
28	dAxis current control reference
29	Voltage limit control output
30	qAxis current control output
31	dAxis current control output
32	Output voltage reference (V_q)
33	Output voltage reference (V_d)
45	External torque reference
46	Torque compensation value
49	Control section software number
50	Speed detection PG counter value
53	PID feedback

The resolution of terminal 21 is 9 bits plus a sign bit.

H4-02 Terminal 21 Analog Output Gain

B

Setting Range: ±300.0%
Factory Default: 1.0

Sets the terminal 21 output gain for the analog output monitors. To obtain the output level, multiply the monitor output level % by the gain value set in this parameter, (*H4-02).*

H4-03 Terminal 21 Analog Output Bias B

Setting Range: ±109.2%
Factory Default: 0.0%

Sets the terminal 21 output bias for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in *H4-02*, then add the bias value set in *H4-03*.

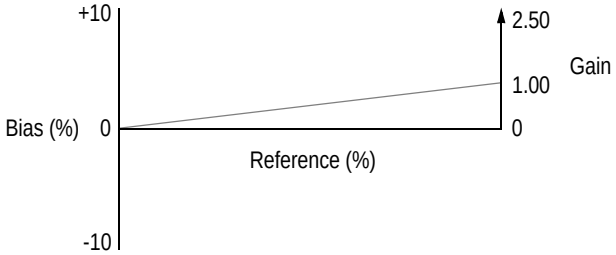


Figure 48 Analog Output Gain and Bias Adjustment

H4-04 Terminal 23 Analog Output Selection B

Selects the analog output monitors for terminal 23 (see Terminal 21 Analog Output Selection). The resolution of terminal 23 is 9 bits plus a sign bit.

H4-05 Terminal 23 Analog Output Gain B

Setting Range: ±300.0%
Factory Default: 1.0

Sets the terminal 23 output gain for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in *H4-05*, (see Figure 48).

H4-06 Terminal 23 Analog Output Bias B

Setting Range: ±109.2%
Factory Default: 0.0%

Sets the terminal 23 output bias for the analog output monitors. To obtain the output level, multiply the monitor output level by the gain value set in *H4-05*, then add the bias value set in *H4-06*, (see Figure 48).

H4-07 Analog Output Signal Selection B

Selects the type of voltage signal output at terminals 21 and 23.

Setting	Description
0	0 to 10V output *(factory default)*
1	±10V output

H Control Circuit Terminal Parameters

H5 Modbus Communication Parameters

The inverter uses communication port 6CN to communicate via MODBUS protocol.

H5-01 Serial Communication Station Address

A

Setting Range: 0 to 1F
Factory Default:1F

Selects a station address for identification of the inverter during serial communication.

H5-02 Serial Communication Baud Rate

A

Selects the baud rate at which the inverter serially communicates with external devices.

Setting	Description
0	1200 Baud per Second
1	2400 Baud per Second
2	4800 Baud per Second
3	9600 Baud per Second *(factory default)*
4	19200 Baud <1110>

H5-03 Serial Communication Parity Selection

A

Selects the transmission parity for the 6CN MODBUS port.

Setting	Description
0	No parity *(factory default)*
1	Even parity
2	Odd parity

H5-04 Stopping Method After Communication Error

A

Selects the stopping method after a transmission error is detected.

Setting	Description
0	Ramp to stop according to the time set in *C1-02*.
1	Fast-stop according to the time set in *C1-09*.
2	Coast to stop
3	Alarm only, continuous operation *(factory default)*

H5-05 MODBUS Time Out Detection

A

H5-05 enables or disables the MODBUS time out detection function. After initial communication begins, if communication is interrupted for longer than 2 seconds, then a communication fault will occur.
During a communication fault, the following fault code will be displayed: “bus”.

Setting	Description
0	Disabled - Time out detection is disabled.
1	*Enabled - Time out detection is enabled.*

L Protection Parameters

L2 Power Loss Ride-through

When momentary power loss occurs, Power Loss Ride-through function is disabled.

L2-01 Momentary Power Loss Ride-through B

Selects whether the inverter stops when power loss is detected or “rides through” a momentary power loss. When ride-through operation is selected, speed search starts from the current output Speed.

Momentary power loss ride-through is disabled *(factory default)*. When momentary power loss is detected, a fault contact trips, stopping the inverter.

L2-02 Momentary Power Loss Ride-through Time B

Setting Range: 0.0 to 2.0s
Factory Default: Inverter model dependent

Sets the ride-through time allowed before the inverter trips, after momentary power loss. This setting is activated when *L2-01* is set to “1.” If power is restored within this time, operation restarts automatically. If power is not restored within this time, a fault contact trips, stopping the inverter.

Maximum Acceptable values are indicated in the following tables.

200V Models

Capacity Kw	0.4	0.7	1.5	2.2	3.7~15
L2-02	0.7	1.0	1.0	1.0	2.0

400V Models

Capacity Kw	0.4-2.2	3.7-300
L2-02	1.0	2.0

L2-05 Undervoltage Detection Level A

Setting Range: 150 to 210V (230V class), 300 to 420V (460V class)
Factory Default: 190V (230V class), 380V (460V class)

Sets the inverter’s main circuit DC bus undervoltage level.
When setting this value less than the factory default, it is necessary to install an AC reactor on the input side. The AC reactor reduces peak current input to the inverter and smooths out the DC bus current ripple when operating at low voltages.

L3 Stall Prevention/Current Limit

This function automatically adjusts the output deceleration rate in order to continue operation without tripping (overvoltage avoidance function) when the motor is regenerating.

L3-01 Over-voltage Protection (Stall Prevention During Deceleration) B

If deceleration times are set too short for load conditions, the inverter automatically extends the deceleration time according to the main circuit DC bus voltage level. When using an optional braking resistor for the VS-616PS5, set parameter L3-01 to ”0”.

Setting	Description
0	Stall prevention during deceleration is disabled. An excessively short deceleration time will generate an overvoltage fault (OV), and the motor will coast.
1	Stall prevention during deceleration is enabled *(factory default)*. The DC bus voltage level is monitored, and the deceleration rate is automatically extended to prevent an overvoltage condition. This deceleration time may be longer than the set value (C1-02).

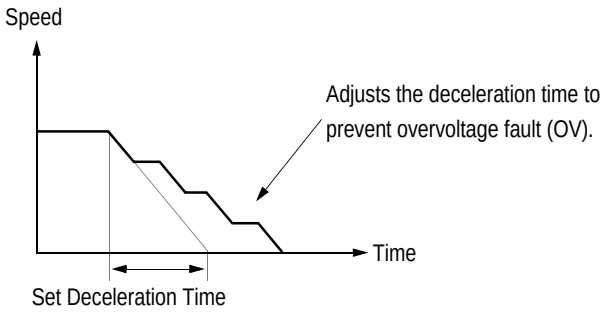


Figure 52 Stall Prevention During Deceleration

L4 Reference Detection

The VS-616PS5 utilizes three different functions for detecting output speed:

- When speed agree is enabled at the multi-function contact outputs (*H2-__* = “2” or “13”), the contact closes whenever the output speed “agrees” with the speed reference, plus or minus the speed agree detection width.
- When desired speed agree is enabled at the multi-function contact outputs (*H2-__* = “3” or “14”), the contact closes whenever the output speed “agrees” with the speed agree detection level, plus or minus the speed agree detection width.
- When speed detection is enabled at the multi-function contact outputs (*H2-__* = “4”, “5”, “15” or “16”), the contact closes whenever the output speed is less than or more than the speed agree detection level, depending on which detection is selected.

Refer to section ***H2***, ***Digital Outputs***, for more detailed information on setting these functions.

L4-01 Speed Agree Detection Level (without sign) B

Setting Range: 0.0 to 100.0%
Factory Default: 0.0%

Sets the detection level for the desired speed agree 1 and speed detection 1 & 2 functions. The set detection level is effective during both FWD and REV operation.

L4-02 Speed Agree Detection Width B

Setting Range: 0.0 to 100.0%
Factory Default: 2.0%

Sets the detection width for frequency and desired speed agree 1 and speed detection 1 & 2 functions.

L4-03 Speed Agree Detection Level (with sign) A

Setting Range: 0.0 to ±100.0%
Factory Default: 0.0%

Sets the detection level for the desired speed agree 2 and speed detection 3 & 4 functions. The set detection level is effective during either FWD or REV operation, depending on the set detection level (positive value for FWD operation, negative value for REV operation).

L4-04 Speed Agree Detection Width A

Setting Range: 0.0 to 100.0%
Factory Default: 2.0%

Sets the detection width, for desired speed agree 2, and for speed detection 3 & 4 functions.

L4-05 Operation when Speed Reference is Missing A

Selects operation when the speed reference from the control circuit terminal is reduced by 90% within 400ms. (Reference loss condition).

Setting	Description
0	Stop *(factory default)*.
1	Run at 80% of the previous frequency reference.

L5 Fault Restart

After a fault occurs, the inverter can be reset automatically. The automatic restart function allows the inverter to reset itself and continue operation after certain faults (Provided the fault condition no longer exists.

L5-01 Number of Automatic Restart Attempts B

Setting Range: 0 to 10
Factory Default: 0

Sets the number of automatic restart attempts. Setting to “0” disables this function.

Automatic Restart Operation

- When a fault is detected, the inverter output shuts OFF. The digital operator displays the fault while the inverter output is shut OFF.
- The fault is reset automatically and speed search starts from the motor speed as detected by the PG feedback.
- When the total number of faults exceeds the number of automatic restart attempts, the faults are *not* reset automatically and the inverter output remains OFF. At this time, a fault contact output is activated.

The inverter can be set to automatically restart after the following faults occur:

- Overcurrent (OC)
- Overvoltage (OV)
- Undervoltage PUV (UV1)
- Ground fault (GF)
- Regenerative transistor fault (rr)

Automatic restart is not available for the following faults:

- Control circuit undervoltage (UV2)
- MC answer-back fault (UV3)
- Load short-circuit (SC)
- Heatsink overheat (OH)
- Run command fault (EF)
- Overspeed (OS)
- Excessive speed deviation (DEV)
- PG disconnection (PGO)
- Parameter setting error (OPR)
- Communication error (CE)
- External fault (EF3 to EF8)

The number of restart attempts is reset to 0 when:

- A fault does not occur for more than 10 minutes after the last restart has been performed.
- A fault reset command is input from the control circuit terminal or the digital operator.
- Power is cycled.

L5-02 Automatic Restart Operation Selection B

Selects whether a fault contact output is activated during automatic restart.

Setting	Description
0	No fault relay *(factory default)*.
1	Fault relay is active.

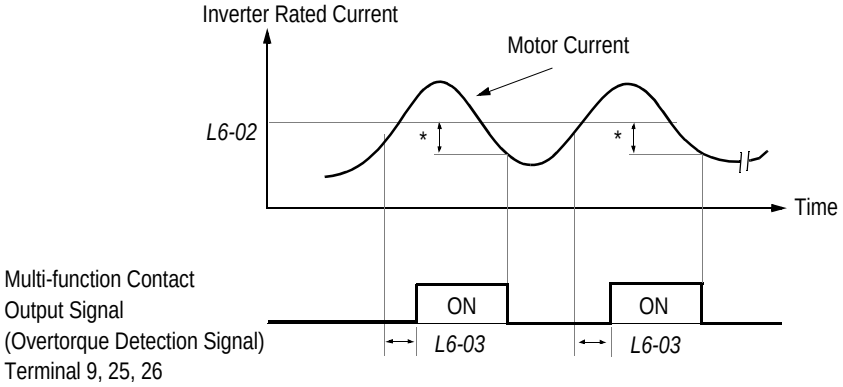
A setting of “0” will energize the fault relay only after the number of restart attempts as programmed in parameter L5-01 has been exhausted.

A setting of “1” will energize the fault relay upon every fault. Thus, the fault contact will energize and then de-energize as the restart procedure is occurring.

L6 Torque Detection

The overtorque detection circuit activates when the motor load causes the motor current (or torque during vector control) to exceed the overtorque detection level *(L6-02)*. When an overtorque condition is detected, an “OL3” indication is generated on the digital operator.

To output an overtorque detection signal, select torque detection 1 at either of the multi-function contact outputs (*H2-XX* = “B” or “17”). Refer to section ***H2***: ***Digital Outputs***, for more details.



* Release width (hysteresis) during overtorque detection is 5% of the inverter rated current level.

Figure 54 Overtorque Characteristics Timing Diagram

L6-01 Overtorque Detection 1 Selection B

Activates overtorque detection, and selects whether detection generates an alarm or a fault.

Setting	Description
0	Overtorque detection is disabled *(factory default).*
1	Overtorque detection is enabled whenever at the speed agree level (when inverter is not accelerating or decelerating). Continue running after detection (OL3 alarm).
2	Overtorque detection is enabled always. Continue running after detection (OL3 alarm).
3	Overtorque detection is enabled whenever at the speed agree level. Coast to a stop after detection (OL3 fault).
4	Overtorque detection is enabled always. Coast to a stop after detection (OL3 fault).

Notes:

1. To detect torque during acceleration or deceleration, set to “2” or “4.”
2. To continue operation after overtorque detection, set to “1” or “2.” During detection, the digital operator displays an “*OL3*” alarm (blinking).
3. To stop the inverter (fault) after upon overtorque detection fault, set to “3” or “4.” During detection, the digital operator displays an “*OL3*” fault.

L6-02 Overtorque Detection 1 Level B

Setting Range: 0 to 300%
Factory Default: 150%

Sets the overtorque detection level as a percentage of motor rated torque.

L6-03 Overtorque Detection 1 Time B

Setting Range: 0.0 to 10.0s
Factory Default: 0.1s

The overtorque detection time sets the time for which the motor current (or torque) must exceed the overtorque detection level *(L6-02)* before the overtorque condition is acknowledged as a valid overtorque condition. The digital operator then displays "OL3."

L6-04 Overtorque Detection 2 Selection A

Activates overtorque detection 2, and selects whether detection generates an alarm or a fault.

Setting	Description
0	Overtorque detection is disabled *(factory default).*
1	Overtorque detection is enabled whenever at the speed agree level (when inverter is not accelerating or decelerating). Continue running after detection (OL4 alarm).
2	Overtorque detection is enabled always. Continue running after detection (OL4 alarm).
3	Overtorque detection is enabled whenever at the speed agree level. Coast to a stop after detection (OL4 fault).
4	Overtorque detection is enabled always. Coast to a stop after detection (OL4 fault).

Overtorque detection 2 functions the same as overtorque detection 1 *(L6-01)*, except that "OL4" is displayed on the digital operator instead. This function is used when two levels of detection are required.

L6-05 Overtorque Detection 2 Level A

Setting Range: 0 to 300%
Factory Default: 150%

Sets the second overtorque detection level as a percentage of motor rated torque.

L6-06 Overtorque Detection 2 Time A

Setting Range: 0.0 to 10.0s
Factory Default: 0.1s

The overtorque detection time sets the time for which the motor current (or torque) must exceed the overtorque detection level *(L6-05)* before the overtorque condition is acknowledged as a valid overtorque condition. The digital operator then displays "*OL3*."

L7 Torque Limit

The torque limit function limits the amount of motor torque in all four quadrants of vector control operation:

- Forward Motoring
- Reverse Motoring
- Forward Regenerating
- Reverse Regenerating

Torque limit is activated in both the speed and torque control modes. When an analog input is programmed for torque reference, the lower of the analog signal on the L7 settings takes priority.

L7-01 Forward Torque Limit B

Setting Range: 0 to 300%
Factory Default: 150%

Sets the motoring side torque limit value during FWD run.

L7-02 Reverse Torque Limit B

Setting Range: 0 to 300%
Factory Default: 150%

Sets the motoring side torque limit value during REV run.

L7-03 Regenerative Forward Torque Limit B

Setting Range: 0 to 300%
Factory Default: 150%

Sets the regenerating side torque limit value during FWD run.

L7-04 Regenerative Reverse Torque Limit B

Setting Range: 0 to 300%
Factory Default: 150%

Sets the regenerating side torque limit value during REV run.

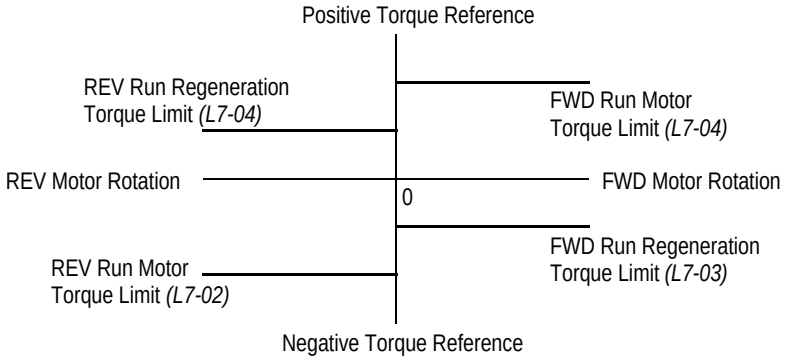


Figure 55 Torque Limit - 4 Quadrant Operation

L8 Hardware Protection

The VS-616PS5 comes equipped with a number of built-in functions designed to protect the inverter and its components from damage. This section describes set-up for these functions.

L8-01 Protection Selection for Internal DB Resistor A

When a Yaskawa-brand 3% duty cycle dynamic braking resistor is used, this function enables protection against overheating. The duty cycle of the braking resistor is monitored in the software so that it does not exceed 3%.

Setting	Description
0	DB resistor overheat protection is not provided *(factory default)*.
1	DB resistor overheat protection is provided.

If the duty cycle exceeds 3%, a DB overheat fault (RH) occurs, and the inverter coasts to stop.

L8-02 OH Pre-Alarm Level A

Setting Range: 50 to 110°C
Factory Default: 95°C

Sets the heatsink temperature level for protection against overheat (OH).

L8-03 Stopping Method Selection At OH Pre-Alarm A

Selects the stopping method when heatsink overheat is detected.

Setting	Description
0	Ramp to stop according to *C1-02* (Deceleration time).
1	Coast to stop
2	Ramp to stop according to *C1-09* setting (fast-stop).
3	Operation continues, alarm only *(factory default).*

L8-05 Input Phase Loss Protection A

The input phase loss detection circuit monitors the DC bus voltage ripple and activates when one of the input phases is lost. The detection circuit calculates the maximum and minimum values of the DC bus voltage, and compares the difference (ΔV) between these values with an internal detection level. If ΔV reaches or exceeds the detection level, an input phase loss is detected, a PFfault occurs, and the motor coasts to stop.

Setting	Description
0	Input phase loss protection is disabled *(factory default)*.
1	Input phase loss protection is enabled.

Input phase loss detection is disabled in the following cases:
- A Stop command is input
- Magnetic Contact (MC) shuts OFF
- CPU A/D converter fault (CPF5)
- During deceleration
- Output current ≤ 30% of Inverter rated current

L8-07 Output Phase Loss Protection A

This parameter detects the inverter output open-phase.

Setting	Description
0	Inverter output open-phase detection is disabled *(factory default)*.
1	Inverter output open-phase detection is enabled.

An open phase condition may be erroneously detected at the output if inadequate motor capacity is applied to the inverter, or the load torque is low.

L8-10 Ground Fault Protection A

The ground fault detection circuit monitors the output current and activates when excessive ground current is detected.

Setting	Description
0	Ground fault detection is disabled
1	Ground fault detection is enabled.*(factory default)*.

A ground fault will occur when the inverter output grounding current has exceeded 50% of the inverter rated current.

O Operator Parameters
O1 Monitor Selection

O1-01 *User Monitor Selection* B

The operation menu allows simple viewing of four monitor variables (via the DSPL key). These are Speed ref, Speed out, I_{out}, and a user-selected monitor. Using the table below, set this parameter to the setting corresponding to the monitor item desired for the fourth (user monitor) selection.

Setting	Description
5	Motor speed
6	Output voltage *(factory default)*
7	DC bus voltage
8	Output power
9	Torque reference (internal)
15	Terminal 13 input voltage level
16	Terminal 14 input voltage or current level
17	Terminal 16 input voltage level
18	Motor secondary current (Iq)
19	Motor excitation current (Id)
20	SFS output frequency
21	ASR input
22	ASR output
27	Voltage reference (Vd output)
28	CPU ID number
29	Voltage limit control output
30	qAxis current control output
31	dAxis current control output
32	Output voltage reference (Vq)
33	Output voltage reference (Vd)
41	LED check
42	Internal control status 2
43	Command 1 from option
44	Command 2 from option
45	External torque reference
46	Torque compensation value
47	DO-08H output status
48	Momentary power loss decrease capacity
49	Control section software number
50	Speed detection PG counter value
51	PID feedback
52	DI-16H input status

O1-02 Monitor Selection After Power-up B

Selects the monitor to be displayed on the digital operator immediately after the power supply is turned ON.

Setting	Description
1	Displays frequency reference *(factory default)*.
2	Displays output frequency.
3	Displays output current.
4	Displays the monitor set in *O1-01*.

O1-03 Scale for Setting and Monitoring Frequency B

Units for parameters and monitors related to frequency can be scaled as shown below.

Setting	Description
1	Unit: 0.01%. Speed reference is displayed as P☐☐.☐☐
2 ~ 39	• Unit: rpm • Unit: 120 (Hz) frequency reference/(E1-05) • The speed reference is displayed as n ☐☐☐☐
40 ~ 3999	Digits: 5th 4th 3rd 2nd 1st 0 0 0 0 0 The 1st through 4th digits determine the set value at 100% output frequency. The decimal point position is set with the 5th digit of O1-03, as follows: 5th digit = 0: displayed as ☐☐☐☐ 5th digit = 1: displayed as ☐☐☐.☐ 5th digit = 2: displayed as ☐☐.☐☐ 5th digit = 3: displayed as ☐.☐☐☐ (Example 1) If 100% output frequency is equal to 200.0 units: Set *O1-03* = "12000" 100% of this reference is displayed as 200.0 and 60% of this reference is displayed as 120.0. Example 2 If 100% output frequency is equal to 65.00: Set *O1-03* = "26500" 60% of this reference is displayed as 39.00.

O2 Key Selection

O2-01 Local/Remote Key B

Enables/disables the digital operator LOCAL/REMOTE key.

Setting	Description
0	Local/Remote key is disabled.
1	Local/Remote key is enabled *(factory default)*. Depressing the Local/Remote key switches operation commands between the digital operator and the settings of *B1-01* & *B1-02*.

O2-02 STOP Key During External Terminal Operation B

Enables/disables the digital operator STOP key, during operation from the external terminals and during serial communication.

Setting	Description
0	The digital operator STOP key is disabled when Run command does *not* come from the digital operator *(factory default)*.
1	The digital operator STOP key is always enabled. The STOP key is enabled even during external terminal operation and serial communication.

O2-04 Inverter Model Selection A

Setting Range: 00 to FF
Factory Default: Inverter model dependent, kVA dependent

Sets the inverter capacity, according to the model number. Control parameters with defaults specific to the inverter's capacity are set automatically (i.e. carrier frequency, motor data, etc.). This parameter does *not* need changing, unless the control board is replaced. When replacing the control board, set parameter 02-04 to the appropriate value per the following tables and re-initialize with parameter A1-03.

230 V Models

Model	20P4	20P7	21P5	22P2	23P7	25P7	27P7	2011	2015
02-04	0	1	2	3	4	5	6	7	8
C6-02 (KHz)	8	8	8	8	8	8	8	8	8
L2-02 (sec)	0.7	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0

460 V Models

Model	40P4	40P7	41P5	42P2	43P7	44P0	45P5	47P5	4011	4015	4018	4022	4030	4037	4045
02-04	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E
C6-02 (KHz)	8	8	8	8	8	8	8	8	8	8	8	8	8	4	4
L2-02 (sec)	1.0	1.0	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0

Model	4055	4075	4110	4160	4185	4220	4300
02-04	2F	30	32	34	35	36	37
C6-02 (KHz)	4	4	4	4	2	2	2
L2-02 (sec)	2.0	2.0	2.0	2.0	2.0	2.0	2.0

O2-05 Digital Operator M.O.P. Mode Selection

A

Selects whether the ENTER key is used when the frequency reference is set by the digital operator. The digital operator can simulate a motor operated potentiometer (M.O.P.) by setting this parameter.

Setting	Description
0	The digital operator M.O.P. mode is disabled *(factory default)*. The inverter accepts the reference command when the ENTER key is depressed.
1	The digital operator M.O.P. mode is enabled. The inverter accepts the reference command as soon as changes are made with the arrow keys, *without* the ENTER key being depressed.

O2-06 Digital Operator Disconnection Detection

A

If the digital operator is disconnected from the inverter, this parameter selects whether the inverter detects this condition.

Setting	Description
0	Detection is disabled. Operation continues *(factory default)*.
1	Detection is enabled. When the inverter detects that the digital operator has been disconnected while running, the inverter coasts to stop and the error message "oPr" is displayed on the digital operator, after it has been connected again.

This function can only be activated when the run command comes from the digital operator.

O2-07 Operator Time Setting

A

Setting Range: 0 to 65535 Hours
Factory Default: 0 Hours

Sets the initial value for the cumulative operation time. Operation time starts accumulating from the set value. Commonly used for preventive maintenance purposes.

O2-08 Cumulative Operation Time Selection

A

Defines the operation time that accumulates in the timer.

Setting	Description
0	Power-On time is the accumulated time *(factory default)*. The timer counts the time while the inverter power supply is turned ON as operation time.
1	Running time is the accumulated time. The timer counts the time while the inverter is running as operation time.

After changing this setting, reinitialize the inverter in parameter *A1-03*. This initialization affects application dependent parameter settings (motor-related parameters, carrier frequency, inverter rated current, etc.).

T Tuning Parameters

T1 Auto-tuning

Auto-tuning is required at the time of commissioning to allow the drive to determine the angular displacement between the magnetic pole position and hall sensor/ encoder marker pulse position. This is necessary to insure optimum performance in the Pm machine.

T1-02 Tuning Mode

Q

The tuning mode is set in this parameter. Tuning is performed in the drive mode by setting T1-02 = 2, and pressing the digital operator **RUN** key.

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Setting	Description
0	Normal running mode *(factory default)*
2	Auto-tuning mode

After auto-tuning is completed, the setting automatically returns to “0.”

T1-03 Tuning Operation Selection

Q

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Setting	Description
0	Auto-tuning procedures are performed on all parameters (under development.
1	Only PG origin pulse adjustment is performed *(factory default)*.

Appendix: VS-616PS5 Parameter List

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
Operation						
U	**Operation**					
U1	**Monitor**					
U1-01	Speed reference	%	0.0~100.0	0.0	Q	
U1-02	Output frequency	Hz	-	-	Q	
U1-03	Inverter output current	A	-	-	Q	
U1-05	Motor speed	%	-	-	Q	
U1-06	Output voltage	V_{ac}	-	-	Q	
U1-07	DC bus voltage	V_{dc}	-	-	Q	
U1-08	Output power	kW	-	-	Q	
U1-09	Torque reference (internal)	%	-	-	Q	
U1-10	Input terminal status	-	-	-	Q	
U1-11	Output terminal status	-	-	-	Q	
U1-12	Internal control status 1	-	-	-	Q	
U1-13	Elapsed time	H	-	-	Q	
U1-14	Flash ID number	-	-	-	Q	
U1-15	External terminal 13 input voltage	%	-	-	B	
U1-16	External terminal 14 input voltage	%	-	-	B	
U1-17	External terminal 16 input voltage	%	-	-	B	
U1-18	Motor torque current (I_q)	%	-	-	B	
U1-19	Motor excitation current ($I_{d)}$	%	-	-	B	
U1-20	Primary frequency after SFS	%	-	-	A	
U1-21	Speed controller ASR input	%	-	-	A	
U1-22	Speed controller ASR output	%	-	-	A	
U1-27	q Axis current control reference	%	-	-	A	
U1-28	d Axis current control reference	%	-	-	A	
U1-29	Voltage limit control output	%	-	-	A	
U1-30	q Axis current control output	%	-	-	A	
U1-31	d Axis current control output)	%	-	-	A	
U1-32	Output voltage reference (V_q)	V	-	-	A	
U1-33	Output voltage reference (V_d)	V	-	-	A	
U1-41	LED check	-	-	-	A	
U1-42	Internal control status 2	-	-	-	A	
U1-43	Command 1 from option	-	-	-	A	
U1-44	Command 2 from option	-	-	-	A	
U1-45	External torque reference	%	-	-	A	
U1-46	Torque compensation value	%	-	-	A	
U1-47	DO-08H output status	-	-	-	A	
U1-49	Control section software number	-	-	-	A	
U1-50	Speed detection PG counter value	-	-	-	A	
U1-53	PID feedback	%	-	-	A	
U1-54	DI-16H input status	-	-	-	A	
U1-55	Hall Sensor Status	-	-	-		

Appendix
VS-616PS5 Parameter List

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
U2	**Fault Trace**					
U2-01	Existing detected fault	-	-	-	Q	
U2-02	Previous detected fault	-	-	-	Q	
U2-03	Frequency reference when fault was detected	%	-	-	Q	
U2-04	Output frequency when fault was detected	Hz	-	-	Q	
U2-05	Output current when fault was detected	A	-	-	Q	
U2-06	Motor speed reference	%	-	-	Q	
U2-07	Output voltage when fault was detected	V_{ac}	-	-	Q	
U2-08	DC bus voltage	V_{dc}	-	-	Q	
U2-09	Output power	kW	-	-	Q	
U2-10	Torque reference at fault	%	-	-	Q	
U2-11	Input terminal status	-	-	-	Q	
U2-12	Output terminal status	-	-	-	Q	
U2-13	Drive status before fault was detected	-	-	-	Q	
U2-14	Elapsed time since fault was detected	H	-	-	Q	
U2-15	Motor magnetizing current (I_q) at fault	%	-	-	B	
U2-16	Motor magnetizing current (I_d) at fault	%	-	-	B	
U2-17	Internal control status 2 at fault	-	-	-	A	
U2-18	Command 1 from option at fault	-	-	-	A	
U2-19	Command 2 from option at fault	-	-	-	A	
U2-20	External torque reference at fault	%	-	-	A	
U2-21	Torque compensation at fault	%	-	-	A	
U2-22	Speed controller ASR output at fault	-	-	-	A	
U3	**Fault History**					
U3-01	Most recent fault code	-	-	-	Q	
U3-02	2nd most recent fault code	-	-	-	Q	
U3-03	3rd most recent fault code	-	-	-	Q	
U3-04	4th most recent fault code	-	-	-	Q	
U3-05	Elapsed time since most recent fault	H	-	-	Q	
U3-06	Elapsed time since 2nd most recent fault	H	-	-	Q	
U3-07	Elapsed time since 3rd most recent fault	H	-	-	Q	
U3-08	Elapsed time since 4th most recent fault	H	-	-	Q	
Initialization						
A	**Initialization**					
A1	**Initialization Set-up**					
A1-01	Parameter access level 0: Operation only 3: Basic level 1: User program 4: Advanced level 2: Quick start level	-	0~4	2	Q	
A1-03	Operator status 0: No initialization 3330: 3-Wire initialization 2220: 2-Wire initialization	-	0~9999	0	Q	
A1-04	Password entry	-	0000~9999	-	Q	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
Programming						
B	**Application**					
B1	**Sequence**					
B1-01	Frequency reference selection 0: Operator 3: Option PCB 1: Terminals 4: CP-717 2: Serial communication	-	0~4	1	Q	
B1-02	Operation method selection 0: Operator 3: Option PCB 1: Terminals 4: CP-717 2: Serial communication	-	0~4	1	Q	
B1-03	Stopping method selection 0: Ramp to stop 3: Coast with timer 1: Coast to stop	-	0~3	0	Q	
B1-04	Prohibition of reverse operation 0: Reverse enabled 1: Reverse disabled	-	0/1	0	B	
B1-05	Operation selection at zero speed 0: RUN at freq. ref 2: RUN at min freq. 1: Stop 3: RUN at zero rpm	-	0~3	1	A	
B1-06	Local/Remote run select 0: Cycle extra RUN 1: Accept extra RUN	-	0/1	1	A	
B2	**Servo Speed Level**					
B2-01	Zero speed level (BB starting speed)	%	0.0~20.0	0.5	B	
B3	**Magnetic Pull-in**					
B3-02	Magnetic pull-in current	%	0~150	50	A	
B3-04	Current ramp-up time	s	0.0~5.0	1.0	A	
B3-05	Magnetic pull-in time	s	0.0~5.0	1.0	A	
B4	**Delay Timers**					
B4-01	On-delay timer	s	0.0~300.0	0.0	A	
B4-02	Off-delay timer	s	0.0~300.0	0.0	A	
B5	**PID Control**					
B5-01	PID control mode selection 0: Disabled 1: Enabled D = feedback 2: Enabled D = feedfwd	-	0~2	0	A	
B5-02	PID control proportional gain	-	0.00~25.00	1.00	A	
B5-03	PID control integral time	s	0.00~360.0	1.00	A	
B5-04	PID control integral limit	%	0.0~100.0	100.0	A	
B5-05	PID control derivative time	s	0.00~10.00	0.00	A	
B5-06	PID control limit	%	0.0~100.0	100.0	A	
B5-07	PID control offset	%	±100.0	0.0	A	
B5-08	PID control output primary delay time	s	0.00~10.00	0.00	A	
B6	**Reference Hold**					
B6-01	Dwell reference at start (dwell level)	%	0.0~100.00	0.00	A	
B6-02	Dwell time at start (dwell time)	s	0.0~10.0	0.0	A	
B6-03	Dwell reference at stop (dwell level)	%	0.0~100.00	0.00	A	
B6-04	Dwell time at stop (dwell time)	s	0.0~10.0	0.0	A	
B7	**Droop Control**					
B7-01	Droop capacity	%	0.0~100.0	0.0	A	
B7-02	Droop delay time	s	0.00~1.00	0.10	A	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
C	**Tuning Parameters**					
C1	**Accel/Decel**					
C1-01	Acceleration time 1	s	0.00~6000.0	10.0	Q	
C1-02	Deceleration time 1	s	0.00~6000.0	10.0	Q	
C1-03	Acceleration time 2	s	0.00~6000.0	10.0	B	
C1-04	Deceleration time 2	s	0.00~6000.0	10.0	B	
C1-05	Acceleration time 3	s	0.00~6000.0	10.0	A	
C1-06	Deceleration time 3	s	0.00~6000.0	10.0	A	
C1-07	Acceleration time 4	s	0.00~6000.0	10.0	A	
C1-08	Deceleration time 4	s	0.00~6000.0	10.0	A	
C1-09	Fast-stop time	s	0.00~6000.0	10.0	B	
C1-10	Accel/decel time setting units 0: 0.01 seconds 1: 0.1 seconds	-	0/1	1	A	
C1-11	Accel/decel time switching speed level	%	0.0~100.0	0.0	A	
C2	**PG Origin Pulse Compensation**					
C2-13	PG origin pulse compensation value	degrees	±180°	-	Q	
C3	**Voltage Limit Control**					
C3-05	Voltage limit control selection	-	0/1	0	A	
C5	**ASR Tuning**					
C5-01	ASR proportional gain 1	-	0.00~300.00	5.00	B	
C5-02	ASR integral time 1	s	0.000~10.000	0.500	B	
C5-03	ASR proportional gain 2	-	0.00~300.00	5.00	B	
C5-04	ASR integral time 2	s	0.000~10.000	0.500	B	
C5-05	ASR output primary delay time	s	0.000~0.500	0.004	A	
C5-06	ASR switching speed level	%	0.00~100.00	0.00	A	
C5-07	ASR p gain at start	-	0.00~300.00	5.00	A	
C6	**Carrier Frequency**					
C6-02	Carrier frequency	kHz	2,4,6,8,12	*	A	
C6-13	Pulse Reference Ratio Denominator Value	-	0~1000	0	A	
C6-14	Pulse Reference Ratio Numerator Value	-	0~1000	0	A	
C7	**S-Curve Accel/Decel Characteristics**					
C7-01	S-Curve characteristic time at start of acceleration	s	0.00~250.0	0.00	A	
C7-02	S-Curve characteristic time at end of acceleration	s	0.00~250.0	0.00	A	
C7-03	S-Curve characteristic time at start of deceleration	s	0.00~250.0	0.00	A	
C7-04	S-Curve characteristic time at end of deceleration	s	0.00~250.0	0.00	A	
D	**Reference Parameters**					
D1	**Preset References**					
D1-01	Preset reference 1	%	0.00~100.00	0.00	Q	
D1-02	Preset reference 2	%	0.00~100.00	0.00	Q	
D1-03	Preset reference 3	%	0.00~100.00	0.00	Q	
D1-04	Preset reference 4	%	0.00~100.00	0.00	Q	
D1-05	Preset reference 5	%	0.00~100.00	0.00	B	
D1-06	Preset reference 6	%	0.00~100.00	0.00	B	
D1-07	Preset reference 7	%	0.00~100.00	0.00	B	
D1-08	Preset reference 8	%	0.00~100.00	0.00	B	
D1-09	Jog frequency reference	%	0.00~100.00	10.00	Q	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
D2	**Reference Limits**					
D2-01	Reference upper limit	%	0.0~110.0	100.0	B	
D2-02	Reference lower limit	%	0.0~100.0	0.0	B	
D3	**Jump Frequencies**					
D3-01	Jump frequency reference 1	%	0.0~200.0	0.0	A	
D3-02	Jump frequency reference 2	%	0.0~200.0	0.0	A	
D3-03	Jump frequency reference 3	%	0.0~200.0	0.0	A	
D3-04	Jump frequency reference bandwidth	%	0.0~200.0	1.0	A	
D4	**Hold reference memory**					
D4-01	Hold reference memory selection - Up/Down 0: Disabled 1: Enabled	-	0/1	0	A	
D5	**Torque Control**					
D5-01	Torque control selection 0: Speed control 1: Torque control	-	0/1	0	A	
D5-02	Torque limit primary delay time	ms	0~1000	0	A	
D5-03	Speed limit input selection 1: Analog Input 2: Program Setting	-	1/2	1	A	
D5-04	Speed limit value	%	±120	0	A	
D5-05	Speed limit bias	%	0~120	5	A	
D5-06	Reference delay time	ms	0~1000	50	A	
E	**Motor Parameters**					
E1	**Motor Constant**					
E1-01	Input voltage setting	V	180~230	230	Q	
E1-02	Motor capacity selection	-	1000~1239	1000	Q	
E1-03	Motor rated voltage	V	0.0~255.0	*	Q	
E1-04	Motor rated current	A	0.0~200.0	*	Q	
E1-05	Number of motor poles	-	2, 4, 6, 8	*	Q	
E1-06	Maximum motor speed	rpm	0~6000	*	Q	
E1-07	Base motor speed	rpm	0~6000	*	Q	
E1-08	Minimum motor speed	rpm	0~6000	*	Q	
E1-09	Motor armature resistance	Ω	0.000~65.535	*	Q	
E1-10	Motor d axis inductance	mH	0.00~600.00	*	Q	
E1-11	Motor q axis inductance	mH	0.00~600.00	*	Q	
E1-13	Induced voltage constant	mV/rpm	20.0~500.0	*	Q	
E1-15	Motor mechanical loss	%	0.0~10.0	*	A	
E1-16	Motor feeder resistance	%	0.0~10.0	*	A	
E1-17	Motor connection selection 0: 1D 2: 1Y 1: 2D 3: 2Y	-	0~3	0	Q	
F	**Option Parameters**					
F1	**PG Option Setup**					
F1-01	PG pulses per revolution	-	0~10000	30	Q	
F1-02	PG disconnection detection stopping method 0: Ramp to stop 2: Fast-stop 1: Coast to stop 3: Alarm only	-	0~3	1	B	
F1-03	Overspeed detection stopping method 0: Ramp to stop 2: Fast-stop 1: Coast to stop 3: Alarm only	-	0~3	1	B	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
F1-04	PG deviation detection stopping method 0: Ramp to Stop 2: Fast-Stop 1: Coast to Stop 3: Alarm Only	-	0~3	3	B	
F1-05	PG rotation selection 0: CCW 1: CW	-	0/1	1	Q	
F1-08	Overspeed detection level	%	0~120	115	A	
F1-09	Overspeed detection time	s	0~2.0	0.0	A	
F1-10	PG deviation detection level	%	0~50	10	A	
F1-11	PG deviation detection time	s	0~10.0	0.5	A	
F1-13	PG open phase detection delay time	s	0.0~10.0	3.0	A	
F2	**A1-14B Setup**					
F2-01	Bipolar or unipolar input selection 0: 3-channel individual 1: 3-channel additional	-	0/1	0	A	
F3	**D1-08/DI-16H Setup**					
F3-01	Digital input option 0: BCD 1% 2: BCD 0.01% 1: BCD 0.1% 7: Binary	-	0~7	0	A	
F4	**AO-08/AO-12 Setup**					
F4-01	Analog output Channel 1 selection 1: Speed reference 2: Output frequency 3: Inverter output current 5: Motor speed 6: Output voltage 7: DC bus voltage 8: Output power 9: Torque reference (internal) 15: External terminal 13 input voltage 16: External terminal 14 input voltage 17: External terminal 16 input voltage 18: Motor secondary current (I_q) 19: Motor excitation current (I_d) 20: Primary frequency after SFS 21: Speed controller ASR input 22: Speed controller ASR output 27: q Axis current control reference 28: d Axis current control reference 29: Voltage limit control output 30: q Axis current control output 31: d Axis current control output 32: Output voltage reference (V_q) 33: Output voltage reference (V_d) 45: External torque reference 46: Torque compensation value 49: Control section software number 50: Speed detection PG counter value 53: PID feedback	-	1~60	5	A	
F4-02	Analog output channel 1 gain	-	±300.0	1.0	A	
F4-03	Analog output channel 1 bias	%	±109.2	0.0	A	
F4-04	Analog output channel 2 selection (same as F4-01)	-	1~60	3	A	
F4-05	Analog output channel 2 gain	-	±300.0	1.0	A	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
F4-06	Analog output channel 2 bias	-	±109.2	0.0	A	
F5	**DO-02 Setup**					
F5-01	DO-02C digital output channel 1 selection 0: During RUN 1 1: Zero speed 2: Fref/Fout agree 1 3: Fref/Set agree 1 4: Frequency detection 1 5: Frequency detection 2 6: Inverter Ready 7: DC bus undervoltage 8: Baseblock 1 9: Option reference A: Remote operation B: Torque detection 1 (N.O.) C: Loss of reference D: DB overheat E. Fault F: Not used 10: Minor fault 11: Reset command active 12: Timer output 13: Fref/Fout agree 2 14: Fref/Set agree 2 15: Frequency detection 3 16: Frequency detection 4 17: Torque detection 1 (N.C.) 18: Torque detection 2 (N.O.) 19: Torque detection 2 (N.C.) 1A: Reverse direction 1B: Baseblock 2 1D: Regenerating 1E: Restart enabled 1F: Overload (OL1) 20: OH prealarm 30: Current/Torque limit 31: Speed limit 37: During RUN 2	-	0~FF	0	A	
F5-02	DO-02C digital output Channel 2 selection (same as F5-01)	-	0~3F	1	A	
F6	**DO-08 Set-up**					
F6-01	DO-08 digital output selection 0: 8-channel Individual 1: Binary Output	-	0/1	0	A	
F8	**PG-P2/H2 Set-up**					
F8-01	Speed feedback method selection 0: Encoder inputs 1: Hall sensor input	-	0/1	1	Q	
F8-02	Pulse train moving average value 0=1 Scan (5msec)	-	0-50	0	B	
F9	**CP-916 Set-up**					
F9-01	External fault input level from communication option	-	0/1	0	A	
F9-02	External fault from communication level	-	0/1	0	A	
F9-03	Operation at external fault input from communication option 0: Ramp to stop 2: Fast-stop 1: Coast to stop 3: Alarm only	-	0~3	1	A	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
F9-04	Trace sampling of option	-	0~60000	0	A	
F9-05	Torque reference selection from communication option 0: Torque reference/limit from terminal 1: Torque reference/limit from option	-	0/1	0	A	
F9-06	Operation at bus error detection 0: Ramp to stop 2: Fast-stop 1: Coast to stop 3: Alarm only	-	0~3	1	A	
H	**Control Circuit Terminal Parameters**					
H1	**Digital Inputs**					
H1-01	Multi-function input terminal 3 selection 0: 3-Wire control 1: Local/Remote selection 2: Option/Inverter selection 3: Multi-step reference 1 4: Multi-step reference 2 5: Multi-step reference 3 6: Jog frequency reference 7: Multi-accel/decel 1 8: External baseblock N.O. 9: External baseblock N.C. A: Accel/Decel ramp hold B: OH2 alarm signal C: Terminal 16 enable E: ASR integral reset F: Terminal not used 10: MOP increase 11: MOP decrease 12: Forward jog 13: Reverse jog 14: Fault reset 15: Fast-stop 18: Timer function 19: PID disable 1A: Multi-accel/decel 2 1B: Program lockout 1E: Reference sample hold 1F: Terminal 13/14 switch 24: external Fault 71: Speed/Torque control change 77: ASR gain switch	-	0~FF	24	B	
H1-02	Multi-function input terminal 4 selection (same as H1-01)	-	0~FF	14	B	
H1-03	Multi-function input terminal 5 selection (same as H1-01)	-	0~FF	3	B	
H1-04	Multi-function input terminal 6 selection (same as H1-01)	-	0~FF	4	B	
H1-05	Multi-function input terminal 7 selection (same as H1-01)	-	0~FF	6	B	
H1-06	Multi-function input terminal 8 selection (same as H1-01)	-	0~FF	8	B	
H2	**Digital Outputs**					
H2-01	Multi-function output 1 selection (terminal 9, 10) (same as F5-01)	-	0~FF	0	B	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
H2-02	Multi-function output 2 selection (terminal 25, 27) (same as F5-01)	-	0~FF	1	B	
H2-03	Multi-function output 3 (terminal 26, 27) (same as F5-01)	-	0~3F	2	B	
H3	**Analog Inputs**					
H3-01	Terminal 13 signal selection 0: 0 to 10V_{dc} 1: ±10V_{dc}	-	0/1	0	B	
H3-02	Terminal 13 reference % gain	%	0.0~1000.0	100.0	B	
H3-03	Terminal 13 reference ±% bias	%	±100.0	0.0	B	
H3-04	Terminal 16 signal selection 0: 0 to 10V_{dc} 1: ±10V_{dc}	-	0/1	0	A	
H3-05	Terminal 16 multi-function selection 0: Auxiliary reference 1: Frequency gain 2: Frequency bias 7: Overtorque level 9: Reference lower limit A: Jump frequency B: PID feedback 10: Forward torque limit 11: Reverse torque limit 12: Regenerative torque limit 13: Torque reference 14: Torque compensation 15: Forward/reverse torque limit	-	0~1F	0	A	
H3-06	Terminal 16 reference % gain)	%	0.0~1000.0	100.0	A	
H3-07	Terminal 16 reference ±% bias	%	±100.0	0.0	A	
H3-08	Terminal 14 signal selection 0: 0 to 10V 2: 4 to 20mA 1: ±10V	-	0~2	2	A	
H3-09	Terminal 14 multi-function selection (same as H3-05)	-	0~1F	1F	A	
H3-10	Terminal 14 reference % gain	%	0.0~1000.0	100.0	A	
H3-11	Terminal 14 reference ±% bias	%	±100.0	0.0	A	
H3-12	Analog input filter time constant (terminals 13, 14 & 16)	s	0.00~2.00	0.00	A	
H4	**Analog Outputs**					
H4-01	Terminal 21 analog output selection (same as F4-01)	-	1~60	5	B	
H4-02	Terminal 21 analog output gain	-	±300.0	1.0	B	
H4-03	Terminal 21 analog output bias	%	±109.2	0.0	B	
H4-04	Terminal 23 analog output selection (same as F4-01)	-	1~60	3	B	
H4-05	Terminal 23 analog output gain	-	±300.0	1.0	B	
H4-06	Terminal 23 analog output bias	%	±109.2	0.0	B	
H4-07	Analog output signal selection 0: 0 to 10V_{dc} 1: ±10V_{dc}	-	0/1	0	B	
H5	**Serial Communications**					
H5-01	Serial communication station address	1	0-20	1F	A	
H5-02	Serial communication speed selection 0: 1200 bps, 1: 2400 bps, 2: 4800 bps, 3: 9600 bps	1	0-3	3	A	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
H5-03	Serial communication speed selection 0: No parity, 1: Even parity, 2: Odd parity	1	0-2	0	A	
H5-04	Stopping method after communication error 0: Ramp to stop, 1: Coast to stop, 2: Fast stop, 3: Alarm only	1	0-3	3	A	
H5-05	Serial communication timeover detection 0: Disabled , 1: Enabled	1	0,1	1	A	
L	**Protection Parameters**					
L2	**Power Loss Ride through**					
L2-01	Momentary power loss ride through 0: Disabled	-	0	0	B	
L2-02*	Momentary power loss ride through time	s	0.0~2.0	0.7	B	
L2-05	Undervoltage detection level	V	150~210	190	A	
L3	**Stall Prevention/Current Limit**					
L3-01	Overvoltage protection (stall prevention during decel) 0: Disabled 1: Enabled	-	0~1	1	B	
L4	**Reference Detection**					
L4-01	Speed agree detection level (without sign)	%	0.0~100.0	0.0	B	
L4-02	Speed agree detection width	%	0.0~100.0	2.0	B	
L4-03	Speed agree detection level (with sign)	%	0~±100.0	0.0	A	
L4-04	Speed agree detection width	%	0.0~100.0	2.0	A	
L4-05	Operation when frequency reference is missing 0: Stop 1: Run at 80% of previous reference	-	0/1	0	A	
L5	**Fault Restart**					
L5-01	Number of automatic restart attempts	-	0~10	0	B	
L5-02	Automatic restart operation selection 0: No fault relay 1: Fault relay active	-	0/1	0	B	
L6	**Torque Detection**					
L6-01	Overtorque detection 1 selection 0: Disabled 3: Fault at speed agree 1: Alarm at speed agree 4: Fault at run 2: Alarm at run	-	0~4	0	B	
L6-02	Overtorque detection 1 level	%	0~300	150	B	
L6-03	Overtorque detection 1 time	s	0.0~10.0	0.1	B	
L6-04	Overtorque detection 2 selection 0: Disabled 3: Fault at speed agree 1: Alarm at speed agree 4: Fault at run 2: Alarm at run	-	0~4	0	A	
L6-05	Overtorque detection 2 level	%	0~300	150	A	
L6-06	Overtorque detection 2 time	s	0.0~10.0	0.1	A	
L7	**Torque Limit**					
L7-01	Forward torque limit	%	0~300	150	B	
L7-02	Reverse torque limit	%	0~300	150	B	
L7-03	Regenerative forward torque limit	%	0~300	150	B	
L7-04	Regenerative reverse torque limit	%	0~300	150	B	
L8	**Hardware Protection**					
L8-01	Protection selection for internal DB resistor 0: Not Provided 1: Provided	-	0/1	0	A	
L8-02	OH pre-alarm level	ºC	50~110	95	A	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
L8-03	Stopping method selection after OH pre-alarm 0: Ramp to stop 2: Fast-stop 1: Coast to stop 3: Alarm only	-	0~3	3	A	
L8-05	Input phase loss protection 0: Disabled 1: Enabled	-	0/1	0	A	
L8-07	Output phase loss protection 0: Disabled 1: Enabled	-	0/1	0	A	
L8-10	Ground fault protection selection 0: Disabled 1: Enabled	-	0/1	1	A	
O	**Operator Parameters**					
O1	**Monitor Selection**					
O1-01	Analog output Channel 1 selection 5: Motor speed 6: Output voltage 7: DC bus voltage 8: Output power 9: Torque reference (internal) 15: External terminal 13 input voltage 16: External terminal 14 input voltage 17: External terminal 16 input voltage 18: Motor secondary current (I_q) 19: Motor excitation current (I_d) 20: Primary speed after SFS 21: Speed controller ASR input 22: Speed controller ASR output 27: q Axis current control reference 28: d Axis current control reference 29: Voltage limit control output 30: q Axis current control output 31: d Axis current control output 32: Output voltage reference (V_q) 33: Output voltage reference (V_d) 45: External torque reference 46: Torque compensation value 49: Control section software number 50: Speed detection PG counter value 53: PID feedback 54: DI-16H input status	-	5~53	6	B	
O1-02	Monitor selection after power-up 1: Speed reference 3: Output current 2: Output speed 4: User monitor	1	1~4	1	B	
O1-03	Scale for setting and monitoring frequency	-	0~39999	1	B	
O2	**Key Selection**					
O2-01	Local/remote key 0: Disabled 1: Enabled	-	0/1	1	B	
O2-02	STOP key during external terminal operation 0: Disabled 1: Enabled	-	0/1	0	B	
O2-04	Inverter model selection	-	00~FF	kVA dependent	B	
O2-05	Digital operator M.O.P. mode selection 0: Disabled 1: Enabled	-	0/1	0	A	
O2-06	Digital operator disconnection detection 0: Disabled 1: Enabled	-	0/1	0	A	
O2-07	Operation time setting	H	0~65535	0	A	

No.	Parameter Description	Unit	Setting Range	Default	Access Level	User Setting
O2-08	Cumulative 0peration time selection 0: Power-ON time 1: Running time	-	0/1	0	A	
T	**Tuning**					
T1	**Auto-tuning**					
T1-02	Tuning mode 0: Normal running mode 2: Auto-tuning mode	-	0/2	0	Q	
T1-03	Tuning operation selection 0: Auto-tuning procedures are performed for all parameters 1: Only PG origin pulse adjustment is performed	-	0/1	1	Q	

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