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USER MANUAL

• 15P0087B5 •

VEGA DRIVE

SPACE VECTOR CONTROL

UPD. **09/10/02** R. 01 *English*

• This manual is integrant and essential to the product. Carefully read the instructions contained herein as they provide important hints for use and maintenance safety.
• This device is to be used only for the purposes it has been designed to. Other uses should be considered improper and dangerous. The manufacturer is not responsible for possible damages caused by improper, erroneous and irrational uses.
• Elettronica Santerno is responsible for the device in its original setting.
• Any changes to the structure or operating cycle of the device must be performed or authorized by the Engineering Department of Elettronica Santerno.
• Elettronica Santerno assumes no responsibility for the consequences resulting by the use of non original spare-parts.
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! ! WARNING ! !

Electrical Shock Prevention !!

1. Do not remove the front cover when input power is connected. 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 must be performed 10 minutes after disconnecting the input power and checking 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 an authorized personnel must perform wiring and inspections.
7. Wire the inverter after installing the inverter.
8. Do not operate the switches with wet hands. Doing so can result in electric shock.
9. Electric Shock can occur if the cable coating is damaged or if heavy objects that can give excess stress are put on the cable.

! ! 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. Not doing so could lead to secondary accident and 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 can damage the inverter.
3. Incorrectly connecting the polarity (+/-) of the terminals can damage the inverter.
4. Inverter is very hot during operation and few minutes after disconnection, so human contact can result in burns.

Other Important Precautions !!

Pay attention to the following items. Not doing so can result in damage of the inverter and electric shock.

☐ Handling and installation

1. Handle according to the weight of the product. Not doing so can result in damage of the product.
2. Do not stack inverters more than the limited rating.
3. Install according to the specifications listed in this manual.
4. Do not apply power to the inverter that is damaged of missing components even when the inverter is fully installed.
5. Do not open the front cover when carrying the inverter.
6. Do not place heavy items on the inverter.
7. Installation orientation must follow the standards listed in this manual
8. Do not allow combustible material like screws, metal objects, water, or oil to enter the inverter interior.
9. Do not drop the inverter or inflict intense shock to the inverter.
10. Install and operate the inverter under the specified conditions.

☐ Wiring

1. Do not connect phase-advancing capacitors, surge filter, or radio noise filters to the output circuits.
2. Connect the output terminals (U, V, W) according to the exact order.

☐ Operation

1. The inverter restarts after alarm stop when the retry function is selected, so take caution.
2. The stop key of the loader can only be used when the function is set, so install a separate emergency stop switch.
3. The inverter restarts when alarm contents are reset when the run signal is inputted, so verify the run signal before handling the alarm reset switch.
4. Do not modify or alter anything inside the inverter.
5. Motor might not be protected by the electronic thermal function.
6. Do not start or stop the inverter using an electromagnetic contact installed at the power input.
7. Install a noise filter to minimize the influence of the noise transmitting from the inverter. Electrical equipment near the inverter needs protection from damage.
8. In case of input voltage unbalance, install an AC reactor. Phase advancing capacitors and generators may get overheated and damaged due to the high frequency noise transmitting from the inverter.

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9. Use an insulation-rectified motor or take measures to suppress the micro surge voltage when driving a 400V class motor with the inverter. A micro surge voltage attributable to the wiring constant is generated at the motor terminals, and the micro surge voltage may deteriorate the insulation and damage the motor
10. After initializing parameters, set the parameters again before operation. Parameter values reset to the factory settings when the parameters are initialized.
11. Inverter can be easily set to high-speed operations, so operate after verifying the capability of the motor or machinery.
12. Stop torque is not produced when using the DC-brake function of the inverter. Install separate equipment when stop torque is needed.

☐ **Fault prevention precautions**

☐ When the inverter is damaged and cannot be controlled, the machinery can be left in a dangerous situation. Install additional safety equipment such as emergency brakes to prevent these situations.

☐ **Maintenance, inspection, and exchanging components**

1. Do not conduct megger test (insulation resistance measurement) the control circuitry of the inverter.
2. Refer to Chapter 5 for routine inspection methods.

☐ **General precautions**

The diagrams in this manual may be indicated without covers or circuit breakers. Be sure to restore covers and circuit breakers according to specifications and operate according to the instructions described in this manual.

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USER SELECTION GUIDE (VEGA DRIVE SPECIFICATIONS)

230V Class (0.5 ~ 5.4HP)

Inverter Type (VEGA DRIVE XX000BIK)		2S0001	2S0002	2S0003	2T0001	2T0002	2T0003	2T0005	2T0007
Motor Rating[1]	HP	0.5	1	2	0.5	1	2	3	5.4
	kW	0.55	1,1	1,8	0,55	0.75	1.5	2.2	4.0
Output Ratings	Capacity[2] [kVA]	1.1	1.9	3.0	1.1	1.9	3.0	4.5	6.5
	FLA [A]	3	5	8	3	5	8	12	17
	Max torque	180% Tn							
	Frequency	0 ~ 400 Hz							
	Voltage	200 ~ 230 V [3]							
Input Ratings	Voltage	1 Phase 200 ~ 230 V (± 10 %)			3 Phase 200 ~ 230 V (± 10 %)				
	Current [A]	6	10	16	3.3	5.5	9	13	19
	Frequency	50 ~ 60 Hz (±5 %)							
Dynamic Braking	Braking Circuit	On Board							
	Average Braking Torque	20 % (Optional Extrernal DB Resistor : 100% ,150%)							
	Max. Continuous Braking Time(s)	15							10
	Duty	30 % ED							10%
	Minimun value of braking resistor [4](Ω)	47	47	39	47	47	39	27	42
Weight [lbs]/[Kg]		2.65/1.2	3.97/1.8	4.63/2.1	2.65/1.2	2.65/1.2	3.97/1.8	4.63/2.1	4.85/2.2

460V Class (0.5 ~ 5.4HP)

Inverter Type (VEGA DRIVE XX000BIK)		4T0001	4T0002	4T0003	4T0005	4T0007
Motor Rating[1]	HP	0.5	1	2	3	5.4
	kW	0.55	0,9	1.5	2.2	4.0
Output Ratings	Capacity[2] [kVA]	1.1	1.9	3.0	4.5	6.5
	FLA [A]	1.5	2.5	4	6	9
	Max torque	180% Tn				
	Frequency	0 ~ 400 Hz				
	Voltage	380 ~ 460 V[3]				
Input Ratings	Voltage	3 Phase, 380 ~ 460 V (± 10 %)				
	Current	1.5	2.5	4	6	9
	Frequency	50 ~ 60 Hz (±5 %)				
Dynamic Braking	Braking Circuit	On Board				
	Average Braking Torque	20 % (Optional Extrernal DB Resistor : 100% ,150%)				
	Max. Continuous Baking Time (seconds)	15				10
	Duty	30 % ED				10%
	Minimun value of braking resistor [4](Ω)	100	100	100	100	100
Weight [lbs]/[Kg]		3.75/1.7	3.75/1.7	3.97/1.8	4.63/2.1	4.85/2.2

[1] Indicates the maximum applicable capacity when using 4 pole LG standard motor.

[2] Rated capacity (√ 3*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 can be set.

[4] Indicates the minimun resitor than can be connected to dynamic braking resistor terminals (B1,B2)

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CONTROL	Control method			V/F control
	Frequency setting resolution			Digital reference : 0.01 Hz (below 100 Hz), 0.1 Hz (over 100 Hz) Analog reference : 0.03 Hz / 50 Hz
	Frequency accuracy			Digital: 0.01 % of max. output frequency Analog: 0.1 % of max. output frequency
	V/F ratio			Linear, Square patter, User V/F
	Overload capacity			150 % of rated current for 1 min, 200% short time (characteristic is inversely proportional to time)
	Torque boost			Manual torque boost (0 ~ 15 %), Auto torque boost
OPERATION	Input Signal	Operation method		Key / terminal / communication operation
		Frequency setting		Analog : 0 ~ 10V / 4 ~ 20 mA Digital : keypad
		Start signal		forward, reverse
		Multi-step speed		Up to 8 speeds can be set (use multi-function terminal)
		Multi Step accel/decel time		0 ~ 6,000 sec, up to 8 types can be set and selected for each setting (use the multi- function terminal), Accel/Decel pattern : linear pattern, U pattern, S pattern
		Emergency stop		Interrupts the output of the inverter
		Jog		Jog operation
		Fault reset		Reset faults when protective function is active
	Output Signal	Operating status		Frequency level detection, Overload alarm, stalling, overvoltage, undervoltage, inverter over-heating, running, stop, constant speed, speed searching
		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, PID control
Protection	Inverter trip			Overvoltage, undervoltage, overcurrent, inverter overheating, motor over heating, input/output phase loss, input/output mis-wiring, overload protection, communication error, loss of speed command, hardware fault
	Inverter alarm			Stall prevention, overload alarm
	Momentary power loss			Less than 15 msec : continuous operation, more than 15 msec : auto restart possible
Disply	Keypad	Operation information		Output frequency, output current, output voltage, frequency value setting, operating speed, DC voltage
		Trip information		Indicates the fault when the protection function activates, memorizes up to 5 faults
Environment	Ambient temperature			-10 °C ~ 40 °C
	Storage temperature			-20 °C ~ 65 °C
	Ambient humidity			90 % RH max.(Non condensing)
	Altitude.Vibration			Below 1,000 m · below 5.9m/sec²(=0.6g)
	Application site			No corrosive gas, combustible gas, oil mist, or dust
	Atmospheric pressure			70 ~ 106 kPa
Cooling method				Forced air cooling[4]

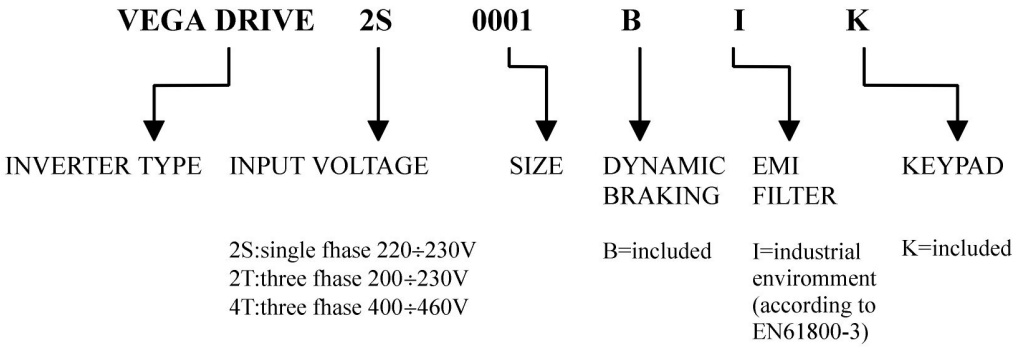
[4] 'Self-cooling' for models SV008VEGA DRIVE-4.

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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 for the VEGA DRIVE inverter. Verify that the inverter unit is the correct one for the application. The numbering system of a ELETTRONICA SANTERNO inverter is as below.

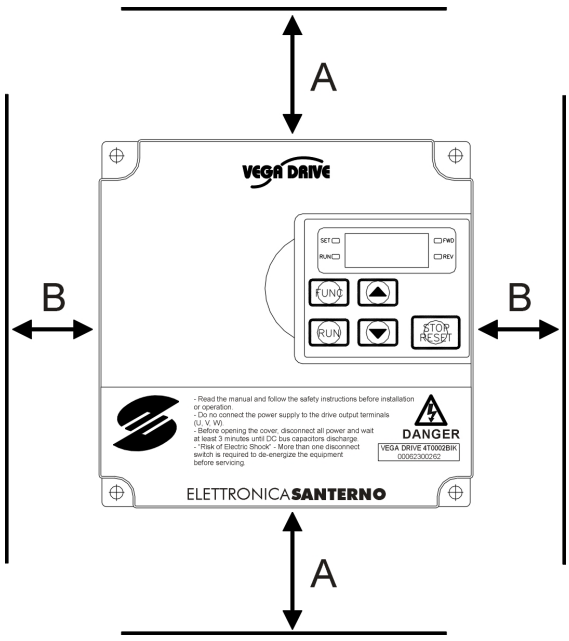


1.2 Environmental Conditions

☐ Verify that ambient condition of the mounting location. Ambient temperature should not be below 14ºF (-10ºC) and must not exceed 104ºF (40ºC). Relative humidity should be less than 90% (non-condensing). The altitude should be below 3,300ft (1,000m).
☐ Do not mount the inverter in direct sunlight. Isolate the inverter from excessive vibration.

1.3 Mounting

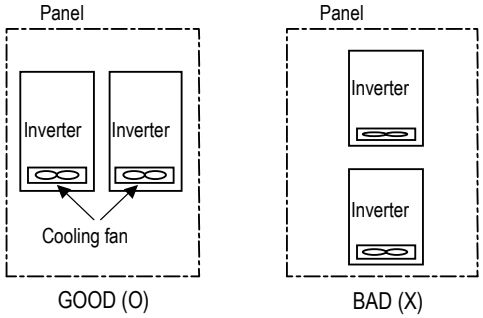
☐ The VEGA DRIVE must be mounted vertically with sufficient space (horizontally and vertically) between adjacent equipment (A: over 6" (150mm), B: over 2"(50mm).



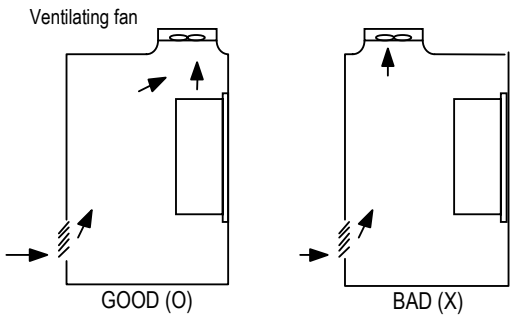
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1.4 Others to be cautious

- ☐ The inverter uses plastic components, so take care to avoid damage. Especially do not carry the inverter holding only the front cover..
- ☐ Do not install in a location with excessive oscillation. Be cautious when installing the inverter on presses or moving equipment
- ☐ The life span of the inverter is greatly effected by the ambient temperature. Install the inverter in a location with a temperature that is within the permissible limits(- 10 ~ 40 °C).
- ☐ The inverter is a high-temperature equipment. Install the inverter on a non-combustible surface.
- ☐ Do not install the inverter in high-temperature and high-humidity locations. Avoid locations in direct sunlight, and high temperature and high humidity locations.
- ☐ Do not install the inverter in a location with oil mist, combustible gas, and dust. Install the inverter in a clean location or in an enclosed panel that is free from alien substance.
- ☐ Be cautious when installing the inverter inside a panel.
  Take caution when installing the inverter and the ventilating fan when installing multiple inverters or when installing a ventilation fan in a panel. If incorrectly installed, the ambient temperature will rise and the ventilation performance will drop, so do not let the ambient temperature to rise higher than the approved value.



[When installing several inverters in a panel]

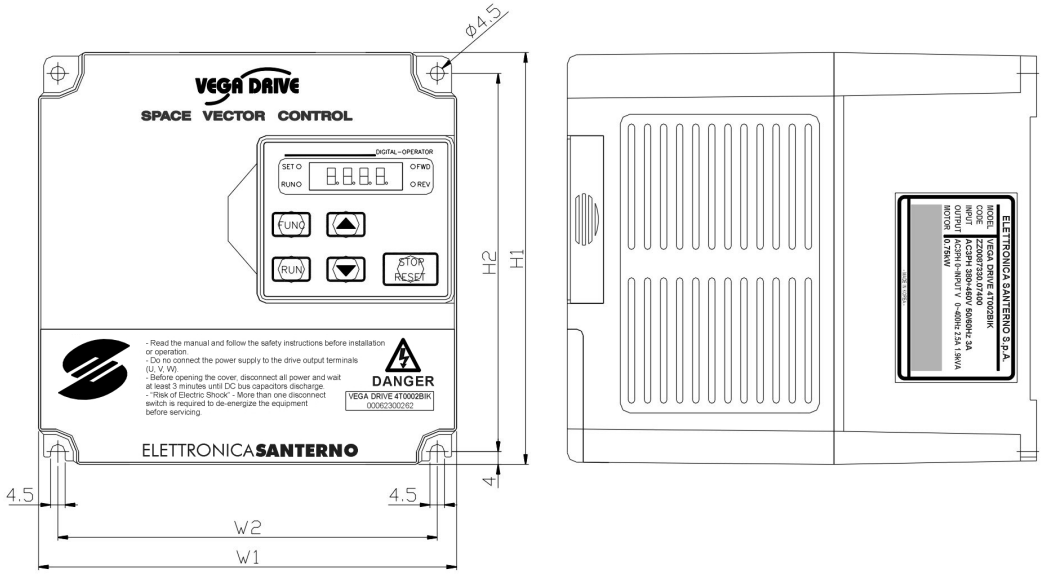


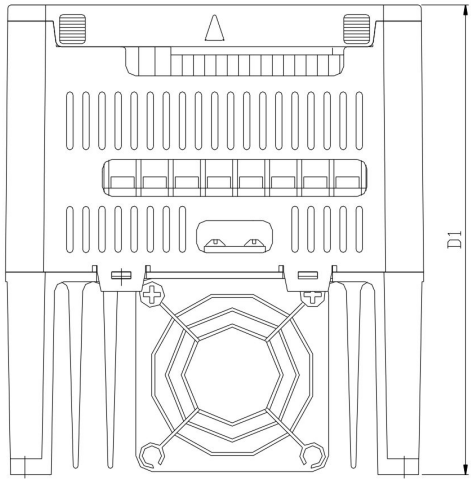
[When installing a ventilating fan in a panel]

- ☐ Install the inverter using screws or bolts so that the inverter is firmly fastened.

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1.5 Dimensions



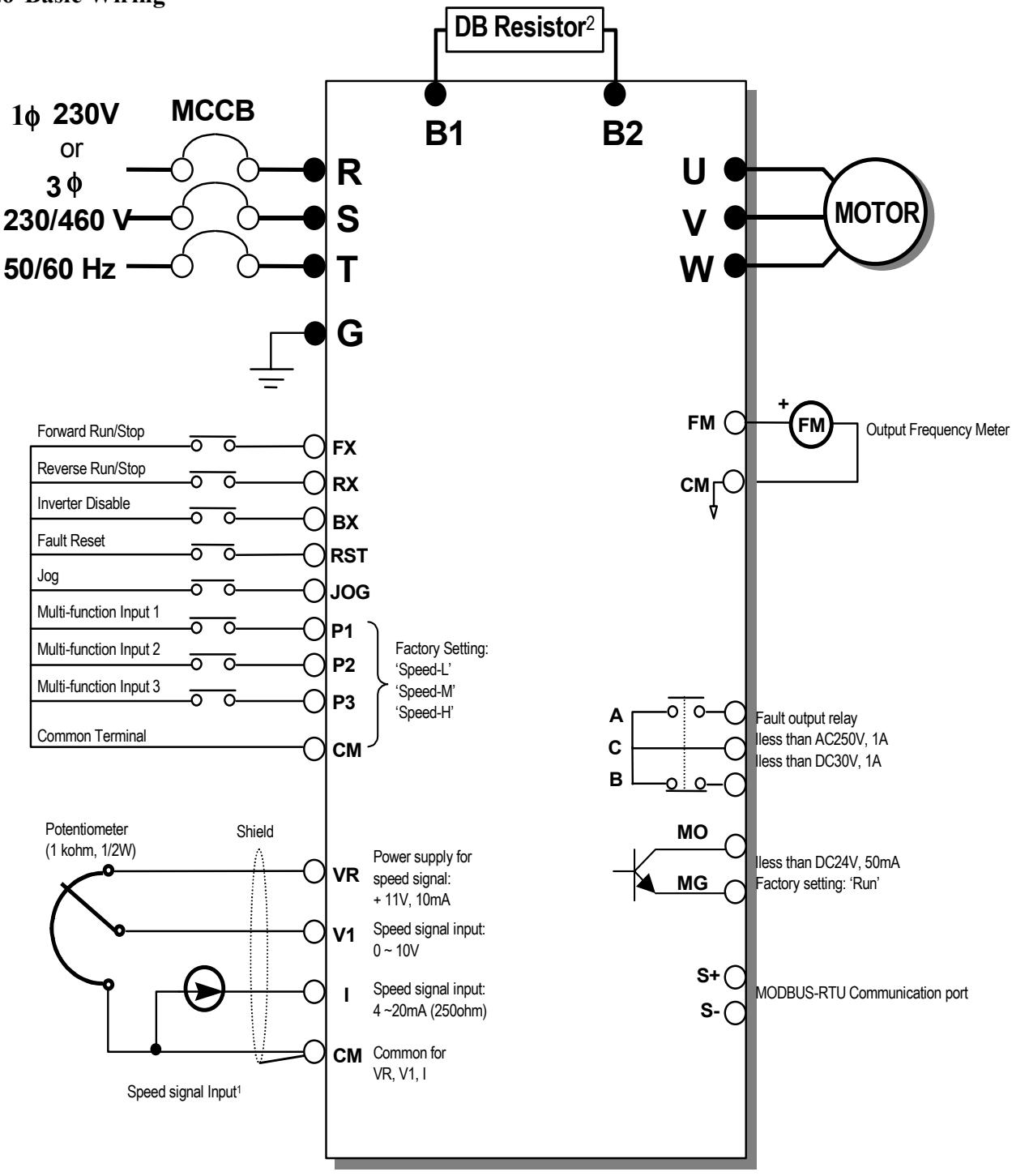


Unit: mm (inch)

Inverter	KW	W1	W2	H1	H2	D1
2S0001BIK	0.55	100 (3.94)	88 (3.46)	128 (5.04)	117.5 (4.63)	130.9 (5.15)
2T0001BIK	0.55	100 (3.94)	88 (3.46)	128 (5.04)	117.5 (4.63)	130.9 (5.15)
2S0002BIK	1.1	130 (5.12)	118 (4.65)	128 (5.04)	117.5 (4.63)	150.9 (5.94)
2T0002BIK	1.1	100 (3.94)	88 (3.46)	128 (5.04)	117.5 (4.63)	130.9 (5.15)
2S0003BIK	1.8	150 (5.90)	138 (5.43)	128 (5.04)	117.5 (4.63)	155 (6.10)
2T0003BIK	1.8	130 (5.12)	118 (4.65)	128 (5.04)	117.5 (4.63)	150.9 (5.94)
2T0005BIK	2.2	150 (5.90)	138 (5.43)	128 (5.04)	117.5 (4.63)	155 (6.10)
2T0007BIK	4.0	150 (5.90)	138 (5.43)	128 (5.04)	117.5 (4.63)	155 (6.10)
4T0001BIK	0.55	130 (5.12)	118 (4.65)	128 (5.04)	117.5 (4.63)	150.9 (5.94)
4T0002BIK	0.9	130 (5.12)	118 (4.65)	128 (5.04)	117.5 (4.63)	150.9 (5.94)
4T0003BIK	1.5	130 (5.12)	118 (4.65)	128 (5.04)	117.5 (4.63)	150.9 (5.94)
4T0005BIK	2.2	150 (5.90)	138 (5.43)	128 (5.04)	117.5 (4.63)	155 (6.10)
4T0007BIK	4.0	150 (5.90)	138 (5.43)	128 (5.04)	117.5 (4.63)	155 (6.10)

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1.6 Basic Wiring

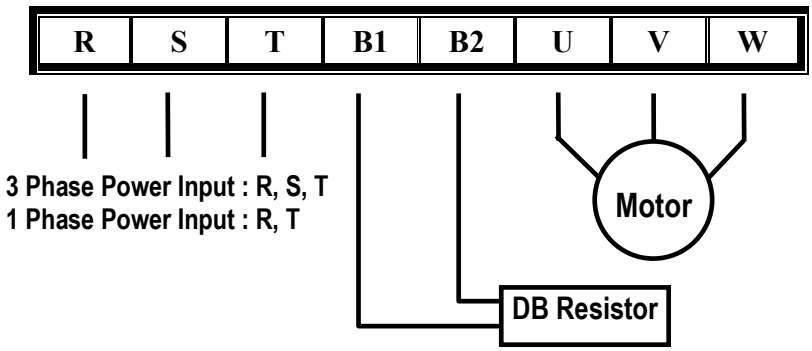


Note) ● display main circuit terminals, ○ display control circuit terminals.

1. Analog speed command can be set by Voltage, Current and both of them.
2. DB resistor is optional.

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1.7 Power Terminals



Symbols	Functions
R	AC Line Input Terminal
S	3(1) phase, 200 ~ 230V AC for 200V class units and 380 ~ 460V AC for 400V class units.
T	1Phase input Terminals: R and T
U	3-Phase Output Terminals to Motor
V	
W	
B1	Dynamic Braking Resistor Connection Terminal
B2	

Suitable for use on a circuit capable of delivering not more than 10,000 rms symmetrical amperes, 240 volts maximum for 230V class models and 480 volts maximum for 460V class models.

!! 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. Do not apply power to the inverter if the inverter frame (Power terminal G) is not grounded.

1.7.1 Wiring Power Terminals

■ **Precautions on Wiring**

☐ If a power supply is connected and applied to the output terminals (U,V,W), the internal circuits of the inverter will be damaged.

☐ Use ring terminals with insulated caps when wiring the input power and the motor.

☐ Do not leave wire fragments inside the inverter. Wire fragments can cause faults, breakdowns, and malfunctions.

☐ Use wires for input and output with sufficient thickness to ensure the voltage drop is less than 2%. If the wire length between the inverter and the motor is long, and the inverter is operating at low frequencies, the motor torque drops due to the voltage drop caused by the wire.

☐ The total wire length should be less than 500m. The overcurrent protective function can operate or the equipment connected to the output side can malfunction due to the increased leakage capacitance between the wiring when the motor is far away from the inverter. The total wiring length should also be less than 500m when more than one motor is connected to the inverter. Do not use a 3-wire cable for long distances.

☐ Connect only the recommended braking resistor between the B1, B2 terminals. And never short the B1 and B2 terminal. Shorting the terminals can cause internal damages to the inverter.

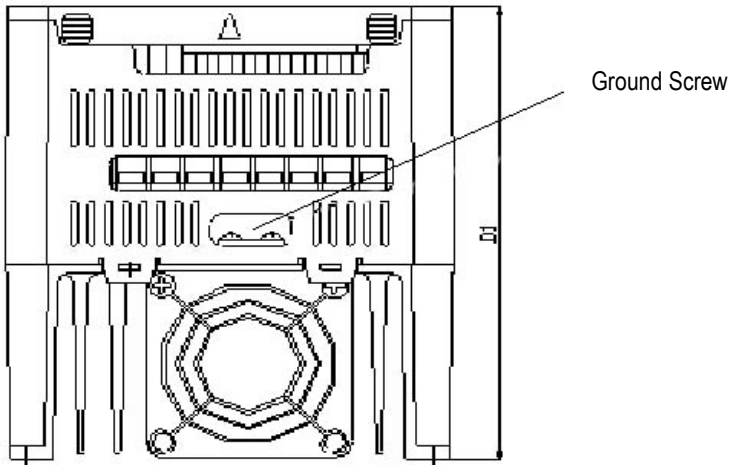
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- ☐ The main circuit of the inverter contains high frequency noise, and can hinder communication equipment near the inverter. Installing radio noise filters, line noise filter on the input side of the inverter can reduce the hindrance
- ☐ Do not use a phase advancing capacitor, surge killers, radio noise filters on the output side of the inverter. Doing so can cause inverter trip, or damage the capacitor or the surge killer.
- ☐ Always check the charge lamp of the power terminal are OFF before wiring the terminals. The capacitor is charged with high-voltage even after the power is disconnected, and can be dangerous.

■ **Grounding**

- ☐ The inverter is a high switching device, and a lot of leakage current may flow. Ground the inverter to avoid electrical shock.
- ☐ Connect only to the dedicated ground terminal of the inverter. Do not use the case or the chassis screw for grounding.
- ☐ Grounding wire should be as thick as possible. The grounding wire should be at least the thickness that is listed in the following table and as short as possible. Connect the grounding point as near to the inverter as possible.

Grounding wire dimensions, AWG (mm²)	
200V class	400Vclass
12 (4.0)	14 (2.5)



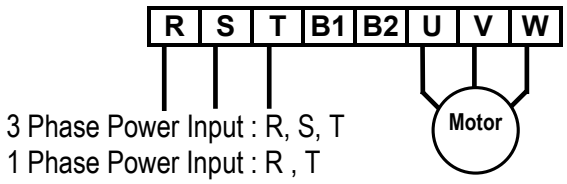
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■ Wires and Terminal lugs

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

Inverter		Terminal screw size	Screw torque[5] (Kgf·cm)	Wire[6]			
				mm²		AWG	
				R,S,T	U,V,W	R,S,T	U,V,W
200V Class(1Φ)	0001	M3.5	10	2.5	2.5	14	14
	0002÷0003	M4.0	15	2.5	2.5	14	14
200V Class(3Φ)	0001÷0002	M3.5	10	2.5	2.5	14	14
	0003÷0005	M4.0	15	2.5	2.5	14	14
	0007	M4.0	15	4	4	12	12
400V Class(3Φ)	0001÷0007	M4.0	15	2.5	2.5	14	14

■ Power and Motor Connection



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

Motor should be connected to the U, V, W terminals.
If the forward switch (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.

[5] Apply the rated torque to the terminal screws. Loosen screws can cause of short circuit and malfunction. Tightening the screws too much can damage the terminals and cause short circuit and malfunction.
[6] Use copper wires with 600V, 75° ratings for wiring.

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1.8 Control Terminals

30A	30C	30B

1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10
MO	MG	CM	FX	RX	CM	BX	JOG	RST	CM	P1	P2	P3	VR	V1	CM	I	FM	S+	S-

Terminal name	Terminal screw size	Screw torque (Nm)	Wire		Stripped Length (mm)
			Single wire [solid] (mm²)	Standard wire (mm²)	
30 A B C	M3	0.5	2.5	1.5	7
MO MG 24 FX RX ~ S-	M2	0.4	1.5	1.0	5.5

Type		Symbol	Name	Description
Input signal	Starting Contact Function Select	P1,P2,P3	Multi function input 1,2,3	Used for multi function input. Factory default is set to step frequency 1, 2, 3.
		FX	Forward run command	Forward run when closed and stop when open.
		RX	Reverse run command	Reverse run when closed and stop when open.
		JOG	Jog frequency reference	Runs at jog frequency when the jog signal is on. The direction is set by the FX (or BX) signal.
		BX	Emergency stop	When the BX signal is ON the output of the inverter is cut off. When the motor uses an electrical brake to stop, BX is used to cut off the output signal. When the BX signal, which does not cut off by latching, is OFF and the FX signal (or the RX signal) is ON the motor keeps running, so be cautious.
		RST	Fault reset	Used to release the protective status when the protective circuit is active.
		CM	Sequence common (0V)	Used for the common terminal for contact input terminals.
	Analog frequency setting	VR	Frequency setting power(+12V)	Used as power for the analog frequency setting. Maximum output is +12V, 10mA.
		V1	Frequency reference (Voltage)	Used for frequency reference and uses 0-10V for input. Input resistance is 20 kΩ
		I	Frequency reference(Current)	Used for frequency reference and uses DC 4-20mA for input. Input resistance is 250 Ω
		CM	Frequency setting common terminal(0V)	Common terminal for the analog frequency reference signal and for the FM (analog output)
Output signal	Pulse	FM	Analog output(For external monitoring)	Outputs one of the followings: output frequency, output current, output voltage, DC link voltage. Factory default is set to output frequency. Maximum output voltage and output current is 0-12V, 1mA.
	Contact	30A 30C 30B	Fault contact output	Activates when the protective function is operating. AC250V 1A or less, DC30V 1A or less. Fault : 30A-30C short (30B-30C open) Normal : 30B-30C short (30A-30C open)
		MO - MG	Multi-function output (Open collector output)	Use after defining the multi-function output terminal. DC24V, 50mA or less.
RS-485		S+, S-	Communication port	Communication port for MODBUS-RTU communication

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1.8.1 Wiring Control Terminals

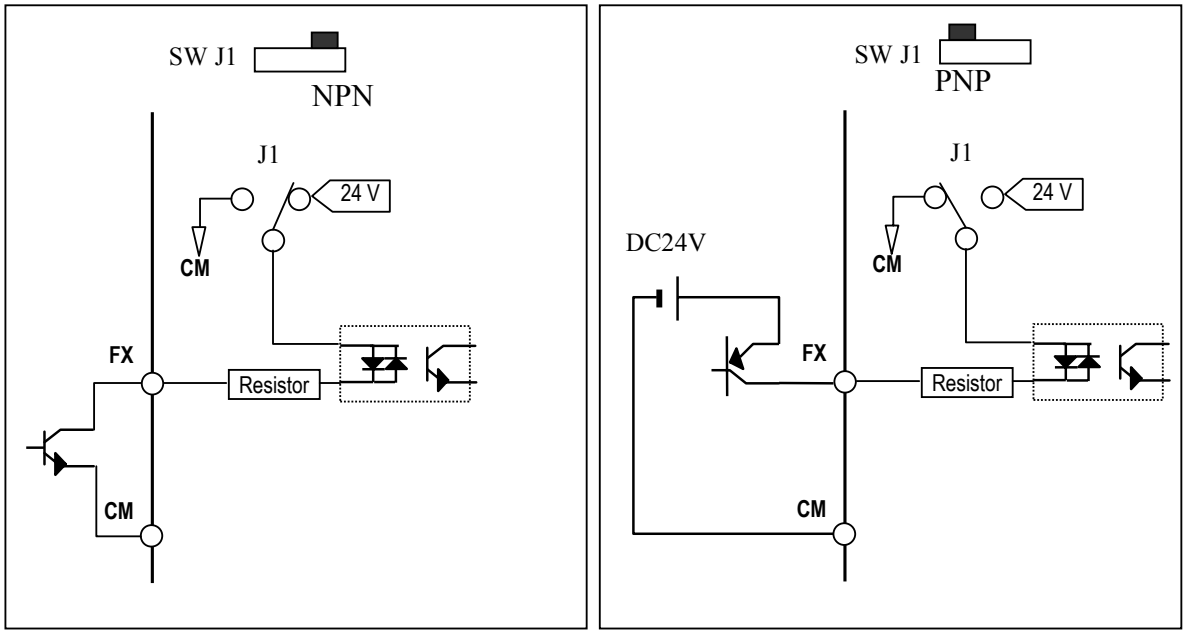
■ **Precautions on Wiring**

☐ Use shielded wires or twisted wires for control circuit wiring, and separate these wires from the main power circuits and other high voltage circuits like 200V relay sequence circuits.

☐ Use 1.25mm²(22AWG) stranded cables for control terminal connection.

■ **Control Circuit Terminal**

The input terminals can be selected for either NPN or PNP type logic by change switch J1 CM terminal is the common terminal for the input signals.



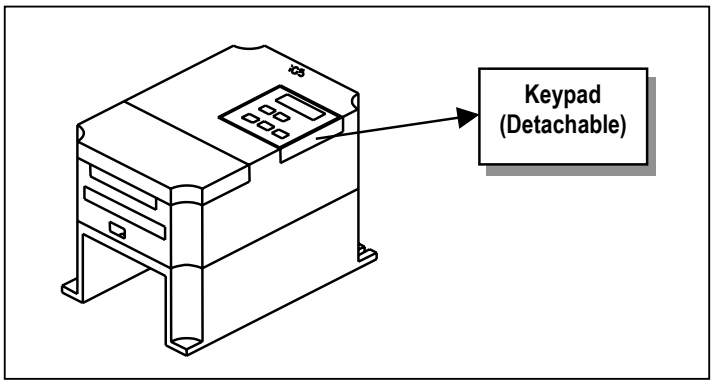
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1.8.2 Keypad

■ Wiring the Keypad

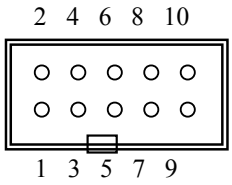
Keypad is installed before shipping for standard type models as shown below. When using an optional remote cable, install the buffer cover and connect the remote cable. If the keypad is not connected properly, the letters will not be displayed.

☞ **Note:** Do not connect the keypad and remote cable while the inverter power is introduced.
☞ **Note:** Do not touch the live part of the keypad connector. Doing this may cause personal injury or electric shock.



■ Keypad connector pin configuration (Inverter side)

(Top view)



Pin No.	Pin Name	Keypad	Description
1	5V	Used	5V DC power supply (Isolated from VR, V1, I of control terminal)
2	GND	Used	5V DC power ground (Isolated from CM of control terminal)
3	RES	Used	Used for writing the flash ROM inside inverter.
4	VPP	Used	
5	LAT	Used	Latch signal for transmitting/receiving
6	TXD	Used	Transmitting signal pin
7	CLK	Used	Clock signal pin
8	RXD	Used	Receiving signal pin
9		Not used	
10		Not used	

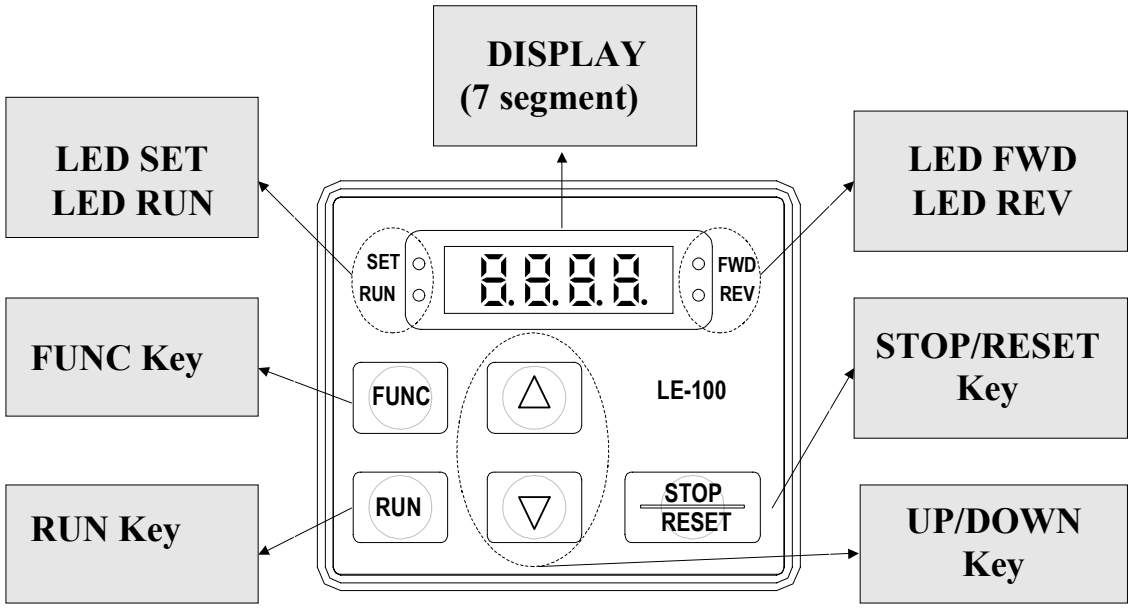
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CHAPTER 2 - OPERATION

2.1 Keypad and parameter group setting

2.1.1 Keypad description

7-Segment keypad displays up to 4 english letters and numbers, and the user can directly check various settings of the inverter. The following is an illustration of the keypad and the functions of each part.



Class	Display	Name	Description
Key	FUNC	Program key	Press to change the parameter setting.
	▲ (Up)	Up key	Press to move through codes or to increase the parameter values.
	▼ (Down)	Down key	Press to move through codes or to decrease the parameter values.
	RUN	Run key	Use to operate the inverter.
	STOP/RESET	STOP/RESET key	Press to stop during operation. Press to reset when a fault has occurred.
LED	REV	Reverse run display	Lit during reverse run.
	FWD	Forward run display	Lit during forward run.
	SET	Setting	Lit when the user is setting the parameters using the FUNC key
	RUN	Operating	Lit when in constant speed and blinks when accelerating or decelerating.

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2.2 Parameter Setting and Change

Numerous parameters are built in the inverter. The keypad allows the operator to operate the inverter by setting the required parameters, and enter the proper value according to the load and operating conditions. Refer to Chapter 4 PARAMETER DESCRIPTION for detailed description of the functions.

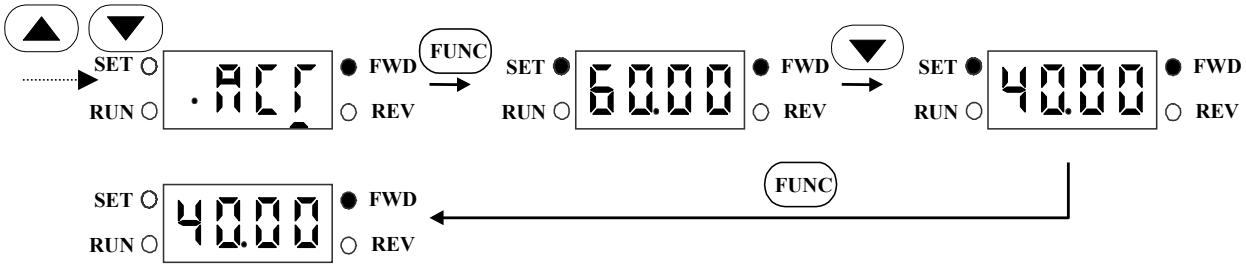
☐ Procedures

First move to the code of the group that needs changing.
Press [FUNC] key then the keypad LED (SET) will turn ON.
Use the [▲ (Up)], [▼ (Down)] keys to set the data to the desired value.
Press [FUNC] key, the data display will blink and the data will be stored in the inverter.

Note) When the data does not changed, check whether:
- the inverter is running (Refer to the function table in Chapter 3)
- the function is locked in H 94 [Parameter Lock])

☐ Setting the DRV group data

Ex) Changing the acceleration time from 60 sec to 40 sec.



The data will blink when the data setting is finished to indicate the setting is complete.

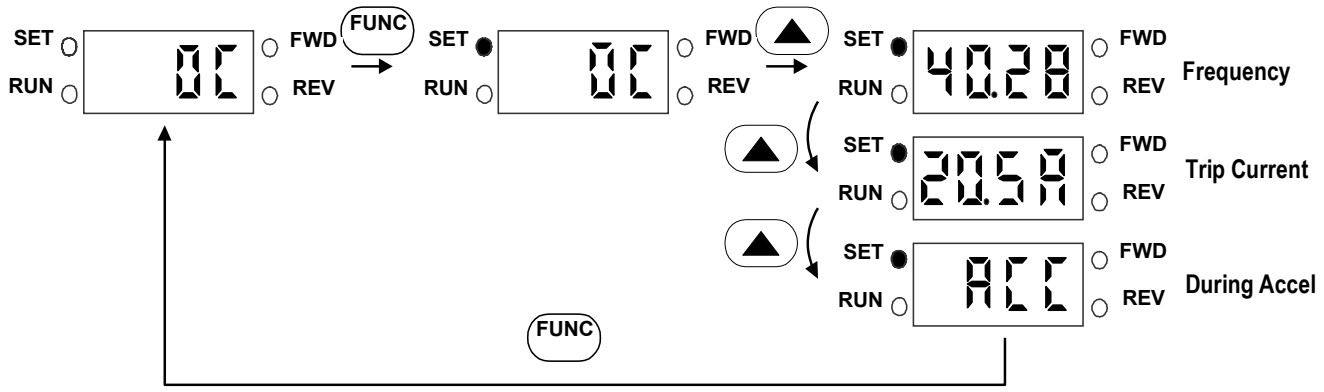
☐ To monitor the current output current from the DRV group

To monitor the current of inverter (Data cannot be set,)



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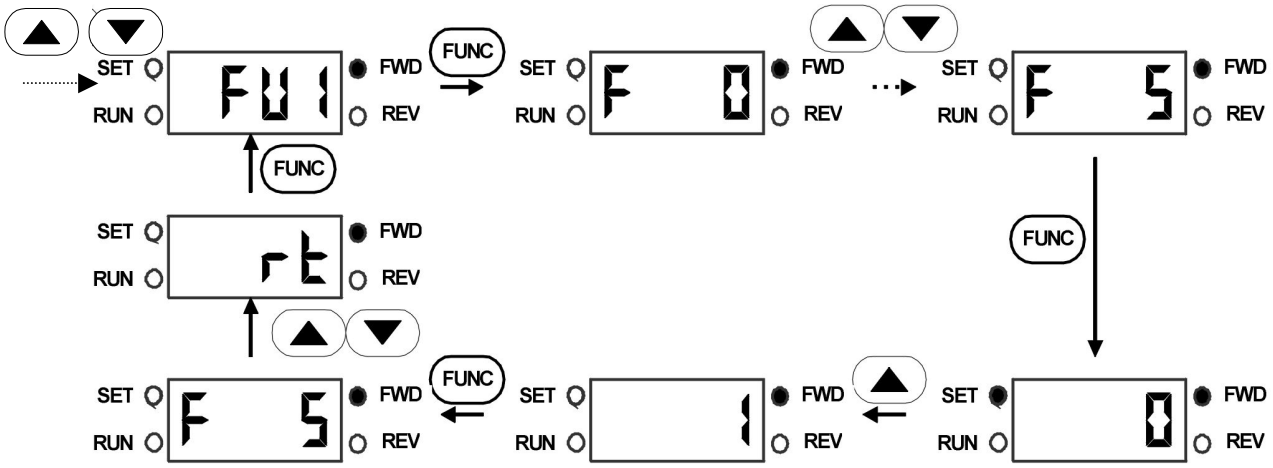
☐ **To monitor the fault type when a fault occurs (Data cannot be set.)**



The fault type is displayed at the DRV group when a fault occurs, and the frequency, current, operating status (accelerating, decelerating, in constant speeds) can be monitored by using the UP, DOWN KEY.
(Ex: Fault occurred when the inverter was accelerating at40.28 Hz, 20.5A) 4 LED is blinking in this situation.
Fault status can be removed by using the STOP/REST Key, and the LED turns OFF.
(The inverter must be turned OFF and turned ON again to remove HW fault status.)

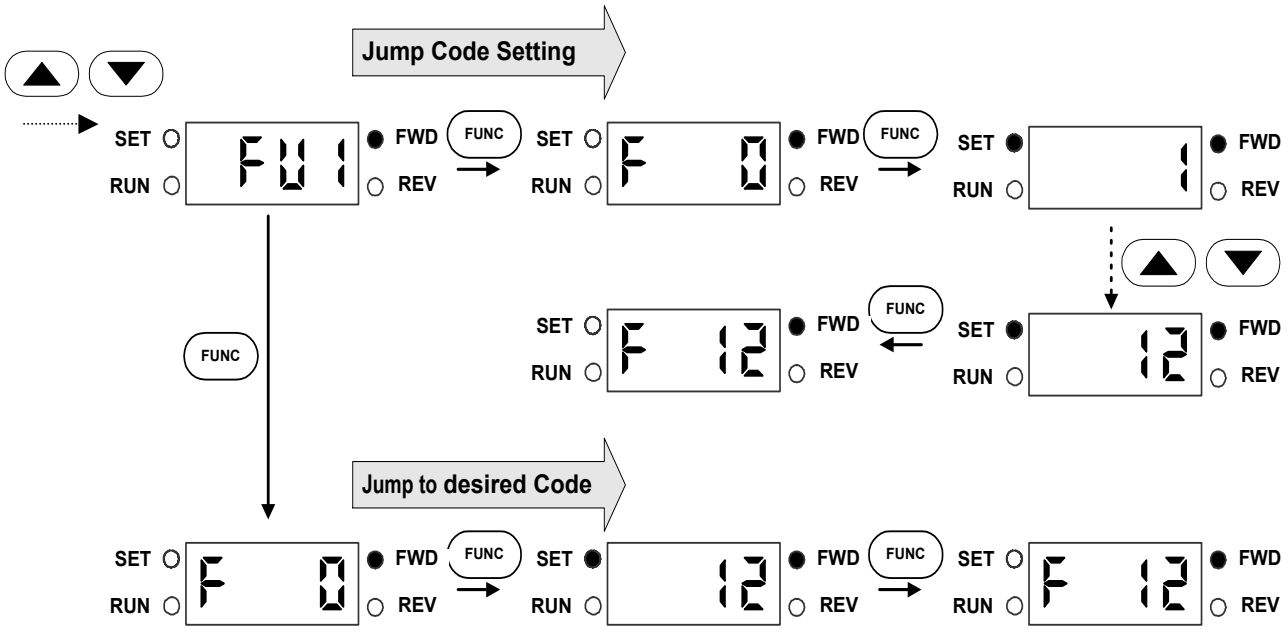
☐ **Adjusting the Function and I/O group data**

Ex) Changing the F 5 data to 1.



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☐ **Setting the Function group Jump CODE and jump method**



2.3 Parameter group

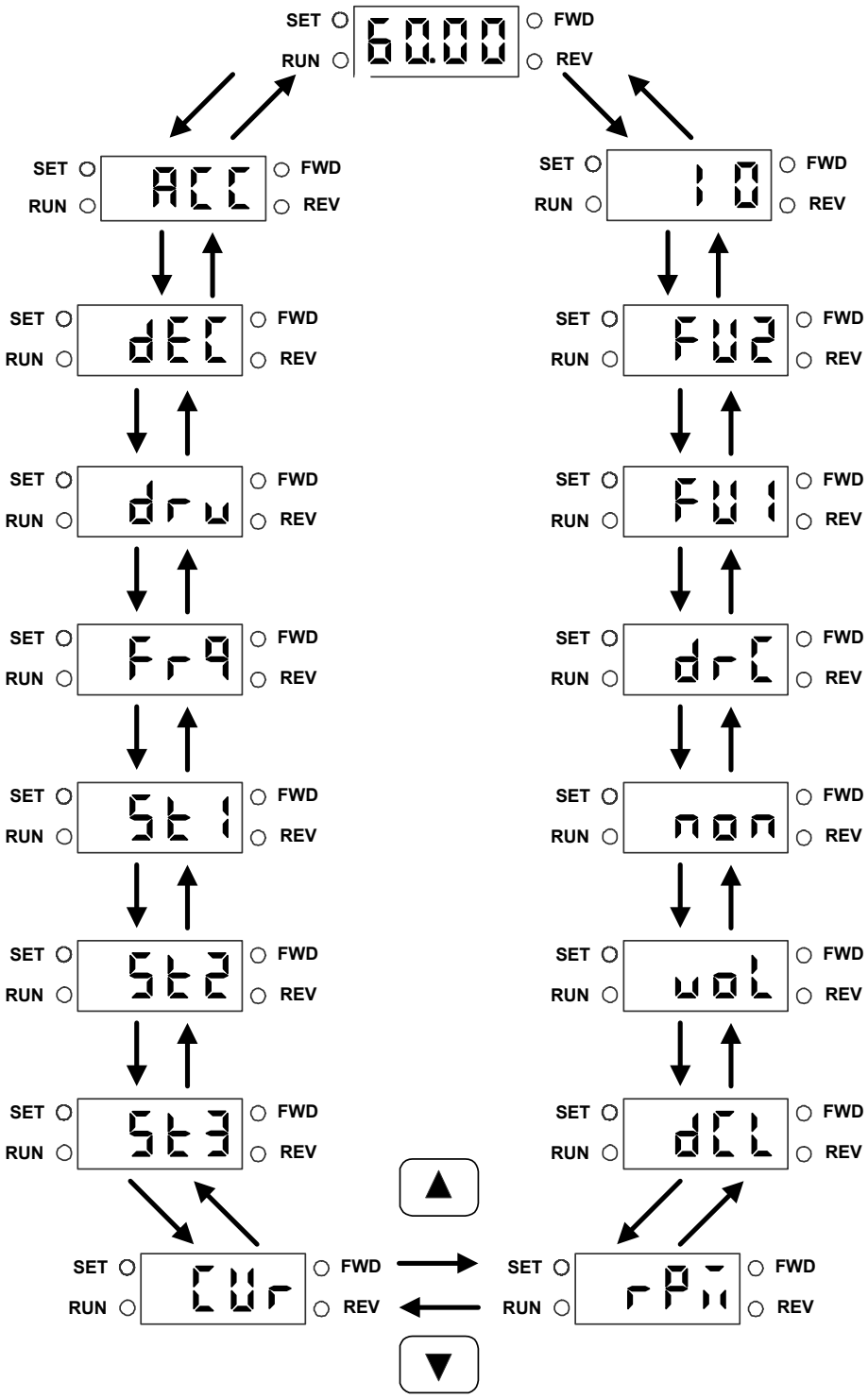
SV-VEGA DRIVE series offers the 7-segment (LED) keypad for the user. Parameters are separated into 4 function groups according to their application fields. The groups' names and the descriptions are as follows.

Group name	Description
Drive group	Basic parameters of Command frequency, Accel/Decel time etc.
Function 1 group	Basic parameters of Max. Frequency, Torque boost etc.
Function 2 Group	Application parameters of Frequency jump, Frequency limit etc.
Input/Output group	Multi function terminal setting and Sequence operation parameters

Refer to the function description of Chapter 4 for detailed description of each group.

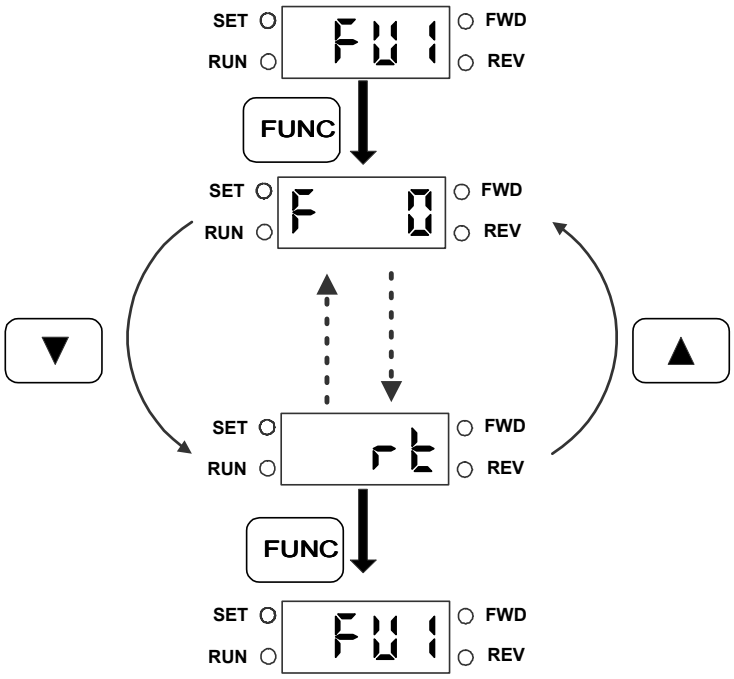
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☐ **Moving through the DRV group codes**

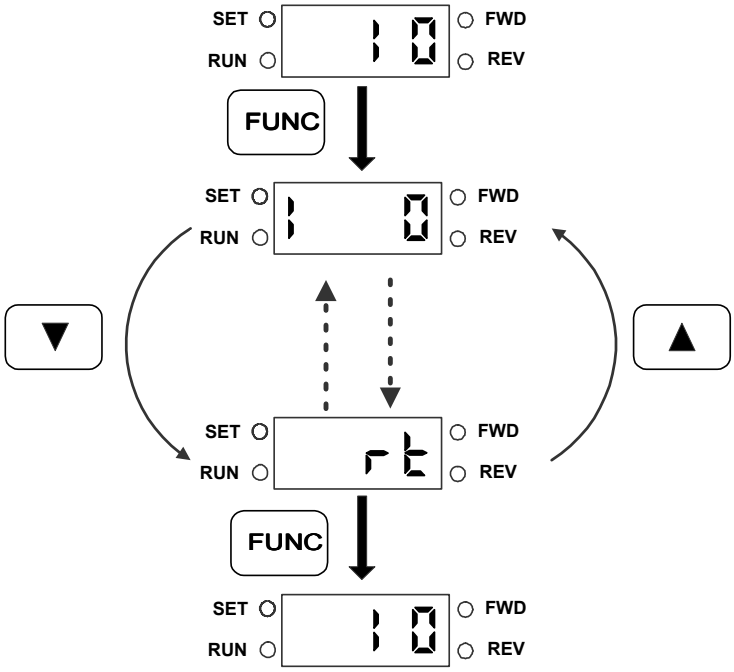


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☐ **Moving through the Function group codes**



☐ **Moving through the I/O group codes**



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2.4 Operation

2.4.1 Operation with the Keypad and Control terminal

When the operation reference signal is given to the control terminal and the frequency setting is given by the keypad, set the DRV-03 [Drive mode] to Fx/Rx-1, and set the DRV-04 [Frequency mode] to the Keypad. The frequency reference signal is set from the control terminal, and the forward, reverse, stop key of the keypad will be invalid.

1. Turn the power ON and set the operation and the frequency setting.
2. Set the **drv** [Operation Reference Source Selection] to Fx/Rx-1, and the **Frq** [Frequency Reference Source Selection] to Keypad.
3. Turn ON the operation reference signal FX (or RX). Keypad LED (FWD key or REV key) will turn ON.
4. Set the operating frequency with the keypad. Use the FUNC, ⇧(Up), FUNC keys and set the frequency to 50.00Hz. The motor will rotate at 50Hz. The LED (RUN) of the keypad will blink when the inverter is accelerating or decelerating.
5. Turn the operation reference signal FX (or RX) OFF. The LED (FWD of REV) of the keypad will turn ON.

Note: The user can also operate the inverter by setting the operation reference signal from the Keypad, and sending the frequency reference signal to the control terminal. (Set DRV-03 [Drive mode] to "Keypad", and the DRV-04 [Frequency mode] to "V1".)

2.4.2 Operation with Control terminal

1. Turn the power ON and set the operation and the frequency reference to the control terminal mode.
2. Set the drv [Operation Reference Source Selection] to Fx/Rx-1, and the Frq [Frequency Reference Source Selection] to V1.
3. Set the analog frequency reference by turning the volume (frequency volume) slowly to the right. The keypad will display the output frequency (50.00 Hz).
4. By slowly turning the volume (frequency volume) to the left will decrease the output frequency. The inverter will stop operating and the motor will come to a halt when the frequency reaches 0.00Hz.
5. Turn OFF the operation reference signal FX (or RX).

2.4.3 Operation with Keypad

1 Turn the power ON and set the operation and the frequency reference to the keypad operating mode.
2 Set the drv [Operation Reference Source Selection] to Keypad, and the Frq [Frequency Reference Source Selection] to Keypad-1.
3 Use FUNC, ▲(Up), FUNC keys to set the operating frequency to 50.00Hz. When the inverter is not running the command frequency is displayed.
4 Press the RUN key. The motor will rotate and the keypad will display the output frequency.
5 Press the STOP/RESET key. The motor will decelerate and come to a halt, and the keypad will display the command frequency.

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CHAPTER 3 - PARAMETER LIST

3.1 Drive Group [DRV]

Code	Description	Keypad Display	Setting Range	Units	Factory Default	Adjustable during run	Page
DRV-00	Output Frequency during running, Reference Frequency during stop	**0.00**	0 to Max. Freq. (FU1-20)	0.01	50.00 [Hz]	Yes	**33**
DRV-01	Acceleration Time	**ACC**	0 to 6000 [sec]	0.1	10.0 [sec]	Yes	**33**
DRV-02	Deceleration Time	**DEC**	0 to 6000 [sec]	0.1	10.0 [sec]	Yes	**33**
DRV-03	Drive Mode (Run/Stop method)	**Drv**	**0** (keypad) **1** (Fx/Rx-1) **2** (Fx/Rx-2) **3** (RS485)	-	Fx/Rx-1 **1**	No	**33**
DRV-04	Frequency Mode (Freq. setting method)	**Frq**	**0** [Keypad-1] **1** (Keypad-2) **2** (V1) **3** (I) **4** (V1+I) **5** (RS485)	-	(V1) **2**	No	**34**
DRV-05	Step Frequency 1	**St1**	Starting freq (FU1-22) to Max. freq (FU1-20)	0.01	10.00 [Hz]	Yes	**35**
DRV-06	Step Frequency 2	**St2**			20.00 [Hz]		
DRV-07	Step Frequency 3	**St3**			30.00 [Hz]		
DRV-08	Output Current	**Cur**	* [A]	-	- [A]	-	**35**
DRV-09	Motor Speed	**RPM**	* [rpm]	-	- [rpm]	-	**35**
DRV-10	DC link Voltage	**DCL**	* [V]	-	- [V]	-	**38**
DRV-11	User Display selection	**vOL, Por, tOr**	Selected in FU2-73 (User disp)	-	-	-	**35**
DRV-12	Fault Display	**nOn**	**-**	-	None **nOn**	-	**35**
DRV-13	Motor Direction set	**drc**	**F** (Forward) **r** (Reverse)	-	**F**	Yes	**35**
DRV-20	**FU1** Group selection	**FU1**					**35**
DRV-21	**FU2** Group selection	**FU2**					**35**
DRV-22	**I/O** Group selection	**I O**					**35**

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3.2 Function 1 Group [FU1]

Code	Description	Keypad Display	Setting Range	Units	Factory Default	Adjustable during run	Page
FU1-00	Jump to desired code #	**F 0**	1 to 99	1	3	Yes	**37**
FU1-03	Run Prevention	**F 3**	**0** (None) **1** (Forward Prev) **2** (Reverse Prev)	-	None **0**	No	**37**
FU1-05	Acceleration Pattern	**F 5**	**0** (Linear) **1** (S-curve) **2** (U-curve) **3** (Minimum) **4** (Optimum)	-	Linear **0**	No	**37**
FU1-06	Deceleration Pattern	**F 6**	**0** (Linear) **1** (S-curve) **2** (U-curve) **3** (Minimum) **4** (Optimum)	-	Linear **0**	No	**37**
FU1-07	Stop Mode	**F 7**	**0** (Decel) **1** (DC-brake) **2** (Free-run)	-	Decel **0**	No	**38**
FU1-08[7]	DC Injection Braking Frequency	**F 8**	FU1-22 to 50 [Hz]	0.01	5.00 [Hz]	No	**39**
FU1-09	DC Injection Braking On-delay Time	**F 9**	0 to 60 [sec]	0.01	0.5 [sec]	No	
FU1-10	DC Injection Braking Voltage	**F 10**	0 to 200 [%]	1	50 [%]	No	
FU1-11	DC Injection Braking Time	**F 11**	0 to 60 [sec]	0.1	1.0 [sec]	No	
FU1-12	Starting DC Injection Braking Voltage	**F 12**	0 to 200 [%]	1	50 [%]	No	**39**
FU1-13	Starting DC Injection Braking Time	**F 13**	0 to 60 [sec]	0.1	0.0 [sec]	No	
FU1-20	Maximum Frequency	**F 20**	40 to 400 [Hz]	0.01	50.00 [Hz]	No	**40**
FU1-21	Base Frequency	**F 21**	30 to FU1-20	0.01	50.00 [Hz]	No	
FU1-22	Starting Frequency	**F 22**	0.1 to 10 [Hz]	0.01	0.10 [Hz]	No	
FU1-23	Frequency Limit selection	**F 23**	**0** (No) **1** (Yes)	-	No **0**	No	**40**
FU1-24[8]	Low Limit Frequenc y	**F 24**	FU1-22 to FU1-25	0.01	0.50 [Hz]	No	
FU1-25	High Limit Frequency	**F 25**	FU1-24 to FU1-20	0.01	50.00 [Hz]	No	

[7] Code FU1-08 through FU1-11 appears only when FU1-07 is set at 'DC-brake'.
[8] Code FU1-24 through FU1-25 appears only when FU1-23 is set at 'Yes'.

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FU1-26	Manual/Auto Torque Boost selection	**F 26**	**0** (Manual) **1** (Auto)	-	Manual **0**	No	**40**
FU1-27	Torque Boost in Forward Direction	**F 27**	0 to 15 [%]	0.1	5.0 [%]	No	**40**
FU1-28	Torque Boost in Reverse Direction	**F 28**		0.1	5.0 [%]	No	
FU1-29	Volts/Hz Pattern	**F 29**	**0** (Linear) **1** (Square) **2** (User V/F)	-	Linear **0**	No	**41**
FU1-30[9]	User V/F – Frequency 1	**F 30**	0 to FU1-32	0.01	12.50 [Hz]	No	**42**
FU1-31	User V/F – Voltage 1	**F 31**	0 to 100 [%]	1	25 [%]	No	
FU1-32	User V/F – Frequency 2	**F 32**	FU1-30 to FU1-20	0.01	25.00 [Hz]	No	
FU1-33	User V/F – Voltage 2	**F 33**	0 to 100 [%]	1	50 [%]	No	
FU1-34	User V/F – Frequency 3	**F 34**	FU1-32 to FU1-20	0.01	37.5 [Hz]	No	
FU1-35	User V/F – Voltage 3	**F 35**	0 to 100 [%]	1	75 [%]	No	
FU1-36	User V/F – Frequency 4	**F 36**	FU1-34 to FU1-20	0.01	50.00 [Hz]	No	
FU1-37	User V/F – Voltage 4	**F 37**	0 to 100 [%]	1	100 [%]	No	
FU1-38	Output Voltage Adjustment	**F 38**	40 to 110 [%]	0.1	100.0 [%]	No	**42**
FU1-39	Energy Save Level	**F 39**	0 to 30 [%]	1	0 [%]	Yes	**43**
FU1-50	Electronic Thermal selection	**F 50**	**0** (No) **1** (Yes)	-	No **0**	Yes	**43**
FU1-51[10]	Electronic Thermal Level for 1 minute	**F 51**	FU1-52 to 250 [%]	1	180 [%]	Yes	
FU1-52	Electronic Thermal Level for continuous	**F 52**	50 to FU1-51	1	120 [%]	Yes	
FU1-53	Electronic Thermal Characteristic selection (Motor type)	**F 53**	**0** (Self-cool) **1** (Forced-cool)	-	Self-cool **0**	Yes	
FU1-54	Overload Warning Level	**F 54**	30 to 150 [%]	1	150 [%]	Yes	**44**
FU1-55	Overload Warning Hold Time	**F 55**	0 to 30 [sec]	0.1	10.0 [sec]	Yes	
FU1-56	Overload Trip selection	**F 56**	**0** (No) **1** (Yes)	-	Yes **1**	Yes	**44**
FU1-57	Overload Trip level	**F 57**	30 to 250 [%]	1	200 [%]	Yes	
FU1-58	Overload Trip Delay Time	**F 58**	0 to 60 [sec]	1	60.0 [sec]	Yes	
FU1-59	Stall Prevention Mode selection	**F 59**	**000 – 111** (bit set) Bit 0: during Accel. Bit 1: during Steady speed Bit 2: during Decel.	bit	000	No	**45**
FU1-60	Stall Prevention Level	**F 60**	30 to 250 [%]	1	200 [%]	No	
FU1-99	Return Code	**rt**		-	-	-	**46**

[9] Code FU1-30 through FU1-37 appears only when FU1-29 is set at 'User V/F'.
[10] Code FU1-51 through FU1-53 appears only when FU1-50 is set at 'Yes'.

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3.3 Function 2 Group [FU2]

Code	Description	Keypad Display	Setting Range	Units	Factory Default	Adjustable during run	Page
FU2-00	Jump to desired code #	**H 0**	1 to 99	1	30	Yes	**46**
FU2-01	Previous Fault History 1	**H 1**		-	None **0**	-	**46**
FU2-02	Previous Fault History 2	**H 2**					
FU2-03	Previous Fault History 3	**H 3**					
FU2-04	Previous Fault History 4	**H 4**					
FU2-05	Previous Fault History 5	**H 5**					
FU2-06	Erase Fault History	**H 6**	**0** (No) **1** (Yes)	-	No **0**	Yes	
FU2-07	Dwell Frequency	**H 7**	0 to FU1-20	0.01	5.00 [Hz]	No	**47**
FU2-08	Dwell Time	**H 8**	0 to 10 [sec]	0.1	0.0 [sec]	No	
FU2-10	Frequency Jump selection	**H 10**	**0** (No) **1** (Yes)	-	No **0**	No	**47**
FU2-11[11]	Jump Frequency 1 Low	**H 11**	FU1-22 to FU2-12	0.01	0.00 [Hz]	No	
FU2-12	Jump Frequency 1 High	**H 12**	FU2-11 to FU1-20	0.01	0.00 [Hz]	No	
FU2-13	Jump Frequency 2 Low	**H 13**	FU1-22 to FU2-14	0.01	0.00 [Hz]	No	
FU2-14	Jump Frequency 2 High	**H 14**	FU2-13 to FU1-20	0.01	0.00 [Hz]	No	
FU2-15	Jump Frequency 3 Low	**H 15**	FU1-22 to FU2-16	0.01	0.00 [Hz]	No	
FU2-16	Jump Frequency 3 High	**H 16**	FU2-15 to FU1-20	0.01	0.00 [Hz]	No	
FU2-19	Input/Output Phase Loss Protection	**H 19**	**00 – 11** (bit set) Bit 0: Output phase loss protection Bit 1: Intput phase loss protection	-	00	Yes	**47**
FU2-20	Power ON Start selection	**H 20**	**0** (No) **1** (Yes)	-	No **0**	Yes	**48**
FU2-21	Restart after Fault Reset	**H 21**	**0** (No) **1** (Yes)	-	No **0**	Yes	**48**
FU2-22	Speed Search selection	**H 22**	**0000 – 1111** (bit set) Bit 0: during Accel. Bit 1: after fault reset Bit 2: after instant power failure restart Bit 3: when FU2-20 is set to 1 (Yes).	-	0000	No	**49**
FU2-23	Current Limit Level during Speed Search	**H 23**	80 to 250 [%]	1	100 [%]	Yes	**49**
FU2-24	P Gain during Speed Search	**H 24**	0 to 9999	1	100	Yes	
FU2-25	I Gain during speed search	**H 25**	0 to 9999	1	5000	Yes	
FU2-26	Number of Auto Restart Attempt	**H 26**	0 to 10	1	0	Yes	**49**
FU2-27	Delay Time before Auto Restart	**H 27**	0 to 60 [sec]	0.1	1.0 [sec]	Yes	**49**

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

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Code	Description	Keypad Display	Setting Range	Units	Factory Default	Adjustable during run	Page
FU2-30	Rated Motor selection	**H 30**	**0.4** (0.37kW) **0.8** (0.75kW) **1.5** (1.5kW) **2.2** (2.2kW) **4.0** (4.0kW)	-	[12]	No	**50**
FU2-31	Number of Motor Pole	**H 31**	2 to 12	1	4	No	**50**
FU2-32	Rated Motor Slip	**H 32**	0 to 10 [Hz]	0.01	[13]	No	**50**
FU2-33	Rated Motor Current in RMS	**H 33**	0.1 to 99.9 [A]	1		No	**50**
FU2-34[14]	No Load Motor Current in RMS	**H 34**	0.1 to 99.9 [A]	1		No	**50**
FU2-36	Motor Efficiency	**H 36**	50 to 100 [%]	1		No	**50**
FU2-37	Load Inertia	**H 37**	0 to 2	1	0	No	**50**
FU2-39	Carrier Frequency	**H 39**	1 to 10 [kHz]	1	3 [kHz]	Yes	**51**
FU2-40	Control Mode selection	**H 40**	**0** (V/F) **1** (Slip Compen) **2** (PID)	-	V/F **0**	No	**51**
FU2-50[15]	PID Feedback Signal selection	**H 50**	**0** (I) **1** (V1)	-	I **0**	No	**51**
FU2-51	P Gain for PID Control	**H 51**	0 to 9999	1	3000	Yes	
FU2-52	I Gain for PID Control	**H 52**	0 to 9999	1	300	Yes	
FU2-53	D Gain for PID Control	**H 53**	0 to 9999	1	0	Yes	
FU2-54	Limit Frequency for PID Control	**H 54**	0 to FU1-20	0.01	50.00 [Hz]	Yes	
FU2-70	Reference Frequency for Accel and Decel	**H 70**	**0** (Max Freq) **1** (Delta Freq)	-	Max frq **0**	No	**52**
FU2-71	Accel/Decel Time Scale	**H 71**	**0** (0.01 sec) **1** (0.1 sec) **2** (1 sec)	-	0.1[sec] **1**	Yes	**53**
FU2-72	Power On Display	**H 72**	**0** (Cmd. Freq) **1** (Acc. Time) **2** (Dec. Time) **3** (Drv mode) **4** (Freq mode) **5** (Step Freq 1) **6** (Step Freq 2) **7** (Step Freq 3) **8** (Current) **9** (Speed) **10**(DC link Vtg) **11** (User disp) **12** (Fault Display) **13** (Motor direction)	1	**0**	Yes	**53**

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

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

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

[15] Code FU2-50 through FU2-54 appears only when FU2-40 is set at 'PID'.

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Code	Description	Keypad Display	Setting Range	Units	Factory Default	Adjustable during run	Page
FU2-73	User Display selection	H 73	0 (Voltage) 1 (Watt) 2 (Torque)	-	Voltage 0	Yes	53
FU2-74	Gain for Motor Speed Display	H 74	1 to 1000 [%]	1	100 [%]	Yes	53
FU2-75	DB (Dynamic Braking) Resistor Mode selection	H 75	0 (None) 1 (None) 2 (Ext. DB-R)	-	2	Yes	54
FU2-76	Duty of Dynamic Braking Resistor	H 76	0 to 30 [%]	1	10 [%]	Yes	54
FU2-79	Software Version	H 79	.	-	. E	-	54
FU2-81[16]	2nd Acceleration Time	H 81	0 to 999.9 [sec]	0.1	5.0 [sec]	Yes	54
FU2-82	2nd Deceleration Time	H 82	0 to 999.9 [sec]	0.1	10.0 [sec]	Yes	
FU2-83	2nd Base Frequency	H 83	30 to FU1-20	0.01	50.00 [Hz]	No	
FU2-84	2nd V/F Pattern	H 84	0 (Linear) 1 (Square) 2 (User V/F)	-	Linear 0	No	
FU2-85	2nd Forward Torque Boost	H 85	0 to 15 [%]	0.1	5.0 [%]	No	
FU2-86	2nd Reverse Torque Boost	H 86	0 to 15 [%]	0.1	5.0 [%]	No	
FU2-87	2nd Stall Prevention Level	H 87	30 to 250 [%]	1	150[%]	No	
FU2-88	2nd Electronic Thermal Level for 1 minute	H 88	FU2-89 to 250 [%]	1	150 [%]	Yes	
FU2-89	2nd Electronic Thermal Level for continuous	H 89	50 to FU2-88	1	100 [%]	Yes	
FU2-90	2nd Rated Motor Current	H 90	0.1 to 99.9 [A]	0.1	1.8 [A]	No	
FU2-91	Read Parameters into Keypad from Inverter	H 91	0 (No) 1 (Yes)	-	No 0	No	1
FU2-92	Write Parameters to Inverter from Keypad	H 92	0 (No) 1 (Yes)	-	No 0	No	
FU2-93	Initialize Parameters	H 93	0 (No) 1 (All Froups) 2 (DRV) 3 (FU1) 4 (FU2) 5 (I/O)	-	No 0	No	55
FU2-94	Parameter Write Protection	H 94	0 to 255[17]	1	0	Yes	55
FU2-99	Return Code	rt		-	1	Yes	55

[16] Code FU2-81 through FU2-90 appear only when one of I/O-12 ~ I/O-14 is set at '2nd function'.
[17] This function is used to lock the parameters from being changed. When the parameters are locked, the display arrow changes from solid to outlined.
The lock and unlock code is '12'.

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3.4 Input/Output Group [I/O]

Code	Description	Keypad Display	Setting Range	Units	Factory Default	Adjustable during run	Page
I/O-00	Jump to desired code #	I 0	1 to 99	1	1	Yes	55
I/O-01	Filtering Time Constant for V1 Signal Input	I 1	0 to 9999 [ms]	1	500 ms	Yes	55
I/O-02	V1 Input Minimum Voltage	I 2	0 to I/O-04	0.01	0.00 [V]	Yes	
I/O-03	Frequency corresponding to V1 Input Minimum Voltage	I 3	0 to FU1-20	0.01	0.00 [Hz]	Yes	
I/O-04	V1 Input Maximum Voltage	I 4	I/O-02 to 10 [V]	0.01	10.00 [V]	Yes	
I/O-05	Frequency corresponding to V1 Input Maximum Voltage	I 5	0 to FU1-20	0.01	50.00 [Hz]	Yes	
I/O-06	Filtering Time Constant for I Signal Input	I 6	0 to 9999 [ms]	1	500 ms	Yes	56
I/O-07	I Input Minimum Current	I 7	0 to I/O-09	0.01	4.00 [mA]	Yes	
I/O-08	Frequency corresponding to I Input Minimum Current	I 8	0 to FU1-20	0.01	0.00 [Hz]	Yes	
I/O-09	I Input Maximum Current	I 9	I/O-07 to 20 [mA]	0.01	20.00 [mA]	Yes	56
I/O-10	Frequency corresponding to I Input Maximum Current	I 10	0 to FU1-20	0.01	50.00 [Hz]	Yes	
I/O-11	Criteria for Analog Input Signal Loss	I 11	**0** (None) **1** (Half of x1) **2** (Below x1)	-	None **0**	Yes	56
I/O-12	Multi-function Input Terminal 'P1' define 8,9, 15, 20, 21, 22, 23, 24, 25, 26 (-Reserved-)	I 12	**0** (Speed-L) **1** (Speed-M) **2** (Speed-H) **3** (XCEL-L) **4** (XCEL-M) **5** (XCEL-H) **6** (Dc-brake) **7** (2nd Func) **10** (Up) **11** (Down) **12** (3-Wire) **13** (Ext trip-A) **14** (Ext trip-B) **16** (Open-loop) **17** (Main-drive) **18** (Analog hold) **19** (XCEL stop)	-	Speed-L **0**	NO	57
I/O-13	Multi-function Input Terminal 'P2' define	I 13	Same as above	-	Speed-M **1**	NO	57
I/O-14	Multi-function Input Terminal 'P3' define	I 14	Same as above	-	Speed-H **2**	NO	
I/O-15	Terminal Input Status	I 15	00000000 – 11111111 (bit set)	-	-	-	60
I/O-16	Terminal Output Status	I 16	0 – 1 (bit set)	-	-	-	

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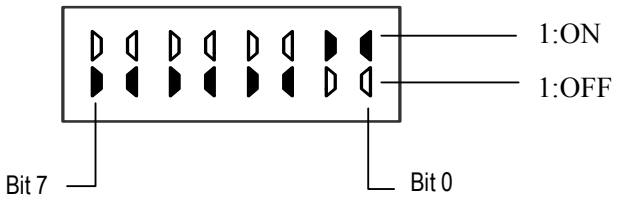
Code	Description	Keypad Display	Setting Range	Units	Factory Default	Adjustable during run	Page
I/O-17	Filtering Time Constant for Multi-function Input Terminals	I 17	2 to 50	1	15	Yes	60
I/O-20	Jog Frequency setting	I 20	FU1-22 to FU1-20	0.01	10.00 [Hz]	Yes	60
I/O-21	Step Frequency 4	I 21	FU1-22 to FU1-20		40.00 [Hz]	Yes	60
I/O-22	Step Frequency 5	I 22	FU1-22 to FU1-20		50.00 [Hz]	Yes	
I/O-23	Step Frequency 6	I 23	FU1-22 to FU1-20		40.00 [Hz]	Yes	
I/O-24	Step Frequency 7	I 24	FU1-22 to FU1-20		30.00 [Hz]	Yes	
I/O-25	Acceleration Time 1	I 25	0 to 6000 [sec]	0.1	20.0 [sec]	Yes	65
I/O-26	Deceleration Time 1	I 26	0 to 6000 [sec]	0.1	20.0 [sec]	Yes	
I/O-27	Acceleration Time 2	I 27	0 to 6000 [sec]	0.1	30.0 [sec]	Yes	
I/O-28	Deceleration Time 2	I 28	0 to 6000 [sec]	0.1	30.0 [sec]	Yes	
I/O-29	Acceleration Time 3	I 29	0 to 6000 [sec]	0.1	40.0 [sec]	Yes	
I/O-30	Deceleration Time 3	I 30	0 to 6000 [sec]	0.1	40.0 [sec]	Yes	
I/O-31	Acceleration Time 4	I 31	0 to 6000 [sec]	0.1	50.0 [sec]	Yes	
I/O-32	Deceleration Time 4	I 32	0 to 6000 [sec]	0.1	50.0 [sec]	Yes	
I/O-33	Acceleration Time 5	I 33	0 to 6000 [sec]	0.1	40.0 [sec]	Yes	
I/O-34	Deceleration Time 5	I 34	0 to 6000 [sec]	0.1	40.0 [sec]	Yes	
I/O-35	Acceleration Time 6	I 35	0 to 6000 [sec]	0.1	30.0 [sec]	Yes	
I/O-36	Deceleration Time 6	I 36	0 to 6000 [sec]	0.1	30.0 [sec]	Yes	
I/O-37	Acceleration Time 7	I 37	0 to 6000 [sec]	0.1	20.0 [sec]	Yes	
I/O-38	Deceleration Time 7	I 38	0 to 6000 [sec]	0.1	20.0 [sec]	Yes	
I/O-40	FM (Frequency Meter) Output selection	I 40	**0** (Frequency) **1** (Current) **2** (Voltage) **3** (DC link Vtg)	-	Frequency **0**	Yes	60
I/O-41	FM Output Adjustment	I 41	10 to 200 [%]	1	100 [%]	Yes	
I/O-42	Frequency Detection Level	I 42	0 to FU1-20	0.01	30.00 [Hz]	Yes	61
I/O-43	Frquency Detection Bandwidth	I 43	0 to FU1-20	0.01	10.00 [Hz]	Yes	
I/O-44	Multi-function Output define (MO) 15, 16, 18, 19, 20 (-Reserved-)	I 44	**0** (FDT-1) **1** (FDT-2) **2** (FDT-3) **3** (FDT-4) **4** (FDT-5) **5** (OL **6** (IOL) **7** (Stall) **8** (OV) **9** (LV) **10** (OH) **11** (Lost Command) **12** (Run) **13** (Stop) **14** (Steady) **17** (Search)	-	Run **12**	Yes	61

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Code	Description	Keypad Display	Setting Range	Units	Factory Default	Adjustable during run	Page
I/O-45	Fault Output Relay setting (30A, 30B, 30C)	**I 45**	**000 – 111** (bit set) Bit 0: LV Bit 1: All Trip Bit 2: Auto retry	-	010	Yes	**64**
I/O-46	Inverter Number	**I 46**	1 to 32	1	1	Yes	
I/O-47	Baud Rate	**I 47**	**0** (1200 bps) **1** (2400 bps) **2** (4800 bps) **3** (9600 bps) **4** (19200 bps)	-	9600 bps **3**	Yes	**64**
I/O-48	Operating selection at Loss of Freq. Reference	**I 48**	**0** (None) **1** (FreeRun) **2** (Stop)	-	None **0**	Yes	Errore. Il segnalibro non è definito.
I/O-49	Waiting Time after Loss of Freq. Reference	**I 49**	0.1 to 120 [sec]	0.1	1.0 [sec]	Yes	
I/O-50	Communication Protocol selection	**I 50**	**0** (ELETTRONICA SANTERNO- BUS) **1~6** (ModbusASCII) **7~9** (Modbus-RTU)		7	Yes	**67**
I/O-99	Return Code	**rt**		-	1	Yes	

Note: parameters that are set by bit are ON (1) when the upper LED is lit as shown below.
(F59, H19, H22, I15, I16, I45 are the parameters that are set by bit).

Example when the keypad displays '00000011'



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CHAPTER 4 - PARAMETER DESCRIPTION

4.1 Drive Group [DRV]

DRV-00: Output Frequency / Output Current

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 [FUNC] 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: select the frequency setting method. [Keypad-1, Kepad-2, V1, I, V1+I]
- FU1-20: set 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.

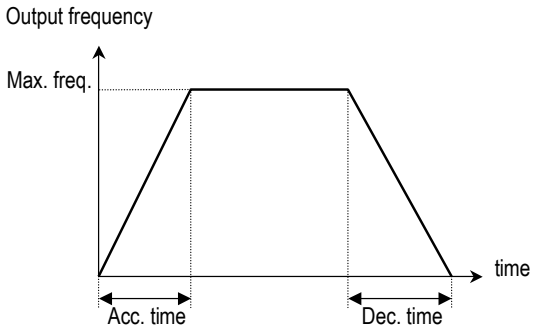
DRV-01: Acceleration Time

DRV-02: Deceleration Time

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 that the motor takes to reach FU1-20 from 0 Hz. And also the deceleration time is the time that the motor takes 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 it takes 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 binaty 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]

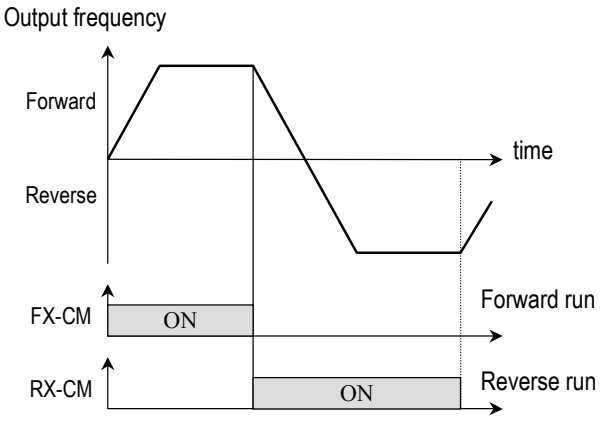
- FU1-05,FU1-06 select acc/dec pattern
- FU2-70: select the frequency to be targeted for acceleration and deceleration. [Max freq, Delta freq]
- FU2-71: select the time scale. [0.01, 0.2, 1]
- I/O-12 to I/O-14: set the terminal function of P1, P2, P3 terminal inputs.
- I/O-25 to I/O-38: preset the accel/decel time activated via multifunction inputs (P1, P2, P3)

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

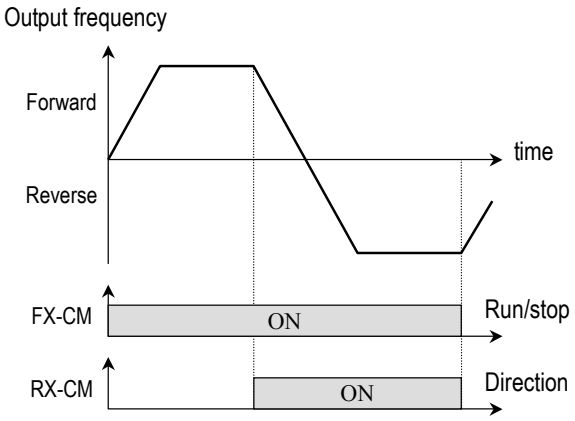
Select the source of run/stop command.

Setting range		Description
Select	Display	
Keypad	0	Run/stop is controlled by Keypad.
Fx/Rx-1	1	Run/stop is controlled by control terminals FX, RX and CM. (Method 1)
Fx/Rx-2	2	Run/stop is controlled by control terminals FX, RX and CM. (Method 2)
MODBUS-RTU	3	Run/stop is controlled by Serial Communication(MODBUS-RTU)

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



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

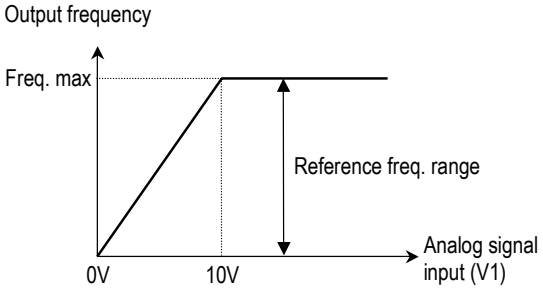
DRV-04: Frequency Mode (Frequency setting Method)

Select the source of frequency setting.

Setting range		Description
Select	Display	
Keypad-1	0	Frequency is set at DRV-00. The frequency is changed by pressing [FUNC] key and entered by pressing [FUNC] key. The inverter does not output the changed frequency until the [FUNC] key is pressed.
Keypad-2	1	Frequency is set at DRV-00. Press [FUNC] key and then by pressing the [▲], [▼] key, the inverter immediately outputs the changed frequency. Pressing the [FUNC] 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.
MODBUS-RTU	5	Frequency is set by Serial Communication(MODBUS-RTU)

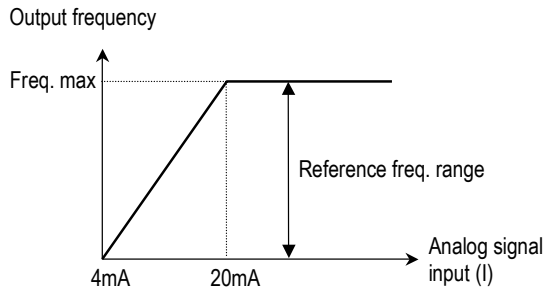
Related functions: I/O-01 to I/O-10 [Reference inputs]

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

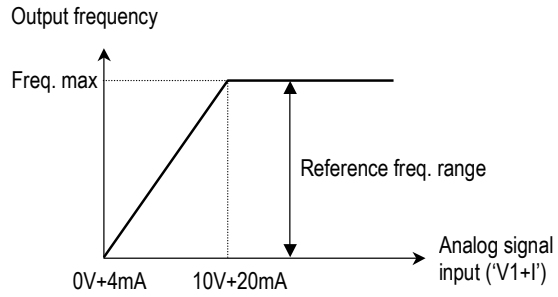


[Freq Mode: 'V1']

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[Freq Mode: 'I']

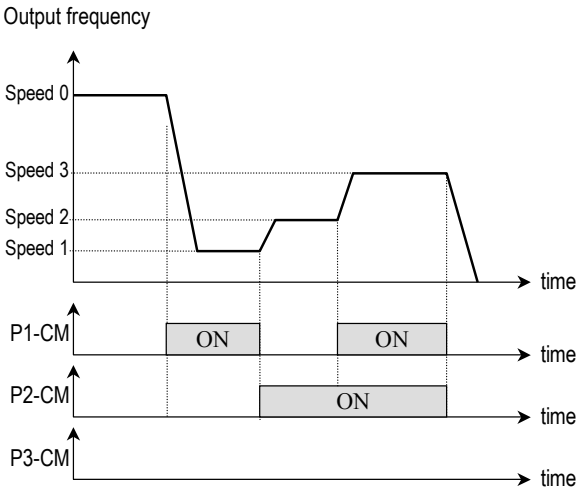


[Freq Mode: V1+'I']

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

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 frequency	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-01 to I/O-10: scaling the analog input signals (V1 and I) for frequency reference.
- I/O-17: adjust the response sensibilty of the input terminal to eleminate the noise of contact.

DRV-08: Output Current

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

DRV-09: Motor Speed

This code display the motor speed in RPM during 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 pole

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DRV-10: DC link Voltage

This code displays the DC link voltage inside the inverter.

DRV-11: User Display selection

This code display the parameter selected in FU2-73 [User Display]. There are 3 kind of parameter in FU2-73 of Voltage, Watt and Torque.

DRV-12: Fault Display

This code displays the current fault (trip) status of the inverter. Use the [FUNC], [▲] and [▼] key before pressing the [FUNC] key to check the fault content(s), output frequency, output current, and whether the inverter was accelerating, decelerating, or in constant speed at the ime of the fault occurred. Press the [FUNC] key to exit. The fault content will be stored in FU2-01 to FU2-05 when the [RESET] key is pressed.

[Fault Contents]

Fault (Trip)	Keypad display	
	Select	Display
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**
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 - FAN Lock - CPU Error - Miss Wire	HW-Diag	**HW**
External trip input B	External-B	**EXTB**
Output Phase loss	Phase Open	**PO**
Inverter Over-load	Inv. OLT	**IOLT**
Intput Phase open	Phase Open	**COL**

☞ **Note:** 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: FU2-01 to FU2-05 [Previous Fault History]
FU2-06 [Erase Fault History]

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

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

This code sets the motor direction.

7-Segment Display	Description
F	Run to forward direction
r	Run to reverse direction

DRV-20: FU1 Group selection

DRV-21: FU2 Group selection

DRV-22: I/O Group selection

Select the desired group and press the [FUNC] key to move into the desired group. The parameter in the group can be read and written after moving into the desired group.

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4.2 Function 1 Group [FU1]

FU1-00: Jump to desired code

Any parameter code can be jumped to directly by entering the desired code number.

FU1-03: Run Prevention

This function prevents the motor from rotating at opposite directions. This function can be used for loads that rotate only in one direction such as fans and pumps.

Setting range		Description
Select	Display	
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

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

Setting range		Description
Select	Display	
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 take 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 the application like winding machines.
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 GD² 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.

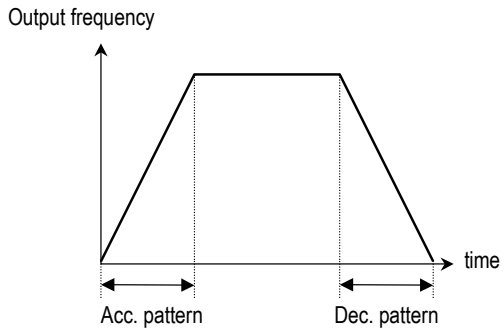
☞ **Note:** In case of selecting the 'Minimum' or 'Optimum', the DRV-01 and DRV-02 is ignored.

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

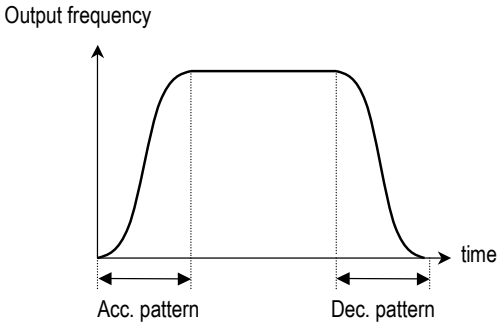
☞ **Note:** 'Optimum' is useful when the motor capacity is smaller than the inverter capacity.

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

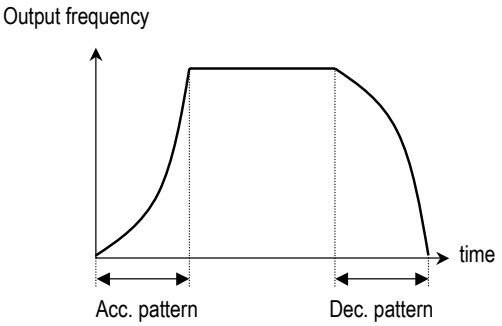
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[Accel/Decel Pattern: 'Linear']



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

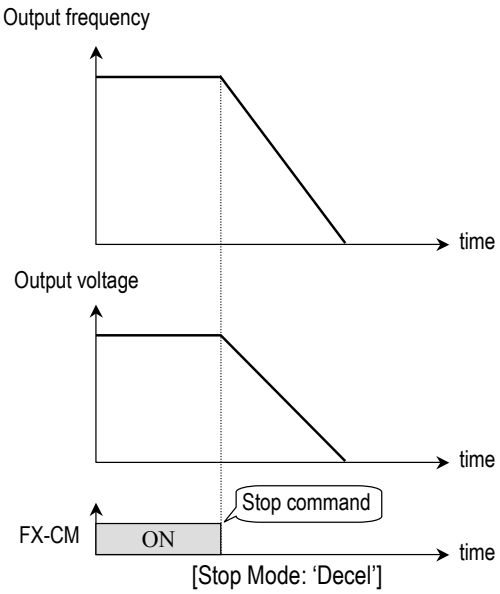


[Accel/Decel Pattern: 'U-curve']

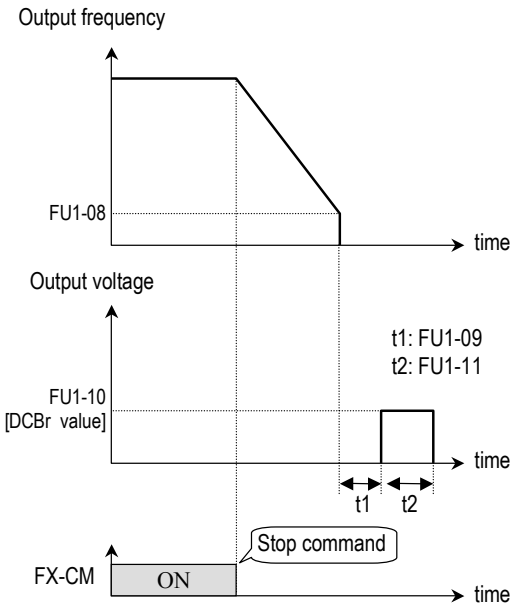
FU1-07: Stop Mode

Setting Range		Description
Select	Display	
Decel	0	Inverter stops by the decelaration pattern.
DC-brake	1	Inverter stops with DC injector braking. Inverter Outputs DC voltage when the frequency reached the DC injection braking frequency set in FUI-08 during decelaration:
Free-run (Coast to stop)	2	Inverter cuts off its immediately when the stop signal is entered.

Sets the stopping method for the inverter.

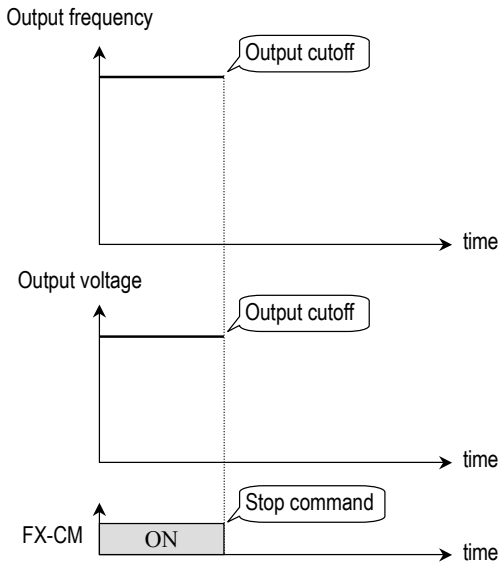


[Stop Mode: 'Decel']



[Stop Mode: 'Dc-brake']

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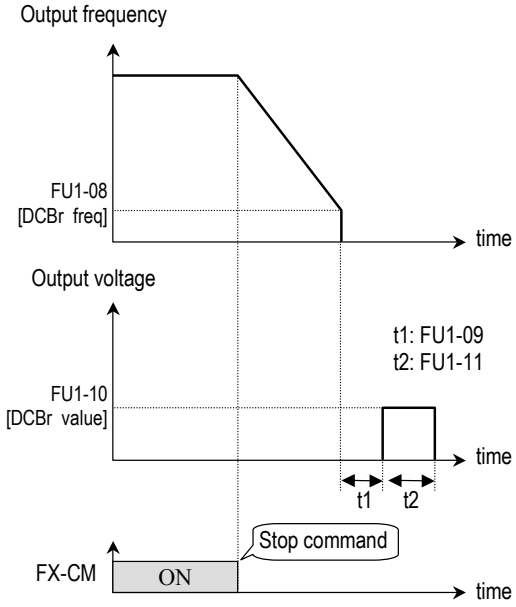


[[Stop Mode: 'Free-run']

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

This function is used to stop the motor immediately by introducing DC voltage to the motor. 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 decelerating.
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 the FU2-33 [Rated Current of Motor].
FU1-11 [DC Injection Braking Time] is the time the DC current is applied to the motor.

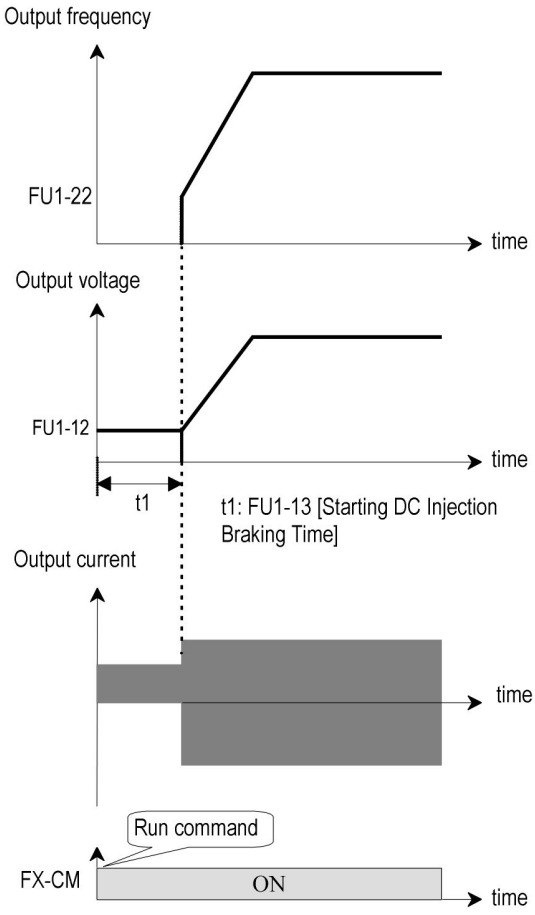


[DC Injection Braking Operation]

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

The inverter 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.

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[Starting DC Injection Braking Operation]

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

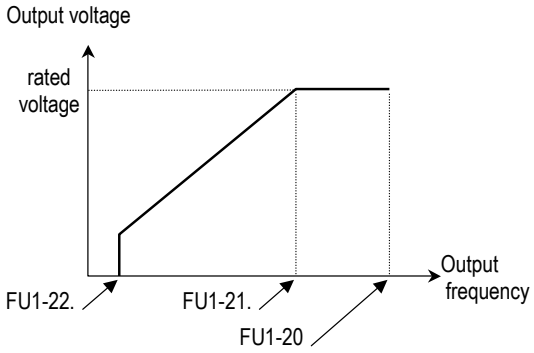
☞ **Note:** The DC injection braking function does not function when either FU1-12 or FU1-13 is set to "0".

☞ **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

FU1-20 [Maximum Frequency] is the maximum output frequency of the inverter. Make sure that this maximum frequency does not exceed the rated speed of motor.

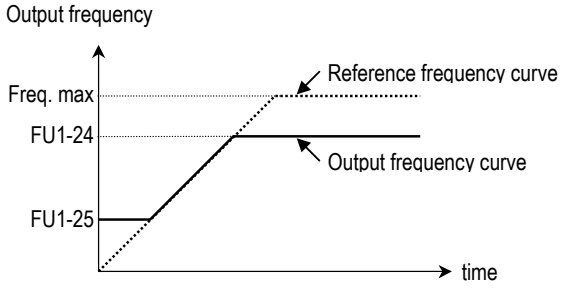
FU1-21 [Base Frequency] is the frequency that inverter outputs its rated voltage. In case of using 50Hz motor, set this to 50Hz.
FU1-22 [Starting Frequency] is the frequency that inverter starts to output the voltage.



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

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

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. 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.

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

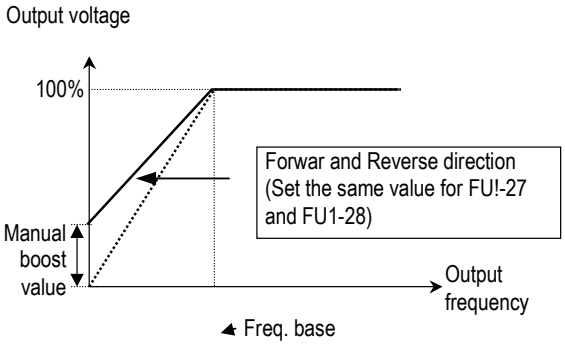
This function is used to increase the starting torque at low speed by increasing the output voltage of inverter. If the boost value is set too high than required, it may cause the motor flux to saturate causing over-current trip. Increase the boost value when the distance between inverter and motor is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

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

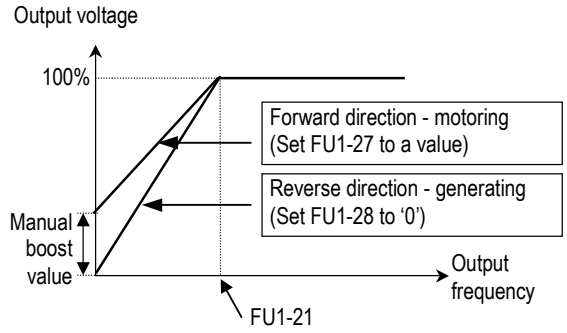
☞ **Note:** The torque boost value is the percentage of inverter rated voltage.
☞ **Note:** When FU1-29 [Volts/Hz Pattern] is set to 'User V/F', this function does not work.

[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. For the 2nd motor, Manual torque boost must be used.
☞ **Note:** The auto torque boost value is added to the manual torque boost value.



[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

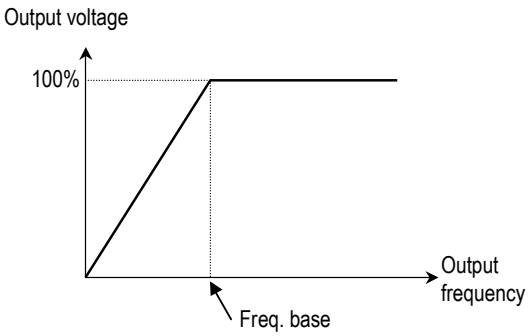
This is the pattern of voltage / frequency ratio. Select the proper V/F pattern according to the load. The motor torque is dependent on this V/F pattern.

[Linear] pattern is used where constant torque is required. This pattern maintains a linear volts/hertz ratio from zero to base frequency. This pattern applies to conveyor, parking facility etc.
[Square] pattern is used where variable torque is required. This pattern maintains squared volts/hertz ratio. This pattern applies to fan, pump etc.

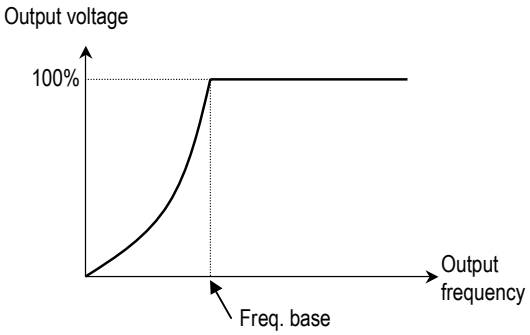
[User V/F] pattern is used for special applications.

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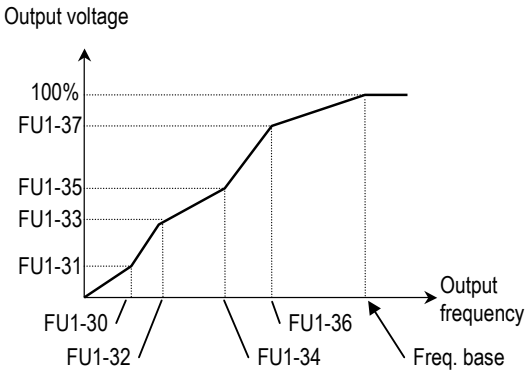
Users can adjust the volts/hertz ratio according to applications. This is done by setting the voltage and hertz, respectively, at four points between starting frequency and base frequency.
The four points of voltage and hertz are set in FU1-30 through FU1-37.



[V/F Pattern: 'Linear']



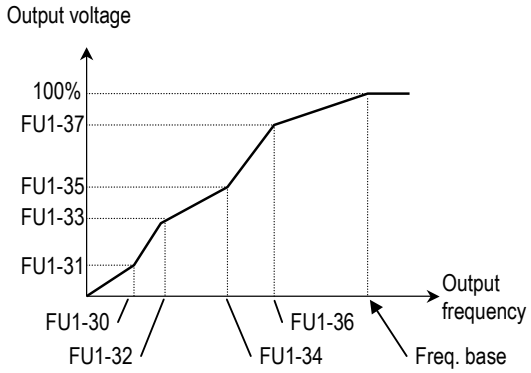
[V/F Pattern: 'Square']



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

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

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].

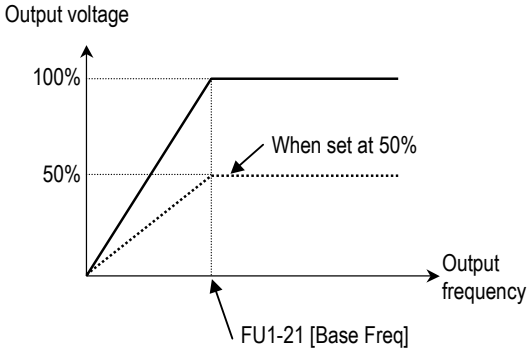


[User V/F]

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

FU1-38: Output Voltage Adjustment

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

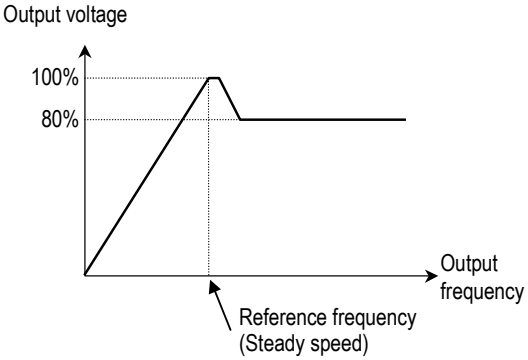


☞ Note: the inverter output voltage does not exceed the main input voltage, even though FU1-38 is set at 110%.

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FU1-39: Energy Save Level

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

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 relay. Inverter calculates the temperature rising of the motor using several parameters and judges using the load current whether the motor is overheated. Inverter cuts off its output and displays a trip message when the electronic thermal function is operated.

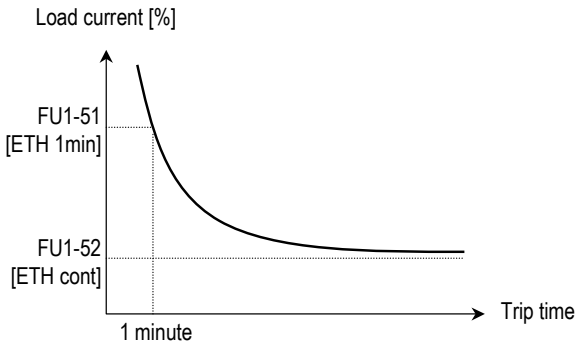
FU1-50 activates the ETH parameters by setting 'Yes'.

FU1-51 is the reference current when the inverter determines that the motor is overheated. Inverter is tripped in 1 minute when 150% of rated motor current set in FU2-33 flows for 1 minute.

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

FU1-52 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].



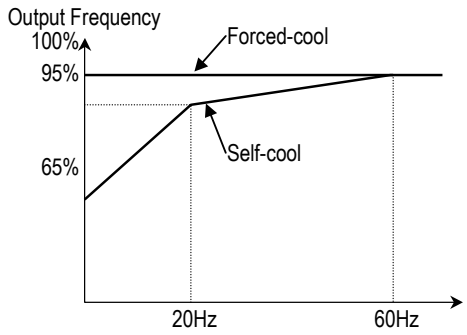
[Motor i²t Characteristic Curve]

FU1-53: To make the ETH function (Motor i^2t) work correctly, 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 motor shaft. The cooling effects of this type of motor decrease when the motor is running at low speed. The motor current is derated as the motor speed decrease.

[Forced-cool] is a motor that has a separate power to the cooling fan. The cooling effects of this type of motor do not change as the motor speed changes.

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[Load Current Derating Curve]

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

Related functions:	FU2-33 [Rated Motor Current]

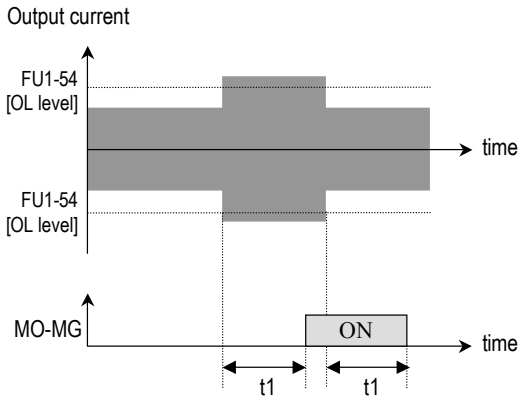
FU1-54: Overload Warning Level
FU1-55: Overload Warning Time

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 though the current has become the level below the FU1-54.

Multi-function output terminal (MO-MG) 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]

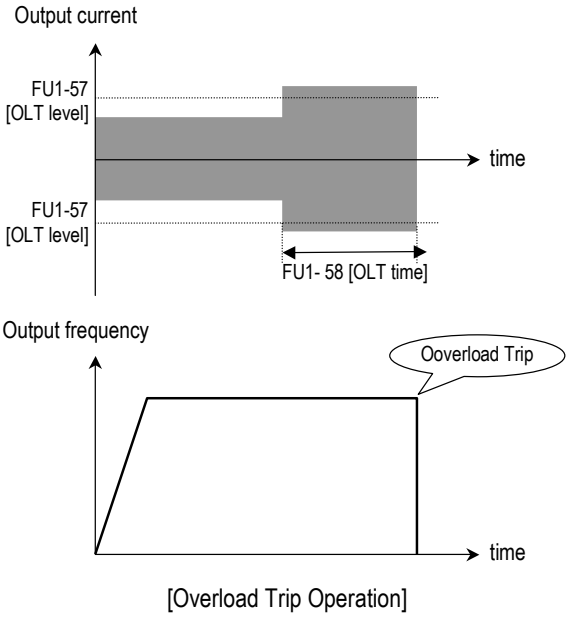
Related functions:	FU2-33 [Rated Motor Current] I/O-44 [Multi-function Auxiliary Contact Output]

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

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 inverter and motor from abnormal load conditions.

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

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[Overload Trip Operation]

Related functions:	FU2-33 [Rated Motor Current]

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

FU1-59 follows the conventions used in I/O-15 and I/O-16 to show the ON (bit set) status with the 7-sengment keypad throughout this manual.

FU1-60 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]

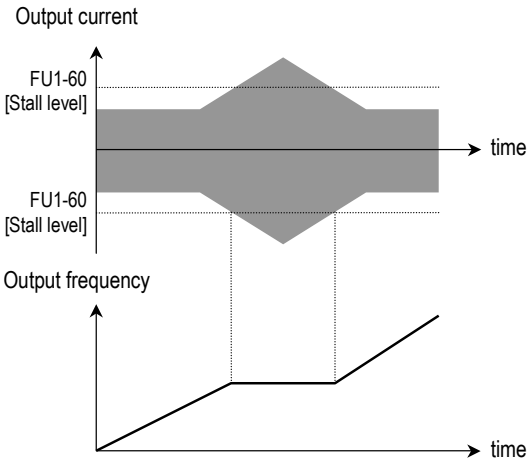
Setting range			FU1-59	Description
3rd bit	2nd bit	1st bit		
0	0	1	001	Stall Prevention during Acceleration
0	1	0	010	Stall Prevention during Steady Speed
1	0	0	100	Stall Prevention during Deceleration

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

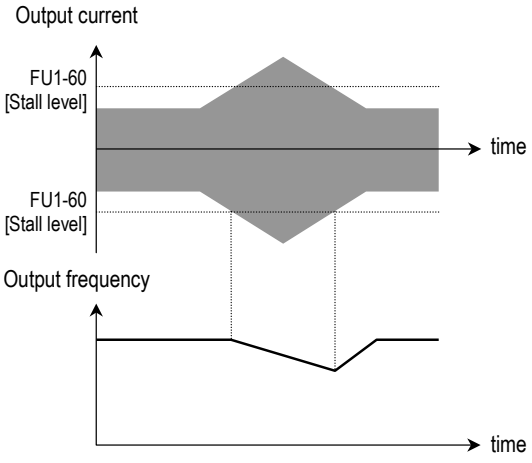
☞ Note: the acceleration and deceleration time may take longer than the time set in DRV-01, DRV-02 when Stall Prevention is selected.

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

Related functions:	FU2-33 [Rated Motor Current]

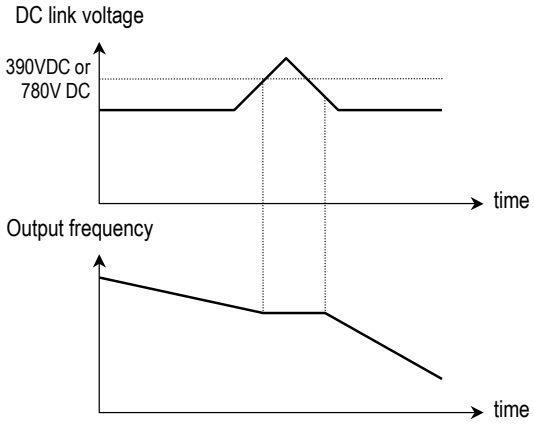


[Stall Prevention during Acceleration]



[Stall Prevention during Steady Speed]

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[Stall Prevention during Deceleration]

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

This code is used to exit a group when using a 7-segment keypad.

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

4.3 Function 2 Group [FU2]

FU2-00: Jump to desired code #

Any parameter code can be jumped to directly by entering the desired code number.

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

This code displays the previous fault (trip) status of the inverter up to five. Use the [FUNC], [▲] 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 [FUNC] key to exit. The fault content will be stored in FU2-01 through FU2-05 when the [RESET] key is pressed.

[Fault Contents]

Fault (Trip)	Keypad display	
	Select	Display
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**
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 - FAN Lock - CPU Error - Miss Wire	HW-Diag	**HW**
External trip input B	External-B	**EXTB**
Output Phase loss	Phase Open	**PO**
Inverter Over-load	Inv. OLT	**IOLT**
Intput Phase open	Phase Open	**COL**

☞ **Note:** 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.

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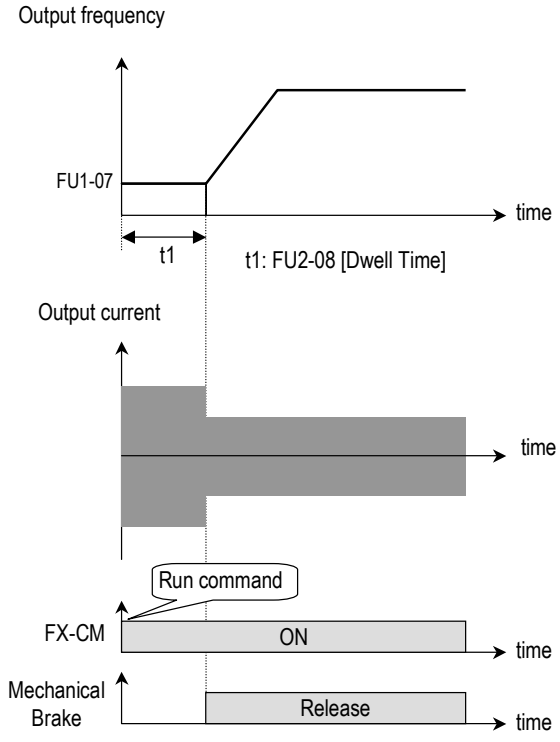
Related functions:	DRV-12 [Fault Display] displays current fault status.

FU2-06 erases all fault histories of FU2-01 to FU-05 from the memory.

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

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

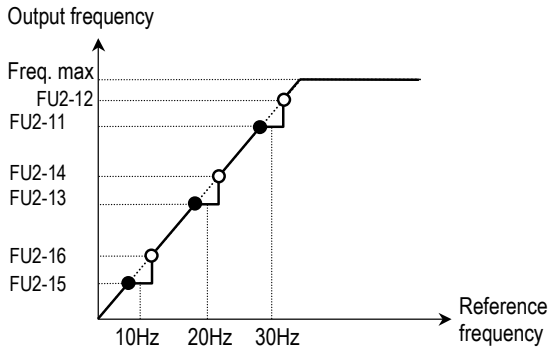
☞ Note: DC Injection Braking does not output a torque to an intended direction. It is just to hold the motor.



[Dwell Operation]

FU2-10 ~ FU2-16: Frequency Jump

To prevent undesirable resonance and vibration on the structure of the machine, this function locks out the resonance frequency from operation. Three different jump frequency rages can be set. This jumping of frequencies does not occur during accelerating or decelerating. It only occurs during continuos operation.



☞ **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 one range.

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

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

FU2-19 [Phase Loss Protection select]

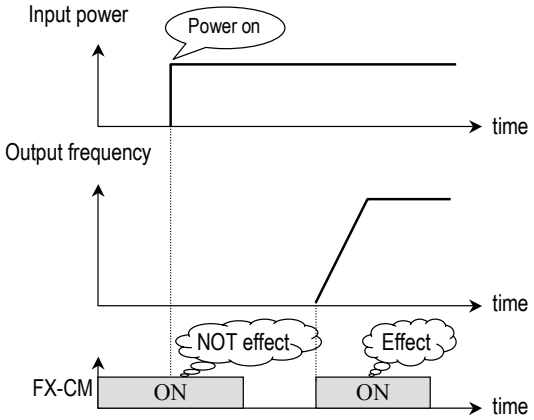
Setting range		FU2-19	Description
2nd bit	1st bit		
0	0	00	Phase loss protection does not work
0	1	01	Protect inverter from output phase loss
1	0	10	Protect inverter from input phase loss
1	1	11	Protect inverter from input and output phase loss

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

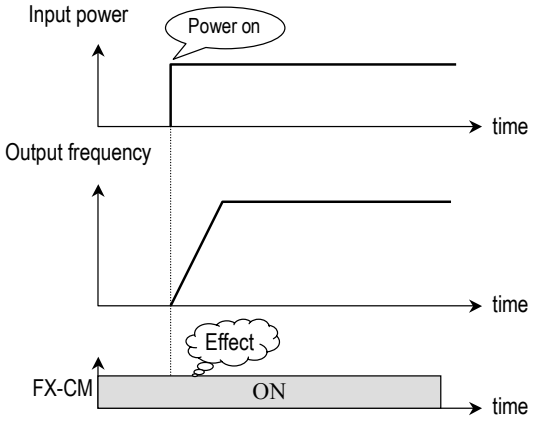
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FU2-20: Power ON Start selection

If set to 'No', the FX or RX terminal should be connected to CM terminal again after power is restored.
If set to 'Yes', the drive will restart after power is restored. If the motor is rotating by inertia at the time of power restore, inverter may be tripped. To avoid this trip, use 'Speed Search' functions by setting FU2-22 to '1xxx'.



[Power ON Start: 'No']



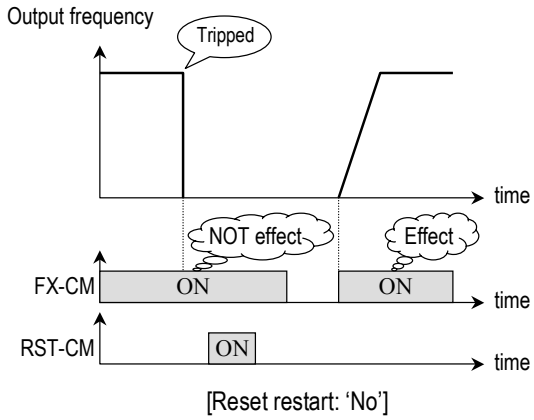
[Power ON Start: 'Yes']

☞ **Note:** In case of using 'Power ON Start' to 'Yes', make sure to place a notice near the motor like "Don't touch the motor".

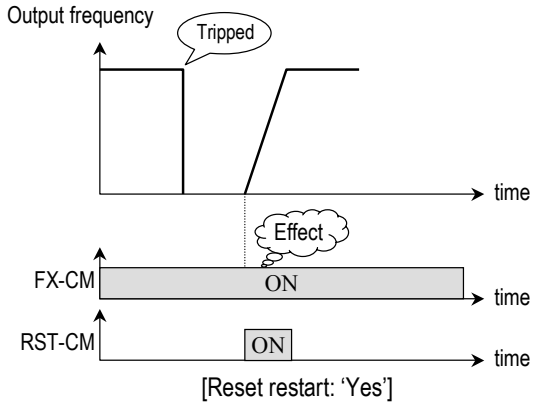
Related functions:	FU2-22 ~ FU2-25 [Speed Search]

FU2-21: Restart after Fault Reset

If FU2-21 is set to 'Yes', inverter will restart after the RST (reset) terminal has reset a fault.
If set to 'No', the FX or RX terminal should be connected to CM terminal again after resetting the fault. If the motor is rotating by inertia at the time of power restore, inverter may be tripped. To avoid this trip, use 'Speed Search' functions by setting FU2-22 to 'xx1x'.



[Reset restart: 'No']



[Reset restart: 'Yes']

☞ **Note:** In case of using 'Reset restart' to 'Yes', be sure to check safety before resetting a fault.

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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

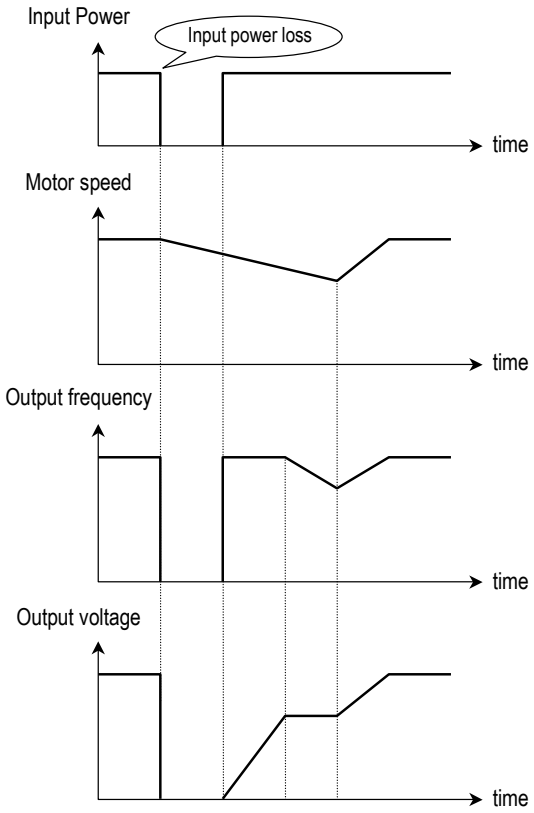
This function is used to permit automatic restarting after Power ON, Fault Reset and Instant Power Failure without waiting for the motor to stop.
The speed search gain should be set after considering the inertia moment (GD^2) and magnitude of torque of the load. FU2-37 [Load Inertia] must be set at the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

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 which inverter limits its current rising to 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 searching. Set this value considering the load inertia set in FU2-37.
FU2-25 [I Gain] is the Integral gain used for speed searching. Set this value considering the load inertia set in FU2-37.



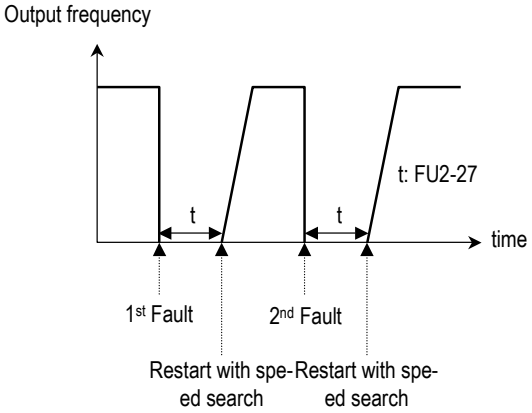
[Speed Search Operation]

Related functions:	FU2-20 [PowerON 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

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

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

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 set in according to its model name before shipping.

FU2-30 sets the motor capacity. Other motor related parameters are changed automatically according to this 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.

FU2-32 is used to display the motor speed. If you set this value to 2, inverter will display 3000 rpm instead 1500rpm at 50Hz output frequency. (See motor name plate)

FU2-32 is used in 'Slip Compensation' control. If you set this value incorrectly, motor may be stalled during slip compensation control. (See motor name plate)

FU2-33 is very importance parameter that must be set correctly. This value is referenced in many functions of the inverter. (See motor name plate)

FU2-34 is only displayed when 'Slip Compen' is selected in FU2-40 [Control Method].
(This value is set according to the motor capacity set in FU2-30)

Slip compensation is used to maintain the motor speed constantly. 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.

FU2-36 is used for calculating the output wattage when FU2-72 is set to 'Watt'.
(This value is set according to the motor capacity set in FU2-30)

FU2-37 is used for 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 having load inertia less than 10 times of motor inertia.
Set '1' for loads that having load inertia about 10 times of motor inertia.
Set '2' for loads that having load inertia larger than 10 times of motor inertia.
If the application requires more rapid deceleration, use dynamic braking unit or resistor.

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FU2-39: Carrier Frequency

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

☞ Note: If this value must be set higher than 3 kHz, derate the load current by 5% per 1 kHz.

FU2-40: Control Method selection

This is to select the control method of inverter.

Setting range		Description
Select	Display	
V/F	**0**	Volts/Hz Control
Slip compen	**1**	Slip compensation operation
PID	**2**	PID feedback operation

[V/F]: This is to control the voltage/frequency ratio constantly. It is recommended to use torque boost function when a lager starting torque is required.

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

[Slip compen]: This is used to maintain the motor speed constantly. 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]

[PID]: 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 form of Speed, Temperature, Pressure, Flow level, etc. Both the 'Set-point' and the feedback signals are provided externally to the inverter analog input terminals V1, V2 or I. The drive compares the signals in calculating 'total-error' which is reflected in the inverter output.
Please see FU2-50 to FU2-54 for more detail.

Related functions:	FU2-50 ~ FU2-54 [PID Feedback]

FU2-50: PID Feedback Signal selection
FU2-51: P Gain for PID Control
FU2-52: I Gain for PID Control
FU2-53: D Gain for PID Control
FU2-54: Limit Frequency for 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 form of Speed, Temperature, Pressure, Flow level, etc. Both the 'Set-point' and the feedback signals are provided externally to the inverter analog input terminals V1 or I. The drive compares the signals in calculating 'total-error' which is reflected in the inverter output. To use this function, FU2-40 must be set to 'PID'.

☞ 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.

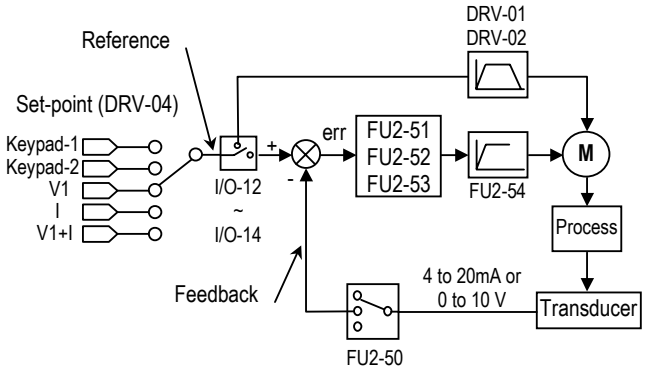
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FU2-50 selects the feedback signal for PID control. This can be set one of 'I'and 'V1' according to the signal (current or voltage)
FU2-51 sets the proportional gain for PID control.

FU2-52 sets the integral gain for PID control.

FU2-53 sets the differential gain for PID control.

FU2-54 is the frequency at which the output frequency is limited during PID control.



[PID Control Block Diagram]

[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 works stable in many systems. If D control added to this control, it becomes the 3rd order system from the 2nd order system. This may make the system unstable.

[D Control]
Since the D control uses the variation ratio of error, it has the merit of controlling the error before the error gets 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 itself, it cannot be used alone. Always use it with the P control or PI control.

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

FU2-70: Reference Frequency for Accel/Decel

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
Select	**Display**	
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]

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FU2-71: Accel/Decel Time Scale

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
Select	Display	
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

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

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

Setting range		Description
Select	Display	
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

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]

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

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

Setting range		Description
SELCT	7-Seg	
None	**0**	This is selected when there is no resistor connected. At this time, inverter does not generate DB turn on signal.
None	**1**	
Ext. DB-R	**2**	This is selected when using an external DB resistor. This must be selected for 0.5~5.4 HP inverters. 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 overvoltage 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].

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

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

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 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. Overvoltage or overcurrent 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.

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

This is useful when programming inverters to have same parameter settings. The keypad can read (upload) the parameter settings from the inverter memory and can write (download) them to other inverters.

FU2-93: Parameter Initialize

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

Setting range		Description
Select	Display	
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.

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

FU2-94: Parameter Write Protection

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

FU2-99: Return Code

This code is used to exit a group. Pressing [FUNC] key exits the parameter group.

Related functions:	FU1-99 [Return Code] I/O-99 [Return Code]

4.4 Input/Output Group [I/O]

I/O-00: Jump to desired code

Any parameter code can be jumped to directly by entering the desired code number.

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-01 is the filtering time constant for V1 signal input. If the V1 signal is affected by a noise causing unstable operation of the inverter, increase this value. Increasing this value makes response time slow.

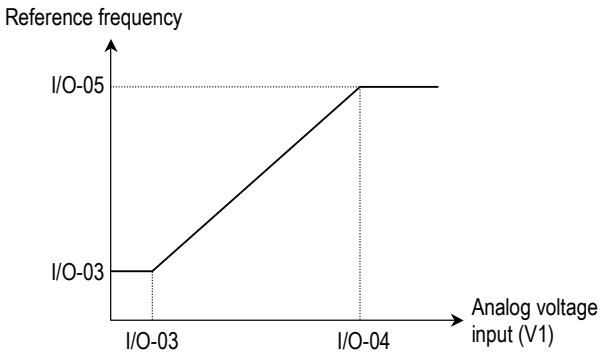
I/O-02 is the minimum voltage of the V1 input at which inverter outputs minimum frequency.

I/O-03 is the minimum frequency inverter output when there is the minimum voltage (I/O-02) on V1 terminal.

I/O-04 is the maximum voltage of the V1 input at which inverter outputs maximum frequency.

I/O-05 is the maximum frequency inverter output when there is the maximum voltage (I/O-04) on V1 terminal.

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[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

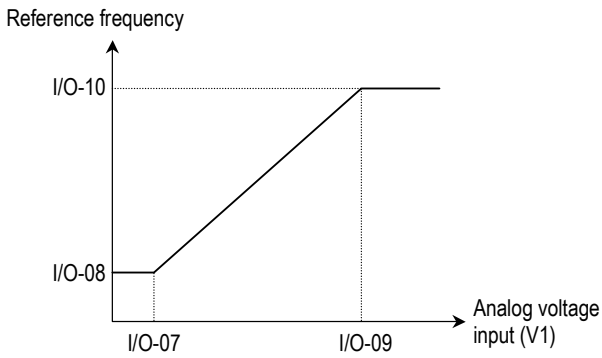
This is used to adjust the analog current input signal when the frequency is referenced by the control terminal 'I'. This function is applied when DRV-04 is set to 'V1' or V1+I'. Reference frequency versus Analog current input curve can be made by four parameters of I/O-07 ~ I/O-10.

I/O-06 is the filtering time constant for I signal input. If the I signal is affected by a noise causing unstable operation of the inverter, increase this value. Increasing this value makes response time slow.

I/O-07 is the minimum current of the I input at which inverter outputs minimum frequency.

I/O-08 is the minimum frequency inverter outputs when there is the minimum current (I/O-07) on I terminal.

I/O-09 is the maximum current of the I input at which inverter outputs maximum frequency.
I/O-10 is the maximum frequency inverter outputs when there is the maximum current (I/O-09) on 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

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
Select	**Display**	
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 '___**L**' in keypad.

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

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Setting range		Description
Select	Display	
None	0	Continues 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 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

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

Setting range		Description
Select	Display	
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
-Reserved-	8	Reserved for future use
-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
-Reserved-	15	Reserved for future use
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
-Reserved-	20	Reserved for future use

[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, P3 terminals as following table.

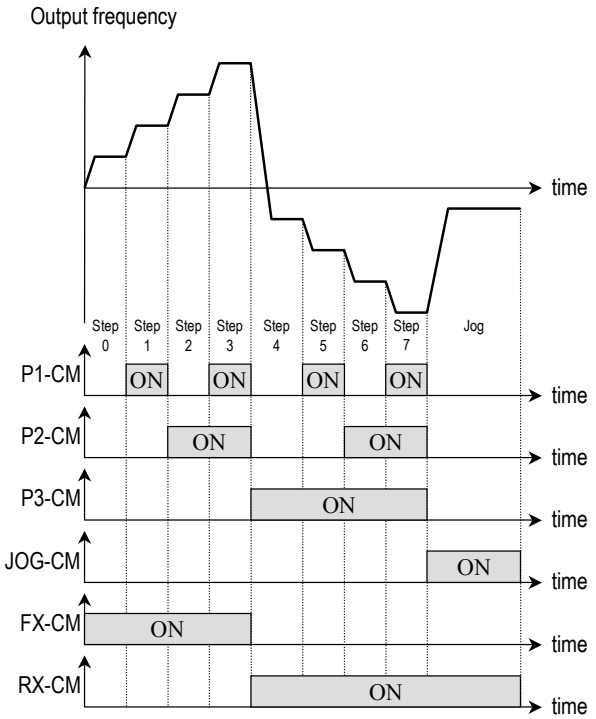
Step Frequency	Parameter Code	Speed-H (P3)	Speed-M (P2)	Speed-L (P1)
Step Freq-0	DRV-00	0	0	0
Step Freq-1	DRV-05	0	0	1
Step Freq-2	DRV-06	0	1	0
Step Freq-3	DRV-07	0	1	1
Step Freq-4	I/O-21	1	0	0
Step Freq-5	I/O-22	1	0	1
Step Freq-6	I/O-23	1	1	0
Step Freq-7	I/O-24	1	1	1

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 regard other terminal inputs.

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[Multi-Step Frequency Operation]

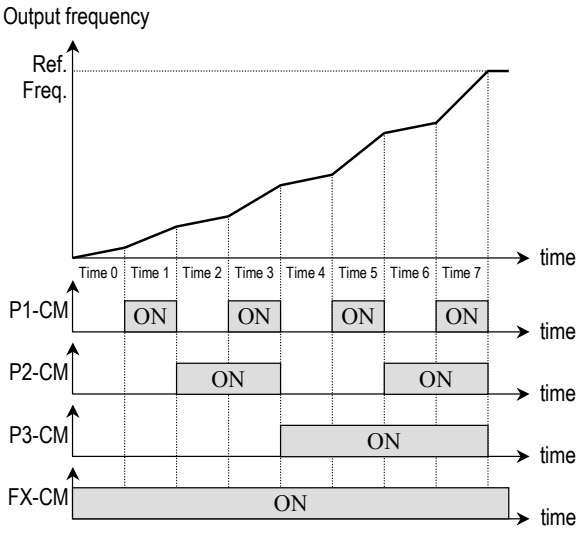
Related functions:	DRV-05 ~ DRV-07 [Step Frequency] I/O-20 [Jog Frequency] I/O-20 ~ I/O-24 [Step Frequency]

[XCEL-L, XCEL-M, XCEL-H]
By setting P1, P2, P3 terminals to 'XCEL-L', 'XCEL-M' and 'XCEL-H' respectively, up to 8 different accel and decel time 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, P3 terminals as 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

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



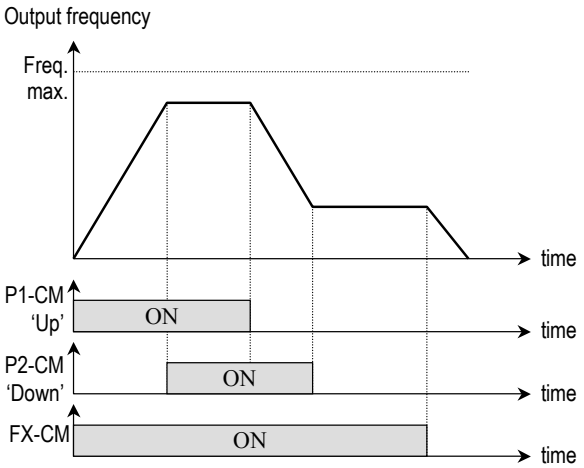
[Multi-Accel/Decel Time Operation]

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 terminal (P1, P2, P3) to 'Dc-bake'. To activate the DC Injection Braking, Contact the terminal while the inverter is stopped.

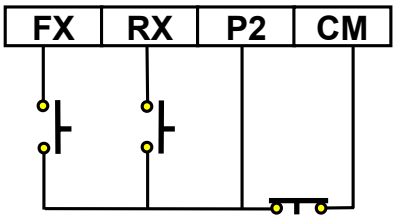
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[Up, Down]
By using the Up and Down function, the drive can accelerate to a steady speed and decelerate down to a desired speed by using only two input terminals.

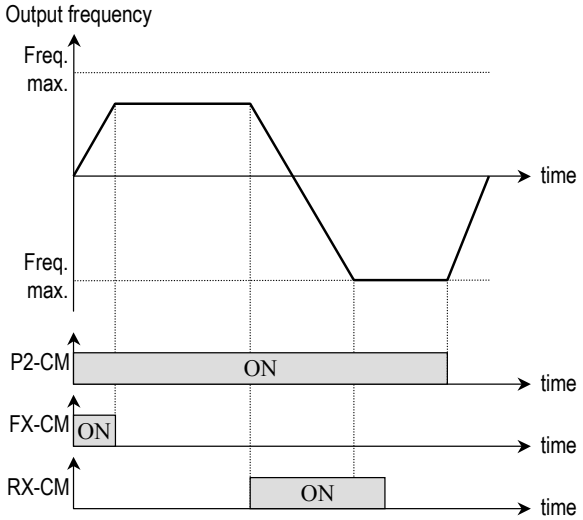


[Up/Down Operation]

[3-Wire]
This function is for 3-wire star/stop operation.
This function is mainly used as 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 normal 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 normal close 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.

[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.

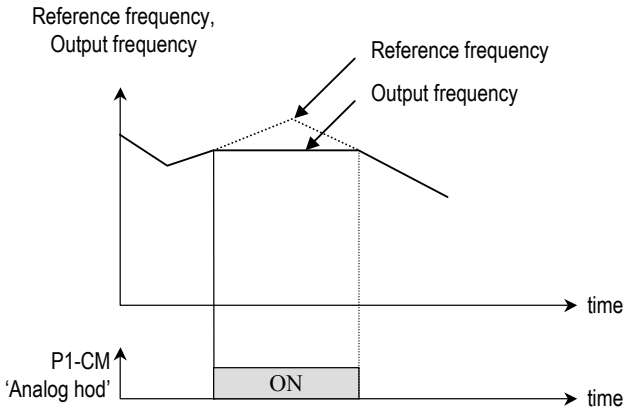
☞ Note: this function can be used only when the inverter is stopped.

[Main-drive]
The inverter operation can be changed to manual operation using this function without changing parameters.
DRV-04 [Frequency Mode] and DRV-03 [Drive Mode] are applied when the mode has been changed.

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

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[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.

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

I/O-15 displays the input status of control terminals.

I/O-16 displays the output status of control terminals.

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

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

I/O-20: Jog Frequency

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

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-funtion inputs] I/O-17 [Filtering Time Constant]

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

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-funtion inputs]

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

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

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

* Max. Output voltage is 220V for 230V class inverters and 440V for 460V class inverters.

[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

* Max. DC link voltage is 400V for 230V class inverters and 800V for 460V class inverters.

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

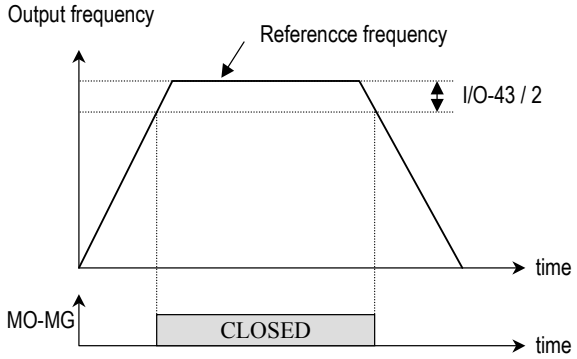
These functions are used in I/O-44 [Multi-function Output]. See [FDT-#] in I/O-44.

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

I/O-44: Multi-function Output define (MO)

Setting range		Description
Select	Display	
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	Overvoltage 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
Reserved	15	Reserved for future use
Reserved	16	
Ssearch	17	Speed search mode detection
Reserved	18	Reserved for future use
Reserved	19	Reserved for future use
Reserved	20	

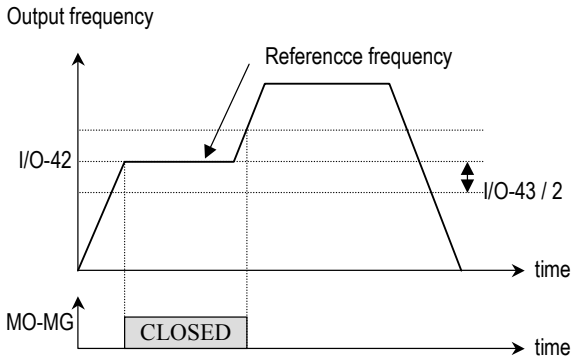
[FDT-1]
When the output frequency reaches the reference frequency (target frequency), MO-MG terminal is CLOSED.



[MO configured as 'FDT-1']

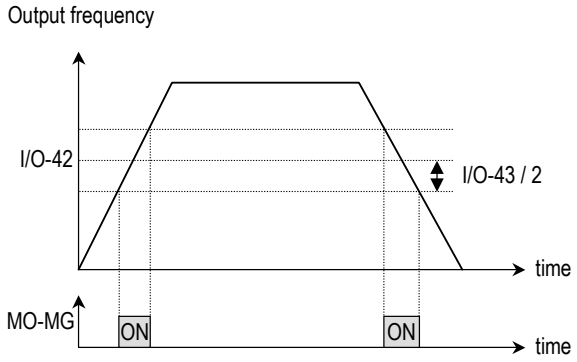
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[FDT-2]
MO-MG is CLOSED when the reference frequency is in I/O-43 [FDT Bandwidth] centered on I/O-42 [FDT Frequency], and the output frequency reaches I/O-43 centered on I/O-42.



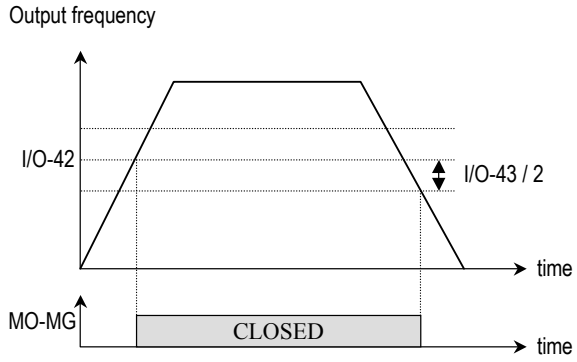
[MO configured as 'FDT-2']

[FDT-3]
MO-MG 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.



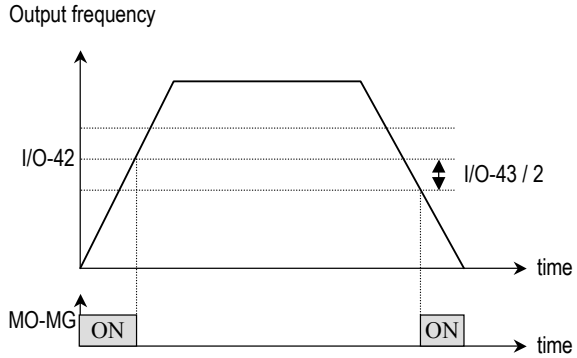
[MO configured as 'FDT-3']

[FDT-4]
MO-MG 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.



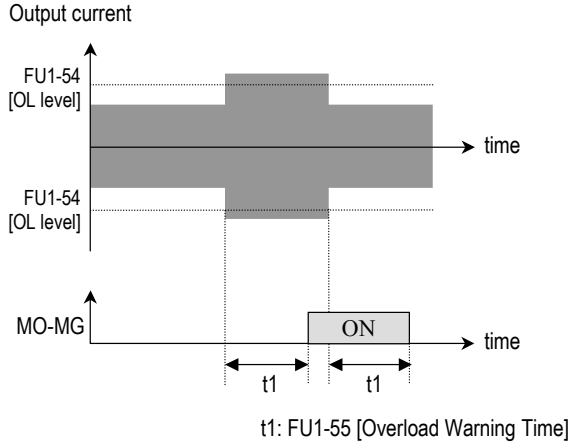
[MO configured as 'FDT-4']

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



[MO configured as 'FDT-5']

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

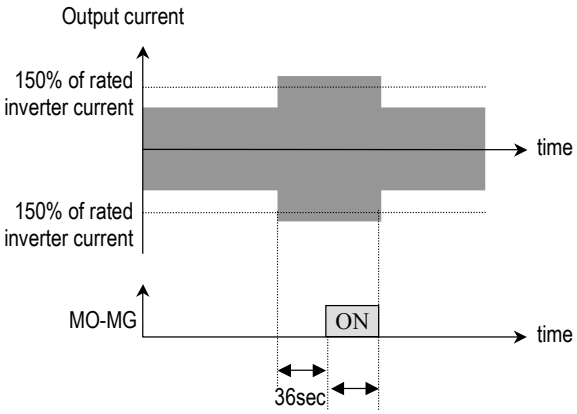


[MO configured as 'OL']

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

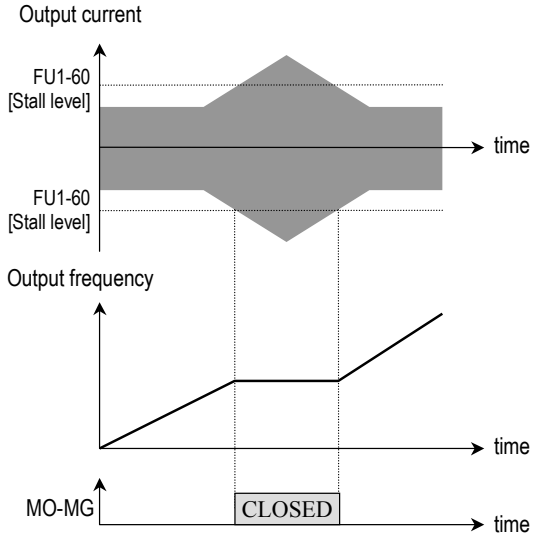
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[IOL]
MO-MG is CLOSED when the output current is above the 150% of rated inverter current for 36 seconds. If this situation is continued for 1 minute, inverter will cut off its output and displays 'IOL' (Inverter over-load) Trip. See the name plate for the rated inverter current.



[MO configured as 'IOL']

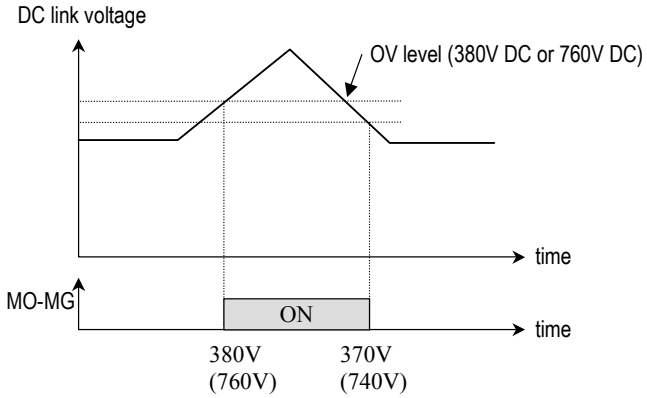
[Stall]
MO-MG is CLOSED when the inverter is in the stall prevention mode.



[MO configured as 'Stall']

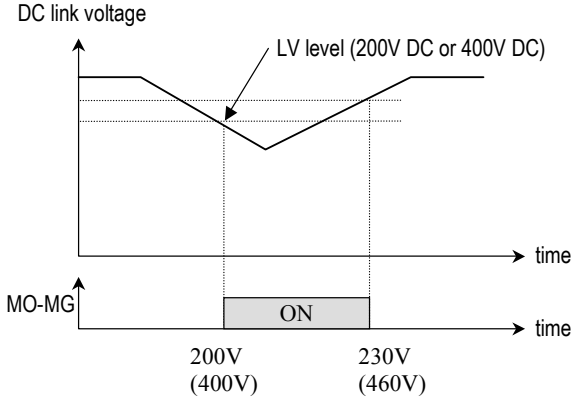
Related functions:	FU1-59 [Stall Prevention Mode] FU1-60 [Stall Prevention Level]

[OV]
MO-MG is CLOSED when the DC link voltage is above the Over-voltage level.



[MG configured as 'OV']

[LV]
MO-MG is CLOSED when the DC link voltage is below the Low-voltage level.



[MO configured as 'LV']

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

[Lost Command]
MO-MG is CLOSED when frequency reference is lost.

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

[Run]
MO-MG is CLOED when the inverter is running.

[Stop]
MO-MG is CLOED when the inverter is stopped.

[Search]
MO-MG is CLOSED during the inverter is speed searching.

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

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 normal open contact and 30B-30C is normal close 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-46 sets the inverter number. This number is used in communication between inverter and computer.

I/O-47 sets the communication speed. This is used in communication between inverter and computer.

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

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
Select	Display	
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-49 is the time with which inverter determine whether there is a frequency reference or not. If there is a frequency reference satisfying I/O-11 during this time, inverter determines that it is the loss of frequency reference.

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

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I/O-50: Communication Protocol selection

I/O-50 is to select the RS485 communication protocol properties with range between 0-9.

Setting range		Description
Select	Display	
RESERVED	0	
Modbus ASCII	1	<7bit data,No parity,2Stop>
Modbus ASCII	2	<7bit data,Even parity,1Stop>
Modbus ASCII	3	<7bit data,Odd parity,1Stop>
Modbus ASCII	4	<8bit data,No parity,2Stop>
Modbus ASCII	5	<8bit data,Even parity,1Stop>
Modbus ASCII	6	<8bit data,Odd parity,1Stop>
Modbus RTU	7	<8bit data,No parity,2Stop>
Modbus RTU	8	<8bit data,Even parity,1Stop>
Modbus RTU	9	<8bit data,Odd parity,1Stop>

This parameter can be set during operation.

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CHAPTER 5 - TROUBLESHOOTING & MAINTENANCE

5.1 Fault Display

When a fault occurs, the inverter cuts 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.

Display	Protective function	Description
OC	Over Current Protection	The inverter cuts off its output when the output current of the inverter flows more than 200% of the inverter rated current.
Ov	Over voltage protection	The inverter cuts 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.
OLt	Current Limit Protection (Overload Protection)	The inverter cuts 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).
OH	Heat Sink Over Heat	The inverter cuts 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.
EtH	Electronic Thermal	The internal electronic thermal of the inverter determines the over heating of the motor if the motor is overloaded and the inverter cuts 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
Lv	Low Voltage Protection	The inverter cuts 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.
COL	Input Phase Open	The inverter cuts off the output when one or more of the input(R, S, T) phase is open and the output load is over 50% of the inverter rated current for more than 1 minute. The inverter checks whether the phase is open by detecting the DC voltage of the main circuit.
OPO	Output Phase open	The inverter cuts 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.
bb	BX Protection (instant cut off)	Use for the emergency stop of the inverter. The inverter instantly cuts 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.
IOLt	Inverter Overload	The inverter cuts off its output when the output current of the inverter flows more than the rated level .
Et A	External fault A	Use this function if the user needs to cut off the output by an external fault signal. (Normal Open Contact)
Et b	External fault B	Use this function if the user needs to cut off the output by an external fault signal. (Normal Close Contact)
---L	Operating Method when the Frequency Reference is Lost	There are 3 modes, continue operation, decelerate and stop, and free run, according to the I/O-48 [Operating Method when the Frequency Reference is Lost] setting.
E01	EEPROM Error 1	The EEPROM of keypad has a fault causing parameter read/write error.
E02	EEPROM Error 2	The ROM version of inverter and keypad is different.
HW	Inverter H/W Fault	A fault signal is outputted 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
CPU2	CPU Error	The CPU has a fault.
EEP	EEP Error	The EEPROM on inverter main baord has a fault.

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Display	Protective function	Description
WI rE	Mis-wiring	The input/otuput wiring of inverter is wrong.
FAn	Fan fault	The cooling fan does not lotate.

Note: “HW” is displayed when “FAN”, “WIRE”, “EEP”, “CPU2” faults occur. Use “FUNC”, “UP”, “UP”, “UP” keys to see the detailed fault contents.

5.1.1 Operating Method and Fault Display when the Frequency Reference is Lost

■ **The I/O-48 [Operating Method when the Frequency Reference is Lost] has the following functions**

I/O-48 setting	Function description
0 (None)	Continues operation when the frequency reference is lost (Factory default)
1 (FreeRun)	Free runs and stops when the frequency reference is lost.
2 (Stop)	Decelerates and stops when the frequency reference is lost.

■ **Keypad display when the reference is lost**

Keypad Display	Contents
___L	Displayed when V1 analog frequency reference is lost.
___L	Displayed when I analog frequency reference is lost.

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■ **To see the Fault Contents and the Operating Status just before the Fault occurred**

1) Present Fault Contents (Ex: Overcurrent)

Code	Display	Description
DRV-7	OC	Displays the present fault contents.(over current)

Check the fault contents before pressing the reset key. Press the [PROG] key and then use the [▲(Up)], [▼(Down)] keys to check the operating information (output frequency, output current, acceleration, deceleration, constant speed status) just before the fault occurred. Press the [ENT] key to exit. The inverter will store the fault contents to the memory in FU2-1 when the [RESET] key is pressed.

2) Fault history contents FU2-1~5 [Fault history] has up to 5 most current faults in its memory. The smallest number will have the most current fault in its memory. Checking methods for the operating information just before the fault occurred is same as above.

Code	Display	Description
FU2-1	Last trip-1	Fault history 1
FU2-2	Last trip-2	Fault history 2
FU2-3	Last trip-3	Fault history 3
FU2-4	Last trip-4	Fault history 4
FU2-5	Last trip-5	Fault history 5

The FU2-6 [Erase Fault History] erases the FU2-1~5 [Fault History] contents form the memory, and returns the contents to the factory default status..

5.2 Fault (Inverter Fault) Reset

There are 3 ways to reset the inverter. The auto retry number will be initialized when the user resets the inverter.

1) Reset by using the [STOP/RESET] key of the keypad.
2) Reset by shorting the RST-CM terminals of the control terminal.
3) Turn OFF the inverter and turn the inverter back ON.

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5.3 Fault Remedy

Protective Function	Cause	Remedy
Overcurrent Protection	1) The acceleration/deceleration time is too short compared to the GD²of the load. 2) The load is larger than the inverter rating. 3) The inverter applies the output when the motor is free running. 4) Output short has occurred. 5) The mechanical brake of the motor is operating too fast. 6) The components of the main circuit has overheated due to a faulty cooling fan.	1) Increase the accel/decel time. 2) Increase the inverter capacity. 3) Operate after the motor has stopped. 4) Check the output wiring. 5) Check the mechanical brake operation. 6) Check the cooling fan. **(Caution)** Operate the inverter after correcting the cause, if not the IGBT can get damaged.
Overvoltage Protection	1) The acceleration time is too short compared to the GD²of the load. 2) There is a regenerative load at the output. 3) Line voltage is too high.	1) Increase the deceleration time. 2) Use the regenerative resistor option. 3) Check the line voltage.
Current Limit Protection (Overload Protection)	1) The load is larger than the inverter rating. 2) Selected the incorrect inverter capacity. 3) Set the incorrect V/F pattern.	1) Increase the capacity of the motor and the inverter. 2) Select a correct inverter capacity. 3) Select a correct inverter capacity.
Heat Sink Overheat	1) Cooling fan is damaged or an alien substance is inserted. 2) The cooling system has faults. 3) Ambient temperature is high.	1) Exchange the cooling fans and/or eliminate the alien substance. 2) Check for any alien substances in the heat sink. 3) Keep the ambient temperature under 40 °C.
Electronic Thermal	1) The motor has overheated. 2) The load is larger than the inverter rating. 3) ETH level is too low. 4) Selected the incorrect inverter capacity. 5) Set the incorrect V/F pattern. 6) Operated too long at low speeds.	1) Reduce the load and/or the running duty. 2) Increase the inverter capacity. 3) Adjust the ETH level to an appropriate level. 4) Select a correct inverter capacity. 5) Select a correct V/F pattern. 6) Install a cooling fan with a separate power supply.
Low Voltage Protection	1) Line voltage is too low. 2) A load larger than the line capacity is connected to the line. (welding machine, motor with high starting current connected to the commercial line) 3) Damaged of faulty magnetic switch at the input side of the inverter.	1) Check the line voltage. 2) Increase the line capacity. 3) Exchange the magnetic switch.
Output Phase Open	1) Faulty contact of the magnetic switch at the output. 2) Faulty output wiring	1) Check the magnetic switch at the output . 2) Check the output wiring.
H/W Fault	1) Fan fault 2) Mis-wiring 3) CPU Error 4) EEPROM Error	1) Check the cooling fan. 2) Check the input and output wiring. 3) Exchange the inverter.
LOV (V1) LOI (I)	The Frequency Reference is Lost	Eliminate the cause of the fault.
Inverter Overload	1) The load is larger than the inverter rating. 2) Selected the incorrect inverter capacity.	1) Increase the motor and/or the inverter capacity. 2) Select the correct inverter capacity.

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5.4 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 ☞ Do the operating signal input to the inverter. ☞ Do the forward and the reverse signal input simultaneously to the inverter? ☞ Do 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 restrained.(mechanical brake) 5) Other ☞ Is the alarm displayed on the keypad, or the alarm LED (STOP LED blinks) lit.
The motor rotates at 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 big	☞ 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 is 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. ☞ 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 does 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 is correct. ☞ Is the load too large? ☞ Is the Torque Boost (FU1-27, 28) value is 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)

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5.5 Maintenance

The VEGA DRIVE series is an industrial electronic product with advanced semiconductor elements, however it can still be affected by temperature, humidity, vibration and eventually aging parts. To avoid this, it is recommended to perform routine inspections.

5.5.1 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.

5.5.2 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.

5.5.3 Periodical Inspection

- Any loose bolt, nut or rust caused by surrounding conditions?
  Tighten up or replace.
- Any deposits inside of the drive of cooling fan?
  Remove the deposits by using air.
- Any deposit on the drive's PCB (Printed Circuit Boards)?
  Remove the deposits by using air.
- Any abnormal contacts in the various connectors of the drive's PCB?
  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 it if there is any abnormality.

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5.6 Daily and Periodic Inspection Items

Inspection location	Inspection Item	Inspection	period			Inspection method	Criterion	Measuring instrument
			Daily	1 year	2 year			
All	Ambient environment	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
	Input voltage	Is the input voltage of the main circuit normal	O			Measure the voltage between the terminals R,S,T		Digital multimeter/tester
Main circuit	All	Megger check(between the main circuit and the ground) Is any fixed parts removed. Is there any traces of overheating at each components 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 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 to the next page)	Digital multimeter/analog tester
	Braking 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 multimeter/analog tester
cuit Protective	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,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 multimeter/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	Is 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, W connections and tie the motor wiring.	Over 5MΩ	500V class megger

Note: Values in ( ) is for the 400V class inverters.

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CHAPTER 6 - OPTIONS

6.1 Braking Resistor

6.1.1 Standard application

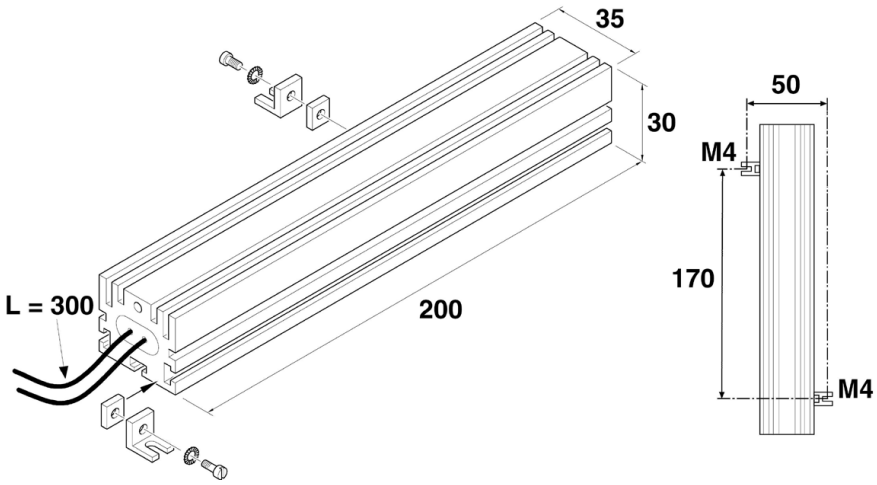
230V Class Inverter

Inverter VEGADRIVE	**2S0001 2T0001 230V 0.55kW**	**2S0002 2T0002 230V 1.1kW**	**2S0003 2T0003 230V 1.8kW**	**2T0005 230V 2.2kW**	**2T0007 230V 4.0kW**
Resistor	200Ω 350W	100Ω 350W	56Ω 350W	56Ω 350W	56Ω 350W
Code	RE2644200	RE2644100	RE2643560	RE2643560	RE2643560
Average braking torque (%)	150	150	150	120	80
Max enable duty (%)	0	25	15	15	15
Continuos braking time (s)	14	7	4	4	4

460V Class Inverter

Inverter VEGADRIVE	***4T0001 400V 0.55kW***	***4T0002 400V 1.1kW***	***4T0003 400V 1.8kW***	***4T0005 400V 2.2kW***	***4T0007 400V 4.0kW***
Resistor	400Ω 350W	400Ω 350W	200Ω 350W	200Ω 350W	200Ω 350W
Code	RE2644400	RE2644400	RE2644200	RE2644200	RE2644200
Average braking torque (%)	150	150	150	150	100
Max enable duty (%)	25	25	12	12	12
Continuos braking time (s)	6	6	3	3	3

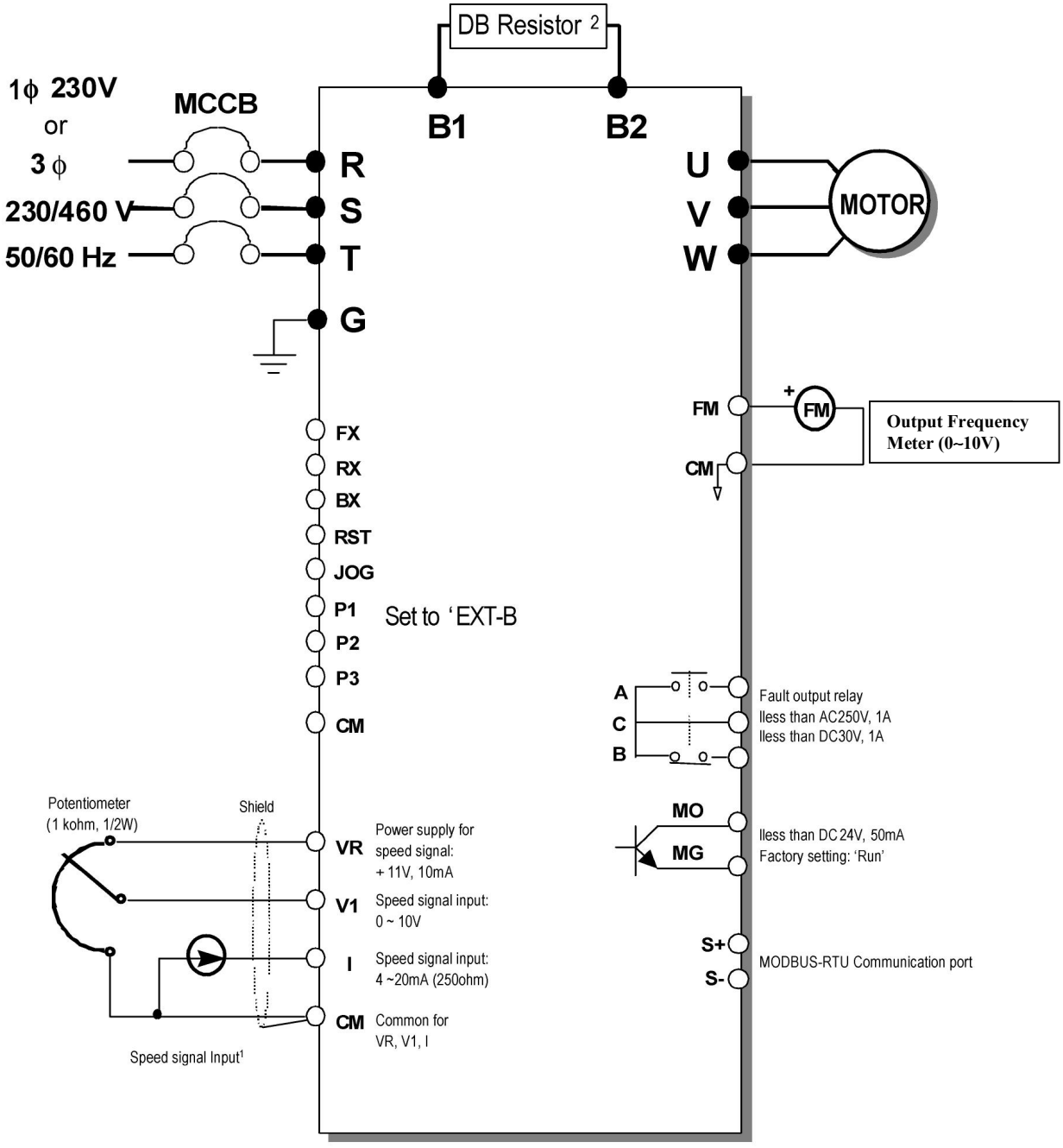
Suggested braking resistors are for standard applications where enable duty and continuos braking are lower then those in the table. For heavy duty (applications where load is pulled for more time than max continuos braking, stopping of big flywheels and so on) contact Elettronica Santerno.



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6.1.2 Braking resistor wiring diagram

Wire the braking resistor to the inverter as short as possible.



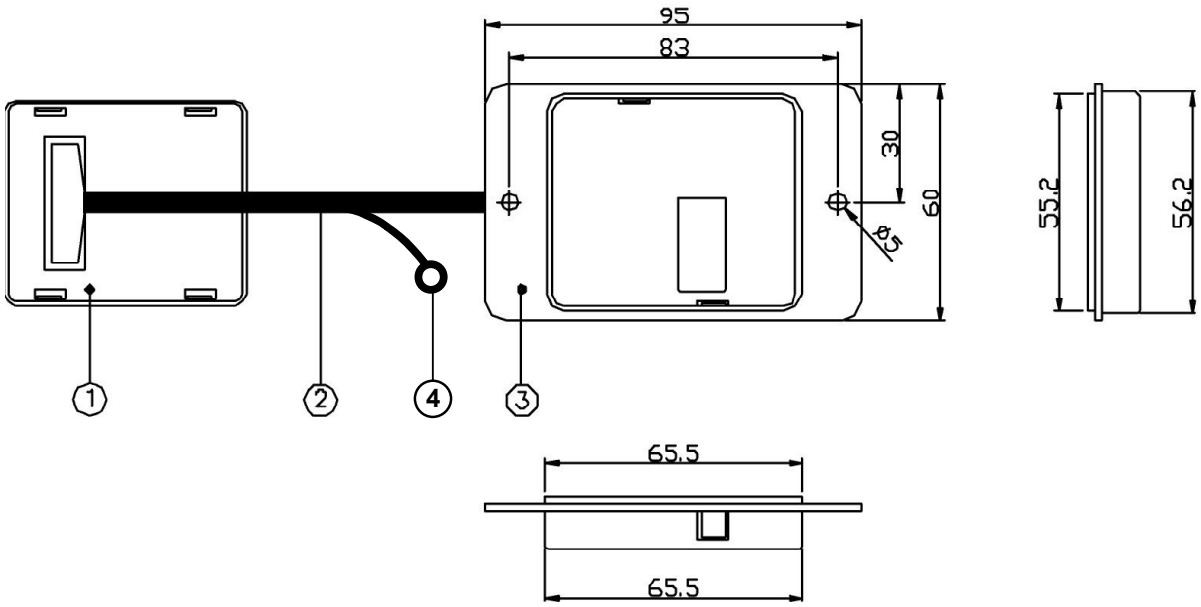
Note) ● display main circuit terminals, ○ display control circuit terminals.

1. Analog speed command can be set by Voltage, Current and both of them.
2. DB resistor is optional.

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6.2 Remote Cable

Remote operation option consists of interface device, plastic molded base and a long cable.



No.	Name	Note
1	Interface device.	To insert on the inverter instead of the keypad.
2	Connection cable.	Length: 3 mt.
3	Plastic mold cover to fasten to the panel.	Use to fasten the keypad to the front panel of the cubicle.
4	Grounding cable.	Connect to ground.

Istruction

Switch off power supply from the inverter.
Insert interface device ① instead of keypad.
Fasten plastic mold cover ③ where the keypad must be remoted.
Insert the keypad in the plastic mold cover.
Connect the cable ②. Be careful to connect the side with grounding cable ④ to the keypad. Connect grounding cable ④ to ground.

Caution: Never connector disconnect keypad from the inverter when the inverter is powered.
Caution: Using an unauthorized product for connection cable can cause voltage drops to the keypad and malfunction due to noise, so please use an authorized product.

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6.3 RFI Filters

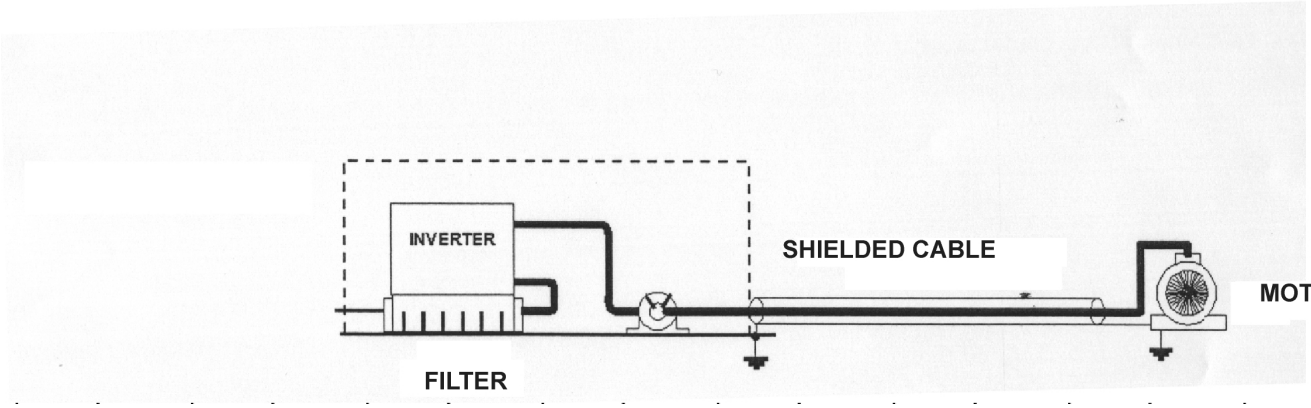
This filters series, have been specifically designed with high frequency VEGA DRIVE inverters, the use l.g. Filters, with the installation advice overleaf help to ensure trouble free use along side sensitive devices and compliance to conducted emission and immunity standards

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.

6.3.1 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 enclosure, usually directly after the enclosures 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 enclosure 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



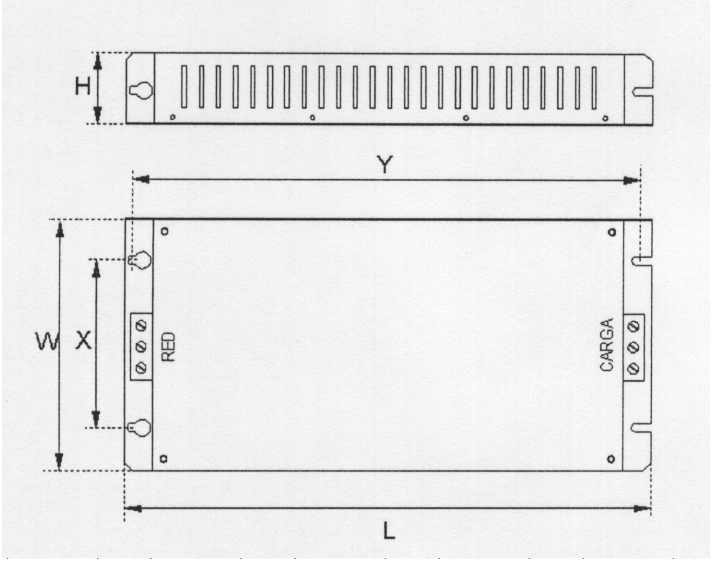
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STANDARD			**EN61800-3 Second environment Restricted and unrestricted distribution**	**EN61800-3 First environment Restricted distribution EN55011 gr.1 cl.A EN55022 cl.A VDE0875N**			**EN61800-3 First environment Unrestricted distribution EN55011 gr.1 cl.B EN55022 cl.B VDE0875G**			
VEGA DRIVE	MOTOR	SUPPLY	FILTER	INPUT FILTER		OUTPUT FILTER	INPUT FILTER		OUTPUT FILTER	
2S0001	.55kW	240V SINGLE-PHASE	NO	FV10-1S-FP	AC1710114	NO	FV10-1S-FP	AC1710114	2x K618	AC1810302
2S0002	1.1kW	240V SINGLE-PHASE	NO	FV11-1S-FP	AC1710224	NO	FV11-1S-FP	AC1710224	2x K618	AC1810302
2S0003	1.8kW	240V SINGLE-PHASE	NO	FV20-1S-FP	AC1710226	NO	FV20-1S-FP	AC1710226	2x K618	AC1810302
2T0001	.55kW	240V THREE-PHASE	NO	FV05-2T-FP	AC1710116	NO	FV05-2T-FP	AC1710116	2x K618	AC1810302
2T0002	1.1kW	240V THREE-PHASE	NO	FV05-2T-FP	AC1710116	NO	FV05-2T-FP	AC1710116	2x K618	AC1810302
2T0003	1.8kW	240V THREE-PHASE	NO	FV12-2T-FP	AC1710228	NO	FV12-2T-FP	AC1710228	2x K618	AC1810302
2T0005	2.2kW	240V TRIFASE	NO	FV20-2T-FP	AC1710230	NO	FV20-2T-FP	AC1710230	2x K618	AC1810302
2T0007	4.0kW	240V THREE-PHASE	NO	FV20-2T-FP	AC1710230	NO	FV20-2T-FP	AC1710230	2x K674	AC1810402
4T0001	.55kW	460V THREE-PHASE	NO	FV06-4T-FP	AC1710118	NO	FV06-4T-FP	AC1710118	2x K618	AC1810302
4T0002	1.1kW	460V THREE-PHASE	NO	FV06-4T-FP	AC1710118	NO	FV06-4T-FP	AC1710118	2x K618	AC1810302
4T0003	1.8kW	460V THREE-PHASE	NO	FV06-4T-FP	AC1710118	NO	FV06-4T-FP	AC1710118	2x K618	AC1810302
4T0005	2.2kW	460V THREE-PHASE	NO	FV11-4T-FP	AC1710232	NO	FV11-4T-FP	AC1710232	2x K618	AC1810302
4T0007	4.0kW	460V THREE-PHASE	NO	FV11-4T-FP	AC1710232	NO	FV11-4T-FP	AC1710232	2x K618	AC1810302

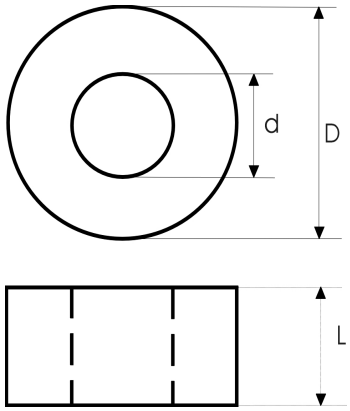
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6.3.2 Input filter ratings(mm)

FILTER	VOLTAGE	CURRENT	LEAKAGE CURRENT		DIMENSIONS				
			Typical	MAX	L	W	H	Y	X
FV10-1S-FP	250Vac 1ph	10A	-	3.5mA	173.5	103.5	40	159.5	80
FV11-1S-FP	250Vac 1ph	11A	-	3.5mA	173.5	133.5	40	159.5	110
FV20-1S-FP	250Vac 1ph	20A	-	3.5mA	173.5	153.5	45	159.5	130
FV05-2T-FP	250Vac 3ph	5A	0.3mA	18mA	173.5	103.5	40	159.5	80
FV12-2T-FP	250Vac 3ph	12A	0.3mA	18mA	173.5	133.5	40	159.5	110
FV20-2T-FP	250Vac 3ph	20A	0.3mA	18mA	173.5	153.5	45	159.5	130
FV06-4T-FP	460Vac 3ph	6A	0.5mA	27mA	173.5	133.5	40	159.5	110
FV11-4T-FP	460Vac 3ph	11A	0.5mA	27mA	173.5	153.5	45	159.5	130



6.3.3 Output filter dimensions(mm)

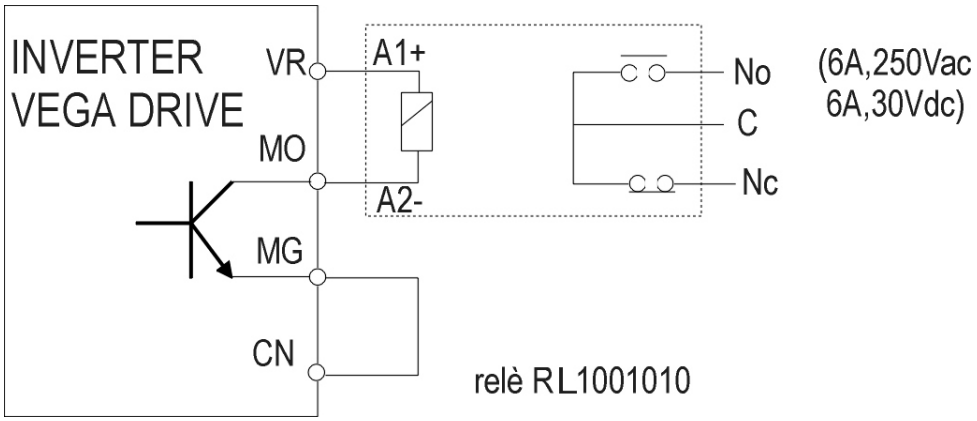


FILTER	d	D	L
2xK618	15	26	22
2xK674	23	37	31

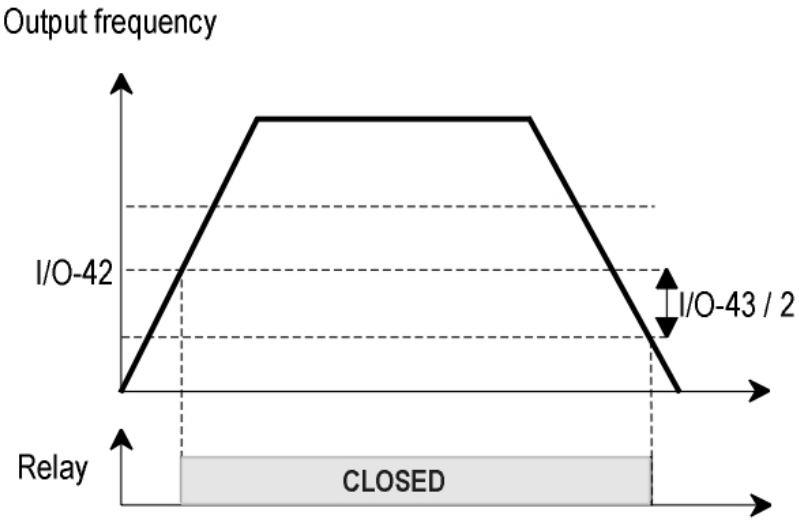
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6.4 Zero-speed relay

An external relay (optional) with a 12V low-consumption coil may be supplied for a zero-speed contact.

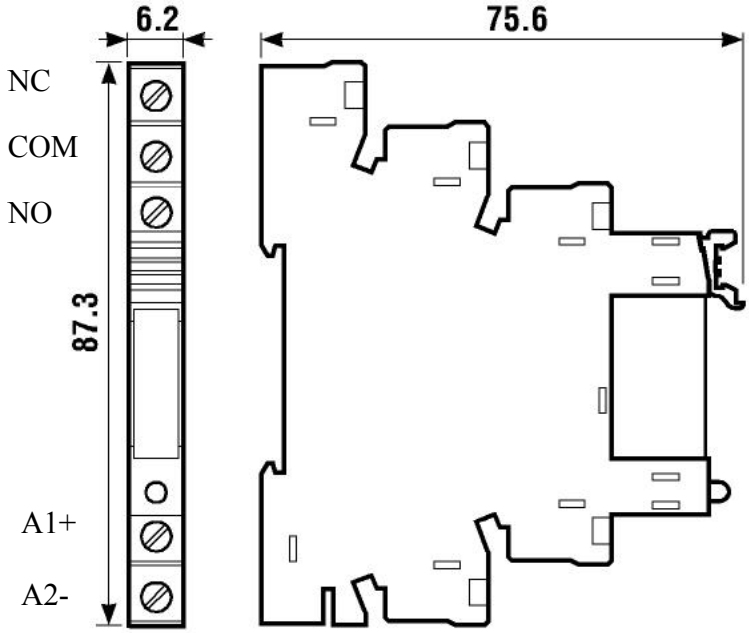


In that case, if the speed command is sent through a potentiometer, a 2.5kΩ potentiometer must be used. The relay is provided with a connector for DIN rail. To program the speed level, the following parameters are to be set:
Multifunction MO output configured as FDT-3 (I/O 44=3)



I/O 42,43,44.An example is shown in the figure below.

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CHAPTER 7 - MODBUS-RTU COMMUNICATION

7.1 Introduction

This manual is about the specifications, installation and operation of MODBUS-RTU for communication with PC or FA computer.

7.1.1 Features

Easy use of drives in Factory Automation by user programming.
Change and monitoring of drive parameters using computer.

7.1.2 Interfacing type of RTU Reference:

- Allows the drive to communicate with any other computers.
- Allows connection of up to 4 drives with multi-drop link system.
- Ensure noise-resistant interface.

Users can use any kind of RS232-485 converters. However a converter that has built-in 'automatic RTS control' is highly recommended. Because the specifications of converters depend on the manufacturers, please refer to the manual for detailed converter specifications.

7.1.3 Before Installation

Before installation and operation, this manual should be read thoroughly. If not, it can cause personal injury or damage other equipment.

7.2 Specifications

7.2.1 Performance Specifications

Items	**Specifications**
Communication method	RS485
Transmission form	Bus method Multi-drop Link System
Applicable inverter	VEGA DRIVE series drive
Number of drives	Maximum 4 drives connectable
Transmission distance	Max. 1200m

7.2.2 Hardware Specifications

Items	**Specifications**
Installation	S+, S-, CM terminals on control terminal strip
PowerSupply	Insulated from the inverter power supply

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7.2.3 Communication Specifications

Items	Specifications
Communication speed	19200/9600/4800/2400/1200 bps selectable
Control procedure	Asynchronous communication system
Communication system	Half duplex system
Character system Modbus	ASCII (8 bit)

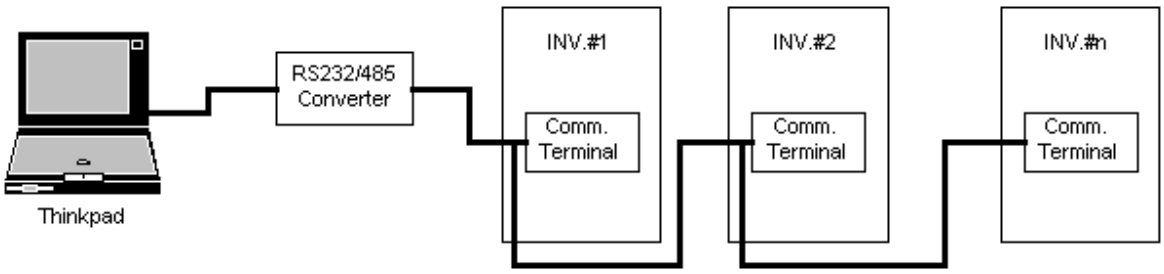
7.3 Installation

7.3.1 Connecting the communication line

- First connect the 485 GND of MODBUS-RTU communication line to the inverter's (CM) terminals of the control terminals.
- Then connect the MODBUS-RTU communication line to the inverter's (S+),(S-) terminals of the control terminals.
- Check the connection and turn ON the inverter.
- Set with keypad the following data:
  I/O-46 [Inv. Number] : If more than 1 inverters are connected, be sure to use different numbers for each inverter
  I/O-47 [Baud-rate]
  I/O-48 [Lost Mode] : Lost mode frequency ref.
  I/O-49 [Time-Out] : First lost frequency ref.
  I/O-50 [Comm.Prot]

To interface the inverter with Remote Drive application of Elettronica Santerno, you have to set I/O-50=7(modbus RTU, 8 bits data, no parity, 2 stop bit)

- If you have to drive the inverter via Modbus is necessary to set (with key pad or via Modbus)
  DRV-03 [control mode]=3 (RS485)
  DRV-04 [frequency mode]=5 (RS485)



7.3.2 System configuration

The number of drives to be connected is up to 4 drives.
The specification of length of communication line is max. 1200m. To ensure stable communication, limit the length below 700m.
Use shielded wire for all control signal wiring.

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7.4 Operating

7.4.1 Operating Steps

- Check whether the computer and the inverter are connected correctly.
- Turn ON the inverter. But, do not connect the load until stable communication between the computer and the inverter is verified.
- Start the operating program for the inverter from the computer.
- Operate the inverter using the operating program for the inverter.
- Refer to “7. Troubleshooting” if the communication is not operating normally.

7.5 Communication Protocol

The communication structure is that the VEGA DRIVE drives are slaves and a computer/host is the master.

7.5.1 Supported Function Code

Function Code	Name
0x03	Read Hold Register
0x04	Read Input Register
0x06	Preset Single Register
0x10	Preset Multiple Register

7.5.2 Exception Code

Exception Code	Name
0x01	ILLEGAL FUNCTION
0x02	ILLEGAL DATA ADDRESS
0x03	ILLEGAL DATA VALUE
0x06	SLAVE DEVICE BUSY

7.5.3 BaudRate

1200, 2400, 4800, **9600**, 19200bps (default value of 9600bps)

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7.6 Parameter Code List

< Common >

Parameter address	Description	Unit	Read/Write	Data value (HEX)	Note
0000	Inverter model	-	R	7: VEGA DRIVE	
0001	Inverter capacity	-	R	0: 0001 ,1: 0002 , 2: 0003 3: 0005 , 5: 0007	
0002	Inverter input voltage	-	R	0: 220V class, 1:440V class	
0003	Version	-	R	313045: Version 1.0E 353045: Version 5.0E	
0004	Parameter write enable	-	R/W	0: Write disable(default) 1: Write enable	
0005	Reference frequency	0.01 Hz	R/W		
0006	Operation reference	-	R/W	Bit 0: Stop(R/W) Bit 1: Forward(R/W) Bit 2: Reverse(R/W) Bit 3: Fault reset(W) Bit 4: Emergency stop(W)	
0007	Accel time	0.1 sec	R/W		
0008	Decel time	0.1 sec	R/W		
0009	Output Currrent	0.1 A	R		
000A	Output frequency	0.01 Hz	R		
000B	Output voltage	1 V	R		
000C	DC Link voltage				
000D	Output power				Not used
000E	Operating status	-	R	Bit 0: Stop Bit 1: Forward Bit 2: Reverse Bit 3: Fault (Trip) Bit 4: Accelerating Bit 5: Decelerating Bit 6: Speed reached Bit 7: DC Braking	
000F	Trip info	-	R	Bit 0: OC Bit 1: OV Bit 2: EXT Bit 3: BX Bit 4: LV Bit 5: Fuse Open Bit 6: GF Bit 7: OH	
0010	Input terminal info	-	R	Bit 0: FX Bit 1: RX Bit 2: BX Bit 3: RST- Bit 8: P1 Bit 9: P2 Bit 10: P3	
0011	Output terminal info	-	R	Bit 0: Q1 (OC)	
0012	V1	-	R	0 - FFFF	
0013	V2	-	-		Not used
0014	I	-	R	0 - FFFF	
0015	RPM	-	R		

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< DRV Group >

Parameter address(*3)	Parameter Code	Description	Default value	Max. value	Min. value	Unit	Note
6100	DRV #00	Cmd. Freq.	5000	max Freq.(*1)	start Freq.(*2)	0.01Hz	
6101	DRV #01	Acc. Time	1000	60000	0	0.01sec	
6102	DRV #02	Dec. Time	1000	60000	0	0.01sec	
6103	DRV #03	Drive mode	1	2	0		
6104	DRV #04	Freq. mode	0	4	0		
6105	DRV #05	Speed - 1	1000	maxFreq	startFreq	0.01Hz	
6106	DRV #06	Speed - 2	2000	maxFreq	startFreq	0.01Hz	
6107	DRV #07	Speed - 3	3000	maxFreq	startFreq	0.01Hz	
6108	DRV #08	Output Current	0	-	-	0.1A	Read Only
6109	DRV #09	Output speed	0	-	-	RPM	Read Only
610A	DRV #10	DC Link Voltage	0	-	-	0.1V	Read Only

(*1) Refer to FU1 for #20 max Freq.
(*2) Refer to FU1 #22 for Start Freq.
(*3) Parameter address is HEX data

< FU1 Group >

Parameter address	Parameter Code	Description	Default value	Max. value	Min. value	Unit	Note
6203	FU1 #03	Run prohibit	0	2	0		
6205	FU1 #05	Acc. pattern	0	4	0		
6206	FU1 #06	Dec. pattern	0	4	0		
6207	FU1 #07	Stop mode	0	2	0		
6208	FU1 #08	DcBr freq.	500	5000	startFreq	0.01Hz	
6209	FU1 #09	DcBlk time	50	6000	0	0.01sec	
620A	FU1 #10	DcBr value	50	200	0	1%	
620B	FU1 #11	DcBr time	10	600	0	0.1sec	
620C	FU1 #12	DcSt value	50	200	0	1%	
620D	FU1 #13	DcSt time	0	600	0	0.1sec	
6214	FU1 #20	Max freq.	5000	40000	4000	0.01Hz	
6215	FU1 #21	Base freq.	5000	MaxFreq	3000	0.01Hz	
6216	FU1 #22	Start freq.	10	1000	10	0.01Hz	
6217	FU1 #23	Freq limit	0	1	0		Yes/No
6218	FU1 #24	F-limit Lo.	50	HighFreq	startFreq	0.01Hz	
6219	FU1 #25	F-limit Hi.	5000	MaxFreq	lowFreq	0.01Hz	
621A	FU1 #26	Torque boost	0	1	0		boostMsg
621B	FU1 #27	Fwd boost	50	150	0	0.1%	
621C	FU1 #28	Rev boost	50	150	0	0.1%	
621D	FU1 #29	V/F pattern	0	2	0		VfPatternMsg
621E	FU1 #30	User freq. 1	1250	MaxFreq	0	0.01Hz	
621F	FU1 #31	User volt. 1	25	100	0	%	
6220	FU1 #32	User freq. 2	2500	MaxFreq	0	0.01Hz	
6221	FU1 #33	User volt. 2	50	100	0	%	
6222	FU1 #34	User freq. 3	3750	MaxFreq	0	0.01Hz	
6223	FU1 #35	User volt. 3	75	100	0	%	
6224	FU1 #36	User freq. 4	5000	MaxFreq	0	0.01Hz	
6225	FU1 #37	User volt. 4	100	100	0	%	
6226	FU1 #38	Volt control	1000	1100	40	%	
6227	FU1 #39	Energy save	0	30	0	%	
6232	FU1 #50	ETH select	0	1	0		Yes/No
6233	FU1 #51	ETH level 1	180	250	contPerc	%	
6234	FU1 #52	ETH level 2	120	150	50	%	
6235	FU1 #53	Motor type	0	1	0		MotorMsg
6236	FU1 #54	OL level	150	150	30	%	
6237	FU1 #55	OL time	100	300	0	0.1sec	
6238	FU1 #56	OLT select	1	1	0		Yes/No
6239	FU1 #57	OLT level	200	200	30	%	
623A	FU1 #58	OLT time	600	60000	0	0.1sec	
623B	FU1 #59	Stall prev.	0	7	0		
623C	FU1 #60	Stall level	200	250	30	%	

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< FU2 Group >

Parameter address	Parameter Code	Description	Default value	Max. value	Min value	Unit	Note
630A	FU2 #10	Jump freq	0	1	0		
630B	FU2 #11	Jump lo 1	0	jump Hi 1	StartFreq	0.01Hz	
630C	FU2#12	Jump Hi 1	0	maxFreq	jump Lo 1	0.01Hz	
630D	FU2 #13	Jump lo 2	0	jump Hi 2	StartFreq	0.01Hz	
630E	FU2 #14	jump Hi 2	0	maxFreq	jump Lo 2	0.01Hz	
630F	FU2 #15	jump lo 3	0	jump Hi 3	startFreq	0.01Hz	
6310	FU2 #16	jump Hi 3	0	maxFreq	jump Lo 3	0.01Hz	
6314	FU2 #20	Power-on run	0	1	0		
6315	FU2 #21	RST restart	0	1	0		
6316	FU2 #22	Flying mode	0	15	0		
6317	FU2 #23	SS P-Current	180	200	80		
6318	FU2 #24	SS P-Gain	100	9999	0		
6319	FU2 #25	SS I-Gain	5000	9999	0		
631A	FU2 #26	Retry number	0	10	0		
631B	FU2 #27	Retry delay	10	600	0	0.1sec	
631E	FU2 #30	Motor select	0	3	0		
631F	FU2 #31	Pole number	4	12	2		
6320	FU2 #32	Rated-Slip	200	1000	0	0.01Hz	
6321	FU2 #33	Rated-Curr	18	999	1	0.1A	
6322	FU2 #34	Noload-Curr	7	999	1	0.1A	
6324	FU2 #36	Efficiency	85	100	50	%	
6325	FU2 #37	Inertiarate	0	2	0		
6327	FU2 #39	Carrier freq	30	100	10	0.1kHZ	
6328	FU2 #40	Control mode	0	2	0		
6332	FU2 #50	PID F/B	0	1	0		
6333	FU2 #51	PID P-gain	3000	9999	0		
6334	FU2 #52	PID I-time	300	9999	0		
6335	FU2 #53	PID D-time	0	9999	0		
6336	FU2 #54	PID limit	5000	MaxFreq	0	0.01Hz	
6346	FU2 #70	Acc/Dec freq	0	1	0		
6347	FU2 #71	Time scale	1	2	0		
6348	FU2 #72	PowerOn disp	0	13	0		
6349	FU2 #73	User disp	0	2	0		
634A	FU2 #74	RPM factor	100	1000	1	%	
634B	FU2#75	DB Mode	2	2	0		
634C	FU2#76	DB % ED	10	30	0	%	
634F	FU2 #79	S/W version					
6351	FU2 #81	2nd Acc time	50	60000	0	0.1sec	
6352	FU2 #82	2nd Dec time	100	60000	0	0.1sec	
6353	FU2 #83	2nd BaseFreq	5000	maxFreq	3000	0.01Hz	
6354	FU2 #84	2nd V/F	0	2	0		
6355	FU2 #85	2nd F-boost	50	150	0	0.1%	
6356	FU2 #86	2nd R-boost	50	150	0	0.1%	
6357	FU2 #87	2nd Stall	200	250	30	%	
6358	FU2 #88	2nd ETH	180	250	0	%	
6359	FU2 #89	2nd ETH	120	150	50	%	
635A	FU2 #90	2nd R-Curr	18	999	1	0.1A	

(*1), (*2), (*3) value can change according to the capacity.

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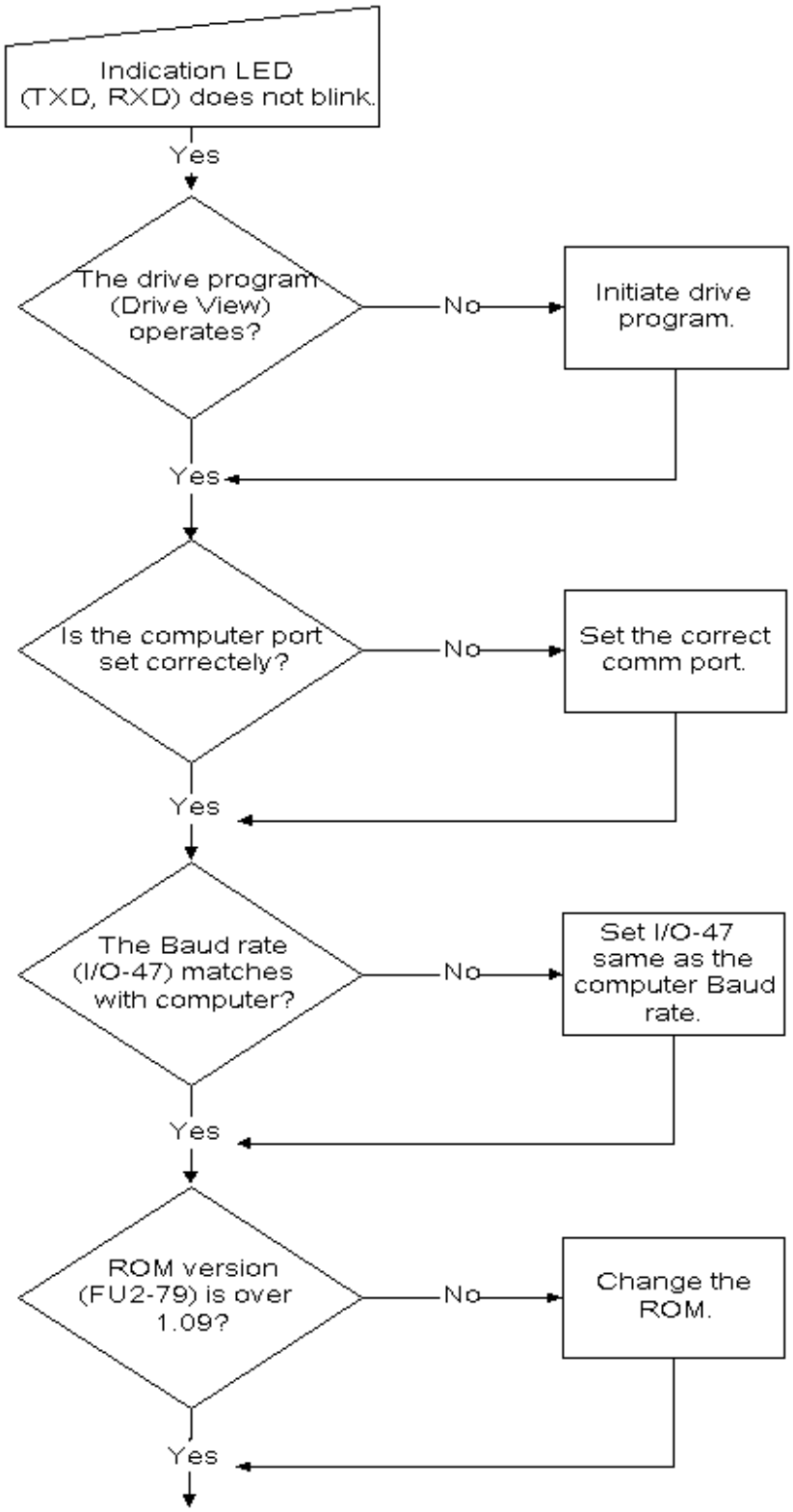
< I/O Group>

Parameter address	Parameter Code	Description	Default value	Max. value	Min value	Unit	Note
6401	I/O #01	V1 filter	500	9999	0	ms	
6402	I/O #02	V1 volt x1	0	V1 vort x2	0	0.01V	
6403	I/O #03	V1 freq y1	0	MaxFreq	0	0.01Hz	
6404	I/O #04	V1 volt x2	1000	1000	V1 volt x1	0.01V	
6405	I/O #05	V1 freq y2	5000	MaxFreq	0	0.01Hz	
6406	I/O #06	I filter	500	9999	0	ms	
6407	I/O #07	I curr x1	400	I curr x2	0	0.01mA	
6408	I/O #08	I freq y1	0	maxFreq	0	0.01Hz	
6409	I/O #09	I curr x2	2000	2000	I curr x1	0.01mA	
640A	I/O #10	I freq y2	5000	maxFreq	0	0.01Hz	
640B	I/O #11	Wire broken	0	2	0		
640C	I/O #12	P1 define	0	26	0		
640D	I/O #13	P2 define	1	26	0		
640E	I/O #14	P3 define	2	26	0		
640F	I/O #15	In Status					
6410	I/O #16	Out Status					
6411	I/O #17	TI Filt Num	15	20	2		
6414	I/O #20	Jog freq	1000	maxFreq	startFreq	0.01Hz	
6415	I/O #21	Speed - 4	4000	maxFreq	startFreq	0.01Hz	
6416	I/O #22	Speed - 5	5000	maxFreq	startFreq	0.01Hz	
6417	I/O #23	Speed - 6	4000	maxFreq	startFreq	0.01Hz	
6418	I/O #24	Speed - 7	3000	maxFreq	startFreq	0.01Hz	
6419	I/O #25	Acc - 1	200	60000	0	0.1sec	
641A	I/O #26	Dec - 1	200	60000	0	0.1sec	
641B	I/O #27	Acc - 2	300	60000	0	0.1sec	
641C	I/O #28	Dec - 2	300	60000	0	0.1sec	
641D	I/O #29	Acc - 3	400	60000	0	0.1sec	
641E	I/O #30	Dec - 3	400	60000	0	0.1sec	
641F	I/O #31	Acc – 4	500	60000	0	0.1sec	
6420	I/O #32	Dec – 4	500	60000	0	0.1sec	
6421	I/O #33	Acc – 5	400	60000	0	0.1sec	
6422	I/O #34	Dec – 5	400	60000	0	0.1sec	
6423	I/O #35	Acc – 6	300	60000	0	0.1sec	
6424	I/O #36	Dec – 6	300	60000	0	0.1sec	
6425	I/O #37	Acc – 7	200	60000	0	0.1sec	
6426	I/O #38	Dec – 7	200	60000	0	0.1sec	
6428	I/O #40	FM mode	0	3	0		
6429	I/O #41	FM adjust	100	200	10	%	
642A	I/O #42	FDT freq	3000	MaxFreq	0	0.01Hz	
642B	I/O #43	FDT band	1000	MaxFreq	0	0.01Hz	
642C	I/O #44	Aux mode	12	20	0		
642D	I/O #45	Relay mode	2	7	0	BIT3	
642E	I/O #46	Inv. no	1	32	1		
642F	I/O #47	Baud rate	3	4	0		
6430	I/O #48	Lost command	0	2	0		
6431	I/O #49	Time out	10	1200	1	0.1sec	
6432	I/O #50	Comm. Prot	7	9	0		

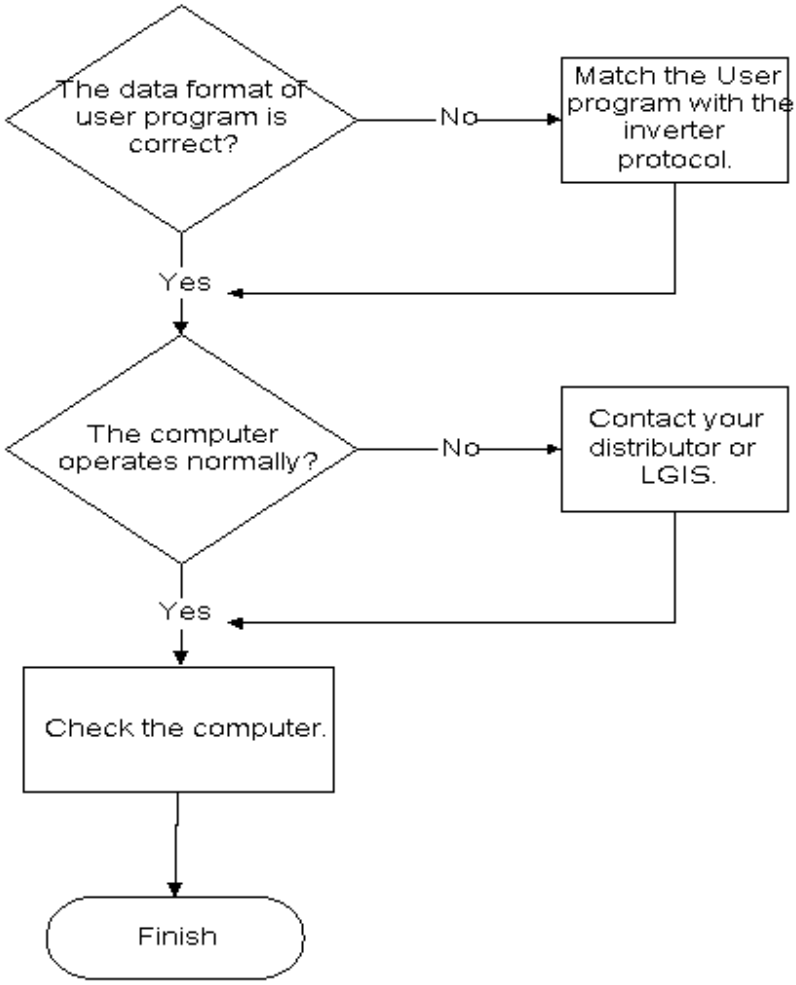
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7.7 Troubleshooting

Refer to this chapter when a trouble is occurred.



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7.8 ASCII Code List

Character	Hex	Character	Hex	Character	Hex
A	41	q	71	@	40
B	42	r	72	[	5B
C	43	s	73	\	5C
D	44	t	74	]	5D
E	45	u	75		5E
F	46	v	76		5F
G	47	w	77		60
H	48	x	78	{	7B
I	49	y	79	|	7C
J	4A	z	7A	}	7D
K	4B	0	30	~	7E
L	4C	1	31	BEL	07
M	4D	2	32	BS	08
N	4E	3	33	CAN	18
O	4F	4	34	CR	0D
P	50	5	35	DC1	11
Q	51	6	36	DC2	12
R	52	7	37	DC3	13
S	53	8	38	DC4	14
T	54	9	39	DEL	7F
U	55	space	20	DLE	10
V	56	!	21	EM	19
W	57	"	22	ACK	06
X	58	#	23	ENQ	05
Y	59	$	24	EOT	04
Z	5A	%	25	ESC	1B
a	61	&	26	ETB	17
b	62	'	27	ETX	03
c	63	(	28	FF	0C
d	64	)	29	FS	1C
e	65	*	2A	GS	1D
f	66	+	2B	HT	09
g	67	,	2C	LF	0A
h	68	-	2D	NAK	15
i	69	.	2E	NUL	00
j	6A	/	2F	RS	1E
k	6B	:	3A	S1	0F
l	6C	;	3B	SO	0E
m	6D	<	3C	SOH	01
n	6E	=	3D	STX	02
o	6F	>	3E	SUB	1A
p	70	?	3F	SYN	16
				US	1F
				VT	0B

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- **ASCII Code List**

Character	Hex	Character	Hex	Character	Hex
space	20	A	41	a	61
!	21	B	42	b	62
"	22	C	43	c	63
#	23	D	44	d	64
$	24	E	45	e	65
%	25	F	46	f	66
&	26	G	47	g	67
'	27	H	48	h	68
(	28	I	49	i	69
)	29	J	4A	j	6A
*	2A	K	4B	k	6B
+	2B	L	4C	l	6C
,	2C	M	4D	m	6D
-	2D	N	4E	n	6E
.	2E	O	4F	o	6F
/	2F	P	50	p	70
0	30	Q	51	q	71
1	31	R	52	r	72
2	32	S	53	s	73
3	33	T	54	t	74
4	34	U	55	u	75
5	35	V	56	v	76
6	36	W	57	w	77
7	37	X	58	x	78
8	38	Y	59	y	79
9	39	Z	5A	z	7A
:	3A	[	5B		
;	3B	\	5C		
<	3C	]	5D		
=	3D		5E		
>	3E		5F		
?	3F		60		
@	40				

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APPENDIX A - FUNCTIONS BASED ON THE USE

Set the function properly according to the load and operating conditions. The application and the related functions are listed at 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 time accel/decel	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 50 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 character-istics 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 ad-justing	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 output 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]

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APPENDIX B- PERIPHERAL DEVICES

INVERTER VEGADRIVE	MOTOR	MCCB,ELB	MAGNETIC CONTACTOR	WIRE SIZE (mm2/AWG)			AC INPUT FUSE (classe gG)	AC REACTOR
				R,S,T	U,V,W	Terra		
1S001	.55kW	240V/10A	240V/10A	2.5/14	2.5/14	4/12	10A	2.1mH/10A
1S002	1.1kW	240V/10A	240V/10A	2.5/14	2.5/14	4/12	10A	2.1mH/10A
1S003	1.8kW	240V/10A	240V/10A	2.5/14	2.5/14	4/12	16A	1.1mH /18A
2T001	.55kW	240V/10A	240V/10A	2.5/14	2.5/14	4/12	10A	2.1mH/10A
2T002	1.1kW	240V/10A	240V/10A	2.5/14	2.5/14	4/12	10A	2.1mH/10A
2T003	1.8kW	240V/10A	240V/10A	2.5/14	2.5/14	4/12	16A	2.1mH/10A
2T005	2.2kW	240V/16A	240V/16A	2.5/14	2.5/14	4/12	25A	1.1mH /18A
2T007	4.0kW	240V/25A	240V/25A	4/12	4/12	4/12	40A	1.1mH/18A
4T001	.55kW	480V/10A	480V/10A	2.5/14	2.5/14	2.5/14	6A	2.1mH/10A
4T002	1.1kW	480V/10A	480V/10A	2.5/14	2.5/14	2.5/14	6A	2.1mH/10A
4T003	1.8kW	480V/10A	480V/10A	2.5/14	2.5/14	2.5/14	10A	2.1mH/10A
4T005	2.2kW	480V/10A	480V/10A	2.5/14	2.5/14	2.5/14	10A	2.1mH/10A
4T007	4.0kW	480V/10A	480V/10A	2.5/14	2.5/14	2.5/14	20A	2.1mH/10A

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Cod. Fisc. 00330410374
Part. IVA 00504051202

Cod. Identificativo IVA Intracomunitario: IT00504051202
R.E.A. BO 203016 - "M" BO 000183

Capitale Sociale euro 550.000 i.v.

EC DECLARATION OF CONFORMITY

Elettronica Santerno S.p.A.

Via G. Di Vittorio, 3 - 40020 Casalfiumanese (BO) - Italy

AS MANUFACTURER

DECLARE

UNDER OUR SOLE RESPONSABILITY

THAT THE SPACE VECTOR MODULATION DIGITAL THREE-PHASE AC INVERTER OF **VEGA DRIVE** TYPE, AND RELATED ACCESSORIES,
TO WHICH THIS DECLARATION RELATES,
APPLIED UNDER CONDITIONS SUPPLIED IN THE USER'S MANUAL,
CONFORMS TO THE FOLLOWING STANDARDS OR NORMATIVE DOCUMENTS:

EN 50081-1 (1992-01)	Electromagnetic compatibility (EMC). Generic emission standard. Part 1: Residential, commercial and light industry.
EN 50082-2 (1995-03)	Electromagnetic compatibility (EMC). Generic immunity standard. Part 2: Industrial environment.
EN 55022 (1994-08)	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
EN 61000-4-2 (1995-03)	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 2: Electrostatic discharge immunity test. Basic EMC Publication.
EN 61000-4-4 (1995-03)	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 4: Electrical fast transient/burst immunity test. Basic EMC Publication.
EN 61000-4-5 (1995-03)	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 5: Surge immunity test.
EN 61000-4-8 (1993-09)	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 8: Power frequency magnetic field immunity test. Basic EMC Publication.
EN 61000-4-11 (1994-08)	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 11: Voltage dips, short interruptions and voltage variations immunity tests.
ENV 50140 (1993-08)	Electromagnetic compatibility. Basic immunity standard. Radiated, radio-frequency electromagnetic field. Immunity test.
ENV 50141 (1993-08)	Electromagnetic compatibility. Basic immunity standard. Conducted disturbances induced by radio-frequency fields. Immunity test.
ENV 50204 (1995-03)	Radiated electromagnetic field from digital radio telephones. Immunity test.

FOLLOWING THE PROVISIONS OF ELECTROMAGNETIC COMPATIBILITY DIRECTIVE 89/336/EEC
AND SUBSEQUENT AMENDMENTS 92/31/EEC, 93/68/EEC AND 93/97/EEC.

PLACE AND DATE OF ISSUE
Casalfiumanese, 01/02/2002

SIGNATURE
Vice President .
Zanarini Ing. Sergio

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CERTIFIED QUALITY SYSTEM UNI EN ISO 9001 SINCERT DNV

Cod. Fisc. 00330410374
Part. IVA 00504051202

Cod. Identificativo IVA Intracomunitario: IT00504051202
R.E.A. BO 203016 - "M" BO 000183

Capitale Sociale euro 550.000 i.v.

EC DECLARATION OF CONFORMITY

Elettronica Santerno S.p.A.
Via G. Di Vittorio, 3 - 40020 Casalfiumanese (BO) - Italy

AS MANUFACTURER

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UNDER OUR SOLE RESPONSABILITY

THAT THE SPACE VECTOR MODULATION DIGITAL THREE-PHASE AC INVERTER OF **VEGA DRIVE** TYPE, TO WHICH THIS DECLARATION RELATES,

CONFORMS TO THE FOLLOWING STANDARDS OR NORMATIVE DOCUMENTS:

EN 60146-1-1 (1993-02)	Semiconductor convertors. General requirements and line commutated convertors. Part 1-1: Specifications of basic requirements.
EN 60146-2 (2000-02)	Semiconductor convertors. Part 2: Self-commutated semiconductor converters including direct d.c. converters.
IEC 664-1 (1992-10)	Insulation coordination for equipment within low-voltage systems. Part 1: Principles, requirements and tests.
EN 61800-2 (1998-04)	Adjustable speed electrical power drive systems. Part 2: General requirements - Rating specifications for low voltage adjustable frequency a.c. power drive systems.
EN 60204-1 (1997-12)	Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
EN 60204-1 Modifica 1 (1988-08)	Electrical equipment of industrial machines. Part 2: Item designation and examples of drawings, diagrams, tables and instructions.
EN 60529 (1991-10)	Degrees of protection provided by enclosures (IP Code).
EN 50178 (1997-10)	Electronic equipment for use in power installations.

FOLLOWING THE PROVISIONS OF LOW VOLTAGE DIRECTIVE 73/23/EEC AND SUBSEQUENT AMENDMENT 93/68/EEC.

LAST TWO DIGITS OF THE YEAR IN WHICH THE CE MARKING WAS AFFIXED: **01**

PLACE AND DATE OF ISSUE
Casalfiumanese, 01/02/2002

SIGNATURE
Vice President.
Zanarini Ing. Sergio

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MANUFACTURER'S DECLARATION

Elettronica Santerno S.p.A.
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UNDER OUR SOLE RESPONSABILITY

THAT THE SPACE VECTOR MODULATION DIGITAL THREE-PHASE AC INVERTER OF
VEGA DRIVE TYPE,
TO WHICH THIS DECLARATION RELATES,
APPLIED UNDER CONDITIONS SUPPLIED IN THE USER'S MANUAL,
CONFORMS TO THE FOLLOWING STANDARDS OR NORMATIVE DOCUMENTS:

EN 60204-1 (1997-12)	Safety of machinery. Electrical equipment of machines. Part 1: General requirements.
EN 60204-1 Modifica 1 (1988-08)	Electrical equipment of industrial machines. Part 2: Item designation and examples of drawings, diagrams, tables and instructions.

AND MUST NOT BE PUT INTO SERVICE UNTIL THE MACHINERY INTO WHICH IT IS TO BE INCORPORED HAS BEEN DECLARED IN CONFORMITY WITH THE PROVISIONS OF MACHINERY DIRECTIVE 89/392/EEC AND SUBSEQUENT AMENDMENTS 91/368/EEC, 93/44/EEC AND 93/68/EEC.

LUOGO E DATA
Casalfiumanese, 01/02/2002

FIRMA
Il Vice Presidente
Zanarini Ing. Sergio

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