APPENDIX B: OPTIONAL I/O CARD

BASIC INFORMATION

The ACN-EIO Extension IO option card provides additional discrete and analog IO points for any ACN(ND) series drives. This appendix explains specifications, installation, and features of the option card.

CHARACTERISTICS

Additional terminals

- *Digital Input : 3ea*
- *Digital Output : 2ea(1FormC)*
- *Analog Input : 2ea*
- *Analog Output : 1ea*

COMPONENTS

ACN Extension I/O consists of following items.

- *ACN Extension I/O : 1ea*
- *Installation Instructions : 1ea*
- *Brass supporter(M3xL17.3) : 1ea*
- *Brass supporter(M3xL23) : 1ea*
- *Screw(M3xL8) : 2ea*
- *Other parts*

SPECIFICATIONS

INPUT AND OUTPUT SPECIFICATION

Function		Label	Name	Description
INPUT	Multi-function terminal configuration	P8 ~ P10	Multi-function Input 8~10	Configurable for multi-function input terminals.
		CM	Common Sequence	Common terminal for analog terminal inputs and outputs.
	Analog input configuration	V3	Voltage input for frequency reference input	Used to setup or modify a frequency reference via analog voltage input terminal. • Unipolar: 0–10V (12V Max.) • Bipolar: -10–10V (±12V Max.)
		I4	Voltage/current input for frequency reference input	Used to setup or modify a frequency reference via analog voltage or current input terminals. Switch between voltage (V4) and current (I4) modes using a control board switch (SW2). V4 Mode: • Unipolar: 0–10V (12V Max.) I4 Mode • Input current: 4–20mA • Maximum Input current: 24mA • Input resistance: 249Ω
OUTPUT	Analog Output	AO3	Voltage/Current Output	Devices: output frequency, output current, output voltage, or a DC voltage. Operate switch (SW3) to select the signal output type (voltage or current) at the AO terminal. Output Signal Specifications: • Output voltage: 0–10V • Maximum output voltage/current: 12V/10mA • Output current: 0–20mA • Maximum output current: 24mA • Factory default output: Frequency
	Digital Output	CM	Common Sequence	Common terminal for analog terminal inputs and outputs.
		A3, C3, B4	Fault signal output	Sends out alarm signals when the drive's safety features are activated (AC 250V <1A, DC 30V < 1A). Fault condition: A3 and C3 contacts are connected (B3 and C3 open connection) Normal operation: B3 and C3 contacts are connected (A3 and C3 open connection)
		A4, C4, B4	Fault signal output	Sends out alarm signals when the drive's safety features are activated (AC 250V <1A, DC 30V < 1A). Fault condition: A4 and C3 contacts are connected (B4 and C4 open connection) Normal operation: B4 and C4 contacts are connected (A4 and C4 open connection)

INSTALLATION

INSTALLATION OF ACN I/O CARD

The following steps illustrate how to install the ACN-EIO or the ACN-ETH Option Card on the IronHorse ACN series drive.

> NOTE: Ensure all control board cables are terminated BEFORE installing the option card. Once the option card is installed, there is no access to the control terminals.

> ⚠ WARNING: ENSURE ALL POWER IS REMOVED FROM THE DRIVE BEFORE INSTALLING OR REMOVING ANY OPTION CARD. FAILURE TO COMPLY WILL DAMAGE THE DRIVE.

1) Loosen all front cover screws and remove the cover plate. Remove the face plate from the front of the Option card.

2) Remove keypad connector.

3) Remove the white keypad adapter PCB. It may be helpful to use a screwdriver to clear the plastic tabs (circled).


4) Once the keypad PCB adapter is removed, remove the existing bottom left screw (A) on the IO board. Keep this screw for later use. Fasten the included brass bar (M3xL23) to (A), and (M3xL17.3) to (B).
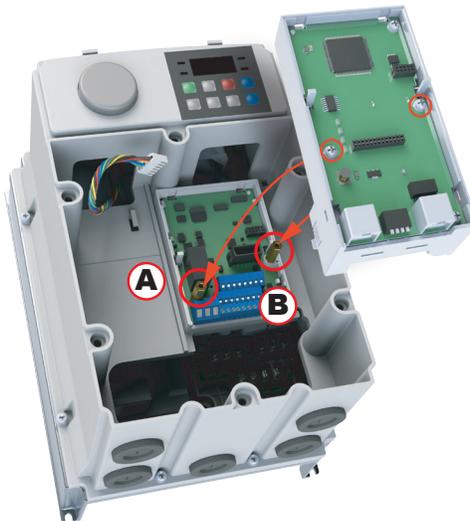
5) Install the Option Card and fasten the screws to the brass bars installed in the previous step.

6) Snap the keypad adapter PCB back into place on the Option Card and reconnect the keypad connector cable. Connect the field cables to the Option Card and install the Option Card cover (not shown). Re-install the drive front cover and tighten the screws.

CONTROL TERMINAL WIRING
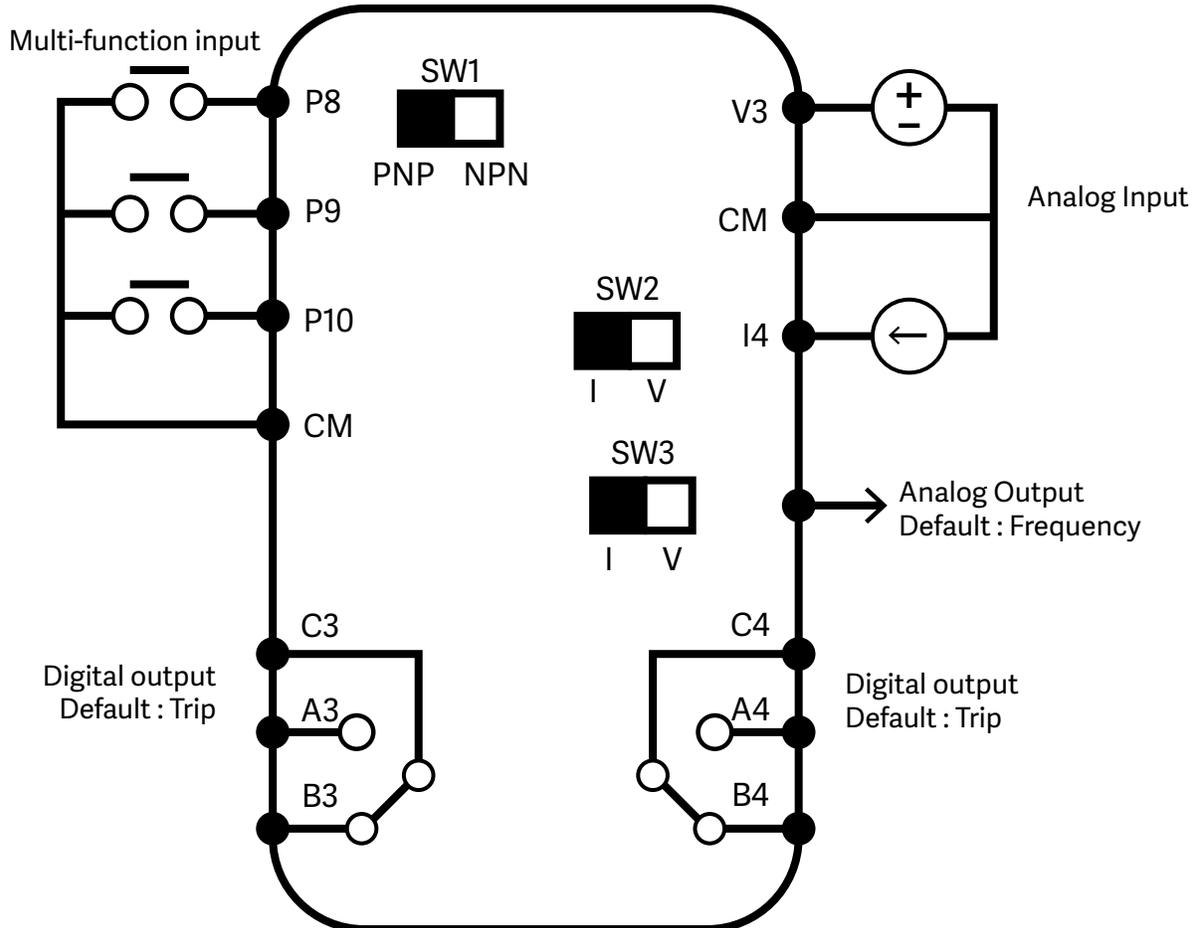
NPN(Sink)/PNP(Source) Mode Selection

The ACN Extension I/O supports both PNP (Source) and NPN (Sink) modes for sequence inputs at the terminal. Select an appropriate mode to suit requirements using the PNP/NPN selection switch (SW1) on the control board. Refer to the following information for detailed applications.

NPN Mode (Sink)

Select NPN using the PNP/NPN selection switch (SW1). Note that the factory default setting is NPN mode. CM is the common ground terminal for all analog inputs at the terminal, and P12 is 12V internal source.
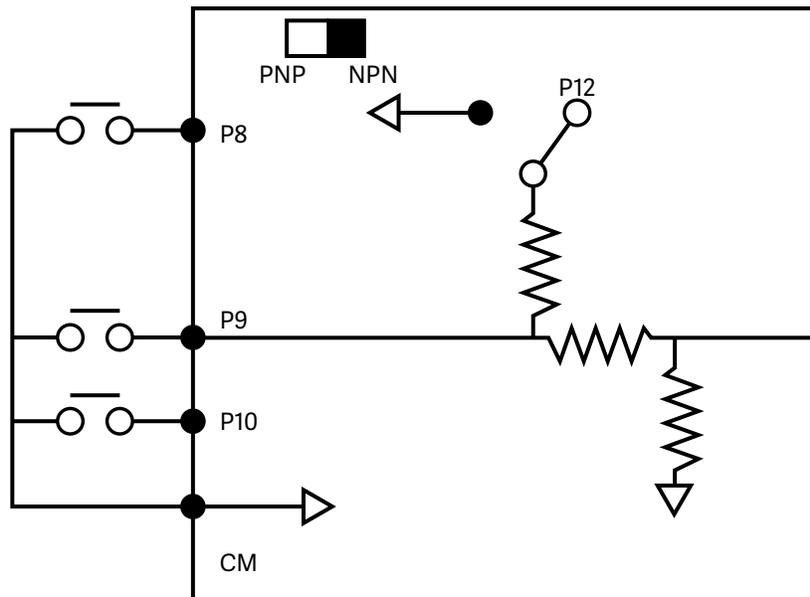
PNP Mode (Source)

Select PNP using the PNP/NPN selection switch (SW1). Note that the factory default setting is NPN mode. CM is is the common ground terminal for all analog inputs at the terminal, and P12 is 12V internal source. If you are using an external Voltage source, build a circuit that connects the external source (-) and the CM terminal In case of PNP, you should apply more than 3V source for on-state and less than 2V for off-state.
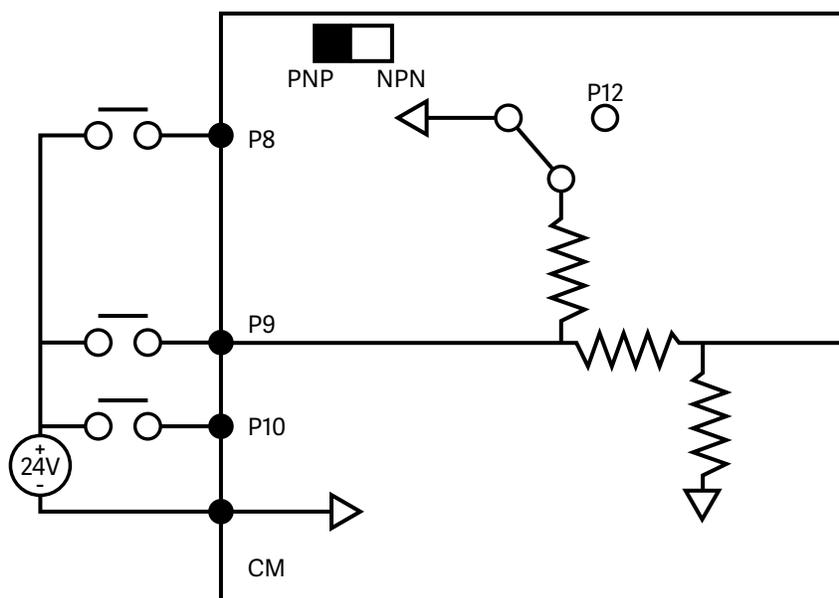
SIGNAL (CONTROL) CABLE SPECIFICATIONS

Control (Signal) 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	17	1.5	15

PRE-INSULATED CRIMP TERMINAL CONNECTORS (BOOTLACE FERRULE)

Use pre-insulated crimp terminal connectors to increase reliability of the control terminal wiring. Use this drawing and table to determine the crimp terminals to fit various cable sizes.
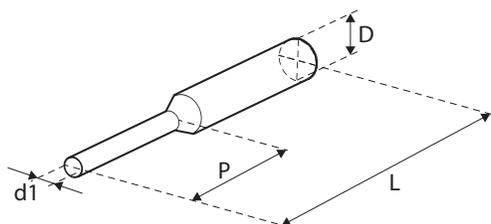
| Cable Spec		Dimensions (mm)			
AWG	mm²	L*	P	d1	D
26	0.25	10.4	6.0	1.1	2.5
		12.4	8.0		
22	0.50	12.0	6.0	1.3	3.2
20	0.75	12.0	6.0	1.5	3.4

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

To connect cables to the control terminals without using crimp terminals, refer to this drawing showing the correct length of exposed conductor at the end of the control cable.

0.2"
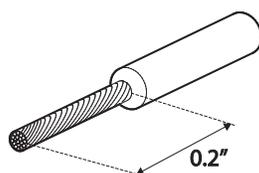
NOTE: Please read these general wiring recommendations:
- *While making wiring connections at the control terminals, ensure that the total cable length does not exceed 165ft (50m).*
- *Ensure that the length of any safety related wiring does not exceed 100ft (30m).*
- *Ensure that the cable length between an LCD keypad and the drive does not exceed 10ft (3.04 m). Cable connections longer than 10ft (3.04 m) 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 in. (15.24 cm) from the drive. This provides sufficient access to fully close the front cover.*
- *When making control terminal cable connections, use a small flat-tip screw driver (0.1 in wide (2.5 mm) and 0.015 in thick (0.4 mm) at the tip).*

0.1 in. or less

0.015 in. or less
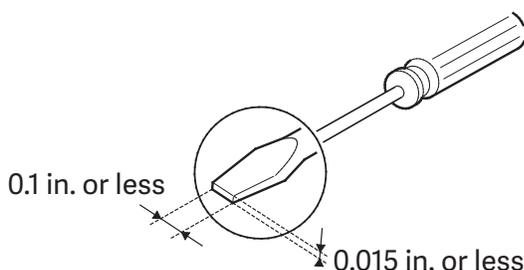
PARAMETER CONFIGURATION

For P8, P9, P10 Digital Input configuration parameters, see In.72, 73,74 on Page 4–30.

For A3-C3, A4-C4 Digital Output Configuration parameters, see OU.34,35 on Page 4–33.

For V3, I4, AO3 Analog configuration, parameters, see group AO (APO), on Page 4–44. This parameter group is only available when the option card is installed.

BASIC FEATURES

BASIC FUNCTION

Basic Function	Example
Frequency reference source configuration for the terminal block (input voltage)	Configures the drive to allow input voltages at the terminal block (V3, V4) and to setup or modify a frequency reference.
Frequency reference source configuration for the terminal block (input current)	Configures the drive to allow input currents at the terminal block (I4) and to setup or modify a frequency reference.
Multi-step speed (frequency) configuration	Configures multi-step frequency operations by receiving an input at the terminals defined for each step frequency.
Multi-stage Acc/Dec time configuration using the multi-function terminal	Configures multi-stage acceleration and deceleration times for a motor based on defined parameters for the multi-function terminals.
Command source configuration for terminal block inputs	Configures the drive to accept inputs at the FX/RX terminals.
Multi-function input terminal control configuration	Enables the user to improve the responsiveness of the multi-function input terminals.

SETTING FREQUENCY REFERENCE

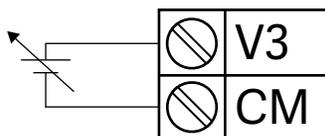| Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	Frq	Frequency reference source	Ref Freq Src	0	KeyPad-1	0–16	-
				1	KeyPad-2		
				2	V1		
				4	V2		
				5	I2		
				6	Int 485		
				8	Field Bus		
				12	Pulse		
				13	V3		
				15	V4		
				16	I4		

V3 Terminal as the Source

You can set and modify a frequency reference by setting voltage inputs when using 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

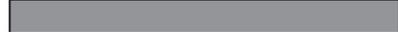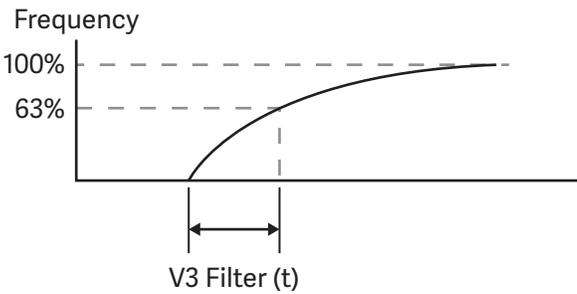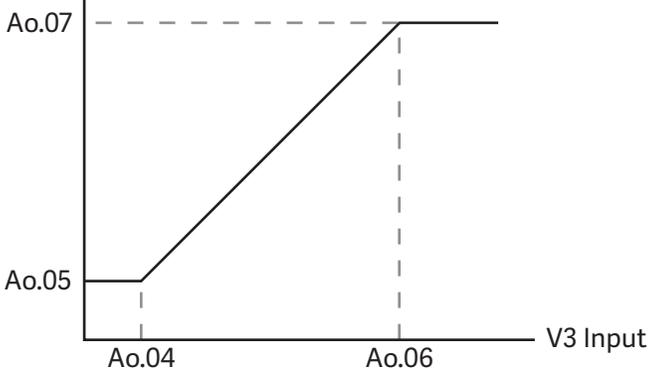#### *Setting a Frequency Reference for 0–10V Input*

Set the Frq (Frequency reference source) code in the Operation group to 13 (V3), and then set code 02 (V3 Polarity) to 0 (unipolar) in the AO group . Use a voltage output from an external source or use the voltage output from the VR terminal (Standard I/O) to provide inputs to V3. Refer to the diagrams below for the wiring required for each application.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	13	V3	0–16	-
In	1	Frequency at maximum analog input	Freq at 100%	Maximum frequency		0.00–Max. Frequency	Hz
Ao	1	V3 input monitor	V3 Monitor [V]	0.00		0.00–12.00	V
	2	V3 polarity options	V3 Polarity	0	Unipolar	0–1	-
	3	V3 input filter time constant	V3 Filter	10		0–10000	ms
	4	V3 minimum input voltage	V3 volt x1	0.00		0.00–10.00	V
	5	V3 output at minimum voltage (%)	V3 Perc y1	0.00		0.00–100.00	%
	6	V3 maximum input voltage	V3 Volt x2	10.00		0 .00– 12.00	V
	7	V3 output at maximum voltage (%)	V3 Perc y2	100.00		0–100	%
	8	Rotation direction options	V3 Inverting	0	No	0–1	-
	9	V3 Quantizing level	V3 Quantizing	0.04		0.00*, 0.04–10	%

Quantizing is disabled if '0' is selected.

0–10V Input Voltage Setting Details

| Code	Description
In.01 Freq at 100%	Configures the frequency reference at the maximum input voltage when a potentiometer is connected to the control terminal block. A frequency set with code In.01 becomes the maximum frequency only if the value set in code Ao.07 (or Ao.13) is 100(%). • Set code In.01 to 40.00 and use default values for codes Ao.01–Ao.09. Motor will run at 40.00Hz when a 10V input is provided at V3 • Set code Ao.07 to 50.00and use default values for codes In.01, Ao.01–Ao.09. Motor will run at 30.00Hz (50% of the default maximum frequency–60Hz)when a 10V input is provided at V3.
Ao.01 V3 Monitor[V]	Configures the drive to monitor the input voltage at V3.
Ao.03 V3 Filter	V3 Filter may be used when there are large variations between reference frequencies. Variations can be mitigated by increasing the time constant, but this will require an increased response time. 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. V3 Input from external source Frequency 100% 63% V3 Filter (t)
Ao.04 V3 Volt x1– Ao.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. Frequency Reference Ao.07 Ao.05 Ao.04 Ao.06 V3 Input
Ao.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.

Code	Description
Ao.09.V3 **Quantizing**	Quantizing may be used when the noise level is high in the analog input (V3 terminal) signal. Quantizing is useful when you are operating a noise-sensitive system, because it suppresses any signal noise. However, quantizing will diminish system sensitivity (resultant power of the output frequency will decrease based on the analog input). You can also turn on the low-pass filter using code Ao.03 to reduce the noise, but increasing the value will reduce responsiveness and may cause pulsations (ripples) in the output frequency. Parameter values for quantizing refer to a percentage based on the maximum input. Therefore, if the value is set to 1% of the analog maximum input (60Hz), the output frequency will increase or decrease by 0.6Hz per 0.1V difference. When the analog input is increased, an increase to the input equal to 75% of the set value will change the output frequency, and then the frequency will increase according to the set value. Likewise, when the analog input decreases, a decrease in the input equal to 75% of the set value will make an initial change to the output frequency. As a result, the output frequency will be different at acceleration and deceleration, mitigating the effect of analog input changes over the output frequency.
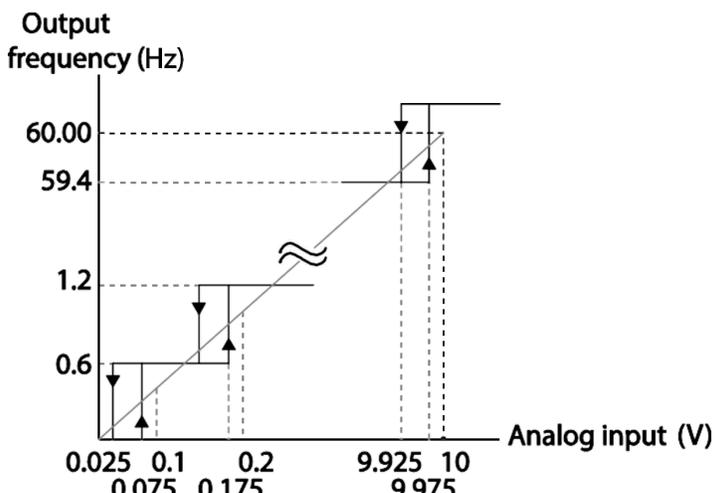
Setting a Frequency Reference for -10–10V Input

Set the Frq (Frequency reference source) code in the Operation group to 13 (V3), and then set code 02 (V3 Polarity) to 1 (bipolar) in the AO group (APO). Use the output voltage from an external source to provide input to V3.
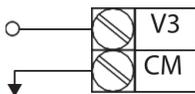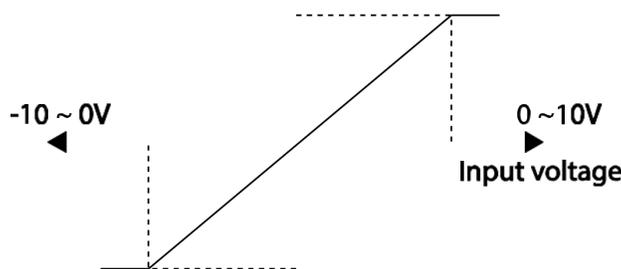
Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	13	V3	0–16	-
In	1	Frequency at maximum analog input	Freq at 100%	60.00		0– Max Frequency	Hz
Ao	1	V3 input monitor	V3 Monitor	0.00		0.00–12.00V	V
	2	V3 polarity options	V3 Polarity	1	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 V3- volt x1– Ao.13 V1- Perc y2	Sets the gradient level and offset value of the output frequency in relation to the input voltage. These codes are displayed only when Ao.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. For details about the 0–+10V analog inputs, refer to the code descriptions Ao.10 V3 volt x1–Ao.13 V1 Perc y2.

Setting a Reference Frequency using Input Current (I4)

You can set and modify a frequency reference using input current at the I4 terminal after selecting current input at SW 2. Set the Frq (Frequency reference source) code in the Operation group to 16 (I4) and apply 4–20mA input current to I4.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	16	I4	0–16	-
In	1	Frequency at maximum analog input	Freq at 100%	60.00		0– Maximum Frequency	Hz
Ao	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 Freq at 100%	Configures the frequency reference for operation at the maximum current (when Ao.27 is set to 100%). • If In.01 is set to 40.00Hz, and default settings are used for Ao.24–27, 20mA input current (max) to I4 will produce a frequency reference of 40.00Hz. • If Ao.27 is set to 50.00 (%), and default settings are used for In.01 (60Hz) and Ao.24–26, 20mA input current (max) to I4 will produce a frequency reference of 30.00Hz (50% of 60Hz).
Ao.22 I4 Monitor	Used to monitor input current at I4.
Ao.23 I4 Filter	Configures the time for the operation frequency to reach 63% of target frequency based on the input current at I4.
In.24 I4 Curr x1– In.27 I4 Perc y2	Configures the gradient level and offset value of the output frequency. Frequency Reference Ao.27 ┈┈┈┈┈┈┈┈┈┈┈┈┈┈┈ Ao.25 Ao.24 Ao.26 I4 Input

SETTING A FREQUENCY REFERENCE WITH INPUT VOLTAGE (TERMINAL I4)

Set and modify a frequency reference using input voltage at I4 (V4) terminal by setting SW2 to V4. Set the Frq (Frequency reference source) code in the Operation group to 15 (V4) and apply 0–12V input voltage to I4 (=V4, Analog current/voltage input terminal). Codes Ao.14–21 will not be displayed when I4 is set to receive current input (Frq code parameter is set to 16).

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	Frq	Frequency reference source	Freq Ref Src	15	V4	0–16	-
Ao	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	%
*Quantizing is disabled if '0' is selected.							

ANALOG OUTPUT

An analog output terminal provides output of 0–10V voltage, 4–20mA current.

VOLTAGE AND CURRENT ANALOG OUTPUT

An output size can be adjusted by selecting an output option at AO3(Analog Output3) terminal. Set the analog voltage/current output terminal setting switch (SW3) to change the output type (voltage/current).

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Ao	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

Code	Description
AO.30 AO3 Mode	Select a constant value for output. The following example for output voltage setting.

	Setting	Function
	0	Frequency	Outputs operation frequency as a standard. 10V output is made from the frequency set at dr.20(Max Freq).
	1	Output Current	10V output is made from 200% of drive rated current (heavy load).
	2	Output Voltage	Sets the outputs based on the drive output voltage. 10V output is made from a set voltage in bA.15 (Rated V). If 0V is set in bA.15, 200V/400V models output 10V based on the actual input voltages (240V and 480V respectively).
	3	DC Link Volt	Outputs drive DC link voltage as a standard. Outputs 10V when the DC link voltage is 410Vdc for 200V models, and 820Vdc for 400V models.
	4	Torque	Outputs the generated torque as a standard. Outputs 10V at 250% of motor rated torque.
	5	Ouput Power	Monitors output wattage. 200% of rated output is the maximum display voltage (10V).
	6	Idse	Outputs the maximum voltage at 200% of no load current.
	7	Iqse	Outputs the maximum voltage at 250% of rated torque current. $$\frac{rated\ torque}{current} = \sqrt{rated\ current^2 - no\ load\ current^2}$$
	8	Target Freq	Outputs set frequency as a standard. Outputs 10V at the maximum frequency (dr.20).
	9	Ramp Freq	Outputs frequency calculated with Acc/Dec function as a standard. May vary with actual output frequency. Outputs 10V.
	12	PID Ref Value	Outputs command value of a PID controller as a standard. Outputs approximately 6.6V at 100%.
	13	PID Fdk Value	Outputs feedback volume of a PID controller as a standard. Outputs approximately 6.6V at 100%.
	14	PID Output	Outputs output value of a PID controller as a standard. Outputs approximately 10V at 100%.
	15	Constant	Outputs OU.05 (AO1 Const %) value as a standard.

Code	Description
AO.31 AO3 Gain, AO.32 AO3 Bias	Adjusts output value and offset. If frequency is selected as an output item, it will operate as shown below. $$AO3 = \frac{Frequency}{MaxFreq} \times AO3\ Gain + AO3\ Bias$$ The graph below illustrates the analog voltage output (AO3) changes depend on Ao.31 (AO3 Gain) and Ao.32 (AO3 Bias) values. Y-axis is analog output voltage (0–10V), and X-axis is % value of the output item. Example, if the maximum frequency set at dr.20 (Max Freq) is 60Hz and the present output frequency is 30Hz, then the x-axis value on the next graph is 50%.
AO.33 AO3 Filter	Set filter time constant on analog output.
AO.34 A013Const %	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 AO3 Monitor	Monitors analog output value. Displays the maximum output voltage as a percentage (%) with 10V as the standard.

DIGITAL OUTPUT

MULTI-FUNCTION OUTPUT TERMINAL AND RELAY SETTINGS

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
OU	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	
	58	Detection frequency band	FDT Band	10.00			Hz
In	65– 74	Px terminal configuration	Px Define	16	Exchange	-	-

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.
OU.41 DO Status	Set output terminal and relay functions according to OU.57 FDT (Frequency), OU.58 (FDT Band) settings and fault trip conditions.

Setting details for OU.41 DO Status:

Setting		Function
0	None	No output signal.
1	FDT-1	Detects drive output frequency reaching the user set frequency. Outputs a signal when the absolute value (set frequency–output frequency) < detected frequency width/2. When detected frequency width is 10Hz, FDT-1 output is as shown in the graph below.
2	FDT-2	Outputs a signal when the user set frequency and detected frequency (FDT Frequency) are equal, and fulfills FDT-1 condition at the same time. [Absolute value (set frequency-detected frequency) < detected frequency width/2]&[FDT-1] Detected frequency width is 10Hz. When the detected frequency is set to 30Hz, FDT-2 output is as shown in the graph below.

Code			Description
OU.41 DO Status	3	FDT-3	Outputs a signal when the Absolute value (output frequency–operation frequency) < detected frequency width/2. Detected frequency width is 10Hz. When detected frequency is set to 30Hz, FDT-3 output is as shown in the graph below. 35Hz 30Hz 25Hz Frequency Q1 Run cmd
	4	FDT-4	Output signal can be separately set for acceleration and deceleration conditions. • In acceleration: Operation frequency ≥ Detected frequency • In deceleration: Operation frequency>(Detected frequency–Detected frequency width/2) Detected frequency width is 10Hz. When detected frequency is set to 30Hz, FDT-4 output is as shown in the graph below. 30Hz 25Hz Frequency Q1 Run cmd
	5	Overload	Outputs a signal at motor overload.
	6	IOL	Outputs a signal when a fault is triggered from a protective function operation by drive overload inverse proportion.
	7	Underload	Outputs a signal at load fault warning.
	8	Fan Warning	Outputs a signal at fan fault warning.
	9	Stall	Outputs a signal when a motor is overloaded and stalled.
	10	Over voltage	Outputs a signal when the drive DC link voltage rises above the protective operation voltage.
	11	Low Voltage	Outputs a signal when the drive DC link voltage drops below the low voltage protective level.
	12	Over Heat	Outputs signal when the drive overheats.
	13	Lost command	Outputs a signal when there is a loss of analog input terminal and RS-485 communication command at the terminal block. Outputs a signal when communication power and expansion an I/O power card is installed, and also outputs a signal when losing analog input and communication power commands.
	14	RUN	Outputs a signal when operation command is entered and the drive outputs voltage. No signal output during DC braking. Frequency Q1 Run cmd
	15	Stop	Outputs a signal at operation command off, and when there is no drive output voltage.
	16	Steady	Outputs a signal in steady operation.
	17	Drive line	Outputs a signal while the motor is driven by the drive line.
	18	Comm line	Outputs a signal while the motor is driven by a commercial power source..
	19	Speed search	Outputs a signal during drive speed search operation.
	22	Ready	Outputs signal when the drive is in stand by operation and ready to receive an external operation command.
	28	Timer Out	A timer function to operate terminal output after a certain time by using multi-function terminal block input..

Code		Description
OU.41 DO Status	29 Trip	Outputs a signal after a fault trip
	31 DB Warn %ED	In case of exceeding DB resistor usage rate, the signal changes to on-state.
	34 On/Off Control	Outputs a signal using an analog input value as a standard.
	35 BR Control	Outputs a brake release signal.

Fault Trip Output using Multi-Function Output Terminal and Relay

The drive can output fault trip state using multi-function output terminal (Q1) and relay (Relay 3, 4).

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
OU	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 OnDly	0.00		0.00–100.00	sec
	54	Fault trip output off delay	TripOut OffDly	0.00		0.00–100.00	sec

Fault Trip Output by Multi-function Output Terminal and Relay - Setting Details

Code	Description			
OU.30 Trip Out Mode	Fault trip relay operates based on the fault trip output settings. Select fault trip output terminal/relay and select 29 (Trip Mode) at codes OU. 34, 35. When a fault trip occurs in the drive, the relevant terminal and relay will operate. Depending on the fault trip type, terminal and relay operation can be configured as shown in the table below.			
	Setting			Function
	bit3	bit2	bit1	
			X	Operates when low voltage fault trips occur
		X		Operates when fault trips other than low voltage occur
	X			Operates when auto restart fails (Pr. 08–09)
OU.34 Relay3	Set relay output (Relay 3).			
OU.35 Relay4	Set relay output (Relay 4).			
OU.53 TripOut On Dly OU.54 TripOut OffDly	If a fault trip occurs, trip relay or multi-function output operates after the time delay set in OU.53. Terminal is off with the input initialized after the time delay set in OU.54.			

### MULTI-FUNCTION OUTPUT TERMINAL DELAY TIME SETTINGS

Set on-delay and off-delay times separately to control the output terminal and relay operation times. The delay time set at codes OU.50–51 applies to multi-function output terminal (Q1), relay (Relay 1, 3, 4), except when the multi-function output function is in fault trip mode.

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
OU	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

On the 7-seg screen of multi-function output contact parameter, clicking of left/right key switches between extension I/O and built-in I/O

Output Terminal Delay Time Setting Details

Code	Description
OU.52 DO NC/NO Sel	Select terminal type for relay and multi-function output terminal. An additional three terminal type selection bits at the terminal block will be added when an expansion I/O is added. By setting the relevant bit to 0, it will operate A terminal (Normally Open), and setting it to 1 will operate B terminal (Normally Closed). Shown below in the table are Relay 1 and Q1 settings starting from the right bit.

OU.51 DO Off Delay

Run cmd
Multi-function output

OU.50 DO On Delay
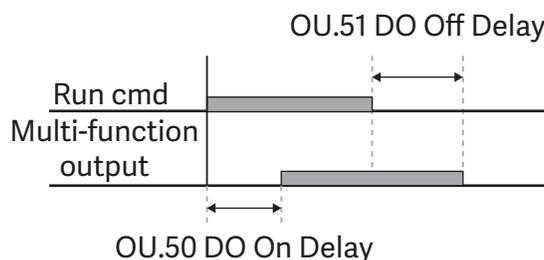
SETTING MULTI-STEP FREQUENCY

Multi-step operations can be carried out by assigning different speeds (or frequencies) to the Px terminals. Step 0 uses the frequency reference source set with the Frq code in the Operation group. Px terminal parameter values 7 (Speed-L), 8 (Speed-M) and 9 (Speed-H) are recognized as binary commands and work in combination with Fx or Rx run commands. The drive operates according to the frequencies set with St.1–3 (multi-step frequency 1–3) , bA.53–56 (multi-step frequency 4–7) and the binary command combinations.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	St1–St3	Multi-step frequency 1–3	Step Freq - 1–3	-		0–Maximum frequency	Hz
bA	53–56	Multi-step frequency 4–7	Step Freq - 4–7	-		0–Maximum frequency	Hz
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 frequency1–3. If an LCD keypad is in use, bA.50–52 is used instead of St1–St3 (multi-step frequency 1–3).
bA.53–56 Step Freq - 4–7	Configure multi-step frequency 4–7.
In.72–74 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). Provided that terminals P3, P4 and P5 have been set to Speed-L, Speed-M and Speed-H respectively, the following multi-step operation will be available. | Speed	Fx/Rx	P5	P4	P3
---	---	---	---	---
0	X	-	-	-
1	X	-	-	X
2	X	-	X	-
3	X	-	X	X
4	X	X	-	-
5	X	X	-	X
6	X	X	X	-
7	X	X	X	X	

Code	Description
In.89 InCheck Time	Set a time interval for the drive 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 drive will search for inputs at other terminals for 100ms, before proceeding to accelerate or decelerate based on P8's configuration.

MULTI-STEP ACC/DEC TIME CONFIGURATION

Acc/Dec times can be configured via a multi-function terminal by setting the ACC (acceleration time) and dEC (deceleration time) codes in the Operation group.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
Operation	ACC	Acceleration time	Acc Time	20.0		0.0–600.0	sec
	dEC	Deceleration time	Dec Time	30.0		0.0–600.0	sec
bA	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	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 Setup via Multi-function Terminals – Setting Details

Code	Description
bA. 70–82 Acc Time 1–7	Set multi-step acceleration time1–7.
bA.71–83 Dec Time 1–7	Set multi-step deceleration time1–7.
In.72–74 Px Define (P8–P10)	Choose and configure the terminals to use for multi-step Acc/Dec time inputs. 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. If, for example, the P8 and P9 terminals are set as XCEL-L and XCEL respectively, the following operation will be available.
In.89 In Check Time	Set the time for the drive to check for other terminal block inputs. If In.89 is set to 100ms and a signal is supplied to the P8 terminal, the drive 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.

Within In.72–74 Px Define (P8–P10):

Configuration	Description	
11	XCEL-L	Acc/Dec command-L
12	XCEL-M	Acc/Dec command-M
49	XCEL-H	Acc/Dec command-H

Acc/Dec time	P5	P4
0	-	-
1	-	X
2	X	-
3	X	X

STOPPING THE ACC/DEC OPERATION

Configure the multi-function input terminals to stop acceleration or deceleration and operate the drive at a fixed frequency.

Group	Code	Name	LCD Display	Parameter Setting		Setting Range	Unit
In	72–74	Px terminal configuration	Px Define(Px: P8– P10)	25	XCEL Stop	0–54	-
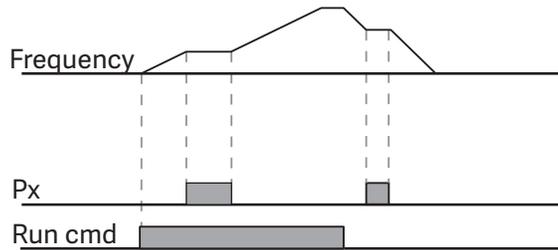
MULTI-FUNCTION INPUT TERMINAL CONTROL

Filter time constants and the type of multi-function input terminals can be configured to improve the response of input terminals

Group	Code	Name	LCD Display	Parameter Setting	Setting Range	Unit
In	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	0 0000*	-	-
	90	Multi-function input terminal status	DI Status	0 0000*	-	-
On the 7-seg screen of multi-function output contact parameter, clicking of left/right key switches between extension I/O and built-in I/O						

Multi-function Input Terminal Control Setting Details

Code	Description
In.85 DI On Delay, In.86 DI Off Delay	If the input terminal's state is not changed during the set time, when the terminal receives an input, it is recognized as On or Off.
In.87 DI NC/NO Sel	Select terminal contact types for each input terminal. The position of the indicator light corresponds to the segment that is on as shown in the table below. With the bottom segment on, it indicates that the terminal is configured as a A terminal (Normally Open) contact. With the top segment on, it indicates that the terminal is configured as a B terminal (Normally Closed) contact. From right to left side, there are P1~P5 terminals. In case of installation of extension I/O, P8/P9/P10 terminals are added.

Source	B terminal status (Normally Closed)	A terminal status (Normally Open)
Keypad		
LCD keypad		

Code	Description
In.90 DI Status	Display the configuration of each contact. When a segment is configured as A terminal using dr.87, the On condition is indicated by the top segment turning on. The Off condition is indicated when the bottom segment is turned on. When contacts are configured as B terminals, the segment lights behave conversely. From right to left side, there are P1~P5 terminals. In case of installation of extension I/O, P8/P9/P10 terminals are added.

Source	A terminal setting (On)	A terminal setting (Off)
Keypad		
LCD keypad		