Extended IO Module

For RSi H2Series Variable Frequency Drive

Instruction Manual

890053-01-00

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.

Table of Contents

1 About the Product

The H2 Extended IO option module provides additional digital and analog inputs/outputs to the Benshaw H2 series inverters.

2 Product Specification Details

Refer to the following table for added I/O and specifications for each.

Items		Terminal	Description	Switch
Digital Inputs		P8 P9	• 2 Channels available • Multifunction input • Use switch (SW1) to select PNP/NPN mode.	[Switch 1] PNP/ NPN selection
Digital Outputs (Relay)		A6 C6 A7 C7 A8 C8	• 3 outputs available, Form A contact • Multifunction relay output contact (AC 250 V< 5 A, DC 30 V< 5 A).	
Analog Input	 Voltage Or Current	V3	• 1 Input available • Use switch (SW2) to select voltage or current. **Voltage** Unipolar: 0–10 V (Max. 12 V) input Sets the frequency based on the voltage supplied to the terminal. **Current** Input current: 4-20 mA (Max. 0~24 mA) Sets the frequency based on the current supplied to the terminal.	[Switch 2] Voltage (V3) Current (I3) Selection
Analog Output	Voltage or Current	AO3	• 1 Output available Select output frequency, output current, output voltage, or DC voltage. • Use switch (SW3) to select voltage or current Output voltage: 0–10 V Maximum output voltage/current: 12 V/10 mA Output current: 0–20 mA Maximum output current: 24 mA	[Switch 3] Voltage(VO3) Current (IO3) selection
CM Terminal		CM	• 2 available • Common ground terminal for analog inputs/outputs	

3 Items Included

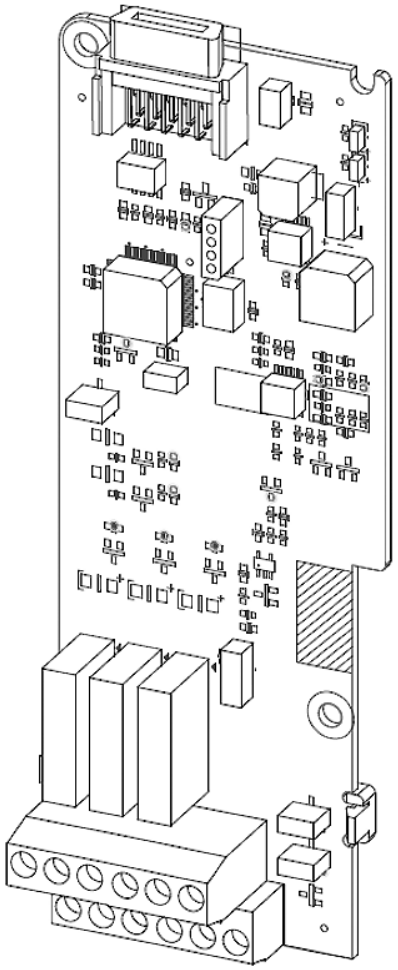
Benshaw Part #: PC-100097-00

- 1 x H2 extended IO PCB module
- 1 x H2 extended IO module user manual
- 2 x screws
- Plastic components

4 Overview and Installation

4.1 Overview

Refer to the following illustration for the H2 extended IO module layout.

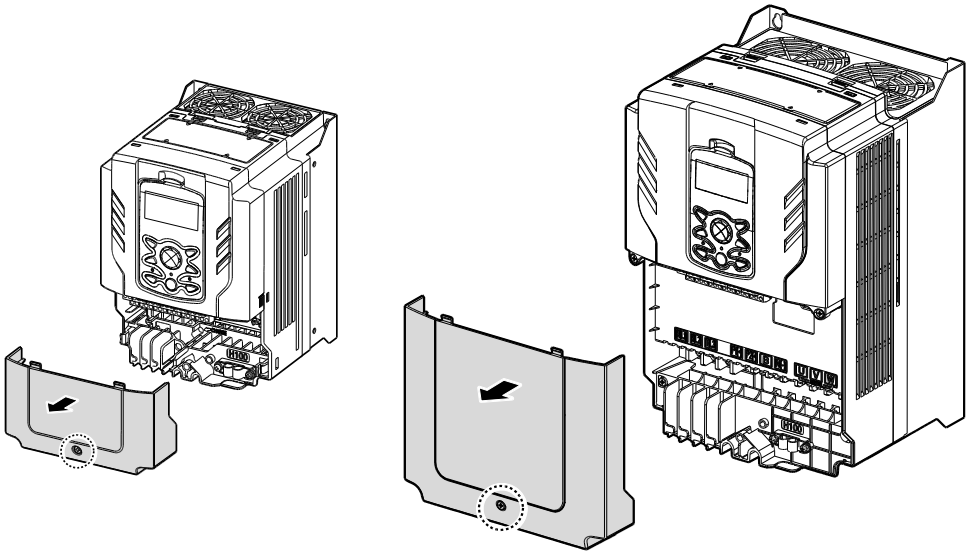


4.2 Installing the H2 extended IO Module

Follow the instructions below to properly install the H2 extended IO module.

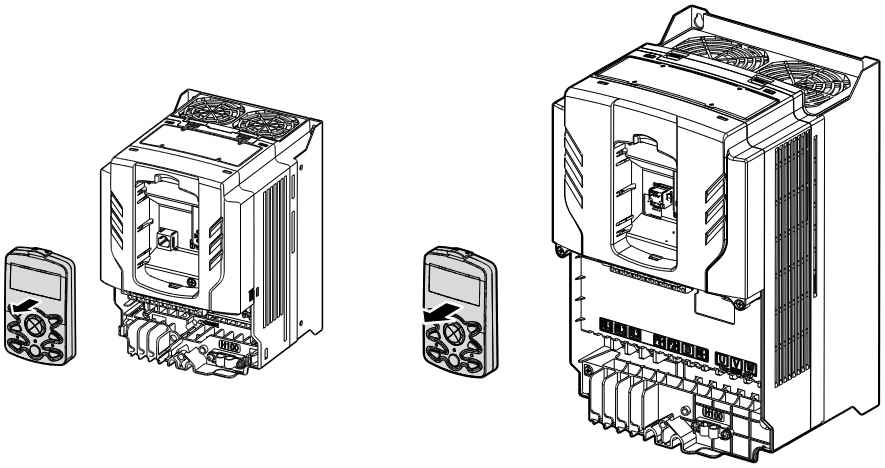
1. Turn off the inverter and make sure that the DC link voltage has dropped to a safe level.

2. Loosen the screw on the power cover then remove the power cover.



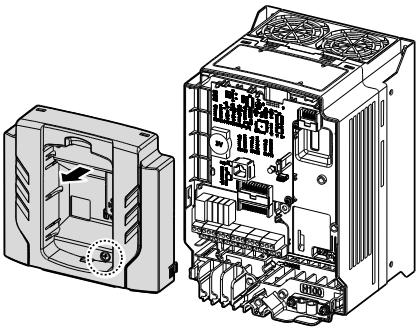
1 HP-40 HP (0.75–30 kW) 50 HP-125 HP (37–90 kW)

3. Remove the keypad from the inverter body.

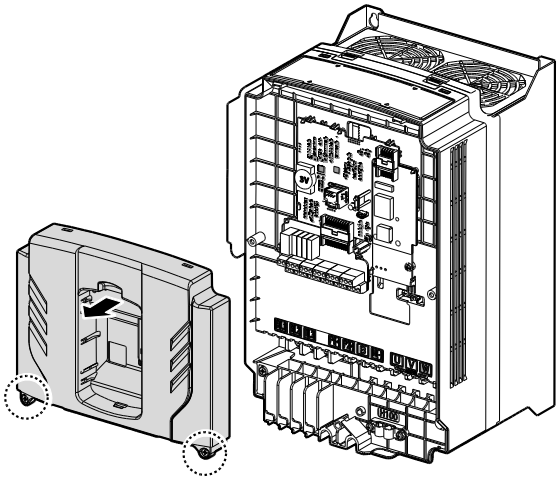


1 HP-40 HP (0.75–30 kW) 50 HP-125 HP (37–90 kW)

4. Loosen the screws securing the front cover. Then, remove the front cover by lifting it. The main PCB is exposed.

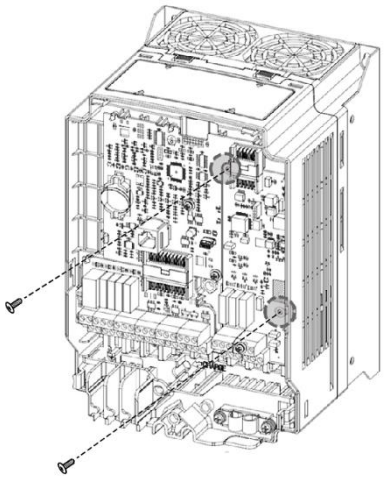


1 HP-40 HP (0.75–30 kW)



50 HP-125 HP (37–90 kW)

5. Place the H2 extended I/O PCB module on the expansion slot and fasten it with the screws included in the box.



6. Reattach the front cover, the power cover, and the keypad back onto the inverter body.

Caution

Ensure that the inverter is turned off and that the DC link voltage has dropped to a safe level before opening the terminal cover and installing (or removing) the H2 extended IO module.

Note

Use the keypad to check the software version and the keypad installation options.

**Use the keypad at [CNF-10] to check if the inverter's S/W version is higher than 0.11.

4.3 Signal (Control) Cable Specifications

Terminal	Wire Thickness 1)	
	mm^2	AWG
P8~P9/CM/V3(I3)	0.33-1.25	16-22
AO3	0.33-2.0	14-22
A6/C6/A7/C7/A8/C8	0.33-2.0	14-22

1) Use STP (shielded twisted-pair) cables for signal wiring.

4.4 Installation Considerations

Refer to the following table for the operating conditions, and find an appropriate installation location accordingly.

Items	Description
Ambient Temperature	14°F~104°F (- 10°C~40°C) 2.5% Current derating up to 122°F (50°C) max.
Ambient Humidity	90% relative humidity (no condensation)
Storage Temperature	- 4–149 °F (-20–65 ℃)
Environmental Factors	Prevent contact with corrosive gases, flammable gases, oil residue, dust and other pollutants
Altitude/Vibration	Maximum 3,280 ft (1,000m) above sea level for standard operation. Above derate the drive rated voltage and the rated output current by 1% for every 328 ft (100m) up to 13,123 ft (4,000m) max. Less than 1.0 G (9.8 m/sec^2)
Air Pressure	10 - 15 PSI (70 –106 kPa)

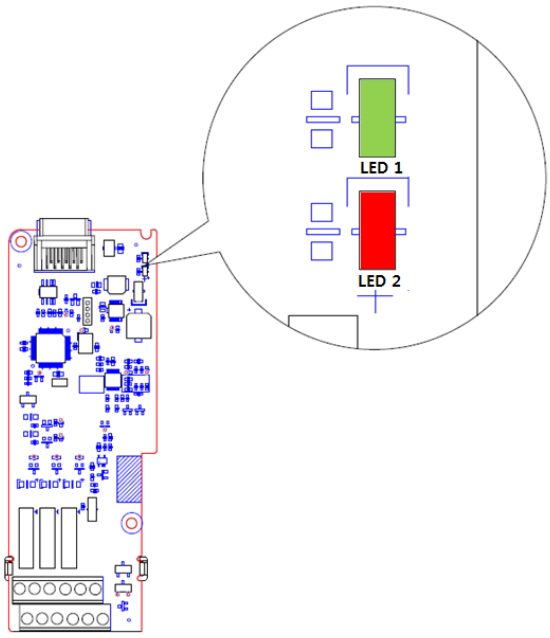
Caution

Do not allow the ambient temperature to exceed the allowable range while operating the inverter.

4.5 LED Status and Switch Settings

4.5.1 LED Status

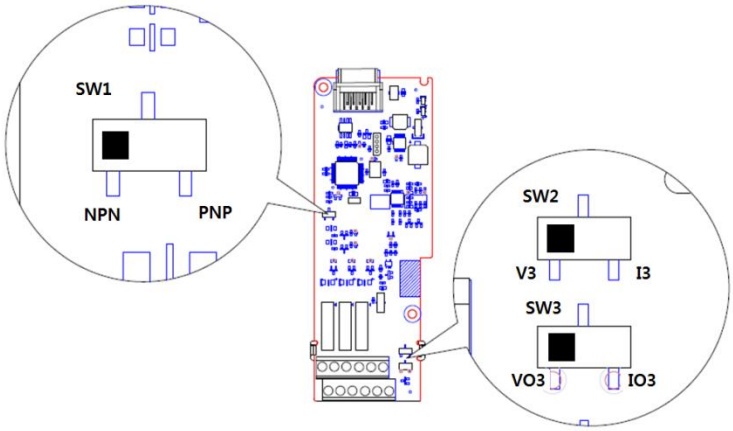
The H2 extended IO module has two LED indicators. Remove the front cover to check the LED status.



Status	LED 1	LED 2
LED Test Operation	LED is on for one second when power is on.	LED is on for one second when power is on.
Normal	Flashing	Off
	ON→OFF every second	-
Inverter Connection Error	Off	Off
Inverter Version Error	Synchronous flashing[1]	Synchronous Flashing[1]
	On→Off every second	On→Off every second
H/W Interface Error between Inverter and Option Module	Alternately Flashing[2]	Alternately Flashing[2]
	On→Off every second	On→Off every second

1. LED 1 and LED 2 flash simultaneously.
2. LED 1 and LED 2 flash alternately.

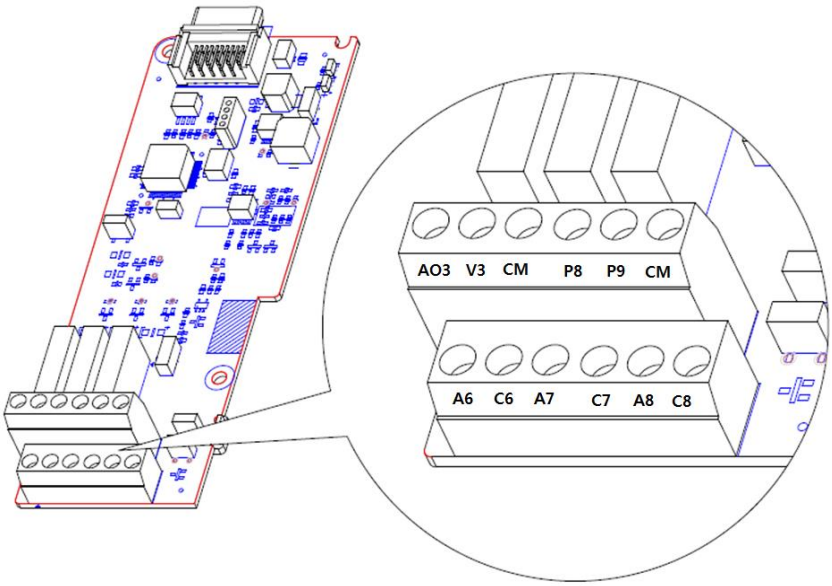
4.5.2 Switch Symbols and Descriptions



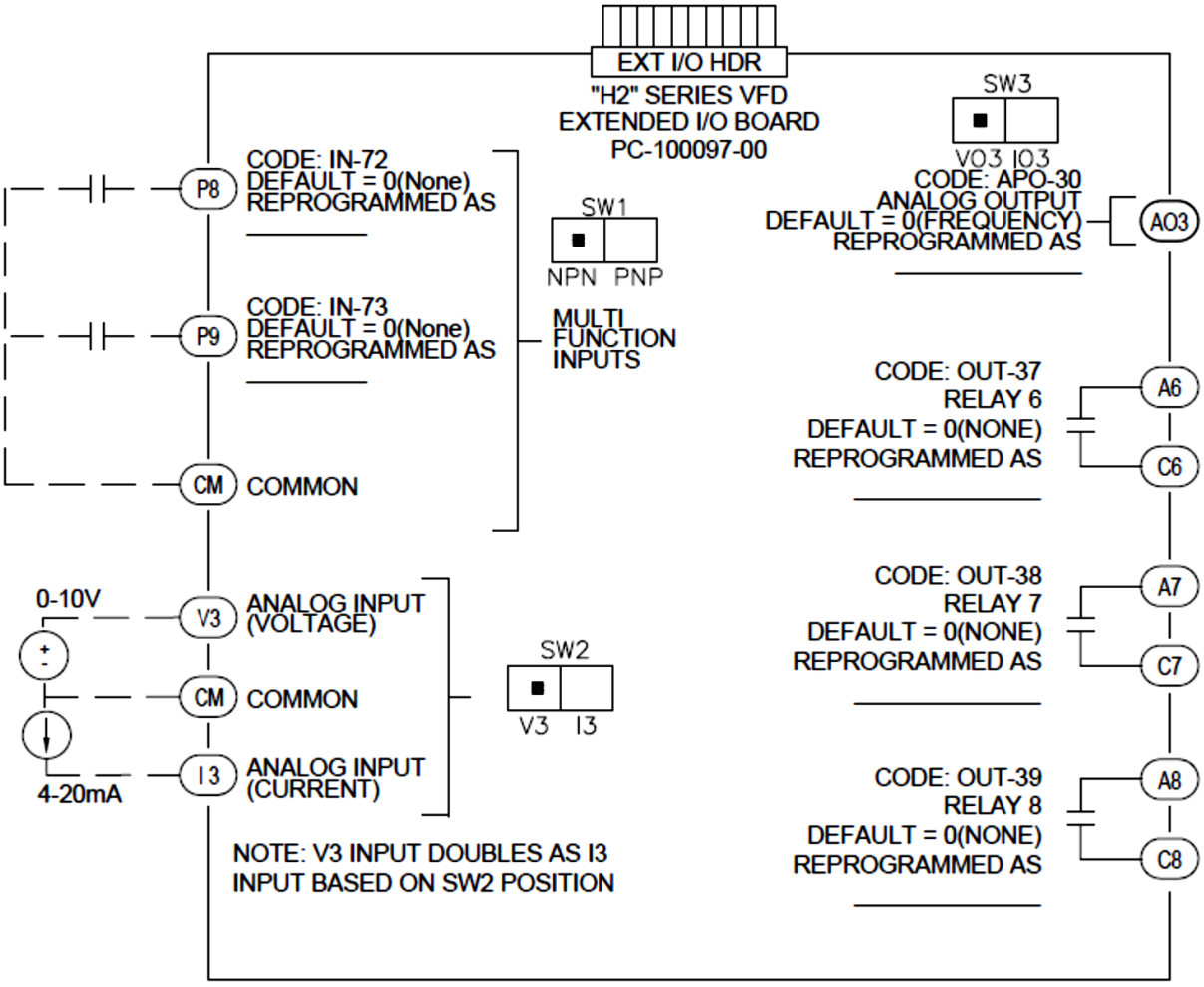
Switch	Description	Factory Default
SW1	NPN/PNP mode selection switch (Left: NPN, Right: PNP)	Left: NPN
SW2	V3/I3 mode selection switch (Left: V3, Right: I3)	Left: V3
SW3	VO3/IO3 mode selection switch (Left: VO3, Right: IO3)	Left: VO3

4.6 Terminal Block Wiring Diagram

The following illustration describes the wiring of the H2 extended IO module. Refer to the detailed description to complete installation. Refer to **4.3 Signal(Control) Cable Specifications** on page 5 for detailed information.



4.7 Control Terminal Block Wiring Diagram

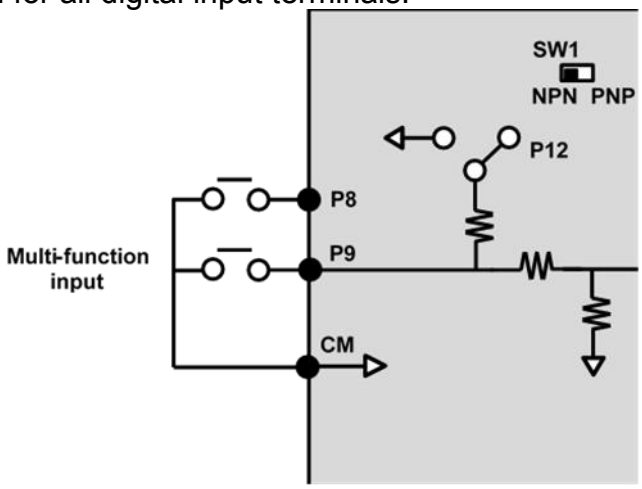


4.7.1 NPN/PNP Mode Selection

The H2 extended IO module supports both PNP (Source) and NPN (Sink) modes for activating the digital inputs at the terminal block. Select an 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-90.

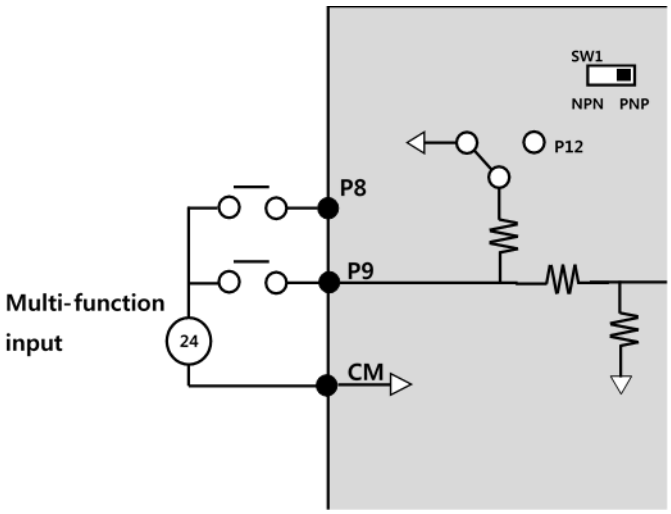
4.7.1.1 NPN (Sink mode)

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 by connecting the internal 24V source to CM (sink). CM is the common ground terminal for all digital input terminals.



4.7.1.2 PNP (Source Mode)

With SW1 in the PNP position, the input is activated by applying 24V to the digital input. Connect an external contact (switch, relay, transistor) between 24 and Px terminal. When the contact closes, the input is activated by applying 24V to the digital input. The 24V source can be from the inverter's 24 terminal or an external supply. When using an external 24V source, connect the external source (-) to the CM terminal. CM is the common ground terminal for all digital inputs.



Caution

- Power source for a PNP configuration: VHI=3.25 [V], VLO=1.75 [V]
- Power source for an NPN configuration: Do not use LED switches with built-in resistors with the extended IO module.

5 Learning to Perform Basic Operations

5.1 Basic Features for the H2 Extended I/O module

Basic Tasks	Example
Frequency reference source configuration for the terminal block (input voltage)	Configures the inverter to allow input voltages at the terminal block (V3) and setup or modify a frequency reference.
Frequency reference source configuration for the terminal block (input current)	Configures the inverter to allow input currents at the terminal block (I3) and to setup or modify a frequency reference.
Multistep speed (frequency) configuration	Configures multistep frequency operations by receiving an input at the terminals defined for each step frequency.
Multistage Acc/Dec time configuration using the multifunction terminal	Configures multistage acceleration and deceleration times for a motor based on defined parameters for the multifunction terminals.
Acc/Dec stop command	Stops the current acceleration or deceleration and controls motor operation at a constant speed. Multifunction terminals must be configured for this command.
Multifunction input terminal control configuration	Enables the user to improve the responsiveness of the multi-function input terminals.

5.2 Setting Frequency Reference

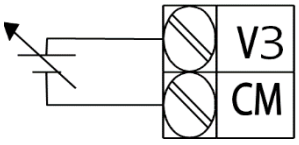
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	0	KeyPad-1	0-11	-
				1	KeyPad-2		
				2	V1		
				4	V2		
				5	I2		
				6	Int 485		
				7	Field Bus		
				9	Pulse		
				10	V3		
				11	I3		

5.2.1 V3 Terminal as the Frequency Reference Source

You can set and modify a frequency reference using a voltage input at the V3. With SW2 select V3 (left) for voltage input. Use voltage inputs ranging from 0–10 V (unipolar) for forward only operation.

5.2.1.1 Setting a Frequency Reference for 0–10 V Input

Set DRV-07 (Freq Ref Src) to “10 (V3)”. Use a voltage output from an external source or use the voltage output from the VR terminal to provide a 0-10V input to V3. Refer to the diagram below for the wiring. Scaling of the input voltage is done with APO-03 ~ APO-06. View the input voltage at APO-01.



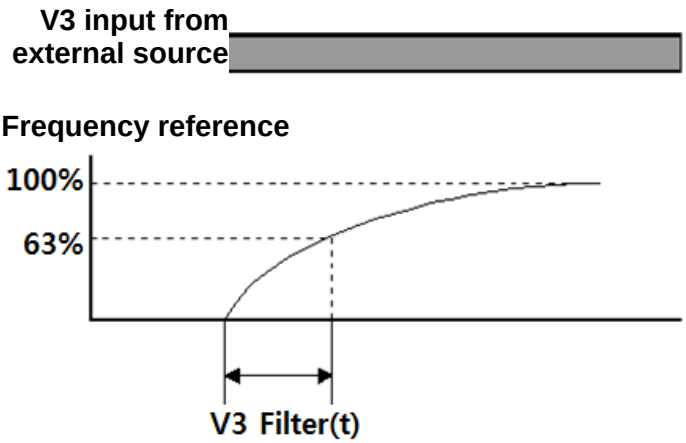
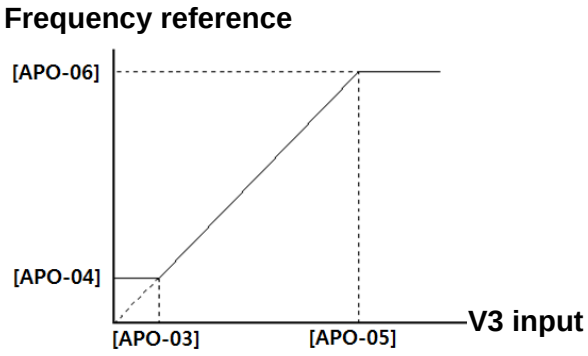
[External source application]

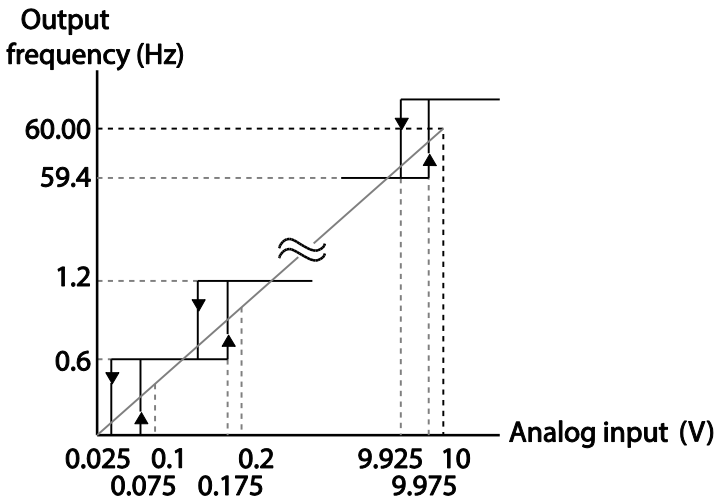
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	10	V3	0-11	-
IN	01	Frequency at maximum analog input	Freq at 100%	Maximum frequency		Initial frequency–Max. Frequency	Hz
APO	01	V3 input monitor	V3 Monitor[V]	0.00		0.00-12.00	V
	02	V3 input filter time constant	V3 Filter	10		0-10,000	msec
	03	V3 minimum input voltage	V3 volt x1	0.00		0.00-10.00	V
	04	V3 output at minimum voltage (%)	V3 Perc y1	0.00		0.00-100.00	%
	05	V3 maximum input voltage	V3 Volt x2	10.00		0.00-12.00	V
	06	V3 output at maximum voltage (%)	V3 Perc y2	100.00		0.00-100.00	%
	07	Rotation direction options	V3 Inverting	0	No	0-1	-
	08	Quantizing level	V3 Quantizing	0.04		0.00*, 0.04-10.00	%

* Quantizing is disabled if ‘0’ is selected.

■ 0–10 V Input Voltage Setting Details

Code	Description
[IN-01] Freq at 100%	Configures the frequency reference at maximum input voltage to the IN-01 frequency. A frequency set with code IN-01 becomes the maximum frequency when the value set in code APO-06 (or APO-04) is 100 (%). • Set code IN-01 to “60.00” and use default values for codes APO-01–APO-08. The motor will run at 60.00 Hz when a 10 V input is provided at V3. • Set code APO-06 to “50.00” (%) and use default values for codes IN-01, APO-01–APO-08. The motor will run at 30.00 Hz (50% of the default maximum frequency–60 Hz) when a 10 V input is provided at V3.
[APO-01] V3 Monitor[V]	Monitor the input voltage at V3.

Code	Description
[APO-02] 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. 
[APO-03] V3 volt x1 ~ [APO-06] V3 Perc y2	These parameters are used to configure the gradient level and offset values of the output frequency, based on the input voltage. 
[APO-07] V3 Inverting	Inverts the direction of rotation. This inverts the input value set at V3. Set this code to “1 (Yes)” if you need the motor to run in the opposite direction from the current rotation.

Code	Description
[APO-08] 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 APO-08 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 (APO-07), 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. 

5.2.2 I3 (V3) Terminal as the Frequency Reference Source

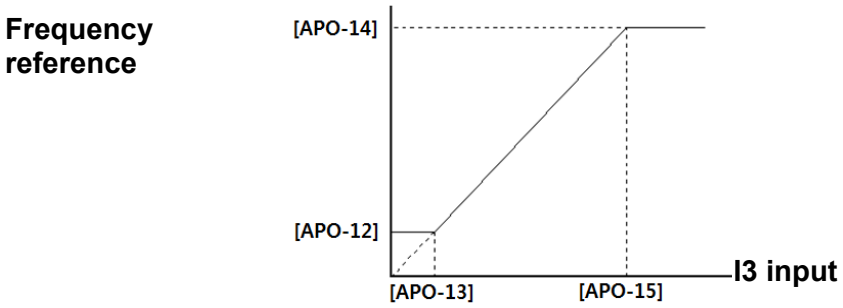
You can set and modify a frequency reference by applying a current input to the I3 (V3) terminal. With SW2 select I3 (right) for current input at the V3 terminal. Use current inputs ranging from 0(4)–20mA for forward operation.

5.2.2.1 Setting a Reference Frequency for Input Current, 0(4) - 20mA (I3/V3)

Set DRV-07 (Freq Ref Src) to “11 (I3)” and apply 4–20 mA input current to V3 the terminal.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
DRV	07	Frequency reference source	Freq Ref Src	11	I3	0~11	-
IN	01	Frequency at maximum analog input	Freq at 100%	Max Freq.		Start Freq.-Max Freq.	Hz
APO	10	I3 input monitor	I3 Monitor	0.00		0.00-24.00	mA
	11	I3 input filter time constant	I3 Filter	10		0-10,000	mA
	12	I3 minimum input current	I3 Curr x1	4.00		0.00-20.00	mA
	13	I3 output at minimum current (%)	I3 Perc y1	0.00		0.00 – 100.00	%
	14	I3 maximum input current	I3 Curr x2	20.00		0.00-24.00	mA
	15	I3 output at maximum current (%)	I3 Perc y2	100.00		0.00-100.00	%
	16	I3 rotation direction options	I3 Inverting	0	No	0-1	-
	17	I3 Quantizing level	I3 Quantizing	0.04		0.00*, 0.04-10.00	%

■ Input Current (I3) Setting Details

Code	Description
[IN-01] Freq at 100%	Configures the frequency reference at maximum input current to the IN-01 frequency. A frequency set with code IN-01 becomes the maximum frequency when the value set in code APO-15 (or APO-13) is 100 (%). • If IN-01 is set to 60.00 and the default settings are used for APO-10–APO-16, a 20 mA input to the I3 (V3) terminal will produce a frequency reference of 60.00Hz. • If APO-15 is set to 50.00 (%) and the default settings are used for IN-01, APO-10–APO-16, a 20 mA input will produce a frequency reference of 30.00Hz.
[APO-10] I3 Monitor	Monitor input current at I3.
[APO-11] I3 Filter	Configures the time for the operation frequency to reach 63% of target frequency based on the input current at I3.
[APO-12] I3 Curr x1 ~ [APO-15] I3 Perc y2	Configures the gradient level and off-set value of the output frequency. 

5.3 Analog Output

The analog output terminal (AO3) provides outputs of 0-10V OR (0)4–20 mA current. Switch (SW3) selects a voltage (VO3, left) or a current (IO3, right) output at the AO3 terminal.

5.3.1 Voltage and Current Analog Output

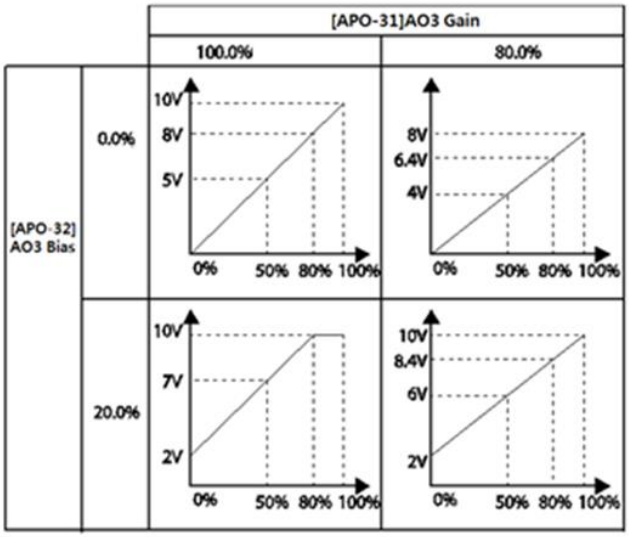
The analog output (AO3) can represent one of a variety of signals. Parameter APO-30 (AO3 Mode) provides 12 choices. Scaling (gain, bias) and filtering can also be applied to the output signal.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
APO	30	Analog output 3	AO3 Mode	0	Frequency	0-15	-
	31	Analog output 3 gain	AO3 Gain	100.0		-1000.0-1000.0	%
	32	Analog output 3 bias	AO3 Bias	0.0		-100.0-100.0	%
	33	Analog output 3 filter	AO3 Filter	5		0-10000	ms
	34	Analog constant output 3	AO3 Const %	0.0		0.0-100.0	%
	35	Analog output 3 monitor	AO3 Monitor	0.0		0.0-1000.0	%

■ Voltage and Current Analog Output Setting Details

Code	Description		
[APO-30] AO3 Mode	Select the type of signal to output. The following example uses a 0-10V output voltage at terminal AO3 representing frequency.		
	Setting		Function
	0	Frequency	Outputs operating frequency as a standard. A 10 V output is supplied based on the frequency set at DRV-20 (Max Freq).
	1	Output Current	A 10 V output is supplied based on 150% of the inverter's rated current.
	2	Output Voltage	Sets the output based on the inverter output voltage. 10 V output is made from a set voltage in MOT-07 (Motor Voltage). If '0' is set in MOT-07, 230 V/460 V inverter's output 10 V based on the actual input voltages (240 V and 480 V respectively).
	3	DC Link Volt	Outputs inverter DC link voltage as a standard. Outputs 10 V when the DC link voltage is 410 V DC for 230 V models, and 820 V DC for 460 V models.
	4	Output Power	Monitors output wattage. 10 V is output at 150% of inverter rated output.
	7	Target Freq	Outputs the set frequency as a standard. Outputs 10 V at the maximum frequency (DRV-20).

<table>
<tr><th>Code</th><th colspan="3">Description</th></tr>
<tr><td></td><td>8</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></td><td>9</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></td><td>10</td><td>PID Fdk Value</td><td>Outputs feedback amount of the PID controller. Outputs approximately 6.6 V at 100%.</td></tr>
<tr><td></td><td>11</td><td>PID Output</td><td>Outputs the output value of the PID controller. Outputs approximately 10 V at 100%.</td></tr>
<tr><td></td><td>12</td><td>Constant</td><td>Outputs APO-34 (AO3 Const %) value as a standard.</td></tr>
<tr><td>[APO-31]
AO3 Gain

[APO-32]
AO3 Bias</td><td colspan="3">The Gain and Bias settings provide scaling adjustment of the analog outputs. The graphs below illustrate adjustments of APO-31 (AO3 Gain) and APO-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.
 

Frequency setting example: With APO-30 set to ‘0’, using default values of 100% Gain and 0% Bias and the maximum frequency set at DRV-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.
$$AO3 = \frac{Frequency}{MaxFreq} \times AO3\ Gain + AO3\ Bias$$</td></tr>
<tr><td>[APO-33]
AO3 Filter</td><td colspan="3">Set filter time constant on the analog output.</td></tr>
<tr><td>[APO-34]
A03 Const %</td><td colspan="3">If the analog output at APO-30 (AO3 Mode) is set to “12 (Constant)”, the analog voltage output is dependent on the set parameter value (0–100%).</td></tr>
<tr><td>[APO-35]
AO3 Monitor</td><td colspan="3">Monitors the analog output value. Displays the maximum output voltage as a percentage (%) with 10 V as the standard.</td></tr>
</table>

Note
AO3 Current Output Calibration Method for 4‐20mA output, APO-31 (AO3 Gain) and APO-32 (AO3 Bias)
Bias Tuning
Set APO-30 (AO3 Mode) to 12 'Constant' and set APO-34 (AO3 Const %) to 0.0 %.
Set APO-32 (AO3 Bias) to 20.0% and then check current output. 4mA output should be displayed. If the value is less than 4mA, gradually increase APO-32 (AO3 Bias) until 4mA is measured. If the value is more than 4mA, gradually decrease APO-32 (AO3 Bias) until 4mA is measured.
Gain Tuning
Set APO-34 (AO3 Const %) to 100.0%. Set APO-31 (AO3 Gain) to 80.0% and measure current output at 20mA. If the value is less than 20mA, gradually increase APO-31 (AO3 Gain) until 20mA is measured. If the value is more than 20mA, gradually decrease APO-31 (AO3 Gain) until 20mA is measured.
The functions for each code are identical to the descriptions for the 0–10V voltage outputs with an output range 4–20mA.

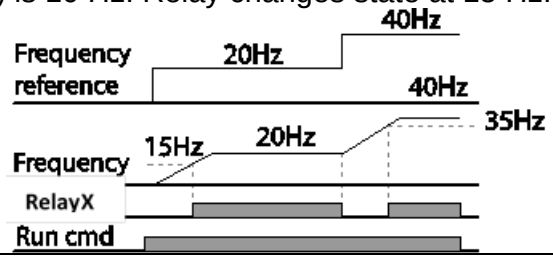
5.4 Digital Output

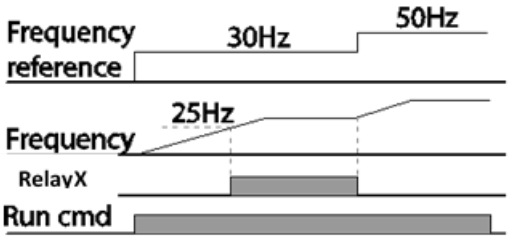
5.4.1 Multifunction Output Terminal and Relay Settings

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
OUT	30	Fault trip output mode	Trip Out Mode	010		-	bit
	31	Multifunction relay 1	Relay 1	23	Trip	-	-
	32	Multifunction relay 2	Relay 2	14	Run	-	-
	33	Multifunction relay 3	Relay 3	0	None	-	
	34	Multifunction relay 4	Relay 4	0	None	-	
	35	Multifunction relay 5	Relay 5	0	None	-	
	36	Multifunction output1	Q1 Define	0	None	-	-
	37	Multifunction relay 6	Relay 6	0	None	-	
	38	Multifunction relay 7	Relay 7	0	None	-	
	39	Multifunction relay 8	Relay 8	0	None	-	
	53	Fault output on delay	TripOut On Dly	0.00		0.00-100.00	sec
	54	Fault output off delay	TripOut Off Dly	0.00		0.00-100.00	sec

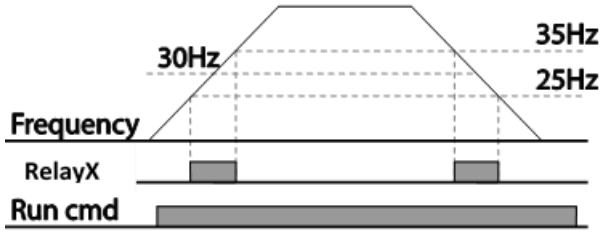
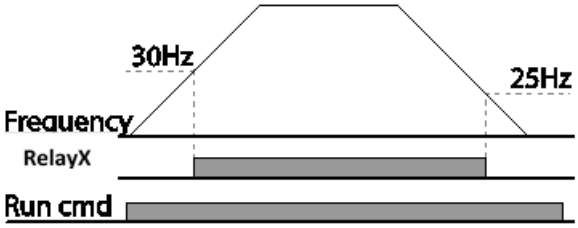
■ Multifunction Output Terminal and Relay Setting Details

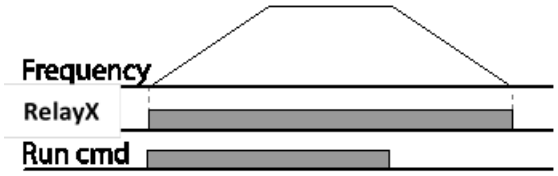
<table>
<tr><th>Code</th><th colspan="3">Description</th></tr>
<tr><td rowspan="4">[OUT-31]
Relay 1
~
[OUT-39]
Relay 8</td><td colspan="3">Set relay (Relay 1–8) output options.</td></tr>
<tr><td colspan="2">Setting</td><td>Function</td></tr>
<tr><td>0</td><td>None</td><td>No output signal</td></tr>
<tr><td>1</td><td>FDT-1</td><td>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 (OUT-58 / 2).

Example: Frequency Reference is 20 Hz. Bandwidth (OUT-58) is 10 Hz. Relay changes state at 15 Hz.
 
</td></tr>
<tr><td>2</td><td>FDT-2</td><td>Relay changes state when the reference frequency and detection frequency (OUT-57) are equal and fulfills FDT-1 condition at the same time.
Conditions are: [Absolute value (Ref frequency detection frequency) < frequency bandwidth/2] & [FDT-1].

Example: Frequency Reference is 30 Hz. Detection frequency (OUT-57) is 30 Hz. Frequency bandwidth (OUT-58) is 10 Hz. Relay changes state at 25 Hz.
 
</td></tr>
<tr><td>3</td><td>FDT-3</td><td>Relay changes state when the output frequency is within the frequency bandwidth (OUT-58) centered around the detection frequency (OUT-57).
Conditions are: Absolute value (output frequency–operating frequency) < frequency bandwidth/2.

Example: Detection frequency (OUT-57) is 30 Hz. Frequency bandwidth (OUT-58) is 10 Hz. Relay changes state when the output frequency is between 25 Hz. and 35 Hz.</td></tr>
</table>

Code	Description		
			
	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 (OUT-57) is 30 Hz. Frequency bandwidth (OUT-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. 
	5	Over Load	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	Under Load	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:

Code	Description		
			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.
	19	Speed Search	Relay changes state during speed search operation.
	20	Ready	Relay changes state when the inverter is in stand by operation and ready to receive a run command.
	22	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.
	23	Trip	Relay changes state after a fault condition.
	24	Lost Keypad	Relay changes state when a communication error occurs between the keypad and the inverter.
	25	DB Warn %ED	Relay changes state when the Dynamic Brake Duty Cycle (PRT-66) is exceeded.
	26	On/Off Control	Relay changes state based on the analog input signal levels set with OUT-67~OUT-69.
	27	Fire Mode	Relay changes state when Fire Mode is activated.
	28	Pipe Break	Relay changes state when a broken pipe is detected.
	29	Damper Err	Relay changes state when damper open signal is not entered.
	30	Lubrication	Relay changes state during lubrication operation.

Code	Description		
	31	Pump Clean	Relay changes state during pump cleaning operation.
	32	Level Detect	Relay changes state when an LDT trip occurs.
	33	Damper Control	Relay changes state when a damper open signal is set at IN-65~IN-73 the run command is active.
	36	AUTO State	Relay changes state when in AUTO mode.
	37	HAND State	Relay changes state when in HAND mode.
	38	TO	For Q1 Terminal to output a pulsed signal.
	39	Except Date	Associated with Time Event Scheduling. Relay changes state during ‘Exception Dates’.
	40	KEB Operating	Relay changes state when the inverter is operating in KEB mode.
	41	Broken Belt	Relay changes state when a Broken Belt is detected
	42	BR Control	Used for external electro-mechanical brake control. Relay operates based on ADV-41~ADV-47 settings.
	43	2nd Source	Relay changes state when Auxiliary Mode is selected.
[OUT-36] Q1 Define	Selects an output item for the multifunction output terminal (Q1) of the terminal block. Q1 stands for the open collector TR output.		
[OUT-41] DO Status	Used to check On/Off state of the D0 by each bit.		

Caution

- FDT-1 and FDT-2 functions are related to the frequency setting of the inverter. If the inverter enters standby mode by pressing the Off key during auto mode operation, FDT-1 and FDT-2 function operation may be different because the set frequency of the inverter is different compared to the set frequency of the auto mode.
- If monitoring signals such as “Under load” or ”LDT” are configured at multifunction output terminals, signal outputs are maintained unless certain conditions defined for signal cutoff are met.

5.4.2 Fault Output using Relay or Q1 Terminals

With Relay1 ~ Relay8 or Q1 set to 23 (Trip), OUT-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 outputs when set to 23 (Trip).).

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
OUT	30	Fault trip output mode	Trip Out Mode	010		-	bit
	31	Multifunction relay 1	Relay 1	23	Trip	-	-
	32	Multifunction relay 2	Relay 2	14	Run	-	-
	33	Multifunction relay 3	Relay 3	0	None	-	
	34	Multifunction relay 4	Relay 4	0	None	-	
	35	Multifunction relay 5	Relay 5	0	None	-	
	36	Multifunction output1	Q1 Define	0	None	-	-
	37	Multifunction relay 6	Relay 6	0	None	-	
	38	Multifunction relay 7	Relay 7	0	None	-	
	39	Multifunction relay 8	Relay 8	0	None	-	
	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 Relay and Q1- Setting Details

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>[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>Keypad display</td><td>  </td><td>  </td></tr>
</table>
Set OUT-31~39 (Relay1-Relay8)) or OUT-36 (Q1) 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 fault trips occur</td></tr>
<tr><td></td><td>✓</td><td></td><td>Operates when fault trips other than low voltage occur</td></tr>
<tr><td>✓</td><td></td><td></td><td>Operates when auto restart fails (PRT-08–09)</td></tr>
</table>
</td></tr>
</table>

Code	Description
[OUT-31]Relay 1 ~[OUT-39] Relay 8	Configure Relay1~Relay8 output function.
[OUT-36] Q1 Define	Configure Q1 output function. Q1 is open collector TR output.
[OUT-53] TripOut OnDly [OUT-54] TripOut OffDly	When a trip occurs, the relays will be activated after the delay time set in OUT-53 (On Dly). After a reset, the relays will be initialized after the delay time set in OUT-54 (Off Dly).

5.4.3 Multifunction Output Terminal Delay Time Settings

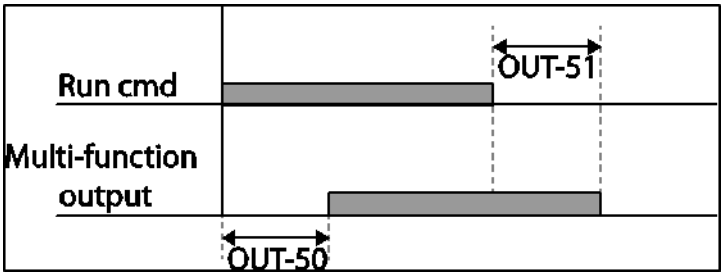
Set On/Off delay times to adjust the relay operation time. The delay times set in OUT-50 and OUT-51 will be applied to all Relays (1~8) and Q1 except when any are set to (23) Trip. Additionally, a NO or NC setting can be individually applied to the outputs.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
OUT	50	Multifunction output On delay	DO On Delay	0.00	0.00- 100.00	sec
	51	Multifunction output Off delay	DO Off Delay	0.00	0.00- 100.00	sec
	52	Select multifunction output terminal	DO NC/NO Sel	0 0000 0000* R8<-R6,Q1,R5<-R1	0 0000 0000~ 1 1111 1111	bit

Item	Closed	Open
Keypad display		

■ Output Terminal Delay Time and NC/NO Setting Details

Code	Description
[OUT-50] DO On Delay	When relays or Q1 are operated based on OUT-31~39 settings, they will activate after the delay time set at OUT-50.
[OUT-51] DO Off Delay	When relays or Q1 are initialized (reset or off signal occurs), they will de-activate after the time delay set at OUT-51.



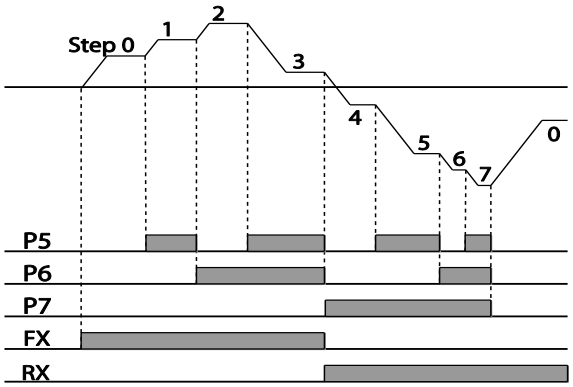
<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>[OUT-52]
DO NC/NO Sel</td><td>Each output can be set to operate as Type A or Type B. Type A is deenergized in its normal state. Type B is energized in its normal state. By setting the relevant bit to 0 (off), it will operate as Type A (the NO 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 1~8 and Q1 settings starting from the right bit.
<table>
<tr><th>Item</th><th>bit on (Type B)</th><th>bit off (Type A)</th></tr>
<tr><td>LCD keypad</td><td>  </td><td>  </td></tr>
</table>
<table>
<tr><th colspan="2">bit</th><th></th><th>Relay8~6, Q1, Relay5~Relay1</th><th></th></tr>
<tr><td rowspan="2">0 (off)</td><td rowspan="2">A contact (NO)</td><td rowspan="2"></td><td>0 0 0 0 0 0 0 0</td><td rowspan="2">All set as NO</td></tr>
<tr><td>R8 R7,R6,Q1,R5 R4,R3,R2,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 1 1 1 1</td><td rowspan="2">All set as NC</td></tr>
<tr><td>R8 R7,R6,Q1,R5 R4,R3,R2,R1</td></tr>
</table></td></tr>
</table>

5.5 Setting Multistep Frequency

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 DRV-07. Set Px terminals 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 BAS-50 – 56 and the binary command combinations.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
BAS	50~56	Multistep frequency 1–7	Step Freq-1~7	-		Start Freq-Max Freq	Hz
IN	65~73	Px terminal configuration	Px Define (Px: P1~P9)	7	Speed-L	0-42	-
				8	Speed-M		-
				9	Speed-H		-
	89	Multistep command delay time	InCheck Time	1		1-5000	ms

■ Multistep Frequency Setting Details

Code	Description
[BAS-50~56] Step Freq-1-7	Configure multistep frequencies 1–7.
[IN-65~73] Px Define	Choose the terminals to setup as multistep inputs, and then set the relevant codes (IN-65–73) to “7 (Speed-L)”, “8 (Speed-M)”, and “9 (Speed-H)”. Example below uses terminals P5, P6, and P7 and have been set to Speed-L, Speed-M and Speed-H respectively. The following multistep operation will be available.  [An example of a multistep operation]

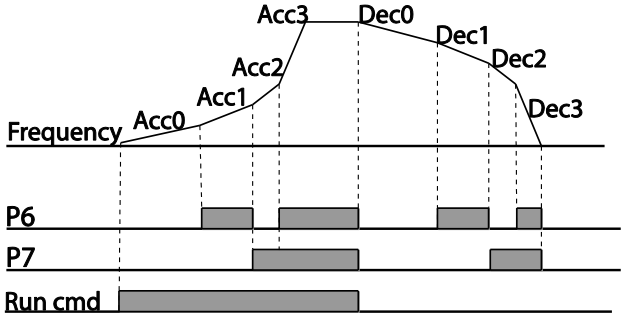
<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><th>Speed</th><th>Fx/Rx</th><th>P7</th><th>P6</th><th>P5</th></tr>
<tr><td>0</td><td>✓</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>1</td><td>✓</td><td>-</td><td>-</td><td>✓</td></tr>
<tr><td>2</td><td>✓</td><td>-</td><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]
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 100 ms and an input signal is received at P6, the inverter will search for inputs at other terminals for 100 ms, before proceeding to accelerate or decelerate based on the configuration at P6.</td></tr>
</table>

5.6 Multistep 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 (P1 ~ P9) and set the corresponding parameters (IN-65~IN-73) 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
DRV	03	Acceleration time	Acc Time	20.0		0.0-600.0	sec
	04	Deceleration time	Dec Time	30.0		0.0-600.0	sec
BAS	70-83	Multistep acceleration/Deceleration time1–7	Acc Time 1-7	x.xx		0.0-600.0	sec
			Dec Time 1-7	x.xx		0.0-600.0	sec
IN	65-73	Px terminal configuration	Px Define (Px: P1-P9)	11	XCEL-L	0-52	-
				12	XCEL-M		
				13	XCEL-H		
	89	Multistep command delay time	In Check Time	1		1-5000	ms

■ Acc/Dec Time Setup via Multifunction Terminals – Setting

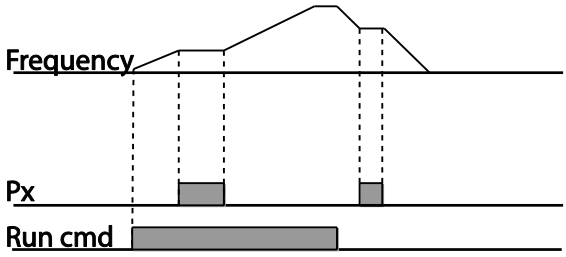
<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>[BAS-70-82]
Acc Time 1-7</td><td>Set multistep acceleration time1–7.</td></tr>
<tr><td>[BAS-71-83]
Dec Time 1-7</td><td>Set multistep deceleration time1–7.</td></tr>
<tr><td>[IN-65~73]
Px Define (P1~P9)</td><td>Choose and configure the terminals to use for multistep Acc/Dec time inputs
<table>
<tr><th colspan="2">Configuration</th><th>Description</th></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>13</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 BAS-70–82 and BAS-71–83.
Example: The P6 and P7 terminals are set as XCEL-L and XCEL-M respectively, the following operation will be available.


<table>
<tr><th>Acc/Dec time</th><th>P7</th><th>P6</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>
[Multifunction terminal P6, P7 configuration]</td></tr>
<tr><td>[IN-89]
In Check Time</td><td>Sets the time for the inverter to check for other terminal block inputs. If IN-89 is set to 100 ms and a signal is supplied to the P6 terminal, the inverter searches for other inputs over the next 100 ms. When the time expires, the Acc/Dec time will be set based on the input received at P6.</td></tr>
</table>

5.7 Stopping the Acc/Dec Operation

Configure a multifunction 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	65-73	Px terminal configuration	Px Define(Px: P1-P9)	14	XCEL Stop	0-42	-



5.8 Multifunction Input Terminal Control

Each of the digital inputs can be assigned to function as On Delay and/or Off Delay. Filter time constants can also be applied independently to the digital inputs. 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. The status of the inputs can be viewed at IN-90.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
IN	83	Enable On Delay	DI On DelayEn	0 0000 0000 P9 <-------P1*	0 0000 0000 ~ 1 1111 1111	-
	84	Enable Off Delay	DI Off DelayEn	0 0000 0000 P9 <-------P1*	0 0000 0000 ~ 1 1111 1111	
	85	Multifunction input terminal On filter	DI On Delay	10	0-10,000	msec
	86	Multifunction input terminal Off filter	DI Off Delay	3	0-10,000	msec
	87	Multifunction input terminal selection	DI NC/NO Sel	0 0000 0000* P9 <-------P1*	0 0000 0000~ 1 1111 1111	-
	90	Multifunction input terminal status	DI Status	0 0000 0000* P9 <-------P1*	0 0000 0000~ 1 1111 1111	-

* Bits are numbered P9~P1 (left to right).

■ Multifunction Input Terminal Control Setting Details

<table>
<tr><th>Code</th><th>Description</th></tr>
<tr><td>[IN-83] DI On Delay En
I[N-84] DI Off Delay En</td><td>Individual Input Terminals can be set (enabled) to function as On Delay and/or Off Delay. Set the corresponding bits in IN-83 to activate the inputs with an On Delay function. Set the corresponding bits in IN-84 to activate the inputs with an Off Delay function.</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-83 and 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] DI NC/NO Sel</td><td>Select terminal contact types 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. With the top segment on, it indicates that the terminal is configured as a B terminal (Normally Closed) contact. Terminals are numbered P9<–P1, from left to right.
<table>
<tr><td>Type</td><td>Form A contact terminal status (Normally Open)</td><td>Form B contact terminal status (Normally Closed)</td></tr>
<tr><td>Keypad</td><td>  </td><td>  </td></tr>
</table></td></tr>
<tr><td>[IN-90] DI Status</td><td>Display the status of each contact. When a digital input is configured as an A type terminal using DRV-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 cconfigured as a B type terminal, the segment lights behave conversely. Terminals are numbered P9<-P1, from left to right.
<table>
<tr><td>Type</td><td>Form A contact terminal setting (On)</td><td>Form B contact terminal setting (Off)</td></tr>
<tr><td>Keypad</td><td>  </td><td>  </td></tr>
</table></td></tr>
</table>

6 Keypad Parameters for the Extended I/O Module

Keypad Parameters in the Extended I/O module are displayed when the Extended I/O module is installed.

APO Group - Extended IO Group

Code	Comm. Address	LCD Display	Initial Value	Property*	Setting Range
APO-01	0x1E01	V3 Monitor	-	X	-
APO-02	0x1E02	V3 Filter	10	O	0~10000 msec
APO-03	0x1E03	V3 Volt x1	0	O	0.00~10.00 V
APO-04	0x1E04	V3 Perc Y1	0	O	0.00~100.00 %
APO-05	0x1E05	V3 Volt x2	10	O	0.00~12.00 V
APO-06	0x1E06	V3 Perc Y2	100	O	0.00~100.00 %
APO-07	0x1E07	V3 Inverting	0	O	0 No
					1 Yes
APO-08	0x1E08	V3 Quantizing	0.04	O	0.04~10.00 %
APO-10	0x1E0A	I3 Monitor	-	O	-
APO-11	0x1E0B	I3 Filter	10	O	0~10000 msec
APO-12	0x1E0C	I3 Curr x1	4	O	0.00~20.00 mA
APO-13	0x1E0D	I3 Perc Y1	0	O	0.00~100.00 %
APO-14	0x1E0E	I3 Curr x2	20	O	0.00~24.00 mA
APO-15	0x1E0F	I3 Perc Y2	100	O	0.00~100.00 %
APO-16	0x1E10	I3 Inverting	0	O	0 No
					1 Yes
APO-17	0x1E11	I3 Quantizing	0.04	O	0.04~10.00 %
APO-30	0x1E1E	AO3 Mode	0	O	0 Frequency
					1 Output Current
					2 Output Voltage
					3 DC Link Voltage
					4 Output Power
					5 Reserved
					6 Reserved
					7 Target Freq
					8 Ramp Freq
					9 PID Ref Value
					10 PID Fdb Value
					11 PID Output

Code	Comm. Address	LCD Display	Initial Value	Property*	Setting Range
					12 Constant
APO-31	0x1E1F	AO3 Gain	100	O	-1000.0~1000.0 %
APO-32	0x1E20	AO3 Bias	0	O	-100.0~100.0 %
APO-33	0x1E21	AO3 Filter	5	O	0~10000 msec
APO-34	0x1E22	AO3 Const %	0	O	0.0~100.0 %
APO-35	0x1E23	AO3 Monitor	0	X	-

** Groups created for the H2 extended I/O may be used when the extended I/O is installed and when displayed as read-only, based on settings or switch options.

** Reset the related parameters after uninstalling the H2 extended I/O module. The parameter settings for the H2 extended I/O module are not automatically initialized when the module is removed.

Additional parameters and additional parameter settings related to the Extended IO module are shown in the below table. These are shaded in dark grey.

Code	Comm. Address	LCD Display	Initial Value	Property*	Setting Range
CNF-30		Option-1 Type	-		Displays “Ext IO 1” when the H2 extended IO module is connected.
COM-06		FBus S/W Ver	-		Displays the version when the H2 extended IO module is connected.
DRV-07	0h1107	Freq Ref Src	0	Δ	0 Keypad-01
					1 Keypad-02
					2 V1
					3 Reserved
					4 V2
					5 I2
					6 Int 485
					7 FieldBus
					8 Reserved
					9 Pulse
					10 V3
					11 I3
BAS-03	0h1303	Aux Ref Src	0	Δ	0 None
					1 V1

Code	Comm. Address	LCD Display	Initial Value	Property*	Setting Range
					2 Reserved
					3 V2
					4 I2
					5 Reserved
					6 Pulse
					7 Int 485
					8 FieldBus
					9 Reserved
					10 V3
					11 I3
BAS-02	0h1302	Freq 2nd Src	0	O	0 Keypad-1
					1 Keypad-2
					2 V1
					3 Reserved
					4 V2
					5 I2
					6 Int 485
					7 FieldBus
					8 Reserved
					9 Pulse
					10 V3
					11 I3
OUT-67	0h1743	OnOff Ctrl Src	0	O	0 None
					1 V1
					2 Reserved
					3 V2
					4 I2
					5 Reserved
					6 Pulse
					7 V3
					8 I3
IN-72	0h1648	P8 Define	0	Δ	0 None

Code	Comm. Address	LCD Display	Initial Value	Property*	Setting Range
IN-73	0h1649	P9 Define			1 Fx
					2 Rx
					3 RST
					4 External Trip
					5 Bx
					6 JOG
					7 Speed-L
					8 Speed-M
					9 Speed-H
					10 Reserved
					11 XCEL-L
					12 XCEL-M
					13 XCEL-H
					14 XCEL-STOP
					15 RUN Enable
					16 3-Wire
					17 2nd Source
					18 Exchange
					19 Up
					20 Down
					21 Reserved
					22 U/D Clear
					23 Analog Hold
					24 I-Term Clear
					25 PID Openloop
					26 PID Gain 2
					27 PID Ref Change
					28 Pre Excite
					29 Timer In
					30 Reserved
					31 dis Aux Ref

Code	Comm. Address	LCD Display	Initial Value	Property*	Setting Range
					32 FWD Jog
					33 REV Jog
					34 Fire Mode
					35 Time Event En
					36 Pre Heat
					37 Damper Open
					38 Pump Clean
					39 Sleep Wake Chg
					40 PID Step Ref L
					41 PID Step Ref M
					42 PID Step Ref H
OUT-37 OUT-38 OUT-39	0h1725 0h1726 0h1727	Relay6 Relay7 Relay8	0	O	0 None
					1 FDT-1
					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
					20 Ready

Code	Comm. Address	LCD Display	Initial Value	Property*	Setting Range
					21 Reserved
					22 Timer Out
					23 Trip
					24 Lost Keypad
					25 DB Warn %ED
					26 On/Off Control
					27 Fire Mode
					28 Pipe Broken
					29 Damper Err
					30 Lubrication
					31 Pump Clean
					32 Level Detect
					33 Damper Control
					34 Reserved
					35 Reserved
					36 AUTO State
					37 HAND State
					38 TO
					39 Except Date
					40 KEB Operating
					41 Broken Belt
					42 BR Control
					43 2nd Source
PID-10	0h190A	PID Ref 1 Src	0	Δ	0 Keypad
					1 V1
					2 Reserved
					3 V2
					4 I2
					5 Int 485
					6 FieldBus
					7 Reserved
					8 Pulse

Code	Comm. Address	LCD Display	Initial Value	Property*	Setting Range
					9 V3
					10 I3
PID-12	0h190C	PID Ref1AuxSrc	0	Δ	0 None
					1 V1
					2 Reserved
					3 V2
					4 I2
					5 Reserved
					6 Pulse
					7 Int 485
					8 FieldBus
					9 Reserved
					10 V3
					11 I3
PID-15	0h190F	PID Ref2AuxSrc	0	Δ	0 Keypad
					1 V1
					2 Reserved
					3 V2
					4 I2
					5 Int 485
					6 FieldBus
					7 Reserved
					8 Pulse
					9 V3
					10 I3
PID-17	0h1911	PID Ref2AuxSrc	0	Δ	0 None
					1 V1
					2 Reserved
					3 V2
					4 I2
					5 Reserved
					6 Pulse

Code	Comm. Address	LCD Display	Initial Value	Property*	Setting Range
					7 Int 485
					8 FieldBus
					9 Reserved
					10 V3
					11 I3
PID-20	0h1914	PID Fdb Source	0	Δ	0 V1
					1 Reserved
					2 V2
					3 I2
					4 Int 485
					5 FieldBus
					6 Reserved
					7 Pulse
					8 V3
					9 I3
PID-21	0h1915	PID Fdb AuxSrc	0	Δ	0 None
					1 V1
					2 Reserved
					3 V2
					4 I2
					5 Reserved
					6 Pulse
					7 Int 485
					8 FieldBus
					9 Reserved
					10 V3
					11 I3

BENSHAW
615 Alpha Drive
Pittsburgh, PA 15238
Phone: (412) 968-0100
Fax: (412) 968-5415

BENSHAW Canada 550 Bright Street
Listowel, Ontario N4W 3W3 Phone: (519) 291-5112
Fax: (519) 291-2595