⚠ WARNING

Electrical Shock Prevention

1. Do not remove the front cover when input power is applied. Doing so can result in electric shock.
2. Do not operate the inverter with the front cover removed. Electric shock can occur due to the exposed high voltage terminals and capacitor.
3. Do not remove the cover except for routine inspections or wiring, even if the input power is not applied. The capacitor will remain charged for a long time even when the power is not applied.
4. Wiring and routine checkups should be performed 10 minutes after disconnecting the input power and after checking to see whether the DC voltage is discharged with a tester. (Below DC 30V)
5. Do not use a higher grounding method than the Type 3 grounding method.
6. Only authorized personnel may perform wiring and inspections.
7. Wire the inverter after the inverter installation.
8. Do not operate the switches with wet hands. Doing so may result in electrical shock.
9. Electrical shock may occur if the cable insulation is damaged. Insure proper mounting of equipment to minimize excess stress on power cables.

⚠ CAUTION

Fire Prevention

1. Install the inverter on a non-combustible surface. Installing the inverter on or near combustible materials can result in fire.
2. Disconnect the inverter when the inverter is damaged. Failure to do so could lead to a secondary accident and fire.
3. Do not connect a resistance directly between the DC terminals P. N. Doing so can result in fire.

Damage Prevention

1. Do not apply voltages higher than the values specified in this manual to the terminals. Doing so can damage the inverter.
2. Incorrect terminal connection may damage the inverter.
3. Incorrectly connecting the polarity (+/-) of the terminals can damage the inverter.
4. After disconnecting, the inverter may still be hot. Use caution to prevent the possibility of personal injury.

Other Important Precautions

Pay attention to the following items. Failure to do so can result in damage of inverter and/or electrical shock.

▶ Handling and installation

1. Handle according to the weight of product. Failure to do so can result in damage to product.
2. Do not stack inverters beyond listed specifications.
3. Install according to specifications listed within this manual.
4. Do not apply power to a damaged inverter or to an inverter with missing components.
5. Do not open front cover while carrying inverter.
6. Do not place heavy items on inverter.
7. Installation orientation must follow specifications listed within this manual.
8. Do not allow conducted material such as screws, metal objects, water, or oil to enter interior of inverter.
9. Do not drop or inflict intense impact to inverter.
10. Install and operate inverter only under specified conditions.

▶ Wiring

1. Do not connect Power Factor capacitors, surge suppressors, or RFI filters to output circuits.
2. Connect the output terminals (U, V, W) according to specifications.

▶ Operation

1. CAUTION: When the retry function is selected the inverter restarts after an alarm stop.
2. Stop key on keypad can only be used when stop key function is set. Install separate emergency stop switch if required.
3. When run signal is received, inverter restarts only when alarm contents have been reset. Verify run signal before resetting alarm.
4. Do not start or stop inverter using electromagnetic switch installed in power input circuit.
5. Do not modify or alter anything inside inverter.
6. CAUTION: Motor might not be protected by electronic thermal function of inverter.
7. Install noise filter to minimize potential noise interference on equipment installed near inverter.
8. In case of input voltage unbalance, install AC reactor. Power Factor capacitors and generators may become overheated and damaged due to potential high frequency noise transmitted from inverter.
9. Use an insulation-rectified motor or take measures to suppress the micro surge voltage when driving 400V class motor with inverter. A micro surge voltage attributable to wiring constant is generated at motor terminals, and may deteriorate insulation and damage motor
10. Before operating unit and prior to user programming, reset user parameters to default settings
11. Inverter can easily be set to high-speed operations, Verify capability of motor or machinery prior to operating unit.
12. Stopping torque is not produced when using the DC-Break function. Install separate equipment when stopping torque is needed.

▶ Fault Prevention Precautions

Install additional safety equipment, such as emergency brakes, to prevent uncontrolled machine operation from a damaged inverter.

▶ Maintenance, Inspection, and Exchanging Components

1. Do not conduct megger test (insulation resistance measurement) of control circuitry in inverter.
2. Refer to Chapter 7 for routine inspection methods.

▶ General Precautions

The diagrams in this manual may show removed inverter covers and removed circuit breakers. Prior to operating unit, be sure to restore covers and circuit breakers according to specifications.

CONTENTS

USER SELECTION GUIDE (iS5 SPECIFICATIONS)

230V Class (1 ~ 30HP)

Model Number (SV xxx iS5 - 2)		008	015	022	037	055	075	110	150	185	220
Motor Rating[1]	HP	1	2	3	5	7.5	10	15	20	25	30
	kW	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
Output Ratings	Capacity[2] [kVA]	1.9	3.0	4.5	6.1	9.1	12.2	17.5	22.9	28.2	33.5
	FLA [A]	5	8	12	16	24	32	46	60	74	88
	Frequency	0 ~ 400 Hz									
	Voltage	200 ~ 230 V [3]									
Input Ratings	Voltage	3 Phase, 200 ~ 230 V (± 10 %)									
	Frequency	50 ~ 60 Hz (±5 %)									
Dynamic Braking[4]	Braking Circuit	On Board		On Board		On Board		Optional (Braking Unit, Resistor)			
	Average Braking Torque	100%		100%		100%		150%			
	Max. Continuous Baking Time	5 seconds		5 seconds		5 seconds		Controlled by Braking Unit			
	Max. Duty	30 % ED		30 % ED		30 % ED		10 % ED			
Weight [lbs]		10.1	10.1	10.6	10.8	16.5	17.0	30.4	31.5	42.8	44.1

460V Class (1 ~ 30HP)

Model Number (SV xxx iS5 - 4)		008	015	022	037	055	075	110	150	185	220
Motor Rating[1]	HP	1	2	3	5	7.5	10	15	20	25	30
	kW	0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22
Output Ratings	Capacity[2] [kVA]	1.9	3.0	4.5	6.1	9.1	12.2	18.3	22.9	29.7	34.3
	FLA [A]	2.5	4	6	8	12	16	24	30	39	45
	Frequency	0 ~ 400 Hz									
	Voltage	380 ~ 460 V [3]									
Input Ratings	Voltage	3 Phase, 380 ~ 460 V (± 10 %)									
	Frequency	50 ~ 60 Hz (±5 %)									
Dynamic Braking[4]	Braking Circuit	On Board		On Board		On Board		Optional (Braking Unit, Resistor)			
	Max. Braking Torque	100%		100%		100%		150%			
	Max. Continuous Baking Time	5 seconds		5 seconds		5 seconds		Controlled by Braking Unit			
	Max. Duty	30 (3) % ED		30 (2) % ED		30 % ED		10 % ED			
Weight [lbs]		10.4	10.4	10.6	10.8	17.0	17.0	30.6	31.7	44.1	44.1

[1] Indicates the maximum applicable capacity when using a 4 Pole motor.

[2] Rated capacity (û3*V*I) is based on 220V for 200V class and 440V for 400V class.

[3] Maximum output voltage will not be greater than the input voltage. Output voltage less than the input voltage may be programmed.

[4] 1~5 HP inverters have internal braking resistors as standard. 7.5~10 HP inverters utilize optional braking resistors.

CONTROL	Control Method			V/F Control, Sensorless Vector Control (Selectable)
	Frequency Setting Resolution			Digital Reference: 0.01 Hz (Below 100 Hz), 0.1 Hz (Over 100 Hz) Analog Reference: 0.03 Hz / 60 Hz
	Frequency Accuracy			Digital: 0.01 % of Max. Output Frequency Analog: 0.1 % of Max. Output Frequency
	V/F Ratio			Linear, Squared Pattern, User V/F
	Overload Capacity			150 % of Rated Current for 1 Min., 200% of Rated Current for 0.5 sec. (Characteristic is Inversely Proportional to Time)
	Torque Boost			Manual Torque Boost (0 ~ 20 %), Auto Torque Boost
OPERATION	Input Signal	Operation Method		Key / Terminal / Communication Operation
		Frequency Setting		Analog: 0 ~ 10V / 4 ~ 20mA / Additional port for Sub-Board (0 ~ 10V) Digital: Keypad
		Start Signal		Forward, Reverse
		Multi-Step		Up to 8 Speeds can be Set (Use Multi-Function Terminal)
		Multi Step Accel/Decel Time		0 ~ 6,000 sec, Up to 4 Types can be Set and Selected for Each Setting (Use Multi-Function Terminal) Accel/Decel Pattern: Linear, U-Curve, S-Curve
		Emergency Stop		Interrupts the Output of Inverter
		Jog		Jog Operation
		Auto Operation		Operates from Internal Sequence by Setting Multi-Function Terminal (5 Way * 8 Step)
		Fault Reset		Trip Status is Removed when Protection Function is Active
	Output Signal	Operating Status		Frequency Detection Level, Overload Alarm, Stalling, Over Voltage, Under Voltage, Inverter Overheating, Running, Stop, Constant Speed, Inverter By-Pass, Speed Searching, Auto-Operation Step, Auto-Operation Sequence
		Fault Output		Contact Output (30A, 30C, 30B) – AC250V 1A, DC30V 1A
		Indicator		Choose 1 from Output Frequency, Output Current, Output Voltage, DC Voltage (Output Pulse: 500Hz, Output Voltage: 0 ~ 10V)
	Operation Function			DC Braking, Frequency Limit, Frequency Jump, Second Function, Slip Compensation, Reverse Rotation Prevention, Auto Restart, Inverter By-Pass, Auto-Tuning, PID Control
Protective Function	Inverter Trip			Over Voltage, Under Voltage, Over Current, Fuse Open, Ground Fault, Inverter Overheating, Motor Overheating, Output Phase Open, Overload Protection, External Fault 1, 2, Communication Error, Loss of Speed Command, Hardware Fault, Option Fault etc.
	Inverter Alarm			Stall Prevention, Overload Alarm, Temperature Sensor Fault
	Momentary Power Loss			Less than 15msec: Continuous Operation, More than 15msec: Auto Restart Possible
Display	Keypad	Operation Information		Output Frequency, Output Current, Output Voltage, Frequency Value Setting, Operating Speed, DC Voltage
		Trip Information		Indicates a Fault when the Protection Function activates, Retains Up to 5 Faults
Environment	Ambient Temperature			-10 °C ~ 40 °C (14 °F ~ 104 °F)
	Storage Temperature			-20 °C ~ 65 °C (-4 °F ~ 149 °F)
	Ambient Humidity			90 % RH Max.(Non-Condensing)
	Altitude - Vibration			Below 1,000m or 3,300ft · Below 5.9m/sec^2 (=0.6g)
	Application Site			No Corrosive Gas, Combustible Gas, Oil Mist, or Dust
Cooling Method				Forced Air Cooling

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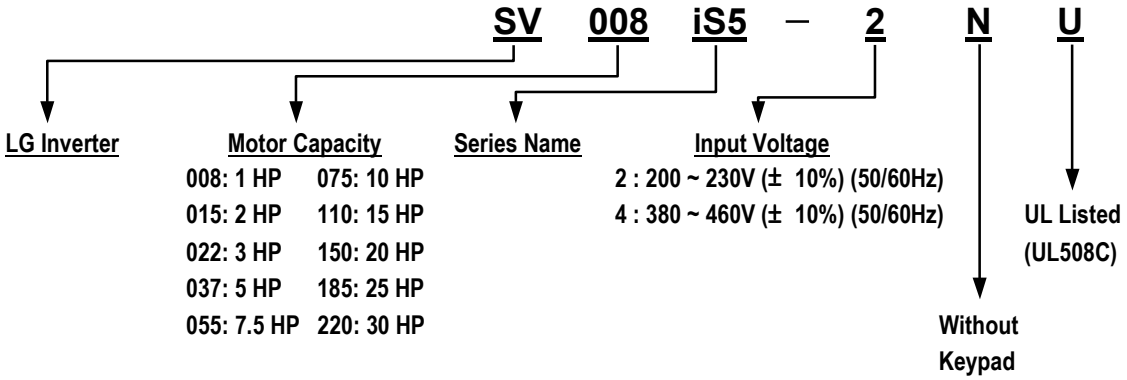
CHAPTER 1 - INSTALLATION

1.1 Inspection

- ✓ Inspect the inverter for any damage that may have occurred during shipping.
- ✓ Check the nameplate on the inverter. Verify the inverter unit is the correct one for the application. The numbering system for the inverter is as shown below.

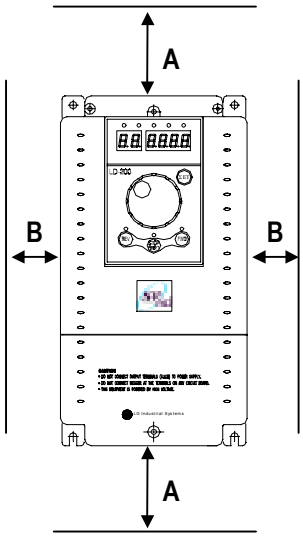


1.2 Environmental Conditions

- ✓ Verify ambient condition for the mounting location.
  - Ambient temperature should not be below 14ºF (-10ºC) or exceed 104ºF (40ºC).
  - Relative humidity should be less than 90% (non-condensing).
  - Altitude should be below 3,300ft (1,000m).
- ✓ Do not mount the inverter in direct sunlight and isolate it from excessive vibration.

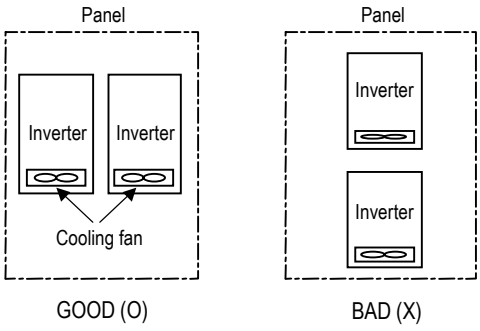
1.3 Mounting

- ✓ The inverter must be mounted vertically with sufficient horizontal and vertical space between adjacent equipment (A= Over 6" (150mm), B= Over 2" (50mm)).

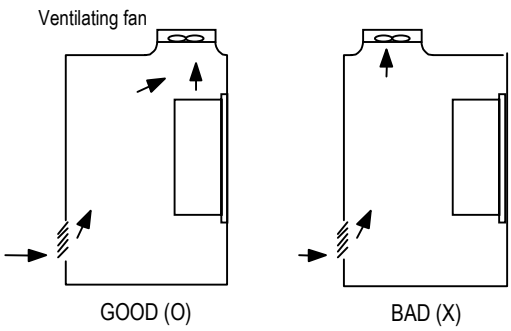


1.4 Other Precautions

- ✓ Do not carry the inverter by the front cover.
- ✓ Do not install the inverter in a location where excessive vibration is present. Be cautious when installing on presses or moving equipment.
- ✓ The life span of the inverter is greatly affected by the ambient temperature. Install in a location where temperature are within permissible limits (- 10 ~ 40 ℃).
- ✓ The inverter operates at high-temperatures - install on a non-combustible surface.
- ✓ Do not install the inverter in high-temperature or high-humidity locations.
- ✓ Do not install the inverter in a location where oil mist, combustible gas, or dust is present. Install the inverter in a clean location or in an enclosed panel, free of foreign substance.
- ✓ When installing the inverter inside a panel with multiple inverters or a ventilation fan, use caution. If installed incorrectly, the ambient temperature may exceed specified limits.



[When installing several inverters in a panel]

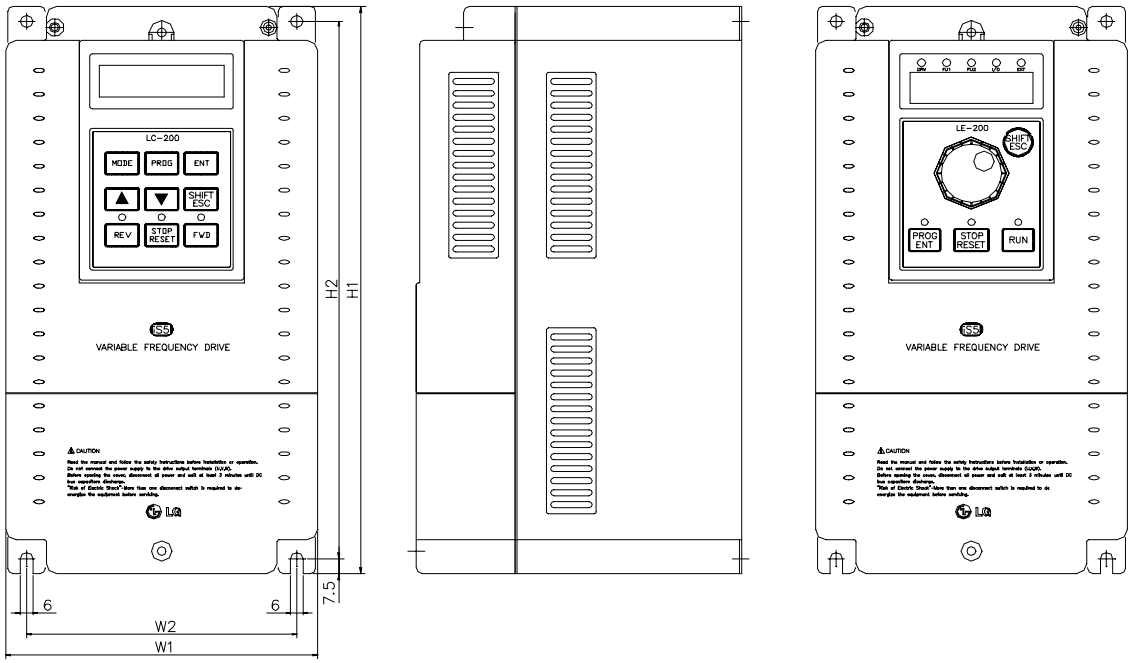


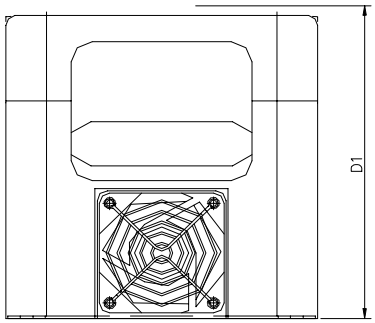
[When installing a ventilating fan in a panel]

- ✓ Install the inverter using screws or bolts to insure the inverter is firmly fastened.

1.5 Dimensions

- **Frame # 1**: 1 ~ 5 HP
- **Frame # 2**: 7.5 ~ 10 HP

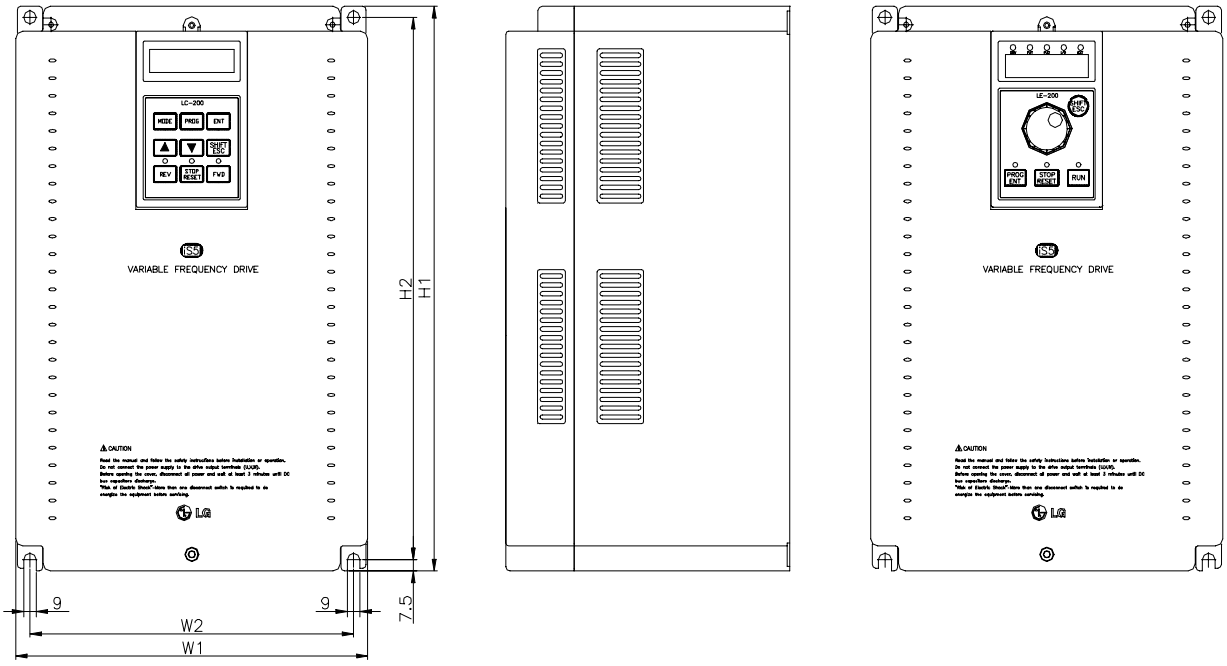


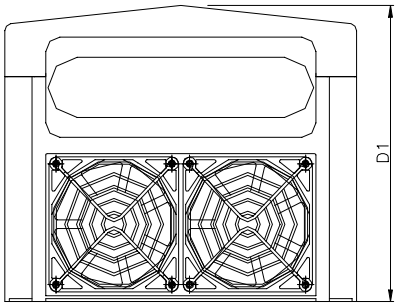


mm (inches)

Frame	HP	Model Number	W1	W2	H1	H2	D1
Frame # 1	1	SV008iS5-2/4	150 (5.91)	130 (5.12)	284 (11.18)	269 (10.69)	156.5 (6.16)
	2	SV015iS5-2/4					
	3	SV022iS5-2/4					
	5	SV037iS5-2/4					
Frame # 2	7.5	SV055iS5-2/4	200 (7.87)	180 (7.09)	355 (13.98)	340 (13.39)	182.5 (7.19)
	10	SV075iS5-2/4					

- **Frame # 3**: 15 ~ 20 HP
- **Frame # 4**: 25 ~ 30 HP

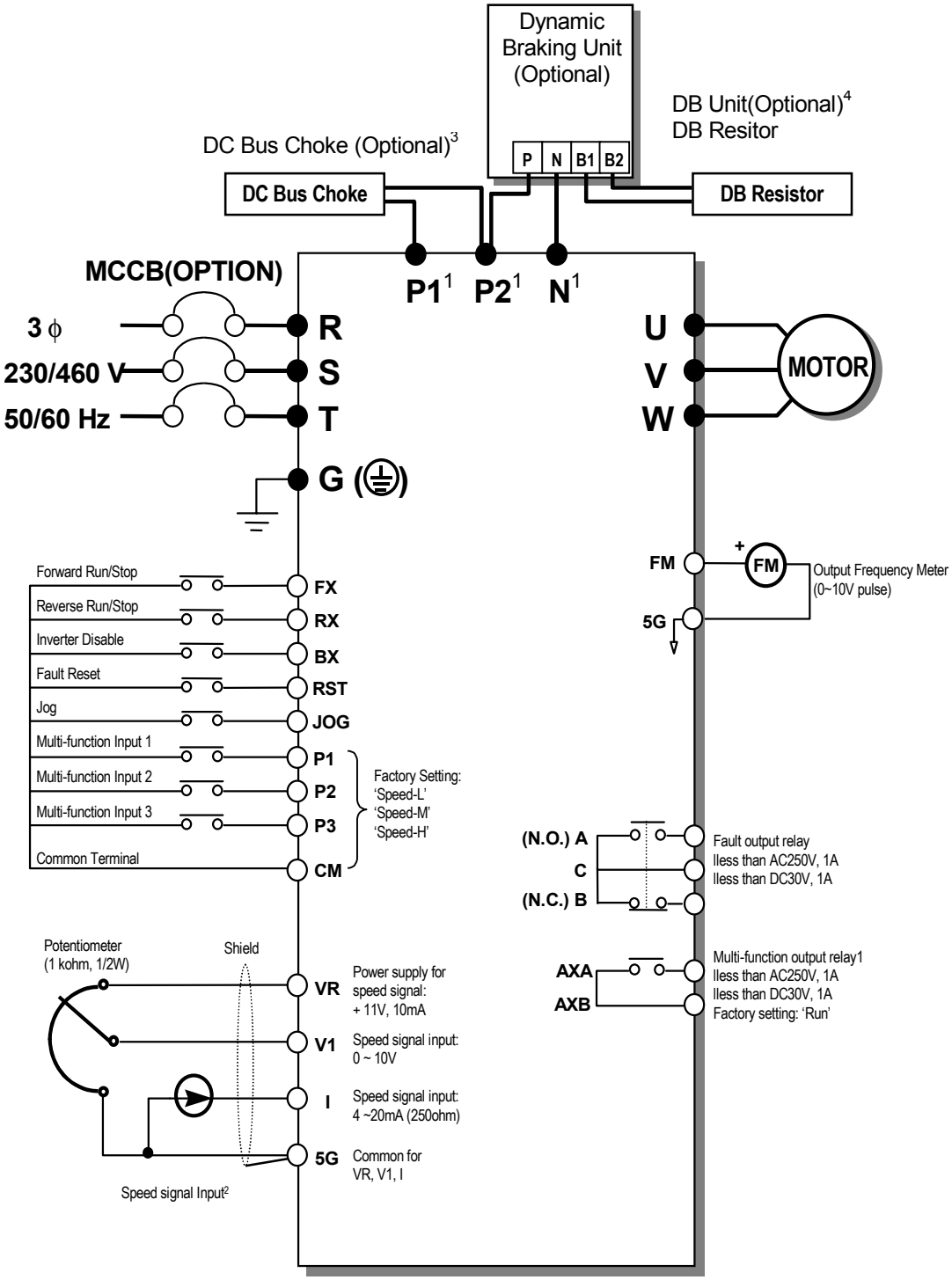




mm (inches)

Frame	HP	Model Number	W1	W2	H1	H2	D1
Frame # 3	15	SV110iS5-2/4	250 (9.84)	230 (9.06)	385 (15.16)	370 (14.57)	201 (7.91)
	20	SV150iS5-2/4					
Frame # 4	25	SV185iS5-2/4	304 (11.97)	284 (11.18)	460 (18.11)	445 (17.52)	234 (9.21)
	30	SV220iS5-2/4					

1.6 Basic Wiring



Note) ● Main Circuit Terminals ○ Control Circuit Terminals.

1. The terminal configuration varies depend on the model number. Please refer to the '1.7 Power terminals'.
2. Analog speed command may be set by Voltage, Current or both.
3. When installing the DC Reactor, the Common Busbar between P1 and P2 must be removed.
4. 1 ~ 10 HP inverters have on-board braking circuit. Braking resistors are only included for 1 ~ 5 inverters.
   15 ~ 30 HP inverters need optional braking unit and resistor for dynamic braking.

1.7 Power Terminals

- **Type A Configuration: 1 ~ 5 HP** (SV008iS5-2, SV015iS5-2, SV022iS5-2, SV037iS5-2, SV008iS5-4, SV015iS5-4, SV022iS5-4, SV037iS5-4)

- **Type B Configuration: 7.5 ~ 10 HP** (SV055iS5-2, SV075iS5-2, SV055iS5-4, SV075iS5-4)

- **Type C Configuration: 15 ~ 30 HP** (SV110iS5-2, SV150iS5-2, SV185iS5-2, SV220iS5-2, SV110iS5-4, SV150iS5-4, SV185iS5-4, SV220iS5-4)

Symbols	Functions
R	AC Line Voltage Input (3 Phase, 200 ~ 230VAC or 380 ~ 460VAC)
S	
T	
G	Earth Ground
P	*Positive DC Bus Terminal* DB Unit (P-P[5]) Connection Terminals (DB Unit may be added when more braking duty (More than 30%ED) is required)
P1	External DC Reactor (P1-P2) and DB Unit (P2-P[5]) Connection Terminals
P2	
N	*Negative DC Bus Terminal* DB Unit (N-N[6]) Connection Terminal
B1	Dynamic Braking Resistor (B1-B2) Terminals
B2	
U	3-Phase Power Output Terminals to Motor (3 Phase, 200 ~ 230VAC or 380 ~ 460VAC)
V	
W	

[5] This P terminal is provided on optional Dynamic Braking Unit.

[6] This N terminal is provided on optional Dynamic Braking Unit.

1.7.1 Type A Configuration

As standard on the iS5 inverter, this type of configuration has internal dynamic braking resistor of 3% ED. When an application requires more braking duty, an external dynamic braking resistor may be connected instead of the internal resistor.

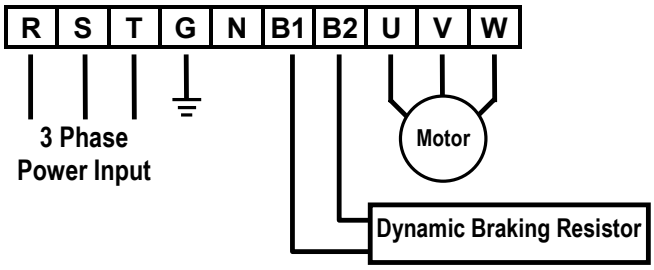


Figure 1 – Type A Dynamic Braking Resistor Installation

1.7.2 Type B Configuration

A Dynamic Braking Resistor or a Dynamic Braking Unit may be added to iS5 series inverters that have a Type B configuration power terminal strip. As standard, this type of configuration has in

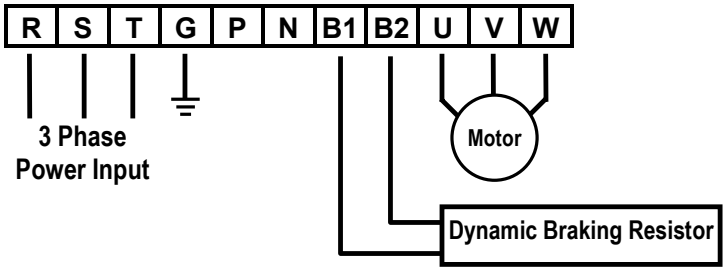


Figure 2 – Type B Dynamic Braking Resistor Installation

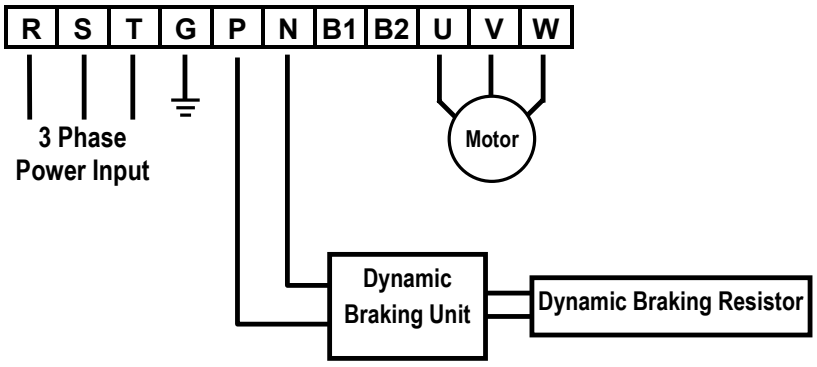


Figure 3 – Type B Additional Dynamic Braking Unit and Resistor Installation

1.7.3 Type C Configuration

A Dynamic Braking Unit or a DC Bus Choke or both of them may be added to iS5 series inverters that have a Type A Configuration power terminal strip.

⚠ Jumper Between P1 and P2 Must Be Removed In Order To Install a DC Bus Choke.

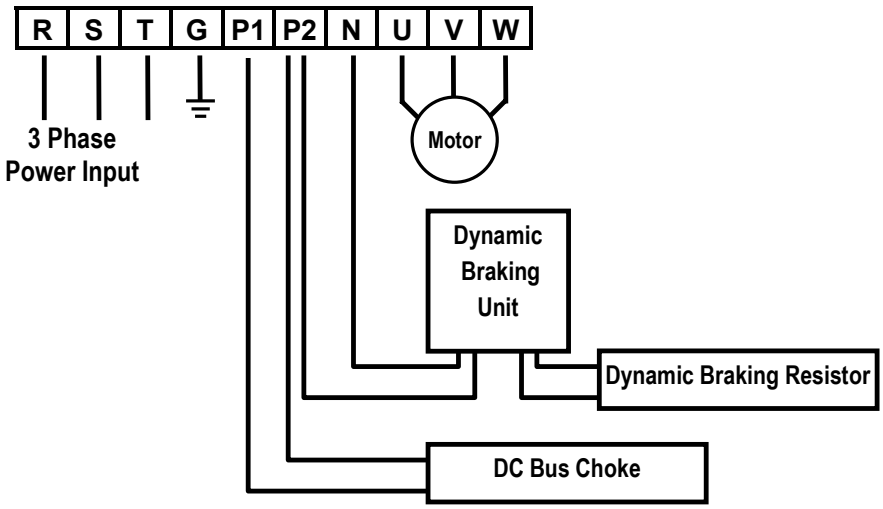


Figure 4 – Type C Dynamic Braking Unit, DC Bus Choke Installation

⚠ WARNING

Normal stray capacitance between the inverter chassis and the power devices inside the inverter and AC line can provide a high impedance shock hazard. Refrain from applying power to the inverter if the inverter frame (Power terminal G) is not grounded.

1.7.4 Wiring Power Terminals

■ **Wiring Precautions**

- ✓ The internal circuits of the inverter will be damaged if the incoming power is connected and applied to output terminals (U, V, W).
- ✓ Use ring terminals with insulated caps when wiring the input power and motor wiring.
- ✓ Do not leave wire fragments inside the inverter. Wire fragments can cause faults, breakdowns, and malfunctions.
- ✓ For input and output, use wires with sufficient size to ensure voltage drop of less than 2%. Motor torque may drop of operating at low frequencies and a long wire run between inverter and motor.
- ✓ Do not use a 3-wire cable for long distances. Due to increased leakage capacitance between wires, over-current protective feature may operate or equipment connected to the output side may malfunction.
- ✓ Never short between B1 and B2 terminals of the inverter.
- ✓ The main circuit of the inverter contains high frequency noise, and can hinder communication equipment near the inverter. To reduce noise, install line noise filters on the input side of the inverter.
- ✓ Do not use power factor capacitor, surge killers, or RFI filters on the output side of the inverter. Doing so may damage these components.
- ✓ Always check whether the LCD and the charge lamp for the power terminal are OFF before wiring terminals. The charge capacitor may hold high-voltage even after the power is disconnected. Use caution to prevent the possibility of personal injury.

■ **Grounding**

- ✓ The inverter is a high switching device, and leakage current may flow. Ground the inverter to avoid electrical shock. Use caution to prevent the possibility of personal injury.
- ✓ Connect only to the dedicated ground terminal of the inverter. Do not use the case or the chassis screw for grounding.
- ✓ When installing, grounding wire should be connected first and removed last.
- ✓ Grounding wire should be at least the size listed in the following table and be as short as possible.

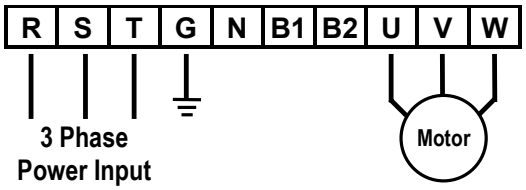
Inverter Capacity	Grounding wire dimensions, AWG (mm²)	
	200V class	400Vclass
Below 5 HP	12 ((3.5)	14 (2)
7.5 ~ 10 HP	10 (5.5)	12 (3.5)
15 ~ 20 HP	6 (14)	8 (8)
25 ~ 30 HP	4 (22)	6 (14)

■ Wires and Terminal Lugs

Refer to the following table for wires, terminal lugs, and screws used to connect the inverter power input (R, S, T) and output (U, V, W).

Inverter Capacity		Terminal Screw Size	Screw Torque[7] (Kgf·cm)	Ring Terminals		Wire[8]			
						mm²		AWG	
				R,S,T	U,V,W	R,S,T	U,V,W	R,S,T	U,V,W
200V Class	1 ~ 3 HP	M3.5	15	2-4	2-4	2	2	14	14
	5 HP	M3.5	15	2-4	2-4	3.5	3.5	12	12
	7.5 HP	M4	15	5.5-5	5.5-5	5.5	5.5	10	10
	10 HP	M4	15	14-5	8-5	14	8	6	8
	15 HP	M5	26	14-5	14-5	14	14	6	6
	20 HP	M5	26	22-6	22-6	22	22	4	4
	25 HP	M6	45	38-8	38-8	30	30	2	2
	30 HP	M6	45	38-8	38-8	38	30	2	2
400V Class	1 ~ 5 HP	M3.5	15	2-4	2-4	2	2	14	14
	7.5 HP	M4	15	5.5-5	5.5-5	3.5	2	12	14
	10 HP	M4	15	14-5	8-5	3.5	3.5	12	12
	15 HP	M5	26	14-5	14-5	5.5	5.5	10	10
	20 HP	M5	26	22-6	22-6	14	8	6	8
	25 HP	M6	45	38-8	38-8	14	8	6	8
	30 HP	M6	45	38-8	38-8	22	14	4	6

■ Power and Motor Connection



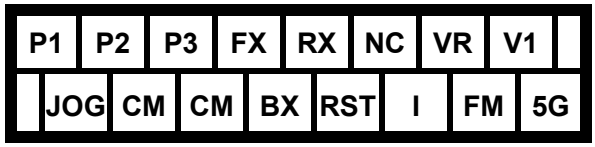
Power supply must be connected to the R, S, and T terminals.
Connecting it to the U, V, and W terminals causes internal damages to the inverter. Arranging the phase sequence is not necessary.

Motor should be connected to the U, V, and W terminals.
If the forward command (FX) is on, the motor should rotate counter clockwise when viewed from the load side of the motor. If the motor rotates in the reverse, switch the U and V terminals.

[7] Apply the rated torque to terminal screws. Loose screws can cause of short circuit or malfunction. Tightening the screws too much can damage the terminals and cause a short circuit or malfunction.

[8] Use copper wires with 600V, 75℃ ratings for wiring.

1.8 Control Terminals



Type		Symbol	Name	Description
Input signal	Starting Contact Function Select	P1, P2, P3	Multi-Function input 1, 2, 3	Used for Multi-Function Input Terminal. (Factory default is set to "Step Frequency 1, 2, 3".)
		FX	Forward Run Command	Forward Run When Closed and Stopped When Open.
		RX	Reverse Run Command	Reverse Run When Closed and Stopped When Open.
		JOG	Jog Frequency Reference	Runs at Jog Frequency when the Jog Signal is ON. The Direction is set by the FX (or RX) Signal.
		BX	Emergency Stop	When the BX Signal is ON the Output of the Inverter is Turned Off. When Motor uses an Electrical Brake to Stop, BX is used to Turn Off the Output Signal. When BX Signal is OFF (Not Turned Off by Latching) and FX Signal (or RX Signal) is ON, Motor continues to Run. ⚠
		RST	Fault Reset	Used for Fault Reset.
		CM	Sequence Common	Common Terminal for Contact Inputs.
	Analog frequency setting	NC	-	Not Used.
		VR	Frequency Setting Power (+10V)	Used as Power for Analog Frequency Setting. Maximum Output is +12V, 100mA.
		V1	Frequency Reference (Voltage)	Used for 0-10V Input Frequency Reference. Input Resistance is 20 KΩ
		I	Frequency Reference (Current)	Used for 4-20mA Input Frequency Reference. Input Resistance is 250 Ω
		5G	Frequency Setting Common Terminal	Common Terminal for Analog Frequency Reference Signal and FM (For Monitoring).
Output signal	Pulse	FM	PWM Output (For External Monitoring)	Outputs One of the Following: Output Frequency, Output Current, Output Voltage, DC Link Voltage. Default is set to Output Frequency. Maximum Output Voltage and Output Current are 0-12V and 1mA. Output Frequency is Set at 500Hz.
	Contact	30A 30C 30B	Fault Contact Output	Activates when Protective Function is Operating. AC250V, 1A or less; DC30V, 1A or less. Fault: 30A-30C Closed (30B-30C Open) Normal: 30B-30C Closed (30A-30C Open)
		AXA, AXC	Multi-Function Output Relay	Use after Defining Multi-Function Output Terminal. AC250V, 1A or less; DC30V, 1A or less.
Comm.		CN3	Communication Port	Keypad Connection Port.

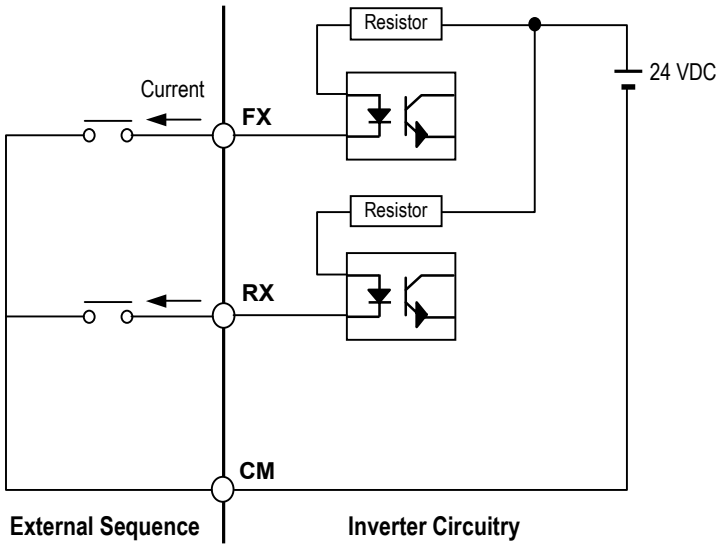
1.8.1 Wiring Control Terminals

■ **Wiring Precautions**

- ✓ CM and 5G terminals are insulated to each other. Do not connect these terminals with each other and do not connect these terminals to the power ground.
- ✓ Use shielded wires or twisted wires for control circuit wiring, and separate these wires from the main power circuits and other high voltage circuits.
- ✓ Use 1.25mm² (22AWG) stranded cables for control terminal connection.

■ **Control Circuit Terminal**

The control input terminal of the control circuit is ON when the circuit is configured to the current flows out of the terminal, as shown in the following illustration. CM terminal is the common terminal for the contact input signals.

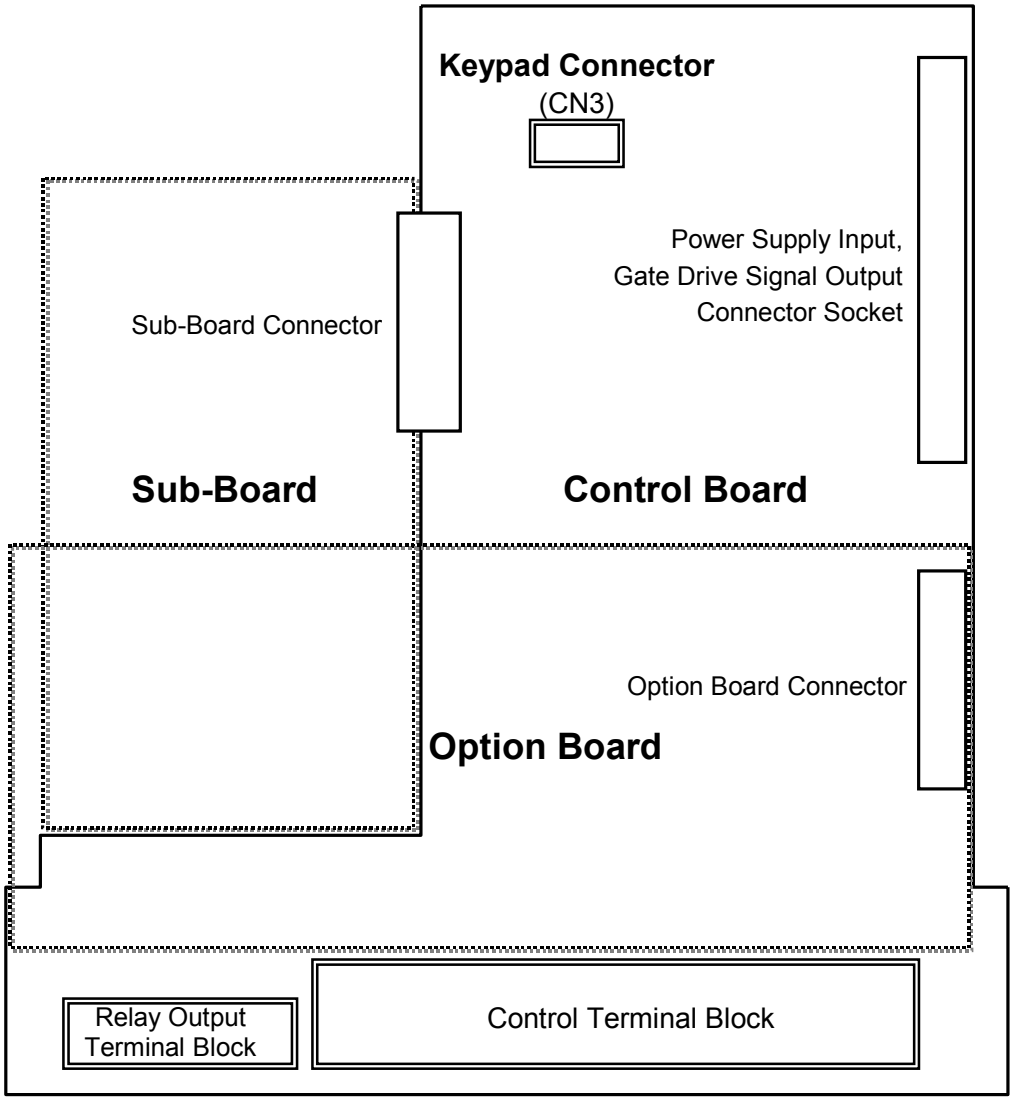


⚠ CAUTION

Do not apply voltage to any control input terminals (FX, RX, P1, P2, P3, JOG, BX, RST, CM).

1.8.2 Keypad Connection

Connect keypad to the keypad connector as illustrated below. The LCD output will not be displayed on the keypad if the keypad is not connected properly.



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CHAPTER 2 - OPERATION

The iS5 series inverter has seven parameter groups separated according to their applications as indicated in the following table.
The iS5 series inverter provides two kinds of keypad. One is of 32-character alphanumeric LCD keypad and the other is of 7-Segment LED keypad.

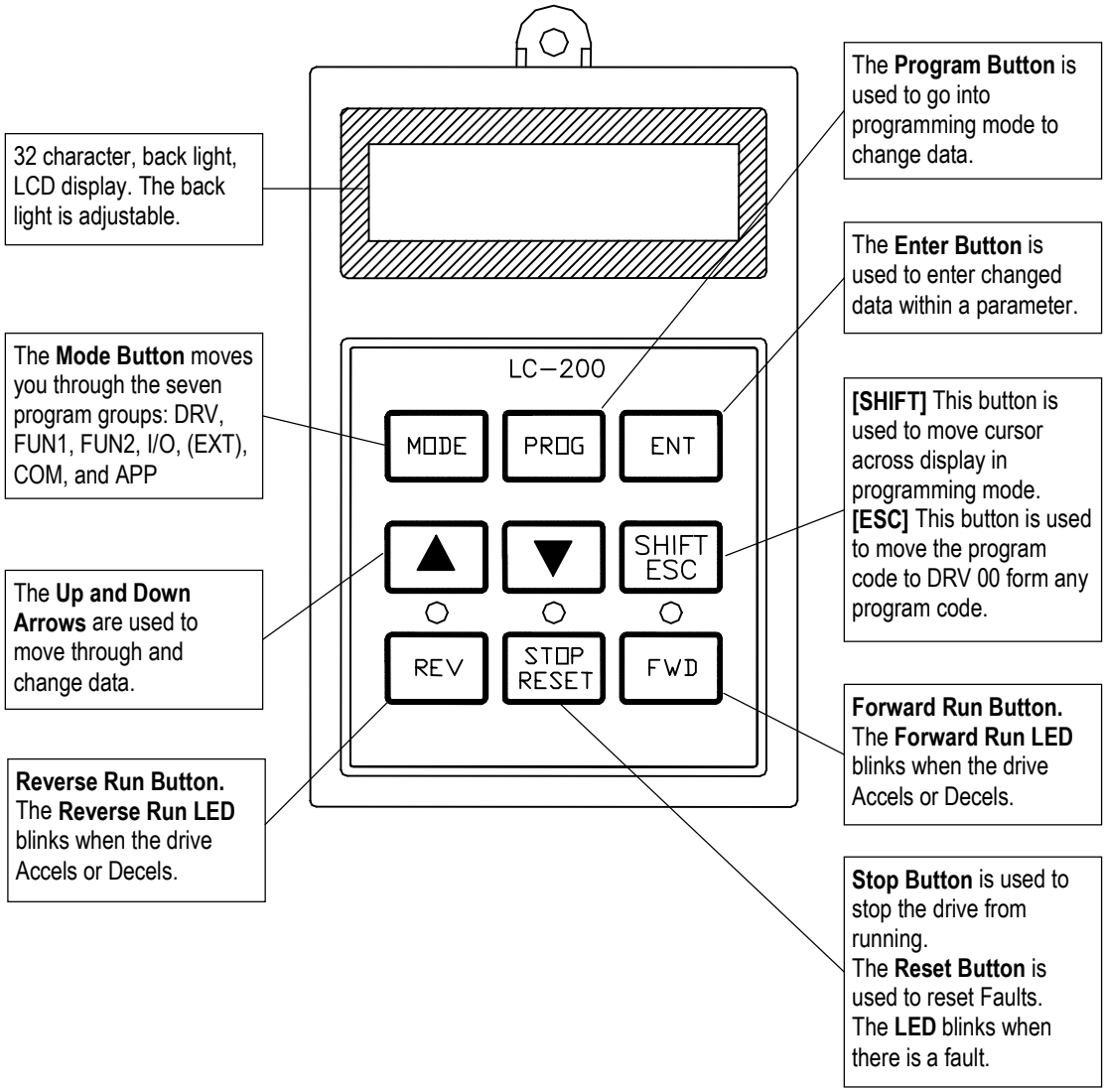
2.1 Parameter Groups

Parameter Group	LCD Keypad (Upper left Corner)	7-segment Keypad (LED is lit)	Description
Drive Group	DRV	'DRV' LED	Command Frequency, Accel/Decel Time etc. Basic Parameters
Function 1 Group	FU1	'FU1' LED	Max. Frequency, Amount of Torque Boost etc. Basic Related Parameters
Function 2 Group	FU2	'FU2' LED	Frequency Jumps, Max./Min. Frequency Limit etc. Basic Application Related Parameters
Input / Output Group	I/O	'I/O' LED	Multi-Function Terminal Setting, Auto Operation etc. Parameters needed for Sequence Operation
Sub-Board Group	EXT	'EXT' LED	Displayed when Sub-Board is Installed.
Option Group	COM	'I/O' + 'EXT' LED	Displayed when Option Board is Installed.
Application Group	APP	'FU2' + 'I/O' + 'EXT' LED	Traverse, MMC (Multi-Motor Control), Draw etc. Application Related Parameters

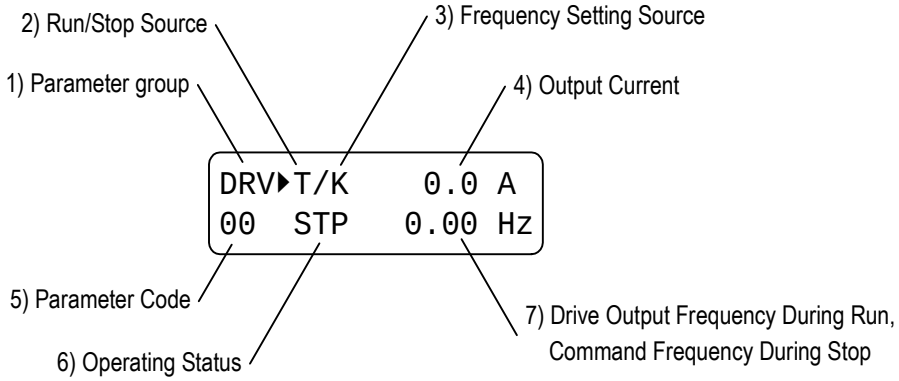
Refer to the function descriptions in chapter 5 for detailed description of each group.

2.2 LCD Keypad

LCD keypad can display up to 32 alphanumeric characters, and various settings can be checked directly from the display. The following is an illustration of the keypad.



2.2.1 LCD Keypad Display



Displays	Description
1) Parameter Group	Displays the parameter group. There are DRV, FU1, FU2, I/O, EXT, COM, APP groups.
2) Run/Stop Source	Displays the source of motor Run and Stop **K**: Run/Stop using FWD, REV buttons on keypad **T**: Run/Stop using control terminal input FX, RX **O**: Run/Stop via option board
3) Frequency Setting Source	Displays the source of command frequency setting **K**: Frequency setting using keypad **V**: Frequency setting using V1 (0 ~10V) or V1 + I terminal **I:** Frequency setting using I (4 ~ 20mA) terminal **U**: Up terminal input when Up/Down operation is selected **D**: Down terminal input when Up/Down operation is selected **S**: Stop status when Up/Down operation is selected **O**: Frequency setting via Option board **X**: Frequency setting via Sub board **J**: Jog terminal input **1 ~ 8**: Step frequency operation ** During Auto operation, 2) and 3) display the 'sequence number/step'.*
4) Output Current	Displays the Output Current during operation.
5) Parameter Code	Displays the code of a group. Use the ▲ (Up), ▼ (Down) key to move through 0~99 codes.
6) Operating Status	Displays the operation information. **STP**: Stop Status **FWD**: During Forward operation **REV**: During Reverse operation **DCB**: During DC Braking **LOP**: Loss of Reference from Option Board (DPRAM fault) **LOR**: Loss of Reference from Option Board (Communication network fault) **LOV**: Loss of Analog Frequency Reference (V1: 0~10V) **LOI**: Loss of Analog Frequency Reference (I: 4~20mA) **LOS**: Loss of Reference from Sub-Board
7) Drive Output Frequency Command Frequency	Displays the Output Frequency during run. Displays the Command Frequency during stop.

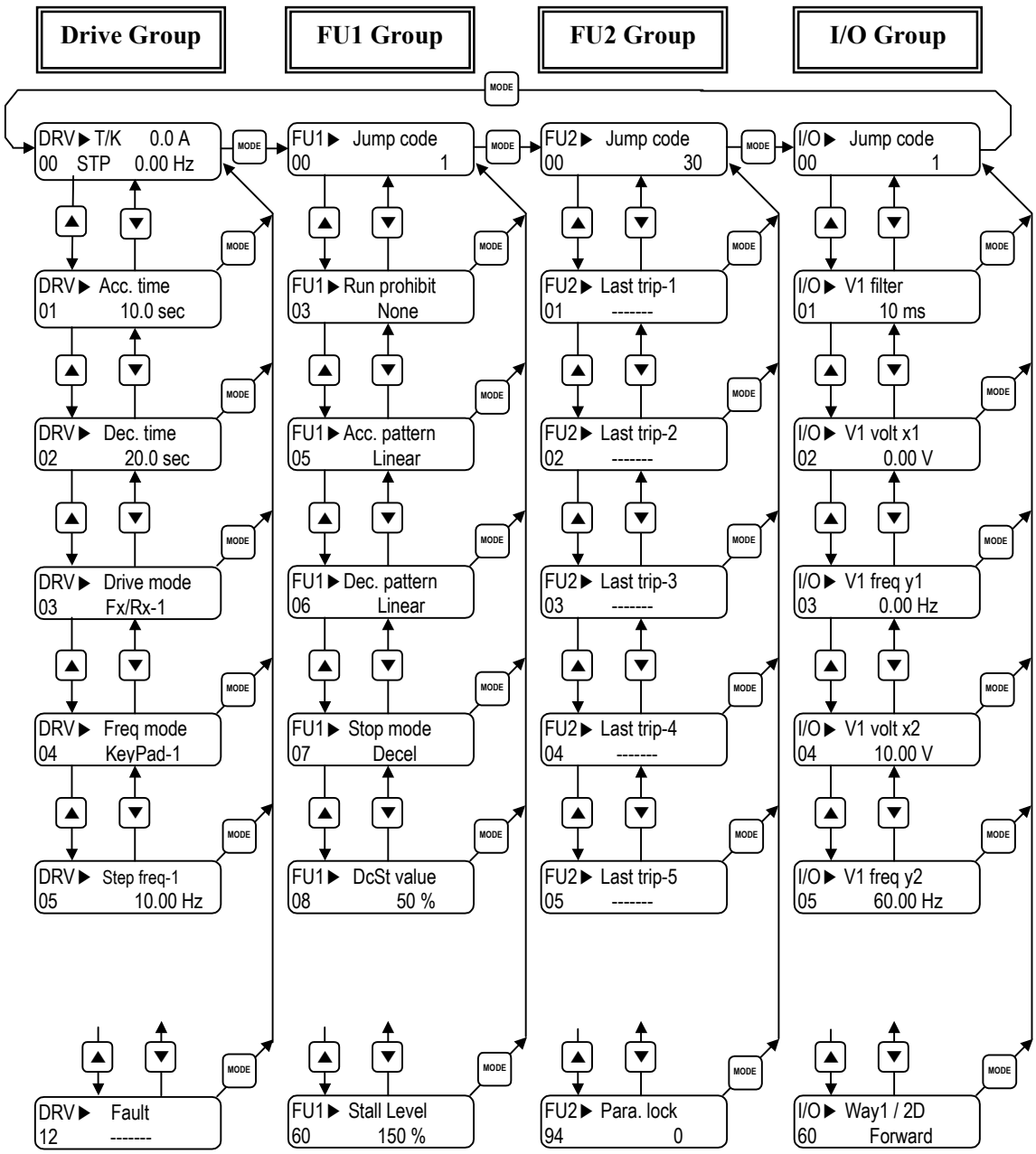
2.2.2 Procedure for Setting Data (LCD Keypad)

1. Press MODE key until the desired parameter group is displayed.
2. Press ▲ or ▼ keys to move to the desired parameter code. If you know the desired parameter code, you can set the code number of each parameter group in "Jump code", except DRV group.
3. Press PROG key to go into the programming mode, the cursor starts blinking.
4. Press SHIFT/ESC key to move the cursor to the desired digit.
5. Press ▲ or ▼ keys to change the data.
6. Press ENT key to enter the data. The cursor stops blinking.

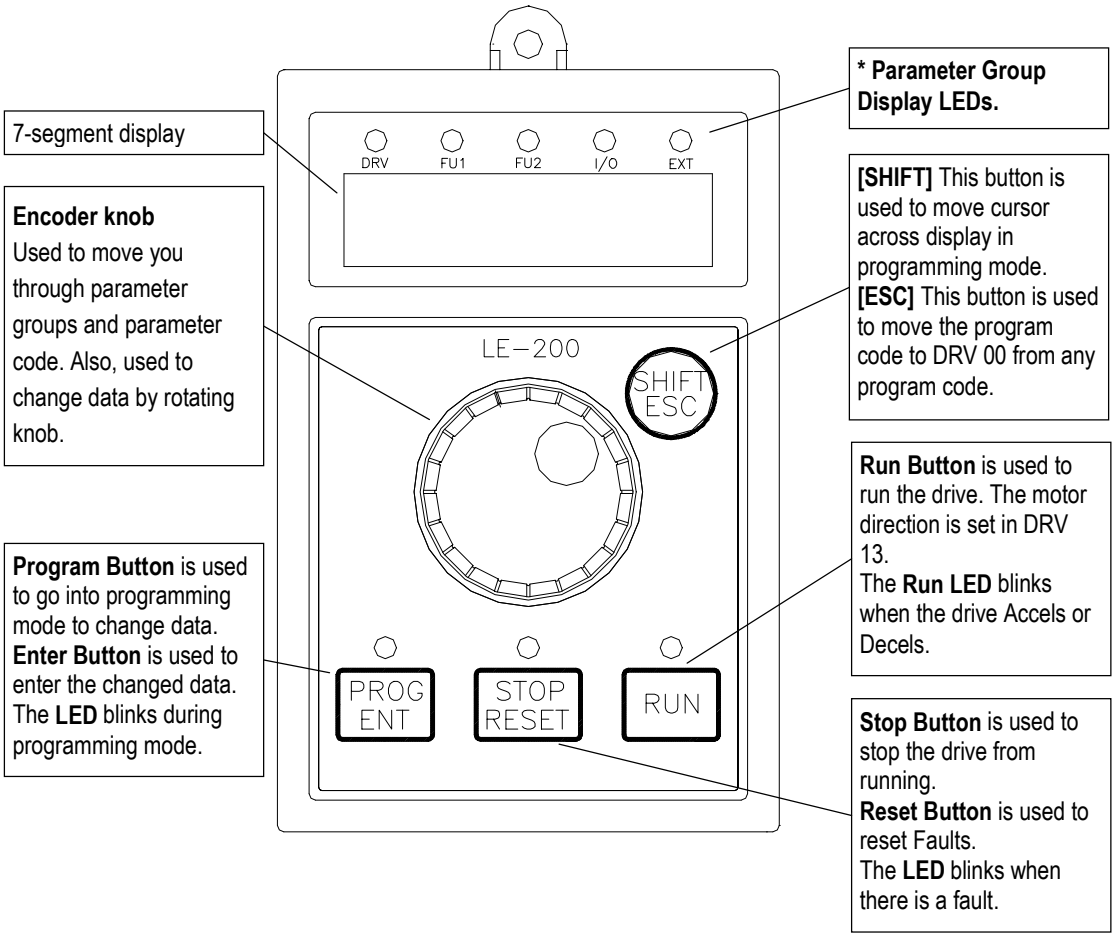
- **Note:** Data cannot be changed when:
  1) The parameter is not adjustable during the inverter is running. (Refer to the function table in Chapter 5), or,
  2) Parameter Lock function is activated in FU2-94 [Parameter Lock].

2.2.3 Parameter Navigation (LCD Keypad)

The parameter group moves directly to DRV group by pressing **SHIFT/ESC** key in any parameter code.



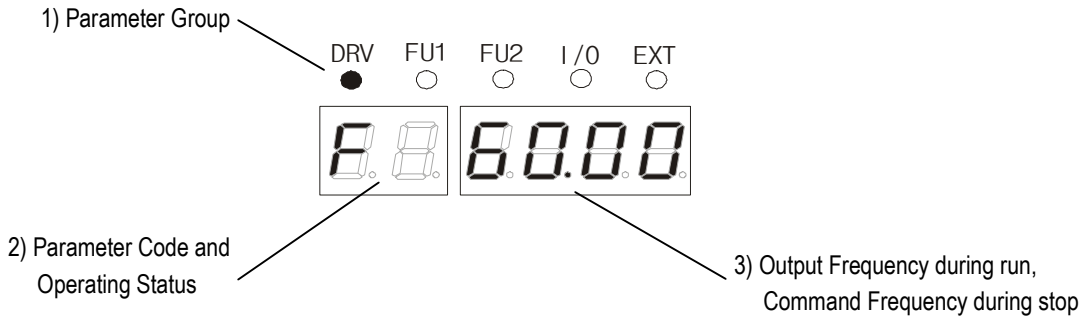
2.3 7-Segment Keypad



*** Parameter Group Display LEDs** – When parameter code is located on DRV 20, DRV 21, DRV 22 and DRV 23, respectively, by rotating the encoder knob, the parameter group display LEDs of DRV, FUN1, FUN2, I/O, EXT blink.

LED	Parameter Group	Description
DRV	Drive Group	Lit in Drive group.
FU1	FUNCTION 1 Group	Blinks when the parameter code is located on DRV 20 [FUN1]. Lit when FUNCTION 1 group is selected.
FU2	FUNCTION 2 Group	Blinks when the parameter code is located on DRV 21 [FUN2]. Lit when FUNCTION 2 group is selected.
I/O	Input/Output Group	Blinks when the parameter code is located on DRV 22 [I/O]. Lit when Input/Output group is selected
EXT	Sub-Board Group	Blinks when the parameter code is located on DRV 23 [EXT]. Lit when Sub-Board group is selected. This group appears only when a Sub-Board is installed.
I/O + EXT	Option Group	Blinks when the parameter code is located on DRV 24 [EXT]. Lit when Option group is selected. This group appears only when an Option Board is installed.
FU2 + I/O + EXT	Application Group	Blinks when the parameter code is located on DRV 25 [FUN2].

2.3.1 7-Segment Keypad Display



Display	Description
1) Parameter Group	Displays the parameter groups of DRV, FU1, FU2, I/O, EXT, COM, APP groups. Each LED is lit when its parameter group is selected and blinks when the parameter code is located on DRV 20, DRV 21, DRV 22, DRV 23, DRV 24, and DRV 25.
2) Parameter Code and Operating Status	Displays the code of a group. Rotate the encoder knob to move through 0 ~ 99 codes. Displays the operation information. **[First digit]** **F**: Forward operation **r**: Reverse operation **[Second digit]** **d**: DC Braking **J**: Jog Terminal Input **1~8**: Step Frequency Input (Displays the Step of the Auto operation) **[Two digits]** - when the reference is lost. **LP**: Loss of Reference from the Option Board (DPRAM fault) **Lr**: Loss of Reference from the Option Board (Communication network fault) **Lv**: Loss of Analog Frequency Reference (V1: 0~10V) **LI**: Loss of Analog Frequency Reference (I: 4~20mA) **LX**: Loss of Reference from the Sub-Board
3) Output Frequency, Command Frequency	Displays the Output Frequency during run. Displays the Command Frequency during stop.

2.3.2 Procedure for Setting Data (7-Segment Keypad)

■ **In DRV Group:**

1. Rotate the encoder knob until the desired parameter code is displayed.
2. Press **PROG/ENT** key to go into the programming mode, then the display blinks.
3. Press **SHIFT/ESC** key to move the cursor to the desired digit.
4. Rotate the encoder knob to change the data.
5. Press **PROG/ENT** key to enter the changed data.

■ **In FUN1 Group:**

1. Rotate the encoder knob until parameter code '20' is displayed in drive group.
2. Press **PROG/ENT** key to go into the FUN1 group.
3. Rotate the encoder knob until the desired parameter code is displayed.
4. Press **PROG/ENT** key to go into the programming mode, then the display blinks.
5. Press **SHIFT/ESC** key to move the cursor to the desired digit.
6. Rotate the encoder knob to change the data.
7. Press **PROG/ENT** key to enter the changed data.

■ **In FUN2 Group:**

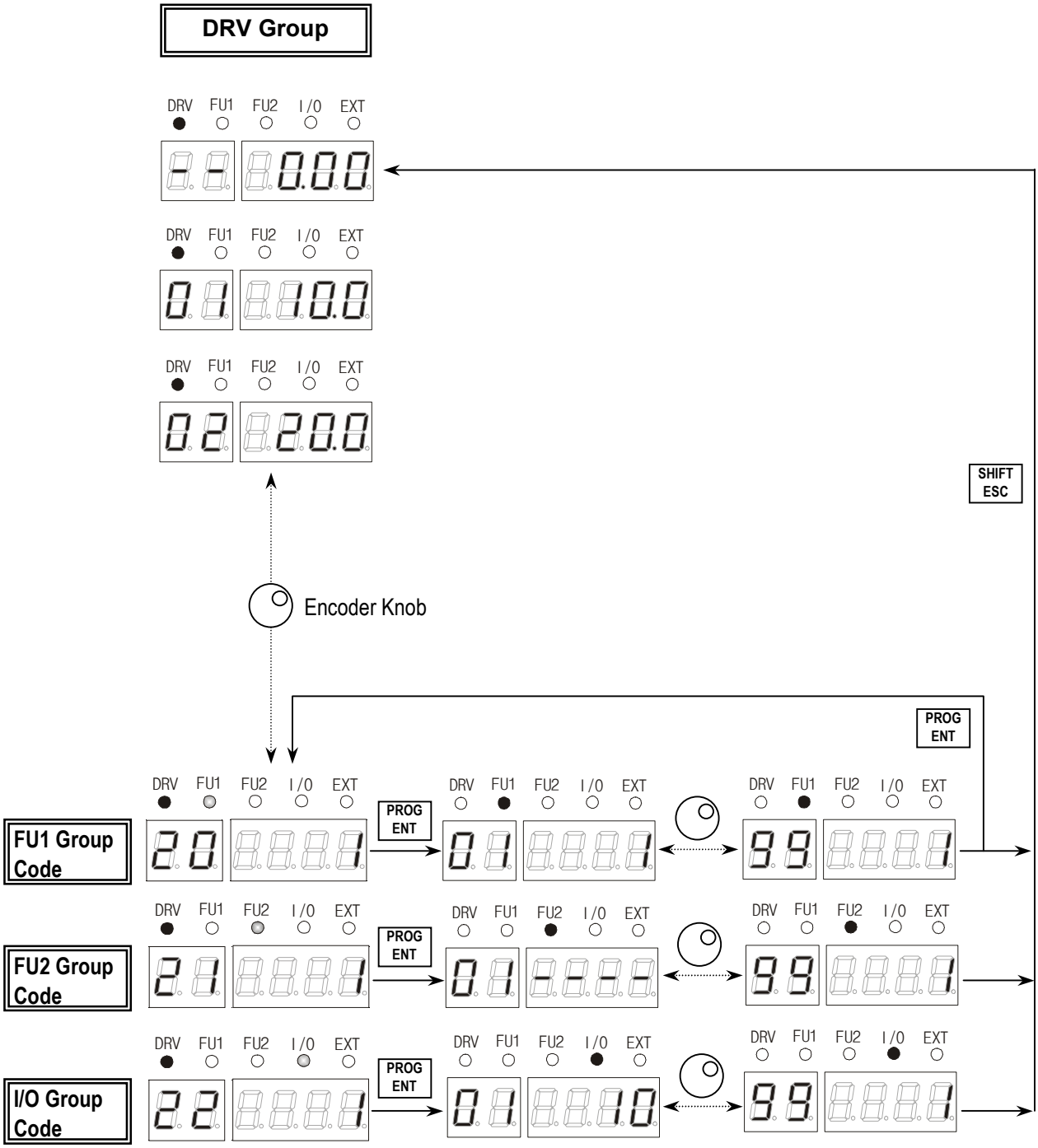
1. Rotate the encoder knob until parameter code '21' is displayed in drive group.
2. Go to step 2 of 'In FUN1 Group' above, and follow the rest procedure.

■ **In I/O Group:**

1. Rotate the encoder knob until parameter code '22' is displayed in drive group.
2. Go to step 2 of 'In FUN1 Group' above, and follow the rest procedure.

2.3.3 Parameter Navigation (7-Segment Keypad)

The parameter group moves directly to DRV group by pressing SHIFT/ESC key in any parameter code.



2.4 Operation Method

The iS5 has several operation methods as shown below.

Operation Method	Function	Function Setting
Operation using **Keypad**	Run/Stop command and frequency are set only through the keypad.	DRV 03: Keypad DRV 04: Keypad-1 or -2
Operation using **Control Terminals**	Closing FX or RX terminal performs Run/Stop. Frequency reference is set through V1 or I or V1+I terminal.	DRV 03: Fx/Rx-1 or -2 DRV 04: V1 or I or V1+I
Operation using both **Keypad and Control Terminals**	Run/Stop is performed by the keypad. Frequency reference is set through the V1 or I or V1+I terminal.	DRV 03: Keypad-1 or -2 DRV 04: V1 or I or V1+I
	Closing FX or RX terminal performs Run/Stop. Frequency reference is set through the keypad.	DRV 03: Fx/Rx-1 or -2 DRV 04: Keypad-1 or -2
Operation using **Option Board**	Operation using option board. The iS5 has five option boards and three sub-boards. **Option Boards:** RS485, Device-Net, F-Net, ProfiBus and ModBus **Sub-Boards:** Sub-A Board, Sub-B Board and Sub-C Board (Please refer to 'Chapter 6 - Options' for more information.)	

CHAPTER 3 - QUICK-START PROCEDURES

These Quick-Start Up instructions are for those applications where:

- The user wants to get the iS5 inverter started quickly
- The factory-preset values are suitable for the user application

The factory-preset values are shown on the 'Chapter 4 - Parameter List'. The iS5 inverter is configured to operate a motor at 60Hz (base frequency). If the application requires coordinated control with other controllers, it is recommended the user become familiar with all parameters and features of the inverter before applying AC power.

1. Mounting the inverter (mount the inverter as described in '1.3 Mounting')
   - Install in a clean, dry location
   - Allow a sufficient clearance around top and sides of inverter
   - The ambient temperature should not exceed 40°C (104°F)
   - If two or more inverters are installed in an enclosure, add additional cooling

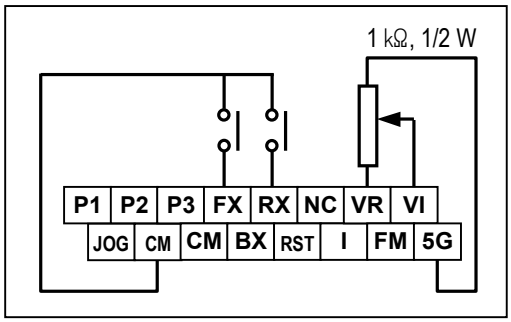
2. Wiring the inverter (connect wiring as described in '1.7 Power Terminals')
   - AC power should be turned OFF
   - Verify the AC power matches the nameplate voltage
   - Remove the screw on the bottom front cover of the inverter for terminal board access (For terminal board access on 15~ 30HP inverters you must disconnect the keypad cable from the inverter and fully removed the cover)

3.1 Operation using Keypad

	LCD Display	7-Segment Display
1. Apply AC power.	DRV▶T/K 0.0 A 00 STP 0.00Hz	F 0.00 The DRV LED is ON.
2. **LCD:** Press ▲ key three times. **7-Seg:** Rotate the encoder knob until '03' is displayed.	DRV▶ Drive mode 03 Fx/Rx-1	03 1 The DRV LED is turned ON.
3. **LCD:** Press **PROG** key. **7-Seg:** Press **PROG/ENT** key.	DRV▶ Drive mode 03 Fx/Rx-1	03 1 The PROG/ENT LED turned ON.
4. **LCD:** Press ▼ key one time. **7-Seg:** Rotate the encoder knob left.	DRV▶ Drive mode 03 Keypad	03 0 The PROG/ENT LED is turned ON.
5. **LCD:** Press **PROG** key. **7-Seg:** Press **PROG/ENT** key.	DRV▶ Drive mode 03 Keypad	03 0
6. Press **PROG/ENT** key.	DRV▶K/K 0.0 A 00 STP 0.00Hz	F 0.00
7. **LCD :** Press **PROG** key. **7-Seg :** Press **PROG/ENT** key.	DRV▶ Cmd. freq 00 0.00Hz	00 00.00 The PROG/ENT LED is turned ON.
8. **LCD:** Press **SHIFT/ESC** key and press ▲ key to increase the command frequency. **7-Seg:** Rotate the encoder knob right to change the command frequency. The changing digit moves by pressing the **SHIFT/ESC** key.	DRV▶ Cmd. freq 00 60.00Hz	00 60.00 The PROG/ENT LED is turned ON.
9. **LCD:** Press **ENT** key to save the data. **7-Seg:** Press **PROG/ENT** key to save the data.	DRV▶K/K 0.0 A 00 STP 60.00Hz	F 60.00
10. **LCD:** Press **FWD** or **REV** key to start motor. **7-Seg:** Press **RUN** key to start motor.	The FWD or REV LED starts blinking.	The RUN LED starts blinking. To change the motor running direction, change DRV 13 to '1'.
11. Press **STOP/RESET** key to stop motor.	The STOP/RESET LED starts blinking.	The STOP/RESET LED starts blinking.

3.2 Operation using Control Terminals

	LCD Display	7-Segment Display
1. Install a potentiometer on terminals V1, VR, 5G and connect wiring as shown below.		

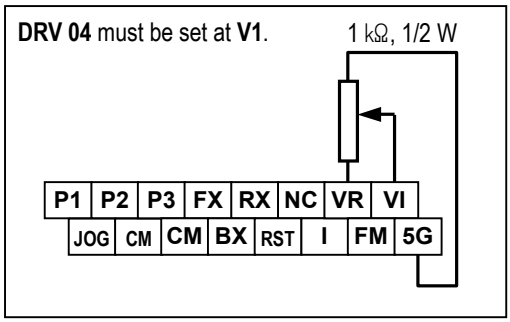


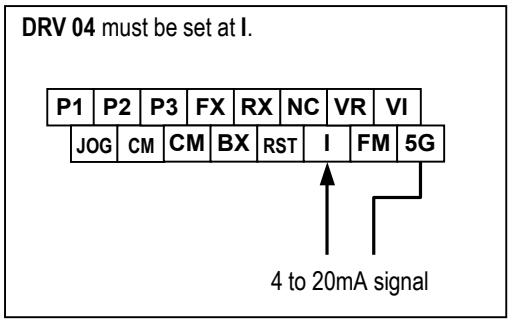
2. Apply AC power.	DRV▶T/K 0.0 A 00 STP 0.00Hz	F 0.00 The DRV LED is ON.
3. Confirm that the DRV 03 is set at 'Fx/Rx-1'.	DRV▶ Drive mode 03 Fx/Rx-1	03 1
4. **LCD:** Press ▲ key to move DRV 04. **7-Seg:** Rotate encoder knob until '04' is displayed.	DRV▶ Freq mode 04 Keypad-1	04 0
5. **LCD:** Press **PROG** key. **7-Seg:** Press **PROG/ENT** key.	DRV▶ Freq mode 04 Keypad-1	04 0 The PROG/ENT LED is turned ON.
6. **LCD:** Press ▲ key and set at 'V1'. **7-Seg:** Rotate encoder knob and set at '2'.	DRV▶ Freq mode 04 V1	04 2 The PROG/ENT LED is turned ON.
7. **LCD:** Press **ENT** key. **7-Seg:** Press **PROG/ENT** key.	DRV▶ Freq mode 04 V1	04 2 The PROG/ENT LED is turned OFF.
8. Press **SHIFT/ESC** key.	DRV▶T/V 0.0 A 00 STP 0.00Hz	F 0.00
9. Set the frequency by rotating the potentiometer.	DRV▶T/V 0.0 A 00 STP 60.00Hz	F 60.00
10. Close the FX or RX contact to run the motor.	The FWD or REV LED starts blinking.	The RUN LED starts blinking.
11. Open the FX or RX contact to stop the motor.	The STOP/RESET LED starts blinking.	The STOP/RESET LED starts blinking.

3.3 Operation using Keypad and Control Terminals

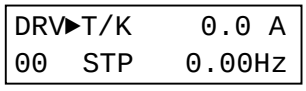
3.3.1 Frequency set by External Source and Run/Stop by Keypad

1. Install a potentiometer on terminals V1, VR, 5G and connect wiring as shown below left.
   When a '4 to 20mA' current source is used as the frequency reference, use terminals I and 5G as shown below right.



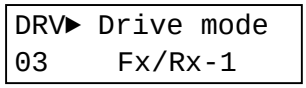


2. Apply AC power.

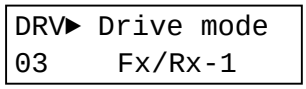


The DRV LED is ON.

3. **LCD:** Press ▲ key to move DRV 03.
   7-Seg: Rotate encoder knob until '03' is displayed.

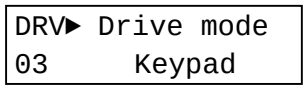


4. **LCD:** Press **PROG** key.
   7-Seg: Press **PROG/ENT** key.



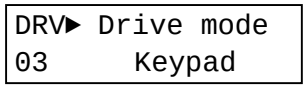
The PROG/ENT LED is turned ON.

5. **LCD:** Press ▲ key one time.
   7-Seg: Rotate encoder knob and set at '0'.



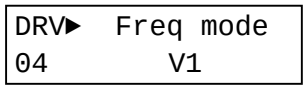
The PROG/ENT LED is turned ON.

6. **LCD:** Press **ENT** key.
   7-Seg: Press **PROG/ENT** key.



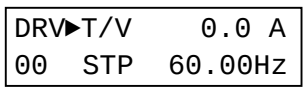
The PROG/ENT LED is turned OFF.

7. Confirm that the DRV 04 is set at 'V1'.



The PROG/ENT LED is turned ON.

8. Press **SHIFT/ESC** key.
   Set the frequency by rotating the potentiometer.



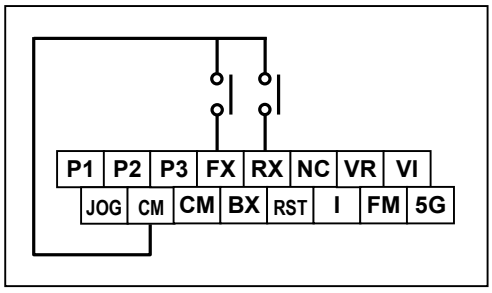
9. **LCD:** Press **FWD** or **REV** key.
   7-Seg: Press **RUN** key.

The FWD or REV LED starts blinking.

The RUN LED starts blinking.
To change the motor running direction, change DRV 13 to '1'.

3.3.2 Frequency set by Keypad and Run/Stop by External Source.

		LCD Display	7-Segment Display
1.	Connect wiring as shown below.		



2.	Apply AC power.	DRV▶T/K 0.0 A 00 STP 0.00Hz	F 0.00 The DRV LED is ON.
3.	Confirm that the DRV 03 is set at 'Fx/Rx-1'.	DRV▶ Drive mode 03 Fx/Rx-1	03 1
4.	Confirm that the DRV 04 is set at 'Keypad-1'.	DRV▶ Freq mode 04 Keypad-1	04 0
5.	Press **SHIFT/ESC** key.	DRV▶T/K 0.0 A 00 STP 0.00Hz	F 0.00
6.	**LCD:** Press **PROG** key. **7-Seg:** Press **PROG/ENT** key.	DRV▶ Cmd. freq 00 0.00Hz	00 0.00 The PROG/ENT LED is turned ON.
7.	**LCD:** Set the frequency using **SHIFT/ESC** and ▲ key. **7-Seg:** Set the frequency by rotating the encoder knob.	DRV▶ Cmd. freq 00 60.00Hz	00 60.00 The PROG/ENT LED is turned ON.
8.	**LCD:** Press **ENT** key to save the data. **7-Seg:** Press **PROG/ENT** key to save the data.	DRV▶T/V 0.0 A 00 STP 60.00Hz	F 60.00
9.	Close the FX or RX contact to run the motor.	The FWD or REV LED starts blinking.	The RUN LED starts blinking.
10.	Open the FX or RX contact to stop the motor.	The STOP/RESET LED starts blinking.	The STOP/RESET LED starts blinking.

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CHAPTER 4 - PARAMETER LIST

4.1 Drive Group [DRV]

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
DRV-00	Output Frequency or Reference Frequency, Output Current (LCD)	Cmd. freq	**F** or **r** (DRV-13)	0 to FU1-20 (Max. freq)		0.01	0.00 [Hz]	Yes	57
DRV-01	Acceleration Time	Acc. time	**01**	0 to 6000		0.1	10.0 [sec]	Yes	57
DRV-02	Deceleration Time	Dec. time	**02**	0 to 6000		0.1	20.0 [sec]	Yes	57
DRV-03	Drive Mode (Run/Stop Method)	Drive mode	**03**	Keypad	**0**	-	Fx/Rx-1	No	58
				Fx/Rx-1	**1**				
				Fx/Rx-2	**2**				
DRV-04	Frequency Mode (Freq. setting Method)	Freq mode	**04**	Keypad-1	**0**	-	Keypad-1	No	58
				Keypad-2	**1**				
				V1	**2**				
				I	**3**				
				V1+I	**4**				
DRV-05	Step Frequency 1	Step freq-1	**05**	FU1-22 to FU1-20 (Starting freq to Max. freq)		0.01	10.00 [Hz]	Yes	59
DRV-06	Step Frequency 2	Step freq-2	**06**				20.00 [Hz]		
DRV-07	Step Frequency 3	Step freq-3	**07**				30.00 [Hz]		
DRV-08	Output Current	Current	**08**	The Load Current in RMS		-	[A]	-	59
DRV-09	Motor Speed	Speed	**09**	The Motor Speed in rpm		-	[rpm]	-	60
DRV-10	DC link Voltage	DC link Vtg	**10**	The DC Link Voltage inside inverter		-	[V]	-	60
DRV-11	User Display Selection	User disp	**11**	Selected in FU2-73 (User Disp)		-	-	-	60
DRV-12	Fault Display	Fault	**12**	-	**-**	-	None **nOn**	-	60
DRV-13	Motor Direction Set	Not displayed in LCD keypad	**13**	Not available	**0** [Forward]	-	**0**	Yes	61
					1 [reverse]				
DRV-14	Target/Output Frequency Display	TAR OUT	**14**	-	**-**	-	0.00 [Hz]	Yes	61
DRV-15[9]	Reference/Feedback Frequency Display	REF FBK	**15**	-	**-**	-	0.00 [Hz]	Yes	61
DRV-20	**FU1** Group Selection	Not displayed in LCD keypad	**20**	Not available	Press [PROG/ENT] key	-	**1**	Yes	61
DRV-21	**FU2** Group Selection		**21**						61
DRV-22	**I/O** Group Selection		**22**						61
DRV-23[10]	**EXT** Group Selection		**23**						61
DRV-24	**COM** Group Selection		**24**			-	**1**	Yes	61
DRV-25	**APP** Group Selection		**25**			-	**1**	Yes	61

[9] Code DRV-15 appears only when FU2-47 is set to 'Yes'.

[10] Code DRV-23 through DRV-24 appears only when a Sub-Board or an Option Board is installed.

4.2 Function 1 Group [FU1]

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
FU1-00	Jump to Desired Code #	Jump code	Not displayed	1 to 60	Not available	1	1	Yes	63
FU1-03	Run Prevention	Run Prev.	03	None Forward Prev Reverse Prev	0 1 2	-	None	No	63
FU1-05	Acceleration Pattern	Acc. pattern	05	Linear S-curve U-curve Minimum Optimum	0 1 2 3 4	-	Linear	No	63
FU1-06	Deceleration Pattern	Dec. pattern	06	Linear S-curve U-curve Minimum Optimum	0 1 2 3 4	-	Linear	No	63
FU1-07	Stop Mode	Stop mode	07	Decel DC-brake Free-run	0 1 2	-	Decel	No	64
FU1-08[11]	DC Injection Braking Frequency	DcBr freq	08	FU1-22 to 60 [Hz]		0.01	5.00 [Hz]	No	65
FU1-09	DC Injection Braking On-delay Time	DcBlk time	09	0 to 60 [sec]		0.01	0.1 [sec]	No	
FU1-10	DC Injection Braking Voltage	DcBr value	10	0 to 200 [%]		1	50 [%]	No	
FU1-11	DC Injection Braking Time	DcBr time	11	0 to 60 [sec]		0.1	1.0 [sec]	No	
FU1-12	Starting DC Injection Braking Voltage	DcSt value	12	0 to 200 [%]		1	50 [%]	No	66
FU1-13	Starting DC Injection Braking Time	DcSt time	13	0 to 60 [sec]		0.1	0.0 [sec]	No	
FU1-20	Maximum Frequency	Max freq	20	40 to 400 [Hz]		0.01	60.00 [Hz]	No	66
FU1-21	Base Frequency	Base freq	21	30 to FU1-20		0.01	60.00 [Hz]	No	
FU1-22	Starting Frequency	Start freq	22	0.1 to 10 [Hz]		0.01	0.50 [Hz]	No	
FU1-23	Frequency Limit selection	Freq limit	23	No Yes	0 1	-	No	No	67
FU1-24[12]	Low Limit Frequency	F-limit Lo	24	FU1-22 to FU1-25		0.01	0.50 [Hz]	No	
FU1-25	High Limit Frequency	F-limit Hi	25	FU1-24 to FU1-20		0.01	60.00 [Hz]	No	
FU1-26	Manual/Auto Torque Boost Selection	Torque boost	26	Manual Auto	0 1	-	Manual	No	67

[11] Code FU1-08 through FU1-11 appears only when FU1-07 is set to 'DC-Brake'.

[12] Code FU1-24 through FU1-25 appears only when FU1-23 is set to 'Yes'.

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
FU1-27	Torque Boost in Forward Direction	Fwd boost	**27**	0 to 15 [%]		0.1	2.0 [%]	No	67
FU1-28	Torque Boost in Reverse Direction	Rev boost	**28**	0 to 15 [%]		0.1	2.0 [%]	No	
FU1-29	Volts/Hz Pattern	V/F pattern	**29**	Linear Square User V/F	**0** **1** **2**	-	Linear	No	68
FU1-30[13]	User V/F – Frequency 1	User freq 1	**30**	0 to FU1-20		0.01	15.00 [Hz]	No	69
FU1-31	User V/F – Voltage 1	User volt 1	**31**	0 to 100 [%]		1	25 [%]	No	
FU1-32	User V/F – Frequency 2	User freq 2	**32**	0 to FU1-20		0.01	30.00 [Hz]	No	
FU1-33	User V/F – Voltage 2	User volt 2	**33**	0 to 100 [%]		1	50 [%]	No	
FU1-34	User V/F – Frequency 3	User freq 3	**34**	0 to FU1-20		0.01	45.00 [Hz]	No	
FU1-35	User V/F – Voltage 3	User volt 3	**35**	0 to 100 [%]		1	75 [%]	No	
FU1-36	User V/F – Frequency 4	User freq 4	**36**	0 to FU1-20		0.01	60.00 [Hz]	No	
FU1-37	User V/F – Voltage 4	User volt 4	**37**	0 to 100 [%]		1	100 [%]	No	
FU1-38	Output Voltage Adjustment	Volt control	**38**	40 to 110 [%]		0.1	100.0 [%]	No	69
FU1-39	Energy Save Level	Energy save	**39**	0 to 30 [%]		1	0 [%]	Yes	69
FU1-50	Electronic Thermal Selection	ETH select	**50**	No Yes	**0** **1**	-	No	Yes	70
FU1-51[14]	Electronic Thermal Level for 1 Minute	ETH 1 min	**51**	FU1-52 to 200 [%]		1	150 [%]	Yes	
FU1-52	Electronic Thermal Level for Continuous	ETH cont	**52**	50 to FU1-51		1	100 [%]	Yes	
FU1-53	Electronic Thermal Characteristic Selection (Motor Type)	Motor type	**53**	Self-cool Forced-cool	**0** **1**	-	Self-cool	Yes	
FU1-54	Overload Warning Level	OL level	**54**	30 to 150 [%]		1	150 [%]	Yes	71
FU1-55	Overload Warning Hold Time	OL time	**55**	0 to 30 [sec]		0.1	10.0 [sec]	Yes	
FU1-56	Overload Trip Selection	OLT select	**56**	No Yes	**0** **1**	-	Yes	Yes	71
FU1-57	Overload Trip Level	OLT level	**57**	30 to 150 [%]		1	180 [%]	Yes	
FU1-58	Overload Trip Delay Time	OLT time	**58**	0 to 60 [sec]		1	60.0 [sec]	Yes	
FU1-59	Stall Prevention Mode Selection	Stall prev.	**59**	000 to 111 (Bit Set)		bit	000	No	72
FU1-60	Stall Prevention Level	Stall level	**60**	30 to 150 [%]		1	150 [%]	No	
FU1-99	Return Code	Not displayed	**99**	Not available	[PROG/ENT] or [SHIFT/ESC]	-	-	-	73

[13] Code FU1-30 through FU1-37 appears only when FU1-29 is set to 'User V/F'.

[14] Code FU1-51 through FU1-53 appears only when FU1-50 is set to 'Yes'.

4.3 Function 2 Group [FU2]

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
FU2-00	Jump to desired code #	Jump code	Not displayed	1 to 94	Not available	1	1	Yes	75
FU2-01	Previous Fault History 1	Last trip-1	01	By pressing [PROG] and [▲] key, the frequency, current, and operational status at the time of fault can be seen.		-	None	-	75
FU2-02	Previous Fault History 2	Last trip-2	02						
FU2-03	Previous Fault History 3	Last trip-3	03						
FU2-04	Previous Fault History 4	Last trip-4	04						
FU2-05	Previous Fault History 5	Last trip-5	05						
FU2-06	Erase Fault History	Erase trips	06	No Yes	0 1	-	No	Yes	
FU2-07	Dwell Frequency	Dwell freq	07	FU1-22 to FU1-20		0.01	5.00 [Hz]	No	76
FU2-08	Dwell Time	Dwell time	08	0 to 10 [sec]		0.1	0.0 [sec]	No	
FU2-10	Frequency Jump Selection	Jump freq	10	No Yes	0 1	-	No	No	76
FU2-11[15]	Jump Frequency 1 Low	Jump lo 1	11	FU1-22 to FU2-12		0.01	10.00 [Hz]	No	
FU2-12	Jump Frequency 1 High	Jump Hi 1	12	FU2-11 to FU1-20		0.01	15.00 [Hz]	No	
FU2-13	Jump Frequency 2 Low	Jump lo 2	13	FU1-22 to FU2-14		0.01	20.00 [Hz]	No	
FU2-14	Jump Frequency 2 High	Jump Hi 2	14	FU2-13 to FU1-20		0.01	25.00 [Hz]	No	
FU2-15	Jump Frequency 3 Low	Jump lo 3	15	FU1-22 to FU2-16		0.01	30.00 [Hz]	No	
FU2-16	Jump Frequency 3 High	Jump Hi 3	16	FU2-15 to FU1-20		0.01	35.00 [Hz]	No	
FU2-17	Start Curve for S-Curve Accel/Dedel Pattern	Start Curve	17	0 to 100%		1	40%	No	77
FU2-18	End Curve for S-Curve Accel/Dedel Pattern	End Curve	18	0 to 100%		1	40%	No	77
FU2-19	Input/Output Phase Loss Protection	Trip select	19	00 to 11 (Bit Set)		-	00	Yes	77
FU2-20	Power ON Start Selection	Power-on run	20	No Yes	0 1	-	No	Yes	77
FU2-21	Restart after Fault Reset	RST restart	21	No Yes	0 1	-	No	Yes	78
FU2-22	Speed Search Selection	Speed Search	22	0000 to 1111 (Bit Set)		-	0000	No	78
FU2-23	Current Limit Level During Speed Search	SS Sup-Curr	23	80 to 200 [%]		1	100 [%]	Yes	78
FU2-24	P Gain During Speed Search	SS P-gain	24	0 to 30000		1	100	Yes	
FU2-25	I Gain During speed search	SS I-gain	25	0 to 30000		1	1000	Yes	
FU2-26	Number of Auto Restart Attempt	Retry number	26	0 to 10		1	0	Yes	79

[15] Code FU2-11 through FU2-16 appears only when FU2-10 is set to 'Yes'.

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
FU2-27	Delay Time Before Auto Restart	Retry Delay	27	0 to 60 [sec]		0.1	1.0 [sec]	Yes	79
FU2-30	Rated Motor Selection	Motor select	30	0.75kW 1.5kW 2.2kW 3.7kW 5.5kW 7.5kW 11.0kW 15.0kW 18.5kW 22.0kW	0 1 2 3 4 5 6 7 8 9	-	[16]	No	80
FU2-31	Number of Motor Poles	Pole number	31	2 to 12		1	4	No	80
FU2-32	Rated Motor Slip	Rated-Slip	32	0 t o10 [Hz]		0.01	[17]	No	80
FU2-33	Rated Motor Current (RMS)	Rated-Curr	33	1 to 200 [A]		1		No	80
FU2-34[18]	No Load Motor Current (RMS)	Noload-Curr	34	0.5 to 200 [A]		1		No	80
FU2-36	Motor Efficiency	Efficiency	36	70 to 100 [%]		1		No	80
FU2-37	Load Inertia	Inertia rate	37	0 to 1		1	0	No	80
FU2-39	Carrier Frequency	Carrier freq	38	1 to 15 [kHz]		1	5 [kHz]	Yes	81
FU2-40	Control Mode Selection	Control mode	40	V/F Slip comp Sensorless	0 1 3	-	V/F	No	81
FU2-41	Auto Tuning	Auto tuning	41	No Yes	0 1	-	No	No	83
FU2-42	Stator Resistance of Motor	Rs	42	0 to 5 [ohm]		0.001	[19]	No	
FU2-43[20]	Rotor Resistance of Motor	Rr	43	0 to 5 [ohm]		0.001		No	
FU2-44	Leakage Inductance of Motor	Lsigma	44	0 to 30 [mH]		0.001		No	
FU2-45	P Gain for Sensorless Control	SL P-gain	45	0 to 32767		1	32767	Yes	83

[16] The rated motor is automatically set according to the inverter model name. If different, set the motor capacity connected.

[17] This value is automatically entered according to the rated motor set in FU2-30. If different, set the correct value of the motor.

[18] Code FU2-34 appears only when FU2-40 is set to 'Slip comp'.

[19] This value is automatically entered according to the rated motor set in FU2-30. If different, set the correct value of the motor.

[20] Code FU2-43 through FU2-46 appears only when FU2-40 is set to 'Sensorless'.

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
FU2-46	I Gain for Sensorless Control	SL I-gain	46	0 to 32767		1	3276	Yes	83
FU2-47	PID Operation Selection	Proc PI mode	47	No Yes	0 1	-	No	No	83
FU2-48[21]	PID Reference Frequency Selection	PID Ref	48	Ramp freq. Target freq.	0 1	-	Ramp freq.	No	84
FU2-49	PID Reference Mode Selection	PID Ref Mode	49	Freq mode Keypad-1 Keypad-2 V1 I V1+I	0 1 2 3 4 5	-	Freq mode	No	84
FU2-50	PID Output Direction Selection	PID Out Dir	50	Ramp freq. Target freq.	0 1	-	Ramp freq.	No	84
FU2-51	PID Feedback Signal Selection	PID F/B	51	I V1 V2	0 1 2	-	I	No	84
FU2-52	P Gain for PID Control	PID P-gain	52	0 to 999.9 [%]		0.1	300.0 [%]	Yes	
FU2-53	I Gain for PID Control	PID I-time	53	0 to 32.0 [sec]		0.1	30 [sec]	Yes	
FU2-54	D Gain for PID Control	PID D-time	54	0 to 999.9 [msec]		0.1	0.0 [msec]	Yes	
FU2-55	High Limit Frequency for PID Control	PID +limit	55	0 to FU1-20		0.01	60.00 [Hz]	Yes	
FU2-56	Low Limit Frequency for PID Control	PID -limit	56	0 to FU1-20		0.01	60.00 [Hz]	Yes	
FU2-57	PID Output Inversion	PID Out Inv.	57	No Yes	0 1	-	No	No	85
FU2-58	PID Output Scale	PID OutScale	58	0 to 999.9 [%]		0.1	100 [%]	No	85
FU2-59	PID P2 Gain	PID P2-gain	59	0 to 100 [%]		0.1	100 [%]	No	85
FU2-60	P Gain Scale	P-gain Scale	60	0 to 100 [%]		0.1	100 [%]	No	85
FU2-69	Accel/Decel Change Frequency	Acc/Dec ch F	69	0 to FU1-20				No	87
FU2-70	Reference Frequency for Accel and Decel	Acc/Dec freq	70	Max freq Delta freq	0 1	-	Max freq	No	87
FU2-71	Accel/Decel Time Scale	Time scale	71	0.01 [sec] 0.1 [sec] 1 [sec]	0 1 2	-	0.01 [sec]	Yes	87
FU2-72	Power On Display	PowerOn disp	72	0 to 12		1	0	Yes	88
FU2-73	User Display Selection	User disp	73	Voltage Watt Torque	0 1 2	-	Voltage	Yes	88

[21] Code FU2-48 through FU2-60 appears only when FU2-47 is set to 'Yes'.

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
FU2-74	Gain for Motor Speed Display	RPM factor	**74**	1 to 1000 [%]		1	100 [%]	Yes	88
FU2-75	DB (Dynamic Braking) Resistor Mode Selection	DB mode	**75**	None Int. DB-R Ext. DB-R	**0** **1** **2**	-	Int. DB-R	Yes	88
FU2-76[22]	Duty of Dynamic Braking Resistor	DB %ED	**76**	0 to 30 [%]		1	10 [%]	Yes	89
FU2-79	Software Version	S/W version	**79**	Ver 1.05		-	-	-	89
FU2-81[23]	2nd Acceleration Time	2nd Acc time	**81**	0 to 6000 [sec]		0.1	5.0 [sec]	Yes	89
FU2-82	2nd Deceleration Time	2nd Dec time	**82**	0 to 6000 [sec]		0.1	10.0 [sec]	Yes	
FU2-83	2nd Base Frequency	2nd BaseFreq	**83**	30 to FU1-20		0.01	60.00 [Hz]	No	
FU2-84	2nd V/F Pattern	2nd V/F	**84**	Linear Square User V/F	**0** **1** **2**	-	Linear	No	
FU2-85	2nd Forward Torque Boost	2nd F-boost	**85**	0 to 15 [%]		0.1	2.0 [%]	No	
FU2-86	2nd Reverse Torque Boost	2nd R-boost	**86**	0 to 15 [%]		0.1	2.0 [%]	No	
FU2-87	2nd Stall Prevention Level	2nd Stall	**87**	30 to 150 [%]		1	150[%]	No	
FU2-88	2nd Electronic Thermal Level for 1 minute	2nd ETH 1min	**88**	FU2-89 to 200 [%]		1	150 [%]	Yes	
FU2-89	2nd Electronic Thermal Level for continuous	2nd ETH cont	**89**	50 to FU2-88 (Maximum 150%)		1	100 [%]	Yes	
FU2-90	2nd Rated Motor Current	2nd R-Curr	**90**	1 to 200 [A]		0.1	3.6 [A]	No	
FU2-91	Read Parameters into Keypad from Inverter	Para. Read	**91**	No Yes	**0** **1**	-	No	No	89
FU2-92	Write Parameters to Inverter from Keypad	Para. Write	**92**	No Yes	**0** **1**	-	No	No	
FU2-93	Initialize Parameters	Para. Init	**93**	No All Groups DRV FU1 FU2 I/O EXT	**0** **1** **2** **3** **4** **5** **6**	-	No	No	90
FU2-94	Parameter Write Protection	Para. Lock	**94**	0 to 255		1	0	Yes	90
FU2-99	Return Code	Not displayed	**99**	Not available	[PROG/ENT] or [SHIFT/ESC]	-	1	Yes	90

[22] Code FU2-76 appears only when FU2-75 is set to 'Ext. DB-R'.

[23] Code FU2-81 through FU2-90 appear only when one of I/O-12 ~ I/O-14 is set to '2nd function'.

4.4 Input/Output Group [I/O]

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
I/O-00	Jump to Desired Code #	Jump code	Not displayed	1 to 84	Not available	1	1	Yes	91
I/O-01	Filtering Time Constant for V1 Signal Input	V1 filter	01	0 to 10000 [ms]		1	10 [ms]	Yes	91
I/O-02	V1 Input Minimum Voltage	V1 volt x1	02	0 to 10 [V]		0.01	0.00 [V]	Yes	
I/O-03	Frequency Corresponding to V1 Input Minimum Voltage	V1 freq y1	03	0 to FU1-20		0.01	0.00 {Hz}	Yes	
I/O-04	V1 Input Maximum Voltage	V1 volt x2	04	0 to 10 [V]		0.01	10.00 [V]	Yes	
I/O-05	Frequency Corresponding to V1 Input Maximum Voltage	V1 freq y2	05	0 to FU1-20		0.01	60.00 [Hz]	Yes	
I/O-06	Filtering Time Constant for I Signal Input	I filter	06	0 to 10000 [ms]		1	10 [ms]	Yes	91
I/O-07	I Input Minimum Current	I curr x1	07	0 to 20 [mA]		0.01	4.00 [mA]	Yes	
I/O-08	Frequency Corresponding to I Input Minimum Current	I freq y1	08	0 to FU1-20		0.01	0.00 [Hz]	Yes	
I/O-09	I Input Maximum Current	I curr x2	09	0 to 20 [mA]		0.01	20.00 [mA]	Yes	91
I/O-10	Frequency Corresponding to I Input Maximum Current	I freq y2	10	0 to FU1-20		0.01	60.00 [Hz]	Yes	
I/O-11	Criteria for Analog Input Signal Loss	Wire broken	11	None half x1 below x1	0 1 2	-	None	Yes	92
I/O-12	Multi-Function Input Terminal 'P1' Define	P1 define	12	Speed-L Speed-M Speed-H XCEL-L XCEL-M XCEL-H Dc-brake 2nd Func Exchange - Reserved - Up Down 3-Wire Ext Trip-A Ext Trip-B iTerm Clear Open-loop Main-drive	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	-	Speed-L	Yes	93

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
				Analog hold	18				
				XCEL stop	19				
				P Gain2	20				
				SEQ-L	21				
				SEQ-M	22				
				SEQ-H	23				
				Manual	24				
				Go step	25				
				Hold step	26				
				Trv Off.Lo	27				
				Trv Off.Hi	28				
				Interlock1	29				
				Interlock2	30				
				Interlock3	31				
				Interlock4	32				
I/O-13	Multi-function Input Terminal 'P2' Define	P2 define	13	Same as Above		-	Speed-M	Yes	93
I/O-14	Multi-function Input Terminal 'P3' Define	P3 define	14			-	Speed-H	Yes	
I/O-15	Terminal Input Status	In status	15	000000000 to 111111111		-	-	-	98
I/O-16	Terminal Output Status	Out status	16	0000 to 1111		-	-	-	
I/O-17	Filtering Time Constant for Multi-Function Input Terminals	Ti Filt Num	17	2 to 50		1	15	Yes	98
I/O-20	Jog Frequency Setting	Jog freq	20	FU1-22 to FU1-20		0.01	10.00 [Hz]	Yes	98
I/O-21	Step Frequency 4	Step freq-4	21				40.00 [Hz]	Yes	99
I/O-22	Step Frequency 5	Step freq-5	22				50.00 [Hz]	Yes	
I/O-23	Step Frequency 6	Step freq-6	23				40.00 [Hz]	Yes	
I/O-24	Step Frequency 7	Step freq-7	24				30.00 [Hz]	Yes	
I/O-25	Acceleration Time 1 for Step Frequency	Acc time-1	25	0 to 6000 [sec]		0.1	20.0 [sec]	Yes	99
I/O-26	Deceleration Time 1 for Step Frequency	Dec time-1	26	0 to 6000 [sec]		0.1	20.0 [sec]	Yes	
I/O-27	Acceleration Time 2	Acc time-2	27	0 to 6000 [sec]		0.1	30.0 [sec]	Yes	
I/O-28	Deceleration Time 2	Dec time-2	28	0 to 6000 [sec]		0.1	30.0 [sec]	Yes	
I/O-29	Acceleration Time 3	Acc time-3	29	0 to 6000 [sec]		0.1	40.0 [sec]	Yes	
I/O-30	Deceleration Time 3	Dec time-3	30	0 to 6000 [sec]		0.1	40.0 [sec]	Yes	
I/O-31	Acceleration Time 4	Acc time-4	31	0 to 6000 [sec]		0.1	50.0 [sec]	Yes	
I/O-32	Deceleration Time 4	Dec time-4	32	0 to 6000 [sec]		0.1	50.0 [sec]	Yes	
I/O-33	Acceleration Time 5	Acc time-5	33	0 to 6000 [sec]		0.1	40.0 [sec]	Yes	
I/O-34	Deceleration Time 5	Dec time-5	34	0 to 6000 [sec]		0.1	40.0 [sec]	Yes	
I/O-35	Acceleration Time 6	Acc time-6	35	0 to 6000 [sec]		0.1	30.0 [sec]	Yes	
I/O-36	Deceleration Time 6	Dec time-6	36	0 to 6000 [sec]		0.1	30.0 [sec]	Yes	

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
I/O-37	Acceleration Time 7	Acc time-7	37	0 to 6000 [sec]		0.1	20.0 [sec]	Yes	
I/O-38	Deceleration Time 7	Dec time-7	38	0 to 6000 [sec]		0.1	20.0 [sec]	Yes	
I/O-40	FM (Frequency Meter) Output Selection	FM mode	40	Frequency Current Voltage	0 1 2	-	Frequency	Yes	99
I/O-41	FM Output Adjustment	FM adjust	41	10 to 200 [%]		1	100 [%]	Yes	
I/O-42	Frequency Detection Level	FDT freq	42	0 to FU1-20		0.01	30.00 [Hz]	Yes	100
I/O-43	Frequency Detection Bandwidth	FDT band	43	0 to FU1-20		0.01	10.00 [Hz]	Yes	
I/O-44	Multi-Function Auxiliary Contact Output Define (AXA, AXC)	Aux mode	44	FDT-1 FDT-2 FDT-3 FDT-4 FDT-5 OL IOL Stall OV LV OH Lost Command Run Stop Steady INV line COMM line Ssearch Step pulse Seq pulse Ready Trv. ACC Trv. DEC MMC	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	-	Run	Yes	100
I/O-45	Fault Output Relay Setting (30A, 30B, 30C)	Relay mode	45	000 to 111 (Bit Set)		-	010	Yes	104
I/O-46[24]	Inverter Number	Inv No.	46	1 to 31		1	1	Yes	105
I/O-47	Baud Rate	Baud rate	47	1200 bps 2400 bps 4800 bps 9600 bps 19200 bps	0 1 2 3 4	-	9600 bps	Yes	105

[24] Code I/O-46 through I/O-49 are used in Option Board like RS485, Device, Net and F-net etc.

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
I/O-48	Operating selection at Loss of Freq. Reference	Lost command	48	None FreeRun Stop	0 1 2	-	None	Yes	105
I/O-49	Waiting Time after Loss of Freq. Reference	Time out	49	0.1 to 120 [sec]		0.1	1.0 [sec]	Yes	
I/O-50	Auto (Sequence) Operation selection	Auto mode	50	None Auto-A Auto-B	0 1 2	-	None	No	105
I/O-51	Sequence Number Selection	Seq select	51	1 to 5		1	1	Yes	
I/O-52	The Number of Steps of Sequence Number #	Step number	52	1 to 8		1	2	Yes	
I/O-53[25]	1st Step Frequency of Sequence 1	Seq1 / 1F	53	0.01 to FU1-20		0.01	11.00 [Hz]	Yes	107
I/O-54	Transient Time to 1st Step of Sequence 1	Seq1 / 1T	54	0.1 to 6000 [sec]		0.1	1.1 [sec]	Yes	
I/O-55	Steady Speed Time at 1st Step of Sequence 1	Seq1 / 1S	55	0.1 to 6000 [sec]		0.1	1.1 [sec]	Yes	
I/O-56	Motor Direction of 1st Step of Sequence 1	Seq1 / 1D	56	Reverse Forward	0 1	-	Forward	Yes	
I/O-57	1st Step Frequency of Sequence 2	Seq1 / 2F	57	0.01 to FU1-20		0.01	21.00 [Hz]	Yes	
I/O-58	Transient Time to 1st Step of Sequence 2	Seq1 / 2T	58	0.1 to 6000 [sec]		0.1	1.1 [sec]	Yes	107
I/O-59	Steady Speed Time at 1st Step of Sequence 2	Seq1 / 2S	59	0.1 to 6000 [sec]		0.1	1.1 [sec]	Yes	
I/O-60	Motor Direction of 1st Step of Sequence 2	Seq1 / 2D	60	Reverse Forward	0 1	-	Forward	Yes	
I/O-99	Return Code	Not displayed	99	Not available	[PROG/ENT] or [SHIFT/ESC]	-	1	Yes	

4.5 External Group [EXT]

EXT group appears only when the corresponding Sub-Board is installed.

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
EXT-00	Jump to Desired Code #	Jump code	Not displayed	0 to 99	Not available	1	1	Yes	109

[25] The 'Seq#' of code I/O-53 through I/O-60 varies according to the sequence number selected in I/O-51.
The parameter code may be extended to I/O-84 depending the number of steps set in I/O-52 because the steps can be set up to 8.

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
EXT-01	Sub Board Type Display	Sub B/D	01	None SUB-A SUB-B SUB-C SUB-D SUB-E SUB-F SUB-G SUB-H	0 1 2 3 4 5 6 7 8	-	None	Automatically set	109
EXT-02	Multi-Function Input Terminal 'P4' Define	P4 define	02	Speed-L Speed-M Speed-H XCEL-L XCEL-M XCEL-H Dc-brake 2nd Func Exchange - Reserved - Up Down 3-Wire Ext Trip-A Ext Trip-B iTerm Clear Open-loop Main-drive Analog hold XCEL stop P Gain2 SEQ-L SEQ-M SEQ-H Manual Go step Hold step Trv Off.Lo Trv Off.Hi Interlock1 Interlock2 Interlock3 Interlock4	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32	-	XCEL-L	Yes	109

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
EXT-03	Multi-Function Input Terminal 'P5' Define	P5 define	**03**	Same as Above		-	XCEL-M	Yes	109
EXT-04	Multi-Function Input Terminal 'P6' Define	P6 define	**04**			-	XCEL-H	Yes	
EXT-05	V2 Mode Selection	V2 mode	**05**	None Override Reference	**0** **1** **2**	-	None	No	110
EXT-06	Filtering Time Constant for V2 Input Signal	V2 filter	**06**	0 to 10000 [ms]		1	10 [ms]	Yes	110
EXT-07	V2 Input Minimum Voltage	V2 volt x1	**07**	0 to 10 [V]		0.01	0.00 [V]	Yes	
EXT-08	Frequency Corresponding to V2 Input Minimum Voltage	V2 freq y1	**08**	0 to FU1-20		0.01	0.00 [Hz]	Yes	
EXT-09	V2 Input Maximum Voltage	V2 volt x2	**09**	0 to 10 [V]		0.01	10.00 [V]	Yes	
EXT-10	Frequency Corresponding to V2 Input Maximum Voltage	V2 freq y2	**10**	0 to FU1-20		0.01	60.00 [Hz]	Yes	
EXT-14	Usage of Pulse Input Signal	F mode	**14**	None Feed-back Reference	**0** **1** **2**	-	None	No	111
EXT-15	Pulse Input Signal Selection	F pulse set	**15**	A+B A	**0** **1**	-	A+B	Yes	111
EXT-16	Encoder Pulse Number	F pulse num	**16**	360 to 4096		1	1024	No	111
EXT-17	Filtering Time Constant for Pulse Input Signal	F filter	**17**	0 to 10000 [ms]		1	10 [ms]	Yes	111
EXT-18	Pulse Input Minimum Frequency	F pulse x1	**18**	0 to 100 [kHz]		0.01	0.00 [kHz]	Yes	112
EXT-19	Frequency Output Corresponding to Pulse Input Minimum Frequency	F freq y1	**19**	0 to FU1-20		0.01	0.00 [Hz]	Yes	112
EXT-20	Pulse Input Maximum Frequency	F pulse x2	**20**	0 to 100 [kHz]		0.01	10.00 [kHz]	Yes	
EXT-21	Frequency Output Corresponding to Pulse Input Maximum Frequency	F freq y2	**21**	0 to FU1-20		0.01	60.00 [Hz]	Yes	
EXT-22	P-Gain for 'Sub-B'	PG P-gain	**22**	0 to 30000		1	3000	Yes	112
EXT-23	I-Gain for 'Sub-B'	PG I-gain	**23**	0 to 30000		1	300	Yes	
EXT-24	Slip Frequency for 'Sub-B' Board	PG Slip freq	**24**	0 to 200 [%]		1	100 [%]	Yes	112

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
EXT-30	Multi-Function Output Terminal 'Q1' Define	Q1 define	30	FDT-1 FDT-2 FDT-3 FDT-4 FDT-5 OL IOL Stall OV LV OH Lost Command Run Stop Steady INV line COMM line Ssearch Step pulse Seq pulse Ready Trv. ACC Trv. DEC MMC	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23	-	FDT-1	Yes	113
EXT-31	Multi-function Output Terminal 'Q2' Define	Q2 define	31	Same as Above		-	FDT-2	Yes	113
EXT-32	Multi-function Output Terminal 'Q3' Define	Q3 define	32			-	FDT-3	Yes	
EXT-34	LM (Load Meter) Output Selection	LM mode	34	Frequency Current Voltage DC link Vtg	0 1 2 3	-	Current	Yes	113
EXT-35	LM Output Adjustment	LM adjust	35	100 to 200 [%]		1	100 [%]	Yes	113
EXT-40	AM1 (Analog Meter 1) Output Selection	AM1 mode	40	Frequency Current Voltage DC link Vtg	0 1 2 3	-	Frequency	Yes	114
EXT-41	AM1 Output Adjustment	AM1 adjust	41	100 to 200 [%]		1	100 [%]	Yes	
EXT-42	AM2 (Analog Meter 2) Output Selection	AM2 mode	42	Frequency Current Voltage DC link Vtg	0 1 2 3	-	DC link Vtg	Yes	

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
EXT-43	AM2 Output Adjustment	AM2 adjust	**43**	100 to 200 [%]		1	100 [%]	Yes	
EXT-99	Return Code	Not displayed	**99**	Not available	[PROG/ENT] or [SHIFT/ESC]	-	1	Yes	

4.6 Communication Group [COM]

COM group appears only when the corresponding Option Boards are installed. Please refer to the option manual for detail.

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
COM-00	Jump to Desired Code #	Jump code	Not displayed	0 to 99	Not available	1	1	Yes	
COM-01	Option Board Type	Opt B/D	**01**	None Device Net Synchro PLC-GF Profibus-DP Digital-In RS485 Modbus-RTU	**0** **1** **2** **3** **4** **5** **6** **7**	-	None	Yes	
COM-02	Option Mode	Opt Mode	**02**	None Command Freq Cmd + Freq	**0** **1** **2** **3**	-	None	No	
COM-03	Option Version	Opt Version	**03**	-	**-**	-	-	No	
COM-04	Binary Option Input Selection	D-In Mode	**04**	8 Bit Bin 8 BCD 1% 8 BCD 1Hz 12 Bit Bin 12 BCD 0.1% 12 BCD 0.1Hz 12 BCD 1Hz	**0** **1** **2** **3** **4** **5** **6**	-	8 Bit Bin	No	
COM-05	Binary Input Filter Value	Digital Ftr	**05**	2-50		1	15	Yes	
COM-10	Device Net ID	MAC ID	**10**	0-63		1	0	Yes	
COM-11	Device Net Communication Speed	Baud Rate	**11**	125 kbps 250 kbps 500 kbps	**0** **1** **2**	-	125 kbps	Yes	
COM-12	Device Net Output Instance	Out Instance	**12**	20 21 100 101	**0** **1** **2** **3**	-	20	No	

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
COM-13	Device Net Input Instance	In Instance	13	70 71 110 111	0 1 2 3	-	70	No	
COM-17	PLC Option Station Number	Station ID	17	0 to 63		1	1	Yes	
COM-20	Profibus ID	Profi MAC ID	20	0 to 127		1	1	Yes	
COM-30	Output Number	Output Num	30	0 to 8		1	3	Yes	
COM-31	Output 1	Output 1	31	0000-57FF(HEX)			000A(HEX)	Yes	
COM-32	Output 2	Output 2	32	0000-57FF(HEX)			000E(HEX)	Yes	
COM-33	Output 3	Output 3	33	0000-57FF(HEX)			000F(HEX)	Yes	
COM-34	Output 4	Output 4	34	0000-57FF(HEX)			0000(HEX)	Yes	
COM-35	Output 5	Output 5	35	0000-57FF(HEX)			0000(HEX)	Yes	
COM-36	Output 6	Output 6	36	0000-57FF(HEX)			0000(HEX)	Yes	
COM-37	Output 7	Output 7	37	0000-57FF(HEX)			0000(HEX)	Yes	
COM-38	Output 8	Output 8	38	0000-57FF(HEX)			0000(HEX)	Yes	
COM-40	Input Number	Input Num	40	0 to 8		1	2	Yes	
COM-41	Input 1	Input 1	41	0000-57FF(HEX)			0005(HEX)	Yes	
COM-42	Input 2	Input 2	42	0000-57FF(HEX)			0006(HEX)	Yes	
COM-43	Input 3	Input 3	43	0000-57FF(HEX)			0000(HEX)	Yes	
COM-44	Input 4	Input 4	44	0000-57FF(HEX)			0000(HEX)	Yes	
COM-45	Input 5	Input 5	45	0000-57FF(HEX)			0000(HEX)	Yes	
COM-46	Input 6	Input 6	46	0000-57FF(HEX)			0000(HEX)	Yes	
COM-47	Input 7	Input 7	47	0000-57FF(HEX)			0000(HEX)	Yes	
COM-48	Input 8	Input 8	48	0000-57FF(HEX)			0000(HEX)	Yes	
COM-52	ModBus Option Selection	ModBus Mode	52	ModBus RTU			ModBus RTU	Yes	
COM-99	Return Code	Not displayed	99	Not available	[PROG/ENT] or [SHIFT/ESC]	-	1	Yes	

4.7 Application Group [APP]

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
APP-00	Jump to Desired Code #	Jump code	Not displayed	0 to 99	Not available	1	1	Yes	115
APP-01	Application Mode Selection	App Mode	01	None Traverse MMC DRAW	0 1 2 3	-	None	No	115

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
APP-02[26]	Traverse Amplitude	Trv. Amp	02	0.0 to 20.0 [%]		0.1	0.0 [%]	Yes	116
APP-03	Traverse Scramble Amplitude	Trv. Scr	03	0.0 to 50.0 [%]		0.1	0.0 [%]	Yes	116
APP-04	Traverse Accel Time	Trv Acc Time	04	0 to 6000 [sec]		0.1	2.0 [sec]	Yes	116
APP-05	Traverse Decel Time	Trv Dec Time	05	0 to 6000 [sec]		0.1	3.0 [sec]	Yes	116
APP-06	Traverse Offset (Hi) Setting	Trv Off Hi	06	0.0 to 20.0 [%]		0.1	0.0 [%]	Yes	117
APP-07	Traverse Offset (Lo) Setting	Trv Off Lo	07	0.0 to 20.0 [%]		0.1	0.0 [%]	Yes	117
APP-08[27]	Running Auxiliary Motor Number Display	Aux Mot Run	08	-		-	-	-	117
APP-09	Starting Aux. Motor Selection	Starting Aux	09	1 to 4		1	1	Yes	117
APP-10	Operation Time Display on Auto Change	Auto Op Time	10	-		-	-	-	117
APP-11	Start Frequency of Aux. Motor 1	Start freq 1	11	0 to FU1-20		0.01	49.99 [Hz]	Yes	117
APP-12	Start Frequency of Aux. Motor 2	Start freq 2	12	0 to FU1-20		0.01	49.99 [Hz]	Yes	
APP-13	Start Frequency of Aux. Motor 3	Start freq 3	13	0 to FU1-20		0.01	49.99 [Hz]	Yes	
APP-14	Start Frequency of Aux. Motor 4	Start freq 4	14	0 to FU1-20		0.01	49.99 [Hz]	Yes	
APP-15	Stop Frequency of Aux. Motor 1	Stop freq 1	15	0 to FU1-20		0.01	15.00 [Hz]	Yes	118
APP-16	Stop Frequency of Aux. Motor 2	Stop freq 2	16	0 to FU1-20		0.01	15.00 [Hz]	Yes	
APP-17	Stop Frequency of Aux. Motor 3	Stop freq 3	17	0 to FU1-20		0.01	15.00 [Hz]]	Yes	
APP-18	Stop Frequency of Aux. Motor 4	Stop freq 4	18	0 to FU1-20		0.01	15.00 [Hz]	Yes	
APP-19	Delay Time before Operating Aux Motor	Aux start DT	19	0 to 9999 [sec]		0.1	60.0 [sec]	Yes	118
APP-20	Delay Time before Stopping Aux Motor	Aux stop DT	20	0 to 9999 [sec]		0.1	60.0 [sec]	Yes	
APP-21	The Number of Aux Motor	Nbr Aux's	21	0 to 4		1	4	Yes	118
APP-22	PID Bypass Selection	Regul Bypass	22	No Yes	0 1	-	No	Yes	119
APP-23	Sleep Delay Time	Sleep Delay	23	0 to 9999 [sec]		0.1	60.0 [sec]	Yes	119
APP-24	Sleep Frequency	Sleep Freq	24	0 to FU1-20		0.01	19.00 [Hz]	Yes	119

[26] Code APP-02 through APP-07 appears only when APP-01 is set to 'Traverse'.

[27] Code APP-08 through APP-31 appears only when APP-01 is set to 'MMC'.

Code	Description	Keypad Display		Setting Range		Units	Factory Default	Adj. During Run	Page
		LCD	7-Segment	LCD	7-Segment				
APP-25	Wake-Up Level	WakeUp Level	25	0 to 100 [%]		1	35 [%]	Yes	119
APP-26	Auto Change Mode Selection	AutoCh-Mode	26	0 to 2		1	1	Yes	120
APP-27	Auto Change Time	AutoEx-intv	27	00:00 to 99:00		00:01	70:00	Yes	120
APP-28	Auto Change Level	AutoEx-level	28	0 to 100 [%]		0.1	20 [%]	Yes	
APP-29	Inter-Lock Selection	Inter-lock	29	No Yes	0 1	-	No	Yes	121
APP-30	Actual Value Display	Actual Value	30	-		-	-	Yes	121
APP-31	Actual Value Display in Percentage	Actual Perc	31	-		-	-	Yes	121
APP-32[28]	Draw Mode Selection	Draw Mode	32	None V1_Draw I_Draw V2_Draw	0 1 2 3	-	None	Yes	121
APP-33	Draw Size Setting	DrawPerc	33	0 to 150 [%]		0.1	100 [%]	Yes	121

[28] Code APP-32 through APP-33 appears only when APP-01 is set to 'Draw'.

4.8 Sub-Board Selection Guide According To Function

Code	Function Description	LCD Display	Sub-Board Type		
			SUB-A Board	SUB-B Board	SUB-C Board
EXT-02	Multi-function Input Terminal 'P4'	P4 define	√		√
EXT-03	Multi-function Input Terminal 'P5'	P5 define	√		√
EXT-04	Multi-function Input Terminal 'P6'	P6 define	√		√
EXT-05	V2 Mode Selection	V2 mode	√		√
EXT-06	Filtering Time Constant for V2 Input Signal	V2 filter	√		√
EXT-07	V2 Input Minimum Voltage	V2 volt x1	√		√
EXT-08	Frequency Corresponding to V2 Input Minimum Voltage	V2 freq y1	√		√
EXT-09	V2 Input Maximum Voltage	V2 volt x2	√		√
EXT-10	Frequency Corresponding to V2 Input Maximum Voltage	V2 freq y2	√		√
EXT-14	Usage for Pulse Input Signal	F mode		√	
EXT-15	Pulse Input Signal Selection	F pulse set		√	
EXT-16	Encoder Pulse Selection	F pulse num		√	
EXT-17	Filtering Time Constant for Pulse Input Signal	F filter		√	
EXT-18	Pulse Input Minimum Frequency	F pulse x1		√	
EXT-19	Frequency Output corresponding to Pulse Input Minimum Frequency	F freq y1		√	
EXT-20	Pulse Input Maximum Frequency	F pulse x2		√	
EXT-21	Frequency Output corresponding to Pulse Input Maximum Frequency	F freq y2		√	
EXT-22	P-Gain for PG Option	PG P-gain		√	
EXT-23	I-Gain for PG Option	PG I-gain		√	
EXT-24	Slip Frequency for PG Option	PG Slip freq		√	
EXT-30	Multi-function Output Terminal 'Q1'	Q1 define	√		√
EXT-31	Multi-function Output Terminal 'Q2'	Q2 define	√		
EXT-32	Multi-function Output Terminal 'Q3'	Q3 define	√		
EXT-34	LM (Load Meter) Output Selection	LM mode	√		
EXT-35	LM Output Adjustment	LM adjust	√		
EXT-40	AM1 (Analog Meter 1) Output Selection	AM1 mode			√
EXT-41	AM1 Output Adjustment	AM1 adjust			√
EXT-42	AM2 (Analog Meter 2) Output Selection	AM2 mode			√
EXT-43	AM2 Output Adjustment	AM2 adjust			√

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CHAPTER 5 - PARAMETER DESCRIPTION

5.1 Drive Group [DRV]

DRV-00: Output Frequency / Output Current

DRV►T/K 0.0 A 00 STP 0.00Hz	F	0.00

Factory Default:	0.00 Hz	0.00

With LCD keypad, this code gives information regarding motor run/stop method, frequency setting method, output current, inverter operating status, and output or reference frequency.
With 7-Segment keypad, this code just gives information regarding motor direction set in DRV-13, and output or reference frequency.

You can set the command frequency by pressing **PORG** key in this code.

Related Functions: DRV-04 [Freq mode]
FU1-20 [Max freq]
I/O-01 to I/O-10 [Reference inputs]

- DRV-04: Selects the frequency setting method. [Keypad-1, Kepad-2, V1, I, V1+I]
- FU1-20: Sets the maximum frequency that the inverter can output.
- I/O-01 to I/O-10: Scaling the analog input signals (V1 and I) for frequency reference.

DRV-01: Acceleration Time

DRV► Acc. time 01 10.0 sec	01	10.0

Factory Default:	10.0 sec	10.0

DRV-02: Deceleration Time

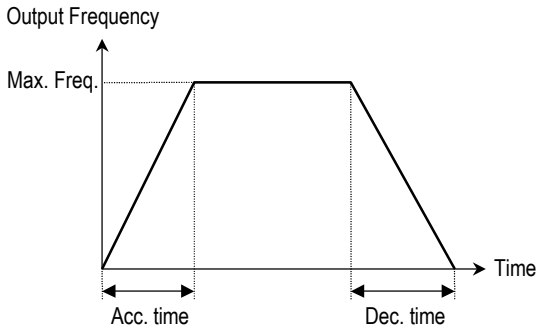
DRV► Dec. time 02 20.0 sec	02	20.0

Factory Default:	20.0 sec	20.0

The inverter targets the FU2-70 when accelerating or decelerating. When the FU2-70 is set to "Maximum Frequency", the acceleration time is the time taken by the motor to reach FU1-20 from 0 Hz. The deceleration time is the time taken by the motor to reach 0 Hz from FU1-20 [Maximum Frequency].

When the FU2-70 is set to 'Delta Frequency', the acceleration and deceleration time is the time taken to reach a targeted frequency (instead the maximum frequency) from a frequency.

The acceleration and deceleration time can be changed to a preset transient time via multi-function inputs. By setting the multi-function inputs (P1, P2, P3) to 'XCEL-L', 'XCEL-M', 'XCEL-H' respectively, the Accel and Decel time set in I/O-25 to I/O-38 are applied according to the binary inputs of the P1, P2, P3.



Related Functions: FU1-20 [Max freq]
FU2-70 [Reference freq. for Accel/Decel]
FU2-71 [Accel/Decel time scale]
I/O-12 to I/O-14 [Multi-function input terminal P1, P2, P3]
I/O-25 to I/O-38 [Acc/Dec time for step frequency]

- FU2-70: Selects the frequency to be targeted for acceleration and deceleration. [Max Freq, Delta Freq]
- FU2-71: Selects the time scale. [0.01, 0.2, 1]
- I/O-12 to I/O-14: Sets the terminal function of P1, P2, P3 terminal inputs.
- I/O-25 to I/O-38: Presets the Accel/Decel time activated via multifunction inputs (P1, P2, P3)

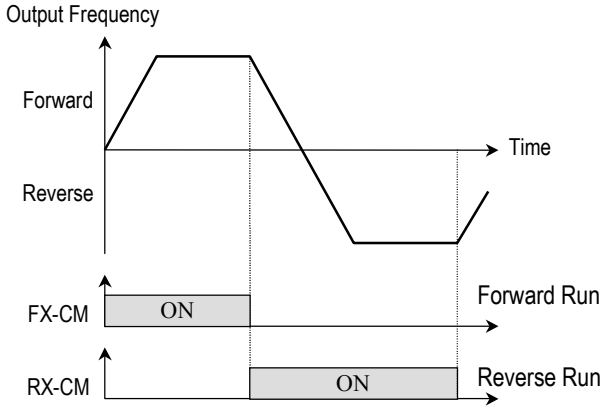
DRV-03: Drive Mode (Run/Stop Method)

DRV▶ Drive mode 03 Keypad	03	1

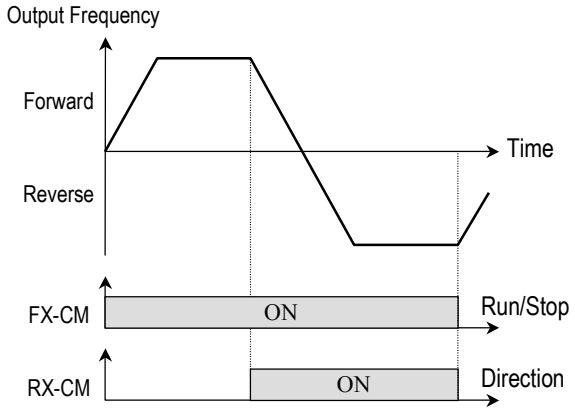
Factory Default: Fx/Rx-1 **1**

Select the source of run/stop command.

Setting Range		Description
LCD	7-Seg	
Keypad	**0**	Run/Stop is controlled by Keypad.
Fx/Rx-1	**1**	Control Terminals FX, RX and 5G control Run/Stop. (Method 1)
Fx/Rx-2	**2**	Control Terminals FX, RX and 5G control Run/Stop. (Method 2)



[Drive Mode: 'Fx/Rx-1']



[Drive Mode: 'Fx/Rx-2']

DRV-04: Frequency Mode (Frequency Setting Method)

DRV▶ Freq mode 04 Keypad-1	04	0

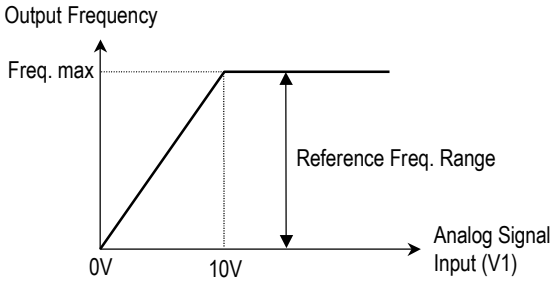
Factory Default: Keypad-1 **0**

Select the source of frequency setting.

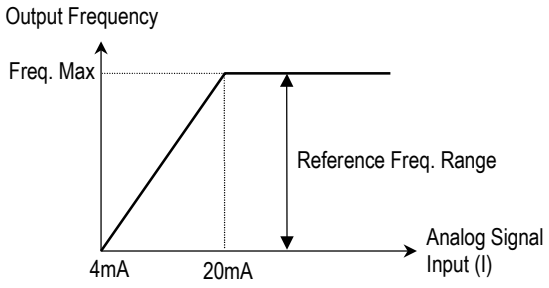
Setting Range		Description
LCD	7-Seg	
Keypad-1	**0**	Frequency is set at DRV-00. The frequency is changed by pressing PROG key and entered by pressing ENT key. The inverter does not output the changed frequency until the ENT key is pressed.
Keypad-2	**1**	Frequency is set at DRV-00. Press PROG key and then by pressing the ▲, ▼ key, the inverter immediately outputs the changed frequency. Pressing the ENT key saves the changed frequency.
V1	**2**	Input the frequency reference (0-10V) to the "V1" control terminal. Refer to the I/O-01 to I/O-05 for scaling the signal.
I	**3**	Input the frequency reference (4~20mA) to the "I" control terminal. Refer to the I/O-06 to I/O-10 for scaling the signal.
V1+I	**4**	Input the frequency reference (0~10V, 4~20mA) to the "V1","I" control terminals. The 'V1' signal overrides the 'I' signal.

Related Functions: I/O-01 to I/O-10 [Reference inputs]

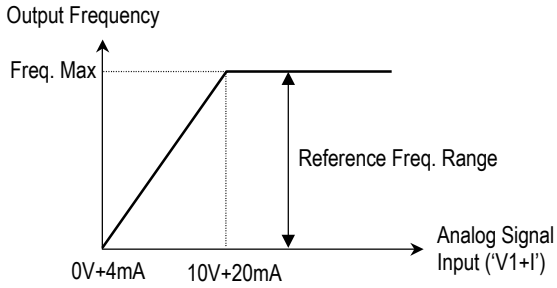
- I/O-01 to I/O-10: scaling the analog input signals (V1 and I) for frequency reference.



[Freq Mode: 'V1']



[Freq Mode: 'I']



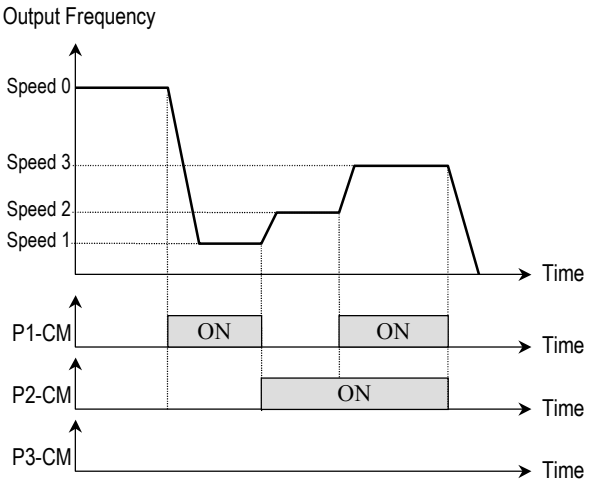
[Freq Mode: V1+'I']

DRV-05 ~ DRV-07: Step Frequency 1 ~ 3

DRV▶ Step freq-1 05 10.00 Hz	05	10.00
Factory Default: 10.00 Hz		10.00
DRV▶ Step freq-2 06 20.00 Hz	06	20.00
Factory Default: 20.00 Hz		20.00
DRV▶ Step freq-3 07 30.00 Hz	07	30.00
Factory Default: 30.00 Hz		30.00

The inverter outputs preset frequencies set in these codes according to the multi-function terminals configured as 'Speed-L', 'Speed-M' and 'Speed-H'. The output frequencies are decided by the binary combination of P1, P2, P3 configured in I/O-12 to I/O-17. Refer to the following table for the preset frequency outputs.

Binary Combination of P1, P2, P3			Output	Step Speed
Speed-L	Speed-M	Speed-H		
0	0	0	DRV-00	Speed 0
1	0	0	DRV-05	Speed 1
0	1	0	DRV-06	Speed 2
1	1	0	DRV-07	Speed 3



[Step Frequency Output]

Related Functions: I/O-12 to I/O-14 [Reference Inputs]
I/O-17 [Filtering Time Constant]
I/O-21 to I/O-21 [Step Frequency 4~7]

- I/O-01 to I/O-10: Scaling the analog input signals (V1 and I) for frequency reference.
- I/O-17: Adjusts the response sensibility of the input terminal to eliminate contact noise.
- I/O-21 to I/O-24: Sets the step frequency from 4 to 7.

☞ **Note:** The frequency setting method of 'Speed 0' is decided by DRV-04.

DRV-08: Output Current

DRV▶ Current 08 0.0 A	08	0.0
Factory Default: 0.0 A		0.0

This code displays the output current of the inverter in RMS.

DRV-09: Motor Speed

DRV► Speed 09 0rpm	09	0

Factory Default:	0rmp	0

This code displays the motor speed in RPM while the motor is running.
Use the following equation to scale the mechanical speed using FU2-74 [Gain for Motor Speed display] if you want to change the motor speed display to rotation speed (r/min) or mechanical speed (m/min).

Motor speed = 120 * (F/P) * FU2-74
Where, F= Output Frequency and P= the Number of Motor Poles

DRV-10: DC Link Voltage

DRV► DC link vtg 10 ----- V	10	----

Factory Default:	---- V	----

This code displays the DC link voltage inside the inverter.

DRV-11: User Display Selection

DRV► User disp 11 Out 0.0 V	11	0.0

Factory Default:	0.0 V	0.0

This code displays the parameter selected in FU2-73 [User Display]. There are types of parameters in FU2-73: Voltage, Watt and Torque.

DRV-12: Fault Display

DRV► Fault 12 None	12	nOn

Factory Default:	None	nOn

This code displays the current fault (trip) status of the inverter. Use the PROG, ▲ and ▼ key before pressing the RESET key to check the fault content(s), output frequency, output current, and whether the inverter was accelerating, decelerating, or in constant speed at the time of the fault occurred. Press the ENT key to exit. The fault content will be stored in FU2-01 to FU2-05 when the RESET key is pressed. For more detail, please refer to Chapter 7.

[Fault Contents]

Fault (Trip)	Keypad display	
	LCD	7-Segment
Over-Current 1	Over Current 1	OC
Over-Voltage	Over Voltage	OV
External Trip Input A	External-A	EXTA
Emergency Stop (Not Latched)	BX	BX
Low-Voltage	Low Voltage	LV
Fuse Open	Fuse Open	FUSE
Ground Fault	Ground Fault	GF
Over-Heat on Heat sink	Over Heat	OH
Electronic Thermal Trip	E-Thermal	ETH
Over-Load Trip	Over Load	OLT
Inverter H/W Fault - EEP Error - ADC Offset - WDOG Error - In-Phase Open	HW-Diag	HW
External Trip Input B	External-B	EXTB
Over-Current 2	Arm Short	ASHT
Option Error	Option	OPT
Output Phase Loss	Phase Open	PO
Inverter Over-Load	Inv. OLT	IOLT

☞ **Note:** There are WDOG error, EEP error, and ADC Offset for the inverter Hardware Fault - the inverter will not reset when H/W fault occurs. Repair the fault before turning on the power.

☞ **Note:** Only the highest-level fault will be displayed when multiple faults occur.

Related Functions: FU2-01 to FU2-05 [Previous Fault History]
FU2-06 [Erase Fault History]

- FU2-01 to FU2-05: There are up to 5 faults saved.
- FU2-06: Erases the faults saved in FU2-01 to FU2-05.

DRV-13: Motor Direction Set (7-Segment Keypad)

13	0

Factory Default: **0**

This code sets the motor direction when using the 7-Segment keypad.

7-Segment Display	Description
0	Run to forward direction
1	Run to reverse direction

DRV-14: Command/Output Frequency Display (LCD Keypad)

```
DRV▶TAR   0.00Hz
14  OUT   0.00Hz
```

Factory Default: 0.00Hz

This code shows the Command (Target) Frequency set in DRV00 and inverter Output Frequency.

DRV-15: Reference/Feedback Frequency Display (LCD Keypad)

```
DRV▶REF   0.00Hz
15  FBK   0.00Hz
```

Factory Default: 0.00Hz

This code shows the Reference Frequency and Feedback Frequency while PID operation.
This code appears only when 'PID' is selected in FU2-47.

DRV-20: FU1 Group Selection (7-Segment keypad)

DRV-21: FU2 Group Selection (7-Segment keypad)

DRV-22: I/O Group Selection (7-Segment keypad)

DRV-23: EXT Group Selection (7-Segment keypad)

DRV-24: COM Group Selection (7-Segment keypad)

DRV-25: APP Group Selection (7-Segment keypad)

Select the desired group and press the **PROG/ENT** key to move into the desired group. The parameter in the group can be read and written after moving into the desired group.

Blank Page

5.2 Function 1 Group [FU1]

FU1-00: Jump to Desired Code

FU1► Jump code 00 1

Factory Default:	1

Jumping directly to any parameter code can be accomplished by entering the desired code number. This code is available only with LCD keypad.

FU1-03: Run Prevention

FU1► Run prev. 03 None	03	0

Factory Default:	None	0

This function prevents reverse operation of the motor. This function may be used for loads that rotate only in one direction such as fans and pumps.

Setting Range		Description
LCD	7-Seg	
None	0	Forward and Reverse run is available.
Forward Prev	1	Forward run is prevented.
Reverse Prev	2	Reverse run is prevented.

FU1-05: Acceleration Pattern
FU1-06: Deceleration Pattern

FU1►Acc. pattern 05 Linear	05	0

Factory Default:	Linear	0

FU1►Dec. pattern 06 Linear	06	0

Factory Default:	Linear	0

Different combinations of acceleration and deceleration patterns can be selected according to the application.

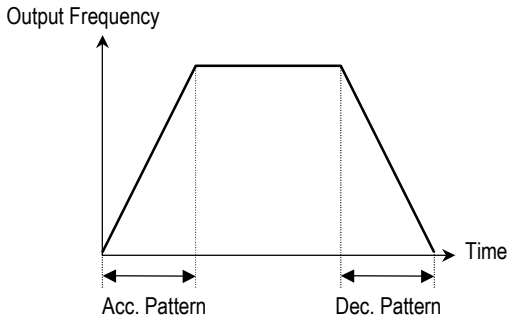
Setting Range		Description
LCD	7-Seg	
Linear	0	This is a general pattern for constant torque applications.
S-curve	1	This pattern allows the motor to accelerate and decelerate smoothly. The actual acceleration and deceleration time takes longer- about 40% than the time set in DRV-01 and DRV-02. This setting prevents shock during acceleration and deceleration, and prevents objects from swinging on conveyors or other moving equipment.
U-curve	2	This pattern provides more efficient control of acceleration and deceleration in typical winding machine applications.
Minimum	3	The inverter makes shorten the acceleration time by accelerating with a current rate of about 150% of its rated current and reduces the deceleration time by decelerating with a DC voltage rate of 95% of its over-voltage trip level. *Appropriate application:* When the maximum capability of the inverter and the motor are required. *Inappropriate application:* The current limit function may operate for a long period of time for loads that have high inertia such as fans.
Optimum	4	The inverter accelerates with a current rate of about 120% of its rated current and decelerates with a DC voltage rate of 93% of its over-voltage trip level.

☞ **Note:** In case of selecting the 'Minimum' or 'Optimum', the DRV-01 and DRV-02 is ignored.

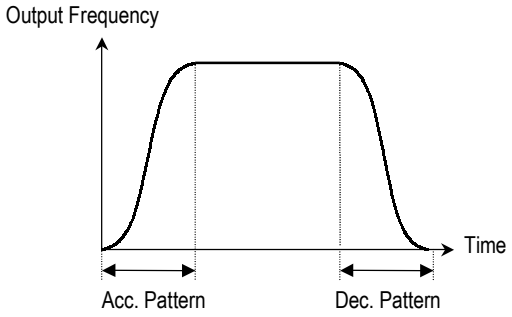
☞ **Note:** 'Minimum' and 'Optimum' functions operate normally when the load inertia is less than 10 times compared to the motor inertia. (FU2-37)

☞ **Note:** 'Optimum' is useful when the motor capacity is smaller than the inverter capacity.

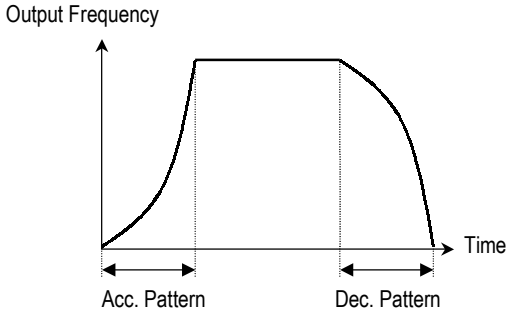
☞ **Note:** 'Minimum' and 'Optimum' functions are not appropriate for down operation in an elevator application.



[Accel/Decel Pattern: 'Linear']



[Accel/Decel Pattern: 'S-curve']



[Accel/Decel Pattern: 'U-curve']

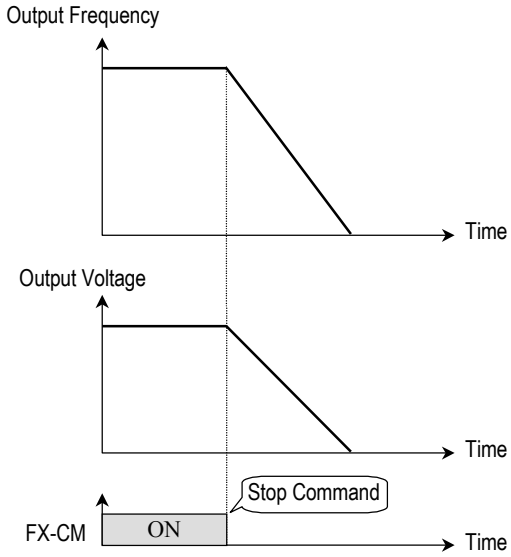
FU1-07: Stop Mode

FU1► Stop mode 07 Decel	07	0

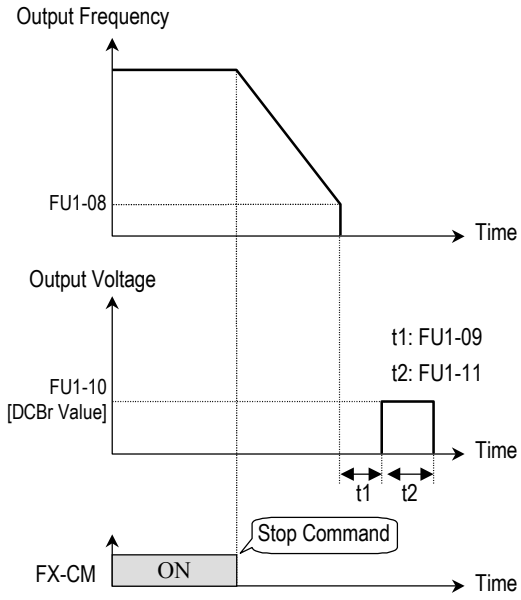
Factory Default:	Decel	0

Sets the stopping method for the inverter.

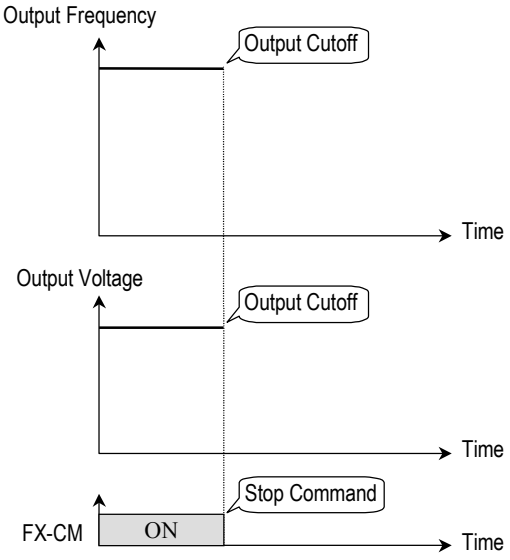
Setting Range		Description
LCD	7-Seg	
Decel	0	Inverter stops by the deceleration pattern.
Dc-brake	1	Inverter stops with DC injection braking. Inverter outputs DC voltage when the frequency reached the DC injection braking frequency set in FU1-08 during decelerating.
Free-run (Coast to stop)	2	Inverter cuts off its output immediately when the stop signal is commanded.



[Stop Mode: 'Decel']



[Stop Mode: 'Dc-brake']



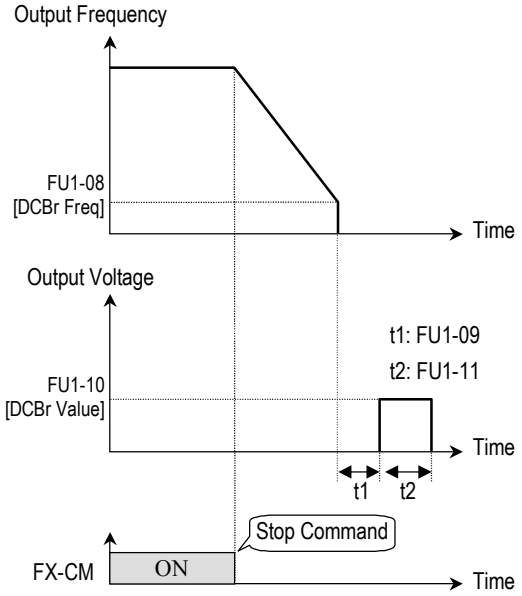
[[Stop Mode: 'Free-run']

FU1-08: DC Injection Braking Frequency
FU1-09: DC Injection Braking On-delay Time
FU1-10: DC Injection Braking Voltage
FU1-11: DC Injection Braking Time

FU1▶ DcBr freq 08 5.00 Hz	08	5.00
Factory Default: 5.00 Hz		5.00
FU1▶ DcBlk time 09 0.10 sec	09	0.10
Factory Default: 0.10 sec		0.10
FU1▶ DcBr value 10 50 %	10	50
Factory Default: 50 %		50
FU1▶ DcBr time 11 1.0 sec	11	1.0
Factory Default: 1.0 sec		1.0

By introducing a DC voltage to the motor windings this function stops the motor immediately. Selecting 'DC-Brake' in FU1-07 activates FU1-08 through FU1-11.

FU1-08 [DC Injection Braking Frequency] is the frequency at which the inverter starts to output DC voltage during deceleration.
FU1-09 [DC Injection Braking On-delay Time] is the inverter output blocking time before DC injection braking.
FU1-10 [DC Injection Braking Voltage] is the DC voltage applied to the motor and is based on FU2-33 [Rated Current of Motor].
FU1-11 [DC Injection Braking Time] is the time the DC current is applied to the motor.



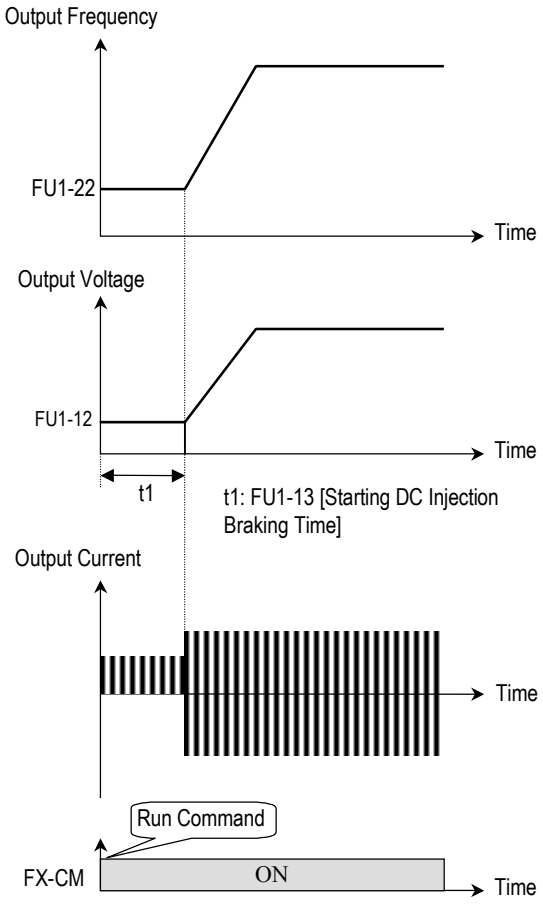
[DC Injection Braking Operation]

FU1-12: Starting DC Injection Braking Time
FU1-13: Staring DC Injection Braking Time

FU1▶ DcSt value 12 50 %	12	50
Factory Default: 50 %		50

FU1▶ DcSt time 13 0.0 sec	13	0.0
Factory Default: 0.0 sec		0.0

Inverter holds the starting frequency for Starting DC Injection Braking Time. It outputs DC voltage to the motor for FU1-13 [Starting DC Injection Braking Time] with the FU1-12 [Starting DC Injection Braking Voltage] before accelerating.



[Starting DC Injection Braking Operation]

Related Functions: FU2-33 [Rated Current of Motor]
- FU2-33: the DC current is limited by this parameter.

☞ **Note:** The DC injection braking function does not function when either FU1-12 or FU1-13 is set to "0".

☞ **Note:** FU1-12 [Starting DC Injection Braking Voltage] is also used as the DC Injection Braking Voltage for the multifunction input when the multifunction input is set to "DC braking".

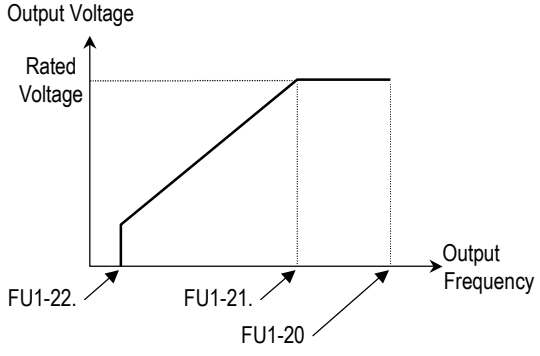
FU1-20: Maximum Frequency
FU1-21: Base Frequency
FU1-22: Starting Frequency

FU1▶ Max freq 20 60.00 Hz	20	60.00
Factory Default: 60.00 Hz		60.00

FU1▶ Base freq 21 60.00 Hz	21	60.00
Factory Default: 60.00 Hz		60.00

FU1▶ Start freq 22 0.50 Hz	22	0.50
Factory Default: 0.50 Hz		0.50

FU1-20 [Maximum Frequency] is the maximum output frequency of the inverter. Make sure this maximum frequency does not exceed the rated speed of the motor.
FU1-21 [Base Frequency] is the frequency where the inverter outputs its rated voltage. In case of using a 50Hz motor, set this to 50Hz.
FU1-22 [Starting Frequency] is the frequency where the inverter starts to output its voltage.



☞ **Note:** If the command frequency is set lower than the starting frequency, inverter does not output voltage to motor.

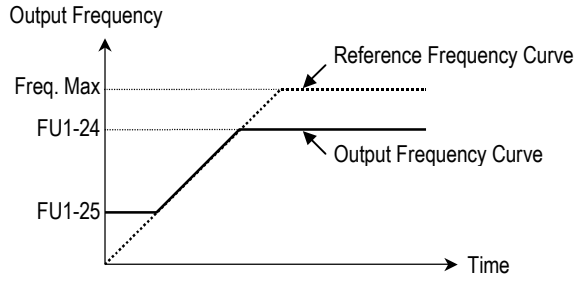
FU1-23: Frequency Limit Selection
FU1-24: Low Limit Frequency
FU1-25: High Limit Frequency

FU1► Freq limit 23 --- No ---	23	0
Factory Default: No		0

FU1► F-limit Lo 24 0.50 Hz	24	0.50
Factory Default: 0.50 Hz		0.50

FU1► F-limit Hi 25 60.00 Hz	25	60.00
Factory Default: 60.00 Hz		60.00

FU1-23 selects the limits for the inverter operating frequency. If FU1-23 is set to 'Yes', inverter operates within the upper and lower limit setting. The inverter operates at the upper or the lower limit when the frequency reference is outside the frequency limit range.



[Freq. limit: 'Yes']

☞ **Note:** Frequency limit does not work during accelerating and decelerating.

FU1-26: Manual/Auto Boost Selection
FU1-27: Torque Boost in Forward Direction
FU1-28: Torque Boost in Reverse Direction

FU1►Torque boost 26 Manual	26	0
Factory Default: Manual		0

FU1► Fwd boost 27 2.0 %	27	2.0
Factory Default: 2.0 %		2.0

FU1► Rev boost 28 2.0 %	28	2.0
Factory Default: 2.0 %		2.0

This function is used to increase the starting torque at low speed by increasing the output voltage of the inverter. If the boost value is set too high than required, it may cause the motor flux to saturate, causing over-current trip. Increase the boost value when there is excessive distance between inverter and motor.

[Manual Torque Boost]: The forward and reverse torque boost is set separately in FU1-27 and FU1-28.

☞ **Note:** The torque boost value is the percentage of inverter rated voltage.

☞ **Note:** When FU1-29 [Volts/Hz Pattern] is set to 'User V/F', this function does not work.

☞ **Note:** When FU2-40 [Control Mode] is set to 'Sensorless', the torque boost value is the rate per thousand of inverter rated voltage.

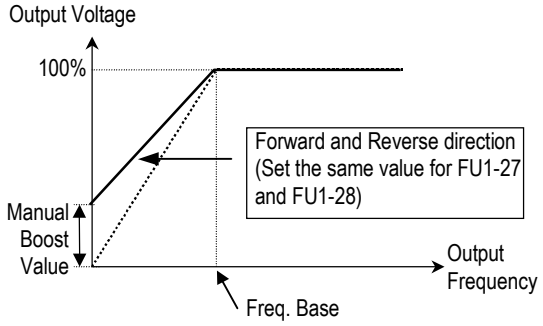
[Auto Torque Boost]: Inverter outputs high starting torque by automatic boosting according to the load.

☞ **Note:** Auto torque boost is only available for the 1st motor. Manual torque boost must be used for the 2nd motor.

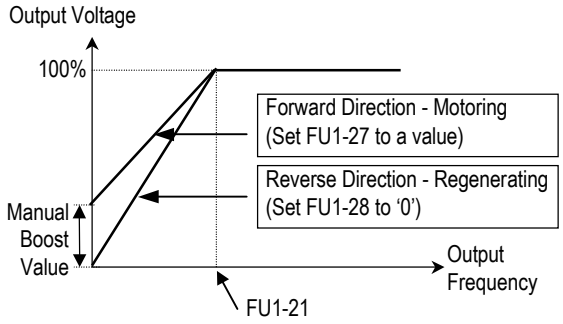
☞ **Note:** The auto torque boost value is added to the manual torque boost value.

☞ **Note:** Auto torque boost is available only when FU2-40 [Control Mode] is set to 'Sensorless'.

☞ **Note:** Conduct Auto tuning in FU2-41 [Auto tuning] to use Auto torque boost effectively.



[Constant Torque Loads: Conveyor, Moving Equip. etc.]



[Ascending and Descending Loads: Parking, Hoist etc.]

Related Functions:	FU1-29 [Volts/Hz Pattern] FU2-40 [Control Mode selection]

FU1-29: Volts/Hz Pattern

FU1► V/F pattern 29 Linear	29	0

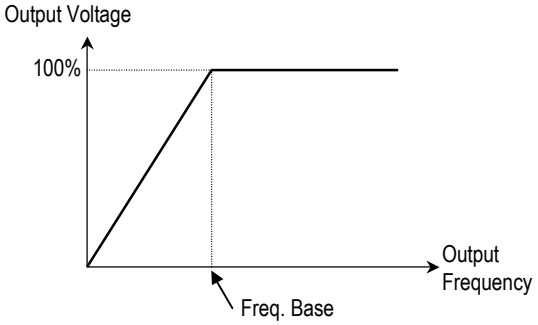
Factory Default:	Linear	0

This is the pattern of voltage/frequency ratio. Select the proper V/F pattern according to the load. The motor torque is dependent on this V/F pattern.

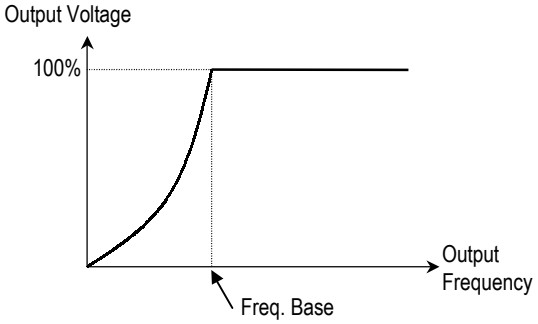
[Linear] pattern is used where constant torque is required. This pattern maintains a linear volts/frequency ratio from zero to base frequency. This pattern is appropriate for constant torque applications.

[Square] pattern is used where variable torque is required. This pattern maintains squared volts/hertz ratio. This pattern is appropriate for fans, pumps, etc.

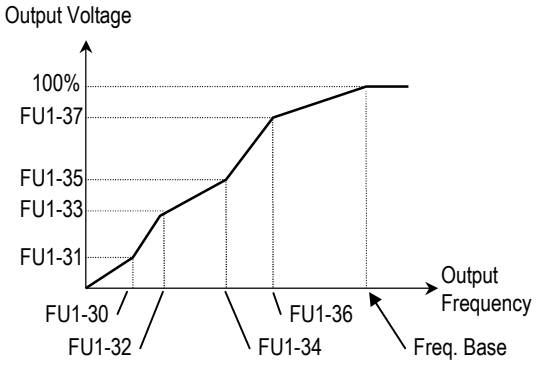
[User V/F] pattern is used for special applications. Users can adjust the volts/frequency ratio according to the application. This is accomplished by setting the voltage and frequency, respectively, at four points between starting frequency and base frequency. The four points of voltage and frequency are set in FU1-30 through FU1-37.



[V/F Pattern: 'Linear']



[V/F Pattern: 'Square']



[V/F Pattern: 'User V/F']

FU1-30 ~ FU1-37: User V/F Frequency and Voltage

FU1▶ User freq 1 30 15.00 Hz	30	15.00
Factory Default: 15.00 Hz		15.00

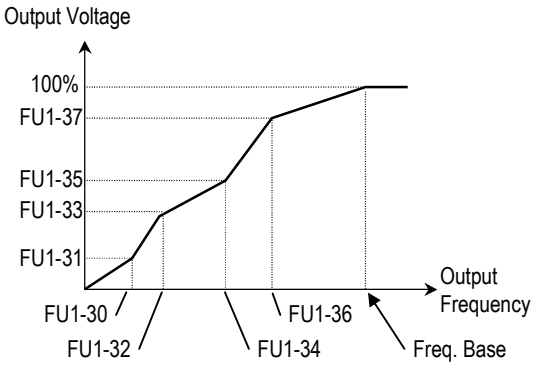
FU1▶ User volt 1 31 25 %	31	25
Factory Default: 25 %		25

⋮

FU1▶ User freq 4 36 60.00 Hz	36	15.00
Factory Default: 60.00 Hz		15.00

FU1▶ User volt 4 37 100 %	37	100
Factory Default: 100 %		100

These functions are available only when 'User V/F' is selected in FU1-29 [V/F pattern]. Users can make the custom V/F pattern by setting four points between FU1-22 [Starting Frequency] and FU1-21 [Base Frequency].



[User V/F]

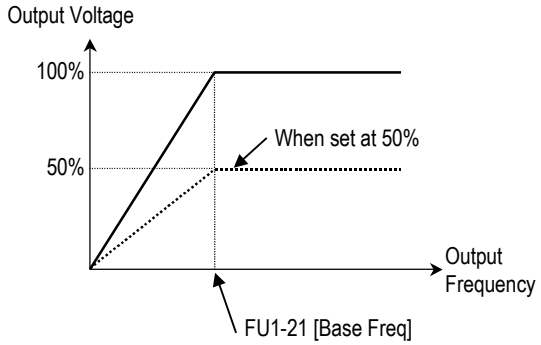
☞ **Note:** When the 'User V/F' is selected, the torque boost of FU1-26 through FU1-28 is ignored.

Related Functions:	FU1-21 [Base Frequency] FU1-22 [Starting Frequency] FU1-29 [Volts/Hz Pattern]

FU1-38: Output Voltage Adjustment

FU1▶Volt control 38 100.0 %	38	100
Factory Default: 100.0 %		100

This function is used to adjust the output voltage of the inverter. This is useful when using a motor with a lower rated voltage than the main input voltage. When this is set at 100%, inverter outputs its rated voltage.

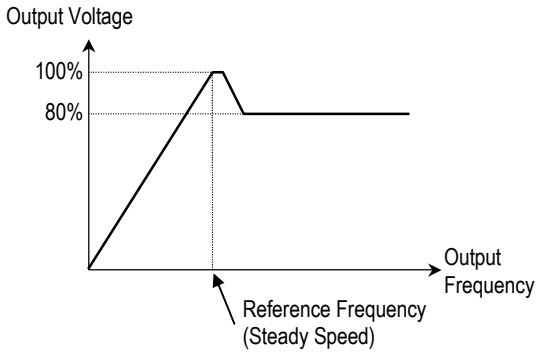


☞ **Note:** The inverter output voltage does not exceed the main input voltage, even though FU1-38 is set at 110%.

FU1-39: Energy Save Level

FU1▶ Energy save 39 0 %	39	0
Factory Default: 0 %		0

This function is used to reduce the output voltage in applications that do not require high torque and current at its steady speed. The inverter reduces its output voltage after accelerating to the reference frequency (steady speed) if the energy save level is set at 20%. This function may cause over-current trip due to the lack of output torque in a fluctuating load. This function does not work with 0% set point value.



[When Energy Save Level is set at 20%]

☞ **Note:** This function is not recommended for a large load or for an application that need frequent acceleration and deceleration.

☞ **Note:** This function does not work when 'Sensorless' is selected in FU2-40 [Control Mode].

FU1-50: Electronic Thermal (Motor i²t) Selection
FU1-51: Electronic Thermal Level for 1 Minute
FU1-52: Electronic Thermal Level for Continuous
FU1-53: Electronic Thermal Characteristic (Motor type) selection

These functions are to protect the motor from overheating without using additional thermal overload relay. Inverter calculates the temperature rising of the motor using several parameters and determines whether or not the motor is overheated. Inverter will turn off its output and display a trip message when the electronic thermal feature is activated.

FU1► ETH select 50 --- No ---	50	0
Factory Default: No		0

This function activates the ETH parameters by setting 'Yes'.

FU1► ETH 1min 51 150 %	51	150
Factory Default: 150 %		150

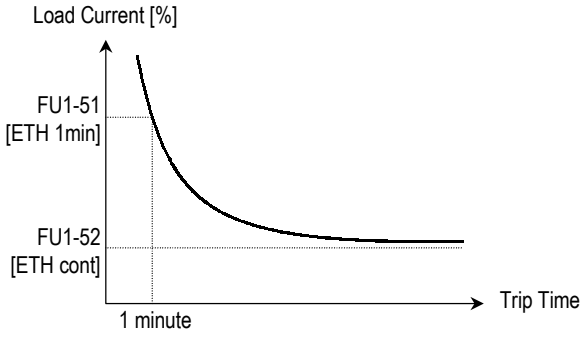
This is the reference current when the inverter determines the motor has overheated. It trips in one minute when 150% of rated motor current established in FU2-33 flows for one minute.

☞ **Note:** The set value is the percentage of FU2-33 [Rated Motor Current].

FU1► ETH cont 52 100 %	52	100
Factory Default: 100 %		100

This is the current at which the motor can run continuously. Generally, this value is set to '100%' and which means the rated motor current set in FU2-33. This value must be set less than FU1-52 [ETH 1min].

☞ **Note:** The set value is the percentage of FU2-33 [Rated Motor Current].



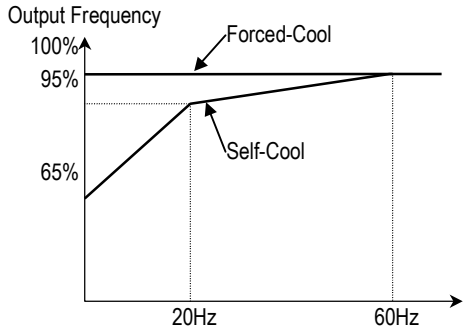
[Motor i²t Characteristic Curve]

FU1► Motor type 53 Self-cool	53	0
Factory Default: Self-cool		0

To make the ETH function (Motor i^2t) work correctly, the motor cooling method must be selected correctly according to the motor.

[Self-cool] is a motor that has a cooling fan connected directly to the shaft of the motor. Cooling effects of a self-cooled motor decrease when a motor is running at low speeds. The motor current is derated as the motor speed decreases.

[Forced-cool] is a motor that uses a separate motor to power a cooling fan. As the motor speed changes, the cooling effects doe not change.



[Load Current Derating Curve]

☞ **Note:** Despite the motor current changing frequently due to load fluctuation or acceleration and deceleration, the inverter calculates the i^2t and accumulates the value to protect the motor.

Related Functions:	FU2-33 [Rated Motor Current]

FU1-54: Overload Warning Level
FU1-55: Overload Warning Time

FU1▶ OL level 54 150 %	54	150

Factory Default:	150 %	150

FU1▶ OL time 55 10.0 sec	55	10.0

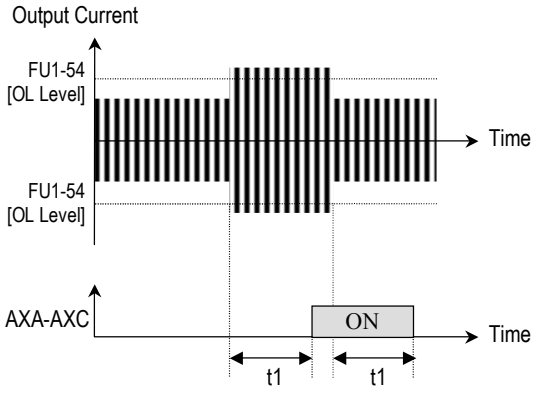
Factory Default:	10.0 sec	10.0

The inverter generates an alarm signal when the output current has reached the FU1-54 [Overload Warning Level] for the FU1-55 [Overload Warning Time]. The alarm signal persists for the FU1-55 even if the current has become the level below the FU1-54.

Multi-function output terminal (AXA-AXC) is used as the alarm signal output. To output the alarm signal, set I/O 44 [Multifunction Auxiliary Contact Output] to 'OL'.

☞ **Note:** Inverter is not tripped by this function.

☞ **Note:** The set value is the percentage of FU2-33 [Rated Motor Current].



t1: FU1-55 [Overload Warning Time]

[Overload Warning]

Related Functions:	FU2-33 [Rated Motor Current] I/O-44 [Multi-function Auxiliary Contact Output]

FU1-56: Overload Trip Selection
FU1-57: Overload Trip Level
FU1-58: Overload Trip Delay Time

FU1▶ OLT select 56 --- Yes ---	56	1

Factory Default:	Yes	1

FU1▶ OLT level 57 180 %	57	180

Factory Default:	180 %	180

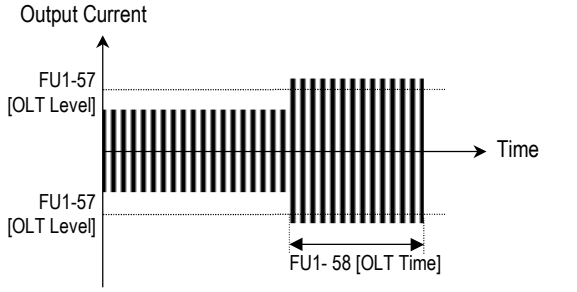
FU1▶ OLT time 58 60.0 sec	58	60.0

Factory Default:	60.0 sec	60.0

Inverter cuts off its output and displays fault message when the output current persists over the FU1-57 [Overload Trip Level] for the time of FU1-58 [Overload Trip Time]. This function protects the

inverter and motor from abnormal load conditions.

☞ **Note:** The set value is the percentage of FU2-33 [Rated Motor Current].



[Overload Trip Operation]

Related Functions:	FU2-33 [Rated Motor Current]

FU1-59: Stall Prevention Mode Selection (Bit set)
FU1-60: Stall Prevention Level

FU1► Stall prev. 59 000	59	000

Factory Default:	000	000

This bit set parameter follows the conventions used in I/O-15 and I/O-16 to show the ON (bit set) status.

FU1► Stall level 60 150 %	60	150

Factory Default:	150 %	150

This function is used to prevent the motor from stalling by reducing the inverter output frequency until the motor current decreases below the stall prevention level. This function can be selected for each mode of acceleration, steady speed, and deceleration via bit combination.

☞ **Note:** The set value is the percentage of FU2-33 [Rated Motor Current].

FU1-59 [Stall Prevention Mode Selection]

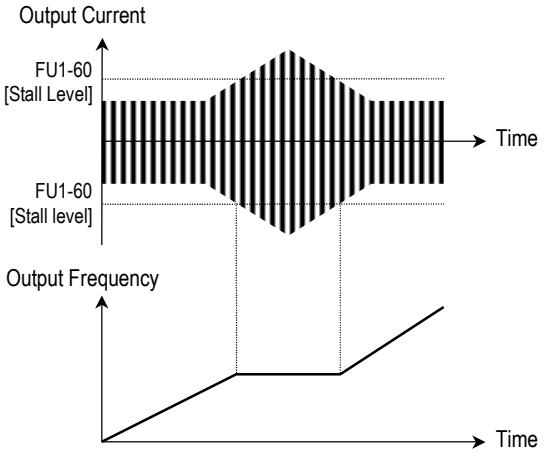
Setting Range			FU1-59	Description
3rd bit	2nd bit	1st bit		
0	0	1	001	Stall Prevention during Acceleration
0	1	0	010	Stall Prevention during Steady Speed
1	0	0	100	Stall Prevention during Deceleration

When FU1-59 is set to '111', stall prevention works during accelerating, steady speed and decelerating.

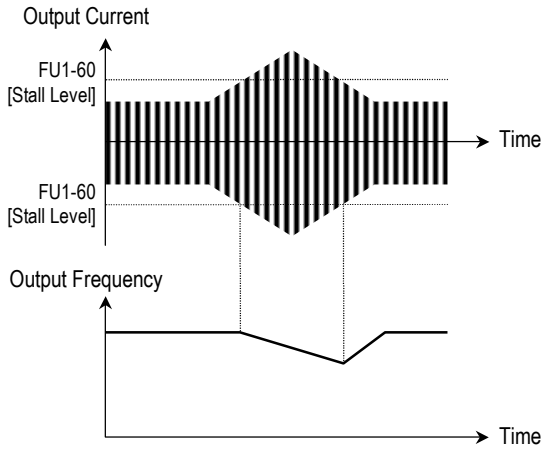
☞ **Note:** The acceleration and deceleration time may take longer than the time set in DRV-01, DRV-02 when Stall Prevention is selected.

☞ **Note:** If stall prevention status persists, inverter may stop during acceleration.

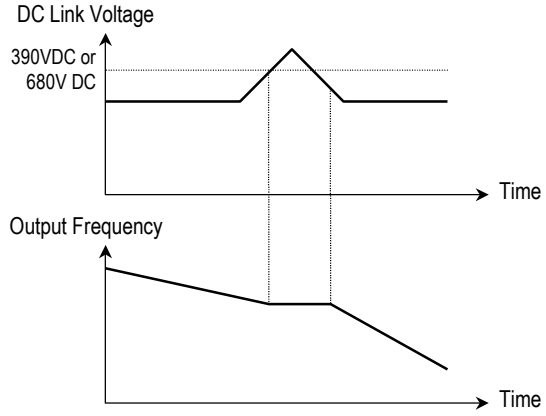
Related Functions:	FU2-33 [Rated Motor Current]



[Stall Prevention during Acceleration]



[Stall Prevention during Steady Speed]



[Stall Prevention during Deceleration]

FU1-99: Return Code (7-Segment Keypad)

99	0

Factory Default:	0

This code is used to exit a group when using a 7-segment keypad. After pressing **PROG/ENT** key, set the value to '1' and press the **PROG/ENT** key again to exit.

Related Functions:	FU2-99 [Return Code] I/O-99 [Return Code] EXT-99 [Return Code] COM-99 [Return Code]

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5.3 Function 2 Group [FU2]

FU2-00: Jump to desired code #

FU2► Jump code 00 1

Factory Default:	1

Jumping directly to any parameter code can be accomplished by entering the desired code number. This code is available only with LCD keypad.

FU2-01: Previous Fault History 1
FU2-02: Previous Fault History 2
FU2-03: Previous Fault History 3
FU2-04: Previous Fault History 4
FU2-05: Previous Fault History 5
FU2-06: Erase Fault History

FU2► Last trip-1 01 None	01	0

Factory Default:	None	0

⋮

FU2► Last trip-5 05 None	05	0

Factory Default:	None	0

This code displays up to five previous fault (trip) status of the inverter. Use the PROG, ▲ and ▼ key before pressing the RESET key to check the fault content(s), output frequency, output current, and whether the inverter was accelerating, decelerating, or in constant speed at the time of the fault occurred. Press the ENT key to exit. The fault content will be stored in FU2-01 through FU2-05 when the RESET key is pressed. For more detail, please refer to Chapter 7.

[Fault Contents]

Fault (Trip)	Keypad Display	
	LCD	7-Segment
Over-Current 1	Over Current 1	OC
Over-Voltage	Over Voltage	OV
External Trip Input A	External-A	EXTA
Emergency Stop (Not Latched)	BX	BX
Low-Voltage	Low Voltage	LV
Fuse Open	Fuse Open	FUSE
Ground Fault	Ground Fault	GF
Over-Heat on Heat sink	Over Heat	OH
Electronic Thermal Trip	E-Thermal	ETH
Over-Load Trip	Over Load	OLT
Inverter H/W Fault - EEP Error - ADC Offset - WDOG Error - In-Phase Open	HW-Diag	HW
External Trip Input B	External-B	EXTB
Over-Current 2	Arm Short	ASHT
Option Error	Option	OPT
Output Phase Loss	Phase Open	PO
Inverter Over-Load	Inv. OLT	IOLT

☞ **Note:** There are WDOG error, EEP error, and ADC Offset for the inverter Hardware Fault, and the inverter will not reset when H/W fault occurs. Repair the fault before turning on the power.

☞ **Note:** When multiple faults occur, only the highest-level fault will be displayed.

Related Functions:	DRV-12 [Fault Display] displays current fault status.

FU2► Erase trips 06 --- No ---	06	0

Factory Default:	No	0

This function erases all fault histories of FU2-01 to FU-05 from the memory.

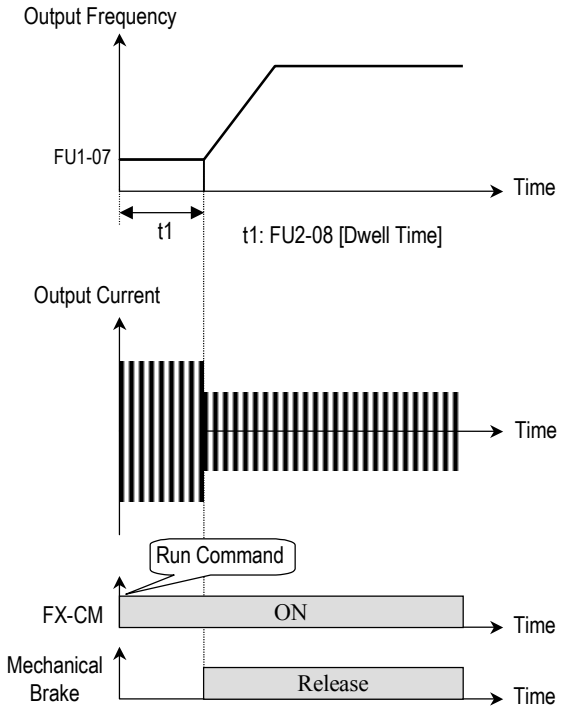
FU2-07: Dwell Frequency
FU2-08: Dwell Time

FU2▶ Dwell freq 07 5.00 Hz	07	5.00
Factory Default: 5.00 Hz		5.00

FU2▶ Dwell time 08 0.0 sec	08	0.0
Factory Default: 0.0 sec		0.0

This function is used to output torque in an intended direction. It is useful in hoisting applications to get enough torque before a releasing mechanical brake. If the dwell time is set at '0', this function is not available. In dwell operation, the inverter outputs AC voltage not a DC voltage.

☞ **Note:** DC Injection Braking does not output torque to an intended direction. It is just to hold the motor.



[Dwell Operation]

FU2-10 ~ FU2-16: Frequency Jump

FU2▶ Jump freq 10 --- No ---	10	0
Factory Default: No		0

FU2▶ jump lo 1 11 10.00 Hz	11	10.00
Factory Default: 10.00 Hz		10.00

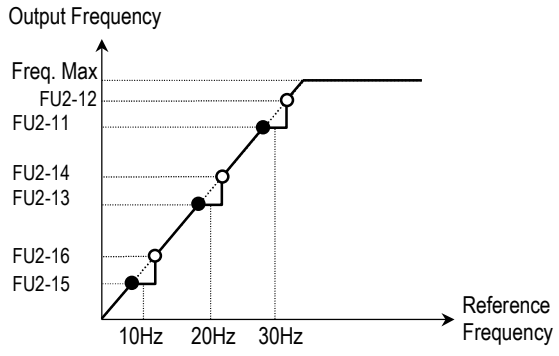
FU2▶ jump Hi 1 12 15.00 Hz	12	15.00
Factory Default: 15.00 Hz		15.00

□
□

FU2▶ jump lo 3 15 30.00 Hz	15	30.00
Factory Default: 30.00 Hz		30.00

FU2▶ jump Hi 3 16 35.00 Hz	16	35.00
Factory Default: 35.00 Hz		35.00

To prevent undesirable resonance and vibration on the structure of the machine, this function locks out the potential resonance frequency from occurring. Three different jump frequency ranges may be set. This avoidance of frequencies does not occur during accelerating or decelerating. It only occurs during continuous operation.



[Frequency Jump]

☞ **Note:** When the reference frequency is set inside the jump frequency, the output frequency goes to the frequency marked by "●" symbol.

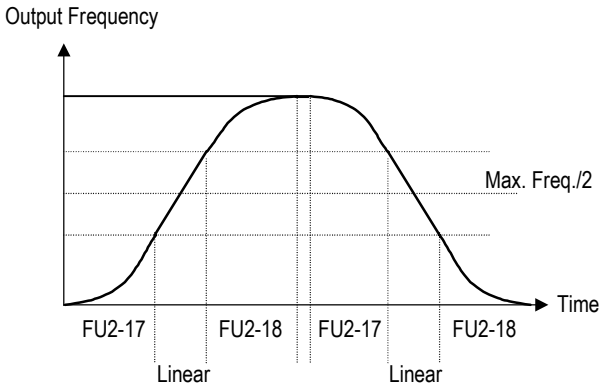
☞ **Note:** If one frequency jump range is required, set all ranges to the same range.

FU2-17: Start Curve for S-Curve Accel/Decel Pattern
FU2-18: End Curve for S-Curve Accel/Decel Pattern

FU2► Start Curve 17 40 %	17	40
Factory Default: 40%		40

FU2► End Curve 18 40 %	18	40
Factory Default: 40%		40

This parameter is used to adjust the Accel and Decel pattern when 'S-Curve' is selected in FU1-05 and FU1-06 respectively. To use this function, the Reference Frequency for Accel and Decel set in FU2-70 should be set to 'Delta freq'.



[S0Curve Adjustment]

Actual Accel Time = DRV-01 + (DRV-01 * FU2-17)/2 + (DRV-01*FU2-18)/2

Actual Decel Time = DRV-02 + (DRV-02 * FU2-17)/2 + (DRV-02*FU2-18)/2

Ex) If DRV-10: 1 sec, FU2-17: 40%, FU2-18: 20%, Actual Accel Time = 1 sec + (1sec*0.4)/2 + (1sec*0.2)/2 = 1.3 sec

FU2-19: Input/Output Phase Loss Protection (Bit Set)

FU2► Trip select 19 00	19	00
Factory Default: 00		00

This function is used to cut the inverter output off in case of phase loss in either input power or inverter output.

FU2-19 [Phase Loss Protection Select]

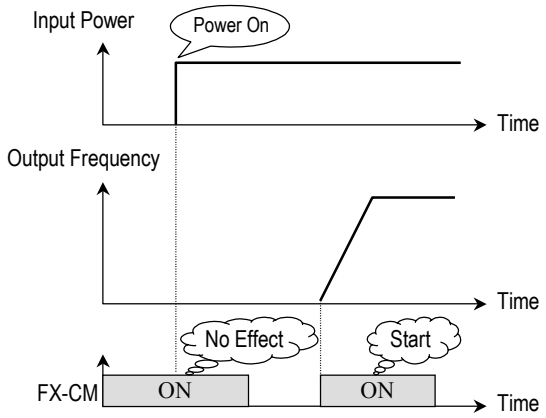
Setting Range		FU2-19	Description
2nd bit	1st bit		
0	0	00	Phase loss protection does not work
0	1	01	Protect inverter from output phase loss
1	0	10	Protect inverter from input phase loss
1	1	11	Protect inverter from input and output phase loss

Related Functions: FU2-22 to FU2-25 [Speed Search]

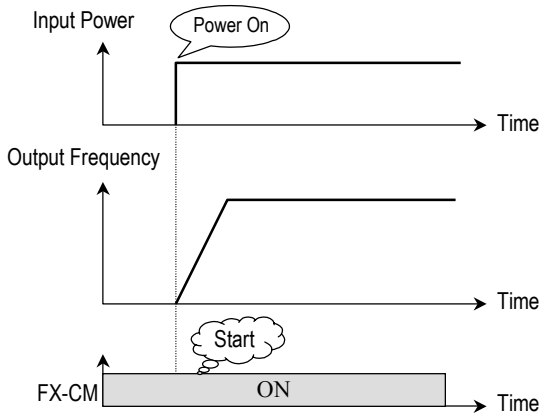
FU2-20: Power ON Start Selection

FU2►Power-on run 20 --- No ---	20	0
Factory Default: No		0

If FUN-20 is set to 'No', restart the inverter by cycling the FX or RX terminal to CM terminal after power has been restored.
If FUN-20 is set to 'Yes', the inverter will restart after power is restored. If the motor is rotating by inertia at the time power is restored, the inverter may trip. To avoid this trip, use 'Speed Search' function by setting FU2-22 to '1xxx'.



[Power ON Start: 'No']



[Power ON Start: 'Yes']

☞ **Note:** In case of using 'Power ON Start' to 'Yes', make sure to utilize appropriate warning notices to minimize the potential for injury or equipment damage.

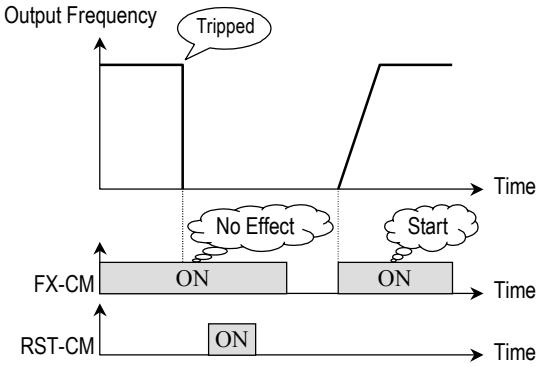
Related Functions:	FU2-22 ~ FU2-25 [Speed Search]

FU2-21: Restart After Fault Reset

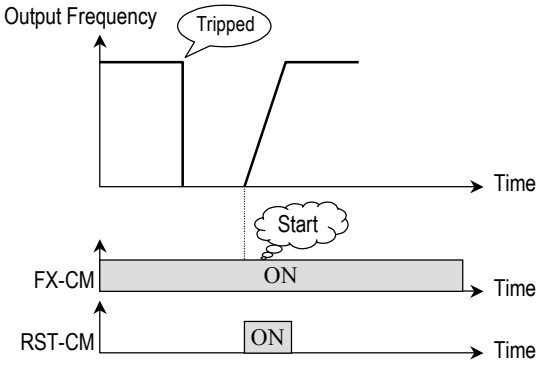
FU2▶ RST restart 21 --- No ---	21	0

Factory Default:	No	0

If FU2-21 is set to 'Yes', inverter will restart after the RST (reset) terminal has been reset a fault.
If FU2-21 is set to 'No', restart the inverter by cycling the FX or RX terminal to CM terminal after the fault has been reset. If the motor is rotating by inertia at the time power is restored, the inverter may trip. To avoid this trip, use 'Speed Search' function by setting FU2-22 to 'xx1x'.



[Reset restart: 'No']



[Reset restart: 'Yes']

☞ **Note:** In case of using 'Reset Restart' to 'Yes', make sure to utilize appropriate warning notices to minimize the potential for injury or equipment damage.

Related Functions:	FU2-22 ~ FU2-25 [Speed Search]

FU2-22: Speed Search Selection (Bit Set)
FU2-23: Current Limit Level During Speed Search
FU2-24: P Gain During Speed Search
FU2-25: I Gain During Speed Search

FU2▶Speed Search 22 0000	22	0000

Factory Default:	0000	0000

FU2► SS Sup-Curr 23 100 %	23	100
Factory Default: 100 %		100

FU2► SS P-gain 24 100	24	100
Factory Default: 100		100

FU2► SS I-gain 25 1000	25	1000
Factory Default: 1000		100

This function is used to permit automatic restarting after Power ON, Fault Reset, and Instant Power Failure without waiting for the motor to stop.
The speed search gain should be set after considering the inertia moment (GD^2) and magnitude of torque of the load. FU2-37 [Load Inertia] must be set at the correct value to make this function operate correctly.

FU2-22 [Speed Search Select]

Setting Range				Description
4th bit	3rd bit	2nd bit	1st bit	
0	0	0	0	Speed search function does not work
0	0	0	1	Speed search during Accelerating
0	0	1	0	Speed search during a Fault Reset restarting (FU2-21) and Auto restarting (FU2-26)
0	1	0	0	Speed search during Instant Power Failure restarting.
1	0	0	0	Speed search during Power ON starting (FU2-20)

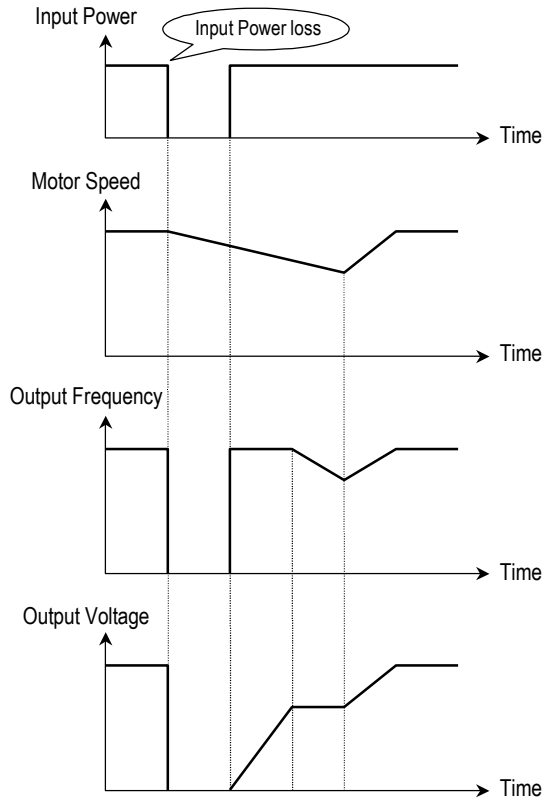
When FU2-22 is set to '1111', Speed Search works for all conditions.

FU2-22 [Speed Search Selection] selects the speed search function.

FU2-23 [Current Limit Level] is the current that the inverter limits its current rise during speed searching. (The set value is the percentage of FU2-33 [Rated Motor Current])

FU2-24 [P Gain] is the proportional gain used for speed search. Set this value according to load inertia set in FU2-37.

FU2-25 [I Gain] is the Integral gain used for speed search. Set this value according to load inertia set in FU2-37.



[Speed Search Operation]

Related Functions:	FU2-20 [Power ON Start] FU2-21 [Restart after Fault Reset] FU2-26 ~ FU2-27 [Auto Restart] FU2-30 ~ FU2-37 [Motor Parameters]

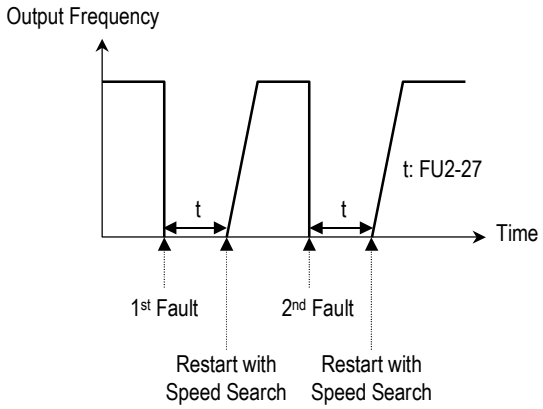
FU2-26: Number of Auto Restart Attempt
FU2-27: Delay Time Before Auto Restart

FU2►Retry number 26 0	26	0
Factory Default: 0		0

FU2►Retry delay 27 1.0 sec	27	1.0

Factory Default:	1.0 sec	1.0

This function is used to allow the inverter to reset itself for a selected number of times after a fault has occurred. The inverter can restart itself automatically when a fault occurs. To use the speed search function during auto restarting set FU2-22 to 'xx1x'. See FU2-22 ~ FU2-25.
When an under voltage (LV) fault, inverter disable (BX) or Arm short occurs, the drive does not restart automatically.



☞ **Note:** Inverter decreases the retry number by one as a fault occurs. When restarted without a fault during 30 seconds, the inverter increases the retry number by one.

FU2-30: Rated Motor Selection
FU2-31: Number of Motor Pole
FU2-32: Rated Motor Slip
FU2-33: Rated Motor Current
FU2-34: No Load Motor Current
FU2-36: Motor Efficiency
FU2-37: Load Inertia

If you do not set these values, inverter will use its default values.

FU2▶Motor select 30 0.75kW	30	0

Factory Default:	0.75 kW	0
(This value is set according to the model number before shipping)		

This parameter sets the motor capacity. Other motor related parameters are changed automatically according to motor capacity. The motor related parameters are FU2-32 [Rated Motor Slip], FU2-33 [Rated Motor Current], FU2-34 [No Load Motor Current], FU2-42 [Stator Resistance], FU2-43 [Rotor Resistance], and FU2-44 [Leakage Inductance].
If you know the motor parameters, set the values in the relevant codes for better control performance.

FU2▶ Pole number 31 4	31	4

Factory Default:	4	4

This is used to display the motor speed. If you set this value to 2, inverter will display 3600 rpm instead 1800rpm at 60Hz output frequency. (See motor nameplate)

FU2▶ Rated-Slip 32 3.00 Hz	32	3.00

Factory Default:	3.00 Hz	3.00

This is used in 'Slip Compensation' control. If you set this value incorrectly, motor may stall during slip compensation control. (See motor nameplate)

FU2▶ Rated-Curr 33 3.6 A	33	3.6

Factory Default:	3.6 A	3.6
(This value is set according to the motor capacity set in FU2-30)		

This is very importance parameter that must be set correctly. This value is referenced in many other inverter parameters. (See motor nameplate)

FU2▶ Noload-Curr 34 1.8 A	34	1.8

Factory Default:	1.8 A	1.8
(This value is set according to the motor capacity set in FU2-30)		

This parameter is only displayed when 'Slip Compen' is selected in FU2-40 [Control Method].

This function is used to maintain constant motor speed. To keep the motor speed constant, the output frequency varies within the limit of slip frequency set in FU2-32 according to the load current. For example,

when the motor speed decreases below the reference speed (frequency) due to a heavy load, the inverter increases the output frequency higher than the reference frequency to increase the motor speed. The inverter increases or decreases the output by delta frequency shown below.

$$\text{Delta Freq.} = \frac{\text{Output current} - \text{No load current}}{\text{Rated current} - \text{No load current}} \times \text{Rated Slip}$$

Output frequency = Reference freq. + Delta freq.

FU2► Efficiency 36 72 %	36	72
Factory Default: 72%		72
(This value is set according to the motor capacity set in FU2-30)		

This value is used for calculating the output wattage when FU2-72 is set to 'Watt'.

FU2►Inertia rate 37 0	37	0
Factory Default: 0		0

This parameter is used for sensorless control, minimum Accel/Decel, optimum Accel/Decel and speed search. For better control performance, this value must be set as exact as possible.

Set '0' for loads that has load inertia less than 10 times that of motor inertia.

Set '1' for loads that have load inertia about 10 times that of motor inertia.

FU2-39: Carrier Frequency

FU2►Carrier freq 39 15.0 kHz	39	5.0
Factory Default: 5.0		5.0

This parameter affects the audible sound of the motor, noise emission from the inverter, inverter temperature, and leakage current. If the ambient temperature where the inverter is installed is high or other equipment may be affected by potential inverter noise, set this value lower.
This is also used to avoid a induced resonance in the machine or motor.

☞ **Note:** If this value must be set higher than 10 kHz, derate the load current by 5% per 1 kHz.

FU2-40: Control Method Selection

FU2►Control mode 40 V/F	40	0
Factory Default: V/F		0

This is to select the control method of inverter.

Setting Range		Description
LCD	7-Seg	
V/F	0	Volts/Hz Control
Slip compen	1	Slip compensation operation
PID	2	PID feedback operation
Sensorless	3	Sensorless Control

[V/F]: This parameter controls the voltage/frequency ratio constant. It is recommended to use the torque boost function when a greater starting torque is required.

Related Functions: FU2-26 ~ FU2-28 [Torque Boost]

[Slip compen]: This function is used to maintain constant motor speed. To keep the motor speed constant, the output frequency varies within the limit of slip frequency set in FU2-32 according to the load current. For example, when the motor speed decreases below the reference speed (frequency) due to a heavy load, the inverter increases the output frequency higher than the reference frequency to increase the motor speed. The inverter increases or decreases the output by delta frequency shown below.

$$\text{Delta Freq.} = \frac{\text{Output current} - \text{No load current}}{\text{Rated current} - \text{No load current}} \times \text{Rated Slip}$$

Output frequency = Reference freq. + Delta freq.

☞ **Note:** Motor parameters must be set correctly for better performance of control.

Related Functions:	FU2-30 ~ FU2-37 [Motor Parameters]

[Sensorless]: This function estimates the motor speed without using a sensor, and controls the magnetic flux and the torque. Use this function when additional torque is needed for starting and at low speeds, or when the load fluctuates severely.
In case of not using standard motor, auto tuning must be conducted in FU2-41 [Auto tuning] before starting.

☞ **Note:** Motor parameters must be set correctly for better performance of control.

Related Functions:	FU2-30 ~ FU2-37 [Motor Parameters] FU2-41 ~ FU2-44 [Motor Constants] FU2-45 ~ FU2-46 [Sensorless PI Gain]

Conditions for Sensorless Control

Conditions for sensorless control is as follows. If one of the following conditions is not satisfied, the inverter may malfunction with insufficient torque, irregular rotation, or excessive motor noise. It is recommended to use V/F control.

- ☐ Use a motor capacity that is equal to or one horsepower level lower than the inverter capacity.
- ☐ Two different motor parameters can be set for one inverter, but use only one motor parameter for sensorless control.
- ☐ Utilize the auto tuning feature in FU2-41 [Auto tuning] before starting.
- ☐ Set appropriate values for the electronic thermal function, the overload limit function and the stall prevention. The set values should not exceed 150% of the rated motor current.
- ☐ When FU1–02 [Frequency Mode] is set to “V1”, “I”, or “V1+I”, eliminate any potential noise influence with the frequency reference.
- ☐ Pole number of the motor should be 2 pole, 4 pole, or 6 pole.
- ☐ The distance between the inverter and the motor should not exceed 100m (328 ft).

Precautions When Using Sensorless Control

- ☐ Forced-cooling should be used for the motor when the average operating speed is under 20Hz and more than 100% load is used constantly.
- ☐ The motor may rotate 0.5% faster than the maximum speed if the motor temperature does not reach normal operating temperature.
- ☐ The performance can be improved during regeneration for systems with frequent acceleration and deceleration operations by installing the DB (Dynamic Brake) braking unit option.
- ☐ Utilize the auto-tuning feature when the motor reaches normal temperature (average temperature where the motor normally operates).
- ☐ Output torque may be reduced when an output filter option is used between the inverter and the motor.
- ☐ Speed change is more frequent than the V/F control.
- ☐ If the speed changes excessively when the FU2–39 [Carrier Frequency Selection] is set to a value more than 10kHz, change the setting to 5~10kHz.
- ☐ Over current fault can occur if the FU2-42 [Stator Resistance (Rs)] is set to a value more than twice the auto tuned value

Applications Suitable for Sensorless Control

- ☐ When a large starting torque is needed
- ☐ When load changes frequently
- ☐ When sufficient low speed torque is needed

Tuning Method for Sensorless Control

- ☐ Adjust the FU2–42 [Stator Resistance (Rs)] value larger or smaller by 5% units if the current is larger or smaller than that of V/F control with small load.
- ☐ Adjust the FU2–43 [Rotor Resistance (Rr)] value larger or smaller by 5% units if the speed is faster or slower than that of V/F control with small load.
- ☐ Adjust the FU2–43 [Rotor Resistance (Rr)] value larger or smaller by 5% units if the average speed is fast or slow when load is applied.

FU2-41: Auto Tuning
FU2-42: Stator Resistance (Rs)
FU2-43: Rotor Resistance (Rr)
FU2-44: Leakage Inductance (Lsigma)

FU2► Auto tuning 41 --- No ---	41	0

Factory Default:	No	0

The auto tuning function automatically measures the motor parameters needed for sensorless control such as stator resistance, rotor resistance, and leakage inductance when the FU2-40 [Control Method Selection] is set to 'Sensorless'. The motor does not rotate during auto tuning so there is no need to separate the motor from the system.

☞ **Note:** The rated current of the motor on the nameplate must be entered before auto tuning.

☞ **Note:** The motor parameter values change with temperature change, so auto tuning is to be conducted after the temperature of the motor is stabilized.

☞ **Note:** user can set the motor parameters (Rs, Rr, Lsigma).

FU2► Rs 42 0.026 ohm	42	0.026

Factory Default:	0.026 ohm	0.026

This code displays the stator resistance of the motor.

FU2► Rr 43 0.053 ohm	43	0.053

Factory Default:	0.053 ohm	0.053

This code displays the rotor resistance of motor.

FU2► Lsigma 44 80893 mH	44	8.893

Factory Default:	8.893 mH	8.893

This code displays the leakage inductance of motor.

Related Functions:	FU2-30 ~ FU2-37 [Motor Parameters] FU2-40 [Control Method]

FU2-45: P Gain for Sensorless Control
FU2-46: I Gain for Sensorless Control

FU2► SL P-gain 45 32767	45	3276

Factory Default:	32767	3276

SL P-gain is the proportional gain of speed controller. If this value is set high, you can get fast speed response characteristic. However, if this value is set too high, the steady state characteristics may become unstable.

FU2► SL I-gain 46 3276	46	3276

Factory Default:	3276	3276

SL I-gain is the integral gain of speed controller. If this value is set low, you can get better transient response characteristic and steady state characteristic. However, if this value is set too low, there may be an overshoot in speed control.

☞ **Note:** The response time of a system is affected by the load inertia. For better control performance, set the FU2-37 [Load Inertia] correctly.

Related Functions:	FU2-30 ~ FU2-37 [Motor Parameters] FU2-40 [Control Method]

FU2-47: PID Operation Selection

FU2►Proc PI mode 47 --- No ---	47	0

Factory Default:	No	0

This code selects the PID control.
For HVAC or Pump applications, the PID control can be used to adjust the actual output by comparing a feedback with a 'Set-point' given to the inverter. This 'Set-point' can be in the form of Speed, Temperature, Pressure, Flow level, etc. The 'Set-point' and the feedback signals are provided externally to the inverter analog input terminals V1, V2 or I. The inverter compares the signals in

calculating 'total-error' which is reflected in the inverter output.
Please see FU2-50 to FU2-54 for more detail.

☞ **Note:** PID control can be bypassed to manual operation temporarily by defining one of the multifunction input terminals (P1~P3) to "Open-loop". The inverter will change to manual operation from PID control when this terminal is ON, and change back to PID control when this terminal is OFF.

Related Functions:	DRV-04 [Frequency Mode] I/O-01 to I/O-10 [Analog Signal Setting] I/O-12 to I/O-14 [Multi-Function Input] EXT-15 to EXT-21 [Pulse Input Setting] FU2-50 to FU2-54 [PID Feedback]

FU2-48: PID Reference Frequency Selection
FU2-49: PID Reference Mode Selection
FU2-50: PID Output Direction Selection

FU2► PID Ref 48 Ramp freq.	48	0

Factory Default:	No	0

This code selects reference frequency for PID control.

[Ramp Freq]: PID control references frequency with Accel and Decel pattern and time.

[Target Freq]: PID control references frequency without Accel and Decel pattern and time.

FU2►PID Ref Mode 49 Freq mode	49	0

Factory Default:	Freq mode	0

This code selects reference input for PID control.

[Freq Mode]: PID control references signal set in DRV-04. When selected other than 'Freq mode', PID control references the selected signal regardless the selection in DRV-04.

FU2► PID Out Dir 50 Ramp Freq.	50	0

Factory Default:	Ramp Freq.	0

This code selects the direction of output value of PID controller. The output value is added to reference frequency.

FU2-51: PID Feedback Signal Selection
FU2-52: P Gain for PID Control
FU2-53: I Gain for PID Control
FU2-54: D Gain for PID Control
FU2-55: High Limit Frequency for PID Control
FU2-56: Low Limit Frequency for PID Control

FU2► PID F/B 51 I	51	0

Factory Default:	I	0

Select the feedback signal for PID control. This can be set one of 'I', 'V1', 'V2' according to the signal (current or voltage) and the terminal (V1 or V2).

FU2► PID P-gain 52 300.0 %	52	300.0

Factory Default:	300.0 %	300.0

Set the proportional gain for PID control. When P-Gain is set at 100% and I-Gain at 0.0 second, it means the PID controller output is 100% for 100% error value.

FU2► PID I-time 53 30.0 sec	53	30.0

Factory Default:	30.0 sec	30.0

Set the integral gain for PID control. This is the time the PID controller takes to output 100% for 100% error value.

FU2► PID D-time 54 0.0 ms	54	0.0

Factory Default:	0.0 ms	0.0

Set the differential gain for PID control.

FU2► PID +limit 55 60.00 Hz	55	60.00

Factory Default:	60.00 Hz	60.00

This is the frequency at which the output frequency is limited under during PID control.

FU2► PID -limit 56 60.00 Hz	56	60.00

Factory Default:	60.00 Hz	60.00

This is the frequency at which the output frequency is limited over during PID control.

FU2-57: PID Output Inversion
FU2-58: PID Output Scale
FU2-59: PID P2 Gain
FU2-60: P Gain Scale

FU2►PID Out Inv. 57 --- No ---	57	0

Factory Default:	No	0

This code is used to inverter PID controller output.

FU2►PID OutScale 58 100.0 %	58	100.0

Factory Default:	100.0 %	100.0

This code sets the scale of PID controller output.

FU2► PID P2-gain 59 100.0 %	59	100.0

Factory Default:	100.0 %	100.0

This code sets the second P-Gain for PID control. The second P-Gain is can be selected for PID controller by setting a multi-function input (I/O-12 ~ I/O14 or EXT-02 ~ EXT-04) to 'Open-loop'.

FU2►P-gain Scale 60 100.0 %	60	100.0

Factory Default:	100.0 %	100.0

This code sets the scale of P-Gain and P2-Gain. (FU2-52, FU2-59)

☞ PID output value can be set to '0' by setting a multi-function input terminal (P1 ~ P6) to 'Open loop' in I/O-12 ~ I/O-14 or EXT-02 ~ EXT-04.

☞ The accumulated value by I-Gain can be set to '0' by setting a multi-function input terminal (P1 ~ P6) to 'iTerm Clear' in I/O-12 ~ I/O-14 or EXT-02 ~ EXT-04.

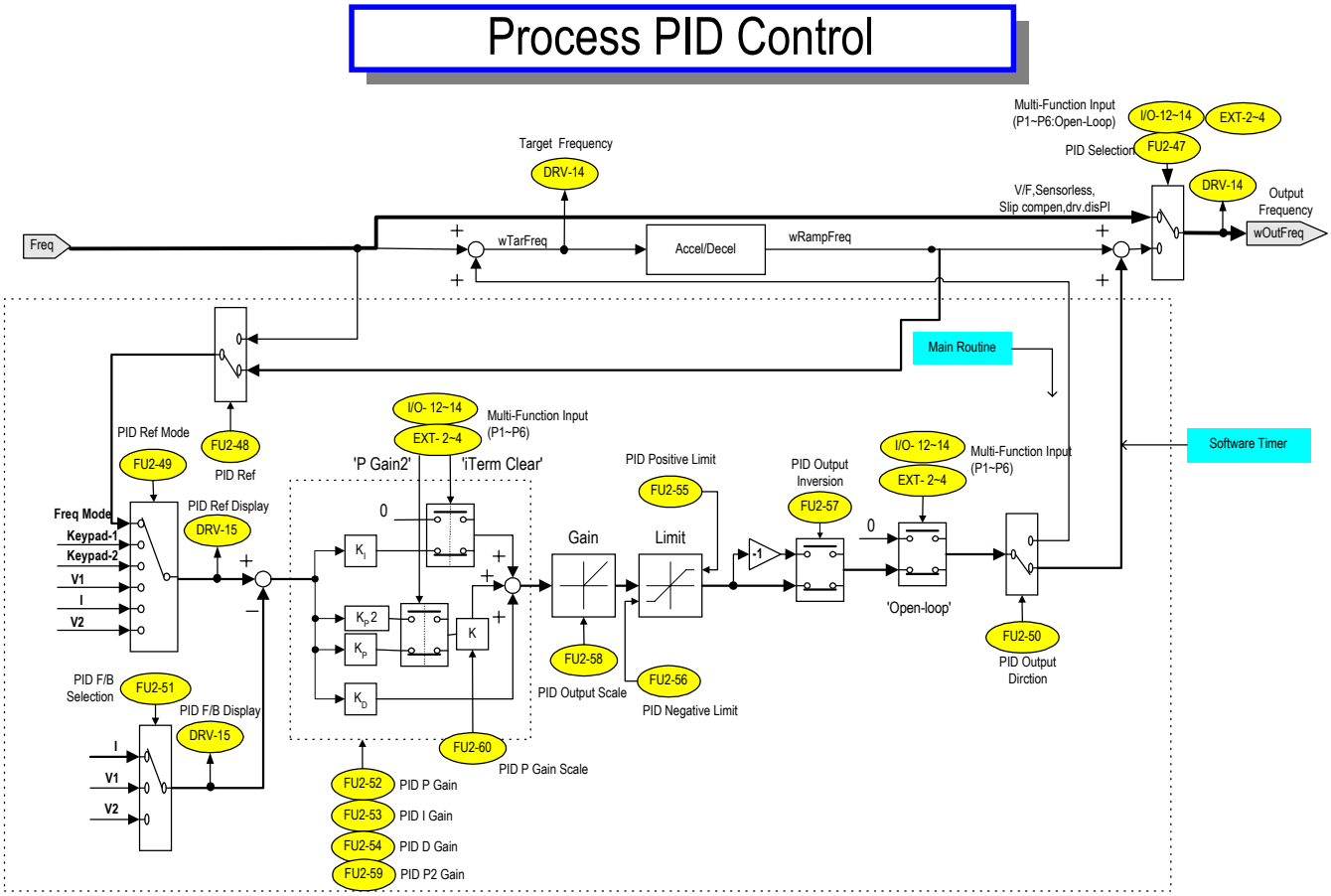
[P Control] This is to compensate the error of a system proportionally. This is used to make the controller response fast for an error. When P control is used alone, the system is easily affected by an external disturbance during steady state.

[I Control] This is to compensate the error of a system integrally. This is used to compensate the steady state error by accumulating them. Using this control alone makes the system unstable.

[PI control] This control is stable in many systems. If "D control" is added, it becomes the 3rd order system. In some systems this may lead to system instability.

[D Control] Since the D control uses the variation ratio of error, it has the merit of controlling the error before the error is too large. The D control requires a large control quantity at start, but has the tendency of increasing the stability of the system. This control does not affect the steady state error directly, but increases the system gain because it has an attenuation effect on the system. As a result, the differential control component has an effect on decreasing the steady state error. Since the D control operates on the error signal, it cannot be used alone. Always use it with the P control or PI control.

Related Functions:	DRV-04 [Frequency Mode] FU2-40 [Control Method] I/O-01 ~ I/O-10 [Analog Signal Scaling] EXT-15 ~ EXT-21 [Pulse Input Signals]



[PID Control Block Diagram]

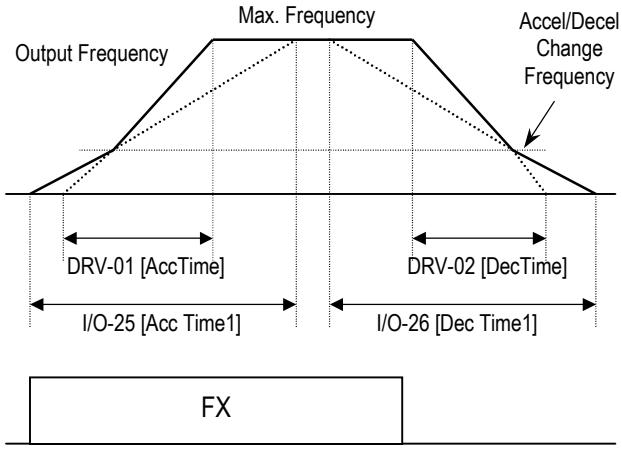
FU2-69: Accel/Decel Change Frequency

FU2▶Acc/Dec ch F 70 0.00 Hz	70	0

Factory Default:	0.00 Hz	0

This function is used to change Accel/Decel ramp at a certain frequency. This is useful in textile machine application.

☞ **Note:** If the multi-function input terminal (I/O-12 ~ I/O-14) is set to 'XCEL-L', XCEL-M', or XCEL-H', The Multi-Accel/Decel Time (I/O-25 ~ I/O-38) has the priority.



[Accel/Decel Change Operation]

FU2-70: Reference Frequency for Accel/Decel

FU2▶Acc/Dec freq 70 Max freq	70	0

Factory Default:	Max freq	0

This is the reference frequency for acceleration and deceleration. If a decided Accel/Decel time from a frequency to a target frequency is required, set this value to 'Delta freq'.

Setting Range		Description
LCD	7-Seg	
Max freq	0	The Accel/Decel time is the time that takes to reach the maximum frequency from 0 Hz.
Delta freq	1	The Accel/Decel time is the time that takes to reach a target frequency from a frequency (currently operating frequency).

Related Functions:	DRV-01, DRV-02 [Accel/Decel Time] FU2-71 [Accel/Decel Time Scale] I/O-25 ~ I/O-38 [1st ~ 7th Accel/Decel Time]

FU2-71: Accel/Decel Time Scale

FU2▶ Time scale 71 0.1 sec	71	0.1

Factory Default:	0.1 sec	0.1

This is used to change the time scale.

Related Functions:	DRV-01, DRV-02 [Accel/Decel Time] FU2-70 [Reference Freq. for Accel/Decel] I/O-25 ~ I/O-38 [1st ~ 7th Accel/Decel Time]

Setting Range		Description
LCD	7-Seg	
0.01 sec	0	The Accel/Decel time is changed by 0.01 second. The maximum setting range is 600 seconds.
0.1 sec	1	The Accel/Decel time is changed by 0.1 second. The maximum setting range is 6000 seconds.
1 sec	2	The Accel/Decel time is changed by 1 second. The maximum setting range is 60000 seconds.

FU2-72: Power On Display

FU2▶PowerOn disp 72 0	72	0

Factory Default: 0 **0**

This code selects the parameter to be displayed first on keypad (DRV-00) when the power is turned on.

Setting Range	Description
0	DRV-00 [Command Frequency]
1	DRV-01 [Acceleration Time]
2	DRV-02 [Deceleration Time]
3	DRV-03 [Drive Mode]
4	DRV-04 [Frequency Mode]
5	DRV-05 [Step Frequency 1]
6	DRV-06 [Step Frequency 2]
7	DRV-07 [Step Frequency 3]
8	DRV-08 [Output Current]
9	DRV-09 [Motor Speed]
10	DRV-10 [DC link Voltage
11	DRV-11 [User Display selected in FU2-73]
12	DRV-12 [Fault Display]

FU2-73: User Display selection

FU2▶ User disp 73 Voltage	73	0

Factory Default: Voltage **0**

This code selects the kind of display to be displayed in code DRV-11.

Setting range		Description
LCD	7-Seg	
Voltage	**0**	Displays the output voltage of inverter.
Watt	**1**	Displays the output power of inverter.
Torque	**2**	Displays the output torque of inverter.

☞ **Note:** The display of 'Watt' and 'Torque' is approximate value.

Related Functions: DRV-11 [User Display]

FU2-74: Gain for Motor Speed Display

FU2▶ RPM factor 74 100 %	74	100

Factory Default: 100 % **100**

This code is used to change the motor speed display to rotating speed (r/min) or mechanical speed (m/min). The display is calculated by following equation.

Rotating speed = 120 x F / P, where F=Output frequency, P= motor pole number

Mechanical speed = Rotating speed x Motor RPM Display Gain

Related Functions: DRV-00 [Output Frequency]
DRV-09 [Motor Speed]
FU2-31 [Number of Motor Pole]

FU2-75: DB (Dynamic Braking) Resistor Mode Selection

FU2▶ DB mode 75 Int. DB-R	75	1

Factory Default: Int. DB-R **1**

This code is used to protect the DB resistor from over heating.

Setting Range		Description
LCD	7-Seg	
None	**0**	This is selected when there is no resistor connected. At this time, inverter does not generate DB turn on signal.
Int. DB-R	**1**	This is selected when using the internal DB resistor. This must be selected for 1~5 HP inverters because they have internal DB resistor as a default. Enable Duty (%): 2 ~ 3 % Continuous Turn On Time: 5 seconds
Ext. DB-R	**2**	This is selected when using an external DB resistor. This must be selected for 7.5~10 HP inverters. This must be selected for 1~5 HP inverters in case of using an external DB resistor. Enable Duty (%): 0 ~ 30 % Continuous Turn On Time: 15 seconds

☞ The inverter turns the DB turn on signal OFF when the Continuous Turn On Time expires during dynamic braking, and an over voltage fault can occur. When this happens, increase the deceleration time or install an external high-duty DB resistor.

☞ Install an exterior high-duty DB resistor when the load accelerates and decelerates frequently. Set the FU2-75 [DB Resistor Mode selection] to 'Ext. DB-R', and set the FU2-76 [Duty of DB Resistor].

☞ This does not apply to 15~30 HP inverters. They need the Optional DB unit to use DB resistor.

FU2-76: Duty of DB (Dynamic Braking) Resistor

FU2► DB %ED 76 10 %	76	10
Factory Default: 10 %		10

This must be set when using an external DB resistor. The duty is calculated by '%ED=Decel time * 100 / (Accel time + Steady speed time + Decel time + Stop status time)'.

FU2-79: Software Version

FU2► S/W Version 79 Ver 1.05	79	1.05
Factory Default: Ver. 1.05		1.05

Displays the software version.

FU2-81 ~ FU2-90: 2nd Motor Related Functions

These functions are displayed only when one of the multifunction inputs is set at '2nd func' in I/O-12 to I/O-14.
When using two motors with an inverter by exchanging them, different values can be set for the 2nd motor by using the multifunction input terminal. Following table is the 2nd functions corresponding to the 1st functions.

2nd Functions	1st Functions	Description
FU2-81 [2nd Acc time]	DRV-01 [Acc. time]	Acceleration time
FU2-82 [2nd Dec time]	DRV-02 [Dec. time]	Deceleration time
FU2-83 [2nd BaseFreq]	FU1-21 [Base freq]	Base Frequency
FU2-84 [2nd V/F]	FU1-29 [V/F Pattern]	Volts/Hz mode
FU2-85 [2nd F-boost]	FU1-27 [Fwd Boost]	Forward torque boost
FU2-86 [2nd R-boost]	FU1-28 [Rev Boost]	Reverse torque boost
FU2-87 [2nd Stall]	FU1-60 [Stall Level]	Stall prevention level
FU2-88 [2nd ETH 1min]	FU1-51 [ETH 1min]	ETH level for 1 minute
FU2-88 [2nd ETH cont]	FU1-52 [ETH cont]	ETH level for continuous
FU2-90 [2nd R-Curr]	FU2-33 [Rated-Curr]	Motor rated current

☞ The 1st functions are applied if the multifunction terminal is not defined to '2nd Func' or if it is not ON. The 2nd function parameters are applied when the multifunction input terminal set to '2nd Func' is ON. Parameters not listed on the table above are applied to the 2nd motor as to the 1st motor.

☞ Exchange the motor connection from the 1st motor to the 2nd motor or the opposite when the motor is stopped. Over voltage or over current fault can occur when the motor connection is exchanged during operation.

☞ The 'User V/F' function of FU1-29 [V/F Pattern] is used for both the 1st motor and the 2nd motor.

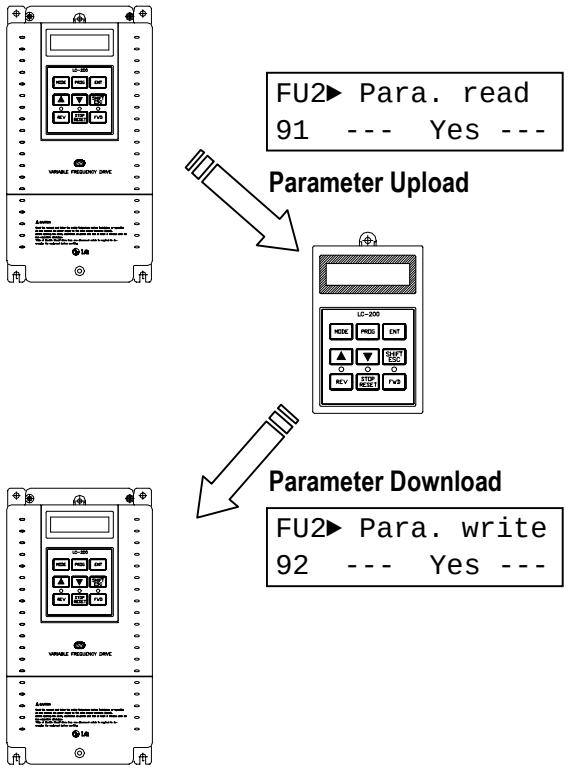
FU2-91: Parameter Read
FU2-92: Parameter Write

FU2► Para. read 91 --- No ---
Factory Default: No

FU2► Para. write 92 --- No ---
Factory Default: No

This is useful for programming multiple inverters to have same parameter settings. The LCD keypad can

read (upload) the parameter settings from the inverter memory and can write (download) them to other inverters. This function is only available with LCD keypad.



FU2-93: Parameter Initialize

FU2▶ Para. init 93 --- No ---	93	0

Factory Default:	No	0

This is used to initialize parameters back to the factory default values. Each parameter group can be initialized separately.

Setting Range		Description
LCD	7-Seg	
No	0	Displayed after initializing parameters.
All Groups	1	All parameter groups are initialized to factory default value.
DRV	2	Only Drive group is initialized.
FU1	3	Only Function 1 group is initialized.
FU2	4	Only Function 2 group is initialized.
I/O	5	Only Input/Output group is initialized.
EXT	6	Only External group is initialized.
COM	7	Only Communication group is initialized.
APP	8	Only Application group is initialized.

☞ **Note:** FU1-30 ~ FU1-37 [Motor Parameters] must be set first after initializing parameters.

FU2-94: Parameter Write Protection

FU2▷ Para. lock 94 0	94	0

Factory Default:	0	0

This function is used to lock the parameters from being changed. When the parameters are locked, the display arrow changes from solid to dashed line. The lock and unlock code is '12'.

FU2-99: Return Code (7-Segment Keypad)

	99	0

Factory Default:	0

This code is used to exit a group when using a 7-segment keypad. After pressing **PROG/ENT** key, set the value to '1' and press the **PROG/ENT** key again to exit.

Related Functions:	FU1-99 [Return Code] I/O-99 [Return Code] EXT-99 [Return Code] COM-99 [Return Code]

5.4 Input/Output Group [I/O]

I/O-00: Jump to Desired Code

I/O► Jump code 00 1

Factory Default:	1

Jumping directly to any parameter code can be accomplished by entering the desired code number. This code is available only with LCD keypad.

I/O-01 ~ I/O-05: Analog Voltage Input (V1) Signal Adjustment

This is used to adjust the analog voltage input signal when the frequency is referenced by the control terminal 'V1'. This function is applied when DRV-04 is set to 'V1' or 'V1+I'. Reference frequency versus Analog voltage input curve can be made by four parameters of I/O-02 ~ I/O-04.

I/O► V1 filter 01 10 ms	01	10

Factory Default:	10 ms	10

This is the filtering time constant for V1 signal input. Increase this value if the V1 signal is affected by noise causing unstable operation of the inverter. Increasing this value makes response time slower.

I/O► V1 volt x1 02 0.00 V	02	0.00

Factory Default:	0.00 V	0.00

This is the minimum voltage of the V1 input at which inverter outputs minimum frequency.

I/O► V1 volt y1 03 0.00 Hz	03	0.00

Factory Default:	0.00 Hz	0.00

This is the inverter output minimum frequency when there is the minimum voltage (I/O-02) on the V1 terminal.

I/O► V1 volt x2 04 0.00 V	04	10.00

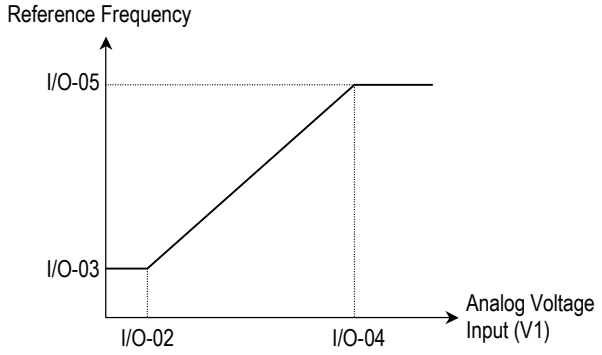
Factory Default:	10.00 V	10.00

This is the maximum voltage of the V1 input at which inverter outputs maximum frequency.

I/O► V1 volt y2 05 60.00 Hz	05	60.00

Factory Default:	60.00 Hz	60.00

This is the inverter output maximum frequency when there is the maximum voltage (I/O-03) on the V1 terminal.



[Reference Frequency vs. Analog Voltage Input, V1 (0 to 10V)]

Related Functions:	DRV-04 [Frequency Mode] FU1-20 [Maximum Frequency]

I/O-06 ~ I/O-10: Analog Current Input (I) Signal Adjustment

This is used to adjust the analog current input signal when the terminal 'I' references the frequency. This function is applied when DRV-04 is set to 'V1' or V1+I'. Reference frequency versus Analog current input curve can be made by four parameters of I/O-07 ~ I/O-10.

I/O► I filter 06 10 ms	06	10

Factory Default:	10 ms	10

This is the filtering time constant for 'I' signal input. If the 'I' signal is affected by noise causing unstable operation of the inverter, increase this value. Increasing this value makes response time slower.

I/O► I curr x1 07 4.00 mA	07	4.00

Factory Default:	4.00 mA	4.00

This is the minimum current of the 'I' input at which inverter outputs minimum frequency.

I/O► I freq y1 08 0.00 Hz	08	0.00

Factory Default:	0.00 Hz	0.00

This is the inverter output minimum frequency when there is minimum current (I/O-07) on the 'I' terminal.

I/O► I curr x2 09 20.00 mA	09	20.00

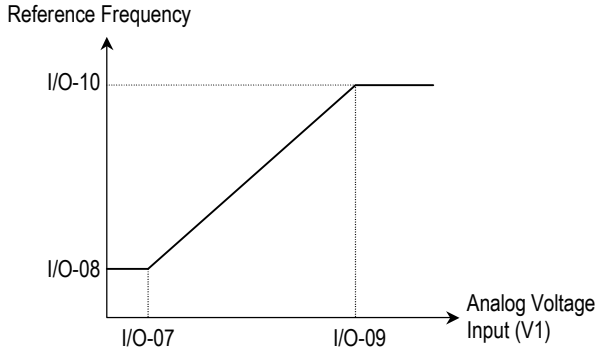
Factory Default:	20.00 mA	20.00

This is the maximum current of the 'I' input at which inverter outputs maximum frequency.

I/O► I freq y2 10 60.00 Hz	10	60.00

Factory Default:	60.00 Hz	60.00

This is the inverter output maximum frequency when there is the maximum current (I/O-09) on the 'I' terminal.



[Reference Frequency vs. Analog Current Input, I (4 to 20mA)]

Related Functions:	DRV-04 [Frequency Mode] FU1-20 [Maximum Frequency]

I/O-11: Criteria for Analog Input Signal Loss

I/O► Wire broken 11 None	11	0

Factory Default:	None	0

This is to set the criteria for analog input signal loss when DRV-04 [Frequency Mode] is set to 'V1', 'I' or 'V1+I'. Following table shows the setting value.

Setting Range		Description
LCD	7-Seg	
None	0	Does not check the analog input signal.
half of x1	1	The inverter determines that the frequency reference is lost when the analog input signal is less than half of the minimum value (I/O-02 or I/O-07).
below x1	2	The inverter determines that the frequency reference is lost when the analog input signal is less than the minimum value (I/O-02 or I/O-07).

When the analog input signal is lost, inverter displays the following table.

Setting Range		Description
LCD	7-Seg	
LOP	LP	Loss of frequency reference from Option Board (DPRAM time out)
LOR	LR	Loss of frequency reference from Option Board (Communication fault)
LOV	LV	Loss of analog input signal, V1
LOI	LI	Loss of analog input signal, I
LOX	LX	Loss of frequency reference from Sub-Board, V2 or ENC

Related Functions: I/O-48 [Lost command] selects the operation after determining the loss of frequency reference.

The following table shows the selection in I/O-48.

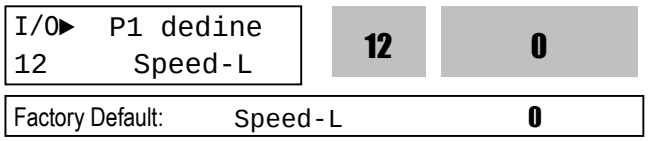
Setting Range		Description
LCD	7-Seg	
None	0	Continuous operating after loss of frequency reference.
FreeRun	1	Inverter cuts off its output after determining loss of frequency reference.
Stop	2	Inverter stops by its Decel pattern and Decel time after determining loss of frequency reference.

I/O-49 [Time out] sets the waiting time before determining the loss of reference signal. Inverter waits to determine the loss of a reference signal until times out.

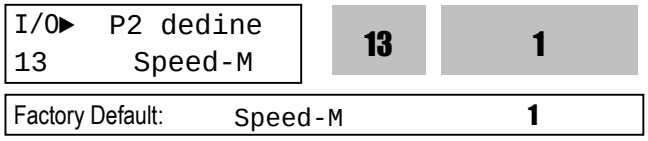
☞ **Note:** I/O-48 and I/O-49 also apply when DRV-04 is set to 'Keypad-1' or 'Keypad-2' for determining the loss of command frequency.

Related Functions:	DRV-04 [Frequency Mode] I/O-02 [V1 Input Minimum Voltage] I/O-07 [I Input Minimum Current] I/O-48 [Lost command] I/O-49 [Time out]

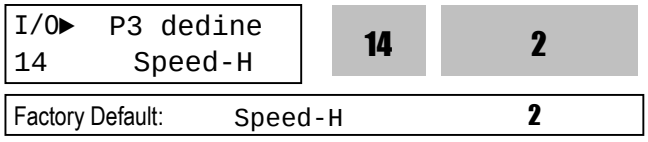
I/O-12: Multi-function Input Terminal 'P1' Define
I/O-13: Multi-function Input Terminal 'P2' Define
I/O-14: Multi-function Input Terminal 'P3' Define



Factory Default: Speed-L 0



Factory Default: Speed-M 1



Factory Default: Speed-H 2

Multi-function input terminals can be defined for many different applications. The following table shows the various definitions for them.

Setting Range		Description
LCD	7-Seg	
Speed-L	0	Multi-step speed - Low
Speed-M	1	Multi-step speed - Mid
Speed-H	2	Multi-step speed - High
XCEL-L	3	Multi-accel/decel - Low
XCEL-M	4	Multi-accel/decel - Mid
XCEL-H	5	Multi-accel/decel - High
Dc-brake	6	DC injection braking during stop
2nd Func	7	Exchange to 2nd functions
Exchange	8	Exchange to commercial power line
-Reserved-	9	Reserved for future use
Up	10	Up drive
Down	11	Down drive
3-Wire	12	3 wire operation
Ext Trip-A	13	External trip A
Ext Trip-B	14	External trip B
iTerm Clear	15	Used for PID control
Open-loop	16	Exchange between PID mode and V/F mode
Main-drive	17	Exchange between Option and Inverter
Analog hold	18	Hold the analog input signal
XCEL stop	19	Disable accel and decel
P Gain2	20	Used for PID control
SEQ-L	21	Sequence operation - Low
SEQ-M	22	Sequence operation - Mid
SEQ-H	23	Sequence operation - High
Manual	24	Exchange between Sequence operation and Manual operation
Go step	25	Triggering Sequence operation (Auto-B)
Hold step	26	Hold last step (Auto-A)
Trv Off.Lo	27	Used for Traverse Operation
Trv Off.Hi	28	
Interlock1	29	Used for MMC operation
Interlock2	30	
Interlock3	31	
Interlock4	32	

[Speed-L, Speed-M, Speed-H]
By setting P1, P2, P3 terminals to 'Speed-L', 'Speed-M' and 'Speed-H' respectively, inverter can operate at the preset frequency set in DRV-05 ~ DRV-07 and I/O-20 ~ I/O-24.

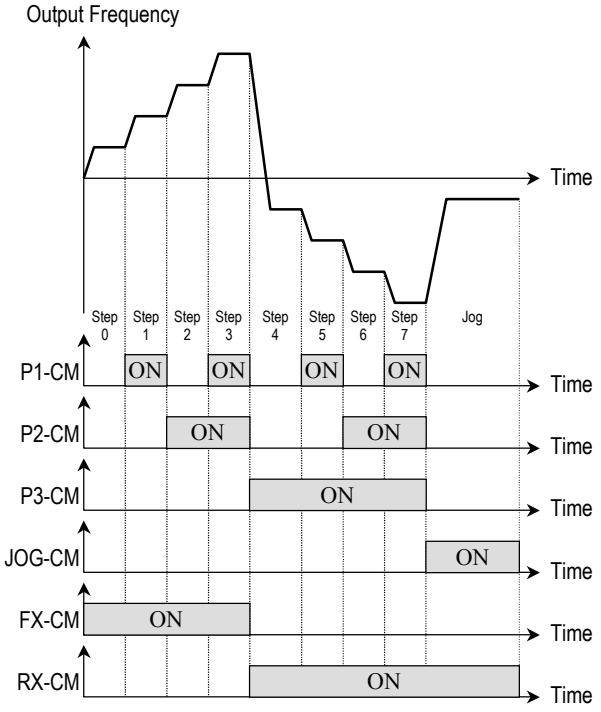
The step frequencies are determined by the combination of P1, P2 and P3 terminals as shown in the following table.

Step Frequency	Parameter Code	Speed-H (P3)	Speed-M (P2)	Speed-L (P1)
Step Freq-0	DRV-00	0	0	0
Step Freq-1	DRV-05	0	0	1
Step Freq-2	DRV-06	0	1	0
Step Freq-3	DRV-07	0	1	1
Step Freq-4	I/O-21	1	0	0
Step Freq-5	I/O-22	1	0	1
Step Freq-6	I/O-23	1	1	0
Step Freq-7	I/O-24	1	1	1

0: OFF, 1: ON

☞ I/O-20 [Jog Frequency] can be used as one of the step frequencies.

☞ If the 'Jog' terminal is ON, inverter operates to Jog frequency regardless of other terminal inputs.



[Multi-Step Frequency Operation]

Related Functions:	DRV-05 ~ DRV-07 [Step Frequency] I/O-20 [Jog Frequency] I/O-20 ~ I/O-24 [Step Frequency]

☞ **Note:** The frequency for 'Speed 0' is determined by DRV-04.

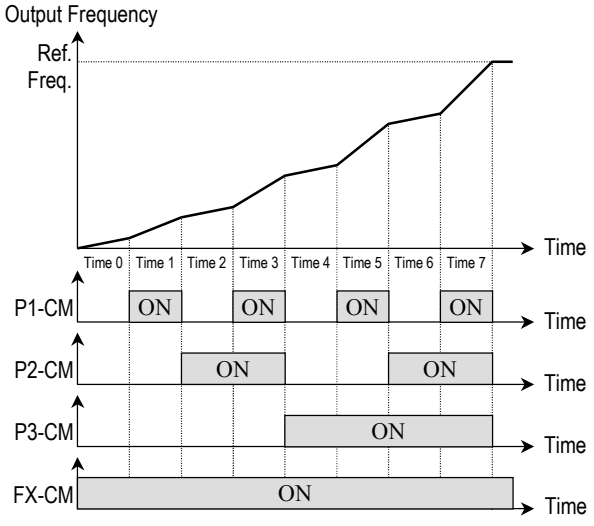
[XCEL-L, XCEL-M, XCEL-H]

By setting P1, P2 and P3 terminals to 'XCEL-L', 'XCEL-M' and 'XCEL-H' respectively, up to 8 different Accel and Decel times can be used. The Accel/Decel time is set in DRV-01 ~ DRV-02 and I/O-25 ~ I/O-38.

The Accel/Decel time is determined by the combination of P1, P2 and P3 terminals as shown in the following table.

Accel/Decel Time	Parameter Code	XCEL-H (P3)	XCEL-M (P2)	XCEL-L (P1)
Accel Time-0	DRV-01	0	0	0
Decel Time-0	DRV-02			
Accel Time-1	I/O-25	0	0	1
Decel Time-1	I/O-26			
Accel Time-2	I/O-27	0	1	0
Decel Time-2	I/O-28			
Accel Time-3	I/O-29	0	1	1
Decel Time-3	I/O-30			
Accel Time-4	I/O-31	1	0	0
Decel Time-4	I/O-32			
Accel Time-5	I/O-34	1	0	1
Decel Time-5	I/O-35			
Accel Time-6	I/O-36	1	1	0
Decel Time-6	I/O-37			
Accel Time-7	I/O-38	1	1	1
Decel Time-7	I/O-39			

0: OFF, 1: ON

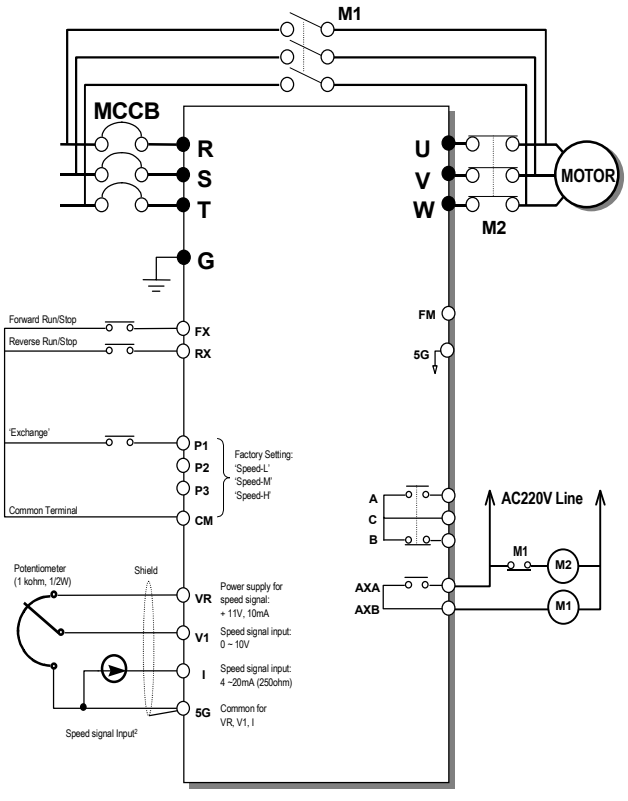


[Multi-Accel/Decel Time Operation]

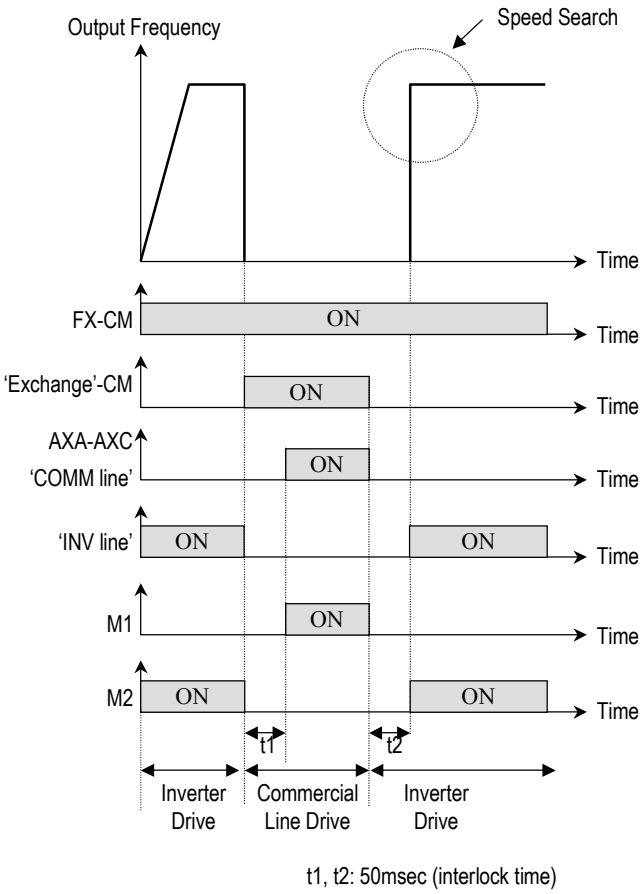
Related Functions:	I/O-25 ~ I/O-38 [1st ~7th Accel/Decel Time]

[Dc-brake]
DC Injection Braking can be activated during inverter stopped by configuring one of the multi-function input terminals (P1, P2, P3) to 'Dc-bake'. To activate the DC Injection Braking, close the contact on the assigned terminal while the inverter is stopped.

[Exchange]
Exchange is used to bypass the motor from the inverter line to commercial power or the opposite. To bypass the motor to commercial line, set the 'Exchange' function in multi-function output terminal and 'INV line', 'COMM line' function in multi-function output terminal. Speed search function (FU2-22) is activated automatically during exchanging operation.

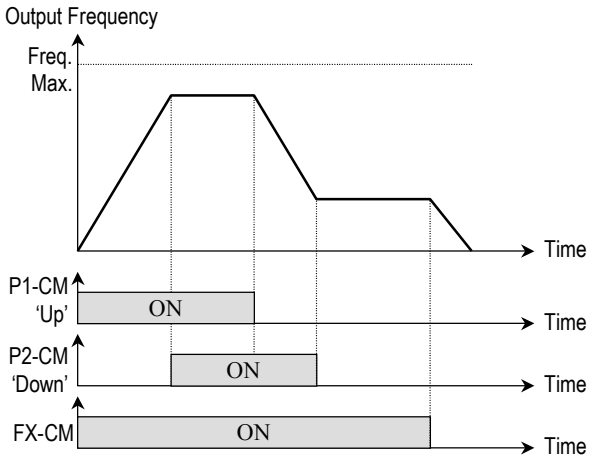


[Wiring to By-Pass Motor to Commercial line]



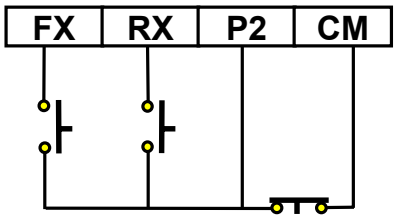
[Exchanging Sequence]

[Up, Down]
By using the Up and Down function, the drive can accelerate to a steady speed and decelerate down to a desired speed by using only two input terminals.

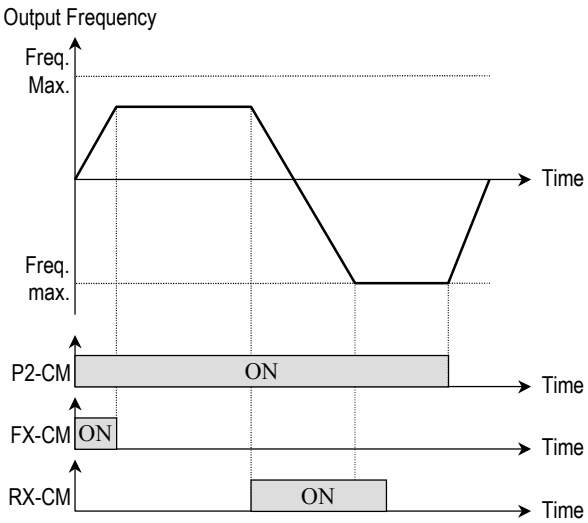


[Up/Down Operation]

[3-Wire]
This function is for 3-wire start/stop control.
This function is mainly used with a momentary push button to hold the current frequency output during acceleration or deceleration.



[Wiring for 3-Wire Operation, P2 set to '3-Wire']



[3-Wire Operation]

[Ext Trip-A]
This is a normally open contact input. When a terminal set to 'Ext Trip-A' is ON, inverter displays the fault and cuts off its output. This can be used as an external latch trip.

[Ext Trip-B]
This is a normally closeed contact input. When a terminal set to 'Ext Trip-B' is OFF, inverter displays the fault and cuts off its output. This can be used as an external latch trip.

[iTerm Clear]
This function is used for PID control. When this terminal is ON, the accumulated value by I-Gain is set to '0'. Refer to PID Control Block Diagram.

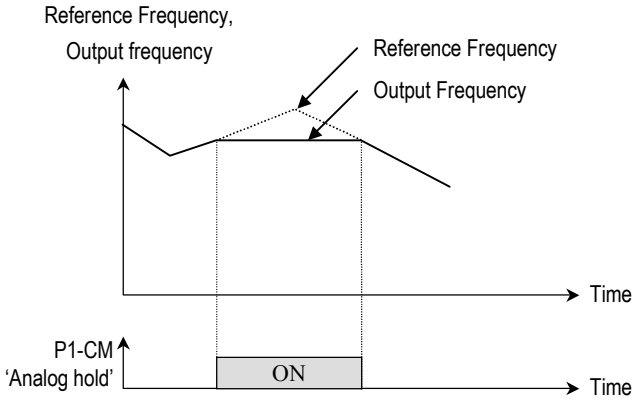
[Open-loop]
This is used to exchange the control mode of inverter from PID mode (Close Loop) to V/F mode (Open Loop).
DRV-03 [Drive Mode] and DRV-04 [Frequency Mode] are applied when the mode has been changed.

☞ **Note:** This function can be used only when the inverter is stopped.

[Main-drive]
When an option board (like RS485, DeviceNet, F-Net) is installed and used for the frequency setting and the run/stop command, the inverter operation can be changed to manual operation using this function without changing parameters.
FU1-02 [Frequency Mode] and FU1-01 [Drive Mode] are applied when the mode has been changed.

☞ **Note:** this function can be used only when the inverter is stopped.

[Analog hold]
When there is an analog input signal for frequency reference and 'Analog hold' terminal is ON, inverter fixes its output frequency regardless of the frequency reference change. The changed frequency reference is applied when the terminal is OFF.
This function is useful when a system requires constant speed after acceleration.



[Analog hold Operation]

[XCEL stop]
Inverter stops accelerating and decelerating when this terminal is ON.

[P Gain2]
This function is used to change P-Gain during PID operation. When this terminal is ON, PID controller changes P-Gain with PID P2-Gian set in FU2-59. Refer to PID Control Block Diagram.

[SEQ-L, SEQ-M, SEQ-H]
These functions are used for Auto drive (I/O-50). Five different sequences can be selected according to the combination of these terminals. Eight step frequencies, Accel/Decel time and steady speed time can be set for each sequence. The following table shows the sequence of selection.

Step Frequency	Parameter Code	Speed-H (P3)	Speed-M (P2)	Speed-L (P1)
Sequence 1	I/O-50 ~ I/O-84	0	0	1
Sequence 2		0	1	0
Sequence 3		1	0	0
Sequence 4		0	1	1
Sequence 5		1	0	1

0: OFF, 1: ON

☞ **Note:** The inverter stops after finishing all steps of that sequence once the Auto (Sequence) operation is started. To stop the inverter during sequence operation, use 'BX' terminal on the control terminal strip.

Related Functions: I/O-51 ~ I/O-84 [Sequence Operation]

[Manual]
This is used to exchange the operation mode of inverter from Auto (Sequence) to manual operation. DRV-03 [Drive Mode] and DRV-04 [Frequency Mode] are applied when the mode has been changed.

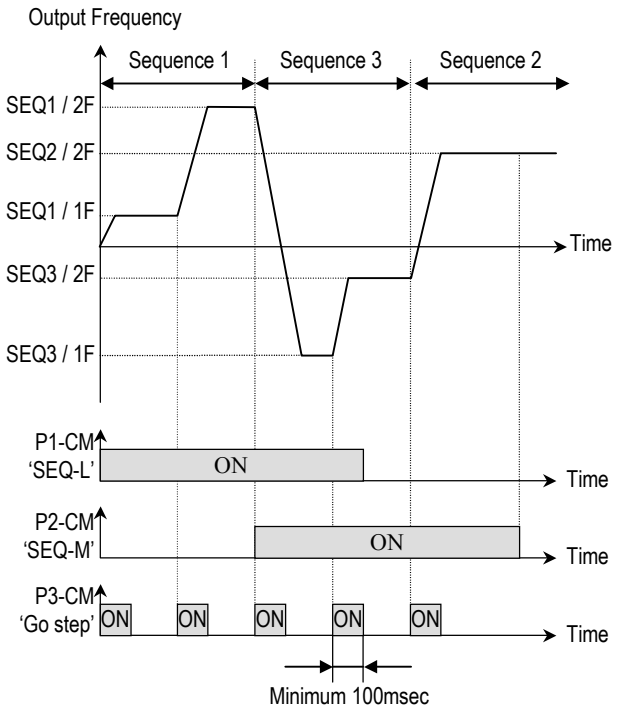
☞ **Note:** This function can be used only when the inverter is stopped.

[Go step]
This is used to trigger the next step in a sequence of Auto-B operation.

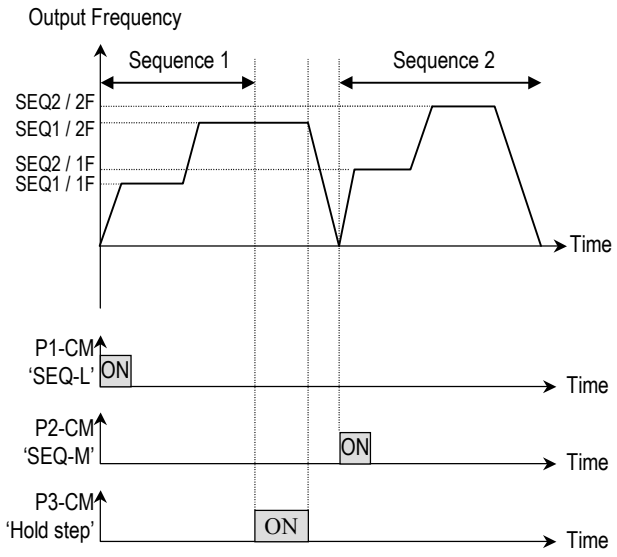
Related Functions: I/O-51 ~ I/O-84 [Sequence Operation]

[Hold step]
This is used to hold the last step frequency in Auto-A operation.

Related Functions: I/O-51 ~ I/O-84 [Sequence Operation]



['Go step' in Auto-B Operation]



['Hold step' in Auto-A Operation]

[Trv Off.Lo]
This function is used to make negative offset during traverse operation.

Related Functions:	APP-06 ~ APP-07 [Traverse Offset]

[Trv Off.Hi]
This function is used to make positive offset during traverse operation.

Related Functions:	APP-06 ~ APP-07 [Traverse Offset]

[Interlock1, 2, 3, 4]
This function is used for MMC operation. Refer to MMC operation.

Related Functions:	APP-29 [Inter-Lock Selection]

I/O-15: Terminal Input Status
I/O-16: Terminal Output Status

I/O► In status 15 000000000	15	0000

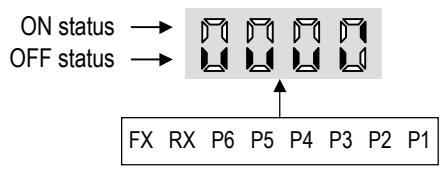
Factory Default:	000000000

This code displays the input status of control terminals. Terminals P4, P5, P6 and Q1, Q2, Q3 are provided on optional Sub-Board.

[LCD Keypad Display]

Input Terminals	JOG	FX	RX	P6	P5	P4	P3	P2	P1
	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
OFF status	0	0	0	0	0	0	0	0	0
ON status	1	1	1	1	1	1	1	1	1

[7-Segment Keypad Display]
The 'JOG' terminal is not displayed on 7-Segment keypad.



I/O► Out status 16 0000	16	0000

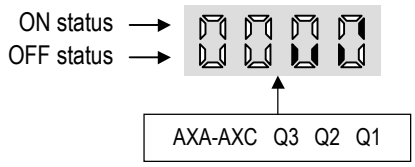
Factory Default:	0000

This code displays the output status of control terminals.

[LCD Keypad Display]

Output Terminals	AXA-AXC	Q3	Q2	Q1
	Bit 3	Bit 2	Bit 1	Bit 0
OFF status	0	0	0	0
ON status	1	1	1	1

[7-Segment Keypad Display]
The 'JOG' terminal is not displayed on 7-Segment keypad.



I/O-17: Filtering Time Constant for Multi-function Input Terminals

I/O►Ti Filt Num 17 15	17	15

Factory Default:	15	15

This is the response time constant for terminal inputs (JOG, FX, RX, P3, P2, P1, RST, BX). This is useful where there is a potential for noise. The response time is determined by 'Filtering time constant * 0.5msec'.

I/O-20: Jog Frequency

I/O► Jog freq 20 10.00 Hz	20	10.00

Factory Default:	10.00 Hz	10.00

This code sets the jog frequency. See [Speed-L, Speed-M, Speed-H] in I/O-12 ~ I/O-14.

I/O-21 ~ I/O-24: Step Frequency 4, 5, 6, 7

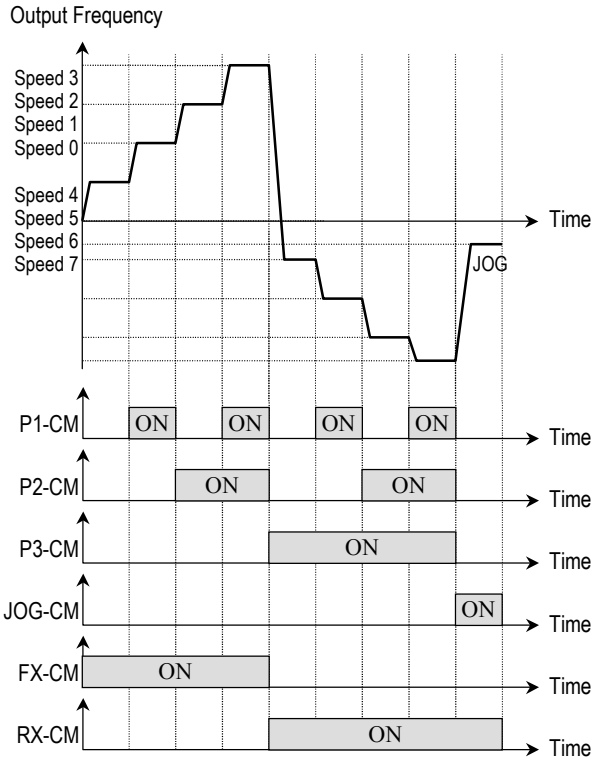
I/O▶ Step freq-4 21 40.00 Hz	21	40.00
Factory Default: 40.00 Hz		40.00

⋮

I/O▶ Step freq-7 24 30.00 Hz	24	30.00
Factory Default: 30.00 Hz		30.00

These codes set the step frequencies. These frequencies are applied when the multi-function input terminals (P1, P2, P3) select the step. See [Speed-L, Speed-M, Speed-H] in I/O-12 ~ I/O-14.

Related Functions: DRV-05 ~ DRV-07 [Step Frequency 1 ~ 3]
I/O-12 ~ I/O-14 [Multi-function inputs]
I/O-17 [Filtering Time Constant]



['JOG' and 'Multi-Step' Operation]

I/O-25 ~ I/O-38: 1st ~ 7th Accel/Decel Time

I/O▶ Acc time-1 25 20.0 sec	25	20.00
Factory Default: 20.0 sec		20.0

⋮

I/O▶ Dec time-7 38 20.0 sec	38	20
Factory Default: 20.0 sec		20.0

These codes are applied when the multi-function input terminals (P1, P2, P3) select the Accel/Decel time. See [XCEL-L, XCEL-M, XCEL-H] in I/O-12 ~ I/O-14.

Related Functions: DRV-01 ~ DRV-02 [Accel/Decel Time]
FU2-70 [Reference Freq. for Accel/Decel]
FU2-71 [Accel/Decel Time Scale]
I/O-12 ~ I/O-14 [Multi-function inputs]

I/O-40: FM (Frequency Meter) Output
I/O-41: FM Adjustment

I/O▶ FM mode 40 Frequency	40	0
Factory Default: Frequency		0

I/O▶ FM Adjust 41 100 %	41	100
Factory Default: 100 %		100

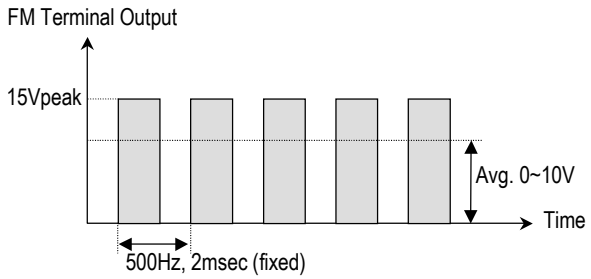
Frequency meter displays the inverter output Frequency, Current, Voltage and DC link voltage with pulse signals on the FM terminal. The average ranges from 0V to 10V. I/O-41 is used to adjust the FM value.

[Frequency]
FM terminal outputs inverter output frequency. The output value is determined by,
FM Output Voltage = (Output freq. / Max. freq.) × 10V × IO-41 / 100

[Current]
FM terminal outputs inverter output current. The output value is determined by,
FM Output Voltage = (Output current / Rated current) × 10V × IO-41 / 150

[Voltage]
FM terminal outputs inverter output voltage. The output value is determined by,
FM Output Voltage = (Output voltage / Max. output voltage) × 10V × IO-41 / 100

[DC link vtg]
FM terminal outputs the DC link voltage of inverter. The output value is determined by,
FM Output Voltage = (DC link voltage / Max. DC link voltage) × 10V × IO-41 / 100



[FM Output (FM-CM terminal)]

I/O-42: FDT (Frequency Detection) Level
I/O-43: FDT Bandwidth

I/O► FDT freq 42 30.00 Hz	42	30.00

Factory Default:	30.00 Hz	30.00

I/O► FDT band 43 10.00 Hz	43	10.00

Factory Default:	10.00 Hz	10.00

These functions are used in I/O-44 [Multi-function Auxiliary Contact Output]. See [FDT-#] in I/O-44.

Related Functions:	I/O-44 [Multi-function Auxiliary Output]

I/O-44: Multi-function Auxiliary Contact Output define (AXA-AXC)

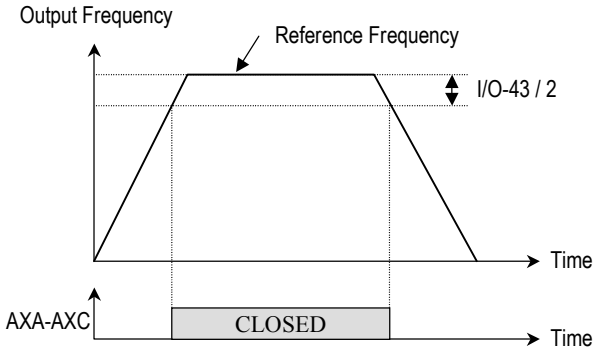
I/O► Aux mode 44 Run	44	12

Factory Default:	Run	12

The auxiliary contact works (Close) when the defined condition has occurred.

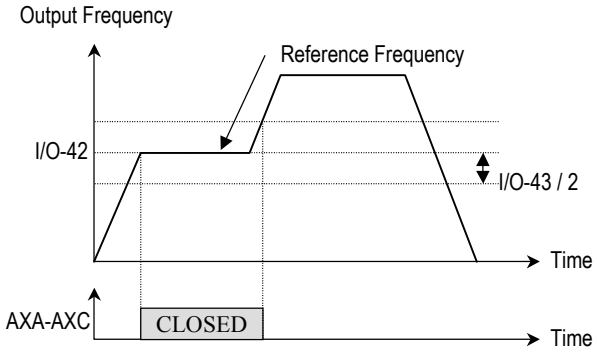
Setting Range		Description
LCD	7-Seg	
FDT-1	0	Output frequency arrival detection
FDT-2	1	Specific frequency level detection
FDT-3	2	Frequency detection with pulse
FDT-4	3	Frequency detection with contact closure
FDT-5	4	Frequency detection with contact closure (inverted FDT-4)
OL	5	Overload detection
IOL	6	Inverter overload detection
Stall	7	Stall prevention mode detection
OV	8	Over voltage detection
LV	9	Low voltage detection
OH	10	Overheat detection
Lost Command	11	Lost command detection
Run	12	Inverter running detection
Stop	13	Inverter stop detection
Steady	14	Steady speed detection
INV line	15	Exchange signal outputs
COMM line	16	
Ssearch	17	Speed search mode detection
Step pulse	18	Step detection in Auto mode
Seq pulse	19	Sequence detection in Auto mode
Ready	20	Inverter ready detection
Trv. ACC	21	Traverse acceleration frequency
Trv. DEC	22	Traverse deceleration frequency
MMC	23	Used for MMC operation

[FDT-1]
When the output frequency reaches the reference frequency (target frequency), AXA-AXC terminal is CLOSED.



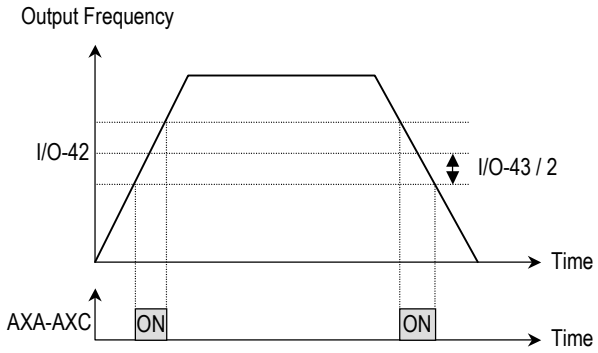
[AXA-AXC configured as 'FDT-1']

[FDT-2]
AXA-AXC is CLOSED when the reference frequency is in I/O-43 [FDT Bandwidth] centered on I/O-42 [FDT Frequency], and the output frequency reaches I/O-43 centered on I/O-42.



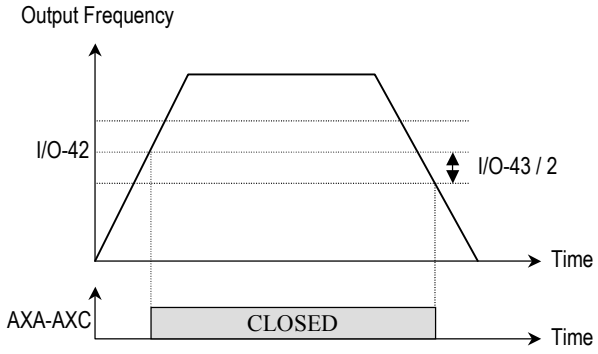
[AXA-AXC configured as 'FDT-2']

[FDT-3]
AXA-AXC is CLOSED when the output frequency reaches the band centered on the FDT frequency. The output is OPENED when the output frequency goes outside the FDT bandwidth centered on the FDT frequency.



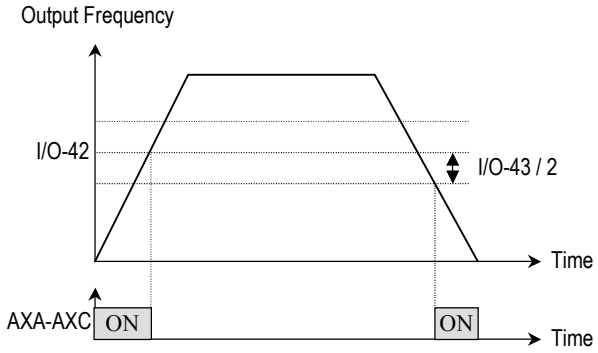
[AXA-AXC configured as 'FDT-3']

[FDT-4]
AXA-AXC is CLOSED when the output frequency reaches the FDT frequency. The output is OPENED when the output frequency goes below the FDT bandwidth centered on the FDT frequency.



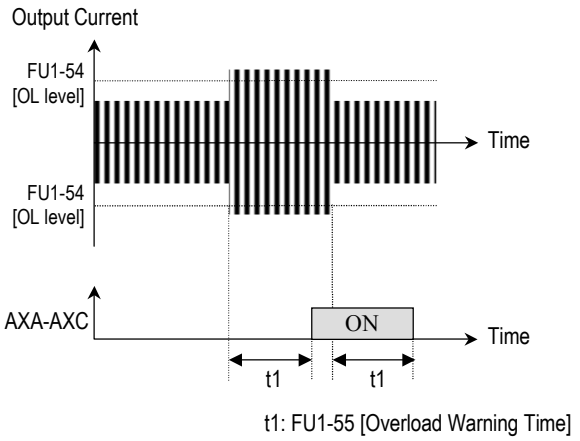
[AXA-AXC configured as 'FDT-4']

[FDT-5]
This is the inverted output of [FDT-4].



[AXA-AXC configured as 'FDT-5']

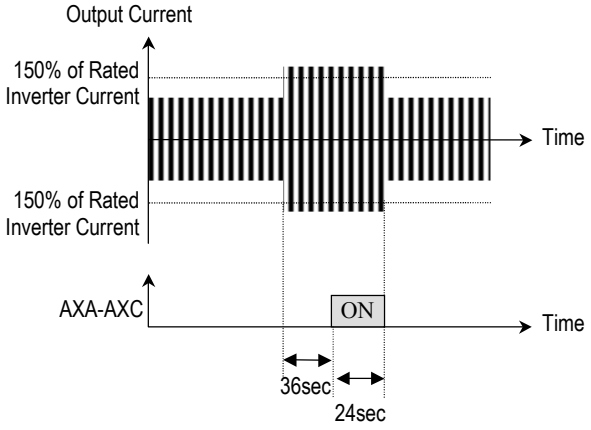
[OL]
AXA-AXC is CLOSED when the output current has reached the FU1-54 [Overload Warning Level] for the FU1-55 [Overload Warning Time].



[[AXA-AXC configured as 'OL']

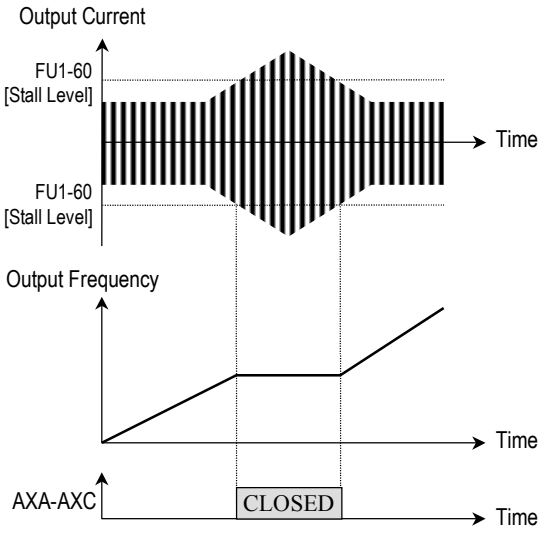
Related Functions:	FU1-54 [Overload Warning Level] FU1-55 [Overload Warning Time]

[IOL]
AXA-AXC is CLOSED when the output current is above the 150% of rated inverter current for 36 seconds. If this situation is continued for one minute, the inverter will cut off its output and displays 'IOL' (Inverter overload) Trip. See the nameplate for the rated inverter current.



[AXA-AXC configured as 'IOL']

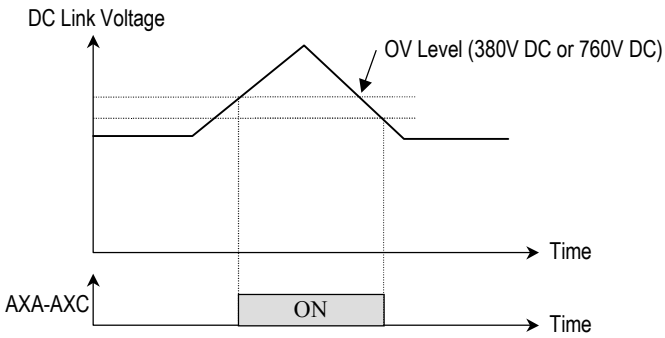
[Stall]
AXA-AXC is CLOSED when the inverter is on the stall prevention mode.



[AXA-AXC configured as 'Stall']

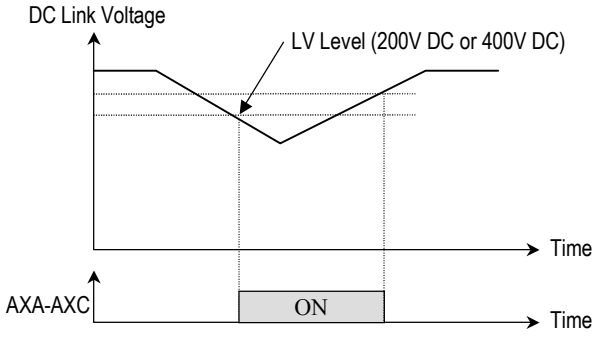
Related Functions:	FU1-59 [Stall Prevention Mode] FU1-60 [Stall Prevention Level]

[OV]
AXA-AXC is CLOSED when the DC link voltage is above the Over-voltage level.



[AXA-AXC configured as 'OV']

[LV]
AXA-AXC is CLOSED when the DC link voltage is below the Low-voltage level.



[AXA-AXC configured as 'LV']

[OH]
AXA-AXC is CLOSED when the heat sink of the inverter is above the reference level.

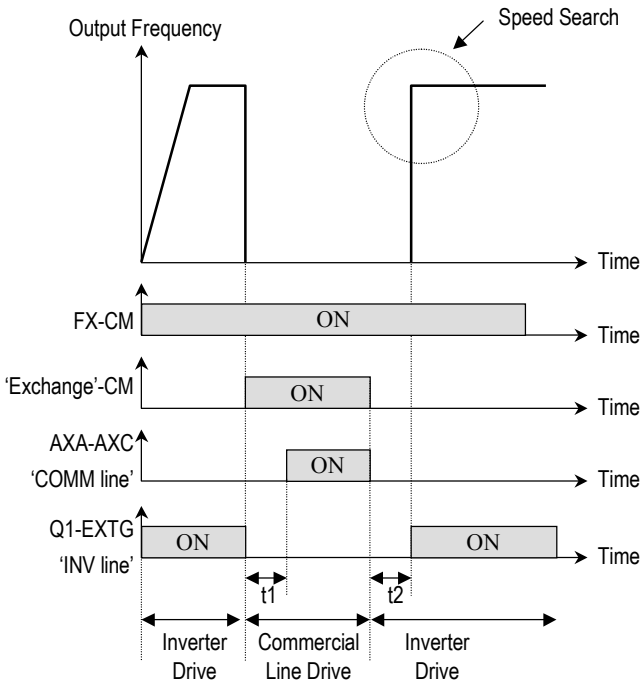
[Lost Command]
AXA-AXC is CLOSED when frequency reference is lost.

Related Functions:	I/O-11 [Criteria for Analog Signal Loss] I/O-48 [Operating Method at Signal Loss] I/O-49 [Waiting Time for Time Out]

[Run]
AXA-AXC is CLOED when the inverter is running.

[Stop]
AXA-AXC is CLOED when the inverter is stopped.

[INV line, COMM line]
This function is used in conjunction with 'Exchange' function of multi-function input for commercial line exchange. To use both signal of 'INV line' and 'COMM line', the optional Sub-A or Sub-C board must be installed.



t1, t2: 50msec (interlock time)

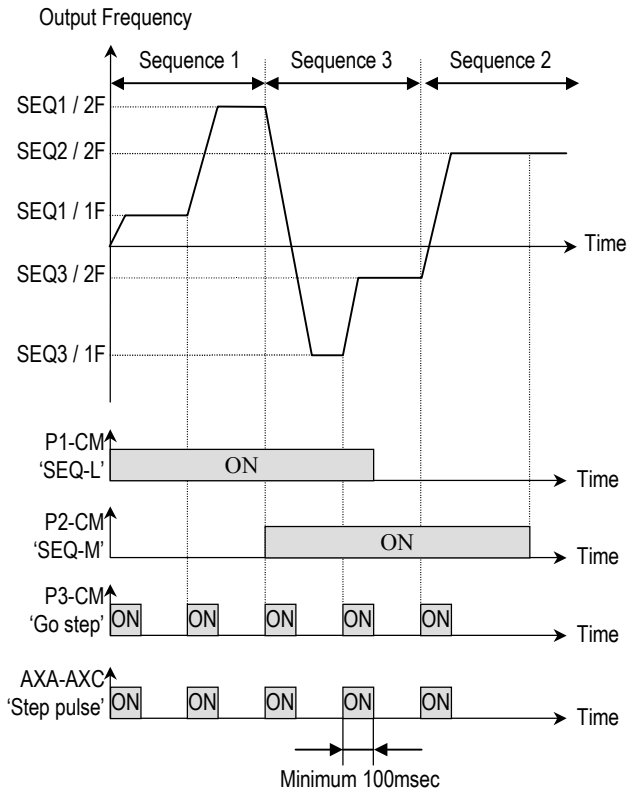
[AXA-AXC configured as 'COMM line' and 'Q1' as INV line']

Related Functions:	I/O-12 ~ I/O-14 [Multi-function input] - [Exchange]

[Ssearch]
AXA-AXC is CLOSED during the inverter is speed searching.

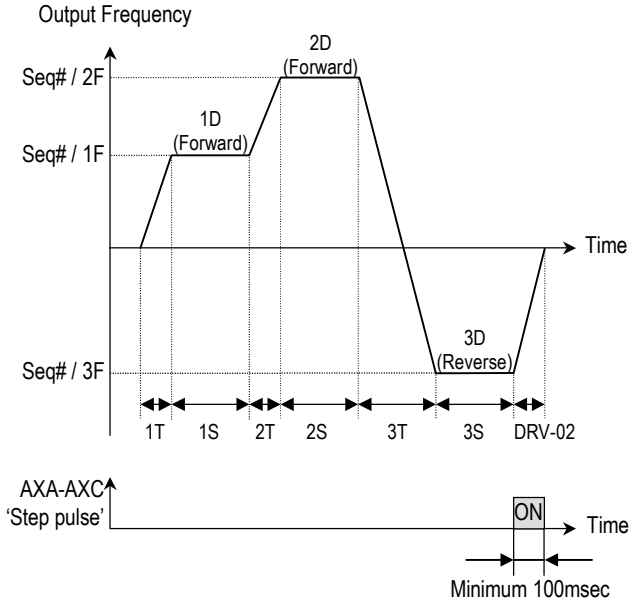
[Step pulse]
When Auto (Sequence) operation is selected in I/O-50, AXA-AXC outputs pulse signals on every step.

Related Functions:	I/O-50 ~ I/O-84 [Auto Operation]



[AXA-AXC configured as 'Step pulse']

[Seq pulse]
When Auto (Sequence) operation is selected in I/O-50, AXA-AXC outputs pulse signals on the last step.



[AXA-AXC configured as 'Step pulse']

[Ready]
AXA-AXC is CLOED when the inverter is ready to run.

[Trv. ACC]
CLOSED when output frequency reaches Accel frequency.
[Trv. DEC]
CLOSED when output frequency reaches Decel frequency.
[MMC]
Automatically set to 'MMC' when 'MMC' is selected in APP-01.

I/O-45: Fault Output Relay (30A, 30B, 30C)

I/O► Relay mode 45 010	45	010

Factory Default:	010	010

This function is used to allow the fault output relay to operate when a fault occurs. The output relay terminal is 30A, 30B, 30C where 30A-30C is a normally open contact and 30B-30C is a normally closed contact.

Bit	Setting	Display	Description
Bit 0 (LV)	0	000	Fault output relay does not operate at 'Low voltage' trip.
	1	001	Fault output relay operates at 'Low voltage' trip.
Bit 1 (Trip)	0	000	Fault output relay does not operate at any fault.
	1	010	Fault output relay operates at any fault **except** 'Low voltage' and 'BX' (inverter disable) fault.
Bit 2 (Retry)	0	000	Fault output relay does not operate regardless of the retry number.
	1	100	Fault output relay operates when the retry number set in FU2-26 decreases to 0 by faults.

☞ When several faults occurred at the same time, Bit 0 has the first priority.

Related Functions: DRV-12 [Fault Display]
FU2-26 [Retry number]

I/O-46: Inverter Number
I/O-47: Baud Rate

I/O► Inv No. 46 1	46	1
Factory Default: 1		1

This code sets the inverter number. This number is used in communication between inverter and communication board.

I/O► Baud rate 47 9600 bps	47	9600
Factory Default: 9600		9600

This code sets the communication speed. This is used in communication between inverter and communication board.

I/O-48: Operating at Loss of Freq. Reference
I/O-49: Waiting Time after Loss of Freq. Reference

I/O►Lost command 48 None	48	0
Factory Default: None		0

There are two kinds of loss of frequency reference. One is the loss of digital frequency reference and the other is of analog frequency reference.

Loss of digital frequency reference is applied when DRV-04 [Frequency Mode] is set to 'Keypad-1' or 'Kepad-2'. At this time, the 'Loss' means the communication error between inverter and keypad or communication board during the time set in I/O-49.

Loss of analog frequency reference is applied when DRV-04 [Frequency Mode] is set to other than 'Keypad-1' or 'Kepad-2'. At this time, the 'Loss' is determined by the criteria set in I/O-11 [Criteria for Analog Input Signal Loss].

Setting Range		Description
LCD	7-Seg	
None	0	Inverter keeps on operating at the previous frequency.
FreeRun (Coast to stop)	1	Inverter cuts off its output.
Stop	2	Inverter stops with Decel time (DRV-02) and Decel pattern (FU1-26).

I/O► Time out 49 1.0 sec	49	1.0
Factory Default: 1.0 sec		1.0

This is the time inverter determines whether there is a frequency reference or not. If there is no frequency reference satisfying I/O-11 during this time, inverter determines that it has lost of frequency reference.

Related Functions: DRV-04 [Frequency Mode]
I/O-11 [Criteria for Analog Signal Loss]

I/O-50: Auto (Sequence) Operation
I/O-51: Sequence Number Selection (Seq #)
I/O-52: The Number of Steps of Sequence

I/O► Auto mode 50 None	50	0
Factory Default: None		0

There are two modes of 'Auto-A' and 'Auto-B' in Auto mode. Auto operation is activated by the multi-function input terminals set to [SEQ-L], [SEQ-M], [SEQ-H] and [Go step] in I/O-12 ~ I/O-14.

I/O► Seq select 51 3	51	1
Factory Default: 1		1

This code selects the sequence to set frequency, transient time, steady speed time and motor direction the steps.

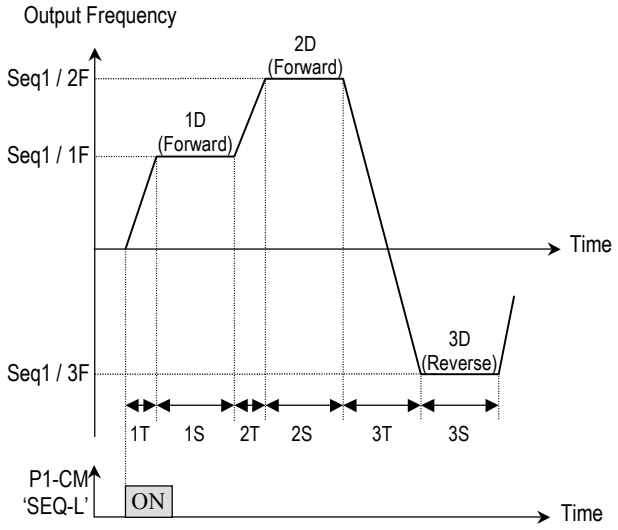
I/O► Step number 52 2	52	2
Factory Default: 2		2

This code sets the number of steps to use for the sequence number selected in I/O-51.

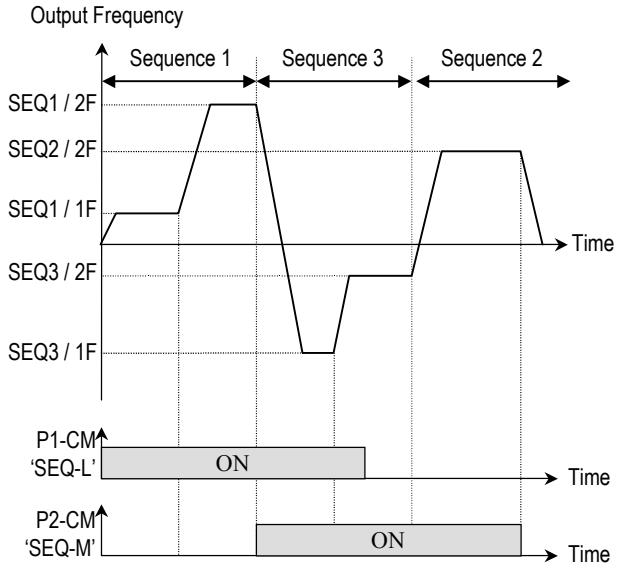
[Auto-A]
This mode will allow the inverter to operate automatically followed by its pre-programmed sequence. According to this sequence, eight different steps of Frequency, Transient Time, Steady Speed time and Motor Direction can be initiated with only a single multi-function input contact closure (I/O-12 ~ I/O-14). The sequence and steps are set in I/O-51 ~ I/O-84.

Step Frequency	Parameter Code	Speed-H (P3)	Speed-M (P2)	Speed-L (P1)
Sequence 1	I/O-50 ~ I/O-84	0	0	1
Sequence 2		0	1	0
Sequence 3		1	0	0
Sequence 4		0	1	1
Sequence 5		1	0	1

0: OFF, 1: ON

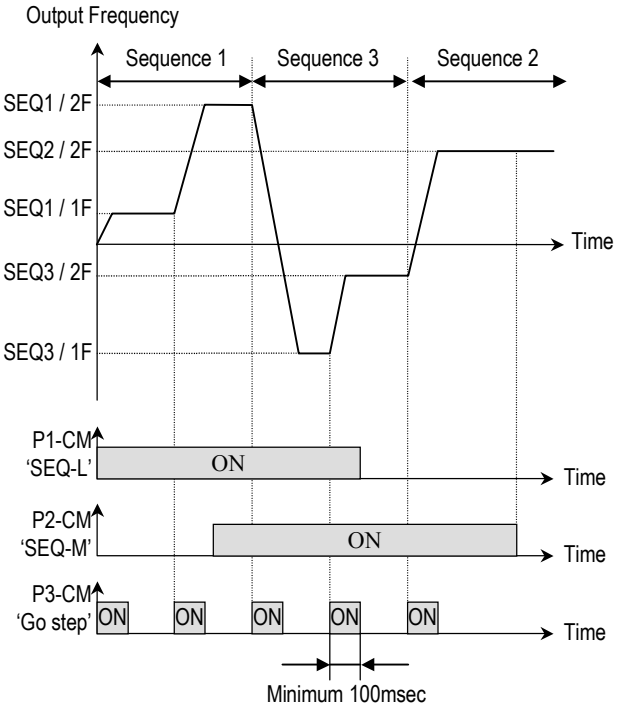


[Example 1 of 'Auto-A' operation]



[Example 2 of 'Auto-A' operation]

[AUTO B]
This mode can be also used to program up to 8 different steps as Auto A. However, to switch from one step to another, an external contact closure set to 'Go step' is required.



[Example of 'Auto-B' operation]

☞ **Note:** When a new sequence is selected during a sequence operating, the new sequence starts after the current sequence is finished.

I/O-53 ~ I/O-84: Frequency, Transient Time, Steady Speed Time, Motor Direction setting of each Step and Sequence

These parameter codes set the frequency, transient time, steady speed time, and motor direction. These codes are displayed according to the sequence number and steps.

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5.5 External Group [EXT]

EXT group appears only when an optional Sub-Board is installed.

EXT-00: Jump to Desired Code

EXT▶ Jump code	
00	1

Factory Default:	1

Jumping directly to any parameter code can be accomplished by entering the desired code number. This code is available only with LCD keypad.

EXT-01: Sub-Board Display

EXT▶ Sub B/D	01	1
01 Sub-A		

Factory Default:	Sub-A	1

This code automatically displays the kind of Sub-Board installed.

Setting Range		Description
LCD	7-Seg	
Sub-A	1	This board provides three multi-function input terminals (P4, P5, P6), three multi-function output terminals (Q1, Q2, Q3), Load meter output (LM) and second input frequency reference (V2).
Sub-B	2	This board provides encoder input terminals (AOC, BOC / A+, A-, B+, B-), encoder output terminals (FBA, FBB) and power terminals (+5V input, Vcc output).
Sub-C	3	This board provides three multi-function input terminals (P4, P5, P6), one multi-function output terminal (Q1), isolated second input frequency reference (V2) and two analog meters (AM1, AM2).

See 'Chapter 7 - Options' for more detail descriptions.

EXT-02 ~ EXT-04: Multi-Function Input Terminal Define (P4, P5, P6) – Sub-A, Sub-C

EXT▶ P4 define	02	17
02 XCEL-L		

Factory Default:	XCEL-L	17

An optional Sub-Board is needed if an application requires more than three multi-function input terminals.
'Sub-A' and 'Sub-C' boards provide additional three multi-function terminals. These terminals are used in conjunction with P1, P2 and P3 terminals. Refer to I/O-12 ~ I/O-14 for use. The following table shows the terminal definitions.

Setting Range		Description
LCD	7-Seg	
Speed-L	0	Multi-Step Speed - Low
Speed-M	1	Multi-Step Speed - Mid
Speed-H	2	Multi-Step Speed - High
XCEL-L	3	Multi-Accel/Decel - Low
XCEL-M	4	Multi-Accel/Decel - Mid
XCEL-H	5	Multi-Accel/Decel - High
Dc-brake	6	DC injection braking during stop
2nd Func	7	Exchange to 2nd functions
Exchange	8	Exchange to commercial power line
iTerm Clear	9	Reserved for future use
Up	10	Up drive
Down	11	Down drive
3-Wire	12	3 wire operation
Ext Trip-A	13	External trip A
Ext Trip-B	14	External trip B
iTerm Clear	15	Used for PID control
Open-loop	16	Exchange between PID mode and V/F mode
Main-drive	17	Exchange between Option and Inverter
Analog hold	18	Hold the analog input signal
XCEL stop	19	Disable accel and decel
P Gain2	20	Used for PID control
SEQ-L	21	Sequence operation - Low
SEQ-M	22	Sequence operation - Mid
SEQ-H	23	Sequence operation - High
Manual	24	Exchange between Sequence operation and Manual operation
Go step	25	Triggering Sequence operation (Auto-B)
Hold step	26	Hold last step (Auto-A)
Trv Off.Lo	27	Used for Traverse Operation
Trv Off.Hi	28	

Setting Range		Description
LCD	7-Seg	
Interlock1	29	Used for MMC operation
Interlock2	30	
Interlock3	31	
Interlock4	32	

EXT-05: V2 Mode Selection – Sub-A, Sub-C

EXT▶ V2 mode 05 None	05	0

Factory Default: None 0

'V2' signal can be used as the frequency reference and override function.

[None]
V2 signal is not used.

[Override]
'V2' signal override the frequency reference signal (V1, I, V1+I) selected in DRV-04.

[Reference]
'V2' signal is used as the frequency reference. At this time, the frequency reference selected in DRV-04 is ignored.

EXT-06 ~ EXT-10: Analog Voltage Input (V2) Signal Adjustment – Sub-A, Sub-C

This is used to adjust the analog voltage input signal when the frequency is referenced or overridden by the 'V2' control terminal. This function is applied when EXT-05 is set to 'Override' or 'Reference'. Reference Frequency versus Analog Voltage Input Curve can be made by four parameters of EXT-07 ~ EXT-10.

EXT▶ V2 filter 06 10 ms	06	10

Factory Default: 10 ms 10

This is the filtering time constant for 'V2' signal input. If the 'V2' signal is affected by noise causing unstable operation of the inverter, increase this value. Increasing this value may make response time slower.

EXT▶ V2 volt x1 07 0.00 V	07	0.00

Factory Default: 0.00 V 0.00

This is the minimum voltage of the 'V2' input at which the inverter outputs minimum frequency.

EXT▶ V2 volt y1 08 0.00 Hz	08	0.00

Factory Default: 0.00 Hz 0.00

This is the minimum frequency the inverter outputs when there is the minimum voltage (EXT-07) on the 'V2' terminal.

EXT▶ V2 volt x2 09 0.00 V	09	10.00

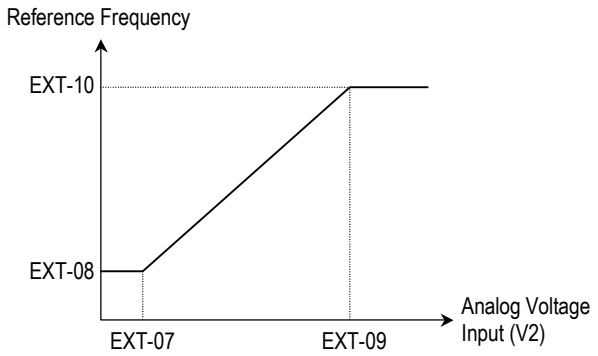
Factory Default: 10.00 V 10.00

This is the maximum voltage of the 'V2' input at which the inverter outputs maximum frequency.

EXT▶ V2 volt y2 10 60.00 Hz	10	60.00

Factory Default: 60.00 Hz 60.00

This is the maximum frequency the inverter outputs when there is the maximum voltage (EXT-09) on the 'V2' terminal.



[Reference Frequency vs. Analog Voltage Input, V2 (0 to 10V)]

Related Functions: DRV-04 [Frequency Mode]
I/O-01 ~ I/O-05 [V1 Adjustment]

EXT-14: Usage of Pulse Input Signal – Sub-B

EXT▶ F mode 14 None	14	0

Factory Default:	None	0

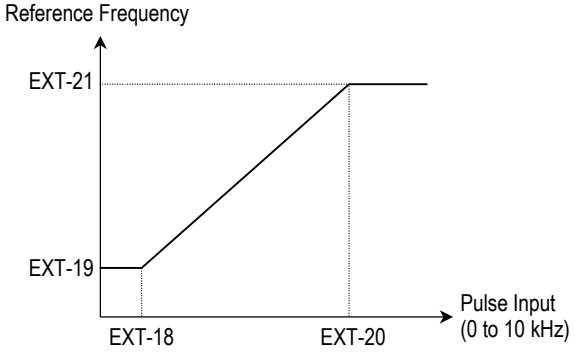
This function is to select the usage of encoder pulse signal of 'Sub-B' board. The pulse signal from encoder can be used as the motor speed feedback or frequency reference. When 'Sub-B' board is installed, FU2-40 must be set to 'V/F'.

[None]
The encoder pulse signal is not used.

[Feed-back]
The encoder pulse signal is used as the motor speed feedback. The inverter can maintain the motor speed constantly, regardless of the load fluctuation, by using the encoder feedback. The encoder pulse related functions must be set correctly for better performance in EXT-15 ~ EXT-24.

Related Functions:	EXT-15 [Pulse Input Signal selection] EXT-16 [Encoder Pulse Number] EXT-22 [P-Gain for 'Sub-B'] EXT-23 [I-Gain for 'Sub-B'] EXT-24 [Slip Frequency for 'Sub-B']

[Reference]
The encoder pulse signal is used as the frequency reference. When this function is selected, the frequency reference selected in DRV-04 is ignored. Reference Frequency versus Pulse Input Curve can be made by four parameters of EXT-18 ~ EXT-20.



[Reference Frequency vs. Pulse Input]

Related Functions:	EXT-15 [Pulse Input Signal selection] EXT-17 [Filtering Time Constant] EXT-18 [Minimum Pulse Frequency] EXT-19 [Minimum Output Frequency] EXT-20 [Maximum Pulse Frequency] EXT-21 [Maximum Output Frequency]

EXT-15: Pulse Input Signal Selection – Sub-B

EXT▶ F pulse set 15 A + B	15	0

Factory Default:	A + B	0

This code sets the encoder pulse to use. [A+B] uses two encoder signal lines of A and B, and [A] uses one encoder signal line of A or B.

EXT-16: Encoder Pulse Number – Sub-B

EXT▶ F pulse num 16 1024	16	1024

Factory Default:	1024	1024

This code sets the encoder pulse per rotation of encoder.

EXT-17: Filtering Time Constant for Pulse Input Signal – Sub-B

EXT▶ F filter 17 10 ms	17	10

Factory Default:	10 ms	10

This is the filtering time constant of pulse input signal. This is used to make the inverter respond slowly to the pulse input signal when the EXT-14 is set to 'Reference'.

EXT-18 ~ EXT-21: Pulse Input Signal Adjustment – Sub-B

This is used to adjust the pulse input signal when the pulse input through Sub-B board references the frequency. This function is applied when EXT-14 is set to 'Reference'. Reference Frequency versus Analog Voltage Input Curve can be made by four parameters of EXT-18 ~ EXT-21.

EXT▶ F pulse x1 18 0.0 kHz	18	0.0

Factory Default:	0.0 kHz	0.0

This is the minimum pulse frequency at which the inverter outputs minimum frequency.

EXT▶ F freq y1 19 0.00 Hz	19	0.00

Factory Default:	0.00 Hz	0.00

This is the minimum frequency the inverter outputs when there is the minimum pulse frequency (EXT-18).

EXT▶ F pulse x2 20 10.0 kHz	20	10.0

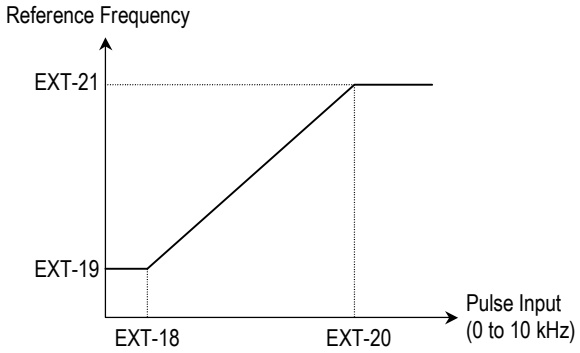
Factory Default:	10.0 kHz	10.0

This is the maximum pulse frequency at which the inverter outputs maximum frequency.

EXT▶ F freq y2 21 60.00 Hz	21	60.00

Factory Default:	60.00 Hz	60.00

This is the maximum frequency the inverter outputs when there is the maximum pulse frequency (EXT-20).



[Reference Frequency vs. Pulse Input]

EXT-22 ~ EXT-23: Gains for 'Sub-B' Board

EXT▶ PG P-gain 22 3000	22	3000

Factory Default:	3000	3000

This is the proportional gain when the EXT-14 is set to 'Feed-back'.

EXT▶ PG I-gain 23 300	23	300

Factory Default:	300	300

This is the integral gain when the EXT-14 is set to 'Feed-back'.

EXT-24: Slip Frequency for 'Sub-B' Board

EXT▶PG Slip Freq 24 100 %	24	100

Factory Default:	100 %	100

This is the limit frequency the inverter uses to compensate the motor speed drop due to load fluctuation. The set point value is the percentage of FUN-32 [Rated Motor Slip].

EXT-30 ~ EXT-32: Multi-Function Output Terminal (Q1, Q2, Q3) Define – Sub-A, Sub-C

Q1, Q2, Q3 terminals are provided on Sub-A and Sub-C board as an open collector output. The functions of these terminals can be selected the same as I/O-44 [Multi-function Auxiliary Contact Output Define].

EXT▶ Q1 define 30 FDT-1	30	0
Factory Default: FDT-1		0

EXT▶ Q2 define 31 FDT-2	31	1
Factory Default: FDT-2		1

EXT▶ Q3 define 32 FDT-3	32	2
Factory Default: FDT-3		2

Related Functions:
- FU1-54 [Overload Warning Level]
- FU1-55 [Overload Warning Time]
- FU1-59 [Stall Prevention Mode]
- FU1-60 [Stall Prevention Level]
- I/O-12 ~ I/O-14 [Multi-function Input Terminal define]
- I/O-42 ~ I/O-43 [Frequency Detection]
- I/O-44 [Multi-function Auxiliary Contact Output define]
- I/O-50 ~ I/O-56 [Auto Operation]

EXT-34: LM (Load Meter) Output – Sub-A
EXT-35: LM Adjustment

EXT▶ LM mode 34 Current	34	1
Factory Default: Current		1

EXT▶ LM Adjust 35 100 %	35	100
Factory Default: 100 %		100

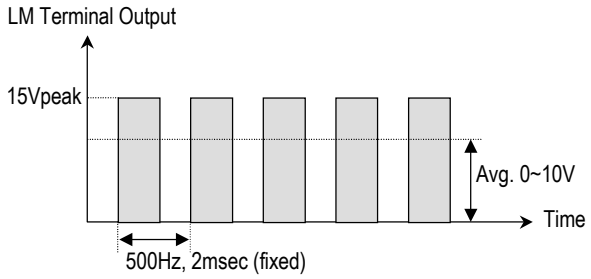
Load meter displays the inverter output Frequency, Current, Voltage and DC link voltage with pulse signals on the LM terminal of Sub-A board. The average ranges from 0V to 10V. EXT-35 is used to adjust the LM value.

[Frequency]
LM terminal outputs inverter output frequency. The output value is determined by,
LM Output Voltage = (Output freq. / Max. freq.) × 10V × EXT-35 / 100

[Current]
LM terminal outputs inverter output current. The output value is determined by,
LM Output Voltage = (Output current / Rated current) × 10V × EXT-35 / 150

[Voltage]
LM terminal output inverter output voltage. The output value is determined by,
LM Output Voltage = (Output voltage / Max. output voltage) × 10V × EXT-35 / 100

[DC link vtg]
LM terminal outputs the DC link voltage of inverter. The output value is determined by,
LM Output Voltage = (DC link voltage / Max. DC link voltage) × 10V × EXT-35 / 100



[LM Output (LM-CM terminal)]

Related Functions: I/O-40 ~ I/O-41 [FM Output]

EXT-40: AM1 (Analog Meter 1) Output – Sub-C
EXT-41: AM1 Adjustment
EXT-42: AM2 (Analog Meter 2) Output – Sub-C
EXT-43: AM2 Adjustment

These terminals are provided on Sub-C board.

EXT► AM1 mode 40 Frequency	40	0
Factory Default:	Frequency	0

EXT► AM1 Adjust 41 100 %	41	100
Factory Default:	100 %	100

EXT► AM2 mode 42 DC link Vtg	42	3
Factory Default:	DC link Vtg	3

EXT► AM2 Adjust 43 100 %	43	100
Factory Default:	100 %	100

Analog meter displays the inverter output Frequency, Current, Voltage and DC link voltage with analog voltage on the AM1 and AM2 terminals of Sub-C board. The output voltage ranges from 0V to 10V. EXT-41 and EXT-43 are used to adjust the AM output value.

[Frequency]
The AM terminal outputs inverter output frequency. The output value is determined by,
AM Output Voltage = (Output freq. / Max. freq.) × 10V

[Current]
The M terminal outputs inverter output current. The output value is determined by,
AM Output Voltage = (Output current / Rated current) × 10V

[Voltage]
The AM terminal outputs inverter output voltage. The output value is determined by,
AM Output Voltage = (Output voltage / Max. output voltage) × 10V

[DC link vtg]
The AM terminal outputs the DC link voltage of inverter. The output value is determined by,
AM Output Voltage = (DC link voltage / Max. DC link voltage) × 10V

5.6 Application Group [APP]

APP-00: Jump to desired code

APP► Jump code 00 1

Factory Default:	1

Jumping directly to any parameter code can be accomplished by entering the desired code number. This code is available only with LCD keypad.

APP-01: Application Mode Selection

APP► App. mode 01 None	01	0

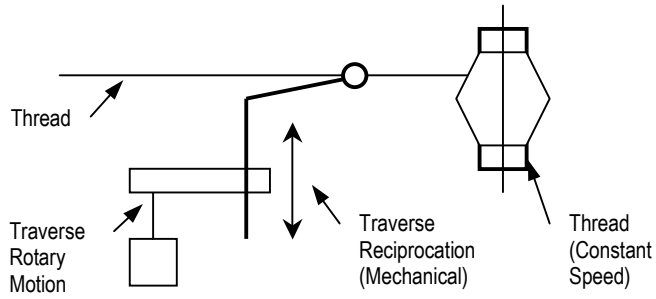
Factory Default:	None	0

This code sets the application mode.

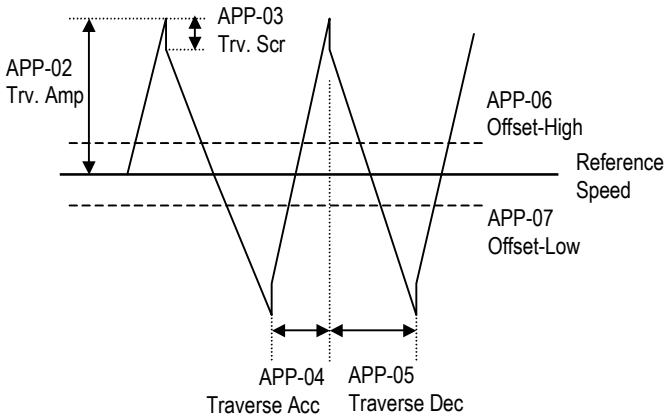
Setting Range		Description
LCD	7-Seg	
None	0	Application mode is not selected.
Traverse	1	Traverse mode is selected in application group. Related functions (APP-02~07) are displayed.
MMC	2	MMC (Multi-Motor Control) mode is selected in application group. Related functions (APP-08~31) are displayed.
DRAW	3	DRAW mode is selected in application group. Related functions (APP-32~33) are displayed.

[Traverse]: This is a mechanism to wind thread to an intended shape on a reel with a rotary motion and reciprocation. Adjusting the speed of mechanical reciprocation can make different shapes of thread reel. The following figure shows an example. The guide should move with low speed at the center of the reel and fast at the edge of the reel.

Related Functions:	APP-02 to APP-07 [Traverse Parameters] I/O-12 to I/O-14 [Multi-Function Input] EXT-30 to EXT-32 [Multi-Function Output]



[An example of Traverse Operation]



[Traverse Operation Pattern]

[MMC]: The 'PID' control should be selected in FU2-47 to use this function.

♦ One inverter can control multiple motors. This function is often used when controlling the amount and pressure of flow in fans or pumps. Built-in PI controller controls a main motor after receiving process control value and keeps the control value constant by connecting auxiliary motors to commercial line when needed.

♦ In case that flow amount or flow pressure is beyond or below the reference so the main drive cannot control by itself, auxiliary motors are automatically turned on/off. Maximum four (Q1~3 and Aux. output) auxiliary motors can be run. Each Starting and Stop Frequency should be set to four auxiliary motors.

♦ Auto Change can be selected to automatically switch the order of the running motors for keeping

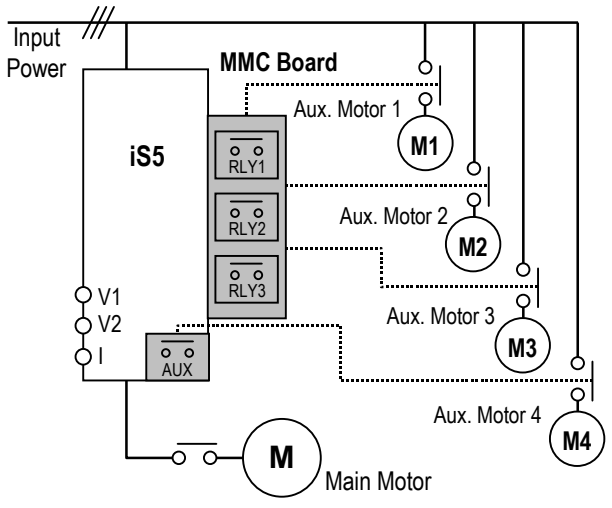
motor run-time constant. Set mode '1' for automatic changing of auxiliary motors only and set mode '2' for automatic changing of all motors including main motor. For mode '2', external sequence (Refer to APP-26) should be configured.

♦ Abnormal motor can be skipped from running by using the multi-function input terminals (P1, P2, P3, and P4). If a multi-function terminal is opened, the inverter stops all running motors and restarts operation with only normal motors except the abnormal motor. (Refer to APP-29)

♦ Sleep function is initiated when flow demand is low. Inverter stops motor when the motor runs below Sleep Frequency (APP-24) during Sleep Delay Time (APP-23). While in the sleep state, inverter keeps monitoring and initiates Wake-Up function when the real value of the controlling amount has decreased below the Wake-Up level (APP-25).

☞ **Note:** Only one auxiliary motor can be connected with AUX terminal on control terminal strip without using MMC Option Board.

Related Functions:	APP-08 to APP-31 [MMC Parameters] DRV-04 [Frequency Mode] FU2-47 [PID Operation Selection] I/O-01 to I/O-10 [Analog Signal Input] EXT 15 to EXT21 [Pulse Input Signal] I/O-12 to I/O-14 [Multi-Function Input] EXT-30 to EXT-32 [Multi-Function Output]



[MMC Diagram]

[Draw]: This is a kind of Open-Loop Tension Control. This is used to maintain constant tension of material with the speed difference between main motor and subordinate motor.

Related Functions:	APP-32 to APP-33 [Draw Parameters] DRV-04 [Frequency Mode] I/O-01 to I/O-10 [Analog Signal Input] EXT 06 to EXT-10 [Analog Input Setting] I/O-12 to I/O-14 [Multi-Function Input] EXT-02 to EXT-04 [Multi-Function Input]

APP-02: Traverse Amplitude

APP▶Trv. Amp[%] 02 0.0%	02	0.0

Factory Default:	0.0%	0.0

This code sets the frequency amplitude of traverse operation. The value is the percentage of reference frequency. The output value is determined by,
Trv. Amp Frequency = (Reference Freq. * Trv. Amp)/100

APP-03: Traverse Scramble Amplitude

APP▶Trv. Scr[%] 03 0.0%	03	0.0

Factory Default:	0.0%	0.0

This code sets the frequency amplitude of scramble operation. The output value is determined by,
Trv. Scr Frequency = (Trv. Amp Frequency * (100 - Trv. Scr))/100

APP-04: Traverse Accel Time
APP-05: Traverse Decel Time

APP▶Trv Acc Time 04 2.0 sec	04	2.0

Factory Default:	2.0 sec	2.0

APP▶Trv Dec Time 05 3.0 sec	05	3.0

Factory Default:	3.0 sec	3.0

Sets the acceleration and deceleration time for traverse operation.

- ☞ The 'Trv Acc' terminal set in EXT-30 to EXT-32 is ON during traverse acceleration time. (Open Collector Output)
- ☞ The 'Trv Dec' terminal set in EXT-30 to EXT-32 is ON during traverse deceleration time. (Open Collector Output)
- ☞ APP-04 and APP-05 should be set to a value less than APP-03. If not, traverse control does not accomplished correctly.

APP-06: Traverse Offset (Hi) Setting
APP-07: Traverse Offset (Lo) Setting

APP▶ Trv Off Hi 06 0.0 %	06	0.0
Factory Default: 0.0 %		0.0

This code makes positive offset during traverse operation by multi-function input terminal. When the 'Trv Off Hi' terminal is ON, the offset frequency is added to the reference frequency. To use this function, set a terminal out of multi-function input terminals (P1, P2, P3) to 'Trv Off Hi' in I/O-12 ~ I/O-14. The offset value is determined by,
Trv. Off Hi Frequency =(Reference Frequency * Trv. Off Hi)/100

APP▶ Trv Off Lo 07 0.0 %	07	0.0
Factory Default: 0.0 %		0.0

This code makes negative offset during traverse operation by multi-function input terminal. When the 'Trv Off Lo' terminal is ON, the offset frequency is subtracted from the reference frequency. To use this function, set a terminal out of multi-function input terminals (P1, P2, P3) to 'Trv Off Lo' in I/O-12 ~ I/O-14. The offset value is determined by,
Trv. Off Lo Frequency =(Reference Frequency * Trv. Off Lo)/100

APP-08: Running Auxiliary Motor Number Display

APP▶Aux Mot Run 08 0	08	0
Factory Default: 0		0

This code shows how many auxiliary motors are running by MMC control.

APP-09: Starting Auxiliary Motor Selection

APP▶Starting Aux 09 1	09	1
Factory Default: 1		1

This code sets the starting auxiliary motor for MMC control.

APP-10: Operation Time Display on Auto Change

APP▶Auto Op Time 10 00:00	10	00:00
Factory Default: 00:00		00:00

This code displays the operation time after Auto Change is accomplished.

APP-11: Stat Frequency of Aux. Motor 1
APP-12: Stat Frequency of Aux. Motor 2
APP-13: Stat Frequency of Aux. Motor 3
APP-14: Stat Frequency of Aux. Motor 4

APP▶Start freq1 11 49.99 Hz	11	49.99
Factory Default: 49.99 Hz		49.99

APP▶Start freq2 12 49.99 Hz	12	49.99
Factory Default: 49.99 Hz		49.99

APP▶Start freq3 13 49.99 Hz	13	49.99
Factory Default: 49.99 Hz		49.99

APP▶Start freq4 14 49.99 Hz	14	49.99
Factory Default: 49.99 Hz		49.99

The inverter turns on AUX, RLY1, RLY2, and RLY3 in order if the output frequency is over the frequencies set in APP-11 to APP-14, respectively, and the time is over APP-19.

APP-15: Stop Frequency of Aux. Motor 1
APP-16: Stop Frequency of Aux. Motor 2
APP-17: Stop Frequency of Aux. Motor 3
APP-18: Stop Frequency of Aux. Motor 4

APP▶Stop freq1 15 15.00 Hz	15	15.00
Factory Default: 15.00 Hz		15.00

APP▶Stop freq2 16 15.00 Hz	16	15.00
Factory Default: 15.00 Hz		15.00

APP▶Stop freq3 17 15.00 Hz	17	15.00
Factory Default: 15.00 Hz		15.00

APP▶Stop freq4 18 15.00 Hz	18	15.00
Factory Default: 15.00 Hz		15.00

The inverter turns off RLY3, RLY2, RLY1, and AUX in order if the output frequency is below the frequencies set in APP-15 to APP-18, respectively, and the time is over APP-20.

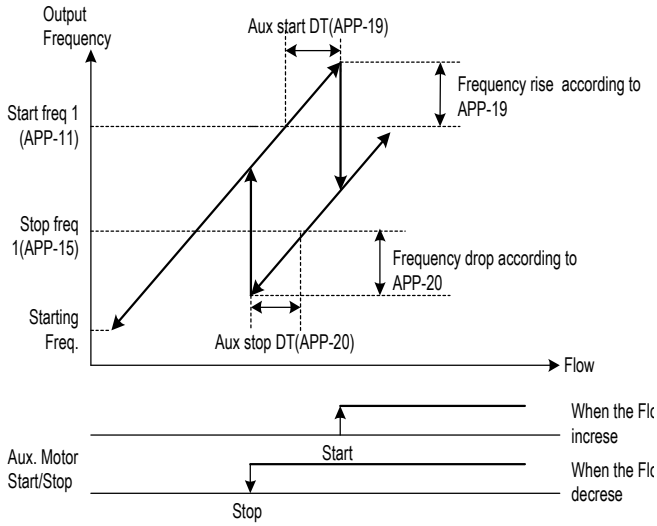
APP-19: Delay Time before Operating Aux. Motor
APP-20: Delay Time before Stopping Aux. Motor

APP▶Aux Start DT 19 60.0 sec	19	60.0
Factory Default: 60.0 sec		60.0

Sets the time the inverter waits before starting the auxiliary motors.

APP▶Aux Stop DT 20 60.0 sec	20	60.0
Factory Default: 60.0 sec		60.0

Sets the time the inverter waits before stopping the auxiliary motors.



[Aux. Motor Start/Stop with MMC]

APP-21: The Number of Aux. Motors

APP▶Nbr Aux's 21 4	21	4
Factory Default: 4		4

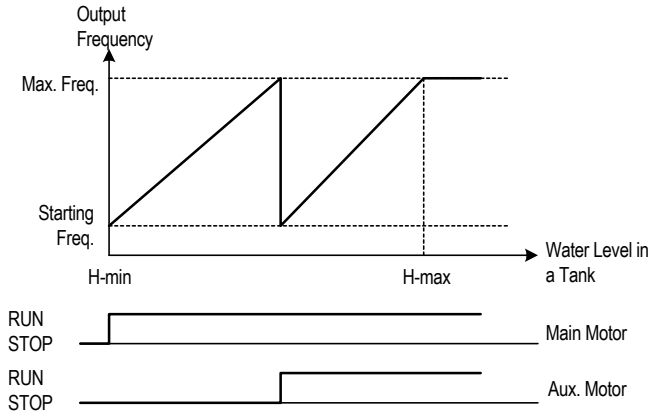
Sets the number of auxiliary motors connected to the inverter.

APP-22: PID Bypass Selection

APP▶Regul Bypass 22 --- No ---	22	0
Factory Default: No		0

This is used to bypass the PID operation selected in FU2-47. Select this code to 'Yes' when using MMC function without PID control. The frequency is determined by real value of control amount instead PID controller output. The real value is also used as the Start/Stop reference of Aux. motors.

The following figure shows the running pattern with this function applied for controlling the flow rate of a tank. To control the flow rate according to the water level of a tank, divide the water level of the tank into the region to the number of Aux. motors plus one, and map each region from staring frequency to maximum frequency. The inverter increases output frequency to lower the water level in the tank when the water level in the tank rises. When reaching maximum frequency, inverter connects aux. motors connected directly to commercial line. After connecting aux. motor, inverter starts again from the starting frequency. By selecting APP-22 to 'Yes', PID operation is disabled and Control Mode (FU2-47) is changed to 'V/F'. PID Bypass is available only when Freq. Mode (DRV-04) is set to 'V1', '1' or 'V2'. The level in a tank can be checked in APP-30 [Actual Value] and APP-31 [Actual Percent].



[Aux. Motor Start/Stop without PID Control]

APP-23: Sleep Delay Time
APP-24: Sleep Frequency
APP-25: Wake-Up Level

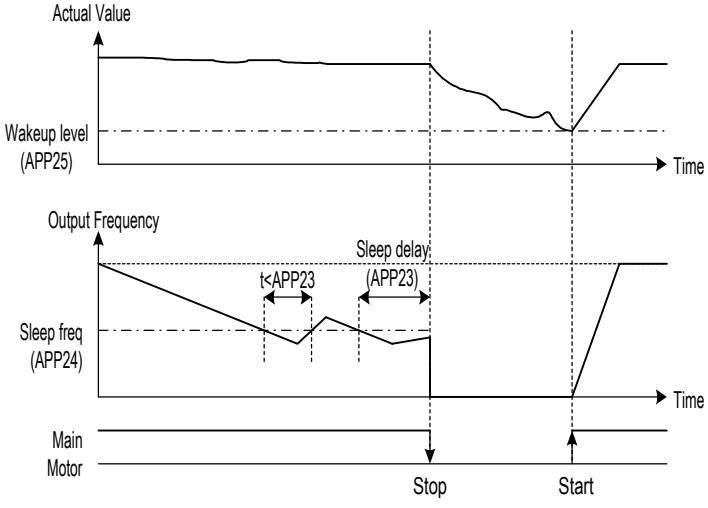
APP▶Sleep Delay 23 60.0 sec	23	60.0
Factory Default: 60.0 sec		60.0

APP▶Sleep Freq 24 19.00 Hz	23	19.00
Factory Default: 19.00 Hz		19.00

APP▶WakeUp level 25 35 %	25	35
Factory Default: 35 %		35

Sleep function is initiated when flow demand is low. Inverter stops motor when the motor runs below Sleep Frequency (APP-24) during Sleep Delay Time (APP-23). While in the sleep state, inverter keeps monitoring and initiates Wake-Up function when the real value of the controlling amount has decreased below the Wake-Up level (APP-25).

☞ **Note:** Sleep function is not operated if the Sleep Delay Time (APP-23) is set to '0'.



[Sleep Operation]

APP-26: Auto Change Mode Selection

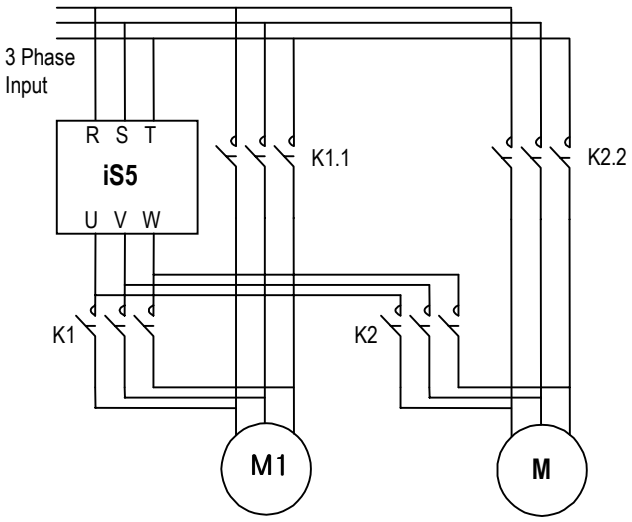
APP▶AutoCh_Mode 26 0	26	0
Factory Default: 0		0

This function is used to change the running order of the motors to regulate their run-time when multiple motors are connected for MMC.

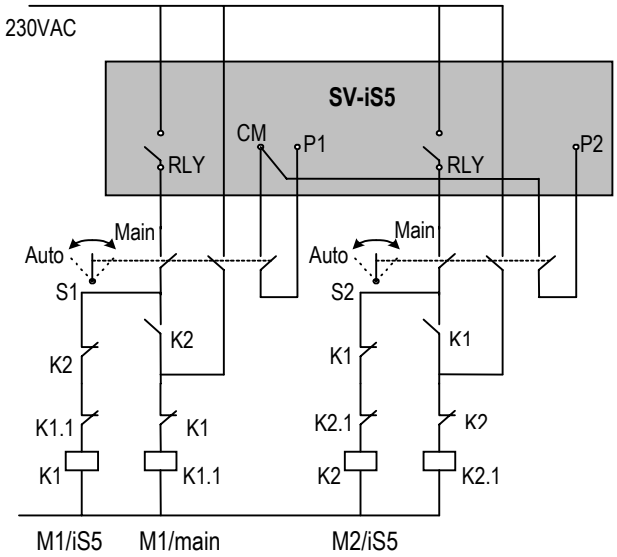
[0]: Not using Auto Change Function.
The inverter keeps the order Main motor ⇒RLY1 ⇒ RLY2 ⇒ RLY3 ⇒ AUX and do not change the running order of auxiliary motors.

[1]: Auto Change Function is applied only to aux. motors. The inverter changes the order of auxiliary motors except the main motor connected to the drive. Running order is Main Motor ⇒ RLY1 ⇒ RLY2 ⇒ RLY3 ⇒ AUX. And then it is changed to Main Motor ⇒ RLY2 ⇒ RLY3 ⇒ AUX ⇒ RLY1.

[2]: Auto Change Function is applied to all motors. The inverter changes the order of all motors. The inverter operates the initial motor and the others are directly powered by commercial line. It should be used with Inter-lock function after configuring external inter-lock sequence circuit as shown below.



[Wiring Diagram for Inter-Lock Configuration]



[Sequence Circuit for Inter-Lock Configuration]

APP-27: Auto Change Time
APP-28: Auto Change Level

APP▶AutoEx-intv 27 72:00	27	72:00
Factory Default: 72:00		72:00

APP▶AutoEx-level 28 20 %	28	20
Factory Default: 20 %		20

This function is used to protect motor from running alone for a long time by changing operation to other motor.

Auto Change is accomplished when the following conditions are satisfied:
1) The time set in APP-27 is over.
2) The actual value of controlling amount is less than the value set in APP-28.
3) Only one motor is running.
When above three conditions are met, the inverter stops the running motor, and changes motor to run by the order set in APP-26. and then continues operation according to new order.
If Auto Change Level (APP-28) is set to '0', the

function is initiated only when the motor is in Stop or Sleep state. The count time for Auto Change is depend on Auto Change Mode (APP-26). In mode '0', inverter starts counting only when auxiliary motor is running. In mode '1' or '2', inverter starts counting when any motor is running including main motor.

APP-29: Inter-Lock Selection

APP▶Inter-lock 29 --- No ---	29	0

Factory Default:	No	0

By setting this code to 'Yes', the multi-function input terminals (P1 ~ P4) are used as auxiliary motor operating condition of RLY1, RLY2, RLY3, and AUX. The multi-function input terminal should be turned on to run the corresponding auxiliary motor. If running with any multi-function input terminal open with this function, the inverter starts motors except the corresponding motor. If multi-function input happens to be turned off during motor running, the inverter stops all running motors and restarts running with only normal motors except the subject motor. By setting this parameter to 'Yes', the multi-function input terminals (P1~P4) are set to 'Interlock1' through 'Interlock4' automatically.

☞ **Note:** P1 through P4 cannot be used for other purpose it this code is set to 'Yes'.

Related Functions:	I/O-12 to I/O-14 [Multi-Function Input] EXT-02 to EXT-04 [Multi-Function Input]

APP-30: Actual Value Display

APP▶Actual Value 30 0.00 Hz	30	0.00

Factory Default:	0.00 Hz	0.00

This code displays the value using on PID controller in frequency.

APP-31: Actual Value Display in Percentage

APP▶Actual Perc 31 0 %	31	0

Factory Default:	0 %	0

This code displays the value using on PID controller in percentage.

APP-32: Draw Mode Selection

APP▶Draw Mode 32 None	32	0

Factory Default:	None	0

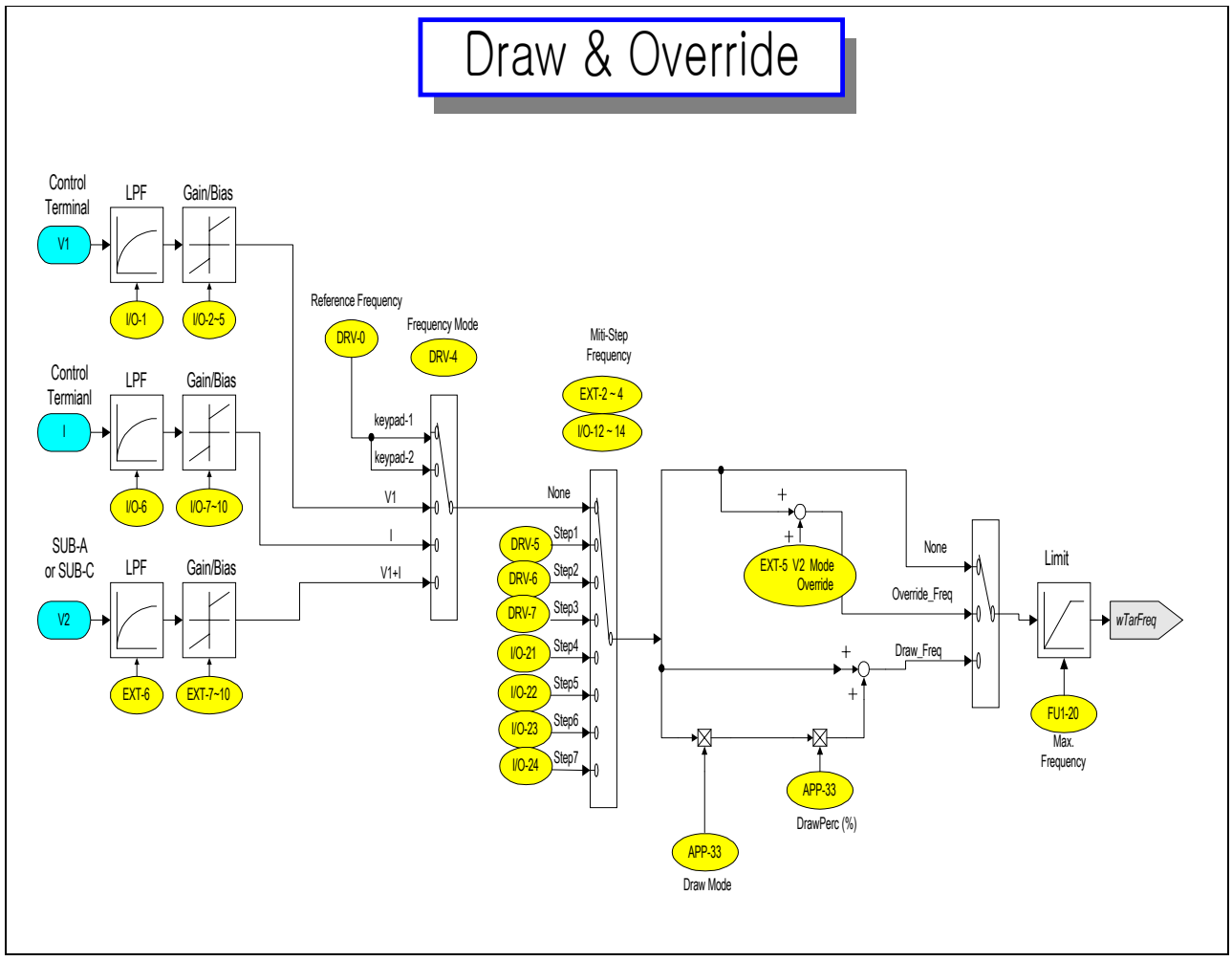
This code sets the signal input to use for Draw operation. The main reference frequency is set in DRV-04. This parameter should be set to a signal that is not selected in DRV-04.

APP-33: Draw Size Setting

APP▶Draw Perc 33 100 %	33	100

Factory Default:	100%	100

This code sets the frequency bandwidth during Draw operation. For example, when Reference Frequency (DRV-00) is set to '30Hz', Draw Mode (APP-32) to 'V1_Draw' and Draw Size (APP-33) to '10%', the frequency difference during Draw operation is between 27 Hz and 33Hz. The following figure shows the block diagram for Draw and Override operation.


Draw & Override
Control Terminal
V1
LPF
Gain/Bias
I/O-1
I/O-2~5
Control Termianl
I
I/O-6
I/O-7~10
SUB-A or SUB-C
V2
EXT-6
EXT-7~10
Reference Frequency
DRV-0
Frequency Mode
DRV-4
keypad-1
keypad-2
V1
I
V1+I
Miti-Step Frequency
EXT-2 ~ 4
I/O-12 ~ 14
None
DRV-5
DRV-6
DRV-7
I/O-21
I/O-22
I/O-23
I/O-24
Step1
Step2
Step3
Step4
Step5
Step6
Step7
EXT-5 V2 Mode Override
None
Override_Freq
Draw_Freq
Limit
FU1-20
Max. Frequency
wTarFreq
APP-33
DrawPerc (%)
APP-33
Draw Mode

CHAPTER 6 - OPTIONS

The iS5 series inverter provides many options for various applications. See the following option table and select the proper options according to your application.

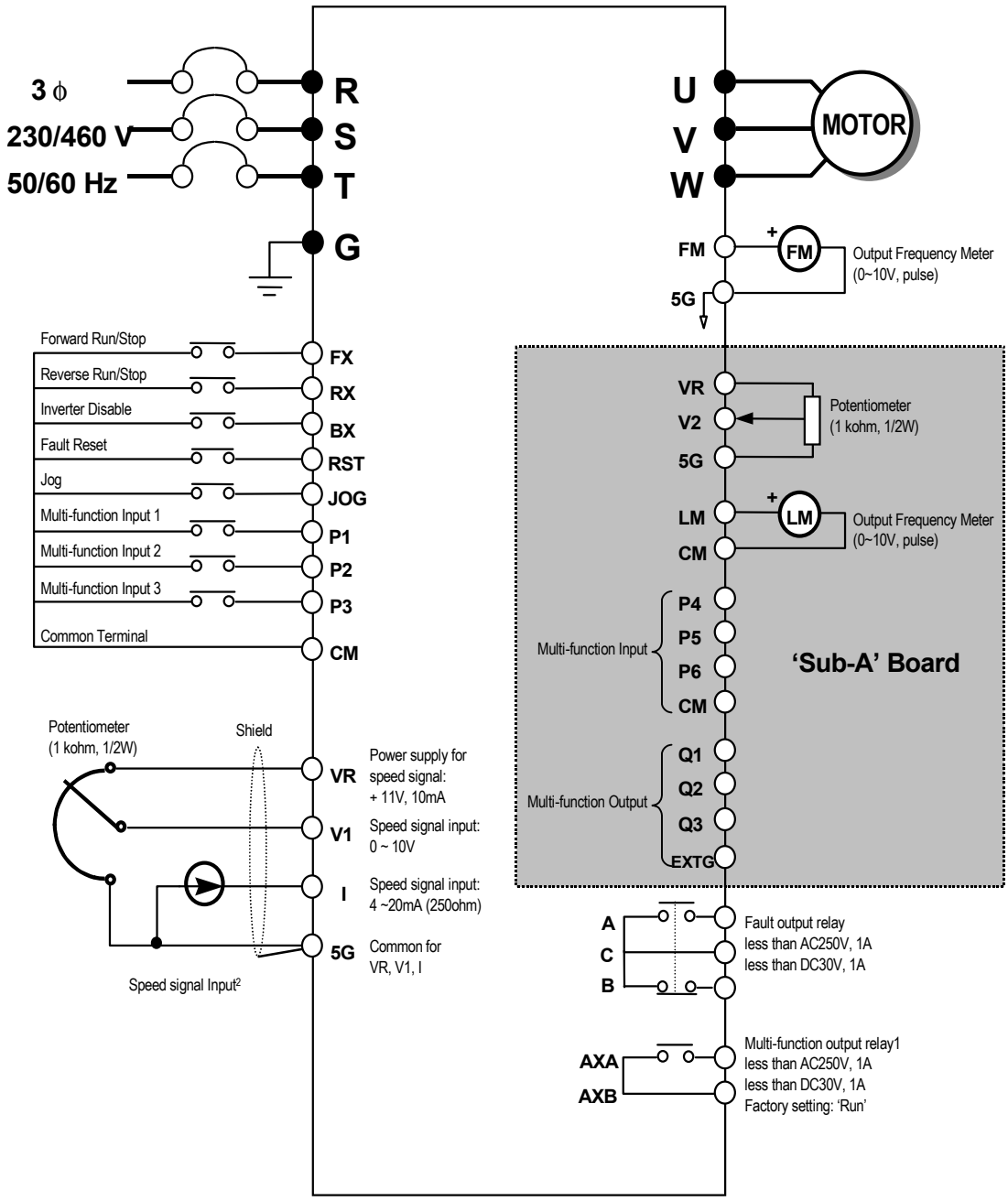
Option		Name	Description
Internal Installation	Sub Board	Sub-A Board (Extended I/O)	□ Extended I/O Module □ Three Multi-Function Inputs (P4, P5, P6) □ Three Multi-Function Outputs (Q1, Q2, Q3) □ Auxiliary Analog Frequency Reference (V2) □ LM (Load Meter) Output (0 ~ 10V)
		Sub-B Board (Speed Feedback)	□ Encoder Pulse Input – Speed Feedback (AOC, BOC / A+, A-, B+, B-) □ Encoder Pulse Output (FBA, FBB)
		Sub-C Board (Extended I/O)	□ Extended I/O Module □ Three Multi-Function Inputs (P4, P5, P6) □ One Multi-Function Outputs (Q1) □ Isolated Auxiliary Analog Frequency Reference (V2) □ Two Isolated Analog Meter Output (AM1, AM2)
	Option Board	Device Net	□ Embedded DeviceNet protocol □ CAN Controller □ Inverter Connection: Max. 64 □ Input Voltage: DC 11 ~ 25V □ Baud Rate: 125, 250, 500k bps □ CSMA/CD-NBA Method
		PLC Communication (F-Net)	□ Connection with Fnet Communication Module for GLOFA PLC □ Inverter Connection: Max. 64 □ Baud Rate: 1M bps □ Token Method
		RS-485	□ RS-485 Communication □ Inverter Connection: Max. 32 □ Baud Rate: Max. 19200 bps
		Profi-Bus	□ Connection to ProfiBus Network □ Device Type: Profibus DP Slave □ Inverter Connection: Max. 64 □ Baud Rate: Max. 12M bps
External Installation	Keypad	LCD	□ 32-Character Display □ Download and Upload from the Keypad
		7-Segment	□ Six Digit 7-Sengment Display
	Remote Cable	Remote Cable	□ 2m, 3m, 5m long keypad cables for separate keypad installation
	Dynamic Braking	DB Resistor	□ Enables Inverter to decelerate rapidly
		DB Unit	□ DB units are provided as an option for 15 ~ 30 HP inverters

The following table shows the Sub-Board Selection Guide According To Functions.

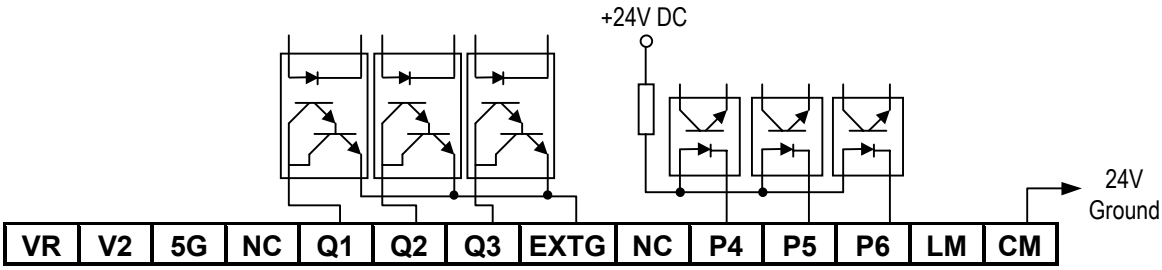
Code	Function Description	Sub-Board Type		
		SUB-A Board	SUB-B Board	SUB-C Board
EXT-02	Multi-Function Input Terminal 'P4'	√		√
EXT-03	Multi-Function Input Terminal 'P5'	√		√
EXT-04	Multi-Function Input Terminal 'P6'	√		√
EXT-05	V2 Mode Selection	√		√
EXT-06	Filtering Time Constant for V2 Input Signal	√		√
EXT-07	V2 Input Minimum Voltage	√		√
EXT-08	Frequency Corresponding to V2 Input Minimum Voltage	√		√
EXT-09	V2 Input Maximum Voltage	√		√
EXT-10	Frequency Corresponding to V2 Input Maximum Voltage	√		√
EXT-14	Usage for Pulse Input Signal		√	
EXT-15	Pulse Input Signal Selection		√	
EXT-16	Encoder Pulse Selection		√	
EXT-17	Filtering Time Constant for Pulse Input Signal		√	
EXT-18	Pulse Input Minimum Frequency		√	
EXT-19	Frequency Output corresponding to Pulse Input Minimum Frequency		√	
EXT-20	Pulse Input Maximum Frequency		√	
EXT-21	Frequency Output corresponding to Pulse Input Maximum Frequency		√	
EXT-22	P-Gain for PG Option		√	
EXT-23	I-Gain for PG Option		√	
EXT-24	Slip Frequency for PG Option		√	
EXT-30	Multi-function Output Terminal 'Q1'	√		√
EXT-31	Multi-function Output Terminal 'Q2'	√		
EXT-32	Multi-function Output Terminal 'Q3'	√		
EXT-34	LM (Load Meter) Output Selection	√		
EXT-35	LM Output Adjustment	√		
EXT-40	AM1 (Analog Meter 1) Output Selection			√
EXT-41	AM1 Output Adjustment			√
EXT-42	AM2 (Analog Meter 2) Output Selection			√
EXT-43	AM2 Output Adjustment			√

6.1 Sub-A Board

6.1.1 Board Configuration



6.1.2 Terminal Configuration



6.1.3 Terminal Description

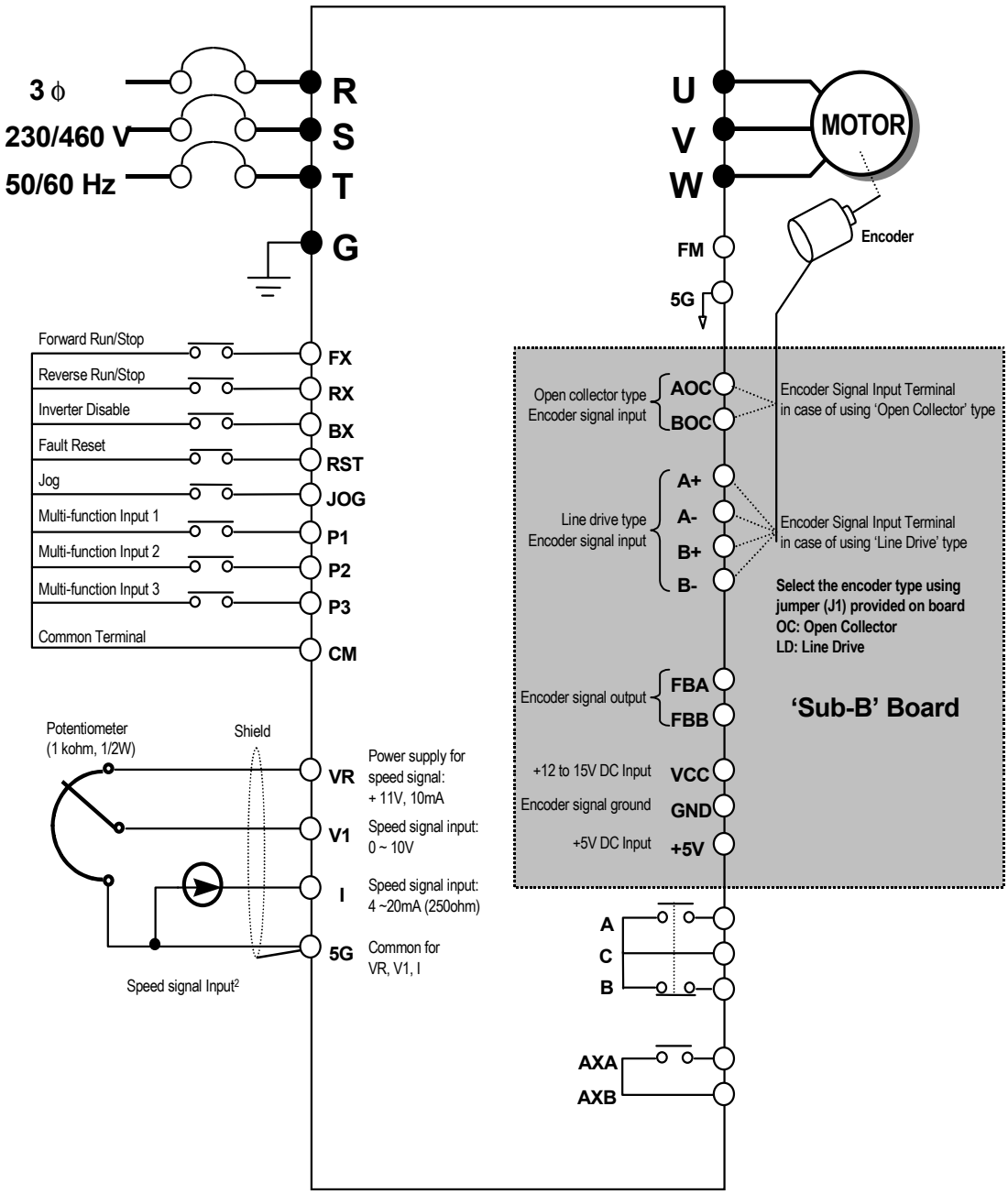
Section		Terminal	Name	Description
Input	Contact Input	P4, P5, P6	Multi-Function Input	Used as the extended function of P1, P2, P3 (I/O-12 ~ I/O-14)
		CM	Common Terminal	Common terminal for P4, P5, P6
	Analog Frequency Reference	VR	Power Supply for V2	DC voltage output terminal for V2 (+12V, 10mA)
		V2	Analog Voltage Input	Analog voltage input terminal for frequency reference or override.
		5G	Common Terminal	Common terminal for VR and V2
Output	+15V Pulse Output	LM	Load Meter	Used to monitor one of Output Frequency, Output Current, Output Voltage, DC link Voltage. (+15V Pulse output, Average voltage: 0 ~ 10V DC)
		CM	Common Terminal	Common terminal for LM
	Open Collector Output	Q1, Q2, Q3	Multi-Function Output (Open-Collect Output)	Used as the extended function of AXA, AXC (I/O-44)
		EXTG	External Common Terminal	Common terminal for Q1, Q2, Q3
		NC	Not Used	

6.1.4 Parameters of Sub-A Board

Code	Parameter Description	Code	Parameter Description
EXT-01	Sub Board Type Display	EXT-09	Analog Voltage Input Signal (V2) Adjustment
EXT-02	Multi-Function Input Terminal (P4, P4, P6) Define	EXT-10	
EXT-03		EXT-30	Multi-Function Output Terminal (Q1, Q2, Q3) Define
EXT-04		EXT-31	
EXT-05	V2 Mode Selection	EXT-32	
EXT-06	Filtering Time Constant for V2 Input Signal	EXT-34	LM Output Adjustment
EXT-07	Analog Voltage Input Signal (V2) Adjustment	EXT-35	
EXT-08			

6.2 Sub-B Board

6.2.1 Board Configuration



6.2.2 Terminal Configuration

AOC	BOC	A+	A-	B+	B-	FBA	FBB	GND	GND	+5V	+5V	VCC	VCC

6.2.3 Terminal Description

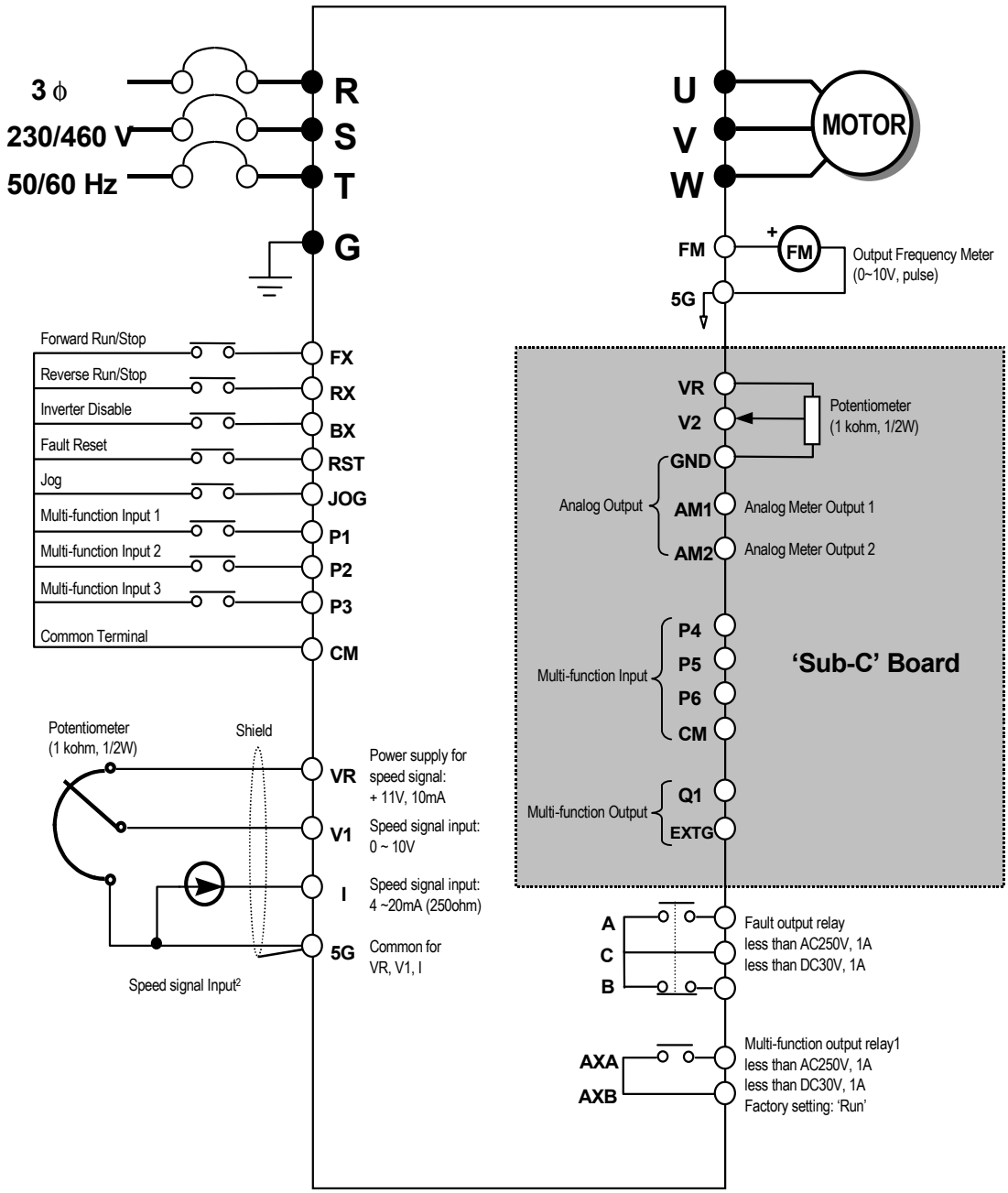
Section		Terminal	Name	Description
Encoder Signal Input	Open Collector Type	AOC	A Pulse Input Terminal	Connect A signal of Open Collector type encoder
		BOC	B Pulse Input Terminal	Connect B signal of Open Collector type encoder
	Line Drive Type	A+	A+ Pulse Input Terminal	Connect A+ signal of Line Drive type encoder
		A-	A- Pulse Input Terminal	Connect A- signal of Line Drive type encoder
		B+	B+ Pulse Input Terminal	Connect B+ signal of Line Drive type encoder
		B-	B- Pulse Input Terminal	Connect B- signal of Line Drive type encoder
Signal Output	Encoder Signal Output	FBA	Encoder A Pulse Output	Outputs A signal received from the encoder
		FBB	Encoder B Pulse Output	Outputs B signal received from the encoder
Power Supply Input		+5V	+5V DC Input Terminal	Provide +5V DC from external power supply (5V DC, Minimum 0.5A)
		VCC	+12 to 15V DC Input Terminal	This is the encoder supply voltage. Supply proper voltage according to the encoder specification. (+12 to 15V DC, Minimum 0.5A)
		GND	Ground Terminal	Ground for Power supply and encoder signal

6.2.4 Parameters of Sub-B Board

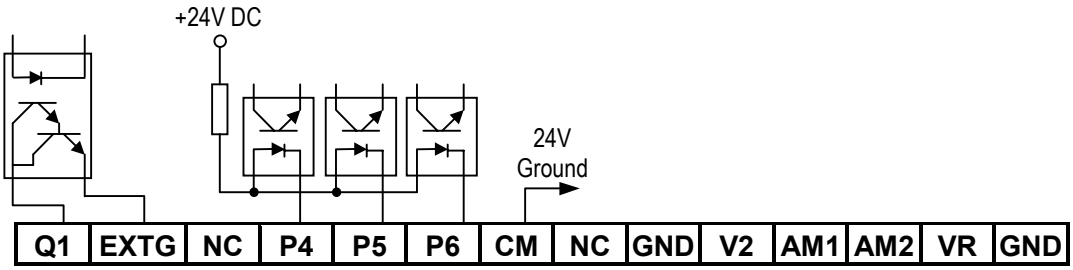
Code	Parameter Description
EXT-01	Sub Board Type Display
EXT-14	Usage for Pulse Input Signal
EXT-15	Pulse Input Signal Selection
EXT-16	Encoder Pulse Number
EXT-17	Filtering Time Constant
EXT-18	Pulse Input Signal Adjustment
EXT-19	
EXT-20	
EXT-21	
EXT-22	P-Gain
EXT-23	I-Gain
EXT-24	Slip Frequency

6.3 Sub-C Board

6.3.1 Board Configuration



6.3.2 Terminal Configuration



6.3.3 Terminal Description

Section		Terminal	Name	Description
Input	Contact Input	P4, P5, P6	Multi-Function Input	Used as the extended function of P1, P2, P3 (I/O-12 ~ I/O-14).
		CM	Common Terminal	Common terminal for P4, P5, P6
	Analog Frequency Reference	VR	Power supply for V2	DC voltage output terminal for V2 (+12V, 10mA)
		V2	Analog Voltage Input	Analog voltage or current input terminal for frequency reference or override. (0 ~ 10V DC, 4 ~ 20mA) Connecting jumper pin (J1) select current input.
		5G	Common Terminal	Common terminal for VR and V2
Output	Analog Voltage	AM1	Analog Meter 1	Used to monitor one of Output Frequency, Output Current, Output Voltage, DC link Voltage (0 ~ 10V DC analog output, 1mA)
		AM2	Analog Meter 2	
		GND	Common Terminal	Common terminal for LM
	Open Collector Output	Q1	Multi-function Output	Used as the extended function of AXA, AXC (I/O-44)
		EXTG	External Common Terminal	Common terminal for Q1
		NC	Not Used	

6.3.4 Parameters of Sub-A Board

Code	Parameter Description	Code	Parameter Description
EXT-01	Sub Board Type Display	EXT-09	Analog Voltage Input Signal (V2) Adjustment
EXT-02	Multi-Function Input Terminal (P4, P4, P6) define	EXT-10	
EXT-03		EXT-30	Multi-function Output Terminal (Q1) define
EXT-04		EXT-40	AM1, AM2 Adjustment
EXT-05	V2 Mode Selection	EXT-41	
EXT-06	Filtering Time Constant for V2 Input Signal	EXT-43	
EXT-07	Analog Voltage Input Signal (V2) Adjustment	EXT-43	
EXT-08			

6.4 Option Board

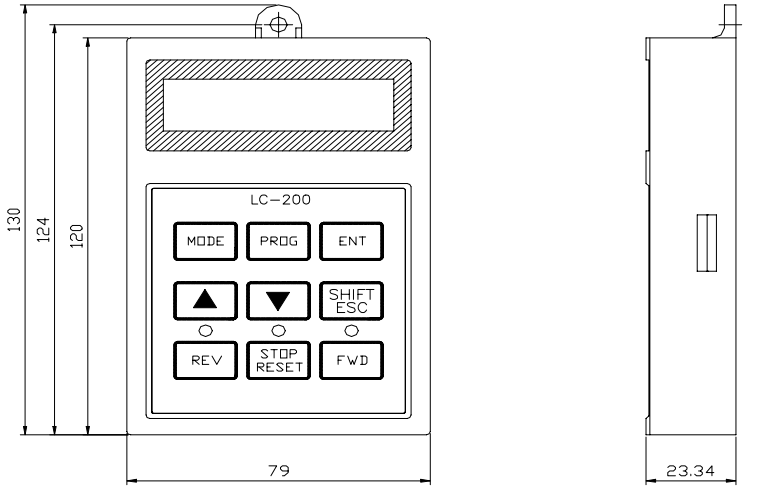
Refer to option manual for detail descriptions.

6.5 Keypad

The iS5 series has two kind of keypad for convenience.

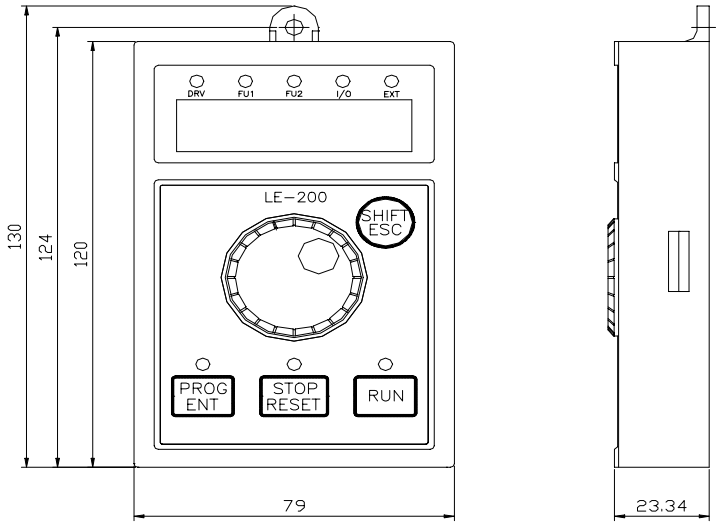
6.5.1 LCD Keypad

(Weight: 140g, Unit: mm)



6.5.2 7-Segment Keypad

(Weight: 110g, Unit: mm)



6.6 DB Unit

The iS5 series inverter provide DB circuits as standard for 1 ~ 10 HP models. However, for 15 ~ 30 HP models, an optional DB unit is necessary to use dynamic braking resistor. Refer to DB unit manual for detail descriptions.

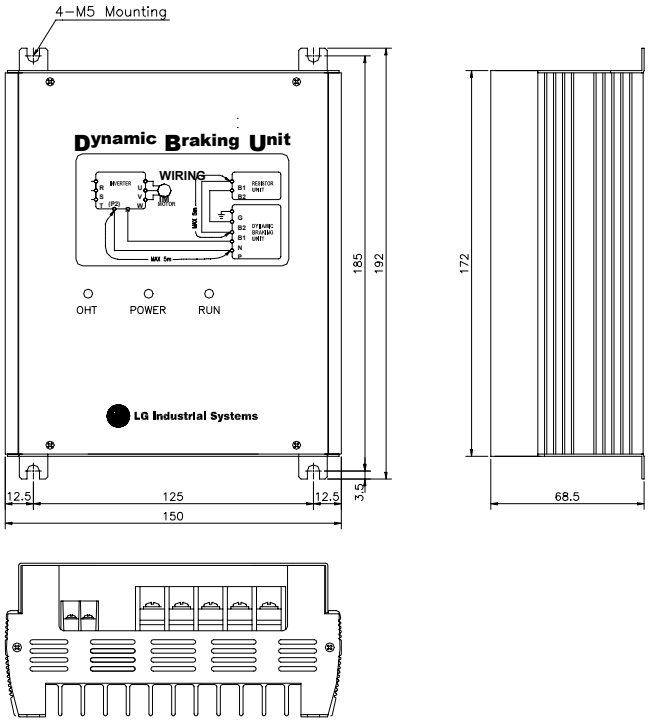
6.6.1 Specifications

Model Name		SV150DBU-2		SV220DBU-2		SV150DBU-4		SV220DBU-4	
Max. DC Input Voltage		DC400V		DC400V		DC800V		DC800V	
Applicable Motor [HP]		15	20	25	30	15	20	25	30
DB Resistor	Wattage [kW]*	2.4	2.4	3.6		2.0	2.4	3.6	
	Resistor Value [Ω]	10	8	5		40	30	20	
Average Braking Torque		150%		150%		150%		150%	
Enable Duty (ED)		10%		10%		10%		10%	
Output Signal		Heat sink over-heat signal output							
Protection		Heat sink over-heat output cut-off							
Environment	Ambient Temp.	-10℃ ~ 40℃							
	Humidity	Below 90% Relative Humidity (Non Condensing)							
	Altitude	Less than 3,300ft (1,000m) without derating							
	Cooling Method	Self-cooling							
	Installation	Avoid corrosive gas, oil mist, flammable gas and dust							

* This resistor wattage is based on 150% braking torque and 5% ED. Double the wattage in case of using with 10% ED application.

6.6.2 Dimensions

(Unit: mm)



6.7 DB Resistor

6.7.1 Internal Resistors

DB resistors are standard in 1~5HP models.

Inverter Model	HP	Internal DB Resistor	ED / Continuous Braking time
SV008iS5-2	1	200 Ω , 100 Watt	3 % / 5 seconds
SV015iS5-2	2	100 Ω , 100 Watt	3 % / 5 seconds
SV022iS5-2	3	60 Ω , 100 Watt	2 % / 5 seconds
SV037iS5-2	5	40 Ω , 100 Watt	2 % / 5 seconds
SV008iS5-4	1	900 Ω , 100 Watt	3 % / 5 seconds
SV015iS5-4	2	450 Ω , 100 Watt	3 % / 5 seconds
SV022iS5-4	3	300 Ω , 100 Watt	2 % / 5 seconds
SV037iS5-4	5	200 Ω , 100 Watt	2 % / 5 seconds

Above table is based on 100% braking torque.

6.7.2 External (Optional) DB Resistor Selection

Inverter Model	HP	DB Resistor (100% Braking Torque)	DB Resistor (150% Braking Torque)	Dimensions (W × H × D)
SV008iS5-2	1	200 Ω , 100 Watt	150 Ω , 150 Watt	64 × 412 × 40
SV015iS5-2	2	100 Ω , 200 Watt	60 Ω , 300 Watt	
SV022iS5-2	3	60 Ω , 300 Watt	50 Ω , 400 Watt	
SV037iS5-2	5	40 Ω , 500 Watt	33 Ω , 600 Watt	128 × 390 × 43
SV055iS5-2	7.5	3 Ω , 700 Watt	20 Ω , 800 Watt	220 × 345 × 93
SV075iS5-2	10	20 Ω , 1000 Watt	15 Ω , 1200 Watt	
SV110iS5-2	15	15 Ω , 1400 Watt	10 Ω , 2400 Watt	
SV150iS5-2	20	11 Ω , 2000 Watt	8 Ω , 2400 Watt	
SV185iS5-2	25	9 Ω , 2400 Watt	5 Ω , 3600 Watt	
SV220iS5-2	30	8 Ω , 2800 Watt	5 Ω , 3600 Watt	
SV008iS5-4	1	900 Ω , 100 Watt	600 Ω , 150 Watt	64 × 412 × 40
SV015iS5-4	2	450 Ω , 200 Watt	300 Ω , 300 Watt	
SV022iS5-4	3	300 Ω , 300 Watt	200 Ω , 400 Watt	
SV037iS5-4	5	200 Ω , 500 Watt	130 Ω , 600 Watt	128 × 390 × 43
SV055iS5-4	7.5	120 Ω , 700 Watt	85 Ω , 1000 Watt	220 × 345 × 93
SV075iS5-4	10	90 Ω , 1000 Watt	60 Ω , 1200 Watt	
SV110iS5-4	15	60 Ω , 1400 Watt	40 Ω , 2000 Watt	
SV150iS5-4	20	45 Ω , 2000 Watt	30 Ω , 2400 Watt	
SV185iS5-4	25	35 Ω , 2400 Watt	20 Ω , 3600 Watt	
SV220iS5-4	30	30 Ω , 2800 Watt	20 Ω , 3600 Watt	

Above table is based on 5% ED, 15 second continuous braking time.

WARNING

- ☐ Do not touch the DB resistor. DB resistor may be hot (over 150 °C) during inverter operation.
- ☐ Use DB resistors equipped with thermal sensor.
- ☐ Connect the thermal sensor to one of the multi-function input terminals (P1, P2, P3) after selecting ‘External-A’ or ‘External-B’ in parameter code I/O-12 ~ I/O-14.

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CHAPTER 7 - TROUBLESHOOTING & MAINTENANCE

7.1 Fault Display

When a fault occurs, the inverter turns off its output and displays the fault status in DRV-07. The last 5 faults are saved in FU2-01 through FU2-05 with the operation status at the instance of fault.

Keypad Display		Protective Function	Description
LCD	7-Segment		
Over Current 1	**OC1**	Over Current Protection	The inverter turns off its output when the output current of the inverter flows more than 200% of the inverter rated current.
Ground Fault	**GF**	Ground Fault Protection	The inverter turns off its output when a ground fault occurs and the ground fault current is more than the internal setting value of the inverter. Over current trip function may protect the inverter when a ground fault occurs due to a low ground fault resistance.
Over Voltage	**OV**	Over voltage protection	The inverter turns off its output if the DC voltage of the main circuit increases higher than the rated value when the motor decelerates or when regenerative energy flows back to the inverter due to a regenerative load. This fault can also occur due to a surge voltage generated at the power supply system.
Over Load	**OLT**	Current Limit Protection (Overload Protection)	The inverter turns off its output if the output current of the inverter flows at 180% of the inverter rated current for more than the current limit time (S/W).
Fuse Open	**FUSE**	Fuse Open	The inverter turns off its output by opening the fuse when something is wrong with the main circuit IGBT to protect the wiring from being damaged from short currents.
Over Heat	**OH**	Heat Sink Over Heat	The inverter turns off its output if the heat sink over heats due to a damaged cooling fan or an alien substance in the cooling fan by detecting the temperature of the heat sink.
E-Thermal	**ETH**	Electronic Thermal	The internal electronic thermal of the inverter determines the over heating of the motor. If the motor is overloaded the inverter turns off the output. The inverter cannot protect the motor when driving a multi-pole motor or when driving multiple motors, so consider thermal relays or other thermal protective devices for each motor. Overload capacity: 150% for 1 min
External-A	**EXTA**	External fault A	Use this function if the user needs to turn off the output by an external fault signal. (Normal Open Contact)
External-B	**EXTB**	External fault B	Use this function if the user needs to tuen off the output by an external fault signal. (Normal Close Contact)
Low Voltage	**LV**	Low Voltage Protection	The inverter turns off its output if the DC voltage is below the detection level because insufficient torque or over heating of the motor can occurs when the input voltage of the inverter drops.
Over Current 2	**OC2**	IGBT Short	The inverter turns off the output if an IGBT short through or an output short occurs.
Phase Open	**PO**	Output Phase open	The inverter turns off its output when the one or more of the output (U, V, W) phase is open. The inverter detects the output current to check the phase open of the output.
BX	**BX**	BX Protection (Instant Cut Off)	Used for the emergency stop of the inverter. The inverter instantly turns off the output when the BX terminal is turned ON, and returns to regular operation when the BX terminal is turned OFF. Take caution when using this function.
Option (**)	**OPT**	Option Fault	Fault at the internal option of the inverter.

Keypad Display		Protective Function	Description
LCD	7-Segment		
HW-Diag	**HW**	Inverter H/W Fault	A fault signal is output when an error occurs to the control circuitry of the inverter. There are the Wdog error, the EEP error, and the ADC Offset for this fault
COM Error CPU Error	**Err**	Communication Error	This fault is displayed when the inverter cannot communicate with the keypad.
LOP LOR LOV LOI LOX	**LP** **LR** **LV** **LI** **LX**	Operating Method when the Frequency Reference is Lost	According to the I/O-48 [Operating Method when the Frequency Reference is Lost] setting, there are three modes: continue operation, decelerate and stop, and free run, LOP: Displayed when option frequency reference is lost (DPRAM time out) LOR: Displayed when option frequency reference is lost (Communication network fault) LOV: Displayed when 'V1' analog frequency reference is lost. LOI: Displayed when 'I' analog frequency reference is lost. LOX: Displayed when sun-board (V2, ENC) analog frequency reference is lost.
Inv. OLT	**IOLT**	Inverter Overload	The inverter turns off its output when the output current of the inverter flows more than the rated level (150% for 1 minute, 200% for 0.5 seconds).
NTC open	**NTC**	Thermal Sensor Opened	Inverter uses NC thermal sensor for detecting heat sink temperature. If this message is displayed, the thermal sensor wire may be cut. (Inverter keeps operating)

To reset fault, Press **RESET** key, Close RST-CM terminals or connect input power.
If a problem persists, please contact the factory or your local distributor.]

7.2 Fault Remedy

Protective Function	Cause	Remedy
Over Current Protection	1) Acceleration/Deceleration time is too short compared to the GD² of the load 2) Load is larger than the inverter rating 3) Inverter turns output on when the motor is free running. 4) Output short or ground fault has occurred 5) Mechanical brake of the motor is operating too fast 6) Components of the main circuit have overheated due to a faulty cooling fan	1) Increase Accel/Decel time 2) Increase inverter capacity. 3) Operate after motor has stopped 4) Check output wiring 5) Check mechanical brake operation 6) Check cooling fan **(Caution)** Operating inverter prior to correcting fault may damage the IGBT
Ground Current Protection	1) Ground fault has occurred at the output wiring of inverter. 2) The insulation of the motor is damaged due to heat.	1) Investigate the output wiring of inverter 2) Exchange motor
Over Voltage Protection	1) Acceleration time is too short compared to the GD² of load 2) Regenerative load at the output 3) Line voltage high	1) Increase deceleration time 2) Use regenerative resistor option 3) Check line voltage
Current Limit Protection (Overload Protection)	1) Load is larger than the inverter rating 2) Selected incorrect inverter capacity 3) Set incorrect V/F pattern	1) Increase capacity of motor and inverter 2) Select correct inverter capacity 3) Select correct V/F pattern
Fuse Damage	1) Damage due to repeated over current protection 2) Damage due to instant deceleration when motor is at an excessive excitation status.	Exchange the fuse **(Caution)** The IGBT receives damages on many occasions when Fuse Open Trip occurs
Heat Sink Overheat	1) Cooling fan damaged or an alien substance inserted 2) Cooling system has faults 3) Ambient temperature high	1) Exchange cooling fans and/or eliminate alien substance 2) Check for alien substances in the heat sink 3) Keep ambient temperature under 40 ℃
Electronic Thermal	1) Motor has overheated 2) Load is larger than inverter rating 3) ETH level too low 4) Selected incorrect inverter capacity 5) Set incorrect V/F pattern 6) Operated too long at low speeds	1) Reduce load and/or running duty 2) Increase inverter capacity 3) Adjust ETH level to an appropriate level 4) Select correct inverter capacity 5) Select correct V/F pattern 6) Install a cooling fan with a separate power supply
External fault A	External fault has occurred	Eliminate fault at circuit connected to external fault terminal or cause of external fault input
External fault B	External fault has occurred	Eliminate fault at circuit connected to external fault terminal or cause of external fault input
Low Voltage Protection	1) Line voltage low 2) Load larger than line capacity is connected to line (welding machine, motor with high starting current connected to the commercial line) 3) Faulty magnetic switch at the input side of the inverter	1) Check line voltage 2) Increase line capacity 3) Exchange magnetic switch
Over Current 2	1) Short has occurred between the upper and lower IGBT. 2) Short has occurred at the output of the inverter 3) Acceleration/Deceleration time is too short compared to the GD² of load	1) Check IGBT 2) Check output wiring of inverter 3) Increase acceleration time
Output Phase Open	1) Faulty contact of magnetic switch at output 2) Faulty output wiring	1) Check magnetic switch at output of inverter 2) Check output wiring
Option Fault	Faulty option connector connection	Check option connection

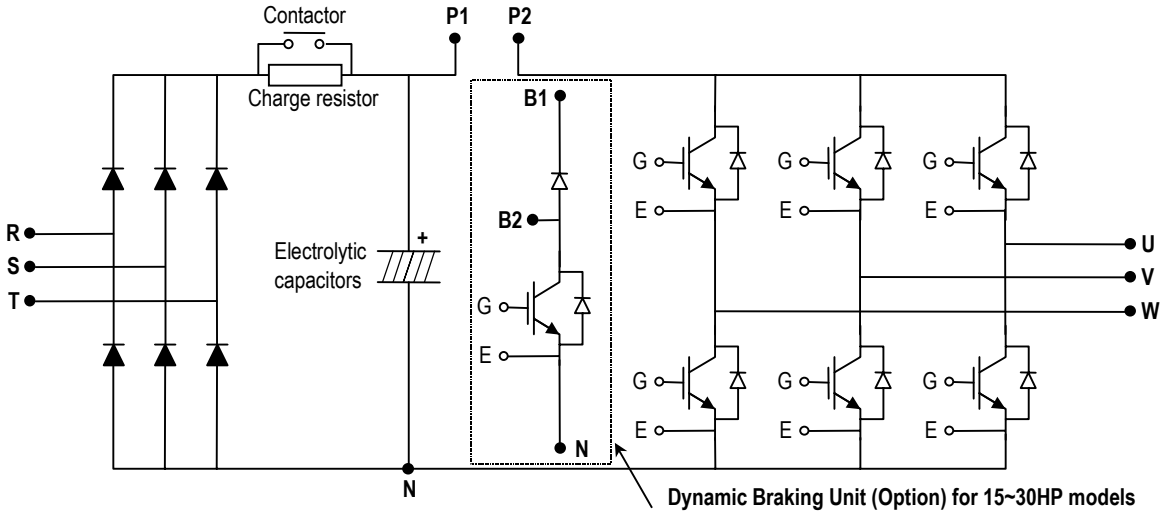
Protective Function	Cause	Remedy
H/W Fault	1) Wdog error (CPU fault) 2) EEP error (memory fault) 3) ADC Offset (current feedback circuit fault)	Exchange inverter
Communication Fault	1) Faulty connection between inverter and keypad 2) Inverter CPU malfunction	1) Check connector 2) Exchange inverter
Operating Method when the Speed Reference is Lost	LOP (Loss of reference from the Option), LOR (Remote) LOV (V1), LOI (I), LOX (Sub-V2, ENC)	Eliminate cause of fault
Inverter Overload	1) Load is larger than inverter rating 2) Selected incorrect inverter capacity	1) Increase motor and/or inverter capacity 2) Select correct inverter capacity

7.3 Troubleshooting

Condition	Check Point
The Motor Does Not Rotate	1) Main circuit inspection: ☞ Is the input (line) voltage normal? (Is the LED in the inverter is lit?) ☞ Is the motor connected correctly? 2) Input signal inspection: ☞ Check the operating signal input to the inverter. ☞ Check the forward and the reverse signal input simultaneously to the inverter? ☞ Check the command frequency signal input to the inverter. 3) Parameter setting inspection: ☞ Is the reverse prevention (FU1-03) function set? ☞ Is the operation mode (FU1-01) set correctly? ☞ Is the command frequency set to 0? 4) Load inspection: ☞ Is the load too large or is the motor jammed? (Mechanical brake) 5) Other: ☞ Is the alarm displayed on the keypad or is the alarm LED lit? (STOP LED blinks)
The Motor Rotates in Opposite Directions	☞ Is the phase sequence of the output terminal U, V, W correct? ☞ Is the starting signal (forward/reverse) connected correctly?
The Difference Between the Rotating Speed and the Reference is Too Large	☞ Is the frequency reference signal correct? (Check the level of the input signal) ☞ Is the following parameter setting is correct? Lower Limit Frequency (FU1-24), Upper Limit Frequency (FU1-25), Analog Frequency Gain (I/O-1~10) ☞ Is the input signal line influenced by external noise? (Use a shielded wire)
The Inverter Does Not Accelerate or Decelerate Smoothly	☞ Is the acceleration/deceleration time is set too short a period of time? ☞ Is the load too large? ☞ Is the Torque Boost (FU1-27, 28) value is too high that the current limit function and the stall prevention function do not operate?
The Motor Current is Too High	☞ Is the load too large? ☞ Is the Torque Boost Value (manual) too high?
The Rotating Speed Does Not Increase	☞ Is the Upper Limit Frequency (FU1-25) value correct? ☞ Is the load too large? ☞ Is the Torque Boost (FU1-27, 28) value too high that the stall prevention function (FU1-59, 60) does not operate?
The Rotating Speed Oscillates When the Inverter is Operating.	1) Load inspection: ☞ Is the load oscillating? 2) Input signal inspection: ☞ Is the frequency reference signal oscillating? 3) Other: ☞ Is the wiring too long when the inverter is using V/F control? (over 500m)

7.4 How to Check Power Components

Before checking the power components, be sure to disconnect AC Input supply and wait until the Main Electrolytic Capacitors (DCP-DCN) discharge.



■ Diode Module Check

Check point	*Resistance to be Good*
R, S, T – P1	50 k ohms or more
R, S, T – N	50 k ohms or more

■ Charge Resistor Check

Check point	*Resistance to be Good*
Contactor terminals	Depending on model

■ DB (Dynamic Braking) IGBT (Option)

Check point	*Resistance to be Good*
B2 - N	50 k ohms or more
G - N	A few kilo ohms

■ IGBT Module Check

Check point	*Resistance to be Good*
B2 - N	50 k ohms or more
G - N	A few kilo ohms

7.5 Maintenance

The iS5 series is an industrial electronic product with advanced semiconductor elements. However, temperature, humidity, vibration and aging parts may still affect it. To avoid this, it is recommended to perform routine inspections.

7.5.1 Precautions

- Be sure to remove the drive power input while performing maintenance.
- Be sure to perform maintenance only after checking that the bus has discharged. The bus capacitors in the electronic circuit can still be charged even after the power is turned off.
- The correct output voltage can only be measured by using a rectifier voltage meter. Other voltage meters, including digital voltage meters, are likely to display incorrect values caused by the high frequency PWM output voltage of the drive.

7.5.2 Routine Inspection

Be sure to check the following before operation:
- The conditions of the installation location
- The conditions of the drive cooling
- Abnormal vibration
- Abnormal heating

7.5.3 Periodical Inspection

- Are there any loose bolt, nut or rust caused by surrounding conditions? If so, tighten them up or replace them.
  Tighten up or replace.
- Are there any deposits inside the drive-cooling fan? If so, remove using air.
- Are there any deposits on the drive's PCB (Printed Circuit Boards)? If so, remove using air.
- Are there any abnormalities in the various connectors of the drive's PCB? If so, check the condition of the connector in question.
- Check the rotating condition of the cooling fan, the size and condition of the capacitors and the connections with the magnetic contactor. Replace them if there are any abnormalities.

7.5.4 Internal Fuse Replacement

When the internal fuse is opened the IGBT's should be checked thoroughly before replacing the fuse.
Contact the factory for replacement fuse information.

7.6 Daily and Periodic Inspection Items

Inspection Location	Inspection Item	Inspection	Period			Inspection Method	Criterion	Measuring Instrument
			Daily	1 year	2 year			
All	Ambient Environ-ment	Is there any dust? Is the ambient temperature and humidity adequate?	O			Refer to the precautions	Temperature: -10~+40 no freezing. Humidity: Under 50% no dew	Thermometer, Hygrometer, Recorder
	Equipment	Is there any abnormal oscillation or noise	O			Use sight and hearing	No abnormality	
	Input Voltage	Is the input voltage of the main circuit normal	O			Measure the voltage between the terminals R, S, T		Digital Multi-Meter/Tester
Main Circuit	All	Megger check (between the main circuit and the ground) Are any fixed parts removed? Are there any traces of overheating at each component's cleaning?		O O O	O	Undo the inverter connections short the terminals R, S, T, U, V, W and measure between these parts and the ground. Tighten the screws. Visual check.	Over 5MΩ No fault	DC 500V class Megger
	Conductor/ Wire	Is the conductor rusty? Is the wire coating damaged?		O O		Visual check	No fault	
	Terminal	Is there any damage?		O		Visual check	No fault	
	IGBT Module /Diode Module	Check the resistance between each of the terminals.			O	Undo the inverter connection and measure the resistance between R, S, T ⇔ P, N and U, V, W ⇔ P, N with a tester.	(Refer 'How to Check Power Components")	Digital Multi-Meter/Analog Tester
	Smoothing Capacitor	Is there any liquid coming out? Is the safety pin out, and is there any swelling? Measure the capacitance.	O O	O		Visual check. Measure with a capacitance measuring device.	No fault Over 85% of the rated capacity	Capacitance Measuring Device
	Relay	Is there any chattering noise during operation? Is there any damage to the contact		O O		Auditory check. Visual check.	No fault	
	Resistor	Is there any damage to the resistor insulation? Is the wiring in the resistor damaged (open)?		O O		Visual check. Disconnect one of the connections and measure with a tester.	No fault Error must be within ± 10% the displayed resistance	Digital Multi-Meter/Analog Tester
Control Circuit Protective Circuit	Operation Check	Is there any unbalance between each phases of the output voltage? Nothing must be wrong with display circuit after executing the sequence protective operation		O O		Measure the voltage between the output terminals U, V and W. Short and open the inverter protective circuit output.	The voltage balance between the phases for 200V (800V) class is under 4V (8V). The fault circuit operates according to the sequence.	Digital Multi-Meter/Rectifying Voltmeter
Cooling System	Cooling Fan	Is there any abnormal oscillation or noise? Is the connection area loose?	O	O		Turn OFF the power and turn the fan by hand. Tighten the connections.	Must rotate smoothly. No fault	
Display	Meter	Is the displayed value correct?	O	O		Check the meter reading at the exterior of the panel	Check the specified and management values.	Voltmeter/ Ammeter etc.
Motor	All	Are there any abnormal vibrations or noise? Is there any unusual odor?	O O			Auditory, sensory, visual check. Check for overheat and damage.	No fault	
	Insulation Resistor	Megger check (between the output terminals and the ground terminal)			O	Undo the U, V and W connections and tie the motor wiring.	Over 5MΩ	500V class Megger

Note: Values in ( ) is for the 400V class inverters.

APPENDIX A - FUNCTIONS BASED ON USE

Set the function properly according to the load and operating conditions. Application and related functions are listed in the following table.

Use	Related Parameter Code
Accel/Decel Time, Pattern Adjustment	DRV-01 [Acceleration Time], DRV-02 [Deceleration Time], FU1-05 [Acceleration Pattern], FU1-06 [Deceleration Pattern]
Reverse Rotation Prevention	FU1-03 [Forward, Reverse Prevention]
Minimum Accel/Decel Time	FU1-05 [Acceleration Pattern], FU1-06 [Deceleration Pattern]
Accel/Decel at Continuous Rating Range	FU1-05 [Acceleration Pattern], FU1-06 [Deceleration Pattern]
Braking Operation Adjustment	FU1-0 7[Stop Method], FU1-08~11 [DC Braking], FU1-12~13 [DC braking at start]
Operations for Frequencies Over 60 Hz	FU1-20 [Maximum Frequency], FU1-25 [Frequency Upper Limit], I/O-05 [Frequency Corresponding to Max. Voltage of V1], I/O-10 [Frequency Corresponding to Max. Current of I]
Selecting an Appropriate Output Characteristics for the Load	FU1-20 [Maximum Frequency], FU1-21 [Base Frequency]
Motor Output Torque Adjustment	FU1-22 [Starting Frequency], FU1-26~28 [Torque Boost], FU1-59~60 [Stall Prevention], FU2-30 [Rated Motor]
Output Frequency Limit	FU1-23~25 [Frequency Upper/Lower Limit], I/O-1~10 [Analog Frequency Setting]
Motor Overheat Protection	FU1-50~53 [Electronic Thermal], FU2-30 [Rated Motor]
Multi Step Operation	I/O-12~14 [Define the Multi Function Input Terminals], I/O-20~27 [Jog, Multi Step Frequency], FU1-23~25 [Frequency Upper/Lower Limit]
Jog Operation	I/O-20 [Jog Frequency]
Frequency Jump Operation	FU2-10~16 [Frequency Jump]
Timing the Electronic Brake Operation	I/O-42~43 [Frequency Detection Level], I/O-44 [Multi Function Output]
Displaying the Rotating Speed	DRV-04 [Motor Speed], FU2-74 [Motor RPM Display Gain]
Function Alteration Prevention	FU2-94 [Parameter Lock]
Energy Saving	FU1-39 [Energy Saving]
Auto Restart Operation After Alarm Stop	FU2-27~28 [Auto Retry]
2nd Motor Operation	FU2-81~90 [2nd Function]
PID Feedback Operation	FU2-50~54 [PID Operation]
Frequency Reference Signal and Output Adjusting	I/O-01~10 [Analog Frequency Setting]
Define the Multi-Function Input Terminals	I/O-12~14 [Define the Multi-Function Input Terminals]
Define the Multi-Function Input Terminals	I/O-44 [Multi Function Auxiliary Contact Output Setting]
Commercial Line ⇔ inverter Switchover Operation	I/O-12~14 [Define the Multi-Function Input Terminals], I/O-44 [Multi-Function Auxiliary Contact Output Setting]
Frequency Meter Calibration	I/O-40~41 [FM Output]
Operate by Communicating with a Computer	I/O-46 [Inverter No.], I/O-47 [communication Speed], I/O-48~49 [Loss of Reference]

APPENDIX B - PARAMETERS BASED ON APPLICATION

Intention	Parameter Code
DRV Group	
When you want to change the frequency setting	DRV-00
When you want to change the acceleration and deceleration time of the motor	DRV-01, DRV-02
When you want to change the run/stop method	DRV-03
When you want to change the frequency reference source	DRV-04
When you want to set the multi-function	DRV-005 ~ 07
When you want to see the output current, motor speed and the DC link voltage of inverter	DRV-08 ~ 10
When you want to see the output voltage, output power, output torque from the user display	DRV-11
When you want to check the fault of the inverter	DRV-12
FU1 Group	
When you want to use the Jump Code	FU1-00
When you want to prevent the motor from rotating at opposite directions	FU1-03
When you want to select the acceleration and deceleration pattern suitable for your application	FU1-05 ~ 06
When you want to change the stopping method	FU1-07
When you want to change the stopping accuracy for steady stop	FU1-08 ~ 11
When DC injection braking is required before starting	FU1-12 ~ 13
When you want to set the maximum frequency and the base frequency according to the rated torque of the motor	FU1-20 ~ 21
When you want to adjust the starting frequency	FU1-22
When you want to limit the mechanical rotating speed to a fixed value	FU1-23 ~ 25
When a large starting torque is needed for loads such as elevators (Manual/Auto Torque Boost)	FU1-26 ~ 28
When you want to select an appropriate output characteristic (V/F characteristic) according to loads	FU1-29
When you want to se up your own V/F pattern	FU1-30 ~ 37
When you want to adjust the output voltage of the inverter	FU1-38
When you want to use the energy saving function	FU1-39
When you want to protect the motor from overheating	FU1-50 ~ 53
When you want to output a signal when the overload condition lasts more than a fixed amount of time	FU1-54 ~ 55
When you want to cut off the output when the overload condition lasts more than a fixed amount of time	FU1-56 ~ 58
When you want to set the stall prevention function	FU1-59 ~ 60
FU2 Group	
When you want to check the fault history of the inverter	FU2-01 ~ 06
When you want to use dwell function	FU2-07 ~ 08
When you want to prevent the resonance from the oscillating characteristics of a machine	FU2-10 ~ 16
When you want to protect inverter from input/output phase loss	FU2-19
When you want to start the inverter as soon as the power is turned ON	FU2-20
When you want to restart the inverter by resetting the fault when a fault occur	FU2-21
When you want to use the instant power failure restart function (Speed Search)	FU2-22 ~ 25
When you want to use the retry function	FU2-26 ~ 27
When you want to enter the motor constants	FU2-30 ~ 37
When you want to reduce noise or leakage current by changing the PWM carrier frequency	FU2-39
When you want to change the control method (V/F, slip compensation, PID, or sensorless operation)	FU2-40

Intention	Parameter Code
When you want to use the auto tuning function	FU2-41 ~ 44
When you want to operate using PID feedback	FU2-50 ~ 54
When you want to change the reference frequency for acceleration and deceleration	FU2-70
When you want to change the acceleration and deceleration time scale	FU2-71
When you want to set the initial keypad display that is displayed when the power is turned ON	FU2-72
When you want to set the user defined display	FU2-73
When you want to adjust the gain for the motor RPM display	FU2-74
When you want to set the dynamic braking (DB) resistor mode	FU2-75 ~ 76
When you want to verify the inverter software version	FU2-79
When you want to change the connection from one motor to the other motor which use difference parameters	FU2-81 ~ 90
When you want to copy the inverter parameter to another inverter	FU2-91 ~ 92
When you want to initialize the parameters	FU2-93
When you want to prevent the parameters from being changed	FU2-94
I/O Group	
When you want to set the analog voltage or current for the frequency reference	I/O-01 ~ 10
When you want to set the operating method when the frequency reference is lost	I/O-11
When you want to change the functions for the input terminals P1, P2, and P3	I/O-12 ~ 14
When you want to check the status of the input/output terminals	I/O-15 ~ 16
When you want to change the response time of the input terminals	I/O-17
When you want to use the JOG and multi step speed operation	I/O-20 ~ 24
When you want to change the 1st ~ 7th acceleration/deceleration time	I/O-25 ~ 38
When you want to use the FM meter terminal output	I/O-40 ~ 41
When you want to set the frequency detection level	I/O-42 ~ 43
When you want to change the functions of the multi function auxiliary contact output (AXA-AXC)	I/O-44
When you want to exchange the motor to commercial power line from inverter or the opposite	I/O-44
When you want to use the fault relay (30A, 30B, 30C) functions	I/O-45
When you want to use RS232/485 communication	I/O-46 ~ 47
When you want to set the operating method when the frequency reference is lost	I/O-48 ~ 49
When you want to use the auto (sequence) operation	I/O-50 ~ 84
EXT Group (When a Sub-board and/or an option board is installed)	
When you want to define the functions for the input terminals P4, P5, P6 (SUB-A, SUB-C)	EXT-02 ~ 04
When you want to use the analog voltage (V2) input (SUB-A, SUB-C)	EXT-05 ~ 10
When you want to use the encoder pulse for feedback to control the motor speed, or use the pulse input for frequency reference (SUB-B)	EXT-14 ~ 24
When you want to change the functions of the output terminals Q1, Q2, Q3 (SUB-A, SUB-C)	EXT-30 ~ 32
When you want to use the LM meter terminal output (SUB-A, SUB-C)	EXT-34 ~ 35
When you want to use the analog outputs (AM1, AM2 terminals)	EXT-40 ~ 43

APPENDIX C- PERIPHERAL DEVICES

Inverter Models	Motor [HP]	MCCB, ELB	Magnetic Contactor	Wire, mm² (AWG)			AC Input Fuse	AC Reactor	DC Reactor
				R, S, T	U, V, W	Ground			
SV008iS5-2	1	ABS33a, EBS33	SMC-10P	2 (14)	2 (14)	3.5 (12)	10 A	2.13 mH, 5.7 A	7.00 mH, 5.4 A
SV015iS5-2	2	ABS33a, EBS33	SMC-10P	2 (14)	2 (14)	3.5 (12)	15 A	1.20 mH, 10 A	4.05 mH, 9.2 A
SV022iS5-2	3	ABS33a, EBS33	SMC-15P	2 (14)	2 (14)	3.5 (12)	25 A	0.88 mH, 14 A	2.92 mH, 13 A
SV037iS5-2	5	ABS33a, EBS33	SMC-20P	3.5 (12)	3.5 (12)	3.5 (12)	40 A	0.56 mH, 20 A	1.98 mH, 19 A
SV055iS5-2	7.5	ABS53a, EBS53	SMC-25P	5.5 (10)	5.5 (10)	5.5 (10)	40 A	0.39 mH, 30 A	1.37 mH, 29 A
SV075iS5-2	10	ABS63a, EBS63	SMC-35P	8 (8)	8 (8)	5.5 (10)	50 A	0.28 mH, 40 A	1.05 mH, 38 A
SV110iS5-2	15	ABS103a, EBS103	SMC-50P	14 (6)	14 (6)	14 (6)	70 A	0.20 mH, 59 A	0.74 mH, 56 A
SV150iS5-2	20	ABS103a, EBS103	SMC-65P	22 (4)	22 (4)	14 (6)	100 A	0.15 mH, 75 A	0.57 mH, 71 A
SV185iS5-2	25	ABS203a, EBS203	SMC-80P	30 (3)	30 (3)	22 (4)	100 A	0.12 mH, 96 A	0.49 mH, 91 A
SV220iS5-2	30	ABS203a, EBS203	SMC-100P	38(2)	30 (3)	22 (4)	125 A	0.10 mH, 112 A	0.42 mH, 107 A
SV008iS5-4	1	ABS33a, EBS33	SMC-10P	2 (14)	2 (14)	2 (14)	6 A	8.63 mH, 2.8 A	28.62 mH, 2.7 A
SV015iS5-4	2	ABS33a, EBS33	SMC-10P	2 (14)	2 (14)	2 (14)	10 A	4.81 mH, 4.8 A	16.14 mH, 4.6 A
SV022iS5-4	3	ABS33a, EBS33	SMC-20P	2 (14)	2 (14)	2 (14)	10 A	3.23 mH, 7.5 A	11.66 mH, 7.1 A
SV037iS5-4	5	ABS33a, EBS33	SMC-20P	2 (14)	2 (14)	2 (14)	20 A	2.34 mH, 10 A	7.83 mH, 10 A
SV055iS5-4	7.5	ABS33a, EBS33	SMC-20P	3.5 (12)	2 (14)	3.5 (12)	20 A	1.22 mH, 15 A	5.34 mH, 14 A
SV075iS5-4	10	ABS33a, EBS33	SMC-20P	3.5 (12)	3.5 (12)	3.5 (12)	30 A	1.14 mH, 20 A	4.04 mH, 19 A
SV110iS5-4	15	ABS53a, EBS53	SMC-20P	5.5 (10)	5.5 (10)	8 (8)	35 A	0.81 mH, 30 A	2.76 mH, 29 A
SV150iS5-4	20	ABS63a, EBS63	SMC-25P	14 (6)	8 (8)	8 (8)	45 A	0.61 mH, 38 A	2.18 mH, 36 A
SV185iS5-4	25	ABS103a, EBS103	SMC-35P	14 (6)	8 (8)	14 (6)	60 A	0.45 mH, 50 A	1.79 mH, 48 A
SV220iS5-4	30	ABS103a, EBS103	SMC-50P	22 (4)	14 (6)	14 (6)	70 A	0.39 mH, 58 A	1.54 mH, 55 A

DECLARATION OF CONFORMITY

Council Directive(s) to which conformity is declared:

CD 73/23/EEC and CD 89/336/EEC

Units are certified for compliance with:

EN50178 (1997)
EN 50081-2 (1993)
EN 55011 (1994)
EN 50082-2 (1995)
EN 61000-4-2 (1995)
ENV 50140 (1993) & ENV 50204 (1995)
EN 61000-4-4 (1995)
ENV 50141 (1993)
EN 61000-4-8 (1993)

Type of Equipment:	**Inverter (Power Conversion Equipment)**
Model Name:	**SV - iS5 Series**
Trade Mark:	**LG Industrial Systems Co., Ltd.**
Representative:	**LG International (Deutschland) GmbH**
Address:	**Lyoner Strasse 15,** **60528, Frankfurt am Main,** **Germany**
Manufacturer:	**LG Industrial Systems Co., Ltd.**
Address:	**181, Samsung-Ri, Mokchon-Myon, Chonan-Si,** **330-845, Chungnam,** **Korea**

We, the undersigned, hereby declare that equipment specified above conforms to the Directives and Standards mentioned.

Place:	**Frankfurt am Main** **Germany**	**Choan-Si, Chungnam,** **Korea**
	I. S. Yang 20/03/01 (Signature / Date)	Hyuk Sun Kwon 02/04/01 (Signature / Date)
	Mr. Ik-Seong Yang / Dept. Manager (Full name / Position)	**Mr. Hyuk-Sun Kwon / General Manager** (Full name / Position)

TECHNICAL STANDARDS APPLIED

The standards applied in order to comply with the essential requirements of the Directives 73/23/CEE "Electrical material intended to be used with certain limits of voltage" and 89/336/CEE "Electromagnetic Compatibility" are the following ones:

• **EN 50178 (1997)**	"Safety of information technology equipment".
• **EN 50081-2 (1993)**	"Electromagnetic compatibility. Generic emission standard. Part 2: Industrial environment."
• **EN 55011 (1994)**	"Limits and methods of measurements of radio disturbance characteristics of industrial, scientific and medical (ISM) radio frequency equipment."
• **EN 50082-2 (1995)**	"Electromagnetic compatibility. Generic immunity standard. Part 2: Industrial environment."
• **EN 61000-4-2 (1995)**	"Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 2: Electrostatic discharge immunity test. Basic EMC Publication (IEC 1000-4-2: 1995)."
• **ENV 50140 (1993)**	"Electromagnetic compatibility - Basic immunity standard - Radiated radio-frequency electro magnetic field - Immunity test."
• **ENV 50204 (1995)**	"Radio electromagnetic field from digital radio telephones."
• **EN 61000-4-4 (1995)**	"Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 4: Electrical fast transients / burst immunity test. Basic EMC Publication (IEC 1000-4-4: 1995)."
• **ENV 50141 (1993)**	"Electromagnetic compatibility. Basic immunity standard. Conducted disturbances induced by radio-frequency fields."
• **EN 61000-4-8 (1993)**	"Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 8: Power frequency magnetic field immunity test - Basic EMC Publication (IEC 1000-4-8: 1993)."

EMI / RFI POWER LINE FILTERS

RFI FILTERS

THE L.G. RANGE OF POWER LINE FILTERS FF (Footprint) – FE (Standard) SERIES, HAVE BEEN SPECIFICALLY DESIGNED WITH HIGH FREQUENCY LG INVERTERS, THE USE L.G. FILTERS, WITH THE INSTALLATION ADVICE OVERLEAF HELP TO ENSURE TROUBLE FREE USE ALONG SIDE SENSITIVE DEVICES AND COMPLIANCE TO CONDUCTED EMISSION AND IMMUNITY STANDARDS TO EN50081

CAUTION

IN CASE OF A LEAKAGE CURRENT PROTECTIVE DEVICES IS USED ON POWER SUPPLY, IT MAY BE FAULT AT POWER-ON OR OFF.
IN AVOID THIS CASE, THE SENSE CURRENT OF PROTECTIVE DEVICE SHOULD BE LARGER THAN VALUE OF LAKAGE CURRENT AT WORST CASE IN THE BELOW TABLE.

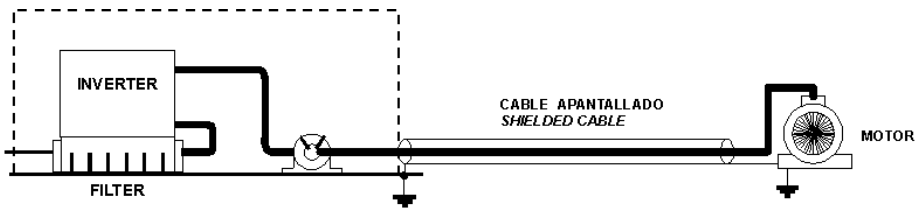
RECOMMENDED INSTALLATION INSTRUCTIONS

To conform to the **EMC** directive, it is necessary that these instructions be followed as closely as possible. Follow the usual safety procedures when working with electrical equipment. All electrical connections to the filter, inverter and motor must be made by a qualified electrical technician.

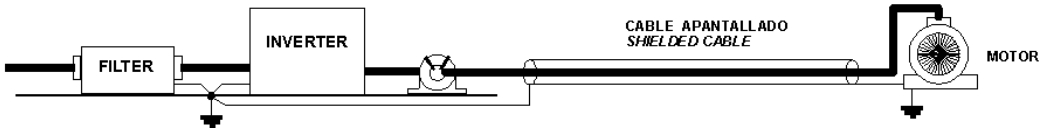
1-) Check the filter rating label to ensure that the current, voltage rating and part number are correct.
2-) For best results the filter should be fitted as closely as possible to the incoming mains supply of the wiring enclousure, usually directly after the enclousures circuit breaker or supply switch.
3-) The back panel of the wiring cabinet of board should be prepared for the mounting dimensions of the filter. Care should be taken to remove any paint etc... from the mounting holes and face area of the panel to ensure the best possible earthing of the filter.
4-) Mount the filter securely.
5-) Connect the mains supply to the filter terminals marked **LINE**, connect any earth cables to the earth stud provided. Connect the filter terminals marked **LOAD** to the mains input of the inverter using short lengths of appropriate gauge cable.
6-) Connect the motor and fit the ferrite core (output chokes) as close to the inverter as possible. Armoured or screened cable should be used with the 3 phase conductors only threaded twice through the center of the ferrite core. The earth conductor should be securely earthed at both inverter and motor ends. The screen should be connected to the enclousure body via and earthed cable gland.
7-) Connect any control cables as instructed in the inverter instructions manual.

IT IS IMPORTANT THAT ALL LEAD LENGHTS ARE KEPT AS SHORT AS POSSIBLE AND THAT INCOMING MAINS AND OUTGOING MOTOR CABLES ARE KEPT WELL SEPARATED.

FF SERIES (Footprint)



FE SERIES (Standard)



EMI / RFI POWER LINE FILTERS

RFI Filters (Footprint - Standard) for iS5 SERIES

iS5 series / Filtros Footprint / *Footprint Filters*										
VARIADOR *INVERTER*	POT. *POWER*	**CODIGO** *CODE*	INTENS. *CURRENT*	TENSION *VOLTAGE*	CORRIENTE DE FUGAS *LEAKAGE CURRENT*	DIMENSIONES *DIMENSIONS* L W H	MONTAJE *MOUNTING* Y X	PESO *WEIGHT*	TORNILLOS DE FIJACION *MOUNT*	CHOQUES DE SALIDA *OUTPUT CHOKES*
TRIFASICOS	***THREE PHASE***				**NOM. MAX.**					
SV008iS5-2	0.8kW	**FFS5-T012-(x)**	12A	250VAC	0.3A 18A	329 x 149.5 x 50	315 x 120		M5	**FS – 2**
SV015iS5-2	1.5kW									
SV022iS5-2	2.2kW	**FFS5-T020-(x)**	20A	250VAC	0.3A 18A	329 x 149.5 x 50	315 x 120		M5	**FS – 2**
SV037iS5-2	3.7kW									
SV055iS5-2	5.5kW	**FFS5-T030-(x)**	30A	250VAC	0.3A 18A	415 x 199.5 x 60	401 x 160		M5	**FS – 2**
SV075iS5-2	7.5kW	**FFS5-T050-(x)**	50A	250VAC	0.3A 18A	415 x 199.5 x 60	401 x 160		M5	**FS – 2**
SV110iS5-2	11kW		100A	250VAC	0.3A 18A					**FS – 3**
SV150iS5-2	15kW									
SV185iS5-2	18kW		120A	250VAC	0.3A 18A					**FS – 3**
SV220iS5-2	22kW									
SV008iS5-4	0.8kW	**FFS5-T006-(x)**	6A	380VAC	0.5A 27A	329 x 149.5 x 50	315 x 120		M5	**FS – 1**
SV015iS5-4	1.5kW									
SV022iS5-4	2.2kW	**FFS5-T012-(x)**	12A	380VAC	0.5A 27A	329 x 149.5 x 50	315 x 120		M5	**FS – 2**
SV037iS5-4	3.7kW									
SV055iS5-4	5.5kW	**FFS5-T030-(x)**	30A	380VAC	0.5A 27A	415 x 199.5 x 60	401 x 160		M5	**FS – 2**
SV075iS5-4	7.5kW									
SV110iS5-4	11kW	**FFS5-T051-(x)**	51A	380VAC	0.5A 27A	466 x 258 x 65	440.5 x 181		M8	**FS – 2**
SV150iS5-4	15kW									
SV185iS5-4	18kW	**FFS5-T060-(x)**	60A	380VAC	0.5A 27A	541 x 332 x 65	515.5 x 255		M8	**FS – 2**
SV220iS5-4	22kW	**FFS5-T070-(x)**	70A	380VAC	0.5A 27A	541 x 332 x 65	515.5 x 255		M8	**FS – 2**

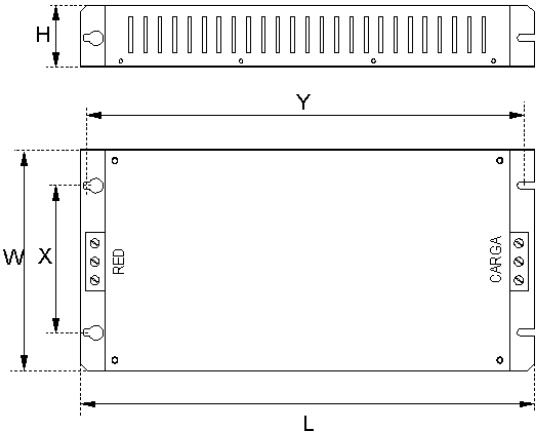
iS5 series / Filtros Estándar / *Standard Filters*										
VARIADOR *INVERTER*	POT. *POWER*	**CODIGO** *CODE*	INTENS. *CURRENT*	TENSION *VOLTAGE*	CORRIENTE DE FUGAS *LEAKAGE CURRENT*	DIMENSIONES *DIMENSIONS* L W H	MONTAJE *MOUNTING* Y X	PESO *WEIGHT*	TORNILLOS DE FIJACION *MOUNT*	CHOQUES DE SALIDA *OUTPUT CHOKES*
TRIFASICOS	***THREE PHASE***				**NOM. MAX.**					
SV008iS5-2	0.8kW	**FE-T012-(x)**	12A	250VAC	0.3A 18A	250 x 110 x 60	238 x 76		---	**FS – 2**
SV015iS5-2	1.5kW									
SV022iS5-2	2.2kW	**FE-T020-(x)**	20A	250VAC	0.3A 18A	270 x 140 x 60	258 x 106		---	**FS – 2**
SV037iS5-2	3.7kW									
SV055iS5-2	5.5kW	**FE-T030-(x)**	30A	250VAC	0.3A 18A	270 x 140 x 60	258 x 106		---	**FS – 2**
SV075iS5-2	7.5kW	**FE-T050-(x)**	50A	250VAC	0.3A 18A	270 x 140 x 90	258 x 106		---	**FS – 2**
SV110iS5-2	11kW	**FE-T100-(x)**	100A	250VAC	0.3A 18A	420 x 200 x 130	408 x 166		---	**FS – 3**
SV150iS5-2	15kW									
SV185iS5-2	18kW	**FE-T120-(x)**	120A	250VAC	1.3A 180A	420 x 200 x 130	408 x 166		---	**FS – 3**
SV220iS5-2	22kW									
SV008iS5-4	0.8kW	**FE-T006-(x)**	6A	380 VAC	0.5A 27A	250 x 110 x 60	238 x 76		---	**FS – 2**
SV015iS5-4	1.5kW									
SV022iS5-4	2.2kW	**FE-T012-(x)**	12A	380 VAC	0.5A 27A	250 x 110 x 60	238 x 76		---	**FS – 2**
SV037iS5-4	3.7kW									
SV055iS5-4	5.5kW	**FE-T030-(x)**	30A	380 VAC	0.5A 27A	270 x 140 x 60	258 x 106		---	**FS – 2**
SV075iS5-4	7.5kW									
SV110iS5-4	11kW	**FE-T050-(x)**	50A	380VAC	0.5A 27A	270 x 140 x 90	258 x 106		---	**FS – 2**
SV150iS5-4	15kW									
SV185iS5-4	18kW	**FE-T060-(x)**	60A	380VAC	0.5A 27A	270 x 140 x 90	258 x 106		---	**FS – 2**
SV220iS5-4	22kW	**FE-T070-(x)**	70A	380VAC	0.5A 27A	350 x 180 x 90	338 x 146		---	**FS – 2**

(x) (1) Industrial environment EN 50081-0 (A class)

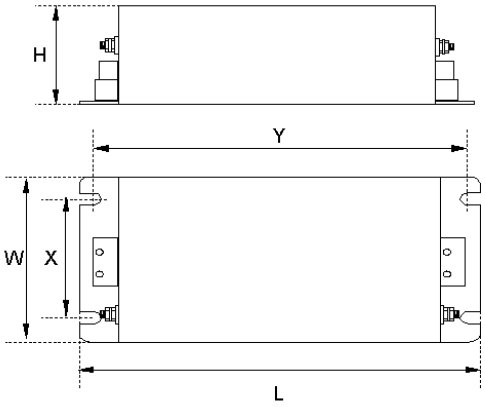
(2) Domestic and industrial environment EN 50081-1 (B class)

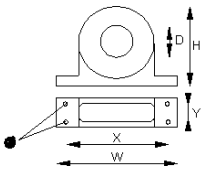
DIMENSIONS

FF SERIES (Footprint)



FE SERIES (Standard)





FS SERIES (output chokes)

TIPO	D	W	H	X	O
FS – 1	21	85	46	70	5
FS – 2	28.5	105	62	90	5
FS – 3	48	150	110	125 x 30	5
FS – 4	58	200	170	180 x 45	5

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INTERNATIONAL CAPACITORS