Extended IO Module

For RSi “S” & “SW” Series Variable Frequency Drive Instruction Manual

890049-08-00

BENSHAW
Applied Motor Controls

Safety Information

Carefully read and follow all safety instructions in this manual to avoid unsafe operating conditions, property damage, personal injury, or death. Please keep this manual for future reference.

Safety symbols in this manual

⚠ Danger

Indicates an imminently hazardous situation which, if not avoided, could result in severe injury or death.

⚠ Warning

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

ⓘ Caution

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

Safety information

ⓘ Caution

- ESD (Electrostatic discharge) from the human body may damage sensitive electronic components on the PCB. Therefore, be extremely careful not to touch the PCB or the components on the PCB with bare hands while you work on the I/O PCB.
- Turn off the power to the inverter before making wiring connections. Otherwise, malfunctions including faulty network communication may occur.
- When installing the option board, ensure that the option board is properly connected to the connector on the inverter. Faulty connections may damage the inverter or the option board.
- Check the parameter units before settings the function codes. Wrong units may lead to faulty network communication.

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1 About the Product

The Extended IO option module provides additional digital and analog inputs/outputs to the Benshaw "S" and "SW" series inverters.

1.1 Additional Inputs and Outputs

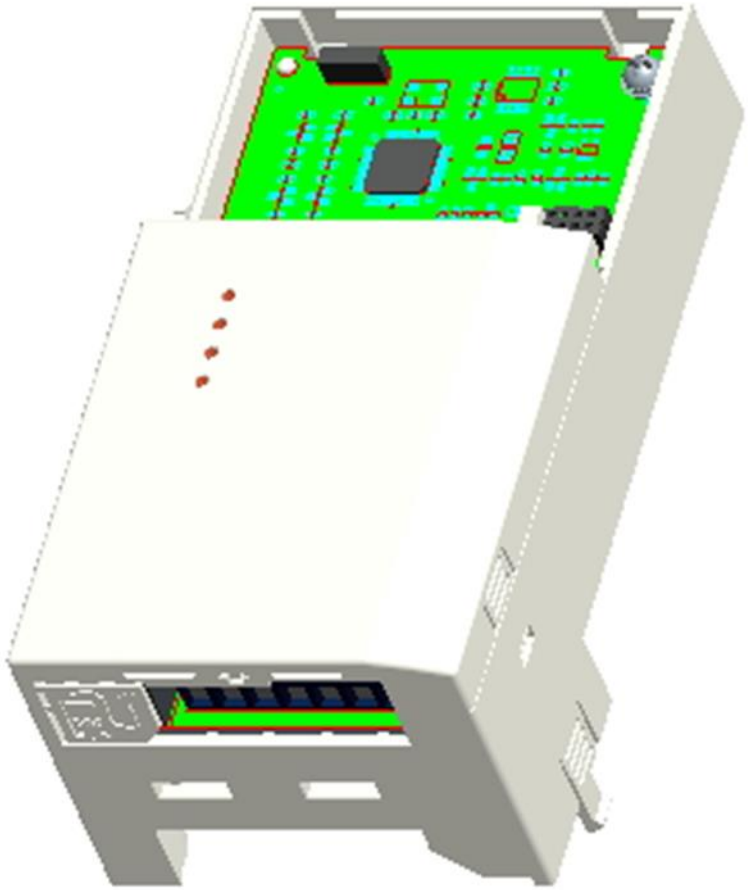
- 3 x Digital Inputs: P8, P9, P10
- 2 x Relay Outputs (Form C): Relay 3 and Relay 4
- 2 x Analog Inputs: V3 and I4 (I4 selectable to V4, 0-10V)
- 1 x Analog Output: A03 selectable to I (4-20mA) or V (0-10V)
- 1 x RJ45 Connector (for Remote LCD)

1.2 Items Included

Benshaw Part # PC-100090-00. The Extended I/O consists of following items.

- 1 x Extended I/O Module
- 1 x User manual
- 1 x Brass Stand Off (M3 x L17.3)
- 1 x Brass Stand Off (M3 x L23)
- 2 x Screws (M3 x L8)

2 Installation

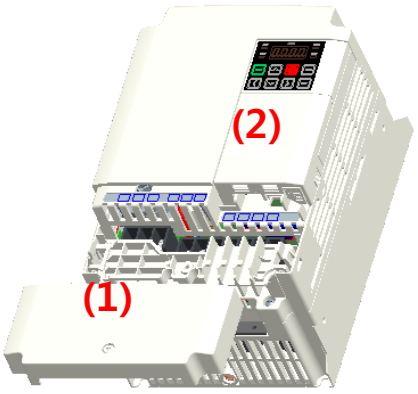


2.1 Installation of the Extended I/O Module

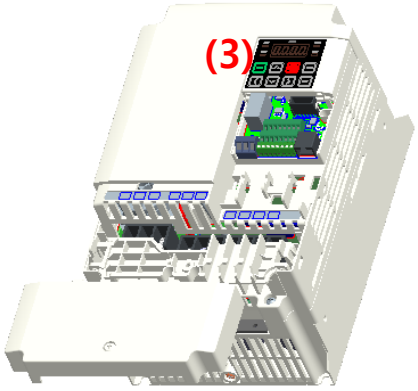
⚠ Warning Install/Remove the Extended IO module after the power supply of the inverter must be off. If the power supply is plugged when Extended I/O is installed/removed, the inverter will be damaged entirely. Remove the Extended I/O module from the product after the power supply is totally discharged.

ⓘ Caution **For the following inverters, 0.5 HP and 1.0 HP, 230V and 460V**, it is impossible to do wiring of main source and standard IO after assembly of Extended I/O module. Install the Extended I/O module after wiring of main source and standard IO.

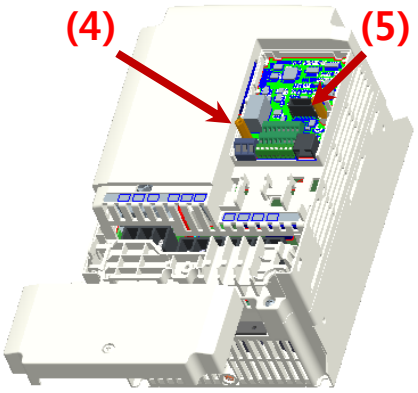
■ Take off the power supply cover (1) and the I/O cover (2) from the inverter.



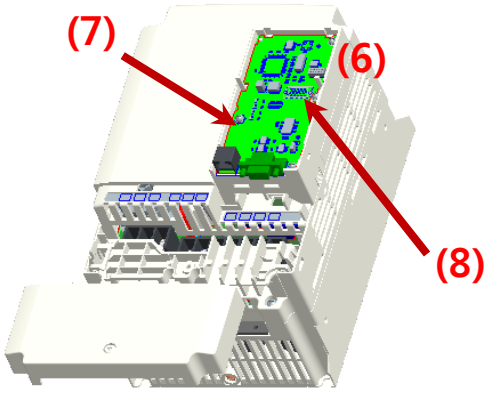
■ Take off the keypad (3).



■ Remove screws from the I/O board and install the provided brass standoffs (M3 x L23) to (4), and (M3 x L17.3) to (5).

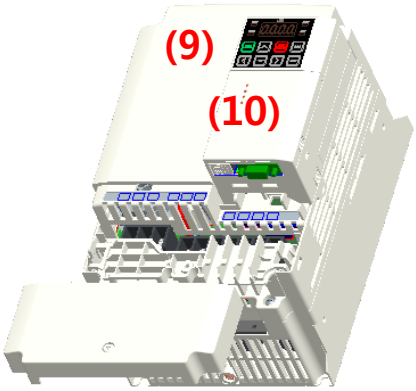


■ Mount the Extended I/O (6) and install the removed screw (7) and the included screw (8).

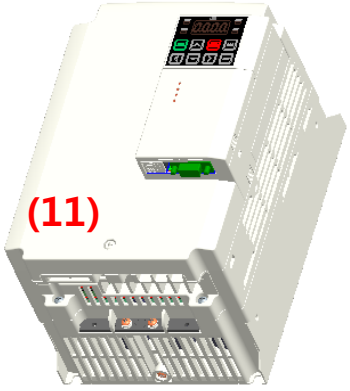


Caution **For the following inverters, 0.5 HP and 1.0 HP, 230V and 460V**, it is impossible to do wiring of main source and standard IO after assembly of Extended I/O module. Install the Extended I/O module after wiring of main source and standard IO.

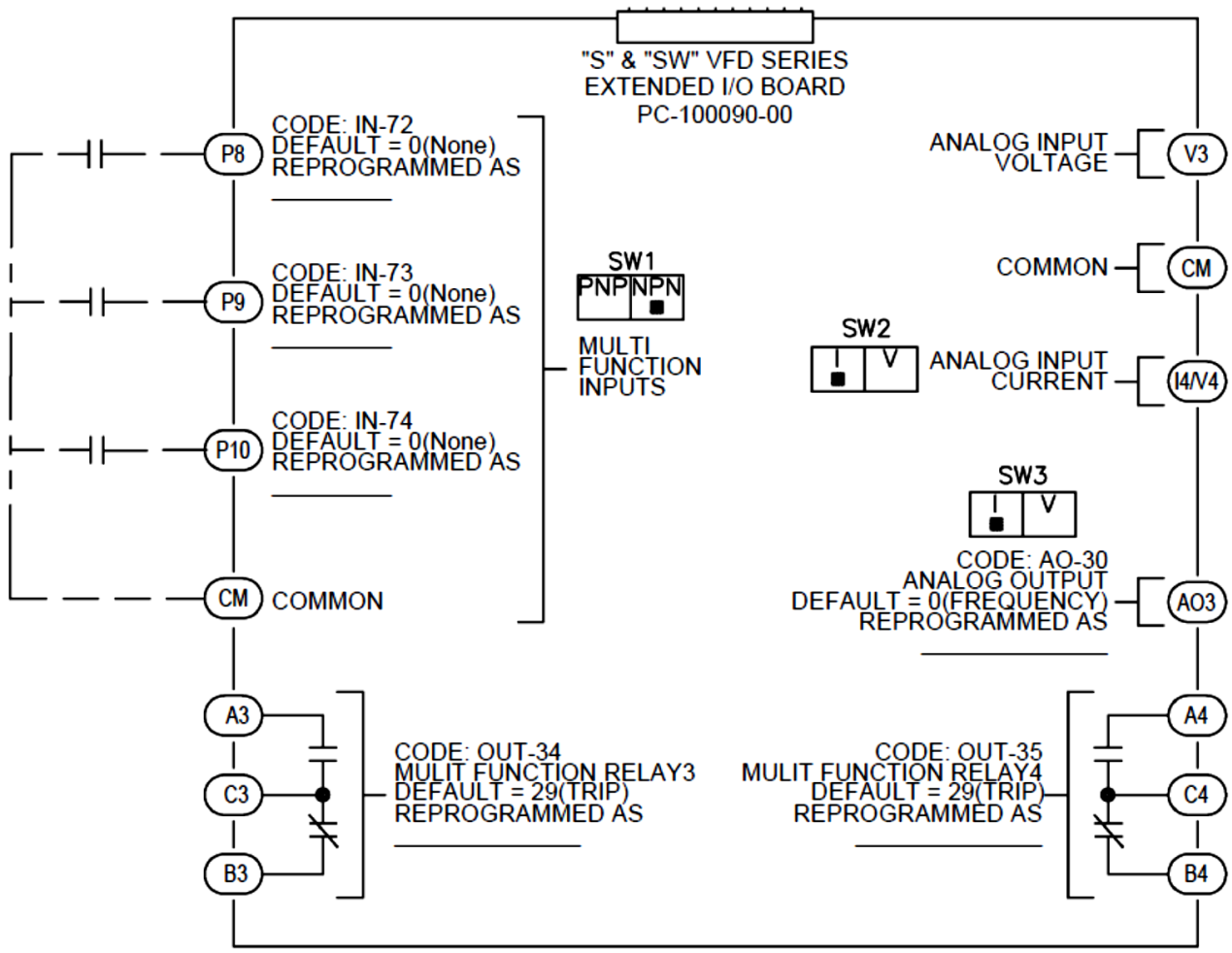
■ Install the keypad (9) first, then the Extended I/O cover (10).



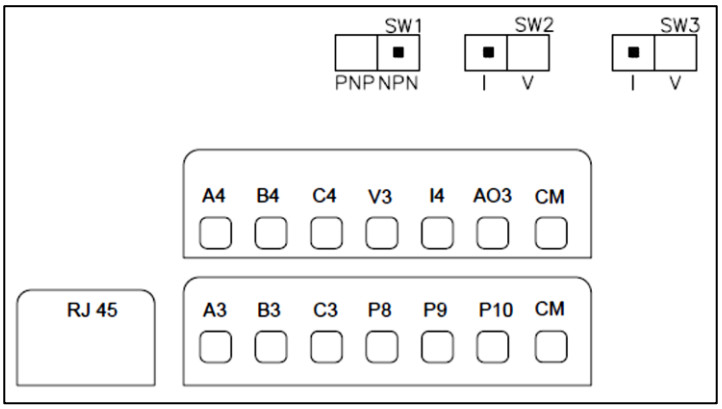
■ Install the power supply cover (11). And the installation is completed.



3 Control Terminal Wiring



3.1 Terminal Block Layout



3.2 Control Terminal Specifications

3.2.1 Input and Output Specification

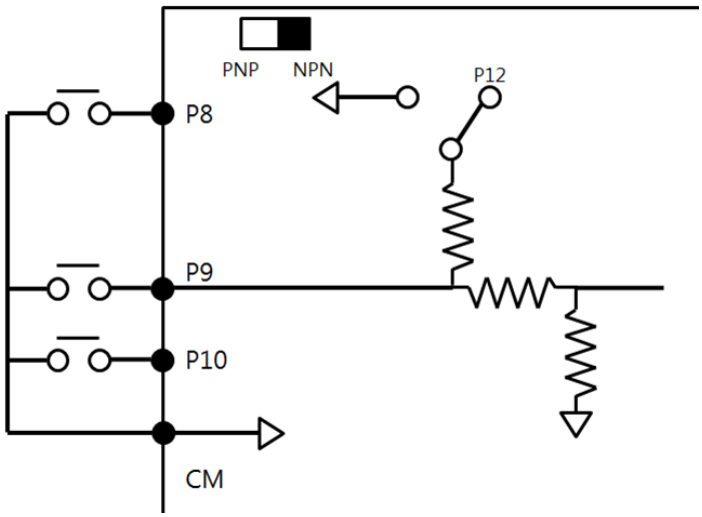
Function		Label	Name	Description
INPUT	Multi-function terminal configuration	P8, P9, P10	Multi-function Input 8~10	Configurable multi-function input terminals.
		CM	Common Sequence	Common terminal for analog and digital inputs and outputs.
	Analog input configuration	V3	Voltage input for frequency reference input	Used to set a frequency reference via analog voltage input at V3 terminal. • Unipolar: 0–10V (12V Max.) • Bipolar: -10–10V (±12V Max.)
		I4	Voltage/ current input for frequency reference input	Used to set a frequency reference via analog current or voltage input at I4 terminal. Switch between current (I4) and voltage (V4) modes with switch (SW2) on the Extended IO module. **I4 Mode:** • Input current: 4–20mA • Maximum Input current: 24mA • Input resistance: 249Ω **V4 Mode:** • Unipolar: 0–10V (12V Max.)
OUTPUT	Analog Output	AO3	Voltage/ Current Output	Set switch (SW3) to select the signal output type (current or voltage) at the AO3 terminal. Output Signal Specifications: • Output current: 0–20mA • Maximum output current: 24mA • Output voltage: 0–10V • Maximum output voltage/current: 12V/10mA • Factory default output: Frequency
	Digital Output	CM	Common Sequence	Common terminal for analog and digital inputs and outputs.
		A3, C3, B4	Relay 3 output	AC 250V <1A, DC 30V < 1A. A3 and C3 contacts are normally open. B3 and C3 contacts are normally closed.
		A4, C4, B4	Relay 4 output	AC 250V <1A, DC 30V < 1A. A4 and C4 contacts are normally open. B4 and C4 contacts are normally closed.
	LCD	RJ45		Remote LCD Connection

3.3 NPN/PNP Mode Selection

The Extended IO module supports both NPN (Sink) and PNP (Source) modes for activating the digital inputs at the terminal block. Select the appropriate mode to suit requirements using the NPN/PNP selection switch (SW1) on the board. The following describes each mode along with connection diagrams. Switch position (status) can be viewed at parameter In.99.

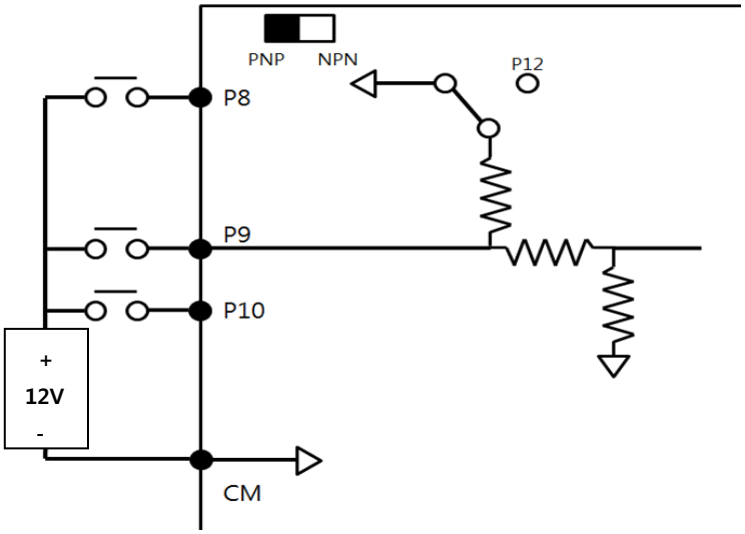
3.3.1 NPN (Sink mode)

This is the factory default setting of the board. With SW1 in the NPN position, connect an external contact (switch, relay, transistor) between Px and CM. When the external contact closes, the input is activated (connects the internal 12V source to CM (sink)). CM is the common ground terminal for all digital input terminals.



3.3.2 PNP (Source Mode)

With SW1 in the PNP position, the input is activated by applying 12V to the digital input. Connect an external contact (switch, relay, transistor) between 12V (external source) and Px terminal. When the contact closes, the input is activated by applying 12V to the digital input. When using an external 12V source, connect the external source (-) to the CM terminal. CM is the common ground terminal for all digital inputs. When using PNP mode, you should apply more than 3V source for on-state and less than 2V for off-state.

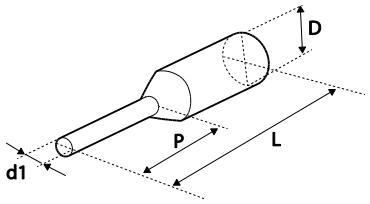


3.4 Signal (Control) Cable Specifications

Terminals	Signal Cable			
	Without Crimp Terminal Connectors (Bare Wire)		With Crimp Terminal Connectors (Bootlace Ferrule))	
	mm2	AWG	mm2	AWG
P8~P10/CM/V3/I4 /AO3	0.75	18	0.5	20
A3/B3/C3 A4/B4/C4	1.0	16	1.5	14

▪ Pre-insulated Crimp Terminal Connectors (Bootlace Ferrule) .

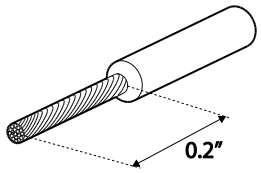
Use pre-insulated crimp terminal connectors to increase reliability of the control terminal wiring. Refer to the specifications below to determine the crimp terminals to fit various cable sizes.



Cable Spec		Dimensions (inches/mm)			
AWG	mm2	L*	P	d1	D
26	0.25	10.4	0.4 / 6.0	0.04 / 1.1	0.1 / 2.5
		12.4	0.5 / 8.0		
22	0.50	12.0	0.45 / 6.0	0.05 / 1.3	0.125 / 3.2
20	0.75	12.0	0.45 / 6.0	0.06 / 1.5	0.13 / 3.4

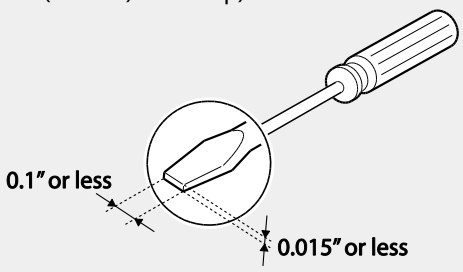
* If the length (L) of the crimp terminals exceeds 0.5" (12.7mm) after wiring, the control terminal cover may not close fully.

To connect cables to the control terminals without using crimp terminals, refer to the following illustration detailing the correct length of exposed conductor at the end of the control cable.



Note

- While making wiring connections at the control terminals, ensure that the total cable length does not exceed 165ft (50m).
- Ensure that the length of any safety related wiring does not exceed 100ft (30m).
- Ensure that the cable length between an LCD keypad and the inverter does not exceed 10ft (3.04m). Cable connections longer than 10ft (3.04m) may cause signal errors.
- Use ferrite material to protect signal cables from electro-magnetic interference.
- Take care when supporting cables using cable ties, to apply the cable ties no closer than 6 inches from the inverter. This provides sufficient access to fully close the front cover.
- When making control terminal cable connections, use a small flat-tip screw driver (0.1in wide (2.5mm) and 0.015in thick (0.4mm) at the tip).



4 Basic Operations

4.1 Basic Functions

Basic Function	Example
Set Frequency reference source as voltage input.	Configures the inverter to allow input voltages at terminals V3 or V4.
Set Frequency reference source as current input.	Configures the inverter to allow input voltages at terminal I4.
Configure the Analog Output.	Configures the analog output terminal A03.
Configure the Digital Outputs.	Configure the Relay 3 and Relay 4 output functions.
Configure the Digital Inputs.	Configure the functions of Digital Inputs, P8, P9 and P10
Multi-step speed (frequency) configuration.	Configure multi-step frequency operations at the digital input terminals.
Multi-stage Acc/Dec time configuration.	Configure multi-stage acceleration and deceleration times at the digital input terminals.
Multi-function input terminal control configuration.	Enables the user to improve the responsiveness of the multi-function input terminals.

4.2 Setting Frequency Reference

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	Frq DRV-07	Frequency reference source	Ref Freq Src	0	KeyPad-1	0–16	-
				1	KeyPad-2		
				2	V1		
				4	V2		
				5	I2		
				6	Int 485		
				8	Field Bus		
				9	UserSeqLink		
				12	Pulse		
				13	V3		
				15	V4		
				16	I4		

4.2.1 V3 Terminal as the Frequency Reference Source

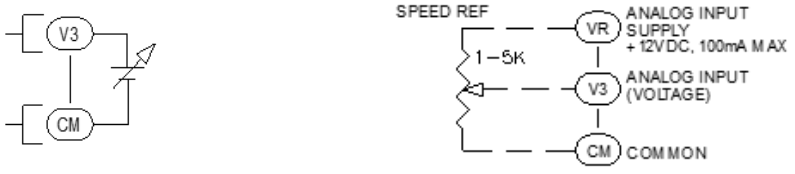
You can set and modify a frequency reference using a voltage input at the V3 terminal. Use voltage inputs ranging from 0 to 10V (unipolar) for forward only operation. Use voltage inputs ranging from -10 to +10V (bipolar) for both directions, where negative voltage inputs are used reverse operations.

4.2.1.1 Setting a Frequency Reference for 0–10V Input

Set the Frq code in the Operations group to 13 (V3). If using LCD, parameter DRV-07. Set code AO.02 (V3 Polarity) to 0 (unipolar). If using LCD, APO-02. Use a voltage output from an external source or use the voltage output from the VR terminal on the control board to provide a 0-10V input to the V3 terminal. Refer to the diagrams below for wiring. Scaling of the input voltage is done with AO.04 ~ AO.07 (LCD, APO-04 ~ APO-07). View the 0-10V input at parameter AO.01 (LCD, APO-01).

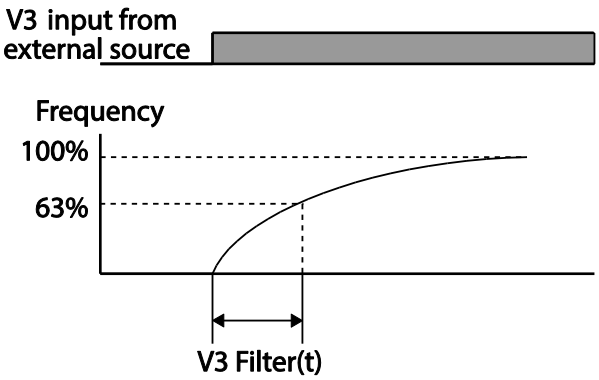
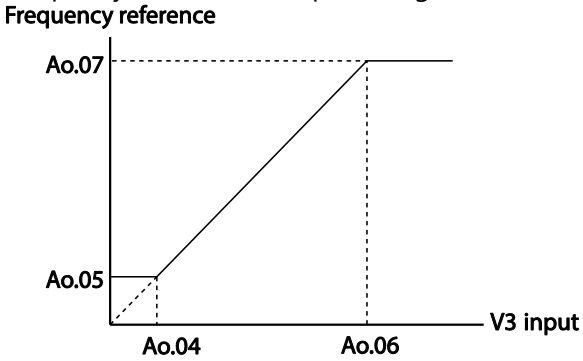
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation DRV-07	Frq	Frequency reference source	Freq Ref Src	13	V3	0–16	-
In IN	01	Frequency at maximum analog input	Freq at 100%	Maximum frequency		0.00– Max. Frequency	Hz
AO APO	01	V3 input monitor	V3 Monitor [V]	0.00		0.00–12.00	V
	02	V3 polarity options	V3 Polarity	0	Unipolar	0–1	-
	03	V3 input filter time constant	V3 Filter	10		0–10000	ms
	04	V3 minimum input voltage	V3 volt x1	0.00		0.00–10.00	V
	05	V3 output at minimum voltage (%)	V3 Perc y1	0.00		0.00–100.00	%
	06	V3 maximum input voltage	V3 Volt x2	10.00		0 .00– 12.00	V
	07	V3 output at maximum voltage (%)	V3 Perc y2	100.00		0–100	%
	08	Rotation direction options	V3 Inverting	0	No	0–1	-
	09	V3 Quantizing level	V3 Quantizing	0.04		0.00*, 0.04–10.00	%

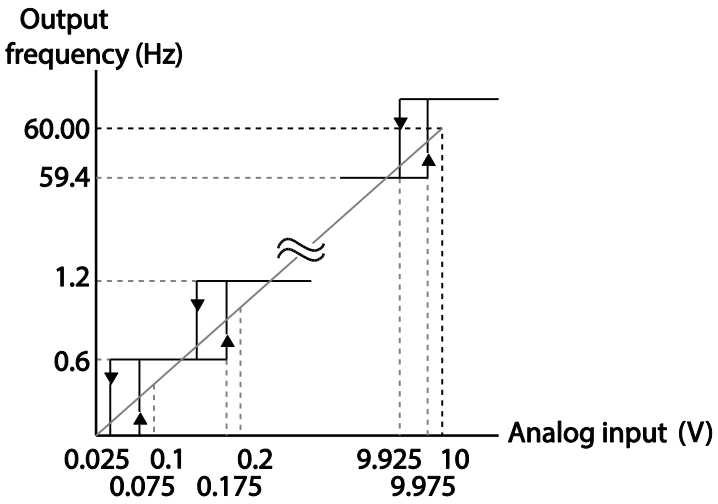
* Quantizing is disabled if '0' is selected.



V3 Input Wiring Diagrams

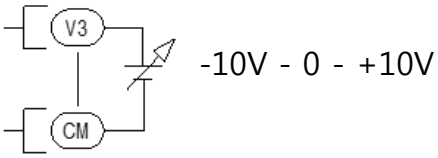
0–10V Input Voltage Setting Details

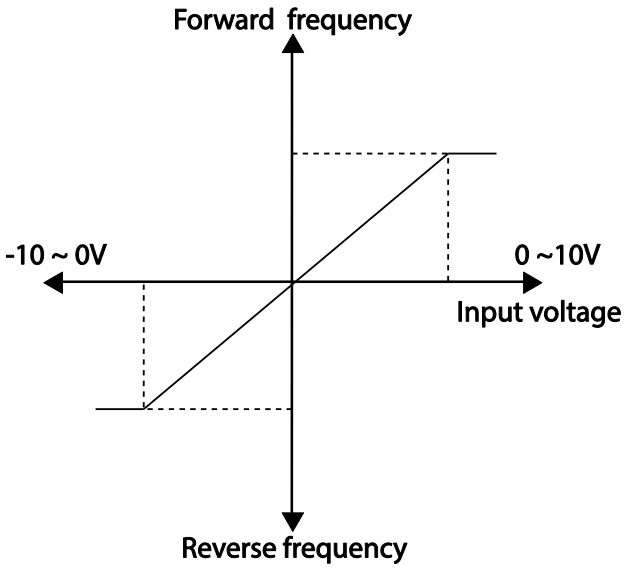
Code	Description
In.01 IN-01 Freq at 100%	Configures the frequency reference at the maximum input voltage to the In.01 (LCD, IN-01) frequency. A frequency set with code In.01 (LCD, IN-01) becomes the maximum frequency when the value set in AO.07 (LCD, APO-07) is 100 (%). • Set code In.01 to "60.00" and use default values for codes AO.01–AO.09. The motor will run at 60.00Hz when a 10V input is provided at V3. • Set code AO.07 to "50.00" (%) and use default values for codes In.01, AO.01–AO.09. Motor will run at "30.00" Hz (50% of the default maximum frequency–60Hz) when a 10V input is provided at V3.
AO.01 APO-01 V3 Monitor[V]	Monitor the input voltage at V3.
AO.03 APO-03 V3 Filter	V3 Filter is a low-pass filter and may be used when there are large variations in the applied reference frequency. The filter passes only the clean input signal. Variations can be mitigated by increasing the time constant, but this will delay the response time when changing the reference frequency. The value t (time) indicates the time required for the frequency to reach 63% of the reference, when external input voltages are provided in multiple steps. 
AO.04 APO-04 V3 Volt x1 AO.05 APO-05 V3 Perc y1 AO.06 APO-06 V3 Volt x2 AO.07 APO-07 V3 Perc y2	These parameters are used to configure the gradient level and offset values of the output frequency based on the input voltage. 

Code	Description
AO.08 APO-08 V3 Inverting	Inverts the direction of rotation. Set this code to 1 (Yes) if you need the motor to run in the opposite direction from the current rotation.
AO.09 APO-09 V3 Quantizing	Quantizing may be used when the noise level is high in the analog input signal. The VFD output frequency changes in consistent intervals (steps) based on measuring (quantizing) the height (value) of the analog input signal. Delicate control (resolution) of the output frequency is not as good compared to standard resolution of 0.1%. Parameter values for quantizing refer to a percentage based on the maximum input. Therefore, when AO.09 (APO-09) is set to 1% of the analog maximum input of 10 V and with a maximum frequency of 60 Hz, the output frequency will increase or decrease by 0.6 Hz per 0.1V difference. With quantizing applied, changes to the VFD output frequency for increasing analog signals and decreasing analog signals are treated differently. When the input signal increases, the output frequency starts increasing when the height becomes equivalent to 3/4 of the quantizing value. From then on, the output frequency increases according to the quantizing value. When the input signal decreases, the output frequency starts decreasing when the height becomes equivalent to 1/4 of the quantizing value. Although the noise can be reduced using the low-pass filter (AO.03, APO-03), the VFD output response to the input signal takes longer with higher filter times. It can become difficult to control the output frequency when the input signal is delayed, a period of long pulse (ripple) may occur on the output frequency. 

4.2.1.2 Setting a Frequency Reference for -10–10V Input

Set the Frq code in the Operations group to 13 (V3). If using LCD, parameter DRV-07. Set code AO.02 (V3 Polarity) to 1 (bipolar). If using LCD, APO-02. Use a voltage output from an external source to provide a -10V ~ +10V input to the V3 terminal. Refer to the diagram below for wiring. Scaling of the Neg. 10V input voltage is done with AO.10 ~ AO.13 (LCD, APO-10 ~ APO-13). View the input voltage at parameter AO.01 (LCD, APO-01).





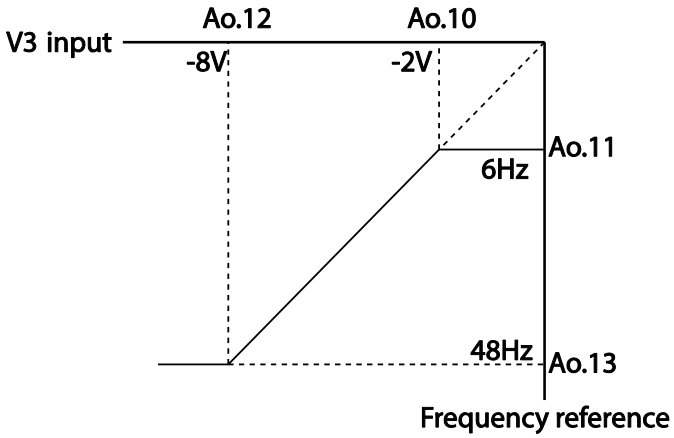
[Bipolar input voltage and output frequency]

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation DRV-07	Frq	Frequency reference source	Freq Ref Src	13	V3	0–16	-
In IN	01	Frequency at maximum analog input	Freq at 100%	60.00		0– Max Frequency	Hz
AO APO	01	V3 input monitor	V3 Monitor	0.00		0.00–12.00V	V
	02	V3 polarity options	V3 Polarity	1	Bipolar	0–1	-
	10	V3 minimum input voltage	V3- volt x1	0.00		10.00–0.00V	V
	11	V3 output at minimum voltage (%)	V3- Perc y1	0.00		-100.00–0.00%	%
	12	V3maximum input voltage	V3- Volt x2	-10.00		-12.00 –0.00V	V
	13	V3 output at maximum voltage (%)	V3- Perc y2	-100.00		-100.00–0.00%	%

Rotational Directions for Different Voltage Inputs

Command / Voltage Input	Input voltage	
	0–10V	-10–0V
FWD	Forward	Reverse
REV	Reverse	Forward

-10–10V Voltage Input Setting Details

Code	Description
AO.10 APO-10 V3- volt x1' AO.11 APO-11 V3-Perc y1' AO.12 APO-12 V3-volt x2' AO.13 APO-13 V1- Perc y2'	These parameters are used to configure the gradient level and off-set value of the output frequency in relation to the negative input voltage. These codes are displayed only when AO.02 (APO-02) is set to 1 (bipolar). As an example, if the minimum input voltage at V3 is set to -2 (V) with 10% output ratio, and the maximum voltage is set to -8 (V) with 80% output ratio respectively, the output frequency will vary within the range of 6 - 48 Hz. 

4.2.2 I4 Terminal as the Frequency Reference Source

You can set and modify a frequency reference by applying a current input (0(4)-20mA) to the I4 terminal. Verify switch SW2 is set to the left (I) position (default). Set the Frq (Frequency reference source) code in the Operation group to 16 (I4). If using LCD, parameter DRV-07. Apply 4–20mA input current to I4. Scaling of the input current is done with AO.24 ~ AO.27 (LCD, APO-24 ~ APO-27). View the 4-20mA input at parameter AO.22 (LCD, APO-22).

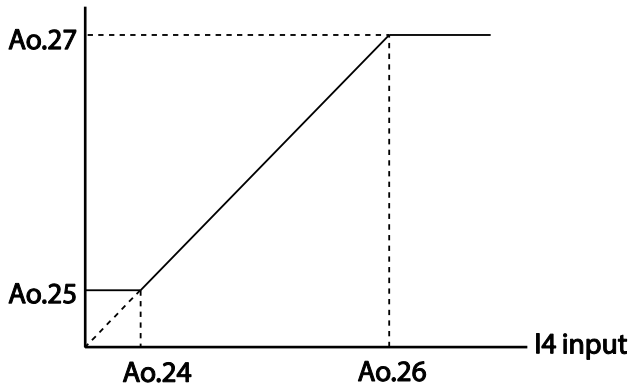
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation DRV-07	Frq	Frequency reference source	Freq Ref Src	16	I4	0–16	-
In/IN	01	Frequency at maximum analog input	Freq at 100%	60.00		0– Maximum	Hz

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
						Frequency	
AO APO	22	I4 input monitor	I4 Monitor	0.00		0.00–24.00	mA
	23	I4 input filter time constant	I4 Filter	10		0–10000	ms
	24	I4 minimum input current	I4 Curr x1	4.00		0.00–20.00	mA
	25	I4 output at minimum current (%)	I4 Perc y1	0.00		0–100	%
	26	I4 maximum input current	I4 Curr x2	20.00		0.00–24.00	mA
	27	I4 output at maximum current (%)	I4 Perc y2	100.00		0.00–100.00	%
	28	I4 rotation direction options	I4 Inverting	0	No	0–1	-
	29	I4 Quantizing level	I4 Quantizing	0.04		0*, 0.04–10.00	%

* Quantizing is disabled if '0' is selected.

Input Current (I4) Setting Details

Code	Description
In.01 IN-01 Freq at 100%	Configures the frequency reference at the maximum input current to the In.01 (LCD, IN-01) frequency. A frequency set with code In.01 (LCD, IN-01) becomes the maximum frequency when the value set in AO.27 (LCD, APO-27) is 100 (%). • Set code In.01 to "60.00" and use default values for codes AO.24–AO.27. The motor will run at 60.00Hz when a 20mA input is provided at I4. • Set code AO.27 to "50.00" (%) and use default values for codes In.01, AO.24–AO.26. The motor will run at "30.00" Hz (50% of the default maximum frequency–60Hz) when a 20mA input is provided at I4.
AO.22 APO-22 I4 Monitor	Monitor input current at I4.
AO.23 APO-23 I4 Filter	I4 Filter is a low-pass filter and may be used when there are large variations in the applied reference frequency. The filter passes only the clean input signal. Variations can be mitigated by increasing the time constant, but this will delay the response time when changing the reference frequency. The value t (time) indicates the time required for the frequency to reach 63% of the reference, when external input voltages are provided in multiple steps.
AO.24 APO-24 I4 Curr x1 AO.25 APO-25 I4 Perc y1	These parameters are used to configure the gradient level and off-set values of the output frequency based on the input current.

Code	Description
AO.26 APO-26 I4 Curr x2 AO.27 APO-27 I4 Perc y2	Frequency Reference 

4.2.3 **I4 (V4) Terminal as the Frequency Reference Source**

Set and modify a frequency reference by applying a voltage input (0-10V) to the I4 terminal. Set switch SW2 to the right (V) position. Set the Frq (Frequency reference source) code in the Operation group to 15 V4). If using LCD, parameter DRV-07. Apply 0-10V input voltage to I4. Scaling of the input voltage is done with AO.16 ~ AO.19 (LCD, APO-16 ~ APO-19). View the 0-10V input at parameter AO.14 (LCD, APO-14).

Parameters AO.14–21 are only displayed when I4 (V4) terminal is set to receive a voltage input with switch SW2 and Frq/DRV-07 parameter is set to 15 (V4).

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation DRV-07	Frq	Frequency reference source	Freq Ref Src	15	V4	0–16	-
AO APO	14	V4 input display	V4 Monitor	0.00		0.00–12.00	V
	15	V4 input filter time constant	V4 Filter	10		0–10000	ms
	16	Minimum V4 input voltage	V4 Volt x1	0.00		0.00–10.00	V
	17	Output% at minimum V4 voltage	V4 Perc y1	0.00		0.00–100.00	%
	18	Maximum V4 input voltage	V4 Volt x2	10.00		0.00–10.00	V
	19	Output% at maximum V4 voltage	V4 Perc y2	100.00		0.00–100.00	%
	20	Invert V4 rotational direction	V4 Inverting	0	No	0–1	-
	21	V4 quantizing level	V4 Quantizing	0.04		0.00*, 0.04–10.00	%

* Quantizing is disabled if '0' is selected.

4.3 Analog Output

The analog output terminal (AO3) provides outputs of 0-10V OR (0)4–20 mA current. Switch (SW3) selects a current output (I, left) or a voltage output (V, right) at the AO3 terminal.

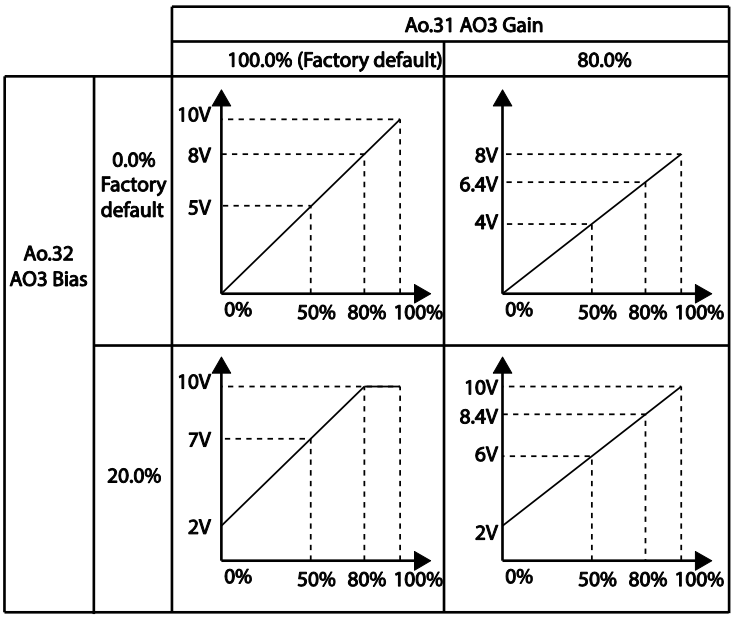
4.3.1 Voltage and Current Analog Output

The analog output (AO3) can represent one of a variety of signals. Parameter AO.30/APO-30 (AO3 Mode) provides 15 choices. Scaling (gain, bias) and filtering can also be applied to the output signal using parameters AO.31 ~ AO.33 (APO-31 ~ APO-33). The analog output can be viewed at parameter AO.35/APO-35 (AO3 Monitor).

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
AO APO	30	Analog output3	AO3 Mode	0 | Frequency	0–15	-
	31	Analog output3 gain	AO3 Gain	100.0	-1000.0–1000.0	%
	32	Analog output3 bias	AO3 Bias	0.0	-100.0–100.0	%
	33	Analog output3 filter	AO3 Filter	5	0–10000	ms
	34	Analog constant output3	AO3 Const %	0.0	0.0–100.0	%
	35	Analog output3 monitor	AO3 Monitor	0.0	0.0–1000.0	%

Voltage and Current Analog Output Setting Details

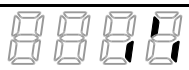
<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>AO.30
APO-30
AO3 Mode</td><td>Select the type of signal to output. The following examples use a 0-10V output voltage at terminal AO3 representing the type of signal.
<table>
<tr><th colspan="2">Setting</th><th>Function</th></tr>
<tr><td>0</td><td>Frequency</td><td>Outputs operating frequency as a standard. A 10V output is supplied based on the frequency set at dr.20 (Max Freq)</td></tr>
<tr><td>1</td><td>Output Current</td><td>A 10V output is supplied based on 200% of inverter rated current (heavy load).</td></tr>
<tr><td>2</td><td>Output Voltage</td><td>Sets the output based on the inverter output voltage. 10V output is made from a set voltage in bA.15 (Rated Volt).
If 0V is set in bA.15, 200V/400V models output 10V based on the actual input voltages (240V and 480V respectively).</td></tr>
<tr><td>3</td><td>DC Link Volt</td><td>Outputs inverter DC link voltage as a standard. Outputs 10V when the DC link voltage is 410Vdc for 240V models, and 820Vdc for 480V models.</td></tr>
<tr><td>4</td><td>Torque</td><td>Outputs the generated torque as a standard. Outputs 10V at 250% of motor rated torque.</td></tr>
<tr><td>5</td><td>Ouput Power</td><td>Monitors output wattage. 10V is output at 200% of the inverter rated output.</td></tr>
<tr><td>6</td><td>Idse</td><td>Outputs the maximum voltage at 200% of no load current.</td></tr>
<tr><td>7</td><td>Iqse</td><td>Outputs the maximum voltage at 250% of rated torque current
$rated\ torque\ current = \sqrt{rated\ current^2 - no\ load\ current^2}$</td></tr>
<tr><td>8</td><td>Target Freq</td><td>Outputs the set frequency as a standard. Outputs 10V at the maximum frequency (dr.20).</td></tr>
<tr><td>9</td><td>Ramp Freq</td><td>Outputs frequency calculated with the Acc/Dec function as a standard. May vary with actual output frequency.</td></tr>
<tr><td>12</td><td>PID Ref Value</td><td>Outputs the commanded value (setpoint) of the PID controller. Outputs approximately 6.6 V at 100%.</td></tr>
<tr><td>13</td><td>PID Fdk Value</td><td>Outputs feedback amount of the PID controller. Outputs approximately 6.6V at 100%.</td></tr>
<tr><td>14</td><td>PID Output</td><td>Outputs the output value of a PID controller. Outputs approximately 10V at 100%.</td></tr>
<tr><td>15</td><td>Constant</td><td>Outputs AO.34 (AO3 Const %) value as a standard.</td></tr>
</table></td></tr>
<tr><td></td><td>The Gain and Bias settings provide scaling adjustment of the analog outputs. The graphs below illustrate adjustments of AO.31 (AO3 Gain) and AO.32 (AO3 Bias) percentages and the effect on the analog output (AO3). The X-axis is the % value of the selected output item and the Y-axis is the corresponding output voltage (0–10 V) at the AO3 terminal.</td></tr>
</table>

Code	Description
AO.31 APO-31 AO3 Gain AO.32 APO-32 AO3 Bias	 Frequency setting example: With AO.30 set to '0', using default values of 100% Gain and 0% Bias and the maximum frequency set at Dr.20 (Max Freq) is 60 Hz. When the output frequency is 30 Hz, the corresponding X-axis value is 50% or 5V output at the AO3 terminal. The percent value of the analog output is based on the following equation. $$AO3 = \frac{Frequency}{MaxFreq} \times AO3\ Gain + AO3\ Bias$$
AO.33 APO-33 AO3 Filter	Set filter time constant on analog output.
AO.34 APO-34 AO13Const %	If analog output at AO.30 (AO3 Mode) is set to 15 (Constant), the analog voltage output is dependent on the set parameter values (0–100%).
AO.35 APO-35 AO3 Monitor	Monitors the analog output value. Displays the maximum output voltage as a percentage (%) with 10V as the standard.

4.4 Digital Outputs

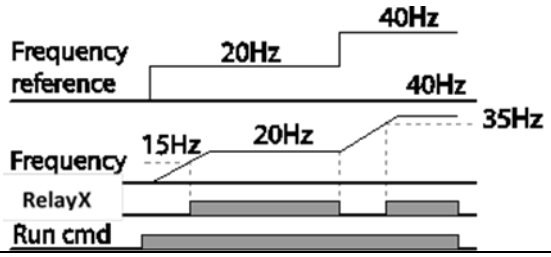
4.4.1 Multi-function Output Relay Settings

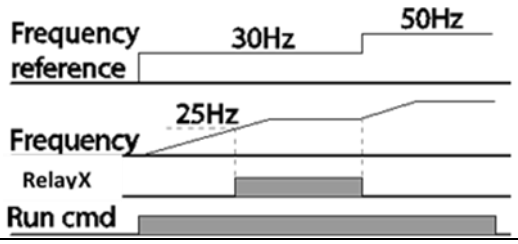
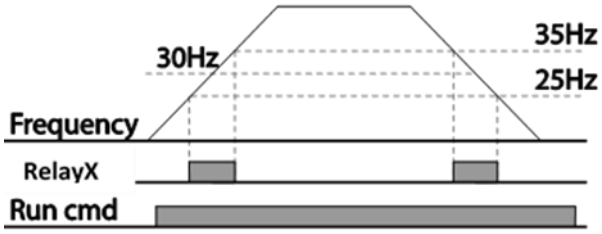
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
OU OUT	30	Fault output item	Trip Out Mode	010*		-	bit
	34	Multi-function relay3 setting	Relay 3	29	Trip	-	-
	35	Multi-function relay4 setting	Relay 4	29	Trip	-	-
	41	Multi-function output monitor	DO Status	-		00– 11	bit
	57	Detection frequency	FDT Frequency	30.00		0.00– Maximum frequency	Hz
	58	Detection frequency band	FDT Band	10.00			

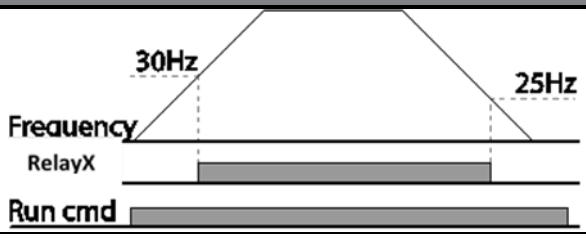
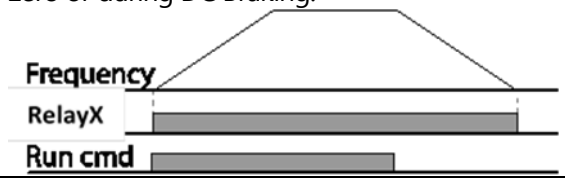
*Displayed as  on the LED keypad.

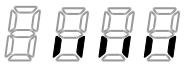
Multi-function Output Terminal and Relay Setting Details

Code	Description
OU.34 Relay3	Set relay (Relay 3) output options.
OU.35 Relay4	Set relay (Relay 4) output options.
	Set output terminal and relay functions according to OU.57 FDT (Frequency), OU.58 (FDT Band) settings and fault trip conditions.

Setting		Function
0	None	No output signal.
1	FDT-1	Relay changes state when the output frequency reaches the reference frequency within frequency bandwidth / 2. Conditions are: Absolute value (Ref frequency - output frequency) <= frequency bandwidth/2 (OU.58 / 2). Example: Frequency Reference is 20 Hz. Bandwidth (OUT-58) is 10 Hz. Relay changes state at 15 Hz. 
2	FDT-2	Relay changes state when the reference frequency and detection frequency (OU.57) are equal and fulfills FDT-1 condition at the same time.

Code	Description		
			Conditions are: [Absolute value (Ref frequency detection frequency) < frequency bandwidth/2] & [FDT-1]. Example: Frequency Reference is 30 Hz. Detection frequency (OU.57) is 30 Hz. Frequency bandwidth (OU.58) is 10 Hz. Relay changes state at 25 Hz. 
	3	FDT-3	Relay changes state when the output frequency is within the frequency bandwidth (OU.58) centered around the detection frequency (OU.57). Conditions are: Absolute value (output frequency–operating frequency) < frequency bandwidth/2. Example: Detection frequency (OU.57) is 30 Hz. Frequency bandwidth (OU.58) is 10 Hz. Relay changes state when the output frequency is between 25 Hz. and 35 Hz. 
	4	FDT-4	Relay changes state based on separate conditions for acceleration and deceleration. **In acceleration:** Operation frequency≧ Detected frequency **In deceleration:** Operation frequency>(Detected frequency–Detected frequency width/2). Example: Detection frequency (OU.57) is 30 Hz. Frequency bandwidth (OU.58) is 10 Hz. During acceleration, relay changes state when output frequency reaches detection frequency. During deceleration, the relay changes state when the output frequency is below the frequency bandwidth/2.

Code	Description		
			
	5	Overload	Relay changes state when inverter trips on motor overload.
	6	IOL	Relay changes state when inverter trips on inverter overload. IOL is based on inverse time characteristics.
	7	Underload	Relay changes state when inverter trips on motor underload.
	8	Fan Warning	Relay changes state when a fan warning occurs.
	9	Stall	Relay changes state when the inverter detects a motor stall condition.
	10	Over voltage	Relay changes state when the inverter trips on Over Voltage.
	11	Low Voltage	Relay changes state when the inverter trips on Low Voltage.
	12	Over Heat	Relay changes state when the inverter trips on Overheat.
	13	Lost command	Relay changes state when the inverter trips on Lost Command. Lost command includes lost reference frequency from: Analog input RS-485 communication Option Cards (Extended I/O and communications)
	14	RUN	Relay changes state when a run command is applied and the inverter outputs voltage. There is no output when reference frequency is at zero or during DC Braking. 
	15	Stop	Relay changes state when a stop command is applied and when there is no inverter output voltage.
	16	Steady	Relay changes state during steady state operation.
	17	Inverter line	Used in combination with "Comm Line" (Bypass) function. Relay maintains state while the motor is driven by the inverter output.
	18	Comm line	Commercial Line: Relay changes state when a digital input set to "exchange" function is applied. Use external logic and components to bypass inverter.

Code	Description		
	19	Speed search	Relay changes state during speed search operation.
	22	Ready	Relay changes state when the inverter is in stand by operation and ready to receive a run command.
	28	Timer Out	Used in combination with a digital input set to "Timer In" function. The relay changes state when the digital input is activated and after the time delay settings.
	29	Trip	Relay changes state after a fault condition.
	31	DB Warn %ED	Relay changes state when the Dynamic Brake Duty Cycle (Pr.66) is exceeded.
	34	On/Off Control	Relay changes state based on the analog input signal levels set with OU.67~OU.69.
	35	BR Control	Used for external electro-mechanical brake control. Relay operates based on Ad.41~Ad.47 settings.
OU.41 OUT-41 DO Status	Used to check On/Off state of each D0 by bit representation. Led Display as  R4, R3, X, X, Q1, R1		

4.4.2 Fault Output using Output Relays

With Relay 3 and/or Relay 4 set to 23 (Trip), OU.30 (Fault Output Mode) can further define relay activation during low voltage faults, all faults and auto restart functions. Additionally, On and Off delay times can also be applied to the fault output when set to 23 (Trip).

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
OU OUT	30	Fault trip output mode	Trip Out Mode	010		-	bit
	34	Multi-function relay3 setting	Relay 3	29	Trip	-	-
	35	Multi-function relay4 setting	Relay 4	29	Trip	-	-
	53	Fault trip output on delay	TripOut On Dly	0.00		0.00–100.00	sec
	54	Fault trip output off delay	TripOut Off Dly	0.00		0.00–100.00	sec

Fault Output Relays - Setting Details

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>OU.30
OUT-30
Trip Out Mode</td><td>Bit On/Off representation on display.

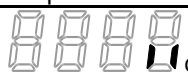
<table><tr><td>Item</td><td>bit on</td><td>bit off</td></tr><tr><td>LED Keypad</td><td>  </td><td>  </td></tr><tr><td>LCD keypad</td><td>  </td><td>  </td></tr></table>
Set OU.34, and/or OU.35 (Relay3 and/or Relay4) to 23 (Trip). When a fault occurs, the output will be activated. Output activation can be set based on trip type per the table below.

<table><tr><td colspan="3">Setting</td><td rowspan="2">Function</td></tr><tr><td>bit3</td><td>bit2</td><td>bit1</td></tr><tr><td></td><td></td><td>✓</td><td>Operates when low voltage faults occur</td></tr><tr><td></td><td>✓</td><td></td><td>Operates when faults other than low voltage occur</td></tr><tr><td>✓</td><td></td><td></td><td>Operates when auto restart fails (Pr. 08–Pr.09)</td></tr></table></td></tr>
<tr><td>OU.34 Relay3</td><td>Configure Relay 3 output function.</td></tr>
<tr><td>OU.35 Relay4</td><td>Configure Relay 4 output function.</td></tr>
<tr><td>OU.53 TripOut OnDly,
OU.54 TripOut OffDly</td><td>If a fault occurs, the relay output operates after the time delay set in OU.53. After a reset, the relay is initialized after the time delay set in OU.54.</td></tr>
</table>

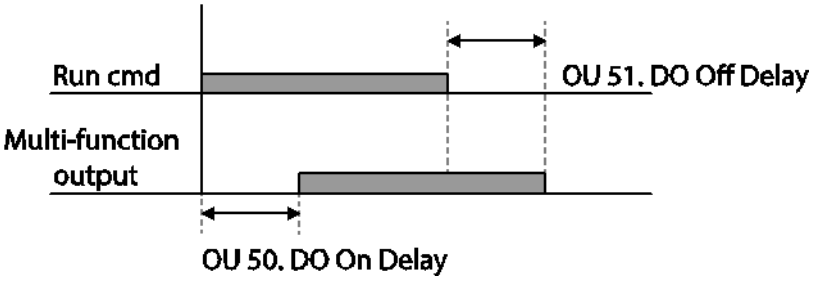
4.4.3 Relay Output Delay Time Settings

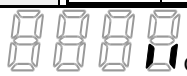
Set On/Off delay times to adjust the relay operation time. The delay times set in OU.50 and OU.51 will be applied to all Relays (1, 3 and 4) and Q1 except when any are set to (23) Trip. Additionally, a NO or NC setting can be individually applied to the outputs.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
OU OUT	50	Multi-function output On delay	DO On Delay	0.00	0.00–100.00	s
	51	Multi-function output Off delay	DO Off Delay	0.00	0.00–100.00	s
	52	Select multi-function output terminal	DO NC/NO Sel	00*	00–11	bit

* Displayed as  on LED keypad. On the LED Keypad, pushing the left/right arrow buttons switches between Extended I/O module and the main control board outputs (Relay1 and Q1).

Output Relay Delay Time and NC/NO Setting Details

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>OU.50
OUT-50
DO On Delay</td><td>When Relay3 or Relay4 are operated based on their OU.34 and OU.35 settings, they will activate after the delay time set at OU.50.</td></tr>
<tr><td>OU.51
OUT-51
DO Off Delay</td><td>When Relay3 or Relay4 are initialized (reset or off signal occurs), they will de-activate after the time delay set at OU.51.</td></tr>
<tr><td></td><td> 
</td></tr>
<tr><td>OU.52
OUT-52
DO NC/NO Sel</td><td>Each output can be set to operate as Type A or Type B. Type A is deenergized in its normal state. Type B is energized in its normal state. By setting the relevant bit to 0 (off), it will operate as Type A (the NO contact is Open) or setting it to 1 (on) it will operate as Type B (the NO contact is Closed). Shown below in the table are Relays 1, 3 and 4 and Q1.
<table>
<tr><td>Item</td><td>bit on (Type B)</td><td>bit off (Type A)</td></tr>
<tr><td>LED Keypad</td><td>  </td><td>  </td></tr>
<tr><td>LCD keypad</td><td>  </td><td>  </td></tr>
</table>
<table>
<tr><td colspan="2">bit</td><td></td><td>Relay4, Relay3<->Q1, Relay1*</td><td></td></tr>
<tr><td rowspan="2">0
(off)</td><td rowspan="2">A contact
(NO)</td><td rowspan="2"></td><td>0 0 <-> 0 0</td><td rowspan="2">All set as NO</td></tr>
<tr><td>R4,R3 <-> Q1,R1</td></tr>
<tr><td rowspan="2">1
(on)</td><td rowspan="2">B contact
(NC)</td><td rowspan="2"></td><td>1 1 <-> 1 1</td><td rowspan="2">All set as NC</td></tr>
<tr><td>R4,R3 <-> Q1,R1</td></tr>
</table></td></tr>
</table>

* Displayed as  on LED keypad. On the LED Keypad, pushing the left/right arrow buttons switches between the main control board outputs (Relay1 and Q1) and the Extended I/O module (Relays 3 and 4).

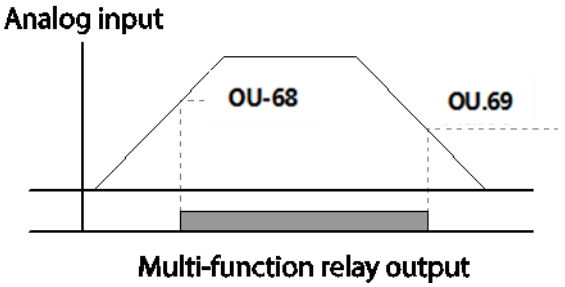
4.4.4 Multi-Function Relay On/Off Control

This feature operates a digital output (Relay3 or Relay4) based on the analog input level. Set either relay to 34 (On/Off Control). Set the On/Off Control Source (OU.67) and set the On level (OU.68) to activate the output and the Off level (OU.69) to de-activate the output.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
OU OUT	67	Output terminal on/off control mode	On/Off Ctrl Src	1	V1	0 ~ 10	-
	68	Output terminal on level	On-Ctrl Level	90.00		Output terminal off level– 100.00%	%
	69	Output terminal off level	Off-Ctrl Level	10.00		0.00–Output terminal on level	%
OU OUT	34	Multi-function Relay 3	Relay 3	34	On/Off Control	-	-
	35	Multi-function Relay 4	Relay 4				

Multi-Function Relay On/Off Control - Setting Details

Code	Description
OUT-67 On/Off Ctrl Src	Select an analog input to be used for On/Off control.
OUT-68 On-Ctrl Level, OUT-69 Off-Ctrl Level	Set the On/Off levels for the output (Relay 3 or Relay 4).



4.5 Digital Inputs

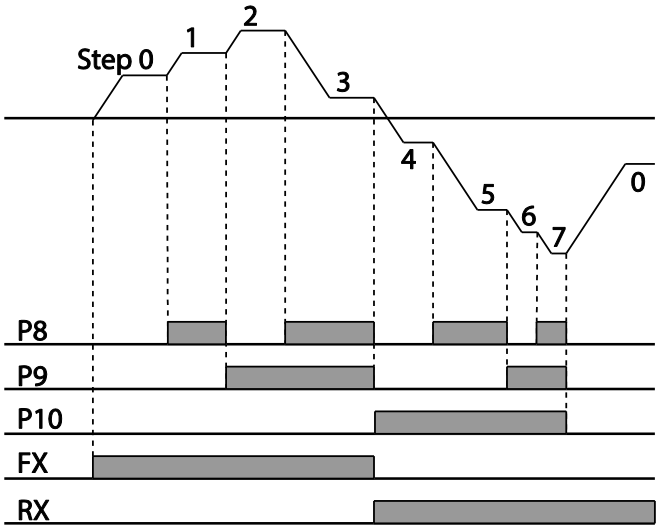
4.5.1 Setting Multi-Step Frequencies

Multi-step operations (Fixed Speed Inputs) can be assigned to the Px terminals. Steps 1 through 7 can be configured using (3) digital input terminals. Step 0 uses the frequency reference source set with Frq (LCD DRV-07). Set P8, P9 and P10 terminals (In.72, In.73, In.74) to 7 (Speed-L), 8 (Speed-M) and 9 (Speed-H). These are recognized as binary inputs (000 ~ 111) and work in combination with Fx or Rx run commands. The VFD operates according to the frequencies set with parameters St1-St3 and bA.53-bA.56 (LCD BAS-50–56) and the binary input combinations.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operations or BAS	St1–St3 or 50-52	Multi-step frequency 1–3	Step Freq - 1–3	-		0–Maximum frequency	Hz
bA BAS	53–56 50-56	Multi-step frequency 4–7	Step Freq - 4–7	-		0–Maximum frequency	Hz
In IN	72–74	Px terminal configuration	Px Define (Px: P8–P10)	7	Speed-L	0–54	-
				8	Speed-M		-
				9	Speed-H		-
	89	Multi-step command delay time	InCheck Time	1		1–5000	ms

Multi-step Frequency Setting Details

Code	Description
Operation group St 1–St3 Step Freq - 1–3	Configure multi-step frequency 1–3. If an LCD keypad is used, BAS-50~BAS-52 are used instead of St1–St3 (multi-step frequency 1–3).
bA.53–bA.56 BAS-50~ 56 Step Freq - 4–7	Configure multi-step frequency 4–7. Configure multi-step frequency 1–7.
In.72~In.74 IN-72~IN-74 Px Define	Choose the terminals to setup as multi-step inputs, and then set the relevant codes (In.72–74) to 7(Speed-L), 8(Speed-M), or 9(Speed-H). Example below uses terminals P8, P9 and P10 and have been set to Speed-L, Speed-M and Speed-H respectively. The following multi-step operation will be available.

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td></td><td>


[An example of a multi-step operation]
<table>
<tr><th>Speed</th><th>Fx/Rx</th><th>P10</th><th>P9</th><th>P8</th></tr>
<tr><td>0</td><td>✓</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>✓</td><td>-</td><td>-</td><td>✓</td></tr>
<tr><td>2</td><td>✓</td><td>-</td><td>✓</td><td>-</td></tr>
<tr><td>3</td><td>✓</td><td>-</td><td>✓</td><td>✓</td></tr>
<tr><td>4</td><td>✓</td><td>✓</td><td>-</td><td>-</td></tr>
<tr><td>5</td><td>✓</td><td>✓</td><td>-</td><td>✓</td></tr>
<tr><td>6</td><td>✓</td><td>✓</td><td>✓</td><td>-</td></tr>
<tr><td>7</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>In.89
IN-89
InCheck Time</td><td>Set a time interval for the inverter to check for additional terminal block inputs after receiving an input signal.

After adjusting In.89 to 100ms and an input signal is received at P8, the inverter will search for inputs at other terminals for 100ms, before proceeding to accelerate or decelerate based on the configuration of P8.</td></tr>
</table>

4.5.2 Multi-step Acc/Dec Time Configuration

Digital input terminals can be configured for different Acc and Dec times. Up to 7 acceleration times and 7 deceleration times can be set. Choose (up to 3) digital input terminals (P8 ~ P10) and set the corresponding parameters (IN-72~IN-74) to 11 (XCEL-L), 12 (XCEL-M) and 49 (XCEL-H). These are recognized as binary inputs (000 ~ 111). Acc times and Dec times are set with BAS-70 through BAS-83.

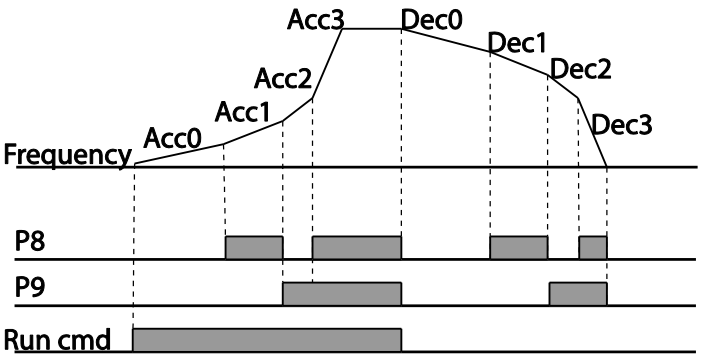
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	ACC	Acceleration time	Acc Time	20.0		0.0–600.0	sec
DRV	03						
Operation	dEC	Deceleration time	Dec Time	30.0		0.0–600.0	sec
DRV	04						
bA BAS	70–82	Multi-step acceleration time1–7	Acc Time 1–7	x.xx		0.0–600.0	sec
	71–83	Multi-step deceleration time1–7	Dec Time 1–7	x.xx		0.0–600.0	sec
In IN	72–74	Px terminal configuration	Px Define (Px: P8–P10)	11	XCEL-L	0–54	-
				12	XCEL-M		
				49	XCEL-H		
	89	Multi-step command delay time	In Check Time	1		1–5000	ms

Acc/Dec Time Configuration – Setting Details

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>bA.70–bA.82
BAS-70-BAS-82
Acc Time 1–7</td><td>Set multi-step acceleration time1–7.</td></tr>
<tr><td>bA.71–bA.83
BAS-71-BAS-83
Dec Time 1–7</td><td>Set multi-step deceleration time1–7.</td></tr>
<tr><td>In.72–In.74
IN-72-IN-74
Px Define (P8–P10)</td><td>Choose and configure the terminals to use for multi-step Acc/Dec time inputs.

<table>
<tr><td colspan="2">Configuration</td><td>Description</td></tr>
<tr><td>11</td><td>XCEL-L</td><td>Acc/Dec command-L</td></tr>
<tr><td>12</td><td>XCEL-M</td><td>Acc/Dec command-M</td></tr>
<tr><td>49</td><td>XCEL-H</td><td>Acc/Dec command-H</td></tr>
</table>

Acc/Dec commands are recognized as binary code inputs and will control the acceleration and deceleration based on parameter values set with bA.70–82 and bA.71–83.
Example: The P8 and P9 terminals are set as XCEL-L and XCEL-M respectively, the following operation will be available.

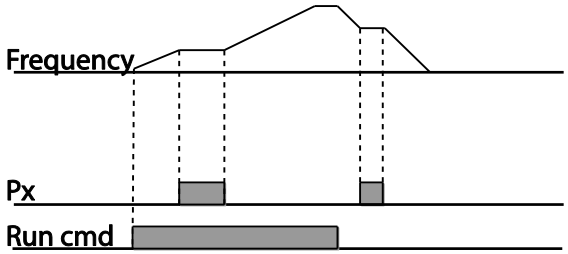


<table>
<tr><th>Acc/Dec time</th><th>P9</th><th>P8</th></tr>
<tr><td>0</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>-</td><td>✓</td></tr>
<tr><td>2</td><td>✓</td><td>-</td></tr>
<tr><td>3</td><td>✓</td><td>✓</td></tr>
</table>
</td></tr>
<tr><td>In.89
IN-9
In Check Time</td><td>Set the time for the inverter to check for other terminal block inputs. If In.89 is set to 100ms and a signal is supplied to the P8 terminal, the inverter searches for other inputs over the next 100ms. When the time expires, the Acc/Dec time will be set based on the input received at P8.</td></tr>
</table>

4.5.4 Stopping the Acc/Dec Operation

Configure a digital input terminal to stop acceleration or deceleration and operate the inverter at a fixed frequency.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
In IN	65–74	Px terminal configuration	Px Define (Px: P1– P10)	25	XCEL Stop	0–54	-



4.5.5 Multi-function Input Terminal Control

Each of the digital inputs can have an On Delay time and an Off Delay time assigned to them. This filter time constant will be applied to all the digital inputs that are selected (enabled) with parameter In.84. Longer time settings will delay the response of the input. Additionally, the digital inputs can be configured independently as a normally open input or a normally closed input with parameter In.87 (DI NC/NO Sel). The status (Opened or Closed) of the digital inputs can be viewed at In.90.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
In IN	84	Multi-function input terminal On filter selection	DI Delay Sel	00000* P5<-P1 0 0 0 P10 P9 P8	000 XXX0 0000 ~ 111 XXX1 1111	bit
	85	Multi-function input terminal On filter	DI On Delay	10	0–10000	ms
	86	Multi-function input terminal Off filter	DI Off Delay	3	0–10000	ms
	87	Multi-function input terminal selection	DI NC/NO Sel	00000* P5<-P1 0 0 0 P10 P9 P8	000 XXX0 0000 ~ 111 XXX1 1111	-
	90	Multi-function input terminal status	DI Status	00000* P5<-P1 0 0 0 P10 P9 P8	000 XXX0 0000 ~ 111 XXX1 1111	-

*The LED (7-Segment) display shows the first 5 terminals (P5<-P1) as  .
The Extended IO terminals (P10, P9, P8) are displayed by pressing the left or right arrow buttons and are shown as  . The LCD display shows all inputs.

Multi-function Input Terminal Control - Setting Details

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>In.84 DI Delay Sel</td><td>Select whether or not to apply the On/Off delay times set in In.85 and In.86 to the individual digital inputs. Each digital input is represented as a bit on the display. Per the table below. The position of the lit segment corresponds to Enable (“1” or “On”) or Disable (“0” or “Off”).
<table>
<tr><td>Type</td><td>Bit Enabled
(“1” or “On”)</td><td>Bit Disabled
(“0” or “Off”)</td></tr>
<tr><td>LED
Keypad</td><td>  </td><td>  </td></tr>
<tr><td>LCD
keypad</td><td>  </td><td>  </td></tr>
</table>
Bit representation of input terminals.
<table>
<tr><td>bit</td><td></td><td>Digital Input
Bit representation</td><td></td></tr>
<tr><td rowspan="2">1
(On)</td><td rowspan="2"></td><td>1 1 1* X X X 1 1 1 1
P10 P9 P8 <-> P5 P4 P3 P2 P1</td><td rowspan="2">All set as Enable</td></tr>
<tr><td rowspan="2">0
(Off)</td><td rowspan="2"></td><td>0 0 0* X X X 0 0 0 0
P10 P9 P8 <-> P5 P4 P3 P2 P1</td><td rowspan="2">All set as Disable</td></tr>
</table>
*LED Keypad: Press the right or left arrow button to display bits for P10, P9 and P8 terminals.</td></tr>
<tr><td>In.85 DI On Delay,
In.86 DI Off Delay</td><td>Set the On/Off delay times for the selected terminals in In.84. When the terminal receives a change of state input it is recognized as On or Off after the set time.</td></tr>
<tr><td>In.87
IN-87
DI NC/NO Sel</td><td>Select terminal contact types (NO or NC) for each input terminal. The position of the lit segment corresponds to an A (open) or B (closed) contact input. With the bottom segment on, it indicates that the terminal is configured as an A terminal (Normally Open) contact input. With the top segment on, it indicates that the terminal is configured as a B terminal (Normally Closed) contact input.
<table>
<tr><td>Type</td><td>A Type (Normally Open)</td><td>B Type (Normally Closed)</td></tr>
<tr><td>LED
Keypad</td><td>  </td><td>  </td></tr>
<tr><td>LCD
keypad</td><td>  </td><td>  </td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td></td><td>Bit representation of input terminals
<table>
<tr><td>bit</td><td></td><td>Digital Input
Bit representation</td><td></td></tr>
<tr><td>1
(NC)</td><td></td><td>1 1 1* X X X 1 1 1 1
P10 P9 P8 <-> P5 P4 P3 P2 P1</td><td>All set as NC</td></tr>
<tr><td>0
(NO)</td><td></td><td>0 0 0* X X X 0 0 0 0
P10 P9 P8 <-> P5 P4 P3 P2 P1</td><td>All set as NO</td></tr>
</table>
*LED Keypad: Press the right or left arrow button to display bits for P10, P9 and P8 terminals.</td></tr>
<tr><td>In.90
IN-90
DI Status</td><td>Display the status of each digital input terminal. When a digital input is configured as an A type terminal using In.87, the On (closed) condition is indicated by the top segment turned on. The Off condition is indicated when the bottom segment is turned on. When a digital input is configured as a B type terminal, the segment lights behave conversely.
<table>
<tr><td>Type</td><td>A Type (Closed)
B Type (Open)</td><td>A Type (Open)
B Type (Closed)</td></tr>
<tr><td>Keypad</td><td>  </td><td>  </td></tr>
<tr><td>LCD keypad</td><td>  </td><td>  </td></tr>
</table>
Bit representation of input terminals
<table>
<tr><td>bit</td><td></td><td>Digital Input
Bit representation</td><td></td></tr>
<tr><td>1
(NC)</td><td></td><td>1 1 1* X X X 1 1 1 1
P10 P9 P8 <-> P5 P4 P3 P2 P1</td><td>Type A - All Closed
Type B - All Open</td></tr>
<tr><td>0
(NO)</td><td></td><td>0 0 0* X X X 0 0 0 0
P10 P9 P8 <-> P5 P4 P3 P2 P1</td><td>Type A - All Open
Type B - All Closed</td></tr>
</table>
*LED Keypad: Press the right or left arrow button to display bits for P10, P9 and P8 terminals. *The LED (7-Segment) display shows the first 5 terminals (P5<-P1) as  .

The Extended IO terminals (P10, P9, P8) are displayed by pressing the left or right arrow buttons and are shown as  . The LCD display shows all inputs.</td></tr>
</table>

5 Keypad Parameters for the Extended I/O Module

LED Display **AO.XX** Group, LCD Display **APO** Group

Keypad Parameters in the Extended I/O module are displayed when the Extended I/O module is installed. Set the parameters according to your operating requirements. The following messages may be displayed during programming of parameters.

- **rd: Re-Do** - value or selection not allocated in software.
- **OL: Overlap** - An input is already programmed to the same function.
- **no: Not Allowed** - The selection or set value is not allowed.

Parameters shaded in gray will be displayed when a related parameter or switch has been selected. The column labeled **"Property"** shows whether the parameter can be changed while the VFD is running and which display (LED or LCD or both) shows the parameter:

O: Write enabled during run, **X:** Write Disabled during run, **"-"**: Read only.

7- 7 segment LED Display, **L** - LCD Keypad/Display, **A**- Common to LED and LCD

5.1 AO, APO Group - Extended IO Group

Code	Comm. Address	Name	LCD Display	Setting Range	Initial Value	Property*
00	-	Jump Code	Jump Code	1~99	0	O/A
01	0h1A01	V3 input voltage display	V3 Monitor[V]	-12.00~ 12.00[V]	0.00	-/A
02	0h1A02	V3 input polarity selection	V3 Polarity	0 Unipolar 1 Bipolar	0:Unipolar	X/A
03	0x1A03	Time constant of V3 input filter	V3 Filter	0 ~ 10000[ms]	10	O/A
04	0x1A04	V3 Minimum input voltage	V3 Volt x1	0.00 ~ 10.00[V]	0.00	O/A
05	0x1A05	V3 output at Minimum voltage (%)	V3 Perc y1	0.00 ~ 100.00[%]	0.00	O/A
06	0x1A06	V3 Maximum input voltage	V3 Volt x2	0.00 ~ 12.00[V]	10.00	O/A
07	0x1A07	V3 output at Maximum voltage (%)	V3 Perc y2	0.00 ~ 100.00[%]	100.00	O/A
08	0x1A08	V3 rotation direction change	V3 Inverting	0 No 1 Yes	0:No	O/A
09	0x1A09	V3 quantization level	V3 Quantizing	0.00, 0.04~10.00[%]	0.04	X/A
10	0x1A0A	V3 Minimum input voltage	V3 –Volt x1'	-10.00~ 0.00[V]	0.00	O/A
11	0x1A0B	V3 output at Minimum voltage	V3 –Perc y1'	-100.00~0.00[%]	0.00	O/A

Code	Comm. Address	Name	LCD Display	Setting Range	Initial Value	Property*
		(%)				
12	0x1A0C	V3 Maximum input voltage	V3 –Volt x2'	-12.00~0.00[V]	-10.00	O/A
13	0x1A0D	V3 output at Maximum voltage (%)	V3 –Perc y2'	-100.00~0.00[%]	-100.00	O/A
14(1)	0x1A0E	V4 input voltage display	V4 Monitor[V]	0.00~12.00[V]	0.00	-/A
15	0x1A0F	Time constant of V4 input filter	V4 Filter	0~10000[ms]	10	O/A
16	0x1A10	V4 Minimum input voltage	V4 Volt x1	0.00~10.00[V]	0.00	O/A
17	0x1A11	V4 output at Minimum voltage (%)	V4 Perc y1	0.00~100.00[%]	0.00	O/A
18	0x1A12	V4 Maximum input voltage	V4 Volt x2	0.00~10.00[V]	10	O/A
19	0x1A13	V4 output at Maximum voltage (%)	V4 Perc y2	0.00~100.00[%]	100.00	O/A
20	0x1A14	V4 rotation direction change	V4 Inverting	0 No 1 Yes	0:No	O/A
21	0x1A15	V4 quantization level	V4 Quantizing	0.00, 0.04~10.00[%]	0.04	O/A
22	0x1A16	I4 input current display	I4 Monitor[mA]	0~24[mA]	0.00	-/A
23	0x1A17	I4 input filter time constant	I4 Filter	0~10000[ms]	10	O/A
24	0x1A18	I4 minimum input current	I4 Curr x1	0.00~20.00[mA]	4.00	O/A
25	0x1A19	I4 output at Minimum current (%)	I4 Perc y1	0.00~100.00[%]	0.00	O/A
26	0x1A1A	I4 maximum input current	I4 Curr x2	0.00~24.00[mA]	20.00	O/A
27	0x1A1B	I4 output at Maximum current (%)	I4 Perc y2	0.00~100.00[%]	100.00	O/A
28	0x1A1C	Changing rotation direction of I4	I4 Inverting	0 No 1 Yes	0:No	O/A
29	0x1A1D	I4 quantization level	I4 Quantizing	0.00, 0.04~10.00[%]	0.04	O/A
30	0x1A1E	Analog output 3 item	AO3 Mode	0 Frequency 1 Output Current 2 Output Voltage 3 DCLink	0: Frequency	O/A

Code	Comm. Address	Name	LCD Display	Setting Range		Initial Value	Property*
					Voltage		
				4	Torque		
				5	Output Power		
				6	Idse		
				7	Iqse		
				8	Target Freq		
				9	Ramp Freq		
				10	Speed Fdb		
				12	PID Ref Value		
				13	PID Fdb Value		
				14	PID Output		
				15	Constant		
31	0x1A1F	Analog output 3 gain	AO3 gain	-1000.0~1000.0 [%]		100.0	O/A
32	0x1A20	Analog output 3 bias	AO3 Bias	-100.0~100.0[%]		0.0	O/A
33	0x1A21	Analog output 3 filter	AO3 Filter	0~10000[ms]		5	O/A
34	0x1A22	Analog constant output 3	AO3 Const %	0.0~100.0[%]		0.0	O/A
35	0x1A23	Analog output 3 monitor	AO3 Monitor	0.0~1000.0[%]		0.0	-/A
36	0x1A24	Ext IO Switch State	Ext IO Switch	00	NPN,V4	01	-/A
				01	NPN,I4		
				10	PNP,V4		
				11	PNP,I4		
37	0x1A25	Ext I/O SW Ver	Ext I/O SW Ver	-		1.00	-/A

(1) Parameters AO.14 ~ AO.21 displayed when switch SW2 is set to the right (V) position. Apply a voltage input (0-10V) to the I4 terminal.

5.2 Additional Extended IO Parameters

Additional parameters and parameter settings in other parameter groups which are related to the Extended IO module are shown in the below table. These parameters and/or settings are shaded in dark grey. For a complete list of all VFD parameters refer to the "S" & "SW" Series Instruction Manual, 890049-07-00.

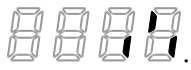
Code	Comm. Address	Name	Keypad Display	Setting Range		Initial Value	Property*
Frq DRV-07	0h1F04	Frequency reference source	Frq Freq Ref Src	0	Keypad-1	0: Keypad-1	X/7 X/L
				1	Keypad-2		
				2	V1		
				4	V2		
				5	I2		
				6	Int 485		
				8	Field Bus		
				12	Pulse		
				13	V3		
				15	V4		
				16	I4		
dr.08 DRV-08	0h1108	Torque reference setting	Trq Ref Src	0	Keypad-1	0: Keypad-1	X/A
				1	Keypad-2		
				2	V1		
				4	V2		
				5	I2		
				6	Int 485		
				8	FieldBus		
				12	Pulse		
				13	V3		
				15	V4		
				16	I4		
bA.02 BAS-02	0h1205	Frequency reference source	Freq Aux (2^{nd}) Src	0	Keypad-1	0: Keypad-1	X/A
				1	Keypad-2		
				2	V1		
				4	V2		
				5	I2		
				6	Int 485		
				8	Field Bus		
				12	Pulse		
				13	V3		
				15	V4		
				16	I4		
bA.03 BAS-03	0h1201	Frequency reference source	Aux Ref Src	0	None	0: None	X/A
				1	V1		
				3	V2		
				4	I2		
				6	Pulse		
				7	V3		

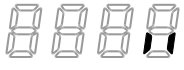
Code	Comm. Address	Name	Keypad Display	Setting Range		Initial Value	Property*
				9	V4		
				10	I4		
bA.06 BAS-06	0h1206	2nd Torque command source	Trq 2nd Src	0	Keypad-1	0: Keypad-1	X/A
				1	Keypad-2		
				2	V1		
				4	V2		
				5	I2		
				6	Int 485		
				8	Field Bus		
				12	Pulse		
				13	V3		
				15	V4		
				16	I4		
dr.93 CNF-40	0h115D	Parameter initialization	-	0	No	0:No	X/7 X/L
				1	All Grp		
				2	dr/DRV Grp		
				3	bA/BAS Grp		
				4	Ad/ADV Grp		
				5	Cn/CON Grp		
				6	In/IN Grp		
				7	OU/OUT Grp		
				8	CM/COM Grp		
				9	AP/APP Grp		
				11	AO/APO Grp		
				12	Pr/PRT Grp		
				13	M2 Grp		
				14	US/USS Grp		
				15	UF/USF Grp		
Cn.53 CON-535	0h1435	Torque limit setting options	Torque Lmt Src	0	Keypad-1	0: Keypad-1	X/A
				1	Keypad-2		
				2	V1		
				4	V2		
				5	I2		
				6	Int 485		
				8	FieldBus		
				12	Pulse		
				13	V3		
				15	V4		
				16	I4		
In.72 IN-72	0h1548	P8 terminal function	P8 Define	0	None	0 : None	X/A
In.73 IN-73	0h1549	P9 terminal function	P9 Define	1	Fx	0 : None	X/A
In.74 INI-74	0h154A	P10 terminal function	P10 Define	2	Rx	0 : None	X/A
				3	RST		
				4	External Trip		

Code	Comm. Address	Name	Keypad Display	Setting Range		Initial Value	Property*
				5	BX		
				6	JOG		
				7	Speed-L		
				8	Speed-M		
				9	Speed-H		
				11	XCEL-L		
				12	XCEL-M		
				13	RUN Enable		
				14	3-Wire		
				15	2nd Source		
				16	Exchange		
				17	Up		
				18	Down		
				20	U/D Clear		
				21	Analog Hold		
				22	I-Term Clear		
				23	PID Openloop		
				24	P Gain2		
				25	XCEL Stop		
				26	2nd Motor		
				34	Pre Excite		
				38	Timer In		
				40	dis Aux Ref		
				46	FWD JOG		
				47	REV JOG		
				49	XCEL-H		
				50	User Seq		
				51	Fire Mode		
In.84 IN-84	0h1554	Multi-function input terminal On filter selection	DI Delay Sel	00000* P5<-P1 0 0 0 P10 P9 P8		000 XXX0 0000 ~ 111 XXX1 1111	O/A
				0	Disable(Off)		
				1	Enable(On)		
In.85 IN-85	0h1555	Multi-function input terminal On filter	DI On Delay	0-10000(ms)		10	O/A
In.86 IN-86	0h1556	Multi-function input terminal Off filter	DI Off Delay	0-10000(ms)		3	O/A
In.87 IN-87	0h1557	Multi-function input contact	DI NC/NO Sel	00000* P5<-P1 0 0 0		000 XXX0 0000 ~	X/A

Code	Comm. Address	Name	Keypad Display	Setting Range		Initial Value	Property*
		selection		P10 P9 P8		111 XXX1 1111	
				0	A contact (NO)		
				1	B contact (NC)		
In.89 IN-89	0h1559	Multi-step command delay time	InCheck Time	1-5000(ms)		1	X/A
In.90 IN-90	0h155A	Multi-function input terminal status	DI Status	00000* P5<-P1 0 0 0 P10 P9 P8		000 XXX0 0000 ~ 111 XXX1 1111	-/A
				0	Open (Off)		
				1	Closed (On)		
OU.34 OUT-34	0h1622	Multi-function Relay 3	Relay 3	0	None	29:Trip	O/A
OU.35 OUT-35	0h1623	Multi-function Relay 4	Relay 4	1	FDT-1	29:Trip	O/A
				2	FDT-2		
				3	FDT-3		
				4	FDT-4		
				5	Over Load		
				6	IOL		
				7	Under Load		
				8	Fan Warning		
				9	Stall		
				10	Over Voltage		
				11	Low Voltage		
				12	Over Heat		
				13	Lost Command		
				14	Run		
				15	Stop		
				16	Steady		
				17	Inverter Line		
				18	Comm Line		
				19	Speed Search		
				22	Ready		
				28	Timer Out		
				29	Trip		
				31	DB Warn%ED		
				34	On/Off Control		
				35	BR Control		
				36	CAP.Warning		
				37	FAN Exchange		

Code	Comm. Address	Name	Keypad Display	Setting Range		Initial Value	Property*
				38	Fire Mode		
OU.30 OUT-30	0h161E	Fault output item	Trip Out Mode	Bit	000-111	010[1]	O/A
				1	Low voltage		
				2	Any faults other than low voltage		
				3	Automatic		
OU.41 OUT-41	0h1629	Multi-function output monitor	DO Status	 R4, R3, X, X, Q1, R1		00	-/A
OU.50 OUT-50	0h1632	Multi-function output On delay	DO On Delay	0.00-100.00(s)		0.00	O/A
OU.51 OUT-51	0h1633	Multi-function output Off delay	DO Off Delay	0.00-100.00(s)		0.00	O/A
OU.52 OUT-52	0h1634	Multi-function output contact selection	DO NC/NO Sel	R4, R3<->Q1, R1		00[2]	X/A
				0	A contact (NO)		
				1	B contact (NC)		
OU.53 OUT-53	0h1635	Fault output On delay	TripOut OnDly	0.00-100.00(s)		0.00	O/A
OU.54 OUT-54	0h1636	Fault output Off delay	TripOut OffDly	0.00-100.00(s)		0.00	O/A
OU.55 OUT-55	h1637	Timer On delay	TimerOn Delay	0.00-100.00(s)		0.00	O/A
OU.56 OUT-56	0h1638	Timer Off delay	TimerOff Delay	0.00-100.00(s)		0.00	O/A
OU.57 OUT-57	0h1639	Detected frequency	FDT Frequency	0.00-Maximum frequency(Hz)		30.00	O/A
OU.58 OUT-58	0h163A	Detected frequency band	FDT Band	0.00-Maximum frequency(Hz)		10.00	O/A
OU.67 OUT-67	0h1342	Output contact On/Off control	On/Off Ctrl Src	0	None	0:None	X/A
				1	V1		
				3	V2		
				4	I2		

[1] The initial value 010 will be displayed on the keypad as  .

[2] Displayed as  on the LED Keypad. On the LED Keypad, pushing the left/right arrow buttons switches between the main control board outputs (Relay1 and Q1) and the Extended I/O module (Relays 3 and 4).

Code	Comm. Address	Name	Keypad Display	Setting Range		Initial Value	Property*
		options		6	Pulse		
				7	V3[4]		
				9	V4[4]		
				10	I4[4]		
OU.68 OUT-68	0h1343	Output contact On level	On-Ctrl Level	Output contact off level-100.00%		90	X/A
OU.69 OUT-69	0h1344	Output contact Off level	Off-Ctrl Level	-100.00-output contact on level (%)		10.00	X/A
AP.20 APP-20	0h1814	PID reference source	PID Ref Source	0	Keypad	0: Keypad	X/A
				1	V1		
				3	V2		
				4	I2		
				5	Int 485		
				7	FieldBus		
				11	Pulse		
				12	V3		
				14	V4		
				15	I4		
AP.21 APP-21	0h1815	PID feedback source	PID F/B Source	0	V1	0:V1	X/A
				2	V2		
				3	I2		
				4	Int 485		
				6	FieldBus		
				10	Pulse		
				11	V3		
				13	V4		
				14	I4		

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